

TELSON ELECTRONICS CO., LTD.

No.

Date : 2001 / 07 / 14

PRODUCT SPECIFICATION

Product : RETRACTABLE HELICAL ANTENNA

Part No. : BAA-00-T6100

Customer's Part No. :

APPROVAL

E.M.W. Antenna Co., Ltd. proposed this document to Telson Electronics Co., Ltd.

E.M.W.ANTENNA CO.,LTD.

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1. THE PRODUCT

1.1 FEATURES

A retractable bottom helical antenna system, consisting of a helical element fixed in the fitting and a retractable whip through the helical element, for use in a hand portable cellular telephone unit (referred to as a handset).

1.2 PRODUCT NUMBER

E.M.W.Antenna Part Number BAA-00-T6100

1.3 UNITS AND DEFINITIONS

Unless otherwise stated, SI units are used.

Tx	Transmit Band
Rx	Receive Band
PCB	Printed Circuit Board
VSWR	Voltage Standing Wave Ratio
Room Temperature	$+20 \pm 3^{\circ}\text{C}$
dBd	dB relative to a dipole
CW	Continuous Wave
g	acceleration of gravity $\cong 9.81 \text{ m/s}^2$

2. ELECTRICAL DATA

2.1 FREQUENCY BANDS

2.1.1 Transmit Band (Tx)

824-849 MHz

2.1.2 Receive Band (Rx)

869-894 MHz

2.2 IMPEDANCE

2.2.1 Normal Value

50Ω

2.2.1 Method

E.M.W.Antenna will supply engineering assistance to get the best possible matching of the antenna system folder opened in extended and retracted, other way folder closed in extended and retracted modes.

The impedance over the frequency bands shall be as close as possible to 50Ω after matching. Both free space and talk position are considered.

2.3 VSWR

The impedance matching should be optimized in the more critical talk position, with restrictions below.

2.3.1 Free space

Typical Maximum Values

Mode		Tx	Rx
Closed Folder	Retracted	2:1	2:1
	Extended	2:1	2:1
Opened Folder	Retracted	2:1	2:1
	Extended	2:1	2:1

2.3.2 Measuring Method

A 50 Ω coaxial cable is connected (soldered) to the 50 Ω point, at the duplex-filter connection(ANT.), on the PCB. The connection of the coaxial cable shall be done to introduce a minimum of mismatch. As much as possible the coaxial cable arrangement shall prevent influences from induced currents on the cable. In the other end, the coaxial cable is connected to a network analyzer. The measurements are performed at room temperature. The handset, including the PCB, must not in any significant way differ from the mass produced handset, i.e. the antenna feeding network has to be equivalent to the network in mass production. The specification shall be met in the entire frequency band Free space means that the handset is placed on a non-conductive surface of cellular plastic. Talk position means that the handset is held in the left hand to the left ear with the microphone directed towards the mouth.

2.3.3 Reference (REF) Antenna

From early production, ten antennas are selected: five defining the lower frequency limit, marked "Approved VSWR low", and five defining the higher frequency limit, marked "Approved VSWR high", See figure 2.4.3.

These ten antennas are our REF antennas. Only the helical elements are considered when finding the REF antennas.

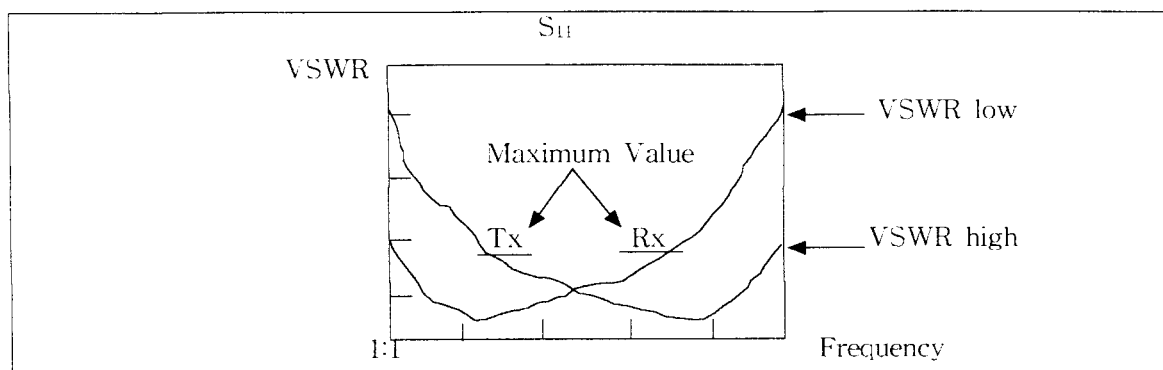


Figure 2.3.3. Two REF Antenna defining the low and high VSWR limits.

2.4 GAIN

2.4.1 Typical Minimum Values in Maximum Direction

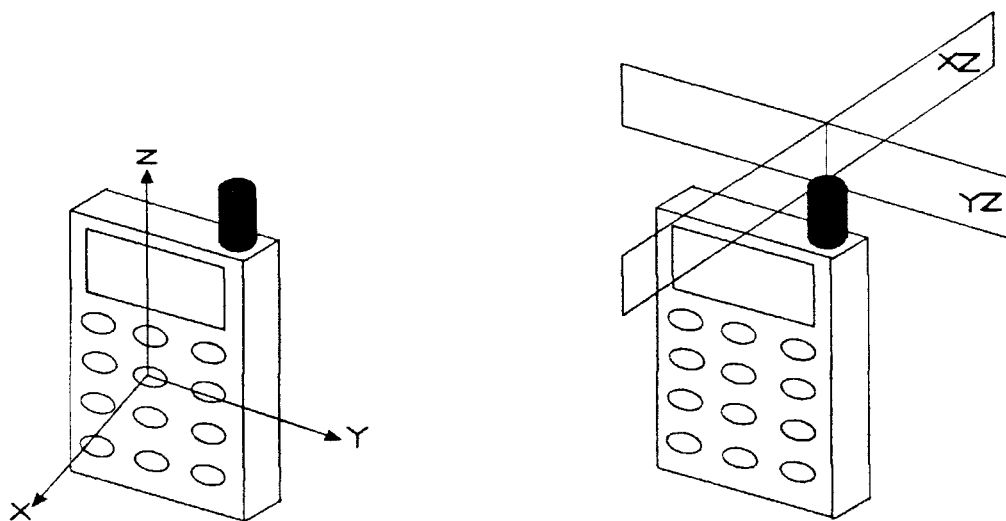
Mode		Tx	Rx
Closed Folder	Retracted	0dBd	0dBd
	Extended	1dBd	1dBd
Opened Folder	Retracted	-1dBd	-1dBd
	Extended	0dBd	0dBd

2.4.2 Measuring Method

The connection is done according 2.4.2. Radiation patterns are measured at 6 different frequencies : $T_{x_{min}}$, $T_{x_{mid}}$, $T_{x_{max}}$: $R_{x_{min}}$, $R_{x_{mid}}$, and $R_{x_{max}}$.

The antenna is measure in 2 orthogonal E-planes(XZ Plane, YZ Plane) in free space, according to figure 2.5.2 (b).

The antenna is also measured in the H-plane as well as in talk position.



(a)Coordinate system for the cellular phone

(b)E-Plane

Figure 2.4.2 Gain Test into phone

2.5 POWER RATING

2.5.1 Maximum Value

$$P = 2W(CW)$$

2.5.2 Demands

No visual deterioration shall occur during the test. The antenna shall satisfy the electrical demands, according to 2.4.1, after the test.

2.5.3 Measuring Method

The connection is according to 2.4.2. The specified power, P, is applied for 10 minutes at room temperature.

3. MECHANICAL DATA

3.1 APPEARANCE

The appearance shall be according to the specification drawing on page 15.
The antenna shall have no marks, cuts, abrasion or other mechanical damages.

3.2 HELIX DEFORMATION

3.2.1 Angle

$$\alpha = 70^\circ$$

3.2.2 Bending Force

$$F_b = 30N$$

3.2.3 Demands

No visual deterioration shall occur, and the fitting and plastic shall remain mechanically bonded, during the test. The antenna shall satisfy the electrical demands, according to 2.4.1, after the test.

3.2.4 Measuring Method

The antenna is assembled to the test equipment according to figure 3.2.4.
A force is applied perpendicular to the antenna 10 mm below the top of the helix. The antenna is bent until the specified angle, α or the specified force, F_b is reached.

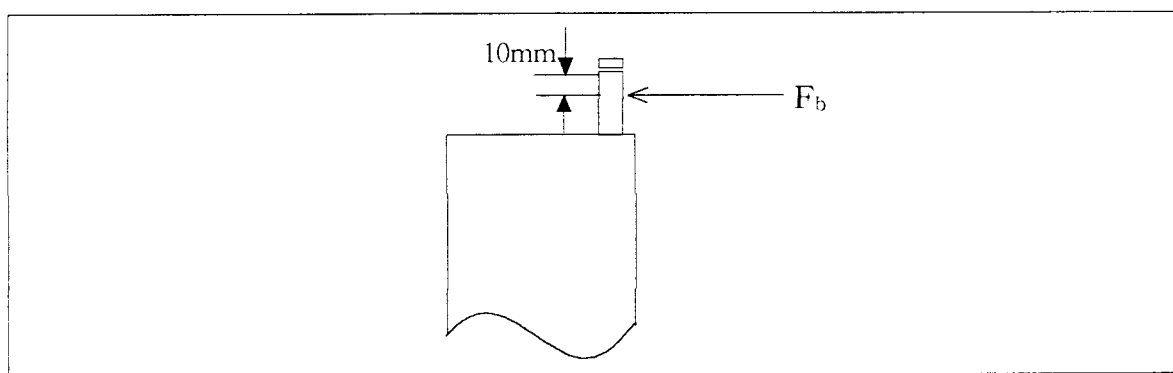


Figure 3.2.4. Helix Deformation

3.3 TORQUE

3.3.1 Minimum Value

$$T = 10N \cdot cm$$

3.3.2 Demands

No visual deterioration shall occur, and the fitting and plastic shall remain mechanically bonded, during the test. The antenna shall satisfy the electrical demands, according to 2.4.1, after the test.

3.3.3 Measuring Method

The antenna is assembled to the test equipment. A torque instrument is attached to the helical antenna. The antenna is exposed to the specified torque, T , between fitting and plastic in clockwise direction according to figure 3.3.3.

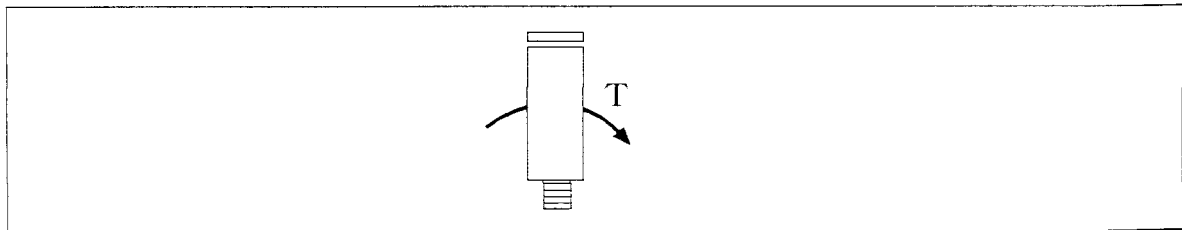


Figure 3.3.3. Torque

3.4 WHIP DEFORMATION

3.4.1 Bending Diameter

$$D = 50.8\text{mm}$$

3.4.2 Demands

Zone 1 : No remaining deformation.

Zone 2 : No fracture. The original shape shall be possible to restore.

The antenna shall satisfy the electrical demands, according to 2.4.1, after the test.

3.4.3 Measuring Method

The antenna is assembled to the test equipment according to figure 3.4.3 (a) A test fixture is attached to the top of the antenna in extended mode. The antenna is bent 180° around a cylinder with diameter D . The antenna is released and sprung back to vertical position. Zone 1 and 2, according to figure 3.4.3 (b) are examined.

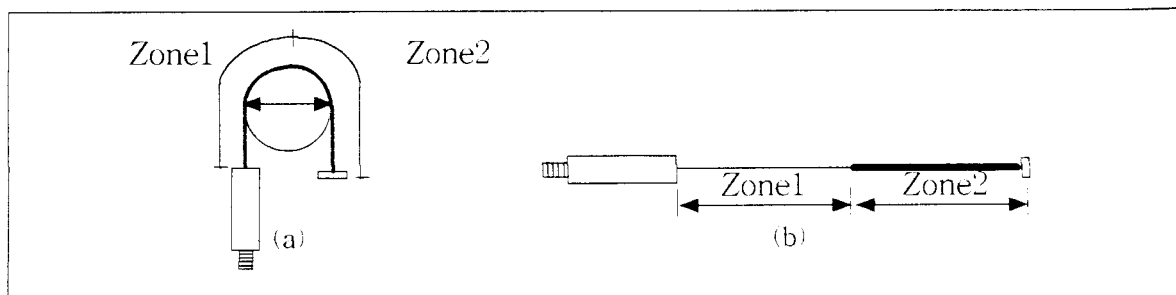


Figure 3.4.3. Whip deformation (a)Bent antenna (b)Close up of the two zones

3.5 PULLING FORCE

3.5.1 Pulling Force

$F_b = 30 \text{ N}$ (static)

3.5.2 Demands

No visual deterioration shall occur, and the knob and wire shall remain mechanically bonded, during the test. The antenna shall satisfy the electrical demands, according to 2.4.1, after the test.

3.5.3 Measuring Method

The antenna is assembled in the equipment according to figure 3.5.3. The specified load, F_p , is applied during 30s to the top of the antenna.

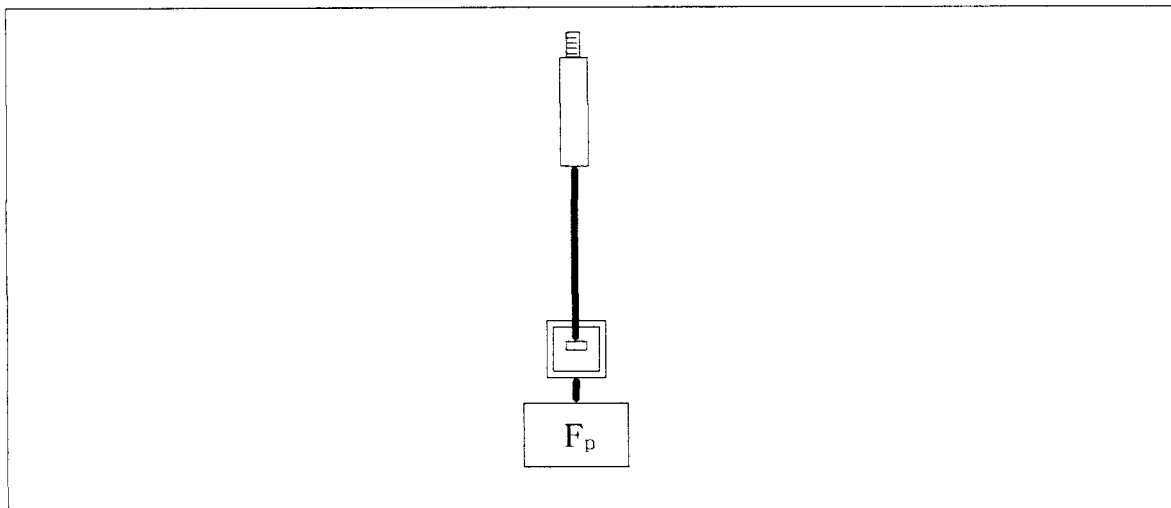


Figure 3.5.3. Pulling force

3.6 DROP

3.6.1 Drops

1 drop in extended mode and 1 drop in retracted mode.

3.6.2 Drop Height

1.5 m

3.6.3 Drop Angle

180°

3.6.4 Handset Weight

200 gram

3.6.5 Demands

The original shape shall be possible to restore. The antenna shall satisfy the electrical demands, according to 2.4.1, after the test.

3.6.6 Measuring Method

The antenna is attached to the handset or an equivalent test fixture.

The handset is dropped with the antenna downwards onto a metal plates of $1 \times 1 \times 0.05\text{m}^3$.

3.7 Bending Endurance

3.7.1 Bending Cycles

720 cycles, according to figure 3.7.3

3.7.2 Demands

No visual deterioration shall occur during the test. The antenna shall satisfy the electrical demands, according to 2.4.1, after the test.

3.7.3 Measuring Method

The antenna is assembled to the test equipment in vertical extended mode according to 3.7.3, The antenna is bend 90° left and 90° right(1cycle). This is repeated for the duration of the test.

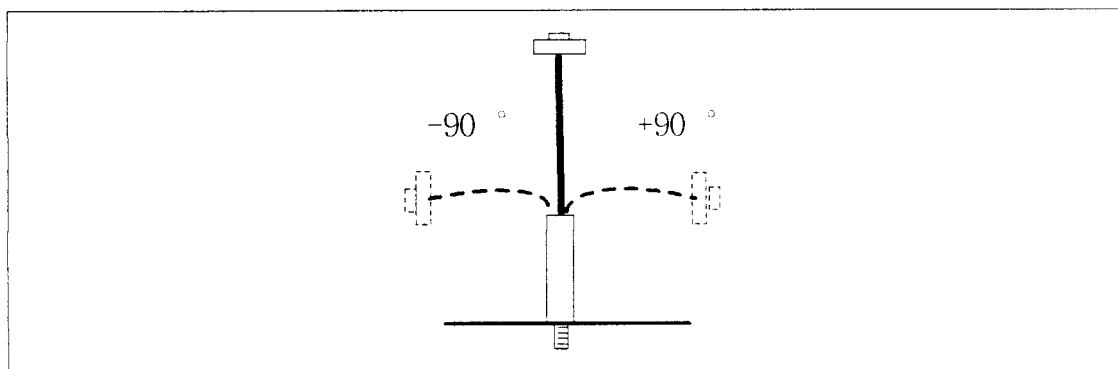


Figure 3.7.3. Bending endurance.

3.8 RETRACTION FROM EXTENDED MODE

3.8.1 Retraction Force

0.5~7.0N

3.8.2 Demands

The mean value from 5 measurements, on each antenna, shall be within the specified limits.

3.8.3 Measuring Method

The antenna is pushed down extended mode with a speed of 2.5mm/s. The maximum force before the antenna is released from extended mode is registered.

3.9 RETRACTION FORCE CONSISTENCY

3.9.1 Retraction Cycles

12,000 cycles

3.9.2 Demands

No visual deterioration shall occur, and the retraction force must not differ from the specified values, according to 3.8.1, during the extension/retraction cycles. The antenna shall satisfy the electrical demands, according to 2.4.1, after the test.

3.9.3 Measuring Method

The antenna is fully extended/retracted(1cycle)with random rotation.
The retraction force is measured every 5,000 cycles.

4. ENVIRONMENT

4.1 OPERATIONAL TEMPERATURE

4.1.1. Low Operational Temperature

$$T_{LO} = -20^{\circ}\text{C}$$

4.1.2 High Operational Temperature

$$T_{HO} = +70^{\circ}\text{C}$$

4.1.3 Demands

No visual deterioration shall occur, and the antenna shall satisfy the electrical demands, according to 2.4.1, during the test.

4.1.4 Measuring Method

The antenna is placed in a climatic chamber at temperature T_{LO} .

The antenna is taken out after 1 hour, and VSWR is immediately measured.

The antenna is placed in a climatic chamber at temperature T_{HO} .

The antenna is taken out after 1 hour, and VSWR is immediately measured.

4.2 TEMPERATURE CYCLING

4.2.1 Low Cycling Temperature

$$T_{LC} = -40^{\circ}\text{C}$$

4.2.2 High Cycling Temperature

$$T_{HC} = +80^{\circ}\text{C}$$

4.2.3 Demands

No visual deterioration shall occur during the test. The antenna shall satisfy the electrical demands, according to 2.4.1, and the mechanical demands, according to 3.2, 3.3, 3.4, 3.5 & 3.6, after the test.

4.2.4 Measuring Method

The antenna is placed in a climatic chamber. The temperature is cycled as follows : The temperature is kept constantly at T_{LC} for 1 hour, increased to T_{HC} during 1 hour, kept constantly at T_{HC} for 1 hour, and then decreased to T_{LC} during 1 hour. This procedure is repeated 10 times, ending at room temperature according to figure 4.2.4.

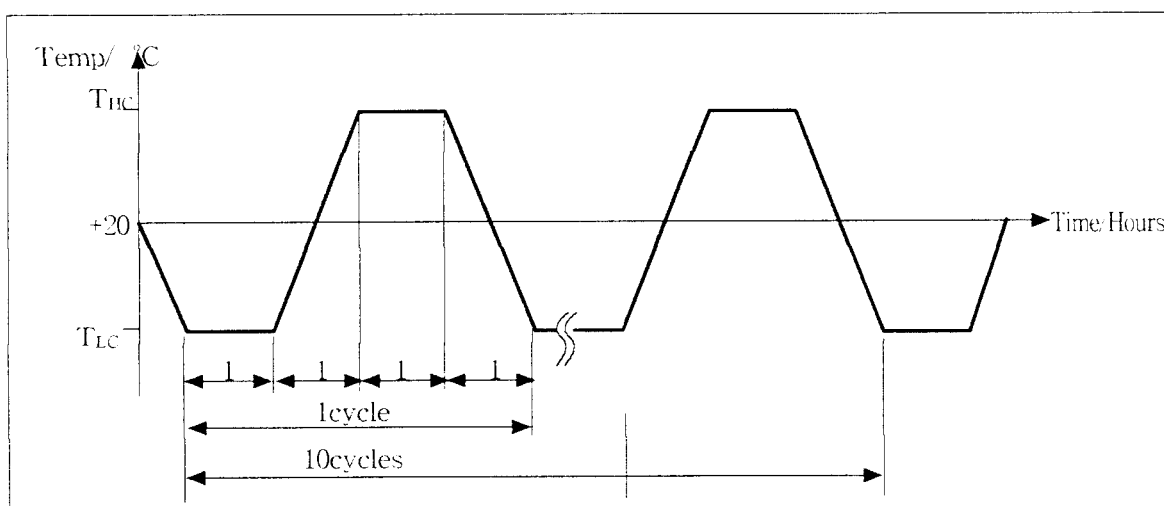


Figure 4.2.4. Temperature cycling.

4.3 HUMIDITY

4.3.1 Relative Humidity

95%

4.3.2 Temperature

+55°C

4.3.3 Demands

No visual deterioration shall occur during the test. The antenna shall satisfy the electrical demands, according to 2.4.1, after the test.

4.3.4 Measuring Method

The antenna is placed in a climatic chamber for 24 hours. The antenna is taken out from the chamber and measured after another 24 hours in room temperature.

4.4 SINUSOIDAL VIBRATION

4.4.1 Vibration Frequencies

8-25-8 Hz(1cycle)

4.4.2 Sweep Rate

1 octave/min (logarithmic)

4.4.3 Maximum Amplitude

$A = 1.5\text{mm}$

4.4.4 Maxim Acceleration

$2g$

4.4.5 Crossover Frequency

18.2 Hz

4.4.7 Measuring Method

The extended antenna is assembled in the test equipment. The vibration is done both in x-and z-directions, according to figure 4.4.7 a), with a duration of 1 hour in each direction.

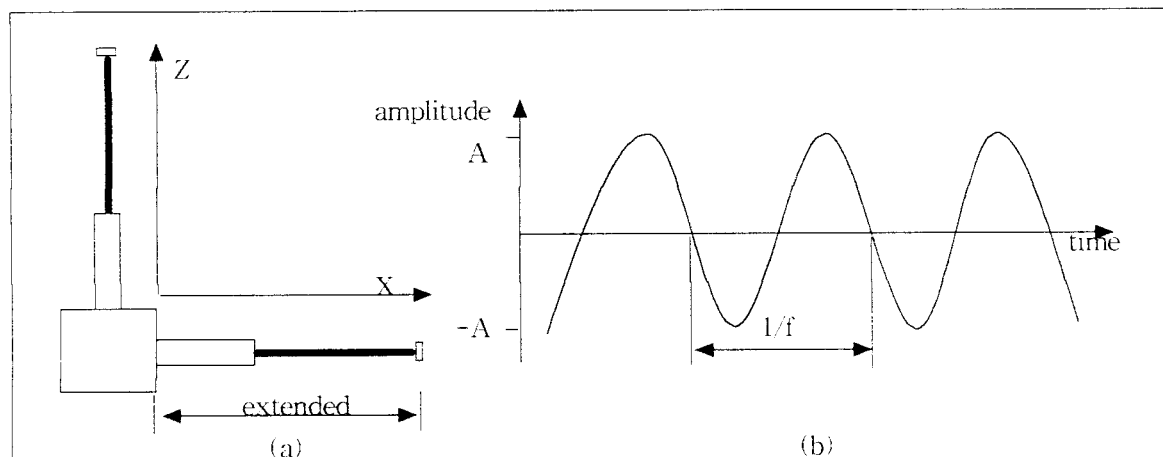


Figure 4.4.7. Sinusoidal vibrator. (a) Vibration directions. (b) Vibration form.

5. QUALITY

5.1 TEST SEQUENCE

The antenna are tested by E.M.W.Antenna's Quality Department according to table 5.1. Unless otherwise stated, all tests shall be performed at room temperature. These tests are repeated prior to approval of major changes in design or materials.

Date	Class	Q.C. Manager	Test Paragraph		Specification	
2001. 1. 8		jin-su Kim	VSWR	Closed	Retracted	2.0
				Folder	Extended	2.0
				Opened	Retracted	2.0
				Folder	Extended	2.0
			MIM.	Closed	Retracted	0dBd
				Folder	Extended	1dBd
			Gain	Opened	Retracted	-1dBd
				Folder	Extended	0dBd
MAX. Power					1W~3W	

(a)

Test Paragraph	VSWR				MIM. Gain(dBd)				MAX.
	Closed Folder		Opened Folder		Closed Folder		Opened Folder		Power
	Retracted	Extended	Retracted	Extended	Retracted	Extended	Retracted	Extended	(W)
Sample Number									
1	1.898	1.678	2.899	1.755	0	1	-1	0	3.1
2	1.759	1.652	2.539	1.702	0	1	-1	0	3.2

(b)

Table 5.1 (a)Test Specification. (b)Test Paragraph.

5.2 FIRST ARTICLE APPROVAL

From an early mass produced, 20 samples shall be sent to Telson. When approved in all matters, i.e. electrically and mechanically, incl. finish, form "First Article Approval" should be completed, and the specification should be signed. The signed specification and the form, mentioned above, should be sent back to E.M.W.Antenna. This procedure is repeated prior to a major change in design or materials.

Technical drawing of a probe assembly, showing two views: a top view and a side view. The drawing includes dimensions and callouts for various features.

Top View Dimensions:

- Overall length (retracted): 83.1 ± 0.8
- Overall length (extended): $96.0^{+0.5}_{-1.8}$
- Tip diameter: $\phi 2.2 \pm 0.05$
- Tip diameter: $\phi 2.6$
- Tip diameter: $\phi 4.2$
- Tip diameter: $\phi 6.0 \pm 0.1$
- Tip diameter: $\phi 7.6 \pm 0.2$
- Tip diameter: $\phi 8.8 \pm 0.2$
- Tip diameter: $\phi 10.7 \pm 0.2$
- Tip diameter: $\phi 14.0 \pm 0.2$
- Tip diameter: $\phi 16.7 \pm 0.3$
- Tip diameter: $\phi 23.9 \pm 0.5$
- Tip diameter: $\phi 8.0$
- Tip diameter: $\phi 2.0$
- Tip diameter: $\phi 7.2 \pm 0.2$
- Tip diameter: $\phi 10.8$
- Tip diameter: $\phi 7$

Side View Dimensions:

- Overall length (retracted): 83.3 ± 0.8
- Overall length (extended): $96.0^{+0.5}_{-1.8}$
- Tip diameter: $\phi 2.2 \pm 0.05$
- Tip diameter: $\phi 2.6$
- Tip diameter: $\phi 4.2$
- Tip diameter: $\phi 6.0 \pm 0.1$
- Tip diameter: $\phi 7.6 \pm 0.2$
- Tip diameter: $\phi 8.8 \pm 0.2$
- Tip diameter: $\phi 10.7 \pm 0.2$
- Tip diameter: $\phi 14.0 \pm 0.2$
- Tip diameter: $\phi 16.7 \pm 0.3$
- Tip diameter: $\phi 23.9 \pm 0.5$
- Tip diameter: $\phi 8.0$
- Tip diameter: $\phi 2.0$
- Tip diameter: $\phi 7.2 \pm 0.2$
- Tip diameter: $\phi 10.8$
- Tip diameter: $\phi 7$

Callouts:

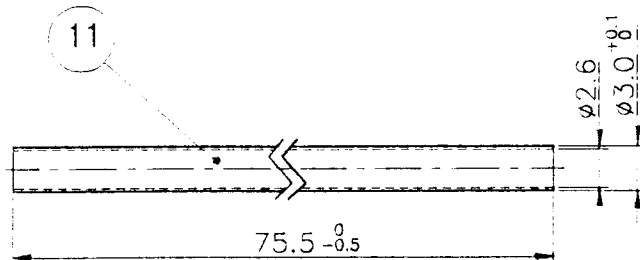
- 1: Tip
- 2: Tip
- 3: Tip
- 4: Tip
- 5: Tip
- 6: Tip
- 7: Tip
- 8: Tip
- 9: Tip
- 10: Tip

Other Dimensions:

- Tip diameter: $\phi 7.8763$
- Tip diameter: $\phi 7.5 \pm 0.2$
- Tip diameter: $\phi 2.6$
- Tip diameter: $\phi 33.8 \pm 0.2$
- Tip diameter: $\phi 83.3 \pm 0.8$ (extended)
- Tip diameter: $\phi 96.0^{+0.5}_{-1.8}$ (extended)
- Tip diameter: $\phi 10.7 \pm 0.2$
- Tip diameter: $\phi 14.0 \pm 0.2$
- Tip diameter: $\phi 16.7 \pm 0.3$
- Tip diameter: $\phi 23.9 \pm 0.5$
- Tip diameter: $\phi 8.0$
- Tip diameter: $\phi 2.0$
- Tip diameter: $\phi 7.2 \pm 0.2$
- Tip diameter: $\phi 10.8$
- Tip diameter: $\phi 7$

Notes:

- "NOTE 1"
- R0.2
- R0.5
- M5.0 X P0.5
- R1.0
- R0.5



1. P/L의 BURR방지를 위해 0.05단차 형성

11		TUBE	P.E	1	지정색	
10	40T-03-00410	LOWER PIN	BsBM2	1	NI PLATED	
9	40-4-40-00200	SPRING CAP	BsBM2	1	NI PLATED	
8	40-4-10-00300	PLATE SPRING	BeCuP	1	NI PLATED	
7	40-4-20-00200	T.M	BsBM2	1	NI PLATED	
6	40-5-10-00200	HELICAL	SWRM	1		
5	40-1-60-00200	BOBBIN	POLY URETHANE(55D)	1	지정색	
4		WHIP TUBE	TPE(Keyflex 1163D)	1	지정색	
3		WHIP WIRE	NI-Ti-Cr Alloy	1		70.2L
2		BODY PLASTIC	POLY URETHANE(55D)		지정색	
1		WHIP PLASTIC	Ny66(Zytel 101F)		지정색	
NO	PART NO	PART NAME	MATERIAL	Q'TY	FINISH//COLOR	REMARKS
GENERAL TOLERANCE		APPROVAL			MODEL	TDC-6100
DIM	GRADE	A	B	C	CHECK	
1~6		±0.05	±0.10	±0.25	DESIGN	
6~18		±0.07	±0.14	±0.35		PART NAME ANT. ASM
18~50		±0.10	±0.20	±0.50		
50~120		±0.15	±0.30	±0.80		
120~250		±0.20	±0.50	±1.00		
250~500		±0.30	±1.50	±2.00		
SCALE		2 / 1	THIRD ANGLE DIMENSION		PART NO	C2-1-T1-00200(E)
METRIC A4		UNIT	mm		E.M.W. Antenna Co., LTD	