Prüfbericht – Produkte
Test Report - Products

TÜVRheinland®

Prüfbericht-Nr.: *Test report no.:*	IN23KSXW 001	**Auftrags-Nr.:** *Order no.:*	146794069 0010	Seite 1 von 4 *Page 1 of 4*
Kunden-Referenz-Nr.: *Client reference no.:*	2503323	**Auftragsdatum** *Order date:*	09-05-2023	
Auftraggeber: *Client:*	Building robotics Inc 3979 Freedom Circle Suite 210, Santa Clara, California United states of America - 95054			
Prüfgegenstand: *Test item:*	SU-6E-2W			
Bezeichnung *Identification*	SU-6E-2W	**Serien -Nr.:** *Serial no.:*	TKUU022313 00001 TKUU022313 00052	
Auftrags-Inhalt: *Order content:*	Maximum Permissible Expsoure			
Prüfgrundlage: *Test specification:*	FCC 1.1310 and RSS 102, Issue 5 KDB 447498 D01			
Wareneingangsdatum: *Date of sample receipt:*	2022-12-20			
Prüfmuster-Nr.: *Test sample no:*	A003483802-002 & A003483802-008 A003483802-009 & A003483802-005			
Prüfzeitraum: *Testing period:*	2023-05-29 - 2023-06-09			
Ort der Prüfung: *Place of testing:*	Wireless laboratory, Bangalore			
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (India) Pvt. Ltd. 27/B,2nd cross road, Electronic city Phase1, Banglore-560100, IndiaFCC Test Site Registration No: 496599 IC Test Site Registration No: 27711 HVIN: 01-03335-03			
Prüfergebnis*: *Test result*:*	Pass			

geprüft von: *tested by:*	Likhithesh M D	**genehmigt von:** *authorized by:*	Madhu K.N
Datum: *Date:* 2023-06-28		**Ausstellatum:** *Issue date:* 2023-12-08	
Stellung / *Position:*	**Likhithesh M D** **Senior Engineer**	**Stellung** / *Position:*	**Madhu K.N** **Assistant Manager**
Sonstiges / *Other:*	FCC ID: AQQ-SU6E IC ID: 10138A-SU6E		

Zustand des Prüfgegenstandes bei Anlieferung: **Prüfmuster vollständig und unbeschädigt**
Condition of the test item at delivery: ***Test item complete and undamaged***

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.
V05

1 RF Exposure Report

1.1 RF Exposure Measurement

The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310. The gain of the antennas used in the product is extracted from the Antenna data sheets provided and also the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis Transmission formula is far field assumption, the calculated result of that is an over-prediction for near field power density. It is taken as worst case to specify the safety range.

1.2 RF Exposure Limit

1.2.1 For FCC

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of the human exposure to radio-frequency (RF) radiation as specified in 1.1307 (b) showed in Table 1.

Table 1: Limits for Maximum Permissible Exposure (MPE) as per FCC

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)
Limits for Occupational / controlled Exposures			
300 - 1500	--	--	F/300
1500 – 100000	--	--	5.0
Limits for General population / Uncontrolled Exposure			
300 - 1500	--	--	F/1500
1500 – 100000	--	--	1.0

F or f = Frequency in MHz

1.2.2 For IC

According to IC RSS 102 Issue 5: The criteria listed in the following table shall be used to evaluate the environmental impact of the human exposure to radiofrequency (RF) radiation as specified in section 4 showed in Table 4.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

1.2.3 Friss Formula

Friss Transmission Formula: Pd = (Pout * G) / (4*pi*r²)

Where
Pd = power density in mW/cm²
Pout = output power to antenna in mW
G = gain of antenna in linear scale
Pi = 3.1416
R = Distance between observation point and the center of radiator in cm

If we know the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value at distance 20cm.

1.3 Compliance criteria

The Radio frequency Human Exposure Evaluation specification, method and procedures for SU-6E-2W is in accordance with the following standard FCC 1.1310 & IC RSS 102 Issue 5.

1.4 Test Results

Protocol: IEEE 802.15.4 & BLE

Data Rate: 1Mbps

Antenna types	Antenna gain
Wire antenna (internal)	0

MPE calculations :

Protocol	Channel Frequency (MHz)	Maximum output power (dBm)	Output Power to Antenna (mW)	Tune up Value in (dB)	Antenna Gain (dBi)	Antenna gain in linear scale	Power Density (Pd) (mW/cm²)	FCC Limit (mW/cm²)	Power Density (Pd) (W/m²)	RSS Limit (W/m²)
IEEE 802.15.4	2405	4.85	4.8417	2	0	1.0	0.0009632	1.0	0.00963	5.355
BLE	2440	7.64	9.2044	2	0	1.0	0.0018311	1.0	0.01831	5.408

Note:

1. MPE evaluation is performed for 20 cm seperation distance
2. *Note: Manufacturer declared Tune-up tolerance of ±2dB is considered in the calculation

1.5 Conclusion:

The Power density of the EUT is less than defined limit as shown above, hence EUT is exempted from routine SAR evaluation.