



RF Exposure evaluation

Applicant Data: Danfoss Drives
Ulsnaes 1
6300 Graasten
Denmark

Product Data: Control panel
136B7732; 136B7733
Danfoss
with Bluetooth Classic; Bluetooth Low Energy; WLAN 2.4 GHz

FCC ID: 2ANSE-CPVIK

IC: -

Standards
OET Bulletin 65 Edition 97-01 August 1997
FCC 47 CFR §1.1307
FCC 47 CFR §1.1310

Maximum Permissible Exposure

As specified in Table 1(ii) of 47 CFR 1.1310(e)(1) – Limits for Maximum Permissible Exposure (MPE), Limits for General Population/ Uncontrolled Exposure

Frequency range (MHz)	Power density (mW/cm ²)
300 – 1500	f/1500
1500 - 100000	1.0

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Calculations

Equation OET bulletin 65, page 18, edition 97-01:

$$S = P * G / (4 \pi R^2)$$

$$R = \sqrt{ (P * G)_{lim} / S * 4 * \pi }$$

$$G = S * (4 * \pi * R^2) / P_{lim}$$

S = power density

P = power input to the antenna

G = power gain of the antenna

R = distance to the centre of radiation of the antenna

Simultaneous Transmission Considerations

The calculation below is used to consider situations in which simultaneous exposure to fields of different frequencies occur. The calculation is performed by the sum of each relative exposure for each equipment according to the following criteria.

$$\sum_1^N \frac{S_{eqn}}{S_{Limn}} = \frac{S_{eq1}}{S_{Lim1}} + \frac{S_{eq2}}{S_{Lim2}} + \dots + \frac{S_{eqN}}{S_{LimN}} \leq 1$$

Where:

S_{eq} is the power density of the electromagnetic field at a given distance by a specific transmitter and a defined frequency

S_{lim} is the MPE limit for the frequency being evaluated

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Assessment

With:

G = 1.4 dBi

R = 20 cm

P_{BT} = 8.5 dBm @ 2441 MHz

P_{BTLE} = 8.7 dBm @ 2440 MHz

P_{WLANb} = 16.3 dBm @ 2412 MHz

P_{WLANg} = 12.9 dBm @ 2412 MHz

P_{WLANn} = 12.7 dBm @ 2412 MHz

Operational Bands	Frequency (MHz)	Antenna Gain (dBi)	G		P		P*G	S	(P(*G)) _{lim}	Margin to FCC Limit (mW/cm ²)
			Antenna Gain -numeric- (mW/cm ²)	Output Power -conducted- (dBm)	Output Power -conducted- (mW)	Output power (EIRP) (dBm)	Output Power (EIRP) (mW)	Power Density value (mW/cm ²)	FCC Limit (mW/cm ²)	
Bluetooth Classic	2441	1,4	1,3804	8,50	7,08	9,90	9,77	0,0019	1,00	0,9981
Bluetooth Low Energy	2440	1,4	1,3804	8,70	7,41	10,10	10,23	0,0020	1,00	0,9980
WLAN - 802.11b	2412	1,4	1,3804	16,30	42,66	17,70	58,88	0,0117	1,00	0,9883
WLAN - 802.11g	2412	1,4	1,3804	12,90	19,50	14,30	26,92	0,0054	1,00	0,9946
WLAN - 802.11n (20MHz BW)	2412	1,4	1,3804	12,70	18,62	14,10	25,70	0,0051	1,00	0,9949

Note 1: only worst-case values are listed in the table above

Note 2: the duty cycle correction factor is already included in the measurement values

Simultaneous (if applicable):

	Bluetooth Classic (BT)	Bluetooth Low Energy (BTLE)	WLAN 2,4 GHz (WLAN)
(S _{eq} / S _{lim})	0.0019	0.0020	0.0117
Sum of (S _{eq} / S _{lim}) BT+WLAN	0.0136		
Sum of (S _{eq} / S _{lim}) BTLE+WLAN	0.0137		
Limit	1.0		
Conclusion	passed		