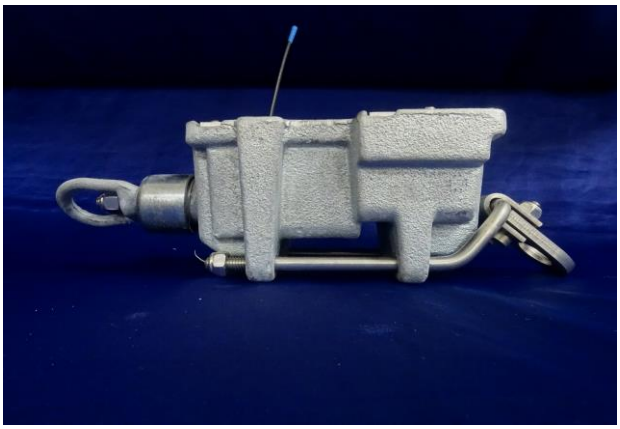
Prüfbericht – Produkte
Test Report - Products

TÜVRheinland®

Prüfbericht-Nr.: *Test report no.:*	**IN24NKH6 001**	**Auftrags-Nr.:** *Order no.:*	146785551 010	Seite 1 von 3 *Page 1 of 3*
Kunden-Referenz-Nr.: *Client reference no.:*	2269507	**Auftragsdatum:** *Order date:*	2023-04-26	
Auftraggeber: *Client:*	Trimble Inc. 5475 Kellenburger Road , Building 2,Dayton, Ohio 45424, United States			
Prüfgegenstand: *Test item:*	Wireless Anti Two Block Switch Sensor			
Bezeichnung *Identification*	GS075-B-V2	**Serien -Nr.:** *Serial no.:* Engineering Sample		
Auftrags-Inhalt: *Order content*:	Testing and issue of Test Report and Grant Certificate			
Prüfgrundlage: *Test specification:*	FCC 1.1310, and RSS 102 Issue 5 KDB 447498 D01			
Wareneingangsdatum: *Date of sample receipt:*	2023-10-18			
Prüfmuster-Nr.: *Test sample no:*	A003584412-018 A003584412-019			
Prüfzeitraum: *Testing period:*	2023-10-19 - 2023-11-05			
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, India FCC Test Site Registration No: 496599 IC Test Site Registration No: 3466E-1			
Prüfergebnis*: *Test result*:*	Pass			



geprüft von: *tested by:*		**genehmigt von:** *authorized by:*	
Datum: *Date:* 2024-08-12		**Ausstellatum:** *Issue date:* 2024-08-12	
Stellung / *Position:*	**Yogesh V** **Senior Engineer**	**Stellung** / *Position:*	**Madhu KN** **Asst Manager**
Sonstiges / *Other:*	FCC ID: S9E-GS200E IC: 5817A-GS000E		
Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery:*	**Prüfmuster vollständig und unbeschädigt** ***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*

1 Maximum Permissible Exposure

1.1 RF Exposure Compliance Requirement

The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. 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 Limits:

1.2.1 For FCC

1. According to FCC Part 1 Subpart I 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/cm^2)
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

Friss Formula

Friss Transmission Formula: $Pd = (Pout * G) / (4*pi*r^2)$

Where

Pd = power density in mW/cm^2

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.

Test Results:

Antenna details:

Sl.No	RF Protocols	Antenna Type	Antenna Gain (dBi)
1	Sub-GHz	Monopole	1.68

Radio Protocol	Antenna Model	Frequency (MHz)	Maximum measured RF output power with tune-up Value (dBm)	Max power Including tune-up tolerance * (mW)	Antenna Gain in linear	Min Separation distance (CM)	Power Density (Pd)(mW/cm²)	FCC Limit (mW/cm2)
Sub-GHz	Monopole	903	7.36	8.36	1.4723125	20	0.0020	0.602

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	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

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

Radio Protocol	Antenna Model	Frequency (MHz)	Maximum measured RF output power with tune-up Value (dBm)	Max power Including tune-up tolerance * (mW)	Antenna Gain in linear	Min Separation distance (CM)	Power Density (Pd)(mW/cm²)	IC Limit (mW/cm2)
Sub-GHz	Monopole	903	7.36	8.36	1.4723125	20	0.0020	0.2792

1.3 Conclusion

The Power density of the EUT is less than defined limit as shown above, Hence EUT is meeting MPE Calculation.