No. SP04-23-47988

Date: September.20, 2004

SPECIFICATION

FOR

2.4/5.2 GHz Dual-band Internal Antenna for Laptop Computers

(HTL008-CP22NN)

Quantity

Your Ref. No.

Our Ref. No.

Signed by

Koichi Tsukamoto

Manager

Electronic & Automotive Products Group

Electronic Wires & Cables Production Div.

Engineering Dept.

Hitachi Cable, Ltd.

Issue and revision record

Rev. No.	Issue Date	Item	Prepared by	Reviewed by	Approved by
-	Sep 20, 2004	First Edition			

1. Scope

This specification covers the 2.4/5.2 GHz dual-band internal antenna suitable for laptop computers (hereinafter called “this product”).

2. Product Name

This product is called “**HTL008-CP22NN**”.

3. Abbreviations

OD	Outer Diameter
LCD	Liquid Crystal Display
VSWR	Voltage Standing Wave Ratio
HCL	Hitachi Cable, Ltd.

4. Structure

This product consists of three individual antennas as shown in the attached drawing EH3853042. Each antenna consists of the following three elements:

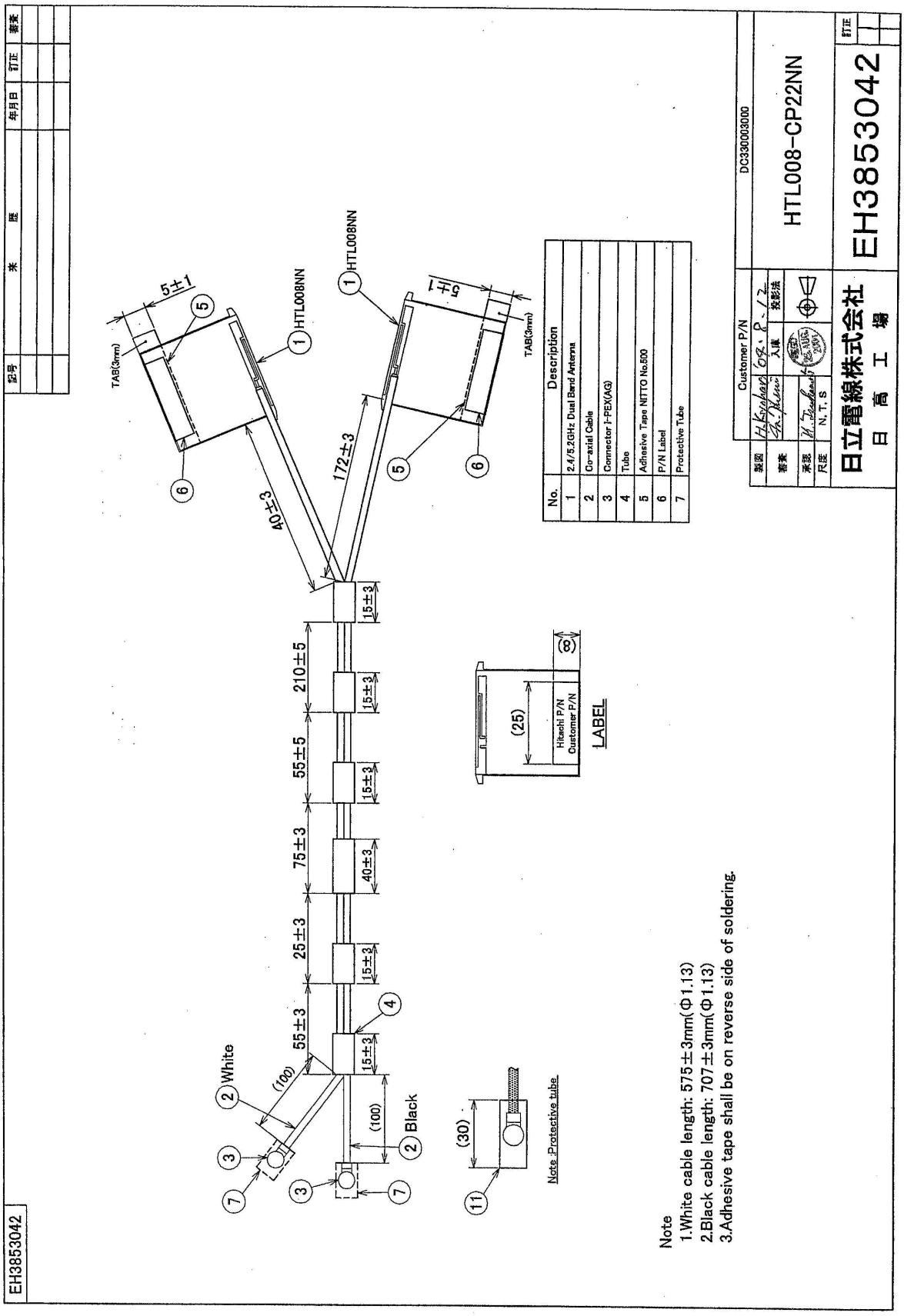
1) Radiator
2) Coaxial cable
3) Connector

Each of the antennas is shown in the attached drawings of which numbers are described in the following Table 4-1.

Table 4-1 Individual antennas composing the product.

Antenna Type	Applicable Frequency	Cable Spec.		
		OD(Max)	Color	Length (mm)
HTL008 -R	2.4/5.2 GHz dual-band	ϕ 1.13 mm	white	575 ± 3
HTL008 -L	2.4/5.2 GHz dual-band	ϕ 1.13 mm	black	707 ± 3

The above antennas are bundled each other with a heat shrinkable tube.



Note
1.White cable length: 575±3mm(Φ1.13)
2.Black cable length: 707±3mm(Φ1.13)
3.Adhesive tape shall be on reverse side of soldering.

5. Materials

5.1. Radiator

The radiator consists of the following two materials:

5.1.1. Phosphor bronze as the electrical conductor

Thickness: 0.1 mm

The conductor is laminated on both surfaces with the following insulating film.

5.1.2. Polyimide as the insulating film

Thickness: 0.025 mm

5.2. Coaxial Cable

5.2.1. OD: See Table 4-1.

5.2.2. Color: See Table 4-1.

5.2.3. Length: See Table 4-1.

NOTE: The “cable length” referred in this document means the distance between the joint of the connector and the edge of the insulating film of the antenna (see Fig. 5-1). Here the cable should be measured under the condition that the cable is drawn horizontally to the antenna.

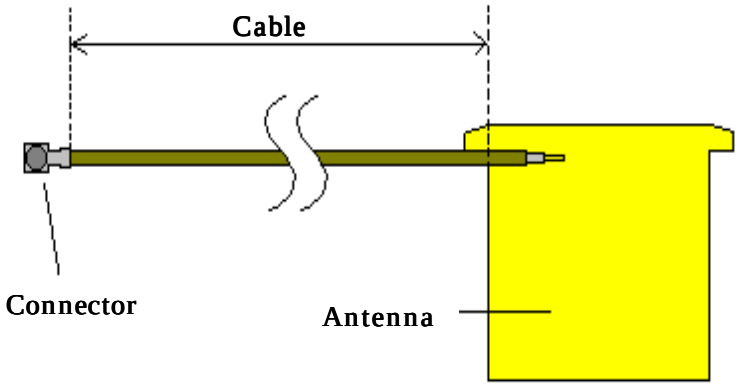


Fig. 5-1 Definition of cable length.

5.3. Connector

5.3.1. Product Name

Coaxial Connector

5.3.2. Product Code

20308-111R-13

5.3.3. Manufacturer

I-PEX CO., LTD.

5.4. Bundling tube

5.4.1. Product Name

Heat Shrinkable Tube

5.4.2. Product Code

HCV4 or SUMITUBE F34

5.4.3. Manufacturer

Tyco Electronics Raychem or SUMIPACK CORPORATION

5.4.4. Color

Black

5.5. Adhesive tape

5.5.1. Product Name

Couple-face adhesive tape

5.5.2. Product Code

No. 500

5.5.3. Manufacturer

Nitto Denko Corporation

6. Electrical Properties

Table 6-1 Return loss properties (in free space).

Antenna Type	Frequency (GHz)*
HFD01NN-R,L	2.60 - 2.80, 5.50 – 6.50

*) When return loss is less than -9.5 dB.

7. Mechanical Properties

7.1. Appearance

Specifications are as follows:

1) Such harmful substances or scratches as affect the antenna performance are not allowed.
2) No peeling of the insulating film at the corners allowed.
3) No bent in the conductor allowed.
4) No significant fault in the soldering allowed.

Appearance is inspected visually at the distance of approx. 30 cm by using no microscopes or any other magnifying aids.

7.2. Cable

7.2.1. Allowable Tensile Strength: Max. 15 N

7.2.2. Minimum Bending Radius

(1) 6.0 mm in the fixed area (e.g. computer casing)

(2) 10.0 mm in the movable area (e.g. hinge)

7.2.3. Allowable Bending Cycle: Max. 20,000 cycles at testing method shown in Fig. 7-1.

L : Length of hinge part

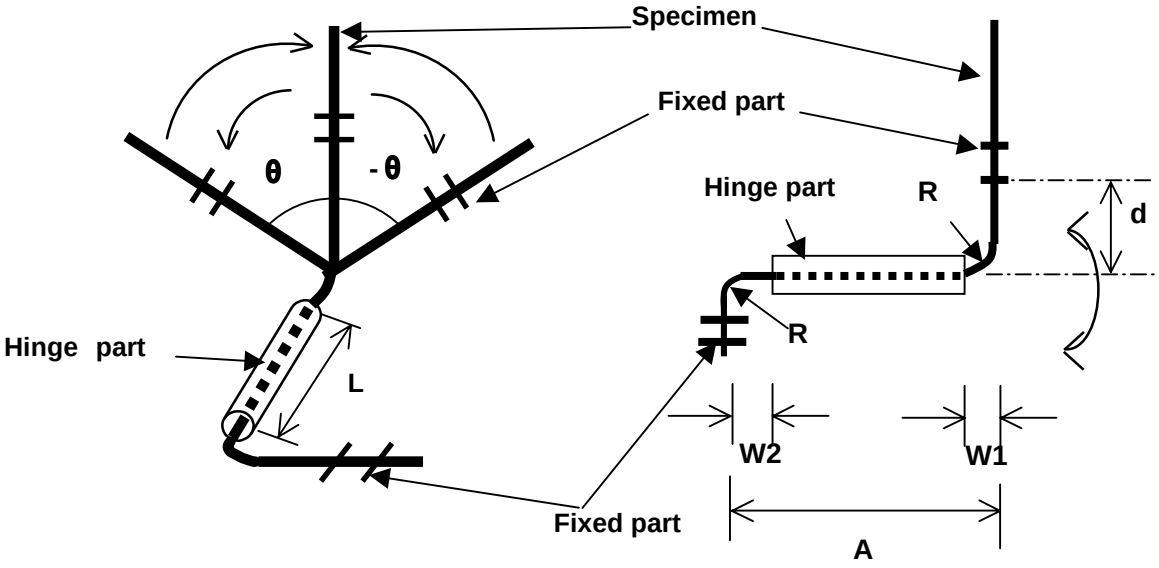
W1 : Distance between hinge and end of fixed part

W2 : Distance between end of fixed part and hinge part

θ :Angle of torsion

d :Distance between center line and fixed end

A :Total length of tortional part



L : Min.20mm

W1 : Min.15mm

W2 : Min.15mm

θ : Within +90～-90 °

R : Min.10mm

A : Min.60mm

Fig. 7-1 Testing method of the bending cycle.

7.3. Soldering

7.3.1. Allowable Peeling Strength

Table 7-1 Allowable peeling strength.

Direction	Allowable Peeling Strength (N)
Direction 1	**12**
Direction 2	**4**
Direction 3	**1**
Direction 4	**4**
Direction 5	**1**

Testing method is shown in Fig. 7-2.

NOTE: It is possible that the antenna is deformed even if the tensile load is below the allowable peeling strength. In this case, the antenna performance may change.

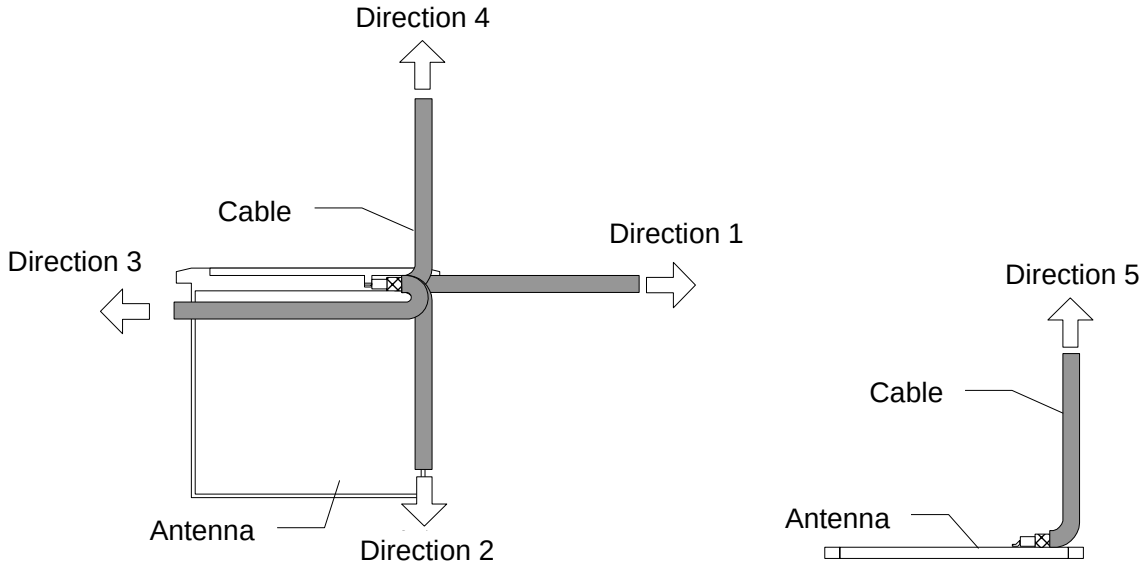


Fig. 7-2 Testing method of the peeling strength.

7.3.2. Wire Breaks

Such stresses as pressure, bending, etc. to the soldered portions may cause the wire breaks.

7.4. Connector

The connectors should be handled according to the user's manual and/or the specification given by the connector manufacturer.

8. Quality

The items shown in Table 8-1 shall be inspected for each manufacturing lot before the shipment:

Table 8-1 Inspection items.

Inspection Items	Quantity
Appearance	All pieces
Cable length	Sampling
Return loss property	Sampling

9. Packing

9.1. Method

The product shall be packed to keep its quality during the transportation.

9.2. Label

A Label in which the following items are described shall be attached to each package.

1) Product Name
2) Specification
3) Quantity
4) Manufacturing No.
5) Date of shipment

CONFIDENTIAL

No. EST04-066	(1/5)

To COMPAL ELECTRONICS , Inc.	Hitachi Cable Asia, Ltd. Taipei Branch Antenna R&D Dept.
ENGINEERING SHEET	Issue Date: Aug. 23, 2004
Subject: **Test Report of Film Antenna installed in Fortworth Banias C test**	

1. Test Conditions

1.1. Antenna

- P/N : HTL008-CP22NN
- With I-PEX 20308-111R-13
- Cable : ϕ 1.13mm, length 575 mm for Main antenna
- ϕ 1.13mm, length 707 mm for Aux antenna

1.2. PC casing

Fortworth C test casing

1.3. Return Loss & VSWR

Measurement frequency band :2.0 GHz to 7.0 GHz

1.4. Gain

- Measured at 2.40 GHz, 2.45 GHz, 2.50 GHz, 5.15 GHz, 5.25 GHz, and 5.35 GHz in the XY plane

2. Installation of the Antennas

The antenna was set as shown in Fig2-1.

Fig. 2-1 Installation of the antennas to Fortworth Banias

DWN	Y.Yamamoto	Aug. 23, 2004
CHKD	R.Komagine	Aug. 23, 2004
APPD	R.Komagine	Aug. 23, 2004

Fig. 2-2 defines the direction of the radiation pattern measurement.

Fig. 2-2 The direction of the radiation pattern measurement.

The average gain is calculated by the following equation.

$$\text{Average Gain (dBi)} = \frac{\sum_{i=0}^{N-1} Max[G_{Vi}, G_{Hi}]}{N}$$

where i = azimuth angle (0, 1, 2, …, 359)
G_{Vi} , G_{Hi} = measurement Gain at i, V, H = Polarization
N = Total Measurement steps (=360)

3. Radiation Pattern

The radiation patterns in XY plane are shown in Fig.3-1.

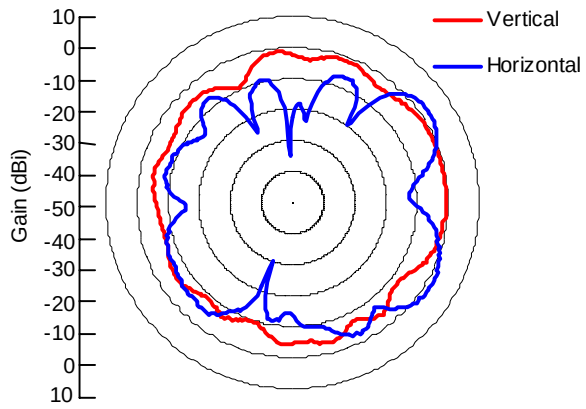
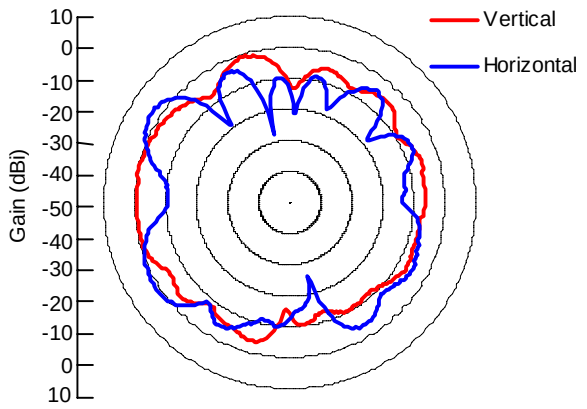
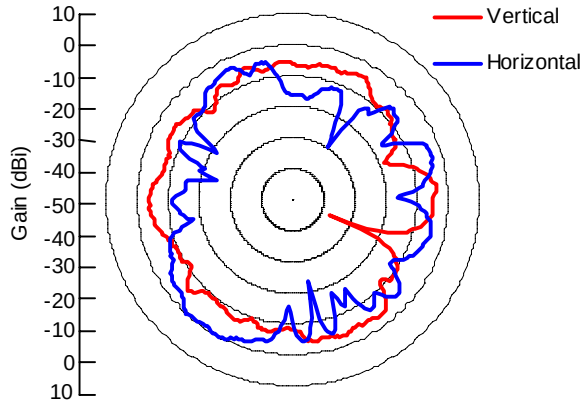
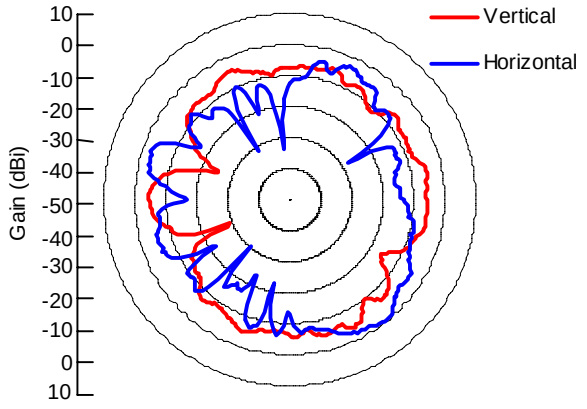
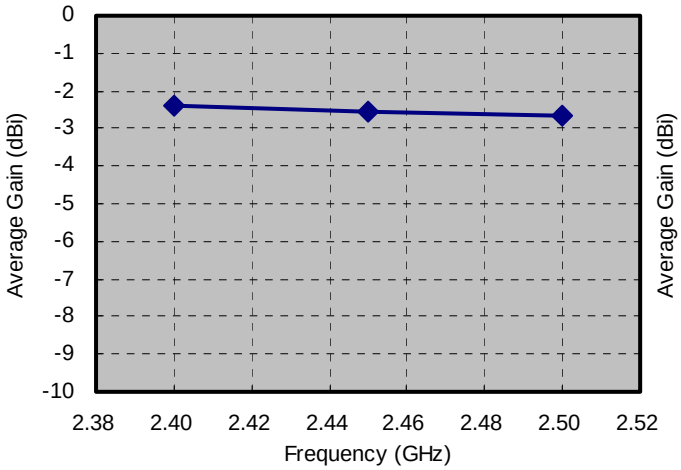
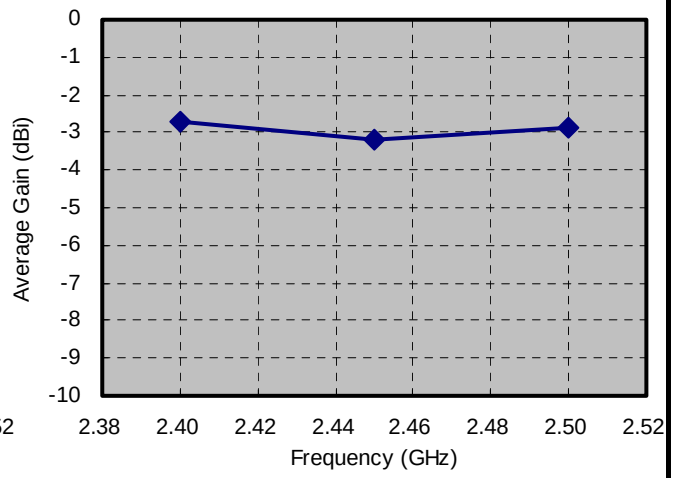
Main antenna	Aux Antenna
	
2.45GHz	**2.45GHz**
Peak Gain (Vertical): -0.36 dBi Peak Gain (Horizontal): 2.62 dBi Average Gain: -2.56 dBi	Peak Gain (Vertical): 0.28 dBi Peak Gain (Horizontal): 3.02 dBi Average Gain: -3.20 dBi
Main antenna	**Aux Antenna**
	
5.25GHz	**5.25GHz**
Peak Gain (Vertical): -3.12 dBi Peak Gain (Horizontal): -0.27 dBi Average Gain: -4.71 dBi	Peak Gain (Vertical): -3.87 dBi Peak Gain (Horizontal): -0.24 dBi Average Gain: -5.71 dBi

Fig. 3-1 Radiation Pattern of antennas

The average gain in XY plane are shown in Fig.3-2.

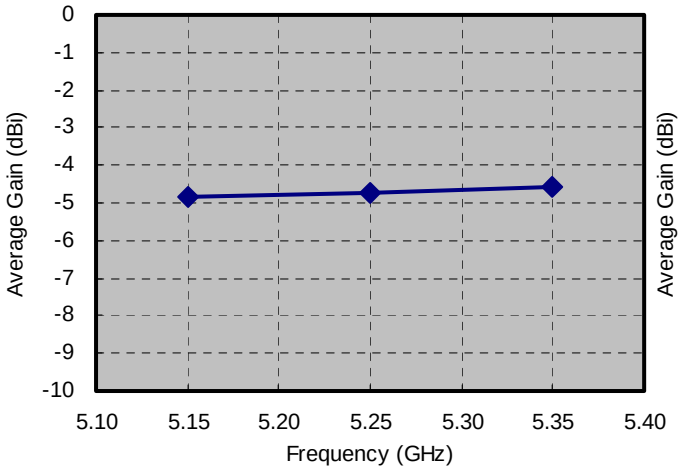


(a) Main antenna

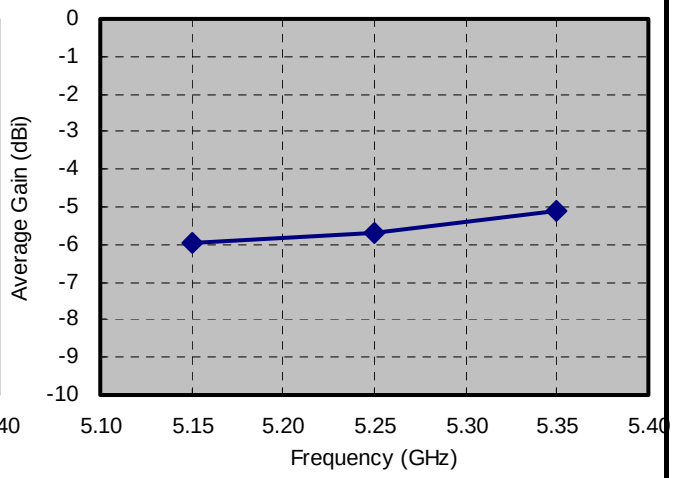


(b) Aux antenna

2GHz Range



(a) Main antenna



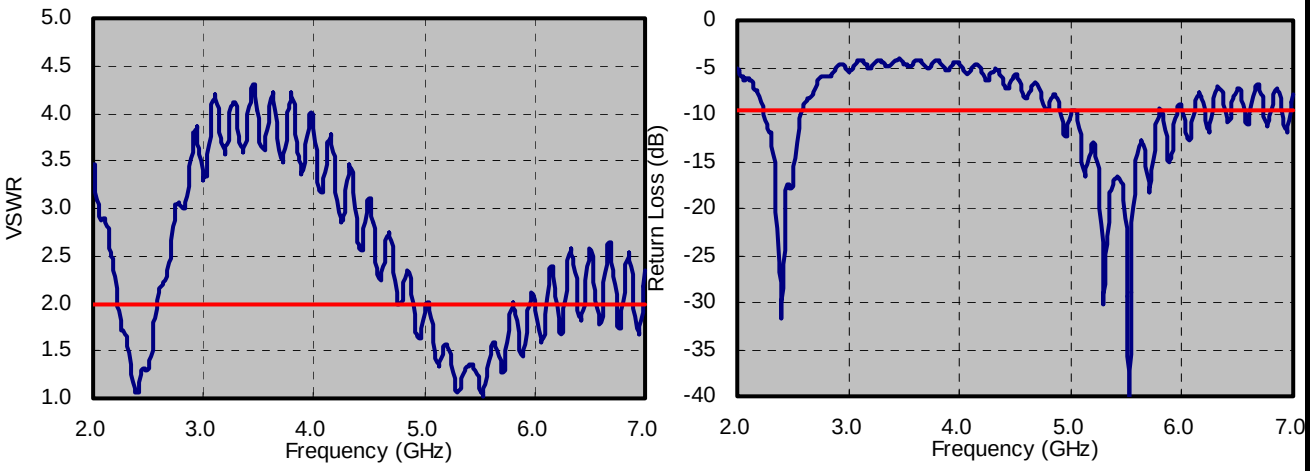
(b) Aux antenna

5GHz Range

Fig. 3-2 Average gain in XY plane

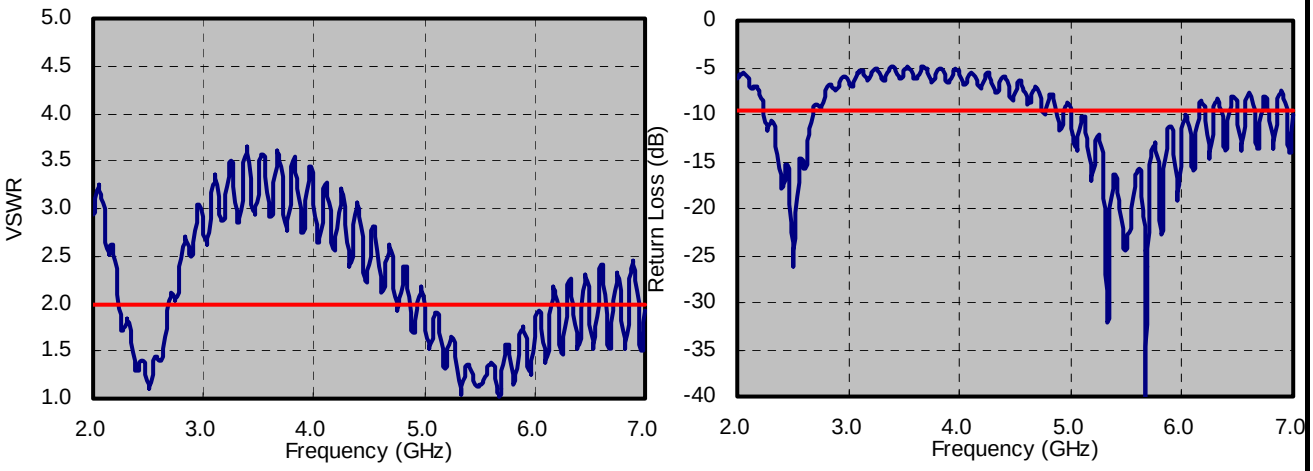
4. VSWR and Return Loss Property

Fig.4-1 and 4-2 shows the VSWR and Return Loss property of antennas measured inPC casing. The red lines in the figures shows "Return Loss = -9.5dB"(VSWR = 2).



Frequency(GHz)	2.40	2.50	5.15	5.35
VSWR	1.05	1.31	1.42	1.26

Fig. 4-1 VSWR and Return Loss properties in PC casing (Main antenna).



Frequency(GHz)	2.40	2.50	5.15	5.35
VSWR	1.30	1.12	1.61	1.18

Fig. 4-2 VSWR and Return Loss properties in PC casing (Aux antenna).

End of Document