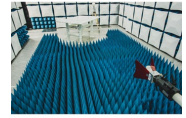




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## RF EXPOSURE EVALUATION Maximal Permissible Exposure [MPE]

**Applicant Name:**  
Samsung Electronics Co., Ltd.  
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**Date of Testing:**  
12/2/2019-12/13/2019  
**Test Site/Location:**  
PCTEST Lab. Columbia, MD  
**Test Report Serial No.:**  
8K19110701-02.A3L

<b>FCC ID:</b>	<b>A3LRT4401-48A</b>
<b>APPLICANT:</b>	<b>Samsung Electronics Co., Ltd.</b>

<b>EUT Type:</b>	Certification
<b>Model:</b>	RT4401-48A
<b>FCC Classification:</b>	Citizens Band Category B Devices (CBD)
<b>FCC Rule Part:</b>	FCC Part 1 (§1.1310)
<b>Test Procedure(s):</b>	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 FCC KDB 447498 D01. 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.

Randy Ortanez  
President





<b>FCC ID:</b> A3LRT4401-48A		<b>MAXIMUM PERMISSIBLE EXPOSURE REPORT</b>		<b>Approved by:</b> Quality Manager
<b>Test Report S/N:</b> 8K19110701-02.A3L	<b>Test Dates:</b> 12/2/2019-12/13/2019	<b>EUT Type:</b> RRU(RT4401)	Page 1 of 7	

## TABLE OF CONTENTS

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1.0	RF EXPOSURE EVALUATION – MAXIMUM PERMISSIBLE EXPOSURE (MPE) .....	3
1.1	Introduction .....	3
1.2	EUT Description.....	3
1.3	MPE Requirements Overview.....	4
1.4	Procedure .....	5
1.5	Summary of Results.....	6
2.0	CONCLUSION .....	7

<b>FCC ID:</b> A3LRT4401-48A		<b>MAXIMUM PERMISSIBLE EXPOSURE REPORT</b>		<b>Approved by:</b> Quality Manager
<b>Test Report S/N:</b> 8K19110701-02.A3L	<b>Test Dates:</b> 12/2/2019-12/13/2019	<b>EUT Type:</b> RRU(RT4401)		Page 2 of 7

# 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 **Samsung CBSD FCC ID: A3LRT4401-48A** is a 4-port device which supports single, two, three and four carrier configurations (1CC, 2CC, 3CC, and 4CC). Each carrier operates using 5, 10, 15 or 20MHz bandwidth. It supports the following modulation schemes: QPSK, 16-QAM, 64-QAM and 256-QAM.

The EUT can operate with following modes:

1. Common Beam Operation:

This mode uses weighted beam forming technique. The transmit power per port is governed by a weighting factor.



<b>FCC ID:</b> A3LRT4401-48A		<b>MAXIMUM PERMISSIBLE EXPOSURE REPORT</b>		<b>Approved by:</b> Quality Manager
<b>Test Report S/N:</b> 8K19110701-02.A3L	<b>Test Dates:</b> 12/2/2019-12/13/2019	<b>EUT Type:</b> RRU(RT4401)	Page 3 of 7	

### 1.3 MPE Requirements Overview

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 CBSD FCC ID: A3LRT4401-48A** is a fixed mounted base station and MPE is evaluated to the General Population/Uncontrolled Exposure limits per 1.1310.

FCC ID: A3LRT4401-48A		<b>MAXIMUM PERMISSIBLE EXPOSURE REPORT</b>		Approved by: Quality Manager
Test Report S/N: <b>8K19110701-02.A3L</b>	Test Dates: 12/2/2019-12/13/2019	EUT Type: RRU(RT4401)		Page 4 of 7

## 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 the powers were recorded. 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.

There is no co-location between the electric fields of any two transmitters therefore following power densities are calculated for the safe distance which must be maintained during installation based on maximum power and antenna gain.

The highest MIMO EIRP from the DUT was 45.71dBm generated from a 4CC 70MHz total band width channel, where each carrier was 15 + 15 + 20 + 20MHz wide.

<b>Frequency</b>	3625 MHz		
<b>Limit</b>	1.000 mW/cm <sup>2</sup>		
<b>Distance (cm), R =</b>	80 cm		
<b>EIRP (dBm), P =</b>	45.71 dBm	37239.17 mW	
<b>Power Density (S) =</b>	0.463 mW/cm <sup>2</sup>	(at 80cm)	
<b>Minimum Distance =</b>	54.4 cm		

**Table 1-2. Calculated MPE Data for Common Mode**



FCC ID: A3LRT4401-48A		<b>MAXIMUM PERMISSIBLE EXPOSURE REPORT</b>		Approved by: Quality Manager
Test Report S/N: <b>8K19110701-02.A3L</b>	Test Dates: 12/2/2019-12/13/2019	EUT Type: RRU(RT4401)		Page 5 of 7

## 1.5 Summary of Results

Mode of Operation	Power Density @ 80 cms [mW/cm <sup>2</sup> ]	Maximum Antenna Gain [dBi]	Minimum Safe Distance @ 1.0 mW/cm <sup>2</sup> [cm]
Common mode	0.463	8.5	54.4



**Table 1-3. Maximum Permissible Exposure Summary Table**

Note: The Common mode is the worst case highest power density at 0.463m. Hence, this mode determines the minimum safe distance. A minimum safe distance 54.4cm for MPE compliance with FCC Limit.

FCC ID: A3LRT4401-48A		<b>MAXIMUM PERMISSIBLE EXPOSURE REPORT</b>		Approved by: Quality Manager
Test Report S/N: <b>8K19110701-02.A3L</b>	Test Dates: 12/2/2019-12/13/2019	EUT Type: RRU(RT4401)	Page 6 of 7	

## 2.0 CONCLUSION

The device meets the MPE Compliance requirements of the FCC Rules and Regulations with minimum safe distance of 54.4cm for operation. An appropriate RF exposure compliance statement will be declared by manufacturer and the recommended distance is 80.0cm in the user's manual.

FCC ID: A3LRT4401-48A		<b>MAXIMUM PERMISSIBLE EXPOSURE REPORT</b>		Approved by: Quality Manager
Test Report S/N: <b>8K19110701-02.A3L</b>	Test Dates: 12/2/2019-12/13/2019	EUT Type: RRU(RT4401)		Page 7 of 7