



February 08, 2023

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.

FCC ID: NU: YETI44-1M34CNU
 CU: YETI41-RECU

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. 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)	FCC Limit (mW/cm ²)
WCDMA Band 5	16.99	0.00997	0.581
LTE Band 04	15.84	0.00997	1.0
LTE Band 12	15.56	0.00997	0.488
LTE Band 13	15.84	0.00997	0.499
LTE Band 25	16.86	0.00997	1.0
LTE Band 30	15.15	0.00997	1.0
LTE Band 48	13.54	0.03969	1.0
LTE Band 71	16.32	0.00997	0.413



Uplink (NU) at 65 cm Separation Distance			
Mode	Output Power (dBm)	Power Density at 20 cm (mW/cm ²)	FCC Limit (mW/cm ²)
WCDMA Band 5	21.68	0.01883	0.551
LTE Band 04	23.37	0.01883	1.0
LTE Band 12	21.92	0.01883	0.468
LTE Band 13	22.01	0.01883	0.520
LTE Band 25	23.48	0.01883	1.0
LTE Band 30	21.51	0.01883	1.0
LTE Band 48	18.87	0.00376	1.0
LTE Band 71	23.94	0.01883	0.444
LTE Modem (LTE B12 as worst case)	24.5	0.141	0.47

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 B4	LTE B12 or LTE B30
	WCDMA B5	LTE B12 or LTE B30
	LTE B12	WCDMA B5 or LTE B25
	LTE B25	LTE B12 or LTE B30
	LTE B30	WCDMA B5, LTE B4 or LTE B25
	<i>Note: worst case bands are: LTE B12 and WCDMA Band 5</i>	
CU work with NU Port 2	LTE B4	LTE B12, LTE B25 or LTE B71
	LTE B12	LTE B4 or LTE B25
	LTE B25	LTE B4, LTE B12 or LTE B71
	LTE B71	LTE B4 or LTE B25
	<i>Note: worst case bands are: LTE B71 and LTE Band 25</i>	
CU work with NU Port 3	LTE B4	LTE B13
	LTE B13	LTE B4, or LTE B25
	LTE B25	LTE B13
	<i>Note: worst case bands are: LTE B13 and LTE Band 25</i>	
CU work with NU Port 4	LTE B48	This port only supports LTE B48



NU has four 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		
NU Port 1	LTE B4	LTE B12 or LTE B30
	WCDMA B5	LTE B12 or LTE B30
	LTE B12	WCDMA B5 or LTE B25
	LTE B25	LTE B12 or LTE B30
	LTE B30	WCDMA B5, LTE B4 or LTE B25
	<i>Note: worst case bands are: LTE B12 and WCDMA Band 5</i>	
NU Port 2	LTE B4	LTE B12, LTE B25 or LTE B71
	LTE B12	LTE B4 or LTE B25
	LTE B25	LTE B4, LTE B12 or LTE B71
	LTE B71	LTE B4 or LTE B25
	<i>Note: worst case bands are: LTE B71 and LTE Band 25</i>	
NU Port 3	LTE B4	LTE B13
	LTE B13	LTE B4, or LTE B25
	LTE B25	LTE B13
	<i>Note: worst case bands are: LTE B13 and LTE Band 25</i>	
NU Port 4	LTE B48	This port only supports LTE B48

4. Worst Case Simultaneous Transmission MPE:

Downlink (CU with NU Port 1) at 20 cm Separation Distance			
Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	FCC MPE ratio (MPE/Limit)
LTE Band 12	0.00997	0.488	0.020430
WCDMA Band 5	0.00997	0.581	0.017160
Sum of the ratios (should be <1.0)			0.03759

Downlink (CU with NU Port 2) at 20 cm Separation Distance			
Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	FCC MPE ratio (MPE/Limit)
LTE Band 71	0.00997	0.413	0.024140
LTE Band 25	0.00997	1.0	0.009970
Sum of the ratios (should be <1.0)			0.03411



Downlink (CU with NU Port 3) at 20 cm Separation Distance			
Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	FCC MPE ratio (MPE/Limit)
LTE Band 13	0.00997	0.499	0.019980
LTE Band 25	0.00997	1.0	0.009970
Sum of the ratios (should be <1.0)			0.02995

Uplink (NU Port 1) at 65 cm Separation Distance			
Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	FCC MPE ratio (MPE/Limit)
LTE Band 12	0.01883	0.468	0.040235
WCDMA Band 5	0.01883	0.551	0.034174
Sum of the ratios (should be <1.0)			0.074409

Uplink (NU Port 2) at 65 cm Separation Distance			
Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	FCC MPE ratio (MPE/Limit)
LTE Band 71	0.01883	0.444	0.042410
LTE Band 25	0.01883	1.0	0.018830
Sum of the ratios (should be <1.0)			0.06124

Uplink (NU Port 3) at 65 cm Separation Distance			
Transmitter type	MPE (mw/cm ²)	FCC Limit (mW/cm ²)	FCC MPE ratio (MPE/Limit)
LTE Band 13	0.01883	0.520	0.036212
LTE Band 25	0.01883	1.0	0.018830
Sum of the ratios (should be <1.0)			0.055042

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)	FCC Limit (mW/cm ²)	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 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):	0.01	(dBi)
Maximum antenna gain:	1.002	(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 ²)
Power density at prediction frequency:	0.00997	(mW/cm ²)
FCC Margin of Compliance:	-17.65	(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):	1.16	(dBi)
Maximum antenna gain:	1.306	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2112.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
Power density at prediction frequency:	0.00997	(mW/cm ²)
FCC Margin of Compliance:	-20.01	(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):	1.44	(dBi)
Maximum antenna gain:	1.393	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	731.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.488	(mW/cm ²)
Power density at prediction frequency:	0.00997	(mW/cm ²)
FCC Margin of Compliance:	-16.90	(dB)

LTE Band 13 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):	1.16	(dBi)
Maximum antenna gain:	1.306	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	748.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.499	(mW/cm ²)
Power density at prediction frequency:	0.00997	(mW/cm ²)
FCC Margin of Compliance:	-16.99	(dB)

LTE Band 25 Downlink at 20 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):	0.14	(dBi)
Maximum antenna gain:	1.033	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1932.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
Power density at prediction frequency:	0.00997	(mW/cm ²)
FCC Margin of Compliance:	-20.01	(dB)



LTE Band 30 Downlink at 20 cm Separation Distance:

Maximum peak output power at antenna input terminal:	15.15	(dBm)
Maximum peak output power at antenna input terminal:	32.73	(mW)
Antenna gain(max):	1.85	(dBi)
Maximum antenna gain:	1.531	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2352.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
Power density at prediction frequency:	0.00997	(mW/cm ²)
FCC Margin of Compliance:	-20.01	(dB)

LTE Band 48 Downlink at 20 cm Separation Distance:

Maximum peak output power at antenna input terminal:	13.54	(dBm)
Maximum peak output power at antenna input terminal:	22.59	(mW)
Antenna gain(max):	9.46	(dBi)
Maximum antenna gain:	8.831	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	3550	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
Power density at prediction frequency:	0.03969	(mW/cm ²)
FCC Margin of Compliance:	-14.01	(dB)

LTE Band 71 Downlink at 20 cm Separation Distance:

Maximum peak output power at antenna input terminal:	16.32	(dBm)
Maximum peak output power at antenna input terminal:	42.85	(mW)
Antenna gain(max):	0.68	(dBi)
Maximum antenna gain:	1.169	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	619.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.413	(mW/cm ²)
Power density at prediction frequency:	0.00997	(mW/cm ²)
FCC Margin of Compliance:	-16.17	(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):	8.32	(dBi)
Maximum antenna gain:	6.792	(numeric)
Prediction distance:	65	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	826.4	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.551	(mW/cm ²)
Power density at prediction frequency:	0.01883	(mW/cm ²)
FCC Margin of Compliance:	-14.66	(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):	6.63	(dBi)
Maximum antenna gain:	4.603	(numeric)
Prediction distance:	65	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	826.4	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
Power density at prediction frequency:	0.01883	(mW/cm ²)
FCC Margin of Compliance:	-17.25	(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):	8.08	(dBi)
Maximum antenna gain:	6.427	(numeric)
Prediction distance:	65	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	701.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.468	(mW/cm ²)
Power density at prediction frequency:	0.01883	(mW/cm ²)
FCC Margin of Compliance:	-13.95	(dB)



LTE Band 13 Uplink at 65 cm Separation Distance:

Maximum peak output power at antenna input terminal:	22.01	(dBm)
Maximum peak output power at antenna input terminal:	158.85	(mW)
Antenna gain(max):	7.99	(dBi)
Maximum antenna gain:	6.295	(numeric)
Prediction distance:	65	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	779.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.520	(mW/cm ²)
Power density at prediction frequency:	0.01883	(mW/cm ²)
FCC Margin of Compliance:	-14.41	(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):	6.52	(dBi)
Maximum antenna gain:	4.487	(numeric)
Prediction distance:	65	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	1852.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
Power density at prediction frequency:	0.01883	(mW/cm ²)
FCC Margin of Compliance:	-17.25	(dB)

LTE Band 30 Uplink at 65 cm Separation Distance:

Maximum peak output power at antenna input terminal:	21.51	(dBm)
Maximum peak output power at antenna input terminal:	141.58	(mW)
Antenna gain(max):	8.49	(dBi)
Maximum antenna gain:	7.063	(numeric)
Prediction distance:	65	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2307.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
Power density at prediction frequency:	0.01883	(mW/cm ²)
FCC Margin of Compliance:	-17.25	(dB)



LTE Band 48 Downlink at 65 cm Separation Distance:

Maximum peak output power at antenna input terminal:	18.87	(dBm)
Maximum peak output power at antenna input terminal:	77.09	(mW)
Antenna gain(max):	4.13	(dBi)
Maximum antenna gain:	2.588	(numeric)
Prediction distance:	65	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	3550	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm ²)
Power density at prediction frequency:	0.00376	(mW/cm ²)
FCC Margin of Compliance:	-24.25	(dB)

LTE Band 71 Uplink at 65 cm Separation Distance:

Maximum peak output power at antenna input terminal:	23.94	(dBm)
Maximum peak output power at antenna input terminal:	247.74	(mW)
Antenna gain(max):	6.06	(dBi)
Maximum antenna gain:	4.036	(numeric)
Prediction distance:	65	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	665.5	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	0.444	(mW/cm ²)
Power density at prediction frequency:	0.01883	(mW/cm ²)
FCC Margin of Compliance:	-13.72	(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(max):	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/cm ²)
Power density at prediction frequency:	0.1408	(mW/cm ²)
FCC Margin of Compliance:	-5.21	(dB)



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6. Power and Calculated Max Antenna Gain 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 B13	22.01	7.99
LTE B25	23.48	6.52
LTE B30	21.51	8.49
LTE B48	18.87	4.13
LTE B71	23.94	6.06
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 B13	15.84	1.16
LTE B25	16.86	0.14
LTE B30	15.15	1.85
LTE B48	13.54	9.46
LTE B71	16.32	0.68



7. Max System Antenna Gain

Port	Max System (Antenna & Cable) Gain
CU	0.01 dBi for WCDMA Band 5 1.16 dBi for LTE Band 4 1.44 dBi for LTE Band 12 1.16 dBi for LTE Band 13 0.14 dBi for LTE Band 25 1.85 dBi for LTE Band 30 9.46 dBi for LTE Band 48 0.68 dBi for LTE Band 71
NU Port 1	8.32 dBi for WCDMA Band 5 6.63 dBi for LTE Band 4 8.08 dBi for LTE Band 12 6.52 dBi for LTE Band 25 8.49 dBi for LTE Band 30
NU Port 2	6.63 dBi for LTE Band 4 8.08 dBi for LTE Band 12 6.52 dBi for LTE Band 25 6.06 dBi for LTE Band 71
NU Port 3	6.63 dBi for LTE Band 4 7.99 dBi for LTE Band 13 6.52 dBi for LTE Band 25
NU Port 4	4.13 dBi (This port only supports LTE B48)

Sincerely,

A handwritten signature in black ink, appearing to read "Ferdie S. Custodio".

Ferdie S. Custodio

Name

Authorized Signatory

Title: Senior EMC Test Engineer /Wireless Team Lead