



**DESIGN SPECIFICATION**  
**Part Number: LT31475 (SM-X306B)**  
**Rev. A**

# DESIGN SPECIFICATION

|                  |                                                 |
|------------------|-------------------------------------------------|
| DESIGN           | INTERNAL ANTENNA                                |
| MODEL / TYPE     | SM-X306B / BT/WiFi 1,2 2.4GHz Planar Inverted F |
| ETHERTRONICS P/N | LT31475                                         |
| SEC CODE         | GH42-07045A                                     |
| CUSTOMER         | SAMSUNG ELECTRONICS CO., LTD.                   |
| SUPPLIER         | KYOCERA AVX COMPONENTS                          |

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



# MSL1

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#### Purpose and Scope

The purpose of this document is to establish a design specification for the antenna DESIGN that Kyocera AVX is developing for the Samsung SM-X306B Tablet. Any changes or additions to this specification can affect schedule and/or cost or the DESIGN and should be negotiated between Kyocera AVX and Samsung before being incorporated into the specification. Upon agreement of this specification, Kyocera AVX will make no changes without the written approval from Samsung. Any changes requested by Samsung will be given to Kyocera AVX with sufficient time to evaluate the cost impact and react as required.

#### 1. 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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**2. ELECTRICAL SPECIFICATION FOR SM-X306B**

**2.1. Frequency Band**

| Mode        | Frequency Band (MHz) |
|-------------|----------------------|
| WiFi 2.4GHz | 2,400MHz~2,485 MHz   |

**2.2. Electrical Characteristics**

**2.2.1. VSWR**

**< Phone mounted typical measurements >**

|                 |                 |                 |
|-----------------|-----------------|-----------------|
| Frequency Range | 2,400 MHz       | 2,485 MHz       |
| V.S.W.R         | $1.6 \pm 0.5:1$ | $2.3 \pm 0.5:1$ |

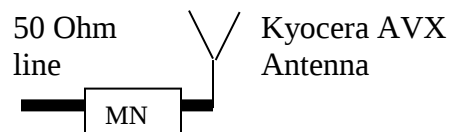
< WiFi 1 2.4GHz Antenna >

|                 |                 |                 |
|-----------------|-----------------|-----------------|
| Frequency Range | 2,400 MHz       | 2,485 MHz       |
| V.S.W.R         | $2.2 \pm 0.5:1$ | $1.5 \pm 0.5:1$ |

< WiFi 2 2.4GHz 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 Phone containing the PCB. The Phone 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 Phone or PCB can affect the performance of the antenna and should be discussed with Kyocera AVX to determine the affect of such changes on the antenna performance and delivery requirements.



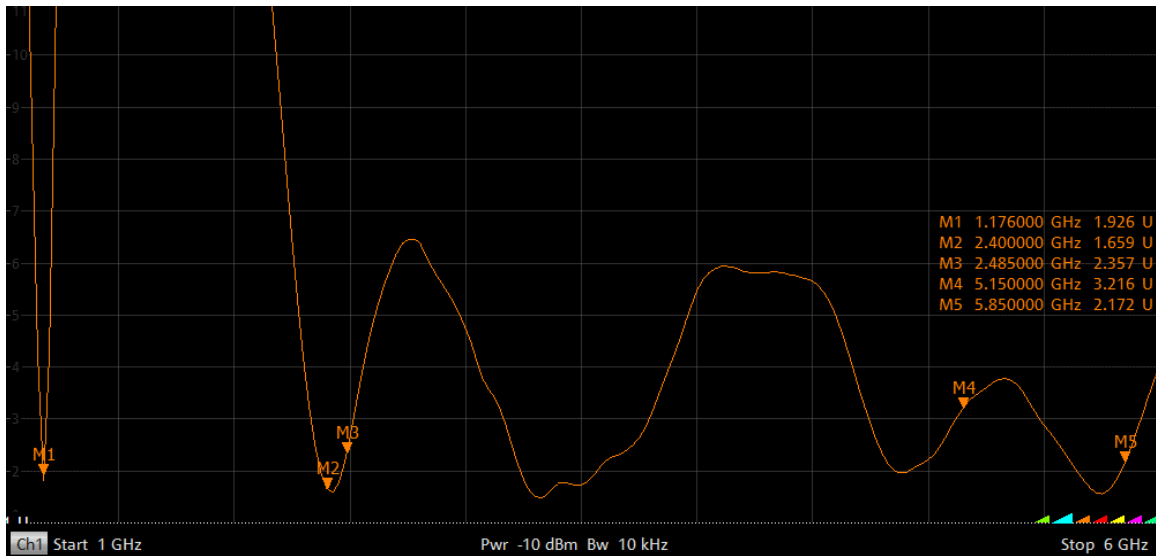
Optional matching network to be  
determined by SAMSUNG RF team if needed.

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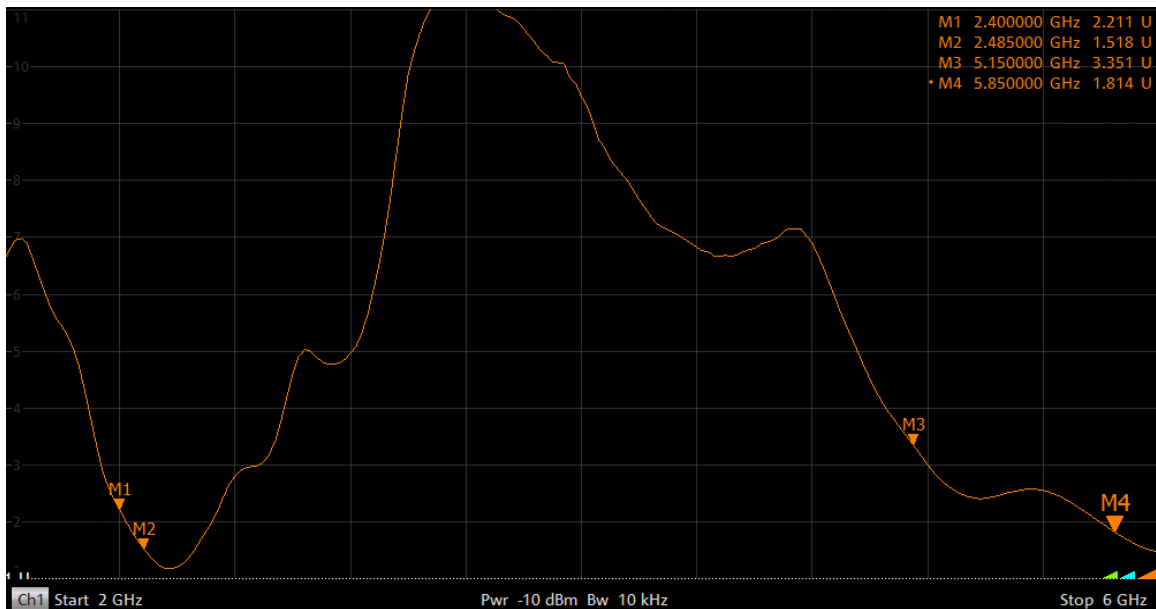
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## 2.3. Passive Measurement

### 2.3.1. Input Return Loss and VSWR



WiFi1 2.4GHz Antenna



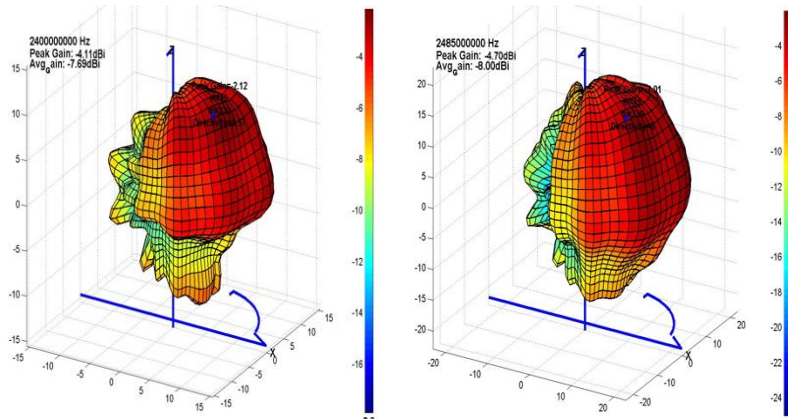
WiFi2 2.4GHz Antenna

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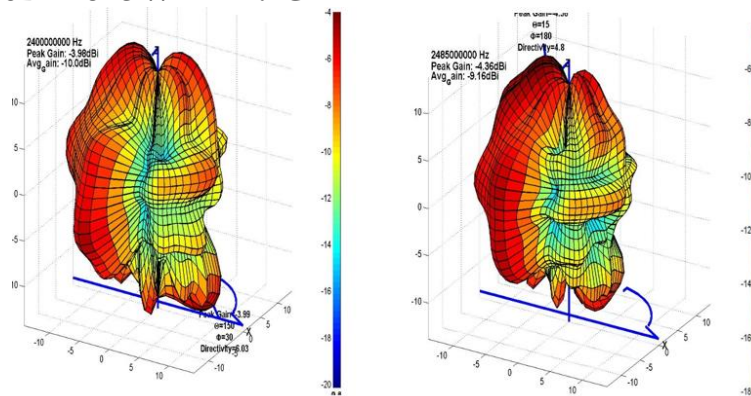
#### 2.4. SM-X306B Phone BT/WiFi 1 2.4GHz INTENNA



<Phone mounted typical measurements>

| Frequency        | Efficiency | Average Gain |          |          | Max Gain |          |          |
|------------------|------------|--------------|----------|----------|----------|----------|----------|
|                  |            | Ver          | Hor      | Total    | Ver      | Hor      | Total    |
| 2,400,000,000 Hz | 17.0 %     | -13.7 dBi    | -8.9 dBi | -7.7 dBi | -5.0 dBi | -8.0 dBi | -4.1 dBi |
| 2,417,000,000 Hz | 17.6 %     | -13.8 dBi    | -8.7 dBi | -7.6 dBi | -4.9 dBi | -7.9 dBi | -4.0 dBi |
| 2,434,000,000 Hz | 17.8 %     | -14.1 dBi    | -8.6 dBi | -7.5 dBi | -4.8 dBi | -7.9 dBi | -4.1 dBi |
| 2,451,000,000 Hz | 17.3 %     | -14.6 dBi    | -8.6 dBi | -7.6 dBi | -5.7 dBi | -8.6 dBi | -4.8 dBi |
| 2,468,000,000 Hz | 17.3 %     | -14.9 dBi    | -8.5 dBi | -7.6 dBi | -6.3 dBi | -9.5 dBi | -5.4 dBi |
| 2,485,000,000 Hz | 15.8 %     | -15.6 dBi    | -8.8 dBi | -8.0 dBi | -8.2 dBi | -6.0 dBi | -4.7 dBi |

#### 2.5. SM-X306B Phone WiFi 2 2.4GHz INTENNA



<Phone mounted typical measurements>

| Frequency        | Efficiency | Average Gain |           |           | Max Gain |          |          |
|------------------|------------|--------------|-----------|-----------|----------|----------|----------|
|                  |            | Ver          | Hor       | Total     | Ver      | Hor      | Total    |
| 2,400,000,000 Hz | 10.0 %     | -12.4 dBi    | -13.7 dBi | -10.0 dBi | -6.5 dBi | -6.0 dBi | -4.0 dBi |
| 2,417,000,000 Hz | 10.0 %     | -12.6 dBi    | -13.5 dBi | -10.0 dBi | -6.4 dBi | -6.5 dBi | -4.8 dBi |
| 2,434,000,000 Hz | 10.8 %     | -12.4 dBi    | -13.0 dBi | -9.7 dBi  | -6.2 dBi | -6.7 dBi | -4.6 dBi |
| 2,451,000,000 Hz | 10.7 %     | -12.6 dBi    | -12.8 dBi | -9.7 dBi  | -6.4 dBi | -7.0 dBi | -4.5 dBi |
| 2,468,000,000 Hz | 11.2 %     | -12.5 dBi    | -12.5 dBi | -9.5 dBi  | -6.4 dBi | -6.9 dBi | -4.5 dBi |
| 2,485,000,000 Hz | 12.1 %     | -12.2 dBi    | -12.1 dBi | -9.2 dBi  | -6.3 dBi | -6.6 dBi | -4.4 dBi |



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### 3. TEST METHOD

#### 3.1. Measurement information

Measurement: KYOCERA AVX Ant Lab  
Equipment: KSS Chamber, E5071B Network Analyzer

**\*KSS Chamber**

The Bluetest Reverberation Test Systems is the ideal choice for developers of wireless devices and components as well as operators wanting to verify their suppliers' wireless devices. Over-The-Air (OTA) measurements reflect the true performance of the device and ensure that the tested product performs as intended once released to the market. The patented design creates a rich and isotropic multipath environment inside the chamber allowing for fast, easy and realistic performance measurements on SISO as well as MIMO devices like LTE and WLAN. The RTS is capable of performing passive measurements like antenna efficiency, diversity and MIMO gain as well as active measurements like TRP, TIS and Throughput (TPUT).

- Chamber Information
- Location : Kyocera-Avx
- Size : 3 x 2.5 x 2.5m
- Frequency : 600MHz to 6000MHz
- Tx Antenna : KSS-HA600 (Double Rigid Horn Antenna)
- KSS 3D Motion Controller

**\* Test Equipment & Software list**

| Part                 | Model Name     | Specification     |                       |
|----------------------|----------------|-------------------|-----------------------|
| Tx Antenna           | KSS-HA600      | 600MHz to 6000MHz |                       |
|                      |                |                   |                       |
| Reference Antenna    | KSS-HA600      | 600MHz to 6000MHz |                       |
|                      |                |                   |                       |
| Network Analyzer     | Agilent E5071B | 300kHz to 8.5GHz  | Cal. Due : 2024.06.04 |
| Measurement Software | KSS-ANT        |                   |                       |

**\* Test Date : 2023-09-25**

**\* Test Person : CSMa / Senior Antenna Engineer / Kyocera AVX Components.**

Signature :

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### 3.2. Return Loss & VSWR Test

The VSWR measurement of antennas assembled into a fully operating SM-X306B Phone is measured on the Network Analyzer. The Phone 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 Phone is positioned on a non-conductive table for free space measurements.

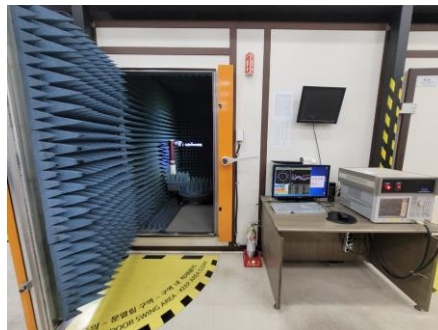


Figure 1: Testing with network analyzer

### 3.3. Return Loss & VSWR Test

Samsung Antenna Lab has a system that can measure VSWR using KSS chamber and E5071B network analyzer. In order to measure the VSWR of each antenna, the lab connects the coaxial cable to the point in contact with the antenna on the main board. The VSWR is measured through the coaxial cable connected in the set. At this time, SM-X306B is assembled in the same state as the user environment.

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### 3.4. Radiation Pattern Test

Antennas tested for Gain and Efficiency must be assembled into the enclosure and tested in the fully assembled and operating SM-X306B Phone. 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.

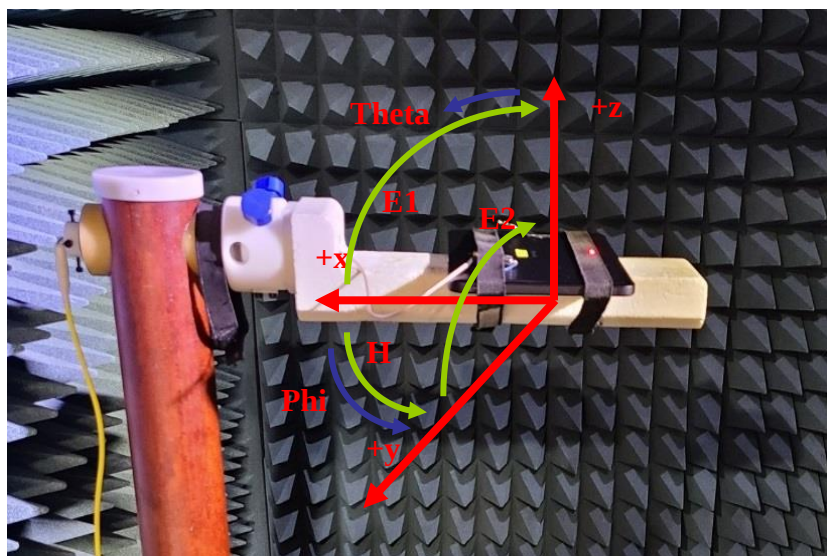


Figure 4: Geometry for SM-X306B for Radiation patterns.

### 3.5. Test Method (Manufacturing)

All measurements are done with SM-X306B fully assembled. Measure in consideration of the customer's usage environment. Use a fully shielded chamber environment to prevent any noise-induced errors. Typically, the electrical properties of the antenna are measured using a jig that can hold the set.