



**DESIGN SPECIFICATION**  
**Part Number: LT31300 (SM-R180)**  
**Rev. A**

## DESIGN SPECIFICATION

|                  |                               |
|------------------|-------------------------------|
| DESIGN           | INTERNAL ANTENNA              |
| MODEL / TYPE     | SM-R180 / Left[BT] INTENNA    |
| ETHERTRONICS P/N | LT31300                       |
| SEC CODE         | GH42-06577A                   |
| CUSTOMER         | SAMSUNG ELECTRONICS CO., LTD. |
| SUPPLIER         | ETHERTRONICS INC.             |

|                                                                                                 |                                                                                               |                                                                                                  |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| ENGINEERING MANAGER<br>CHECKED                                                                  | MECHANICAL MANAGER<br>CHECKED                                                                 | DESIGN MANAGER<br>CHECKED                                                                        |
| <br>JH Jeong | <br>TW Kim | <br>KJ Chun |



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#### 1. Purpose and Scope

The purpose of this document is to establish a design specification for the antenna DESIGN that Ethertronics is developing for the Samsung SM-R750A wireless handset. Any changes or additions to this specification can affect schedule and/or cost or the DESIGN and should be negotiated between Ethertronics and Samsung before being incorporated into the specification. Upon agreement of this specification, Ethertronics will make no changes without the written approval from Samsung. Any changes requested by Samsung will be given to Ethertronics with sufficient time to evaluate the cost impact and react as required.

#### 2. Abbreviations and Definitions

|      |                              |
|------|------------------------------|
| AVG  | Average                      |
| °    | Degree                       |
| °C   | Celsius (degrees Centigrade) |
| cm   | Centimeter                   |
| G    | Gravitational Force          |
| g    | Grams                        |
| Hz   | Hertz                        |
| In   | Inches                       |
| IQC  | Incoming Quality Control     |
| MHz  | Megahertz                    |
| m    | Meter                        |
| mm   | Millimeter                   |
| N    | Newton                       |
| PCB  | Printed Circuit Board        |
| TX   | Transmit Band                |
| RH   | Relative Humidity            |
| RX   | Receive Band                 |
| VSWR | Voltage Standing Wave Ratio  |
| W    | Watt                         |

Design specification: A target specification to guide design process.  
DESIGN Specification: A final specification for the qualified DESIGN.



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**3. ELECTRICAL SPECIFICATION FOR SM-R180**

**3.1. Frequency Band**

| Mode     | Frequency Band (MHz)  |
|----------|-----------------------|
| Left[BT] | 2,400 MHz ~ 2,500 MHz |



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**3.2. Electrical Characteristics**

**3.2.1. VSWR**

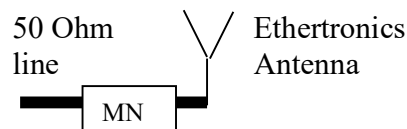
**< Phone mounted typical measurements >**

|                 |                 |                 |
|-----------------|-----------------|-----------------|
| Frequency Range | 2400 MHz        | 2500 MHz        |
| V.S.W.R         | $3.2 \pm 0.5:1$ | $1.9 \pm 0.5:1$ |

<Left[BT] Antenna>

**Matching Requirements**

In order to assure the best performance of the antenna, the matching will be evaluated in free space and in talk position. The antenna will comply with the Electrical Specification requirements, as set out below, while mounted on the handset containing the PCB. The handset and PCB are to be provided by the customer and should be representative of the latest design version of all parts. Any modifications in the handset or PCB can affect the performance of the antenna and should be discussed with Ethertronics to determine the affect of such changes on the antenna performance and delivery requirements.



Optional matching network to be  
determined by SAMSUNG RF team if needed.

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**3.3. Passive Measurement**

**3.3.1. Input Return Loss and VSWR**



<Left[BT] Antenna>

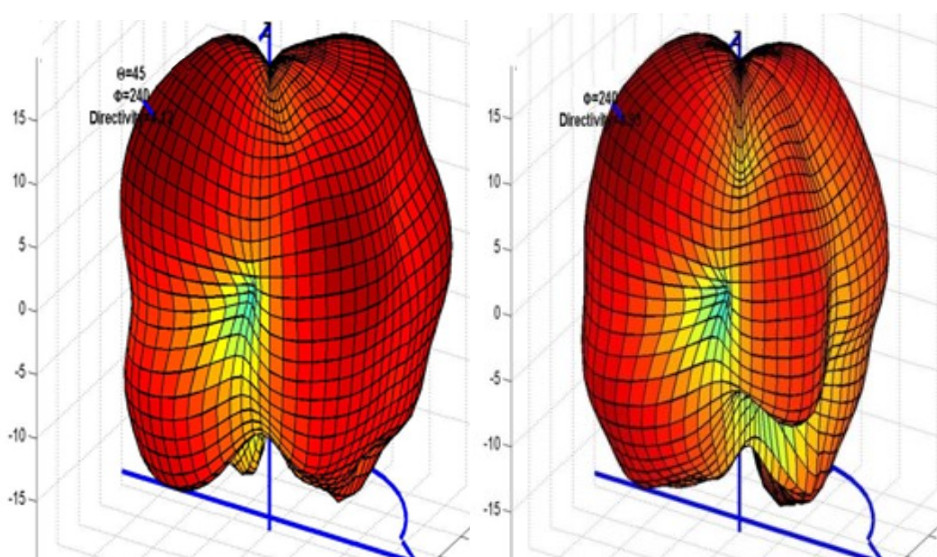
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### 3.4. Radiation Patterns

#### 3.4.1 SM-R180 Phone Left[BT] ANTENNA



<Phone mounted typical measurements>

| Frequency        | Efficiency | Average Gain |           |           | Max Gain  |           |          |
|------------------|------------|--------------|-----------|-----------|-----------|-----------|----------|
|                  |            | Ver          | Hor       | Total     | Ver       | Hor       | Total    |
| 2,400,000,000 Hz | 9.5 %      | -11.6 dBi    | -16.0 dBi | -10.2 dBi | -8.6 dBi  | -8.9 dBi  | -7.5 dBi |
| 2,420,000,000 Hz | 9.6 %      | -11.7 dBi    | -15.5 dBi | -10.2 dBi | -9.4 dBi  | -9.3 dBi  | -7.5 dBi |
| 2,440,000,000 Hz | 9.3 %      | -11.9 dBi    | -15.6 dBi | -10.3 dBi | -9.9 dBi  | -9.6 dBi  | -7.6 dBi |
| 2,460,000,000 Hz | 6.8 %      | -12.7 dBi    | -18.3 dBi | -11.7 dBi | -10.9 dBi | -9.7 dBi  | -8.3 dBi |
| 2,480,000,000 Hz | 5.7 %      | -13.8 dBi    | -18.2 dBi | -12.5 dBi | -11.2 dBi | -10.5 dBi | -8.7 dBi |
| 2,500,000,000 Hz | 4.9 %      | -14.6 dBi    | -18.4 dBi | -13.1 dBi | -12.0 dBi | -11.8 dBi | -9.3 dBi |

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#### **4. TEST METHOD**

##### **4.1. Return Loss & VSWR Test**

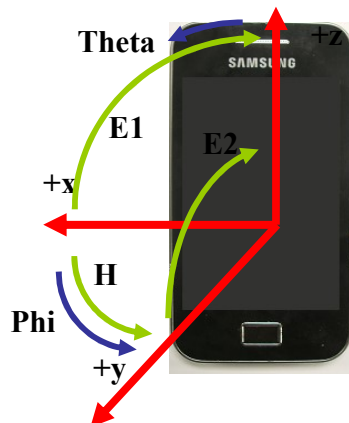
The VSWR measurement of antennas assembled into a fully operating SM-R180 phone handset is measured on the Network Analyzer. The handset is set up with a 50 Ohm coaxial cable connected to the 50 Ohm point. Calibration is done at the end of the 50 Ohm coaxial cable connection. The other end of the 50 Ohm coaxial cable is connected to a network analyzer. The handset is positioned on a non-conductive table for free space measurements.



**Figure 1: Testing with network analyzer**

##### **4.2. Radiation Pattern Test**

Antennas tested for Gain and Efficiency must be assembled into the enclosure and tested in the fully assembled and operating SM-R180 handset. The antenna is tested in free space in the anechoic chamber in the H, E1 and, E2 planes. The radiation patterns are measured at the center of transmit and receive bands.



**Figure 4: Geometry for SM-R180 for Radiation patterns.**



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**4.3. Test Method (Manufacturing)**

In manufacturing it is not practical to electrically test all antennas until it is heat staked into a fully assembled and operating handset supplied by the customer. To ensure the customer has the ability to sample test the antennas prior to heat staking and assembling them into a phone handset, Ethertronics typically designs a test fixture for use to electrically sample test the antennas.

**4.4. Corrosion (Salt Spray) Test**

Place the antennas into the Corrosion (Salt Spray) environmental chamber with 5% sodium atmosphere at 35°C for 72 hours. Then remove antennas from chamber and allow to stabilize at room temperature before measurement.

Post Test Requirements: There will be no evidence of mechanical damage.

Electrical characteristics should be within +/-0.5% of their initial value.