

# AR212026

BLP15H9S30 30-1000MHz

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AMPLEON

Application Report

## Document information

Info	Content
Status	General Publication
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Abstract	Measurement results of the BLP15H9S30 LDMOS Device Measured at 50V over 30-1000MHz

## 1 Revision History

Table 1. Report revisions

Revision No.	Date	Description	Author
1.0	20210208	Initial document	Bill Goumas
2.0	20210309	Add IR Scans	Bill Goumas
3.0	20210413	Fix typos	Bill Goumas
4.0	20220422	Changed to General Publication	Bill Goumas

## 2 Contents

<b>1</b>	<b>Revision History</b> .....	<b>2</b>
<b>2</b>	<b>Contents</b> .....	<b>2</b>
<b>3</b>	<b>List of Figures</b> .....	<b>3</b>
<b>4</b>	<b>List of Tables</b> .....	<b>3</b>
<b>5</b>	<b>General Description</b> .....	<b>3</b>
<b>6</b>	<b>Biasing</b> .....	<b>4</b>
6.1	Bias Details.....	4
<b>7</b>	<b>Test Bench Set Up</b> .....	<b>4</b>
<b>8</b>	<b>Summary</b> .....	<b>5</b>
<b>9</b>	<b>Performance Details</b> .....	<b>6</b>
9.1	Small Signal Results.....	6
9.2	Pulse Gain, Efficiency vs Pout.....	7
9.3	P1, P2 vs Frequency.....	8
9.4	Performance at Fixed Power Output.....	9
<b>10</b>	<b>Modeling</b> .....	<b>10</b>
10.1	Large Signal Simulation.....	10
<b>11</b>	<b>THERMAL TESTS</b> .....	<b>11</b>
11.1	IR Scan at 900MHz.....	11
11.2	IR SCAN at 30MHz.....	12
<b>12</b>	<b>Hardware</b> .....	<b>13</b>
12.1	Board photograph.....	13
12.2	PCB layout.....	14
12.3	Bill of materials.....	15
12.4	PCB materials.....	16
12.5	Device markings.....	16
<b>13</b>	<b>Legal Information</b> .....	<b>17</b>
13.1	Contact information.....	17

## 3 List of Figures

Figure 1. Test Bench Equipment set up .....	4
Figure 2. Small Signal Data, Vdd=50V, Idq=150mA .....	6
Figure 3. Gain(dB), EFF(%) vs Power Out(dBm) .....	7
Figure 4. Gain(dB), EFF(%) vs Power Out(dBm) .....	7
Figure 5. P1,P2(dBm) vs Freq(MHz) .....	8
Figure 6. Gain(dB), EFF(%) vs Frequency(MHz) .....	9
Figure 7. Simulated Gain, Efficiency vs Power Out .....	10
Figure 8. IR Scan Results, Freq=900MHz .....	11
Figure 9. IR Scan Results, Freq=30MHz .....	12
Figure 10. Board Photograph .....	13
Figure 11. PCB Layout .....	14

## 4 List of Tables

Table 1. Report revisions .....	2
Table 2. RF Performance Vdd=50V, Idq=150mA, 5%duty .....	5
Table 3. BOM .....	15
Table 4. Board Specifications .....	16
Table 5. Device Specifications .....	16

## 5 General Description

This report presents the measurements of BLP15H9S30 in board AR212026. The board has been tested over 30-1000 MHz at 50V.

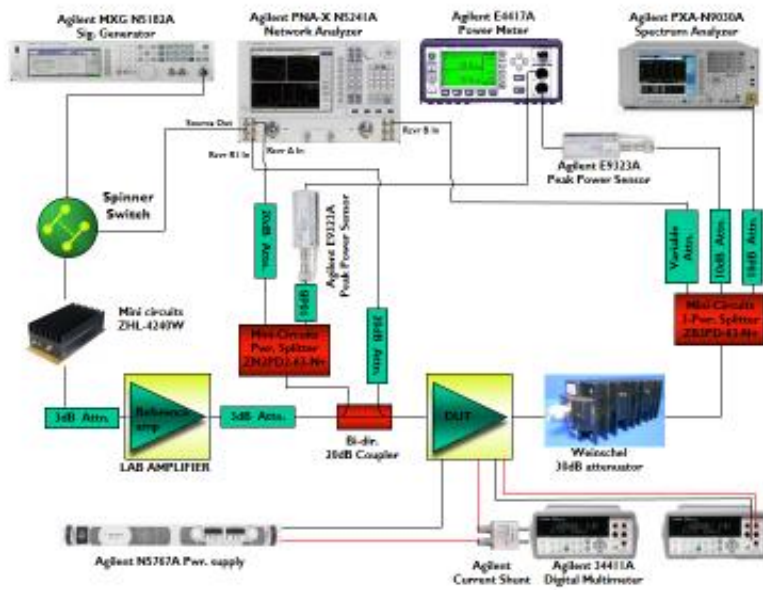
## 6 Biasing

### 6.1 Bias Details

Idq is set via the pot on the bias board.  
 For Vdd =50, Vgs~2.1 V for Idq =150mA.

## 7 Test Bench Set Up

Figure 1. Test Bench Equipment set up



## 8 Summary

Customer is interested in 30-1000MHz and beyond. Initial design is based on IPP-5014 as the key broadband matching element for the input. The 30W device load line is close to 50 Ω, so a simple 2 section match on the output will achieve the power. The IPP-5014 is a broadband 12 Ω to 50 Ω transformer.

Circuit performance is in line with the model and prediction. 25-30W can be achieved over the entire range. Circuit was tested up to 25% duty. The limiting factor for potential CW operation is the Broadband Conical Inductor used on the drain feed. Temperature will be excessive for CW. 50-75% duty would be fine. For CW operation, the conical inductor would need to be replaced by a conventional inductor. This would result in some performance roll-off near 30MHz. IR scans show that at 25% duty, all components are <40 °C.

Customer application is 5% duty so the demo was shipped as is.

**Table 2. RF Performance Vdd=50V, Idq=150mA, 25%duty**

Symbol	Parameter	Range	Unit
Freq.	Frequency Range	30-1000	MHz
Compr	Gain Compression at Pout=25W	<2	dB
Eff.@25W	Efficiency	35-58	%
G <sub>min.</sub> @25W	Minimum Gain	15	dB
G <sub>flatness</sub> @25W	Gain flatness	+/- 1.25	dB

9 Performance Details

9.1 Small Signal Results

Vdd=50V, Idq=150mA, Pin=10dBm

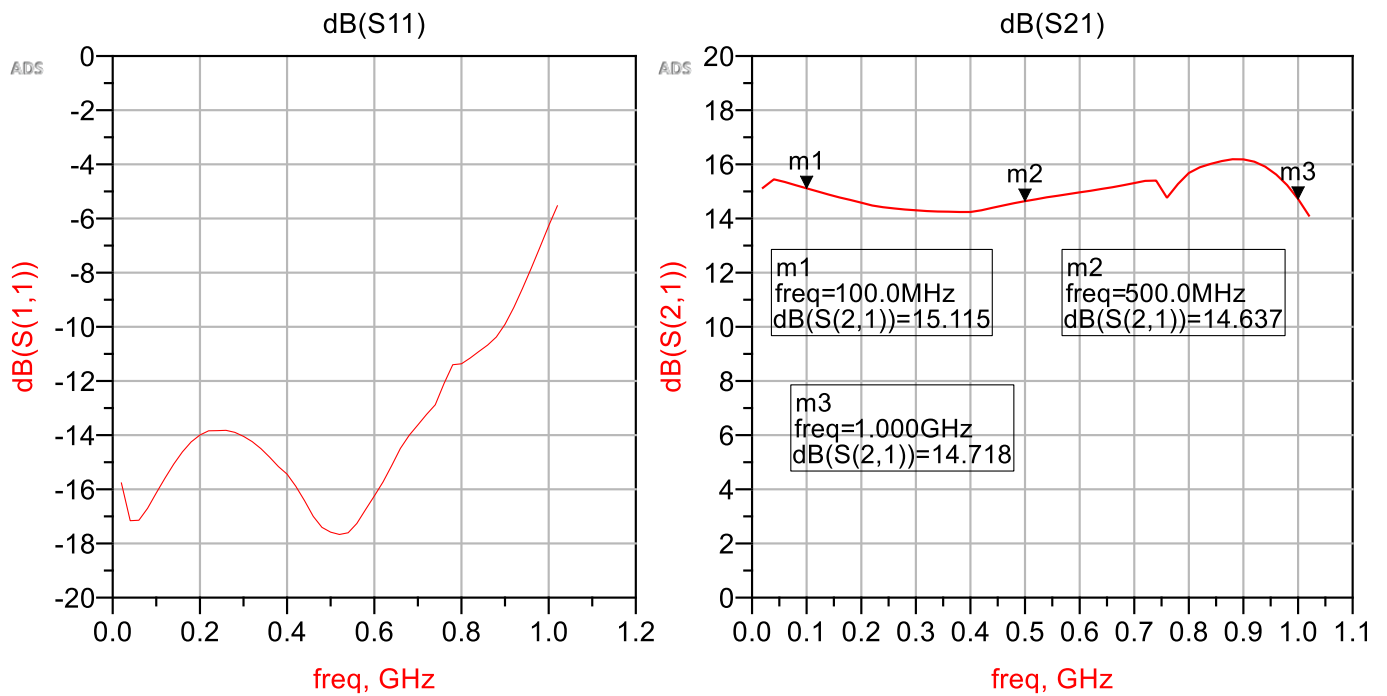


Figure 2. Small Signal Data, Vdd=50V, Idq=150mA

## 9.2 Pulse Gain, Efficiency vs Pout

Vdd=50V, Idq=150mA

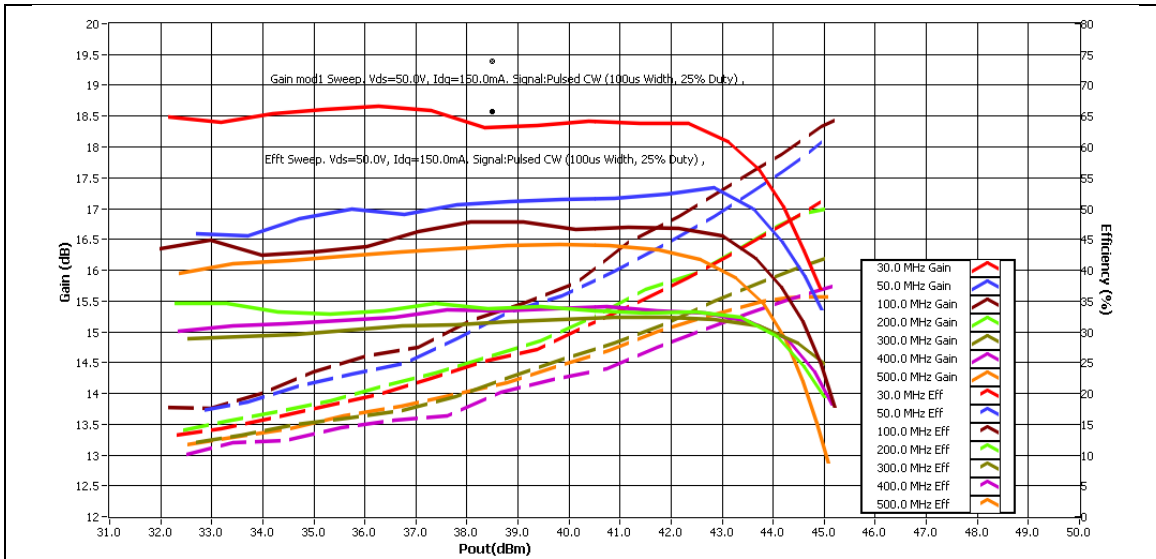


Figure 3. Gain(dB), EFF(%) vs Power Out(dBm)

### High Frequency Range

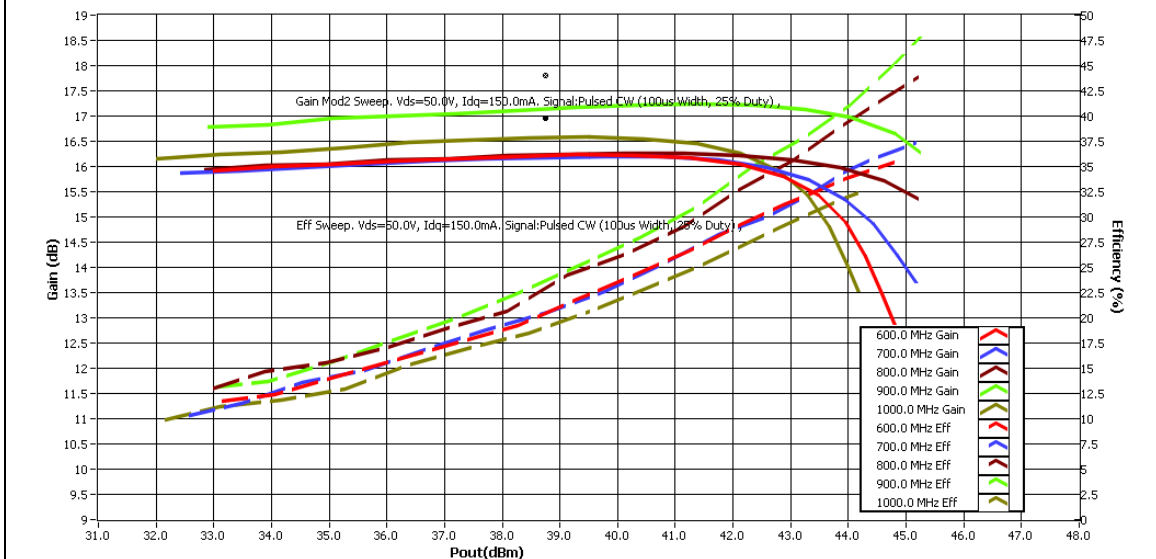
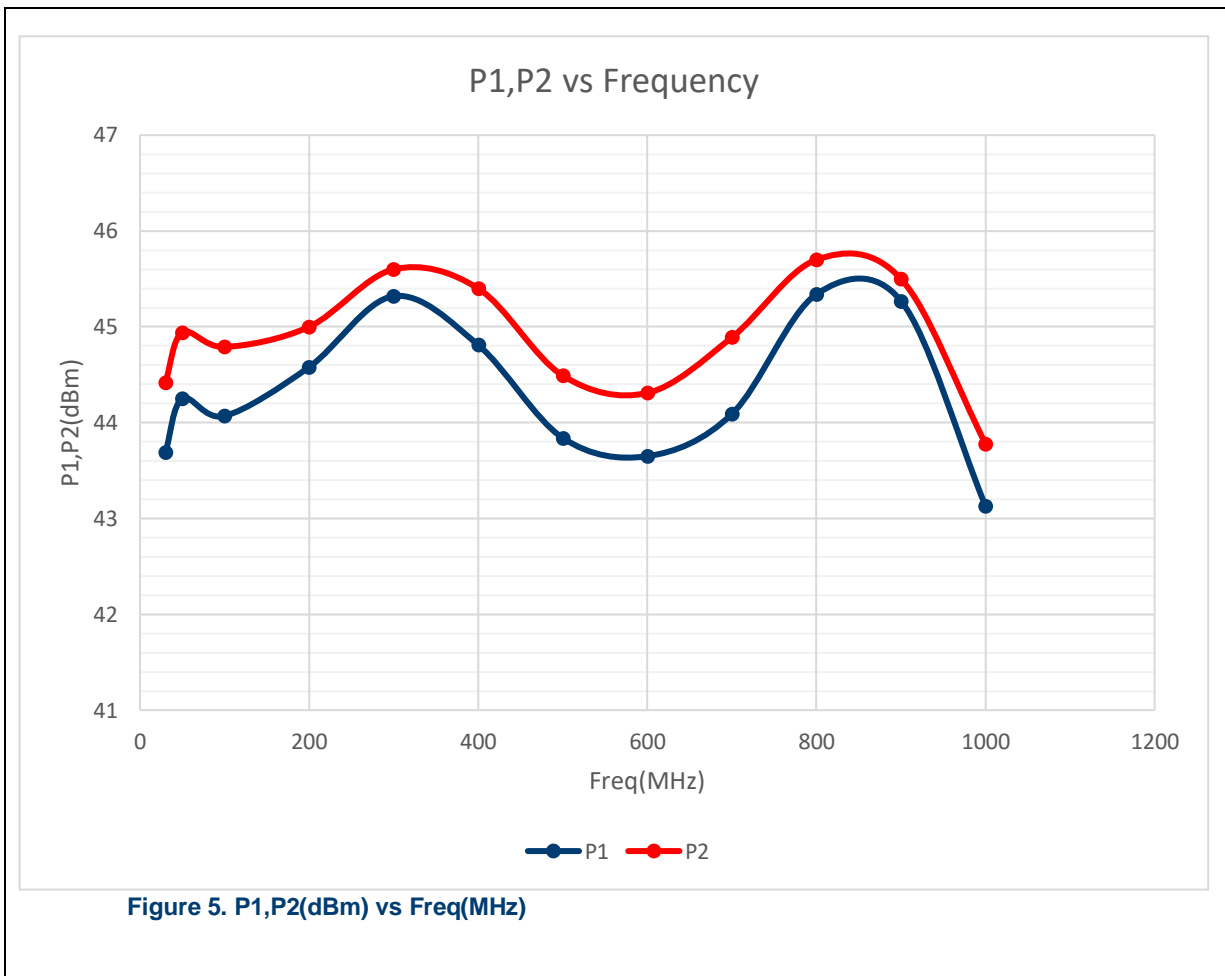


Figure 4. Gain(dB), EFF(%) vs Power Out(dBm)

## 9.3 P1, P2 vs Frequency

P1,P2 (dBm) vs Frequency, Vdd=50V, Idq=150mA

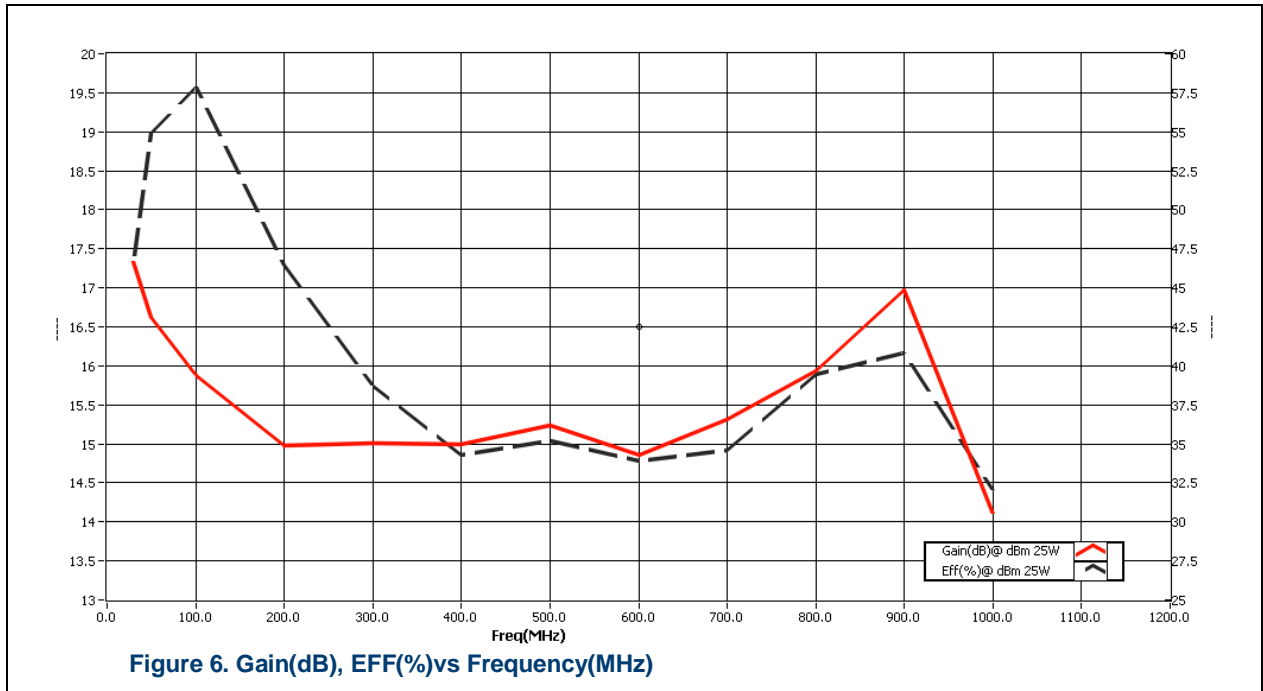




## 9.4 Performance at Fixed Power Output

Gain(dB) vs Frequency, Power Out=25W 25%Duty, Vdd=50V, Idq=150mA

Gain(red), Efficiency(black)



## 10 Modeling

### 10.1 Large Signal Simulation

Gain, Eff vs Pout, Vdd=50V

Drive up, Vd=50V, Final Output Match

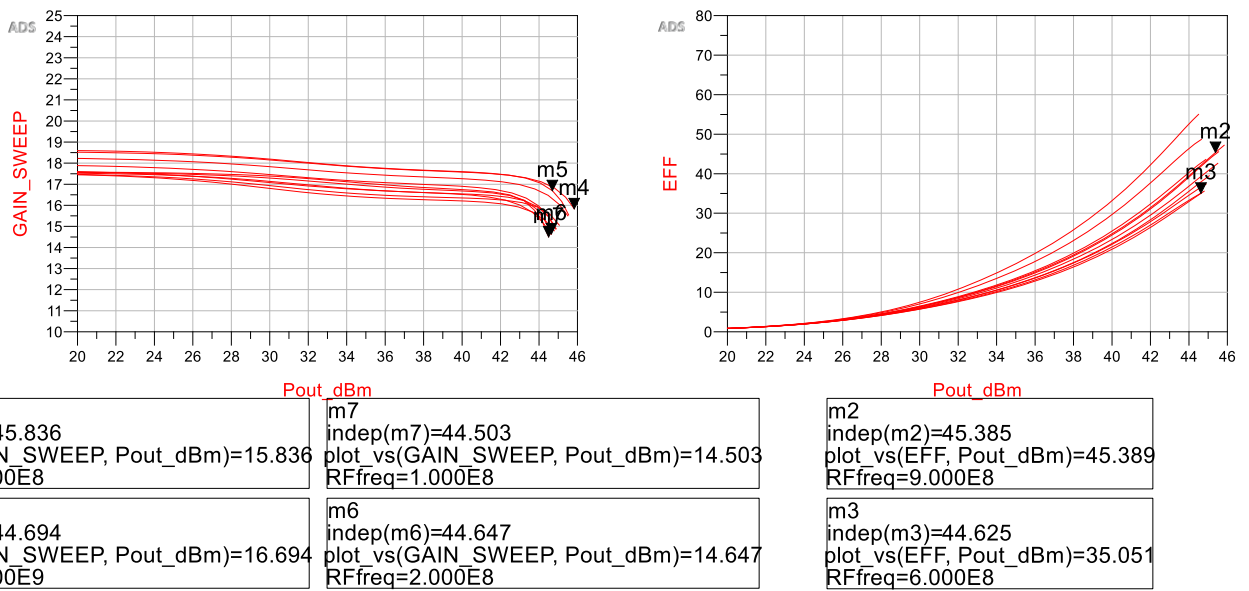


Figure 7. Simulated Gain, Efficiency vs Power Out

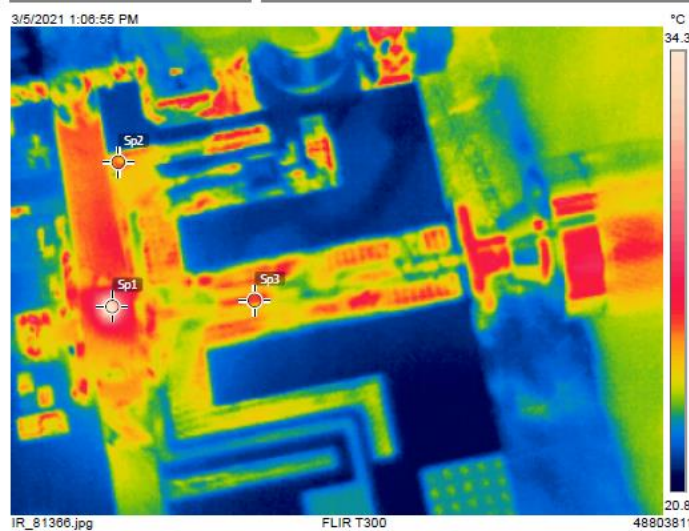
## 11 THERMAL TESTS

### 11.1 IR Scan at 900MHz

Pout=30W, 25% duty



F=900MHz, Pout=30W, Iavg=0.45A, 25% duty



Measurements

Sp1	34.2 °C
Sp2	25.3 °C
Sp3	28.2 °C

Parameters

Emissivity	0.95
Ref. temp.	20 °C

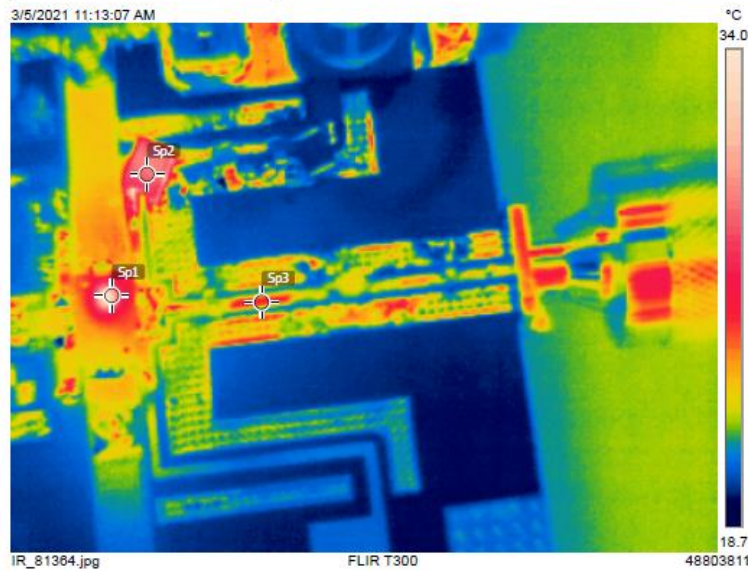
Figure 8. IR Scan Results, Freq=900MHz

## 11.2 IR SCAN at 30MHz

Freq=30MHz, Pout=30W 25% duty



F=30MHz, Pout=30W, Iavg=0.43A, 25% duty



### Measurements

Sp1	32.8 °C
Sp2	29.1 °C
Sp3	25.8 °C

### Parameters

Emissivity	0.95
Ref. temp.	20 °C

Figure 9. IR Scan Results, Freq=30MHz

## 12 Hardware

### 12.1 Board photograph

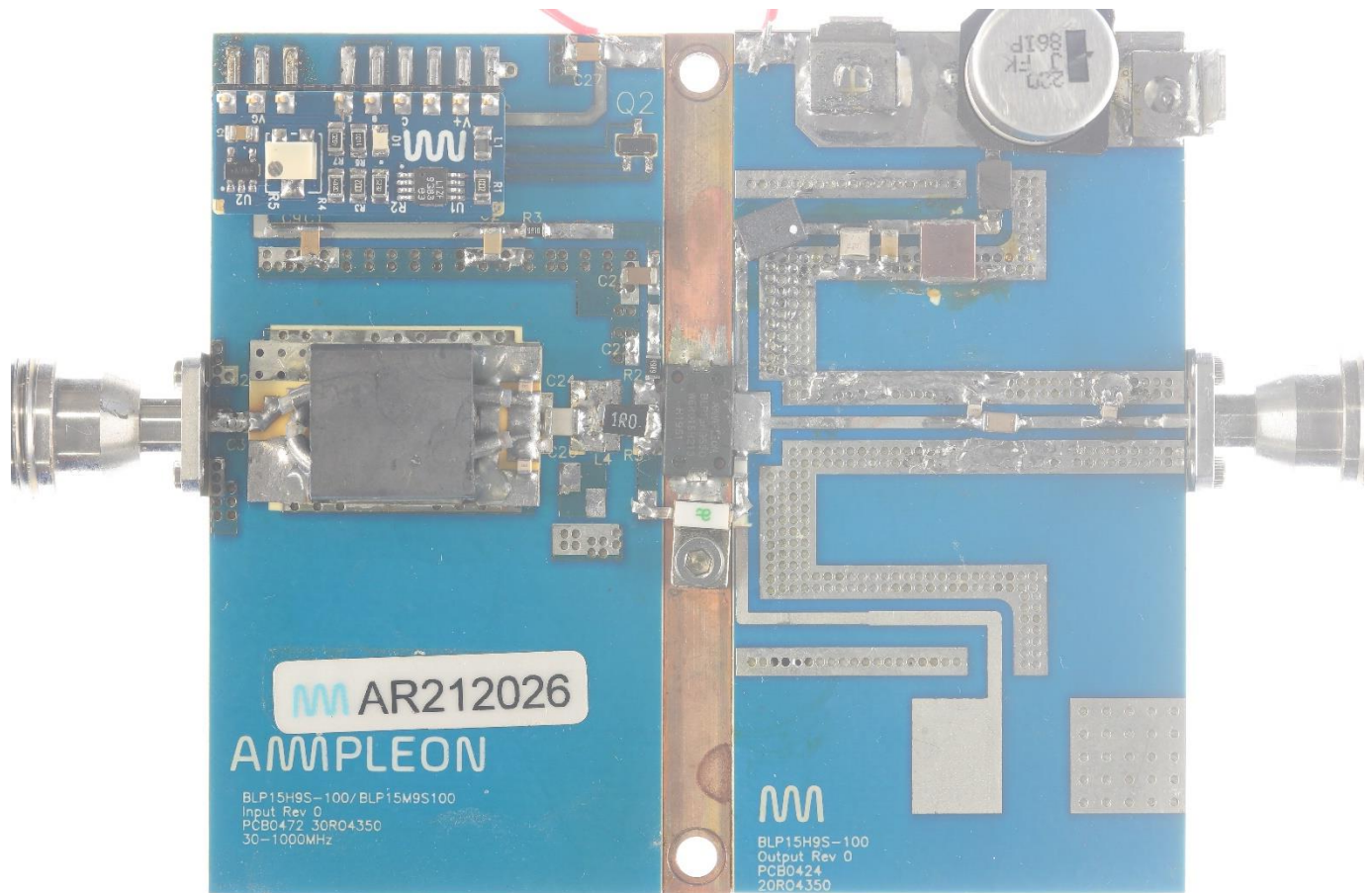


Figure 10. Board Photograph

## 12.2 PCB layout

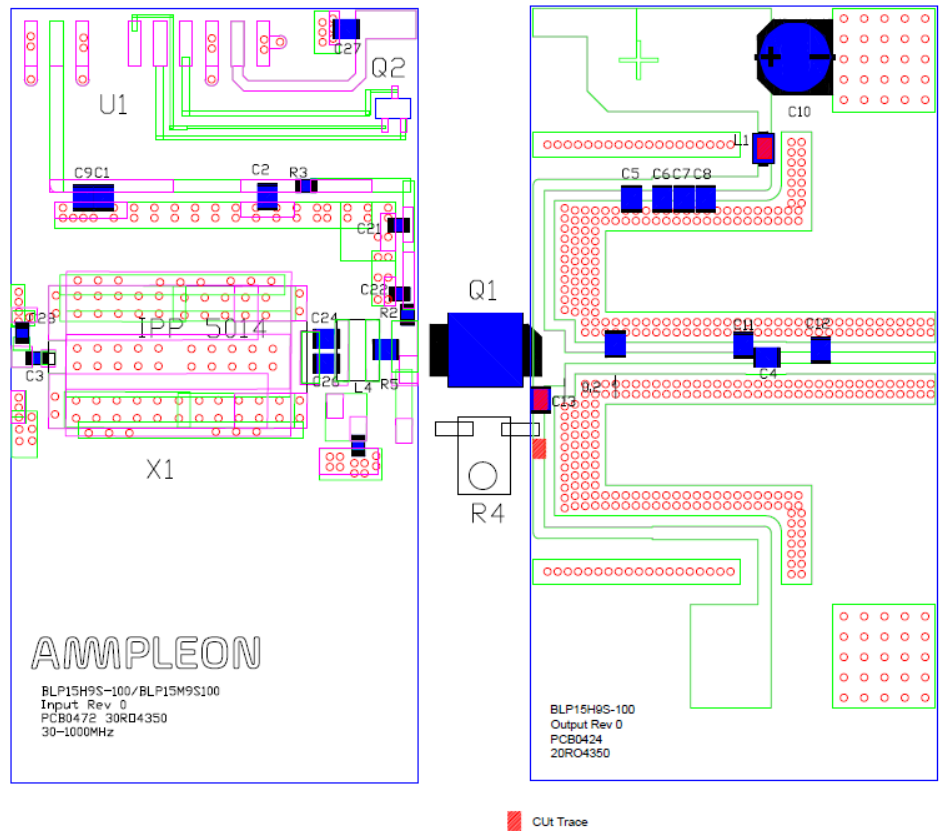


Figure 11.PCB Layout

## 12.3 Bill of materials

Table 3. BOM

Designator	Description	Manufacturer	Part#
PCB Input	30 mil thk. Rogers 4350	Avanti Circuits	PCB0472 Input Rev0
PCB Output	30 mil thk. Rogers 4350	Avanti Circuits	PCB0424 Output Rev0
Q1	RF Transistor 30W 50V LDMOS	Ampleon	BLP15H9S30
Q2	2N2222 NPN Transistor	Fairchild	MMBT2222
U1	LDMOS bias module	Ampleon	CA-330-11
X1	12.5Ω Matching element	IPP	5014
C1,C27	0.01uF,100V,X7R,1206	Murata	GRM319R72A103KA01D
C2	0.1uF 100V,X7R	Murata	GRM319R72A104KA01D
C3	Short out		
C4	1000pF	ATC	800B orPassive Plus 1111N series
C5,C13	1000pF	ATC	800B orPassive Plus 1111N series
C6	0.1uF 100V,X7R	Murata	GRM319R72A104KA01D
C7	1uF 100V,X7R	Murata	
C8	10uF, 100V 10% X7S, 2220	TDK	C5750X7S2A106M
C10	Capacitor, 63V 20%, alum elec	220uF	Panasonic EEV-FK1J221Q
C11	2.2pF	ATC	600F series
C12	3.0pF	ATC	600F series
C13	1000pF	ATC	600F series
C21	1uF, ceramic, 50V, ±10%	Murata	GRM31CR71H105K
C22	Capacitor,10pF	ATC	600F series
C24	4.7nF,100V 5% NPO, 1210	Generic	
L1	Ferrite Bead		Fair Rite, 2743019447
L4	Inductor	DNP	Short Out with Copper
L5	Conical Inductor	Coilcraft	BCR-221J
R1	9.1Ω	Vishay Dale	CRCW08059R09FKEA
R2	50Ω	Generic	1206
R3	9.1Ω	Vishay Dale	CRCW08059R09FKEA
R4	200Ω	ATC-Flanged	
R5	Resistor 1Ω, 2010	Generic	2 x

## 12.4 PCB materials

Table 4. Board Specifications

Parameter	Value
Manufacturer	Rogers
Type	4350
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	BLP15H9S30
Date Code	M2015



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