






DESIGN SPECIFICATION
Part Number: LT31434 (SM-T638U)
Rev. A

DESIGN SPECIFICATION

DESIGN	INTERNAL ANTENNA
MODEL / TYPE	SM-T638U / MAIN1,2 INTENNA
KYOCERA AVX P/N	LT31434
SEC CODE	GH42-06950A
CUSTOMER	SAMSUNG ELECTRONICS CO., LTD.
SUPPLIER	KYOCERA AVX INC.

ENGINEERING MANAGER CHECKED	MECHANICAL MANAGER CHECKED	DESIGN MANAGER CHECKED
 JH Jeong	 JC Kim	 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-T638U 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-T638U

2.1. Frequency Band

Mode	Frequency Band (MHz)
Main1	617~960 MHz, 1,710~2,200 MHz

Mode	Frequency Band (MHz)
Main2	2,300~2,690 MHz, 3,300~4,200 MHz

2.2. Electrical Characteristics

2.2.1. VSWR

< Tablet mounted typical measurements >

Frequency Range	617 MHz	960 MHz	1,710 MHz	2,200 MHz
V.S.W.R	$5.3 \pm 0.5:1$	$5.5 \pm 0.5:1$	$1.2 \pm 0.5:1$	$4.9 \pm 0.5:1$

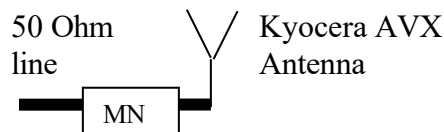
<Main1 Antenna>

Frequency Range	2,300 MHz	2,690 MHz	3,300 MHz	4,200 MHz
V.S.W.R	$1.5 \pm 0.5:1$	$1.6 \pm 0.5:1$	$1.6 \pm 0.5:1$	$1.3 \pm 0.5:1$

<Main2 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 Tablet containing the PCB. The Tablet 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 Tablet 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.



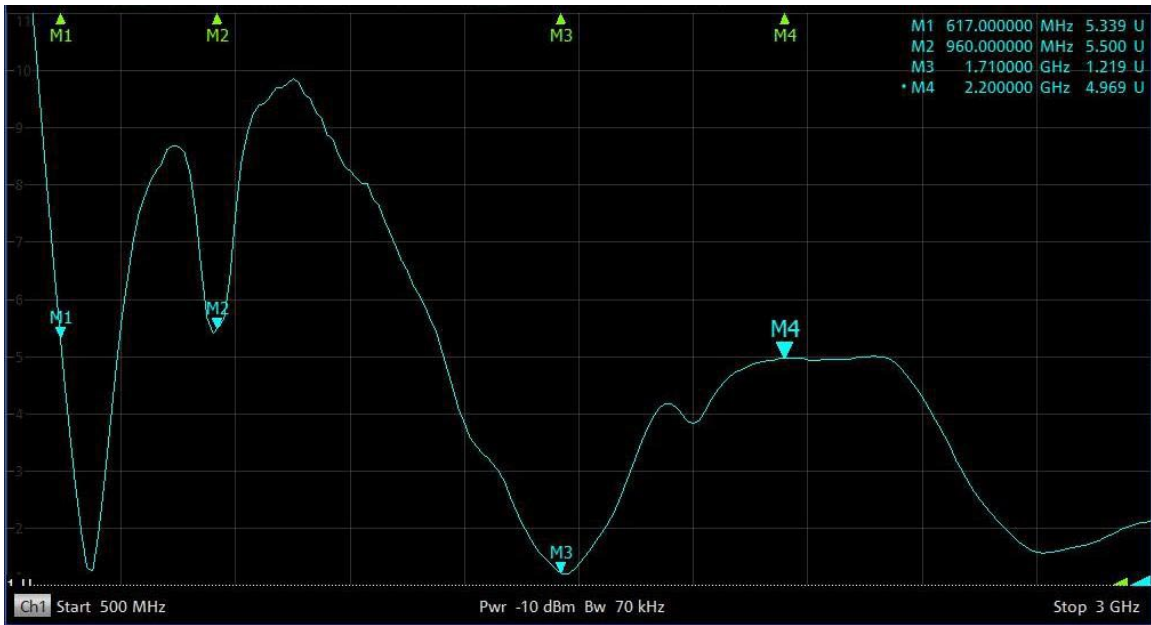
Optional matching network to be
determined by SAMSUNG RF team if needed.



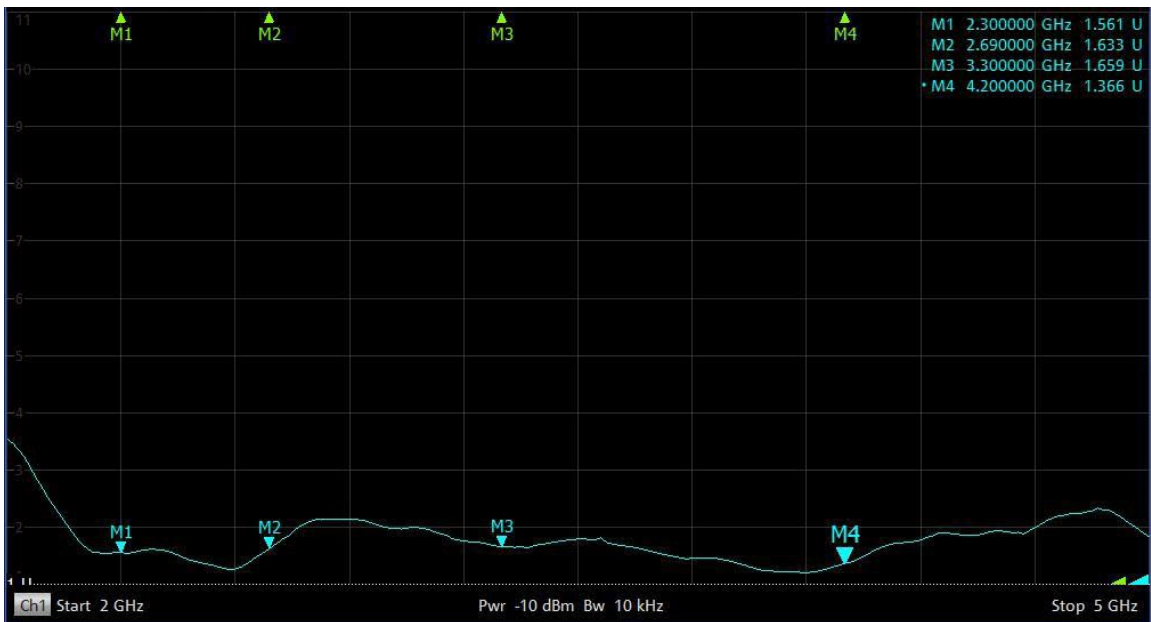
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2.3. Passive Measurement

2.3.1. Input Return Loss and VSWR



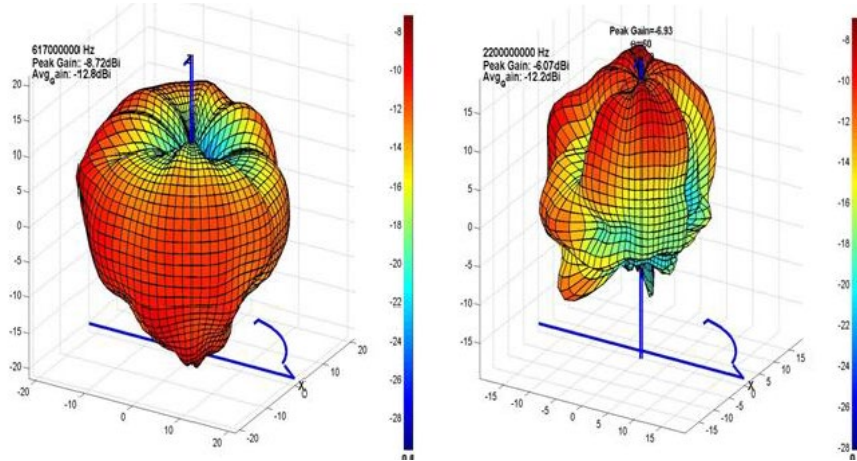
Main1 Antenna



Main2 Antenna

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2.4. SM-T638U Tablet Main1 ANTENNA

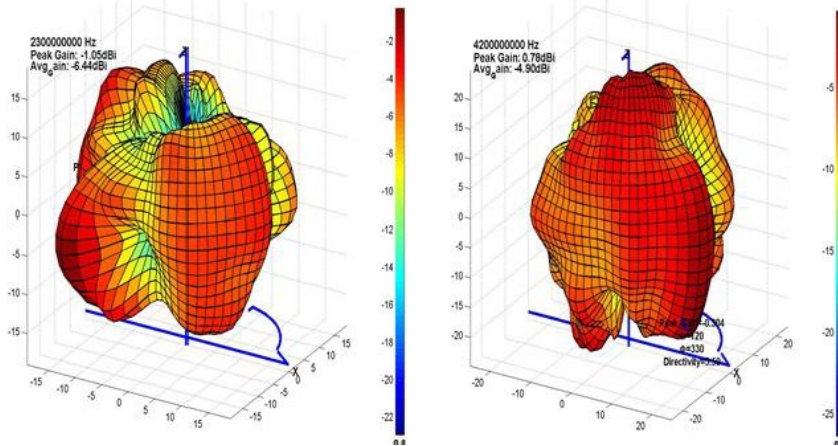


<Tablet mounted typical measurements>

Frequency	Efficiency	Max Gain		
		Ver	Hor	Total
617,000,000 Hz	5.2 %	-11.1 dBi	-10.0 dBi	-8.7 dBi
648,181,818 Hz	7.8 %	-9.4 dBi	-7.5 dBi	-6.7 dBi
679,363,636 Hz	24.2 %	-4.9 dBi	-2.2 dBi	-1.3 dBi
710,545,455 Hz	19.2 %	-5.9 dBi	-3.5 dBi	-2.2 dBi
741,727,273 Hz	29.6 %	-1.9 dBi	-2.5 dBi	-0.8 dBi
772,909,091 Hz	30.0 %	-1.9 dBi	-2.9 dBi	-0.9 dBi
804,090,909 Hz	30.6 %	-1.8 dBi	-1.4 dBi	-0.7 dBi
835,272,727 Hz	41.4 %	-1.0 dBi	-0.9 dBi	1.2 dBi
866,454,545 Hz	32.9 %	-1.5 dBi	-1.7 dBi	0.8 dBi
897,636,364 Hz	26.3 %	-1.8 dBi	-1.4 dBi	-0.2 dBi
928,818,182 Hz	13.5 %	-5.2 dBi	-6.1 dBi	-3.3 dBi
960,000,000 Hz	11.4 %	-8.2 dBi	-6.2 dBi	-5.3 dBi
1,710,000,000 Hz	42.4 %	-0.2 dBi	-0.4 dBi	2.0 dBi
1,754,545,455 Hz	41.5 %	-0.5 dBi	-0.5 dBi	1.6 dBi
1,799,090,909 Hz	39.9 %	-1.1 dBi	-0.7 dBi	1.4 dBi
1,843,636,364 Hz	33.6 %	-1.3 dBi	-1.0 dBi	1.2 dBi
1,888,181,818 Hz	27.7 %	-1.6 dBi	-1.5 dBi	0.9 dBi
1,932,727,273 Hz	20.7 %	-3.1 dBi	-3.0 dBi	-0.4 dBi
1,977,272,727 Hz	12.6 %	-4.8 dBi	-4.8 dBi	-2.8 dBi
2,021,818,182 Hz	11.5 %	-5.3 dBi	-5.0 dBi	-3.3 dBi
2,066,363,636 Hz	12.7 %	-5.4 dBi	-4.3 dBi	-2.9 dBi
2,110,909,091 Hz	10.2 %	-6.6 dBi	-5.2 dBi	-3.7 dBi
2,155,454,545 Hz	8.4 %	-7.5 dBi	-6.0 dBi	-4.5 dBi
2,200,000,000 Hz	6.0 %	-8.9 dBi	-7.4 dBi	-6.0 dBi

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2.1. SM-T638U Tablet Main2 INTENNA



<Tablet mounted typical measurements>

Frequency	Efficiency	Max Gain		
		Ver	Hor	Total
2,300,000,000 Hz	22.7 %	-2.5 dBi	-2.1 dBi	-1.0 dBi
2,335,454,545 Hz	21.5 %	-2.9 dBi	-2.4 dBi	-1.2 dBi
2,370,909,091 Hz	21.6 %	-3.0 dBi	-2.5 dBi	-1.3 dBi
2,406,363,636 Hz	21.3 %	-2.8 dBi	-2.5 dBi	-1.3 dBi
2,441,818,182 Hz	21.2 %	-2.8 dBi	-2.6 dBi	-1.2 dBi
2,477,272,727 Hz	21.5 %	-2.8 dBi	-2.6 dBi	-1.0 dBi
2,512,727,273 Hz	26.1 %	-2.4 dBi	-3.0 dBi	-0.5 dBi
2,548,181,818 Hz	27.7 %	-2.3 dBi	-2.6 dBi	-0.5 dBi
2,583,636,364 Hz	27.9 %	-2.6 dBi	-2.5 dBi	-0.7 dBi
2,619,090,909 Hz	28.8 %	-2.5 dBi	-2.5 dBi	-0.8 dBi
2,654,545,455 Hz	26.6 %	-2.7 dBi	-2.8 dBi	-1.5 dBi
2,690,000,000 Hz	24.9 %	-2.9 dBi	-3.2 dBi	-2.1 dBi
3,300,000,000 Hz	28.6 %	-3.3 dBi	-1.4 dBi	-0.1 dBi
3,381,818,182 Hz	38.1 %	-0.4 dBi	0.4 dBi	1.0 dBi
3,463,636,364 Hz	38.6 %	0.7 dBi	0.9 dBi	1.7 dBi
3,545,454,545 Hz	37.8 %	0.7 dBi	0.8 dBi	1.6 dBi
3,627,272,727 Hz	36.1 %	0.5 dBi	0.5 dBi	1.4 dBi
3,709,090,909 Hz	36.8 %	0.1 dBi	0.4 dBi	1.3 dBi
3,790,909,091 Hz	33.3 %	-0.9 dBi	0.2 dBi	0.8 dBi
3,872,727,273 Hz	32.5 %	-1.1 dBi	0.2 dBi	0.8 dBi
3,954,545,455 Hz	33.4 %	-0.9 dBi	0.4 dBi	1.0 dBi
4,036,363,636 Hz	29.6 %	-2.1 dBi	-0.5 dBi	0.6 dBi
4,118,181,818 Hz	38.5 %	-1.5 dBi	0.8 dBi	1.7 dBi
4,200,000,000 Hz	32.1 %	-1.5 dBi	-1.5 dBi	0.7 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).

* Test Equipment list

Description	Manufacturer	Model	S/N	Cal Due
Network Analyzer	Agilent	E5071B	MY42403245	2021-05-03

3.2. Return Loss & VSWR Test

The VSWR measurement of antennas assembled into a fully operating SM-T638U Tablet is measured on the Network Analyzer. The Tablet 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 Tablet is positioned on a non-conductive table for free space measurements.



Figure 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 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-T638U is assembled in the same state as the user environment.

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-T638U Tablet. 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.

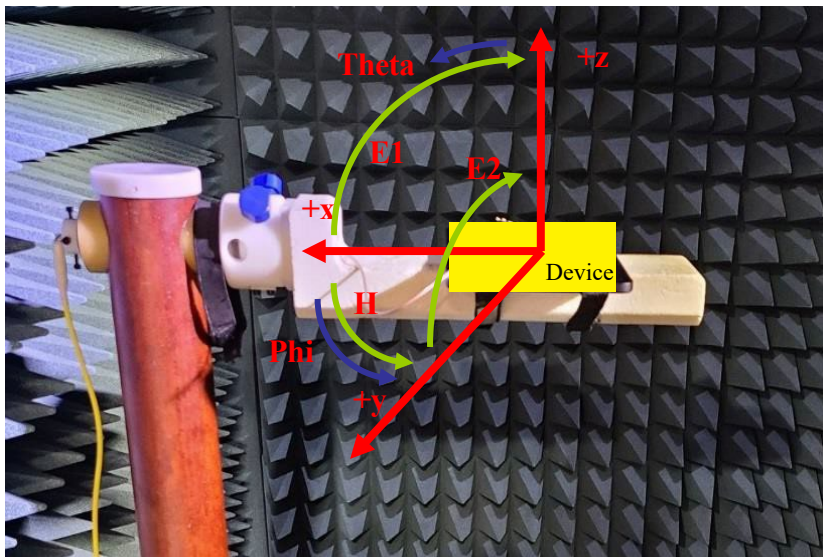


Figure 4: Geometry for SM-T638U for Radiation patterns.

3.5. Test Method (Manufacturing)

All measurements are done with SM-T638U 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.