

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	1/23

<b>APPROVAL SPECIFICATION</b>	Prepared Bv	Reviewed Bv	Checked Bv	Approved Bv

<b>TITLE</b>	Dual Band Retractable Antenna	<b>Model</b>	TX-60B	<b>CUSTOMER</b>	PANTECH & CURITEL
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**DOCUMENT**

NO.	CONTENTS	SHEETS
1	APPROVAL SPECIFICATION	1
2	ANTENNA SPECIFICATION	1
3	Reliability(Mechanical) Test Report	1

We want to approval the suited product.

Approved date : JAN. 23. 2003..

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	2/23

# ANTENNA SPECIFICATION

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	3/23

## - CONTENTS -

1. Revision LIST
2. Technical Items.
  - 2.1 Electrical Spec.
  - 2.2 Mechanical Spec.
  - 2.3 Packing Spec.
3. Test Equipment.
4. Electrical Demands.
  - 4.1 V.S.W.R.
  - 4.2 Radiation Pattern.
  - 4.3 Gain.
5. Mechanical Demands.
  - 5.1 Helix Deformation Test.
  - 5.2 Torque Test.
  - 5.3 Pulling Force Test.
  - 5.4 Bending Endurance.
  - 5.5 Drop Test.
  - 5.6 Retractions and Extension Force Test.
  - 5.7 Retractions and Extension Force Consistency.
  - 5.8 Helix Tensile Load Test
6. Environmental demands.
  - 6.1 Temperature Cycling Test
  - 6.2 Low Temperature Transportation/Storage Test

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	4/23

- 6.3 High Temperature Transportation/Storage Test
- 6.4 Temperature Change in High Humidity
- 7. Antenna Data
  - 7.1 V.S.W.R
  - 7.2 GAIN
- 8. Antenna Drawing
- 9. Packing specification (drawing)
- 10. Notice or handing antenna ( Box or Antenna )

## 1. REVISION LIST

REVISION LIST				
NO	DATE	CHANGE CONTENTS	CHANGE CAUSE	REV
1	2003-01-22			IR
2				
3				
4				
5				
6				
7				
8				
9				

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	5/23

10				
11				
12				
13				
14				

## 2. Technical Items

### 2.1 Electrical Spec.

Electrical Spec.			
Frequency Range (MHz)		AMPS	US PCS
		824~894	1850~1990
V.S.W.R	Retracted	5.0	3.0
	Extended	5.0	4.0
GAIN (in dBi)	Retracted	- 4(0.90)	- 5.5(0.23)
	Extended	- 3(0.43)	- 2.5(0.43)
GAIN (Peak dBi)		<b>1.62</b>	<b>0.57</b>
Impedance (Nominal)		50 ohms	
Polarization		Vertical	
Radiation Pattern		OMNI-DIRECTIONAL	
Maximum Power		2 Watts	

### 2.2 Mechanical Spec.

Mechanical Spec.	
Connector	SCREW TYPE (M5 X P0.5)
Overall length	See drawing

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	6/23

Operating Temperature	-20? ~ +70?
Weight	4.0 g (Unit)

### 2.3 Packing Spec.

Packing Spec.		
PRODUCT	QUALITY	MATERIAL
TRAY	50 EA	P.S
TRAY INNER PAD	2 EA	SW 2 type (B corrugated paper)
CARTON BOX	1,000 EA	DW 4 type (AB corrugated paper)

## 3. Test Equipment

The equipment for antenna test are as follows.

- ◆ Network Analyzer to measure the V.S.W.R and impedance of antenna.
- ◆ Spectrum Analyzer to measure the receiving signal intensity.
- ◆ Standard horn antenna that is adjustable in the AMPS band.
- ◆ Standard horn antenna that is adjustable in the US PCS band.
- ◆ Anechoic Chamber installed the cables, connectors and equipment for measurement.
- ◆ Digital Caliper to measure the dimensions.
- ◆ Torque Driver to measure the torque force of the helix.
- ◆ Push/Pull gauge to measure the pulling forces.
- ◆ Equipment to measure the retraction and extension force consistency.
- ◆ Climatic Chamber for environmental test.

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	7/23

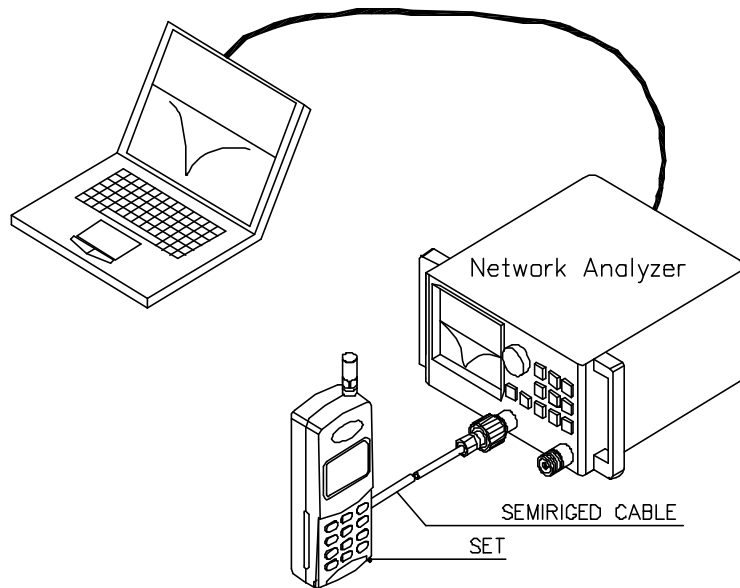
## 4. Electrical Demands

### 4.1 V.S.W.R

### 4.1 V.S.W.R

The V.S.W.R characteristics must satisfy the electrical demands. When the antenna is extended in the AMPS band, the V.S.W.R of must be less than 5.0 : 1 in free space. When the antenna is retracted in the AMPS band, the V.S.W.R of must be less than 5.0:1 in free space. When the antenna is extended in US PCS band the V.S.W.R of must be less than 4.0 : 1 in free space. When the antenna is retracted in US PCS band the V.S.W.R of must be less than 3.0 : 1 in free space.

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	8/23



#### 4.2 Radiation Pattern

The radiation pattern must have the omni-directional characteristic in the extended and retracted state.

#### 4.3 Gain

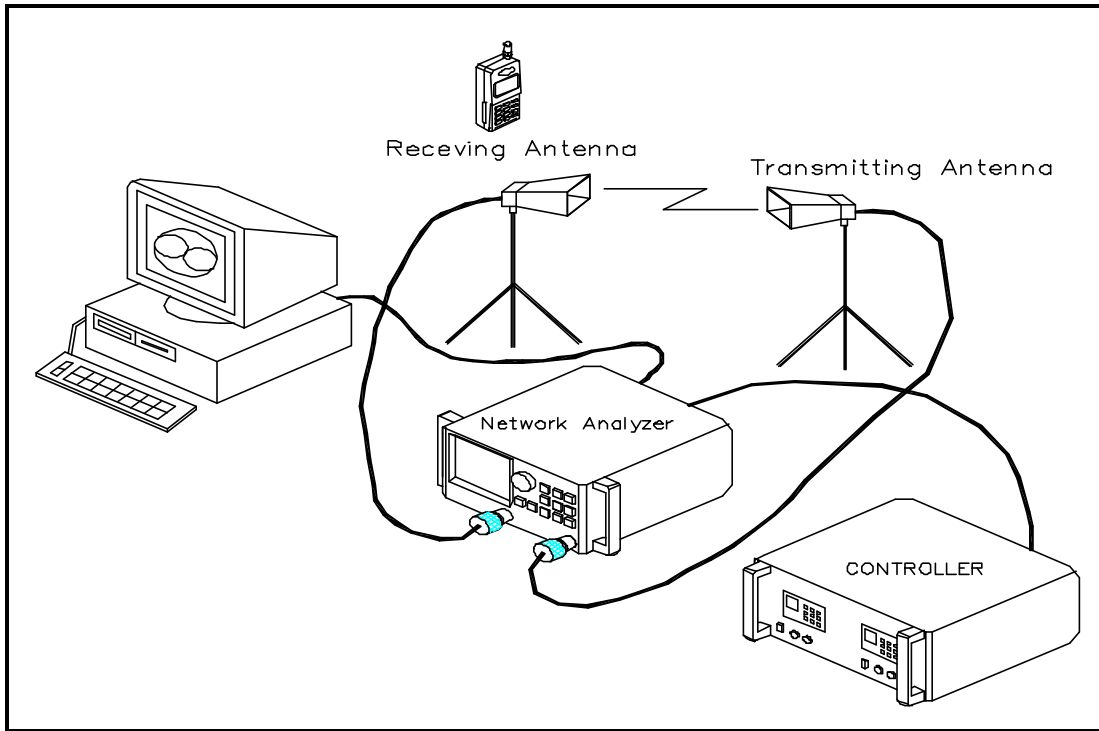
The gain is expressed as dBi that standardizes the standard horn antenna. When the antenna is extended in the AMPS band, The Gain of antenna must be greater than  $-3.0$  dBi. When the antenna is retracted in the AMPS band, the Gain of antenna must be greater than  $-4.0$  dBi. When the antenna is extended in the US PCS band, the Gain of antenna must be greater than  $-2.5$  dBi.

When the antenna is retracted in the US PCS band, the Gain of antenna must be



<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	9/23

greater than  $-5.5\text{dBi}$ .



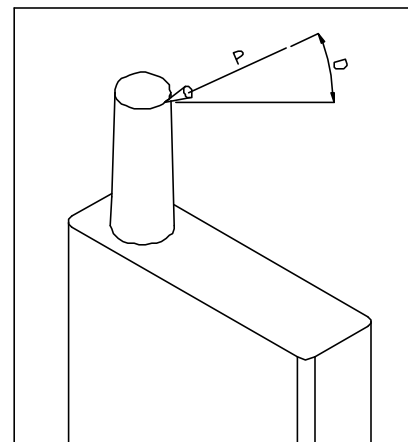
## 5. Mechanical Demands

### 5.1 Helix Deformation Test.

The antenna is assembled to the test equipment. A 4Kgf force is applied up 30 angles from the top of the HELIX. And it's applied with four directions for each 30 angles.

After the test, no visual deterioration shall occur.

Cover and metal shall remain mechanically bonded.



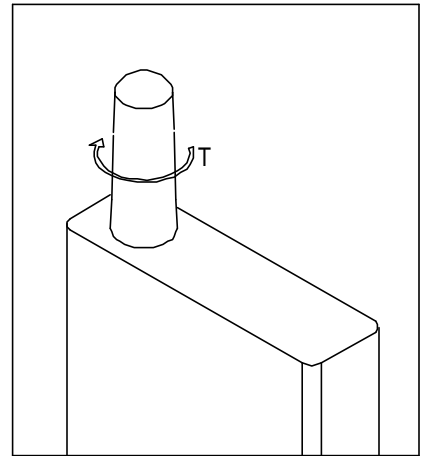
<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	10/23

After the test, the antenna shall satisfy the electrical demands.

### 5.2 Torque Test

The antenna is assembled to the test equipment.

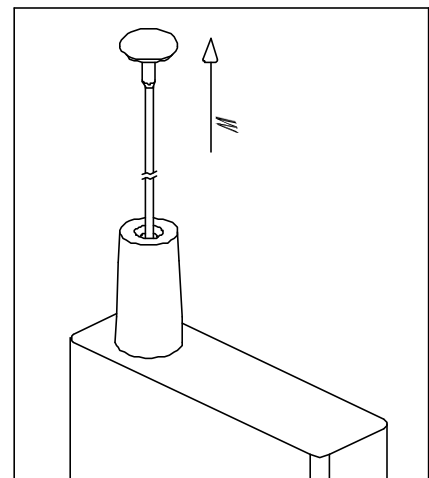
A 3Kgf.Cm force is applied to the antenna in clockwise direction. After the test, no visual deterioration shall occur and the part of the cover and the metal shall remain mechanically bonded. After the test, the antenna shall satisfy the electrical demands.



### 5.3 Pulling Force Test

The antenna is assembled to the test equipment.

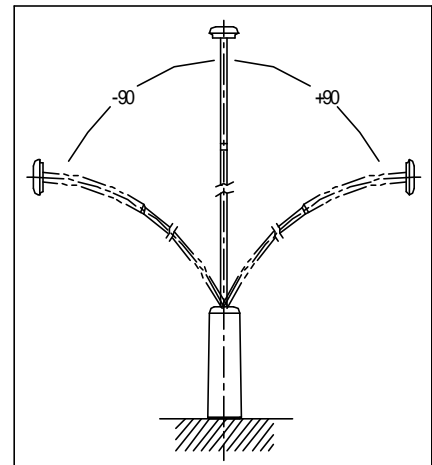
A 4Kgf force is applied to the antenna during 30seconds. After the test, no visual deterioration shall occur and the knob and wire shall remain mechanically bonded. After the test, the antenna shall satisfy the electrical demands.



<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	11/23

#### 5.4 Bending Endurance

The antenna is assembled to the test equipment in vertical extended state. The antenna is bent 90° left and 90° right (1 cycle) with 3s cycle time. This test is repeated 1,000 cycles. No visual deterioration shall occur during the test. The antenna shall satisfy the electrical demands.



#### 5.5 Drop Test

The antenna is assembled to the handset with 100g. The handset is dropped with the antenna downward onto a concrete surface at 150Cm height. The number of drop is 2times for retracted position and one time for extension position. After the test, the original shape shall be possible to restore. The antenna shall satisfy the electrical demands.

#### 5.6 Retraction and Extension Force Test

The antenna shall have the extension force until 100gf to 400gf.

And retraction force until 100gf to 300gf.

This condition sets on the basis of force that the stopper is retracted or extended from the helix.

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	12/23

### 5.7 Retraction and Extension Force Consistency

\* 10,000 cycles

The antenna is assembled to the test equipment. The antenna is fully extended/retracted 10 cycle /min (1 cycle is extension / retraction).

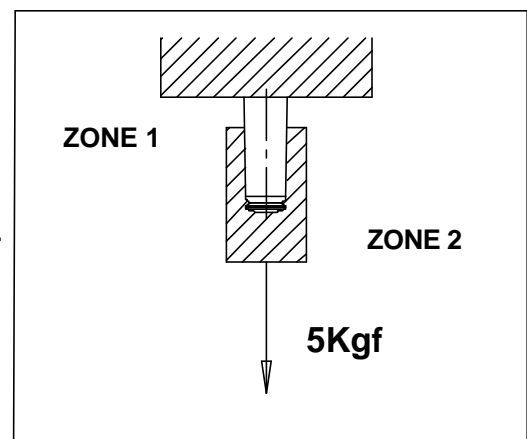
After the test, no visual deterioration shall occur and both retraction and extension force will have 50 to 550gf.

The antenna will satisfy electrical demand after the test also.

### 5.8 Helix Tensile Load Test

Antenna is assembled to test equipment according to following figure.

The specified force 5Kgf is applied during 30 seconds to the helix parallel to the antenna axis. Both electrical and mechanical performance will not be damaged after the test.



## 6.Environmental Demands

### 6.1 Temperature Cycling Test

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	13/23

The object of temperature shock test is to evaluate the reliability of antenna component at fast temperature change.

- Initial measurements : The antenna shall be visually inspected and electrically and mechanically checked as required by TX-60B products standard.
- Test: Temperature cycle is as follows. 60 minutes at -20? , 60 minutes at +85? .  
This procedure is repeated 10 times. Ending at +20? and 50% RH

Post-processing : After testing, The antenna shall be remained in standard condition until the antenna has reached temperature stability state.

Final measurements: The antenna shall be visually inspected and electrically and mechanically checked as required by TX-60B products standard

## 6.2 Low Temperature Transportation/Storage Test

The object of low temperature transportation/storage test is to conform

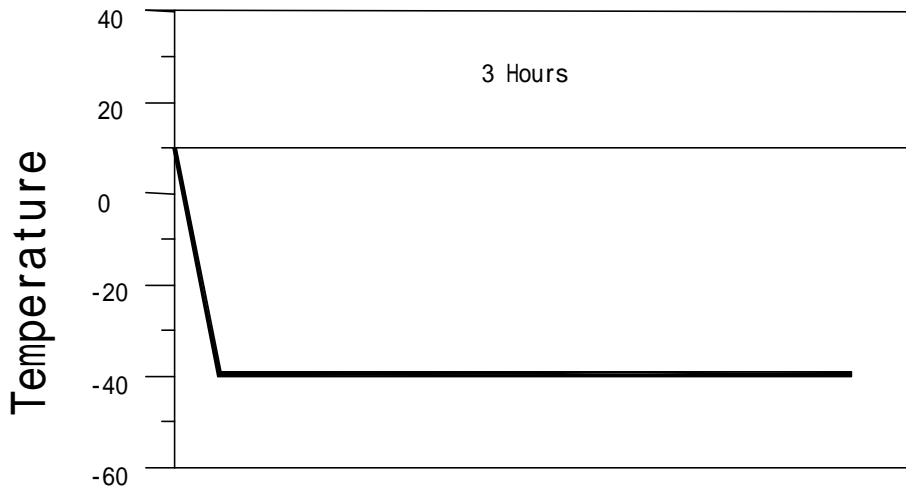
<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	14/23

the endurance of antenna component at low temperature in storage or transportation.

- Initial measurements : The antenna shall be visually inspected and electrically and mechanically checked as required by TX-60B products standard.
- Test: Temperature cycle is as follows. Start at normal conditions, reach to -40? .(velocity:1? /min) Duration : 3hours.
- post-processing : After testing, The antenna shall be remained in standard conditions until the antenna has reached temperature stability state.
- Final measurements : The antenna shall be visually inspected and also electrically and mechanically checked as required by TX-60B product standard.

## Low Temperature Test

Duration : 3 Hours, Temperature : -40(C)



### 6.3 High Temperature Transportation/Storage Test

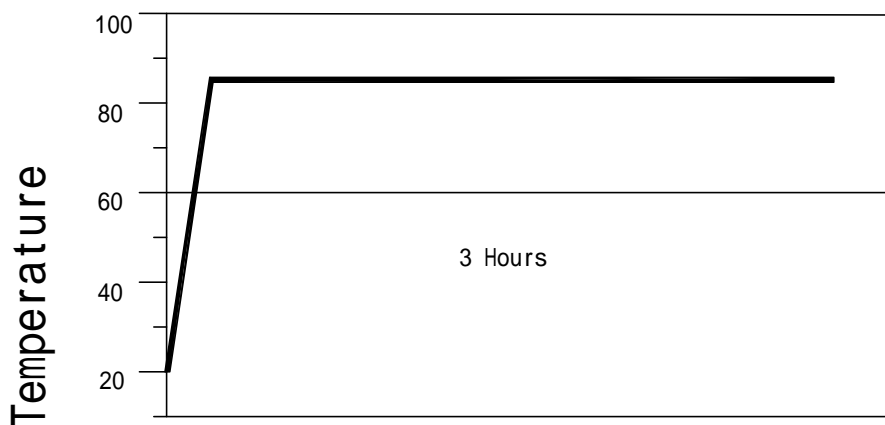
<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	15/23

The object of Low Temperature Transportation/Storage Test is to conform the endurance of antenna component at low temperature in storage or transportation.

- Initial measurements : The antenna shall be visually inspected and electrically and mechanically checked as required by TX-60B products standard.
- Test: Temperature cycle is as follows. Start at normal conditions, reach to +85? velocity.(1? /min) Duration: 3hours.
- post-processing : After testing, The antenna shall be remained in standard conditions until the antenna reach stability.
- Final measurements : The antenna shall be visually inspected and also electrically and mechanically checked as required by TX60B product standard.

## High Temperature Test

Duration : 3 Hours, Temperature : +85(C)

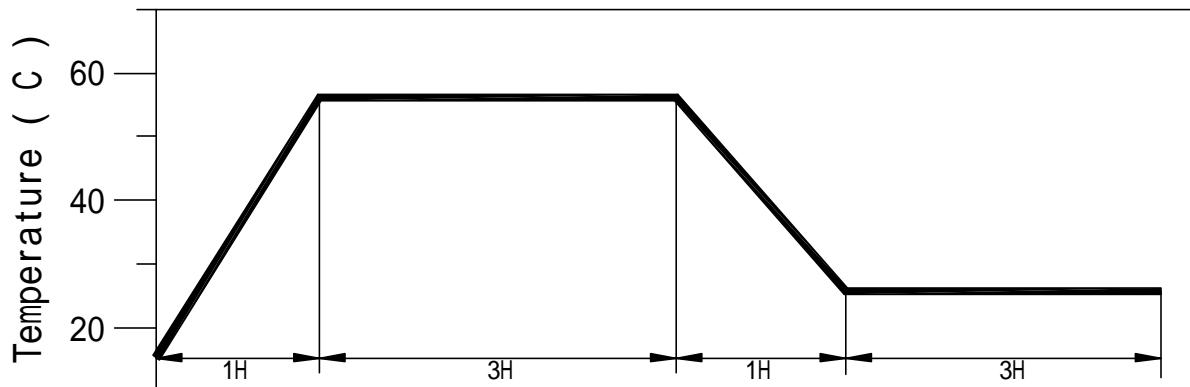


### 6.4 Temperature Change in High Humidity

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	16/23

- Initial measurements : The antenna shall be visually inspected and electrically and mechanically checked as required by TX60B products standard.
- Test: Temperature cycle is as follows. Start at +25° , reach +55° within 1hours. 3hours at +55° , decrease +25° within 1hours and 3hours at +25° . Relative humidity is 95%.
- Post-processing : After testing, The antenna shall remain in standard conditions until taking stable conditions.
- Final measurements : The antenna shall be visually inspected and electrically and also mechanically checked as required by TX-60B products standard.

Temperature Change in High Humidity



## 7. Antenna Data



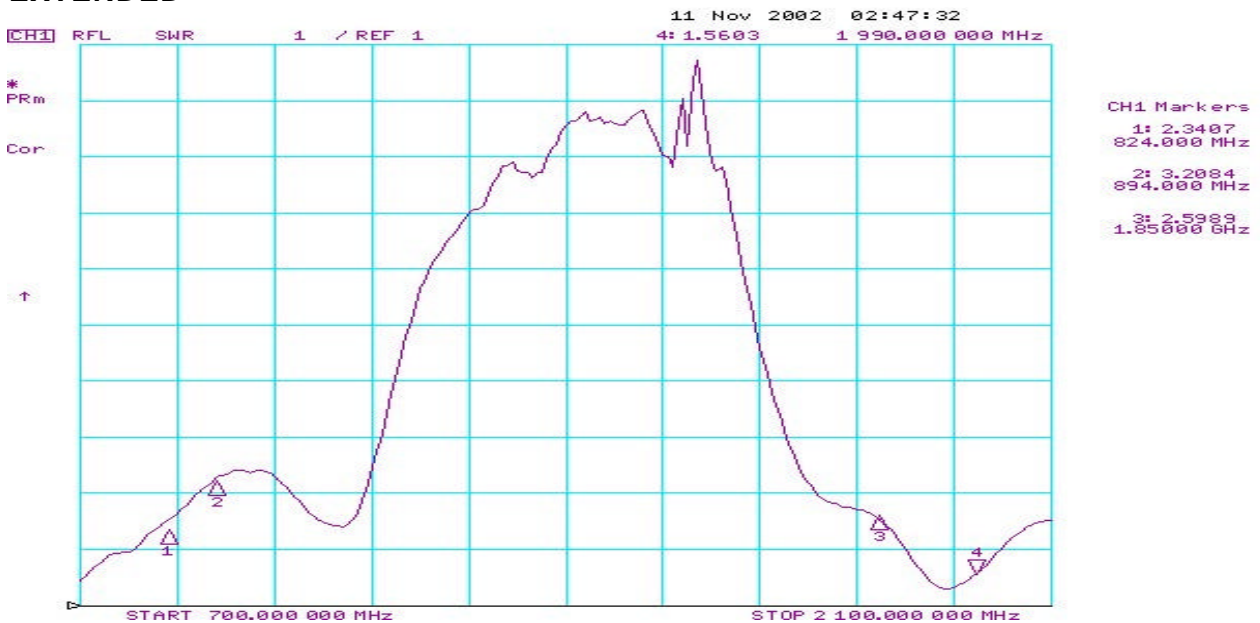
<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	17/23

## 7-1 V.S.W.R

### RETRACTED



### EXTENDED

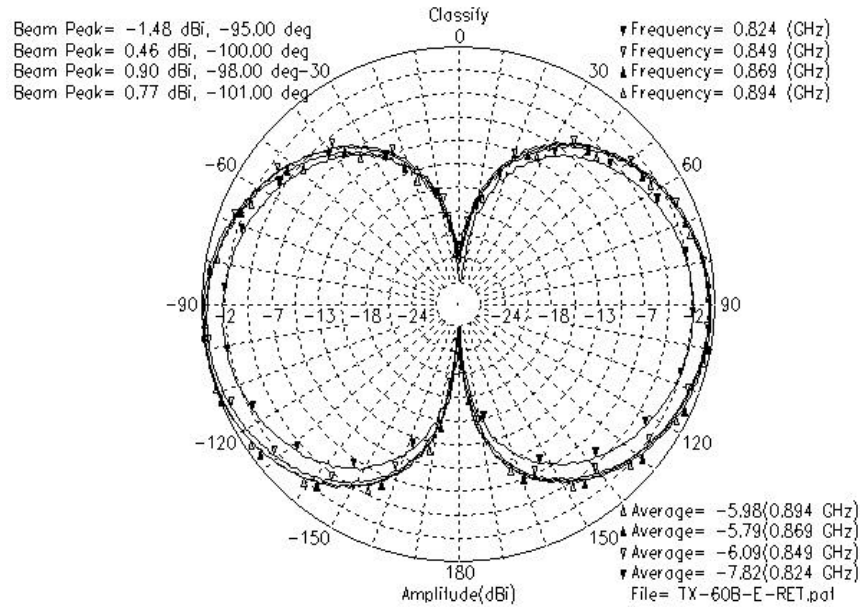


## 7-2 GAIN Data

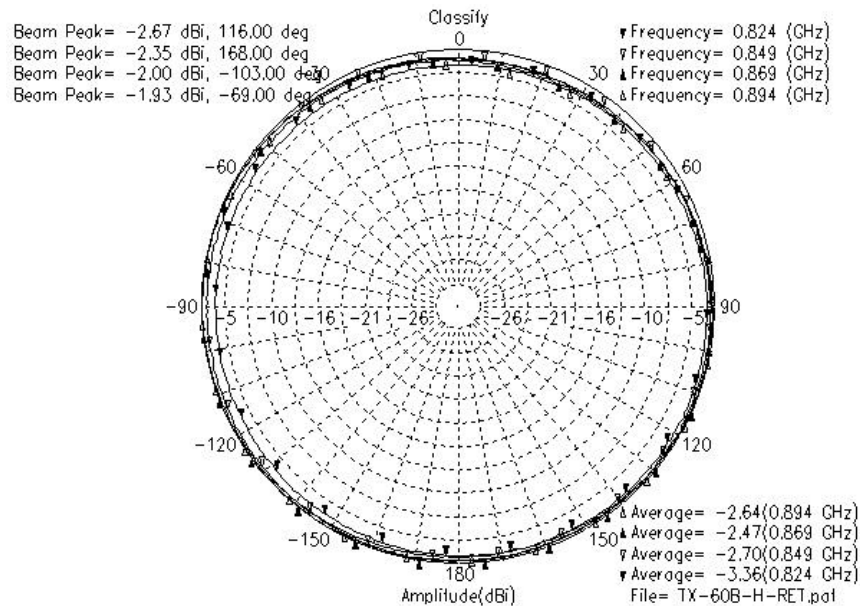
<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	18/23

## AMPS(RETRACTED)

### E-PLANE



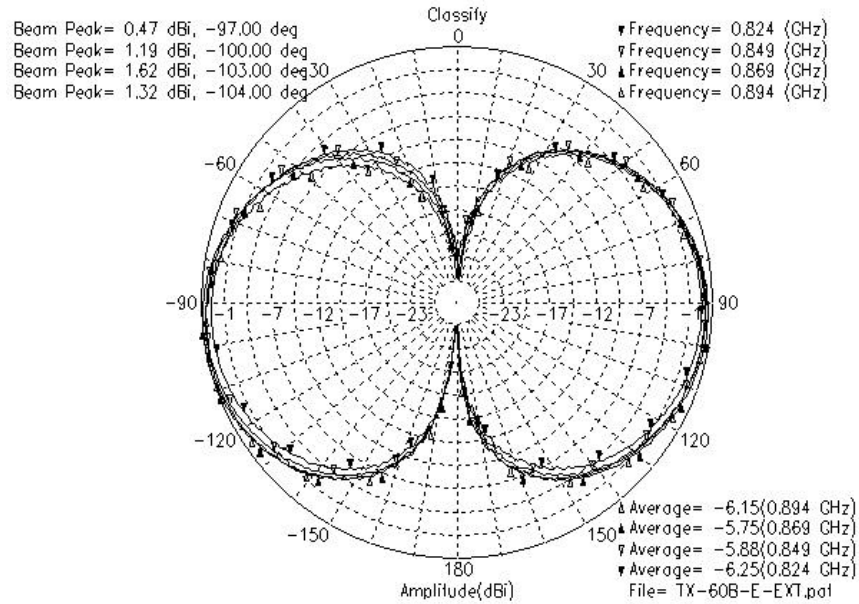
### H-PLANE



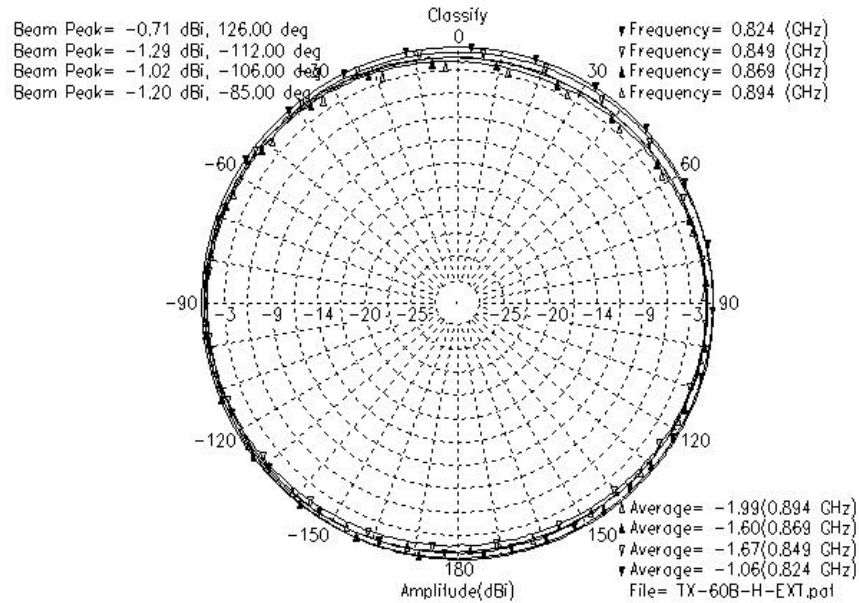
<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	19/23

### AMPS(EXTENDED)

#### E-PLANE



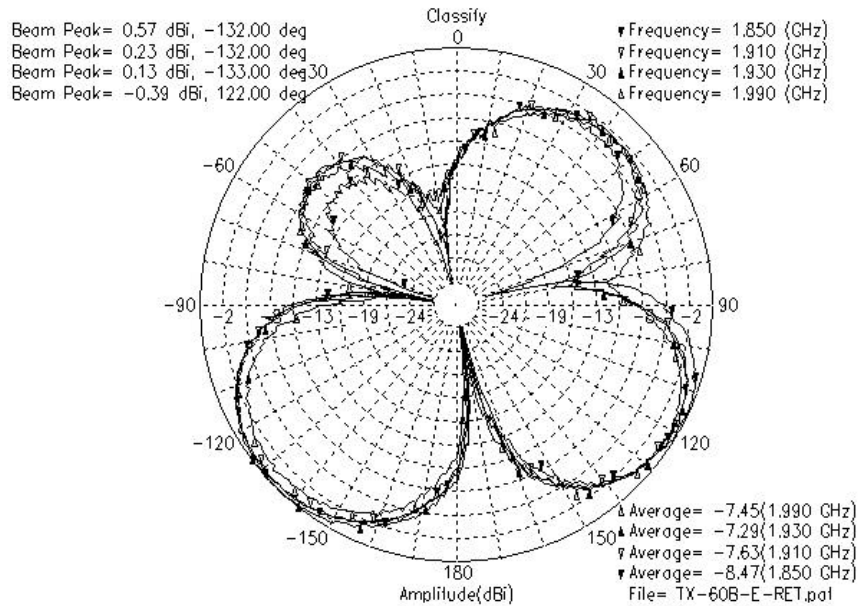
#### H-PLANE



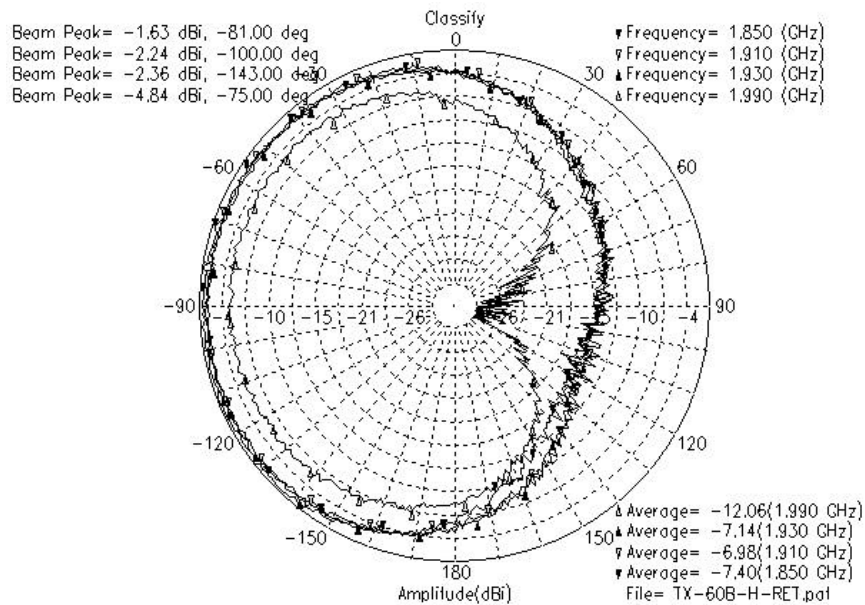
<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	20/23

### US PCS(RETRACTED)

#### E-PLANE



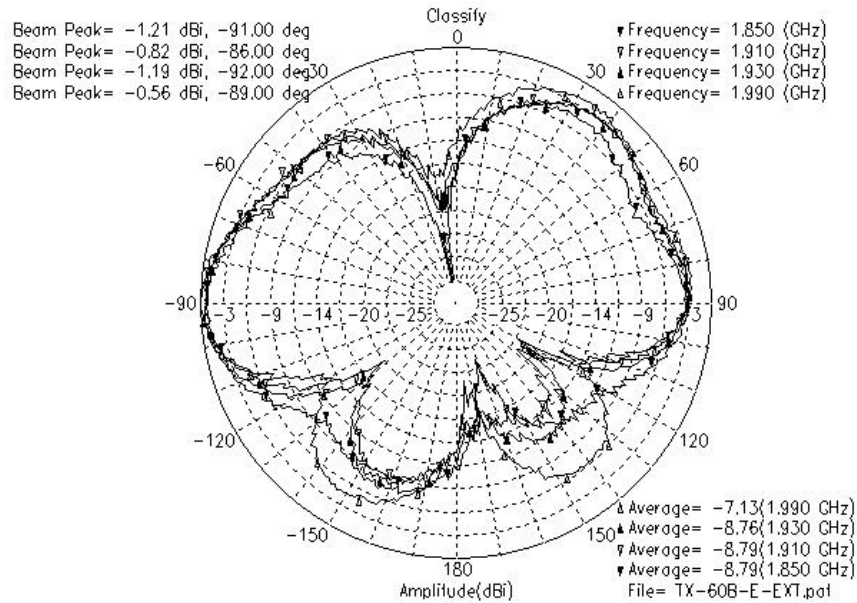
#### H-PLANE



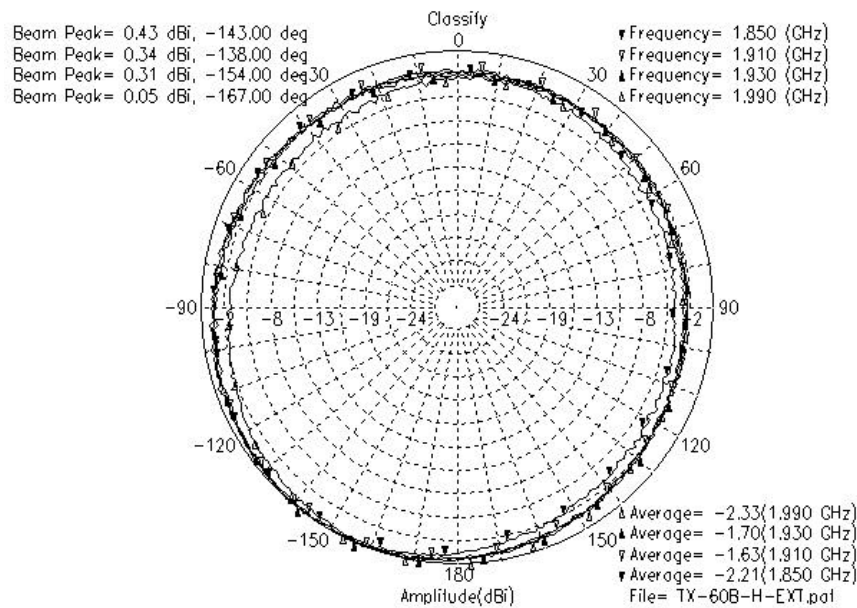
<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	21/23

### US PCS(EXTENDED)

#### E-PLANE

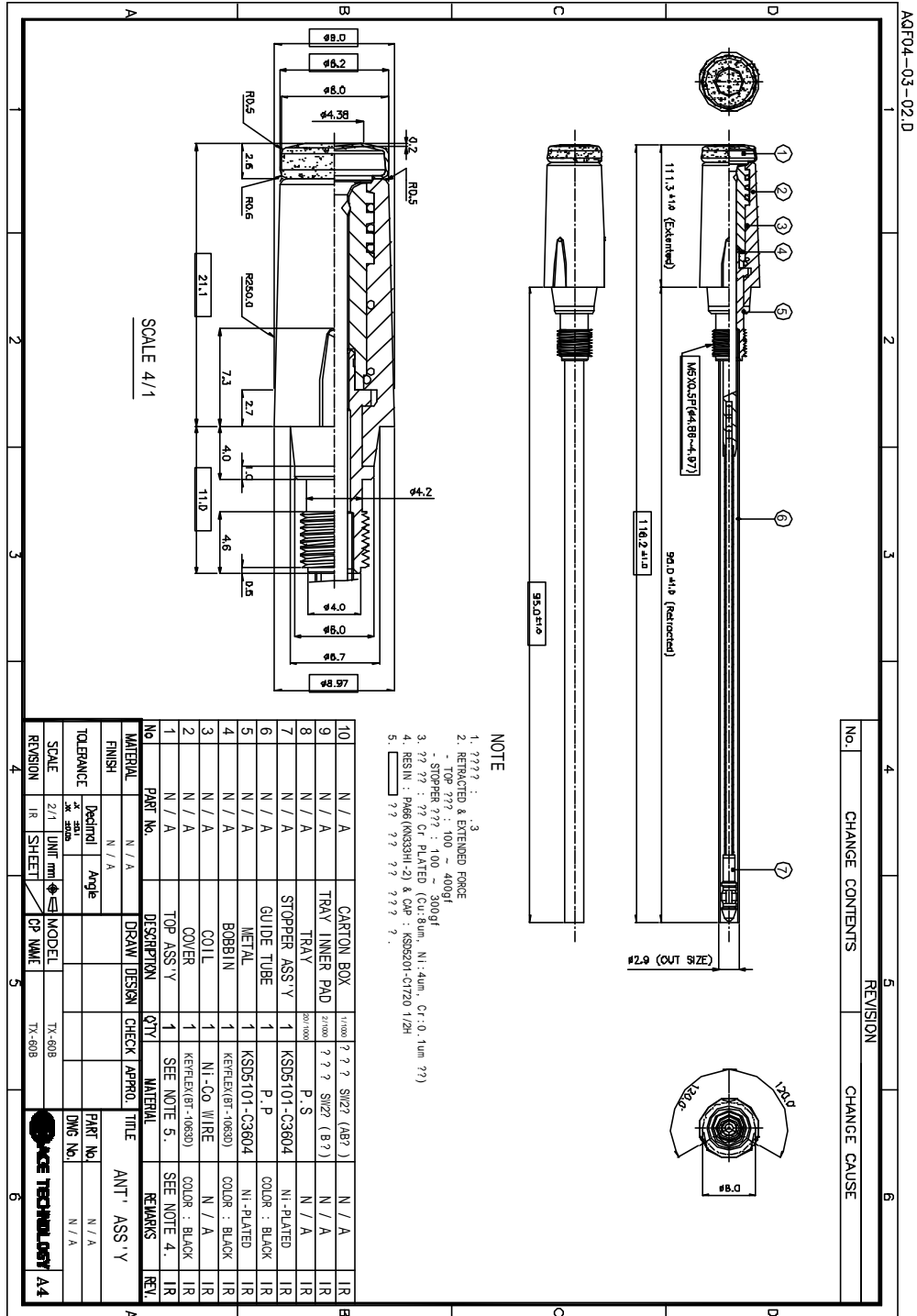


#### H-PLANE



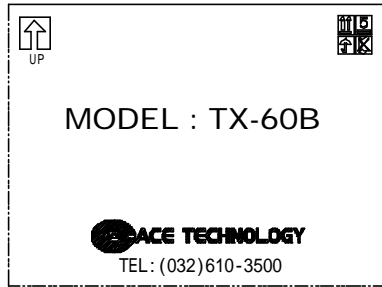
<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	22/23

## 8. Antenna drawing

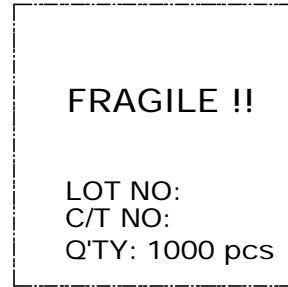


<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	23/23

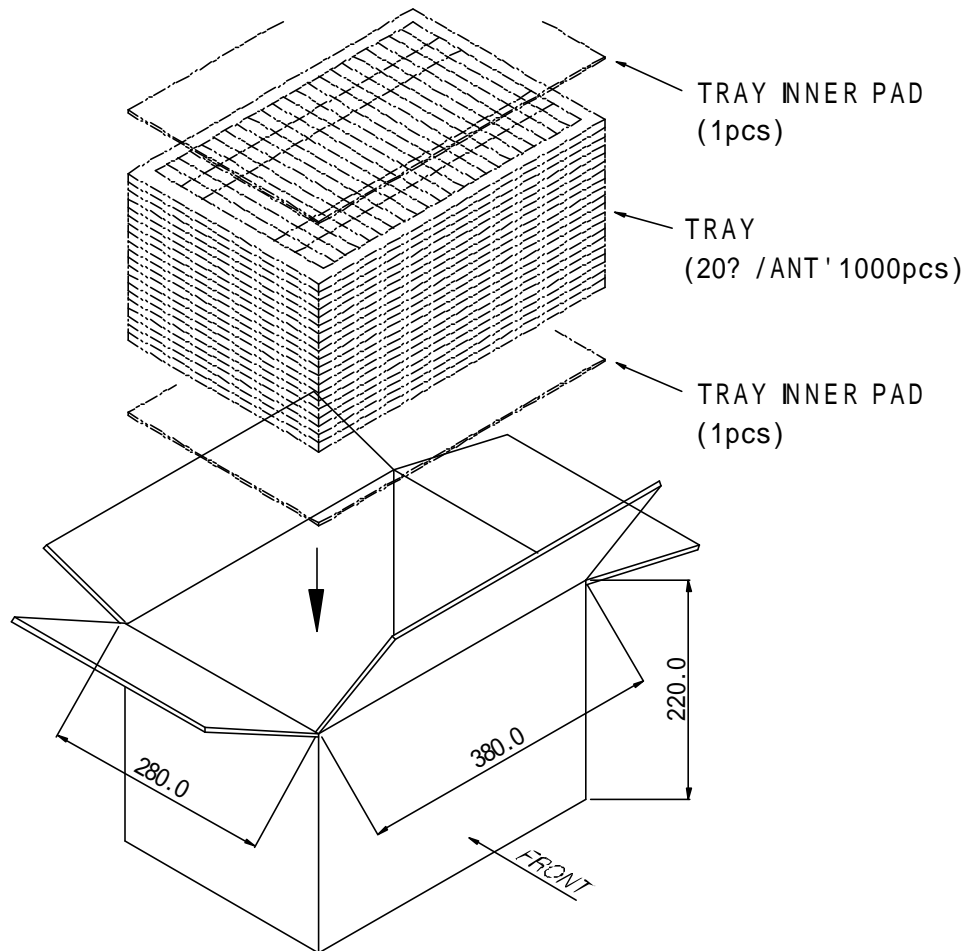
## 9. Packing specification(drawing)



EXPRESSION OR BOTH FRONTS



EXPRESSION OR BOTH SIDES

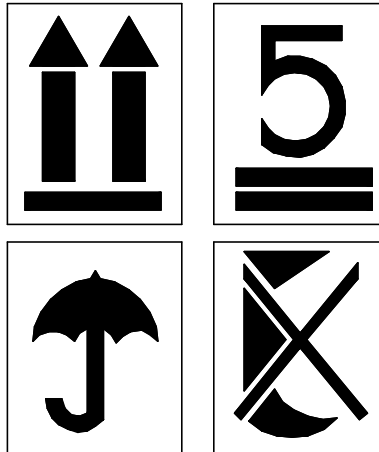


CARTON BOX PACKING

<b>ANTENNA SPECIFICATION</b>		DATE	2003-01-23	REV.	IR
MODEL	TX-60B	TYPE	RETRACTABLE	PAGE	24/23

## 10. Notice of Handing Antenna ( Carton Box or Antenna )

1. Box Packing : Less 5 Stories.
2. Storage ( Carton Box or Antenna ) : Normal Temperature / Normal Humidity  
( 20~30? / RH 45~65% )
3. Keep dry ( Carton Box or Antenna )
4. Fragile ( Carton Box or Antenna )



Expression of Carton Box