# *1880 MHz PA Driver with BFG480W*

Application Note
**JL-9902v0**

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**Abstract**

BFG480W, the new 5th generation transistor from Philips Semiconductors, is well suited for PA driver applications in AMPS, TDMA, CDMA and GSM systems. BFG80W's performance is superior at 1880 MHz, 3.6V applications. Under CW mode, the part is capable of P1dB=20dBm, efficiency of over 40% and typical $G_p$ of 15 dB. BFG480W delivers 20 dBm of linear output power under TDMA with a typical $G_p$ of 15 dB and efficiency of above 30%. Under CDMA mode, BFG480W delivers 19 dBm of linear output power with a typical $G_p$ of above 15 dB and efficiency of 30%.

## INTRODUCTION

BFG480W is Philips Semiconductors' *5th generation* silicon bipolar RF wideband transistor in a SOT343R plastic SMD package. The transistor delivers superior performance at frequencies below 3 GHz. It is manufactured according to the *double poly* process and characterised by a high transition frequency ($f_T$ > 20 GHz) at low sub 3 Volt supply voltages. This application notes describes BFG480W performance at 1880 MHz operation under CW, 2 Tone, TDMA and CDMA conditions.

## PERFORMANCE OVERVIEW

The table below summarises BFG480W's typical performance capabilities under different signal conditions.

| System | Vsupply | P1dB or Plinear* dBm | | Gain** dB | | Efficiency*** % | |
|---|---|---|---|---|---|---|---|
| | | Icq=10mA | Icq=20mA | Icq=10mA | Icq=20mA | Icq=10mA | Icq=20mA |
| CW | 3.0 Volts | 19 | 20 | 14.5 | 14.7 | 37 | 37 |
| | 3.6 Volts | 21 | 21 | 14.9 | 14.8 | 38 | 36 |
| 2Tone | 3.0 Volts | 16 | 15.5 | 15 | 15.5 | 27 | 24 |
| | 3.6 Volts | 17.5 | 16.5 | 16 | 16 | 27 | 22 |
| TDMA | 3.0 Volts | 19 | 19 | 14.5 | 15 | 35 | 34 |
| | 3.6 Volts | 20.5 | 20 | 15 | 14.7 | 33 | 33 |
| CDMA | 3.0 Volts | 17.5 | 17.5 | 15 | 15.5 | 30 | 30 |
| | 3.6 Volts | 19 | 18.5 | 15.5 | 16 | 30 | 27 |

*Table 1: BFG480W 1880 MHz PA driver performance summary*

* - CW - load power @ P1dB
2Tone - load power represents linear average power @ IMD levels reaching –28dBc.
TDMA - load power represents linear average power @ ACPR levels reaching –26dBc or ALT levels reaching –45dBc.
CDMA load power represents linear average power @ ACPR levels reaching –44dBc with 1.25MHz channel offset, 1.25MHz channel bandwidth and 30KHz Adjacent Channel bandwidth
** - typical Gain at P1dB for CW or Plinear for 2Tone, TDMA, CDMA signals
*** - typical Efficiency at P1dB for CW or Plinear for 2Tone, TDMA, CDMA signals.

## CIRCUIT DESCRIPTION

Figure 1 shows a circuit diagram for the 1880 MHz PA driver using the BFG480W. Appendix 1 includes the part list of the demo board.

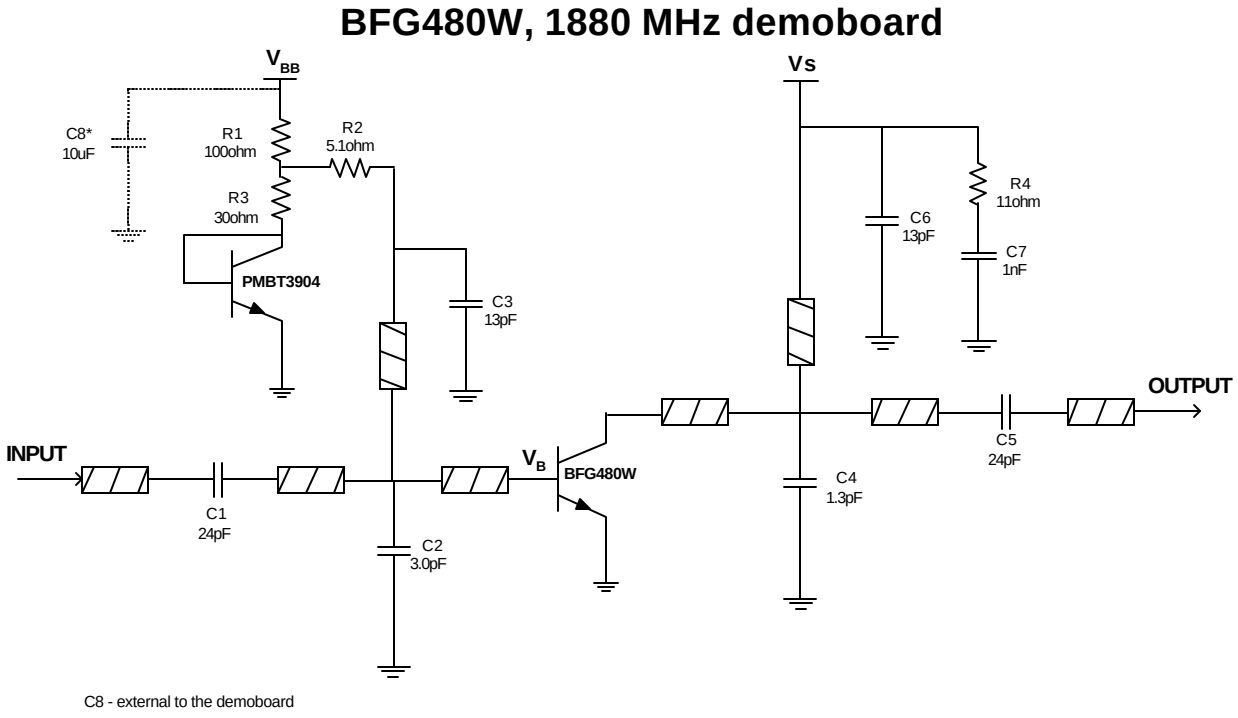



*Figure 1: BFG480W common emitter demoboard for class-AB operation at 1880 MHz.*

## BOARD LAYOUT

Figure 3 shows the layout of the PCB, which has the following properties:

type: double copper-clad PTFE fiber-glass (backside ground)
h = 0.64 mm
t = 35 µm (Cu cladding, not coated)
$\varepsilon_r$ = 6.15
tanδ = 0.0019

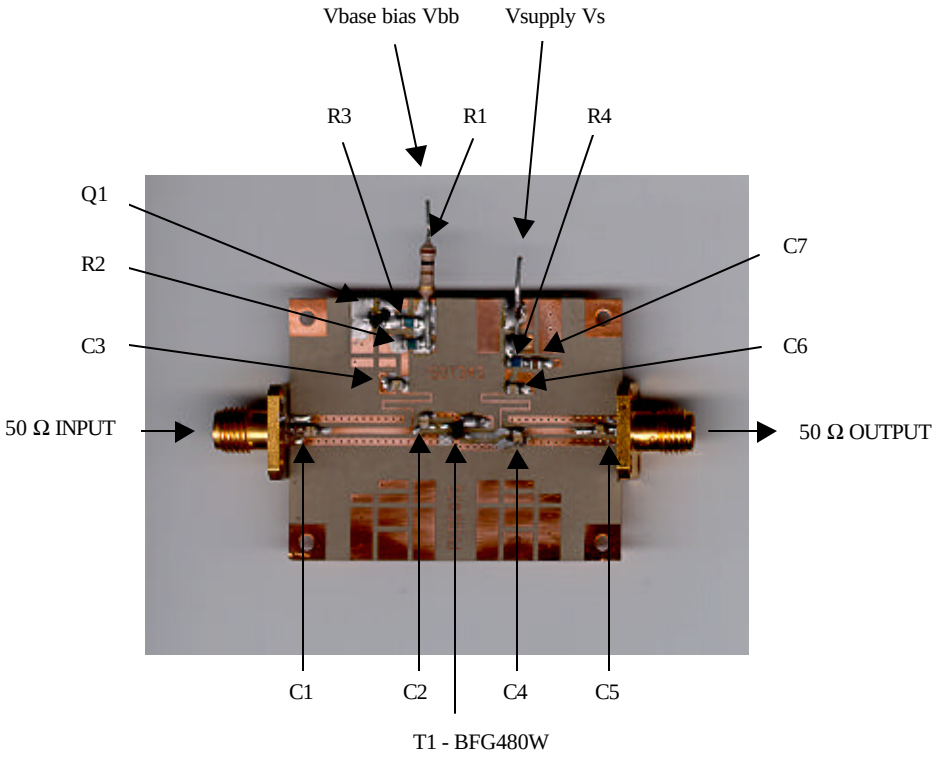



*Figure 3: Layout of the 1880 MHz BFG480W PA driver.*

Appendix 1 contains the part list for the demo board. The position of C2 and C4 components is critical. The artwork file is available on a floppy disc (DXF or Gerber format). Appendix 2 contains Spice model for BFG480W.

## PERFORMANCE

BFG480W was evaluated under 4 different modes of operation. Each mode of operation is summarised below. All measurements were taken with 100% duty cycle signal.

# CW

**BFG480W under CW at 1880 MHz and 25 deg. C**

**Vc=3.6V, Icq=1mA, Vbb=0.9V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | It mA | Eff % |
|---|---|---|---|---|---|
| -5.2 | 5 | 3.16 | 10.2 | 13 | 6.76 |
| -2.3 | 10 | 10.00 | 12.3 | 22 | 12.63 |
| 1.1 | 15 | 31.62 | 13.9 | 39 | 22.52 |
| 5.64 | 20 | 100.00 | 14.36 | 73 | 38.05 |
| 7.1 | 21 | 125.89 | 13.9 | 86 | 40.66 |
| 8.9 | 22 | 158.49 | 13.1 | 103 | 42.74 |
| 10.9 | 23 | 199.53 | 12.1 | 126 | 43.99 |
| 13.28 | 24 | 251.19 | 10.72 | 150 | 46.52 |
| 16.3 | 25 | 316.23 | 8.7 | 184 | 47.74 |

**Vc=3V, Icq=1mA,Vb=0.9V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | It mA | Eff % |
|---|---|---|---|---|---|
| -4.9 | 5 | 3.16 | 9.9 | 13 | 8.11 |
| -2 | 10 | 10.00 | 12 | 22 | 15.15 |
| 1.46 | 15 | 31.62 | 13.54 | 39 | 27.03 |
| 6.74 | 20 | 100.00 | 13.26 | 78 | 42.74 |
| 8.4 | 21 | 125.89 | 12.6 | 93 | 45.12 |
| 10.4 | 22 | 158.49 | 11.6 | 113 | 46.75 |
| 12.95 | 23 | 199.53 | 10.05 | 137 | 48.55 |
| 17.3 | 24 | 251.19 | 6.7 | 176 | 47.57 |

**Vc=3.6V, Icq=5mA, Vbb=1.04V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | It mA | Eff % |
|---|---|---|---|---|---|
| -8.5 | 5 | 3.16 | 13.5 | 16 | 5.49 |
| -4.5 | 10 | 10.00 | 14.5 | 26 | 10.68 |
| -0.3 | 15 | 31.62 | 15.3 | 43 | 20.43 |
| 4.7 | 20 | 100.00 | 15.3 | 78 | 35.61 |
| 6.45 | 21 | 125.89 | 14.55 | 91 | 38.43 |
| 8.35 | 22 | 158.49 | 13.65 | 109 | 40.39 |
| 10.47 | 23 | 199.53 | 12.53 | 132 | 41.99 |
| 12.9 | 24 | 251.19 | 11.1 | 160 | 43.61 |
| 16 | 25 | 316.23 | 9 | 193 | 45.51 |

**Vc=3V, Icq=5mA,Vb=1.05V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | It mA | Eff % |
|---|---|---|---|---|---|
| -8.1 | 5 | 3.16 | 13.1 | 16 | 6.59 |
| -4.1 | 10 | 10.00 | 14.1 | 25 | 13.33 |
| 0.1 | 15 | 31.62 | 14.9 | 43 | 24.51 |
| 6 | 20 | 100.00 | 14 | 82 | 40.65 |
| 7.8 | 21 | 125.89 | 13.2 | 97 | 43.26 |
| 10 | 22 | 158.49 | 12 | 118 | 44.77 |
| 12.6 | 23 | 199.53 | 10.4 | 145 | 45.87 |
| 17.2 | 24 | 251.19 | 6.8 | 186 | 45.02 |

**Vc=3.6V, Icq=10mA, Vbb=1.11V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | It mA | Eff % |
|---|---|---|---|---|---|
| -9.9 | 5 | 3.16 | 14.9 | 20 | 4.39 |
| -5.4 | 10 | 10.00 | 15.4 | 28 | 9.92 |
| -0.9 | 15 | 31.62 | 15.9 | 46 | 19.10 |
| 4.5 | 20 | 100.00 | 15.5 | 80 | 34.72 |
| 6.1 | 21 | 125.89 | 14.9 | 94 | 37.20 |
| 8.2 | 22 | 158.49 | 13.8 | 113 | 38.96 |
| 10.4 | 23 | 199.53 | 12.6 | 136 | 40.75 |
| 12.8 | 24 | 251.19 | 11.2 | 164 | 42.55 |
| 15.7 | 25 | 316.23 | 9.3 | 198 | 44.36 |

**Vc=3V, Icq=10mA,Vb=1.1V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | Ic mA | Eff % |
|---|---|---|---|---|---|
| -9.5 | 5 | 3.16 | 14.5 | 19 | 5.55 |
| -5 | 10 | 10.00 | 15 | 27 | 12.35 |
| -0.4 | 15 | 31.62 | 15.4 | 44 | 23.96 |
| 5.8 | 20 | 100.00 | 14.2 | 84 | 39.68 |
| 7.8 | 21 | 125.89 | 13.2 | 102 | 41.14 |
| 9.9 | 22 | 158.49 | 12.1 | 121 | 43.66 |
| 12.5 | 23 | 199.53 | 10.5 | 148 | 44.94 |
| 17.1 | 24 | 251.19 | 6.9 | 190 | 44.07 |

**Vc=3.6V, Icq=20mA, Vbb=1.16V**

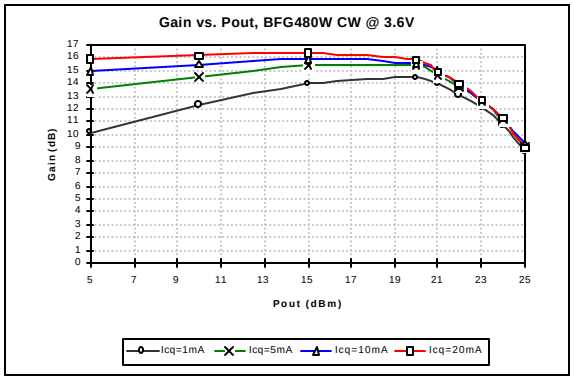
| Pin dBm | Pout dBm | Pout mWatt | Gain dB | It mA | Eff % |
|---|---|---|---|---|---|
| -10.9 | 5 | 3.16 | 15.9 | 27 | 3.25 |
| -6.1 | 10 | 10.00 | 16.1 | 34 | 8.17 |
| -1.34 | 15 | 31.62 | 16.34 | 49 | 17.93 |
| 4.27 | 20 | 100.00 | 15.73 | 83 | 33.47 |
| 6.2 | 21 | 125.89 | 14.8 | 98 | 35.68 |
| 8.1 | 22 | 158.49 | 13.9 | 116 | 37.95 |
| 10.4 | 23 | 199.53 | 12.6 | 135 | 41.05 |
| 12.8 | 24 | 251.19 | 11.2 | 167 | 41.78 |
| 16.1 | 25 | 316.23 | 8.9 | 206 | 42.64 |

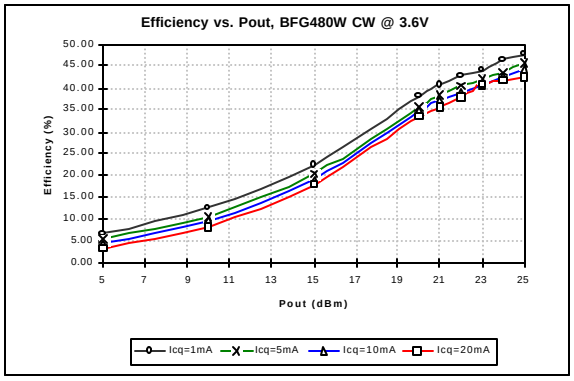
**Vc=3V, Icq=20mA,Vb=1.18V**

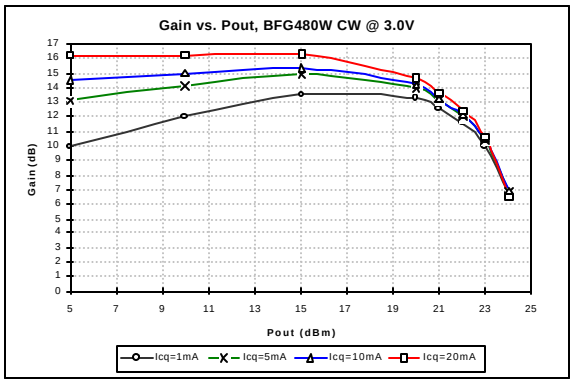
| Pin dBm | Pout dBm | Pout mWatt | Gain dB | It mA | Eff % |
|---|---|---|---|---|---|
| -11.2 | 5 | 3.16 | 16.2 | 26 | 4.05 |
| -6.2 | 10 | 10.00 | 16.2 | 34 | 9.80 |
| -1.3 | 15 | 31.62 | 16.3 | 49 | 21.51 |
| 5.3 | 20 | 100.00 | 14.7 | 88 | 37.88 |
| 7.3 | 21 | 125.89 | 13.7 | 103 | 40.74 |
| 9.6 | 22 | 158.49 | 12.4 | 125 | 42.26 |
| 12.33 | 23 | 199.53 | 10.67 | 151 | 44.05 |
| 17.5 | 24 | 251.19 | 6.5 | 197 | 42.50 |

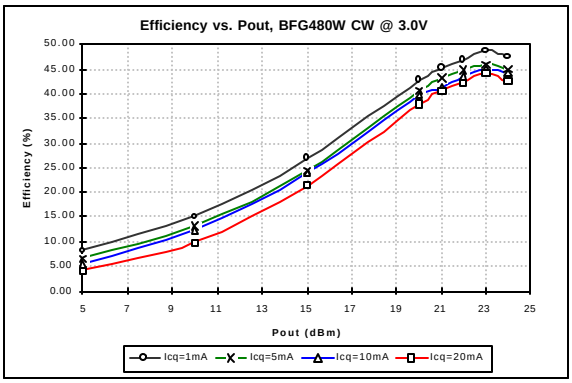
It=Ic+Ib. total current draw.

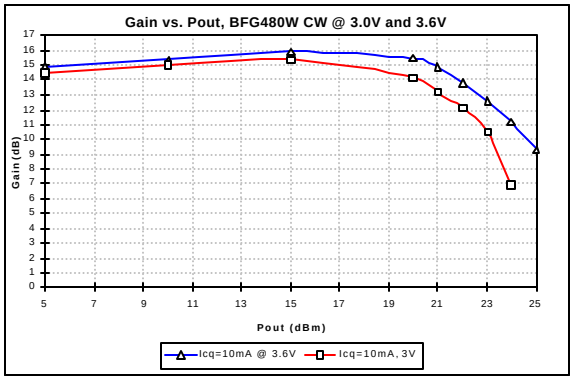
# CW

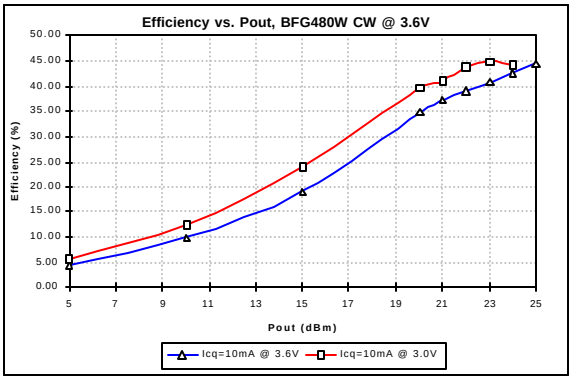

Gain vs. Pout, BFG480W CW @ 3.6V
Gain (dB)
Pout (dBm)
Icq=1mA
Icq=5mA
Icq=10mA
Icq=20mA


Efficiency vs. Pout, BFG480W CW @ 3.6V
Efficiency (%)
Pout (dBm)
Icq=1mA
Icq=5mA
Icq=10mA
Icq=20mA


Gain vs. Pout, BFG480W CW @ 3.0V
Gain (dB)
Pout (dBm)
Icq=1mA
Icq=5mA
Icq=10mA
Icq=20mA


Efficiency vs. Pout, BFG480W CW @ 3.0V
Efficiency (%)
Pout (dBm)
Icq=1mA
Icq=5mA
Icq=10mA
Icq=20mA


Gain vs. Pout, BFG480W CW @ 3.0V and 3.6V
Gain (dB)
Pout (dBm)
Icq=10mA @ 3.6V
Icq=10mA, 3V


Efficiency vs. Pout, BFG480W CW @ 3.6V
Efficiency (%)
Pout (dBm)
Icq=10mA @ 3.6V
Icq=10mA @ 3.0V

# 2 TONE

**BFG480W under 2Tone at 1880 and 1881 MHz and 25 deg. C**

**Vc=3.6V, Icq=10mA, Vbb=1.1V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | 3rd low dBc | 3rd high dBc | 5th low dBc | 5th high dBc | It mA | Eff % |
|---|---|---|---|---|---|---|---|---|---|
| -10 | 5 | 3.16 | 15 | -40 | -45 | -55 | -57 | 19 | 4.62 |
| -5.5 | 10 | 10.00 | 15.5 | -38 | -42 | -49 | -54 | 27 | 10.29 |
| -0.8 | 15 | 31.62 | 15.8 | -37 | -38 | -44 | -51 | 43 | 20.43 |
| 1.4 | 17 | 50.12 | 15.6 | -30 | -30 | -39 | -50 | 53 | 26.27 |
| 2.9 | 18 | 63.10 | 15.1 | -25 | -25 | -35 | -36 | 60 | 29.21 |
| 4.7 | 19 | 79.43 | 14.3 | -20.7 | -20.6 | -27 | -29 | 72 | 30.65 |
| 6.5 | 20 | 100.00 | 13.5 | -18 | -19 | -23 | -25 | 87 | 31.93 |

**Vc=3.6V, Icq=20mA, Vbb=1.16V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | 3rd low dBc | 3rd high dBc | 5th low dBc | 5th high dBc | It mA | Eff % |
|---|---|---|---|---|---|---|---|---|---|
| -11.2 | 5 | 3.16 | 16.2 | -46 | -50 | -57 | -57 | 27 | 3.25 |
| -6.3 | 10 | 10.00 | 16.3 | -38 | -45 | -57 | -57 | 34 | 8.17 |
| -1.3 | 15 | 31.62 | 16.3 | -32 | -40 | -52 | -47 | 48 | 18.30 |
| 0.9 | 17 | 50.12 | 16.1 | -27 | -30 | -51 | -43 | 58 | 24.00 |
| 2.4 | 18 | 63.10 | 15.6 | -24 | -25 | -41 | -45 | 64 | 27.39 |
| 4 | 19 | 79.43 | 15 | -19 | -21 | -30 | -34 | 74 | 29.82 |
| 6 | 20 | 100.00 | 14 | -17 | -19 | -25 | -28 | 89 | 31.21 |

**Vc=3.0V, Icq=10mA, Vbb=1.1V**

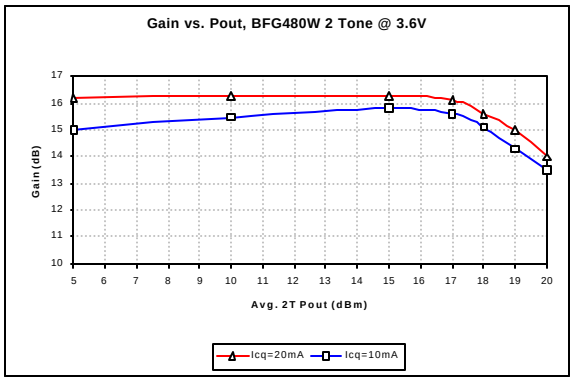
| Pin dBm | Pout dBm | Pout mWatt | Gain dB | 3rd low dBc | 3rd high dBc | 5th low dBc | 5th high dBc | It mA | Eff % |
|---|---|---|---|---|---|---|---|---|---|
| -9.8 | 5 | 3.16 | 14.8 | -40.9 | -44 | -55 | -56 | 19 | 5.55 |
| -5.2 | 10 | 10.00 | 15.2 | -38 | -40 | -49 | -57 | 27 | 12.35 |
| -0.3 | 15 | 31.62 | 15.3 | -34 | -31 | -42 | -50 | 43 | 24.51 |
| 2.3 | 17 | 50.12 | 14.7 | -24 | -23 | -32 | -34 | 54 | 30.94 |
| 4.1 | 18 | 63.10 | 13.9 | -20 | -20 | -26 | -27 | 63 | 33.38 |
| 6.3 | 19 | 79.43 | 12.7 | -17 | -18 | -22 | -23 | 77 | 34.39 |
| 9.1 | 20 | 100.00 | 10.9 | -15 | -14 | -19 | -20 | 94 | 35.46 |

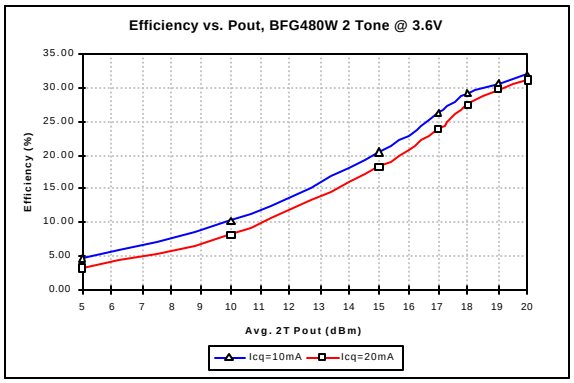
**Vc=3.0V, Icq=20mA, Vbb=1.17V**

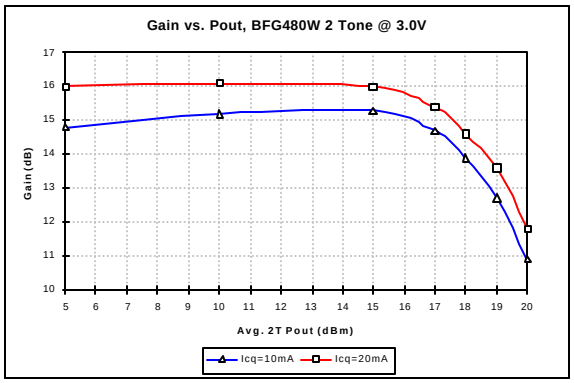
| Pin dBm | Pout dBm | Pout mWatt | Gain dB | 3rd low dBc | 3rd high dBc | 5th low dBc | 5th high dBc | It mA | Eff % |
|---|---|---|---|---|---|---|---|---|---|
| -11 | 5 | 3.16 | 16 | -44 | -52 | -55 | -55 | 27 | 3.90 |
| -6.1 | 10 | 10.00 | 16.1 | -37 | -47 | -56 | -56 | 33 | 10.10 |
| -1 | 15 | 31.62 | 16 | -30.2 | -35 | -48 | -46 | 47 | 22.43 |
| 1.6 | 17 | 50.12 | 15.4 | -24 | -25 | -38 | -46 | 58 | 28.80 |
| 3.4 | 18 | 63.10 | 14.6 | -20.3 | -21.4 | -29 | -33 | 67 | 31.39 |
| 5.4 | 19 | 79.43 | 13.6 | -17 | -18 | -23 | -26 | 79 | 33.52 |
| 8.2 | 20 | 100.00 | 11.8 | -15 | -15 | -19 | -21 | 95 | 35.09 |

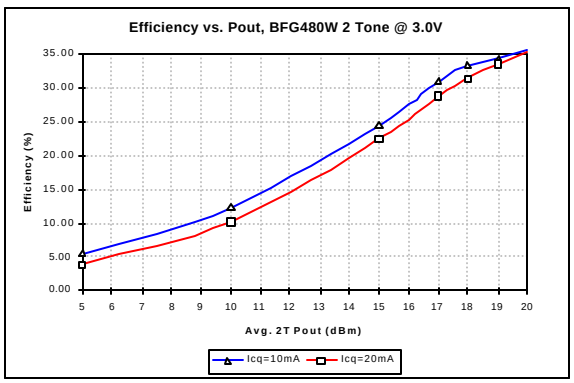
It=Ic+Ib, total current draw.

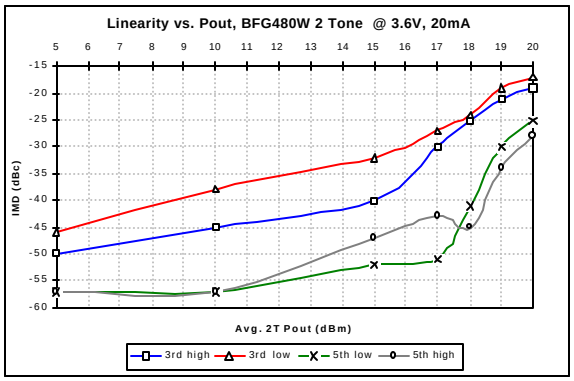
# 2 TONE

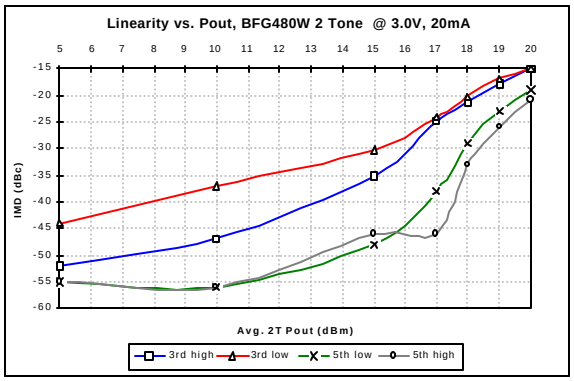

Gain vs. Pout, BFG480W 2 Tone @ 3.6V
Gain (dB)
Avg. 2T Pout (dBm)
Icq=20mA
Icq=10mA


Efficiency vs. Pout, BFG480W 2 Tone @ 3.6V
Efficiency (%)
Avg. 2T Pout (dBm)
Icq=10mA
Icq=20mA


Gain vs. Pout, BFG480W 2 Tone @ 3.0V
Gain (dB)
Avg. 2T Pout (dBm)
Icq=10mA
Icq=20mA


Efficiency vs. Pout, BFG480W 2 Tone @ 3.0V
Efficiency (%)
Avg. 2T Pout (dBm)
Icq=10mA
Icq=20mA


Linearity vs. Pout, BFG480W 2 Tone @ 3.6V, 20mA
IMD (dBc)
Avg. 2T Pout (dBm)
3rd high
3rd low
5th low
5th high


Linearity vs. Pout, BFG480W 2 Tone @ 3.0V, 20mA
IMD (dBc)
Avg. 2T Pout (dBm)
3rd high
3rd low
5th low
5th high

# TDMA

**BFG480W under TDMA at 1880 MHz and 25 deg. C**

**Vc=3.6V, Icq=10mA, Vbb=1.1V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | ACPR low dB | ACPR high dB | 1st ALT low dB | 1st ALT high dB | 2nd ALT low dB | 2nd ALT high dB | It mA | Eff % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -10 | 5 | 3.16 | 15 | -36 | -35 | -65 | -65 | -66 | -66 | 19 | 4.62 |
| -5.6 | 10 | 10.00 | 15.6 | -36 | -35 | -65 | -66 | -69 | -69 | 27 | 10.29 |
| -1 | 15 | 31.62 | 16 | -36 | -36 | -61 | -62 | -66 | -66 | 44 | 19.96 |
| 1 | 17 | 50.12 | 16 | -36 | -34 | -58 | -59 | -67 | -67 | 54 | 25.78 |
| 3.2 | 19 | 79.43 | 15.8 | -31 | -31 | -51 | -52 | -64 | -64 | 72 | 30.65 |
| 4.8 | 20 | 100.00 | 15.2 | -28 | -28.5 | -53 | -53 | -59 | -59 | 82 | 33.88 |
| 6.5 | 21 | 125.89 | 14.5 | -25.5 | -25 | -47 | -47 | -57 | -58 | 96 | 36.43 |
| 8.6 | 22 | 158.49 | 13.4 | -24 | -24 | -41 | -41 | -56 | -56 | 114 | 38.62 |

**Vc=3.6V, Icq=20mA, Vbb=1.16V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | ACPR low dB | ACPR high dB | 1st ALT low dB | 1st ALT high dB | 2nd ALT low dB | 2nd ALT high dB | It mA | Eff % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -11.2 | 5 | 3.16 | 16.2 | -35.4 | -36 | -66 | -66 | -67 | -66 | 26 | 3.38 |
| -6.2 | 10 | 10.00 | 16.2 | -36 | -36 | -68 | -68 | -70 | -70 | 33 | 8.42 |
| -1.3 | 15 | 31.62 | 16.3 | -35 | -36 | -62 | -62 | -65 | -65 | 47 | 18.69 |
| 0.72 | 17 | 50.12 | 16.28 | -36 | -36 | -59 | -59 | -67 | -67 | 58 | 24.00 |
| 3.1 | 19 | 79.43 | 15.9 | -30 | -30 | -53 | -53 | -64 | -64 | 73 | 30.23 |
| 4.7 | 20 | 100.00 | 15.3 | -26.5 | -26 | -52 | -52 | -58 | -58 | 84 | 33.07 |
| 6.5 | 21 | 125.89 | 14.5 | -25 | -25 | -46 | -46 | -58 | -58 | 98 | 35.68 |
| 8.5 | 22 | 158.49 | 13.5 | -24 | -24 | -40 | -40 | -55 | -56 | 116 | 37.95 |

**Vc=3.0V, Icq=10mA Vbb=1.11V**

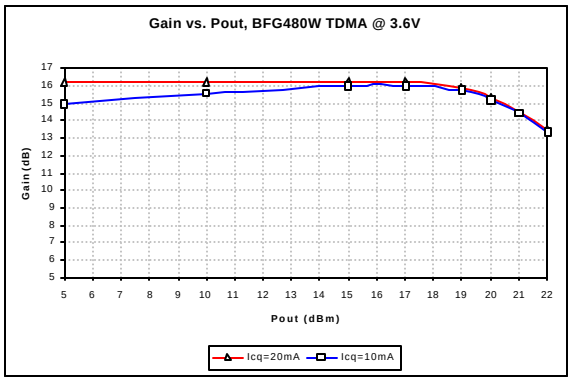
| Pin dBm | Pout dBm | Pout mWatt | Gain dB | ACPR low dB | ACPR high dB | 1st ALT low dB | 1st ALT high dB | 2nd ALT low dB | 2nd ALT high dB | It mA | Eff % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -9.7 | 5 | 3.16 | 14.7 | -35 | -35 | -65 | -65 | -67 | -67 | 19 | 5.55 |
| -5.2 | 10 | 10.00 | 15.2 | -36 | -36 | -65 | -65 | -70 | -70 | 27 | 12.35 |
| -0.5 | 15 | 31.62 | 15.5 | -36 | -35 | -58 | -60 | -66 | -66 | 43 | 24.51 |
| 1.6 | 17 | 50.12 | 15.4 | -33 | -33 | -52 | -52 | -66 | -66 | 55 | 30.37 |
| 4.4 | 19 | 79.43 | 14.6 | -27 | -27 | -51 | -51 | -58 | -58 | 73 | 36.27 |
| 6.1 | 20 | 100.00 | 13.9 | -25 | -25 | -45 | -45 | -56 | -56 | 86 | 38.76 |
| 8.2 | 21 | 125.89 | 12.8 | -24 | -23 | -40 | -40 | -55 | -55 | 102 | 41.14 |
| 10.6 | 22 | 158.49 | 11.4 | -22 | -22 | -38 | -38 | -50 | -50 | 124 | 42.60 |

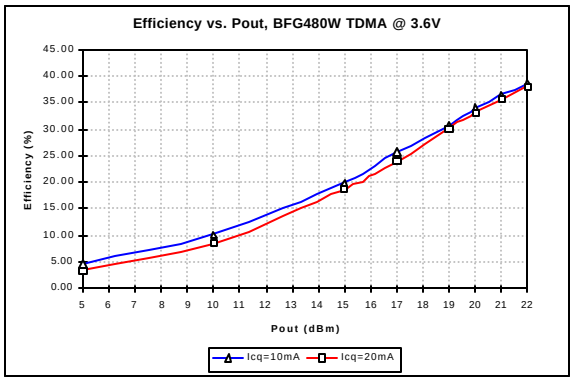
**Vc=3.0V, Icq=20mA Vbb=1.17V**

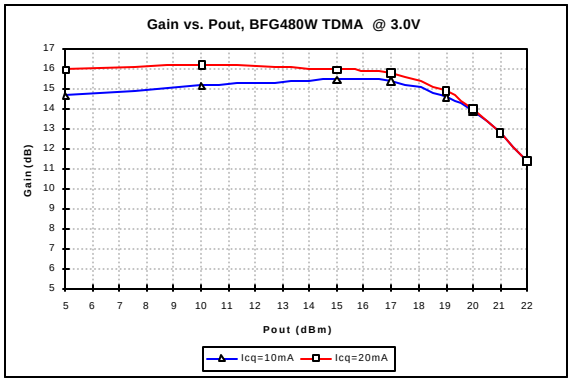
| Pin dBm | Pout dBm | Pout mWatt | Gain dB | ACPR low dB | ACPR high dB | 1st ALT low dB | 1st ALT high dB | 2nd ALT low dB | 2nd ALT high dB | It mA | Eff % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -11 | 5 | 3.16 | 16 | -36 | -36 | -64 | -65 | -65 | -65 | 26 | 4.05 |
| -6.2 | 10 | 10.00 | 16.2 | -36 | -36 | -68 | -68 | -70 | -70 | 33 | 10.10 |
| -1 | 15 | 31.62 | 16 | -34 | -35 | -62 | -62 | -65 | -65 | 48 | 21.96 |
| 1.2 | 17 | 50.12 | 15.8 | -33 | -33 | -54 | -54 | -66 | -66 | 59 | 28.32 |
| 4.1 | 19 | 79.43 | 14.9 | -27 | -27 | -52 | -52 | -59 | -59 | 76 | 34.84 |
| 6 | 20 | 100.00 | 14 | -25 | -25 | -45 | -44 | -58 | -58 | 89 | 37.45 |
| 8.2 | 21 | 125.89 | 12.8 | -23 | -23 | -40 | -40 | -55 | -55 | 106 | 39.59 |
| 10.6 | 22 | 158.49 | 11.4 | -23 | -23 | -38 | -38 | -50 | -50 | 127 | 41.60 |

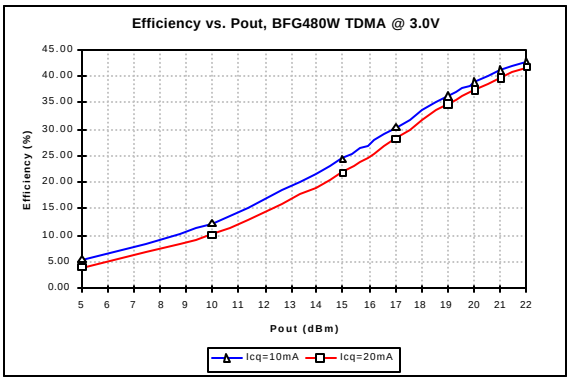
It=Ic+Ib, total current draw.

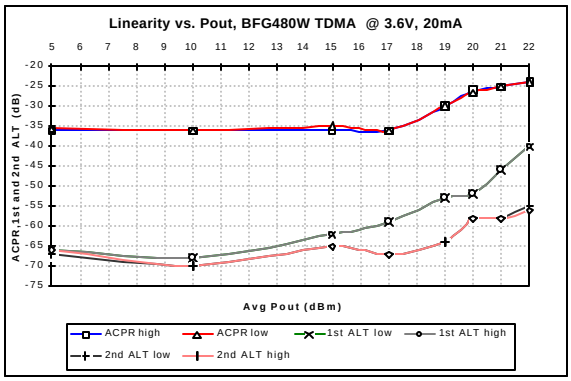
# TDMA

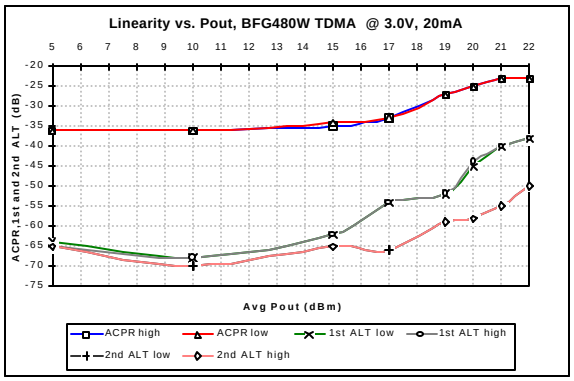

Gain vs. Pout, BFG480W TDMA @ 3.6V
Gain (dB)
Pout (dBm)
Icq=20mA
Icq=10mA


Efficiency vs. Pout, BFG480W TDMA @ 3.6V
Efficiency (%)
Pout (dBm)
Icq=10mA
Icq=20mA


Gain vs. Pout, BFG480W TDMA @ 3.0V
Gain (dB)
Pout (dBm)
Icq=10mA
Icq=20mA


Efficiency vs. Pout, BFG480W TDMA @ 3.0V
Efficiency (%)
Pout (dBm)
Icq=10mA
Icq=20mA


Linearity vs. Pout, BFG480W TDMA @ 3.6V, 20mA
ACPR,1st and 2nd ALT (dB)
Avg Pout (dBm)
ACPR high
ACPR low
1st ALT low
1st ALT high
2nd ALT low
2nd ALT high


Linearity vs. Pout, BFG480W TDMA @ 3.0V, 20mA
ACPR,1st and 2nd ALT (dB)
Avg Pout (dBm)
ACPR high
ACPR low
1st ALT low
1st ALT high
2nd ALT low
2nd ALT high

# CDMA

**BFG480W under CDMA at 1.88GHz and 25 deg. C**

**Vc=3.6V, Icq=10mA, Vbb=1.07V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | ACPR low dB | ACPR high dB | It mA | Eff % |
|---|---|---|---|---|---|---|---|
| -10.1 | 5 | 3.16 | 15.1 | -64 | -70 | 20 | 4.39 |
| -5.6 | 10 | 10.00 | 15.6 | -62 | -69 | 28 | 9.92 |
| -1 | 15 | 31.62 | 16 | -59 | -61 | 44 | 19.96 |
| 1 | 17 | 50.12 | 16 | -51 | -51 | 55 | 25.31 |
| 2.2 | 18 | 63.10 | 15.8 | -47 | -47 | 62 | 28.27 |
| 3.4 | 19 | 79.43 | 15.6 | -44 | -44 | 70 | 31.52 |
| 4.9 | 20 | 100.00 | 15.1 | -42 | -42 | 81 | 34.29 |

**Vc=3.6V, Icq=20mA, Vbb=1.15V**

| Pin dBm | Pout dBm | Pout mWatt | Gain dB | ACPR low dB | ACPR high dB | It mA | Eff % |
|---|---|---|---|---|---|---|---|
| -11.7 | 5 | 3.16 | 16.7 | -70 | -74 | 34 | 2.58 |
| -6.8 | 10 | 10.00 | 16.8 | -61 | -66 | 39 | 7.12 |
| -1.7 | 15 | 31.62 | 16.7 | -54 | -59 | 52 | 16.89 |
| 0.5 | 17 | 50.12 | 16.5 | -49 | -52 | 62 | 22.45 |
| 1.7 | 18 | 63.10 | 16.3 | -46 | -48 | 68 | 25.77 |
| 3.1 | 19 | 79.43 | 15.9 | -43 | -44 | 76 | 29.03 |
| 4.6 | 20 | 100.00 | 15.4 | -41 | -41 | 86 | 32.30 |

**Vc=3.0V, Icq=10mA, Vbb=1.11V**

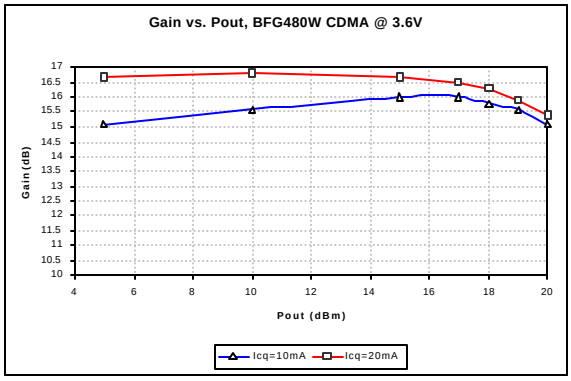
| Pin dBm | Pout dBm | Pout mWatt | Gain dB | ACPR low dB | ACPR high dB | It mA | Eff % |
|---|---|---|---|---|---|---|---|
| -9.7 | 5 | 3.16 | 14.7 | -62 | -64 | 19 | 5.55 |
| -5.2 | 10 | 10.00 | 15.2 | -62 | -60 | 27 | 12.35 |
| -0.5 | 15 | 31.62 | 15.5 | -55 | -53 | 43 | 24.51 |
| 1.7 | 17 | 50.12 | 15.3 | -46 | -46 | 55 | 30.37 |
| 3 | 18 | 63.10 | 15 | -43 | -43 | 62 | 33.92 |
| 4.5 | 19 | 79.43 | 14.5 | -41 | -41 | 72 | 36.77 |
| 6.3 | 20 | 100.00 | 13.7 | -39 | -39 | 86 | 38.76 |

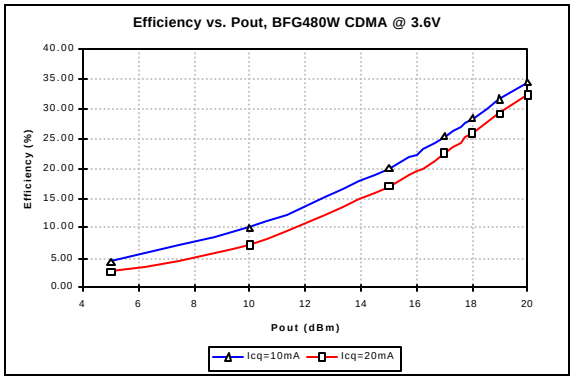
**Vc=3.0V, Icq=20mA, Vbb=1.17V**

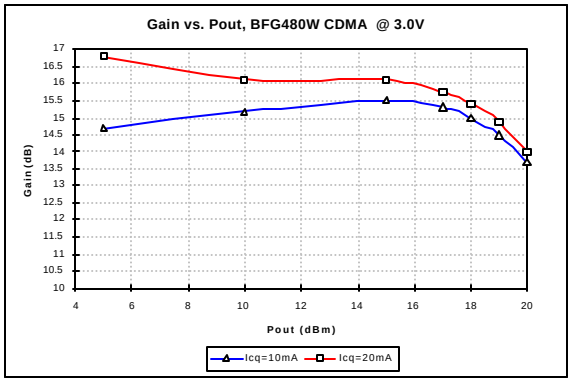
| Pin dBm | Pout dBm | Pout mWatt | Gain dB | ACPR low dB | ACPR high dB | It mA | Eff % |
|---|---|---|---|---|---|---|---|
| -11.8 | 5 | 3.16 | 16.8 | -67 | -73 | 27 | 3.90 |
| -6.1 | 10 | 10.00 | 16.1 | -59 | -68 | 34 | 9.80 |
| -1.1 | 15 | 31.62 | 16.1 | -52 | -55 | 48 | 21.96 |
| 1.26 | 17 | 50.12 | 15.74 | -46 | -45 | 58 | 28.80 |
| 2.6 | 18 | 63.10 | 15.4 | -43 | -43 | 67 | 31.39 |
| 4.1 | 19 | 79.43 | 14.9 | -41 | -40.8 | 76 | 34.84 |
| 6 | 20 | 100.00 | 14 | -39 | -39 | 89 | 37.45 |

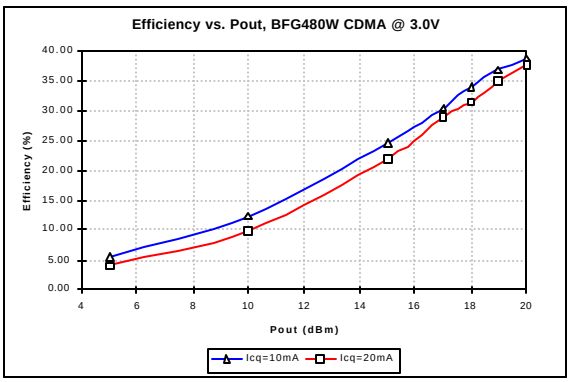
It=Ic+Ib, total current draw.

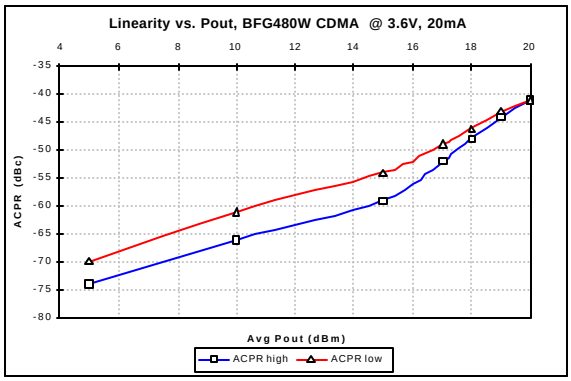
# CDMA

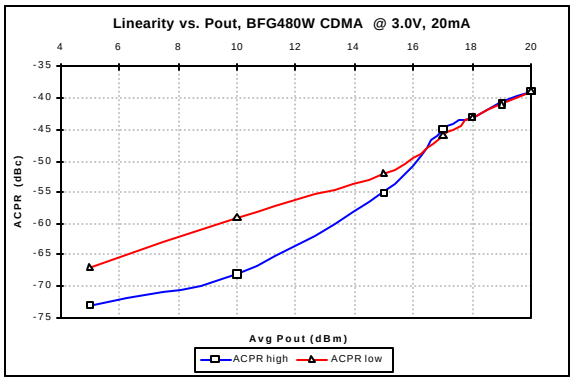

Gain vs. Pout, BFG480W CDMA @ 3.6V
Gain (dB)
Pout (dBm)
Icq=10mA
Icq=20mA


Efficiency vs. Pout, BFG480W CDMA @ 3.6V
Efficiency (%)
Pout (dBm)
Icq=10mA
Icq=20mA


Gain vs. Pout, BFG480W CDMA @ 3.0V
Gain (dB)
Pout (dBm)
Icq=10mA
Icq=20mA


Efficiency vs. Pout, BFG480W CDMA @ 3.0V
Efficiency (%)
Pout (dBm)
Icq=10mA
Icq=20mA


Linearity vs. Pout, BFG480W CDMA @ 3.6V, 20mA
ACPR (dBc)
Avg Pout (dBm)
ACPR high
ACPR low


Linearity vs. Pout, BFG480W CDMA @ 3.0V, 20mA
ACPR (dBc)
Avg Pout (dBm)
ACPR high
ACPR low

## APPENDIX 1: Part list for BFG480W 1880 MHz PA driver

### Resistors

| | | |
|---|---|---|
| R1 | 100 Ω | Leaded wirewound, 0.1W. |
| R2 | 5.1 Ω | Philips 0805, 0.1W metal film resistor. |
| R3 | 30 Ω | Philips 0805, 0.1W metal film resistor. |
| R4 | 11 Ω | Philips 0805, 0.1W metal film resistor. |

### Capacitors

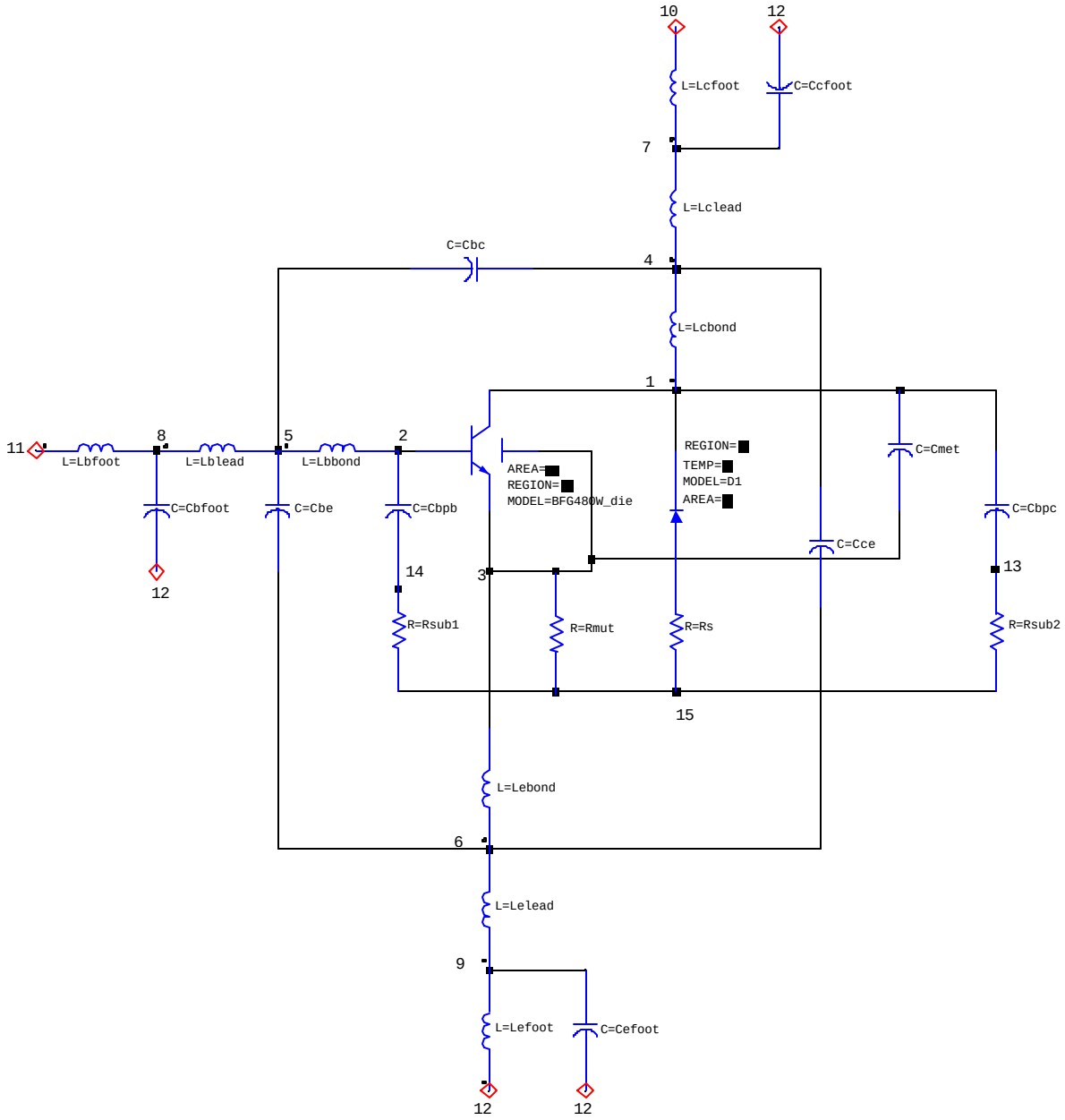
| | | |
|---|---|---|
| C1,C5 | 24 pF | ATC100A, DC blocking capacitor |
| C2 | 3.0 pF | ATC100A, matching capacitor |
| C3,C6 | 13 pF | ATC100A, bias and supply decoupling capacitor. |
| C4 | 1.3 pF | ATC100A, matching capacitor |
| C7 | 1.0 nF | Philips 0805, supply low frequency decoupling capacitor. |
| C8 | 10 µF | Philips electrolytic low frequency decoupling capacitor – not part of the demoboard. |

### Transistors

| | | |
|---|---|---|
| T1 | BFG480W | RF amplifying transistor. |
| Q1 | PMBT3904 | Biasing and thermal tracking small signal transistor. |

**APPENDIX 2:**

# BFG480W Spice and package model (preliminary)




This model is valid from 540MHz to 6GHz. The reference plane has been put at the test substrate for the package (SOT343R). In the next page you can see the test substrate definition. If you want to use this model without the footprint, just use the model at the node points 7,8, and 9.

### Spice parameters of the BFG480W

```
param Lbbond " 709.0p"
param Lblead " 281.0p"
param Lbfoot " 55.00p"
param Cbfoot " 58.50f"
param Lebond " 57.13p"
param Lelead " 69.14p"
param Lefoot " 173.9p"
param Cefoot " 195.0f"
param Lcbond " 559.3p"
param Lclead " 280.0p"
param Lcfoot " 55.00p"
param Ccfoot " 58.50f"
param Cbc " 2.000f"
param Cbe " 80.00f"
param Cce " 80.00f"
param Cbpb " 330.0f"
param Cbpc " 347.0f"
param Cmet " 883.7f"
param Rsub1 " 214.7 "
param Rsub2 " 321.4 "
param Rsub3 " 1.000MEG"
param Rmut " 98.84 "
param Rs " 217.5u"
param D1.IS " 976.6f"
param D1.N " 1.272 "
param Q1.AREA " 1.000 "
param NPN.IS " 176.9a"
param NPN.BF " 136.5 "
param NPN.NF " 986.3m"
param NPN.VAF " 23.00 "
param NPN.IKF " 5.900 "
param NPN.ISE " 1.189p"
param NPN.NE " 2.817 "
param NPN.BR " 9.000 "
param NPN.NR " 996.8m"
param NPN.VAR " 1.750 "
param NPN.IKR " 558.5m"
param NPN.ISC " 20.66f"
param NPN.NC " 1.916 "
param NPN.RB " 2.985 "
param NPN.IRB " 0.000 "
param NPN.RBM " 640.5m"
param NPN.RE " 114.5m"
param NPN.RC " 967.0m"
param NPN.CJE " 1.643p"
param NPN.VJE " 900.0m"
param NPN.MJE " 267.4m"
param NPN.CJC " 545.2f"
param NPN.VJC " 504.2m"
param NPN.MJC " 254.1m"
param NPN.CJS " 917.8f"
param NPN.VJS " 421.8m"
param NPN.MJS " 57.54m"
param NPN.XCJC " 500.0m"
param NPN.TR " 150.0p"
param NPN.TF " 3.680p"
param NPN.XTF " 1.000K"
param NPN.VTF " 652.5m"
param NPN.ITF " 11.13 "
param NPN.PTF " 0.000 "
param NPN.FC " 910.0m"
param NPN.EG " 1.110 "
param NPN.XTI " 4.300 "
param NPN.XTB " 500.0m"
```

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