



RF - TEST REPORT

- Human Exposure -

Type / Model Name : TIRU3

Product Description : Interrogation Unit

PMN: TIRU3, HVIN: TIRU3

Applicant : Tempris GmbH

Address : Industriestr. 7

83607 HOLZKIRCHEN, GERMANY

Manufacturer : Tempris GmbH

Address : Industriestr. 7

83607 HOLZKIRCHEN, GERMANY

Test Result according to the standards listed in clause 1 test standards:

POSITIVE

Test Report No. :

T45651-03-03SK

20. August 2021

Date of issue



Deutsche
Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

FCC ID: RXBTIRU3

IC: 25462 - TIRU3

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ATTACHMENT A as separate supplement

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
KDB 447498 D01 v06	RF Exposure procedures and equipment authorisation policies for mobile and portable devices, October 23, 2015.
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
ETSI TR 100 028 V1.3.1: 2001-03,	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2

ISED Canada Rules and Regulations

RSS-102, Issue 5 + Amendment 1	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
ETSI TR 100 028 V1.3.1: 2001-03,	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2

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2 EQUIPMENT UNDER TEST

2.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

2.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

2.3 Photo documentation of the EUT – See ATTACHMENT A

2.4 Equipment type, category

Unlicensed wireless device, fixed equipment.

2.5 Short description of the equipment under test (EUT)

The EUT is a wireless temperature monitor using DTS with a combination of AM (modulation depth: 100%, modulation frequency: 10000 - 13900 kHz) and PM (digitally PRN spreaded and filtered nPSK bit stream) in the frequency range 2438.25 MHz to 2445.75 MHz together with a temperature sensor.

The sensor uses the operating frequency as power supply. The crystal oscillator in the sensor is stimulated by an AM frequency on the RF carrier. This oscillator is tuned by the temperature and the resulting frequency modulates the reflecting carrier with the temperature information. The EUT reads the frequency deviation and displays the resulting temperature.

The firmware allows the user to switch the transmission on or off. The transmit stimulus power is set to P23 by firmware.

Items	Description
Modulation	Vector modulation (AM + PM)
Frequency range	2400 MHz to 2483.5 MHz
Channel numbers	1

Number of tested samples: 1
Serial number: 336
Firmware version: TLM 10.1.060

2.6 Variants of the EUT

There are no variants.

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2.7 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel	Frequency (MHz)
1	2442

2.8 Transmit operating modes

The transmission can be switched on or off. There are no further operating modes.

2.9 Antennas

The following antennas shall be used with the EUT:

Number	Characteristic	Model number	Plug	Frequency range (GHz)	Gain (dBi)	Cable loss (dB)	Effective gain (dBi)	Input impedance (Ω)
1	directional	ANT-PH1	R-SMA	2.4 - 2.4835	8.5	1.0	7.5	50

2.10 Power supply system utilised

Power supply voltage, V_{nom} : 120 VAC, 60 Hz, 56 VDC (PoE)

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3 TEST RESULT SUMMARY

2.4 GHz device using frequency hopping:

Operating in the 2400 MHz – 2483.5 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
KDB 447498, 7.1	RSS 102, 2.5.2	MPE	passed
KDB 447498, 4.3.1	RSS 102, 2.5.1	SAR exclusion consideration	not applicable
KDB 447498, 7.2	RSS102, 3.2	Co-location, Co-transmission	not applicable

The mentioned RSS Rule Parts in the above table are related to:

RSS 102, Issue 5, Amendment 1, February 2021

3.1 Final assessment

The equipment under test fulfils the requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 18 May 2021

Testing concluded on : 19 May 2021

Checked by:

Tested by:

Jürgen Pessinger
Radio Team

Sabine Kugler
Radio Team

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4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15 - 35 °C

Humidity: 30 - 60 %

Atmospheric pressure: 86 - 106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 2011 + A1 / 2014 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Conformity Decision Rule

The conformity decision rule is based on the ILAC G8 published at the time of reporting.

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5 HUMAN EXPOSURE

5.1 Maximum permissible exposure (MPE)

For test instruments and accessories used see section 6 Part **CPC 3**.

5.1.1 Description of the test location

Test location: **NONE**

5.1.2 Applicable standard

According to FCC Part 15, Section 15.247(i):

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

The test methods used comply with ANSI/IEEE C95.1, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".

This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

5.1.3 Description of Determination

The maximum rated output power conducted included the tune up tolerance is used to calculate the EIRP. Through the Friis transmission formula, the known maximum gain of the antenna and the maximum power, can be calculated the MPE in a defined distance away from the product.

Friis transmission formula:

$$P_d = \frac{P_{out} * G}{4 * \pi * r^2}$$

Where:

P_d = power density (mW/cm²)

P_{out} = output power to antenna (mW)

G = gain of antenna (linear scale)

r = distance between antenna and observation point (cm)

According to FCC Rules 47CFR 2.1093(b) the EUT is not a portable device. The EUT is designed to be used that radiating structures are 20 cm outside of the body of the user. ($r = 20$ cm)

5.1.4 Determination of MPE according FCC

Rated output power: 18.0 dBm 63.1 mW

Tune-up tolerance: 1.0 dB

Maximum output power: 19.0 dBm 79.4 mW

Antenna gain max: 7.5 dBi

Maximum EIRP: 26.5 dBm 446.7 mW

Minimum distance r: 20.0 cm

Channel	max. EIRP	Antgain	EIRP	G	S	Limit S _{eq}	Margin	Exposure ratio
No.	(dBm)	(dBi)	(mW)	linear	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)	(%)
1	26.5	7.5	446.71	5.62	0.0889	1.0	-0.9111	8.89

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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)
(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
300-1500	---	---	f/1500	30
1500-100000	---	---	1.0	30

f = Frequency in MHz

5.1.5 Determination of MPE according ISED:

Rated output power:	18.0 dBm	63.1 mW
Tune-up tolerance:	1.0 dB	
Maximum output power:	19.0 dBm	79.4 mW
Antenna gain max:	7.5 dBi	
Maximum EIRP:	26.5 dBm	446.7 mW
Minimum distance r:	20.0 cm	

Channel	EIRP	Antgain	EIRP	G	S	Limit S _{eq}	Margin	Exposure ratio
MHz	(dBm)	(dBi)	(mW)	linear	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)	(%)
2442.00	26.5	7.5	446.71	5.62	0.0889	2.707	-2.6179	3.283

Exemption limits for routine Evaluation – RF exposure evaluation according RSS102, 2.5.2:

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^0.6834$ W (adjusted for tune-up tolerance), where f is in MHz;

At or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

The requirements are **FULFILLED**.

Remarks: None

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5.2 Co-location and Co-transmission

Applicable standard:

OET Bulletin 65, Edition 97-01, Section 2: Multiple-transmitter sites and Complex Environments

The FCC's MPE limits vary with frequency. Therefore, in mixed or broadband RF fields where several sources and frequencies are involved, the fraction of the recommended limit (in terms of power density or square of the electric or magnetic field strength) incurred within each frequency interval should be determined, and the sum of all fractional contributions should not exceed 1.0, or 100 % in terms of percentage.

Remarks: Not applicable, EUT uses only one transmitter at the same time.

5.3 SAR test exclusion considerations

5.3.1 Applicable standard

According to RF exposure guidance:

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

Remarks: Not applicable, EUT is not portable.

5.4 Exemption limits for routine evaluation - SAR evaluation

5.4.1 Applicable standard

According to RSS-102, item 2.5.1:

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Remarks: Not applicable, EUT is not portable.

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6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
-	-	-	-	-	-	-

- End of test report -