

AR191172

BLP5LA55S, 380-450MHz

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AMPLEON
Application Report

Document information

Status Public

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Abstract Measurement results of a Class AB design
for the 380-450MHz band with the BLP5LA55S

1. Revision History

Table 1: Report revisions

Revision	Date	Description	Author
0.1	20191107	Initial document	Tom Brinkman
1.0	20191125	Final	Tom Brinkman

2. Contents

- 1. Revision History..... 2
- 2. Contents 2
- 3. List of figures 3
- 4. List of tables 3
- 5. General description 3
- 6. Biasing 4
- 7. Performance Indication 380-450MHz..... 4
- 8. Performance Details 5
 - 8.1 CW signal Power sweeps 380-450MHz 5
 - 8.1.1 Gain and efficiency (3dB sweep) 5
 - 8.2 CW Signal performance over 380-450 MHz 6
 - 8.2.1 3dB compressed power 6
 - 8.2.2 Gain 6
 - 8.2.3 Efficiency..... 7
 - 8.2.4 Return loss..... 8
 - 8.3 Harmonics 9
 - 8.4 Two Carrier signal Intermodulation 380-450 MHz 10
 - 8.4.1 Gain and efficiency power sweep (two carrier) 10
 - 8.4.2 IMD3 & IMD5 (max) 10
- 9. Hardware..... 11
 - 9.1 Mechanical drawing 11
 - 9.2 Board Image 11
 - 9.3 Board layout..... 12
 - 9.3.1 Input & Output..... 12
 - 9.4 Bill of materials..... 13
 - 9.4.1 Input & Output..... 13
 - 9.5 Board material..... 14
 - 9.6 Device markings..... 14
- 10. Legal information 15
 - 10.1 Definitions 15
 - 10.2 Disclaimers 15
 - 10.3 Trademarks 15
 - 10.4 Contact information 15

3. List of figures

Figure 1	Demo	Front view.....	3
Figure 2	BLP5LA55S_PS_CW_191031_1619	Gain&Eff vs Pout[W].....	5
Figure 3	BLP5LA55S_PS_CW_191031_1619	P3dB[W] vs Freq	6
Figure 4	BLP5LA55S_PS_CW_191031_1619	MaxGain vs Freq	6
Figure 5	BLP5LA55S_PS_CW_191031_1619	Eff (55W) vs Freq	7
Figure 6	BLP5LA55S_PS_CW_191031_1619	Eff (P3dB) vs Freq.....	7
Figure 7	BLP5LA55S_PS_CW_191031_1619	IRL vs Pout.....	8
Figure 8	BLP5LA55S_PS_CW_19_16	2 nd and 3 rd Harmonic vs Pout	9
Figure 9	BLP5LA55S_PS_CW_19_.....	Two carrier Gain&Eff vs Pout[W].....	10
Figure 10	BLP5LA55S_PS_CW_19_.....	Two carrier IMD3&IMD5 vs Pout[W].....	10

4. List of tables

Table 1:	.....	Report revisions	2
Table 2:	.....	Performance indication, sampled at 380-450MHz.....	4
Table 3:	.....	CW Performance.....	5
Table 4:	.....	CW Performance at Pout = 55Watts	5
Table 5:	.....	Bill of Materials input board	13
Table 6:	.....	Bill of Materials output board.....	13
Table 7:	.....	Board specifications	14
Table 8:	.....	Device specifics.....	14

5. General description

This report presents the measurement results of the Class AB demo AR191172. The device used is a 55W, 9th generation LDMOS, the BLP5LA55S. The presented demo is tuned for the frequency 380-450MHz.

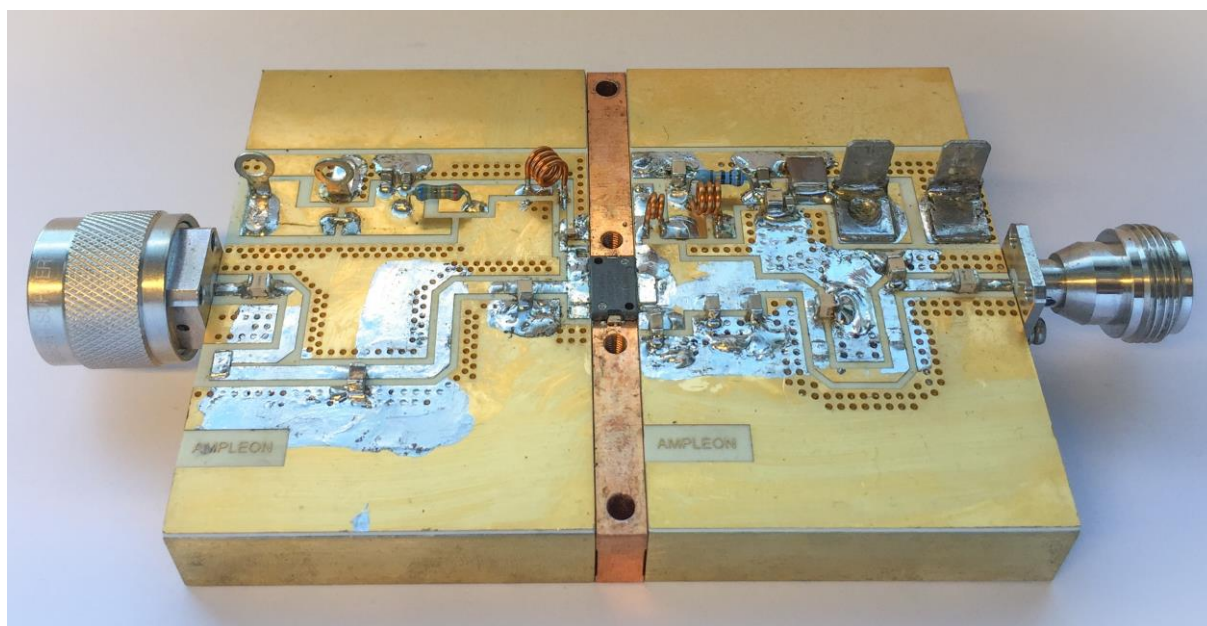


Figure 1 Demo Front view

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:

$$V_{DD} = 13.6V$$

$$V_{GS} = 1.93V, \text{ leading to an } I_{DQ} = 80mA$$

7. Performance Indication 380-450MHz

Table 2: Performance indication, sampled at 380-450MHz

Parameter	Condition	Unit	CW
V_{DD}		V	13.6
S11 at connector		dB	-6.0
P_{1dB}^1	$G_{MAX}-1dB$	W	53
P_{3dB}^1	$G_{MAX}-3dB$	W	68
P_{OUT} of operation	P_o^2	W	55
Gain	@ P_o	dB	>20
Drain Efficiency	@ P_o	%	>62
Drain Efficiency	@ 3dB comp.	dB	>73

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 CW signal Power sweeps 380-450MHz

Table 3: CW Performance

Freq [MHz]	MaxGain [dB]	P1dB [W]*	P3dB [W]*	Eff@P3dB [%]*
380.00	24.0	62.89	82.28	73.5
400.00	23.5	55.50	72.16	74.7
410.00	23.1	53.76	69.56	74.6
420.00	22.9	53.39	68.41	74.1
430.00	22.7	53.60	68.61	73.7
450.00	21.5	52.79	67.78	72.9
70.0	2.415	10.099	14.502	1.859

Table 4: CW Performance at Pout = 55Watts

Freq [MHz]	Obo [dB]@	Gain [dB]@	Eff [%]@	IRL [dB]@	S11 [dB]@
380.00	1.7	23.4	62.3	9.8	-9.8
400.00	1.2	22.5	67.2	6.4	-6.4
410.00	1.0	22.0	68.2	6.3	-6.3
420.00	0.9	21.7	68.3	7.2	-7.2
430.00	1.0	21.6	67.9	9.4	-9.4
450.00	0.9	20.4	67.0	10.4	-10.4
70.0	0.842	3.024	5.993	4.108	4.108

8.1.1 Gain and efficiency (3dB sweep)

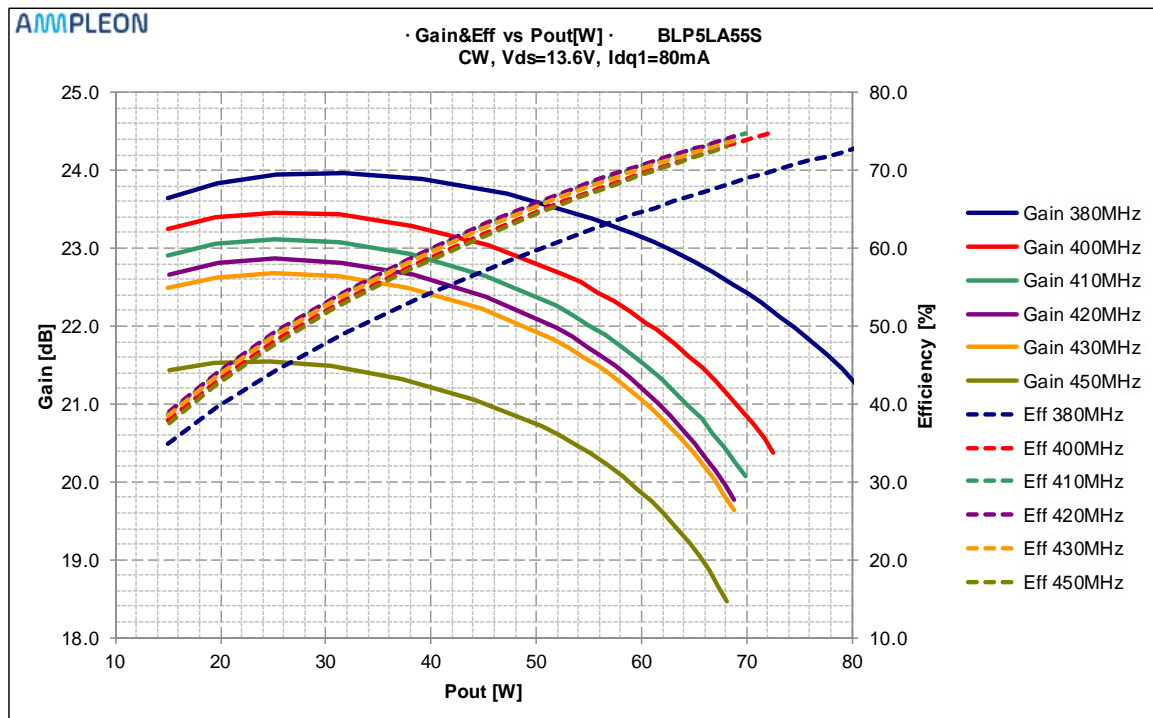


Figure 2 BLP5LA55S_PS_CW_191031_1619 Gain&Eff vs Pout[W]

8.2 CW Signal performance over 380-450 MHz

8.2.1 3dB compressed power

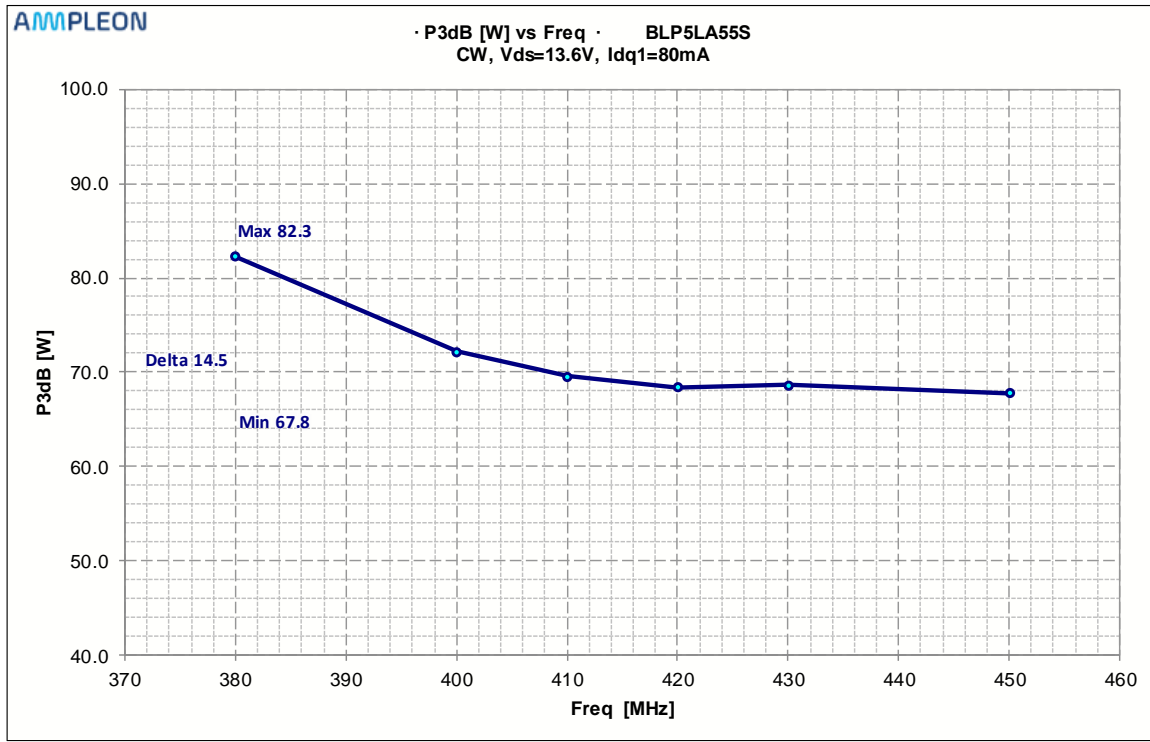


Figure 3 BLP5LA55S_PS_CW_191031_1619 P3dB[W] vs Freq

8.2.2 Gain

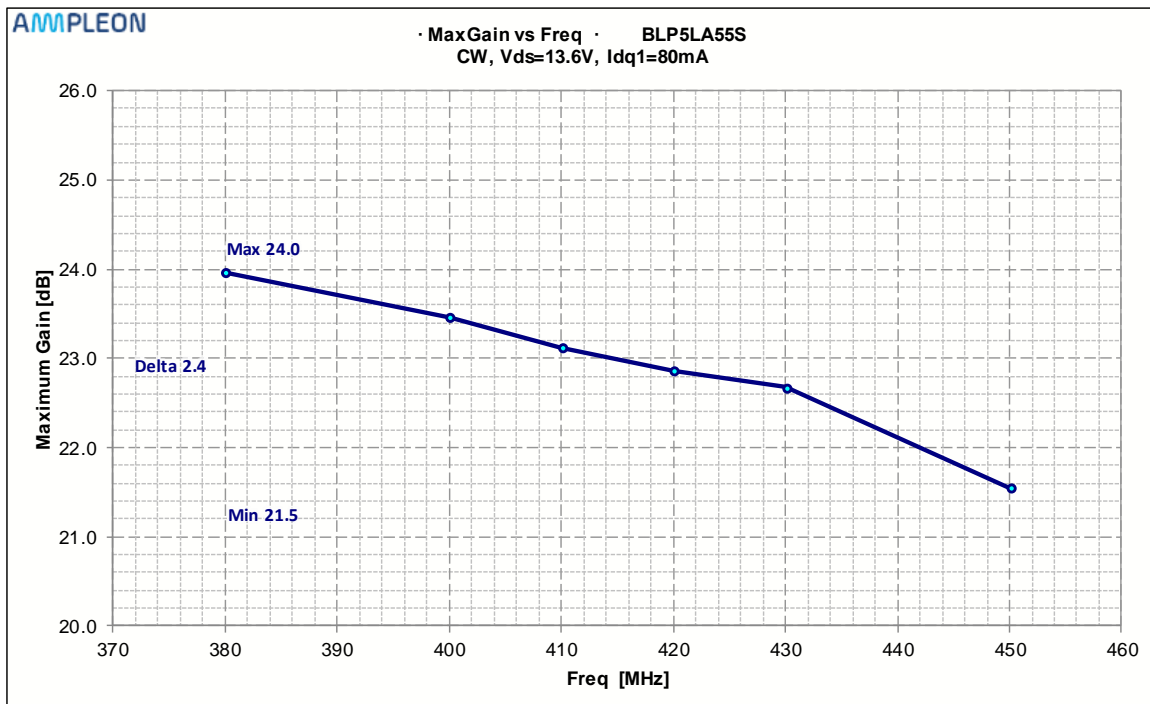


Figure 4 BLP5LA55S_PS_CW_191031_1619 MaxGain vs Freq

8.2.3 Efficiency

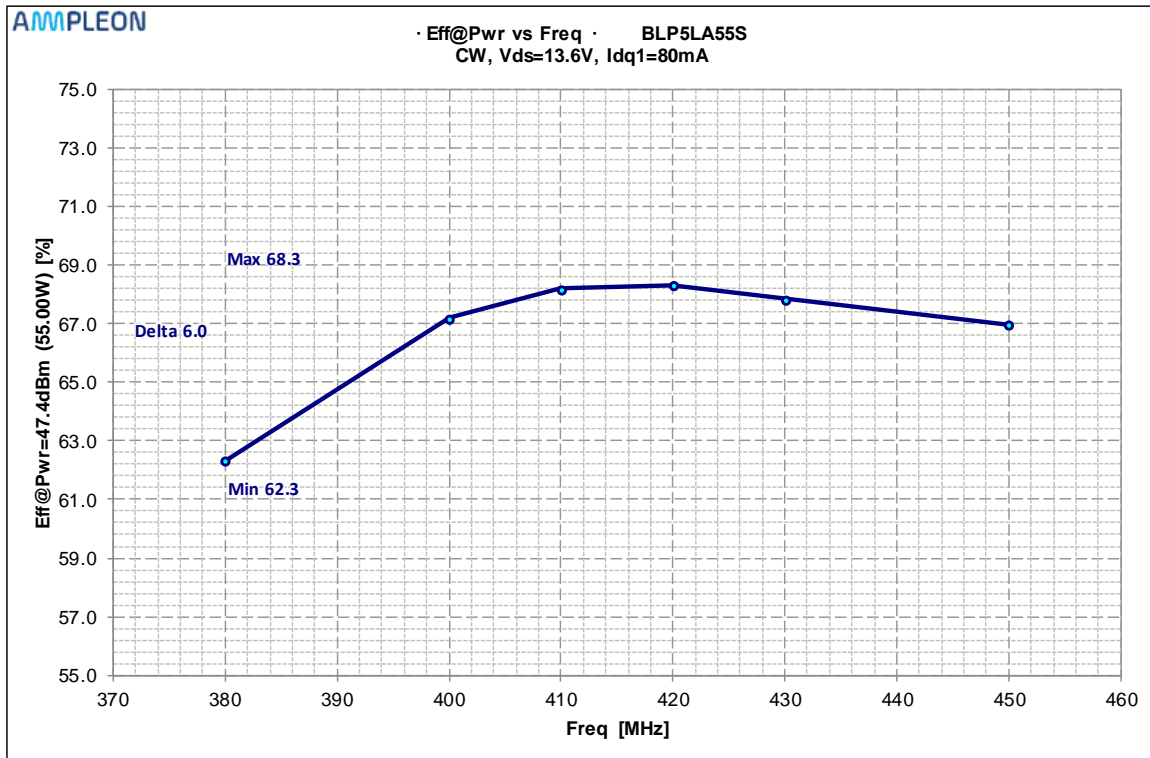


Figure 5 BLP5LA55S_PS_CW_191031_1619 Eff (55W) vs Freq

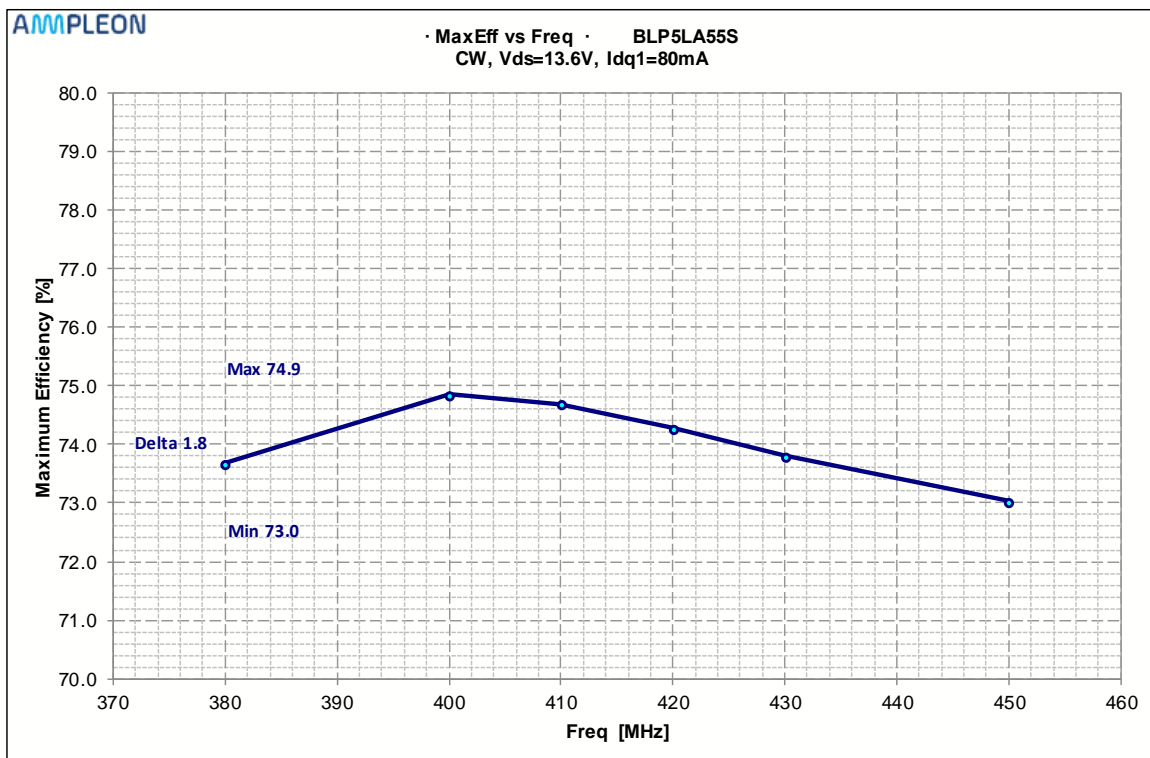


Figure 6 BLP5LA55S_PS_CW_191031_1619 Eff (P3dB) vs Freq

8.2.4 Return loss

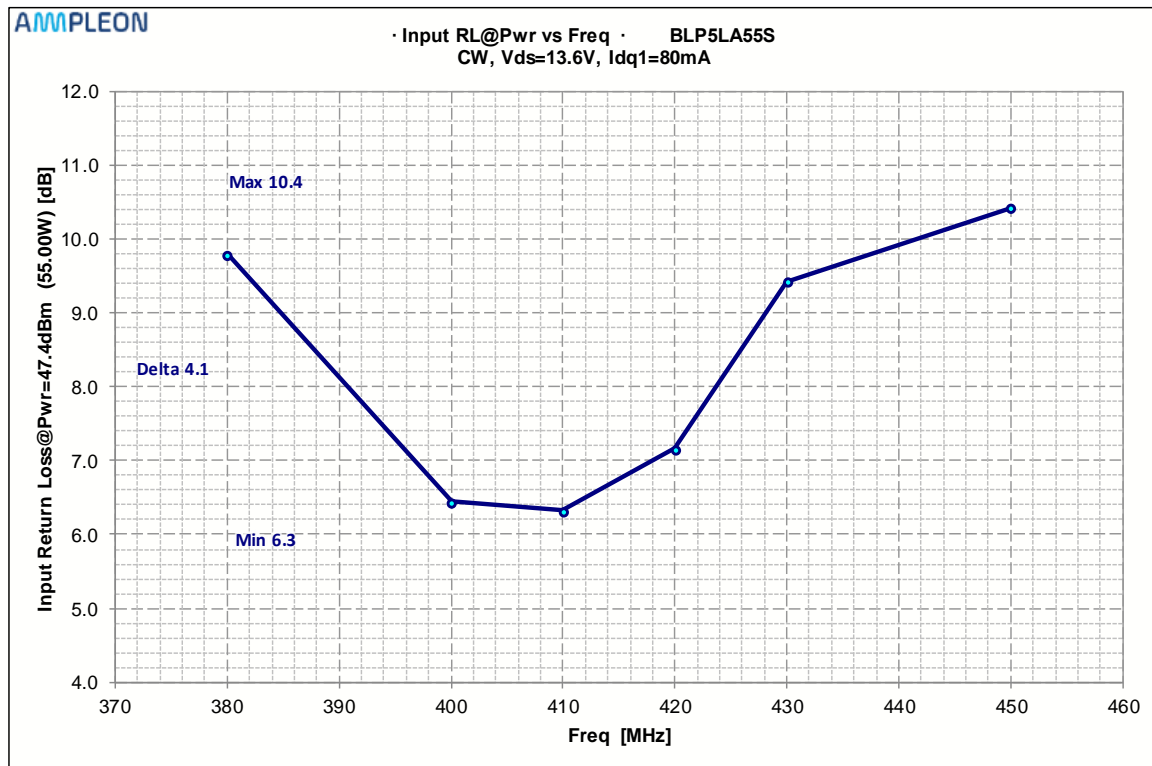
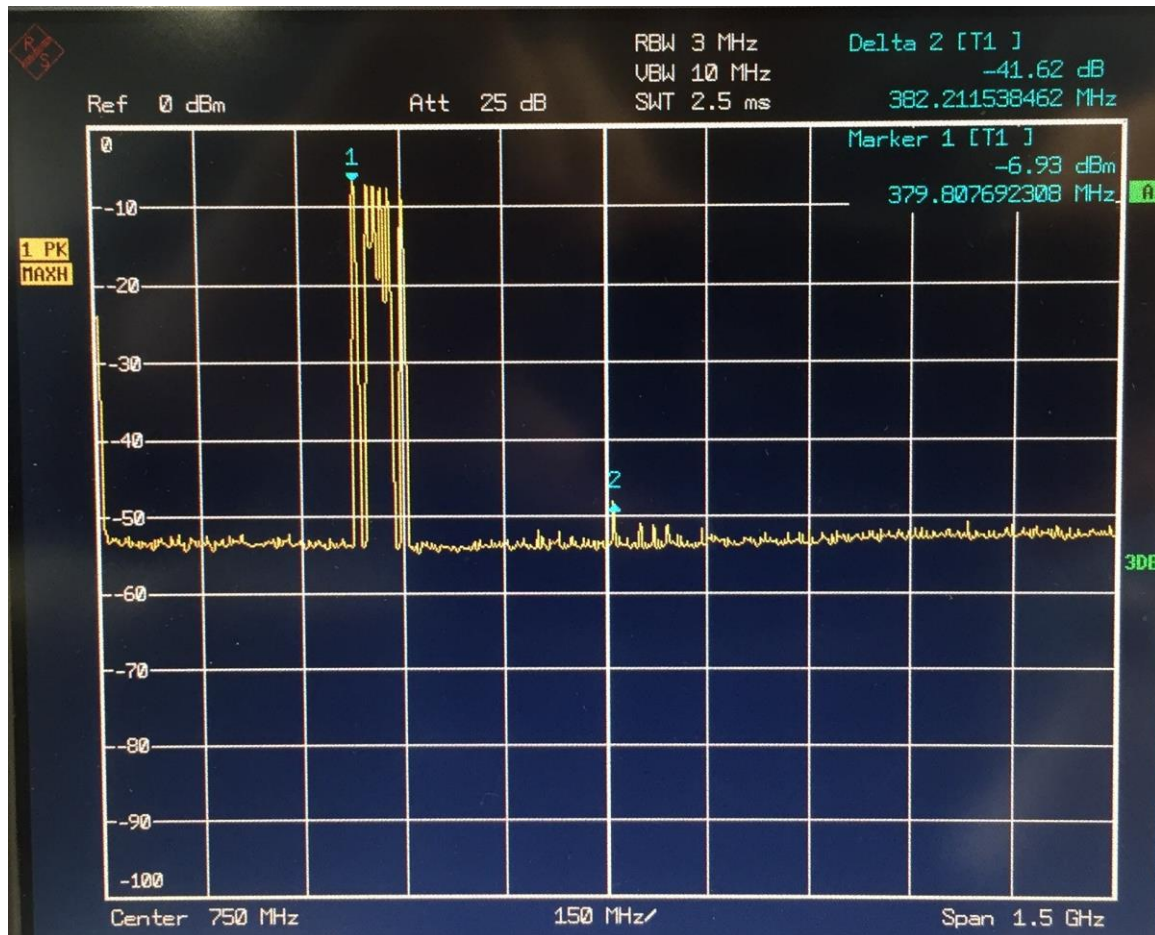


Figure 7 BLP5LA55S_PS_CW_191031_1619 IRL vs Pout

8.3 Harmonics

Figure 8 BLP5LA55S_PS_CW_19_16 2nd and 3rd Harmonic vs Pout



8.4 Two Carrier signal Intermodulation 380-450 MHz

8.4.1 Gain and efficiency power sweep (two carrier)

Up to 0.5dB Gain compression with two carrier separation of 100kHz.

Figure 9 BLP5LA55S_PS_CW_19_ Two carrier Gain&Eff vs Pout[W]

8.4.2 IMD3 & IMD5 (max)

Up to 0.5dB Gain compression with two carrier separation of 100kHz.

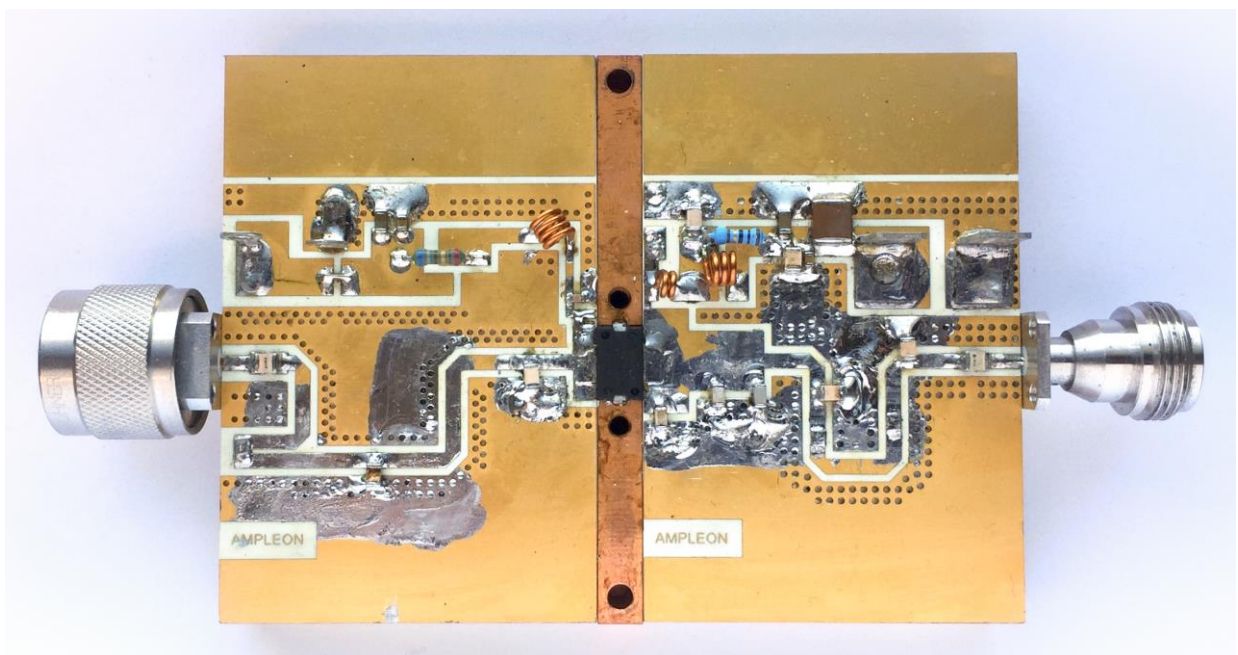
Figure 10 BLP5LA55S_PS_CW_19_ Two carrier IMD3&IMD5 vs Pout[W]

9. Hardware

9.1 Mechanical drawing

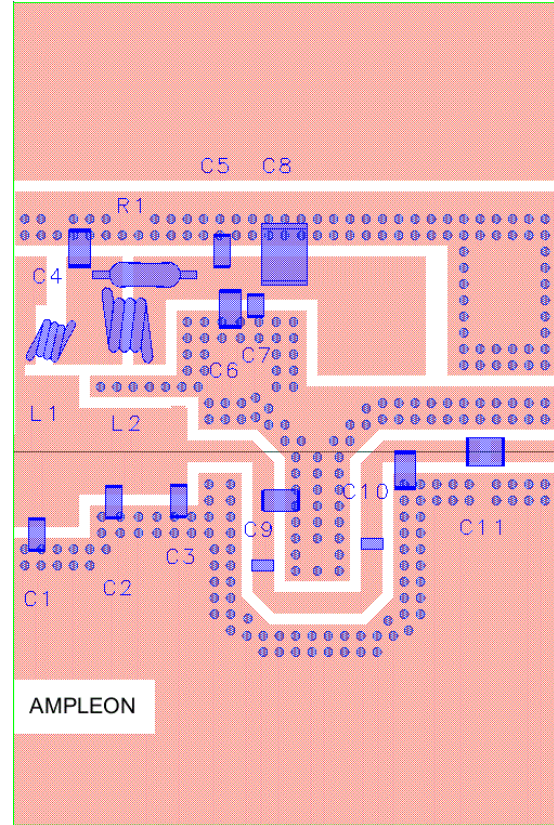
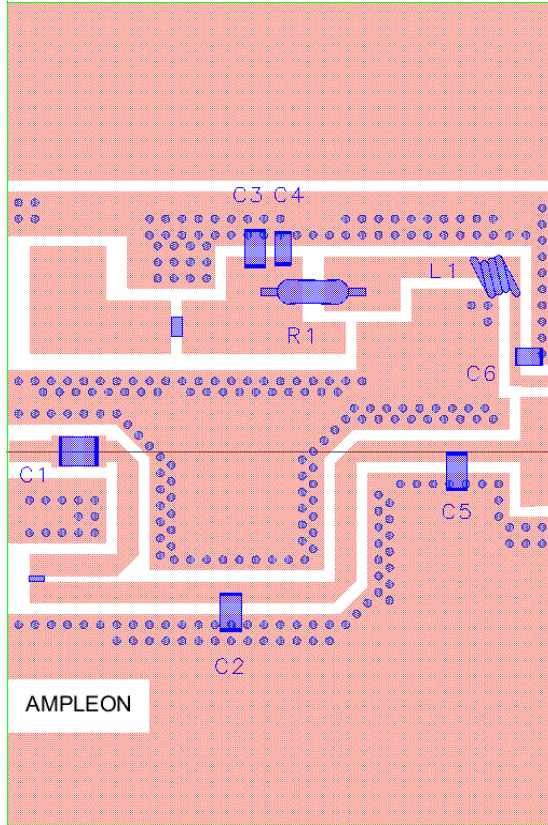
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9.2 Board Image



9.3 Board layout

9.3.1 Input & Output



9.4 Bill of materials

9.4.1 Input & Output

Table 5: Bill of Materials input board

Description	Identifier	Value	Manufacturer	Specification
Capacitor	C1	240 pF	ATC	ATC100B
Capacitor	C2	18 pF	ATC	ATC100B
Capacitor	C3	1 uF / 25V	MURATA	GRM31MR71E105KA01L
Capacitor	C4	100 nF	KEMET	C1206C104K1RAC
Capacitor	C5	75 pF	ATC	ATC100B
Capacitor	C6	120 pF	ATC	ATC600F
Inductor	L1	~30 nH	wire wound	WD=0.8 mm; N=4; D=3 mm; L=4 mm
Resistor	R1	68 Ohm		0.6 Watt

Table 6: Bill of Materials output board

Description	Identifier	Value	Manufacturer	Specification
Capacitor	C1	62 pF	ATC	ATC800B
Capacitor	C2	51 pF	ATC	ATC800B
Capacitor	C3	43 pF	ATC	ATC800B
Capacitor	C4	390 pF	ATC	ATC100B
Capacitor	C5	100 nF	KEMET	C1206C104K1RAC
Capacitor	C6	1 nF	ATC	ATC100B
Capacitor	C7	1 uF / 50V	MURATA	GRM32RR71H105KA01LATC100B
Capacitor	C8	10 uF / 50V		50V
Capacitor	C9	27 pF	ATC	ATC100B
Capacitor	C10	7.5 pF	ATC	ATC100B
Capacitor	C11	130 pF	ATC	ATC100B
Inductor	L1	~60 nH	wire wound	WD=0.8 mm; N=2; D=2 mm; L=2 mm
Inductor	L2	~30 nH	wire wound	WD=0.8 mm; N=3; D=3 mm; L=3.5 mm
Resistor	R1	10 Ohm		0.6 Watt

9.5 Board material

Table 7: Board specifications

Parameter	Value
Manufacturer	Rogers
Type	RO4350B
Thickness	30mil, 0.762mm>
Layers	Top layer: "cond" ; bottom layer: "cond2"
Layer thickness	35um

9.6 Device markings

Table 8: Device specifics

Parameter	Value
Manufacturer	Ampleon
Device	BLP5LA55S
Marking	BLP5LA55S
Comments	Engineering sample

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