

# AR182059

BLF989 474-714MHz.

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AMPLEON

Test Report

## Document information

Info	Content
Status	General Publication
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Abstract	Measurement results of a Class AB Broadband design for the 474-714 MHz.band using the BLF989 Ampleon Gen 9 LDMOS device

## 1 Revision History

Table 1. Report revisions

Revision No.	Date	Description	Author
1.0	20180718	Initial document	Bob Bartola
2.0	20220425	Changed to General Publication	Bill Goumas

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## 5 General Description

This document contains measurement results of Ampleon BLF989 Symmetrical device in an Class AB application with the circuit designed for the 474-714 MHz UHF band. This application board was designed for approximately 240 MHz bandwidth optimizing efficiency, linearity, and harmonic rejection. The application board was tested with an 8MHz DVB-T signal using a Pro-TV exciter with bias levels of  $V_{ds}=50V$ ,  $I_{dq}= 600mA$  (each side of the device) and an output power of 150W average and approx..1KW pulsed Pload @ P-6dB.

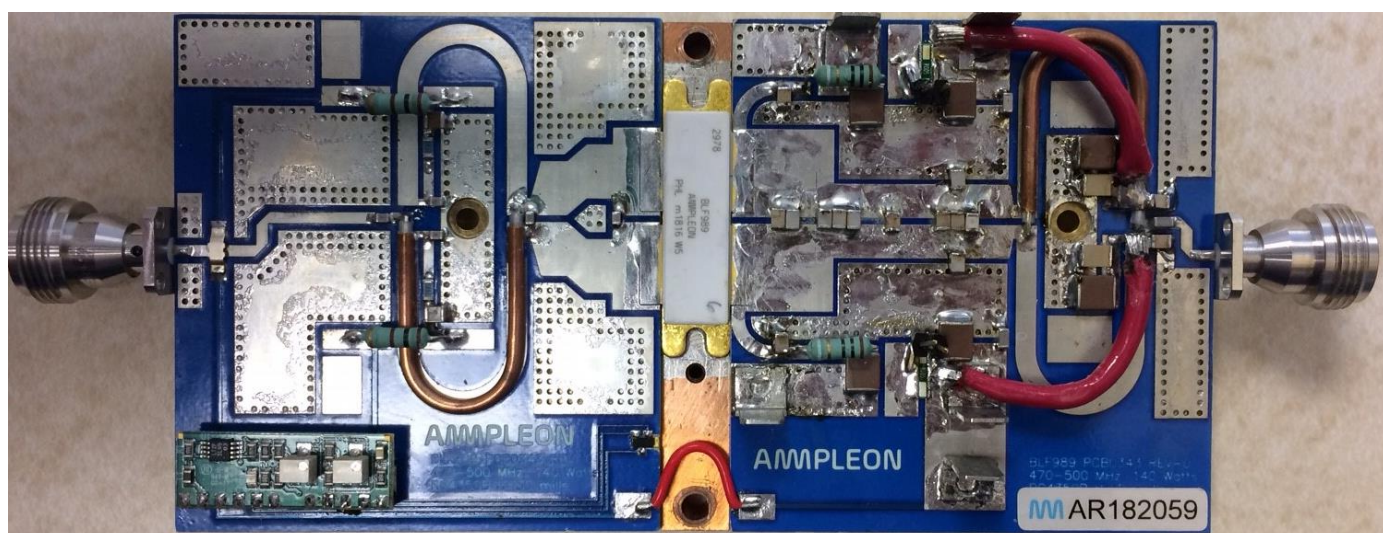


Figure 1. Assembled BLF989 Class AB DVB-T amplifier

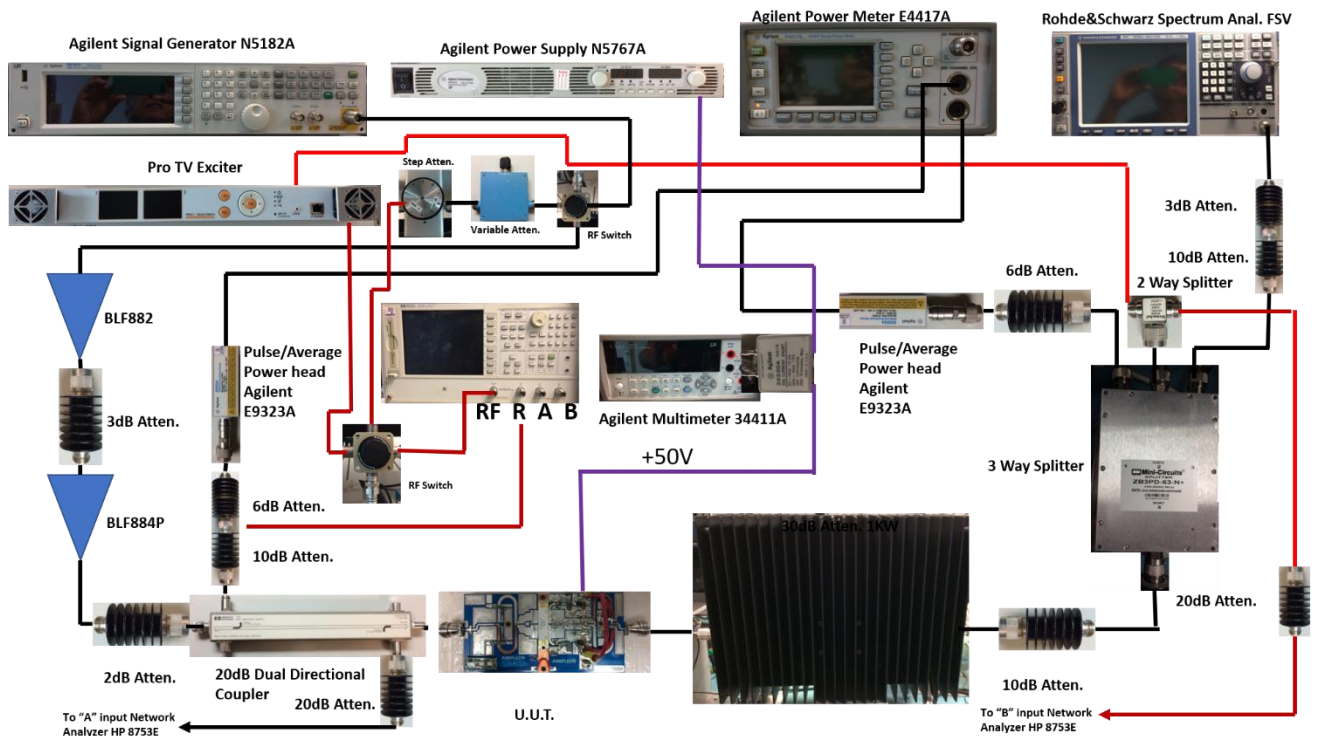
## 6 Biasing

### 6.1 Class AB Demo Bias Levels

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. The biasing is as follows:

$V_{ds} = 50V$

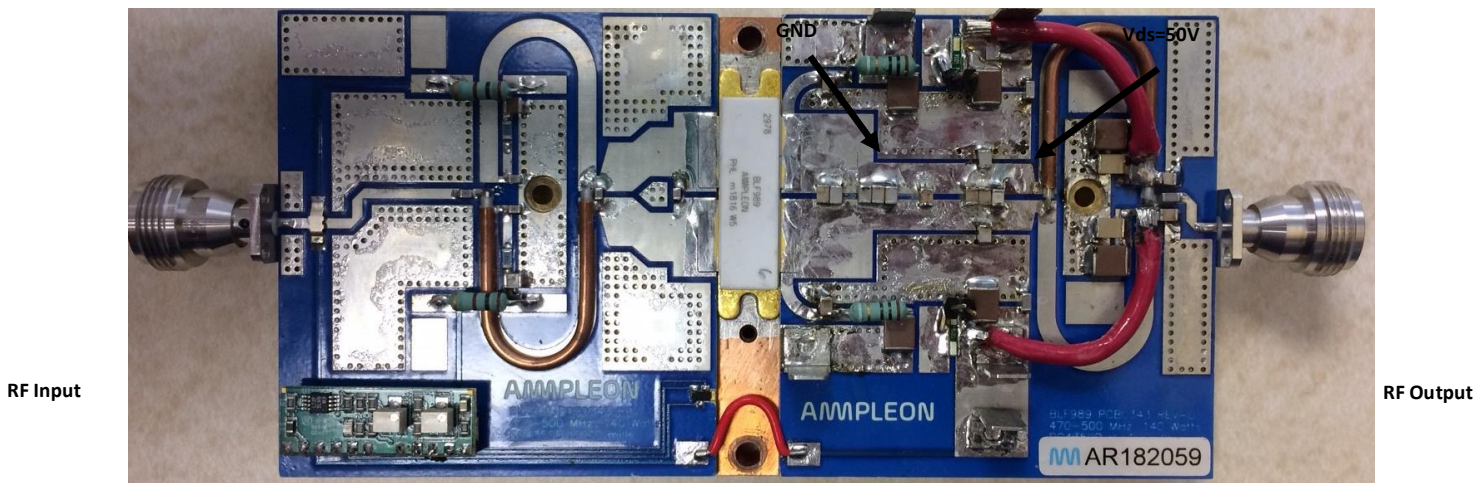
$I_{dq} \text{ (each side)} = 600mA.$



### 6.2 Bench Test Set Up

Figure 2. AR182059 BLF989 Class AB Demo Bench Set Up

## 6.3 BLF989 Class AB Demo DC and RF connections



Idq Adj. CCW increases Idq. (Adjust for 600mA each side)

Vds=50V

## 7 Performance Indicators

Table 2. Demo Bias conditions:  $V_{ds}=50V$   $I_{dq}$  (each side) =600mA.

Parameter	Condition	Unit	Demo "as-is"
Vds	474-714 MHz.	V	50
Corrected Shoulder Attenuation	150W Average	dBc.	-37 max.
AM-PM	Max @ 150W CW	Deg.	< 5
P-6dB	Pulsed source PW=100uS. DF=10%	Watts	>900
CW Efficiency	150W Pload	%	>30.8
DVB-T Efficiency	150W Ave. Pload	%	>33
2'nd Harmonic Output Level @ 150W CW	Fc=474-714 MHz.	dBc.	<-35
Gain @ 150W	CW 474-714 MHz.	dB.	>19



## 8 Test Object details

Transistor type: BLF989

Production code : PHL m1816 W5

PCB Board: PCB0343 REV-0 Rogers RO4350 H=30 mills

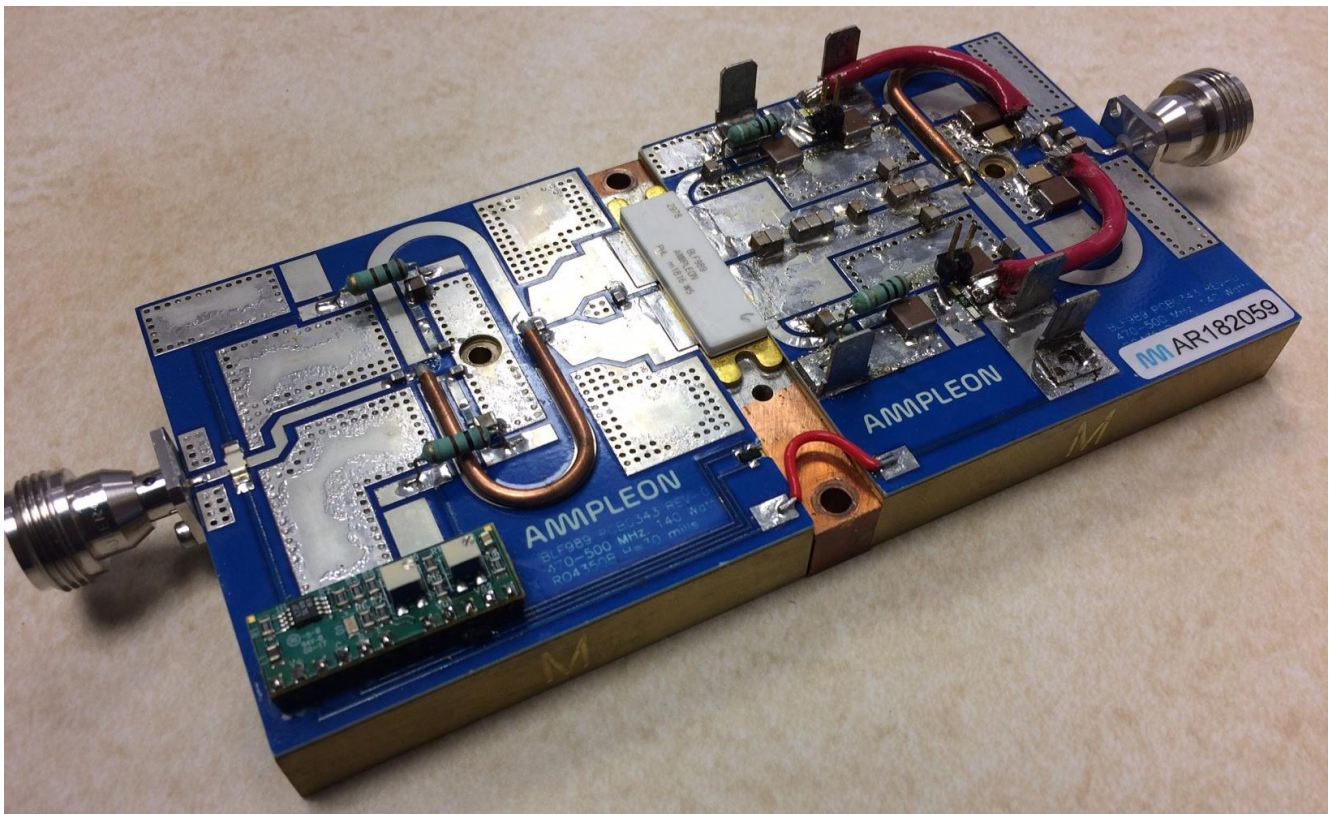


Figure 3. AR182059 BLF989 Demo

## 9 Performance Details

### 9.1 Uncorrected and Corrected Class AB Performance Tables

DVB-T Average Pload (Watts)	Offset Frequency (MHz.)				CW AM/PM (Deg.)
	-8.6	-4.3	+4.3	+8.6	
90	39	33	33	38	+1.6
110	38	32	32	37	+1.8
130	38	33	32	37	+1.9
150	38	33	33	36	+2.0
200					+2.5

**Table 3. Uncorrected Shoulders and CW AM/PM performance at 474 Mhz.**

DVB-T Average Pload (Watts)	Offset Frequency (MHz.)				Efficiency (%)
	-8.6	-4.3	+4.3	+8.6	
90	52	47	47	50	26.1
110	48	44	44	47	28.8
130	45	40	40	45	31.3
150	43	38	38	43	34

**Table 4. Corrected Shoulders and CW AM/PM performance at 474 Mhz.**

	Offset Frequency (MHz.)				
DVB-T Average Pload (Watts)	-8.6	-4.3	+4.3	+8.6	CW AM/PM (Deg.)
90	37	31	31	37	+0.8
110	36	30	30	36	+0.5
130	35	30	30	34	+0.4
150	35	30	29	33	+0.4
200					+0.4

**Table 5. Uncorrected Shoulders and CW AM/PM performance at 594 Mhz.**

	Offset Frequency (MHz.)				
DVB-T Average Pload (Watts)	-8.6	-4.3	+4.3	+8.6	Efficiency (%)
90	48	45	45	48	27
110	46	42	42	46	30
130	43	40	40	43	32.8

150	42	38	38	42	35.4
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**Table 6. Corrected Shoulders and CW AM/PM performance at 594 Mhz.**

DVB-T Average Pload (Watts)	Offset Frequency (MHz.)				CW AM/PM (Deg.)
	-8.6	-4.3	+4.3	+8.6	
90	38	32	31	37	+0.6
110	37	32	31	36	+0.3
130	36	32	31	35	+0.1
150	35	30	30	34	+0.2
200					-0.1

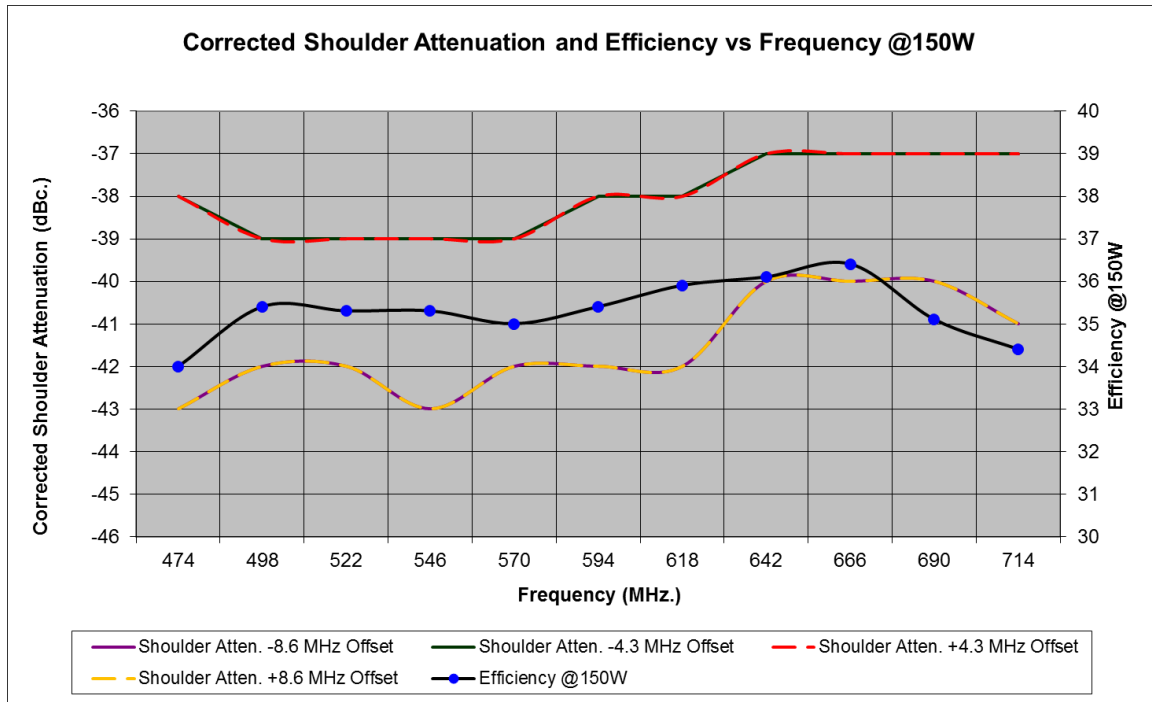
**Table 7. Uncorrected Shoulders and CW AM/PM performance at 714 Mhz.**

DVB-T Average Pload (Watts)	Offset Frequency (MHz.)				Efficiency (%)
	-8.6	-4.3	+4.3	+8.6	
90	47	44	44	47	26.7
110	45	41	41	45	29.7
130	42	39	39	42	32.3
150	41	37	37	41	34.4

**Table 8. Corrected Shoulders and CW AM/PM performance at 714 Mhz.**

Frequency (MHz.)	-8.6 MHz.	-4.3 MHz.	+4.3 MHz.	+8.6 MHz.	Efficiency @150W (%)	CW AM/PM @150W (Deg.)	CW Pulsed (PW=100uS. DF=10%) Pload @ P-6dB. (WATTS)
474	43	38	38	43	34	+2.0	972.7
498	42	39	39	42	35.4	+1.0	977.2
522	42	39	39	42	35.3	+0.91	1004.6
546	43	39	39	43	35.3	+0.24	1025.6
570	42	39	39	42	35	0	1020.9
594	42	38	38	42	35.4	+0.4	995.4
618	42	38	38	42	35.9	+0.2	963.8
642	40	37	37	40	36.1	+0.2	909.9
666	40	37	37	40	36.4	+0.2	893.3
690	40	37	37	40	35.1	+0.2	887.1
714	41	37	37	41	34.4	+0.2	946.2

Table 9. Pro-TV Exciter Corrected DVB-T @ 150W Average Measurements



9.2 Performance Data (Graphs)

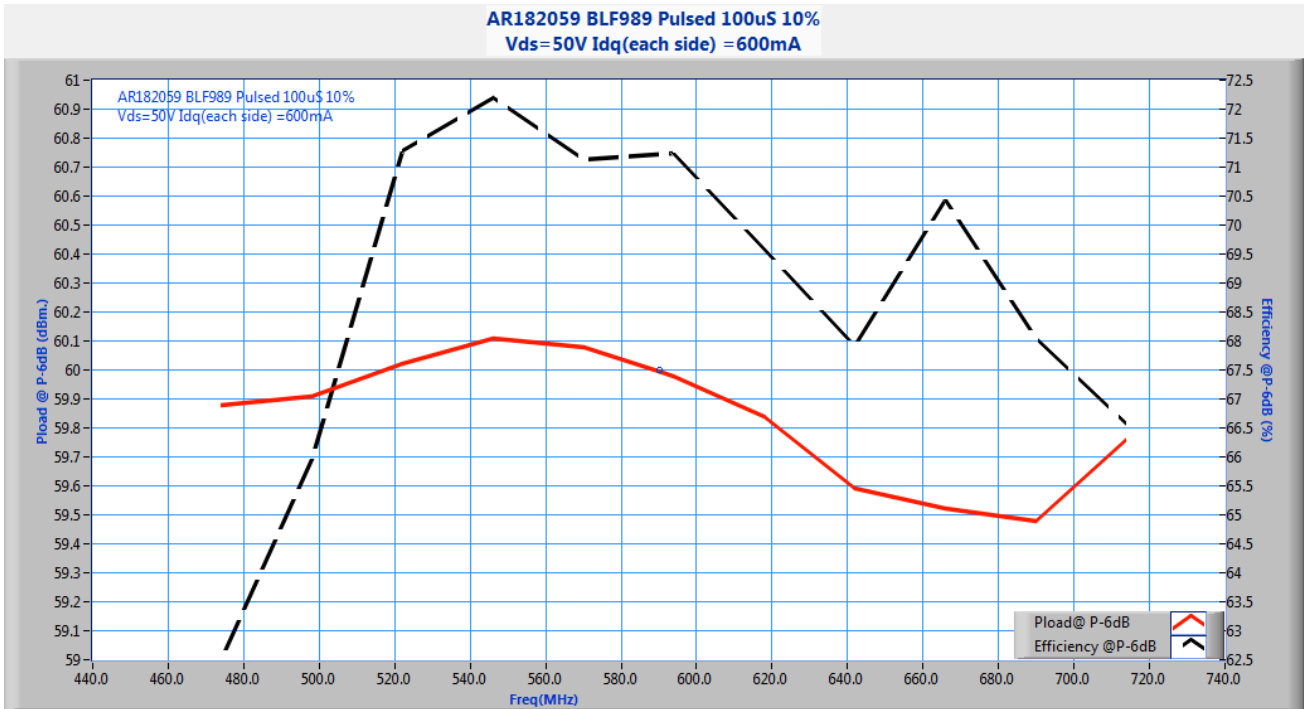


Figure 4. Corrected Shoulder Attenuation and Efficiency vs. Frequency @150W Ave.

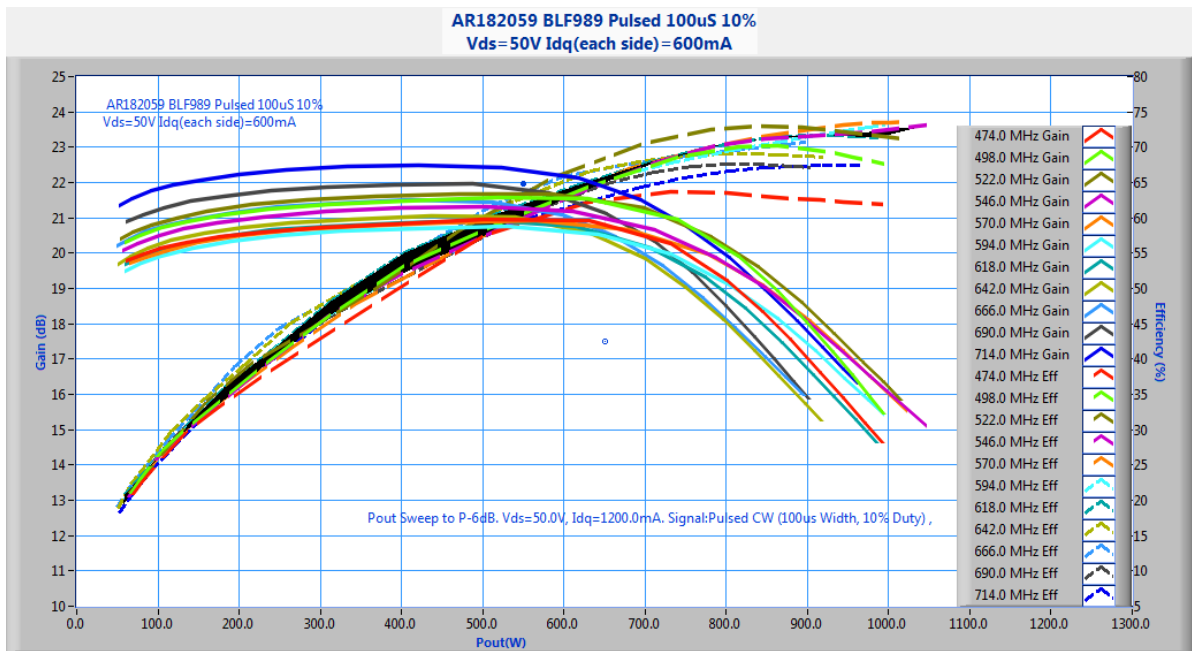


Figure 5. Gain and Efficiency (Pulsed CW 100uS 10%) vs. Pload(Watts) to P-6dB.

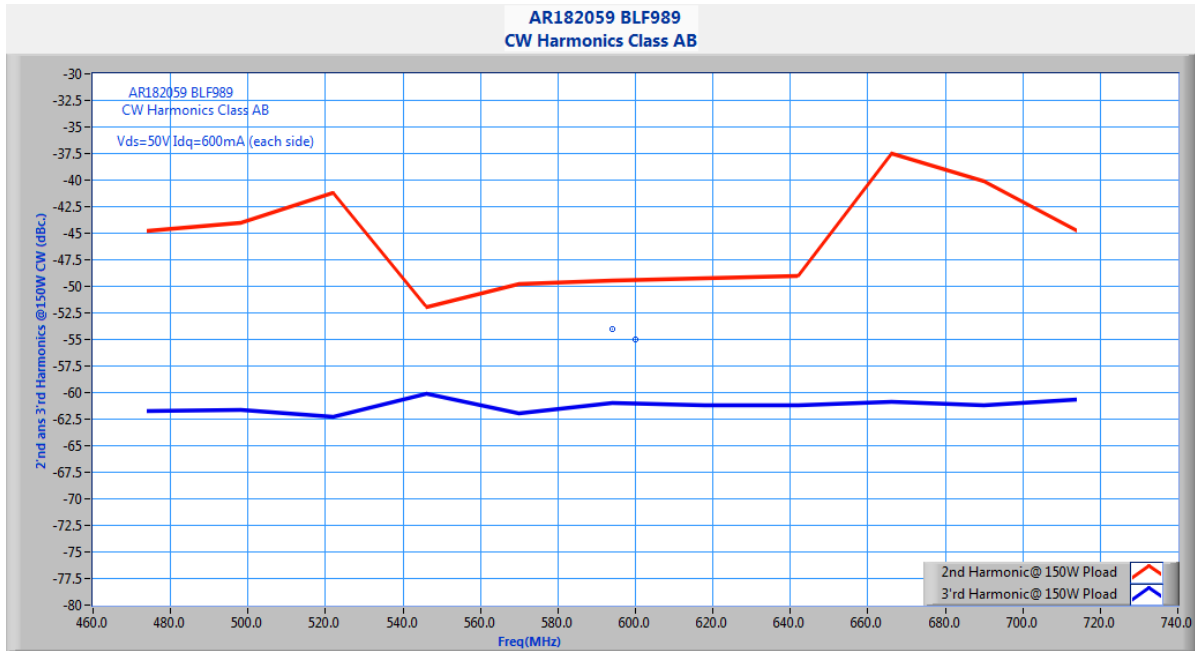


Figure 6. Pulsed 100uS 10% Pload and Efficiency vs. Frequency @ P-6dB.

Figure 7. CW Gain and Efficiency vs frequency @150 Watts

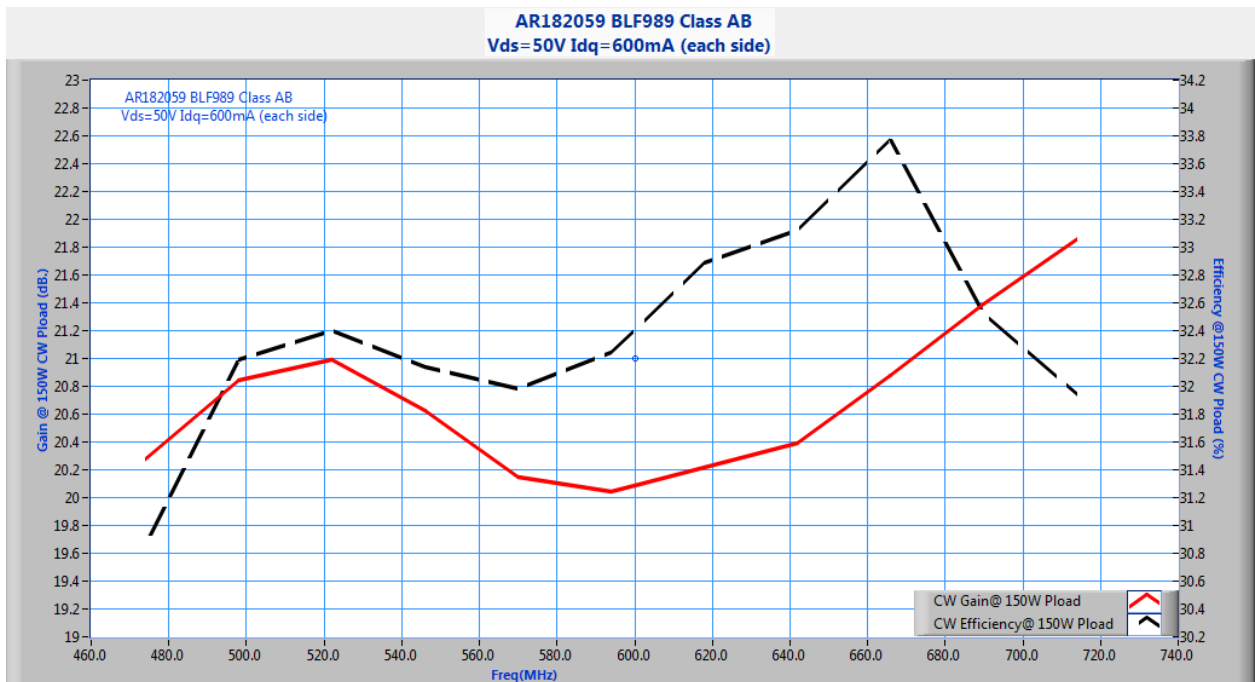
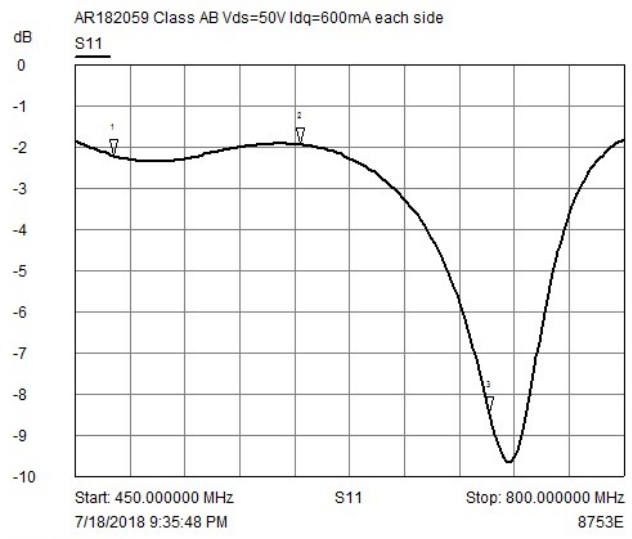


Figure 8. CW 2'nd and 3'rd Harmonic Level @ 150 Watts Pload



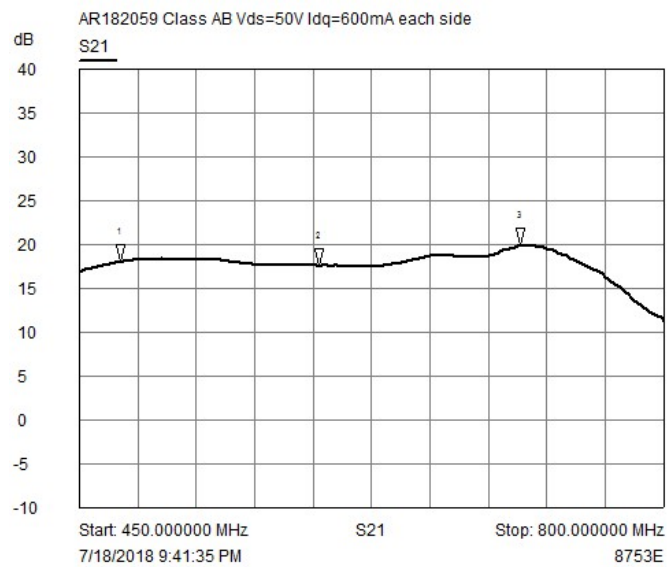
**Figure 9. AR182059 Small Signal S11 and S21**



1	S11	474.500000 MHz	-2.2049 dB
2	S11	593.500000 MHz	-1.9379 dB
3	S11	714.250000 MHz	-8.4696 dB

S11 Vds=50V  
Idq. =600mA. (each side)

BLF989 Class AB  
S11 Vds=50V Idq=600mA Each Side



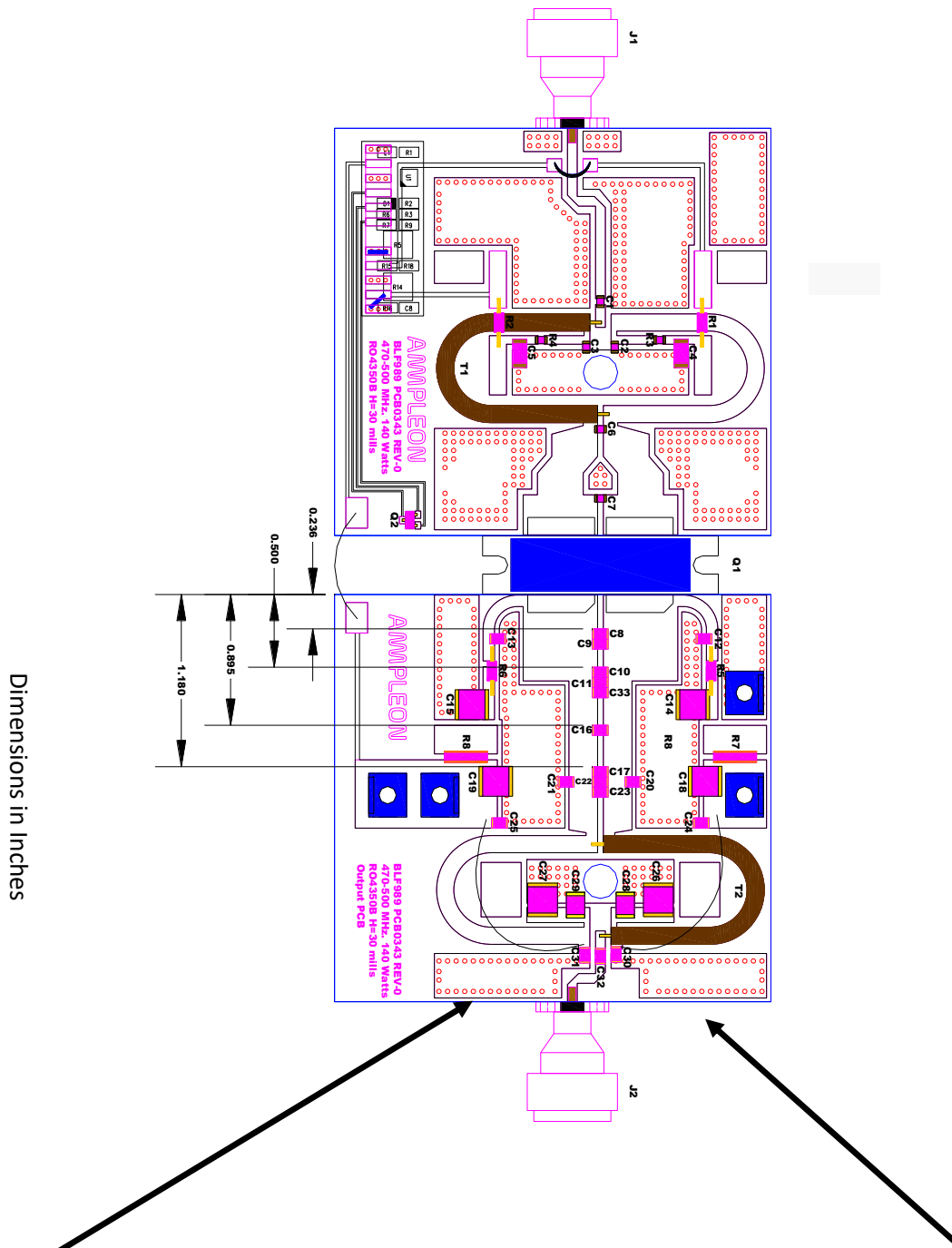
1	S21	474.500000 MHz	18.0691 dB
2	S21	593.500000 MHz	17.5773 dB
3	S21	714.250000 MHz	19.8093 dB

S21 Vds=50V      Idq.  
=600mA. (each side)

BLF989 Class AB  
S21 Vds=50V Idq=600mA Each Side

## 10 AR182059 BLF989 Class AB PCB Layout

Figure 10. AR182059 BLP989 PCB Assembly Layout



#14 or #16 AWG Insulated  
wire to support drain  
currents

#14 or #16 AWG Insulated  
wire to support drain  
currents

## 11 BLF989 Class AB BOM

Table 10. AR182059 BLF989 Class AB Amplifier BOM

Designator	Description	Manufacturer	Part#
PCB Input PCB	Input PCB, 30 mil thk. RO4350B	Avanti Circuits	PCB0343 Rev.0
PCB Output PCB	Input PCB, 30 mil thk. RO4350B	Avanti Circuits	PCB0343 Rev.0
Input Base Plate	Input Brass Carrier 2.8" X 3"	Jones Machine	SMI0018 4350 Input
Output Base Plate	Output Brass Carrier 2.8" X 3"	Jones Machine	SMI0019 4350 Output
	Dual LDMOS Bias Board	Ampleon	
C1, C2, C3	100 pf. 0805 case (A2)	Passive Plus	0805N101JW251X
C4, C5	4.7 uF, 50V SMT 1210 case	TDK	C3216X5R1H475M160AB
C6	12 pf. 0805 case (C1)	Passive Plus	0805N120JW251X
C7	18 pf. 0805 case (G1)	Passive Plus	0805N180JW251X
C8, C9, C20, C21 *Vert. Mount	12 pf. N1111 case	Passive Plus	1111N120JW501X
C10, C11, C16, C33 *Vert. Mount	8.2 pf. N1111 case	Passive Plus	1111N8R2BW501X
C17, C22*Vert. Mount	5.6 pf. N1111 case	Passive Plus	1111N562BW501X
C23*Vert. Mount	0.5 pf. N1111 case	Passive Plus	1111N0R5BW501X
C12, C13, C24, C25, C30, C31, C32 *Vert. Mount	100 pf. N1111 case	Passive Plus	1111N101JW501X
C14, C15, C18, C19, C26, C27	4.7 uF, 100V SMT XR7 2220 case	TDK	C5750X7R2A475K230KA

C28, C29	0.01uf. 500V 1812 case	Vishay	VJ1812Y103KXEAT5Z
Q1	LDMOS	Ampleon	BLF989
Q2 *Mount Upside Down	2N2222 NPN transistor	Fairchild	MMBT2222
R1, R2	100-ohm wire wound axial	Ohmite	Order from Digii-Key
R3, R4	5.6-ohm 1206 case	Panasonic or equiv.	
R5, R6	10-ohm wire wound axial		Ordered from Mouser
R7, R8	0.005-ohm, 1% (3008 case)	Susumu	RL7520WT-R005-F
T1, T2	60mm. (2.36" long outer shield) 25-ohm Balun	E Z Form Cable	Semi Rigid Coax EZ 90-25 (copper jacket)

Input and Output N connectors: Huber+Suhner Part #: 22641166 Type: 23 N-50-0-16

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