RF Exposure / MPE Calculation

No.	:	14011105H
Applicant	:	DENSO TEN Limited
Type of Equipment	:	Car Navigation
Model No.	:	TN0022A
FCC ID	:	BABTN0022A

DENSO TEN Limited declares that Model: TN0022A complies with FCC radiation exposure requirement specified in the FCC Rule 2.1091 (for mobile).

RF Exposure Calculations:

The following information provides the minimum separation distance for the highest gain antenna provided with the "TN0022A" as calculated from (B) Limits for General Population / Uncontrolled Exposure of TABLE 1- LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) of §1.1310 Radiofrequency radiation exposure limits.

[WLAN (2.4 GHz band) part]

This calculation is based on the highest EIRP possible from the system, considering maximum power and antenna gain, and considering a 1mW/cm^2 uncontrolled exposure limit. The Friis formula used was:

$$S = \frac{P \times G}{4 \times \pi \times r^2}$$

Where

P = 22.65 mW (Maximum average output power)

☐ Time average was used for the above value in consideration of 6-minutes time-averaging

☑ Burst power average was used for the above value in consideration of worst condition.

G = 0.693 Numerical Antenna gain; equal to -1.59dBi

r = 20 cm (Separation distance)

Power Density Result S = **0.00312 mW/cm^2**

[Bluetooth (BR/EDR) part]

This calculation is based on the highest EIRP possible from the system, considering maximum power and antenna gain, and considering a 1mW/cm^2 uncontrolled exposure limit. The Friis formula used was:

$$S = \frac{P \times G}{4 \times \pi \times r^2}$$

Where

P = 4.85 mW (Maximum average output power)

☑ Time average was used for the above value in consideration of 6-minutes time-averaging

☐ Burst power average was used for the above value in consideration of worst condition.

G = 0.676 Numerical Antenna gain; equal to -1.7dBi

r = 20 cm (Separation distance)

Power Density Result S = **0.00065 mW/cm^2**

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[Bluetooth Low Energy part]

This calculation is based on the highest EIRP possible from the system,
considering maximum power and antenna gain, and considering a 1mW/cm^2 uncontrolled exposure limit. The Friis formula used was:

$$S = \frac{P \times G}{4 \times \pi \times r^2}$$

Where

P = 0.84 mW (Maximum average output power)

☐ Time average was used for the above value in consideration of 6-minutes time-averaging

☑ Burst power average was used for the above value in consideration of worst condition.

G = 0.676 Numerical Antenna gain; equal to -1.7dBi

r = 20 cm (Separation distance)

Power Density Result S = **0.00011 mW/cm^2**

[WLAN (5 GHz band) part]

This calculation is based on the highest EIRP possible from the system,
considering maximum power and antenna gain, and considering a 1mW/cm^2 uncontrolled exposure limit. The Friis formula used was:

$$S = \frac{P \times G}{4 \times \pi \times r^2}$$

Where

P = 3.61 mW (Maximum average output power)

☐ Time average was used for the above value in consideration of 6-minutes time-averaging

☑ Burst power average was used for the above value in consideration of worst condition.

G = 1.959 Numerical Antenna gain; equal to 2.92dBi

r = 20 cm (Separation distance)

Power Density Result S = **0.00141 mW/cm^2**

Therefore, if WLAN 2.4 GHz and WLAN 5 GHz transmit simultaneously,
S= 0.00312 mW/cm^2 + 0.00141 mW/cm^2 = 0.00453 mW/cm^2

Therefore, if WLAN 2.4 GHz and Bluetooth transmit simultaneously,
S= 0.00312 mW/cm^2 + 0.00065 mW/cm^2 = 0.00377 mW/cm^2

Therefore, if WLAN 5 GHz and Bluetooth transmit simultaneously,
S= 0.00141 mW/cm^2 + 0.00065 mW/cm^2 = 0.00206 mW/cm^2

Even taking into account the tolerance, this device can be satisfied with the limits.

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