



## RF EXPOSURE EVALUATION

### Maximal Permissible Exposure [MPE]

**Applicant Name:**

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**Date of Testing:**

02/18/2020- 03/06/202

**Test Site/Location:**

PCTEST Lab. Columbia, MD, USA

**Test Report Serial No.:**

8K20012202-03.A3L

**FCC ID:**

**A3LAT1K02-A10**

**APPLICANT:**

**Samsung Electronics Co., Ltd.**

**EUT Type:**

5G Access Unit

**Model:**

AT1K02-A10

**FCC Classification:**

Part 30 Fixed Transmitter (5GB)

**FCC Rule Part:**

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 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> A3LAT1K02-A10                 |  | <b>MAXIMUM PERMISSIBLE EXPOSURE<br/>REPORT</b> |  | <b>Approved by:</b><br>Quality Manager |
| <b>Test Report S/N:</b><br>8K20012202-03.A3L | <b>Test Dates:</b><br>02/18/2020-03/06/2020                                         | <b>EUT Type:</b><br>5G Access Unit             |                                                                                       | Page 1 of 7                            |

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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 **Samsung 5G Access Unit FCC ID: A3LAT1K02-A10** is a device supporting mmWave (5G) operations. The EUT operates as 4X4 MIMO system that consists of four antenna arrays (denoted herein as “Antenna A”, “Antenna B”, “Antenna C” and “Antenna D”). Each of the four antenna arrays has 256 antenna elements for a total of 1024 antenna elements. Of the 4 antenna arrays, Antenna A and Antenna C have the same polarization and Antenna B and Antenna D have the same polarization. Beamforming is used with Antenna A and Antenna C and it is also used with Antenna B and Antenna D. Signal correlation is possible between the outputs of all four antenna arrays. The worst case EIRP’s were found adding the co-polarized antennas together.

| Bandwidth | Antenna | CCs active | Max EIRP [dBm] |
|-----------|---------|------------|----------------|
| 50 MHz    | A+C     | 1CC        | 49.32          |
|           |         | 8CC        | 56.24          |
|           | B+D     | 1CC        | 50.04          |
|           |         | 8CC        | 56.60          |
| 100 MHz   | A+C     | 1CC        | 52.93          |
|           |         | 8CC        | 56.78          |
|           | B+D     | 1CC        | 52.99          |
|           |         | 8CC        | 57.03          |

**Table 1-2. Maximum EIRP Summary**

|                                       |                                                                                                                                  |                                        |                                                                                       |                                 |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LAT1K02-A10                 |  <b>PCTEST</b><br>Proud to be part of element | MAXIMUM PERMISSIBLE EXPOSURE<br>REPORT |  | Approved by:<br>Quality Manager |
| Test Report S/N:<br>8K20012202-03.A3L | Test Dates:<br>02/18/2020-03/06/2020                                                                                             | EUT Type:<br>5G Access Unit            |                                                                                       | Page 3 of 7                     |

### 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 5G Access Unit FCC ID: A3LAT1K02-A10** is a professionally installed, fixed installation 5G base station and is considered a device to be used by the General Population/Uncontrolled Exposure.

|                                       |                                                                                                                    |                                        |                                                                                       |                                 |
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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 the mmWave transmitter used in this product was measured in a radiated setup. The EIRP of the mmWave transmitter was calculated through use of the formula: EIRP (dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance in meters.

Through use of the Friis transmission formula, measurement of the maximum EIRP, and knowledge of the operational duty cycle, the minimum safe distance is calculated for MPE (power density) of 1 mW/cm<sup>2</sup>.

### 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>)

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

G = gain of antenna in linear scale

$\pi$  = 3.1416

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

### Calculated MPE

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

|                       |                          |              |  |
|-----------------------|--------------------------|--------------|--|
| Frequency             | 38499.96 MHz             |              |  |
| Power Density (S) =   | 1.000 mW/cm <sup>2</sup> |              |  |
| Average EIRP, PGavg = | 56.24 dBm                | 420726.63 mW |  |
| Minimum Distance, R = | 183.0 cm                 |              |  |

Table 1-2. Calculated MPE Data for 5G mmWave (50M Bandwidth, Ant A + Ant C)

|                       |                          |              |  |
|-----------------------|--------------------------|--------------|--|
| Frequency             | 38499.96 MHz             |              |  |
| Power Density (S) =   | 1.000 mW/cm <sup>2</sup> |              |  |
| Average EIRP, PGavg = | 56.60 dBm                | 457088.19 mW |  |
| Minimum Distance, R = | 190.7 cm                 |              |  |

Table 1-3. Calculated MPE Data for 5G mmWave (50M Bandwidth, Ant B + Ant D)

|                       |                          |              |  |
|-----------------------|--------------------------|--------------|--|
| Frequency             | 38499.96 MHz             |              |  |
| Power Density (S) =   | 1.000 mW/cm <sup>2</sup> |              |  |
| Average EIRP, PGavg = | 56.78 dBm                | 476430.99 mW |  |
| Minimum Distance, R = | 194.7 cm                 |              |  |

Table 1-4. Calculated MPE Data for 5G mmWave (100M Bandwidth, Ant A + Ant C)

|                                       |                                                                                                                            |                                        |                                                                                       |                                 |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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|                              |                          |              |  |
|------------------------------|--------------------------|--------------|--|
| <b>Frequency</b>             | 38499.96 MHz             |              |  |
| <b>Power Density (S) =</b>   | 1.000 mW/cm <sup>2</sup> |              |  |
| <b>Average EIRP, PGavg =</b> | 57.03 dBm                | 504661.30 mW |  |
| <b>Minimum Distance, R =</b> | 200.4 cm                 |              |  |

**Table 1-5. Calculated MPE Data for 5G mmWave (100M Bandwidth, Ant B + Ant D)**

## 1.5 Summary of Results

| Frequency Band [MHz] | Bandwidth [MHz] | Antenna       | Maximum EIRP [dBm] | Minimum Safe Distance @ 1.0 mW/cm <sup>2</sup> [cm] |
|----------------------|-----------------|---------------|--------------------|-----------------------------------------------------|
| 37000-40000          | 50              | Ant A + Ant C | 56.24              | 183.0                                               |
| 37000-40000          | 50              | Ant B + Ant D | 56.60              | 190.7                                               |
| 37000-40000          | 100             | Ant A + Ant C | 56.78              | 194.7                                               |
| 37000-40000          | 100             | Ant B + Ant D | 57.03              | 200.4                                               |

**Table 1-6. Maximum Permissible Exposure Summary Table**

|                                              |                                                                                                                                   |                                                |                                                                                       |                                        |
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## 2.0 CONCLUSION

The device meets the MPE Compliance requirements of the FCC Rules and Regulations with minimum safe distance of 2.004 m for operation. An appropriate RF exposure compliance statement will be placed in the user's manual.

|                                              |                                                                                                                                   |                                                |                                                                                       |                                        |
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