

## RF EXPOSURE EVALUATION

### Maximal Permissible Exposure [MPE]

**Applicant Name:**

Samsung Electronics Co., Ltd.  
129, Samsung-ro,  
Yeongtong-gu, Suwon-si  
Gyeonggi-do, 16677, Korea

**Date of Testing:**

06/10/2021 - 07/27/2021

**Test Site/Location:**

PCTEST KOREA Lab. Yongin-si, Gyeonggi-do, Korea

**Test Report Serial No.:**

8K21060701-01-R1.A3L

**FCC ID:**

**A3LMT6411-41A**

**APPLICANT:**

**Samsung Electronics Co., Ltd.**

**Application Type:**

Certification

**Model:**

MT6411-41A

**EUT Type:**

MMU(MT6411)

**FCC Classification:**

Licensed Non-Broadcast Station Transmitter (TNB)

**FCC Rule Part(s):**

FCC Part 1 (§1.1310) and Part 2 (§2.1091)

**Test Procedure(s):**

KDB 447498 D01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.



I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



Prepared by






Reviewed by

FCC ID: A3LMT6411-41A	 <b>PCTEST</b> Proud to be part of element	<b>MAXIMUM PERMISSIBLE EXPOSURE REPORT</b>		<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 8K21060701-01-R1.A3L	<b>Test Dates:</b> 06/10/2021-07/27/2021	<b>EUT Type:</b> MMU(MT6411)	Page 1 of 6	

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# 1.0 RF EXPOSURE EVALUATION – MAXIMUM PERMISSIBLE EXPOSURE (MPE)

## 1.1 Introduction

This document is prepared to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC Rules and Regulations.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1. According to FCC §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (Minutes)
(A) Limits For Occupational / Control Exposures (f = frequency)				
30-300	61.4	0.163	1.0	6
300-1500	...	...	f/300	6
1500-100,000	...	...	5.0	6
(B) Limits For General Population / Uncontrolled Exposure (f = frequency)				
30-300	27.5	0.073	0.2	30
300-1500	...	...	f/1500	30
1500-100,000	...	...	1.0	30

**Table 1-1. Limits for Maximum Permissible Exposure (MPE)**

## 1.2 EUT Description

The Equipment Under Test (EUT) is the **Samsung MMU(MT6411) FCC ID: A3LMT6411-41A**.



The EUT supports the maximum 3 carriers operation of 20 MHz + 20 MHz + 20 MHz at 100 Watts per unit in contiguous spectrum in the LTE mode of Single RAT operation in the frequency range of B41: 2496 to 2690 MHz

The EUT supports the single carrier operations of 80 MHz at 200 Watts per unit, 100 MHz at 200 Watts per unit in contiguous spectrum in the 5G-NR mode of Single RAT operation in the frequency range of n41: 2496 to 2690 MHz.

The EUT supports of the maximum 4 carriers operation of 20 MHz + 20 MHz + 20 MHz in the LTE mode and 80 MHz or 100 MHz in the 5G-NR mode of multi-RAT operation in the frequency range of B41/n41: 2496 to 2690 MHz.

It supports the following modulation schemes: QPSK, 16QAM, 64QAM and 256QAM.

The EUT operates from a -48V DC power supply.

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### 1.3 MPE Requirements Overview

Three different categories of transmitters are defined by the FCC KDB 447498 D01. These categories are fixed installation, mobile and portable and are defined as follows:



- **Fixed Installations:** fixed location means that the device, including its antenna, is physically secured at a permanent location and is not able to be easily moved to another location. Additionally, distance to humans from the antenna is maintained to at least 2 meters.
- **Mobile Devices:** a mobile device is defined as a transmitting designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located, such as a wireless modem operating in a laptop computer, are considered mobile devices if they meet the 20 centimeter separation requirement. The FCC rules for evaluating mobile devices for RF compliance are found in 46 CFR §2.1091.
- **Portable Devices:** a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. Portable device requirements are found in Section 2.1093 of the FCC's Rules (47 CFR §2.1093).

The FCC also categorizes the use of the device as based upon the user's awareness and ability to exercise control over his or her exposure. The two categories defined are Occupational/ Controlled Exposure and General Population/Uncontrolled Exposure. These two categories are defined as follows:

- **Occupational/Controlled Exposure:** In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.
- **General Population/Uncontrolled Exposure:** The general population / uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

The **Samsung Electronics Co., Ltd. FCC ID: A3LMT6411-41A** is professionally installed on poles or walls in fixed locations.

The device is a fixed mounted base station and MPE is evaluated to the Occupational/Controlled Exposure limits per 1.1310.

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## 1.4 Procedure

The procedure used to determine the RF power density was based upon a calculation for determining compliance with the MPE requirements.

The power generated by each operating mode used in this product was initially measured with a spectrum analyzer and powers were recored. Through use of the Friis transmission formula and knowledge of the maximum antenna gain to be used, the power density level is calculated for the safe distance which must be maintained during installation based on maximum power and antenna gain.

### Friis Transmission Formula

Friis transmission formula:  $P_d = (P_{out} * G) / (4\pi r^2)$

Where,

$P_d$  = Power Density (mW/cm<sup>2</sup>)

$\pi$  = 3.1416

$P_{out}$  = output power to antenna (mW)

$r$  = distance between observation point and center of the radiator (cm)

$G$  = gain of antenna in linear scale

### Calculated MPE

The power density limit for General Population/Uncontrolled Exposure at each frequency is determined based on the information in Table 1-1.

The highest MIMO EIRP from the DUT was 82.98dBm generated from Multi-RAT LTE 3C\_20M+20M+20M & NR 1C\_80M configuration.

<b>Frequency</b>	2690 MHz	
<b>Limit</b>	5.000 mW/cm <sup>2</sup>	
<b>Distance (cm), R =</b>	2000 cm	
<b>EIRP (dBm), PG =</b>	82.11 dBm	162554875.58 mW
<b>Power Density (S) =</b>	3.234 mW/cm <sup>2</sup>	
<b>Minimum Distance =</b>	1608.5 cm	



Table 1-2. Calculated MPE Data

## 1.5 Summary of Results

Mode of Operation	Minimum Safe Distance @ 5.0 mW/cm <sup>2</sup> [cm]
Multi-RAT LTE 3C_20M+20M+20M & NR 1C_80M configuration	1608.5




Table 1-3. Maximum Permissible Exposure Summary Table

Note: A minimum safe distance 16.085 m for MPE compliance with FCC Limit.

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## 2.0 CONCLUSION

The device meets the MPE Compliance requirements as specified in §2.1091 of the FCC Rules and Regulations with minimum safe distance of 16.085 m for operation. An appropriate RF exposure compliance statement will be placed in the user's manual.

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