

RF Reference Design Library

RF Power Field-Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

Device Characteristics (From Device Data Sheet)

Designed for W-CDMA base station applications with frequencies from 2110 to 2170 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications.

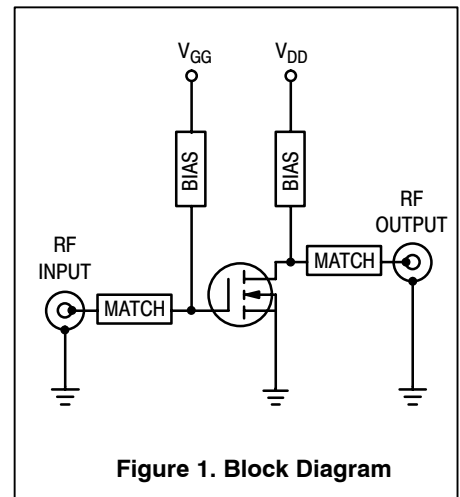
- Typical 2-carrier W-CDMA Performance: $V_{DD} = 28$ Volts, $I_{DQ} = 1300$ mA, $P_{out} = 33$ Watts Avg., Full Frequency Band, Channel Bandwidth = 3.84 MHz, Peak/Avg. = 8.5 dB @ 0.01% Probability on CCDF.
Power Gain — 12.5 dB
Efficiency — 25%
IM3 @ 10 MHz Offset — -37 dBc @ 3.84 MHz Channel Bandwidth
ACPR @ 5 MHz Offset — -39 dBc @ 3.84 MHz Channel Bandwidth
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 2140 MHz, 125 Watts CW Output Power
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Internally Matched, Controlled Q, for Ease of Use
- Qualified Up to a Maximum of 32 V_{DD} Operation
- Integrated ESD Protection
- Lower Thermal Resistance Package
- Low Gold Plating Thickness on Leads, 40 μ m Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

Reference Design Characteristics

- Typical W-CDMA Performance for $V_{DD} = 28$ Volts, $I_{DQ} = 1300$ mA, Full Frequency Band

MRF5S21150HR3
MRF5S21150HSR3
UMTS

W-CDMA
2.11-2.17 GHz



MRF5S21150H UMTS 2.11-2.17 GHz REFERENCE DESIGN

Designed by: Frédéric Fernez

This reference design is designed to demonstrate the typical RF performance characteristics of the MRF5S21150H when applied for the UMTS 2.11-2.17 GHz frequency band. The reference design is tuned for the best tradeoff between good W-CDMA linearity and good power capability and efficiency. It is biased at $V_{DD} = 28$ Volts and $I_{DQ} = 1300$ mA, but data are given to derive the performances under different biasing conditions.

REFERENCE DESIGN LIBRARY TERMS AND CONDITIONS

Freescal Semiconductor is pleased to make this reference design available for your use in development and testing of your own product or products, without charge. The reference design contains easy-to-copy, fully functional amplifier designs. Where possible, it consists of "no tune" distributed element matching circuits designed to be as small as possible, in-

cludes temperature compensated bias circuitry, and is designed to be used as "building blocks" for our customers.

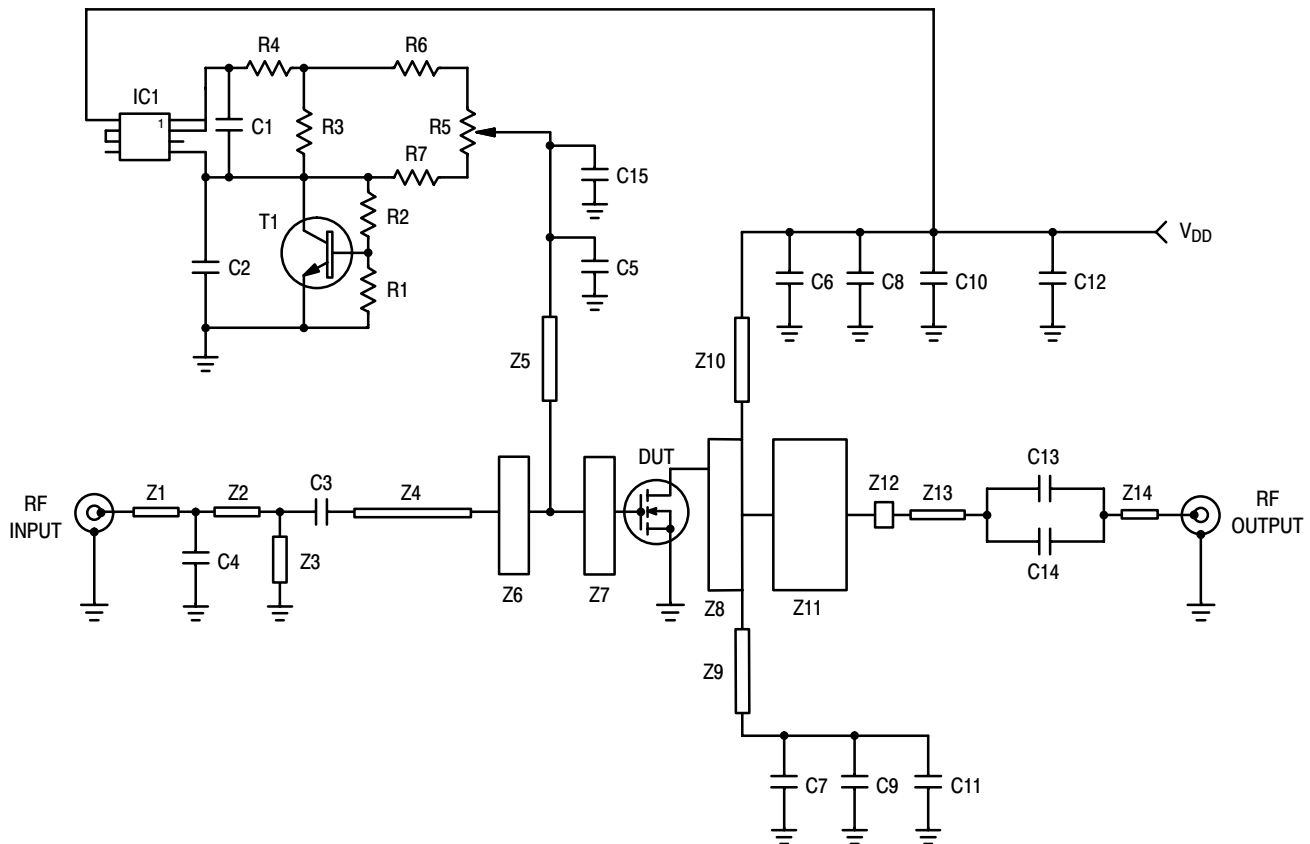
HEATSINKING

When operating this fixture please provide adequate heat-sinking for the device. Excessive heating of the device will prevent repeating of the included measurements.

NONLINEAR SIMULATION

To aid the design process and help reduce time to market for our customers, Freescal Semiconductor provides device models for several commercially available harmonic balance simulators. Our model Library is available for all major computer platforms supported by these simulators. For details on the RF model library and supported harmonic balance simulators, go to the following url:

<http://www.freescal.com/rf/models>

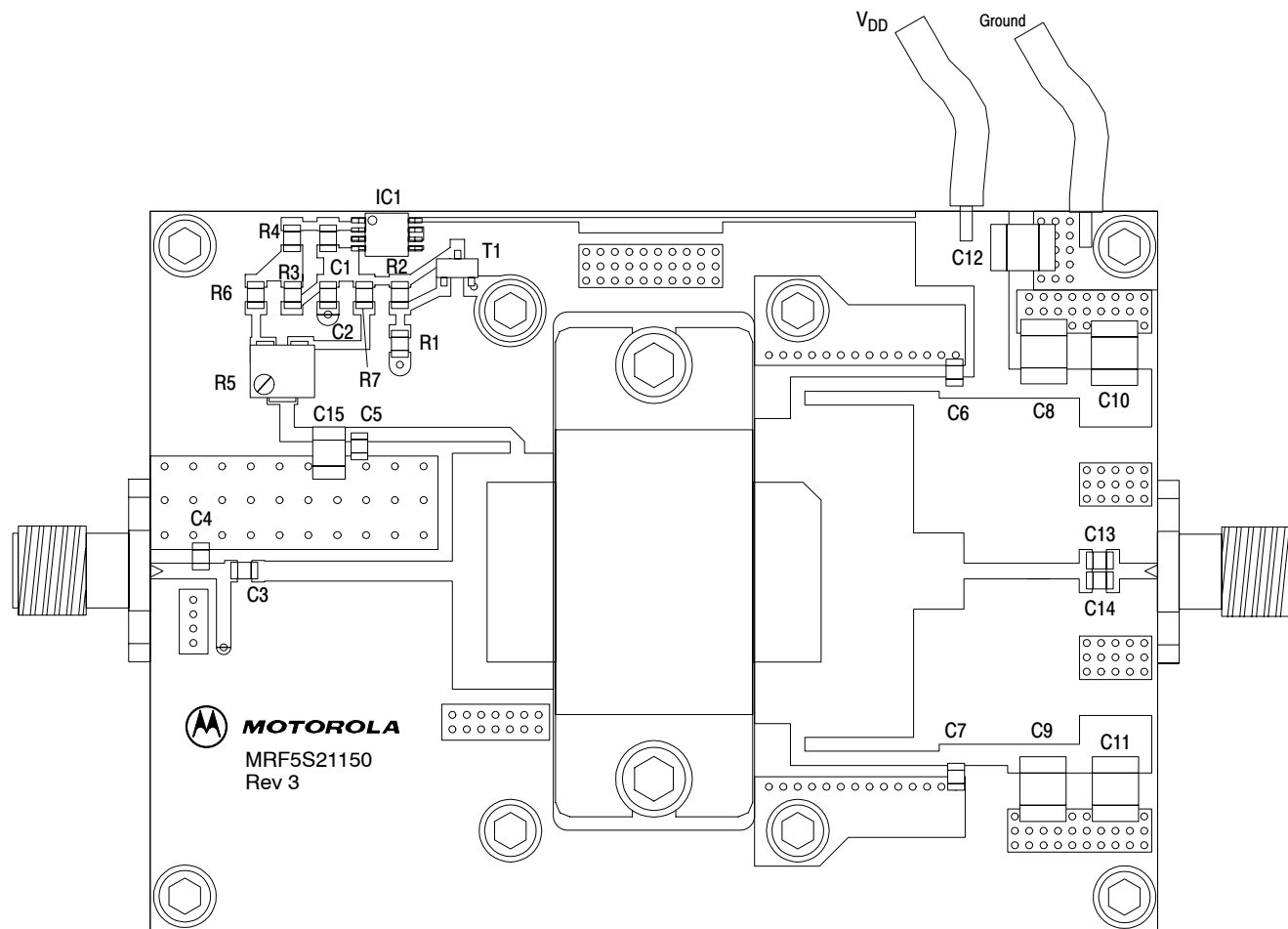


Z1	0.043" x 0.138" Microstrip	Z8	0.835" x 0.134" Microstrip
Z2	0.043" x 0.063" Microstrip	Z9, Z10	0.039" x 0.512" Microstrip
Z3	0.039" x 0.209" Microstrip	Z11	0.909" x 0.317" Microstrip
Z4	0.055" x 0.514" Microstrip	Z12	0.209" x 0.138" Microstrip
Z5	0.039" x 0.482" Microstrip	Z13	0.043" x 0.315" Microstrip
Z6	0.646" x 0.177" Microstrip	Z14	0.043" x 0.104" Microstrip
Z7	0.646" x 0.098" Microstrip	PCB	Rogers 4350, 0.020", $\epsilon_r = 3.5$

Figure 2. MRF5S21150H UMTS Reference Design Schematic

Table 1. MRF5S21150H UMTS Reference Design Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C2	1 μ F Chip Capacitors (0805)	08053G105ZAT	AVX
C3, C5, C6, C7	5.6 pF ACCU-P Chip Capacitors (0805)	08051J5R6CBT	AVX
C4	2.2 pF ACCU-P Chip Capacitor (0805)	08051J2R2BBT	AVX
C8, C9	220 nF Chip Capacitors (1812)	VJ1812Y224KXA	Vishay - Vitramon
C10, C11, C12	2.2 μ F Chip Capacitors (1812)	GCM43ER71H225KA02B	Murata
C13, C14	4.7 pF ACCU-P Chip Capacitors (0805)	08051J4R7CBT	AVX
C15	1000 pF, 100B Chip Capacitor	100B102JW	ATC
IC1	Voltage Regulator, Micro-8	LP2951	
R1	2.7 k Ω , 1/8 W Chip Resistor (0805)		
R2	1.5 k Ω , 1/8 W Chip Resistor (0805)		
R3	1 k Ω , 1/8 W Chip Resistor (0805)		
R4	10 Ω , 1/8 W Chip Resistor (0805)		
R5	5 k Ω Potentiometer CMS Cermet Multi-turn	3224W	Bourns
R6, R7	10 k Ω , 1/8 W Chip Resistors (0805)		
T1	Bipolar NPN Transistor SOT-23	BC847	



Freescall has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescall Semiconductor signature/logo. PCBs may have either Motorola or Freescall markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 3. MRF5S21150H UMTS Reference Design Component Layout

CHARACTERISTICS

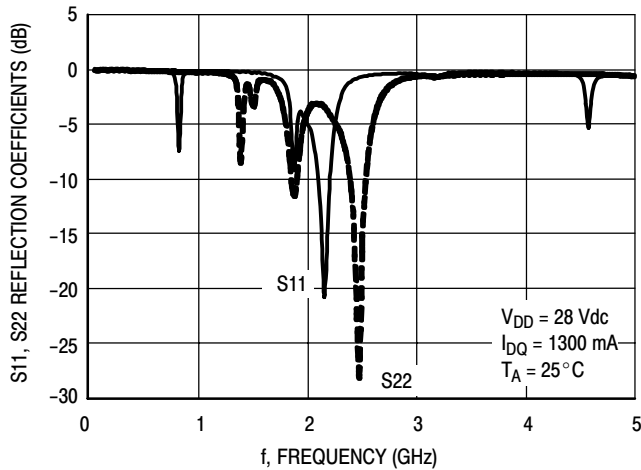


Figure 4. W-CDMA Reference Design Reflection Coefficients Magnitude

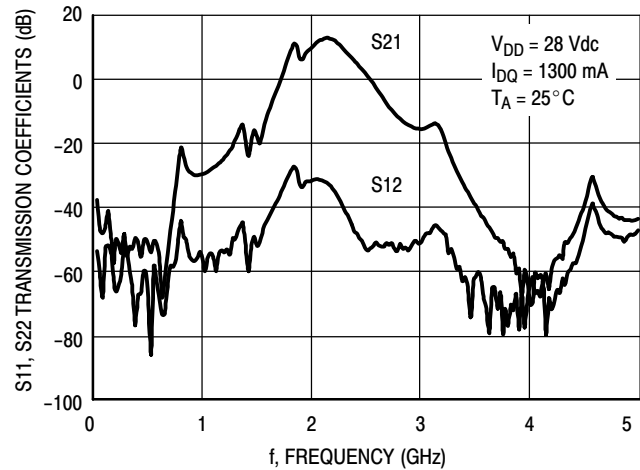


Figure 5. W-CDMA Reference Design Transmission Coefficients Magnitude

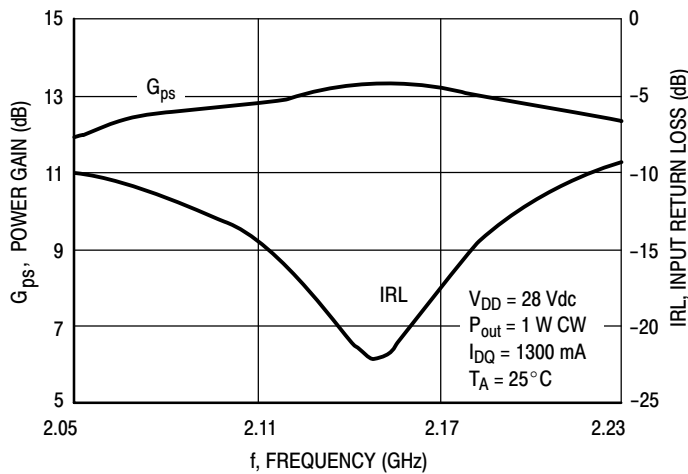


Figure 6. Power Gain and Input Return Loss versus Frequency

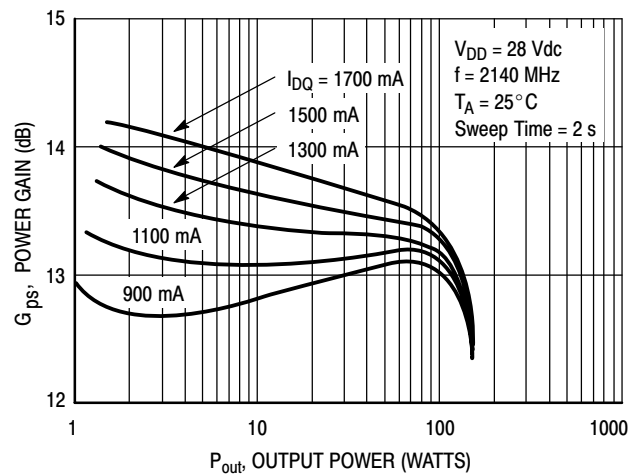


Figure 7. Power Gain versus Output Power

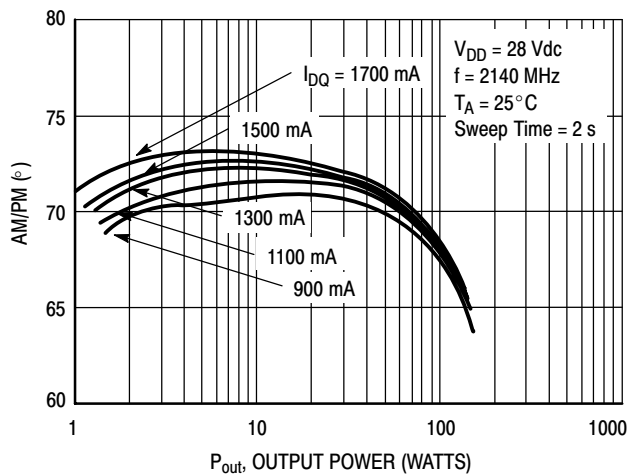


Figure 8. AM/PM Conversion versus Output Power

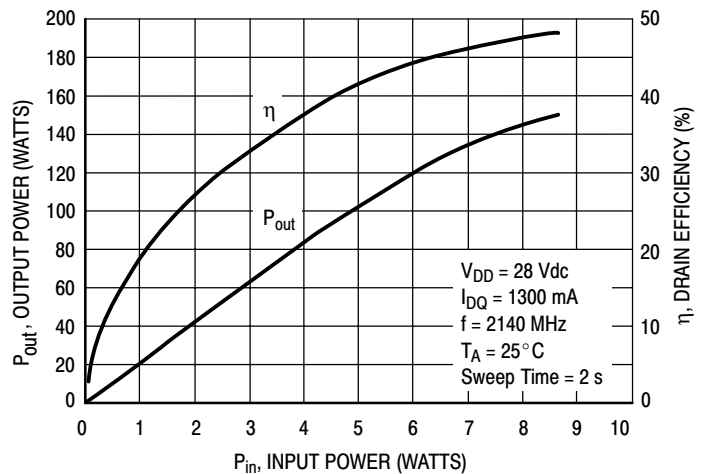


Figure 9. Output Power and Drain Efficiency versus Input Power

CHARACTERISTICS

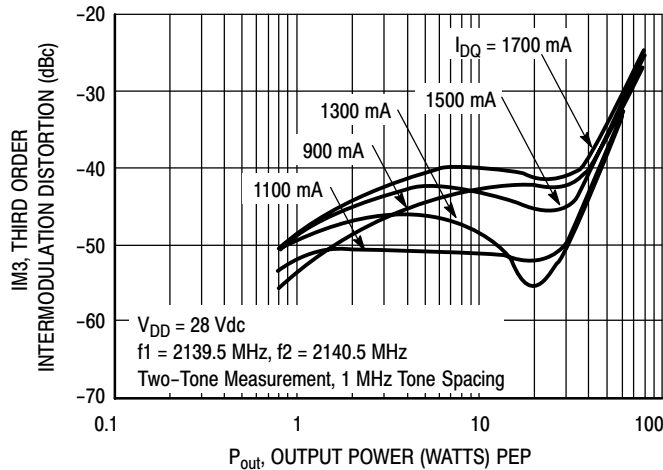


Figure 10. Third Order Intermodulation Distortion versus Output Power

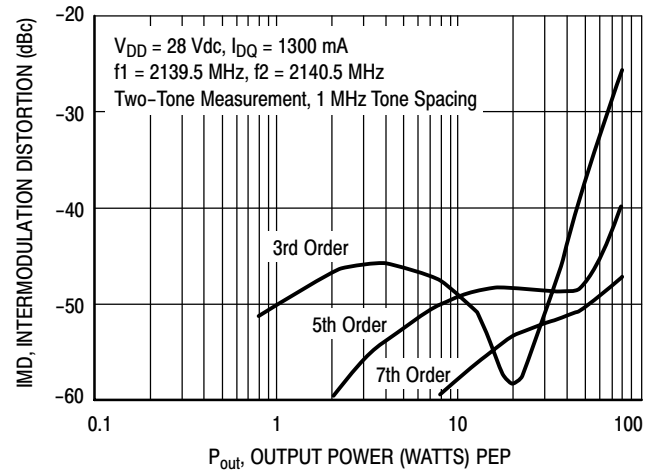


Figure 11. Intermodulation Distortion Products versus Output Power

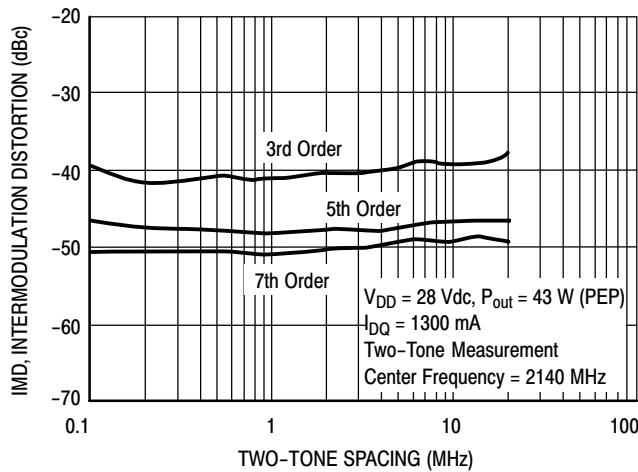


Figure 12. Intermodulation Distortion Products versus Tone Spacing

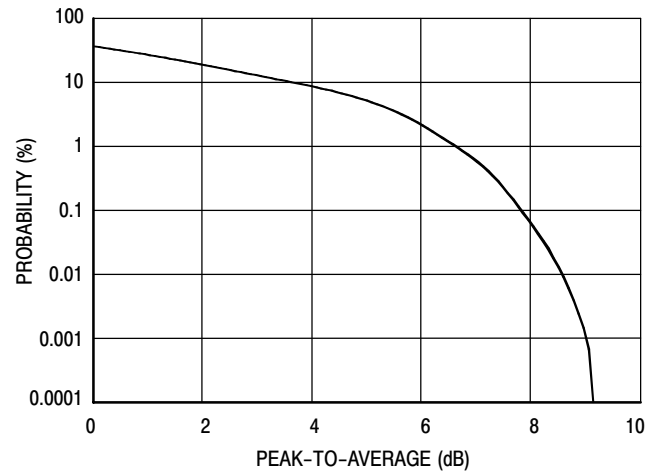


Figure 13. CCDF W-CDMA 3GPP, Test Model 1, 64 DPCH, 67% Clipping, Single Carrier Test Signal

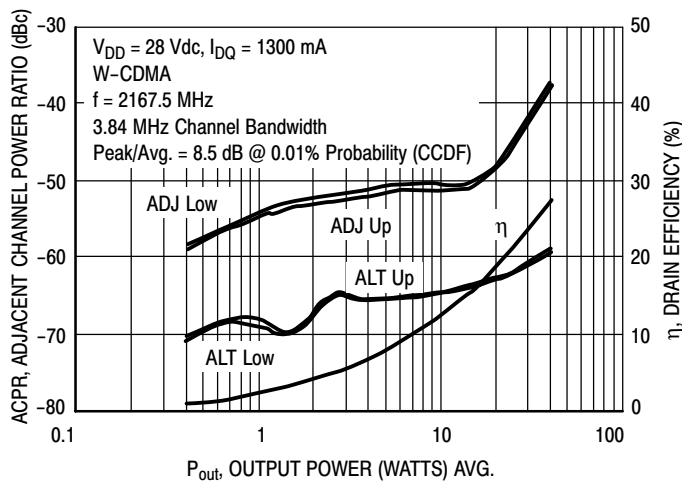


Figure 14. W-CDMA ACPR and Drain Efficiency versus Output Power

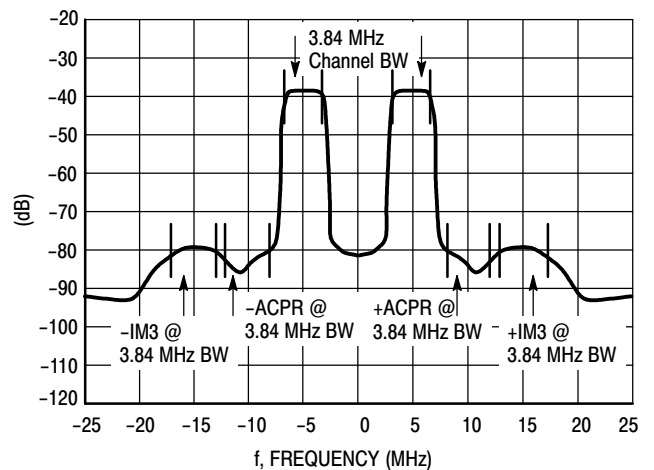


Figure 15. 2-Carrier W-CDMA Spectrum

CHARACTERISTICS

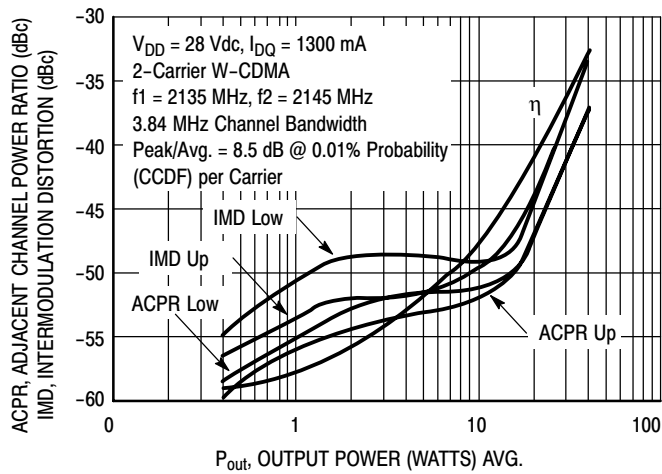


Figure 16. 2-Carrier W-CDMA ACPR, IM3 and Drain Efficiency versus Output Power

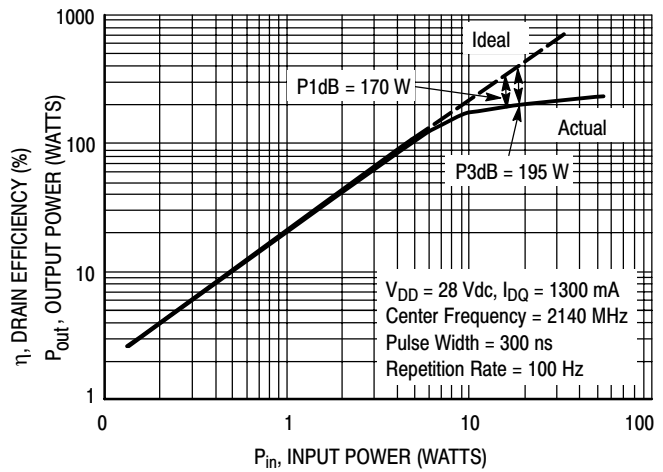


Figure 17. Pulse CW Output Power versus Input Power

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