Application Measurement Report

AR152133 BLF188XR 64MHz Board #3137

Rev.1.0 —26 June 2015

Document information

Info	Content
Author	Scott Blum
Author Role	Application Engineer
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Abstract	This report documents the performance and tune of the BLF188XR for a 1.5T MRI system at 63.86MHz.

Revision History

Revision	Date	Description	Author
1.0	2015 June 26	Initial version	Scott Blum

Contents

1. Introduction

1.1 General Description

This report documents the performance and tune of the BLF188XR for a 1.5T MRI system at 63.86MHz. This is board #3137. The board is designed to achieve high pulse power while achieving a reasonable efficiency.

1.2 Photo

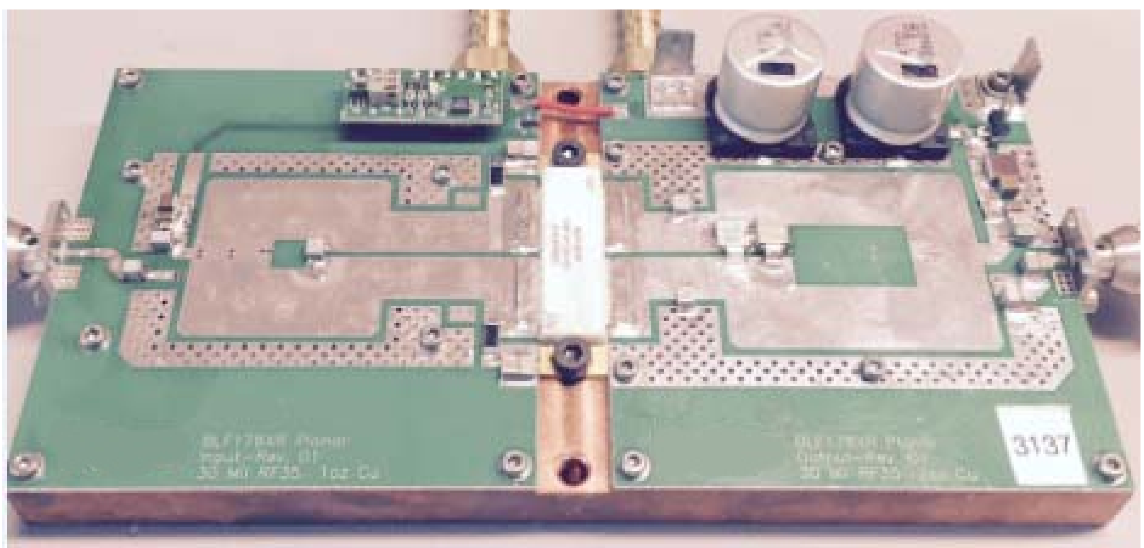

Fig 1. Board Photo

2. Performance Summary

Voltage	P1dB (dBm / W)	Efficiency at P1dB (%)	Gain at P1dB (dB)
46.5	61.93 / 1559	62.5	25
48	62.14 / 1636	62	25
50	62.31 / 1702	60	25
51	62.35 / 1717	59	25.1
52	62.39 / 1734	58	25.1
54	62.36 / 1722	55	25.2

Pulse Condition: 100mA, 6mS, 8% at 63.86MHz.

3. Test Matrix and Spec Targets

Pulse Condition:	6mS, 8% at 63.86MHz
Voltage supply:	46.5V, 48V, 50V, 51, 52, 54V
P1dB goal:	1400W with 1500W target
Efficiency goal:	greater than 60%. Power is more important
IDQ:	100mA
Dynamic range:	As broad as test setup accurately allows

4. Performance

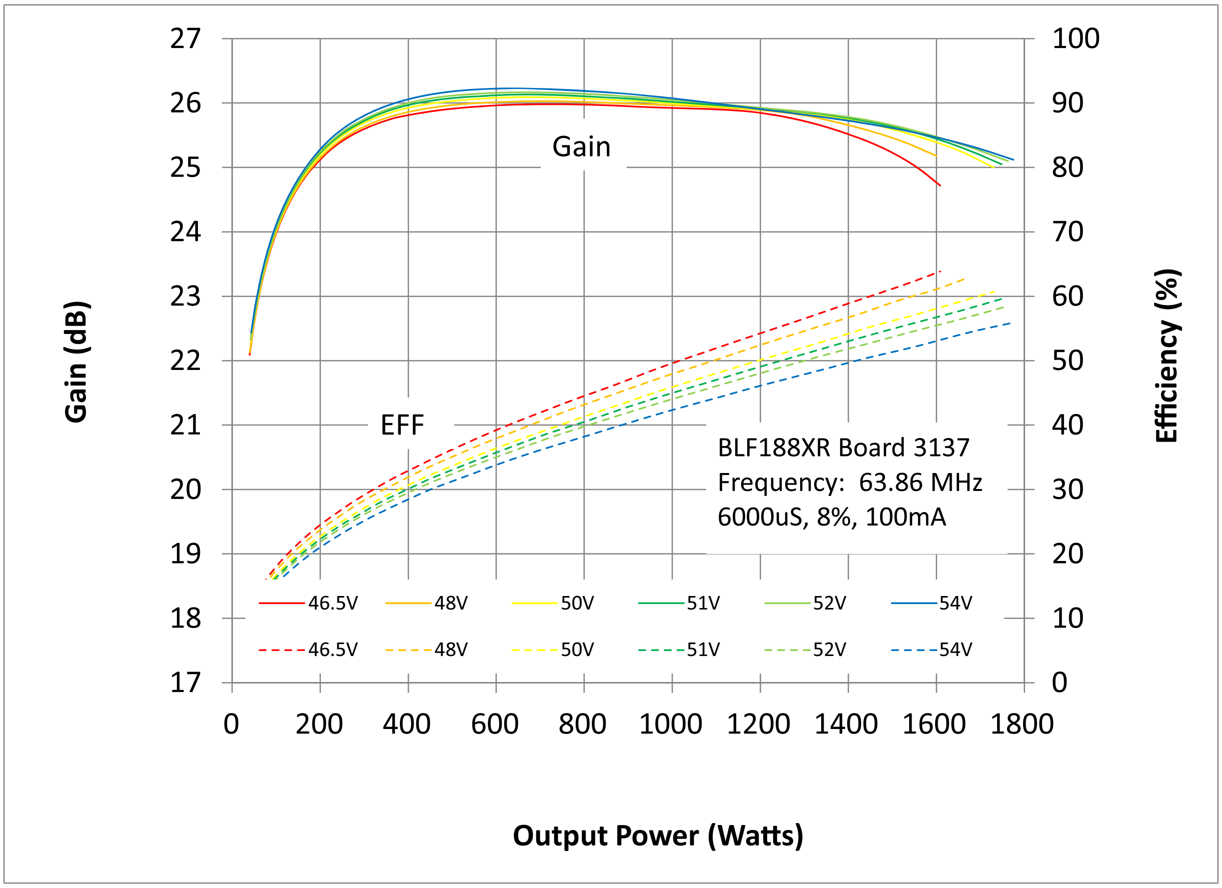

Fig 2. Gain and Efficiency as a function of Output Power with varying Drain Voltage – 6mS, 8%

5. Layout

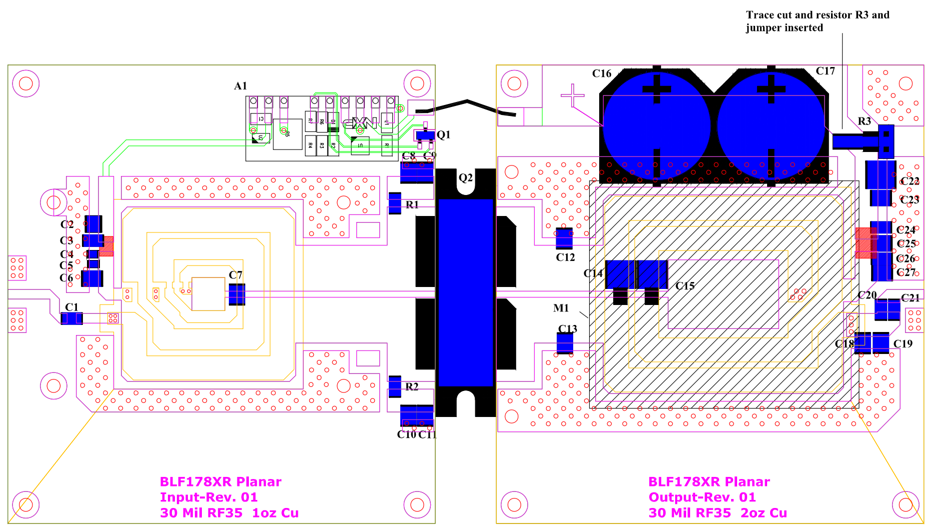

Fig 3. Layout (see Autocad attachment)

6. Tuning Areas

The strongest tuning areas are the locations near the output transformer and the shunt capacitors near the output connector. These are the C13, C14, C18, and C19 components. In general, more power can be obtained by adding capacitance in the C18 and C19 areas. It is harder than expected to gain more efficiency by lowering C18 and C19, however. There is also a slight increase in power and efficiency when making the input cap C7 a little higher, up to 390pF. The 300pF was used in order to keep the values the same as for board #3138 as reported in CA-112-15.

7. Bill of Materials

Component	Description	Value	Remarks
A1	LDMOS bias module		Ampleon CA-330-11
Input PCB	Input PCB 30 mil thk. RF35	Ohio Circuits	BLF178XR Planar Input - Rev.01
Output PCB	Output PCB 30 mil thk. RF35	Ohio Circuits	BLF178XR Planar Output - Rev.01
Q1	2N2222 NPN Transistor	Fairchild	MMBT2222
Q2	BLF188XR	Ampleon	BLF188XR
C1	56 pF	Passive Plus	1111N
C2	10 uF	Murata	GRM32DF51H106ZA01L
C3	1 uF	Murata	GRM31CR72A105KA01L
C4	100 nF	Multicomp	S0805W104K1HRN-P4
C5	10nF	Multicomp	U0805R103KCT
C6, C20, C21, C27	1000 pF	Passive Plus	1111N
C7	300 pF	Passive Plus	1111N
C8,C10	100nF	AVX	12101C104KAT2A
C9,C11	10 nF	TDK	C3225C0G2E103J
C12, C13	39 pF	Passive Plus	1111N
C14	47 pF MICA	Cornell Dubilier CDE	MIN02-002E470J
C15	150 pF MICA	CDE cap	MIN02-002E151J
C16, C17	470 uF	Electrolytic	Panasonic PCE3667CT-ND
C18	51 pF	Passive Plus	1111N
C19	75 pF	Passive Plus	1111N
C22	10uF	TDK	C5750X7R1H106M
C23	2.2 uF	Murata	GRM32ER72A225KA35L
C24	1uF	Murata	GRM31CR72A105KA01L
C25	100 nF	Murata	GRM31CR72E104KW03L
C26	10 nF	TDK	C3225C0G2E103J
R1,R2	Resistor, 5% 75W AlN, 2010	20 Ohms	IMS NDC-2010WA200J
R3	Resistor, 1% 100ppm MF, 2W, 3008	0.005 Ohms	Susumu RL7520WT-R005-F
PCB	Taconic RF35-TC		Er = 3.5, 30 mils thick, 1oz
M1, Thermal pad	0.2" Chomerix Therm-a-gap 976		61-20-0404-976

Figure 6. BLF188XR Board 3137 Material List

8. Copper Baseplate

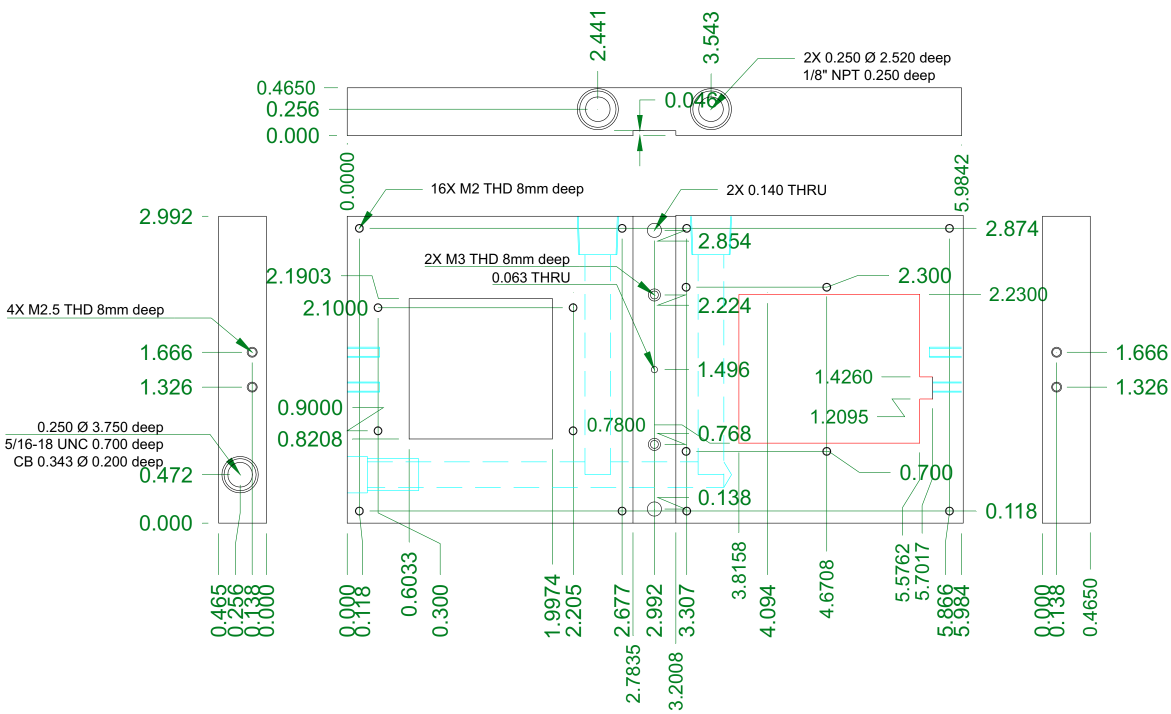

Fig 4. Baseplate Dimensional Drawing (see Autocad attachment)

9. Peak Current Sense Notes

In order to accurately measure the pulsed efficiency, peak current needs to be measured during the pulse. This is accomplished using an Agilent 34411A DMM. The voltage drop is measured over a precision 5mOhm resistor, and V/R calculations are done to calculate the current. The drain bias trace includes a series resistor with pins around the resistor to enable this measurement. A cut was made, and the resistor was inserted in between the electrolytic capacitors and the ceramic capacitors. This is in between C17 and C22 in the layout shown earlier.

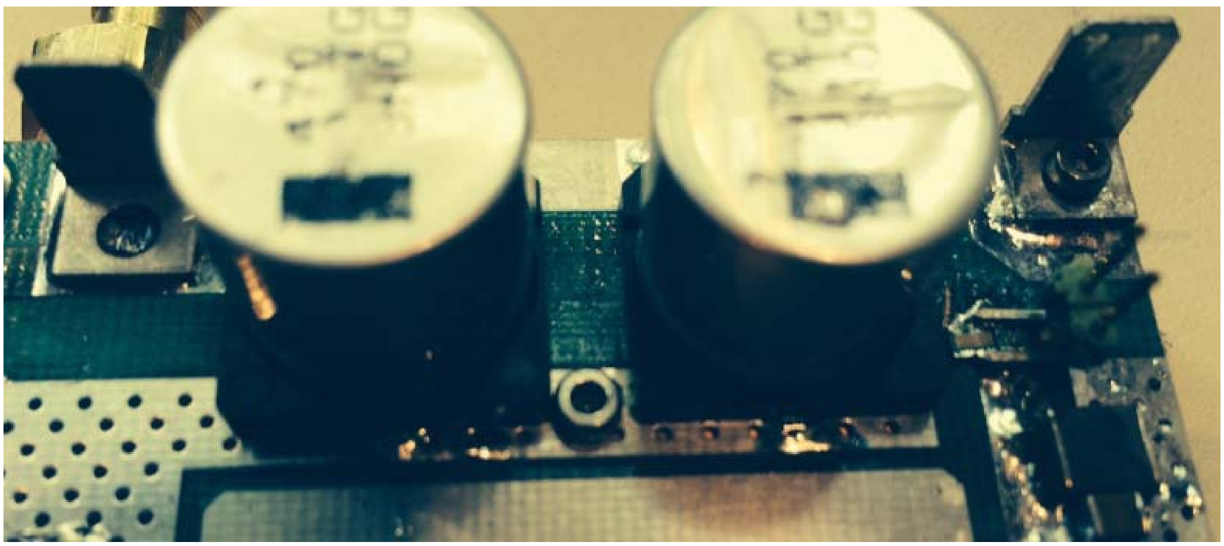

Fig 5. Details of changes to allow for peak current measurements

10. Test Setup

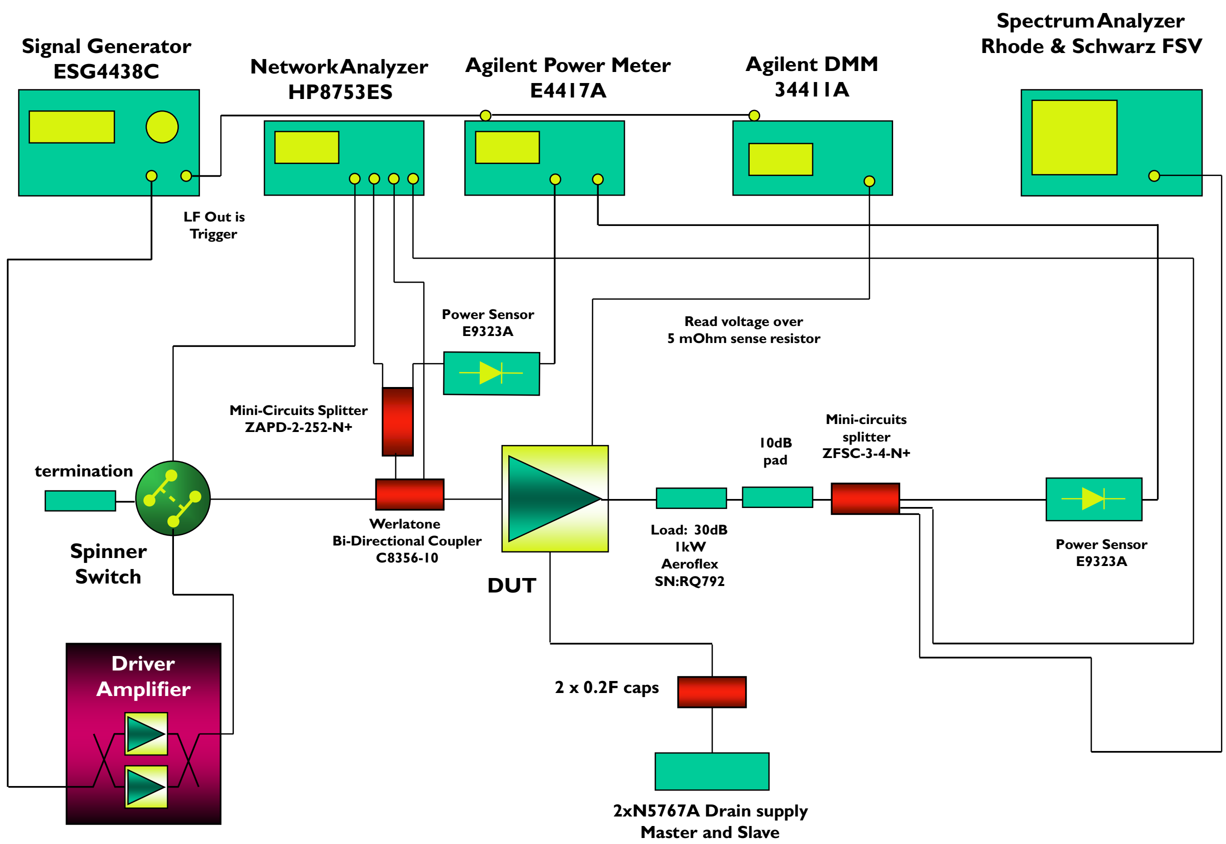

Fig 6. Test Setup

The pulse is set for 6mS, 8% on the signal generator. The signal generator LF Output provides the triggering signal for the peak power meter and the DMM. The automation code allows for a flexible setting of the measurement aperture for current and power readings. These were set to be 5 mS windows, so that almost the entire signal was integrated, while not measuring the pulses during the rise and fall times, which would hurt the accuracy.

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