

EMI – TEST REPORT

- Human Exposure -

Type / Model Name : HR550 FS

Product Description : Wireless hand wheel system

Applicant : DR. JOHANNES HEIDENHAIN GmbH

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Manufacturer : DR. JOHANNES HEIDENHAIN GmbH

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Licence holder : DR. JOHANNES HEIDENHAIN GmbH

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83301 TRAUNREUT, GERMANY

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

POSITIVE

Test Report No. : **T38868-03-06HS**

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 C	4
2.2	Equipment type	4
2.1	Short description of the equipment under test (EUT)	4
2.2	Variants of the EUT	4
2.3	Operation frequency and channel plan	4
2.4	Transmit operating modes	5
2.5	Antennas	5
2.6	Power supply system utilised	5
2.7	Peripheral devices and interface cables	5
2.8	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	11
6.3	SAR test exclusion considerations	12
6.4	Exemption limits for routine evaluation - SAR evaluation	13
7	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	14

ATTACHMENT C 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 C

2.2 Equipment type

IEEE 82.15.4 device

2.1 Short description of the equipment under test (EUT)

The EUT is a mobile wireless hand wheel for remote control a CNC machine.

Number of tested samples: 1 HR 550 FS
 Serial number: HR 550 FS, X 58 241 186,
 Firmware: Channel A: 1199899-01; Channel B: 1199893-01

EUT configuration:

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

2.2 Variants of the EUT

Device-Name	Comment	Antenna	Part number
HR 550 FS	Hand wheel, without mechanical raster	2 Integrated F	1200495-01
HR 550 FS	Hand wheel, with mechanical raster	2 Integrated F	1183021-01

2.3 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.

2.4 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*)

2.5 Antenna

The EUT use two integrated PCB-F-antennas.

2.6 Power supply system utilised

Power supply voltage, V_{nom} : Dedicated NiMh battery pack

2.7 Peripheral devices and interface cables

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

- Base station (wireless) Model : HRA 551 FS
- - Model : -
- - Model : -

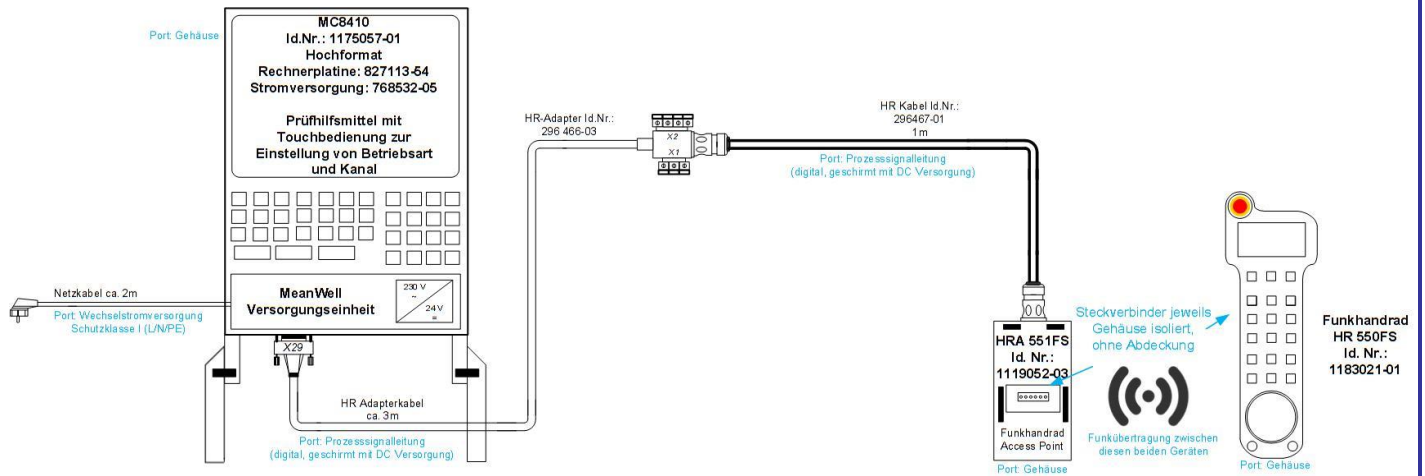
2.8 Determination of worst case conditions for final measurement

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



2.8.1 Test jig

No test jig was used for testing.

2.8.2 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 and 5725 MHz – 5850 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.247(i)	RSS 102, 2.5.2	MPE	not applicable
KDB 447498	RSS 102, 2.5.1	SAR exclusion consideration	passed
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 : 11 August 2017

Testing concluded on : 11 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 102 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.10 and applying the RSS 102 limits.

5 TEST CONDITIONS AND RESULTS

5.1 Maximum output power

Rated output power: 10 mW
Tune-up tolerance: 4 dB
Maximum output power: $10 \text{ dBm} + 4 \text{ dB} = 14 \text{ dBm} = \mathbf{25.1 \text{ mW}}$
Antenna gain max: 2.5 dBi

Maximum EIRP: $14 \text{ dBm} + 2.5 \text{ dBi} = 16.5 \text{ dBm} = \mathbf{44.7 \text{ mW}}$

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: NONE

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).

Remarks: Not applicable, the EUT is a portable device.

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.

6.3.2 Determination of the standalone SAR test exclusion threshold

a) For Bluetooth device:

The minimum separation distance results from the application of the EUT which is operated by hand. This distance is assumed to ≤ 50 mm from antenna to the hand of the user (22 mm distance from the antenna the the first button). The hand of the user is the nearest extremity of a human being therefore the threshold for 10-g is determined.

The formula under 4.3.1 1) for 100 MHz to 6 GHz for standalone equipment is used:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}] \leq 7.5;$$

The max power is according the equipment:

ZigBee device:	Distance:	25.0 mm	
	Max Power:	14.0 dBm,	P: 25.12 mW
	Frequency:	2.440 GHz	

Separation distance ≤ 50 mm;	P/D	$\sqrt{2.48}$	
10g Threshold level	1.00	1.56	$1.57 \leq 7.5$
1g Threshold level	1.00	1.56	$1.57 \leq 3$

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

The requirements are **FULFILLED**.

Remarks:

6.4 Exemption limits for routine evaluation - SAR evaluation

6.4.1 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.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance 4, 5

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

4 The exemption limits in Table 1 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

5 Transmitters operating between 0.003-10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in Section 4.

6.4.2 Conclusion according RSS-102.

The hand wheel is manually operated and the normal position is that the hand has a minimum distance to the radiation structure of 25 mm (distance from the antenna the the first button).

Maximum output power at 2450 MHz, **44.7 mW** is < 52 mW;

For the EUT is SAR measurement is NOT necessary

The requirements are **FULFILLED**.

Remarks:

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.
-	-	-	-	-	-	-