

INTERNAL CELLULAR ANTENNA

For purposes of this exhibit the internal antenna gain is defined as the gain of the stamped metal antenna in the module plastic case exterior, minus all path losses.

INTERNAL ANTENNA GAIN

The internal antenna gain derived below is strictly an evaluation by Sierra Wireless' certified OTA test lab. It uses a device with a different cellular module. However the antenna and antenna circuit PCB topology are identical to that used for the PCB hosting the PHS8-USA cellular module in this application. The module used was rated by Sierra to put out an average of 23.7 dBm in the test configuration. Two samples were tested. The module has a stamped-metal antenna on the plastic case exterior. See the external photos exhibit for details.

Cell Band

For stamped-metal antenna 2 (Unit #2 below), the maximum Peak EIRP is 24.88 dBm in the cellular band. So the estimated gain is $24.88\text{dBm} - 23.7\text{dBm} = +1.18\text{ dBi}$ for the CDMA 800 (CELL) band.

PCS Band

For stamped-metal antenna 2 (Unit #2 below), the maximum Peak EIRP is 25.90 dBm in the PCS band. So the estimated gain is $25.90\text{dBm} - 23.7\text{dBm} = +2.20\text{ dBi}$ for the CDMA 1900 (PCS) band.

Due to similarity, the expected peak gain of the antenna for UMTS/HSPA+ device in this application is expected to be equivalent to that of the CDMA versions.

Radiated Performance Test Results (TRP/TIS)									
Comments:									
1. Unit#1, No ferrite on power cable									
2. ESN:60E050E2									
Band/ Channel	Freq (MHz)	Cond. Power (dBm)	TRP (dBm)	Peak EIRP (dBm)	Band/ Channel	Freq (MHz)	Cond. Sensitivity (dBm)	TIS (dBm)	Peak EIS (dBm)
CDMA 800 (CELL)			Target:20dBm		CDMA 800 (CELL)			Target:-101dBm	
1013	824.70		20.52	23.76	1013	869.70		-97.51	-100.59
384	836.52		20.65	23.56	384	881.52		-96.57	-101.91
777	848.31		20.36	22.78	777	893.31		-96.26	-100.72
Average		0.00	20.51	23.39	Average		0.00	-96.81	-101.12
CDMA 1900 (PCS)			Target:20dBm		CDMA 1900 (PCS)			Target:-101dBm	
25	1851.25		17.46	21.52	25	1931.25		-103.49	-107.80
600	1880.00		19.31	23.54	600	1960.00		-104.41	-109.36
1175	1908.75		19.00	23.39	1175	1988.75		-102.88	-108.65
Average		0.00	18.66	22.91	Average		0.00	-103.64	-108.65
Comments:									
1. Unit#2, No ferrite on power cable									
2. ESN:60E1A8DE									
Band/ Channel	Freq (MHz)	Cond. Power (dBm)	TRP (dBm)	Peak EIRP (dBm)	Band/ Channel	Freq (MHz)	Cond. Sensitivity (dBm)	TIS (dBm)	Peak EIS (dBm)
CDMA 800 (CELL)			Target:20dBm		CDMA 800 (CELL)			Target:-101dBm	
1013	824.70		21.19	24.88	1013	869.70		-96.44	-99.97
384	836.52		20.72	23.65	384	881.52		-96.83	-101.99
777	848.31		20.15	23.04	777	893.31		-95.25	-99.58
Average		0.00	20.71	23.93	Average		0.00	-96.22	-100.65
CDMA 1900 (PCS)			Target:20dBm		CDMA 1900 (PCS)			Target:-101dBm	
25	1851.25		20.64	25.19	25	1931.25		-103.89	-108.19
600	1880.00		21.41	25.90	600	1960.00		-103.73	-108.20
1175	1908.75		21.41	25.89	1175	1988.75		-102.15	-105.59
Average		0.00	21.17	25.67	Average		0.00	-103.32	-107.49

Table 1. Sierra Wireless Radiated Performance Test Results

LAB REPORT - LOW BAND EMISSIONS

The information in this table is compiled from the Gemalto's lab included with the module's FCC listing.

File: "From_Grant_TR1_Radiated_Data.pdf"

Gemalto Report Reference: MDE_CINTE_1108_FCCe

GSM Max Duty Cycle = 12.5%

EDGE Max Duty Cycle (4 upload slots) = 50%

FDD2 Max Duty Cycle = 100%

MEASUREMENTS FROM REPORT FOR: QIPPHS8-US 850 MHz Band RF Power Output §2.1053 §22.917							CALCULATIONS		
BAND:	MODE:	TEST:	CHANNEL:	FREQ (MHz):	PEAK (dBm):	AVG while XMIT (dBm): (note 1)	Max Duty Cycle (%)	Max Duty Cycle (dBm)	(Avg while XMIT)+Max Duty(dBm)
850	EDGE	edge test	128	824.2	30.3	27.1	50.0%	-3.01	24.09
850	EDGE	edge test	190	836.6	30.3	27.1	50.0%	-3.01	24.09
850	EDGE	edge test	251	848.8	30.3	27.1	50.0%	-3.01	24.09
850	GSM	gsm test	128	824.2	33.8	33.5	12.5%	-9.03	24.47
850	GSM	gsm test	190	836.6	33.4	33.1	12.5%	-9.03	24.07
850	GSM	gsm test	251	848.8	33.5	33.3	12.5%	-9.03	24.27
850	FDD5	HSDPA_subtest_1	4132	826.4	27.2	23.5	100.0%	0.00	23.50
850	FDD5	HSDPA_subtest_1	4183	836.6	27.1	23.5	100.0%	0.00	23.50
850	FDD5	HSDPA_subtest_1	4233	846.6	27.0	23.4	100.0%	0.00	23.40
850	FDD5	HSDPA_subtest_2	4132	826.4	27.7	23.7	100.0%	0.00	23.70
850	FDD5	HSDPA_subtest_2	4183	836.6	27.6	23.6	100.0%	0.00	23.60
850	FDD5	HSDPA_subtest_2	4233	846.6	27.5	23.4	100.0%	0.00	23.40
850	FDD5	HSDPA_subtest_3	4132	826.4	27.5	23.2	100.0%	0.00	23.20
850	FDD5	HSDPA_subtest_3	4183	836.6	27.4	23.1	100.0%	0.00	23.10
850	FDD5	HSDPA_subtest_3	4233	846.6	27.3	23.1	100.0%	0.00	23.10
850	FDD5	HSDPA_subtest_4	4132	826.4	27.6	23.2	100.0%	0.00	23.20
850	FDD5	HSDPA_subtest_4	4183	836.6	27.6	23.2	100.0%	0.00	23.20
850	FDD5	HSDPA_subtest_4	4233	846.6	27.4	23.0	100.0%	0.00	23.00
850	FDD5	HSUPA_subtest_1	4132	826.4	28.1	22.5	100.0%	0.00	22.50
850	FDD5	HSUPA_subtest_1	4183	836.6	28.4	23.0	100.0%	0.00	23.00
850	FDD5	HSUPA_subtest_1	4233	846.6	28.1	22.6	100.0%	0.00	22.60
850	FDD5	HSUPA_subtest_2	4132	826.4	27.6	21.7	100.0%	0.00	21.70
850	FDD5	HSUPA_subtest_2	4183	836.6	27.4	21.4	100.0%	0.00	21.40
850	FDD5	HSUPA_subtest_2	4233	846.6	27.4	21.5	100.0%	0.00	21.50
850	FDD5	HSUPA_subtest_3	4132	826.4	28.1	21.9	100.0%	0.00	21.90
850	FDD5	HSUPA_subtest_3	4183	836.6	28.1	21.9	100.0%	0.00	21.90
850	FDD5	HSUPA_subtest_3	4233	846.6	28.2	22.0	100.0%	0.00	22.00
850	FDD5	HSUPA_subtest_4	4132	826.4	27.9	21.7	100.0%	0.00	21.70
850	FDD5	HSUPA_subtest_4	4183	836.6	27.9	21.7	100.0%	0.00	21.70
850	FDD5	HSUPA_subtest_4	4233	846.6	27.9	21.8	100.0%	0.00	21.80
850	FDD5	HSUPA_subtest_5	4132	826.4	28.0	22.5	100.0%	0.00	22.50
850	FDD5	HSUPA_subtest_5	4183	836.6	28.3	23.0	100.0%	0.00	23.00
850	FDD5	HSUPA_subtest_5	4233	846.6	0.0	0.0	100.0%	0.00	0.00
850	FDD5	W-CDMA	4132	826.4	27.2	23.5	100.0%	0.00	23.50
850	FDD5	W-CDMA	4183	836.6	27.2	23.3	100.0%	0.00	23.30
850	FDD5	W-CDMA	4233	846.6	27.2	23.8	100.0%	0.00	23.80
Maximum Conducted Power in 850MHz Band									24.47

No data in
lab report

note 1 - This column is the average taken during transmitter-on time only; duty-factor is not included.

LAB REPORT - HIGH BAND EMISSIONS

The information in this table is compiled from the Gemalto's lab included with the module's FCC listing

File: "From_Grant_TR2_Radiated_Data.pdf"

Gemalto Report Reference: MDE_CINTE_1108_FCCd

GSM Max Duty Cycle = 12.5%

EDGE Max Duty Cycle (4 upload slots) = 50%

FDD2 Max Duty Cycle = 100%

MEASUREMENTS FROM REPORT FOR: QIPPHS8-US 1900 MHz Band RF Power Output \$2.1046 \$24.232							CALCULATIONS		
BAND:	MODE:	TEST:	CHANNEL:	FREQ (MHz):	PEAK (dBm):	AVG while XMIT (dBm): (note 1)	Max Duty Cycle (%)	Max Duty Cycle (dBm)	(Avg while XMIT)+Max Duty(dBm)
1900	EDGE	not given	512	1850.2	29.4	26.2	50.0%	-3.01	
1900	EDGE	not given	661	1880	29.3	26.1	50.0%	-3.01	23.09
1900	EDGE	not given	810	1909.8	29.4	26.2	50.0%	-3.01	23.19
1900	GSM	not given	512	1850.2	30.1	29.9	12.5%	-9.03	20.87
1900	GSM	not given	661	1880	30.5	30.3	12.5%	-9.03	21.27
1900	GSM	not given	810	1909.8	30.2	30	12.5%	-9.03	20.97
1900	FDD2	HSDPA_subtest_1	9262	1852.4	26.9	23.4	100.0%	0.00	23.40
1900	FDD2	HSDPA_subtest_1	9400	1880	27.3	23.8	100.0%	0.00	23.80
1900	FDD2	HSDPA_subtest_1	9538	1907.6	26.8	23.2	100.0%	0.00	23.20
1900	FDD2	HSDPA_subtest_2	9262	1852.4	27.4	23.6	100.0%	0.00	23.60
1900	FDD2	HSDPA_subtest_2	9400	1880	27.5	23.5	100.0%	0.00	23.50
1900	FDD2	HSDPA_subtest_2	9538	1907.6	27.3	23.3	100.0%	0.00	23.30
1900	FDD2	HSDPA_subtest_3	9262	1852.4	27.4	23.2	100.0%	0.00	23.20
1900	FDD2	HSDPA_subtest_3	9400	1880	27.4	23.2	100.0%	0.00	23.20
1900	FDD2	HSDPA_subtest_3	9538	1907.6	27.2	22.8	100.0%	0.00	22.80
1900	FDD2	HSDPA_subtest_4	9262	1852.4	27.6	23.3	100.0%	0.00	23.30
1900	FDD2	HSDPA_subtest_4	9400	1880	27.7	23.3	100.0%	0.00	23.30
1900	FDD2	HSDPA_subtest_4	9538	1907.6	27.4	23.1	100.0%	0.00	23.10
1900	FDD2	HSUPA_subtest_1	9262	1852.4	28.3	22.9	100.0%	0.00	22.90
1900	FDD2	HSUPA_subtest_1	9400	1880	28.1	22.8	100.0%	0.00	22.80
1900	FDD2	HSUPA_subtest_1	9538	1907.6	27.9	22.6	100.0%	0.00	22.60
1900	FDD2	HSUPA_subtest_2	9262	1852.4	27.3	21.7	100.0%	0.00	21.70
1900	FDD2	HSUPA_subtest_2	9400	1880	27.2	21.5	100.0%	0.00	21.50
1900	FDD2	HSUPA_subtest_2	9538	1907.6	27.0	21.4	100.0%	0.00	21.40
1900	FDD2	HSUPA_subtest_3	9262	1852.4	28.0	22.0	100.0%	0.00	22.00
1900	FDD2	HSUPA_subtest_3	9400	1880	27.9	21.9	100.0%	0.00	21.90
1900	FDD2	HSUPA_subtest_3	9538	1907.6	27.5	21.9	100.0%	0.00	21.90
1900	FDD2	HSUPA_subtest_4	9262	1852.4	28.0	22.0	100.0%	0.00	22.00
1900	FDD2	HSUPA_subtest_4	9400	1880	27.6	21.5	100.0%	0.00	21.50
1900	FDD2	HSUPA_subtest_4	9538	1907.6	27.4	21.5	100.0%	0.00	21.50
1900	FDD2	HSUPA_subtest_5	9262	1852.4	28.1	22.8	100.0%	0.00	22.80
1900	FDD2	HSUPA_subtest_5	9400	1880	27.9	22.6	100.0%	0.00	22.60
1900	FDD2	HSUPA_subtest_5	9538	1907.6	27.7	22.4	100.0%	0.00	22.40
1900	FDD2	W-CDMA	9262	1852.4	27.0	23.0	100.0%	0.00	23.00
1900	FDD2	W-CDMA	9400	1880	26.5	22.9	100.0%	0.00	22.90
1900	FDD2	W-CDMA	9538	1907.6	26.5	23.0	100.0%	0.00	23.00
Maximum Conducted Power in 1900MHz Band									23.80

note 1 - This column is the average taken during transmitter-on time only; duty-factor is not included.

