

FCC ID: YJKHR550FS

EMI - TEST REPORT

- FCC Part 15.247, RSS210 -



Test Report No. :	T35988-00-02HS	10. July 2012 Date of issue
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Type / Model Name : HR550 FS**Product Description** : Wireless hand wheel system**Applicant** : DR. JOHANNES HEIDENHAIN GmbHAddress : Dr.-Johannes-Heidenhain-Strasse 5
83301 TRAUNREUT, GERMANY**Manufacturer** : DR. JOHANNES HEIDENHAIN GmbHAddress : Dr.-Johannes-Heidenhain-Strasse 5
83301 TRAUNREUT, GERMANY**Licence holder** : DR. JOHANNES HEIDENHAIN GmbHAddress : Dr.-Johannes-Heidenhain-Strasse 5
83301 TRAUNREUT, GERMANY

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

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2011)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 2011)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

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

ANSI C63.4: 2009	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10: 2009	Testing Unlicensed Wireless Devices
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005 EN 55022: 2006	Information technology equipment
KDB 558074 D01	Guidance for performing compliance measurements on DTS operating under Section 15.247, 2012-1-18.

2 SUMMARY

2.1 Test result summary

WPAN device using digital modulation:

Operating in the 2400 MHz – 2483.5 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 7.2.4.	AC power line conducted emissions	not applicable
15.247(a)(2)	RSS210, A8.2(a)	-6 dB EBW	NT
15.247(b)(3)	RSS-210, A8.4(4)	Peak power	passed
15.247(d)	RSS-210, A8.5	Out-of-band emission, radiated	passed
15.247(d)	RSS-Gen, 7.2.2	Emissions in restricted bands	passed
15.247(e)	RSS-210, A8.2(b)	PSD	NT
15.35(c)	RSS-Gen, 4.5	Pulsed operation	not applicable
15.247(i)	RSS 102, 2.5.2	MPE	NT
15.247(b)(4)	RSS-Gen, 7.1.2	Antenna requirement	passed
	RSS-Gen, 7.2.6	Transmitter frequency stability	not applicable
	RSS-Gen, 4.6.1	99 % Bandwidth	NT
OET Bulletin 65	RSS102, 3.2	Co-location, Co-transmission	not applicable

Note: NT (not tested)

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

RSS Gen, Issue 3, December 2010

RSS 210, Issue 8, December 2010

RSS 102, Issue 4, March 2010

2.2 General remarks

The EUT is a wireless hand wheel for control and safety functions of industrial machines. The EUT connect only to its base station if it is paired to. The EUT is considered to be equivalent to DSSS (IEEE 802.15.4) in the frequency range 2.4 GHz to 2.4835 GHz.

Variants of the EUT

Device-Name	Comment	Antenna	Part number
HR 550 FS	Hand wheel, without mechanical raster	Integrated GF and F	598515-03
HR 550 FS	Hand wheel, with mechanical raster	Integrated GF and F	606622-03

Note: Between the two models hand wheel and base station are no substantial radio frequency differences (no changes in the basic frequency determining and stabilisation circuitry, including clock and data rates, frequency multiplication stages, basic modulator circuit and maximum output power. No simultaneous transmission is possible.

For testing the HR550 FS was used.

Operation frequency and channel plan

The firmware supports the following listed channels:

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

Antennas

The EUT has two integrated PCB-F-antennas.

Transmit operating modes

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

The frequency range is scanned from 30 MHz to 25000 MHz. The frequency range 9 kHz to 30 MHz is not affected by the change in the radio part.

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Update testing

The EUT and its variants are tested and compliant according CFR 47, Part 15.247, FCC ID: YJKHR550FS with the Test Report Ref. No. ARSK00125, 2010-09-09, by IMQ.

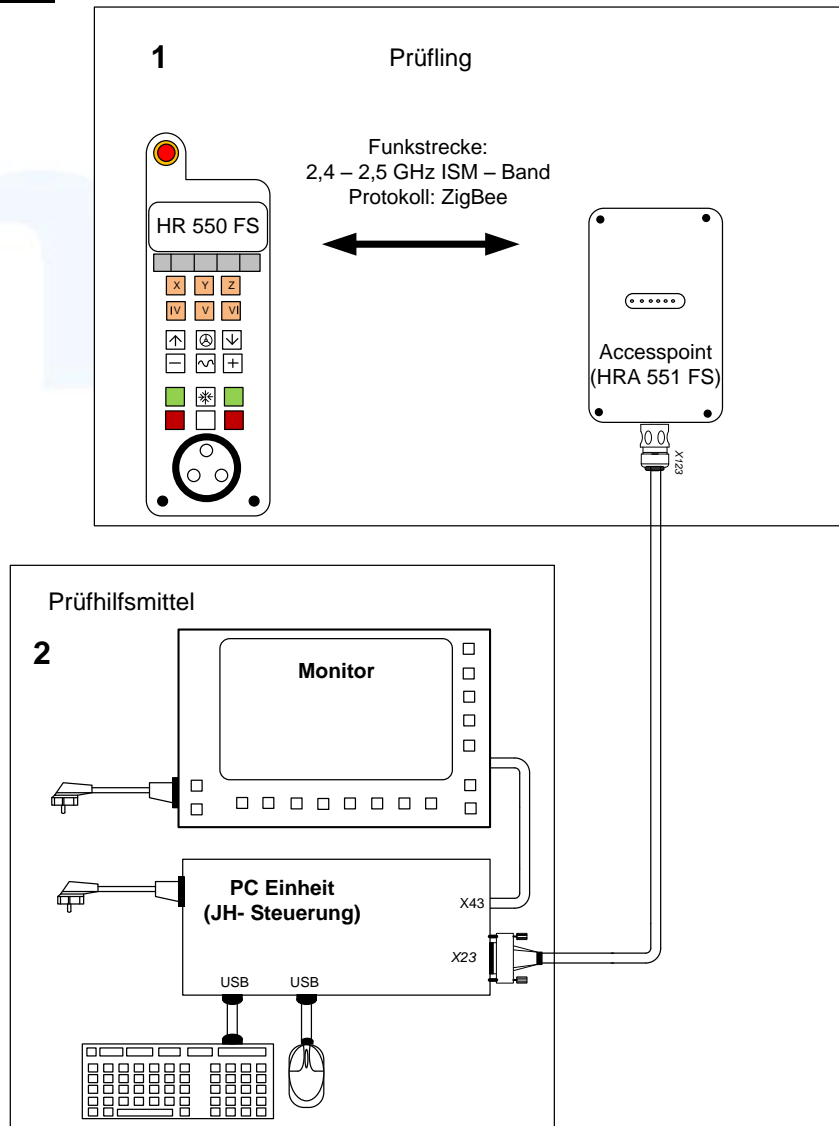
The EUT is now re-designed with another PCB-antenna and a pin-diode-switch for an additional radiation plane for a better transmission. All other devices are in position and value identical. The transmission power is switched between the two integrated antennas. Due to the antenna switch the output power is assumed to be less. The second antenna is folded F-antenna (GF) with less antenna gain as the already tested F-antenna.

This Test Report shows the further compliance with CFR 47, Part 15.247 by re-measurement of the most concerned tests to the changes of the RF-part. The EUT is tested paired with the access point to establish transmission from EUT.

The following tests are selected for re-measurement:

- Equivalent isotropic radiated power
- Transmitter spurious emissions

Schematic test set-up



1 EUT

2 Auxiliary test equipment

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2.3 Final assessment

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

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

Testing commenced on : 18 April 2012

Testing concluded on : 6 July 2012

Checked by:

Tested by:

Klaus Gegenfurtner
Dipl.-Ing.(FH)
Manager: Radio Group

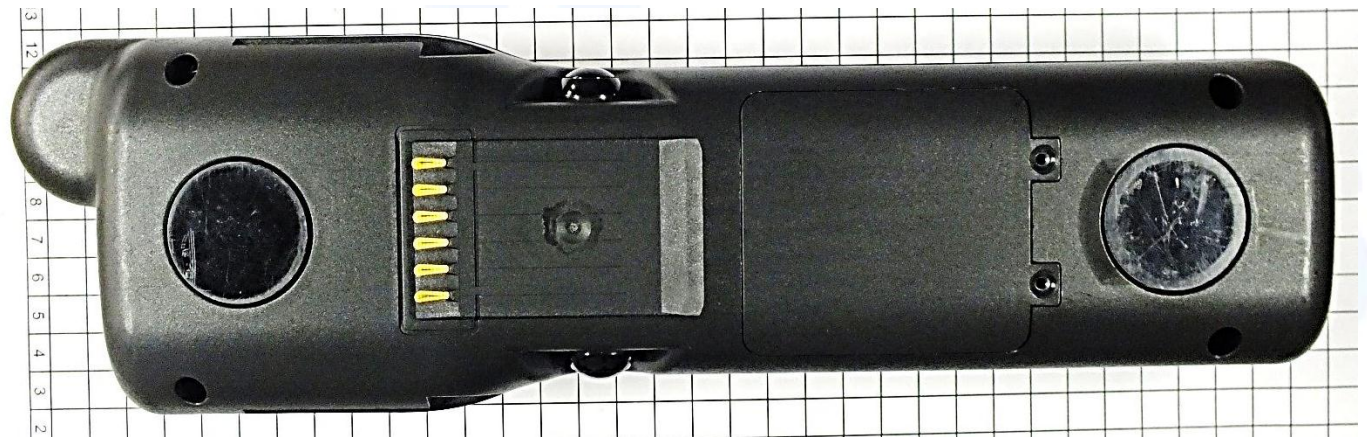
Hermann Smetana
Dipl.-Ing.(FH)
Radio Expert

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3 EQUIPMENT UNDER TEST

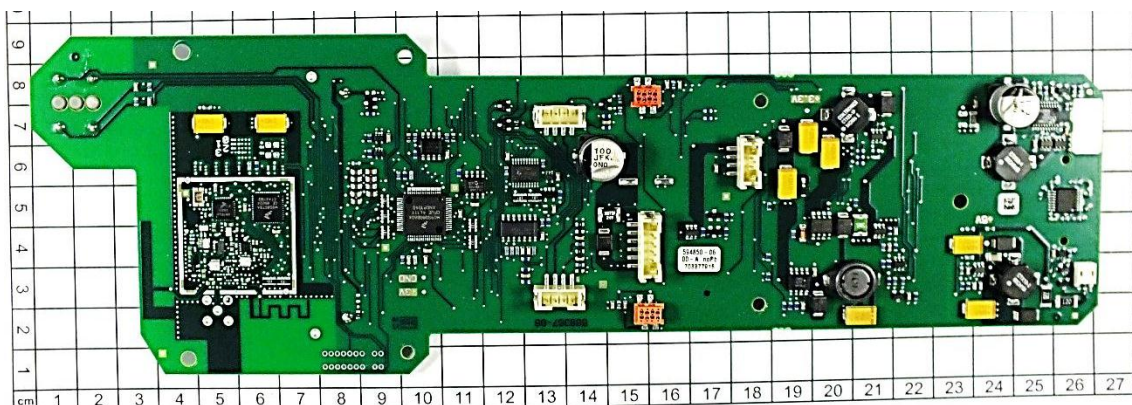
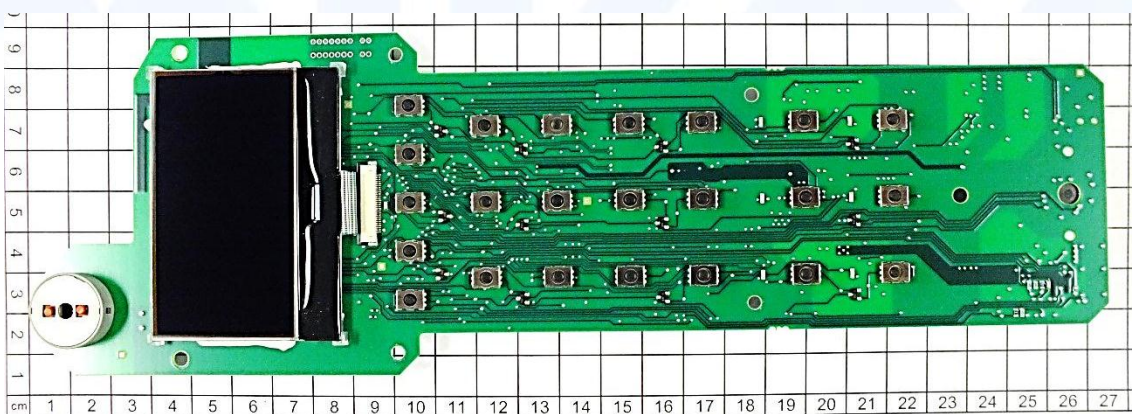
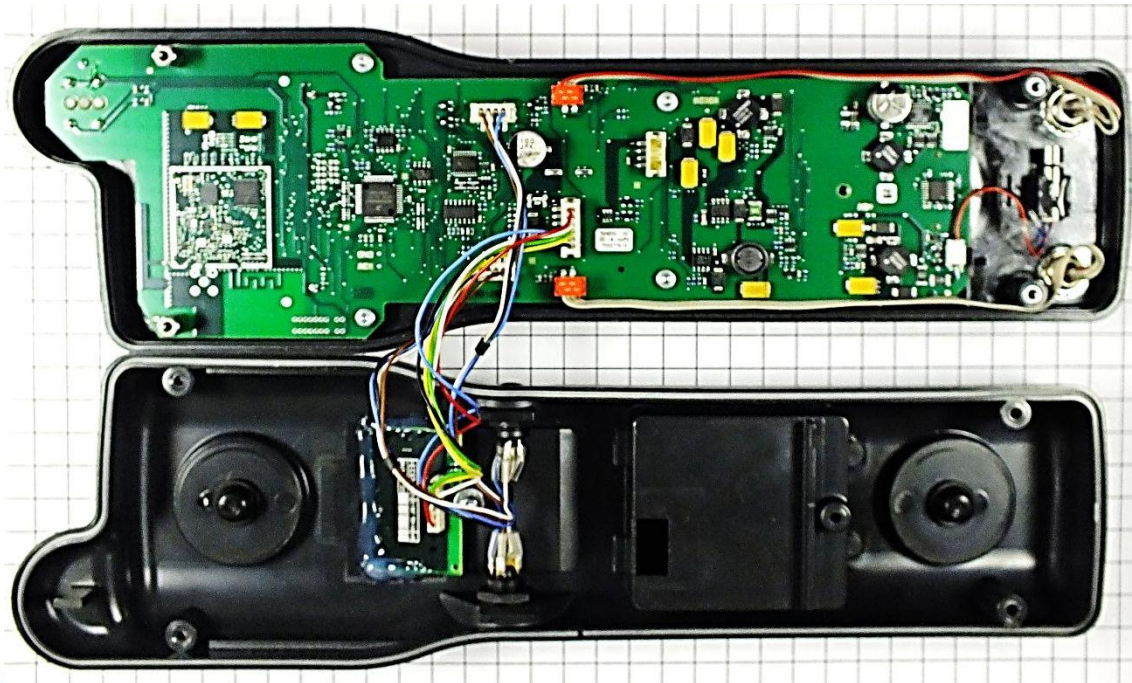
3.1 Photo documentation of the EUT

External view, Mobile:

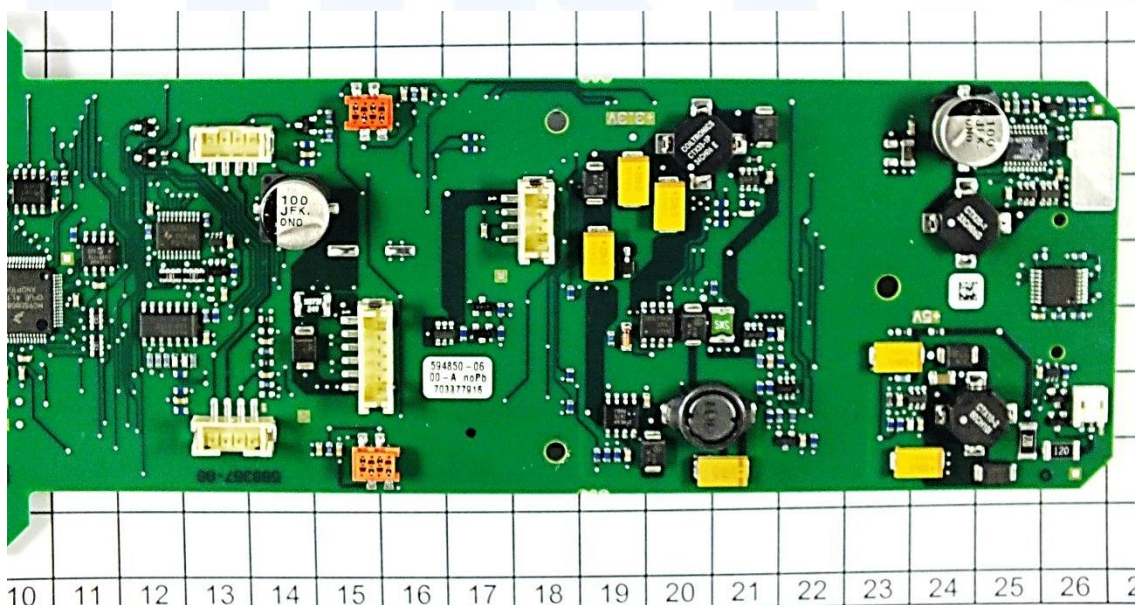
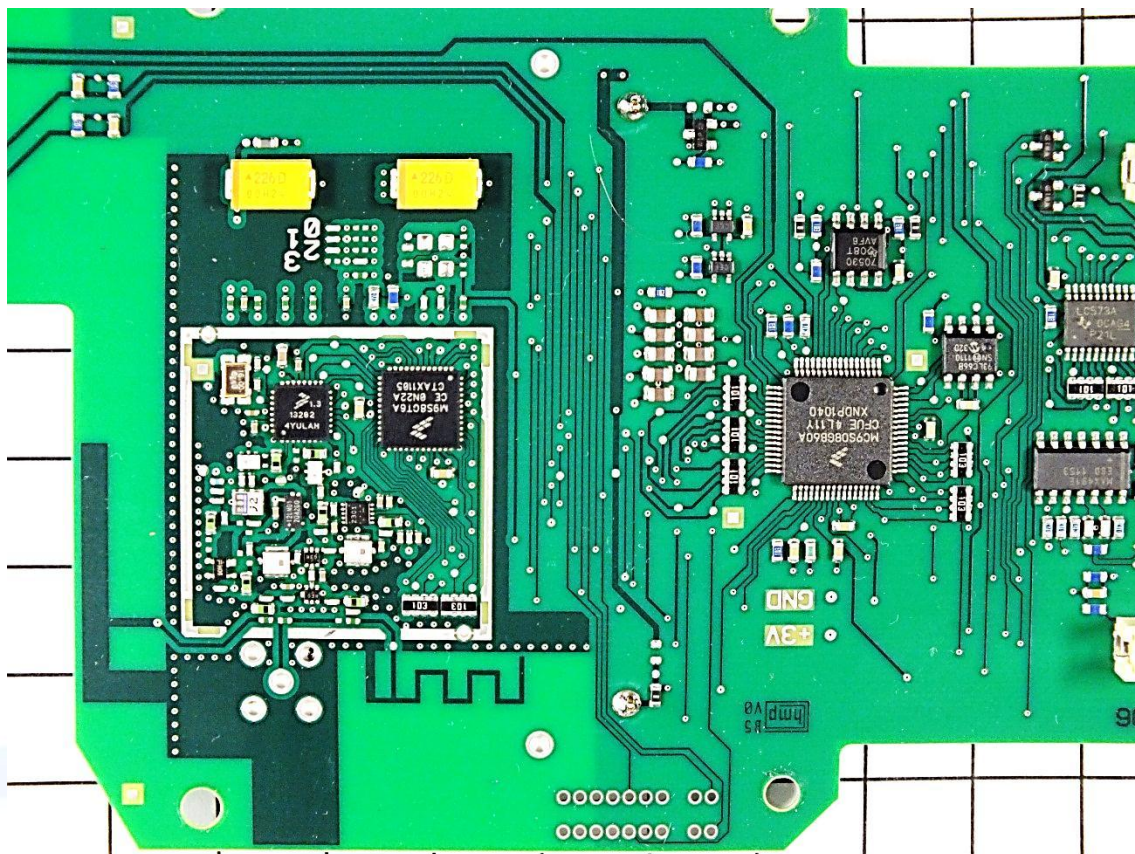


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Internal view:



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10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 2

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3.2 Power supply system utilised

HR 550 FS

Power supply voltage : Dedicated NiMh battery pack

3.3 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, 703377916, Firmware number: 635163-03

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- 802.15.4 transmission in the 2.4 GHz range

EUT configuration:

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

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

- Control Interface (auxiliary equipment) Model : iTNC 530
- Signal and DC power supply, 5 m Model :
- Model :

Note: The auxiliary equipment is not considered to be tested.

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
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. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „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, mikes-testingpartners 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

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The open area test site is a listed under the Canadian Test-Sites File-No:

IC 3009A-1

In compliance with RSS 210 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.4, ANSI C63.10 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 without termination. 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

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". 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, ANSI C63.10 and applying the CISPR 22 limits.

4.4.1.4 Conducted emission

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversion formula apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}) \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω / 50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin of a peak mode measurement appears to be less than 20 dB, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.4.1.5 Radiated emission (electrical field 30 MHz - 1 GHz)

Spurious emission from the EUT is measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 cm to the ground plane are bundled in the centre in a serpentine fashion so that they are at least 40 cm from the ground plane. Cables to simulators/testers (if used in this test) are routed

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through the centre of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 m horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 m and the EUT is rotated 360 degrees.

The final level in dB μ V/m is calculated by add on the reading value from the EMI receiver (level dB μ V) the correction factor. The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:

30 MHz – 1000 MHz: RBW: 120 kHz

Example:

Frequency (MHz)	Reading level (dB μ V)	+	Correction Factor (dB/m)	=	Level (dB μ V/m)	-	CISPR Limit (dB μ V/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.4.2 Radiated emission (electrical field 1 GHz - 40 GHz)

4.4.2.1 Description of measurement

Radiated emissions from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

4.5 Determination of worst case measurement conditions

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.

The tests are carried out in the following frequency band:

2400 – 2483.5 MHz

The channel 11 is tested for output power and spurious emissions to evaluate the difference between one integrated F-antenna and two integrated antennas (F and GF alternating switched).

Following channels and test modes were selected for the final test as listed below:

Technology	Available channel	Tested channels	Modulation	Modulation type	Data rate (Mbps)
802.15.4	11 to 26	11	DSSS	O-QPSK	0.25

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5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: NONE

Remarks: Not applicable, the EUT has no AC mains connection.

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5.2 Maximum peak output power

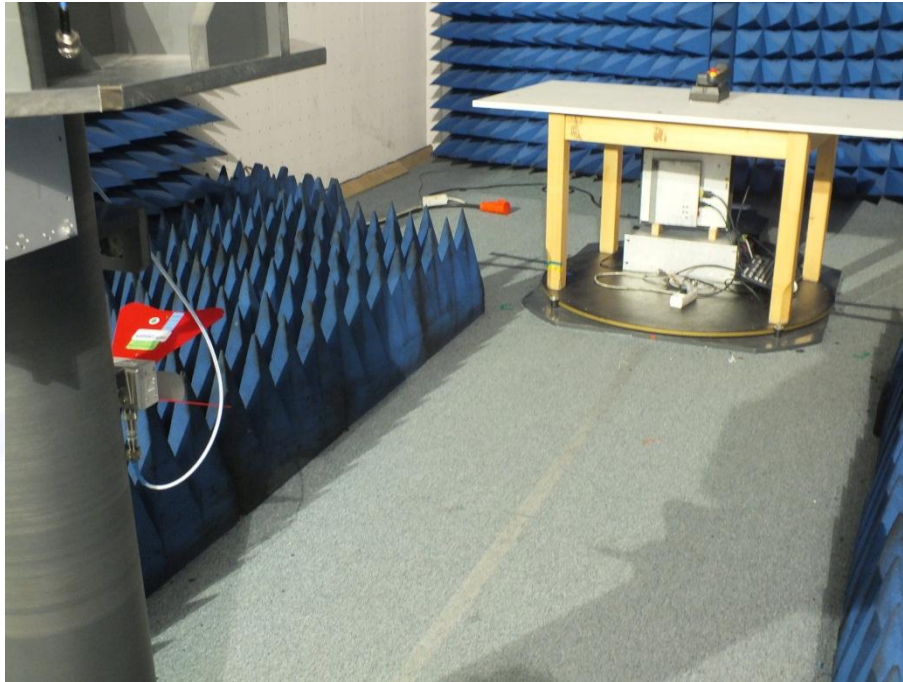
For test instruments and accessories used see section 6 Part CPR 3.

5.2.1 Description of the test location

Test location: Anechoic chamber 2
Test distance: 3 m

5.2.2 Photo documentation of the test set-up

Anechoic chamber



5.2.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):

For systems using digital modulation in the 2400-2483.5 MHz and 5725 – 5850 MHz bands, the maximum peak conducted output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

5.2.4 Description of Measurement

The output power is measured using a spectrum in a test setup following the procedures set out in KDB 558074 D01 for DTS. Measurement procedure PK2.

Spectrum analyser settings:

RBW: 1 MHz, VBW: 3 MHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

The measured field strength is scaled by a bandwidth correction factor for the actual 6 dB bandwidth 1.6 MHz {BWCF=10log (1.6 MHz/1 MHz) = 2.0 dB} and converted to EIRP using the following formula:

$$\text{EIRP} = E - 95.2; (\text{dBm}) (\text{Distance } 3 \text{ m})$$

where: E in (dBμV/m)

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5.2.5 Test result
F and GF-antenna:

Channel	Frequency (MHz)	Power setting	E (dB μ V/m)	Calc. EIRP (dBm)	EIRP limit (dBm)	Delta (dB)
11	2405	max	106.6	13.4	36.0	-22.6
18	2440	max	106.3	13.1	36.0	-22.9
26	2480	max	107.3	14.1	36.0	-21.9

Note: The EIRP is more than 22 dB less than the conducted limit. The GF-antenna has less gain than the F-antenna (-3 dBi). Therefore the conducted limit is also compliant.

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3):

Frequency (MHz)	Peak conducted power limit		EIRP limit (dBm)
	(dBm)	(Watt)	
2400-2483.5	30.0	1.0	36.0

The requirements are **FULFILLED**.

Remarks: The output power now is less as the output power before modification. No need for further measurements in other channels.

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5.4 Spurious emissions radiated

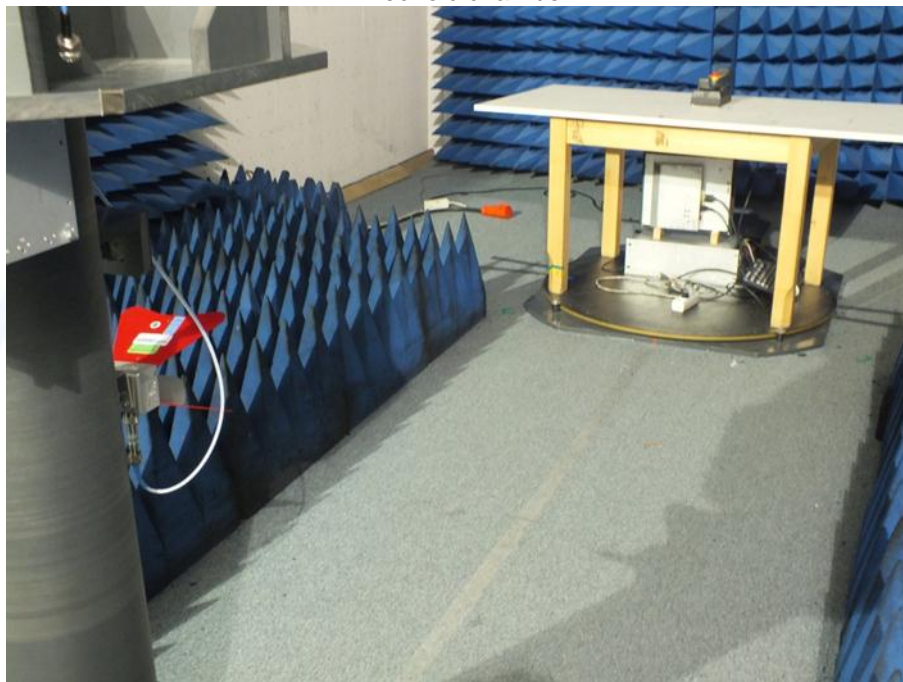
For test instruments and accessories used see section 6 Part **SER 2**, **SER 3**.

5.4.1 Description of the test location

Test location: OATS 1
 Test location: Anechoic chamber 2
 Test distance: 3 m

5.4.2 Photo documentation of the test set-up

Anechoic chamber



5.4.3 Applicable standard

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

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

5.4.4 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. If the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise the emission will be measured in average mode again and reported.

Spectrum analyser settings:

RBW: 100 kHz, VBW: 300 kHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

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Channel 11 (2405 MHz)

In the frequency range < 1 GHz no emission is observed.

In the frequency range 1 GHz to 15 GHz no emission is observed comes 20 dB below the limit.
Note. Emissions below 20 dB to the limit need not to be documented.

In the frequency range 15 GHz to 25 GHz no emission is observed.

Limit according to FCC Part 15, Section 15.247(d) for emissions falling not in restricted bands:

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

Frequency (MHz)	Spurious emission limit
Below 1000	20 dB below the highest level of the desired power
Above 1000	20 dB below the highest level of the desired power

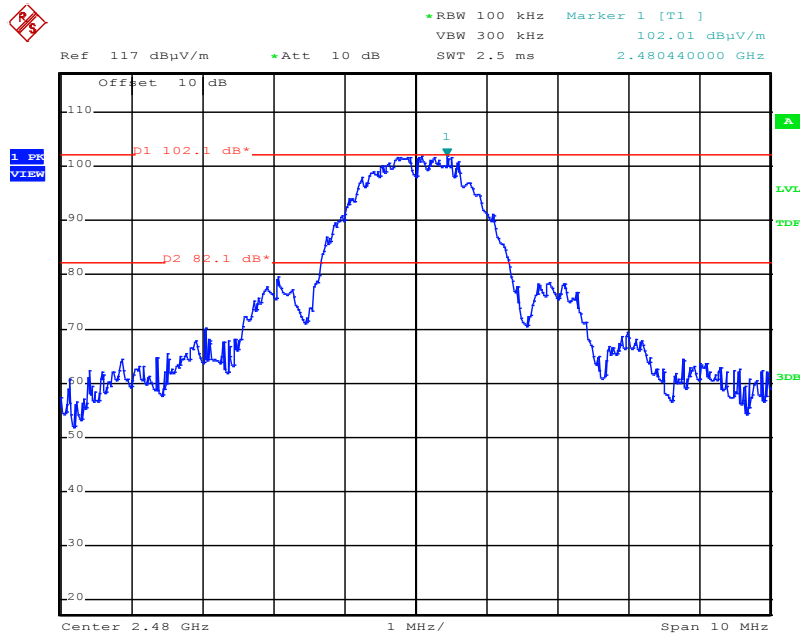
The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic. All emissions more than 20 dB below
the specified limit needs not to be reported. For detailed test results please see following
test protocols.

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5.4.6 Test protocols

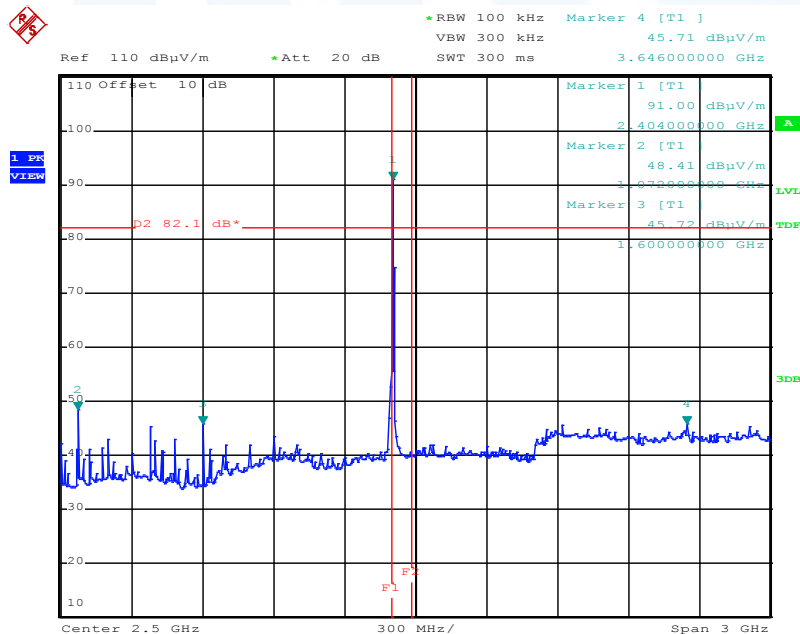
Determination of the reference level and limit using the highest emission



Plots of spurious emissions conducted out of operating frequency bands (-20 dBc)

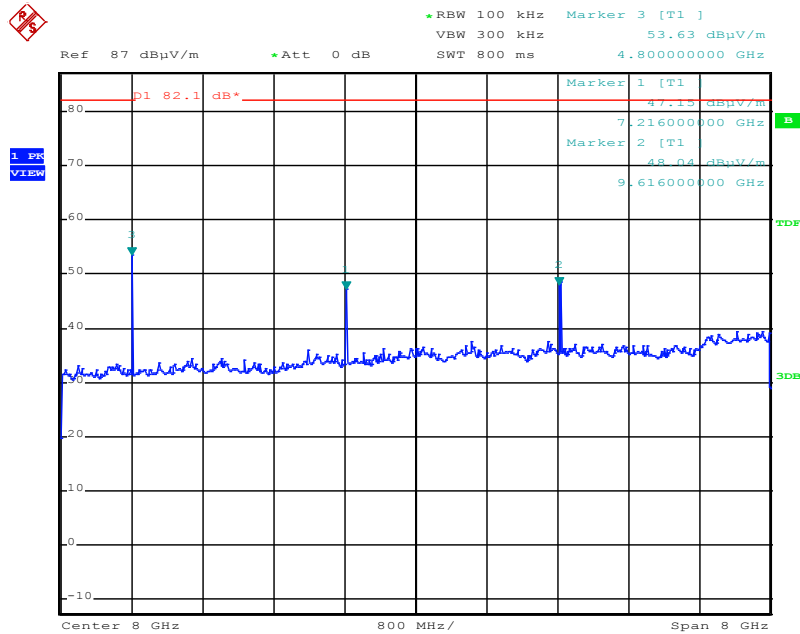
Ch11

Spurious emissions conducted from 1 GHz to 4 GHz

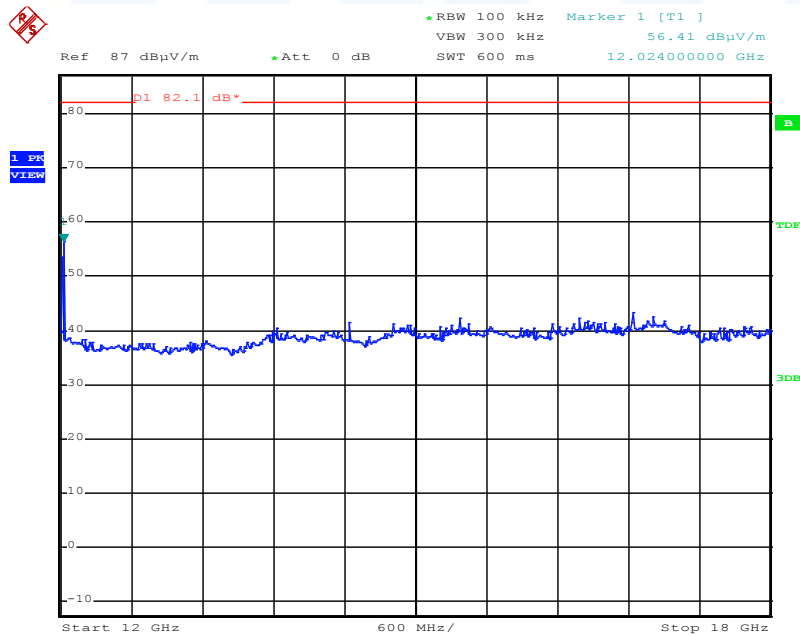


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Spurious emissions conducted from 4 GHz to 12 GHz



Spurious emissions conducted from 12 GHz to 18 GHz



Note: In the frequency range 15 GHz to 25 GHz no emission is observed.

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5.5 Radiated emissions in restricted bands

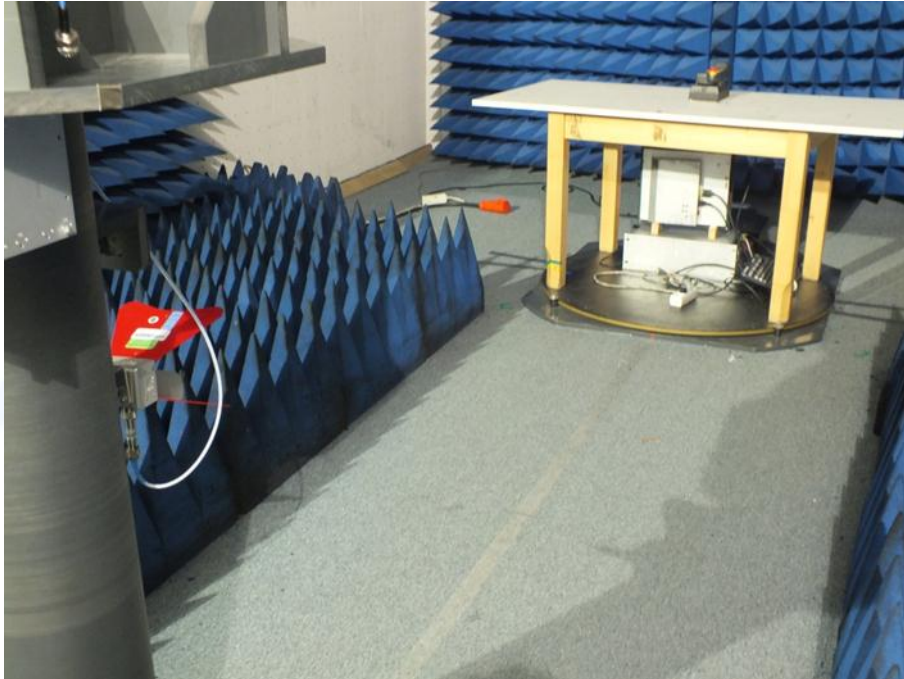
For test instruments and accessories used see section 6 Part **SER 3**.

5.5.1 Description of the test location

Test location: Anechoic chamber 2
Test distance: 3 m

5.5.1 Photo documentation of the test set-up

Anechoic chamber



According to FCC Part 15, Section 15.205(a):

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

5.5.2 Description of Measurement

The restricted bands are measured radiated. The span of the spectrum analyser is set wide enough to capture the restricted band and measure the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The restricted bands are measured falling emissions into it and the nearest restricted band are checked for emissions also the restricted band for the harmonics of the carrier.

Spectrum analyser settings:

PK: RBW: 1 MHz, VBW: 3 MHz, Sweep: Auto, Detector function: Peak

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5.5.1 Test result

Restricted band: 4.5 – 5.15 GHz, 10.6-12.7 GHz

Channel 11 (2405 MHz)

Frequency (MHz)	Peak		Average	
	Value dB(μV/m)	Limit dB(μV/m)	Value dB(μV/m)	Limit dB(μV/m)
4808	63.6	74.0	37.2	54.0
12022	68.0	74.0	41.6	54.0

Note: The AV level is calculated using the duty cycle factor determined in the original report (-26.397 dB).

Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μV/m)	dB(μV/m)	
0.009-0.490	2400/F (kHz)		300
0.490-1.705	24000/F (kHz)		30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic. All emissions more than 20 dB below the specified limit needs not to be reported.

5.6 Antenna application

5.6.1 Applicable standard

According to FCC Part 15C, Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has an integrated antenna. No other antenna can be used with the device.

All supplied antennas meet the requirements of part 15.203 and 15.204.

5.6.2 Antenna requirements

According to FCC Part 15C, Section 15.247(b)(4):

The conducted output power limit specified in paragraph (b) of 15.247 is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2) and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The output power has not to be reduced using the integrated PCB antennas type F and GF.

FCC ID: YJKHR550FS

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.
CPR 3	FSP 30	02-02/11-05-001	05/10/2012	05/10/2011		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	16/02/2013	16/02/2012		
	10 dB / 50 Ohm / 18 GHz	02-02/50-05-036				
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
SER 2	ESVS 30	02-02/03-05-006	26/06/2013	26/06/2012		
	VULB 9168	02-02/24-05-005	16/03/2013	16/03/2012	16/09/2012	16/03/2012
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 3	FSP 30	02-02/11-05-001	05/10/2012	05/10/2011		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	16/02/2013	16/02/2012		
	R1 _ 18 - 40 GHz	02-02/30-09-002	19/12/2012	19/12/2011		
	Sucoflex N-1000-SMA	02-02/50-05-072				
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	WHK 3.0/18G-10EF	02-02/50-05-180				