1 RF Exposure Report

This test report shall be used with main report no.: ULR-TC568822300000087F

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

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

1.2.1 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 Ethernet Gateway is in accordance with the following standard FCC 1.1310

1.4 Test Results

Protocol: LoRa

Data Rate: 10 kbps

Antenna types	**Antenna gain**
Dipole Antenna	Max 2.46dBi
Dipole Antenna	Max 3.20dBi

Note: For more details Please refer Report No: ULR-TC568822300000087F Clause: 3.2

MPE calculations : For FCC 1.1307 (b)

Frequency (MHz)	**Measured Pout (dBm)**	**Output Power to Antenna (mW)**	**Antenna Gain (dBi)**	**Antenna gain (dBd)**	**Power Density (Pd) (mW/cm²)**	**FCC Limit (mW/cm²)**
902.2	29.04	801.67	3.20	1.05	0.1673	0.6015

Note:

1. MPE evaluation is performed for 20 cm saperation distance
2. MPE evaluation is performed for highest antenna gain of 3.2 dBi

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, this evaluation is only applicable to RFID transmission