Open Area Test Site

Open Area Test Site for Industry Canada approval by Bryan Kasper's Office for

TRANSCRYPT EF JOHNSON RADIO SYSTEMS
Street.....299 Johnson Avenue,
P.O. Box 1249 City.....Waseca,
MN Country.....U.S.A., 56093-0514

At this time the site is successfully filed and appears on the List of OATS laboratories, but the identification number has not yet received by the lab.

RF EXPOSURE DATA

Rule: RSS102- issue 1,para. 2.2 :Exposure of Persons Not Classed as RF and Microwave Exposed Workers (including the General Public)

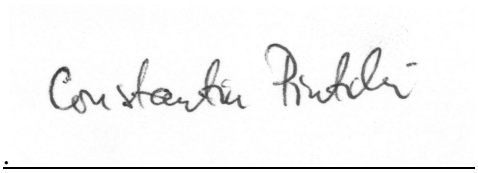
Maximum Standard: Canada's Safety Code 6 para. 2.2.1 Table 5

Frequency range:	300-1500 MHz	values: 806-824MHz (max Tx freq)	
Power Density	f/150	W/m^2	5.3733-5.4933 W/m^2

The exposure should not exceed 5.37 W/m^2

Estimation Result: Meets maximum standard (0.255 W/m^2)

Theoretical Estimation of Exposure Fields: as per Canada's Safety Code 6 Cap. 2.3 (b) for time averaging and Annex III formula (III.6) for power density.



Calculations Performed By . date Jan 17, 2000
Constantin Pintilei

Note: The calculation will consider the worst case for RF exposure as follow:

f=806 MHz

$\lambda=3*10^8(m/s)/806*10^6(Hz)=0.372m$

r=0.5 m - mag-mount antenna and person standing next to the car. $r>\lambda/(2\pi)$ =>far field region

P_T=40W -maximum transmitted power

G=3dB - efficient mag-mount antenna,

no cable loses - for worst case.

no spatial averaging

1% Tx duty cycle (see comments below about DBA time-slotted protocol) this yield 360ms=0.06 min transmission time for each 6 min averaging period

Formulas:

Time - averaged power density: $W = \frac{1}{6}\sum_{i=1}^{n} W_i \Delta t_i$; Far-field region power density: $W_i = \frac{P_T G}{4\pi * r^2}$

For an 1% Tx duty cycle

$$W = \frac{1}{6} * 0.06 * \frac{40 * 2}{4\pi * 0.5^2} = 0.255 \text{ W/m}^2$$

Data for time averaging.

Gemini-based systems use DBA (Dynamic Bandwidth Allocation) communication protocol. This protocol uses 100 ms time slots for one mobile in the network at the time to transmit. The base station rules which mobile will transmit so the messages transmitted by mobiles won't collide and one mobile can not transmit more than 100ms.

A mobile can send two types of messages: data messages and acknowledgements to the base stations. A longer data message will be split is several 100ms ones and they will queue the Tx for available slots. An acknowledgement is 1 slot length.

Traffic survey data shows

Average no of inbound (mobile to base) transmissions (slots per hour)	44
Max	173
Min	13
Std Deviation	36
Average no of outbound (base to mobile) transmissions (slots / hour)	61
Max	241
Min	14
Std Deviation	61

Using the max of inbound transmissions we have

173 slots / hour = 17 slots / 6 mins

Outbound transmissions generate fewer acks; as few as 1:16, but even making a highly conservative worst-worse case assumption that the outbound traffic consists only of short two-slot messages so that mobile transmits one ack for every two, we arrive at

241/2=120 ackslots / hour = 12 slots / 6 min

Adding them we have 17+12 slots/6min= 31 slots/6min. So we have 31 intervals of Δt=100ms=0.00167min when the mobile transmits.

Substituting in time-averaging formula

$$W = \frac{1}{6} * 31 * 0.00167 * \frac{40 * 2}{4\pi * 0.5^2} = 0.2197 \text{ W/m}^2$$

(In a more common time-average value, the maximum Tx duty cycle for mobile is 0.83% so we are allowed to maximize it to 1%)