TÜV SÜD America

June 11, 2020

TUV SUD BABT
Octagon House, Concorde Way
Segensworth Rd N, Fareham
PO15 5RL

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: YETF42-67ENU
CU: YETF41-8XCU

IC: NU: 9298A-F4267ENU
CU: 9298A-F418XCU

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/cm²)	Averaging Time (minutes)
0.3 - 1.34	614	1.63	*(100)	30
1.34 - 30	824/f	2.19/f	*(180/f²)	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	23 dBm
Production Tolerance	±2 dB
Maximum RF Power	25 dBm / 316.23 mW
Frequency Range	1850 MHz to 1910 MHz
Power Density Limit	1.0 mW/cm^2
Antenna Type	LPDA-R Antenna
Antenna Model	A62-V44-200
Antenna System Gain	12.36 dBi (with 1.3m RG-316 Cable)
Antenna System gain (Numeric)	17.219

2.2 NU LTE Band 4

Output RF Power	23 dBm
Production Tolerance	±2 dB
Maximum RF Power	25 dBm / 316.23 mW
Frequency Range	1710 MHz to 1755 MHz
Power Density Limit	1.0 mW/cm^2
Antenna Type	LPDA-R Antenna
Antenna Model	A62-V44-200
Antenna System gain	12.42 dBi (with 1.3m RG-316 Cable)
Antenna System gain (Numeric)	17.458

2.3 NU LTE Band 12

Output RF Power	23 dBm
Production Tolerance	±2 dB
Maximum RF Power	25 dBm / 316.23 mW
Frequency Range	699 MHz to 716 MHz
Power Density Limit	0.466 mW/cm^2
Antenna Type	LPDA-R Antenna
Antenna Model	A62-V44-200
Antenna System gain	11.0 dBi (with 1.3m RG-316 Cable)
Antenna System gain (Numeric)	12.589

2.4 NU LTE Band 14

Output RF Power	21 dBm
Production Tolerance	±2 dB
Maximum RF Power	23 dBm / 199.53 mW
Frequency Range	788 MHz to 798 MHz
Power Density Limit	0.525 mW/cm^2
Antenna Type	LPDA-R Antenna
Antenna Model	A62-V44-200
Antenna System gain	10.94 dBi (with 1.3m RG-316 Cable)
Antenna System gain (Numeric)	12.417

2.5 NU 700 MHz Public Safety

Output RF Power	26 dBm
Production Tolerance	±2 dB
Maximum RF Power	28 dBm / 630.96 mW
Frequency Range	798 MHz to 805 MHz
Power Density Limit	0.532 mW/cm^2
Antenna Type	LPDA-R Antenna
Antenna Model	A62-V44-200
Antenna System gain	10.93 dBi (with 1.3m RG-316 Cable)
Antenna System gain (Numeric)	12.388

2.6 NU 800 MHz Public Safety

Output RF Power	26 dBm
Production Tolerance	±2 dB
Maximum RF Power	28 dBm / 630.96 mW
Frequency Range	806 MHz to 816 MHz
Power Density Limit	0.537 mW/cm^2
Antenna Type	LPDA-R Antenna
Antenna Model	A62-V44-200
Antenna System gain	10.93 dBi (with 1.3m RG-316 Cable)
Antenna System gain (Numeric)	12.388

2.7 CU LTE Band 2

Output RF Power	24 dBm
Production Tolerance	±2 dB
Maximum RF Power	26 dBm / 398.11 mW
Frequency Range	1930MHz to 1990 MHz
Power Density Limit	1.0 mW/cm^2
Antenna Type	External
Antenna Model	F42-10A-100
Antenna Gain	3.8 dBi
Antenna System gain (Numeric)	2.399

2.8 CU LTE Band 4

Maximum Output RF Power	24 dBm
Production Tolerance	±2 dB
Maximum RF Power	26 dBm / 398.11 mW
Frequency Range	2110 MHz to 2155 MHz
Power Density Limit	1.0 mW/cm^2
Antenna Type	External
Antenna Model	F42-10A-100
Antenna Gain	3.8 dBi
Antenna System gain (Numeric)	2.399

2.9 CU LTE Band 12

Output RF Power	24 dBm
Production Tolerance	±2 dB
Maximum RF Power	26 dBm / 398.11 mW
Frequency Range	729 MHz to 746 MHz
Power Density Limit	0.486 mW/cm^2
Antenna Type	External
Antenna Model	F42-10A-100
Antenna Gain	3.3 dBi
Antenna System gain (Numeric)	2.138

2.10   CU LTE Band 14

Output RF Power	24 dBm
Production Tolerance	±2 dB
Maximum RF Power	26 dBm / 398.11 mW
Frequency Range	758 MHz to 768 MHz
Power Density Limit	0.505 mW/cm^2
Antenna Type	External
Antenna Model	F42-10A-100
Antenna Gain	3.3 dBi
Antenna System gain (Numeric)	2.138

2.11   CU 700 MHz Public Safety

Output RF Power	30 dBm
Production Tolerance	±2 dB
Maximum RF Power	32 dBm / 1584.89 mW
Frequency Range	768 MHz to 775 MHz
Power Density Limit	0.512 mW/cm^2
Antenna Type	External
Antenna Model	F42-10A-100
Antenna Gain	3.3 dBi
Antenna System gain (Numeric)	2.138

2.12   CU 800 MHz Public Safety

Output RF Power	30 dBm
Production Tolerance	±2 dB
Maximum RF Power	32 dBm / 1584.89 mW
Frequency Range	851 MHz to 861 MHz
Power Density Limit	0.567 mW/cm^2
Antenna Type	External
Antenna Model	F42-10A-100
Antenna Gain	3.3 dBi
Antenna System gain (Numeric)	2.138

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	700 MHz Public Safety and 800 MHz Public Safety
	LTE B4	700 MHz Public Safety and 800 MHz Public Safety
	LTE B12	700 MHz Public Safety and 800 MHz Public Safety
	LTE B14	700 MHz Public Safety and 800 MHz Public Safety
	700 MHz Public Safety	LTE Band 2, or LTE Band 4, or LTE Band 12 or LTE Band 14, and 800 MHz Public Safety
	800 MHz Public Safety	LTE Band 2, or LTE Band 4, or LTE Band 12 or LTE Band 14, and 700 MHz Public Safety
	Note: worst case bands are LTE B12 and 700 MHz Public Safety and 800 MHz Public Safety	
CU	LTE B2	700 MHz Public Safety and 800 MHz Public Safety
	LTE B4	700 MHz Public Safety and 800 MHz Public Safety
	LTE B12	700 MHz Public Safety and 800 MHz Public Safety
	LTE B14	700 MHz Public Safety and 800 MHz Public Safety
	700 MHz Public Safety	LTE Band 2, or LTE Band 4, or LTE Band 12 or LTE Band 14, and 800 MHz Public Safety
	800 MHz Public Safety	LTE Band 2, or LTE Band 4, or LTE Band 12 or LTE Band 14, and 700 MHz Public Safety
	Note: worst case bands are LTE B12 and 700 MHz Public Safety and 800 MHz Public Safety	

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 A62-V44-200	**54.85**
CU with Antenna F42-10A-100	**33.75**

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 simutaneously are listed below:

Uplink (NU Antenna)				
Bands	**Power Density (mW/cm^2)**	**Evaluation Distance (cm)**	**Limit (mW/cm^2)**	**MPE ratio (MPE/Limit)**
LTE Band 12	$P_{N1}*G_{N1}/(4*PI*R^2)$	R	$L_{N1} = 0.466$	$Ratio_{N1}$
700 MHz Public Safety	$P_{N2}*G_{N2}/(4*PI*R^2)$	R	$L_{N2} = 0.532$	$Ratio_{N2}$
700 MHz Public Safety	$P_{N3}*G_{N3}/(4*PI*R^2)$	R	$L_{N3} = 0.537$	$Ratio_{N3}$
			Sum of the ratios (should be <1.0)	**1.0**

Downlink (CU Antenna)				
Bands	**Power Density (mW/cm^2)**	**Evaluation Distance (cm)**	**Limit (mW/cm^2)**	**MPE ratio (MPE/Limit)**
LTE Band 12	$P_{C1}*G_{C1}/(4*PI*R^2)$	R	$L_{C1} = 0.486$	$Ratio_{C1}$
700 MHz Public Safety	$P_{C2}*G_{C2}/(4*PI*R^2)$	R	$L_{C2} = 0.512$	$Ratio_{C2}$
700 MHz Public Safety	$P_{C3}*G_{C3}/(4*PI*R^2)$	R	$L_{C3} = 0.567$	$Ratio_{C3}$
			Sum of the ratios (should be <1.0)	**1.0**

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

$Ratio_{N1} + Ratio_{N2} + Ratio_{N3} = 1$

Then,

$P_{N1}*G_{N1}/(4*PI*R^2)/L_{N1} + P_{N2}*G_{N2}/(4*PI*R^2)/L_{N2} + P_{N3}*G_{N3}/(4*PI*R^2)/L_{N3} = 1$

Therefore, the shortest distance,

$R = SQRT ((P_{N1}*G_{N1}/L_{N1} + P_{N2}*G_{N2}/L_{N2} + P_{N3}*G_{N3}/L_{N3})/(4*PI))$

$= SQRT ((316.23*12.589/0.466 + 630.96*12.388/0.532 + 630.96*12.388/0.537)/(4*PI))$

$= SQRT (3008.827)$

$= $ **54.85 cm**

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

$Ratio_{C1} + Ratio_{C2} + Ratio_{C3} = 1$

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,

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

$= SQRT ((389.11*2.138/0.486 + 1584.89*2.138/0.512 + 1584.89*2.138/0.567)/(4*PI))$

$= SQRT (1139.021)$

$= \textbf{33.75 cm}$

Sincerely,

Xiaoying Zhang
Name
Authorized Signatory
Title: EMC/Wireless Test Engineer