



December 09, 2019

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: YETQ44-1234CNU  
CU: YETQ41-5ECU

## 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. MPE Calculation Summary using a 20cm separation distance:

Downlink (CU) at 20 cm Separate Distance			
Mode	Output Power (dBm)	Power Density at 20 cm (mW/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )
WCDMA Band 5	14.85	0.00666	0.581
LTE Band 4	16.35	0.01562	1.0
LTE Band 5	15.71	0.00812	0.584
LTE Band 12	14.27	0.00583	0.494
LTE Band 13	13.38	0.00475	0.501
LTE Band 25	16.57	0.01643	1.0
LTE Band 30	13.88	0.00826	1.0
LTE Band 71	16.64	0.01006	0.418

Uplink (NU) at 20 cm Separate Distance			
Mode	Output Power (dBm)	Power Density at 20 cm (mW/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )
WCDMA Band 5	22.92	0.1576631	0.558
LTE Band 4	23.41	0.1628284	1.0
LTE Band 5	21.66	0.1658556	0.554
LTE Band 12	23.79	0.2263238	0.469
LTE Band 13	23.38	0.1926328	0.521
LTE Band 25	23.17	0.2196495	1.0
LTE Band 30	18.52	0.0348121	1.0
LTE Band 71	23.04	0.1966664	0.454
LTE Modem (LTE B12 as worst case)	24.5	0.141	0.47

***(Note: LTE Band 30 and 71 Test Data are for reference only. These two bands are disabled by software on the final product)***



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

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

Downlink (CU)		
Transmitter type		Transmitter type that can transmit at the same time
CU work with NU Port 1	LTE B12	WCDMA B5, or LTE B25 or LTE B4
	LTE B30	WCDMA B5, or LTE B25 or LTE B4
	<i>Note: worst case bands are: LTE B12 and WCDMA Band 5</i>	
CU work with NU Port 2	LTE B71	LTE B4, or LTE B25
	LTE B12	LTE B4, or LTE B25
	LTE B4	LTE B25
	<i>Note: worst case bands are: LTE B12 and LTE Band 25</i>	
CU work with NU Port 3	LTE B13	LTE B4, or LTE B25
	<i>Note: worst case bands are: LTE B13 and LTE Band 25</i>	
CU work with NU Port 4	LTE B5	LTE B25

NU has four Antenna Ports. Each antenna port is assigned to support one operator and has its own separate donor antennas. The antennas from each port point to different directions and they are apart from each other at least 10 meters away. Worst case co-located transmission is two bands per donor antenna port.

Uplink (NU)			
Transmitter type			Transmitter type that can transmit at the same time
NU Port 1	LTE B12	WCDMA B5, or LTE B25 or LTE B4	LTE Modem
	LTE B30	WCDMA B5, or LTE B25 or LTE B4	
	Note: worst case bands are: LTE B12 and WCDMA Band 5		
NU Port 2	LTE B71	LTE B4, or LTE B25	LTE Modem
	LTE B12	LTE B4, or LTE B25	
	LTE B4	LTE B25	
	Note: worst case bands are: LTE B12 and LTE Band 25		
NU Port 3	LTE B13	LTE B4, or LTE B25	LTE Modem
	Note: worst case bands are: LTE B12 and LTE Band 25		
NU Port 4	LTE B5	LTE B25	LTE Modem



**4. Worst Case Simultaneous Transmission MPE:**

Downlink (CU with NU Port 1) at 20 cm Separate Distance			
Transmitter type	MPE (mw/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
LTE Band 12	0.00583	0.494	0.011802
WCDMA Band 5	0.00666	0.581	0.011463
Sum of the ratios (should be <1.0)			0.023265

Downlink (CU with NU Port 2) at 20 cm Separate Distance			
Transmitter type	MPE (mw/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
LTE Band 12	0.00583	0.494	0.011802
LTE Band 25	0.01643	1.0	0.01643
Sum of the ratios (should be <1.0)			0.028232

Downlink (CU with NU Port 3) at 20 cm Separate Distance			
Transmitter type	MPE (mw/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
LTE Band 13	0.00475	0.501	0.009481
LTE Band 25	0.01643	1.0	0.01643
Sum of the ratios (should be <1.0)			0.025911

Downlink (CU with NU Port 3) at 20 cm Separate Distance			
Transmitter type	MPE (mw/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
LTE Band 5	0.00812	0.584	0.013904
LTE Band 25	0.01643	1.0	0.01643
Sum of the ratios (should be <1.0)			0.030334



Uplink (NU Port 1) at 20 cm Separate Distance			
Transmitter type	MPE (mw/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
LTE Band 12	0.2263238	0.469	0.482567
WCDMA Band 5	0.1576631	0.558	0.28255
Sum of the ratios (should be <1.0)			0.765117

Uplink (NU Port 2) at 20 cm Separate Distance			
Transmitter type	MPE (mw/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
LTE Band 12	0.2263238	0.469	0.482567
LTE Band 25	0.2196495	1.0	0.21965
Sum of the ratios (should be <1.0)			0.702216

Uplink (NU Port 3) at 20 cm Separate Distance			
Transmitter type	MPE (mw/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
LTE Band 13	0.1926328	0.521	0.369737
LTE Band 25	0.2196495	1.0	0.21965
Sum of the ratios (should be <1.0)			0.589386

Uplink (NU Port 4) at 20 cm Separate Distance			
Transmitter type	MPE (mw/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
LTE Band 5	0.1658556	0.554	0.299378
LTE Band 25	0.2196495	1.0	0.21965
Sum of the ratios (should be <1.0)			0.519028

The NU RF ports are connected to the antennas with cables more than 10 meters long, and they are apart from the LTE Modem at 10 meters away.

LTE Modem on NU at 20 cm Separate Distance			
Transmitter type	MPE (mw/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
LTE Modem worst case LTE Band 12	0.141	0.47	0.3



## 5. Mobile MPE Calculation using a 20cm separation distance

Using Power Density formula:

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density

P = power input to the antenna

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

R = distance to the center of radiation of the antenna

### WCDMA Band 5 Downlink at 20 cm Separate Distance:

Maximum peak output power at antenna input terminal:	<b>14.85</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>30.55</b>	(mW)
Antenna gain(typical):	<b>0.4</b>	(dBi)
Maximum antenna gain:	<b>10.096</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>871.4</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.581</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.0066639</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.066639</b>	(W/m <sup>2</sup> )
FCC Margin of Compliance:	<b>-19.40</b>	(dB)

### LTE Band 4 Downlink at 20 cm Separate Distance:

Maximum peak output power at antenna input terminal:	<b>16.35</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>43.15</b>	(mW)
Antenna gain(typical):	<b>2.6</b>	(dBi)
Maximum antenna gain:	<b>1.82</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>2145</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>1.0</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.0156218</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.156218</b>	(W/m <sup>2</sup> )
FCC Margin of Compliance:	<b>-18.06</b>	(dB)



***LTE Band 5 Downlink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>15.71</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>37.24</b>	(mW)
Antenna gain(typical):	<b>0.4</b>	(dBi)
Maximum antenna gain:	<b>1.096</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>876.5</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.584</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.0081233</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.081233</b>	(W/m <sup>2</sup> )
FCC Margin of Compliance:	<b>-18.57</b>	(dB)

***LTE Band 12 Downlink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>14.27</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>26.73</b>	(mW)
Antenna gain(typical):	<b>0.4</b>	(dBi)
Maximum antenna gain:	<b>1.096</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>741</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.494</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.0058308</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.058308</b>	(W/m <sup>2</sup> )
FCC Margin of Compliance:	<b>-19.28</b>	(dB)

***LTE Band 13 Downlink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>13.38</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>21.78</b>	(mW)
Antenna gain(typical):	<b>0.4</b>	(dBi)
Maximum antenna gain:	<b>1.096</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>751</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.501</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.0047504</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.047504</b>	(W/m <sup>2</sup> )
FCC Margin of Compliance:	<b>-20.23</b>	(dB)



***LTE Band 25 Downlink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>16.57</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>45.39</b>	(mW)
Antenna gain(typical):	<b>2.6</b>	(dBi)
Maximum antenna gain:	<b>1.82</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>1962.5</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>1.0</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.0164335</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.164335</b>	(W/m <sup>2</sup> )
FCC Margin of Compliance:	<b>-17.84</b>	(dB)

***LTE Band 30 Downlink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>13.88</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>24.43</b>	(mW)
Antenna gain(typical):	<b>2.3</b>	(dBi)
Maximum antenna gain:	<b>1.698</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>2355</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>1.0</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.0082552</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.082552</b>	(W/m <sup>2</sup> )
FCC Margin of Compliance:	<b>-20.83</b>	(dB)

***LTE Band 71 Downlink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>16.64</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>46.13</b>	(mW)
Antenna gain(typical):	<b>0.4</b>	(dBi)
Maximum antenna gain:	<b>1.096</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>627</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.418</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.0100631</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.100631</b>	(W/m <sup>2</sup> )
FCC Margin of Compliance:	<b>-16.18</b>	(dB)





***WCDMA Band 5 Uplink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>22.92</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>195.88</b>	(mW)
Antenna gain(typical):	<b>6.07</b>	(dBi)
Maximum antenna gain:	<b>4.046</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>836.6</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.558</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.1576631</b>	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	<b>-5.49</b>	(dB)

***LTE Band 4 Uplink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>23.41</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>219.28</b>	(mW)
Antenna gain(typical):	<b>5.72</b>	(dBi)
Maximum antenna gain:	<b>3.773</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>1717.5</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>1.0</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.1628284</b>	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	<b>-7.88</b>	(dB)

***LTE Band 5 Uplink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>21.66</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>146.55</b>	(mW)
Antenna gain(typical):	<b>7.55</b>	(dBi)
Maximum antenna gain:	<b>5.689</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>831.5</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.554</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.1658556</b>	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	<b>-5.24</b>	(dB)



***LTE Band 12 Uplink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>23.79</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>239.33</b>	(mW)
Antenna gain(typical):	<b>6.77</b>	(dBi)
Maximum antenna gain:	<b>4.753</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>704</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.469</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.2263238</b>	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	<b>-3.16</b>	(dB)

***LTE Band 13 Uplink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>23.38</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>217.77</b>	(mW)
Antenna gain(typical):	<b>6.48</b>	(dBi)
Maximum antenna gain:	<b>4.446</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>782</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.521</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.1926328</b>	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	<b>-4.32</b>	(dB)

***LTE Band 25 Uplink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>23.17</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>207.49</b>	(mW)
Antenna gain(typical):	<b>7.26</b>	(dBi)
Maximum antenna gain:	<b>5.321</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>1905</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>1.0</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.2196495</b>	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	<b>-6.58</b>	(dB)



***LTE Band 30 Uplink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>18.52</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>71.12</b>	(mW)
Antenna gain(typical):	<b>3.91</b>	(dBi)
Maximum antenna gain:	<b>2.46</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>2312.5</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>1.0</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.0348121</b>	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	<b>-14.58</b>	(dB)

***LTE Band 71 Uplink at 20 cm Separate Distance:***

Maximum peak output power at antenna input terminal:	<b>23.04</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>201.37</b>	(mW)
Antenna gain(typical):	<b>6.91</b>	(dBi)
Maximum antenna gain:	<b>4.909</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>680.5</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.454</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.1966664</b>	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	<b>-3.63</b>	(dB)

***LTE Modem Power Density worst case LTE Band 12:***

Maximum peak output power at antenna input terminal:	<b>24.5</b>	(dBm)
Maximum peak output power at antenna input terminal:	<b>281.838</b>	(mW)
Antenna gain(typical):	<b>4</b>	(dBi)
Maximum antenna gain:	<b>2.512</b>	(numeric)
Prediction distance:	<b>20</b>	(cm)
Source Based Time Average Duty Cycle:	<b>100</b>	(%)
Prediction frequency:	<b>701.5</b>	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	<b>0.467</b>	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	<b>0.1408</b>	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	<b>-5.21</b>	(dB)



America

Sincerely,

Xiaoying Zhang

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Name

Authorized Signatory

Title: EMC/Wireless Test Engineer