

RF EXPOSURE EVALUATION REPORT

Application No.:	FYCR2210000416AT
Applicant:	UAB Teltonika Networks
Address of Applicant:	K. Barsausko st. 66, LT-51436, Kaunas, Lithuania.
Manufacturer:	UAB Teltonika Networks
Address of Manufacturer:	K. Barsausko st. 66, LT-51436, Kaunas, Lithuania.
Factory:	TELTONIKA EMS UAB
Address of Factory:	Ditvos g. 6, LT-02121, Vilnius, Lithuania
Equipment Under Test (EUT):	
EUT Name:	LTE Router
Model No.:	RUT951, RUT956
♣	Please refer to section 3.2 of this report which indicates which model was actually tested and which were electrically identical.
Trade Mark:	TELTONIKA
FCC ID:	2AET4RUT956AF
Standard(s) :	FCC Rules 47 CFR §2.1091
	KDB 447498 D04 interim General RF Exposure Guidance v01
Date of Receipt:	2022-10-21
Date of Evaluation:	2022-10-28 to 2022-11-03
Date of Issue:	2022-11-10

Evaluation Result:	Pass*
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* In the configuration evaluated, the EUT complied with the standards specified above.



Winkey Wang
EMC Technical Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2022-11-10		Original

Authorized for issue by:			
		_____ Tree Zhan/Project Engineer	
		_____ Winkey Wang/Reviewer	

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3 General Information

3.1 General Description of E.U.T.

Product Type:	<input type="checkbox"/> Portable device
	<input type="checkbox"/> Mobile device
	<input checked="" type="checkbox"/> Fixed device

3.2 Details of E.U.T.

Power supply:	Power by switching adapter Adapter Model No.: ASSA107A-090100 Input: AC 100-240V, 50/60Hz, 0.45A Output: DC 9V, 1.0 A, 9.0W
Cable(s):	DC cable from Adapter 200cm unshielded; LAN cable 154cm unshielded; RUT956: 2 pcs WiFi antenna 153cm; 1 pcs GPS antenna 300cm; 2 pcs Mobile antenna 303cm. RUT951: 2 pcs WiFi antenna 19.5cm; 2 pcs Mobile antenna 19.5cm.
Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz; 802.11n(HT40): 2422MHz to 2452MHz
Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK); 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Number of Channels:	802.11b/g/n(HT20):11; 802.11n(HT40):7
Channel Spacing:	5MHz
Antenna Type:	R-SMA Antenna
Antenna Gain:	Antenna 1 and Antenna 2: 3dBi for RUT956, Support MIMO. Antenna 1 and Antenna 2: 5dBi for RUT951, Support MIMO.

Remark: The information in this section is provided by the applicant or manufacturer, CCS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

For WCDMA/LTE	
Operation Frequency Band:	WCDMA Band II/IV/V, LTE Band 2/4/5/12/13/14/66/71
Modulation Type:	(WCDMA)QPSK, (LTE) QPSK, 16QAM
HSDPA UE Category:	24

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HSUPA UE Category:	6
LTE Category:	4
Antenna Type:	Dipole Antenna
Antenna Gain:	WCDMA Band II/IV/V: 4dBi, LTE Band 2/4/5/12/13/14/66/71: 4dBi
Based on Module certification (FCC ID: XMR201808EC25AF)	

Declaration of EUT Family Grouping:

Model No.: RUT951, RUT956

Two models were full tested, since according to the declaration from the applicant, the electrical circuit design, PCB layout, components used, internal wiring and functions were identical for all the above models, with only difference on model No. and RUT951 do not support RS232, RS485, GNSS, USB interfaces and I/O connector (RUT951 is depopulated version of RUT956).

Only show the worst case model RUT951 data in this report.

3.3 Separation Distance

Minimum test separation distance:	20cm
Remark: This minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander.	



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3.4 Test Location

All tests were performed at:

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Fuyong lab. Xinlong TechnoPark, Fengtang Road, Fuyong Subdistrict, Bao'an, Shenzhen, China

Tel: +86 755 8866 3988 Fax: +86 755 2671 0594

No tests were sub-contracted.

3.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **A2LA (Certificate No. 6606.01)**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6606.01.

- **FCC –Designation Number: CN1322**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized as an accredited testing laboratory.

Designation Number: CN1322. Test Firm Registration Number: 718073

- **Innovation, Science and Economic Development Canada**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0129.

IC#: 28189.

3.6 Deviation from Standards

None

3.7 Abnormalities from Standard Conditions

None

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4 FCC Radiofrequency radiation exposure limits

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.

4.1 Blanket 1 mW Blanket Exemption

The 1 mW Blanket Exemption of §1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance.

The 1-mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph §1.1307(b)(3)(ii)(A).

The 1-mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

4.2 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table B.1—Thresholds For Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency		Minimum Distance			Threshold ERP
f_L MHz	f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	—	1.34	159 m	—	35.6 m
1.34	—	30	35.6 m	—	1.6 m
30	—	300	1.6 m	—	159 mm
300	—	1,500	159 mm	—	31.8 mm
1,500	—	100,000	31.8 mm	—	0.5 mm
Subscripts L and H are low and high; λ is wavelength.					
From §1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.					

The table applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least $\lambda/2\pi$. The thresholds are



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based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

For mobile devices that are not exempt per Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in §1.1310 is necessary if the ERP of the device is greater than $ERP_{20\text{cm}}$ in Formula (B.1) [repeated from §2.1091(c)(1); also in §1.1307(b)(1)(i)(B)].

$$P_{th} (\text{mW}) = ERP_{20\text{cm}} (\text{mW}) = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B.1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole).

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

Limit calculation			
Frequency range	Frequency(MHz)	$R(\lambda/2\pi)(\text{m})$	Threshold ERP(W)
300~1500MHz	915	0.0522	0.032
1500~10000MHz	2480	0.0193	0.007

4.3 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.



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The SAR-based exemption formula of §1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad (\text{B.2})$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20\text{cm}}$ is per Formula (B.1).

Example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance(mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
0.3~1.5	0.915	1.474	0.5	8.133
1.5~6	2.48	1.905	0.5	2.717

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5 Measurement and Calculation

Remark: we used the maximum power between the conducted power and ERP/EIRP to perform RF exposure exemption evaluation.

The Max Power is 48.31mW. The best case gain of the Antenna 1 and Antenna 2: 3dBi for RUT956, Support MIMO. Antenna 1 and Antenna 2: 5dBi for RUT951, Support MIMO.

	Evaluation method	Exempt Limit(mW)	Verdict
<input type="checkbox"/>	Blanket 1 mW Blanket Exemption	1mW	N/A
<input type="checkbox"/>	MPE-based Exemption(ERP)	7mW(ERP)	N/A
<input checked="" type="checkbox"/>	SAR-based Exemption(P_{th})	3060	Yes

So, the device is to qualify for SAR test exemption, the exemption report is in lieu of the SAR report.

Exposure condition for simultaneous transmission operations

Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluated_k term) shall be used to determine exemption for simultaneous transmission according to Formula (C.1) [repeated from § 1.1307(b)(3)(ii)(B)].

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1 \quad (C.1)$$

Remark:

- a -number of fixed, mobile, or portable RF sources claiming exemption using the §1.1307(b)(3)(i)(B) formula for P_{th}, including existing exempt transmitters and those being added.
- b -number of fixed, mobile, or portable RF sources claiming exemption using the applicable § 1.1307(b)(3)(i)(C) Table 1 formula for Threshold ERP, including existing exempt transmitters and those being added.
- c -number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance.

P_i -the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

P_{th,i} -the exemption threshold power (P_{th}) according to the § 1.1307(b)(3)(i)(B) formula for fixed, mobile, or portable RF source i.

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ERP_j -the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source j. ERP_{th,j} -exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.

Evaluated_k -the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation.

Exposure Limit_k -either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable sources, as applicable

The Power Data is based on the RF Test Report FYCR221000041602.

Antenna Gain: 5dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 3.16 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
2422	16.84	152.757	0.0304	1.0	PASS

Note: Refer to report No. FYCR221000041602 for EUT test Max Power Value.

The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For standalone WCDMA/LTE

Based on Module certification(FCC ID: XMR201808EC25AF), refer to the Module certification EC25-AF for WCDMA/LTE Module test Max Conducted Peak Output Power value.

The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

Test Mode	Maximum Conducted Power (dBm)	Antenna Gain (dBi)	Power (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratio
WCDMA B2	25.00	4	316.23	0.1579	1	0.1579
WCDMA B4	25.00	4	316.23	0.1579	1	0.1579
WCDMA B5	25.00	4	316.23	0.1579	0.550	0.2871
LTE B2	25.00	4	316.23	0.1579	1	0.1579
LTE B4	25.00	4	316.23	0.1579	1	0.1579

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LTE B5	25.00	4	316.23	0.1579	0.550	0.2871
LTE B7	25.00	4	316.23	0.1579	1	0.1579
LTE B12	25.00	4	316.23	0.1579	0.470	0.3360
LTE B13	25.00	4	316.23	0.1579	0.520	0.3037
LTE B14	25.00	4	316.23	0.1579	0.530	0.2979
LTE B66	25.00	4	316.23	0.1579	1	0.1579
LTE B71	25.00	4	316.23	0.1579	0.450	0.3509

Remark: Max Conducted Output Power (including tune-up tolerance).

The simultaneous transmission result between of WiFi and WCDMA/LTE module:

The SAR Exclusion Threshold Level:

=CPD1 / LPD1 + CPD2 / LPD2

(CPD = Calculation power density, LPD = Limit of power density)

= 0.0304 +0.3509= 0.3813< 1

Since the SAR Exclusion Threshold Level is well below the SAR low threshold level, so the EUT is considered to comply with SAR requirement without testing.

--End of the Report--

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