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RF EXPOSURE EVALUATION

Applicant	Aptiv Connection Systems Korea LLC
Applicant Address	38, Gongdan-ro 140beon-gil, Gunpo-si, Gyeonggi-do, Republic of Korea
FCC ID	2A29I-35703750
IC	29623-35703750
Product Description	Single Coil WPC Type 2 NFC
Basic model	35703750
Variant Model name	-
Operating Frequency	13.56 MHz
Antenna type	PCB Loop Antenna
Power Source	DC 12 V

* * RF Exposure Evaluation * *

Limits for FCC RF Exposure Evaluation

Determination of exemption (FCC Part 1, Subpart I, §1.1307 (b)(3))

(i) For single RF sources (*i.e.*, any single fixed RF source, mobile device, or portable device:

A single RF source is exempt if:

- (A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

Limits for ISED RF Exposure Evaluation

Exemption Limits for Routine Evaluation(RSS-102, Section 2.5.1)

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 level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation - Exemption limits for routine evaluation based on frequency and separation distance

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

Calculation

$$P = \frac{P_t G_t}{4\pi r^2} = \frac{V^2}{Z_0} = \frac{E_{rms}^2}{120\pi}$$

Where
 P = Electrical energy in watts
 V = Voltage in V
 Z₀ : Impedance in free space

$$E = \frac{\sqrt{30P_t G_t}}{r} = \frac{\sqrt{30EIRP(W)}}{r}$$

Where
 P_t = transmitter output power in watts
 G_t = numeric gain of the transmitting antenna (unitless)
 E = electric field strength in V/m
 r = measurement distance in meters (m)

$$20\log(E) = 10\log(30) + 10\log(EIRP) - 20\log(r)$$

$$E(\text{dBV}) = EIRP(\text{dBW}) - 20\log(r) + 14.77$$

$$EIRP(\text{dBm}) = E(\text{dBuV}) + 20\log(r) - 104.77$$

Evaluation results : SAR test is exempt as shown in the table below.

Mode	Frequency [MHz]	Measured power (dBuV / m@3m)	Maximum power		FCC Exemption	ISED Exemption
			[dBm]	[mW]		
RFID	13.56	82.1	-13.13	0.05	Below 1 mW	Below 71 mW*

* Safety distance : 5 mm