PRODUCT SPECIFICATION

Product specification for product no. 3743.1 Retractable Bottom Helical Antenna System for *Samsung* model *CDMA "S-Project"* hand portable unit.

DOCUMENT 3743.1 Issue 1

See page 18 changes from earlier issues.

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Approved date: , 1997
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CONTENTS

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

Allgon Product Number 3743.1

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 ±3 °C
dBd	dB relative to a dipole
CW	Continuos Wave
g	acceleration of gravity ≅ 9.81 m/s^2

2.4 VSWR[1]

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

2.4.1 Free Space

	Maximum Values	
Mode	**Tx**	**Rx**
Extended	2.5:1	2.5:1
Retracted	3:1	2.5:1

2.4.2 Talk Position

	Typical Maximum Values	
Mode	**Tx**	**Rx**
Extended	1.8:1	1.8:1
Retracted	3:1	3:1

2.4.3 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.

2.4.4 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 2.4.4. These ten antennas are our REF antennas. Only the helical elements are considered when finding the REF antennas.

[1] The specified values implies that a correct handset (see 2.3) has been received from Samsung.

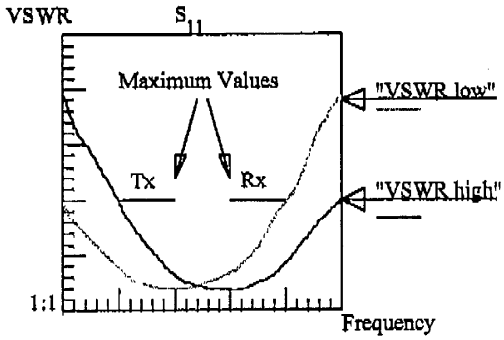


Figure 2.4.4. *Two REF antennas defining the low and high VSWR limits.*

2.5 GAIN[1]

2.5.1 Minimum Values in Maximum Direction

Mode	Tx	Rx
Extended	-1.5 dBd	-1.5 dBd
Retracted	-2.5 dBd	-2.5 dBd

2.5.2 Maximum Lobe Tilt

Mode	Tx	Rx
Extended	45°	45°
Retracted	45°	45°

2.5.3 Measuring Method

The connection is done according to 2.4.3. Radiation patterns are measured at 6 different frequencies: Tx_{min}, Tx_{mid}, Tx_{max}; Rx_{min}, Rx_{mid}, and Rx_{max}. The specified values shall be found within ±45° from the horizontal plane according to figure 2.5.3 a) and b). The antenna is measured in 2 orthogonal E-planes, according to figure 2.5.3 c), in free space. The antenna is also measured in the H-plane as well as in talk position.

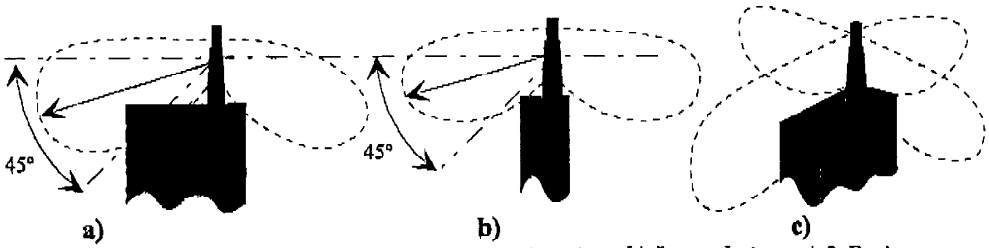


Figure 2.5.3. *Radiation patterns. a) Anterior view. b) Lateral view. c) 3-D view.*

[1] The specified values implies that a correct handset (see 2.3) has been received from Samsung.

2.6 POWER RATING

2.6.1 Maximum Value

P = 2 W (CW)

2.6.2 Demands

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

2.6.3 Measuring Method

The connection is according to 2.4.3. 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 19. The antenna shall have no marks, cuts, abrasion or other mechanical damages.

3.2 HELIX DEFORMATION

3.2.1 Angle

$\alpha = 70°$

3.2.2 Bending Force

$F_b = 30$ N

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.

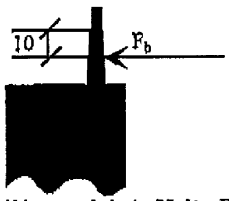


Figure 3.2.4. *Helix Deformation.*

3.3 TORQUE

3.3.1 Minimum Value

T = 10 Ncm

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 = 40 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.

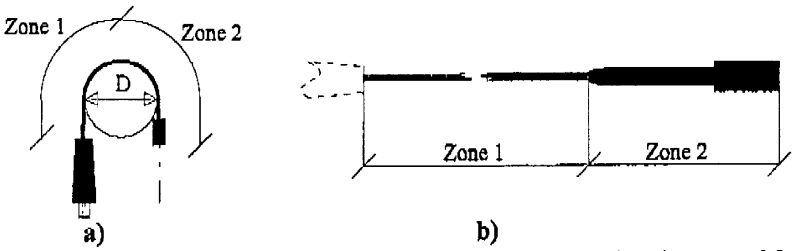


Figure 3.4.3. *Whip deformation. a) Bent antenna. b) Close up of the two zones.*

3.5 PULLING FORCE

3.5.1 Pulling Force

F_p = 50 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 test equipment according to figure 3.5.3. The specified load, F_p, is applied during 30 s to the top of the antenna.

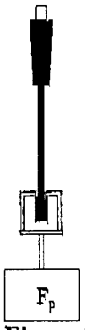


Figure 3.5.3. *Pulling force.*

3.6 DROP

3.6.1 Drops

1 drop in extended mode and 1 drop in retracted mode

3.6.2 Drop Height

0.75 m

3.6.3 Drop Angle

45°

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 concrete surface covered with 20 sheets of Xerox quality paper, having a specific weight of 80 g/m^2.

3.7 BENDING ENDURANCE

3.7.1 Bending Cycles

1,500 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 bent 90° left and 90° right (1 cycle). This is repeated for the duration of the test.

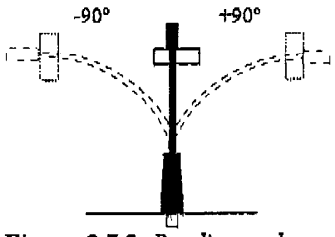


Figure 3.7.3. *Bending endurance.*

3.8 RETRACTION FROM EXTENDED MODE

3.8.1 Retraction Force

1.0 - 8.0 N

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

3.9 RETRACTION FORCE CONSISTENCY

3.9.1 Retraction Cycles

10,000 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 (1 cycle) 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 °C

4.1.2 High Operational Temperature

T_{HO} = +70 °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 the 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 the VSWR is immediately measured.

4.2 TEMPERATURE CYCLING

4.2.1 Low Cycling Temperature

T_{LC} = -40 °C

4.2.2 High Cycling Temperature

T_{HC} = +80 °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.

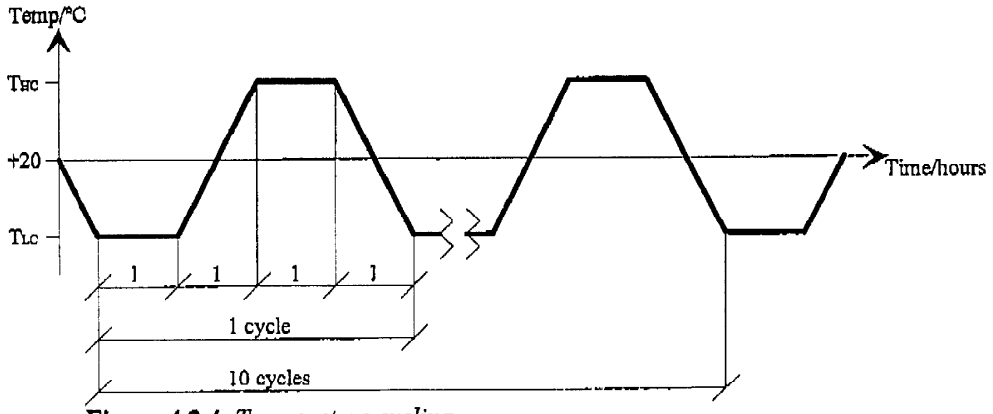


Figure 4.2.4. *Temperature cycling.*

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 (1 cycle)

4.4.2 Sweep Rate

1 octave/min (logarithmic)

4.4.3 Maximum Amplitude

A = 1.5 mm

4.4.4 Maximum Acceleration

2 g

4.4.5 Crossover Frequency

18.2 Hz

4.4.6 Demands

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

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.

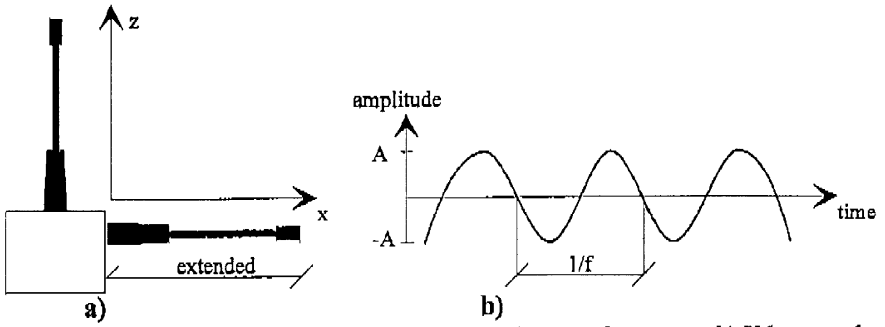


Figure 4.4.7. *Sinusoidal vibration. a) Vibration directions. b) Vibration form.*

5 QUALITY

5.1 TEST SEQUENCE

The antennas are tested by Allgon'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.

		Test Group No.		
No.	**Test Paragraph**	**1**	**2**	**3**
3.1	APPEARANCE (initial)	x	x	x
2.4	VSWR (initial)	x	x	x
2.5	GAIN	x		
2.6	POWER RATING	x		
4.1	OPERATIONAL TEMPERATURE	x		
4.2	TEMPERATURE CYCLING	x	x	
4.3	HUMIDITY	x		
3.2	HELIX DEFORMATION		x	
3.3	TORQUE		x	
3.4	WHIP DEFORMATION		x	
3.5	PULLING FORCE		x	
3.6	DROP		x	
3.7	BENDING ENDURANCE			x
3.8	RETRACTION FROM EXTENDED MODE			x
3.9	RETRACTION FORCE CONSISTENCY			x
4.4	SINUSOIDAL VIBRATION			x
2.4	VSWR (final)	x	x	x
3.1	APPEARANCE (final)	x	x	x
	Number of samples:	3	3	3

Table 5.1. *Test sequence. The paragraphs in the table are listed in the same order as they are tested (within each test group).*

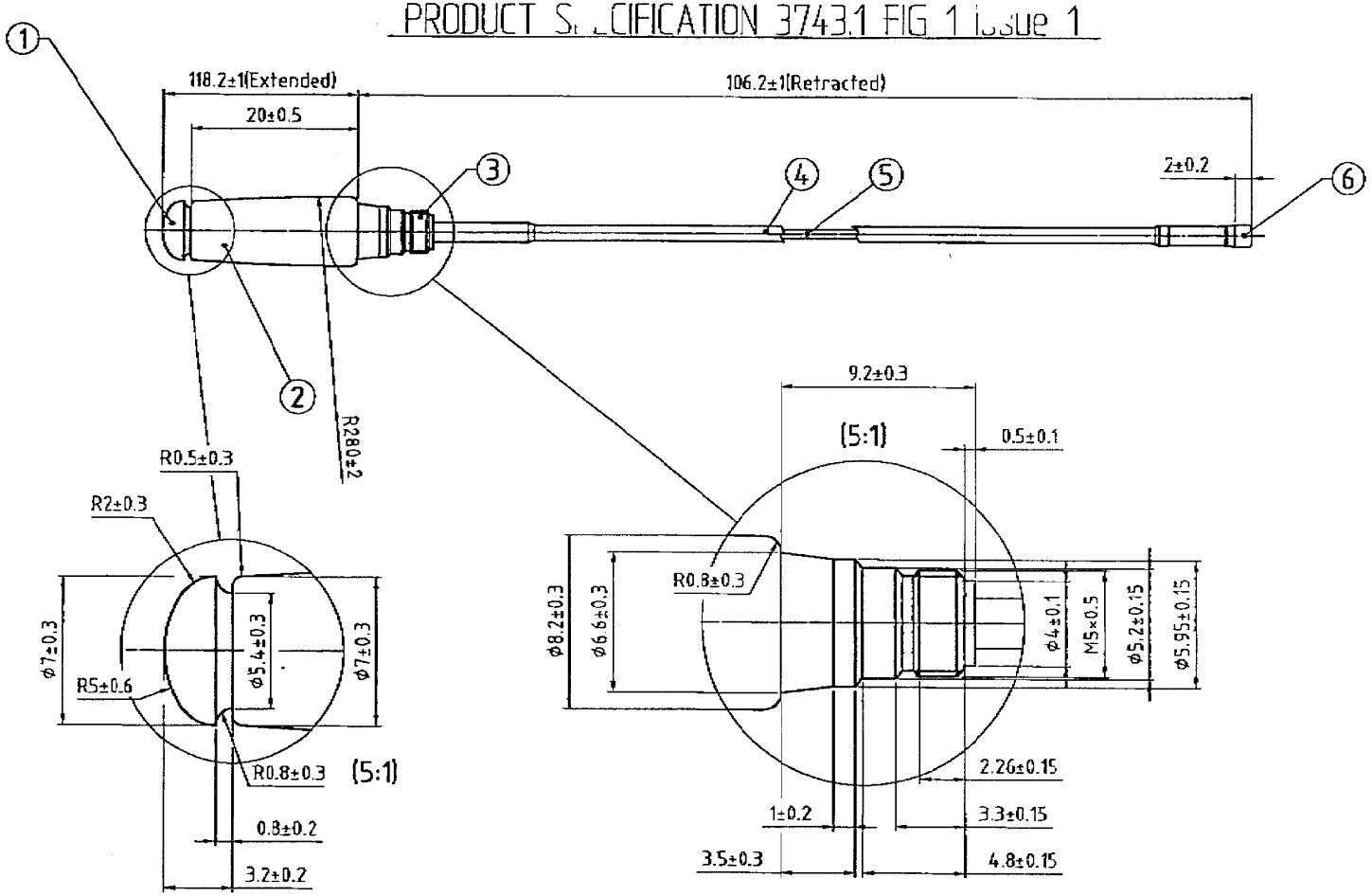
5.2 FIRST ARTICLE APPROVAL

From an early mass produced batch, 20 samples shall be sent to Samsung. When approved in all matters, i.e. electrically and mechanically, incl. finish, form MB-006 "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 Allgon. This procedure is repeated prior to a major change in design or materials.

6 LOG OF CHANGES

Issue no.	Item no.	From	To
1	2.4.1	TBD	Values specified.
1	2.4.2	TBD	Values specified
1	2.5.1	TBD	Values specified

PRODUCT S. .CIFICATION 3743.1 FIG 1 Issue 1



NO.	MATERIAL		SURFACE TREATMENT
1	Plastic	Zytel 66 E101 L	Surface acc. to Charmilles VDI 3400 no. 30, Colour according to NCS 9500
2	Plastic	Santoprene 103-40	Surface acc. to Charmilles VDI 3400 no. 33, Colour according to NCS 8500
3	Brass	SS 5170-04	Cu/CuZNi2-4b acc. to SS ISO 1458
4	Plastic	PVC	
5	Ni-Ti-Cr	Super elastic alloy	
6	Brass	SS 5170-04	Cu/CuZNi10b acc. to SS ISO 1458

Scale: 2:1

Prepared: 97-06-13 JEC

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