
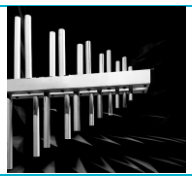
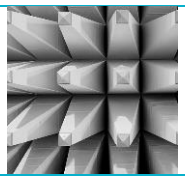

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-03

Maximum Permissible Exposure (MPE) & Exposure evaluation

Report identification number: 1-7901/19-01-23 MPE (FCC_ISED)

Certification numbers and labeling requirements	
FCC ID	2AT94ICU
ISED number	25374-ICU
HVIN (Hardware Version Identification Number)	ICU
PMN (Product Marketing Name)	ICU
FVIN (Firmware Version Identification Number)	-/-
HMN (Host Marketing Name)	-/-

This report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

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EUT technologies:

Technologies:	Max. power [dBm]		Antenna gain max.: [dBi]*	Declared by customer	#
	conducted	EIRP			
WLAN 2.4 GHz	meas. 28.3 (peak)	--	4.2	Max. 29 dBm (peak)	1
WLAN 5GHz	meas. 19.1 (peak)	--	5.9	Max. 20.0 dBm (peak)	2
BT EDR 2.4GHz	meas. 11.2 (peak)	--	3.8	Max. 12.0 dBm (peak)	3
BT LE 2.4GHz	meas. 7.7 (peak)	--	3.8	Max. 8.0 dBm (peak)	4

Details and origins of the measurements shown in the table above:

#	Results from:		Additional information
1	1-7901/19-01-05-A	CTC Advanced GmbH	Max conducted page 25 - MIMO CH6 (2435 MHz)
2	1-7901/19-01-06-A	CTC Advanced GmbH	Max conducted page 31 – n/ac HT20 CH 149 (5745 MHz)
3	1-7901/19-01-12-A	CTC Advanced GmbH	Max conducted page 24, GFSK – 2441 MHz
4	1-7901/19-01-13-A	CTC Advanced GmbH	Max conducted page 22, 2440 MHz / 2448 MHz

)* worst case of all antenna types, from customer document **Antenna Diagramm_v1.pdf (2019-08-26)**

Collocation overview:

	Active scenario:			
Technology	**1**	**2**	**3**	**4**
WLAN 2.4 GHz			x	x
WLAN 5 GHz	x	x		
BT EDR	x		x	
BT LE		x		x

Prediction of MPE limit at given distance - FCC

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG / 4\pi R^2$

where: S = Power density
P = Power input to the antenna
G = Antenna gain
R = Distance to the center of radiation of the antenna
PG = Output Power including antenna gain

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled “Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure”

Frequency Range (MHz)	Power Density (mW/cm^2)	Averaging Time (minutes)
300 -1500	f/1500	30
1500 - 100000	1.0	30

where f = Frequency (MHz)

Prediction: worst case

	Technologies:	WLAN 2.4	WLAN 5	BT EDR	BT LE	
	Frequency (MHz)	2435	5745	2441	2450	
PG	Declared max power (EIRP)	33.2	25.9	15.8	11.8	dBm
R	Distance	20	20	20	20	cm
S	MPE limit for uncontrolled exposure	1	1	1	1	mW/cm^2
	Calculated Power density:	0.4159	0.0774	0.0076	0.0030	mW/cm^2
	Calculated percentage of Limit:	41.59%	7.74%	0.76%	0.30%	
	Collocation:					
	Scenario 1: BT EDR + WLAN 5GHz Calculated percentage of Limit:	7.78%				
	Scenario 2: BT LE+ WLAN 5 GHz Calculated percentage of Limit:	7.75%				
	Scenario 3: BT EDR + WLAN 2.4 GHz Calculated percentage of Limit:	41.59%				
	Scenario 4: BT LE + WLAN 2.4 GHz Calculated percentage of Limit:	41.59%				

This prediction demonstrates the following:

The power density levels for FCC at a distance of 20 cm are below the maximum levels allowed by regulations.

Prediction of MPE limit at given distance - ISED

RSS-102, Issue 5, 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- 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;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

Prediction: worst case

		WLAN 2.4	WLAN 5	BT EDR	BT LE	
	Frequency	2435	5745	2441	2450	MHz
R	Distance	20	20	20	20	cm
PG	Maximum EIRP	33.2	25.9	15.8	11.8	dBm
PG	**Maximum EIRP**	2089.3	389.0	38.0	15.1	mW
	Exclusion Limit from above:	2.70	4.86	2.71	2.71	W
	Calculated percentage of Limit:	77.34%	8.01%	1.40%	0.56%	
	Collocation:					
	Scenario 1: BT EDR + WLAN 5GHz Calculated percentage of Limit:	8.13%				
	Scenario 2: BT LE+ WLAN 5 GHz Calculated percentage of Limit:	8.03%				
	Scenario 3: BT EDR + WLAN 2.4 GHz Calculated percentage of Limit:	77.35%				
	Scenario 4: BT LE + WLAN 2.4 GHz Calculated percentage of Limit:	77.34%				

Conclusion: RF exposure evaluation is not required.