

EMI – TEST REPORT

- Human Exposure -

Type / Model Name : HRA 551 FS

Product Description : Wireless Access point for hand wheel system

Applicant : DR. JOHANNES HEIDENHAIN GmbH

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

POSITIVE

Test Report No. : **T38868-03-04HS**

22. March 2018
Date of issue



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

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results
without the written permission of the test laboratory.

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>EQUIPMENT UNDER TEST</u>	4
2.1	Photo documentation of the EUT – Detailed photos see ATTACHMENT B	4
2.2	Equipment type	4
2.3	Short description of the equipment under test (EUT)	4
2.4	Variants of the EUT	4
2.5	Operation frequency and channel plan	4
2.6	Transmit operating modes	5
2.7	Antenna	5
2.8	Power supply system utilised	5
2.9	Peripheral devices and interface cables	5
2.10	Determination of worst case conditions for final measurement	5
3	<u>TEST RESULT SUMMARY</u>	7
3.1	Final assessment	7
4	<u>TEST ENVIRONMENT</u>	8
4.1	Address of the test laboratory	8
4.2	Environmental conditions	8
4.3	Statement of the measurement uncertainty	8
4.4	Measurement protocol for FCC and ISED	9
5	<u>TEST CONDITIONS AND RESULTS</u>	10
5.1	Maximum peak conducted output power	10
6	<u>HUMAN EXPOSURE</u>	11
6.1	Maximum permissible exposure (MPE)	11
6.2	Co-location and Co-transmission	13
6.3	SAR test exclusion considerations	13
7	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	14

ATTACHMENT B as separate 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 2.1091 Radiofrequency radiation exposure evaluation: **mobile devices**.

Part 1, Subpart 2, Section 2.1093 Radiofrequency radiation exposure evaluation: **portable devices**.

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 v06 Mobile and portable devices RF Exposure procedures and equipment authorisation policies, October 23, 2015.

KDB 865664 D01 v01r04 SAR Measurement Requirements for 100 MHz to 6 GHz, August 7, 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

2 EQUIPMENT UNDER TEST

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

2.2 Equipment type

IEEE 82.15.4 device

2.3 Short description of the equipment under test (EUT)

The EUT consists of a mobile wireless controller, hand wheel, and the access point (base station), as interface between mobile controller and CNC machine. The access point is also able to recharge the mobile controller.

Number of tested samples: 1 HRA 551 FS.
 Serial number: HRA 551 FS, X 58 241 190,
 Firmware Channel A: 1199870-01; Channel B: 1199896-01

EUT configuration:

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

2.4 Variants of the EUT

Device-Name	Comment	Antenna	Part number
HRA 551 FS	Base station, with rear panel	2 Integrated F	1119052-03

2.5 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan:

Channel	Frequency	Channel	Frequency
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

Note: The marked frequencies are used for testing.

2.6 Transmit operating modes

The EUT allows the user to switch the transmission on or off. There are no further operating modes.

The EUT use O-QPSK modulation and may provide following data rate:

- 250 kbps (kbps = *kilobits per second*)

2.7 Antenna

The EUT use two integrated PCB-F-antennas.

2.8 Power supply system utilised

Power supply voltage, V_{nom} : Power type, HRA 551 FS, Supplied by the appropriate controller unit

2.9 Peripheral devices and interface cables

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

- Control PC Model : MC8410, No 7781859
- Signal and DC power supply, 2.5 m Model : -
- - Model : -

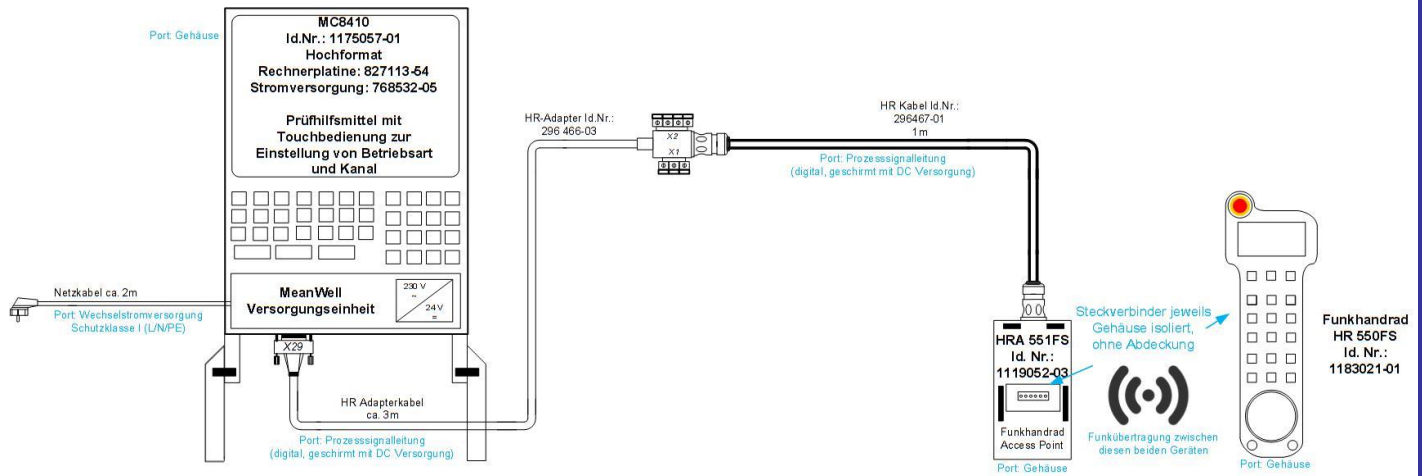
2.10 Determination of worst case conditions for final measurement

The EUT is tested as system, normal transmission is initiated.

IEEE Standard	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.15.4	11 to 26	11, 18, 26	Pmax	DSSS	O-QPSK	250 kbps

Note: The 802.15.4 is only used physically. No other common device may connect to.

Schematic test set-up



2.10.1 Test jig

No test jig was used for testing.

2.10.2 Test software

For testing the normal communication is set up between base station and the portable remote.

3 TEST RESULT SUMMARY

IEEE 802.15.4 device using digital modulation:

Operating in the 2400 MHz – 2483.5 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.247(i)	RSS 102, 2.5.2	MPE	passed
KDB 447498	RSS 102, 2.5.1	SAR exclusion consideration	not applicable
OET Bulletin 65	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, March 2015

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 : 03 August 2017

Testing concluded on : 03 August 2017

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Hermann Smetana
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.

Measurement Type	Range	Confidence Level	Calculated Uncertainty
AC power line conducted emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
EBW and OBW	2400 MHz to 3000 MHz	95%	$\pm 2.5 \times 10^{-7}$
Maximum peak conducted output power	2400 MHz to 3000 MHz	95%	± 0.62 dB
Power spectral density	2400 MHz to 3000 MHz	95%	± 0.62 dB
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	± 2.15 dB
Conducted Spurious Emissions	10000 MHz to 40000 MHz	95%	± 3.47 dB
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	± 3.53 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 3.71 dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	± 2.34 dB
Field strength of the fundamental	100 kHz to 100 MHz	95%	± 3.53 dB

4.4 Measurement protocol for FCC and ISED

4.4.1 General information

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

IC 3009A-1

The Anechoic chamber is a listed test site under the Canadian Test-Sites File-No:

IC 3009A-2

In compliance with RSS 247 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.10 and applying the CISPR 22 limits.

5 TEST CONDITIONS AND RESULTS

5.1 Maximum output power

Rated output power:	10 mW	10 dBm
Tune-up tolerance:	4.0 dB	
Maximum output power:	14.0 dBm	25.1 mW
Antenna gain max:	3.1 dBi	
Maximum EIRP:	17.1 dBm	51.3 mW

Remarks:

6 HUMAN EXPOSURE

6.1 Maximum permissible exposure (MPE)

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

6.1.1 Description of the test location

Test location: AREA4

6.1.2 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).

6.1.3 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/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)

6.1.4 Test result

Channel No.	EIRP (dBm)	EIRP (mW)	EIRP (W)	S (mW/cm ²)	Limit S _{eq} (mW/cm ²)	Margin (mW/cm ²)
11	17.1	51.29	0.0513	0.0102	1.0	-0.9898
18	17.1	51.29	0.0513	0.0102	1.0	-0.9898
26	17.1	51.29	0.0513	0.0102	1.0	-0.9898

According RSS102, 2.5.2

Frequency MHz	EIRP (mW)	Factor	$f^{0.6834}$ (W)	S (W/m ²)	Limit S _{eq} (W/m ²)	Margin (W/m ²)
2405	51.3	0.0131	204.4815	2.6787	5.3554	-2.6767
2440	51.3	0.0131	206.5105	2.7053	5.4085	-2.7032
2480	51.3	0.0131	208.8182	2.7355	5.4689	-2.7334

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	---	---	1.0	30

f = Frequency in MHz

Limits for maximum permissible exposure (MPE) according RSS102, table 4:

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
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

Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).

f = Frequency in MHz

Determination of the limit per frequency:

Applied frequency (MHz)	RSS102 Power density limit (W/m ²)	FCC-limit (mW/cm ²)
2405	5.36	1
2440	5.41	1
2480	5.47	1

The requirements are **FULFILLED**.

Remarks:

6.2 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, the EUT has one transmitter only.

6.3 SAR test exclusion considerations

6.3.1 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, the EUT is a fixed station.

7 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.
-	-	-	-	-	-	-