Excellence in Compliance Testing

Certification Exhibit

FCC ID: AMH101002
IC: 10124A-101002

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Project Number: 12-2036

Manufacturer: Locus Solutions LLC
Model: SmartTraxx Fixed

RF Exposure

General Information:
Applicant: Locus Solutions LLC
ACS Project: 12-2036
Device Category: Mobile
Environment: General Population/Uncontrolled Exposure

Technical Information:
The SmartTraxx Fixed uses an external two way RF divider at the RF output port which is connected to a dipole and a puck antenna. The dipole and puck antennas are designed to be installed at significant distances with significant isolation thus eliminating the need to consider collocation with respect to RF exposure.

Antenna 1 Type:	¼ Wave Dipole Antenna
Antenna Gain:	2.15 dBi
Antenna 2 Type:	Puck Antenna
Antenna Gain:	1 dBi
Conducted RF Output Power:	16.58 dBm, 45.50 mW (Power provided to each antenna)
Maximum System EIRP:	21.184 dBm, 131.3415 mW (Considering directional gain)

The maximum system EIRP is calculated using the directional antenna gain per KDB 662911 D01 Multiple Transmitter Output v01r02.

Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / NANT]$ dBi = $10 \log[(10^{2.15/20} + 10^{1/20})^2 / 2]$
= 4.604 dBi

Note: The insertion loss of the power divider is taken into consideration for determining maximum conducted output power to each antenna. Output power of 19.59 dBm was measured at the EUT RF output. Output power of 16.58 dBm was provided to each antenna.

MPE Calculation
The Power Density (mW/cm^2) is calculated as follows:

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

Where:
S = power density (in appropriate units, e.g. mW/cm2)
P = power input to the antenna (in appropriate units, e.g., mW)
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 (appropriate units, e.g., cm)

MPE Calculator for Mobile Equipment Limits for General Population/Uncontrolled Exposure*							
Transmit Frequency (MHz)	**Radio Power (dBm)**	**Power Density Limit (mW/Cm2)**	**Radio Power (mW)**	**Antenna Gain (dBi)**	**Antenna Gain (mW eq.)**	**Distance (cm)**	**Power Density (mW/cm^2)**
2405	16.58	1.00	45.50	2.15	1.641	20	0.015
2405	16.58	1.00	45.50	1	1.259	20	0.011

Per the customer, the dipole and puck antennas are designed to be installed at significant distances with significant isolation (>>20 cm). Therefore, the maximum power density is calculated using the antenna configuration leading to the highest value = 0.015 mW/cm^2.

Collocation with GSM / GPRS Modem

This Locus Solutions SmartTraxx contains a Quake Modem Q4000 in addition to the 2.4 GHz Zigbee transmitter. The Quake Modem Q4000 encloses a Telit GSM850/PCS1900 transceiver module (FCC ID: RI7GE865 / IC: 5131A-GE865). The Quake Q4000 modem and the Zigbee 2.4 GHz share the triband puck antenna and can transmit simultaneously. The puck antenna provides a 1 dBi gain for both GSM 850 and PCS 1900 bands.

The EUT dipole antenna is designed to be installed at a significant distance (>>20cm) and with significant isolation from the puck antenna thus eliminating the need to consider simultaneous transmissions with respect to RF exposure. Simultaneous transmission with respect to RF exposure is only considered for the triband puck antenna.

Table 2: MPE Calculations – GSM 850 / PCS 1900 Radios

MPE Calculator for Mobile Equipment Limits for General Population/Uncontrolled Exposure*								
Mode of Operation	**Transmit Frequency (MHz)**	**Radio Power (dBm)**	**Power Density Limit (mW/Cm2)**	**Radio Power (mW)**	**Antenna Gain (dBi)**	**Antenna Gain (mW eq.)**	**Distance (cm)**	**Power Density (mW/cm^2)**
GSM 850	824	31.8	0.55	1513.56	1	1.259	20	0.379
PCS 1900	1850.2	29.4	1.00	870.96	1	1.259	20	0.218

Summation of Power Densities – Simultaneous Transmissions

This device contains multiple transmitters which can operate simultaneously and therefore the maximum RF exposure is determined by the summation of MPE ratios. The limit is such that the summation of MPE ratios is ≤ 1.0.

The summation of MPE ratios is as follows:

2.4 GHz Zigbee and GSM 850 Module operating simultaneously:
2.4 GHz Zigbee MPE Ratio + GSM 850 MPE Ratio
(0.011 / 1.00) + (0.379 / 0.55) = (0.011) + (0.689) = 0.700
0.700 < 1

2.4 GHz Zigbee and PCS 1900 Module operating simultaneously:
2.4 GHz Zigbee MPE Ratio + GSM 1900 MPE Ratio
(0.011 / 1.00) + (0.218 / 1.00) = (0.011) + (0.218) = 0.229
0.229 < 1

Installation Guidelines

The installation manual should contain text similar to the following advising how to install the equipment to maintain compliance with the FCC RF exposure requirements:

RF Exposure

In accordance with FCC requirements of human exposure to radio frequency fields, the radiating element shall be installed such that a minimum separation distance of 20 centimeters will be maintained.

Conclusion

This device complies with the MPE requirements by providing adequate separation between the device, any radiating structure and the general population.