

MPE ASSESSMENT COMPLIANCE REPORT FOR MULTIPLE C0-LOCATED TRANSMITTERS

Product Description:

This Vehicle-Mount Computer Model: 8525 G2, FCC ID: GM38525G2 is manufactured by Psion Teklogix Inc. It consist of three radios, a 2.4 GHz Bluetooth radio integrated into main PCB, a 2.4 GHz IEEE 802.11 'g' radio module certified with FCC ID: GM3RA2040 and a UHF radio transceiver module certified with FCC ID: GM3RA1001. The manufacturer has confirmed that antennas of these two modules are magnetic mount and will be installed 20 cm away from each other and from the EUT. The detailed description of them is as per below.

Companion Mobiles and Antennas:

FCC ID	Mobile Description	Antenna(s)
GM3RA2040	Psion Teklogix 'g' Radio Model: RA2040 Frequency: 2412 -2462 MHz Tx Conducted Power: 0.045 W	Mobile Mark Make Magnet Mount Model: IMAG5-2400 Gain: 5 dBi Frequency: 2400 -2500 MHz
GM3RA1001	Psion Teklogix UHF Radio Model: RA1001 Frequency: 435 -470 MHz Tx Conducted Power: 1.0 W	Quaterwave Whip SMA Magnet Mount Model: 92864 Gain: 0 dBi Frequency: 403 -512 MHz

This test report covers the RF Exposure performance of Bluetooth transmitter transmitting at peak power with 100% duty cycle. The Manufacturer has recommended minimum 20 cm Separation distance from EUT when installed in the mobile vehicle. This product is classified as Occupational/Controlled Exposure, However FCC General Population/Uncontrolled Exposure Limits are used to show MPE compliance as worst case.

1.1. RF EXPOSURE REQUIREMENTS @ 1.1310, 2.1091 & RSS-102

1.1.1. Limits

- **FCC 1.1310:-** The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)				
Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
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
(B) 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

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

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

1.1.2. Method of Measurements

Refer to FCC @ 1.1310, 2.1091, RSS-102, IEEE C95.3 (2002).

$$S = PG / 4\pi r^2 \text{ and } E = (30PG)^{1/2}/r$$

- $PG = (Er)^2/30$
- $S = PG/(4\pi r^2) = (Er)^2/120 \pi r^2 = E^2 / (120\pi)$
- $E = (120\pi S)^{1/2} = 19.42S^{1/2}$

Where: E is Field Strength in (V/m) at distance r (meters)
 S: is power density in Watts/m²

The E-field measurements were conducted as per below:

- (1) Connect the transmitter under test to its antenna with maximum gain as specified by the manufacturer and terminate the other Tx antenna ports with 50 Ohm load.
- (2) Set the transmitter to operate at its maximum power as rated by the manufacturer
- (3) Place the EUT and E-Field Isotropic probe in the Semi-Anechoic Chamber at the height of 2 meters above the ground plane with separation distance of 20 cm.
- (4) Measure the field strength E (V/m) at exact distance of manufacturer specified distance of 20 cm.
- (5) Repeat step (4) with the transmitter's antennas placed in both horizontal and vertical position at different test frequencies

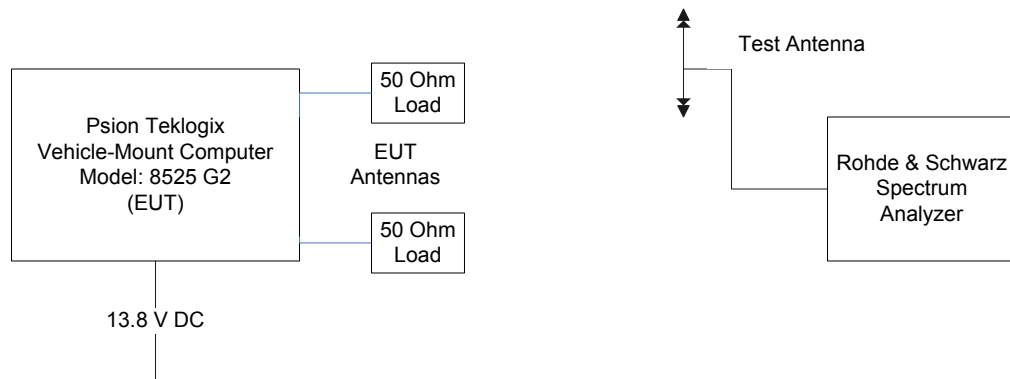
1.1.3. Test Configurations

Manufacturer' instruction for separation distance between EUT and any persons required: 20cm.

1.1.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz to 40 GHz with built-in 30 dB Gain Pre-selector, QP, Average & Peak Detectors.
Dipole Antenna	EMCO	3121C	8907-434	400 MHz – 1 GHz
Horn Antenna	EMCO	3115	9701-5061	1 GHz – 18 GHz
Quarter-Wave Whip Antenna	Psion Teklogix Supplied	92864	--	403 - 512 MHz
Magnet Mount Antenna	Mobile Mark	MAG5-2400	--	2400 - 2500 MHz
50 Ohm Load Terminator	MCL	ANNE-50	1 0229	--

1.1.5. Test Setup Diagram



1.1.6. Test Data

The Manufacturer has specified 20cm as minimum separation distance, hence E-field is measured at 20 cm from antenna or EUT for this configuration.

Antenna specified by Manufacturer: Permanently Integrated Antenna on PCB.

Frequency (MHz)	E-Field (Vertical Polarization) @ 20 cm (dB μ V/m)	E-Field (Horizontal Polarization) @ 20 cm (dB μ V/m)	Peak E-Field in (V/m)
2402	109.28	114.56	0.535
2441	109.86	114.12	0.508
2480	111.38	114.40	0.525

$$\text{Power Density } S_1 = E^2/120\pi \text{ W/m}^2 = (0.535)^2/377 = 0.000759 \text{ W/m}^2 = 0.000759 \text{ mW/cm}^2 < 1.0$$

The MPE results presented herein demonstrate compliance to the applicable FCC/IEEE Occupational/Controlled exposure Power Density limit of 5.0mW/cm² for the frequency range of 1.5-100 GHz.

Compliance to the FCC/IEEE General Population/Uncontrolled exposure Power Density limit of 1.0mW/cm² for the frequency range of 1.5-100 GHz as worst case.

1.1.7. Test Setup Photo

