1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended to comply with § 2.1091 radiofrequency radiation exposure evaluation: mobile devices of the FCC CFR 47 Rules, CFR 1.1310 (b) Radio frequency Radiation Exposure Requirement.

This submittal(s) (test report) is intended to comply with RSS-102 issue 5 For 47 CFR 1.1310 Radio frequency Radiation Exposure requirement.

1.2. SPECIAL ACCESSORIES

Not available for this EUT intended for grant.

1.3. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

1.4. LIMITATION

FCC RULES:

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
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
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

IC RULES:

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field Strength (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-1021	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	0.158 $f^{0.5}$	4.21 x 10-4 $f^{0.5}$	6.67 x 10-5 f	616000/ $f^{1.2}$

F = frequency in MHz
* = Based on nerve stimulation (NS).
** = Based on specific absorption rate (SAR).

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

below 20 MHz6 and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);

at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 22.48/$f_{0.5}$W (adjusted for tune-up tolerance), where f is in MHz;

at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);

at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 $f_{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

1.5. MAXIMUM PERMISSIBLE EXPOSURE (MPE) EVALUATION

The calculation as deduces below presents only worst-ca se that produces highest value of the result:

Note1: only one LTE band can work simultaneously
Note2: Operation Configuration of the Worth-Case picked up to evaluated

Collocated MPE Calculation

The modem may transmit simultaneously with other collocated radio transmitters within a host device, provided the following conditions are met:

- Each collocated radio transmitter has been certified by FCC/IC for mobile application (that will be met since SQNS module will have its own FCC ID and host device will have its own FCC ID)
- At least 20 cm separation distance between the antennas of the collocated transmitters and the user's body must be maintained at all times (host installation should taking care of that)

The output power and antenna gain in a collocated configuration must not exceed the limits and configurations stipulated in the following table.

LTE output power of 24dBm at 777MHz-798MHz with maximum peak gain of 6dBi antenna

WLAN output power of 17dBm at 2412MHz-2462MHz with maximum peak gain of 10dBi antenna

The power density calculations for the individual transmitters per wireless technology at an exposure minimum separation distance of 20cm are shown in Table 1.
For frequency dependent limit, the lowest transmitter frequency was used to represent the lowest MPE limit in this analysis (eg. 777MHz = 0.518mW/cm2)

Table 1 : Collocated MPE Calculation (Worse-case table)

Technology	Frequency (MHz)	Max Conducted Power (dBm)	Max Gain (dBi)	Duty Cycle	FCC Power Density @20cm (mW/cm^2)	IC Power Density @20cm (W/m^2)	FCC MPE Limit (mW/cm^2)	IC MPE Limit (W/m^2)
LTE (B13)	777~787	24	6	1.000	0.199	1.9904	0.518	2.4743
LTE (B14)	788~798	24	6	1.000	0.199	1.9904	0.525	2.4982
LTE (B4)	1710~1755	24	6	1.000	0.199	1.9904	1.000	4.2419
WLAN	2412~2462	17	10	1.000	0.099	0.9975	1.000	5.3660

Per OET Bulletin 65 and IC RSS 102 issue 5, when RF sources have difference frequencies, the fraction of the FCC power density limit shall be determined and the sum of all fractional components shall be less than 1 and IC RSS 102 issue 5 limit.

LTE B13 +WLAN Collocated MPE Calculation **(FCC)**

WLAN (mW/cm^2)	WLAN / MPE limit	(WLAN) / MPE limit	WWAN 700 MHz (mW/cm^2)	FCC MPE limit (mW/cm^2)	(WWAN 700MHz) / MPE limit	(WWAN 700MHz +WLAN)	FCC Limit (mW/cm^2)
0.099	1.00	0.099	0.199	0.518	0.384	0.483	1.000

LTE B13 +WLAN Collocated MPE Calculation **(IC)**

WLAN (W/m^2)	WLAN / MPE limit (W/m^2)	(WLAN) / MPE limit	LTE B13 (W/m^2)	IC MPE limit (W/m^2)	(LTE B13) / MPE limit	(LTE B13 +WLAN)	IC Limit (W/m^2)
0.9975	5.366	0.1858	1.9904	2.4743	0.8044	0.990	1.000

LTE B14 +WLAN Collocated MPE Calculation **(FCC)**

WLAN (mW/cm^2)	WLAN / MPE limit	(WLAN) / MPE limit	WWAN 700 MHz (mW/cm^2)	FCC MPE limit (mW/cm^2)	(WWAN 700MHz) / MPE limit	(WWAN 700MHz +WLAN)	FCC Limit (mW/cm^2)
0.099	1.00	0.099	0.199	0.525	0.379	0.478	1.000

LTE B14 +WLAN Collocated MPE Calculation **(IC)**

WLAN (W/m^2)	WLAN / MPE limit (W/m^2)	(WLAN) / MPE limit	LTE B14 (W/m^2)	IC MPE limit (W/m^2)	(LTE B14) / MPE limit	(LTE B14 +WLAN)	IC Limit (W/m^2)
0.9975	5.366	0.1858	1.9904	2.4982	0.7968	0.9826	1.000

LTE B4 +WLAN Collocated MPE Calculation **(FCC)**

WLAN (mW/cm^2)	WLAN / MPE limit	(WLAN) / MPE limit	WWAN 1700 MHz (mW/cm^2)	FCC MPE limit (mW/cm^2)	(WWAN 700MHz) / MPE limit	(WWAN 700MHz +WLAN)	FCC Limit (mW/cm^2)
0.099	1.00	0.099	0.199	1.000	0.199	0.298	1.000

LTE B4 +WLAN Collocated MPE Calculation **(IC)**

WLAN (W/m^2)	WLAN / MPE limit (W/m^2)	(WLAN) / MPE limit	LTE B4 (W/m^2)	IC MPE limit (W/m^2)	(LTE B4) / MPE limit	(LTE B4 +WLAN)	IC Limit (W/m^2)
0.9975	5.366	0.1858	1.9904	4.2419	0.4690	0.655	1.000