Novariant TX100 RF Exposure Calculation

Note that the Novariant TX100 Terralite Transmitter contains two transmitting antennas, and two transmitters. One is designed & built by Novariant, used for positioning, and the second one is purchased an off-the-shelf component for receiving/transmitting differential updates. The off-the-shelf transmitter (radio modem) is built into our device and carries FCC ID: KNY-6231812519.

This page contains RF exposure calculation for the Novariant transmitter. The remaining two pages contain RF exposure information for the FreeWave radio modem (FCC ID: KNY-6231812519) as supplied by the manufacturer.

Calculation of FCC Exposure Limits per 47 CFR 1.1310

Transmitter specifications:

Transmit power	632 mW
Antenna Gain	12.6 dBic
Duty Cycle (DC)	12.5%

Limits from Table 1 of 47 CFR 1.1310:

Power Density	5 mW/cm^2
Averaging Time	6 minutes

Calculation:

A worker stands 12 inches from the transmit antenna in the direction of maximum radiation. The peak power density is

$S_{pk} = P_t*Gt/(4\pi R^2) = 632\ mW*18.2/(4*\pi*(30.48\ cm)^2) = 0.985\ mW/cm^2$

The average power density in 6 minutes is

$S_{avg} = S_{pk}*DC = 0.123\ mW/cm^2$

This meets the FCC exposure limit by 16 dB.

Maximum peak output power at antenna input terminal: 955 (mW)
Prediction distance: 20 (cm)
Predication frequency: 915 (MHz)
MPE limit for uncontrolled exposure at prediction frequency: 3.05 (mW/cm^2)

Antenna Gain (typical): 5 (dBi)
Maximum antenna gain: 3.16 (numeric)
Power density at predication frequency at 20 cm: 0.60 (mW/cm^2)

Test Result

The EUT is defined to be a mobile device. Predicted power density level at 20cm is 0.60mW/cm^2 which is below the limit of 3.05 mW/cm^2.

RF EXPOSURE

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

(A) Limits for General Population/Uncontrolled Exposure

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
1500-100,000	/	/	1.0	30

(B) Limits for Occupational/Controlled Exposures

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

f = frequency in MHz
* = Plane-wave equivalent power density

MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna