

Antenna H/W Specification

Project Name :	Dunton	Date:	07/07/2005
Project Manager:	Mason Chiang	Rev.:	1.2

Countersign:

Chung-I Chou

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Revision History

Revision	Revision History	Date	Author(s)
1.0		01/24/2005	Chung-I Chou
1.1	Spec modification	06/24/2005	Chung-I Chou
1.2	Spec modification	07/07/2005	Chung-I Chou

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H/W Specification

Embedded Penta-Band Antenna

1. Overview

The document is the specification of the embedded Penta-band antenna for PHONE applications. Penta-band includes GSM850, GSM900, DCS1800, PCS1900, WLAN2400.

1.1 Denotations

dBi: Decibel relative isotropic antenna
VSWR: Voltage Standing Wave Ratio
Tx: Transmit frequency
Rx: Receive frequency
GSM: Global Service for Mobile communication
PCS: Personal Communication System
DCS: Digital Communication System
WLAN: Wireless Local Area Network
SAR: Specific Absorption Rate
Peak Gain: The peak value of the antenna gain
Average Gain: The average value of the antenna gain

2. Measurement Parameters

2.1 VSWR

VSWR indicates the matching characteristics of the antenna. VSWR can be measured by a network analyzer.

2.2 Antenna Gain and Pattern

Antenna gain and far-field pattern can be determined by two measurement skills, depending on the own equipments. One is the far-field measurement; the other is the 3-D measurement system.

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3. Electrical Requirements

3.1 VSWR

	GSM850	GSM900	DCS1800	PCS1900	WLAN2400
Free space	2.5:1	2.5:1	2.5:1	2.5:1	2.5:1

Notably: The VSWR value will be degraded due to mechanical and space constrains.

3.2 Gain and Patterns (Total Field)

	GSM850	GSM900	DCS1800	PCS1900	WLAN2400
Peak gain	0.0 dBi				
Average gain	-4.0 dBi				

Notably: The target values (peak and average gains) will be degraded due to mechanical and space constrains.

3.3 Total Efficiency

	GSM900	DCS1800	PCS1900	WLAN2400
Total efficiency	50%	40%	40%	40%

Notably: The antenna total efficiency will be degraded due to mechanical and space constrains.

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4. Environmental Performance

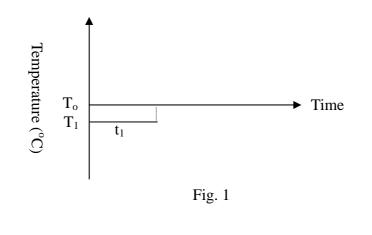
4.1 Test Methods

All of the tests should be carried out with the antenna mounted on the real PHONE to the maximum extent that is possible. Notably, T_0 is $20^{\circ}C \pm 3^{\circ}C$ (T_0 : room temperature).

4.1.1 Temperature (steady state)

The test is according to IEC 60068-2-1 Test Ab (Cold) and IEC 60068-2-2 Test Bb (Dry heat). The antenna is stored in a climatic camber with the following climate and time periods (Figs. 1 and 2):

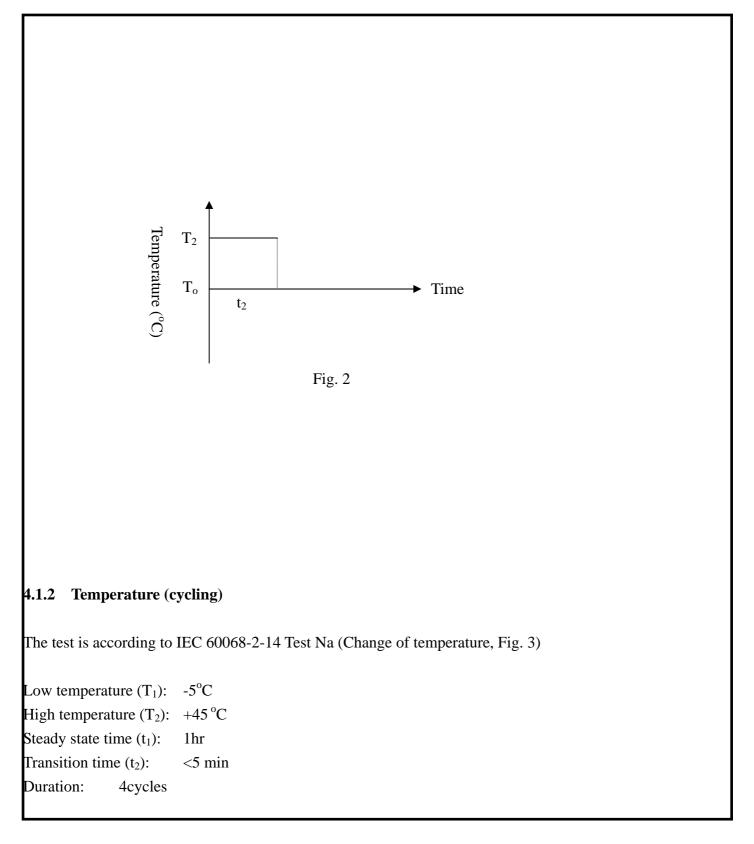
Low temperature/Duration:	$T_1 = -5^{\circ}C/t_1 = 48hr$ (Fig. 1)
High temperature/Duration:	$T_2 = +45^{\circ}C/t_2 = 48hr$ (Fig. 2)



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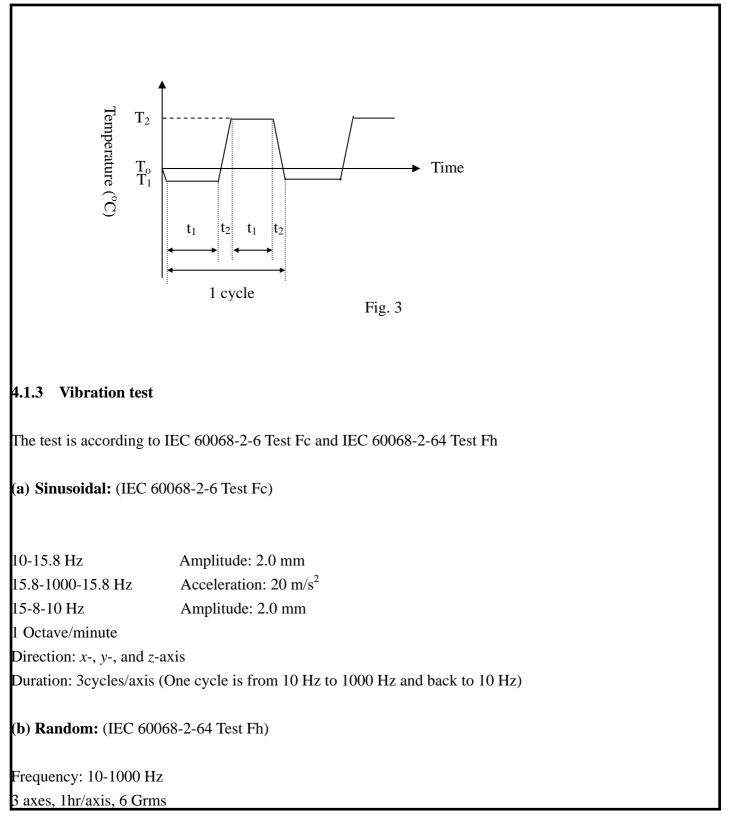
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PROPRIETARY NOTE

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4.2 Environmental Requirements

4.2.1 Temperature (steady state)

The antenna should fulfill the mechanical and electrical requirements after recovered to the room temperature. No visual deterioration should occur.

4.2.2 Temperature (cycling)

The antenna should fulfill the mechanical and electrical requirements after recovered to the room temperature.

4.2.3 Vibration test

The antenna should fulfill the mechanical and electrical requirements after the test.

5. Antenna Materials

The antenna can not have the materials of plumbum (Pb), halogen and mercury (Hg).

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Embedded Bluetooth Antenna

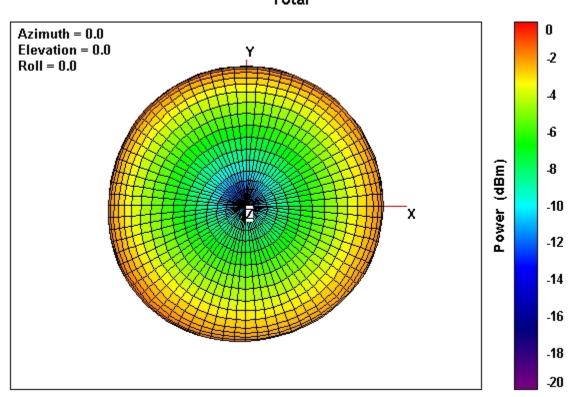
Frequency range	2400 MHz ~ 2500 MHz
VSWR	2.5 : 1
Peak gain	0 dBi
Average gain	4.0 dBi
Reference impedance	50 ohm

Notably: The VSWR and gain values will be degraded due to mechanical and space constrains.

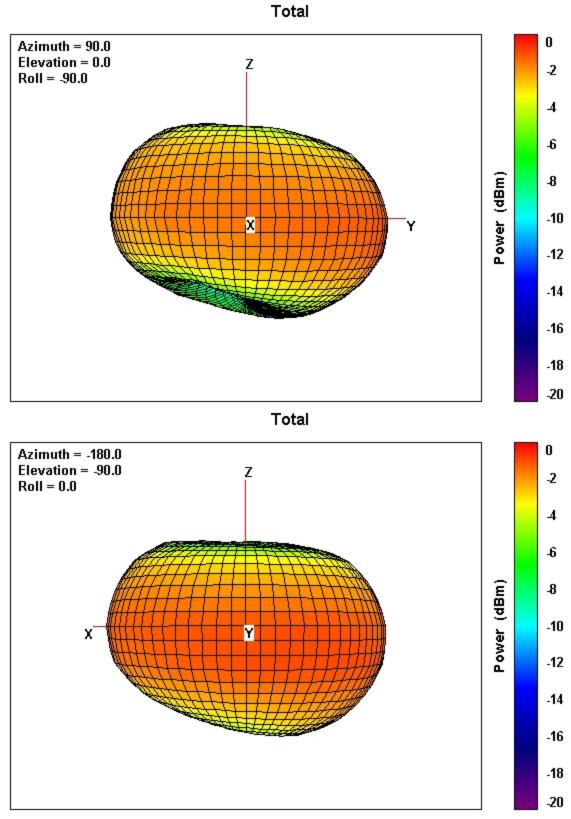
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Antenna	Gain	for	Faraday	1.5 xls

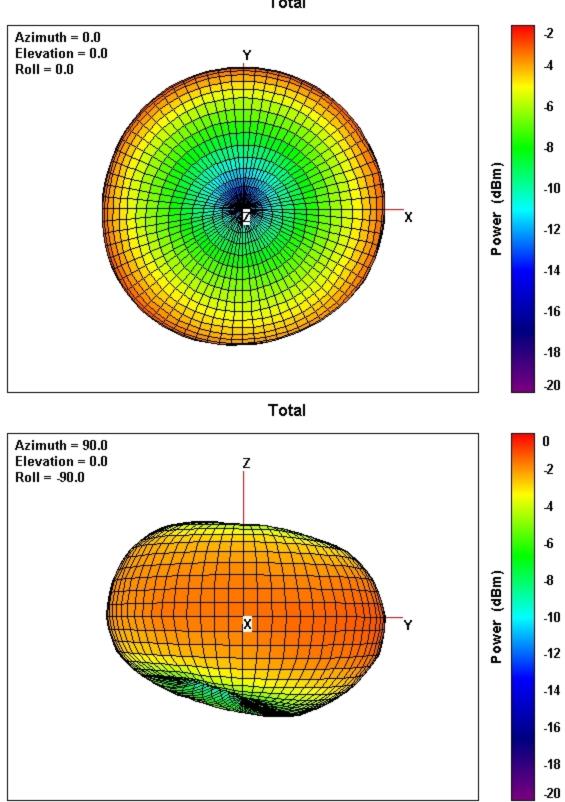
Model						Farad	•		第一	目見		
Test / Position						Gain / Free	Space (TX)					
Band		GSM850			GSM900			GSM1800			GSM1900	
Channel	824.2	836.4	848.8	880.2	898.4	914.8	1710.2	1747.4	1784.8	1850.2	1880	1909.8
Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00 -2.84	0.00	0.00 -1.85	0.00	0.00	0.0
· /	-3.69 -1.42	-3.38 -1.08	-3.38 -1.00	-3.52 -1.26	-3.69 -1.40	-4.19 -1.86	-2.84	-2.24 3.34	-1.85	-2.16	-2.07	-2.2
Peak EIRP (dBm)										3.11	3.13	
Directivity (dBi)	2.27	2.31	2.38	2.26	2.29	2.33	5.60	5.58	5.55	5.27	5.20	5.1
Efficiency (dB)	-3.69	-3.38	-3.38	-3.52	-3.69	-4.19	-2.84	-2.24	-1.85	-2.16	-2.07	-2.2
Gain (dBi)	-1.42	-1.08 -4.07	-1.00	-1.26 -4.21	-1.40	-1.86	2.76	3.34	3.70	3.11	3.13	2.8
NHPRP ±Pi/4 (dBm)	-4.38		-4.07		-4.38	-4.88	-4.33	-3.76	-3.34	-3.59	-3.46	-3.6
NHPRP ±Pi/6 (dBm)	-5.46	-5.15	-5.14	-5.29	-5.45	-5.94	-6.16	-5.64	-5.21	-5.43	-5.33	-5.5
NHPRP ±Pi/8 (dBm)	-6.44	-6.12	-6.11	-6.26	-6.42	-6.91	-7.63	-7.12	-6.70	-6.88	-6.79	-7.0
Front/Back Ratio (dB)	0.40	0.58	0.67	0.49	1.07	1.38	9.01	8.27	7.99	7.17	7.22	6.6
Phi BW (°)	182.00	182.00	182.00	182.00	182.00	182.00	87.00	86.00	86.00	96.00	106.00	105.0
+ Phi BW (°)	91.00	91.00	91.00	91.00 91.00	91.00	91.00	34.00	34.00	34.00 52.00	33.00	40.00	37.00
- Phi BW (°)	91.00 94.00	91.00 95.00	91.00 96.00	91.00	91.00 97.00	91.00 93.00	53.00 69.00	52.00	61.00	63.00 59.00	66.00 57.00	68.0 57.0
Theta BW (°)								66.00				
+ Th. BW (°)	49 45.00	53 42.00	54 42.00	56 43.00	40 57.00	46 47.00	47 22.00	46 20.00	42 19.00	40 19.00	34 23.00	22.0
- Th. BW (°) Borooight Bhi (%)	45.00 225.00	42.00 210.00	42.00 210.00	43.00 210.00	57.00 210.00	47.00 120.00	22.00 150.00	20.00 150.00	19.00 150.00	19.00 150.00	23.00 135.00	22.0 135.0
Boresight Phi (°)	90.00	210.00	210.00 90.00	210.00	210.00	120.00	150.00		150.00	150.00	135.00	
Boresight Th. (°)	-1.42	-1.08	-1.00	-1.26	-1.40	-1.86	2.76	120.00 3.34	120.00 3.70			120.0 2.8
Maximum Power (dBm) Minimum Power (dBm)	-1.42	-1.08 -18.89	-1.00	-1.26 -18.13	-1.40 -17.71	-1.86	-16.56	3.34 -16.51	-17.38	3.11 -15.42	3.13 -15.27	-14.9
Average Power (dBm) Max/Min Ratio (dB)	-4.96 17.96	-4.65 17.81	-4.64 17.80	-4.77 16.87	-4.93 16.32	-5.42 16.31	-2.71 19.32	-2.10 19.84	-1.78 21.08	-2.25 18.53	-2.29 18.40	-2.5
()												
Max/Avg Ratio (dB)	3.54	3.57	3.64	3.51	3.54	3.56	5.47	5.44	5.48	5.36	5.42	5.3
Min/Avg Ratio (dB)	-14.42 -3.69	-14.24 -3.38	-14.16 -3.38	-13.36 -3.52	-12.78 -3.69	-12.75 -4.19	-13.85 -2.84	-14.40 -2.24	-15.60 -1.85	-13.17	-12.98 -2.07	-12.3
Average Gain (dB)	-3.69	-3.38	-3.38	-3.52	-3.69	-4.19	-2.84	-2.24	-1.85	-2.16	-2.07	-2.2
Note												
	1					Farad	av 1 5					
Model						Farad Gain / Free						
Model Test / Position		GSM850				<i>Farad</i> Gain / Free					GSM1900	
Model Test / Position Band	869.2	GSM850	893.8	925.2	GSM900	Gain / Free	Space (RX)	GSM1800	1879 8	1930 2	GSM1900	1989.8
Model Test / Position Band Channel	869.2	881.4	893.8	925.2	GSM900 943.4	Gain / Free 959.8	Space (RX) 1805.2	GSM1800 1842.4	1879.8	1930.2	1960	1989.8
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm)	0.00	881.4 0.00	0.00	0.00	GSM900 943.4 0.00	Gain / Free 959.8 0.00	Space (RX) 1805.2 0.00	GSM1800 1842.4 0.00	0.00	0.00	1960 0.00	0.0
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm)	0.00 -3.09	881.4 0.00 -3.16	0.00 -3.43	0.00 -4.07	GSM900 943.4 0.00 -4.63	Gain / Free 959.8 0.00 -5.21	Space (RX) 1805.2 0.00 -2.08	GSM1800 1842.4 0.00 -2.10	0.00 -1.87	0.00 -2.27	1960 0.00 -2.60	0.0
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm)	0.00 -3.09 -0.76	881.4 0.00 -3.16 -0.88	0.00 -3.43 -1.16	0.00 -4.07 -1.69	GSM900 943.4 0.00 -4.63 -2.34	Gain / Free 959.8 0.00 -5.21 -2.95	Space (RX) 1805.2 0.00 -2.08 3.08	GSM1800 1842.4 0.00 -2.10 2.90	0.00 -1.87 3.01	0.00 -2.27 2.23	1960 0.00 -2.60 1.60	0.00 -3.15 0.75
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi)	0.00 -3.09 -0.76 2.33	881.4 0.00 -3.16 -0.88 2.28	0.00 -3.43 -1.16 2.27	0.00 -4.07 -1.69 2.39	GSM900 943.4 0.00 -4.63 -2.34 2.29	Gain / Free 959.8 0.00 -5.21 -2.95 2.26	Space (RX) 1805.2 0.00 -2.08 3.08 5.16	GSM1800 1842.4 0.00 -2.10 2.90 5.00	0.00 -1.87 3.01 4.87	0.00 -2.27 2.23 4.50	1960 0.00 -2.60 1.60 4.20	0.00 -3.15 0.75 3.90
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB)	0.00 -3.09 -0.76 2.33 -3.09	881.4 0.00 -3.16 -0.88 2.28 -3.16	0.00 -3.43 -1.16 2.27 -3.43	0.00 -4.07 -1.69 2.39 -4.07	GSM900 943.4 0.00 -4.63 2.29 -4.63	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08	GSM1800 1842.4 0.00 -2.10 2.90 5.00 -2.10	0.00 -1.87 3.01 4.87 -1.87	0.00 -2.27 2.23 4.50 -2.27	1960 0.00 -2.60 1.60 4.20 -2.60	0.00 -3.19 0.79 3.90 -3.19
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi)	0.00 -3.09 -0.76 2.33 -3.09 -0.76	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88	0.00 -3.43 -1.16 2.27 -3.43 -1.16	0.00 -4.07 -1.69 2.39 -4.07 -1.69	GSM900 943.4 0.00 -4.63 -2.34 2.29 -4.63 -2.34	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -2.95	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08	GSM1800 1842.4 0.00 -2.10 2.90 5.00 -2.10 2.90	0.00 -1.87 3.01 4.87 -1.87 3.01	0.00 -2.27 2.23 4.50 -2.27 2.23	1960 0.00 -2.60 1.60 4.20 -2.60 1.60	0.00 -3.19 0.79 3.90 -3.19 0.79
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74	GSM900 943.4 0.00 -4.63 2.29 -4.63 -2.34 -5.32	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -2.95 -5.94	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56	GSM1800 1842.4 0.00 -2.10 5.00 -2.10 2.90 -3.54	0.00 -1.87 3.01 4.87 -1.87 3.01 -3.31	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68	1960 0.00 -2.60 1.60 4.20 -2.60 1.60 -4.00	0.00 -3.11 0.75 3.90 -3.11 0.75 -4.55
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -3.83 -4.90	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79	GSM900 943.4 0.00 -4.63 2.29 -4.63 -2.34 -5.32 -6.40	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -2.95 -5.94 -7.04	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56 -5.37	GSM1800 1842.4 0.00 -2.10 5.00 -2.10 2.90 -3.54 -5.34	0.00 -1.87 3.01 4.87 -1.87 3.01 -3.31 -5.15	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57	1960 0.00 -2.60 1.60 4.20 -2.60 1.60 -4.00 -5.89	0.00 -3.11 0.72 3.99 -3.11 0.75 -4.55 -6.4
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/8 (dBm)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75	GSM900 943.4 0.00 -4.63 2.29 -4.63 -2.34 -5.32 -6.40 -7.36	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -2.95 -5.94 -7.04 -8.01	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56 -5.37 -6.77	GSM1800 1842.4 0.00 -2.10 5.00 -2.10 2.90 -3.54 -5.34 -6.74	0.00 -1.87 3.01 -1.87 3.01 -3.31 -5.15 -6.57	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03	1960 0.00 -2.60 1.60 -2.60 1.60 -4.00 -5.89 -7.35	0.00 -3.11 0.77 3.99 -3.11 0.77 -4.55 -6.4 -7.85
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/8 (dBm) Front/Back Ratio (dB)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32	GSM900 943.4 0.00 -4.63 2.29 -4.63 -2.34 -5.32 -6.40 -7.36 1.40	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -5.21 -2.95 -5.94 -7.04 -8.01 1.62	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 3.08 -3.56 (-5.37) -6.77 6.88	GSM1800 1842.4 0.00 -2.10 5.00 -2.10 2.90 -3.54 -5.34 -6.74 6.69	0.00 -1.87 3.01 -3.31 -5.15 -6.57 6.27	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03 5.42	1960 0.00 -2.60 1.60 -2.60 1.60 -4.00 -5.89 -7.35 4.87	0.00 -3.11 0.72 3.99 -3.11 0.72 -4.55 -6.4 -7.85 6.65
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/6 (dBm) Front/Back Ratio (dB) Phi BW (°)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -3.83 -4.90 -5.87 0.38 182.00	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00	GSM900 943.4 0.00 -4.63 2.29 -4.63 -2.34 -5.32 -6.40 -7.36 1.40 182.00	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -2.95 -5.94 -7.04 -8.01 1.62 182.00	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56 -5.37 -6.77 6.88 94.00	GSM1800 1842.4 0.00 -2.10 5.00 -2.10 2.90 -3.54 -5.34 -6.74 6.69 109.00	0.00 -1.87 3.01 4.87 -1.87 3.01 -3.31 -5.15 -6.57 6.27 110.00	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00	1960 0.00 -2.60 4.20 -2.60 1.60 -4.00 -5.89 -7.35 4.87 120.00	0.00 -3.11 0.73 -3.11 0.75 -4.55 -6.4 -7.85 -6.4 -7.85 -6.64 -7.85 -6.64 -7.85 -6.64 -7.85 -6.64 -7.85 -6.64 -7.85 -7.75 -7.85 -7.85 -7.75 -7.85 -7.95 -7.85 -7.75 -7.85 -7.75 -7.75 -7.75 -7.75 -7.75 -7.75 -7.75 -7.75
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/8 (dBm) Front/Back Ratio (dB) Phi BW (°)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91.00	GSM900 943.4 0.00 -4.63 -2.34 -2.34 -5.32 -6.40 -7.36 1.40 182.00 91.00	Gain / Free 959.8 0.00 -5.21 -2.95 2.266 -5.21 -2.95 -5.94 -7.04 -8.01 1.622 182.00 91.00	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56 -5.37 -6.77 -6.78 94.00 38.00	GSM1800 1842.4 0.00 -2.10 5.00 -2.10 2.90 -3.54 -6.74 6.69 109.00 38.00	0.00 -1.87 3.01 4.87 -1.87 3.01 -3.31 -5.15 -6.57 6.27 110.00 36.00	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 33.00	1960 0.00 -2.60 4.20 -2.60 1.60 -4.00 -5.89 -7.35 4.87 120.00 39.00	0.0 -3.1 0.7 3.9 -3.1 0.7 -4.5 -6.4 -7.8 6.6 133.0 66.0
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/8 (dBm) Priort/Back Ratio (dB) Phi BW (°) • Phi BW (°)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91.00 91.00	GSM900 943.4 0.00 -4.63 -2.34 2.29 -4.63 -2.34 -5.32 -6.40 -7.36 -7.36 182.00 182.00 91.00 91.00	Gain / Free 959.8 0.00 -5.21 -2.95 2.266 -5.21 -2.95 -5.94 -7.04 -7.04 -8.01 1.62 182.00 91.00 91.00	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56 -5.37 -6.77 6.88 94.00 38.00 56.00	GSM1800 1842.4 0.00 -2.10 2.90 -2.10 2.90 -3.54 -5.34 -6.74 -6.74 -6.69 109.00 38.00 71.00	0.00 -1.87 3.01 4.87 -1.87 3.01 -3.31 -5.15 -6.57 6.27 110.00 36.00 74.00	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 33.00 81.00	1960 0.00 -2.60 4.20 -2.60 1.60 -4.00 -5.89 -7.35 4.87 120.00 39.00 81.00	0.0 -3.1 0.7 3.9 -3.1 0.7 -4.5 -6.4 -7.8 6.6 133.0 66.0 67.0
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) Front/Back Ratio (dB) Phi BW (°) + Phi BW (°) - Phi BW (°) Theta BW (°)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 93.00	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 93.00	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00 94.00	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91.00 91.00 93.00	GSM900 943.4 0.00 -4.63 -2.34 2.29 -4.63 -2.34 -5.32 -6.40 -7.36 1.40 182.00 91.00 91.00	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -2.95 -5.94 -7.04 -8.01 1.62 182.00 91.00 91.00 98.00	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56 -5.37 -6.77 6.88 94.00 38.00 56.00 77.00	GSM1800 1842.4 0.00 -2.10 2.90 -2.10 2.90 -3.54 -5.34 -6.74 6.69 109.00 38.00 71.00 71.00	0.00 -1.87 3.01 -1.87 3.01 -3.31 -5.15 -6.57 6.27 110.00 36.00 74.00 64.00	0.00 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 33.00 81.00 59.00	1960 0.00 -2.60 4.20 -2.60 1.60 -4.00 -5.89 -7.35 4.87 120.00 39.00 81.00 64.00	0.0 -3.1 0.7 3.9 -3.1 0.7 -4.5 -6.4 -7.8 6.6 133.0 66.0 67.0 62.0
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/8 (dBm) Front/Back Ratio (dB) Phi BW (°) + Phi BW (°) - Phi BW (°) Theta BW (°) + Th. BW (°)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 91.00 93.00 53.00	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 93.00 53.00	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00 94.00	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91.00 91.00 93.00 47.00	GSM900 943.4 0.00	Gain / Free 959.8 0.00 -5.21 -2.95 -5.24 -5.24 -2.95 -5.94 -7.04 -8.01 1.62 182.00 91.00 98.00 98.00 55.00	Space (RX) 1805.2 0.00 -2.08 3.08 -5.16 -2.08 -3.08 -5.57 -6.77 6.88 94.00 38.00 56.00 56.00 58.00	GSM1800 1842.4 0.00 -2.10 2.90 -3.54 -5.34 -6.74 6.69 109.00 38.00 71.00 71.00 51.00	0.00 -1.87 3.01 4.87 -1.87 3.01 -5.15 -6.57 6.27 110.00 36.00 74.00 64.00 46.00	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 33.00 81.00 59.00 44.00	1960 0.00 -2.60 4.20 -2.60 1.60 -5.89 -7.35 4.87 120.00 39.00 81.00 64.00 44.00	0.0 -3.1 0.7 3.9 -3.1 0.7 -4.5 -6.4 -7.8 6.6 133.0 66.0 67.0 66.0 0 67.0 0 62.0
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) Front/Back Ratio (dB) Phi BW (°) + Phi BW (°) Theta BW (°) + Th. BW (°)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 93.00 53.00	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 93.00 53.00 53.00	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00 91.00 94.00 47.00	0.00 -4.07 -1.69 2.39 -4.74 -5.79 -6.75 1.32 182.00 91.00 91.00 93.00 47.00 46.00	GSM900 943.4 0.00 -4.63 -2.34 -2.34 -5.32 -6.40 -7.36 1.40 182.00 91.00 91.00 91.00 95.000 55.000	Gain / Free 959.8 0.000 -5.21 -2.95 2.26 -5.21 -2.95 -5.94 -7.04 -7.04 1.62 182.00 91.00 91.00 98.00 55.00 43.00	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -5.57 -6.77 6.88 94.00 38.00 56.00 77.00 58.00 19.00	GSM1800 1842.4 0.00 -2.10 2.90 -3.54 -5.34 -6.74 6.679 109.00 38.00 71.00 71.00 51.00 20.00	0.00 -1.87 3.01 4.87 -1.87 3.01 -5.15 -6.57 6.27 110.00 36.00 74.00 64.00 46.00	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 33.00 81.00 59.00 44.00 15.00	1960 0.00 -2.60 1.60 4.20 -2.60 1.60 -5.89 -7.35 4.87 120.00 39.00 81.00 64.00 44.00 20.00	0.0 -3.1 0.7 3.9 -3.1 0.7 -4.5 -6.4 -7.8 6.6 133.0 66.0 133.0 67.0 62.0 15.0 47.0
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) Front/Back Ratio (dB) Phi BW (°) + Phi BW (°) Theta BW (°) + Th. BW (°) Boresight Phi (°)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 93.00 53.00 40.00	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 93.00 53.00 210.00	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00 94.00 94.00 47.00 47.00	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91.00 91.00 93.00 93.00 93.00 47.00 46.00	GSM900 943.4 0.00 -4.63 -2.34 -2.34 -5.32 -6.40 -7.36 1.40 182.00 91.00 91.00 91.00 95.000 55.000 45.00	Gain / Free 959.8 0.00 -5.21 -2.95 -5.24 -7.04 -7.04 -7.04 -8.01 1.62 182.00 91.00 91.00 91.00 93.00 43.00 120.00	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56 -5.37 -6.77 6.78 94.00 38.00 56.00 77.00 58.00 19.00 150.00	GSM1800 1842.4 0.00 -2.10 2.90 -3.54 -5.34 -6.74 6.69 109.00 38.00 71.00 71.00 71.00 20.00	0.00 -1.87 3.01 4.87 -1.87 3.01 -3.31 -5.15 -6.57 6.27 110.00 36.00 74.00 64.00 46.00 18.00	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -3.68 -5.57 -7.03 5.42 114.00 33.00 81.00 59.00 44.00 15.00	1960 0.00 -2.60 1.60 4.20 -2.60 1.60 -5.89 -7.35 4.87 120.00 39.00 81.00 64.00 20.00 135.00	0.00 -3.11 0.77 -3.99 -3.11 0.77 -4.55 -6.4 -7.85 -6.4 -7.85 -6.4 -7.85 -6.4 -7.85 -6.40 -6.00 -7.00 -
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/8 (dBm) Front/Back Ratio (dB) Phi BW (°) • Phi BW (°) • Th. BW (°) Th. BW (°) Boresight Phi (°) Boresight Phi (°)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 91.00 93.00 53.00 53.00 40.00 210.00 90.00	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 93.00 53.00 210.00 90.00	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00 91.00 94.00 47.00 47.00 120.00	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 1.32 1.82.00 91.00 91.00 93.00 47.00 46.00 120.00	GSM900 943.4 0.00 -4.63 -2.34 2.29 -4.63 -2.34 -5.32 -6.40 -7.36 -7.36 1.40 182.00 91.00 91.00 91.00 91.00 91.00 00 00 00 00 00 00 00 00 00 00 00 00	Gain / Free 959.8 0.00 -5.21 -2.95 -5.24 -2.26 -5.21 -2.95 -5.94 -7.04 -7.04 -8.02 182.00 91.00 91.00 98.00 55.00 120.00 105.00	Space (RX) 1805.2 0.00 -2.08 3.08 -3.56 -5.37 -6.77 6.88 94.00 38.00 56.00 77.00 58.00 150.00 120.00	GSM1800 1842.4 0.00 -2.10 2.90 -2.10 2.90 -3.54 -5.34 -6.59 109.00 38.00 71.00 51.00 20.00 150.00 120.00	0.00 -1.87 3.01 -3.31 -3.31 -5.15 -6.57 6.57 110.00 36.00 74.00 64.00 46.00 18.00 150.00	0.00 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 33.00 81.00 59.00 44.00 15.00 15.0.00	1960 0.00 -2.60 1.60 -2.60 1.60 -4.00 -5.89 -7.35 4.87 120.00 39.00 81.00 64.00 44.00 20.00 135.00 120.00	0.00 -3.11 0.77 -3.99 -3.11 0.77 -4.53 -6.64 -7.88 -6.64 -7.88 -6.64 -7.88 -6.64 -7.88 -6.64 -7.88 -6.64 -7.80 -6.00 -7.00 -6.00 -7.00 -6.00 -7.00 -6.00 -7.000 -7.000 -7.000 -7.000 -7.000 -7.000 -7.000 -7.000 -7.000 -7.000 -7.0000 -7.000 -7.000 -7.0000 -7.0000 -7.0000 -7.0000 -7.0000 -7.0000 -7.0000 -7.0000 -7.0000 -7.00000 -7.0000 -7.00000 -7.0000 -7.0000 -7.0000 -7.0000 -7.0000 -
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Pote Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/8 (dBm) Print/Back Ratio (dB) Phi BW (°) + Phi BW (°) - Phi BW (°) Theta BW (°) - Th. BW (°) Boresight Phi (°) Boresight Th. (°) Maximum Power (dBm)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 91.00 93.00 53.00 40.00 210.00 90.00 -0.76	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 91.00 93.00 53.00 40.00 210.00 90.00 -0.88	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00 91.00 94.00 47.00 47.00 120.00 120.00 120.00 -1.16	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91.00 91.00 91.00 93.00 47.00 46.00 120.00 120.00 120.00 -1.69	GSM900 943.4 0.00 -4.63 -2.34 2.29 -4.63 -2.34 -5.32 -6.40 -7.36 1.420 91.00 91.00 91.00 95.00 95.00 050.00 45.00 120.00 120.00 120.00 120.00	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -2.95 -5.94 -7.04 -8.01 1.62 182.00 91.00 98.00 98.00 55.00 43.00 120.00 105.00 -2.95	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56 -5.37 -6.77 6.88 94.00 38.00 56.00 77.00 58.00 19.00 150.00 120.00 3.08	GSM1800 1842.4 0.00 -2.10 2.90 5.00 -2.10 2.90 -3.54 -5.34 -5.34 -6.74 -6.74 -6.74 -6.74 -6.79 0.990 38.00 71.00 51.00 20.000 150.00 120.00	0.00 -1.87 3.01 -3.31 -5.15 -6.57 6.27 110.00 36.00 74.00 64.00 46.00 18.00 150.00 120.00 3.01	0.00 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 81.00 59.00 44.00 150.00 120.00 2.23	1960 0.00 -2.60 1.60 4.20 -2.60 1.60 -4.00 -5.89 -7.35 4.87 120.00 81.00 64.00 44.00 20.00 135.00 120.00 1.60	0.0 -3.1 0.7 -3.9 -3.1 0.7 -4.5 -6.4 -7.8 -6.4 -7.8 -6.4 -7.8 -6.4 -7.8 -6.6 133.0 66.0 67.0 -62.0 135.0 -75
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/6 (dBm) Front/Back Ratio (dB) Phi BW (°) + Phi BW (°) + Phi BW (°) Theta BW (°) + Th. BW (°) Boresight Phi (°) Boresight Phi (°) Maximum Power (dBm)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 91.00 93.00 53.00 40.00 210.00 20.00 -0.76 -0.76 -0.76	881.4 0.00 -3.16 -0.88 2.28 -3.16 -3.16 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 91.00 93.00 53.00 40.00 210.00 90.00 90.00 -0.88 -18.81	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00 91.00 94.00 47.00 47.00 47.00 120.00 115.00 -1.16 - 18.52	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91	GSM900 943.4 0.00 -4.63 -2.34 2.29 -4.63 -2.34 -5.32 -6.40 -7.36 1.40 182.00 91.00 9	Gain / Free 959.8 0.00 -5.21 -2.95 -5.24 -5.21 -2.95 -5.94 -7.04 -8.01 1.62 182.00 91.00 98.00 98.00 98.00 93.00 100.00 105.00 -2.95 -18.30	Space (RX) 1805.2 0.00 -2.08 3.08 -5.16 -2.08 3.08 -5.537 -6.77 6.88 94.00 38.00 56.00 77.00 58.00 19.00 150.00 150.00 120.00 3.08 -15.79	GSM1800 1842.4 0.00 -2.10 2.90 -2.10 2.90 -3.54 -5.34 -5.34 -6.74 -6.74 -6.74 -6.74 -6.74 -6.69 109.00 38.00 71.00 71.00 51.00 20.00 120.000 120.000 -2.90 -2.90 -2.486	0.00 -1.87 3.01 4.87 -1.87 3.01 -3.31 -5.15 -6.57 6.27 110.00 74.00 64.00 46.00 18.00 18.00 150.00 120.00 3.01 122.00	0.00 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 33.00 81.00 59.00 44.00 15.00 15.00 150.00 120.00 120.00 2.23 -2.23 -12.49	1960 0.00 -2.60 4.20 -2.60 1.60 -4.00 -5.89 -7.35 4.87 120.00 81.00 81.00 64.00 44.00 20.00 135.00 120.00 1.20.00 1.20.00 -1.173	0.0 -3.1 0.7 3.9 -3.1 0.7 -4.5 -6.4 -7.8 6.6 133.0 66.0 67.0 62.0 15.0 47.0 75.0 135.0 0.7 7 -10.5
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/6 (dBm) Front/Back Ratio (dB) Phi BW (°) + Phi BW (°) - Phi BW (°) - Phi BW (°) Theta BW (°) Theta BW (°) - Th. BW (°) Boresight Phi (°) Boresight Phi (°) Maximum Power (dBm) Minimum Power (dBm)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 91.00 91.00 93.00 53.00 40.00 210.00 90.00 -0.76 -19.17 -4.42	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 93.00 53.00 40.00 210.00 90.08 40.00 210.00 90.08 40.00 210.00	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00 94.00 47.00 47.00 47.00 105.00 -1.16 -18.52 -4.74	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91.00 91.00 93.00 47.00 46.00 105.00 -1.69 -18.83 -5.36	GSM900 943.4 0.00 -4.63 -2.34 -2.34 -6.40 -7.36 1.40 -7.36 1.40 91.00 91.00 91.00 95.00 95.000 50.00 50.00 120.00 105.00 -2.34 -4.50 -2.34 -5.87	Gain / Free 959.8 0.00 -5.21 -2.95 -5.24 -7.04 -7.04 -7.04 182.00 91.00 91.00 91.00 91.00 91.00 01.05.00 -5.00 43.00 120.00 120.00 -2.95 -3.94 -7.95 -5.94 -7.04 -7.04 -8.01 -7.04 -7.00 -7.04 -7.04 -7.04 -7.04 -7.04 -7.04 -7.05 -7.04	Space (RX) 1805.2 0.00 -2.08 3.08 -5.16 -2.08 -3.08 -3.56 -5.37 -6.77 6.88 94.00 38.00 56.00 77.00 58.00 19.00 150.00 120.00 3.08 -15.79 -1.98	GSM1800 1842.4 0.00 -2.10 5.00 -2.10 2.90 -3.54 -5.34 -6.74 6.69 109.00 38.00 71.00 51.00 51.00 51.00 150.00 150.00 120.00 148.66 -2.10	0.00 -1.87 3.01 4.87 -1.87 3.01 -3.31 -5.15 -6.57 6.27 110.00 36.00 64.00 46.00 18.00 18.00 150.00 120.00 3.011 -12.83 -1.99	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 33.00 81.00 59.00 44.00 15.00 150.00 150.00 150.00 120.00 2.23 -12.49	1960 0.00 -2.60 1.60 2.60 1.60 -5.89 -7.35 4.87 120.00 39.00 81.00 64.00 44.00 20.00 135.00 112.00 135.00 120.00 14.73 -2.86	0.00 -3.11 0.77 3.99 -3.11 0.77 -6.4 -7.8 6.6 133.00 66.00 67.00 15.00 47.00 75.00 135.00 0.77 -10.55 -3.4
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/6 (dBm) Front/Back Ratio (dB) Phi BW (°) + Phi BW (°) - Phi BW (°) Theta BW (°) - Th. BW (°) Boresight Phi (°) Boresight Phi (°) Boresight Phi (°) Maximum Power (dBm) Minimum Power (dBm) Max/Min Ratio (dB)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 91.00 91.00 91.00 93.00 53.00 40.00 210.00 90.00 -0.76 -19.17 -4.42 18.41	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 91.00 93.00 53.00 40.00 210.00 90.00 -0.88 -18.81 -4.49 17.93	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -5.17 -6.14 1.25 182.00 91.00 91.00 91.00 94.00 47.00 47.00 120.00 105.00 -1.16 -18.52 -4.74 17.36	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91.00 91.00 93.00 47.00 46.00 120.00 105.00 -1.68 3.30 -1.68 -3.69 -1.69 -4.74 -5.79 -6.75 -7.75 -7.	GSM900 943.4 0.00 -4.63 -2.34 -2.34 -5.32 -6.40 -7.36 1.40 182.00 91.00	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -2.95 -5.94 -7.04 -7.04 1.62 182.00 91.00 91.00 91.00 98.00 55.00 43.00 120.00 120.00 120.00 -2.95 -8.39 15.34	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -5.57 -6.77 6.88 94.00 38.00 56.00 77.00 58.00 19.00 150.00 120.00 3.08 -15.79 -1.98 18.87	GSM1800 1842.4 0.00 -2.10 2.90 -3.54 -5.34 -6.74 -6.74 -6.69 109.00 38.00 71.00 71.00 20.00 150.00 150.00 120.00 2.90 -4.486 -2.10 17.76	0.00 -1.87 3.01 4.87 -1.87 3.01 -5.15 -6.57 6.27 110.00 36.00 74.00 46.00 18.00 18.00 18.00 18.00 18.00 120.00 3.01 142.83 -1.99 15.84	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 81.00 81.00 81.00 15.00 15.00 15.00 150.00 120.00 2.23 -2.29 -2.29 -2.20 14.71	1960 0.00 -2.60 4.20 -2.60 1.60 -5.89 -7.35 4.87 120.00 81.00 81.00 64.00 44.00 20.00 135.00 120.00 135.00 120.00 1.60 1.173 -2.86 13.33	0.00 -3.11 0.77 3.99 -3.11 0.77 -4.55 -6.4 -7.83 6.66 133.00 67.00 67.00 67.00 135.00 75.00 135.00 0.77 -10.55 -3.44 11.2
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) Front/Back Ratio (dB) Phi BW (°) + Phi BW (°) - Phi BW (°) The tar BW (°) + Th. BW (°) Boresight Phi (°) Boresight Phi (°) Maximum Power (dBm) Maximum Power (dBm) Maximum Ratio (dB) Max/Aivg Ratio (dB)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 91.00 91.00 91.00 93.00 53.00 53.00 210.00 90.00 -0.76 -0.76 -0.76 19.10 -0.76 -19.17 -	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 93.00 210.00 210.00 20.00 -0.88 -4.881 -4.893 -5.87 -5.97	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -4.10 -5.17 -6.14 1.25 182.00 91.00 91.00 91.00 94.00 94.00 47.00 120.00 105.00 -1.16 -18.52 -4.74 17.36 3.58	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 1.32 1.32 1.32 91.00 91.00 91.00 91.00 93.00 47.00 46.00 120.00 105.00 -1.69 -1.883 -5.36 17.14 3.67	GSM900 943.4 0.00 -4.63 -2.34 2.29 -4.63 -2.34 -5.32 -6.40 -7.36 -7.36 1.40 182.00 91.00 9	Gain / Free 959.8 0.00 -5.21 -2.95 -5.24 -7.04 -7.04 -7.04 -8.01 1.62 182.00 91.00 91.00 91.00 91.00 91.00 91.00 92.05 -5.94 -8.01 120.00 120.00 120.00 -2.95 -3.830 -2.95 -3.830 -2.95 -3.830 -3.94 -3.95 -3.95 -3.94 -3.95	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -3.56 -5.37 -6.77 6.78 94.00 38.00 56.00 77.00 58.00 19.00 150.00 120.00 3.08 -1.98 18.87 5.06	GSM1800 1842.4 0.00 -2.10 2.90 -3.54 -5.34 -6.74 -6.74 -6.74 -6.74 0.90 109.00 38.00 71.00 71.00 51.00 20.00 150.00 120.00 2.90 -2.10 17.76 5.01	0.00 -1.87 3.01 4.87 -1.87 3.01 -3.31 -5.15 -6.57 6.57 6.57 110.00 36.00 74.00 64.00 46.00 46.00 150.00 120	0.00 -2.27 2.23 -3.68 -5.57 -7.03 5.57 -7.03 5.40 33.00 81.00 33.00 81.00 59.00 44.00 15.0.00 150.00 150.00 120.00 2.23 -12.49 -2.24 -2.24 -2.24 -2.24 -2.25	1960 0.00 -2.60 1.60 -2.60 1.60 -4.00 -5.89 -7.35 4.87 120.00 39.00 81.00 64.00 39.00 81.00 64.00 135.00 120.00 1.60 -1.173 -2.86 13.33 4.46	0.00 -3.11 0.77 -3.11 0.77 -4.55 -6.4 -7.88 -6.64 -7.88 -6.64 -7.78 -6.64 -7.78 -6.64 -7.78 -6.64 -7.78 -6.64 -7.78 -6.64 -7.78 -6.64 -7.78 -6.64 -7.78 -6.64 -7.78 -7.85 -6.64 -7.78 -7.85 -7.95 -7.85 -7.85 -7.85 -7.85 -7.85 -7.85 -7.85 -7.85 -7.85 -7.85 -7.85 -7.85 -7.85 -7.85 -7.9
Model Test / Position Band Channel Ant. Port Input Pwr. (dBm) Tot. Rad. Pwr. (dBm) Peak EIRP (dBm) Directivity (dBi) Efficiency (dB) Gain (dBi) NHPRP ±Pi/4 (dBm) NHPRP ±Pi/6 (dBm) NHPRP ±Pi/6 (dBm) Front/Back Ratio (dB) Phi BW (°) + Phi BW (°) - Phi BW (°) Theta BW (°) - Th. BW (°) Boresight Phi (°) Boresight Phi (°) Boresight Phi (°) Maximum Power (dBm) Minimum Power (dBm) Max/Min Ratio (dB)	0.00 -3.09 -0.76 2.33 -3.09 -0.76 -3.75 -4.82 -5.78 0.48 182.00 91.00 91.00 91.00 91.00 91.00 93.00 53.00 40.00 210.00 90.00 -0.76 -19.17 -4.42 18.41	881.4 0.00 -3.16 -0.88 2.28 -3.16 -0.88 -3.83 -4.90 -5.87 0.38 182.00 91.00 91.00 91.00 93.00 53.00 40.00 210.00 90.00 -0.88 -18.81 -4.49 17.93	0.00 -3.43 -1.16 2.27 -3.43 -1.16 -5.17 -6.14 1.25 182.00 91.00 91.00 91.00 94.00 47.00 47.00 120.00 105.00 -1.16 -18.52 -4.74 17.36	0.00 -4.07 -1.69 2.39 -4.07 -1.69 -4.74 -5.79 -6.75 1.32 182.00 91.00 91.00 93.00 47.00 46.00 120.00 105.00 -1.68 3.30 -1.68 -3.69 -1.69 -4.74 -5.79 -6.75 -7.75 -7.	GSM900 943.4 0.00 -4.63 -2.34 -2.34 -5.32 -6.40 -7.36 1.40 182.00 91.00	Gain / Free 959.8 0.00 -5.21 -2.95 2.26 -5.21 -2.95 -5.94 -7.04 -7.04 1.62 182.00 91.00 91.00 91.00 98.00 55.00 43.00 120.00 120.00 120.00 -2.95 -8.39 15.34	Space (RX) 1805.2 0.00 -2.08 3.08 5.16 -2.08 3.08 -5.57 -6.77 6.88 94.00 38.00 56.00 77.00 58.00 19.00 150.00 120.00 3.08 -15.79 -1.98 18.87	GSM1800 1842.4 0.00 -2.10 2.90 -3.54 -5.34 -6.74 -6.74 -6.69 109.00 38.00 71.00 71.00 20.00 150.00 150.00 120.00 2.90 -4.486 -2.10 17.76	0.00 -1.87 3.01 4.87 -1.87 3.01 -5.15 -6.57 6.27 110.00 36.00 74.00 46.00 18.00 18.00 18.00 18.00 18.00 120.00 3.01 142.83 -1.99 15.84	0.00 -2.27 2.23 4.50 -2.27 2.23 -3.68 -5.57 -7.03 5.42 114.00 81.00 81.00 81.00 15.00 15.00 15.00 150.00 120.00 2.23 -2.50 14.71	1960 0.00 -2.60 4.20 -2.60 1.60 -5.89 -7.35 4.87 120.00 81.00 81.00 64.00 44.00 20.00 135.00 120.00 135.00 120.00 1.60 1.173 -2.86 13.33	0.00 -3.11 0.72 -3.12 0.73 -3.12 0.73 -4.55 -6.4 -7.82 -6.4 -7.82 -6.42 -7.82 -6.42 -7.82 -6.42 -7.82 -6.42 -7.82 -6.42 -7.82 -6.42 -7.82 -6.42 -7.82 -6.42 -7.82 -7.92



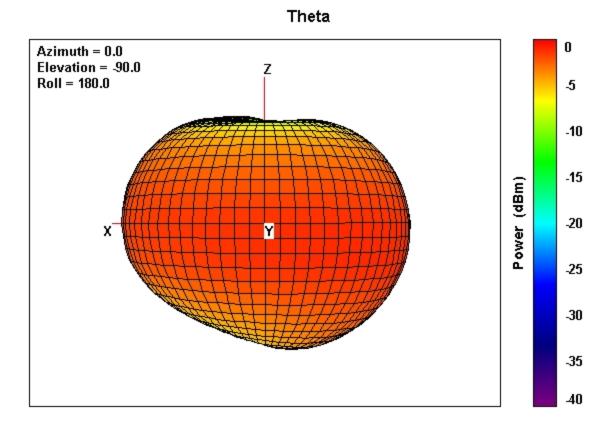
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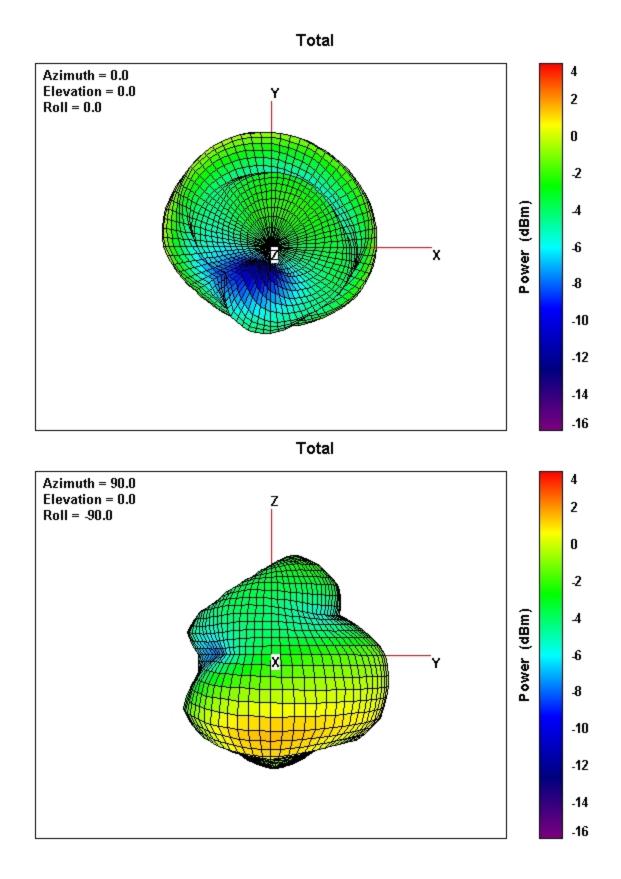
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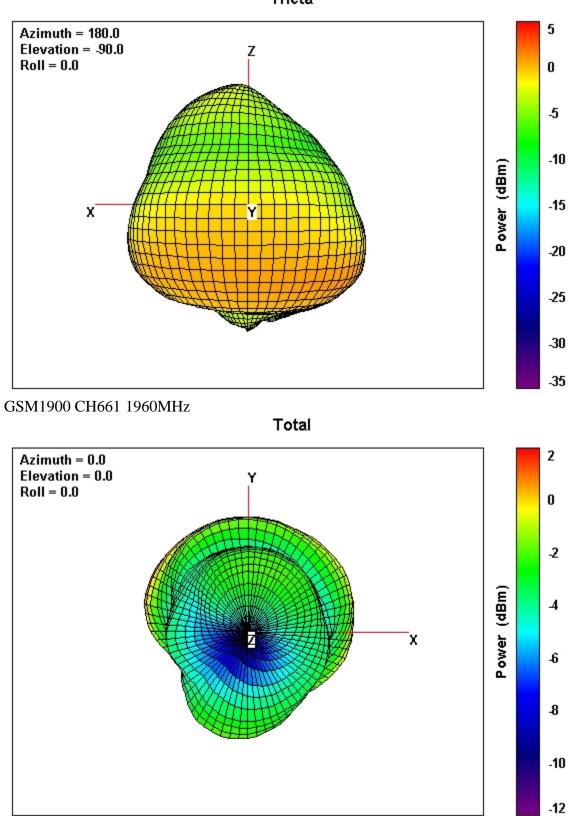


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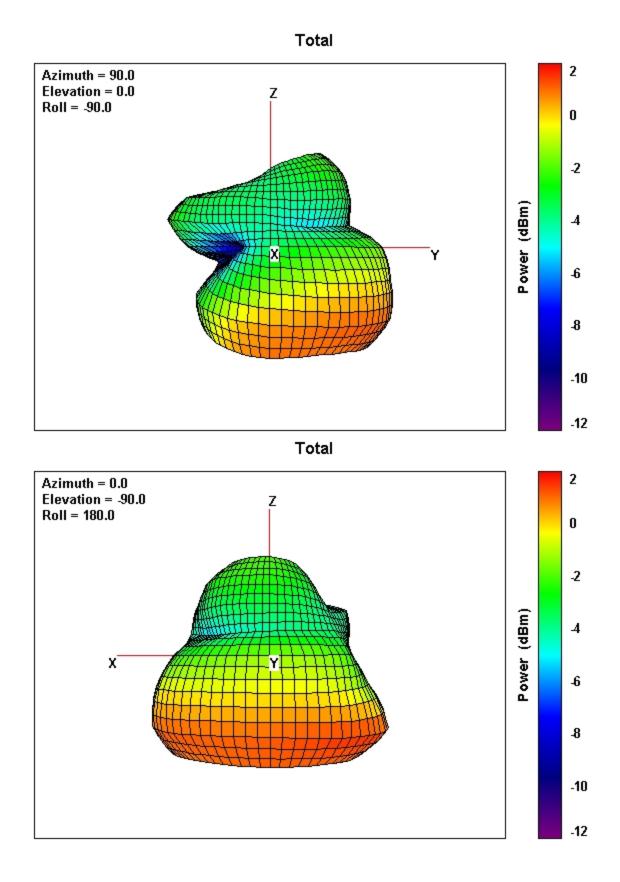


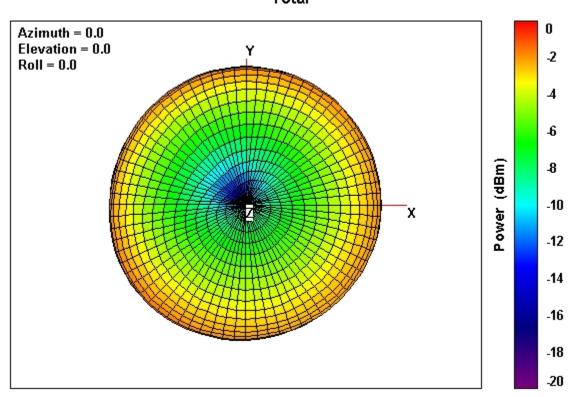
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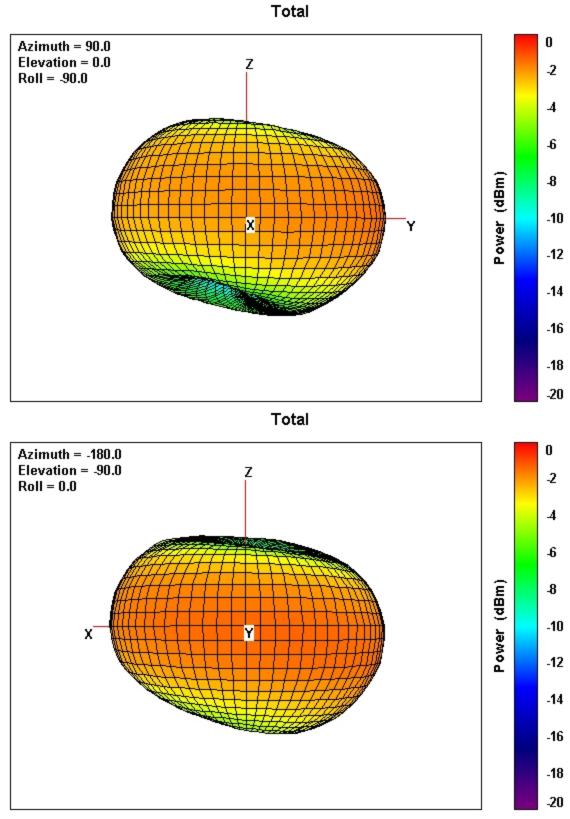


Theta

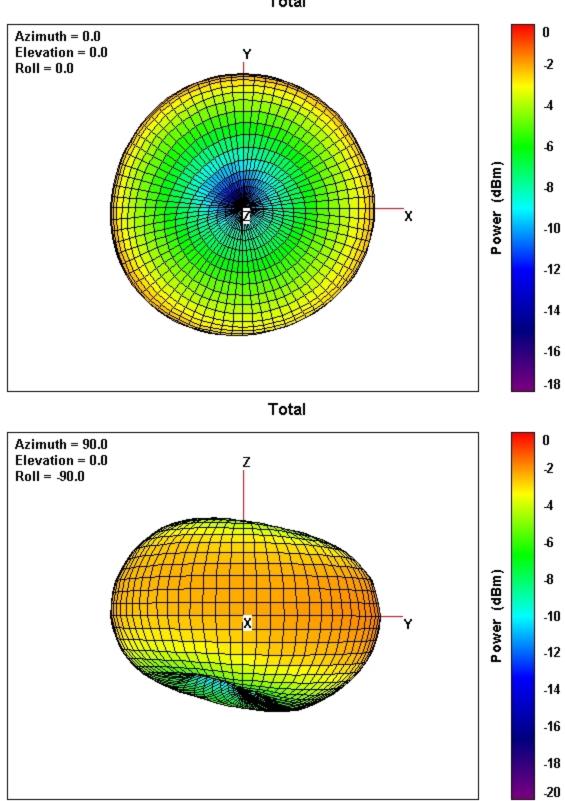




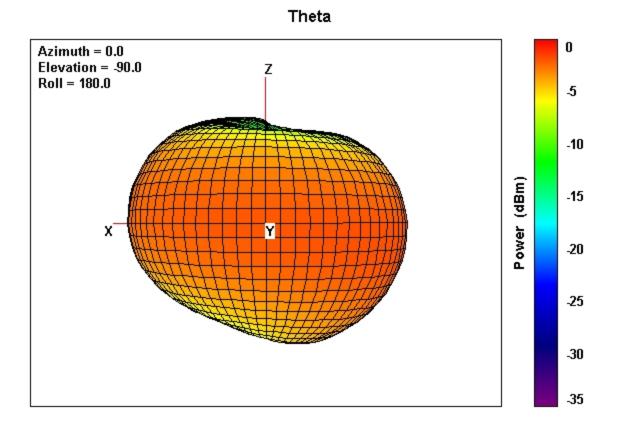
Total



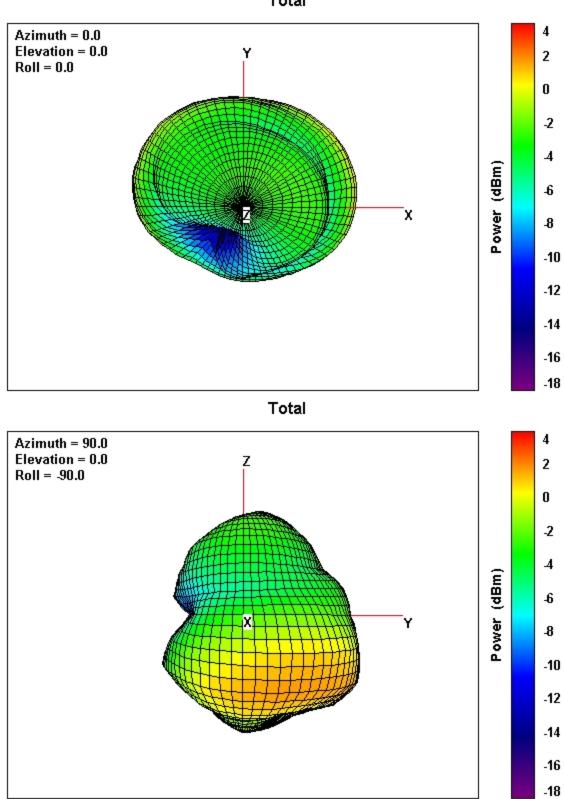
GSM900 CH42 898.4MHz



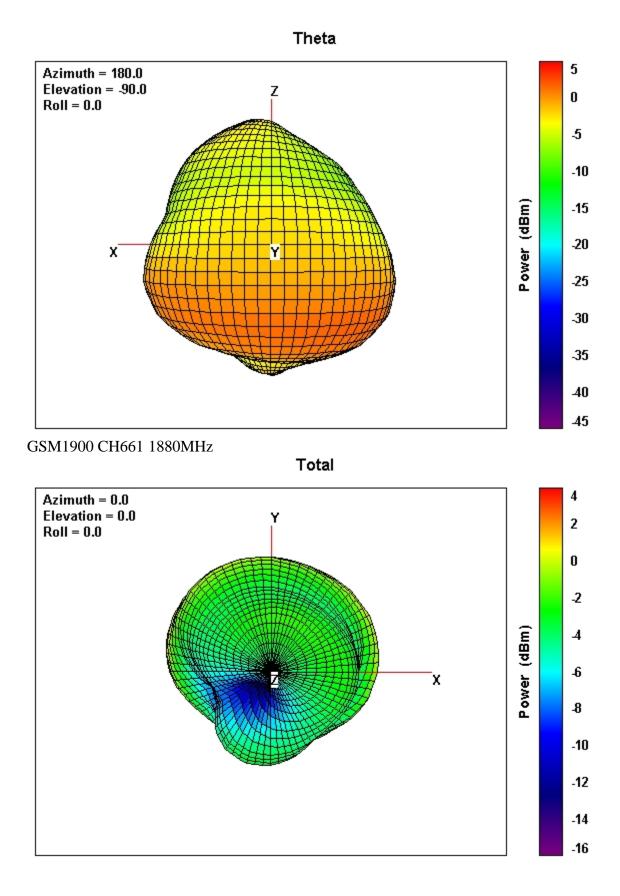
Total

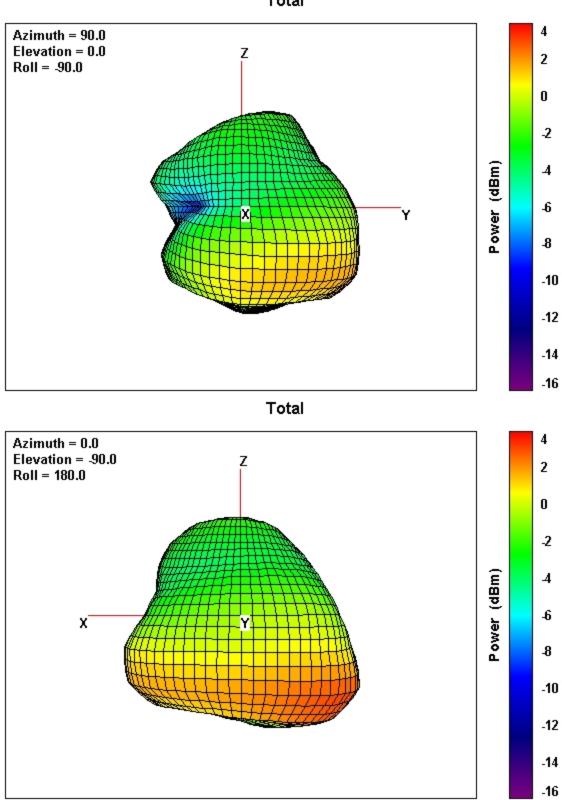


GSM1800 CH698 1747.4MHz



Total





Total

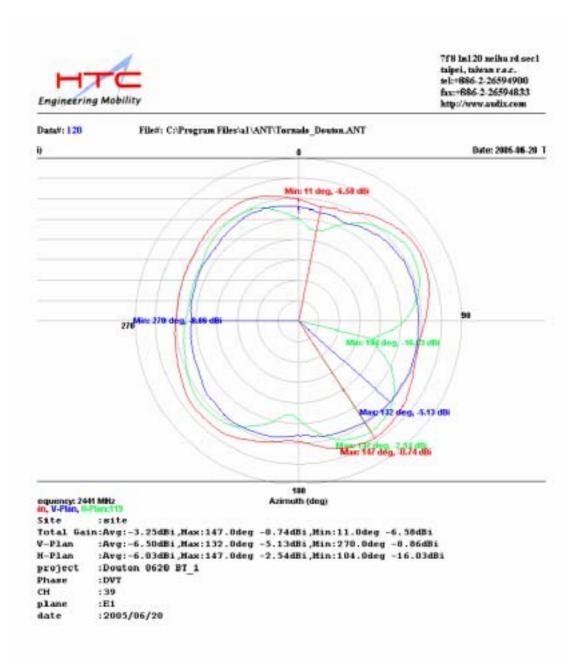
Tornado Bluetooth Chip Antenna Spec:

Frequency range	2400 MHz ~ 2500 MHz
VSWR	2.5 : 1
Peak gain	0 dBi
Average gain	-4.0 dBi
Reference impedance	50 ohm

Notably: The VSWR and gain values will be degraded due to mechanical and space constrains.

Antenna Pattern (2450MHz)

(1) E1-plane:



(1) H-plane:

