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QOLSYS
MPE REPORT

SCOPE OF WORK
MPE CALCULATION
ON THE DS1 94V-0 DS1 94V-0

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103686968LEX-002

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TEST REPORT

Report Number:	**103686968LEX-002**
Project Number:	**G103686968**
Report Issue Date:	**2/6/2019**
Product Name:	**DS1 94V-0**
Model:	**DS1 94V-0**
FCC Standards:	**FCC Part 1.1310 Limits for Maximum Permissible Exposure (MPE)**
Industry Canada Standards:	**RSS-102 Issue 5**

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MPE Calculation

§ 1.1310: The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Part 1.1310 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.

RSS-102 Issue 5 Exposure Limits:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
$0.003\text{-}10^{21}$	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	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

1.1 Test Procedure

An MPE evaluation for was performed in order to show that the device was compliant with §2.1091. The maximum power density was calculated for each transmitter at a separation distance of 20cm. The calculation was performed using the maximum gain from the internal and external antennas declared by the manufacturer.

For each transmitter the maximum RF exposure at a 20 cm distance using the formula:

$$Conducted\,Power_{mW} = 10^{Conducted Power(dBm)/10}$$

$$PowerDensity = \frac{Conducted\,Power_{mW} \times Ant.Gain}{4\pi \times (20_{cm})^2}$$

1.2 Results:

The calculated maximum power density at 20cm distance is less that the limit for general population / uncontrolled exposure. The FCC limit is 0.213 mW/cm^2. The ISED limit is 1.35 W/m^2.

The field strength of the transmitter was measured to be 89.01 dBμV/m at a 3 meter test distance.

The duty cycle correction factor can be calculated using the following correction factor

$$DCCF_{dB} = 20 \times log\left(\frac{T_{on}}{T_{Total}}\right)$$

$$DCCF_{dB} = 20 \times log\left(\frac{10.3625ms}{100ms}\right) = 20 \times log(0.103625) = -19.69dB$$

Converting Field Strength to EIRP can be done using the following correction factor

$$EIRP_{dBm} = FS_{dB\mu V/m} + DCCF + 20 \times log(d_m) - 104.8$$

$$EIRP_{dBm} = 89.01 - 19.69 + 20 \times log(3) - 104.8 = -25.94dBm$$

Converting dBm to mW can be done using the following equation

$$P_{mW} = 10^{P_{dBm}/10}$$

$$P_{mW} = 10^{-25.94/10} = 0.002548mW$$

Converting EIRP to Power Density (using a 20cm distance) can be done using the following equations

$$PowerDensity_{mW/cm^2} = \frac{EIRP_{mW}}{4\pi \times (20_{cm})^2}$$

$$PowerDensity_{W/m^2} = 10 \times PowerDensity_{mW/cm^2}$$

$$PowerDensity_{mW/cm^2} = \frac{0.002548mW}{4\pi \times (20_{cm})^2} = 5.07 \times 10^{-7}mW/cm^2$$

$$PowerDensity_{W/m^2} = 10 \times \frac{0.002548mW}{4\pi \times (20_{cm})^2} = 5.07 \times 10^{-6}W/m^2$$