Application Measurement Report

CA-027-15 BLF188XR 1.6-30MHz

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Document information

Info	Content
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Author Role	Application Engineer
Keywords	CA-027-15
Abstract	Measurement results of the BLF188XR at 1.6-30MHz and 50V & 42V supply voltages.

1. Revision History

Revision	Date	Description	Author
0.0	2015-Feb-20	Initial version	Jacques Liwinski

Contents

2. Introduction

2.1 General Description

The BLF188XR is a 1200W push-pull, extremely rugged LDMOS device from NXP. This document contains measurement results of a BLF188XR device tested in a circuit optimized for P3dB and two-tone performance. Results are shown with the device operating at 50Vds and 42Vds at frequencies of 1.6, 13, and 30MHz.

2.2 Test object details

Transistor type:	BLF188XR (screwed down with arctic paste)
Production code:	m1445
Package:	SOT539
Board number:	3011

2.3 Test Setup

Test Signal: CW Load: 1kW, 30dB, Aeroflex/Weinschel 82-30-43

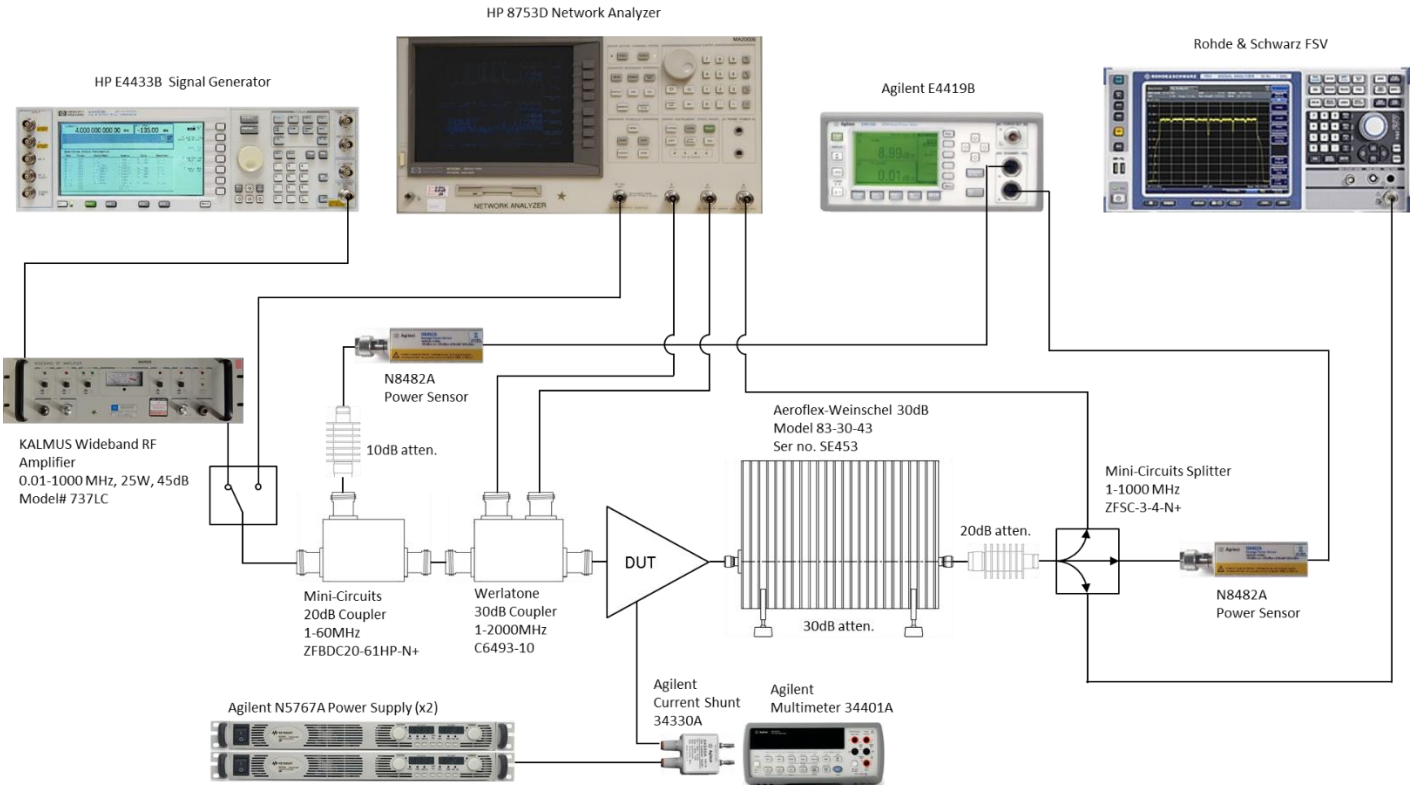


Figure 1: Test Setup

3. Measurement Results

3.1 Power Sweeps CW

Frequency (MHz)	Vgs (V)	Vds (V)	Idq (mA)	Pout @P3dB (W)	Gain @P3dB (dB)	Eff. @P3dB (%)
1.6	1.830	**50**	1000	1242	27.6	71.8
13	1.830	**50**	1000	1340	24.3	72.7
30	1.830	**50**	1000	1400	22.6	78.0

Table 1: Gain & Efficiency @ Vds=50V

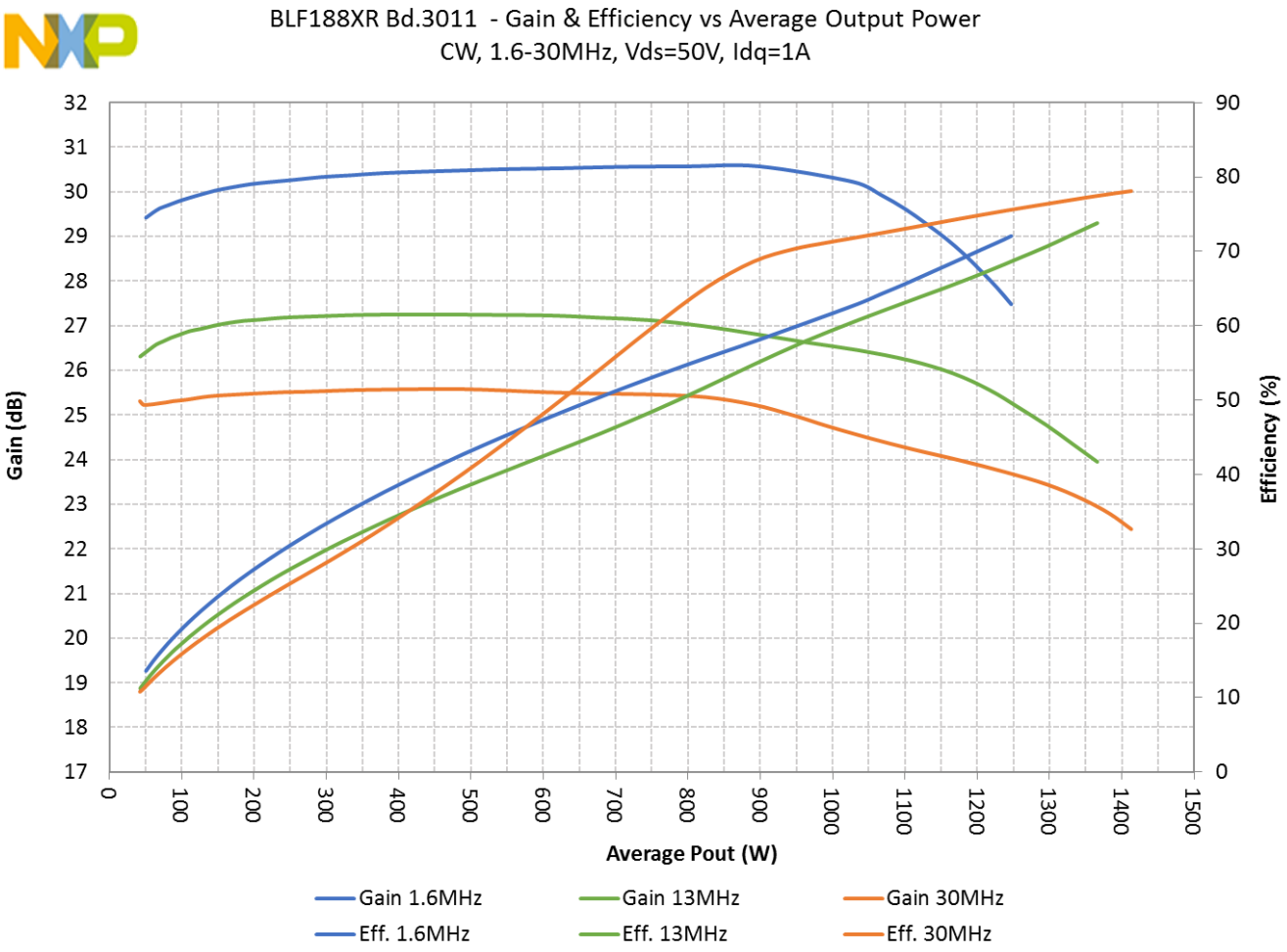


Figure 2: Gain & Efficiency vs Average Power Out @ Vds=50V

Frequency (MHz)	Vgs (V)	Vds (V)	Idq (mA)	Pout @P3dB (W)	Gain @P3dB (dB)	Eff. @P3dB (%)
1.6	1.845	**42**	1000	909	27.4	73.8
13	1.845	**42**	1000	995	24.2	75.0
30	1.845	**42**	1000	1007	22.7	78.8

Table 2: Gain & Efficiency @ Vds=42V

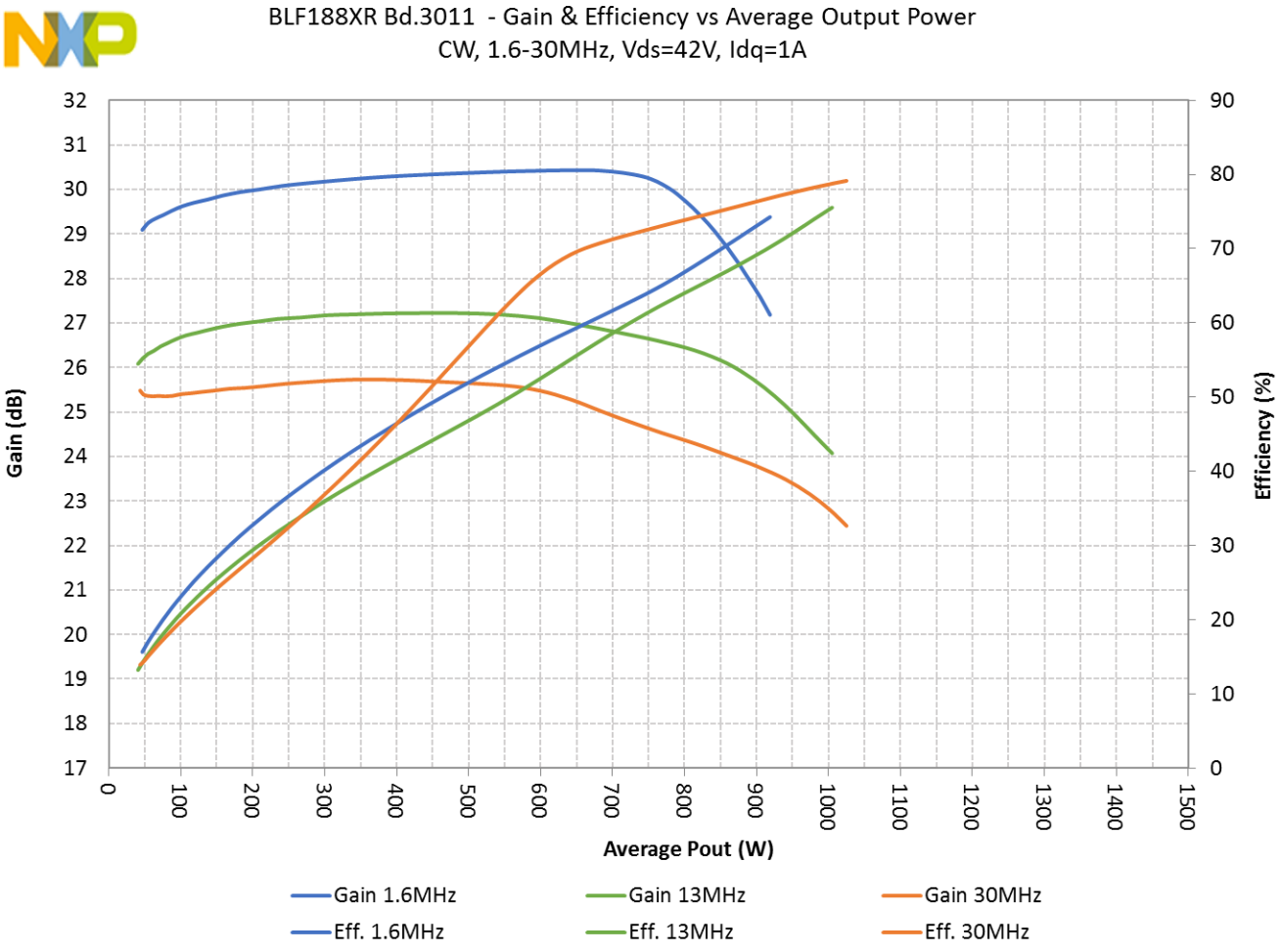


Figure 3: Gain & Efficiency vs Average Power Out @ Vds=42V

3.2 Two-Tone IMD3 Performance (10KHz tone separation)

Frequency (MHz)	Vgs (V)	Vds (V)	Idq (mA)	PEP @ -30dBc (W)
1.6	1.930	**50**	3000	1095
13	1.930	**50**	3000	995
30	1.930	**50**	3000	1005

Table 3: Two-Tone IMD3 Performance Summary @ Vds=50V, Idq=3000mA

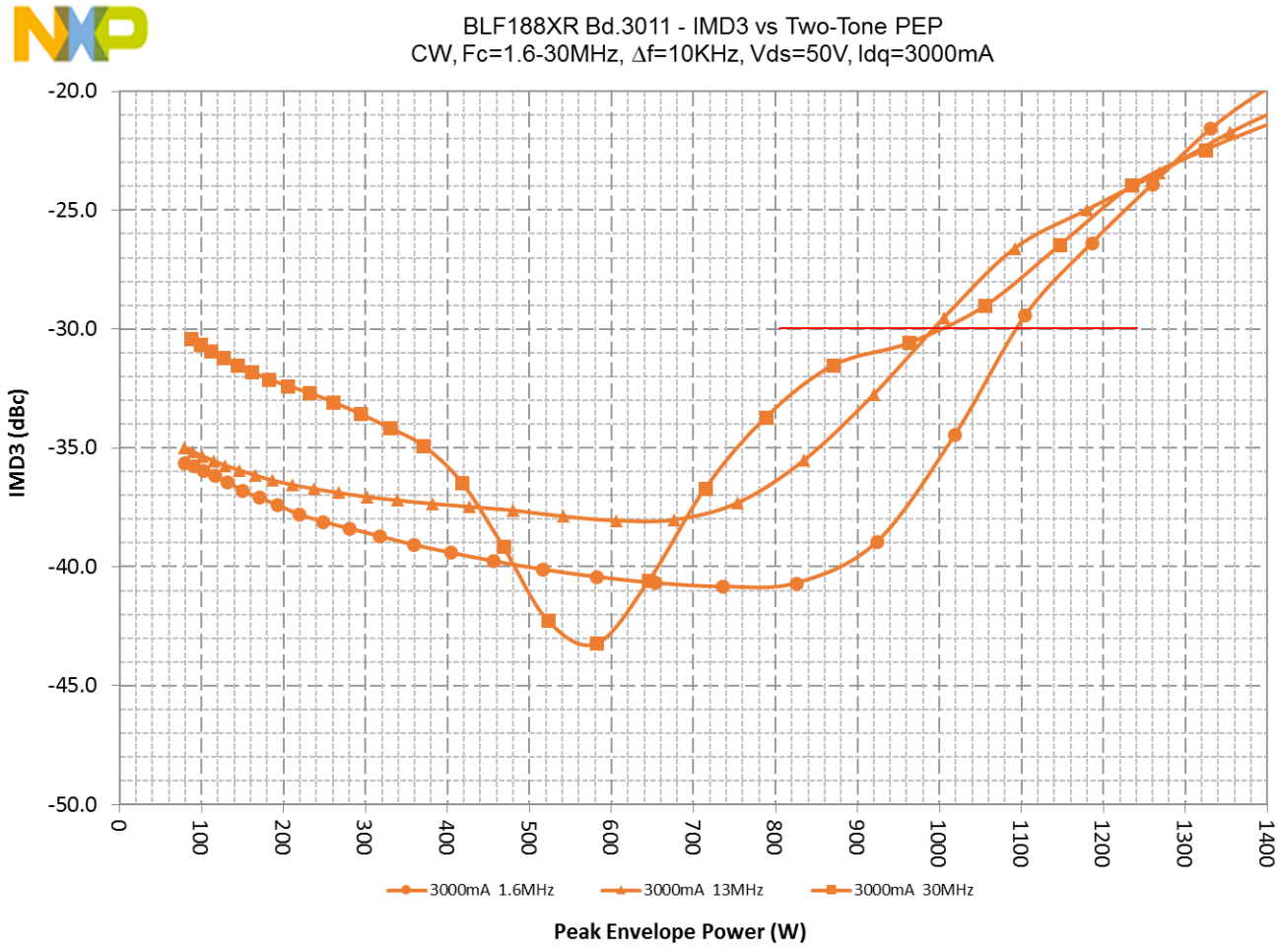


Figure 4: Two-Tone (10KHz spacing) IMD3 performance vs PEP @ Vds=50V, Idq=3000mA

Frequency (MHz)	Vgs (V)	Vds (V)	Idq (mA)	PEP @ -30dBc (W)
1.6	1.950	**42**	3000	845
13	1.950	**42**	3000	800
30	1.950	**42**	3000	740

Table 4: Two-Tone IMD3 Performance Summary @ Vds=42V, Idq=3000mA

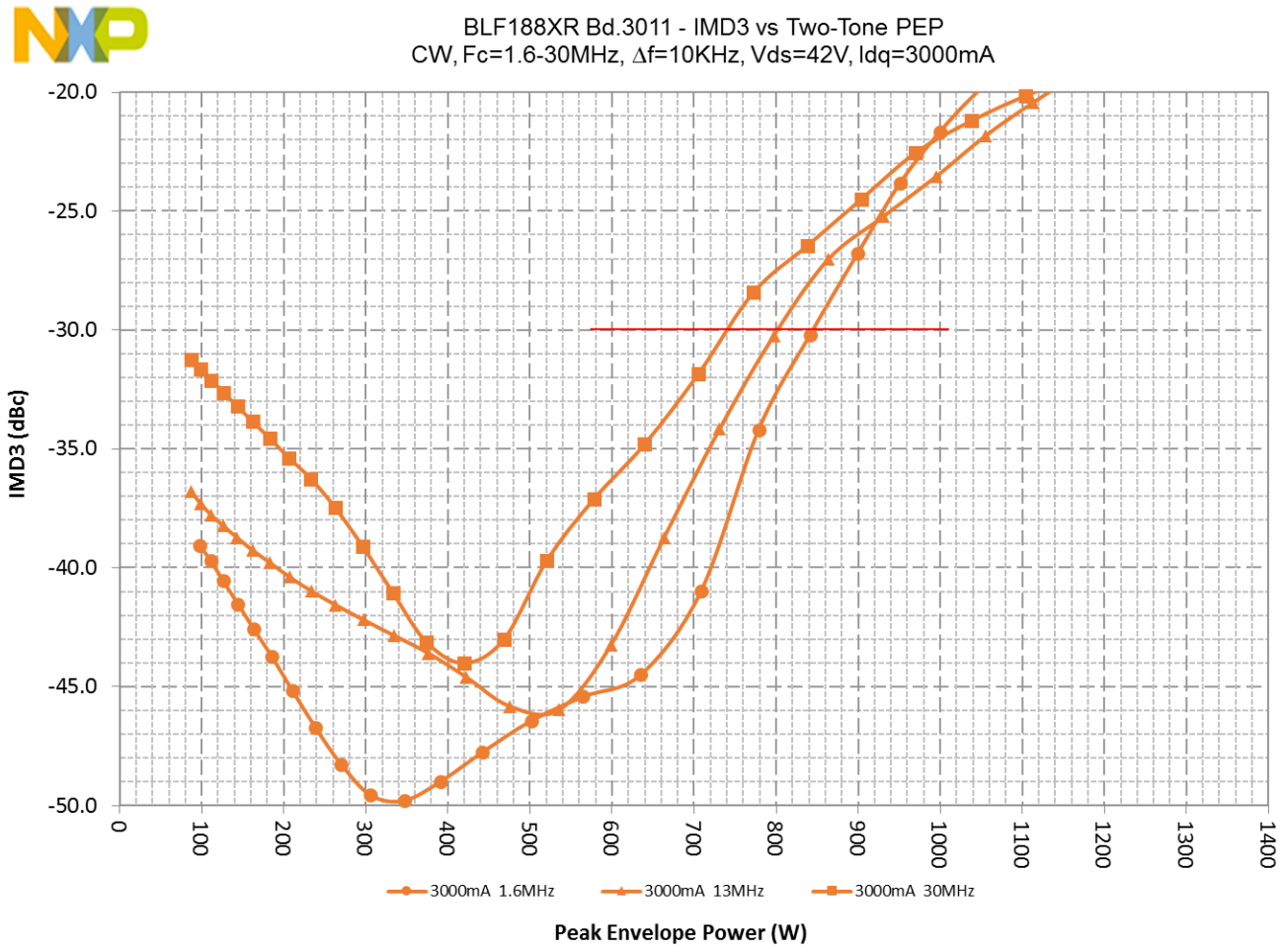


Figure 5: Two-Tone (10KHz spacing) IMD3 performance vs PEP @ Vds=42V, Idq=3000mA

3.3 Network Analyzer Sweep

Frequency (MHz)	Gain (dB)	Input Return Loss (dB)
1.6	30.2	-10.3
13	26.7	-16.4
30	25.1	-17.9

Table 5: Swept Gain & Input Return Loss @ approx. 200W CW

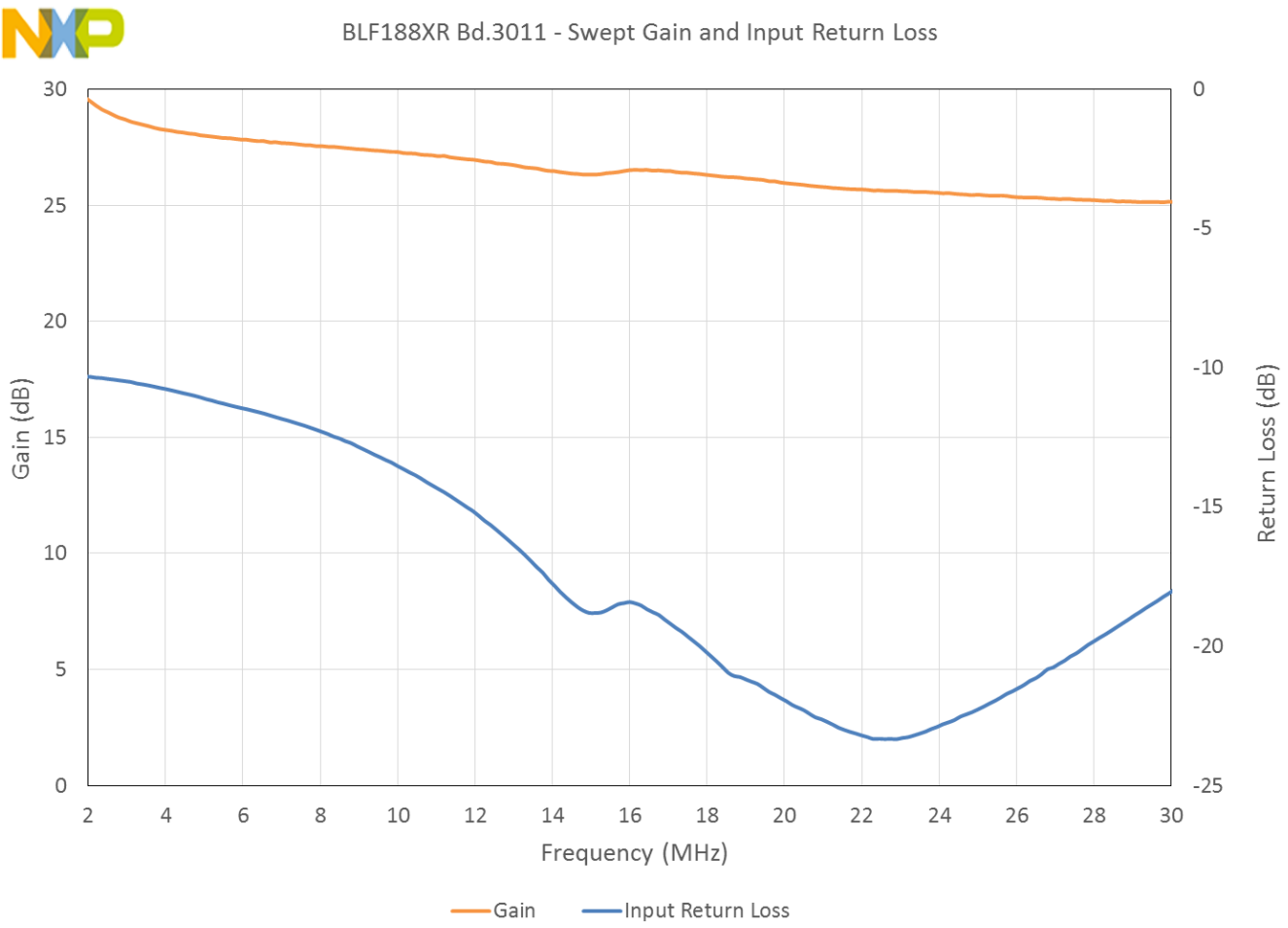
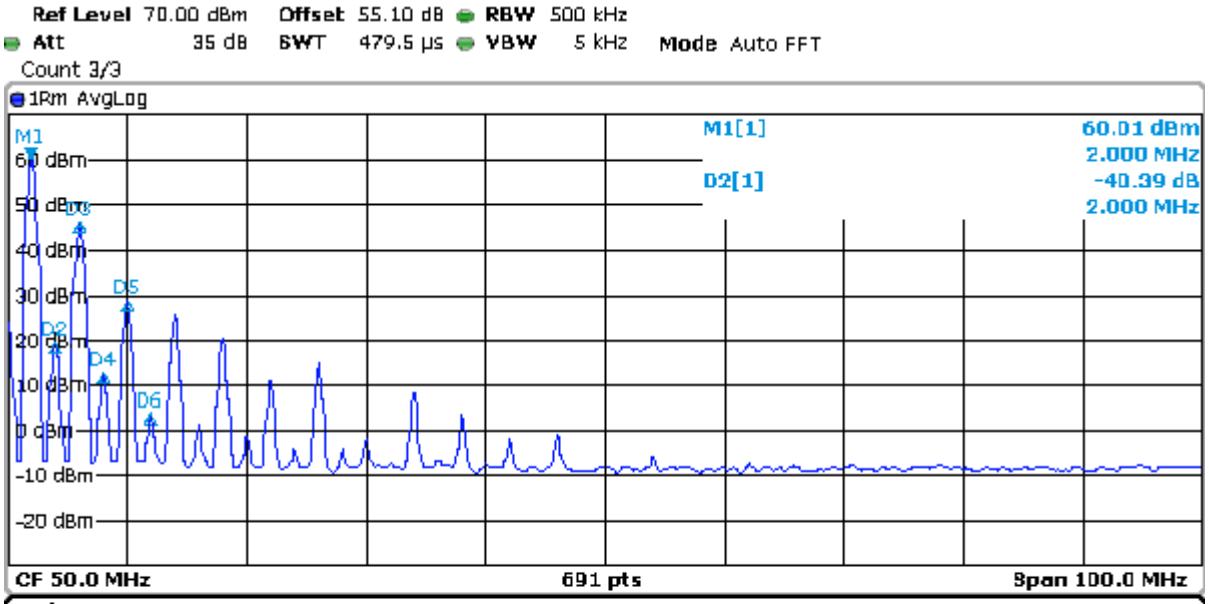


Figure 6: Swept Gain & Input Return Loss @ approx. 200W CW

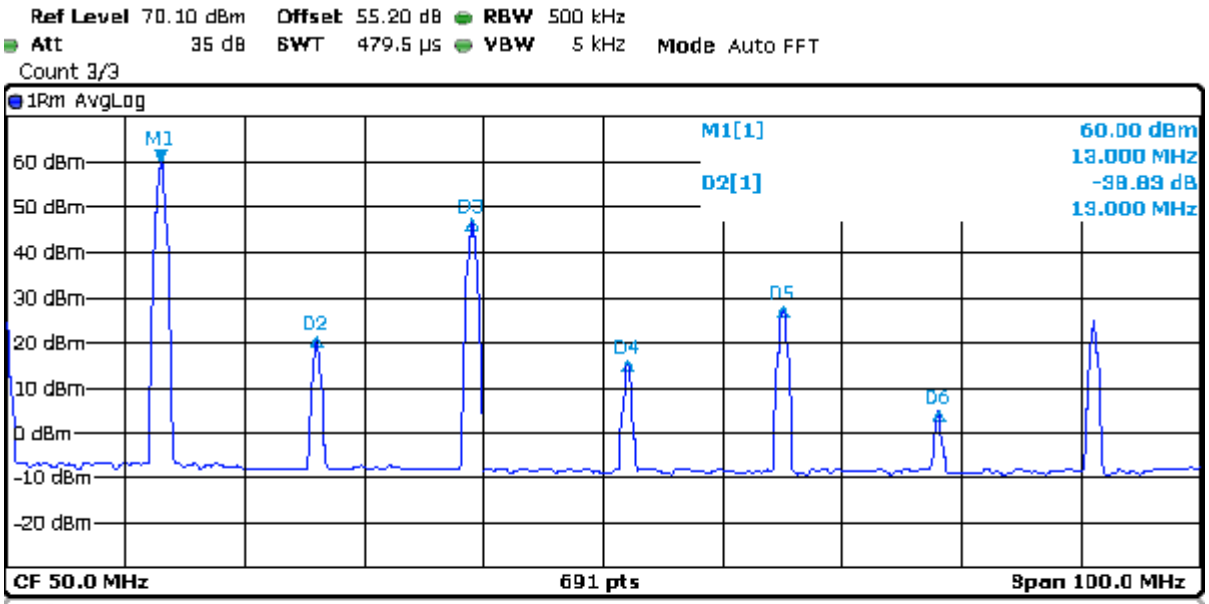
4. Harmonics



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.0 MHz	60.01 dBm		
D2	M1	1	2.0 MHz	-40.39 dB		
D3	M1	1	4.0 MHz	-13.81 dB		
D4	M1	1	6.0 MHz	-47.07 dB		
D5	M1	1	8.0 MHz	-31.07 dB		
D6	M1	1	10.0 MHz	-56.29 dB		

Figure 7: Harmonics; Fc = 2MHz, 1000CW



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	13.0 MHz	60.00 dBm		
D2	M1	1	13.0 MHz	-38.83 dB		
D3	M1	1	26.0 MHz	-12.60 dB		
D4	M1	1	39.0 MHz	-44.23 dB		
D5	M1	1	52.0 MHz	-32.16 dB		
D6	M1	1	65.0 MHz	-55.06 dB		

Figure 8: Harmonics; Fc = 13MHz, 1000CW

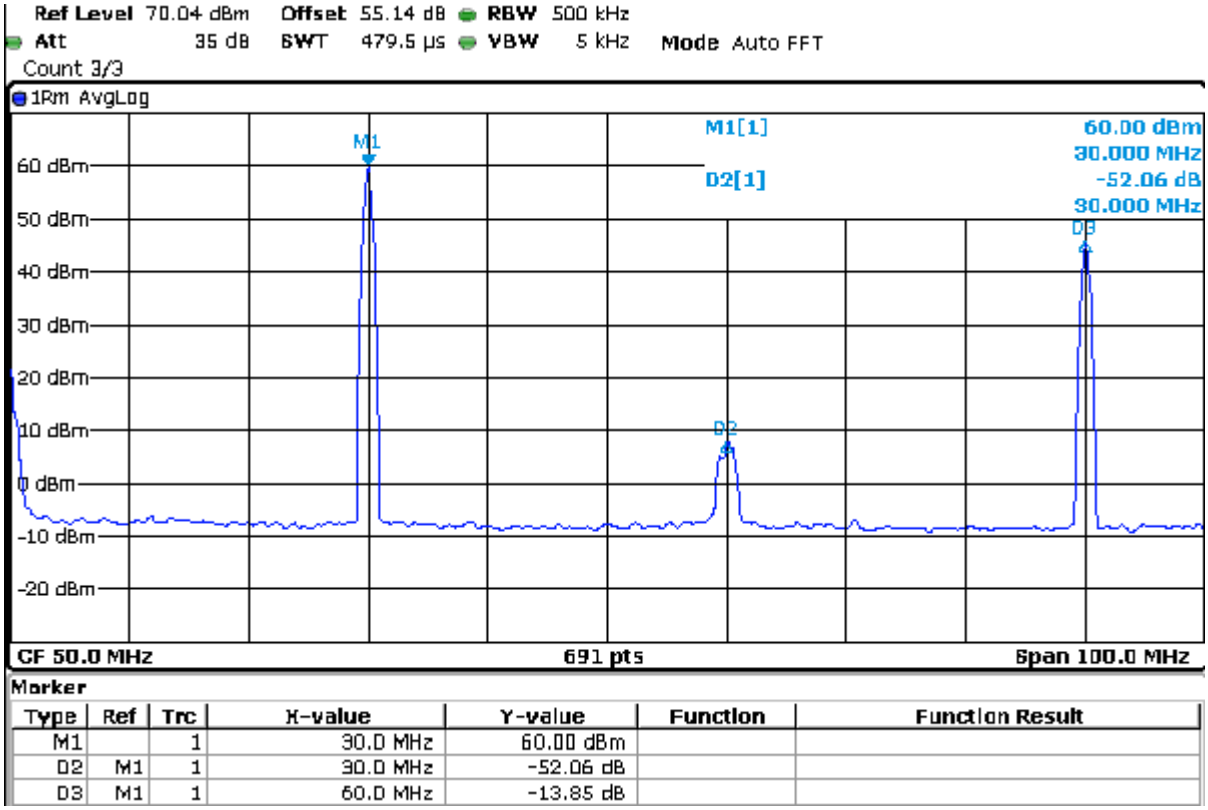


Figure 9: Harmonics; Fc=30MHz, 1000W CW

5. Infrared Scan

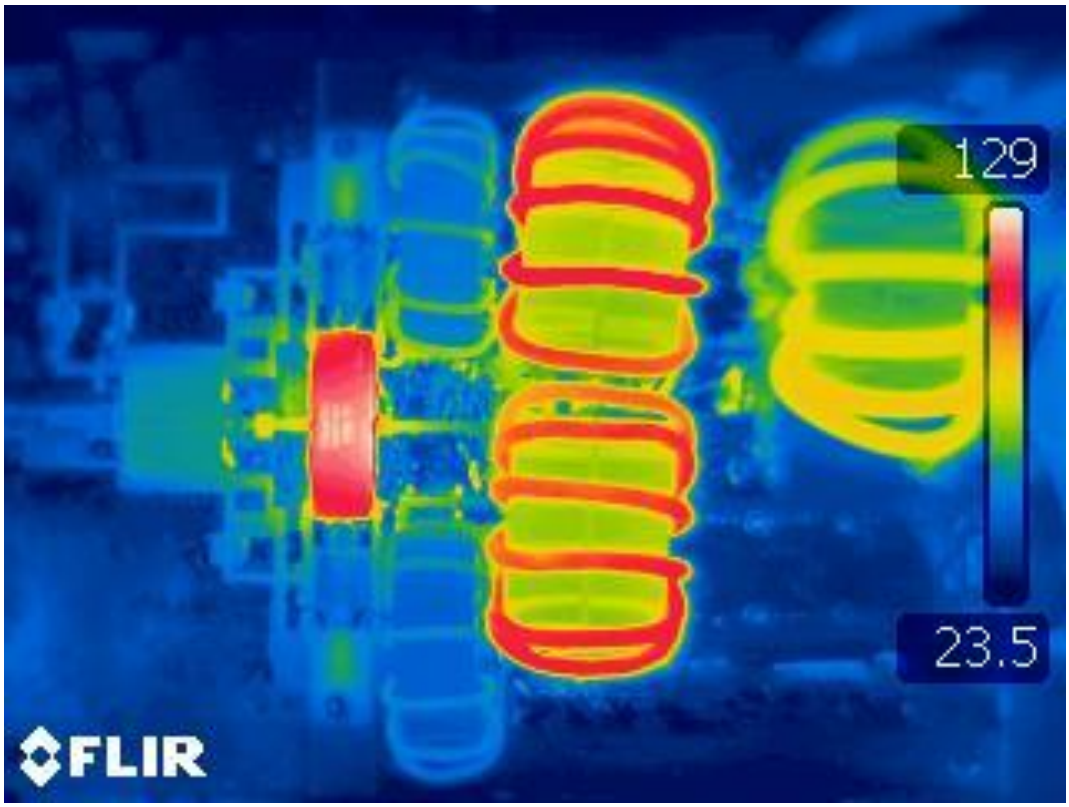
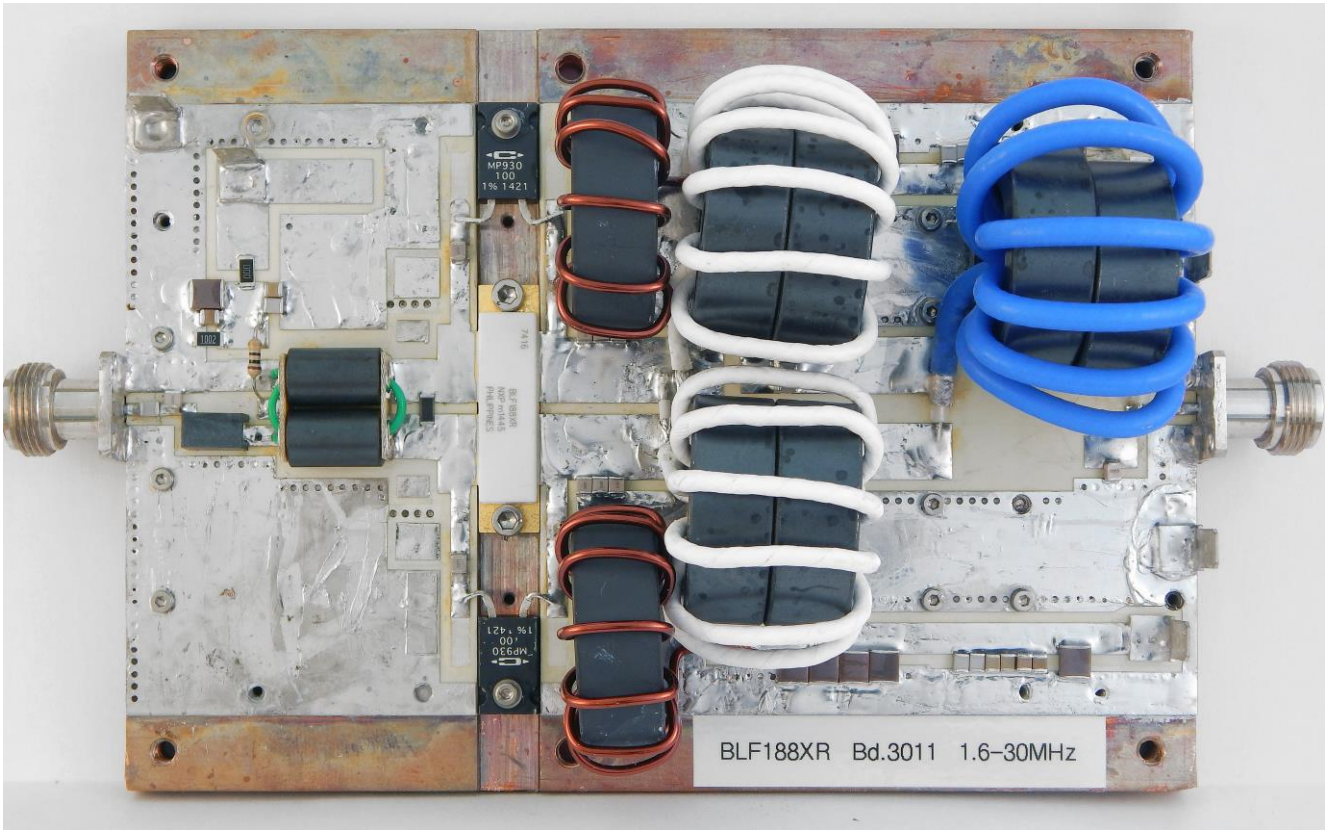
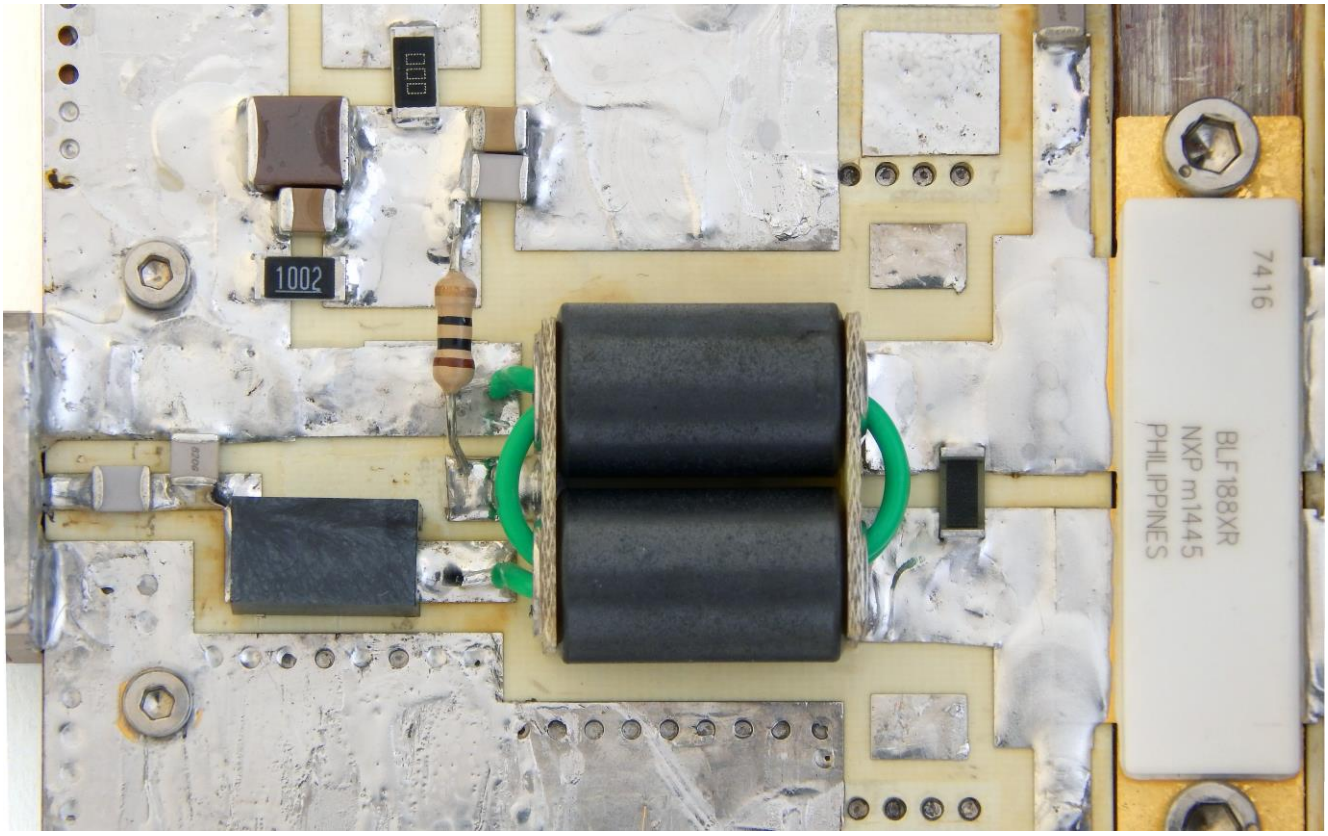


Figure 10: Infrared; Fc=13MHz, 1000W CW, after 5min of turn-on.

6. Photos





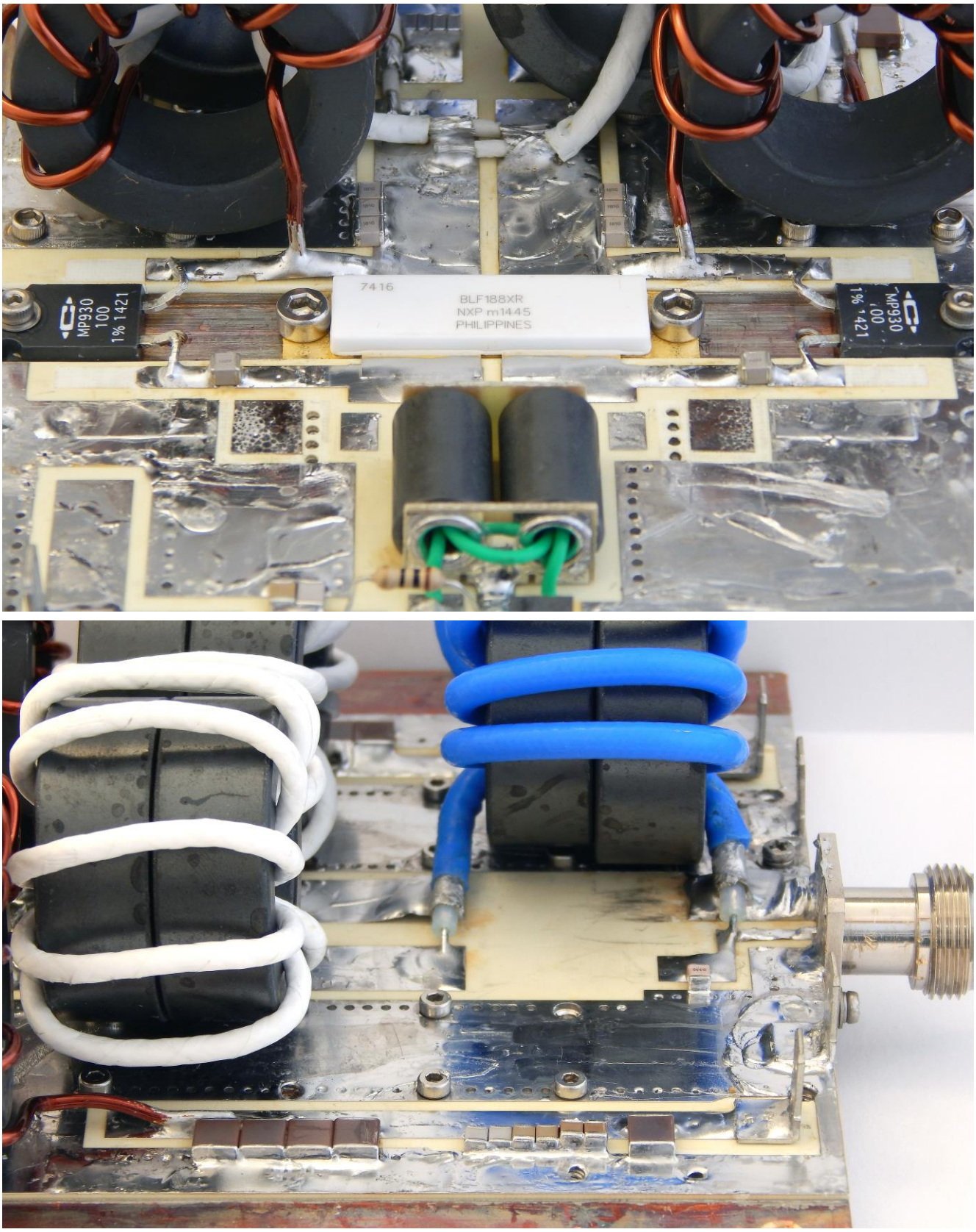


Figure 11: Photos

7. Schematic, Layout and Material List

7.1 Schematic

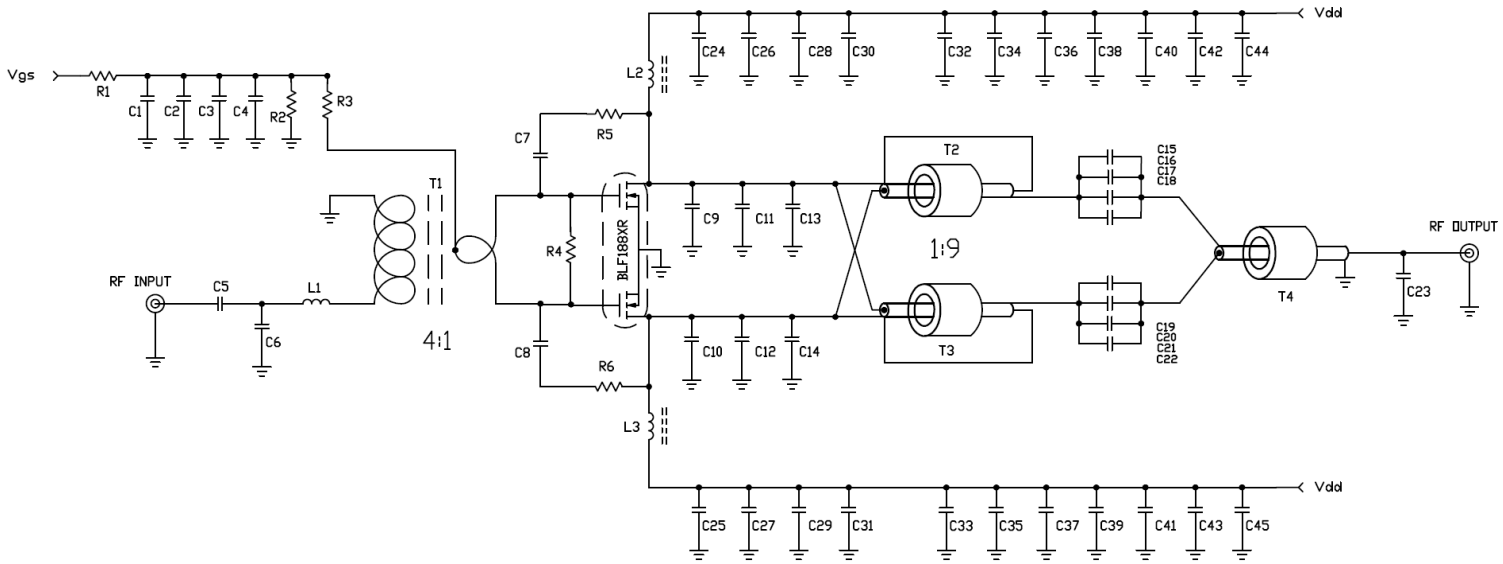


Figure 12: Schematic

7.2 Layout

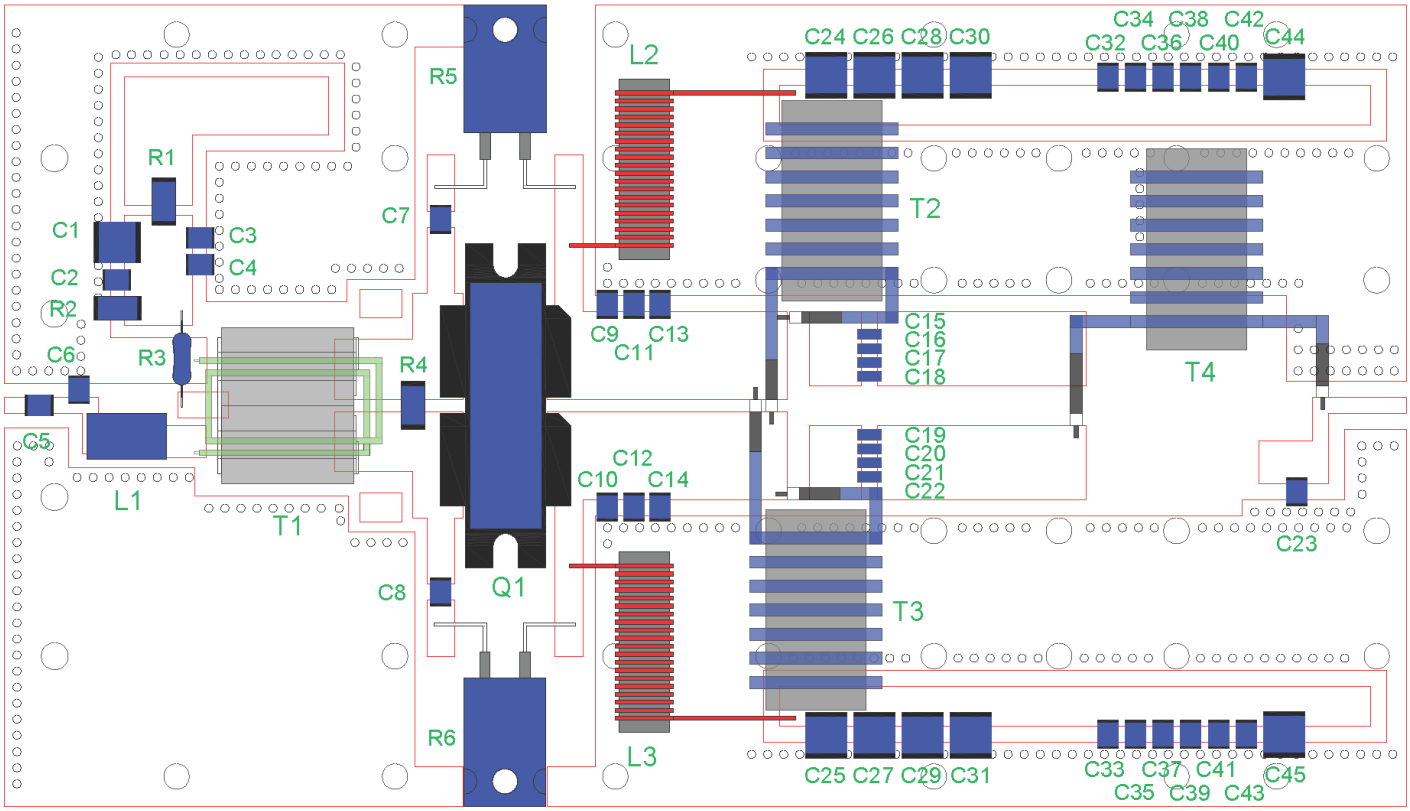


Figure 13: Layout

7.3 Material List

Designator	Description	Part #	Manufacturer
PCB	Rogers RO4350B, Er = 3.5, 30mils, 1oz		Rogers
Q1	BLF188XR	BLF188XR	NXP
R1	0Ω 2010		Generic
R2	10KΩ 2010		Generic
R3	10Ω Leaded		Generic
R4	50Ω, Power Resistor	NDC-2010WA50R0J	IMS
R5,R6	100Ω, 30W, 1%, Power Film, Leaded	MP930-100-1	Caddock
L1	169nH	132-12SMGL	Coilcraft
L2, L3	8 Turn 14 AWG Magnet Wire on Toroid		
T1	4:1 RF Transformer	RF600 Material 43	RF Power Systems
T2 & T3	1:9 Transmission Line Transformer		
T4	Balun		
C1, C24-C31, C44-C45	10uF 2220 100V 10%	C5750X7S2A106K230KE	TDK
C2, C40-C43	1uF 1210 100V 10%	GRM32ER72A105KA01L	Murata
C3, C36-C39	0.1uF 1210 250V 10%	GRM32DR72E104KW01L	Murata
C4, C5, C15-C22, C32-C35	10nF 1210 250V 5%	C3225C0G2E103J160AA	TDK
C7-C8	1000pF 1111 50V 2%	1111N102GW500	Passive Plus
C9-C14	180pF 1111 500V 2%	1111N181GW501	Passive Plus
C6	82pF 1111 500V 2%	1111N820GW501	Passive Plus
C23	33pF 1111 500V 2%	1111N330GW501	Passive Plus
Details for L2 & L3	14 AWG Magnet Wire, 8 Turns		Belden
	1 x Toroid, Material 61 (μ=125):	FT-140-61	Amidon
Details for T2 & T3:	17Ω Coax (24") 8 Turns	TC-18	RF Power Systems
	2 x Toroids, Material 43 (μ=800):	FT-140-43	Amidon
Details for T4:	50Ω Coax (24") 7 Turns		
	2 x Toroids, Material 43 (μ=800):	FT-140-43	Amidon

Table 6: Material List

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