

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/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. 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/cm2)	FCC Limit (mW/cm2)	
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/cm2)	FCC Limit (mW/cm2)	
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				
Cluworkwith	LTE B12	WCDMA B5, or LTE B25 or LTE B4		
CU WORK WITH	LTE B30	WCDMA B5, or LTE B25 or LTE B4		
NO POIL I	No Port 1 Note: worst case bands are: LTE B12 and WCDMA Band 5			
	LTE B71	LTE B4, or LTE B25		
CU work withLTE B12LTE B4, or LTE B25NU Port 2LTE B4LTE B25		LTE B4, or LTE B25		
		LTE B25		
	Note: worst case	e bands are: LTE B12 and LTE Band 25		
CU work with	LTE B13	LTE B4, or LTE B25		
NU Port 3	Note: worst case bands are: LTE B13 and LTE Band 25			
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					
	LTE B12	WCDMA B5, or LTE B25 or LTE B4			
NU Port 1	LTE B30	WCDMA B5, or LTE B25 or LTE B4 (for reference only)			
	Note: worst case bands are: LTE B12 and WCDMA B5				
	LTE B71	LTE B4, or LTE B25 (for reference only)			
NUL Port 2	LTE B12	LTE B4, or LTE B25			
NO POIL 2	LTE B4	LTE B25			
	Note: wor	rst case bands are: LTE B12 and LTE Band 25			
NUL Dort 2	LTE B13	LTE B4, or LTE B25			
NU PULLS	NO Port 3 Note: worst case bands are: LTE B13 and LTE Band 4				
NU Port 4	LTE B5	LTE B25			



4. Worst Case Simultaneous Transmission MPE:

Downlink (CU with NU Port 1) at 20 cm Separate Distance				
Transmitter type     MPE (mw/cm²)     FCC Limit (mW/cm²)     FCC MPE ratio (MPE/Limit)				
LTE Band 12	0.0058308	0.494	0.0118032	
LTE Band 25	0.0164335	1.0	0.0164335	
	0.0282367			

Downlink (CU with NU Port 2) at 20 cm Separate Distance				
Transmitter type	MPE (mw/cm²)	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)	
LTE Band 4	0.0156218	1.0	0.0156218	
LTE Band 25	0.0164335	1.0	0.0164335	
	0.0320553			

Downlink (CU with NU Port 2) at 20 cm Separate Distance (for reference only)				
Transmitter type	MPE (mw/cm²)	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)	
LTE Band 71	0.0100631	0.418	0.0240744	
LTE Band 25	0.0164335	1.0	0.0164335	
Sum of the ratios (should be <1.0)			0.0405079	

Downlink (CU with NU Port 3) at 20 cm Separate Distance				
Transmitter type MPE (mw/cm²) FCC Limit (mW/cm²) FCC MPE ratio (MPE/Limit)				
LTE Band 13	0.0047504	0.501	0.0094818	
LTE Band 25	0.0164335	1.0	0.0164335	
Sum of the ratios (should be <1.0)			0.0259153	

Downlink (CU with NU Port 4) at 20 cm Separate Distance				
Transmitter type	MPE (mw/cm²)	FCC Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)	
LTE Band 5	0.0081233	0.584	0.0139098	
LTE Band 25	0.0164335	1.0	0.0164335	
Sum of the ratios (should be <1.0)			0.0303433	



Uplink (NU Port 1) at 20 cm Separate Distance				
Transmitter type MPE (mw/cm²) FCC Limit (mW/cm²) FCC MPE ratio (MPE/				
LTE Band 12	0.2263238	0.469	0.4825667	
WCDMA Band 5	0.1576631	0.558	0.2825504	
Sum of the ratios (should be <1.0)			0.7651171	

Uplink (NU Port 2) at 20 cm Separate Distance				
Transmitter type MPE (mw/cm²) FCC Limit (mW/cm²) FCC MPE ratio (MPE/Limit)				
LTE Band 12	0.2263238	0.469	0.4825667	
LTE Band 25	0.2196495	1.0	0.2196495	
Sum of the ratios (should be <1.0)			0.7022162	

Uplink (NU Port 3) at 20 cm Separate Distance					
Transmitter type MPE (mw/cm²) FCC Limit (mW/cm²) FCC MPE ratio (MPE/L					
LTE Band 13	0.1926328	0.521	0.3697367		
LTE Band 25	0.2196495	1.0	0.2196495		
Sum of the ratios (should be <1.0)			0.5893862		

Uplink (NU Port 4) at 20 cm Separate Distance				
Transmitter type MPE (mw/cm²) FCC Limit (mW/cm²) FCC MPE ratio (N				
LTE Band 5	5 0.1658556 0.554		0.2993783	
LTE Band 25	0.2196495	1.0	0.2196495	
Sum of the ratios (should be <1.0) 0.5190278				

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	smitter type MPE (mw/cm <sup>2</sup> ) FCC Limit (mW/cm <sup>2</sup> ) FCC MPE ratio (				
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:	14.85	(dBm)
Maximum peak output power at antenna input terminal:	30.55	(mW)
Antenna gain(typical):	0.4	(dBi)
Maximum antenna gain:	10.096	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	871.4	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.581	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.0066639	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	-19.40	(dB)
LTE Band 4 Downlink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	16.35	(dBm)
Maximum peak output power at antenna input terminal:	43.15	(mW)
Antenna gain(typical):	2.6	(dBi)
Maximum antenna gain:	1.82	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2145	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.0156218	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	-18.06	(dB)



# LTE Band 5 Downlink at 20 cm Separate Distance:

Maximum peak output power at antenna input terminal:	15.71	(dBm)
Maximum peak output power at antenna input terminal:	37.24	(mW)
Antenna gain(typical):	0.4	(dBi)
Maximum antenna gain:	1.096	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	876.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.584	(mW/cm²)
Power density at prediction frequency:	0.0081233	(mW/cm²)
FCC Margin of Compliance:	-18.57	(dB)
LTE Band 12 Downlink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	14.27	(dBm)
Maximum peak output power at antenna input terminal:	26.73	(mW)
Antenna gain(typical):	0.4	(dBi)
Maximum antenna gain:	1.096	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	741	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.494	(mW/cm²)
Power density at prediction frequency:	0.0058308	(mW/cm²)
FCC Margin of Compliance:	-19.28	(dB)
LTE Band 13 Downlink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	13.38	(dBm)
Maximum peak output power at antenna input terminal:	21.78	(mW)
Antenna gain(typical):	0.4	(dBi)
Maximum antenna gain:	1.096	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	751	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.501	(mW/cm²)
Power density at prediction frequency:	0.0047504	(mW/cm²)
FCC Margin of Compliance:	-20.23	(dB)



# LTE Band 25 Downlink at 20 cm Separate Distance:

Maximum peak output power at antenna input terminal:	16.57	(dBm)
Maximum peak output power at antenna input terminal:	45.39	(mW)
Antenna gain(typical):	2.6	(dBi)
Maximum antenna gain:	1.82	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1962.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.0164335	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	-17.84	(dB)
LTE Band 30 Downlink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	13.88	(dBm)
Maximum peak output power at antenna input terminal:	24.43	(mW)
Antenna gain(typical):	2.3	(dBi)
Maximum antenna gain:	1.698	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2355	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.0082552	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	-20.83	(dB)
LTE Band 71 Downlink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	16.64	(dBm)
Maximum peak output power at antenna input terminal:	46.13	(mW)
Antenna gain(typical):	0.4	(dBi)
Maximum antenna gain:	1.096	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	627	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.418	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.0100631	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	-16.18	(dB)



# WCDMA Band 5 Uplink at 20 cm Separate Distance:

Maximum peak output power at antenna input terminal:	22.92	(dBm)
Maximum peak output power at antenna input terminal:	195.88	(mW)
Antenna gain(typical):	6.07	(dBi)
Maximum antenna gain:	4.046	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	836.6	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.558	(mW/cm²)
Power density at prediction frequency:	0.1576631	(mW/cm²)
FCC Margin of Compliance:	-5.49	(dB)
LTE Band 4 Uplink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	23.41	(dBm)
Maximum peak output power at antenna input terminal:	219.28	(mW)
Antenna gain(typical):	5.72	(dBi)
Maximum antenna gain:	3.773	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1717.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm²)
Power density at prediction frequency:	0.1628284	(mW/cm²)
FCC Margin of Compliance:	-7.88	(dB)
LTE Band 5 Uplink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	21.66	(dBm)
Maximum peak output power at antenna input terminal:	146.55	(mW)
Antenna gain(typical):	7.55	(dBi)
Maximum antenna gain:	5.689	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	831.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.554	(mW/cm²)
Power density at prediction frequency:	0.1658556	(mW/cm²)
FCC Margin of Compliance:	-5.24	(dB)



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

Maximum peak output power at antenna input terminal:	23.79	(dBm)
Maximum peak output power at antenna input terminal:	239.33	(mW)
Antenna gain(typical):	6.77	(dBi)
Maximum antenna gain:	4.753	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	704	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.469	(mW/cm²)
Power density at prediction frequency:	0.2263238	(mW/cm²)
FCC Margin of Compliance:	-3.17	(dB)
LTE Band 13 Uplink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	23.38	(dBm)
Maximum peak output power at antenna input terminal:	217.77	(mW)
Antenna gain(typical):	6.48	(dBi)
Maximum antenna gain:	4.446	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	782	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.521	(mW/cm²)
Power density at prediction frequency:	0.1926328	(mW/cm²)
FCC Margin of Compliance:	-4.32	(dB)
LTE Band 25 Uplink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	23.17	(dBm)
Maximum peak output power at antenna input terminal:	207.49	(mW)
Antenna gain(typical):	7.26	(dBi)
Maximum antenna gain:	5.321	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1905	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.2196495	(mW/cm²)
FCC Margin of Compliance:	-6.58	(dB)



# LTE Band 30 Uplink at 20 cm Separate Distance:

Maximum peak output power at antenna input terminal:	22.52	(dBm)
Maximum peak output power at antenna input terminal:	178.65	(mW)
Antenna gain(typical):	3.91	(dBi)
Maximum antenna gain:	2.46	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2312.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.0874440	(mW/cm²)
FCC Margin of Compliance:	-10.58	(dB)
LTE Band 71 Uplink at 20 cm Separate Distance:		
Maximum peak output power at antenna input terminal:	23.04	(dBm)
Maximum peak output power at antenna input terminal:	201.37	(mW)
Antenna gain(typical):	6.91	(dBi)
Maximum antenna gain:	4.909	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	680.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.454	(mW/cm²)
Power density at prediction frequency:	0.1966664	(mW/cm²)
FCC Margin of Compliance:	-3.63	(dB)

# LTE Modem Power Density worst case LTE Band 12:

Maximum peak output power at antenna input terminal:	24.5	(dBm)
Maximum peak output power at antenna input terminal:	281.838	(mW)
Antenna gain(typical):	4	(dBi)
Maximum antenna gain:	2.512	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	701.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.467	(mW/cm²)
Power density at prediction frequency:	0.1408	(mW/cm²)
FCC Margin of Compliance:	-5.21	(dB)



Sincerely,

Xiaoying Zhang

Name Authorized Signatory Title: EMC/Wireless Test Engineer