ANTENNA SPECIFICATION
Part Number: KR04001
Rev. A

Antenna Design Specification
Embedded Antenna CDMA
PC-7100
M04

Ethertronics Project

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CONTENTS

1. Purpose and Scope

The purpose of this document is to establish a design specification for the antenna product that Ethertronics is developing for the PANTECH & CURITEL-PC7100 wireless handset. This specification is preliminary. Any changes or additions to this specification can affect schedule and/or cost or the product and should be negotiated between Ethertronics and PANTECH & CURITELE before being incorporated into the specification. Upon agreement of this specification, Ethertronics will make no changes without the written approval from PANTECH & CURITELE. Any changes requested by PANTECH & CURITELE will be given to Ethertronics with sufficient time to evaluate the cost impact and react as required. The development of the product at Ethertronics is conducted in accordance to the QSP-7.3.101.

2. Related Document

QSP-7.3.101 Product Design

3. Abbreviations and Definitions

AVG	Average
°	Degree
˚C	Celsius (degrees Centigrade)
cm	Centimeter
G	Gravitational Force
g	Grams
Hz	Hertz
In	Inches
MHz	Megahertz
m	Meter
mm	Millimeter
N	Newton
PCB	Printed Circuit Board
TX	Transmit Band
RH	Relative Humidity
RX	Receive Band
VSWR	Voltage Standing Wave Ratio
W	Watt

Design specification: A preliminary target specification to guide design process.
Product Specification: A final specification for the qualified product.

4. Description and Part Numbers

4.1. Description

This antenna is an embedded cellular type. The antenna is designed to be affixed to the carrier housing enclosure by a heat stake process. Contact to the PCB is obtained through use of spring or solder contacts.

4.2. Part Number

Ethertronics Part Number	Frequency Band
KR04001	Single-band CDMA 800

4.3. Rating

Operating Temperature	-30˚ C to 90˚ C
Storage Temperature	5˚ C to 35˚ C – condition1 * -40˚ C to 90˚ C – condition 2 *
Input power	2 W max

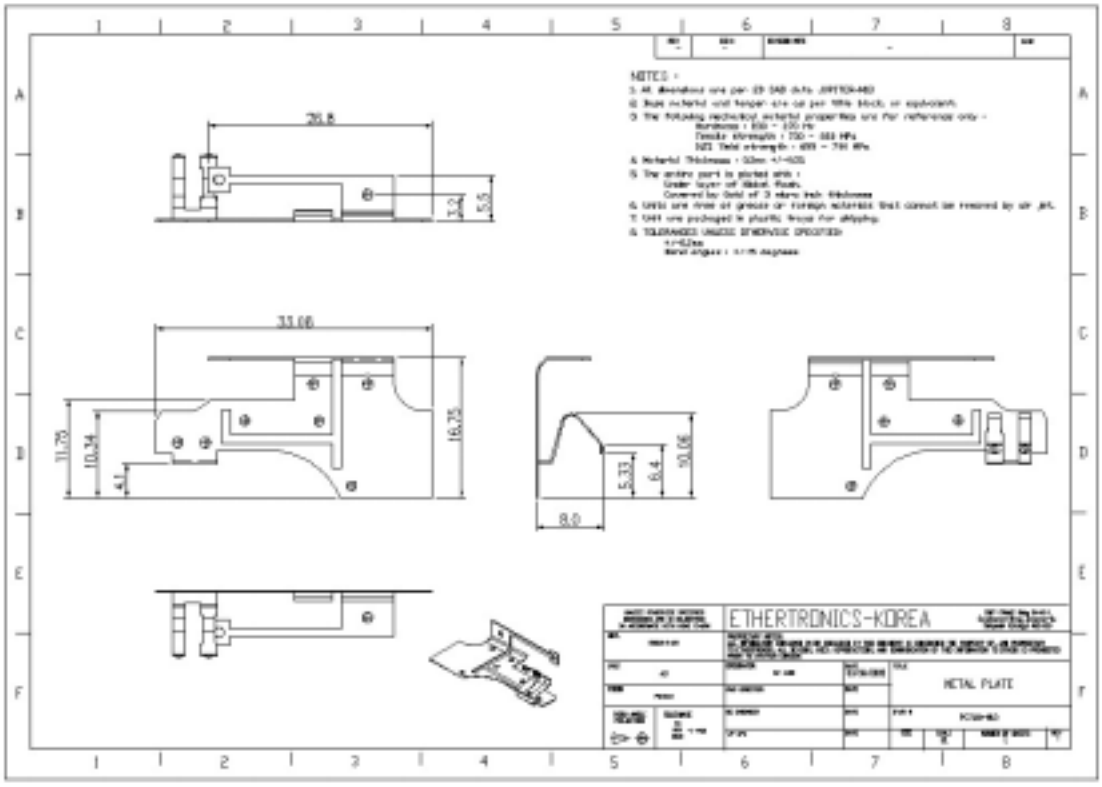
***** See condition information in paragraph 10.1 2) a)

4.4. Antenna Dimension (mm)

Length	Width	Height
33.08	16.75	6.8

For more dimension details see attached part drawing KR04001 below.

4.5. 2D drawing



5. Electrical Specifications

5.1. Frequency Band

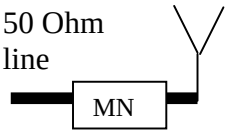
Mode	Frequency Band (MHz)
DCN Tx	824-849
DCN Rx	869-894

5.2. Electrical Characteristics

(MHz)	DCN
Center Frequency in assembled phone	863
Bandwidth (@ VSWR=3.5:1)	83
Frequency at Minimum Return Loss	860
Impedance	50 Ohm

5.3. Matching Requirements

In order to assure the best performance of the antenna, the matching will be evaluated in free space and in talk position. The antenna will comply with the Electrical Specification requirements, as set out below, while mounted on the handset containing the PCB. The handset and PCB are to be provided by the customer and should be representative of the latest design version of all parts. Any modifications in the handset or PCB can affect the performance of the antenna and should be discussed with Ethertronics to determine the affect of such changes on the antenna performance and delivery requirements.



Optional matching network to be determined by PANTECH & CURITEL RF team if needed.

5.4. VSWR

5.4.1. Requirements in free space

	Free space	
Mode	TX	RX
DCN	4:1	4:1

5.5. Test Method (Design Engineering)

The VSWR measurement of antennas assembled into a fully operating PC7100 phone handset is measured on the Network Analyzer. The handset is set up with a 50 Ohm coaxial cable connected to the 50 Ohm point. Calibration is done at the end of the 50 Ohm coaxial cable connection. The other end of the 50 Ohm coaxial cable is connected to a network analyzer. The handset is positioned on a non-conductive table for free space measurements.

Figure 1: Testing with network analyzer

5.6. Test Method (Manufacturing)

In manufacturing it is not practical to electrically test all antennas until it is heat staked into a fully assembled and operating handset supplied by the customer. To ensure the customer has the ability to sample test the antennas prior to heat staking and assembling them into a phone handset, Ethertronics typically designs a test fixture for use to electrically sample test the antennas.

5.7. Gain

5.7.1. Gain Values

Band & Plane		Gain (dBi)				VSWR	
		Tx †		Rx †			
		AVG	PEAK	AVG	PEAK	TX	RX
DCN	H-Plane	-2.65	-0.43	-2.39	-0.38	3.5:1	3.5:1
	E1-Plane	-5.73	-1.19	-4.97	-1.51	3.5:1	3.5:1
	E2-Plane	-6.33	-2.16	-6.22	-2.58	3.5:1	3.5:1

† All Measurements are performed at the center frequencies.

5.7.2. Test Methods

Antennas tested for Gain and Efficiency must be assembled into the enclosure and tested in the fully assembled and operating PC7100 handset. The antenna is tested in free space in the anechoic chamber in the H, E1 and, E2 planes. The radiation patterns are measured at the center of transmit and receive bands.

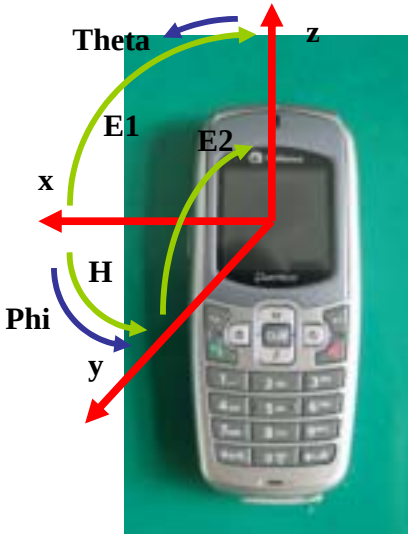


Figure 2: Geometry for PC7100 for radiation patterns.

5.8. Power Rating

5.8.1. Requirements

Maximum value: 2 W

5.8.2. Test Method

The antenna is connected to the handset enclosure. A power of 2 W is applied to the antenna for a period of 30 min. at room temperature (+20˚ +/- 3˚ C). The antenna shall satisfy electrical requirements after the test and have no visible deterioration.

6. Mechanical Specifications

6.1. Mechanical Configuration

The appearance of the antenna is according to the drawing KR04001.

See KR04001 customer part drawing.

6.2. Connection Type

Spring or solder contact.

6.3. Production Material

Phosphor Bronze – C52100 Spring Hard 0.2 mm thick, Gold plated with nickel undercoat.

6.4. Mechanical Test Methods

Ethertronics qualifies product lines, not specific products. The G-series antennas have been internally qualified using the following mechanical criteria.

Item		Specification	Test Method
Vibration resistance	Visual	No evidence of mechanical damage	Antenna shall be measured after being applied vibration of 20G acceleration from 10-2,000Hz vibration frequency in 3 orthogonal directions for 30 minutes each (3, 10 minute sweeps).
	△R/R	+/- 0.5% of the initial value	
Random drop	Visual	No evidence of mechanical damage	Drop height: 1.5 m Drop angle : 45 ˚/ 90 ˚ Drop cycle : each 5 times Weight : 150 g
	△R/R	+/- 0.5% of the initial value	
Spring Contact, if applicable (prototypes can be soldered)	Visual	No evidence of mechanical damage	Measure reaction force at 0.8 mm nominal deflection 10 times.
	Mechanical	Minimum 1 +/- 0.5 N of force required for deflection.	

* △ R/R is a shift ratio of the center frequency

6.4.1. Vibration Resistance Test

Place antennas mounted into the carrier housing (enclosure) onto the vibration table. Vibration will be applied with 3, 10 minute sweeps, 10-2,000Hz 20 G at 0.06 in. double amplitude maximum displacement. Then remove antennas and housing together from the vibration table and for measurements.

Post Test Requirements: There will be no evidence of mechanical damage.
Electrical characteristics should be within +/-0.5% of their initial value.

6.4.2. Drop Test

The antenna will be attached to a dummy weighted radio (150 g). It should be dropped from a height of 1.5 m. The drop will be done at two different angle, 5 drops at ~45˚, and 5 drops from ~90˚. The antenna shall satisfy the electrical specifications 5.4.1 after the test. The antenna should function mechanically after the test. Temperature of the environment will be+24˚C +/- 3˚C.

Post Test Requirements: There will be no evidence of mechanical damage.
Electrical characteristics should be within +/-0.5% of their initial value.

6.4.3. Spring Contact Test

Measure reaction force of the antenna spring contacts at 0.8 mm nominal deflection 10 times.

Post Test Requirements: There will be no evidence of mechanical damage.
Minimum 1 +/- 0.5 N of force required for deflection.

7. Environmental Specification

Ethertronics qualifies product lines, not specific products. The G-series antennas have been internally qualified using the following environmental criteria.

Item		Specification	Test Method
Heat resistance	Visual	No evidence of mechanical damage	Dwell in 90 +/- 2˚ C chamber for 96 hours then stabilize at room temperature for measurement.
	△R/R	+/- 0.5% of the initial value	
Temperature cycle	Visual	No evidence of mechanical damage	Perform 10 cycles as follows: -40 +/- 2˚ C for 30 minutes 90 +/- 2˚ C for 30 minutes
	△R/R	+/- 0.5% of the initial value	
Moisture resistance	Visual	No evidence of mechanical damage	Dwell in test chamber at +65˚ C and 90 to 95% RH for 96 hours and then stabilize at room temperature for measurement.
	△R/R	Minimum 1 +/- 0.5 N of force required for deflection.	
Corrosion (IEC 68-2-11)	Visual	No evidence of mechanical damage	Exposed to 5% sodium atmosphere at +35˚ C for 96 hours.
	△ R/R	Minimum 1 +/- 0.5 N of force required for deflection.	

△ R/R is a shift ratio of the center frequency

7.1. Heat Resistance Test

Place the antennas in an environmental chamber at +90˚C +/- 2˚C for 96 hours. Then remove antennas from chamber and all to stabilize at room temperature before measurement.

Post Test Requirements: There will be no evidence of mechanical damage.
Electrical characteristics should be within +/-0.5% of their initial value.

7.2. Temperature Cycling Test

Place the antennas in an environmental chamber. Set temperature cycles between -40˚C +/- 2˚C for 30 minutes and +90˚C +/-2˚C for 30 minutes. Complete this cycle 10 times. Then remove antennas from chamber and all to stabilize at room temperature before measurement.

Post Test Requirements: There will be no evidence of mechanical damage.
Electrical characteristics should be within +/-0.5% of their initial value.

7.3. Moisture Resistance Test

Place the antennas in an environmental chamber set at +65˚C and 90% RH for 96 hours. Then remove antennas from chamber and all to stabilize at room temperature before measurement.

Post Test Requirements: There will be no evidence of mechanical damage.
Electrical characteristics should be within +/-0.5% of their initial value.

7.4. Corrosion (Salt Spray) Test

Place the antennas into the Corrosion (Salt Spray) environmental chamber with 5% sodium atmosphere at 35˚C for 96 hours. Then remove antennas from chamber and all to stabilize at room temperature before measurement.

Post Test Requirements: There will be no evidence of mechanical damage.
Electrical characteristics should be within +/-0.5% of their initial value.

8. Packaging

The antennas will be packed in compartmentalized vacuum formed trays. The trays are packed in a corrugated cardboard box. The box will be labeled for shipping according to the standards outlined in EIA-STD-556 (See attached packaging specification)

The label should provide the following information:

- Supplier Address
- Customer Address
- Packing Count
- Packing Weight
- Ship Date
- Ship Number
- Sales Order Number
- Vendor’s Part Number
- Packing Identification (Bar Code)
- Special (Bar Code)
- Transaction Identification (Bar Code)
- Customer Product Identification (Bar Code)

9. Caution for Use

9.1. Storage

- Please keep the product away from high temperature and high humidity.
- Please keep product away from corrosive gases such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, etc…. The acid could cause the metal antenna to corrode degrading antenna performance.

9.1.1. Storage condition 1

Temperature: 5 to 35˚C
Humidity: 45 to 75% RH
Period: 6 months from date of packaging

9.1.2. Storage Condition 2

Temperature: -40 to 90˚C
Humidity: 96% RH max
Period: 96 hours

9.2. Handling

- Since the antenna has a spring contact it is important not to bend or push on the spring as it will degrade the spring response and could cause poor contact.
- It is important to handle the antenna carefully and bending or dents made into the metal will cause the antenna to detune and could cause performance issues.
- Please do not touch product directly with bare hands. This will put fingerprints on the antennas and the acids in the hand will cause the antenna to discolor. While this will not have a performance effect it does have a cosmetic effect on the part.

10. Property Verification Test Flowchart

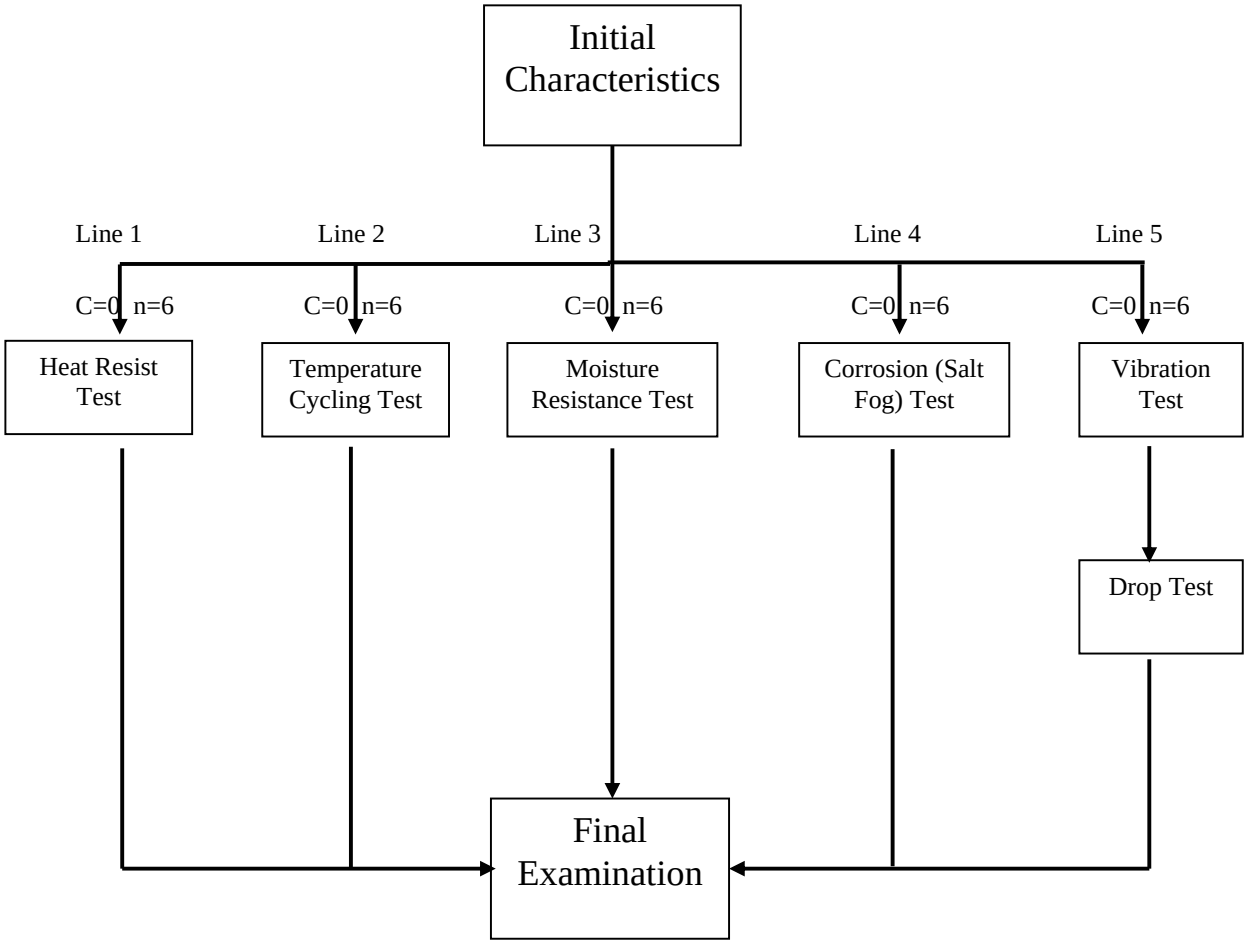


Figure 3: Property Verification Test Flow Chart

Allowed amount of failures after every test line c=0; Sample size n=6

11. Electrical Specifications For Ethertronics KR04001-Antenna For PANTECH & CURITELE Phone PC7100

Phone mounted typical measurements

11.1. Input Return Loss

11.1.1. PC7100

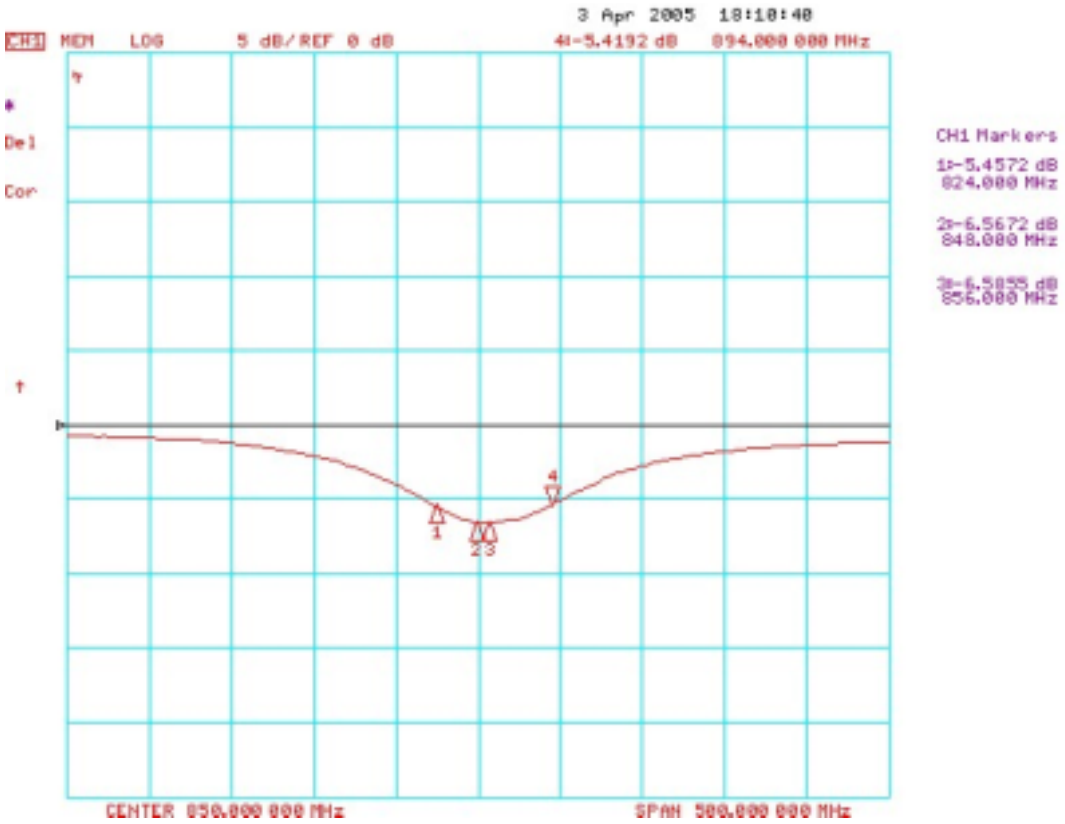


Figure6. Return loss

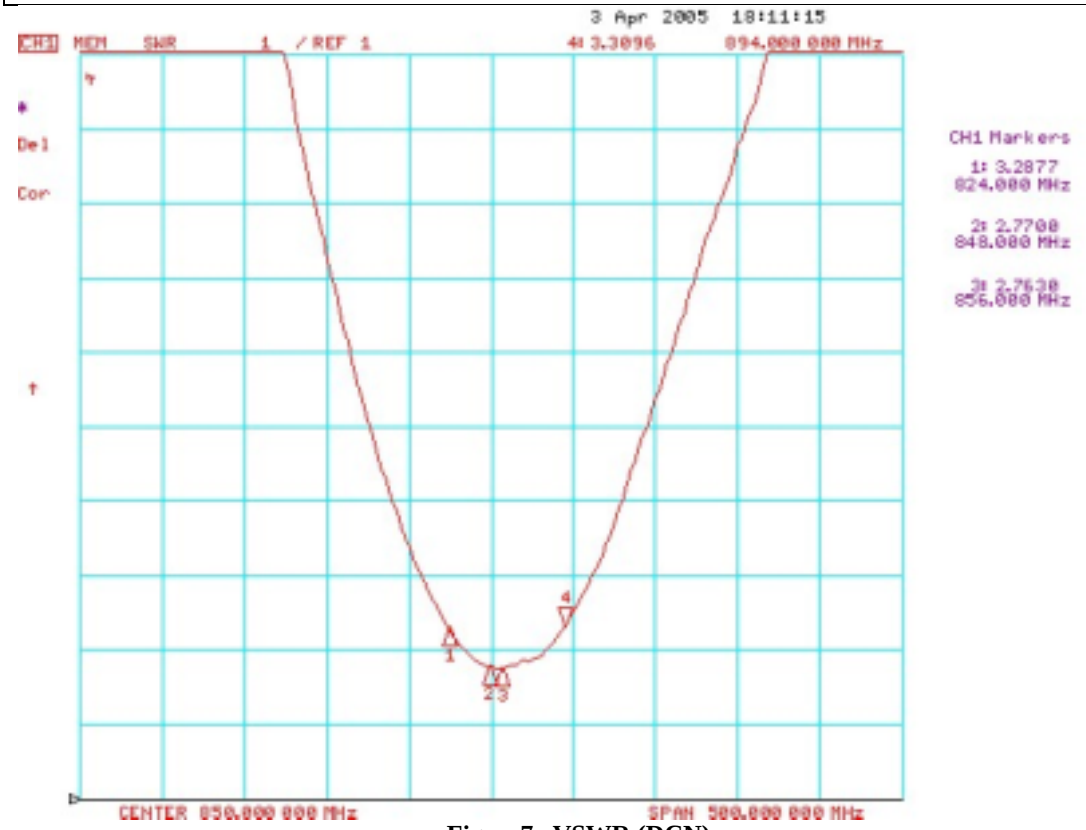


Figure7. VSWR (DCN)

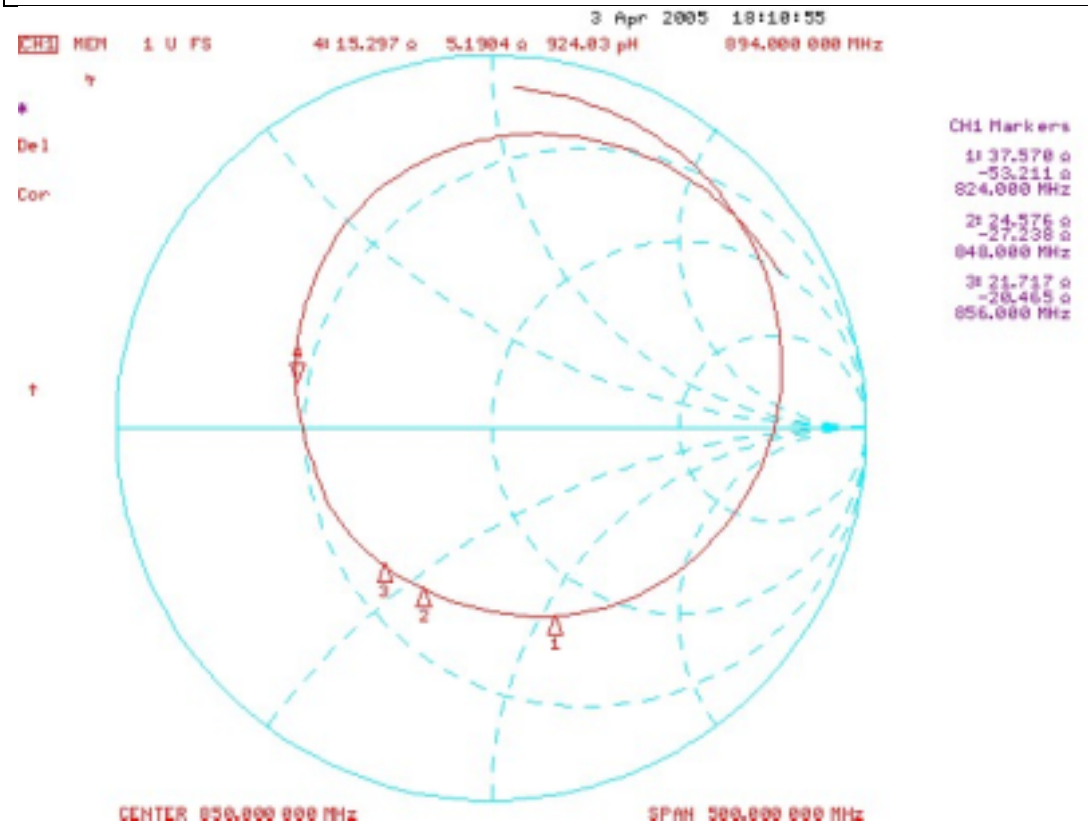
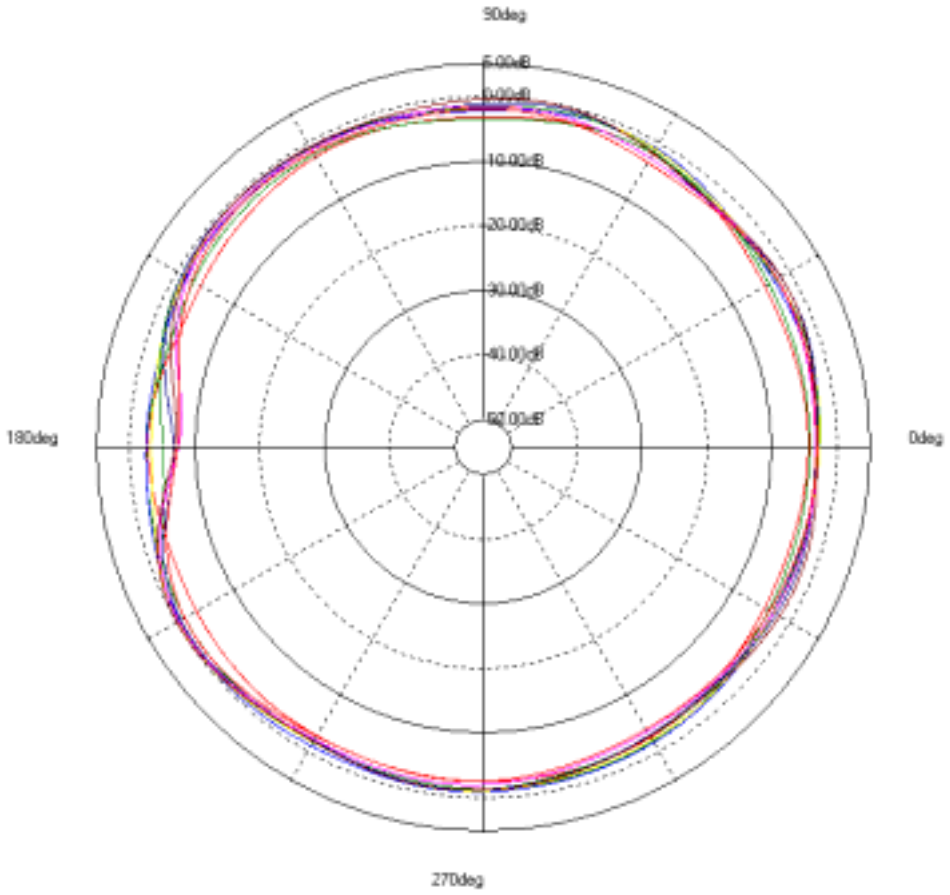


Figure8. Smith Chart

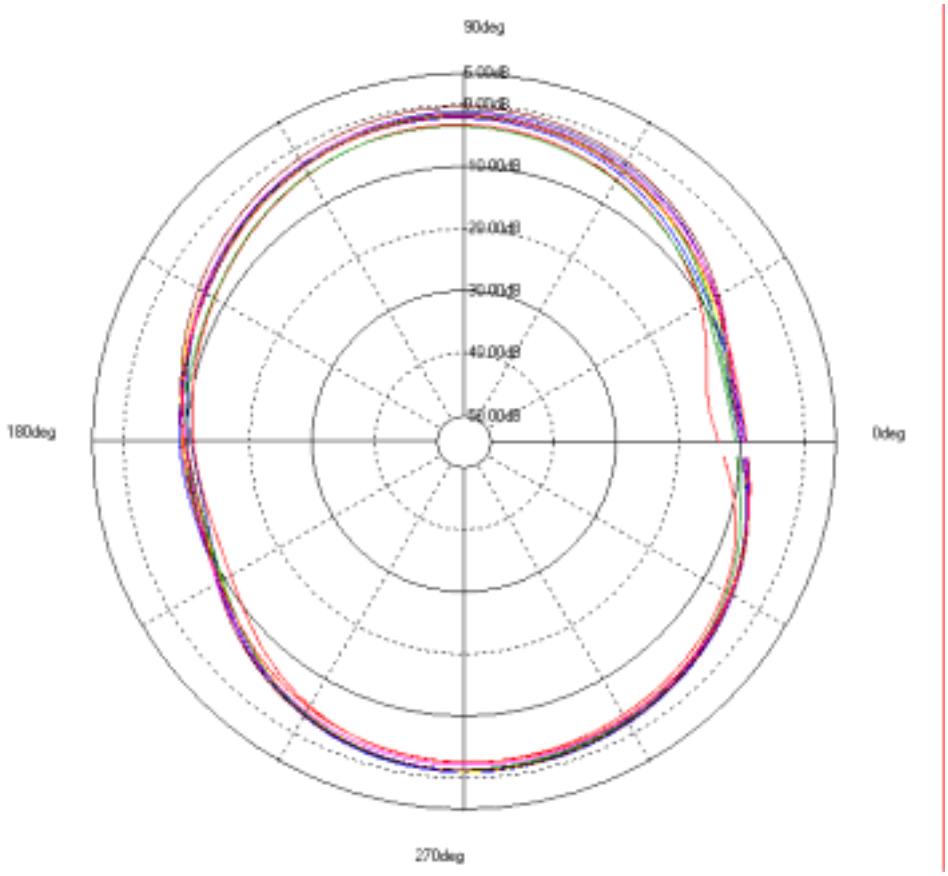
11.2. Radiation Patterns

11.2.1. PANTECH & CURITEL PC7100 Phone cellular band H-plan



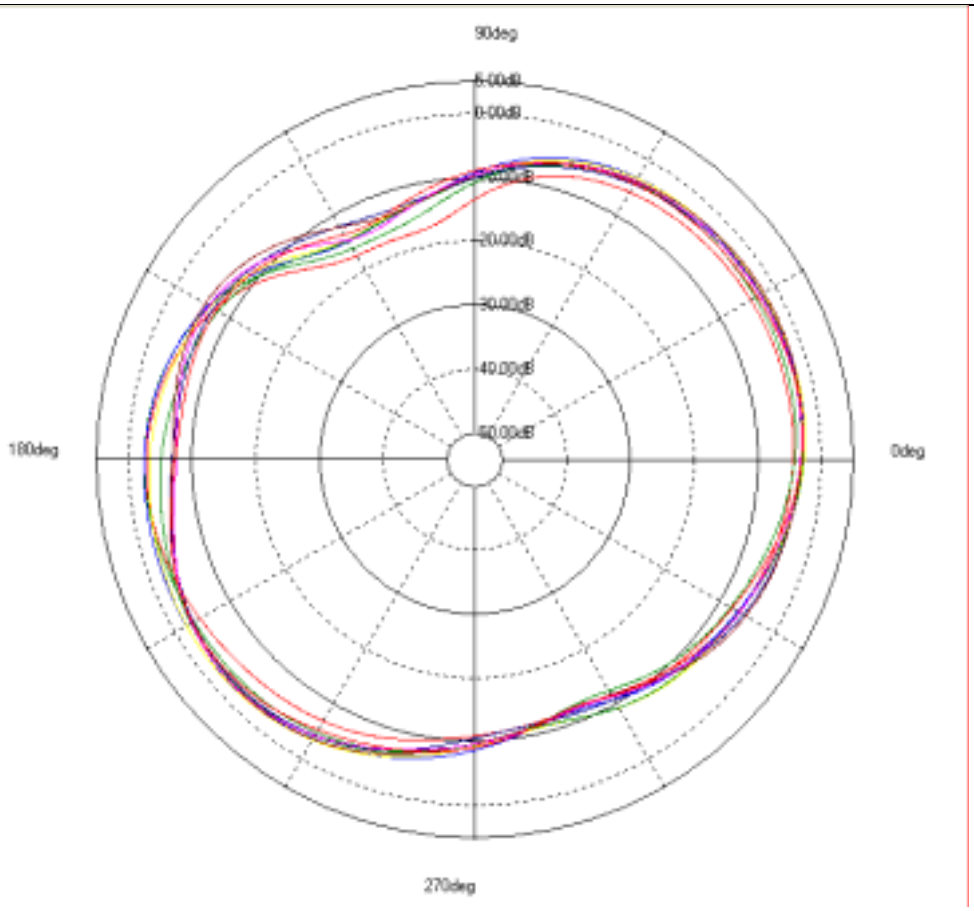
File Name	Color	Freq. MHz	(mm)	Beam Peak(dB)		Avg. Gain (dB)
				Value	Degree	
TXLflipclosed_E1.dat	Red	820	0.00	-2.14	63	-3.41
TXHflipclosed_E1.dat	Black	840	0.00	-0.43	-144	-1.88
RXLflipclosed_E1.dat	Blue	860	0.00	-0.54	-144	-2.15
RXHflipclosed_E1.dat	Yellow	890	0.00	-0.38	-147	-2.63

11.2.2. PANTECH & CURITEL PC7100 Phone cellular band E1-plan



File Name	Color	Freq. MHz	(mm)	Beam Peak(dB)		Avg. Gain (dB)
				Value	Degree	
TXLflipclosed_E1X.dat	Red	820	0.00	-2.76	272.99	-6.55
TXHflipclosed_E1X.dat	Black	840	0.00	-1.19	272.99	-4.92
RXLflipclosed_E1X.dat	Blue	860	0.00	-1.51	272.89	-5.03
RXHflipclosed_E1X.dat	Yellow	890	0.00	-1.69	93	-4.91

11.2.3. PANTECH & CURITEL PC7100 Phone cellular band E2-plane



File Name	Color	Freq. MHz	(mm)	Beam Peak(dB)		Avg. Gain (dB)
				Value	Degree	
TXLflipclosed_E2.dat	Red	820	0.00	-2.81	-177	-7.22
TXHflipclosed_E2.dat	Black	840	0.00	-2.16	-150	-5.44
RXLflipclosed_E2.dat	Blue	860	0.00	-2.59	15	-6.15
RXHflipclosed_E2.dat	Yellow	890	0.00	-2.58	-141	-6.29