
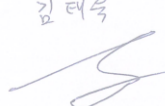





**DESIGN SPECIFICATION**  
**Part Number: : MF20114 (SM-M546B)**  
**Rev. A**

# DESIGN SPECIFICATION

DESIGN	INTERNAL ANTENNA
MODEL / TYPE	SM-M546B / WIFI INTENNA
KYOCERA AVX P/N	MF20114
SEC CODE	
CUSTOMER	SAMSUNG ELECTRONICS CO., LTD.
SUPPLIER	KYOCERA AVX INC.

ENGINEERING MANAGER CHECKED	MECHANICAL MANAGER CHECKED	DESIGN MANAGER CHECKED
 <b>JH Jeong</b>	김태욱  <b>TW Kim</b>	 <b>GC Choi</b>



# MSL1

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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).....	8
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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-M546B wireless Handset. Any changes or additions to this specification can affect schedule and/or cost of 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-M546B**

**2.1. Frequency Band**

Mode	Frequency Band (MHz)
WIFI	2,400~2,485 MHz, 5,150~5,850 MHz

**2.2. Electrical Characteristics**

**2.2.1. VSWR**

< Handset mounted typical measurements >

Frequency Range	2,400 MHz	2,485 MHz	5,150 MHz	5,850 MHz
V.S.W.R	1.57 ± 0.5:1	1.42 ± 0.5:1	1.63 ± 0.5:1	2.43 ± 0.5:1

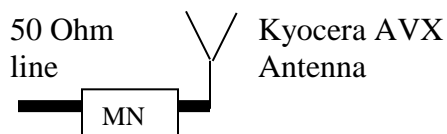
<WiFi1 Antenna>

Frequency Range	2,400 MHz	2,485 MHz	5,150 MHz	5,850 MHz
V.S.W.R	3.18 ± 0.5:1	2.31 ± 0.5:1	3.84 ± 0.5:1	4.08 ± 0.5:1

<WiFi2 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 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.

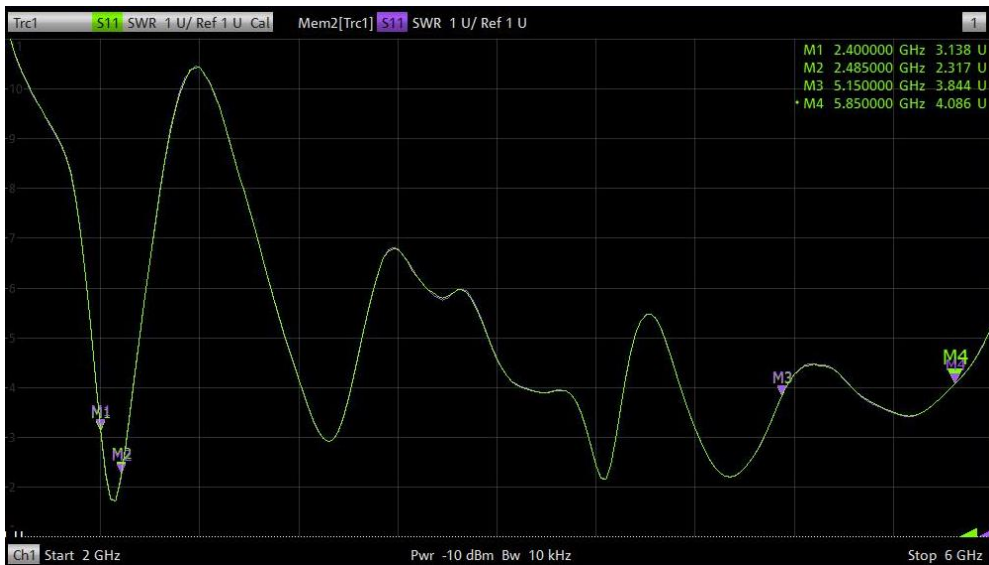
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**2.3. Passive Measurement**

**2.3.1. Input Return Loss and VSWR**



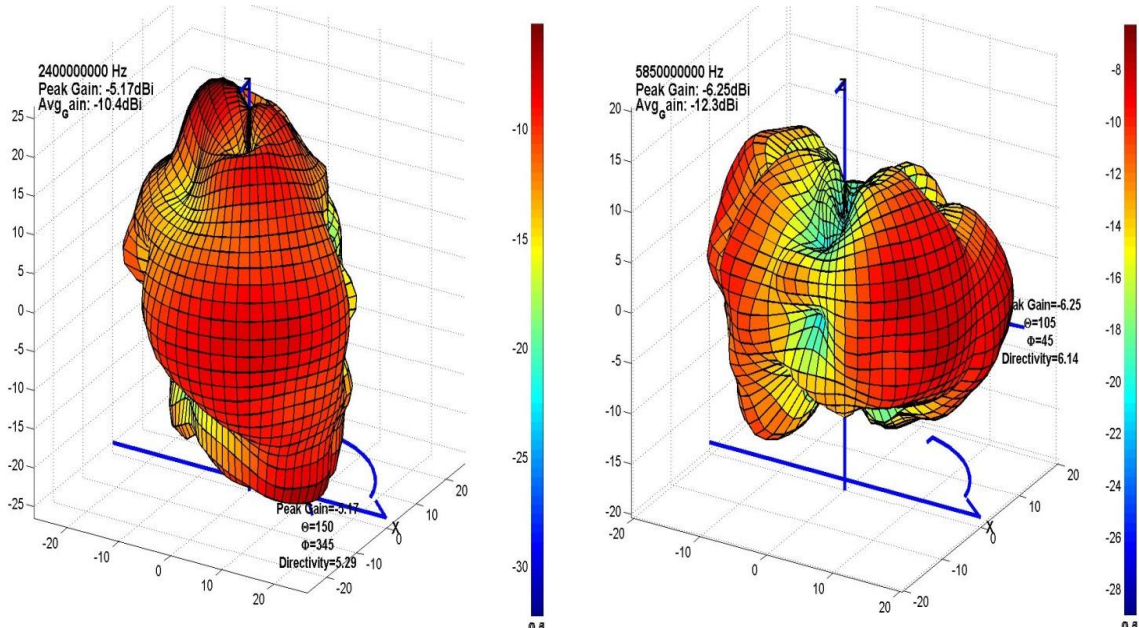
WIFI1 Antenna



WIFI2 Antenna

**DESIGN SPECIFICATION**  
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**2.4. SM-M546B Handset WIFI ANTENNA**

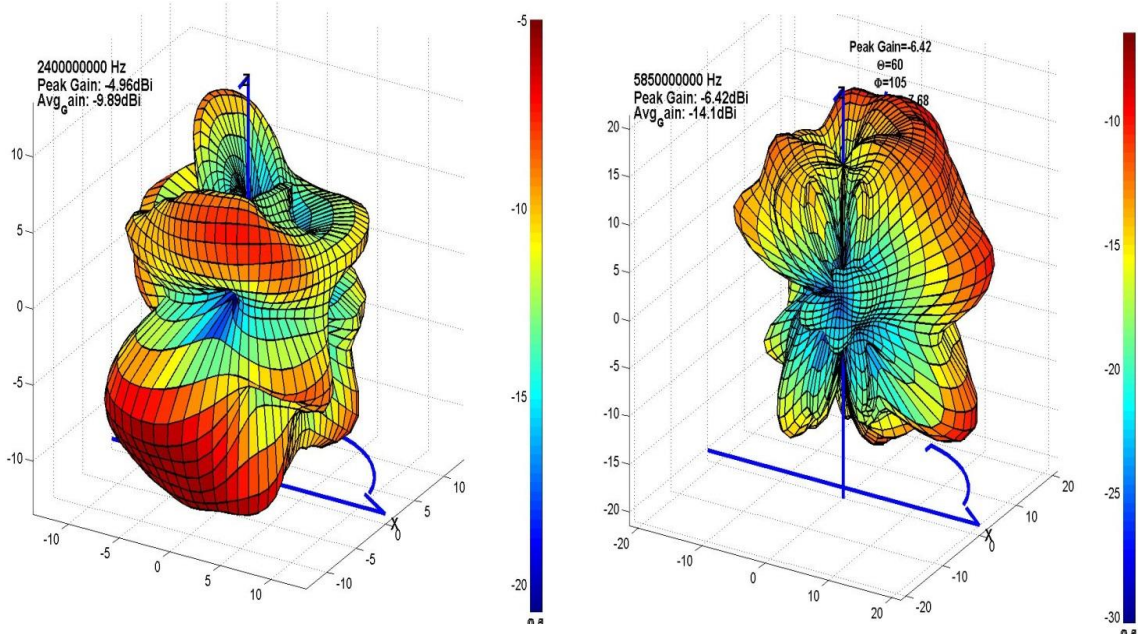


<Handset mounted typical measurements>

Frequency	Efficiency	Average Gain			Max Gain		
		Ver	Hor	Total	Ver	Hor	Total
2,400,000,000 Hz	9.0 %	-12.1 dBi	-15.5 dBi	-10.5 dBi	-6.7 dBi	-6.3 dBi	-5.2 dBi
2,417,000,000 Hz	9.8 %	-11.7 dBi	-15.2 dBi	-10.1 dBi	-6.4 dBi	-6.0 dBi	-4.9 dBi
2,437,000,000 Hz	10.8 %	-11.3 dBi	-14.8 dBi	-9.7 dBi	-6.1 dBi	-5.6 dBi	-4.6 dBi
2,451,000,000 Hz	9.0 %	-12.0 dBi	-15.6 dBi	-10.4 dBi	-6.8 dBi	-6.3 dBi	-5.4 dBi
2,472,000,000 Hz	9.0 %	-12.4 dBi	-14.9 dBi	-10.4 dBi	-6.8 dBi	-7.4 dBi	-5.0 dBi
2,485,000,000 Hz	9.5 %	-11.8 dBi	-15.5 dBi	-10.2 dBi	-6.4 dBi	-6.0 dBi	-5.4 dBi
5,150,000,000 Hz	5.8 %	-14.9 dBi	-15.9 dBi	-12.3 dBi	-8.5 dBi	-8.7 dBi	-6.3 dBi
5,290,000,000 Hz	6.7 %	-14.5 dBi	-15.0 dBi	-11.7 dBi	-7.2 dBi	-10.2 dBi	-5.8 dBi
5,430,000,000 Hz	6.8 %	-14.7 dBi	-14.7 dBi	-11.7 dBi	-8.7 dBi	-8.3 dBi	-5.7 dBi
5,570,000,000 Hz	7.6 %	-13.8 dBi	-14.7 dBi	-11.2 dBi	-7.3 dBi	-7.8 dBi	-5.7 dBi
5,710,000,000 Hz	7.5 %	-13.9 dBi	-14.6 dBi	-11.3 dBi	-6.3 dBi	-9.6 dBi	-5.8 dBi
5,850,000,000 Hz	5.8 %	-16.4 dBi	-14.6 dBi	-12.4 dBi	-11.0 dBi	-7.8 dBi	-6.3 dBi

<WIFI1 Antenna>

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<Handset mounted typical measurements>

Frequency	Efficiency	Average Gain			Max Gain		
		Ver	Hor	Total	Ver	Hor	Total
2,400,000,000 Hz	10.3 %	-12.5 dBi	-13.3 dBi	-9.9 dBi	-5.4 dBi	-7.3 dBi	-5.0 dBi
2,417,000,000 Hz	8.7 %	-13.3 dBi	-14.0 dBi	-10.6 dBi	-6.2 dBi	-6.8 dBi	-5.3 dBi
2,437,000,000 Hz	8.4 %	-13.1 dBi	-14.5 dBi	-10.7 dBi	-6.1 dBi	-8.2 dBi	-4.8 dBi
2,451,000,000 Hz	10.6 %	-13.0 dBi	-12.5 dBi	-9.8 dBi	-6.6 dBi	-6.8 dBi	-5.2 dBi
2,472,000,000 Hz	9.9 %	-13.1 dBi	-13.0 dBi	-10.0 dBi	-5.8 dBi	-7.2 dBi	-5.2 dBi
2,485,000,000 Hz	10.8 %	-11.4 dBi	-14.6 dBi	-9.7 dBi	-6.1 dBi	-8.3 dBi	-5.1 dBi
5,150,000,000 Hz	7.0 %	-13.5 dBi	-15.9 dBi	-11.5 dBi	-7.0 dBi	-10.3 dBi	-6.5 dBi
5,290,000,000 Hz	5.8 %	-15.1 dBi	-15.6 dBi	-12.3 dBi	-8.6 dBi	-8.8 dBi	-6.6 dBi
5,430,000,000 Hz	6.4 %	-14.2 dBi	-15.9 dBi	-12.0 dBi	-6.9 dBi	-9.8 dBi	-5.7 dBi
5,570,000,000 Hz	10.2 %	-11.3 dBi	-15.7 dBi	-9.9 dBi	-6.5 dBi	-7.5 dBi	-5.7 dBi
5,710,000,000 Hz	9.9 %	-11.4 dBi	-15.7 dBi	-10.0 dBi	-6.7 dBi	-7.5 dBi	-5.8 dBi
5,850,000,000 Hz	3.9 %	-17.4 dBi	-16.8 dBi	-14.1 dBi	-9.4 dBi	-8.6 dBi	-6.4 dBi

<WIFI2 Antenna>



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**3. TEST METHOD**

**3.1. Measurement information**

- Measurement: KYOCERA AVX Ant Lab.
- Equipment: KSS Chamber, ZNB 8 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).

**\* Test Equipment list**

Description	Manufacturer	Model	S/N	Cal date
Network Analyzer	R&S	ZNB 8	105816	2022-05-22

\* Test Date: 2022.12.12

**3.2. Return Loss & VSWR Test**

The VSWR measurement of antennas assembled into a fully operating SM-M546B Handset 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.

**Photo #1**

**Testing with network analyzer**





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**3.3. Return Loss & VSWR Test**

Samsung Antenna Lab has a system that can measure VSWR using KSS chamber and ZNB8 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-M546B is assembled in the same state as the user environment.

**Photo #2**



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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-M546B 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.

**Photo #3**

Geometry for SM-M546B for Radiation patterns.



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**3.5. Test Method (Manufacturing)**

All measurements are done with SM-M546B 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.