December 06, 2024

TUV SUD America CB
10 Centennial Drive FL2
Peabody, MA 01960

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 6 December 2023

FCC ID: NU: YETII41-36CNU, CU: YETI41-WXCU
IC ID: NU:9298A-I4236CNU and CU 9298A-I41WXCU

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^2)	Averaging Time (minutes)
0.3 - 1.34	614	1.63	*(100)	30
1.34 - 30	824/f	2.19/f	*($180/f^2$)	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. ISED Limits:

Limits for Devices Used by the General Public (Uncontrolled Environment (RSS-102 Issue 5 March 2015)

Frequency Range (MHz)	Electric Field Strength (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003 - 10^{21}	83	90	-	Instantaneous
0.1 - 10	-	0.73/f	-	6**
1.1 - 10	$87/f^{0.5}$	-	-	6**
10 - 20	27.46	0.0728	2	6
20 - 48	$-58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48 - 300	22.06	0.05852	1.291	6

300 - 6000	$3.142\ f^{0.3417}$	$0.008335\ f^{-0.3417}$	$0.02619\ f^{0.6834}$	6
6000 - 15000	61.4	0.163	10	6
15000 - 150000	61.4	0.163	10	$616000/f^{1.2}$
150000 - 300000	$0.158f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000/f^{1.2}$

f is frequency in MHz
**Based on nerve stimulation (NS)*
*** Based on specific absorption rate (SAR)*

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

Downlink (CU) at 20 cm Separation Distance				
Mode	**Output Power (dBm)**	**Power Density at 20 cm (mW/cm^2)**	**ISED Limit (mW/cm^2)**	**FCC Limit (mW/cm^2)**
WCDMA Band 5	16.99	0.00997	0.2686	0.581
LTE Band 4	15.84	0.00997	0.4901	1
LTE Band 12	15.56	0.00997	0.2401	0.488
LTE Band 25	16.86	0.00997	0.4697	1

Uplink (NU) at 65 cm Separation Distance				
Mode	**Output Power (dBm)**	**Power Density at 65 cm (mW/cm^2)**	**ISED Limit (mW/cm^2)**	**FCC Limit (mW/cm^2)**
WCDMA Band 5	21.68	0.01883	0.2613	0.551
LTE Band 04	23.37	0.01883	0.4310	1
LTE Band 12	21.92	0.01883	0.2321	0.468
23.48	0.01883	0.4485	23.48	1
LTE Modem (LTE B12 as worst case)	24.5	0.141	0.231	0.47

4. 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 B4	LTE B12
	WCDMA B5	LTE B12
	LTE B12	LTE B4, B25 and WCDMA B5
	LTE B25	LTE B12
	Note: worst case bands are: LTE B12 and WCDMA Band 5	
CU work with NU Port 2	Only Single Transmission supported on this port for the Consumer Version	

NU has two Antenna Ports. Each antenna port is assigned to support one operator and has its own Separation 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 B4	LTE B12
	WCDMA B5	LTE B12
	LTE B12	LTE B4, B25 and WCDMA B5
	LTE B25	LTE B12
	Note: worst case bands are: LTE B12 and LTE Band 25	
NU Port 2	Only Single Transmission supported on this port for the Consumer Version	

5. Worst Case Simultaneous Transmission MPE:

Only ISED limits presented being the more stringent between the two limits.

Downlink (CU with NU Port 1) at 20 cm Separation Distance			
Transmitter type	**MPE (mw/cm^2)**	**ISED Limit (mW/cm^2)**	**ISED MPE ratio (MPE/Limit)**
LTE B12	0.00997	0.2401	0.04152
WCDMA B5	0.00997	0.2686	0.03711
Sum of the ratios (should be <1.0)			0.078638

Downlink (CU with NU Port 2) at 20 cm Separation Distance			
Transmitter type	**MPE (mw/cm^2)**	**ISED Limit (mW/cm^2)**	**ISED MPE ratio (MPE/Limit)**
Only Single Transmission supported on this port for the Consumer Version			

Uplink (NU Port 1) at 65 cm Separation Distance			
Transmitter type	**MPE (mw/cm^2)**	**ISED Limit (mW/cm^2)**	**ISED MPE ratio (MPE/Limit)**
LTE B12	0.01883	0.2321	0.081128
WCDMA B5	0.01883	0.2613	0.072062
Sum of the ratios (should be <1.0)			0.15319

Uplink (NU Port 2) at 65 cm Separation Distance			
Transmitter type	**MPE (mw/cm^2)**	**ISED Limit (mW/cm^2)**	**ISED MPE ratio (MPE/Limit)**
Only Single Transmission supported on this port for the Consumer Version			

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 Separation Distance			
Transmitter type	**MPE (mw/cm^2)**	**ISED Limit (mW/cm^2)**	**ISED MPE ratio (MPE/Limit)**
LTE Modem worst case LTE Band 12	0.140841	0.2307	0.61049

6. Mobile MPE Calculation using a 20cm separation distance:

Only ISED limits presented being the more stringent between the two limits.

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 Separation Distance:

Maximum peak output power at antenna input terminal:	**16.99**	(dBm)
Maximum peak output power at antenna input terminal:	**50.00**	(mW)
Antenna gain(max):	**0.0100**	(dBi)
Maximum antenna gain:	**1.002**	(numeric)
Prediction distance:	**20**	(cm)
Source Based Time Average Duty Cycle:	**100**	(%)
Prediction frequency:	**876.4**	(MHz)
ISED MPE limit for uncontrolled exposure at prediction frequency:	**0.2686**	(mW/cm^2)
Power density at prediction frequency:	**0.009971**	(mW/cm^2)
ISED Margin of Compliance:	**-14.30**	(dB)

LTE Band 4 Downlink at 20 cm Separation Distance:

Maximum peak output power at antenna input terminal:	**15.84**	(dBm)
Maximum peak output power at antenna input terminal:	**38.37**	(mW)
Antenna gain(max):	**1.1600**	(dBi)
Maximum antenna gain:	**1.306**	(numeric)
Prediction distance:	**20**	(cm)
Source Based Time Average Duty Cycle:	**100**	(%)
Prediction frequency:	**2112.5**	(MHz)
ISED MPE limit for uncontrolled exposure at prediction frequency:	**0.4901**	(mW/cm^2)
Power density at prediction frequency:	**0.009971**	(mW/cm^2)
ISED Margin of Compliance:	**-16.92**	(dB)

LTE Band 12 Downlink at 20 cm Separation Distance:

Maximum peak output power at antenna input terminal:	**15.56**	(dBm)
Maximum peak output power at antenna input terminal:	**35.97**	(mW)
Antenna gain(max):	**1.4400**	(dBi)
Maximum antenna gain:	**1.393**	(numeric)
Prediction distance:	**20**	(cm)
Source Based Time Average Duty Cycle:	**100**	(%)
Prediction frequency:	**743.5**	(MHz)
ISED MPE limit for uncontrolled exposure at prediction frequency:	**0.2401**	(mW/cm^2)
Power density at prediction frequency:	**0.009971**	(mW/cm^2)
ISED Margin of Compliance:	**-13.82**	(dB)

LTE Band 25 Downlink at 65 cm Separation Distance:

Maximum peak output power at antenna input terminal:	**16.86**	(dBm)
Maximum peak output power at antenna input terminal:	**48.53**	(mW)
Antenna gain(max):	**0.1400**	(dBi)
Maximum antenna gain:	**1.033**	(numeric)
Prediction distance:	**20**	(cm)
Source Based Time Average Duty Cycle:	**100**	(%)
Prediction frequency:	**1985**	(MHz)
ISED MPE limit for uncontrolled exposure at prediction frequency:	**0.4697**	(mW/cm^2)
Power density at prediction frequency:	**0.009971**	(mW/cm^2)
ISED Margin of Compliance:	**-16.73**	(dB)

WCDMA Band 5 Uplink at 65 cm Separation Distance:

Maximum peak output power at antenna input terminal:	**21.68**	(dBm)
Maximum peak output power at antenna input terminal:	**147.23**	(mW)
Antenna gain(max):	**8.3200**	(dBi)
Maximum antenna gain:	**6.792**	(numeric)
Prediction distance:	**65**	(cm)
Source Based Time Average Duty Cycle:	**100**	(%)
Prediction frequency:	**841.6**	(MHz)
ISED MPE limit for uncontrolled exposure at prediction frequency:	**0.2613**	(mW/cm^2)
Power density at prediction frequency:	**0.018835**	(mW/cm^2)
ISED Margin of Compliance:	**-11.42**	(dB)

LTE Band 4 Uplink at 65 cm Separation Distance:

Maximum peak output power at antenna input terminal:	**23.37**	(dBm)
Maximum peak output power at antenna input terminal:	**217.27**	(mW)
Antenna gain(max):	**6.6300**	(dBi)
Maximum antenna gain:	**4.603**	(numeric)
Prediction distance:	**65**	(cm)
Source Based Time Average Duty Cycle:	**100**	(%)
Prediction frequency:	**1750**	(MHz)
ISED MPE limit for uncontrolled exposure at prediction frequency:	**0.4310**	(mW/cm^2)
Power density at prediction frequency:	**0.018835**	(mW/cm^2)
ISED Margin of Compliance:	**-13.59**	(dB)

LTE Band 12 Uplink at 65 cm Separation Distance:

Maximum peak output power at antenna input terminal:	**21.92**	(dBm)
Maximum peak output power at antenna input terminal:	**155.60**	(mW)
Antenna gain(max):	**8.0800**	(dBi)
Maximum antenna gain:	**6.427**	(numeric)
Prediction distance:	**65**	(cm)
Source Based Time Average Duty Cycle:	**100**	(%)
Prediction frequency:	**707.5**	(MHz)
ISED MPE limit for uncontrolled exposure at prediction frequency:	**0.2321**	(mW/cm^2)
Power density at prediction frequency:	**0.018835**	(mW/cm^2)
ISED Margin of Compliance:	**-10.91**	(dB)

LTE Band 25 Uplink at 65 cm Separation Distance:

Maximum peak output power at antenna input terminal:	**23.48**	(dBm)
Maximum peak output power at antenna input terminal:	**222.84**	(mW)
Antenna gain(max):	**6.5200**	(dBi)
Maximum antenna gain:	**4.487**	(numeric)
Prediction distance:	**65**	(cm)
Source Based Time Average Duty Cycle:	**100**	(%)
Prediction frequency:	**1855**	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	**0.4485**	(mW/cm^2)
Power density at prediction frequency:	**0.018835**	(mW/cm^2)
FCC Margin of Compliance:	**-13.77**	(dB)

LTE Modem Power Density worst case LTE Band 12:

Maximum peak output power at antenna input terminal:	**24.50**	(dBm)
Maximum peak output power at antenna input terminal:	**281.84**	(mW)
Antenna gain(max):	**4.0000**	(dBi)
Maximum antenna gain:	**2.512**	(numeric)
Prediction distance:	**65**	(cm)
Source Based Time Average Duty Cycle:	**100**	(%)
Prediction frequency:	**701.5**	(MHz)
ISED MPE limit for uncontrolled exposure at prediction frequency:	**0.2307**	(mW/cm^2)
Power density at prediction frequency:	**0.140841**	(mW/cm^2)
ISED Margin of Compliance:	**-2.14**	(dB)

7. Power and Calculated Max Gain (Antenna & Cable) per Band

Uplink (NU)		
Band	**Worst Case Conducted Power (dBm)**	**Max Antenna Gain (dBi)**
LTE B4	23.37	6.63
WCDMA B5	21.68	8.32
LTE B12	21.92	8.08
LTE B25	23.48	6.52
LTE Modem	24.50	4.00
Downlink (CU)		
Band	**Worst Case Conducted Power (dBm)**	**Max Antenna Gain (dBi)**
LTE B4	15.84	1.16
WCDMA B5	16.99	0.01
LTE B12	15.56	1.44
LTE B25	16.86	0.14

8. Max System Antenna Gain

Port	Max System (Antenna & Cable) Gain
CU	0.01 dBi for WCDMA Band 5 (Fixed on FCC Part 20 limit) 1.16 dBi for LTE Band 4 (Fixed on FCC Part 20 limit) 1.44 dBi for LTE Band 12 (Fixed on FCC Part 20 limit) 0.14 dBi for LTE Band 25 (Fixed on FCC Part 20 limit)
NU Port 1	8.32 dBi for WCDMA Band 5 (Fixed on FCC Part 20 limit) 6.63 dBi for LTE Band 4(Fixed on FCC Part 20 limit) 8.08 dBi for LTE Band 12 (Fixed on FCC Part 20 limit) 6.52 dBi for LTE Band 25 (Fixed on FCC Part 20 limit)
NU Port 2	6.63 dBi for LTE Band 4 (Fixed on FCC Part 20 limit) 6.52 dBi for LTE Band 25 (Fixed on FCC Part 20 limit)

Sincerely,

Name: Miguel Angel Rabago Garcia
Authorized Signatory
Title: Wireless Test Engineer