US Tech Test Report:	FCC Part 15 Certification/ RSS 210
FCC ID:	KE3-30034451
IC:	2721A-30034451
Test Report Number:	23-0105 and 23-0107
Issue Date:	July 11, 2023
Customer:	Radio Systems Corporation
Model:	300-3445 and 300-34451-1

MPE/SAR exclusion/RF Exposure Evaluation

Maximum Permissible Exposure to RF (MPE) CFR 15.247 (i), CFR 1.1310 (e)

The maximum exposure level to the public from the RF power of the EUT shall not exceed a power density, **S** as per the respective limits in Table 1 below, at a distance, d, of 5 cm (Mobile condition) from the EUT.

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)
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
300-1,500			f/1500	30
1,500-100,000			1.0	30

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

Therefore, for:

MPE for 902 MHz – 928 MHz:

Limit: f/1500 mW/cm^2 = 915/1500 = 0.61 mW/cm^2
Peak Power (dBm) = +7.35 dBm
Peak Power (Watts) = 0.005 W
Gain of Transmit Antenna = +1.0 dB$_i$ = 1.259 numeric

d = Distance = 5 cm = 0.05 m

$S = (PG/ 4\pi d^2)$ = EIRP/4A = 0.005 (1.259)/4*π*0.05*0.05)
= 0.006/0.0314 = 0.3701 W/m^2
= (0.2003 W/m^2) (1m^2/W) (0.1 mW/cm^2)
= 0.02003 mW/cm^2

which is << less than S = 0.61 mW/cm^2

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MPE for 2400 – 2483.5 MHz:

Limit = 1.0 mW/cm^2

Peak Power (dBm) = +10.33 dBm (FCC ID: QOQ-GM240S)
Peak Power (Watts) = 0.010 W
Gain of Transmit Antenna = +2.8 dB$_i$ = 1.905 numeric
d = Distance = 5 cm = 0.05 m

$S = (PG/ 4\pi d_2)$ = EIRP/4A = 0.010 (1.905)/4*π*0.05*0.05
= 0.01905/0.0314 = 0.6063 W/^{m2}
= (0.6063 W/m^2) (1m^2/W) (0.1 mW/cm^2)
= 0.06063 mW/cm^2
which is << less than S = 1.0 mW/cm^2

Simultaneous MPE (900 MHz band +2.4 GHz band) Calculation:

Total MPE (%) = [(900 MHz MPE result/limit (f/1500))*100] + [(2.4 GHz MPE result/limit (1.0))*100] << 100%

= [(0.02003 /0.61) * 100] + [(0.06063 /1.0) * 100] = 9.34% << 100%
Calculation above shows device complies with the MPE requirement at distance of 5 cm.

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SAR Exclusion:

General SAR test exclusion per KDB 447498 D01 V06 section 4.3

Test exclusion conditions are based on source-based time averaged maximum conducted output power of the RF channel, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.

For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

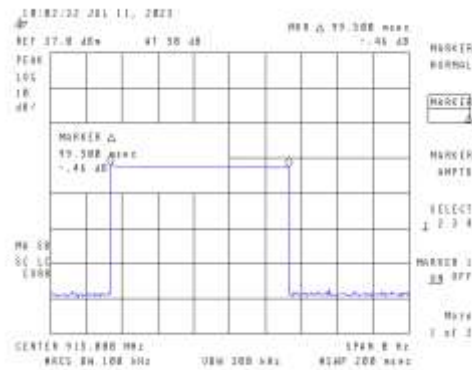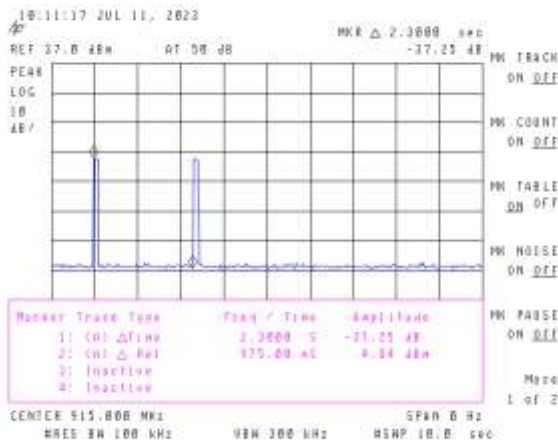[(max. power of channel mW) / (min. test separation distance, mm)] * [($\sqrt{f_{GHz}}$)]

Where the result must be ≤ 3.0 for 1-g SAR and ≤ 7.0 for 10-g SAR

EUT source based time averaged (SBTA) = (output power + antenna gain * duty cycle)

SBTA= 7.35 dBm + 1.0 dBm * (0.019) = 7.369 dBm = 5.45 mW

5.45 mW/50 mm * ($\sqrt{0.915}$ GHz) = 0.104 << 3.0 for 1-g SAR and ≤ 7.0 for 10-g SAR

EUT duty cycle measurement:

DC= 99.5 mSec * 2 = 199 = 1.9 %

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RSS-102, 2.5.1 Exemption Limits for Routine Evaluation SAR Evaluation:

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm except when the device operates at or below the applicable output power levels presented in Table 1 below.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Output power level shall be the higher of the maximum conducted or equivalent isotopically radiated power (e.i.r.p) source-based time averaged (SBTA) output power.

In this case the maximum conducted output power = 5.43 mW and SBTA = 0.104 mW therefore the maximum conducted output power is higher.

The maximum conducted output power is less than 17mW @ 835 MHz and 7mW @ 1900 MHz and is considered to be exempt from routine evaluations.

All calculations performed by:
Test Engineer: ___Gabriel Medina___   Date: July 11, 2023

Signature:_____

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RSS-102, 2.5.2 compliance:

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

for 905 - 925 MHz:

Limit= $1.31 \times 10^{-2} \times 915^{0.6834}$ = 1.38 Watts

Max EIRP = +7.35 dBm + 1.0 dBi = 8.35 dBm = 6.8mW << 1380 mW

2402 MHz – 2480 MHz:

Limit= $1.31 \times 10^{-2} \times 2440^{0.6834}$ = 2.7 Watts

Max EIRP = 10.33 dBm + 2.8 dBi = 13.13 dBm = 20.55mW << 2700 mW

Simultaneous Evaluation Percentage:

[Max EIRP (2.4 GHz)/ Limit in Watts * 100] + [Max EIRP (900 MHz)/Limit in Watts * 100] <<< 100%

[(0.02055/2.71) * 100] + [(0.0068/1.38) *100] = 1.251 % << 100 %

All calculations performed by:

Date: July 11, 2023
Test Engineer: Gabriel Medina

Signature:_ _____