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RADIO TEST REPORT – 452397APFWL

Type of assessment:

MPE Calculation report

Applicant:

FLIR Unmanned Aerial Systems ULC

Product:

Ranger R Series Radar 9GHz band

Model:

Ranger® R6SS-U

Model Variant:

Ranger® R6SS

FCC ID:

2AEYU-R6

Specifications:

- FCC 47 CFR Part 1 Subpart I, §§1.1307, 1.1310
- FCC 47 CFR Part 2 Subpart J, §2.1091
- FCC KDB 447498 D01 General RF Exposure Guidance v06

Date of issue: March 21, 2022

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Prepared by

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Test site identifier	**Organization**	**Ottawa/Almonte**	**Montreal**	**Cambridge**
	FCC:	CA2040	CA2041	CA0101
	ISED:	2040A-4	2040G-5	24676
Website	www.nemko.com			

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 1 Evaluation summary

1.1 MPE calculation for standalone transmission

1.1.1 References, definitions and limits

FCC §2.1091(d)

(2) (2) For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part, except for portable devices as defined in §2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in §2.1093.

Table 1.1-1: *Table 1 to §1.1310(e)(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)
(i) 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
1500–100000			5	<6
(ii) 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
1500–100000			1.0	<30

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

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

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

where: S = power density (mW/cm^2 or W/m^2)
P = power input to the antenna (mW or W)
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 (cm or m)

1.1.2 EUT technical information

Prediction frequency	9650 MHz
Antenna type	Radar antenna
Antenna gain	9 dBi for R6SS-3D/U; 17.5 dBi for R6SS
Number of antennas	1
Maximum transmitter conducted power	39.09 dBm (8 W)
Prediction distance	As table below

	R6SS (8W)		R6SS-3D/U (8W)	
	Uncontrolled	Controlled	Uncontrolled	Controlled
Prediction distance(cm):	200	90	80	40

1.1.3 MPE calculation

1. For R6SS, uncontrolled exposure, 8W operation

Output power nominal: 8 W

Fundamental transmit (prediction) frequency:	9650	MHz
Maximum measured conducted peak output power:	39.09	dBm
Cable and/or jumper loss:	0.0	dB
Maximum peak power at antenna input terminal:	39.09	dBm
Tx On time:	100.000	ms
Tx period time:	100.000	ms
Average factor:	100	%
Maximum calculated average power at antenna input terminal:	8109.611	mW
Single Antenna gain (typical):	17.5	dBi
Number of antennae:	1	
Total system gain (typical):	17.500	dBi
MPE limit for uncontrolled exposure at prediction frequency:	1	mW/cm^2
	10	W/m^2
Minimum calculated prediction distance for compliance:	191	cm
Typical (declared) distance:	200	cm
Average power density at prediction frequency:	**0.907257**	**mW/cm^2**
	9.07257	W/m^2
Margin of Compliance:	**0.42270**	**dB**
Maximum allowable antenna gain:	17.92270	dBi

2. For R6SS, controlled exposure, 8W operation

Output power nominal: 8 W

Fundamental transmit (prediction) frequency:	9650	MHz
Maximum measured conducted peak output power:	39.09	dBm
Cable and/or jumper loss:	0.0	dB
Maximum peak power at antenna input terminal:	39.09	dBm
Tx On time:	100.000	ms
Tx period time:	100.000	ms
Average factor:	100	%
Maximum calculated average power at antenna input terminal:	8109.611	mW
Single Antenna gain (typical):	17.5	dBi
Number of antennae:	1	
Total system gain (typical):	17.500	dBi
MPE limit for uncontrolled exposure at prediction frequency:	5	mW/cm^2
	50	W/m^2
Minimum calculated prediction distance for compliance:	85	cm
Typical (declared) distance:	90	cm
Average power density at prediction frequency:	**4.480280**	**mW/cm^2**
	44.80280	W/m^2
Margin of Compliance:	**0.47665**	**dB**
Maximum allowable antenna gain:	17.97665	dBi

1. **For R6SS-3D/U, uncontrolled exposure, 8W operation**

Output power nominal: 8 W

Fundamental transmit (prediction) frequency:	9650	MHz
Maximum measured conducted peak output power:	39.09	dBm
Cable and/or jumper loss:	0.0	dB
Maximum peak power at antenna input terminal:	39.09	dBm
Tx On time:	100.000	ms
Tx period time:	100.000	ms
Average factor:	100	%
Maximum calculated average power at antenna input terminal:	8109.611	mW
Single Antenna gain (typical):	9	dBi
Number of antennae:	1	
Total system gain (typical):	9.000	dBi
MPE limit for uncontrolled exposure at prediction frequency:	1	mW/cm^2
	10	W/m^2
Minimum calculated prediction distance for compliance:	72	cm
Typical (declared) distance:	80	cm
Average power density at prediction frequency:	**0.800959**	**mW/cm^2**
	8.00959	W/m^2
Margin of Compliance:	**0.96390**	**dB**
Maximum allowable antenna gain:	9.96390	dBi

2. **For R6SS-3D/U, controlled exposure, 8W operation**

Output power nominal: 8 W

Fundamental transmit (prediction) frequency:	9650	MHz
Maximum measured conducted peak output power:	39.09	dBm
Cable and/or jumper loss:	0.0	dB
Maximum peak power at antenna input terminal:	39.09	dBm
Tx On time:	100.000	ms
Tx period time:	100.000	ms
Average factor:	100	%
Maximum calculated average power at antenna input terminal:	8109.611	mW
Single Antenna gain (typical):	9	dBi
Number of antennae:	1	
Total system gain (typical):	9.000	dBi
MPE limit for uncontrolled exposure at prediction frequency:	5	mW/cm^2
	50	W/m^2
Minimum calculated prediction distance for compliance:	32	cm
Typical (declared) distance:	40	cm
Average power density at prediction frequency:	**3.203835**	**mW/cm^2**
	32.03835	W/m^2
Margin of Compliance:	**1.93300**	**dB**
Maximum allowable antenna gain:	10.93300	dBi

1.1.4 Verdict

The calculation is below the limit; therefore, the product is passing the RF Exposure requirements for the declared distance.

End of the test report