PRELIMINARY

CGH27030F

30 W, 2300-2900 MHz, 28V, GaN HEMT for WiMAX

Cree's CGH27030F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGH27030F ideal for 2.3-2.9GHz WiMAX and BWA amplifier applications. The transistor is supplied in a ceramic/metal flange package.



Package Type: 440166
PN: CGH27030F

Typical Performance Over 2.3-2.7GHz (T_c = 25°C) of Demonstration Amplifier

Parameter	2.3 GHz	2.4 GHz	2.5 GHz	2.6 GHz	2.7 GHz	Units
Small Signal Gain	14.1	13.8	13.5	13.2	13.0	dB
EVM @ 21 dBm	2.3	2.1	1.7	1.7	1.9	%
EVM @ 36 dBm	1.7	1.7	1.8	1.8	2.0	%
Drain Efficiency @ 36 dBm	26.0	26.2	26.0	25.8	25.7	%
Input Return Loss	7.9	7.2	6.6	6.4	7.2	dB

Note:
Measured in the CGH27030F-TB amplifier circuit, under 802.16-2004 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.

Features

RoHS COMPLIANT

- 2.3 - 2.9 GHz Operation
- >13.5 dB Small Signal Gain
- 26 % Drain Efficiency at 4 W P_{OUT}
- 3.7°C/W Typical thermal resistance under 4.0 W P_{AVE} OFDM
- WiMAX Fixed Access 802.16-2004 OFDM
- WiMAX Mobile Access 802.16e OFDMA

Rev 1.0 – May 2007

Absolute Maximum Ratings (not simultaneous) at 25˚C Case Temperature

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	84	Volts
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts
Storage Temperature	T_{STG}	-55, +150	˚C
Operating Junction Temperature	T_J	175	˚C
Soldering Temperature	T_S	245	˚C
Thermal Resistance, Junction to Case [1]	$R_{\theta JC}$	3.7	˚C/W

Note:
[1] Measured for the CGH27030F at 14 W P_{DISS}

Electrical Characteristics (T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[4]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.6	-2.5	–	VDC	V_{DS} = 10 V, I_D = 7.2 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.6	–	VDC	V_{DS} = 28 V, I_D = 120 mA
Saturated Drain Current	I_{DS}	4.8	5.4	-	A	V_{DS} = 6.0 V, V_{GS} = 2 V
Drain-Source Breakdown Voltage	V_{BR}	84	100	–	VDC	V_{GS} = -8 V, I_D = 7.2 mA
Case Operating Temperature	T_C	-10	-	+105	˚C	
Screw Torque	T	-	-	60	in-oz	Reference 440166 Package Revision 3
RF Characteristics[2,3] (T_C = 25˚C, F_0 = 2.5 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	–	13.5	–	dB	V_{DD} = 28 V, I_{DQ} = 120 mA
Drain Efficiency[1]	η	–	26.0	–	%	V_{DD} = 28 V, I_{DQ} = 120 mA, P_{AVE} = 4 W
Back-Off Error Vector Magnitude	EVM_1	–	1.9	–	%	V_{DD} = 28 V, I_{DQ} = 120 mA, P_{AVE} = 21 dBm
Error Vector Magnitude	EVM_2	–	1.8	–		V_{DD} = 28 V, I_{DQ} = 120 mA, P_{AVE} = 4 W
Output Mismatch Stress	VSWR	-	TBD	-	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 120 mA
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	9.3	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	2.0	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.9	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz

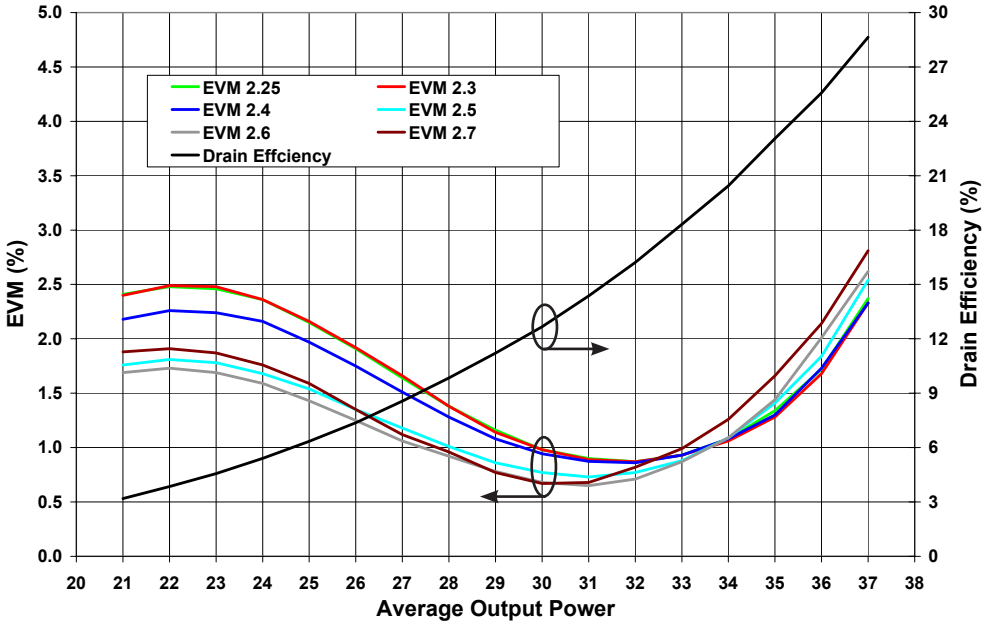
Notes:
[1] Drain Efficiency = P_{OUT} / P_{DC}
[2] Under 802.16-2004 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.
[3] Measured in the CGH27030F-TB test fixture.
[4] Measured on wafer prior to packaging.

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4600 Silicon Drive
Durham, NC 27703
USA Tel: +1.919.313.5300
Fax: +1.919.313.5778
www.cree.com/wireless

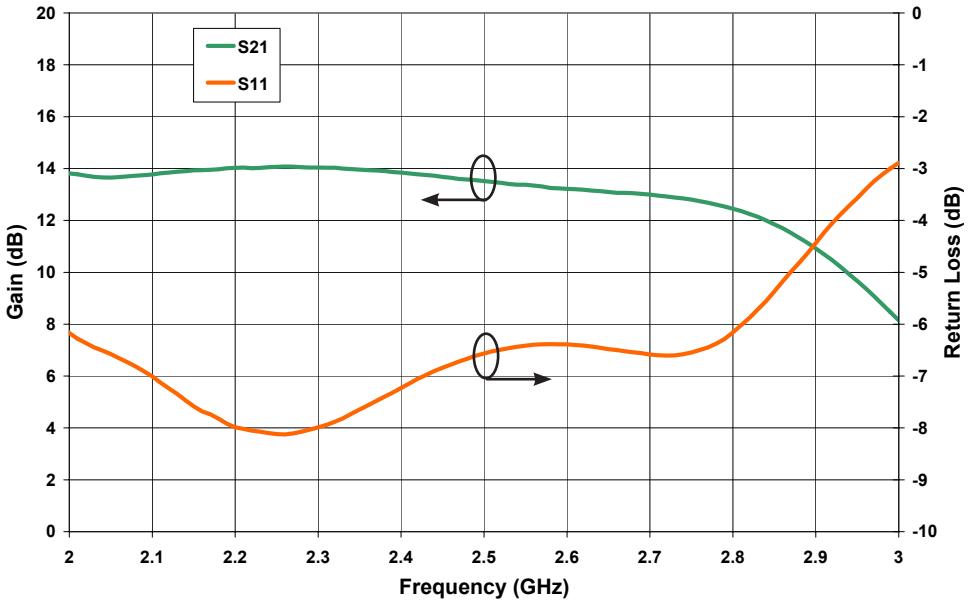
Typical WiMAX Performance

Typical EVM and Efficiency vs Frequency of CGH27030F in Broadband Amplifier Circuit CGH27030F-TB



Note:
Under 802.16-2004 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.

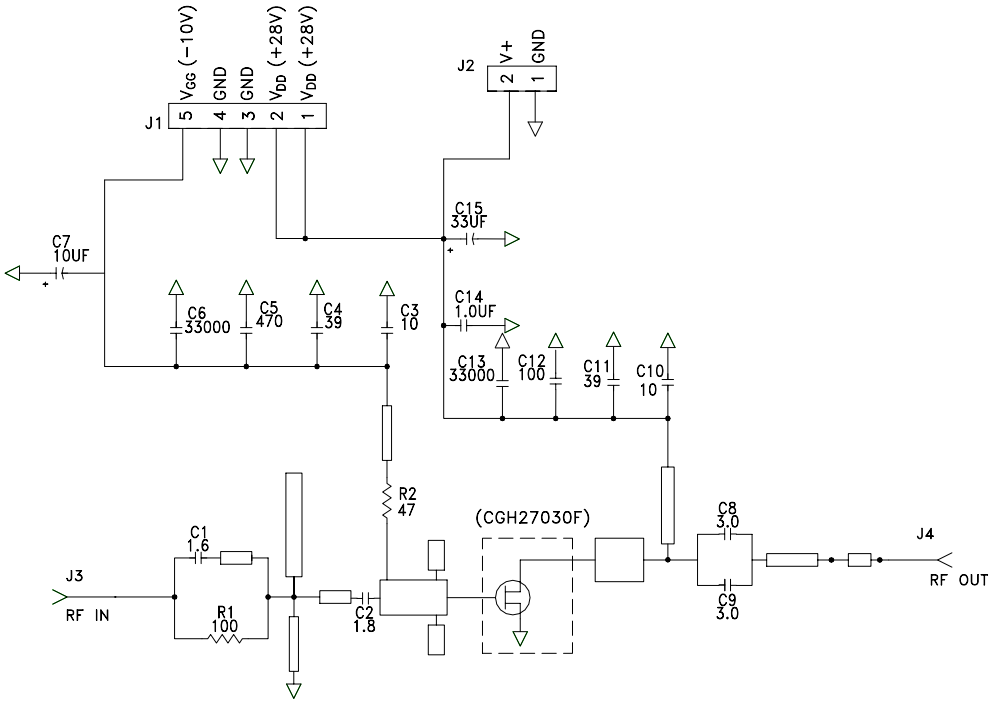
Gain and Return Loss vs Frequency of CGH27030F in Broadband Amplifier Circuit CGH27030F-TB
V_{DD} = 28 V, I_{DQ} = 120 mA, OFDM BW = 3.5 MHz



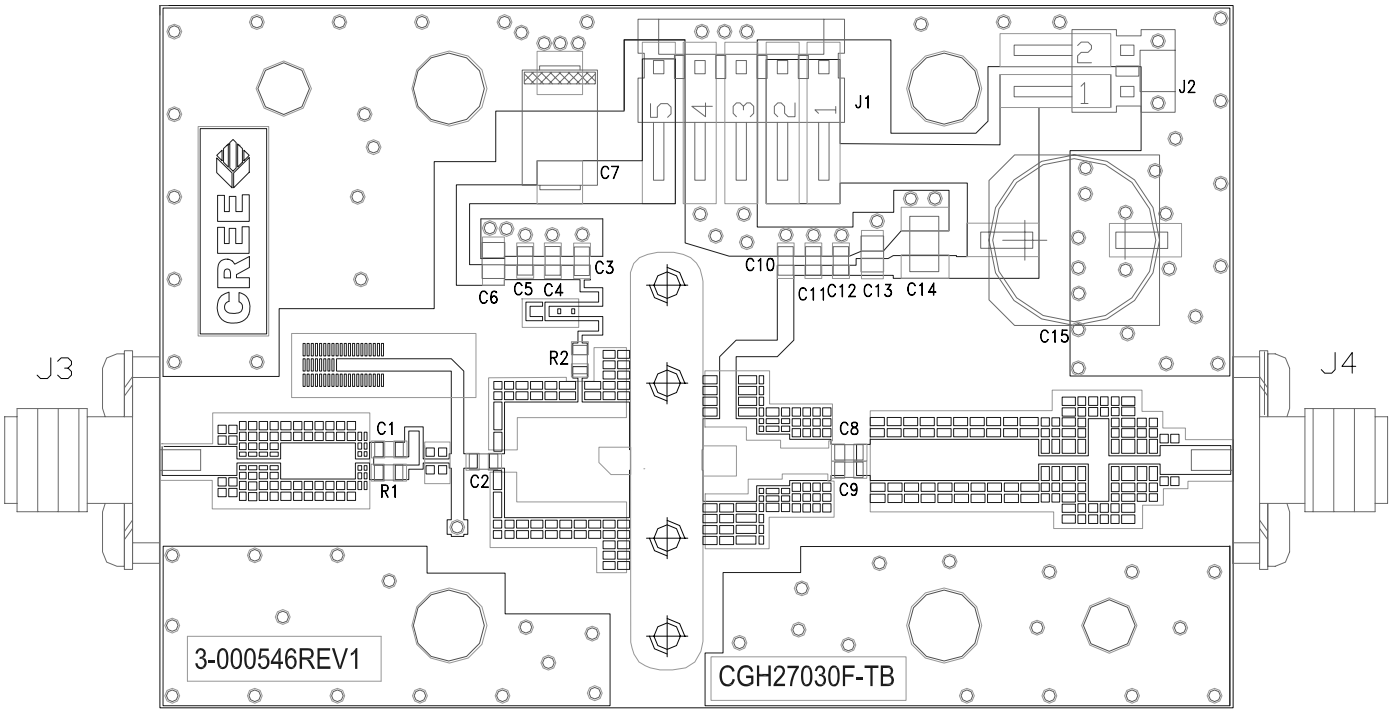
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4600 Silicon Drive
Durham, NC 27703
USA Tel: +1.919.313.5300
Fax: +1.919.313.5778
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CGH27030F-TB Demonstration Amplifier Circuit Schematic



CGH27030F-TB Demonstration Amplifier Circuit Outline



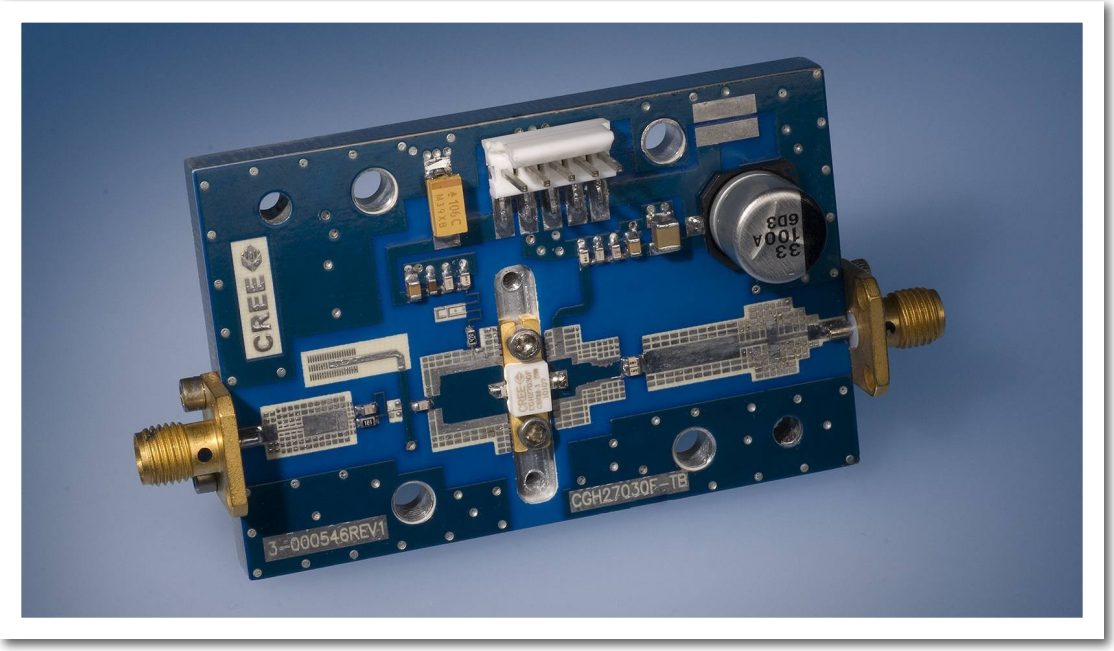
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4600 Silicon Drive
Durham, NC 27703
USA Tel: +1.919.313.5300
Fax: +1.919.313.5778
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CGH27030F-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES,1/16W,0603,1%,100 OHMS	1
R2	RES,1/16W,0603,1%,47 OHMS	1
C5	CAP, 470PF, 10%,100V, 0603	1
C15	CAP, 33 UF, 20%, G CASE	1
C14	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C7	CAP 10UF 16V TANTALUM	1
C12	CAP, 100.0pF, +/-5%, 0603	1
C1	CAP, 1.6pF, +/-0.1pF, 0603	1
C2	CAP, 1.8pF, +/-0.1pF, 0603	1
C3,C10	CAP, 10.0pF,+/-5%, 0603	2
C4,C11	CAP, 39pF, +/-5%, 0603	2
C8,C9	CAP, 3.0pF, +/-0.1pF, 0603	2
C6,C13	CAP,33000PF, 0805,100V, X7R	2
J3,J4	CONN SMA STR PANEL JACK RECP	1
J2	HEADER RT>PLZ.1CEN LK 2 POS	1
J1	HEADER RT>PLZ .1CEN LK 5POS	1
Q1	CGH27030F	1

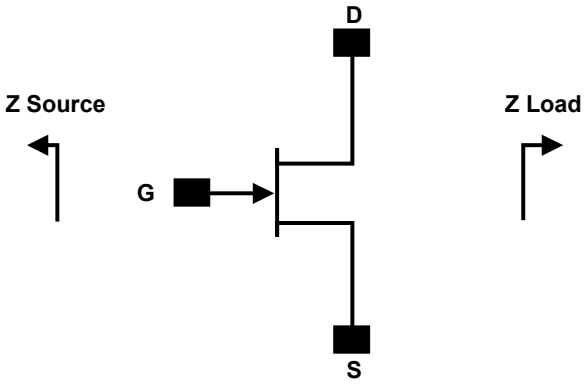
CGH27030F-TB Demonstration Amplifier Circuit



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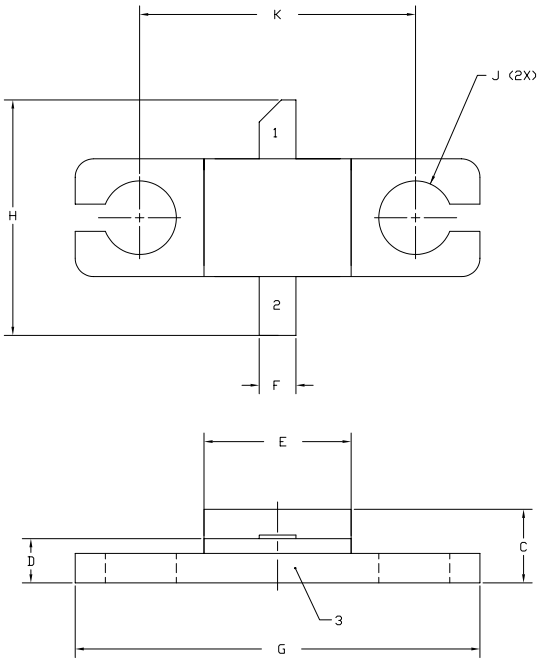
Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
2300	5.5 - j4.9	13.6 - j4.8
2400	5.7 - j4.5	13.3 - j4.0
2500	5.85 - j4.4	13.1 - j3.2
2600	5.8 - j4.5	12.9 - j2.5
2700	5.2 - j4.6	12.9 - j1.7

Note[1]: V_{DD} = 28V, I_{DQ} = 120mA. In the 440166 package.
Note[2]: Impedances are extracted from the CGH27030-TB demonstration circuit and are not source and load pull data derived from the transistor.

Product Dimensions CGH27030F (Package Type — 440166)



NOTES:

1. DIMENSIONING AND TOLERANICING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.
5. ALL PLATED SURFACES ARE NI/AU

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.155	0.165	3.94	4.19
B	0.004	0.006	0.10	0.15
C	0.115	0.135	2.92	3.43
D	0.057	0.067	1.45	1.70
E	0.195	0.205	4.95	5.21
F	0.045	0.055	1.14	1.40
G	0.545	0.555	13.84	14.09
H	0.280	0.360	7.87	8.38
J	ø .100		2.54	
K	0.375		9.53	

PIN 1. GATE
PIN 2. DRAIN
PIN 3. SOURCE

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Fax: +1.919.313.5778
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Typical Package S-Parameters
(Small Signal, V_{DS} = 28 V, I_{DQ} = 120 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
100 MHz	0.9478	-99.95	27.40	127.30	0.0250	37.44	0.530	-135.93
200 MHz	0.9247	-135.24	16.34	108.58	0.0298	18.89	0.631	-155.85
300 MHz	0.9181	-150.29	11.35	99.88	0.0310	10.36	0.657	-163.99
400 MHz	0.9155	-158.58	8.64	94.47	0.0315	5.11	0.667	-168.40
500 MHz	0.9143	-163.93	6.96	90.47	0.0317	1.28	0.672	-171.22
600 MHz	0.9136	-167.75	5.82	87.21	0.0318	-1.82	0.676	-173.22
700 MHz	0.9133	-170.68	5.00	84.38	0.0319	-4.49	0.678	-174.75
800 MHz	0.9131	-173.05	4.38	81.82	0.0319	-6.89	0.680	-175.99
900 MHz	0.9131	-175.05	3.90	79.44	0.0319	-9.11	0.682	-177.03
1.0 GHz	0.9131	-176.78	3.51	77.19	0.0320	-11.20	0.684	-177.93
1.1 GHz	0.9131	-178.32	3.19	75.04	0.0319	-13.20	0.685	-178.74
1.2 GHz	0.9132	-179.72	2.92	72.96	0.0319	-15.12	0.687	-179.48
1.3 GHz	0.9133	178.99	2.70	70.93	0.0319	-16.98	0.688	179.83
1.4 GHz	0.9135	177.78	2.50	68.95	0.0319	-18.80	0.690	179.18
1.5 GHz	0.9136	176.64	2.34	67.01	0.0319	-20.59	0.692	178.55
1.6 GHz	0.9138	175.56	2.19	65.10	0.0319	-22.34	0.694	177.95
1.7 GHz	0.9140	174.52	2.06	63.22	0.0318	-24.07	0.696	177.36
1.8 GHz	0.9142	173.51	1.95	61.36	0.0318	-25.78	0.698	176.78
1.9 GHz	0.9144	172.53	1.84	59.52	0.0318	-27.46	0.700	176.20
2.0 GHz	0.9147	171.57	1.75	57.69	0.0318	-29.13	0.702	175.63
2.1 GHz	0.9149	170.63	1.67	55.88	0.0317	-30.79	0.704	175.06
2.2 GHz	0.9151	169.71	1.59	54.09	0.0317	-32.43	0.706	174.48
2.3 GHz	0.9154	168.80	1.52	52.31	0.0317	-34.06	0.708	173.91
2.4 GHz	0.9156	167.90	1.46	50.54	0.0317	-35.68	0.710	173.33
2.5 GHz	0.9159	167.00	1.40	48.78	0.0317	-37.29	0.712	172.74
2.6 GHz	0.9161	166.11	1.34	47.03	0.0316	-38.90	0.714	172.15
2.7 GHz	0.9163	165.22	1.29	45.29	0.0316	-40.49	0.716	171.55
2.8 GHz	0.9166	164.34	1.25	43.56	0.0316	-42.08	0.719	170.94
2.9 GHz	0.9168	163.45	1.20	41.84	0.0316	-43.66	0.721	170.32
3.0 GHz	0.9170	162.57	1.16	40.12	0.0316	-45.23	0.723	169.69
3.1 GHz	0.9172	161.68	1.13	38.41	0.0316	-46.80	0.725	169.05
3.2 GHz	0.9174	160.79	1.09	36.71	0.0316	-48.37	0.727	168.40
3.3 GHz	0.9176	159.90	1.06	35.01	0.0316	-49.93	0.730	167.74
3.4 GHz	0.9178	159.00	1.03	33.31	0.0316	-51.48	0.732	167.07
3.5 GHz	0.9180	158.10	1.00	31.62	0.0316	-53.04	0.734	166.38
3.6 GHz	0.9182	157.19	0.97	29.94	0.0316	-54.59	0.736	165.69
3.7 GHz	0.9183	156.28	0.95	28.26	0.0316	-56.14	0.738	164.98
3.8 GHz	0.9185	155.36	0.92	26.58	0.0316	-57.69	0.740	164.26
3.9 GHz	0.9186	154.43	0.90	24.90	0.0316	-59.23	0.742	163.52
4.0 GHz	0.9187	153.49	0.88	23.23	0.0317	-60.78	0.744	162.78

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4600 Silicon Drive
Durham, NC 27703
USA Tel: +1.919.313.5300
Fax: +1.919.313.5778
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For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, NC 27703
www.cree.com/wireless

Ryan Baker
Marketing
Cree, Wireless Devices
919.287.7816

Tom Dekker
Sales Director
Cree, Wireless Devices
919.313.5639

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4600 Silicon Drive
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