

Internal Antenna

Approval Paper

MODEL : CDM7126

Part No. : KI-08404

Komatech R&D Center

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Dec 26, 2007



KOMATECH Co., Ltd.

		Subject	Internal Antenna Approval Paper	
Document No.	KOEX-PO-7101-169		Rev.	IR
Part No.	KI-08404		Date	Dec 26, 2007
Application System	DCN, UPCS, AWS		Customer	UTSTARCOM
Notice			Model Name	CDM7126
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	Check	Check	Check	Approval
KOMA-TECH				

	Check	Check	Check	Approval
UTSTARCOM				

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1. Approval Revision Sheet

Approval History Sheet

NO	DATA	Front	After	Reason	REV
1	Dec 26, 2007			Approval	IR
2					
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2. General Outline

2-1 Applicability

This specification is applicable to Planar Inverted F Antenna Module carried in the CDMA phone terminal of DCN, UPCS, AWS Band

2-2 Introduction

The purpose of this document is to establish a design specification for the antenna product that Koma-tech is developing for the CDM7126 wireless handset.

This specification is preliminary.

Any changes or additions to this specification can affect schedule or cost or the product and should be negotiated between Koma-tech and UTSTARCOM before being incorporated into the specification.

Upon agreement of this specification, Koma-tech will make no changes without the written approval from UTSTARCOM.

2-3 SI Unit

SI unit will be used, unless any specialities are announced.

℃	Celsius (degrees Centigrade)
cm	Centimeter
g	Acceleration of gravity = 9.8 m/s ²
MHz	Mega Hertz
N	Newton
W	Watt
RH	Relative Humidity
Tx	Transmit Band
Rx	Receive Band
PCB	Printed Circuit Board
VSWR	Voltage Standing Wave Ratio

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3. Electrical & Mechanical Specifications

Specification Sheet					
Electrical Specification			Frequency Range		
			DCN (824 ~ 894 MHz)	UPCS (1850 ~ 1990 MHz)	AWS (1710 ~ 2155 MHz)
Band Width			70 (MHz)	140 (MHz)	90 (MHz)
V.S.W.R (min)	Open		5.4 : 1	3.1 : 1	3.1 : 1
	Close		6.8 : 1	3.4 : 1	3.2 : 1
Average Gain (min)	Open	H-plane	-12.48 dBi	-4.76 dBi	-5.04 dBi
		E1-plane	-13.45 dBi	-6.25 dBi	-5.62 dBi
		E2-plane	-11.90 dBi	-4.06 dBi	-6.15 dBi
	Close	H-plane	-8.23 dBi	-5.81 dBi	-5.63 dBi
		E1-plane	-12.72 dBi	-7.38 dBi	-6.77 dBi
		E2-plane	-11.74 dBi	-5.36 dBi	-6.81 dBi
Input Impedance			50 (Ω)		
Polarization			Vertical / Linear		
Power (Max)			2W		
Mechanical Specification					
Carrier Material			PC(SC-1004A),EM96P		
Dimension			39.01(±0.2) x 15.97(±0.2) x 7.05(±0.2) mm		
Weight			1.5 (g)		
Radiator Material			SUS 301 3/4H		
Operation Temperature			-30 ~ 80 (°C)		
Operation Humidity			10 ~ 90 (%)		

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4. Mechanical Specifications

4-1 Drop Test

The antenna is attached to a dummy weighted radio (95)g.
It drops a dummy with the antenna directed to a steel plate that is 1,000mm x 1,000mm with thickness 20mm. (Fig. 1)

The drop will be done at six different planes by 5 times each.

- After test is completed : There shall be no visual deterioration or esthetical and mechanical performance.

The antenna shall satisfy the electrical Specifications

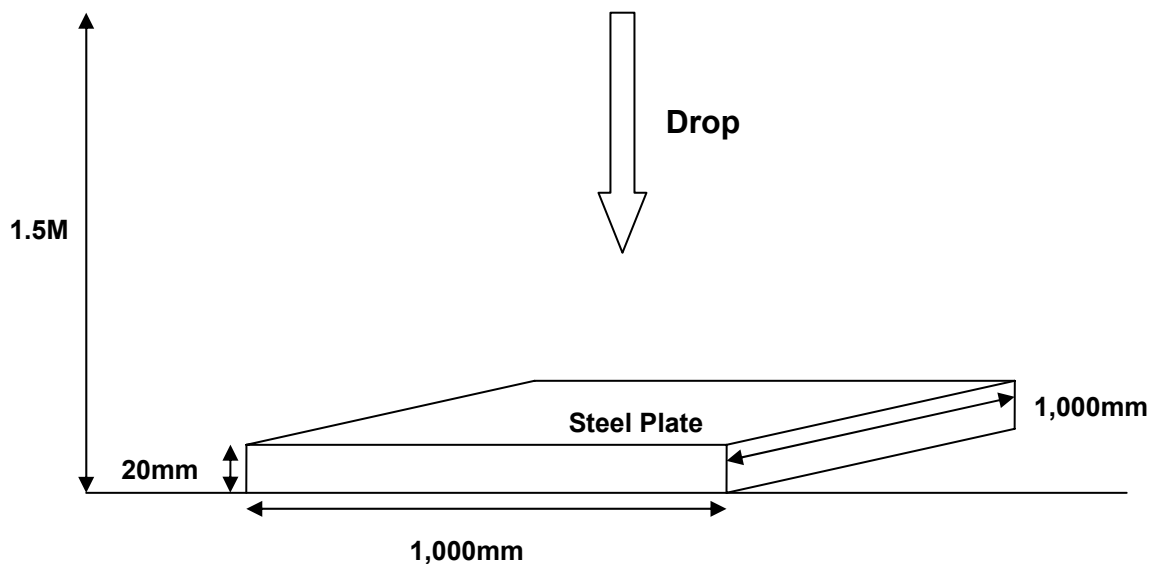


Fig. 1

4-2 A tension test of Contact point

Measure reaction force of the antenna spring contacts with $180\text{gf} \pm 100/-50$ by 500 times.
(Fig.2)

- After test is completed : There will be no evidence of mechanical damage.

The antenna shall satisfy the electrical Specifications.

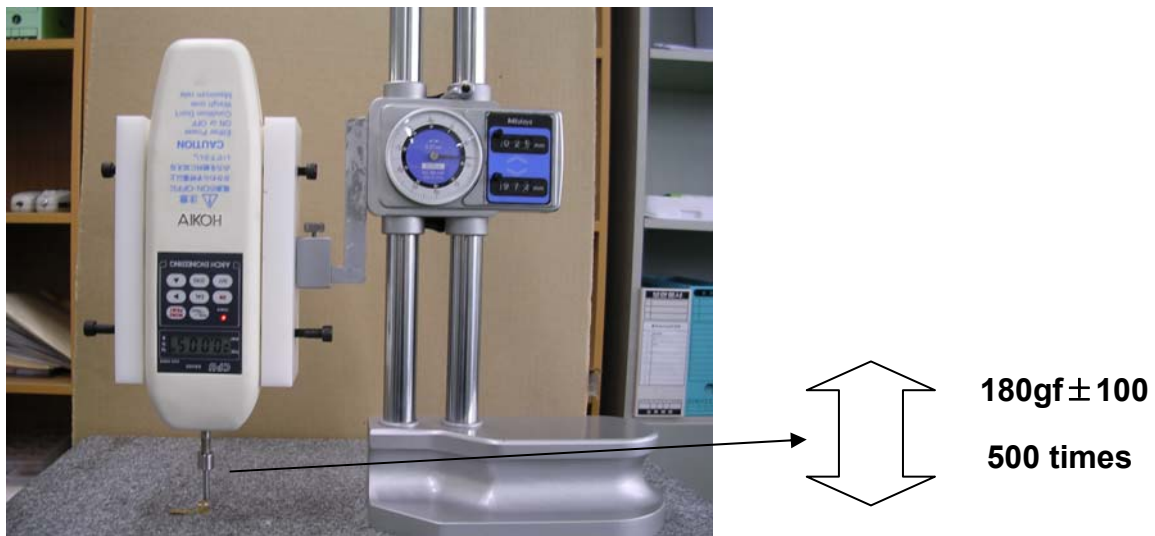


Fig. 2

4-3 Vibration Resistance test

Place antennas mounted into the rear housing (enclosure) onto the vibration table.
The vibration test will be carried out for 30 minutes in the directions of X, Y and Z under condition shown below.

- After test is completed : There shall be no visual deterioration or esthetical and mechanical performance.

The antenna shall satisfy the electrical Specifications

Oscillating frequency	Sweep Time	Amplitude	The maximum acceleration
5 ~ 55 ~ 5 Hz	10 min	1.5 mm	2 g

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5. Environmental Specifications

○ Standard Temperature Range (IEC Specifications)

- Standard Temperature : 15 ~ 35 °C
- Humidity : 25 ~ 85%
- Atmospheric : 86~106 kPa

○ Environmental Specifications

- Specification : No evidence of mechanical damage.

Satisfy the electrical Specifications.

Item	Test Method
Temperature Cycling	Perform 10 cycles as follows : · -30±2°C for 2 hour · +80±2°C for 2 hour
Heat resistance and High static humidity	· Increase temperature +60°C during 1 hour with humidity increasing to 90±5% RH. · Dwell in +60°C, 90±5%RH chamber for 96 hours.
Low temperature Test	· Set temperature -30°C during 1 hour. · Dwell in -30°C chamber for 96 hours then stabilize at room temperature for measurement
Static Humidity Test	· Set temperature +60°C during 1 hour with humidity increasing to 90±5% RH · Dwell in +60°C chamber for 24 hours then stabilize at room temperature for measurement
Corrosion (Salt spray) Test	· Exposed to the salt fog of NaCl solution(5%) at 35°C for 48 hours.
High temperature Test	· Increase temperature +80°C during 1 hour. · Dwell in +80°C chamber for 96 hours then stabilize at room temperature for measurement

5-1 Temperature Cycling

Place the antennas in an environmental chamber. Set temperature cycles between $-30^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 2 hour and $+80^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 2 hour.

Complete this cycle 10 times. Then remove antennas from chamber and allow to stabilize at room temperature before measurement.

5-1-1. Test Method

(1) Firstly, leaving an antenna to the temperature t_1 for 1 hour.

(2) Secondly, the antenna is left to the temperature of t_2 by same method for 1 hour.

10 cycles of this operation (Fig. 3) are to be repeated.

(Relative humidity must be maintained 50%.)

- After test is completed : There shall be no visual deterioration or esthetical and mechanical performance.

The antenna shall satisfy the electrical Specifications.

Display	Division	Temperature
t1	Lower temperature cycling	-30°C
t2	Higher temperature cycling	$+80^{\circ}\text{C}$

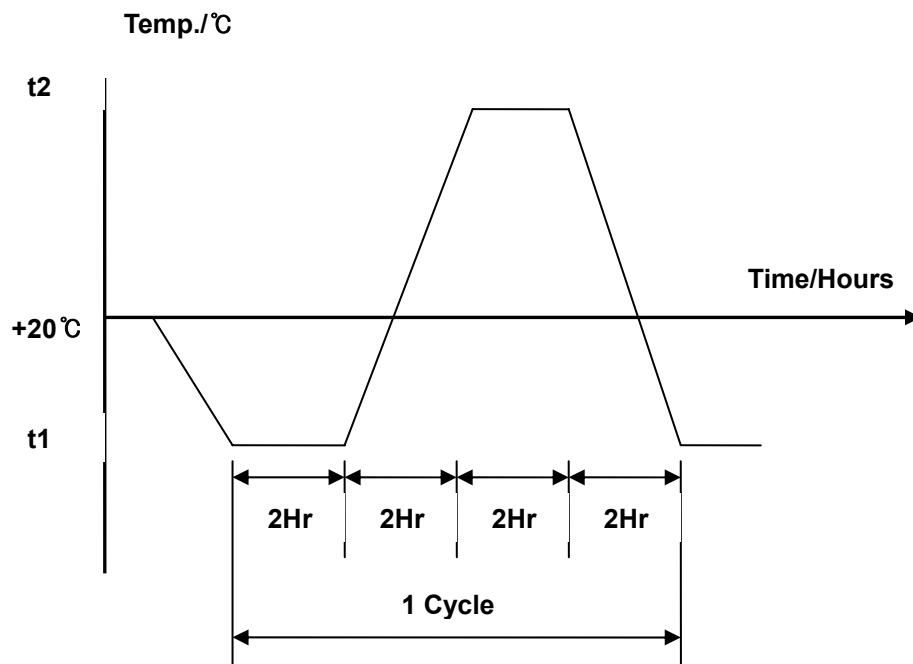


Fig. 3 Temperature cycling

5-2 Heat Resistance and High Static Humidity Test

Place the antennas in an environmental chamber at temperature $t_1=20^{\circ}\text{C}$ expose antenna to this temperature during 1 minutes.

Increase temperature at value of $t_2=+60^{\circ}\text{C}$ during 1 hours with humidity Increasing to $90\pm 5\%$ RH and soak antenna with these parameters for 96 hours continually. (Fig. 4)

- After test is completed : There shall be no visual deterioration or esthetical and mechanical performance.

The antenna shall satisfy the electrical Specifications.

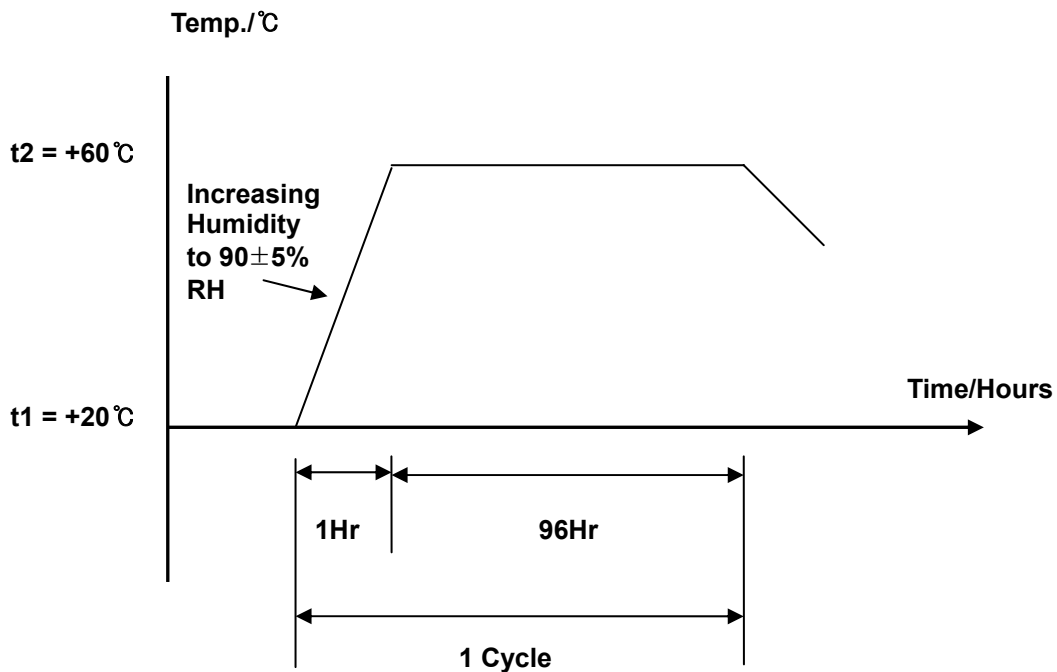


Fig. 4 Heat resistance and High static humidity test cycling

5-3 Low Temperature Test

Place the antennas in an environmental chamber at temperature $t_1 = 20^{\circ}\text{C}$ expose antenna to this temperature during 1 minutes.

Increase temperature to value of $t_2 = -30^{\circ}\text{C}$ during 1 hour, and soak at this temperature during 96 hours continue. (Fig. 5)

- After test is completed : There shall be no visual deterioration or esthetical and mechanical performance.
The antenna shall satisfy the electrical Specifications.

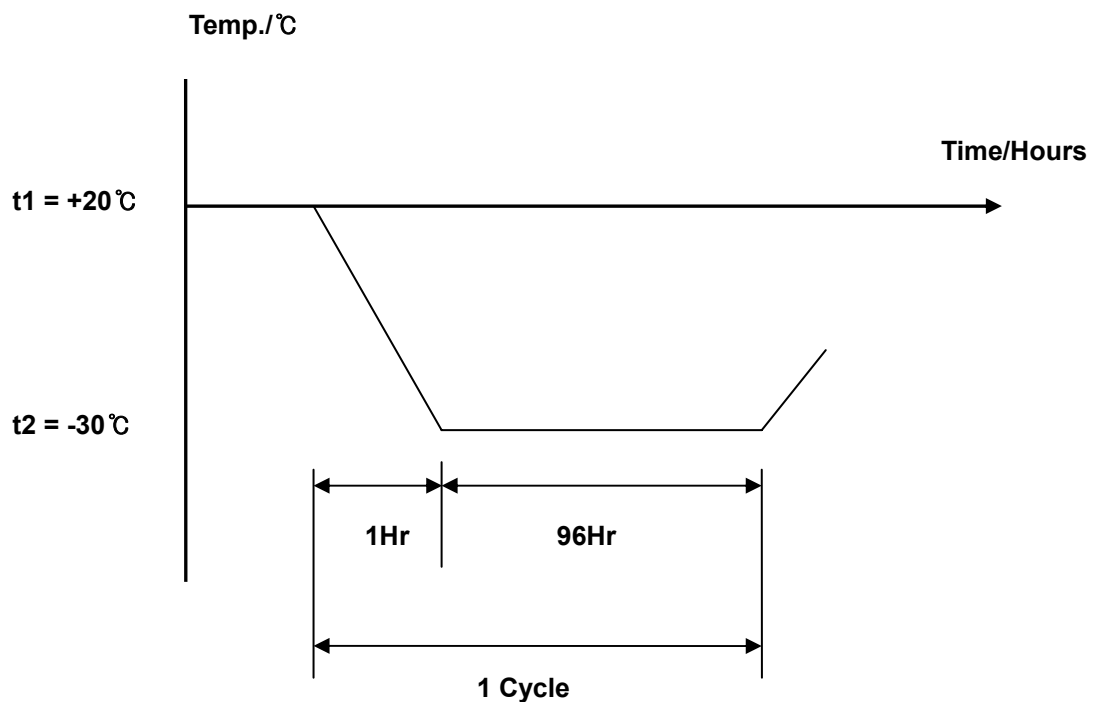


Fig. 5 Low Temperature Test

5-4 Static Humidity Test

Place complete antenna in an environmental chamber at $t_1 = +20^\circ\text{C}$.

Increase temperature at $t_2 = 60 \pm 5^\circ\text{C}$ during 1 hour with humidity increasing to $90 \pm 5\%$ RH and soak antenna with these parameters for 24 hours. After the finish initial ambient parameters should be achieved during 1 hour. (Fig. 6)

After the test perform an inspection of the tested samples.

- After test is completed : There shall be no visual deterioration or esthetical and mechanical performance.

The antenna shall satisfy the electrical Specifications.

Temperature	Relative Humidity	Testing time
$60 \pm 5^\circ\text{C}$	$90 \pm 5\%$ RH	24 hours

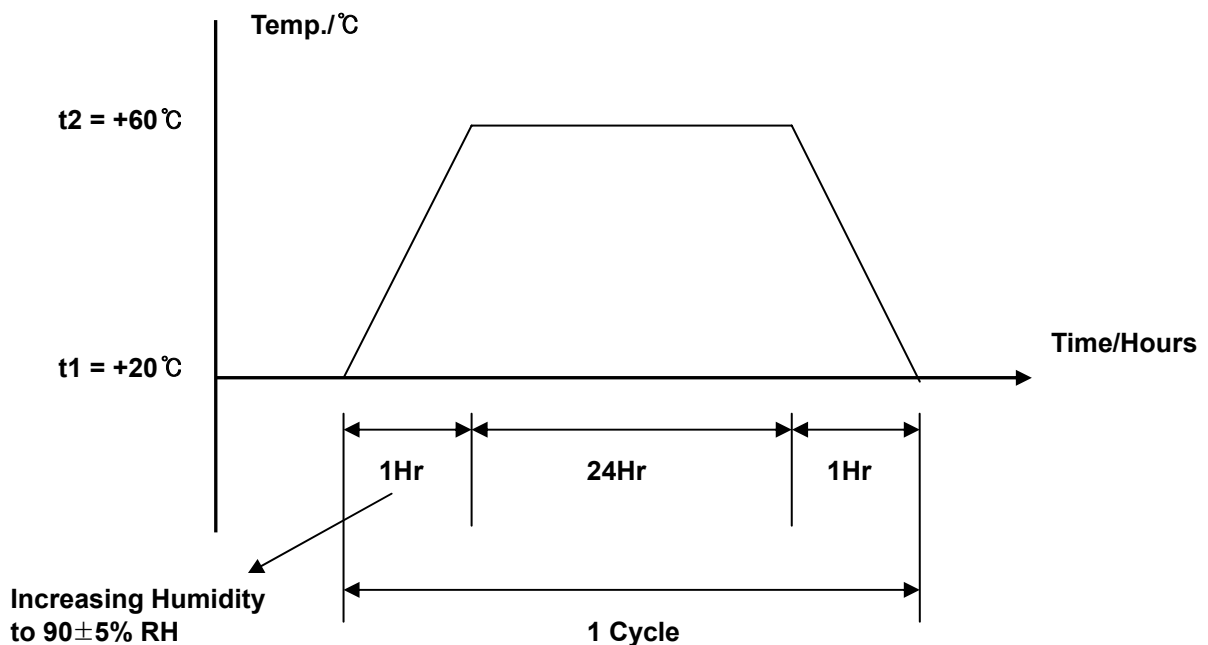


Fig. 6 Static Humidity Test

5-5 Corrosion (Salt Spray) Test

Place complete antenna in salt spray cabinet at temperature +35°C with the salt fog of NaCl solution(5%) : soak time 48 hours.

Then remove antennas from chamber and all to stabilize at room temperature before measurement.

Temperature	Concentration	Testing time
35°C	5%	48 hours

- After test is completed : There shall be no visual deterioration or esthetical and mechanical performance.

The antenna shall satisfy the electrical Specifications

5-6 High Temperature Test

Place the antennas in an environmental chamber at temperature $t_1 = 20^\circ\text{C}$ expose antenna to this temperature during 1 minutes.

Increase temperature to value of $t_2 = +80^\circ\text{C}$ during 1 hour, and soak at this temperature during 96 hours continue. (Fig. 7)

- After test is completed : There shall be no visual deterioration or esthetical and mechanical performance.

The antenna shall satisfy the electrical Specifications.

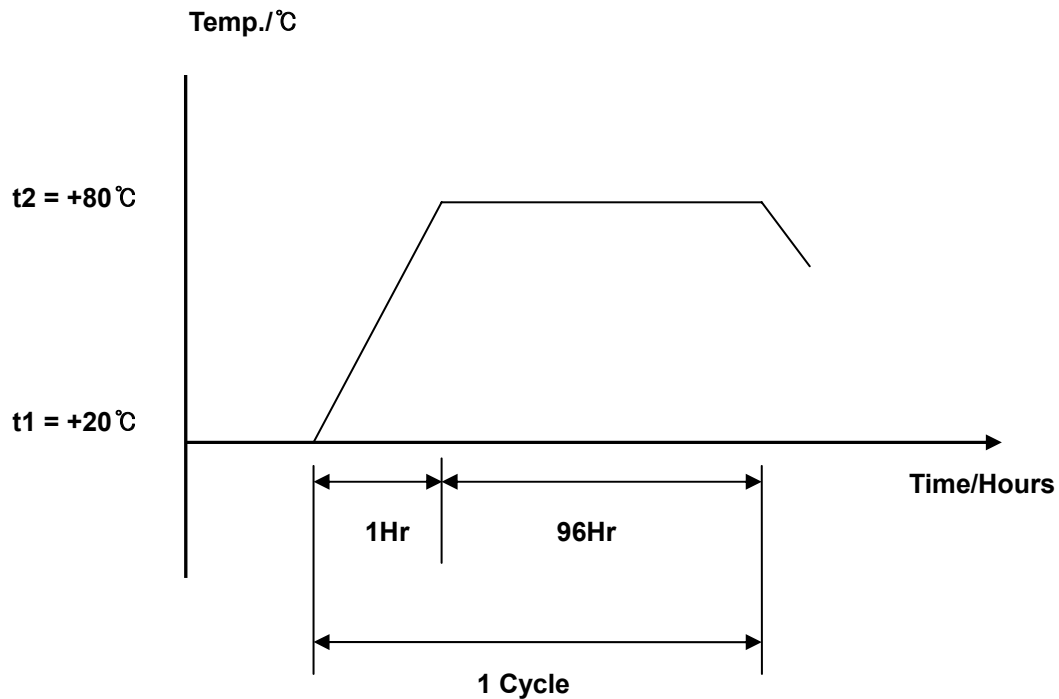


Fig. 7 High Temperature Test

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6. Measurement Setup

6-1 Test Equipments

Network Analyzer	HP8753ES
Calibration Kit	HP85033D
Adaptor	SMA Type Female ↔ SMA male
Measurement Cable	SPS-2801-400-SPS (Insulated Wire Inc.)

6-2 Test Equipments Setting

6.2.1 Display	Dual channel : On Split display : On
6.2.2 Menu	Number of points : 201 Power : 0 dBm
6.2.3 Measure	Channel 1 : S11 Channel 2 : S21

6-3 Calibration

Calibration	Cal. Kit : 50 Ω Calibration menu → Full-2 Port Reflection Forward : Open → Short → Load Reverse : Open → Short → Load Done Transmission Do Both → FWD + REV Done Isolation Omit Isolation Done
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7. Test Procedures

7-1. VSWR

7-1-1. Test Method (Engineering)

The antenna is tested while mounted in the handset. The handset is set up with a 50 Ohm coaxial cable connected to the 50 Ohm point.

Calibration is done at this 50 Ohm point.

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. (Fig. 8)

- Step 1. Connect ANT Port with Cable included Adaptor to Port 1 of Network Analyzer.
- Step 2. Point out Markers on Network Analyzer Display at GSM/US-PCS frequency band.
- Step 3. Inspect $VSWR < 4.4(\text{DCN})$ $2.1(\text{UPCS})$ $2.1(\text{AWS})$
- Step 4. Measurement.



Fig. 8

7-2. Gain and Pattern (Far Field Chamber)

7-2-1. Test Method (Engineering)

The antenna is tested while mounted to the handset.

The antenna is tested in free space in the anechoic chamber.

Radiation patterns are measured at the center of transmit and receive bands. (Fig. 10)

- Step 1. Calibrate Chamber System for Gain Measurement Using Dipole & Horn Antenna.
At the Same Time Set Up Software Program for Chamber System Control.
- Step 2. Change Over from a Dipole & Horn Antenna to Measuring Antenna on Target Positioner.
- Step 3. Start a Software Program for Chamber System Control & Measuring
- Step 4. Measurement Data

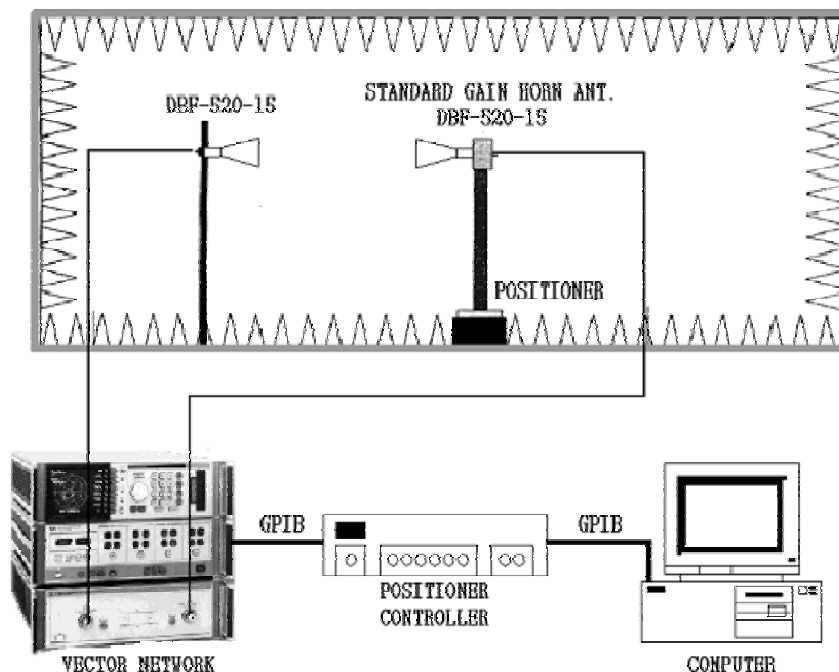


Fig. 10

7-2-2. Measurement of Radiation Pattern

Coordinates and Measurement plane at radiation pattern measurement are defined in Fig. 11(a) and Fig. 11(b)

Radiation pattern measurement is performed at more than 2 frequencies including the highest and lowest limit frequency of the band.

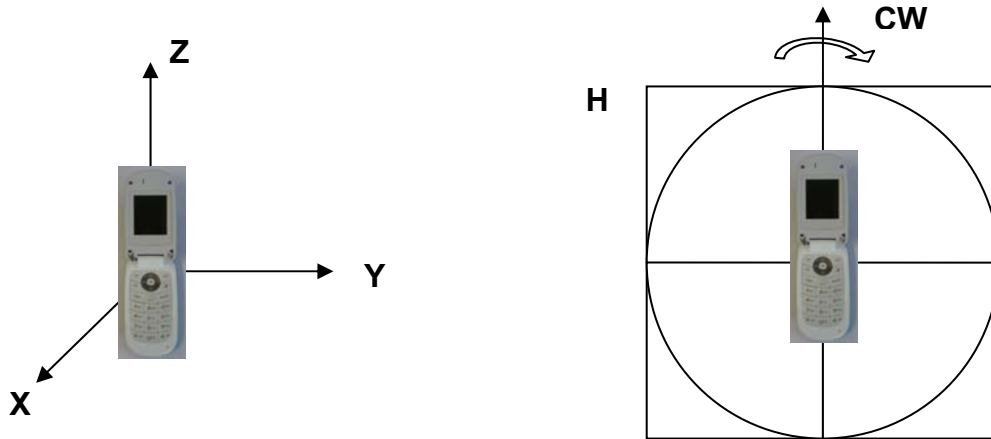


Fig. 11(a)

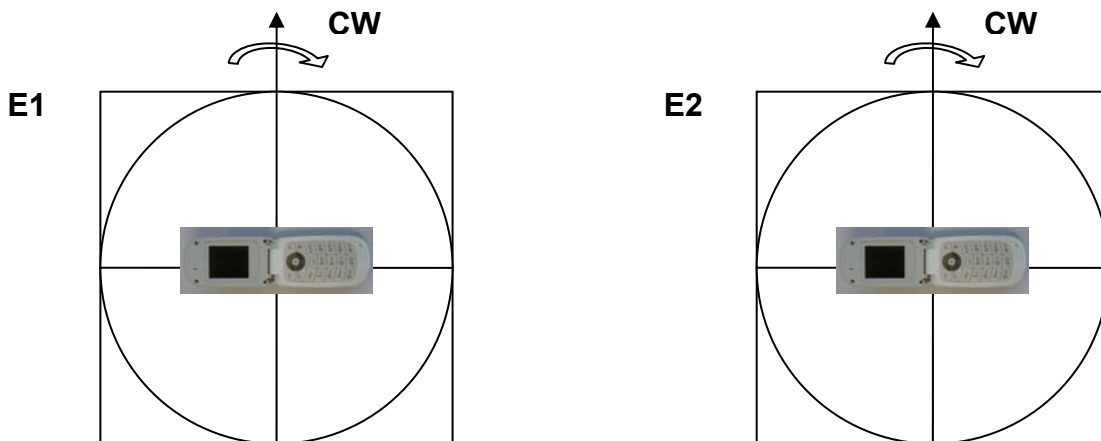


Fig. 11(b)

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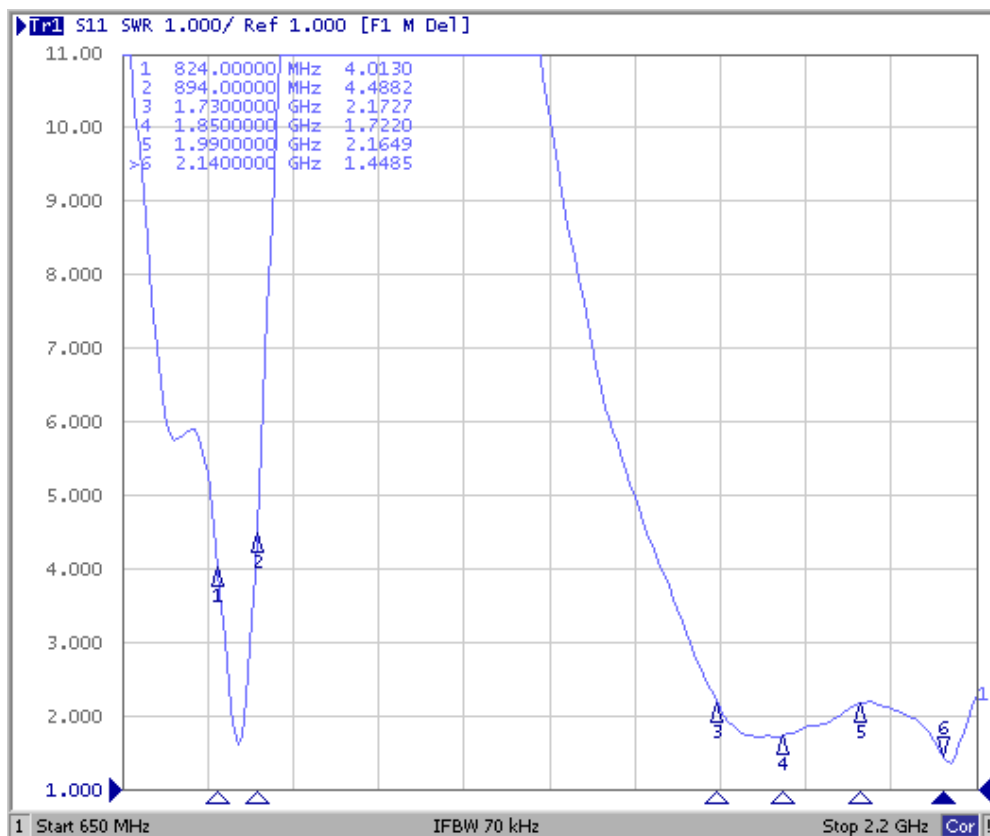
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8. Measurement Data

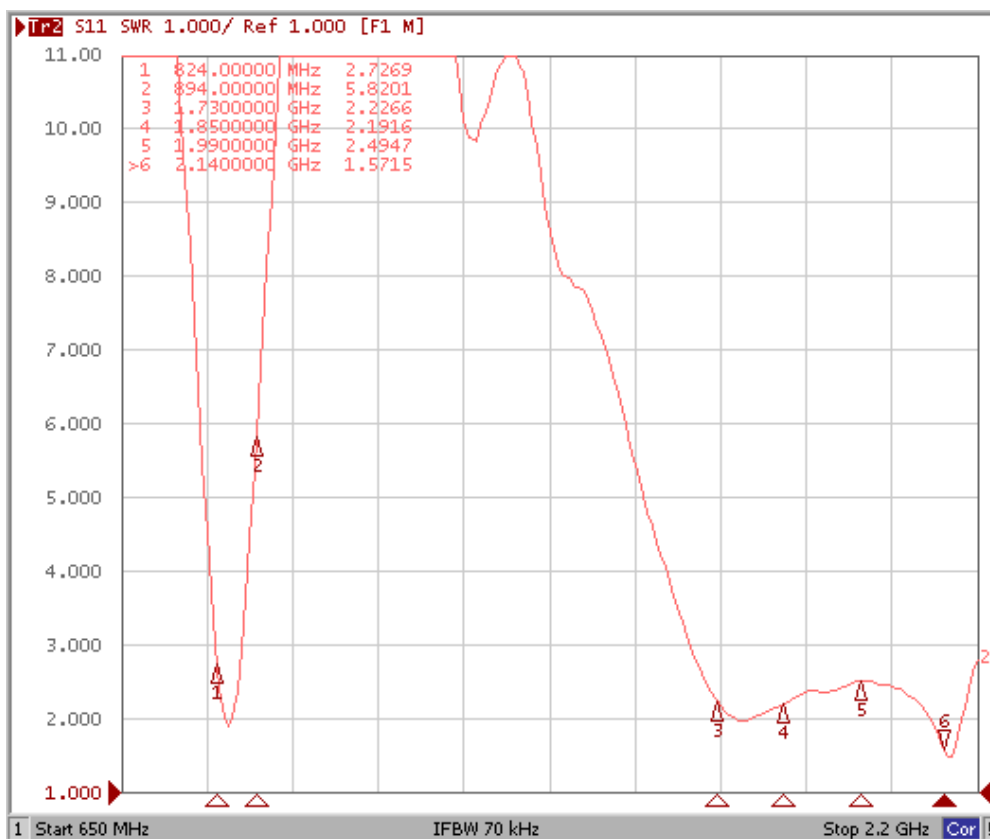
Model	CDM7126	Part No.	KI - 08404
Written by	Jae Kwan Song	Authorized by	Hwan Sung Park
Instrument	Network Analyzer: 8753ES (HP)		
Subject	Internal Antenna		
Frequency	824 ~ 894MHz / 1850 ~ 1990 MHz / 1730 ~ 2140 MHz		

Items			Test Result		
Frequency Range			824 ~ 894 MHz	1850 ~ 1990 MHz	1710 ~ 2155 MHz
V.S.W.R (Min)	Open		4.4 : 1	2.1 : 1	2.1 : 1
	Close		5.8 : 1	2.4 : 1	2.2 : 1
Peak Gain	Open	H-plane	-2.64 dBi	0.97 dBi	-0.19 dBi
		E1-plane	-0.51 dBi	0.56 dBi	-0.51 dBi
		E2-plane	-2.31 dBi	1.50 dBi	0.47 dBi
	Close	H-plane	-2.36 dBi	1.03 dBi	0.31 dBi
		E1-plane	-3.26 dBi	0.39 dBi	-0.95 dBi
		E2-plane	-2.60 dBi	1.02 dBi	0.70 dBi
Average Gain (min)	Open	H-plane	-11.48 dBi	-3.76 dBi	-4.04 dBi
		E1-plane	-12.45 dBi	-5.25 dBi	-4.62 dBi
		E2-plane	-10.90 dBi	-3.06 dBi	-5.15 dBi
	Close	H-plane	-7.23 dBi	-4.81 dBi	-4.63 dBi
		E1-plane	-11.72 dBi	-6.38 dBi	-5.77 dBi
		E2-plane	-10.74 dBi	-4.36 dBi	-5.81 dBi

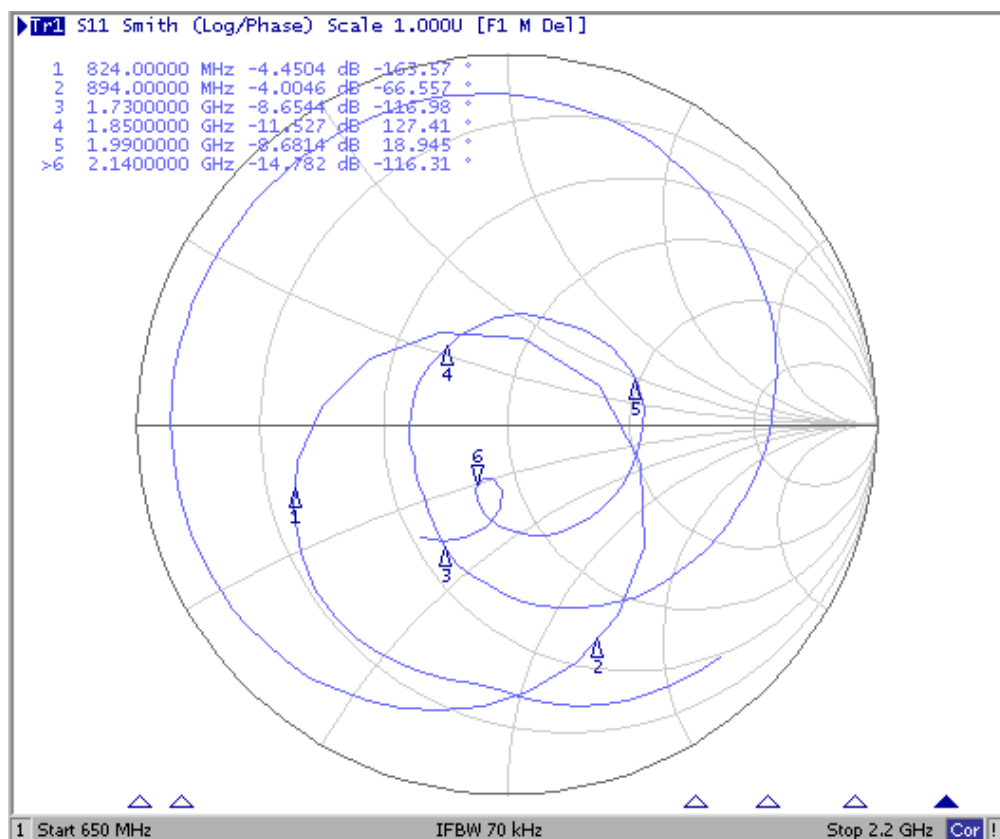
8-1 VSWR



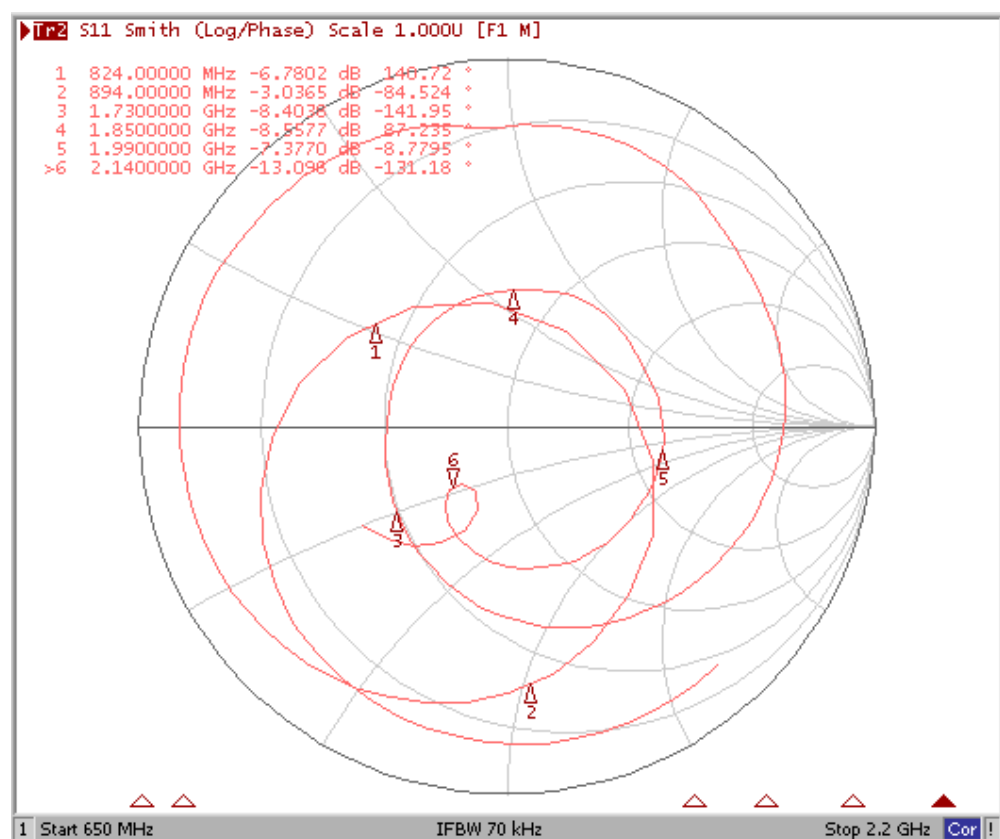
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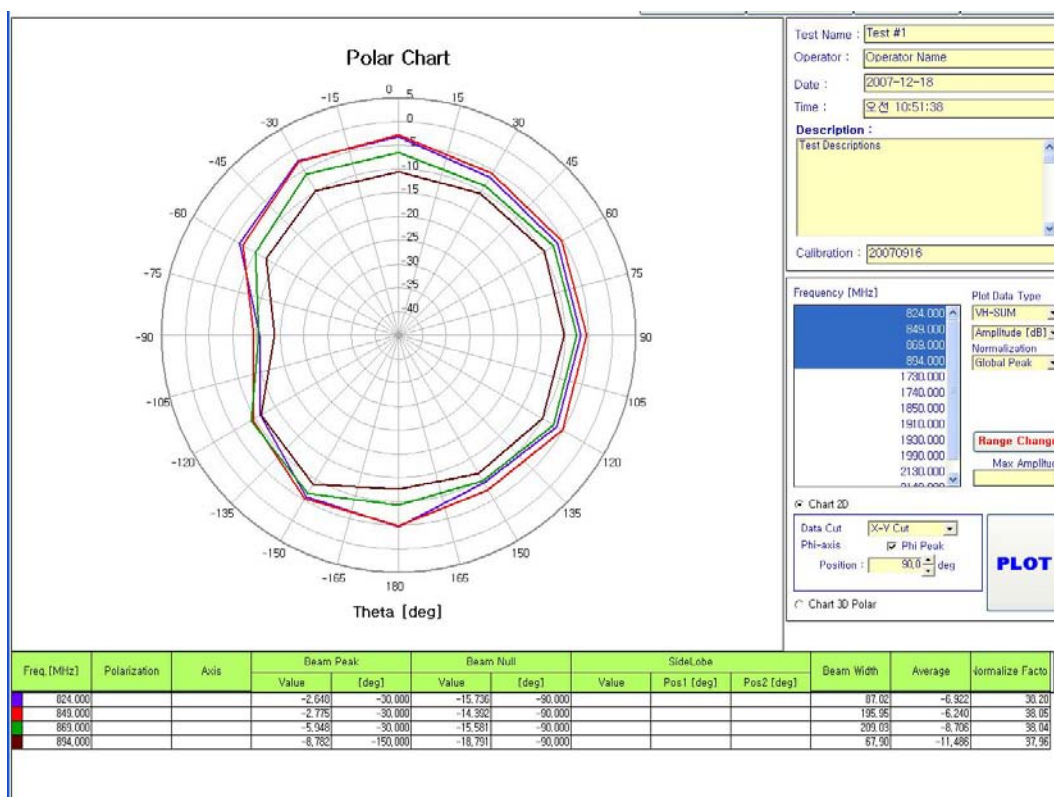
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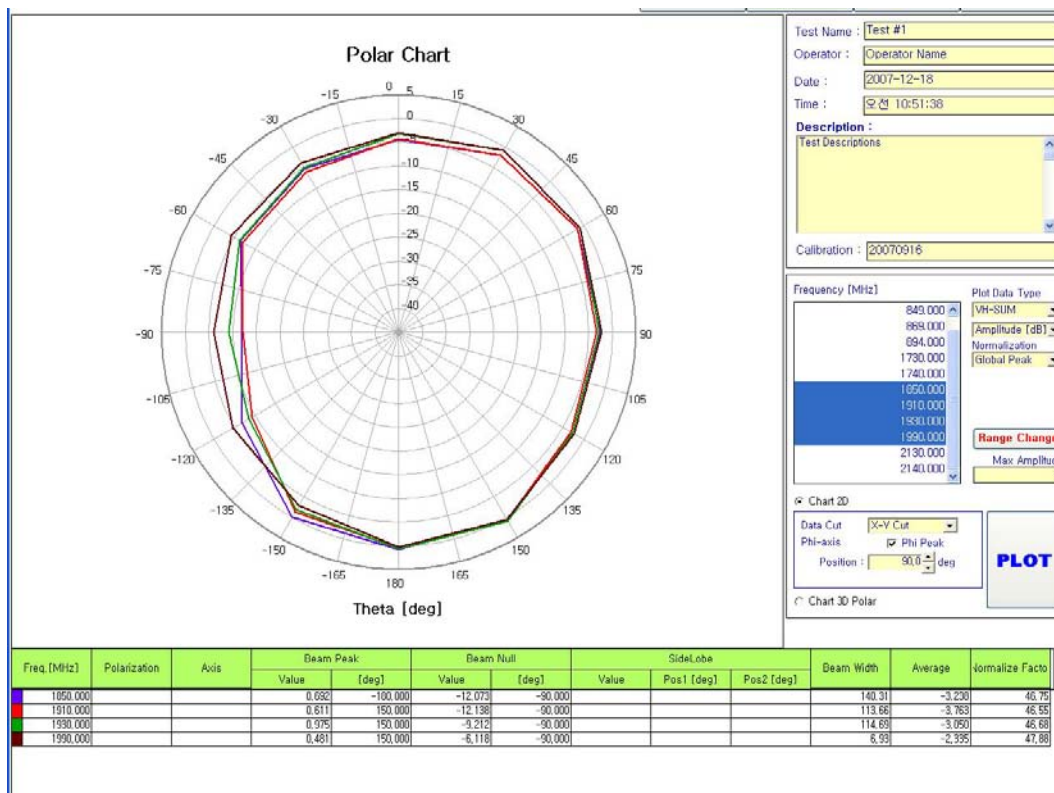
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8-3-1 Radiation Pattern (H-plane)

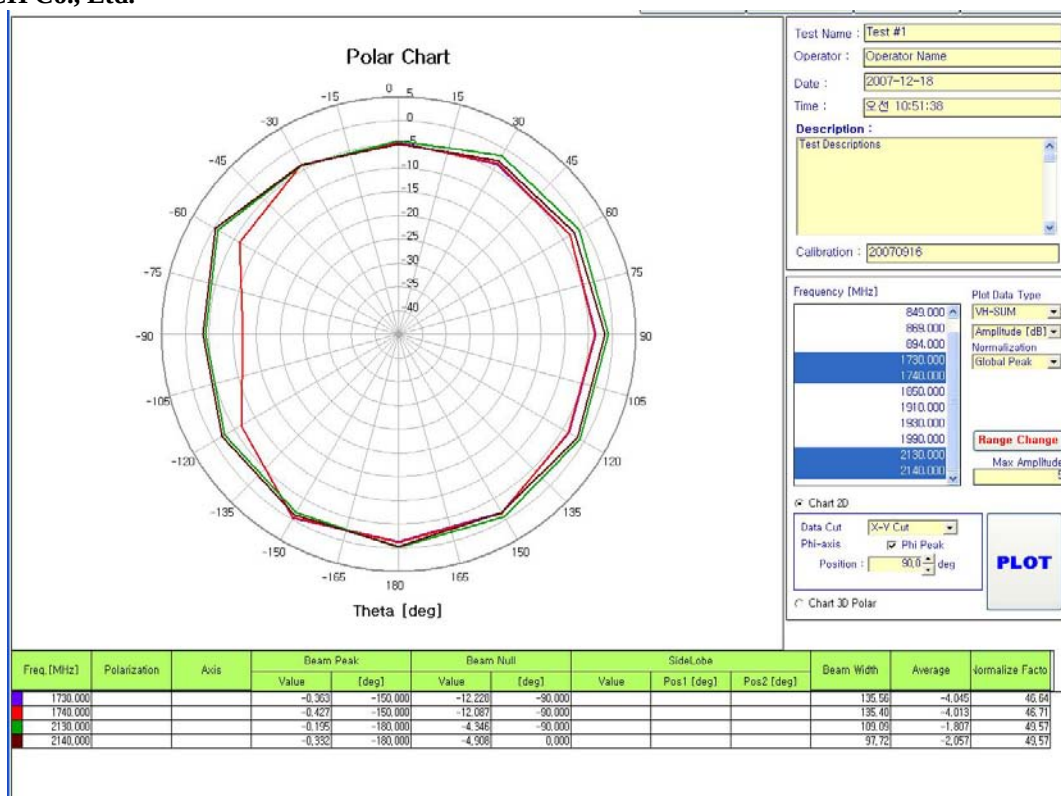
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DCN

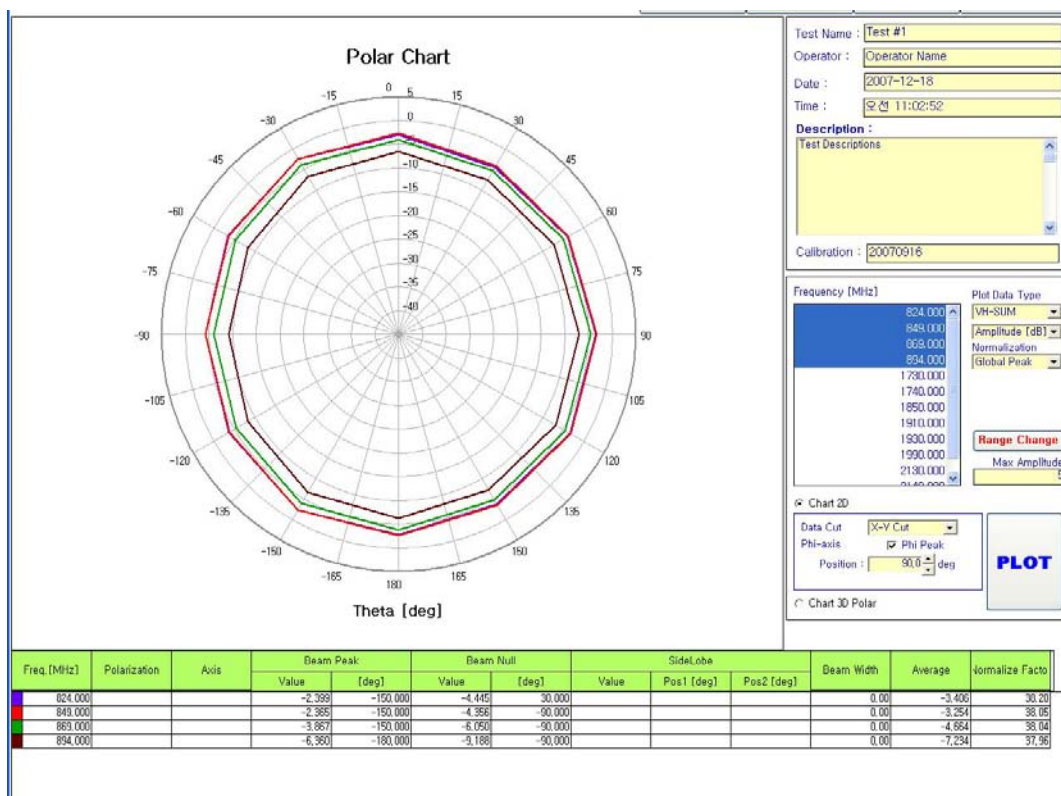


UPCS

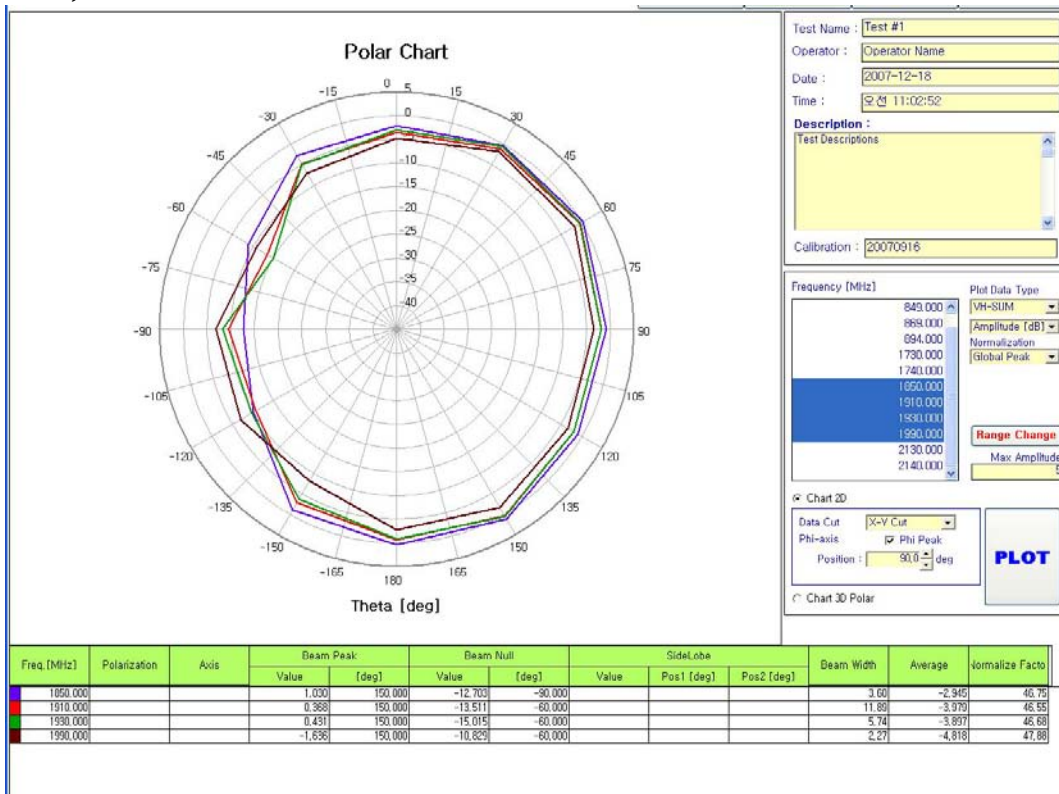


AWS

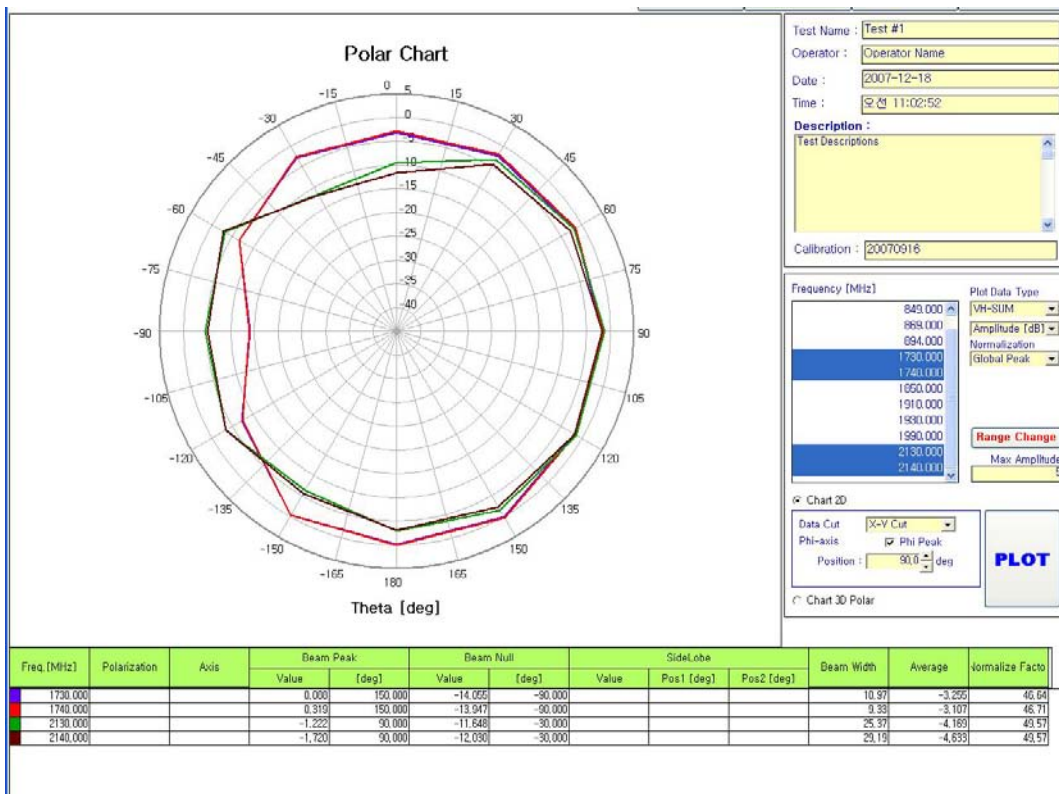
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DCN



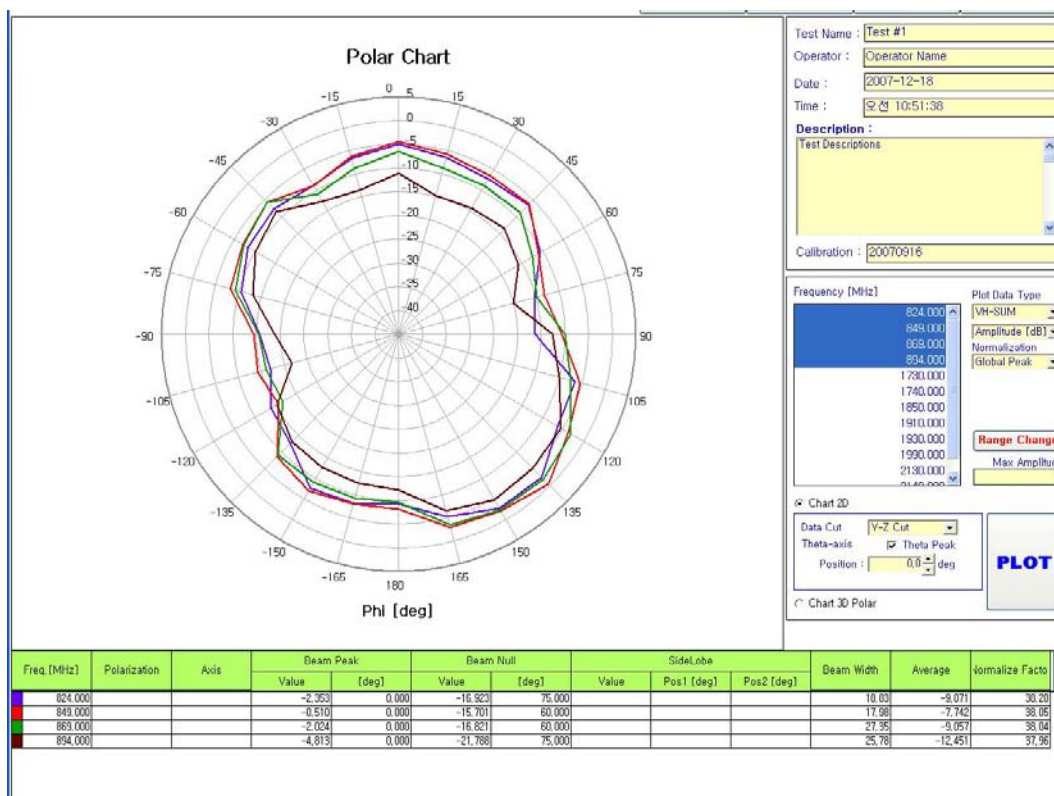
UPCS



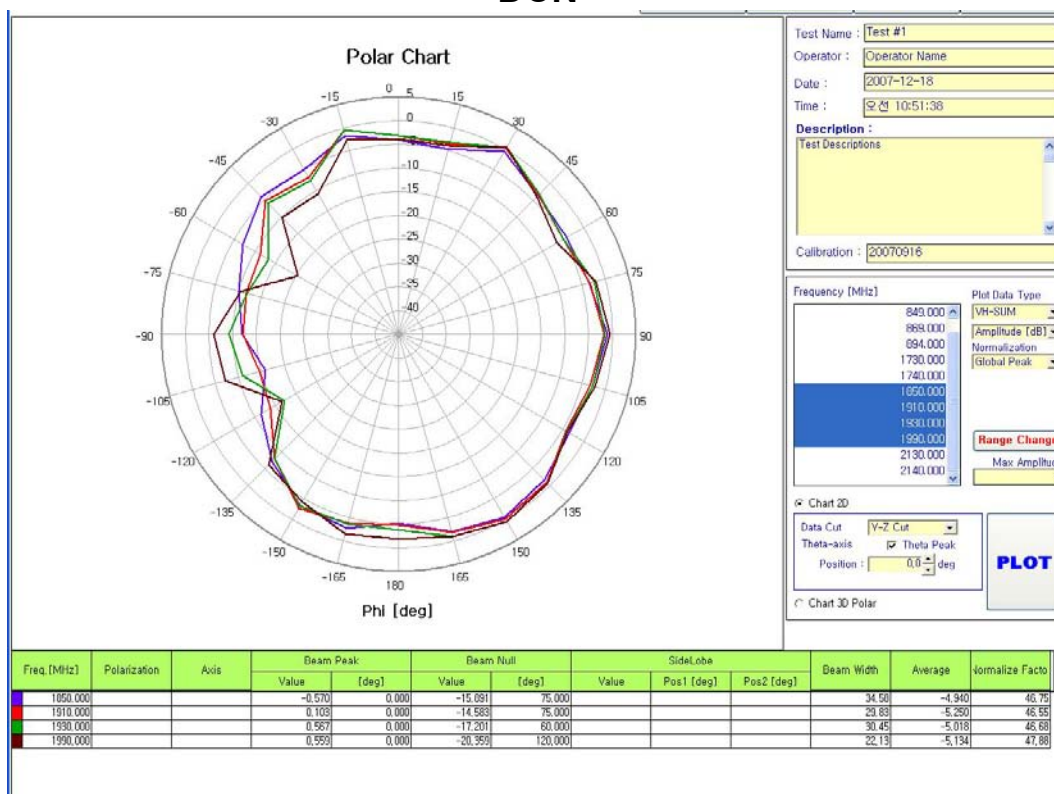
AWS

8-3-2 Radiation Pattern (E1-plane)

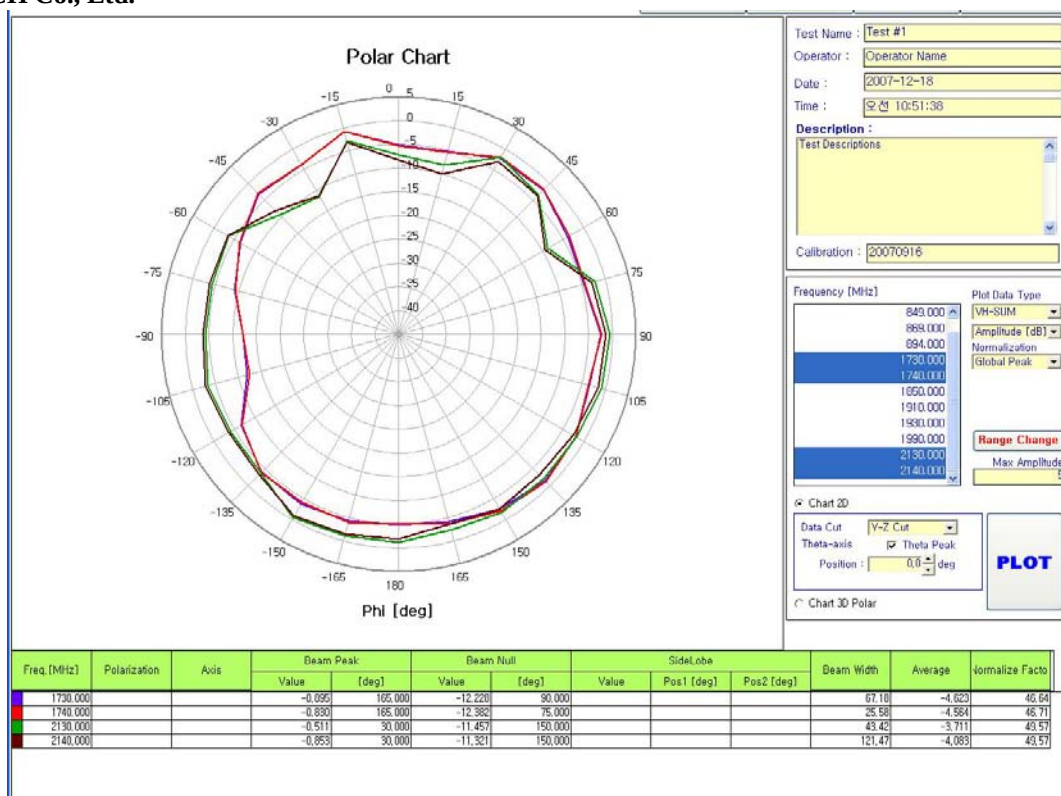
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DCN

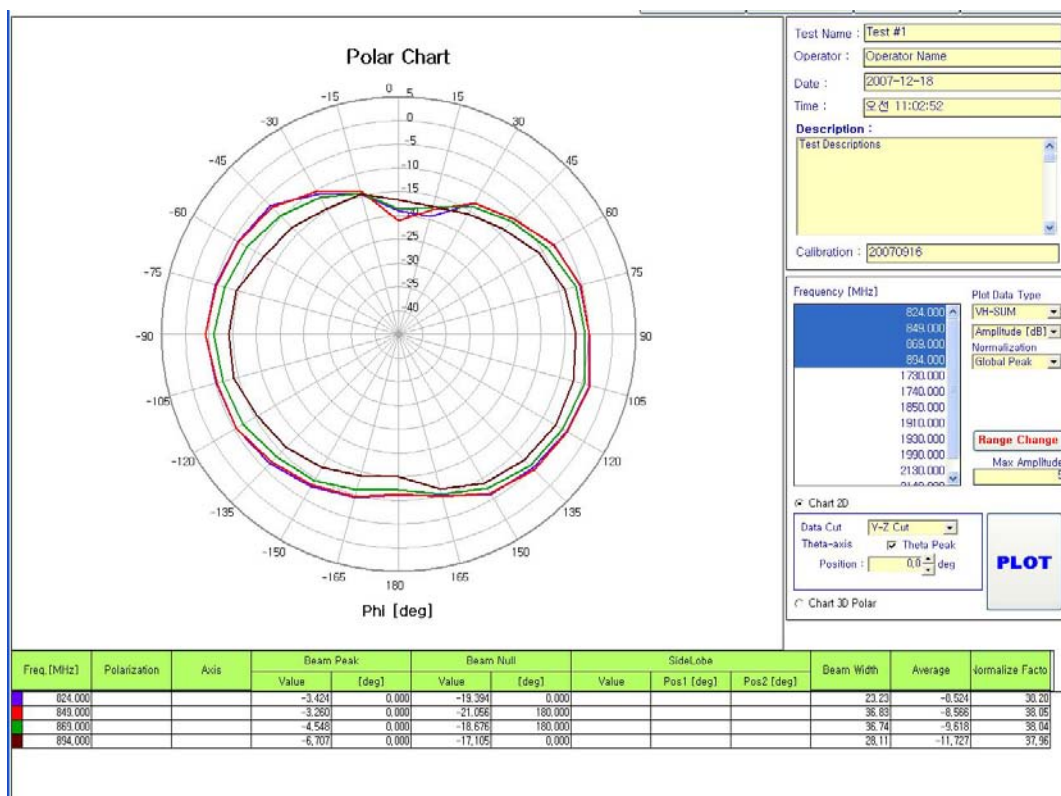


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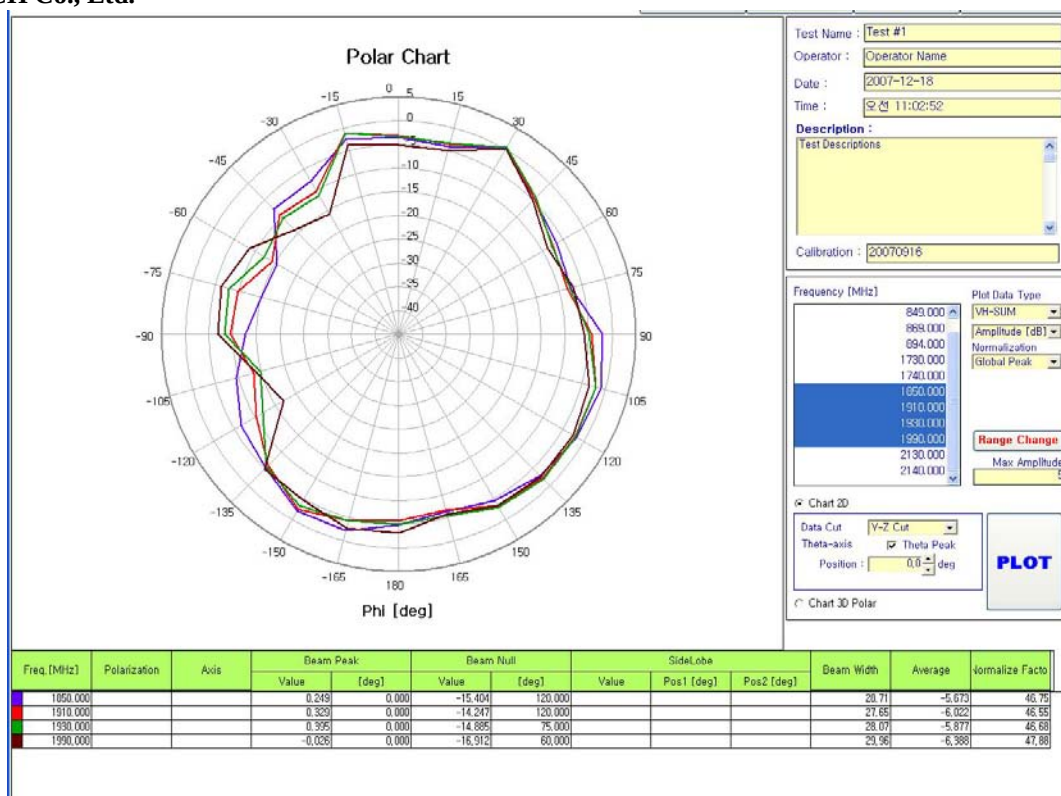


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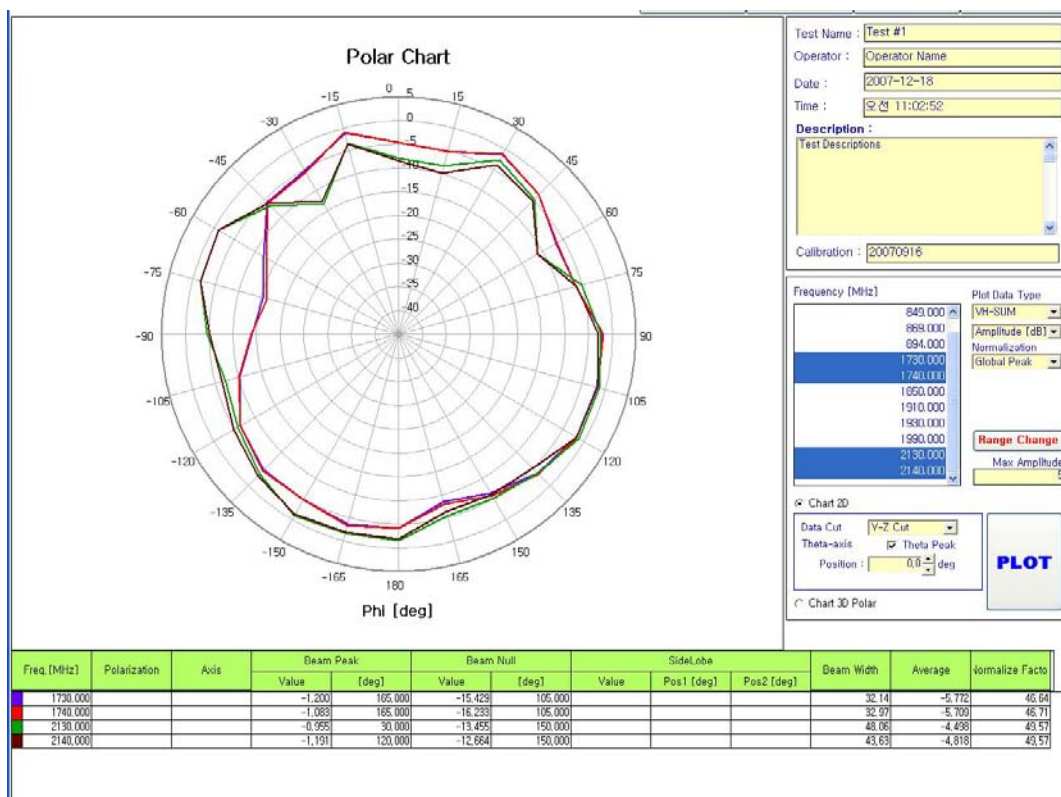
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DCN



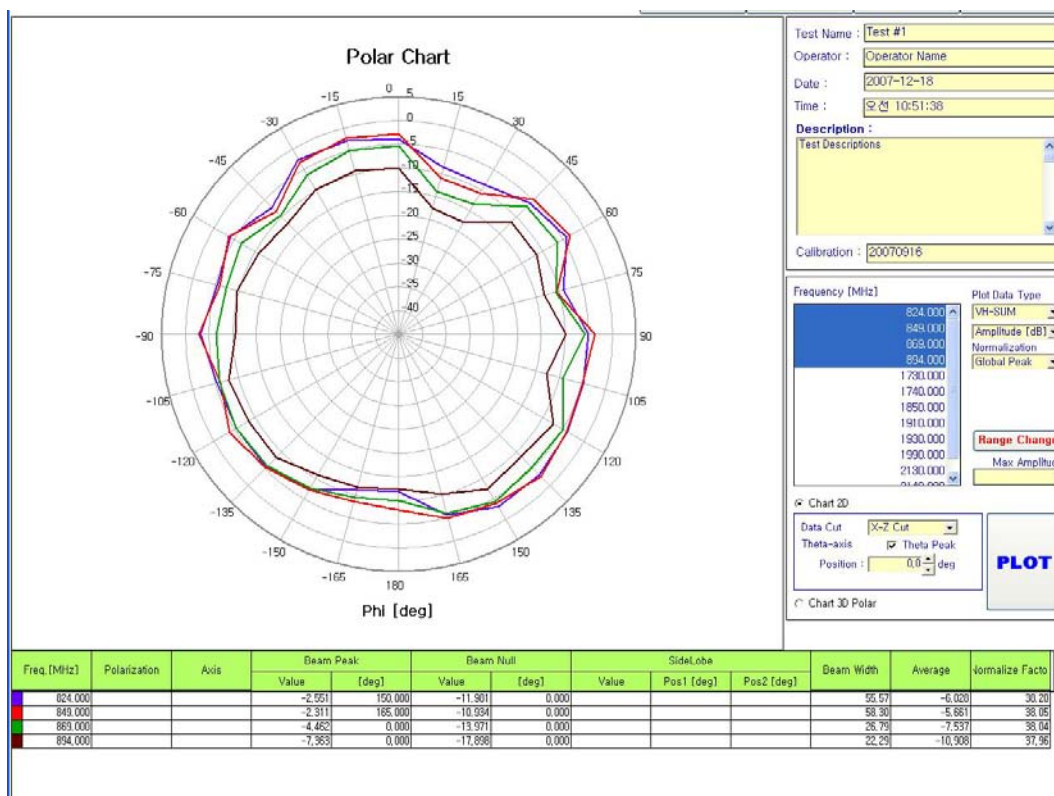
UPCS



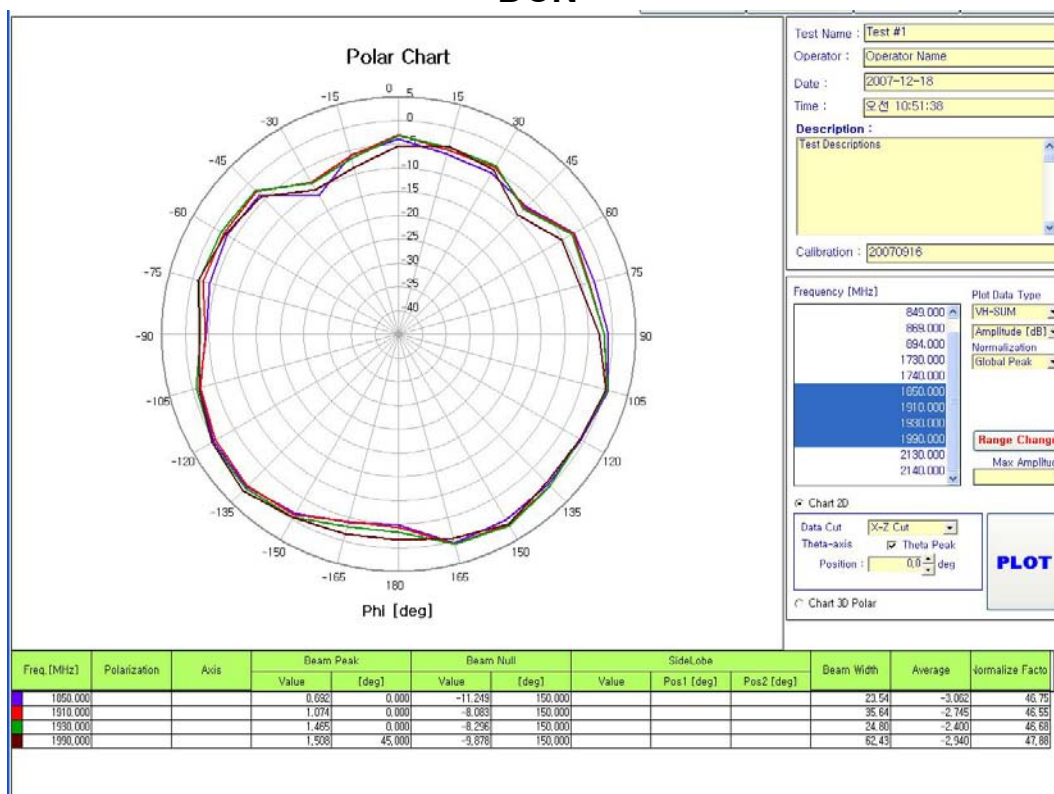
AWS

8-3-3 Radiation Pattern (E2-plane)

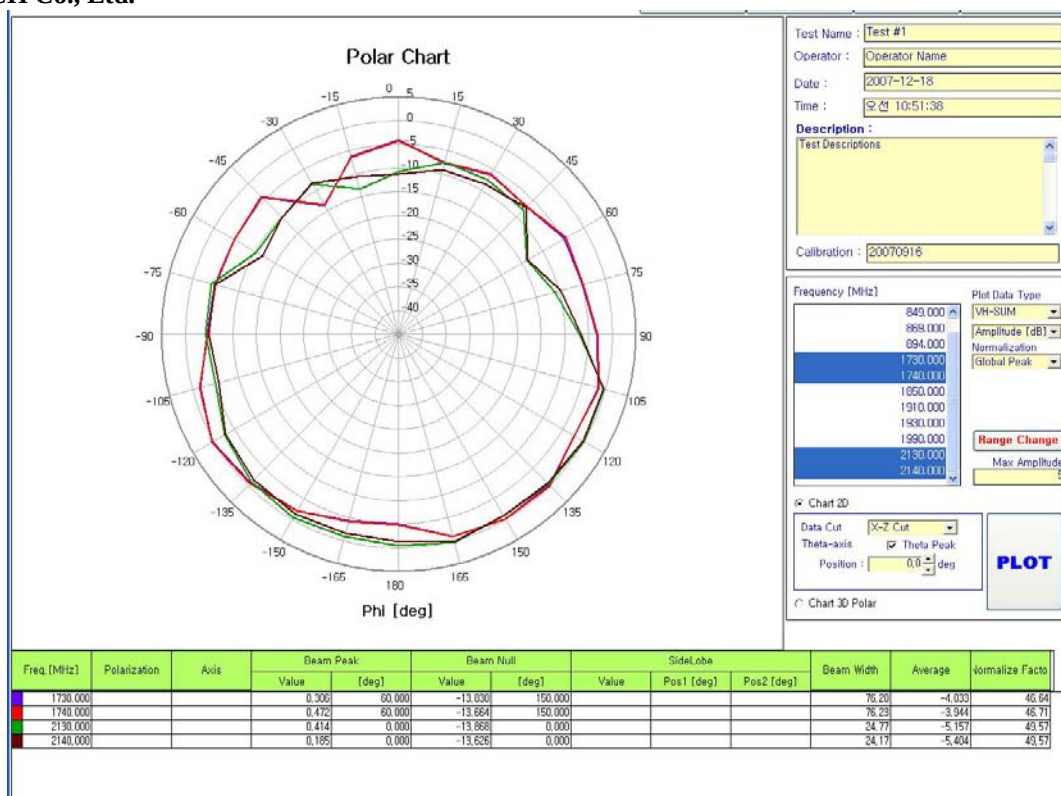
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DCN

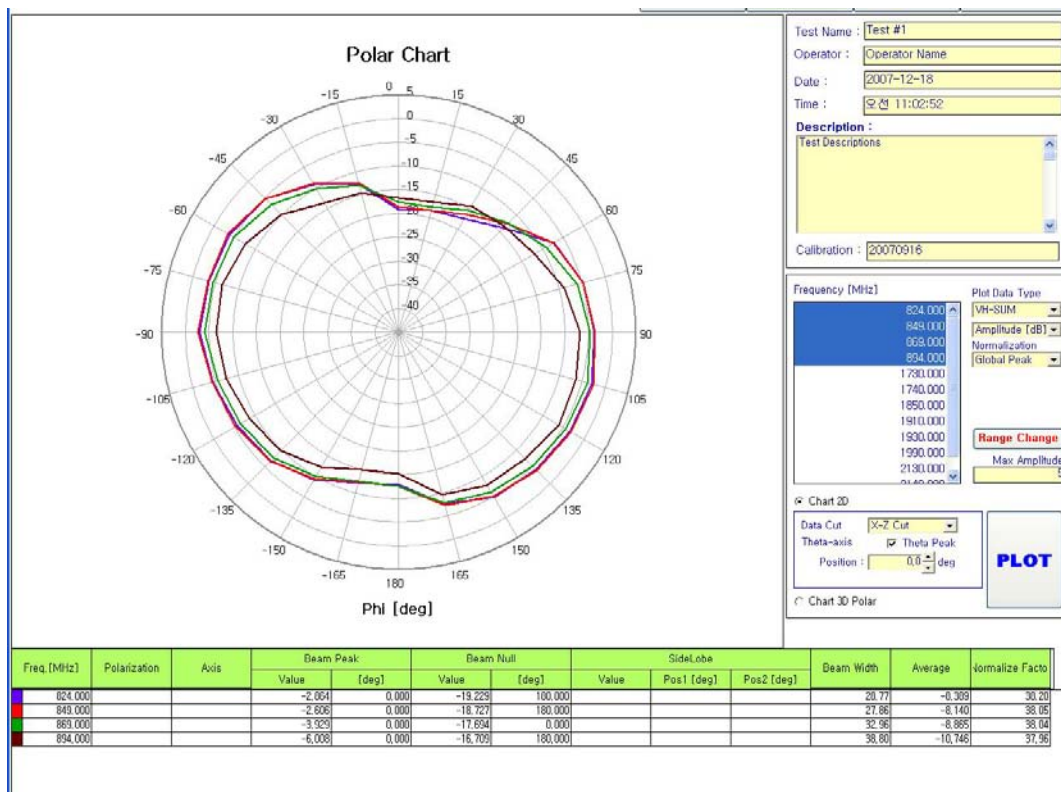


UPCS

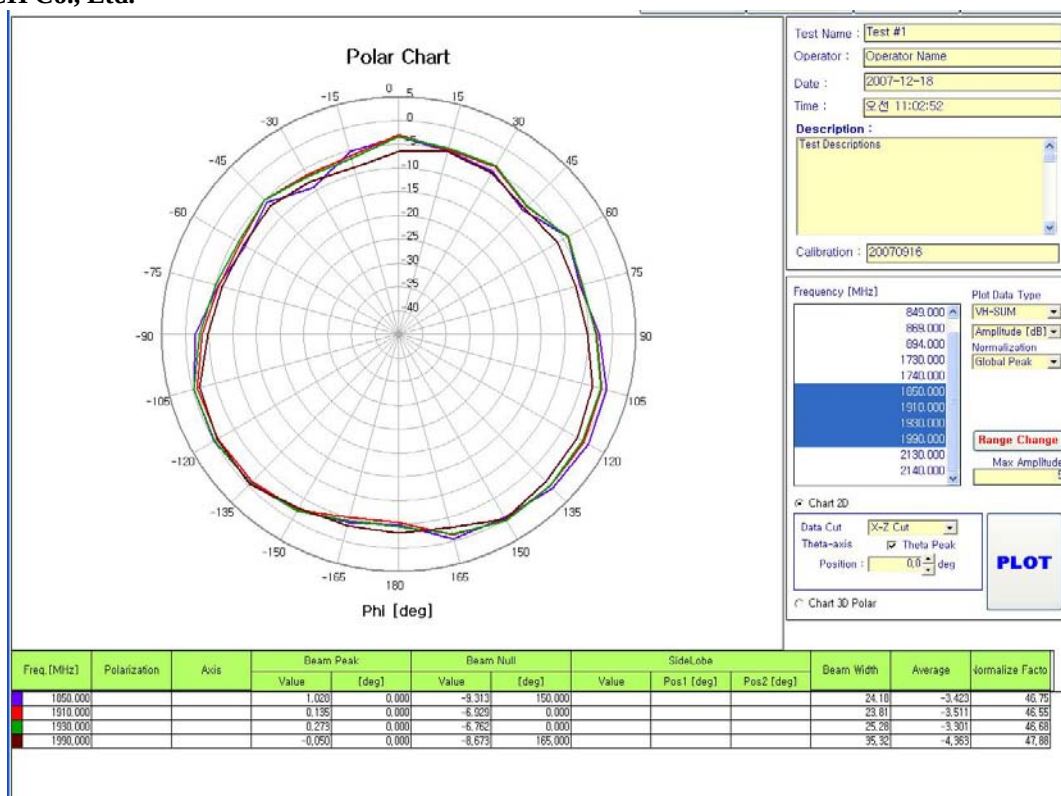


AWS

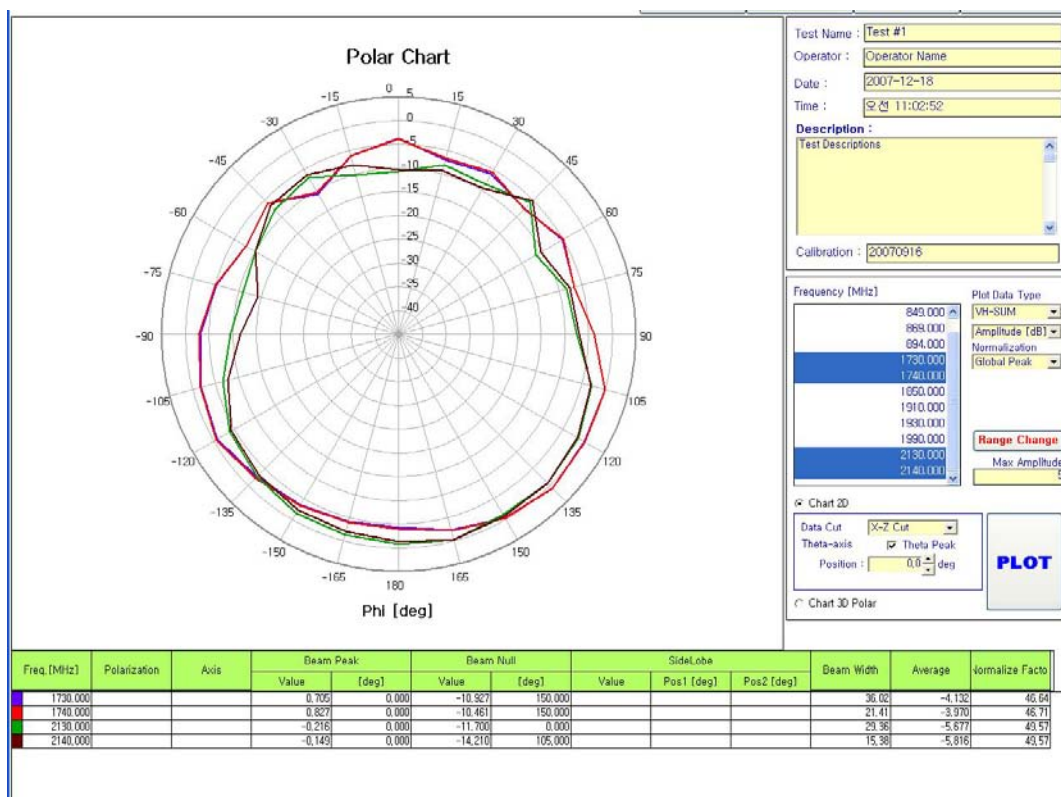
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DCN



UPCS



AWS