

# FCC MPE REPORT

## FCC Certification

**Applicant Name:**

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**Date of Issue:**

November 28, 2017

**Location:**

HCT CO., LTD.,

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**Report No.:** HCT-R-1711-E001-4

**FCC ID:**

**A3LSOL230-48D**

**APPLICANT:**

**SAMSUNG Electronics Co., Ltd.**

**Model(s):**

SOL230-48D

**EUT Type:**

Small cell (SOL230)

The measurements shown in this report were made in accordance with the procedures specified in §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S.C. 853(a)



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## Report Revision

| TEST REPORT NO.   | DATE              | DESCRIPTION                                                                                   |
|-------------------|-------------------|-----------------------------------------------------------------------------------------------|
| HCT-R-1711-E001   | November 09, 2017 | - First Approval Report                                                                       |
| HCT-R-1711-E001-1 | November 13, 2017 | - Revised the typo (Max. Peak -> Max. Average)<br>- Added the CBRS(2Tx *1Carrier) – AB and CD |
| HCT-R-1711-E001-2 | November 15, 2017 | - Revised output power of the WLAN 2.4 MIMO operation                                         |
| HCT-R-1711-E001-3 | November 23, 2017 | - Revised output power of the CBRS operations                                                 |
| HCT-R-1711-E001-4 | November 28, 2017 | - Revised power density of the CBRS(2Tx *1Carrier) – CD /<br>20 MHz BW.                       |

# Result of Test

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# RF Exposure Statement

## 1. LIMITS

According to §1.1310 and §2.1091 RF exposure is calculated.

### (B) Limits for General Population/Uncontrolled Exposures

| Frequency range<br>(MHz) | Electric field<br>Strength (V/m) | Magnetic field<br>Strength (A/m) | Power density<br>(mW/cm <sup>2</sup> ) | Averaging time<br>(minutes) |
|--------------------------|----------------------------------|----------------------------------|----------------------------------------|-----------------------------|
| 0.3 - 1.34.....          | 614                              | 1.63                             | *(100)                                 | 30                          |
| 1.34 - 30.....           | 824/f                            | 2.19/f                           | *(180/ f <sup>2</sup> )                | 30                          |
| 30 - 300.....            | 27.5                             | 0.073                            | 0.2                                    | 30                          |
| 300 - 1500.....          | .....                            | .....                            | f/1500                                 | 30                          |
| 1500 - 100.000.....      | .....                            | .....                            | 1.0                                    | 30                          |

F = frequency in MHz

\* = Plane-wave equivalent power density

## 2. MAXIMUM PERMISSIBLE EXPOSURE Prediction

Prediction of MPE limit at a given distance

$$S = PG/4\pi R^2$$

S = Power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

### 3. RESULTS

#### Omni Antenna (WLAN 4TX, CBRS 2TX)

| WLAN 2.4 MIMO                                               |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 26.50     | dBm                |
| Max. Average output Power at antenna input terminal         | 446.68    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 2412–2462 | MHz                |
| Antenna Gain(typical)                                       | 9.40      | dBi                |
| Antenna Gain(numeric)                                       | 8.71      | –                  |
| EIRP                                                        | 3.89      | W                  |
| Power density at prediction frequency (S)                   | 0.03      | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| WLAN 5G MIMO (UNII1)                                        |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 23.00     | dBm                |
| Max. Average output Power at antenna input terminal         | 199.53    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 5180–5240 | MHz                |
| Antenna Gain(typical)                                       | 7.13      | dBi                |
| Antenna Gain(numeric)                                       | 5.16      | –                  |
| EIRP                                                        | 1.03      | W                  |
| Power density at prediction frequency (S)                   | 0.00820   | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| WLAN 5G MIMO (UNII 2A)                                      |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 23.00     | dBm                |
| Max Average output Power at antenna input terminal          | 199.53    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 5260–5320 | MHz                |
| Antenna Gain(typical)                                       | 7.43      | dBi                |
| Antenna Gain(numeric)                                       | 5.53      | –                  |
| EIRP                                                        | 1.10      | W                  |
| Power density at prediction frequency (S)                   | 0.00879   | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| WLAN 5G MIMO (UNII 2C)                                      |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 23.00     | dBm                |
| Max. Average output Power at antenna input terminal         | 199.53    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 5500–5720 | MHz                |
| Antenna Gain(typical)                                       | 7.14      | dBi                |
| Antenna Gain(numeric)                                       | 5.18      | –                  |
| EIRP                                                        | 1.03      | W                  |
| Power density at prediction frequency (S)                   | 0.00822   | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| WLAN 5G MIMO (UNII 3)                                       |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 23.50     | dBm                |
| Max. Average output Power at antenna input terminal         | 223.87    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 5745–5825 | MHz                |
| Antenna Gain(typical)                                       | 8.57      | dBi                |
| Antenna Gain(numeric)                                       | 7.19      | –                  |
| EIRP                                                        | 1.61      | W                  |
| Power density at prediction frequency (S)                   | 0.01282   | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| CBRS(2Tx *1Carrier) – AB / 20 MHz BW                        |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 33.01     | dBm                |
| Max. Average output Power at antenna input terminal         | 1999.86   | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 3550–3700 | MHz                |
| Antenna Gain(typical)                                       | 6.01      | dBi                |
| Antenna Gain(numeric)                                       | 3.99      | –                  |
| EIRP                                                        | 7.98      | W                  |
| Power density at prediction frequency (S)                   | 0.06      | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| CBRS(2Tx *1Carrier) – CD / 20 MHz BW                        |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 33.01     | dBm                |
| Max. Average output Power at antenna input terminal         | 1999.86   | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 3550–3700 | MHz                |
| Antenna Gain(typical)                                       | 6.01      | dBi                |
| Antenna Gain(numeric)                                       | 3.99      | –                  |
| EIRP                                                        | 7.98      | W                  |
| Power density at prediction frequency (S)                   | 0.06      | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

### Simultaneous transmission operations

1. The power density level at 100 cm is **0.1708 mW/cm<sup>2</sup>**, which is below the uncontrolled exposure limit of **1.0 mW/cm<sup>2</sup>** at **WLAN(2.4 GHz) and WLAN(5GHz) and CBRS summation**.

### Directional Antenna (WLAN 4TX, CBRS 2TX)

| WLAN 2.4 MIMO                                               |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 23.00     | dBm                |
| Max. Average output Power at antenna input terminal         | 199.53    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 2412–2462 | MHz                |
| Antenna Gain(typical)                                       | 10.11     | dBi                |
| Antenna Gain(numeric)                                       | 10.26     | –                  |
| EIRP                                                        | 2.05      | W                  |
| Power density at prediction frequency (S)                   | 0.02      | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| WLAN 5G MIMO (UNII 1)                                       |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 23.00     | dBm                |
| Max. Average output Power at antenna input terminal         | 199.53    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 5180–5240 | MHz                |
| Antenna Gain(typical)                                       | 9.06      | dBi                |
| Antenna Gain(numeric)                                       | 8.05      | –                  |
| EIRP                                                        | 1.61      | W                  |
| Power density at prediction frequency (S)                   | 0.01279   | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| WLAN 5G MIMO (UNII 2A)                                      |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 21.50     | dBm                |
| Max. Average output Power at antenna input terminal         | 141.25    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 5260–5320 | MHz                |
| Antenna Gain(typical)                                       | 9.43      | dBi                |
| Antenna Gain(numeric)                                       | 8.77      | –                  |
| EIRP                                                        | 1.24      | W                  |
| Power density at prediction frequency (S)                   | 0.00986   | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| WLAN 5G MIMO (UNII 2C)                                      |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 22.00     | dBm                |
| Max. Average output Power at antenna input terminal         | 158.49    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 5500–5720 | MHz                |
| Antenna Gain(typical)                                       | 9.20      | dBi                |
| Antenna Gain(numeric)                                       | 8.32      | –                  |
| EIRP                                                        | 1.32      | W                  |
| Power density at prediction frequency (S)                   | 0.01049   | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| WLAN 5G MIMO (UNII3)                                        |           |                    |
|-------------------------------------------------------------|-----------|--------------------|
| Max. Average output Power at antenna input terminal         | 23.00     | dBm                |
| Max. Average output Power at antenna input terminal         | 199.53    | mW                 |
| Prediction distance                                         | 100.00    | cm                 |
| Prediction frequency                                        | 5745–5825 | MHz                |
| Antenna Gain(typical)                                       | 9.93      | dBi                |
| Antenna Gain(numeric)                                       | 9.84      | –                  |
| EIRP                                                        | 1.96      | W                  |
| Power density at prediction frequency (S)                   | 0.01562   | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00      | mW/cm <sup>2</sup> |

| CBRS(2Tx *1Carrier) – AB / 20 MHz BW                        |         |                    |
|-------------------------------------------------------------|---------|--------------------|
| Max. Average output Power at antenna input terminal         | 29.51   | dBm                |
| Max. Average output Power at antenna input terminal         | 893.31  | mW                 |
| Prediction distance                                         | 100.00  | cm                 |
| Prediction frequency                                        | 3600.00 | MHz                |
| Antenna Gain(typical)                                       | 10.01   | dBi                |
| Antenna Gain(numeric)                                       | 10.02   | –                  |
| EIRP                                                        | 8.95    | W                  |
| Power density at prediction frequency (S)                   | 0.07    | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00    | mW/cm <sup>2</sup> |

| CBRS(2Tx *1Carrier) – CD / 20 MHz BW                        |         |                    |
|-------------------------------------------------------------|---------|--------------------|
| Max. Average output Power at antenna input terminal         | 29.51   | dBm                |
| Max. Average output Power at antenna input terminal         | 893.31  | mW                 |
| Prediction distance                                         | 100.00  | cm                 |
| Prediction frequency                                        | 3600.00 | MHz                |
| Antenna Gain(typical)                                       | 10.01   | dBi                |
| Antenna Gain(numeric)                                       | 10.02   | –                  |
| EIRP                                                        | 8.95    | W                  |
| Power density at prediction frequency (S)                   | 0.07    | mW/cm <sup>2</sup> |
| MPE limit for uncontrolled exposure at prediction frequency | 1.00    | mW/cm <sup>2</sup> |

### Simultaneous transmission operations

1. The power density level at 100 cm is **0.1744 mW/cm<sup>2</sup>**, which is below the uncontrolled exposure limit of **1.0 mW/cm<sup>2</sup>** at **WLAN(2.4 GHz) and WLAN(5GHz) and CBRS summation**.