December 14, 2016

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

Attention: Director of Certification

FCC ID: XPY2AGQN1NNN

RE: ***Antenna gain calculation per guidance from KDB 447498 D01 Mobile Portable RF Exposure v06***.

EUT	u-blox San Diego, Inc. SARA-R404M LTE Cat-M1 Module
Input Power of the Antenna	22.99 dBm / 199.07 mW1 (worst case Average power of the EUT)
Frequency	786.9 MHz
FCC Limit (§1.1310 (d)(4))	0.5246 mW/cm^2 @ 786.9 MHz
User separation distance	20 cm

Equation for predicting RF field was used to determine the maximum antenna gain that can be used with the EUT and still comply with the requirements:

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

Where: S=the power flux

P=input power of the antenna

G=antenna gain relative to an isotropic antenna

r=distance from the antenna to the point of investigation

From this formula, using 0.5246 mW/cm^2 as *S*, 20 cm as *r* then the antenna gain *G* is calculated. This is the maximum antenna gain in dBi that can be used with the EUT while still in compliance with the power density requirements.

$$G = \frac{4\pi r^2 S}{P}$$

$$G = \frac{4\pi(20\ cm)^2(0.5246\ mW/cm^2\ )}{199.07\ mW}$$

$$G = \frac{2636.93}{199.07\ mW}$$

Therefore *G* = **13 dBi**

The calculation presented here is based from 3 watts ERP power limit of portable stations (hand-held device).

Sincerely,

Ferdie S. Custodio
Name
Authorized Signatory
Title: Senior EMC/Wireless Test Engineer