Document information

Info	Content
Status	General Publication
Author(s)	Tyler Ware
Abstract	Measurement results of the BLF989 LDMOS Device in Board #AR192124 tuned for 470-700MHz at 50V

1 Revision History

Table 1. Report revisions

Revision No.	Date	Description	Author
1.0	20180608	Initial document	Tyler Ware
2.0	20220426	Updated Security Status	Tyler Ware

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3 List of Figures

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5 General Description

This report presents the measurement results Demo Board AR192124 using the BLF989. The demo achieves ≥ 59.4dBm Pulsed at 470-700MHz.

6 Biasing

6.1 Bias Details

VDD =50V
IDQ =1200mA (600mA each side)

7 Test Bench Set Up

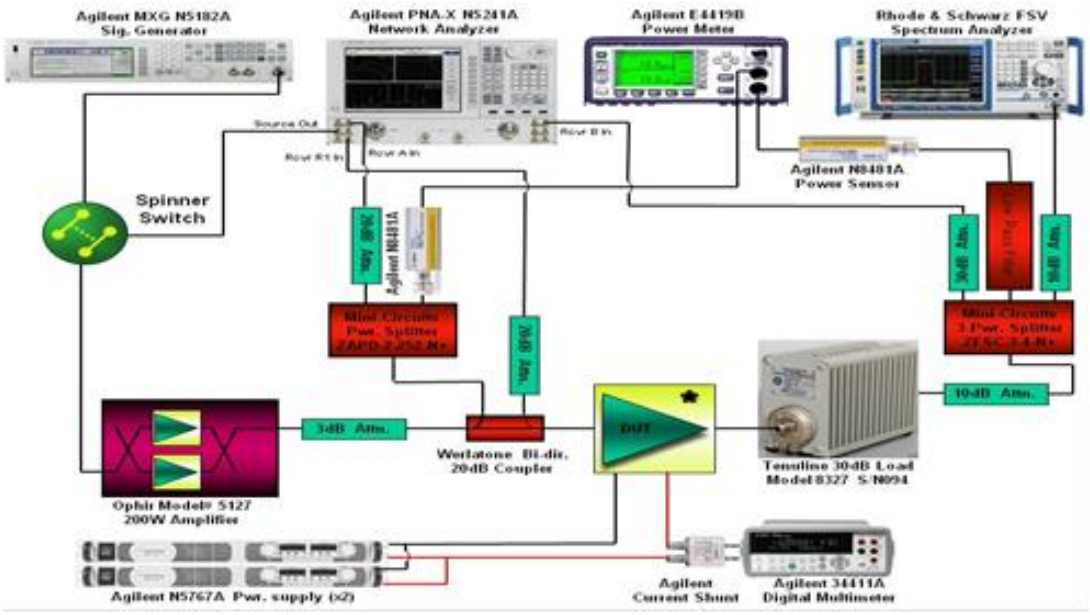

Figure 1.Test Bench Equipment set up

Demo was screwed down to a liquid cold plate for testing

8 Performance Summary

Table 2. RF Performance, Frequency = 470-700MHz, 100uS Pulse Width 10% Duty

Parameter	Measurement	Unit
Specified frequency	600	MHz
Drain voltage	50	V
Quiescent drain current	1200 (600 each side)	mA
Pulse P6dB	916	W
Pulse Efficiency at P6dB	62.3	%
Pulse Gain at P6dB	14.38	dB

The BLF989 is a 900W LDMOS RF power transistor for broadcast Doherty, class-AB transmitter and industrial applications. The excellent ruggedness of this device makes it ideal for digital and analog transmitter applications in the frequency range from 400MHz to 860MHz.

AR192124	50V 1200mA			
Pulse Drive Up Data 100uS Pulse Width 10% Duty Cycle				
Freq(MHz)	P1.0dB	Pout(W)	P1dB Gain (dB)	P1dB Eff(%)
470	58.40	691.83	20.01	62.84
500	58.24	666.81	20.70	67.23
550	57.98	628.06	20.08	61.33
600	58.35	683.91	19.44	59.38
650	58.12	648.63	20.11	58.05
700	57.92	619.44	20.40	51.33
	P2.0dB	Pout(W)	P2dB Gain(dB)	P2dB Eff(%)
470	58.84	765.60	19.00	62.52
500	58.70	741.31	19.70	68.60
550	58.44	698.23	19.09	62.05
600	58.83	763.84	18.45	61.10
650	58.53	712.85	19.12	59.24
700	58.41	693.43	19.40	52.98
	P3.0dB	Pout(W)	P3dB Gain(dB)	P3dB Eff(%)
470	59.06	805.38	18.01	61.77
500	58.95	785.24	18.68	68.13
550	58.79	756.83	18.09	62.20
600	59.13	818.46	17.44	62.03
650	58.82	762.08	18.11	59.84
700	58.74	748.17	18.38	53.82
	P4.0dB	Pout(W)	P4dB Gain(dB)	P4dB Eff(%)
470	59.21	833.68	16.97	60.35
500	59.10	812.83	17.68	67.23
550	59.06	805.38	17.08	62.18
600	59.33	857.04	16.43	62.15
650	59.03	799.83	17.08	59.86
700	58.96	787.05	17.42	54.07
	P5.0dB	Pout(W)	P5dB Gain(dB)	P5dB Eff(%)
470	59.34	859.01	15.98	60.17
500	59.22	835.60	16.68	66.87
550	59.28	847.23	16.07	61.93
600	59.49	889.20	15.44	62.30
650	59.20	831.76	16.11	60.01
700	59.14	820.35	16.42	54.23
	P6.0dB	Pout(W)	P6dB Gain(dB)	P6dB Eff(%)
470	59.42	874.98	14.99	59.92
500	59.32	855.07	15.73	66.67
550	59.44	879.02	15.07	61.68
600	59.62	916.22	14.38	62.30
650	59.35	860.99	15.09	60.07
700	59.29	849.18	15.38	54.38

9 Performance Details

9.1 Small Signal Results

Vdd=50V, Idq=1200mA (600mA each side), Pin=10dBm

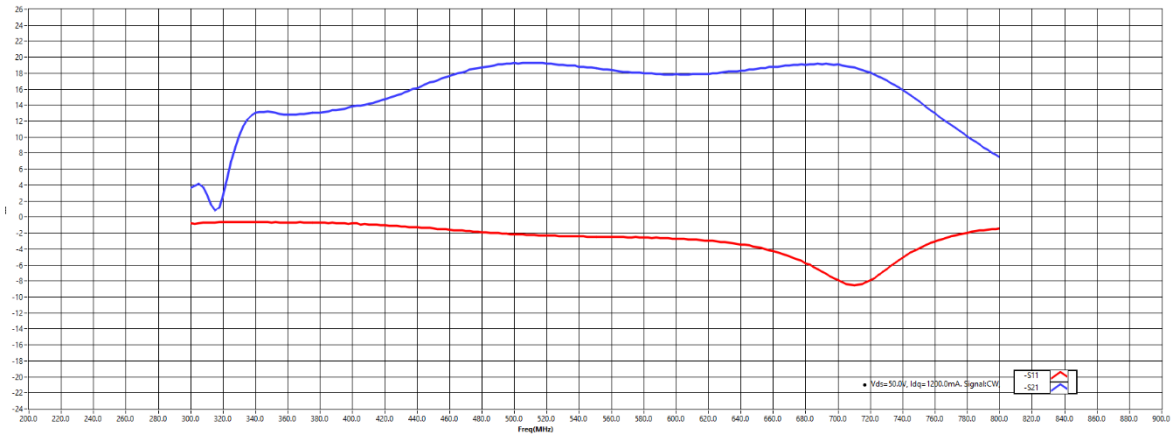

Figure 2. Small Signal results, Vdd=50V, Idq=1200mA (600each side), Pin=10dBm

9.1 Pulse Gain

Vdd = 50V, Idq=1200mA (600mA each side), 100uS Pulse Width 10% Duty, Frequency=470-700MHz

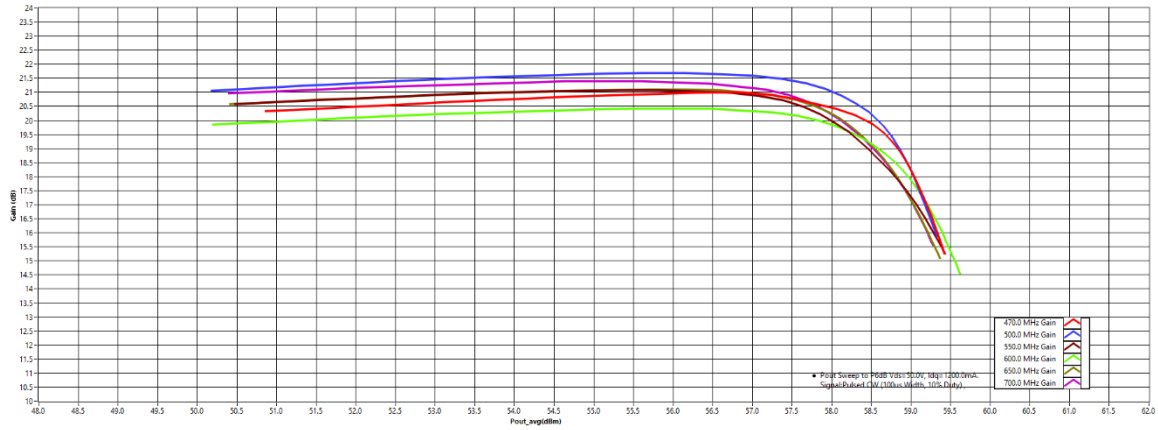

Figure 3. Pulse Gain (dB) vs Power Out(dBm)

9.1 Pulse Efficiency

Vdd = 50V, Idq=1200mA (600mA each side), 100uS Pulse Width 10% Duty, Frequency=470-700MHz

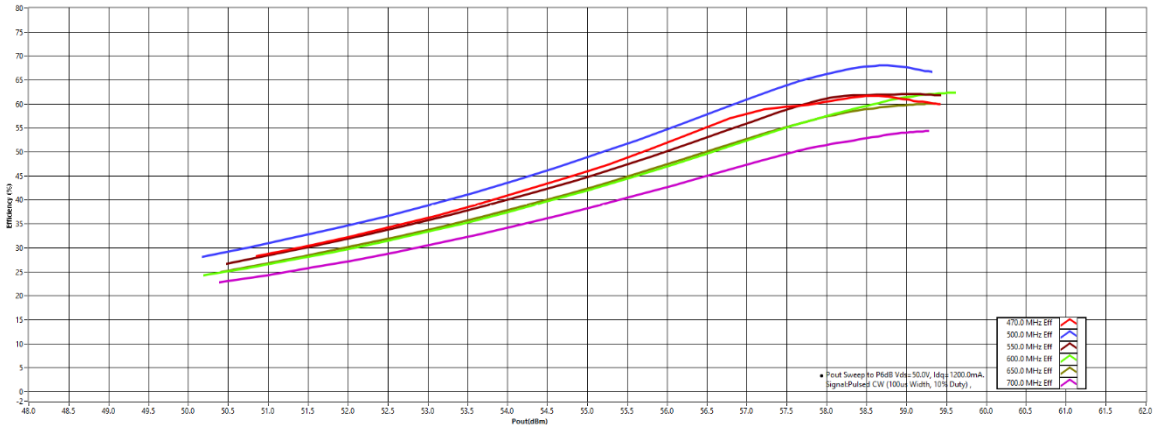

Figure 4. Pulse Efficiency(%) vs Power Out(dBm)

10 Pulse Fixed Power Out Results

10.1 Pulse Output Power v Frequency at P1dB

Vdd = 50V, Idq=1200mA (600mA each side), 100uS Pulse Width 10% Duty, Frequency=470-700MHz, **Pout=P1dB**

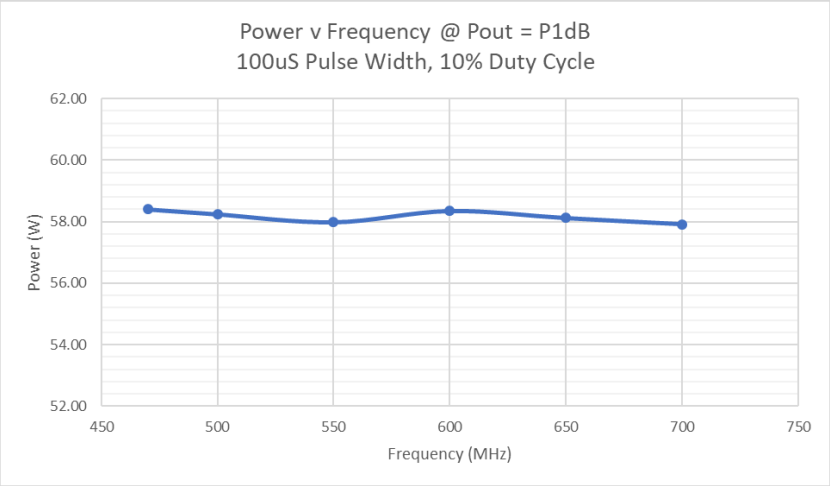

Figure 5. Output Power v Frequency at Pout=P1dB

10.2 Pulse Output Power v Frequency at P6dB

Vdd = 50V, Idq=1200mA (600mA each side), 100uS Pulse Width 10% Duty, Frequency=470-700MHz, **Pout=P6dB**

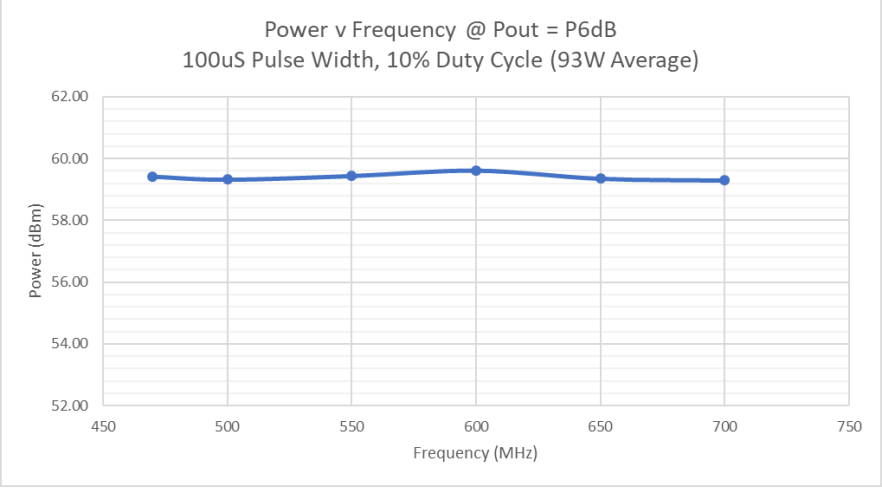

Figure 6. Output Power v Frequency at Pout=P6dB

10.3 Pulse Gain v Frequency at P6dB

Vdd = 50V, Idq=1200mA (600mA each side), 100uS Pulse Width 10% Duty, Frequency=470-700MHz, **Pout=P6dB**

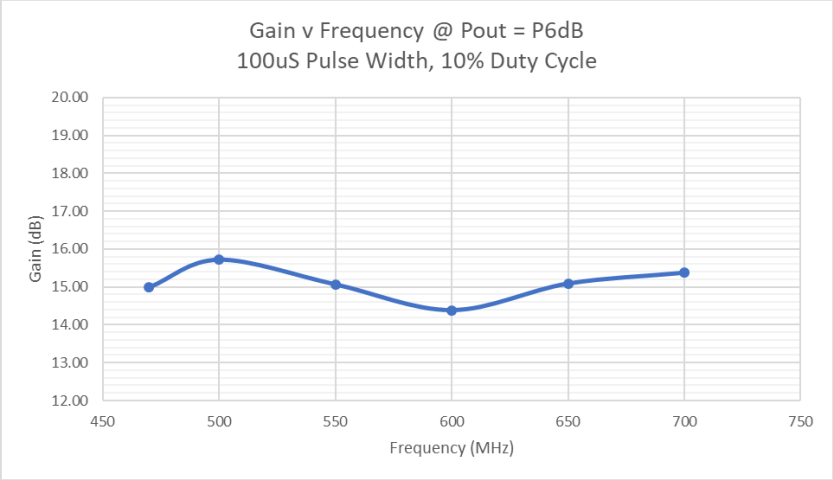

Figure 7. Pulse Gain(dB) vs Power Out(dBm) at P6dB

10.4 Pulse Efficiency v Frequency at P6dB

Vdd = 50V, Idq=1200mA (600mA each side), 100uS Pulse Width 10% Duty, Frequency=470-700MHz, **Pout=P6dB**

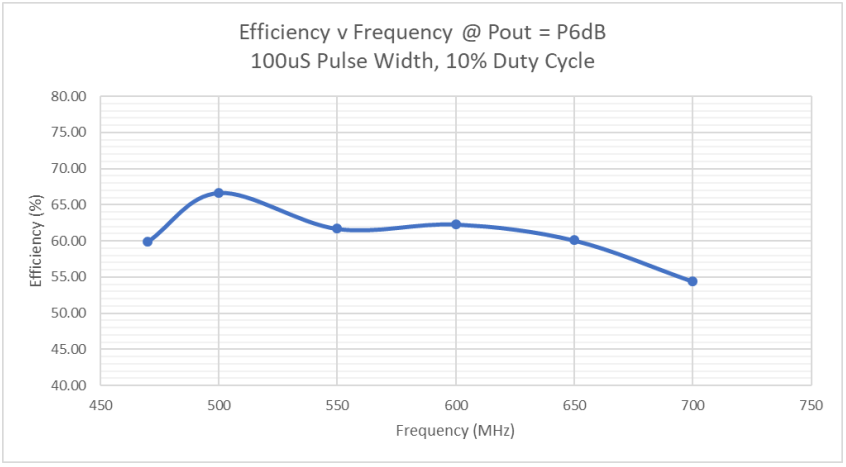

Figure 8. Pulse Efficiency(%) vs Power Out(dBm) at P6dB

11 Uncorrected DVB-T Signal Results

11.1 Uncorrected DVB-T ACPR Results (±4.3MHz offset)

Vdd = 50V, Idq=1200mA (600mA each side), ±4.3MHz offset, Frequency=470-700MHz, **Pout=42-52dBm**

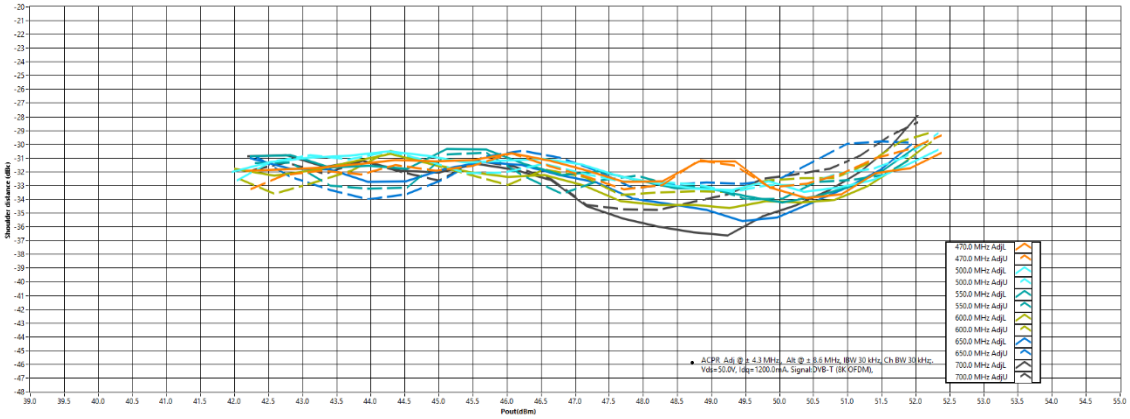

Figure 9. Uncorrected DVB-T ACPR Data (±4.3MHz offset)

11.2 Uncorrected DVB-T ACPR Results (±8.6MHz offset)

Vdd = 50V, Idq=1200mA (600mA each side), ±8.6MHz offset, Frequency=470-700MHz, **Pout=42-52dBm**

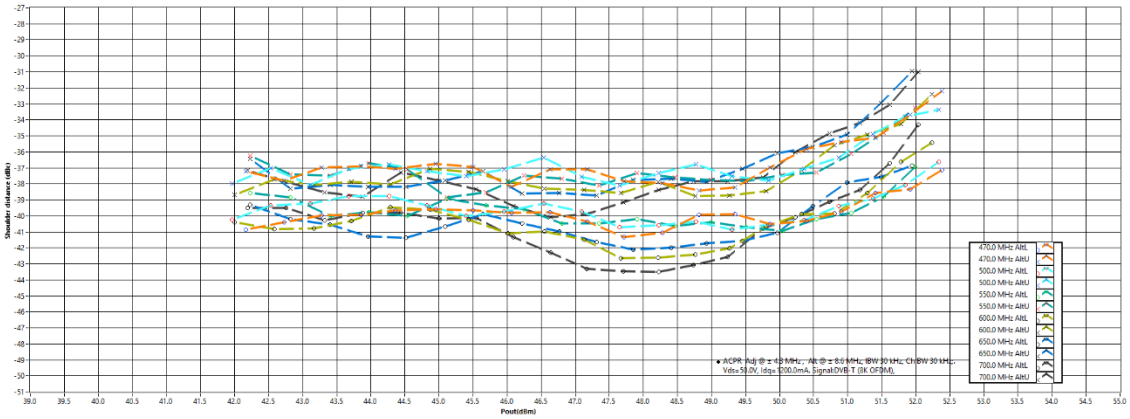

Figure 10. Uncorrected DVB-T ACPR Data (±8.6MHz offset)

11.3 Uncorrected DVB-T Signal Gain and Efficiency

Vdd = 50V, Idq=1200mA (600mA each side), Frequency=470-700MHz, **Pout=42-52dBm**

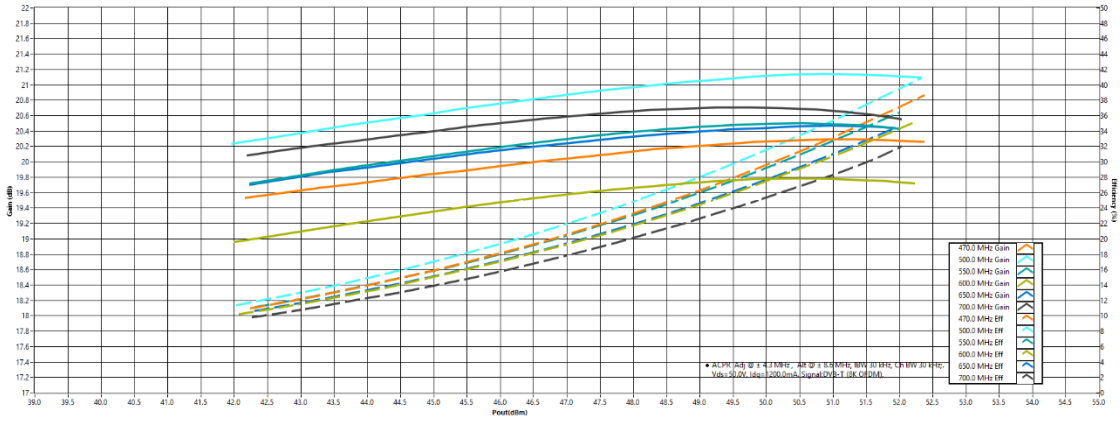

Figure 11. Uncorrected DVB-T Signal Gain and Efficiency Data

11.4 Uncorrected DVB-T Signal at Fixed Power Out

Vdd = 50V, Idq=1200mA (600mA each side), Frequency=470-700MHz, **Pout = 50, 51, and 52dBm**

	Uncorrected DVB-T Data @Pout=50dBm					
Freq(MHz)	Gain	Eff	Adj L (-4.3MHz)	Adj U (+4.3MHz)	Alt L (-8.6MHz)	Alt U (+8.6MHz)
470	20.27	29.59	-33.67	-33.48	-40.61	-36.61
500	21.12	31.58	-32.60	-32.75	-40.34	-37.61
550	20.50	29.22	-34.36	-34.38	-41.24	-37.14
600	19.78	27.52	-34.00	-32.35	-40.17	-38.14
650	20.44	27.72	-35.24	-32.69	-41.17	-35.87
700	20.70	25.37	-34.71	-32.23	-40.34	-36.83
	Uncorrected DVB-T Data @Pout=51dBm					
Freq(MHz)	Gain	Eff	Adj L (-4.3MHz)	Adj U (+4.3MHz)	Alt L (-8.6MHz)	Alt U (+8.6MHz)
470	20.29	33.23	-33.77	-32.12	-39.76	-35.30
500	21.14	35.40	-32.80	-31.72	-39.03	-36.18
550	20.49	32.71	-33.12	-32.71	-39.91	-36.05
600	19.78	30.77	-33.71	-32.25	-39.62	-35.14
650	20.47	31.04	-33.09	-29.64	-37.54	-35.13
700	20.66	28.33	-32.48	-31.37	-38.68	-34.43
	Uncorrected DVB-T Data @Pout=52dBm					
Freq(MHz)	Gain	Eff	Adj L (-4.3MHz)	Adj U (+4.3MHz)	Alt L (-8.6MHz)	Alt U (+8.6MHz)
470	20.28	37.13	-32.00	-30.32	-38.56	-33.28
500	21.11	39.54	-31.14	-30.43	-37.63	-33.61
550	20.43	36.43	-30.13	-30.71	-36.76	-33.18
600	19.74	34.29	-30.67	-29.35	-35.97	-33.47
650	20.44	34.65	-29.64	-29.88	-36.65	-30.77
700	20.56	31.92	-27.95	-28.56	-34.43	-31.06

Figure 12. Uncorrected DVB-T Signal Fixed Power Out Data

12 Hardware

12.1 Board photograph

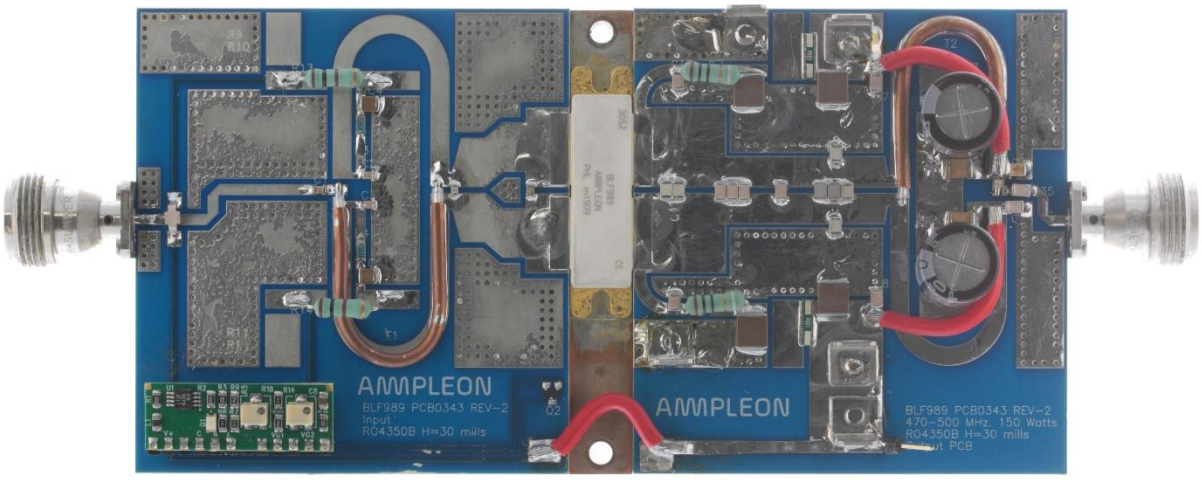

Figure 13. Board Photograph

12.2 PCB layout

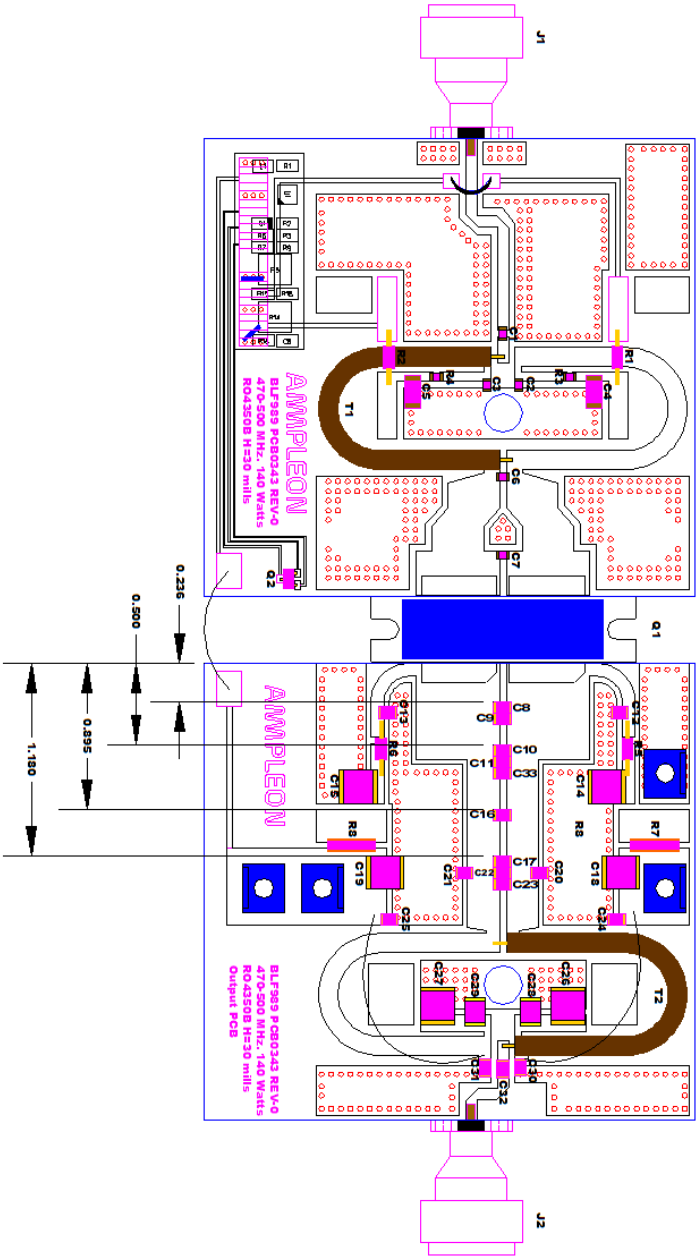

Figure 14. PCB Layout Board #AR192124

12.3 Bill of materials

Table 3. 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*, C11*	12 pf. N1111 case	Passive Plus	1111N120JW501X
C14*, C15*, C16*, C17*, C20*	8.2 pf. N1111 case	Passive Plus	1111N8R2BW501X
C21* See Note 1	4.7 pf. N1111 case	Passive Plus	1111N4R7BW501X
C10*, C24*, C25*, C26*	10 pf. N1111 case	Passive Plus	1111N100JW501X
C12*, C13*, C27*, C28*, C33*, C34*, C35*	100 pf. N1111 case	Passive Plus	1111N101JW501X
C36, C37	470 MFD./63V		Electrolytic
C38	Depop		
C39	3 pf. 0805 case (M0)	Passive Plus	0805N3R0BW251X
C18, C19, C22, C23, C29, C30	4.7 uF, 100V SMT XR7 2220 case	TDK	C5750X7R2A475K230KA
C31, C32	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 1 watt	Ohmite	
R3, R4	5.6-ohm 1206 case	AL N type	
R5, R6	10-ohm wire wound axial		
R7, R8	0.005-ohm, 1% (3008 case)	Susumu	RL7520WT-R005-F
R9, R10, R11, R12	332 ohms 1206 case	Panasonic or eqiv.	**AR182060 CLASS C BUILD ONLY.**
R13, R14	562 ohms 1206 case	Panasonic or eqiv.	**AR182060 CLASS C BUILD ONLY.**
T1, T2	60mm. (2.36" long outer shield) 25-ohm Balun	E Z Form Cable	Semi Rigid Coax EZ 90-25 (copper jacket)

Note 1: AR182060 ONLY C21 set at 4.7pf. Passive Plus N1111 optimized for max. Pload Class-C Peak Amp Side.

12.4 PCB materials

Table 4. Board Specifications

Parameter	Value
Manufacturer	Rogers
Type	4350B
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	BLF989
Date Code	PHL m1909

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