EMI – TEST REPORT

- Human Exposure -

Type / Model Name	:	Type 2761-529
Product Description	:	Remote control with Bluetooth 4.0 Low Energy
Applicant	:	ruwido austria gmbh
Address	:	Köstendorfer Strasse 8
		5202 NEUMARKT, AUSTRIA
Manufacturer	:	ruwido austria gmbh
Address	:	Köstendorfer Strasse 8
		5202 NEUMARKT, AUSTRIA
Licence holder	:	ruwido austria gmbh
Address	:	Köstendorfer Strasse 8
		5202 NEUMARKT, AUSTRIA

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

Test Report No. : T40379-00-03TK	24. November 2015 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

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ATTACHMENT B as separte supplement

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
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

OET Bulletin 65, 65A, 65B Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

KDB 447498 D01 v05r02	Mobile and portable devices RF Exposure procedures and equipment authorisation policies, February 7, 2014.
KDB 865664 D01	SAR Measurement Requirements for 100 MHz to 6 GHz, February 7, 2014.
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
RSS-102, Issue 5, March 2015	Radio Frequency (RF) Exposure Compliance of Radio-communication Apparatus (All Frequency Bands)

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT – Detailed photos see Attachment B

2.2 Equipment category

Bluetooth Low Energy device, portable equipment.

2.3 Short description of the equipment under test (EUT)

The EUT is a Bluetooth Low Energy wireless remote control system. The EUT is compatible with the standard 802.15.1. It supports the 2.4 GHz frequency band. A single PCB antenna is used within the system. The modulation used by the EUT is GFSK with a data rate of 1 Mbits which means worst case for testing. The EUT has only one integrated antenna, no temporary connector and no external antenna can be connected. The EUT is run with two 1.5 V alkaline batteries.

Number of tested samples	:	1 (emission test)	1 (duty cycle meas.)
Serial number	:	Pre-production sample	Pre-production sample
Firmware version	:	Test software	V 0.1.0

Items	Description
BT type	4.0 Low Energy
BT chipset type	Texas Instruments CC2541
Modulation	GFSK
Frequency range	2400 MHz to 2483.5 MHz
Channel numbers	40
Data rate (kbps)	1000
Antenna type	PCB

EUT configuration:
(The CDF filled by the applicant can be viewed at the test laboratory.)

2.4 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

Note: the marked frequencies are determined for final testing.

2.5 Variants of the EUT

None

2.6 Transmit operating modes

The EUT uses GFSK and provide following data rate:

1000 kbps (kbps = *kilobits per second)*

2.7 Antenna

The following antennas shall be used with the EUT:

Number	Characteristic	Certification name	Plug	Frequency range (GHz)	Gain (dBi)
1	Omni	PCB antenna	none	2.4 - 2.4835	2.4

2.8 Power supply system utilised

Power supply voltage, V_{nom} : 3 VDC battery powered (2 x LR03 Size AAA)

2.9 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- _____ Model : _____

- _____ Model : _____

2.10 Determination of worst case conditions for final measurement

Measurements have been made in all three orthogonal axes and the settings of the EUT were changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X position with the following settings:

BT 4.0 LE	Available channels	Tested channels	Power setting	Modulation	Data rate
802.15.1	00 to 39	37, 22, 39	0 dBm	GFSK	1000 kbps

1000 kbps, GFSK with TX continuous modulated.

2.10.1 Test jig

No Test jig was used for test.

2.10.2 Test software

The device for emission test uses a special firmware that allows enabling a continuous modulated output signal.

3 TEST RESULT SUMMERY

WLAN device using digital modulation:

Operating in the 2400 MHz – 2483.5 MHz and 5725 MHz – 5850 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.247(i)	RSS 102, 2.5.2	MPE	passed
KDB 447498	-	SAR exclusion consideration	passed
-	RSS 102, 2.5.1	SAR exemption evaluation	passed
OET Bulletin 65	RSS102, 3.2	Co-location, Co-transmission	not applicable

3.1 Final assessment

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

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

Testing commenced on : 05 November 2015

Testing concluded on : 13 January 2015

Checked by:

Klaus Gegenfurtner
I confirm the correctness and Integrity of this documents
2015.11.24 11:03:22 +01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Tobias Kammerer
I´m the author of this document
2015.11.24 09:42:43 +01'00'

Tobias Kammerer
Radio Team

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 / 11.2003 „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 Measurement protocol for FCC and IC

4.4.1 General information

4.4.1.1 Test methodology

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

IC 3009A

In compliance with RSS 210 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.1.3 Details of test procedures

In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

5 TEST CONDITIONS AND RESULTS

5.1 Maximum peak output power

Note:
No separate measurements were performed. The measurement values for fieldstrength are taken out of the test report T40379-00-02TK, section 5.2 (performed at CSA Group Bayern). All measurements were related to the radiated peak output power to perform the human exposure evaluation.

5.1.1 Applicable standard

According to FCC Part 15, Section 15.249(a):
For systems using digital modulation in the 2400-2483.5 MHz band, the average fieldstrentgh limit of the transmitter shall not exceed 94 µV/m (50 mV/m).

5.1.2 Test result

Frequency	Reading level PK	Bandwidth	Correction factor	Corrected level PK	Limit PK	Duty cycle correction factor K_E	Corrected level AV	Limit AV
(MHz)	(dBµV)	(kHz)	(dB)	dB(µV/m)	dB(µV/m)	(dB)	dB(µV/m)	dB(µV/m)
2405	106.1	1000	-14.8	91.3	114	-24.6	66.8	94
2450	107.2	1000	-14.6	92.6	114	-24.6	68.0	94
2480	107.0	1000	-14.2	92.8	114	-24.6	68.2	94

Note: The correction factor includes cable loss and antenna factor.

Calculation of the peak radiated isotropic output power

TX		Test results radiated	
		Fieldstrength E (dBµV/m)	EIRP (dBm)
Lowest frequency: 2402 MHz			
T_{nom}	V_{nom}	91.3	-3.9
Middle frequency: 2450 MHz			
T_{nom}	V_{nom}	92.6	-2.7
Highest frequency: 2480 MHz			
T_{nom}	V_{nom}	92.8	-2.5

Average Power Limit according to FCC Part 15, Section 15.249(a):

Frequency	Field strength of fundamental	
(MHz)	(mV/m)	dB(µV/m)
902 - 928	50	94
2400 - 2483.5	**50**	**94**
5725-5875	50	94
24000 - 24250	250	108

The requirements are **FULFILLED.**

Remarks: _____

_____

6 HUMAN EXPOSURE

6.1 Maximum permissible exposure (MPE)

6.1.1 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).

6.1.2 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. 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/cm^2)
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)

6.1.3 Test result

FCC:

Channel frequency (MHz)	P_{EIRP} (dBm)	P (mW)	P (W)	P_d (mW/cm^2)	Limit P_d (mW/cm^2)
2402	-3.9	0.406	0.000406	0.000081	1.0
2450	-2.7	0.541	0.000541	0.000108	1.0
2480	-2.5	0.561	0.000561	0.000112	1.0

IC:

Channel frequency (MHz)	P_{EIRP} (dBm)	P (mW)	P (W)	P_d (mW/cm^2)	P_d (W/m^2)	Limit P_d (W/m^2)
2402	-3.9	0.406	0.000406	0.000081	0.00081	5.35
2450	-2.7	0.541	0.000541	0.000108	0.00108	5.42
2480	-2.5	0.561	0.000561	0.000112	0.00112	5.47

FCC-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 – 3.0	614	1.63	100	30
3.0 – 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	30

f = Frequency in MHz

IC-Limits according to RSS-102:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	**Electric Field (V/m rms)**	**Magnetic Field (A/m rms)**	**Power Density (W/m2)**	**Reference Period (minutes)**
0.003-1021	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	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619$f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10^{-4} $f^{0.5}$	6.67 x 10^{-5} f	616000/ $f^{1.2}$
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

The requirements are **FULFILLED.**

Remarks: _____

_____

6.2 SAR test exclusion considerations

6.2.1 Applicable standard

According to General 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.

6.2.2 Determination of the standalone SAR test exemption threshold

The minimum separation distance results from the application of the EUT which is a handheld device. This distance is assumed to ≤ **5** mm from antenna to the hand of the user.
The device can be moved to every region of the human body. In this case the threshold is determined for 1-g limit.

The formula under 4.3.1 1) for 100 MHz to 6 GHz for standalone equipment is used:
[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]*[√f(GHz)] ≤ 3.0

Result of 1-g SAR limit evaluation:

Channel frequency (MHz)	P_{EIRP} (dBm)	P_{EIRP} (mW)	1-g SAR (1)	Limit1-g SAR (1)
2402	-3.9	0.41	0.1258	3.0
2450	-2.7	0.54	0.1694	3.0
2480	-2.5	0.56	0.1768	3.0

Limit according to KDB 447498 D01 General RF Exposure Guidance v05r02, Appendix A:

Frequency (MHz)	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	**10**	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

Conclusion: The Threshold level is much smaller than the limit, no SAR measurement is necessary.

The requirements are **FULFILLED.**

Remarks: _____

6.3 SAR test exemption considerations

6.3.1 Applicable standard

According to RSS-102, Issue 5, Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus: Requirements and measurement techniques used to evaluate RF exposure compliance of radiocommunication apparatus that are designed to be used within the vicinity of the human body.

6.3.2 Determination of the standalone SAR test exemption threshold

The minimum separation distance results from the application of the EUT which is a handheld device. This distance is assumed to ≤ **5** mm from antenna to the hand of the user. The device can be moved to every region of the human body. In this case the threshold is determined for 1-g limit.

Result of SAR exemption evaluation:

Channel frequency (MHz)	P_{EIRP} (dBm)	EIRP (mW)	IC SAR test exemption limit (mW)
2402	-3.9	0.41	4.09
2450	-2.7	0.54	4.00
2480	-2.5	0.56	3.90

Limit according to RSS-102, section 2.5.1, Table 1:

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤ 300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Conclusion: The Threshold level is much smaller than the limit, no SAR measurement is necessary.

The requirements are **FULFILLED.**

Remarks: _____

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6.4 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, the EUT has only one transmitter