



RF EXPOSURE Test Report

Report No.: MTi240911007-01E5

Date of issue: 2024-11-21

Applicant: Emlid Tech Kft

Product: RTK GNSS receiver

Model(s): RRS-2P

FCC ID: 2BAYERCH204

Shenzhen Microtest Co., Ltd.

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Test Result Certification	
Applicant:	Emlid Tech Kft
Address:	1138 Budapest, Esztergomi way 31-39, HUB 3 building, 5 floor Hungary (Republic Of)
Manufacturer:	Ningbo High-tech Zone Ladder Science co., Ltd
Address:	Building#3, Units 4-1, 5-1, 6-1, Zone D, Zhizao Port, No.215 Qingyi Road, Ningbo High-Tech Zone, Zhejiang Province, China
Factory:	Ningbo High-tech Zone Ladder Science co., Ltd
Address:	Building#3, Units 4-1, 5-1, 6-1, Zone D, Zhizao Port, No.215 Qingyi Road, Ningbo High-Tech Zone, Zhejiang Province, China
Product description	
Product name:	RTK GNSS receiver
Trademark:	EMLID
Model name:	RRS-2P
Series Model:	N/A
Standards:	N/A
Test procedure:	KDB 447498 D01 v06
Date of Test	
Date of test:	2024-10-30 to 2024-11-21
Test result:	Pass

Test Engineer	:	<i>James Qin</i>
		(James Qin)
Reviewed By	:	<i>David. Lee</i>
		(David Lee)
Approved By	:	<i>Leon Chen</i>
		(Leon Chen)

RF EXPOSURE EVALUATION

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f ²	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

MPE Calculation Method

Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

P_d = Power density in mW/cm²

P_{out} = output power to antenna in mW

G = Numeric gain of the antenna relative to isotropic antenna

π = 3.1415926

R = distance between observation point and center of the radiator in cm(20cm)

P_d the limit of MPE, 1mW/cm². If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.



Measurement Result

BR&EDR&BLE&2.4G WIFI:

Operation Frequency:

BR&EDR: 2402-2480MHz

BLE: 2402-2480MHz

WIFI 802.11b/g/n HT20: 2412-2462MHz

Power density limited: 1mW/ cm²

Antenna gain:

BR&EDR&BLE&2.4G WIFI: 0.5dBi

R=20cm

$mW=10^{(dBm/10)}$

antenna gain Numeric= $10^{(dBi/10)}=10^{(0.5/10)}=1.12$

LoRa:

Operation Frequency: 903~927MHz

Power density limited: 1mW/ cm²

Antenna gain: 2.02 dBi

R=20cm

$mW=10^{(dBm/10)}$

antenna gain Numeric= $10^{(dBi/10)}=10^{(2.02/10)}=1.59$

GPRS850/GPRS1900:

GPRS&EGPRS: 824.2MHz~848.8MHz

GPRS&EGPRS 1900: 1850.2MHz~1909.8MHz

ANT Gain:

GPRS&EGPRS 850: -1.64dBi

GPRS&EGPRS1900: 2.26dBi

WCDMA:

WCDMA Band II: 1852.4MHz~1907.6MHz

WCDMA Band IV: 1712.4-1752.6 MHz

WCDMA Band V: 826.4MHz~846.6MHz

ANT Gain:

WCDMA Band II: 2.26dBi

WCDMA Band IV: 2.26dBi

WCDMA Band V: -1.64dBi

LTE:

LTE FDD Band 2: 1850.7 – 1909.3MHz

LTE FDD Band 4: 1710.7 – 1754.3MHz

LTE FDD Band 5: 824.7 – 848.3MHz

LTE FDD Band 7: 2502.5 – 2567.5MHz

LTE FDD Band 12: 699.7 – 715.3MHz

LTE FDD Band 13: 779.5 – 784.5MHz

LTE FDD Band 66: 1710.7 – 1779.3MHz

LTE TDD Band 41: 2537.5 – 2645MHz

ANT Gain:

LTE FDD Band 2: 2.26dBi

LTE FDD Band 4: 2.26dBi

LTE FDD Band 5: -1.64dBi

LTE FDD Band 7: 2.37dBi

LTE FDD Band 12: -1.64dBi

LTE FDD Band 13: -1.64dBi

LTE FDD Band 66: 2.26dBi

LTE TDD Band 41: 2.37dBi



BR&EDR:

Channe l Freq. (MHz)	modulation	conducted power	Tune- up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain		(mW/cm ²)	(mW/c m ²)
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK	11.73	11±1	12	19.953	0.5	1.12	0.0035	1
2441		11.84	11±1	12	19.953	0.5	1.12	0.0035	1
2480		12.12	11±1	12	19.953	0.5	1.12	0.0035	1
2402	π/4- DQPSK	9.24	9±1	10	10.000	0.5	1.12	0.0022	1
2441		9.02	9±1	10	10.000	0.5	1.12	0.0022	1
2480		9.16	9±1	10	10.000	0.5	1.12	0.0022	1
2402	8DPSK	9.25	9±1	10	10.000	0.5	1.12	0.0022	1
2441		8.99	9±1	10	10.000	0.5	1.12	0.0022	1
2480		9.17	9±1	10	10.000	0.5	1.12	0.0022	1

The Maximun MPE ratio: 0.00354

BLE:

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna		Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain		Power density(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
2402	BLE-1M	8.17	8±1	9	7.943	0.5	1.12	0.0018	1
2440		8.45	8±1	9	7.943	0.5	1.12	0.0018	1
2480		7.84	8±1	9	7.943	0.5	1.12	0.0018	1

The Maximun MPE ratio: 0.0018

2.4G WIFI:

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna		Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain		Power density(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
2412	802.11b	19.48	19±1	20	100.000	0.5	1.12	0.0223	1
2437		18.41	18±1	19	79.433	0.5	1.12	0.0177	1
2462		18.61	18±1	19	100.000	0.5	1.12	0.0177	1
2412	802.11g	22.52	22±1	23	251.189	0.5	1.12	0.0445	1
2437		22.29	22±1	23	199.526	0.5	1.12	0.0445	1
2462		21.91	21±1	22	199.526	0.5	1.12	0.0354	1
2412	802.11n H20	21.40	21±1	22	158.489	0.5	1.12	0.0354	1
2437		21.12	21±1	22	158.489	0.5	1.12	0.0354	1
2462		21.13	21±1	22	158.489	0.5	1.12	0.0354	1

The Maximun MPE ratio: 0.0445



LoRa:

Channel Freq. (MHz)	modulation	conducted power	Tune- up power	Max		Antenna		Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain		Power density(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)	(dBi)	Numeric		
903	LoRa	18.15	18±1	19	125.893	2.02	1.59	0.0252	1
915		17.7824	17±1	18	100.000	2.02	1.59	0.0200	1
927		18.128	18±1	19	125.893	2.02	1.59	0.0252	1

The Maximun MPE ratio: 0.0252



GSM

WCDMA

LTE:

Modulation	Highest Output Power (dBm)	Duty factor(dBm)	Burst AVG power(dBm)	Tune-up power(dBm)	Max		Antenna Gain	Evaluation result at 20cm	Power density Limits
					tune-up power				
					(dBm)	(mW)	Numeric	Power density(mW/cm2)	(mW/cm2)
GSM850	35	-9.19	25.81	25±1	26	398.107	0.69	0.0543	0.549
PCS1900	32	-9.19	22.81	22±1	23	199.526	1.68	0.0668	1
WCDMA FDD Band II	25	0	25	25±1	26	398.107	1.68	0.1333	1
WCDMA FDD Band IV	25	0	25	25±1	26	398.107	1.68	0.1333	1
WCDMA FDD Band V	25	0	25	25±1	26	398.107	0.69	0.0543	0.551
LTE Band 2	25	0	25	25±1	26	398.107	1.68	0.1333	1
LTE Band 4	25	0	25	25±1	26	398.107	1.68	0.1333	1
LTE Band 5	25	0	25	25±1	26	398.107	0.69	0.0543	0.553
LTE Band 7	25	0	25	25±1	26	398.107	1.73	0.1367	1
LTE Band 12	25	0	25	25±1	26	398.107	0.69	0.0543	0.469
LTE Band 13	25	0	25	25±1	26	398.107	0.69	0.0543	0.52
LTE Band 41	25	0	25	25±1	26	398.107	1.73	0.1367	1
LTE Band 66	25	0	25	25±1	26	398.107	1.68	0.1333	1

Mode	Duty Cycle
LTE	1:1
WCDMA	1:1
GSM	1:8.3

Note:

Duty factor=10*Log (Duty Cycle)

Burst AVG power = Highest Output Power + duty cycle factor

The Maximun GSM MPE ratio: 0.0989 The Maximun WCDMA MPE ratio: 0.1333

The Maximun LTE MPE ratio: 0.1367



Simultaneous transmit:

Operating Band	The MPE ratio
BR&EDR	0.0035
BLE	0.0018
2.4G WIFI	0.0445
LoRa	0.0252
GSM	0.0989
WCDMA	0.1333
LTE	0.1367

So the Maximum simultaneous transmitting antenna pairs as below:

BR&EDR+ 2.4G WIFI+ LoRa+ LTE=0.0035+0.0445+0.0252+0.1367=0.2099

For the max result: $0.2099 \leq 1.0$ SAR, No SAR is required.

----END OF REPORT----