MPE / SAR exemption letter according Interim procedure KDB 447498 D04

Customer	Product	Model	Type	HW Status	SW Status	FCC ID
Lufthansa Technik AG Weg beim Jäger 193 22335 Hamburg Germany	Small Aircraft Cabin Management and Inflight Entertainment System (SAC)	SAC0522	MOD0	SAC0522-001-001	SCDP1-01-A-RC01	2BKRFSAC0522001001

Declared minimum distance to human body according to customer ≥ 20 cm according external customer's document "MPE Information Requirements_v1.3".

The customer thus declares that the device is not body-worn.

RF Exposure Test Exemptions for Single Source

MPE-based Exemption

According 1.1307(b)(3)(i)(C) Option C – ERP at frequencies above 300 kHz but at distances R > λ/2π can be exempted as follows:

TABLE B.1—THRESHOLDS FOR SINGLE RF SOURCES
SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source Frequency			**Minimum Distance**			**Threshold ERP**
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R^2
1.34	–	30	35.6 m	–	1.6 m	3,450 R^2/f^2
30	–	300	1.6 m	–	159 mm	3.83 R^2
300	–	1,500	159 mm	–	31.8 mm	0.0128 R^2f
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R^2
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

SAR-based Exemption

According 1.1307(b)(3)(i)(B) Option B – Available maximum time-averaged power or effective radiated power (ERP) at frequencies above 300 kHz and below 6 GHz, but with distances from 0.5 cm to 40 cm may be exempted as follows:

$$P_{\text{th}}\,(\text{mW}) = ERP_{20\text{ cm}}\,(\text{mW}) = \begin{cases} 2040f & 0.3\text{ GHz} \le f < 1.5\text{ GHz} \\ 3060 & 1.5\text{ GHz} \le f \le 6\text{ GHz} \end{cases} \quad \text{(B. 1)}$$

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$$P_{\text{th}}\,(\text{mW}) = \begin{cases} ERP_{20\text{ cm}}(d/20\text{ cm})^x & d \le 20\text{ cm} \\ ERP_{20\text{ cm}} & 20\text{ cm} < d \le 40\text{ cm} \end{cases} \quad \text{(B. 2)}$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\text{ cm}}\sqrt{f}}\right)$$

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)										
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

Calculation based on external document “MPE Information Requirements_v1.3”, provided by customer.

WLAN 2.4 GHz

MPE-based Exemption

Exemption acc. TABLE 1 TO § 1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION																
Band	Technology	Frequency	λ/2π	R	R ≥ λ/2π fulfilled	Maximum Rated Conducted Output Power	Maximum Tolerance	Minimum Path Loss to Antenna connector	Minimum Path Loss in Antenna cable	Maximum Antenna Gain	Duty Cycle	EIRP	ERP	ERP	Threshold ERP	MPE Exemption fulfilled
		(MHz)	(m)	(m)		(dBm)	(dB)	(dB)	(dB)	(dBi)	(%)	(dBm)	(dBm)	(W)	(W)	
2400 ISM	IEEE802.11 b/g/n OFDM	2401.0	0.020	0.200	yes	14.0	2.0	1.1	0.0	6.6	100	21.5	19.4	0.086	0.768	yes
		2412.0	0.020	0.200	yes							21.5	19.4	0.086	0.768	yes
		2423.0	0.020	0.200	yes							21.5	19.4	0.086	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2406.0	0.020	0.200	yes	15.0	2.0	1.1	0.0	6.6	100	22.5	20.4	0.108	0.768	yes
		2417.0	0.020	0.200	yes							22.5	20.4	0.108	0.768	yes
		2428.0	0.020	0.200	yes							22.5	20.4	0.108	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2411.0	0.020	0.200	yes	16.0	2.0	1.1	0.0	6.6	100	23.5	21.4	0.136	0.768	yes
		2422.0	0.020	0.200	yes							23.5	21.4	0.136	0.768	yes
		2433.0	0.020	0.200	yes							23.5	21.4	0.136	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2416.0	0.020	0.200	yes	17.0	2.0	1.1	0.0	6.6	100	24.5	22.4	0.172	0.768	yes
		2427.0	0.020	0.200	yes							24.5	22.4	0.172	0.768	yes
		2438.0	0.020	0.200	yes							24.5	22.4	0.172	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2421.0	0.020	0.200	yes	17.0	2.0	1.1	0.0	6.6	100	24.5	22.4	0.172	0.768	yes
		2432.0	0.020	0.200	yes							24.5	22.4	0.172	0.768	yes
		2443.0	0.020	0.200	yes							24.5	22.4	0.172	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2426.0	0.020	0.200	yes	17.0	2.0	1.1	0.0	6.6	100	24.5	22.4	0.172	0.768	yes
		2437.0	0.020	0.200	yes							24.5	22.4	0.172	0.768	yes
		2448.0	0.020	0.200	yes							24.5	22.4	0.172	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2431.0	0.020	0.200	yes	17.0	2.0	1.1	0.0	6.6	100	24.5	22.4	0.172	0.768	yes
		2442.0	0.020	0.200	yes							24.5	22.4	0.172	0.768	yes
		2453.0	0.019	0.200	yes							24.5	22.4	0.172	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2436.0	0.020	0.200	yes	17.0	2.0	1.1	0.0	6.6	100	24.5	22.4	0.172	0.768	yes
		2447.0	0.020	0.200	yes							24.5	22.4	0.172	0.768	yes
		2458.0	0.019	0.200	yes							24.5	22.4	0.172	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2441.0	0.020	0.200	yes	17.0	2.0	1.1	0.0	6.6	100	24.5	22.4	0.172	0.768	yes
		2452.0	0.019	0.200	yes							24.5	22.4	0.172	0.768	yes
		2463.0	0.019	0.200	yes							24.5	22.4	0.172	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2446.0	0.020	0.200	yes	15.0	2.0	1.1	0.0	6.6	100	22.5	20.4	0.108	0.768	yes
		2457.0	0.019	0.200	yes							22.5	20.4	0.108	0.768	yes
		2468.0	0.019	0.200	yes							22.5	20.4	0.108	0.768	yes
2400 ISM	IEEE802.11 b/g/n OFDM	2451.0	0.019	0.200	yes	13.0	2.0	1.1	0.0	6.6	100	20.5	18.4	0.068	0.768	yes
		2462.0	0.019	0.200	yes							20.5	18.4	0.068	0.768	yes
		2473.0	0.019	0.200	yes							20.5	18.4	0.068	0.768	yes

WLAN 5 GHz

MPE-based Exemption

Exemption acc. TABLE 1 TO § 1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION																
Band	Technology	Frequency	λ/2π	R	R ≥ λ/2π fulfilled	Maximum Rated Conducted Output Power	Maximum Tolerance	Minimum Path Loss to Antenna connector	Minimum Path Loss in Antenna cable	Maximum Antenna Gain	Duty Cycle	EIRP	ERP	ERP	Threshold ERP	MPE Exemption fulfilled
		(MHz)	(m)	(m)		(dBm)	(dB)	(dB)	(dB)	(dBi)	(%)	(dBm)	(dBm)	(W)	(W)	
5000 ISM	IEEE802.11 a/n/ac	5170.0	0.009	0.200	yes	14.0	2.0	0.96	0.00	6.60	100	21.6	19.5	0.089	0.768	yes
		5180.0	0.009	0.200	yes							21.6	19.5	0.089	0.768	yes
		5190.0	0.009	0.200	yes							21.6	19.5	0.089	0.768	yes
5000 ISM	IEEE802.11 a/n/ac	5190.0	0.009	0.200	yes	15.0	2.0	0.96	0.00	6.60	100	22.6	20.5	0.112	0.768	yes
		5200.0	0.009	0.200	yes							22.6	20.5	0.112	0.768	yes
		5210.0	0.009	0.200	yes							22.6	20.5	0.112	0.768	yes
5000 ISM	IEEE802.11 a/n/ac	5210.0	0.009	0.200	yes	15.0	2.0	0.96	0.00	6.60	100	22.6	20.5	0.112	0.768	yes
		5220.0	0.009	0.200	yes							22.6	20.5	0.112	0.768	yes
		5230.0	0.009	0.200	yes							22.6	20.5	0.112	0.768	yes
5000 ISM	IEEE802.11 a/n/ac	5230.0	0.009	0.200	yes	15.0	2.0	0.96	0.00	6.60	100	22.6	20.5	0.112	0.768	yes
		5240.0	0.009	0.200	yes							22.6	20.5	0.112	0.768	yes
		5250.0	0.009	0.200	yes							22.6	20.5	0.112	0.768	yes

Bluetooth

MPE-based Exemption

Exemption acc. TABLE 1 TO § 1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION																
Band	Technology	Frequency	λ/2π	R	R ≥ λ/2π fulfilled	Maximum Rated Conducted Output Power	Maximum Tolerance	Minimum Path Loss to Antenna connector	Minimum Path Loss in Antenna cable	Maximum Antenna Gain	Duty Cycle	EIRP	ERP	ERP	Threshold ERP	MPE Exemption fulfilled
		(MHz)	(m)	(m)		(dBm)	(dB)	(dB)	(dB)	(dBi)	(%)	(dBm)	(dBm)	(W)	(W)	
2400 ISM	Bluetooth 5.3	2402.0	0.020	0.200	yes	10.0	2.0	0.96	0.00	6.60	100	17.6	15.5	0.035	0.768	yes
		2442.0	0.020	0.200	yes							17.6	15.5	0.035	0.768	yes
		2480.0	0.019	0.200	yes							17.6	15.5	0.035	0.768	yes

Simultaneous Transmission

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

	WLAN 2.4 GHz	WLAN 2.4 GHz	WLAN 5 GHz	WLAN 5 GHz	Bluetooth
Maximum Value	0.223686	0.223686	0.145760	0.145760	0.046093
	MIMO		MIMO		

Total Value	=	0.784986

Conclusion

MPE-/ SAR Based Exemption fulfilled

B.Eng. Martin Nunier

Timo Franke

Version	Applied changes	Date of release
R01	Initial release	2024-Oct-18