



November 17, 2020

TUV SUD America Inc.  
10 Centennial Drive  
Peabody, MA 01960, USA

Attention: Director of Certification

**RE: Analysis of RF Exposure for Mobile and Portable Device per KDB 447498 D01 General RF Exposure Guidance v06 and RSS-102 Issue 5 March 2015.**

FCC ID: NU: YETQ34-2121466NU  
CU: YETQ34-2121466CU

## 1. Limits

Limits for General Population/Uncontrolled Exposure (Title 47 Subpart J §2.1091 and KDB 447498 D01 referring to limits under §1.1310)

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Electric Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Time (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. Internal Radio General Descriptions

### 2.1 *NU LTE Band 2*

|                         |                                       |
|-------------------------|---------------------------------------|
| Maximum Output RF Power | 22 dBm                                |
| Production Tolerance    | ±2 dB                                 |
| Maximum RF Power        | 24 dBm / 251.19mW                     |
| Frequency Range         | 1850 MHz to 1910 MHz                  |
| Power Density Limit     | 1.0 mW/cm <sup>2</sup>                |
| Antenna Type            | External Wideband Directional Antenna |
| Antenna Model           | A52-X12-100                           |
| Antenna Max. Gain       | 8.5 dBi / 7.079 (Numeric)             |

### 2.2 *NU LTE Band 4*

|                      |                                       |
|----------------------|---------------------------------------|
| Output RF Power      | 22 dBm                                |
| Production Tolerance | ±2 dB                                 |
| Maximum RF Power     | 24 dBm / 251.19mW                     |
| Frequency Range      | 1710 MHz to 1755 MHz                  |
| Power Density Limit  | 1.0 mW/cm <sup>2</sup>                |
| Antenna Type         | External Wideband Directional Antenna |
| Antenna Model        | A52-X12-100                           |
| Antenna Max. gain    | 8.5 dBi / 7.079 (Numeric)             |

### 2.3 *NU LTE Band 12*

|                      |                                       |
|----------------------|---------------------------------------|
| Output RF Power      | 20 dBm                                |
| Production Tolerance | ±2 dB                                 |
| Maximum RF Power     | 20 dBm / 100.0 mW                     |
| Frequency Range      | 699 MHz to 716 MHz                    |
| Power Density Limit  | 0.466 mW/cm <sup>2</sup>              |
| Antenna Type         | External Wideband Directional Antenna |
| Antenna Model        | A52-X12-100                           |
| Antenna Max. gain    | 6.5 dBi / 4.467 (Numeric)             |



#### **2.4      *NU LTE Band 14***

|                      |                                       |
|----------------------|---------------------------------------|
| Output RF Power      | 20 dBm                                |
| Production Tolerance | ±2 dB                                 |
| Maximum RF Power     | 20 dBm / 100.0 mW                     |
| Frequency Range      | 788 MHz to 798 MHz                    |
| Power Density Limit  | 0.525 mW/cm <sup>2</sup>              |
| Antenna Type         | External Wideband Directional Antenna |
| Antenna Model        | A52-X12-100                           |
| Antenna Max. gain    | 6.5 dBi / 4.467 (Numeric)             |

#### **2.5      *CU LTE Band 2***

|                      |                                       |
|----------------------|---------------------------------------|
| Output RF Power      | 16 dBm                                |
| Production Tolerance | ±2 dB                                 |
| Maximum RF Power     | 18 dBm / 63.10 mW                     |
| Frequency Range      | 1930MHz to 1990 MHz                   |
| Power Density Limit  | 1.0 mW/cm <sup>2</sup>                |
| Antenna Type         | External Wideband Directional Antenna |
| Antenna Model        | A52-X12-100                           |
| Antenna Max. gain    | 9.0 dBi / 7.943 (Numeric)             |

#### **2.6      *CU LTE Band 4***

|                         |                                       |
|-------------------------|---------------------------------------|
| Maximum Output RF Power | 16 dBm                                |
| Production Tolerance    | ±2 dB                                 |
| Maximum RF Power        | 18 dBm / 63.10 mW                     |
| Frequency Range         | 2110 MHz to 2155 MHz                  |
| Power Density Limit     | 1.0 mW/cm <sup>2</sup>                |
| Antenna Type            | External Wideband Directional Antenna |
| Antenna Model           | A52-X12-100                           |
| Antenna Max. gain       | 9.0 dBi / 7.943 (Numeric)             |



## **2.7 CU LTE Band 12**

|                      |                                       |
|----------------------|---------------------------------------|
| Output RF Power      | 13 dBm                                |
| Production Tolerance | ±2 dB                                 |
| Maximum RF Power     | 15 dBm / 31.62 mW                     |
| Frequency Range      | 729 MHz to 746 MHz                    |
| Power Density Limit  | 0.486 mW/cm <sup>2</sup>              |
| Antenna Type         | External Wideband Directional Antenna |
| Antenna Model        | A52-X12-100                           |
| Antenna Max. gain    | 6.5 dBi / 4.467 (Numeric)             |

## **2.8 CU LTE Band 14**

|                      |                                       |
|----------------------|---------------------------------------|
| Output RF Power      | 13 dBm                                |
| Production Tolerance | ±2 dB                                 |
| Maximum RF Power     | 15 dBm / 31.62 mW                     |
| Frequency Range      | 758 MHz to 768 MHz                    |
| Power Density Limit  | 0.505 mW/cm <sup>2</sup>              |
| Antenna Type         | External Wideband Directional Antenna |
| Antenna Model        | A52-X12-100                           |
| Antenna Max. gain    | 6.5 dBi / 4.467 (Numeric)             |



### 3. Co-Located Transmitters transmission table:

Each CU are apart from each other at least 10 meters away. Worst case co-located transmission is 3 bands per NU or CU.

| Transmitter type |                                                      | Transmitter type that can transmit at the same time |
|------------------|------------------------------------------------------|-----------------------------------------------------|
| NU               | LTE B2                                               | LTE B4 and B12, or LTE B4 and 14                    |
|                  | LTE B4                                               | LTE B2 and B12, or LTE B2 and 14                    |
|                  | LTE B12                                              | LTE B2 and B4                                       |
|                  | LTE B14                                              | LTE B2 and B4                                       |
|                  | <i>Note: worst case bands are LTE B2, B4 and B12</i> |                                                     |
| CU               | LTE B2                                               | LTE B4 and B12, or LTE B4 and 14                    |
|                  | LTE B4                                               | LTE B2 and B12, or LTE B2 and 14                    |
|                  | LTE B12                                              | LTE B2 and B4                                       |
|                  | LTE B14                                              | LTE B2 and B4                                       |
|                  | <i>Note: worst case bands are LTE B2, B4 and B12</i> |                                                     |

### 4. Exposure from sources with multiple frequencies:

Calculation for the shortest distance with Multi-Bands Transmission (NU and CU with Patch antenna as the worst case configuration)

| Antenna Type                | Shortest Distance (cm) |
|-----------------------------|------------------------|
| NU with Antenna A52-X12-100 | <b>18.955</b>          |
| CU with Antenna A52-X12-100 | <b>10.144</b>          |



The test results are based on the following calculation:

The distance between NU antenna and CU antenna is at least 1 meter. Therefore, the worst case bands that can transmit simultaneously are listed below:

| Uplink (NU Antenna)                |                                                 |                          |                             |                       |
|------------------------------------|-------------------------------------------------|--------------------------|-----------------------------|-----------------------|
| Bands                              | Power Density (mW/cm <sup>2</sup> )             | Evaluation Distance (cm) | Limit (mW/cm <sup>2</sup> ) | MPE ratio (MPE/Limit) |
| LTE Band 2                         | $P_{N1} \cdot G_{N1} / (4 \cdot \pi \cdot R^2)$ | R                        | $L_{N1} = 1.0$              | Ratio <sub>N1</sub>   |
| LTE Band 4                         | $P_{N2} \cdot G_{N2} / (4 \cdot \pi \cdot R^2)$ | R                        | $L_{N2} = 1.0$              | Ratio <sub>N2</sub>   |
| LTE Band 12                        | $P_{N3} \cdot G_{N3} / (4 \cdot \pi \cdot R^2)$ | R                        | $L_{N3} = 0.466$            | Ratio <sub>N3</sub>   |
| Sum of the ratios (should be <1.0) |                                                 |                          |                             | <b>1.0</b>            |

| Downlink (CU Antenna)              |                                                 |                          |                             |                       |
|------------------------------------|-------------------------------------------------|--------------------------|-----------------------------|-----------------------|
| Bands                              | Power Density (mW/cm <sup>2</sup> )             | Evaluation Distance (cm) | Limit (mW/cm <sup>2</sup> ) | MPE ratio (MPE/Limit) |
| LTE Band 2                         | $P_{C1} \cdot G_{C1} / (4 \cdot \pi \cdot R^2)$ | R                        | $L_{N1} = 1.0$              | Ratio <sub>C1</sub>   |
| LTE Band 4                         | $P_{C2} \cdot G_{C2} / (4 \cdot \pi \cdot R^2)$ | R                        | $L_{N2} = 1.0$              | Ratio <sub>C2</sub>   |
| LTE Band 12                        | $P_{C3} \cdot G_{C3} / (4 \cdot \pi \cdot R^2)$ | R                        | $L_{N3} = 0.486$            | Ratio <sub>C3</sub>   |
| Sum of the ratios (should be <1.0) |                                                 |                          |                             | <b>1.0</b>            |

To calculate the shortest distance between NU antenna and end user, use the following equation:

$$\text{Ratio}_{N1} + \text{Ratio}_{N2} + \text{Ratio}_{N3} = 1$$

Then,

$$P_{N1} \cdot G_{N1} / (4 \cdot \pi \cdot R^2) / L_{N1} + P_{N2} \cdot G_{N2} / (4 \cdot \pi \cdot R^2) / L_{N2} + P_{N3} \cdot G_{N3} / (4 \cdot \pi \cdot R^2) / L_{N3} = 1$$

Therefore, the shortest distance,

$$\begin{aligned}
 R &= \text{SQRT} ((P_{N1} \cdot G_{N1} / L_{N1} + P_{N2} \cdot G_{N2} / L_{N2} + P_{N3} \cdot G_{N3} / L_{N3}) / (4 \cdot \pi)) \\
 &= \text{SQRT} ((251.19 \cdot 7.079 / 1 + 251.19 \cdot 7.079 / 1 + 100 \cdot 4.467 / 0.466) / (4 \cdot \pi)) \\
 &= \text{SQRT} (359.2869) \\
 &= \mathbf{18.955 \text{ cm}}
 \end{aligned}$$



America

To calculate the shortest distance between CU antenna and end user, use the following equation:

$$\text{Ratio}_{C1} + \text{Ratio}_{C2} + \text{Ratio}_{C3} = 1$$

Then,

$$P_{C1} * G_{C1} / (4 * \pi * R^2) / L_{C1} + P_{C2} * G_{C2} / (4 * \pi * R^2) / L_{C2} + P_{C3} * G_{C3} / (4 * \pi * R^2) / L_{C3} = 1$$

Therefore, the shortest distance,

$$R = \text{SQRT} ((P_{C1} * G_{C1} / L_{C1} + P_{C2} * G_{C2} / L_{C2} + P_{C3} * G_{C3} / L_{C3}) / (4 * \pi))$$

$$= \text{SQRT} ((63.1 * 7.943 / 1 + 63.1 * 7.943 / 1 + 31.62 * 4.467 / 0.486) / (4 * \pi))$$

$$= \text{SQRT} (102.8967)$$

$$= \mathbf{10.144 \text{ cm}}$$

Sincerely,

Xiaoying Zhang

Name

Authorized Signatory

Title: EMC/Wireless Test Engineer