

AR161014

BLF188XR, 41MHz

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AMPLEON

Application
Measurement
Report

Document information

Status	company confidential
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Abstract	Measurement results of a Class C design for the 41MHz band with the BLF188XR

1. Revision History

Table 1: Report revisions

Revision	Date	Description	Author
1.0	18032016	Initial document	Hans Kartman

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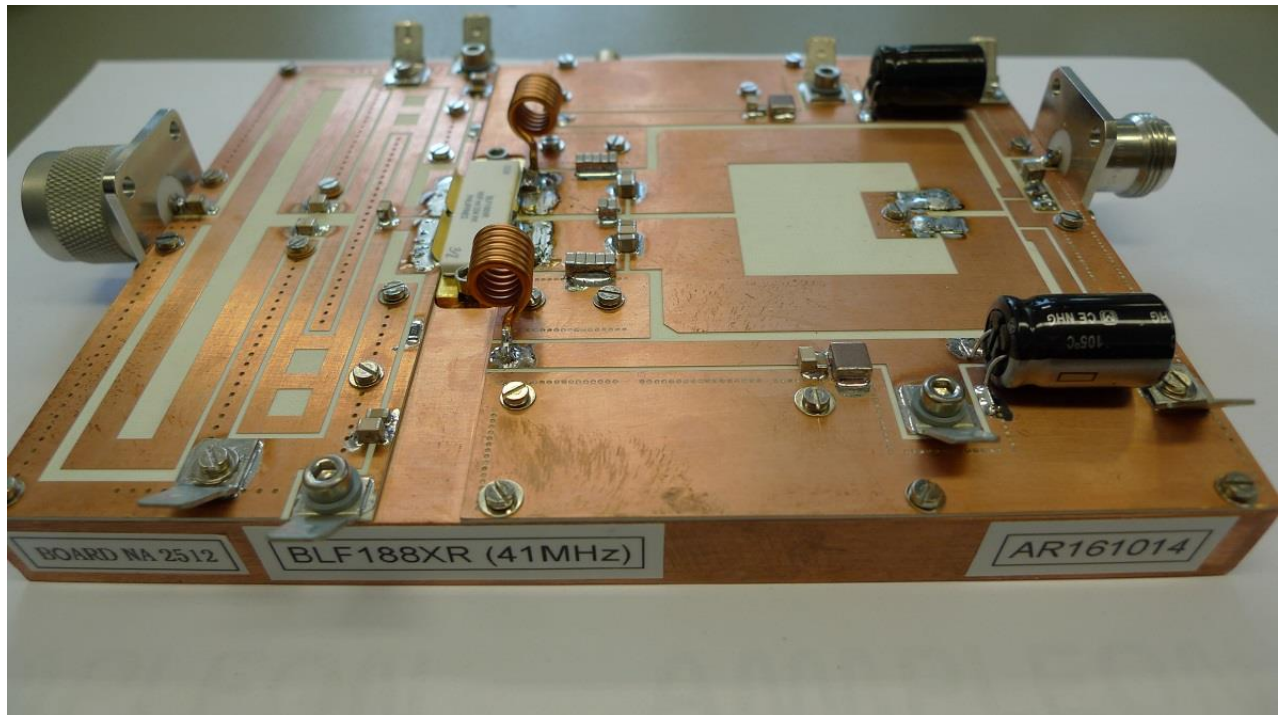
3. General description

This report presents the measurement results of the Class C demo AR161014. The device used is a BLF188XR, 6th generation extremely rugged LDMOS transistor in a ceramic push-pull package. The presented demo is tuned for 41MHz.

The amplifier demo is primarily developed to generate RF power for CO₂ lasers and plasma chambers.

The demo amplifier should be supplied with adequate cooling of the transistor and the circuit. For this purpose the baseplate is equipped with a water channel.

Below a picture of the demo is shown.



4. Biasing

The Amplifier was designed for use at $V_{ds}=50\text{Volts}$ primarily. At this bias condition the amplifier is capable of producing 1200 Watts, under pulsed as well as under full CW conditions.

Alternate measurements were done at $V_{ds}=30\text{Volt}$, because of the requirement to produce about 400Watts CW or pulsed with high efficiency. By reducing the V_{ds} to 30 Volts and keeping the I_{dq} at 200 mA this requirement can be met.

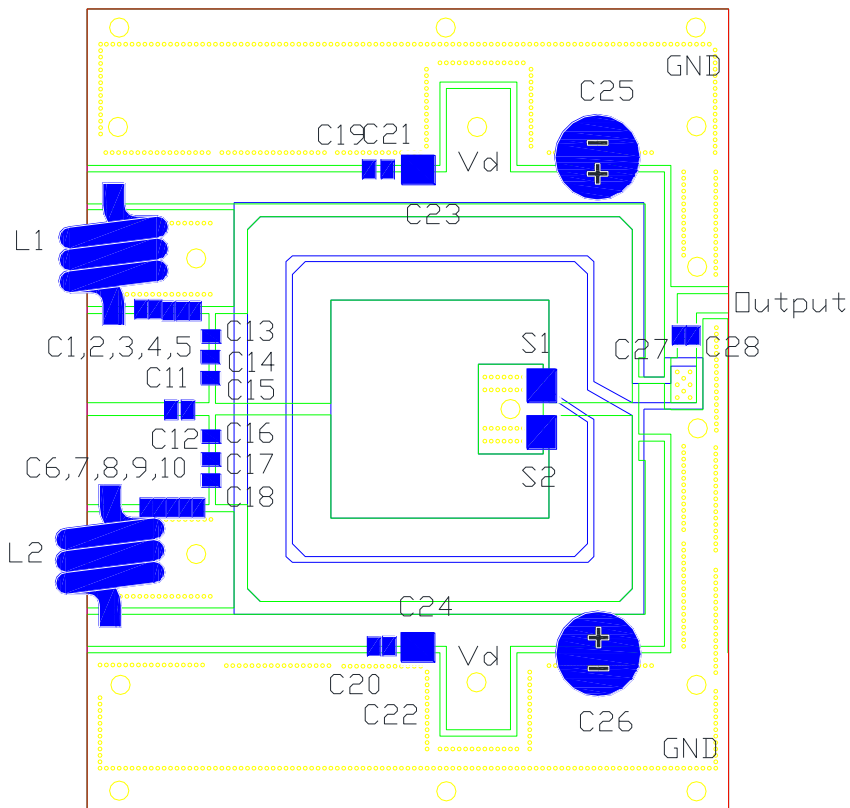
The biasing is as follows:

$$\begin{aligned} V_{ds} &= 50\text{V} / 30\text{V for power reduced to 400Watts} \\ I_{dq} &= 200\text{mA total} \end{aligned}$$

To set the I_{dq} to the appropriate value the gate voltage is first set to 0 Volts, then the drain supply voltage is switched on. Next the gate voltage is slowly increased to the voltage where the I_{dq} is 200mA. The gate voltage for this I_{dq} level is around 1.6 Volts.

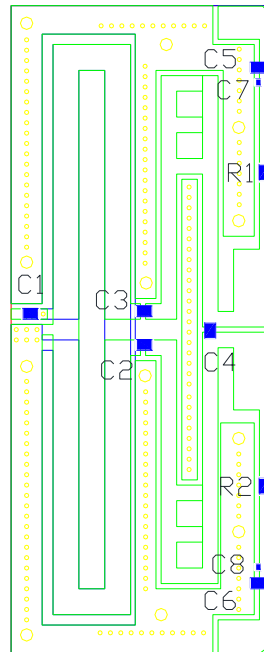
5. Layout drawings and components

Output circuit:



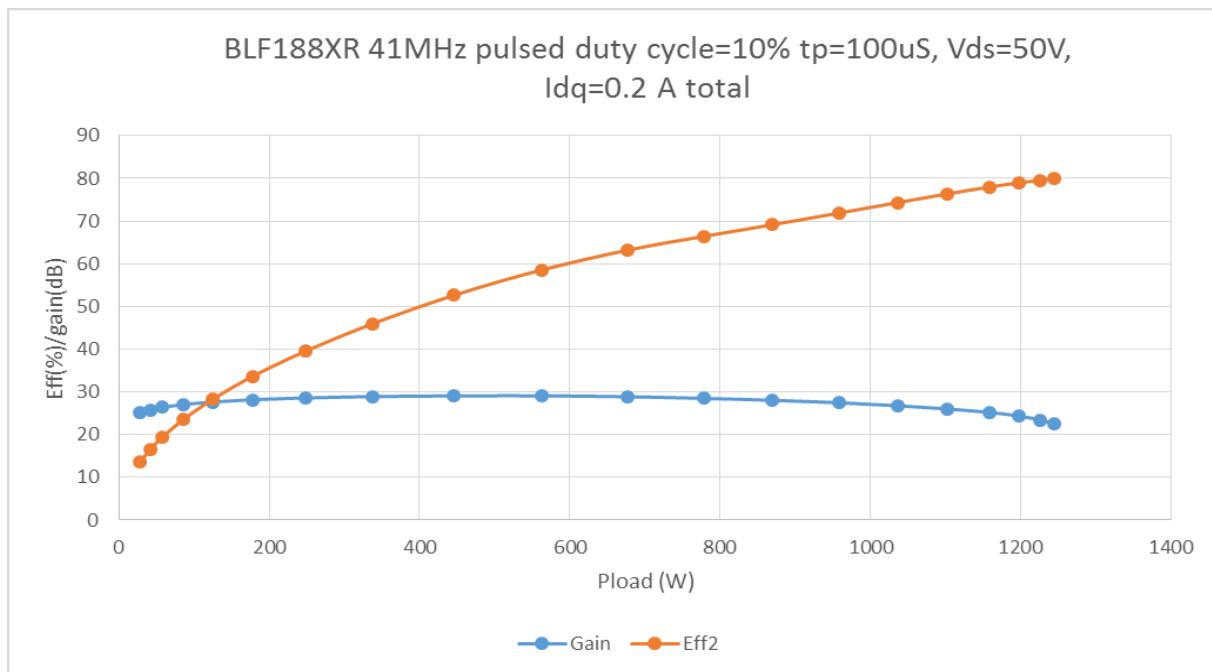
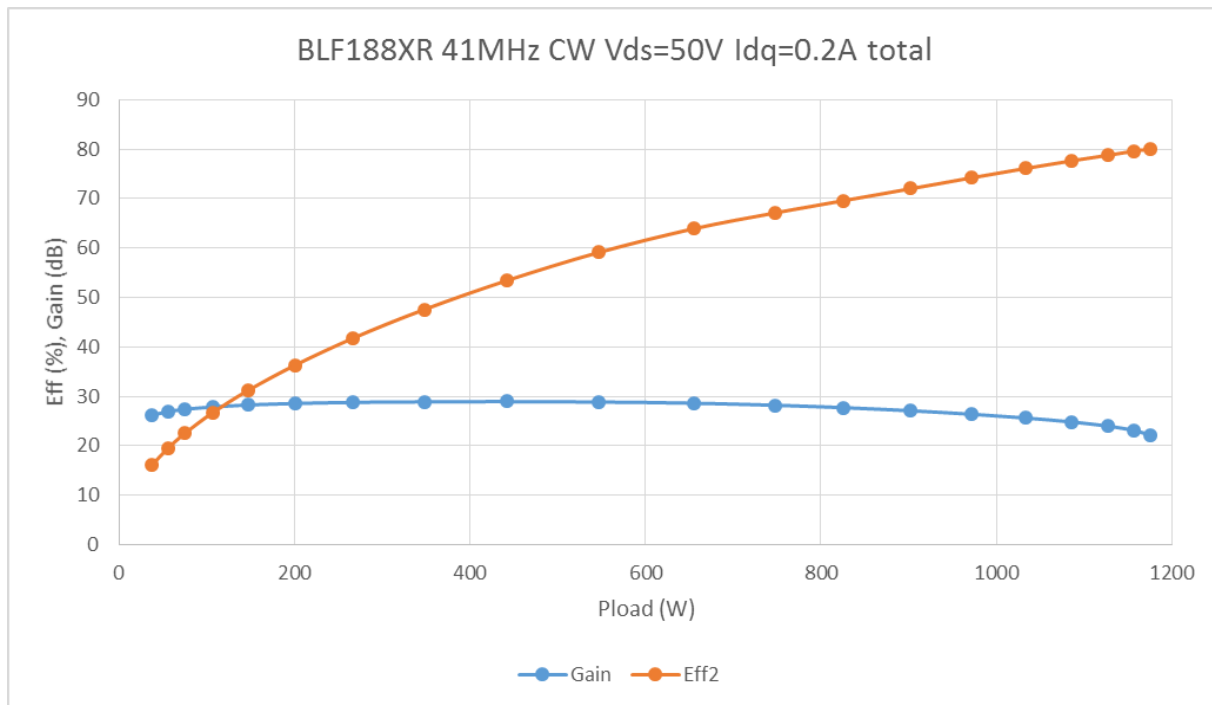
Output Board			
Comp	Value	manufacturer	Remarks
C1	30pF	ATC	800B
C2,C3	47pF	ATC	800B
C4,C5	82pF	ATC	800B
C6,	30pF	ATC	800B
C7,C8	47pF	ATC	800B
C9,C10	82pF	ATC	800B
C11,	15p	ATC	800B, 15mm from transistor case edge
C12	12p	ATC	800B
C13,C18	82p	ATC	800B
C14,C17	1nF	ATC	100B
C15,C16	220pF	ATC	800B
C19, C20	1nF	ATC	100B, 44mm from left edge board, not critical
C21,C22	100nF	TDK	Ceramic multilayer
C23,C24	4.7uF	TDK	Cer
C26,C26	470uF	Elro	63V Electrolytic
C27,C28	1nF	ATC	800B
L1, L2	Aircoil 6turns, 6mm diameter		Enamel 1mm copper wire
Board	Ro 4350	Rogers	Er=3.5
Thermal conductor under Balun	Thermipad TP22626	Mueller Ahlhorn	
Baseplate	Copper with cooling channel		Cavities for coplanar baluns are 5mm deep

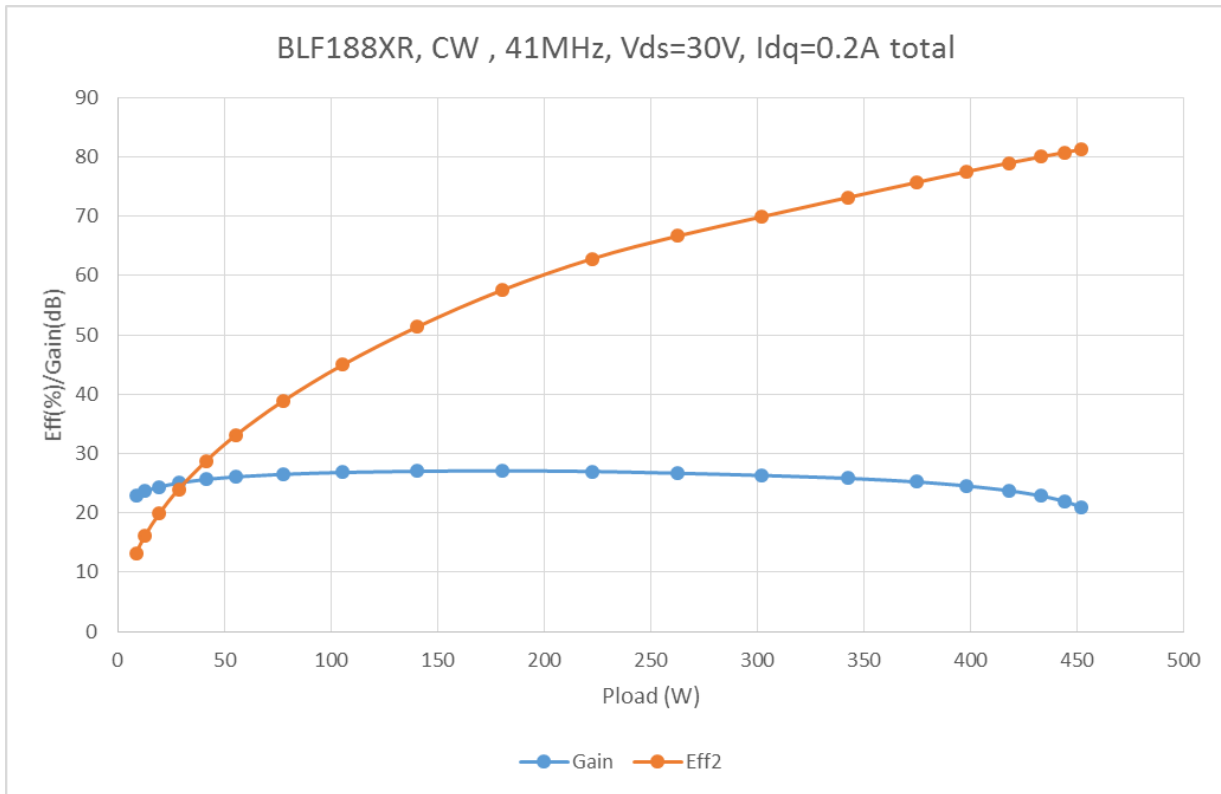
Input circuit:



Input Board			
Comp	Value	manufacturer	remarks
C1	560pF	ATC	100B
C2	470pF	ATC	100B
C3	470pF	ATC	100B
C4	100pF	ATC	100B
C5	100n	ATC	100B
C6	100n	ATC	100B
C7,C8	1n	ATC	100B
R1	22Ohm		0812
R2	22Ohm		0812
Board	Ro 4350	Rogers	Er=3.5

6. Measurement results.





7. Mismatch/Ruggedness testing

This amplifier uses the extremely rugged BLF188XR LDmos transistor to make it capable of withstanding high VSWR mismatch loads. VSWR ruggedness testing is done using a phase unit capable of VSWR >65:1. As the phase unit cannot do 360 degrees phase, the phase is shifted in steps by using some lengths (up to 2 meters of RG214 in series with the phase unit to be able to test the full smithchart perimeter. As the operating frequency is low the losses of this added cable are low, resulting in high VSWR test values. The lower VSWR values are produced by using attenuators between the demo amplifier and the phase unit.

Testing is always done in pulsed mode because full CW testing would result in extreme thermal stress of the amplifier as well as the transistor.

Test results are given in the table below.

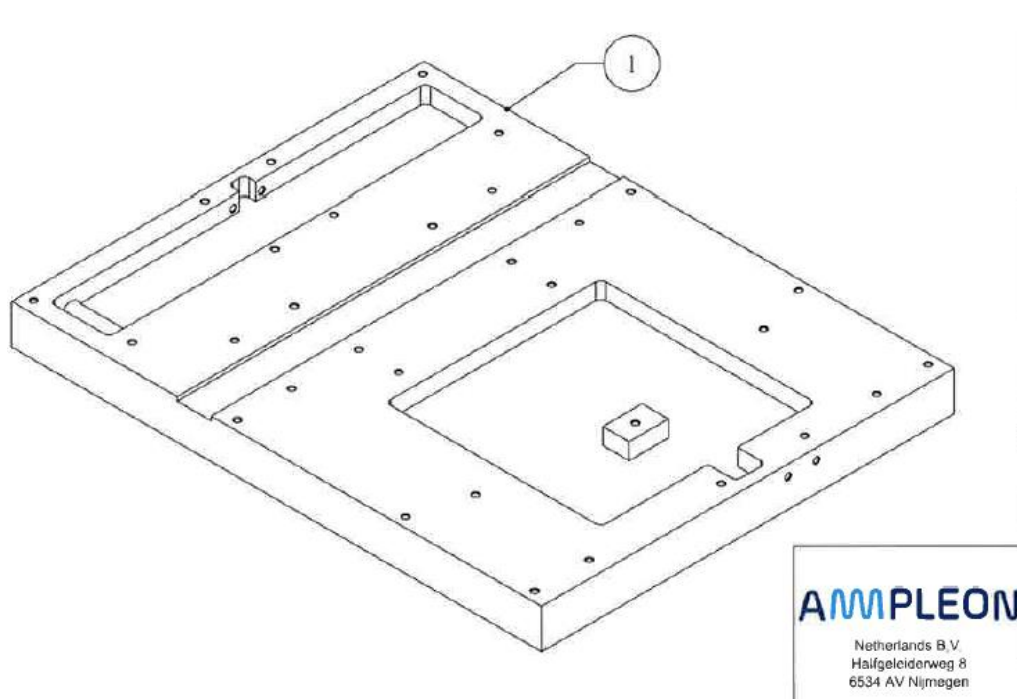
F=41MHz, Vds=50Volts, Idq=0.2A total, Pulsed measurement: tp=100usec, duty cycle=10%				
VSWR:1	Pload (W)			
All phases	600	900	1200	Remarks
3	Pass	Pass	Pass	Attenuator used
10	Pass	Pass	Pass	Attenuator used
65	Pass	Pass	Pass	

8. Baseplate

The demo amplifier pcb boards are mounted on a full copper base plate. The base plate contains a waterchannel to supply the amplifier with sufficient cooling.

The base plate contains two cavities for the coplanar baluns. The input balun cavity is airfilled. The output balun cavity is filled with a thermal conductive material that has good electrical properties. The material is conducting the heat from the balun, generated as a result of RF losses, to the baseplate. The thermal conductive material is absolutely necessary to cool the coplanar output balun.

A drawing of the base plate is shown below.



Output_41MHz_coplaBLF188XR_41MHz_inp
nar1.dxf



ut_1_2.dxf

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