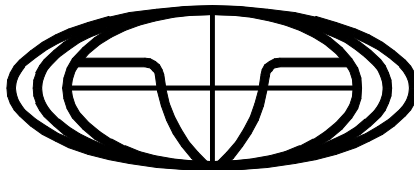




GALTRONICS (GTK) LTD. Revision: P2 / Rev-Preliminary

Part No: 02036075-04367

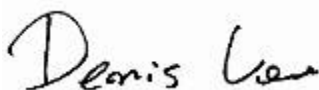
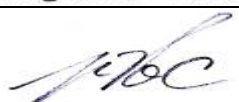

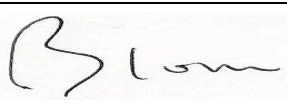
ANTENNA SPECIFICATION Project No: 04367



DESIGN SPECIFICATION

CELL / USPCS

PANTECH "J-TOUCH" INTERNAL ANTENNA

<u>DISTRIBUTION LIST:</u> 1. QC 2. SALES		3. Pantech	
<u>APPROVED BY</u>		<u>SIGNATURE</u>	<u>DATE</u>
Engineering Department Manager Denis			2010-04-16
RF Manager James			2010-04-16
Mechanical Engineer Tommy			2010-04-16
RF Engineer Blom			2010-04-16
<u>Approved By Customer(As Required):</u> Pantech			

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ANTENNA SPECIFICATION

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**ANTENNA SPECIFICATION***** PURPOSE AND SCOPE**

The purpose of this document is to establish a design specification for the antenna product that Galtronics is developing for Pantech. Any changes or additions to this specification can affect schedule and/or cost of the product and should be negotiated between Galtronics and Pantech before being incorporated into the specification. Upon agreement of this specification Galtronics will make no changes without written approval from Pantech. Any changes requested by Pantech will be given to Galtronics with sufficient time frame to evaluate the cost impact and react as required. The development of this product within Galtronics was conducted according to the Design Control Procedure SOP-006E.

-. RELATED DOCUMENTS

SOP006E	Product Launch Procedure (Design Control)
EN006E	Reliability Guidelines
EIA-STD-556	Outer Shipping Container Bar Code Label Standard

-. ABBREVIATIONS AND DEFINITIONS

Ω	Ohm
°	Degree
°C	Celsius (degrees Centigrade)
cm	Centimetre
g	Grams
GHz	Gigahertz
Hz	Hertz
kg	Kilograms
MHz	Megahertz
M	Meter
mm	Millimetre
N	Newton
PCB	Printed Circuit Board
RH	Relative Humidity
W	Watt

Design Specification: A preliminary target specification to guide the design process.

Product Specification: A final specification for the qualified product.

**ANTENNA SPECIFICATION****1. PRODUCT REVISION**

1.1 The list of approval sheet revision

<u>REV NO.</u>	<u>PANTECH REV NO</u>	<u>DATE</u>	<u>DESCRIPTION</u>
P-1	Preliminary	05. Feb, 10	RELEASED FOR CUSTOMER PERLIMINARY APPROVAL
P-2	Preliminary	16.April, 10	RELEASED FOR CUSTOMER PERLIMINARY APPROVAL

2. MATERIAL CERTIFICATION**2.1 Description and part number****2.1.1 DESCRIPTION**

The antenna consists of two components – Element and Carrier.

2.1.2 PART NUMBER

Galtronics Part number	Frequency Band	Pantech Part number
-	CELL / USPCS	

2.1.3 PART LIST

PART NUMBER	PART NAME	MATERIAL & FINISH	PROCESS	SUPPLIER	Q'TY	Remark
02036075-04367	Internal Antenna Assembly	—	Manual Assembly & Heat Stakes Machine	-		
28-5409-03	Carrier	PC Lexan(141R) (Color : Black / Code:701)	Mold Tooling & Injection Machine	QDM TECH	1	QDM
06-5708-03	Pattern	Phosphor Bronze Sheet (Grade : C5210, Hardness : 1H Thickness : 0.15T)	Stamping Tooling & Press Machine Electro pre overall Ni(1.4~4.0 μ m) Plating and Chemical Passivation	HYUN TECH	1	Hand made

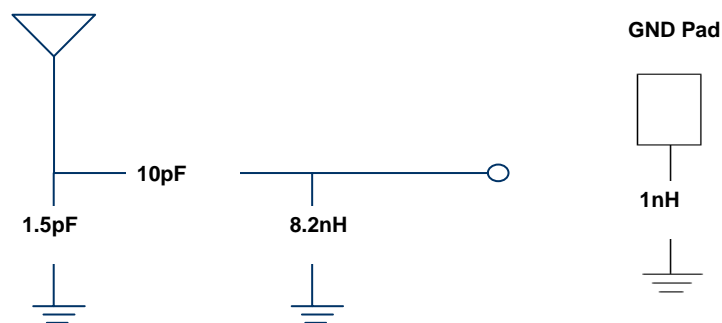
**ANTENNA SPECIFICATION****3. ELECTRICAL SPECIFICATIONS:****3.1 FREQUENCY BAND**

BAND	FREQUENCY
CELL	TX(824-849MHz)
	RX(869-894MHz)
USPCS	TX(1850-1910MHz)
	RX(1930-1990MHz)

3.2 IMPEDANCE - Nominal impedance: 50Ω**3.3 MATCHING REQUIREMENTS.**

In order to assure the best performance of the antenna, the matching shall be evaluated in free space with the antenna vertically positioned. Galtronics shall give design support to the customer to obtain the optimum matching circuit for the antenna system.

The antenna shall comply with the Electrical Specification requirements, as set out below, while mounted on the customer supplied handset containing the PCB with the matching circuit. The handset with PCB is to be supplied by the customer and should be representative of the production parts. Any modifications in the handset or PCB can affect the performance of the antenna and should be discussed with Galtronics to determine the affect of such changes on antenna performance and delivery requirements.

J-touch Matching Network for temporary**FIGURE 1. Matching Circuit****3.4 INPUT VSWR****3.4.1 MAXIMUM VALUES OF VSWR IN FREQUENCY BAND (PHONE JIG SPECIFICATION)**

BAND	FREQUENCY	VSWR_SU	VSWR_SD
CELL	824	4.5	4.0
	894	3.0	3.5
USPCS	1850	3.0	3.0
	1990	4.5	4.5



ANTENNA SPECIFICATION

*** Means pending on final PCB and matching circuit**

3.4.2 TEST METHOD (Engineering)

The antenna is tested while mounted on the handset with the matching circuit (Fig 2). The handset is positioned in the air.

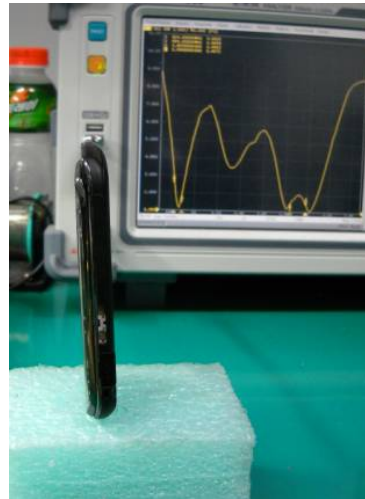


FIGURE 2. Test Method

3.4.3 TEST METHOD (Production)

In mass production it is not practical to use the handset supplied by customer. Galtronics will design a representative production test fixture for use on the processes that require electrical testing. The results of the test fixture will be correlated to the results obtained on the customer handset.

3.4.4 TEST METHOD (Customer)

Galtronics supply the antennas. And then, assemble antenna into the handset before checking the RF performance. (Refer to the Fig. 3)



FIGURE 3. The Antenna



3.4.5 TEST METHOD (RF Test Jig Data)

The antenna is tested while mounted on the test jig that is positioned in the air (Refer to Fig. 4).

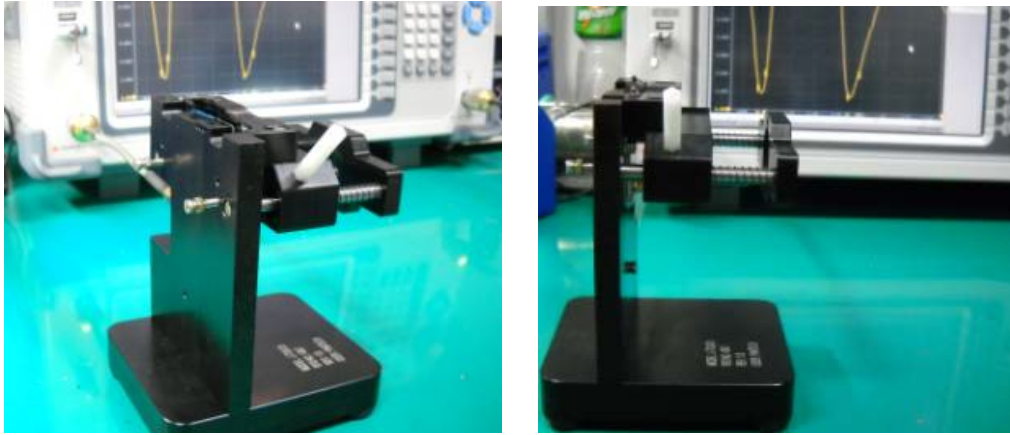


FIGURE 4. RF Test Fixture

3.4.6 RF Test VSWR DATA

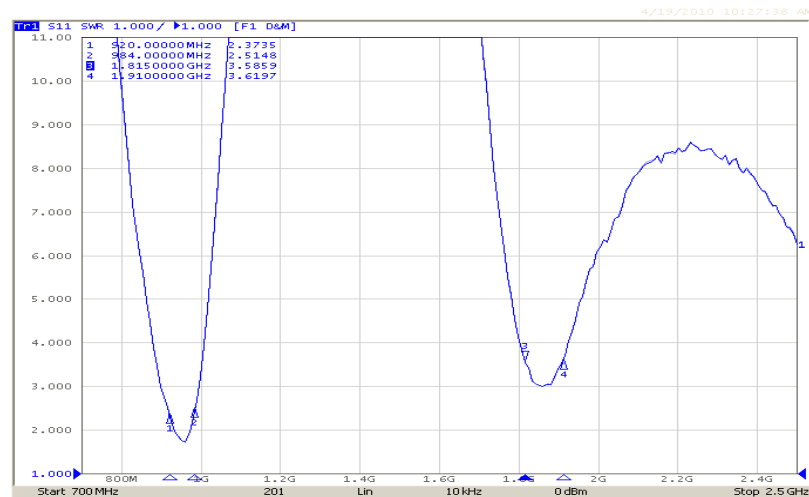


FIGURE 5. RF Test Jig VSWR

3.4.7 MAXIMUM VALUES OF VSWR IN FREQUENCY BAND (RF TEST JIG SPECIFICATION)

BAND	FREQUENCY	VSWR
CELL	920	4.0
	984	4.0
USPCS	1815	5.0
	1910	5.0

****Means pending on the RF test jig**

**ANTENNA SPECIFICATION****3.5 GAIN****3.5.1 MINIMUM GAIN VALUES FOR AVERAGE IN AZIMUTH/ EVALUATION PLANE :**

(Measured in the APLUS TECH Chamber in Galtronics Korea)
(unit : dBi)

BAND	FREQUENCY (MHz)	PLANE	Gain_SU	Gain_SD
CELL	824	H	-5.0	-5.0
		E1	-9.0	-9.5
		E2	-10.0	-10.0
	894	H	-3.0	-4.0
		E1	-8.0	-8.5
		E2	-8.5	-9.5
USPCS	1850	H	-4.5	-5.5
		E1	-9.0	-8.5
		E2	-6.0	-6.5
	1990	H	-7.5	-7.0
		E1	-9.5	-9.5
		E2	-9.5	-9.0

**** Means pending on final PCB and matching circuit**

3.5.2 MEASURED GAIN VALUES FOR AVERAGE IN AZIMUTH/ ELEVATION PLANE

(Measured in the APLUS TECH Chamber in Galtronics Korea)
(unit : dBi)

BAND	FREQUENCY (MHz)	PLANE	Gain_SU	Gain_SD
CELL	824	H	-2.87	-2.85
		E1	-7.23	-7.40
		E2	-8.07	-7.98
	894	H	-1.16	-2.01
		E1	-6.20	-6.58
		E2	-6.62	-7.39
USPCS	1850	H	-2.65	-3.35
		E1	-6.83	-6.45
		E2	-4.03	-4.68
	1990	H	-5.26	-4.96
		E1	-7.61	-7.72
		E2	-7.42	-7.04

**** Means pending on final PCB and matching circuit**



ANTENNA SPECIFICATION

3.5.3 TEST METHOD;

The antenna is tested while mounted on handset with the correct matching circuit in free space. Radiation patterns are measured on following frequencies:

824MHz, 894MHz, 1850MHz, 1990MHz

The antenna is measured for 2 elevation cuts at two different azimuth positions ($\phi = 0$, $\phi = 90$). Azimuth(H) $\theta = 90^\circ$, Elevation $\phi = 0^\circ$, $\phi = 90^\circ$ The results of the test will be correlated to the customer handset and the measurement environment. (Refer to Fig. 2)



ANTENNA SPECIFICATION

4. MECHANICAL SPECIFICATIONS:

4.1 MECHANICAL CONFIGURATION

The appearance of the antenna is in accordance with drawing 020036075-04367

4.2 CONTACT FORCE TEST

4.2.1 COMPRESSION TEST

Place the antenna on the compression test machine, fix the antenna, and press on the top contact point to the height PCB contact area (See figure 6)

The force shall be within the range of 100gf to 500gf.

The test should be done at room temperature $+24^{\circ}\text{C} \pm 3^{\circ}\text{C}$

4.2.2 RESTITUTION TEST

Place the antenna on the compression test machine, fix the antenna, and press on the top contact point to the height PCB contact area. Antenna contact should have no more than 20% of shape change after 500 cycles of the performed test.



FIGURE 6. Compression Test Method

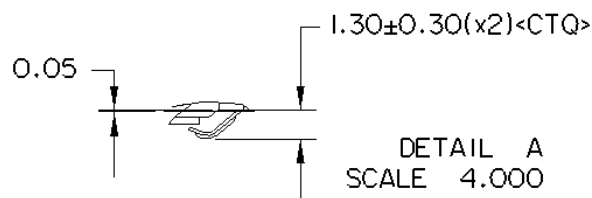


FIGURE 7. Contact Dimensions

4.3 DROP TEST

The antenna assembled to the mobile phone provided by Pantech, should withstand 5 drops per every each 6 sides from 1.5m heights onto a steel plate $500 \times 500\text{mm}$ with thickness of

**ANTENNA SPECIFICATION**

20mm. The antenna should function mechanically after the test. Electrical characteristics should be within the specified range.

The temperature of the environment should be $+24^{\circ}\text{C} \pm 3^{\circ}\text{C}$

5.0 ENVIRONMENTAL SPECIFICATIONS**5.1 LOW TEMPERATURE SOAKING**

The antenna should be placed in an environmental chamber at -40°C for 48 hours.

Soak antenna at ambient temperature at least 1 hour after the test.

After test is complete, the antenna should function mechanically. Electrical characteristics should be within the specified range.

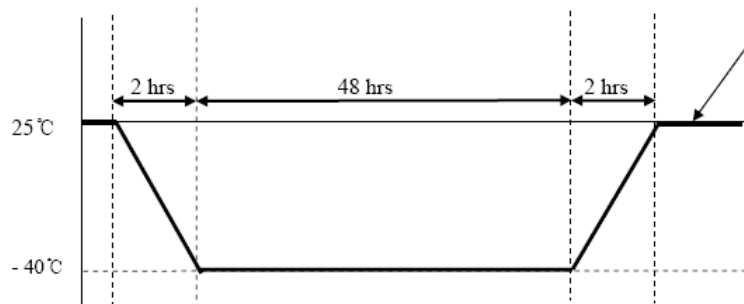


FIGURE 8. Low Temperature soaking

5.2 HIGH TEMPERATURE SOAKING

The antenna should be placed in an environmental chamber at $+85^{\circ}\text{C}$ for 48 hours.

Soak antenna at ambient temperature at least 1 hour after the test.

After test is complete, the antenna should function mechanically. Electrical characteristics should be within the specified range

안

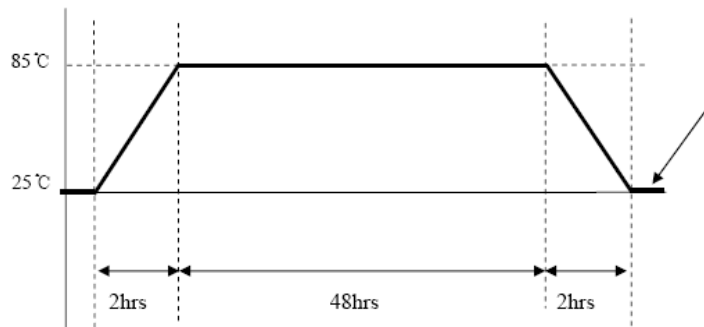


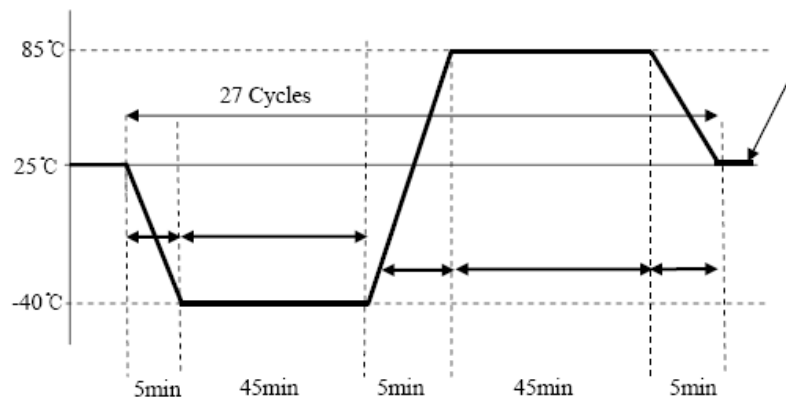
FIGURE 9. High Temperature soaking

5.3 THERMAL SHOCK TEST

Place the antenna in an environmental chamber at temperature $T1 = -40^{\circ}\text{C}$. Expose antenna to this temperature during 45 minutes. Then expose antenna at temperature $T2 = +85^{\circ}\text{C}$ during 45 minutes. Transfer time is 5 min.

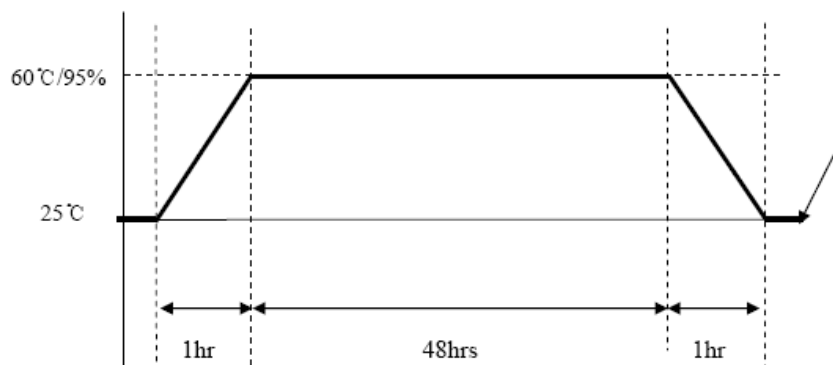
Repeat this cycle 27 times.

After test is complete, there shall be no visual deterioration or damage. Electrical characteristics should be within the specified range.

**ANTENNA SPECIFICATION****FIGURE 10. Thermal Shock Test****5.4 STATIC HUMIDITY TEST**

Place the complete in an environmental chamber at +25°C. Then increase temperature during 1 hour to +60° C with humidity increasing to 95% RH during 1 hours. Soak antenna with these parameters for 48 hours. After the finish initial ambient parameters should be achieved during 1 hour.

After test is complete, there shall be no visual degradation in esthetical and mechanical performance. Electrical characteristics should be within the specified range.

**FIGURE 11. Static Humidity Test****5.5 SALT SPRAY (CORROSION) TEST**

Place complete antenna in Salt Spray Cabinet at temperature +35°C with the salt fog of NaCl solution (5%); soak time - 48 hours.

After test is complete, there shall be no visual degradation in esthetical and mechanical performance. Electrical characteristics should be within the specified range.

6.0 QUALIFICATION

The mechanical and environmental tests mentioned above are performed according to the flow chart shown in Figure 12 below. The entire testing procedure will be conducted according to EN006E. A summary report of the results of the tests will be sent to the customer. Galtronics will not start mass production until the customer will grant the product a qualified status.

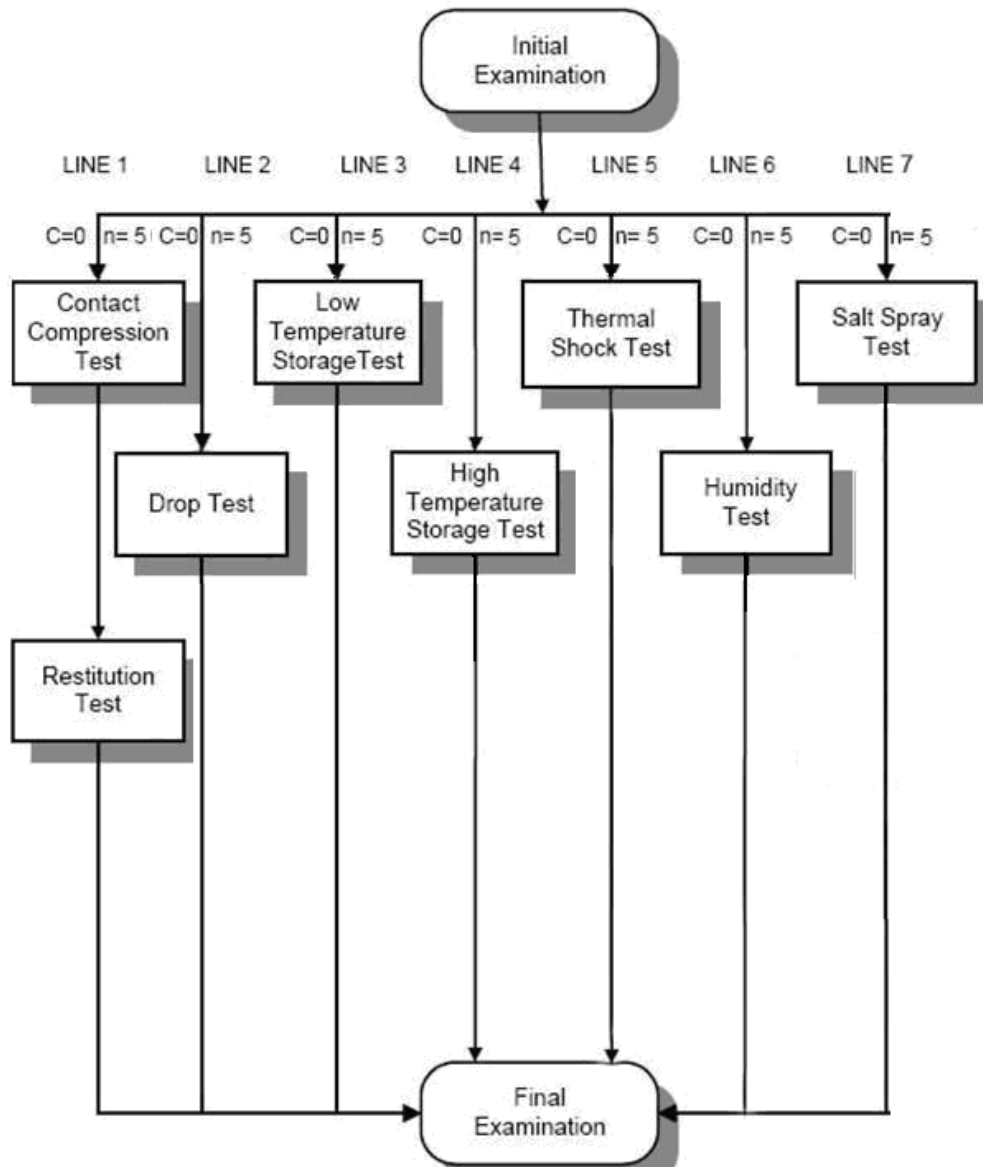


Figure 12. Property Verification test Flow Chart

Note: n - sample size; c - allowable amount of critical failure

7.0 APPENDIX AND CERTIFICATION

7.1 ELECTRICAL DATA (VSWR AND JIG DATA)

Not test

7.2 PRODUCT DRAWING



ANTENNA SPECIFICATION

DWG No 02036075-04367		GALTRONICS DRAWING COVER SHEET	
REV P1 P2	ISSUE DATE 1.Feb.10. 16.April.10.	ECO #	DESCRIPTION Released for Samples Released for Samples
APPLICABLE SPEC'S:		INTERNAL DISTRIBUTION <input checked="" type="checkbox"/> PROCESS <input type="checkbox"/> PURCHASING <input type="checkbox"/> PRODUCTION <input type="checkbox"/> PLASTICS <input checked="" type="checkbox"/> QUALITY <input checked="" type="checkbox"/> INCOMING INSPECTION <input type="checkbox"/> FINAL INSPECTION <input type="checkbox"/> MARKETING	
SURFACE FINISH, MICROMETERS, CLA (UNLESS STATED) 0.8 TOLERANCES UNLESS OTHERWISE SPECIFIED: NO PLACE (X)±1 TWO PLACE (X.XX)±0.1 ONE PLACE (X.X)±0.2 THREE PLACE (X.XXX)±0.05		METRIC SCREW THREAD TO ISO STANDARDS 724, 2861, 965-1 AND 965-2 INCHES SCREW THREAD TO ANSI/ASME B1.1, ALL ANGLES TO BE 90° UNLESS OTHERWISE STATED. TOLERANCE ON ANGLES 1/4° ALL TOLERANCES APPLY AFTER FINISHING. MACHINE CORNER RADS. 0.25 MAX., TO BE FREE FROM BURRS, SHARP EDGES AND ALL FOREIGN MATERIALS. FLASH ALLOWANCE FOR PLASTIC MOLDED PARTS TO BE 0.1mm UNLESS OTHERWISE STATED. DIAMETER MUST BE CONCENTRIC WITHIN 0.08 T.I.R., ENVIRONMENTAL REQUIREMENTS : COMPLIANCE WITH GALTRONICS STANDARD 'SUPPLIER ENVIRONMENTAL DECLARATION PROCEDURE' ISDPG002E1.	
QUALITY ASSURANCE NOTES: NO CHANGE SHALL BE ALLOWED ON PRODUCTION. MATERIAL WITHOUT PRIOR EXPLICIT WRITTEN APPROVAL BY GALTRONICS ENGINEERING AND PURCHASING DEPARTMENTS FOR SPECIAL REQUIREMENTS SEE FM49		<input checked="" type="checkbox"/> XR PROCESS CONTROL CHART REQUIRED WITH EACH SHIPMENT! <input type="checkbox"/> CRITICAL DIMENSION AFFECTS FORM FIT OR FUNCTION	
SUFFIX # 03	DESCRIPTION Finished Piece Part		
SEE NOTE			
THE DRAWING AND INFORMATION ON THIS PRINT ARE GALTRONICS- CONFIDENTIAL AND PROPRIETARY INFORMATION - MAY NOT BE COPIED OR DISCLOSED			
TITLE INTERNAL ANTENNA DIRECT CONTACT		CHG: --	DWG. No. 02036075-04367
APPRD: --		DATE 16.April.10.	REV. P2
		PAGE 1 OF 2	

FIGURE 13. COVER SHEET OF PRODUCT DRAWING



ANTENNA SPECIFICATION

Project No: 04367

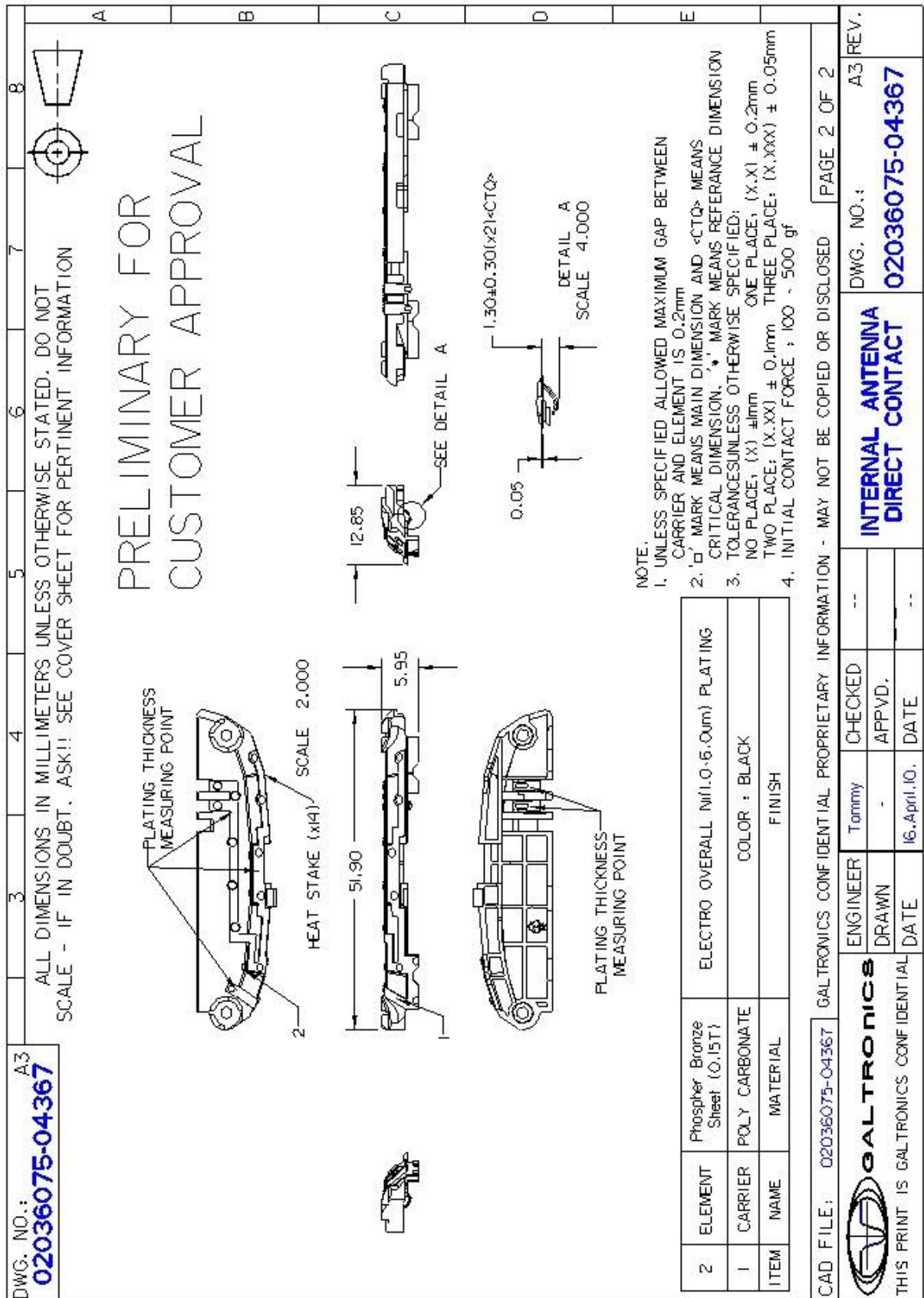


FIGURE 14. PRODUCT DRAWING



GALTRONICS (GTK) LTD.

Revision: P2 / Rev-Preliminary

Part No: 02036075-04367

ANTENNA SPECIFICATION

Project No: 04367

7.3 PACKING

Not decision



7.4 LOT MARKING INFORMATION

Lot Number is made by laser marking on the carrier bottom or upper side (Figure 15).

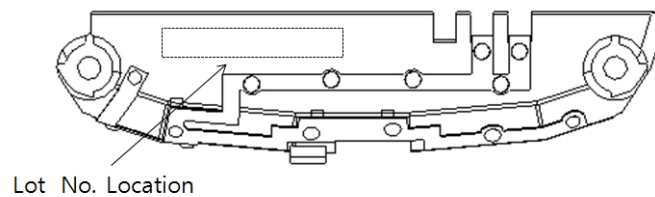
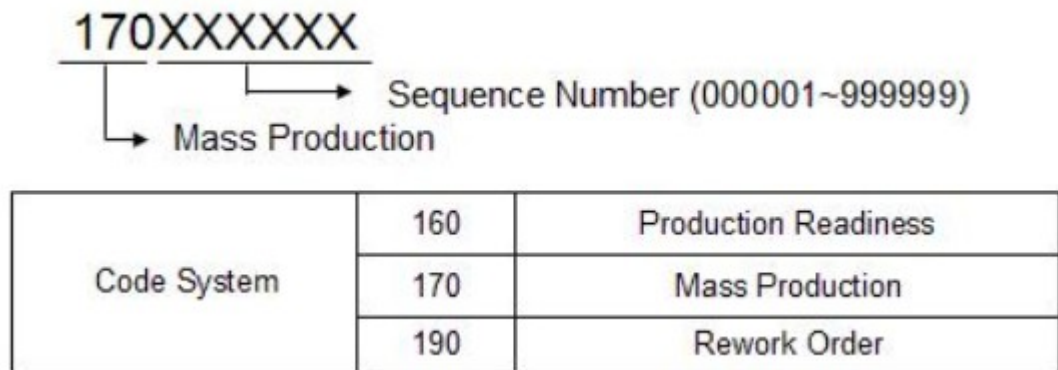


FIGURE 15 LOT MARKING AREA.