

TEST REPORT

Test report no.: 1-3466/17-04-02



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

CTC advanced GmbH

Untertuerkheimer Strasse 6 – 10

66117 Saarbruecken / Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

Internet: <http://www.ctcadvanced.com>

e-mail: mail@ctcadvanced.com

Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

Applicant

Pepperl+Fuchs GmbH

Lilienthalstraße 200

68307 Mannheim / GERMANY

Phone: +49 621 776-0

Fax: +49 (0) 621 776 271725

Contact: Martin Schmitt

e-mail: mschmitt@de.pepperl-fuchs.com

Phone: +49 (0) 621 776 1725

Manufacturer

Pepperl+Fuchs GmbH

Lilienthalstraße 200

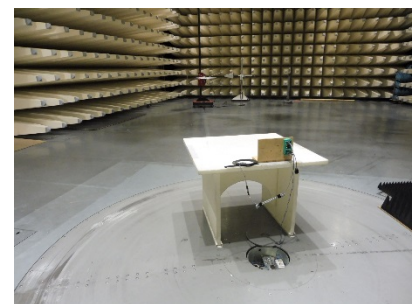
68307 Mannheim / GERMANY

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - Gen Issue 4	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus
RSS - 210 Issue 9	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
For further applied test standards please refer to section 3 of this test report.	

Test Item

Kind of test item:	Read/write head 13.56 MHz
Model name:	IQH1-F198-V1
FCC ID:	IREIQH1F198V1
IC:	7037B-IQH1F198V1
Frequency:	13.56 MHz
Technology tested:	RFID
Antenna:	Integrated PCB loop antenna
Power supply:	20.0 V to 30.0 V DC by external power supply
Temperature range:	-25°C to +70°C



This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

p.o.

Andreas Luckenbill
Lab Manager
Radio Communications & EMC

Test performed:

Yves Olsommer
Testing Manager
Radio Communications & EMC

1 Table of contents

1	Table of contents	2
2	General information	3
2.1	Notes and disclaimer	3
2.2	Application details.....	3
2.3	Test laboratories sub-contracted	3
3	Test standard/s and references	4
4	Test environment.....	5
5	Test item.....	5
5.1	General description.....	5
5.2	Additional information	5
6	Description of the test setup.....	6
6.1	Shielded semi anechoic chamber.....	7
6.2	Shielded fully anechoic chamber	8
6.3	RF measurements normal and extreme conditions.....	9
6.4	AC conducted	10
7	Sequence of testing	11
7.1	Sequence of testing radiated spurious 9 kHz to 30 MHz.....	11
7.2	Sequence of testing radiated spurious 30 MHz to 1 GHz.....	12
8	Measurement uncertainty	13
9	Summary of measurement results	14
10	Additional comments	14
11	Measurement results	15
11.1	Occupied bandwidth.....	15
11.2	Field strength of the fundamental	17
11.3	Field strength of the harmonics and spurious	18
11.4	Conducted limits	21
11.5	Frequency error	24
12	Observations	25
Annex A	Glossary.....	26
Annex B	Document history	27
Annex C	Accreditation Certificate	27

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CTC advanced GmbH.

The testing service provided by CTC advanced GmbH has been rendered under the current "General Terms and Conditions for CTC advanced GmbH".

CTC advanced GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the CTC advanced GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the CTC advanced GmbH test report include or imply any product or service warranties from CTC advanced GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CTC advanced GmbH.

All rights and remedies regarding vendor's products and services for which CTC advanced GmbH has prepared this test report shall be provided by the party offering such products or services and not by CTC advanced GmbH. In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2017-05-30
Date of receipt of test item:	2017-07-05
Start of test:	2017-07-21
End of test:	2017-07-24
Person(s) present during the test:	-/-

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15		Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus
RSS - 210 Issue 9	August 2016	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment

Guidance	Version	Description
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+23 °C during room temperature tests +70 °C during high temperature tests -25 °C during low temperature tests
Relative humidity content	:		42 %
Barometric pressure	:		1010 hpa
Power supply	:	V_{nom} V_{max} V_{min}	24.0 V DC by external power supply 30.0 V 20.0 V

5 Test item

5.1 General description

Kind of test item	:	Read/write head 13.56 MHz
Type identification	:	IQH1-F198-V1
HMN	:	-/-
PMN	:	IQH1-F198-V1
HVIN	:	IQH1-F198-V1
FVIN	:	18-31422
S/N serial number	:	-/-
HW hardware status	:	-/-
SW software status	:	-/-
Frequency	:	13.56 MHz
Type of radio transmission	:	Modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	ASK
Number of channels	:	1
Antenna	:	Integrated PCB loop antenna
Power supply	:	20.0 V to 30.0 V DC by external power supply
Temperature range	:	-25°C to +70°C

5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report:

- 1-3466/17-04-01_AnnexA
- 1-3466/17-04-01_AnnexB
- 1-3466/17-04-01_AnnexC
- 1-3466/17-04-01_AnnexD

6 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
v/k!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

6.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

$$FS = UR + CL + AF$$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

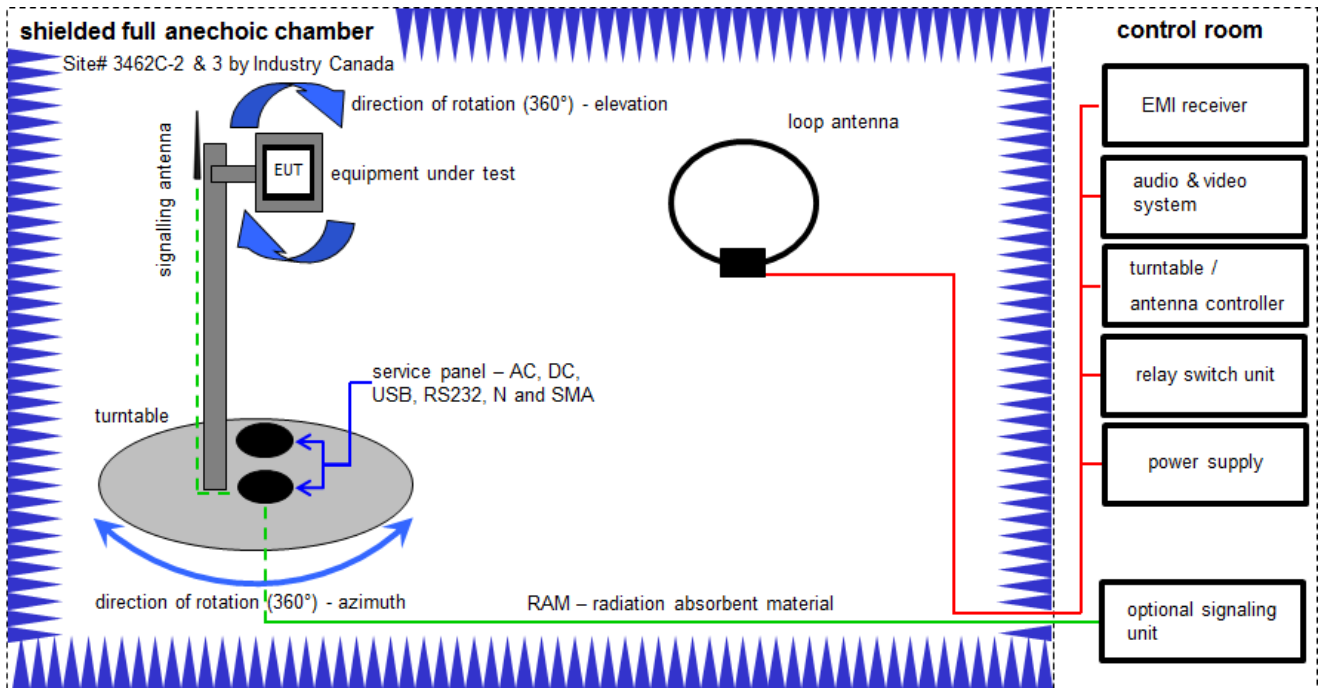
Example calculation:

$$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
2	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	01.02.2017	31.01.2018
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	A	Meßkabine 1	HF-Absorberhalle	MWB AG 300023	-/-	300000551	ne	-/-	-/-
7	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018

6.2 Shielded fully anechoic chamber



Measurement distance: loop antenna 3 meter

$$FS = UR + CA + AF$$

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

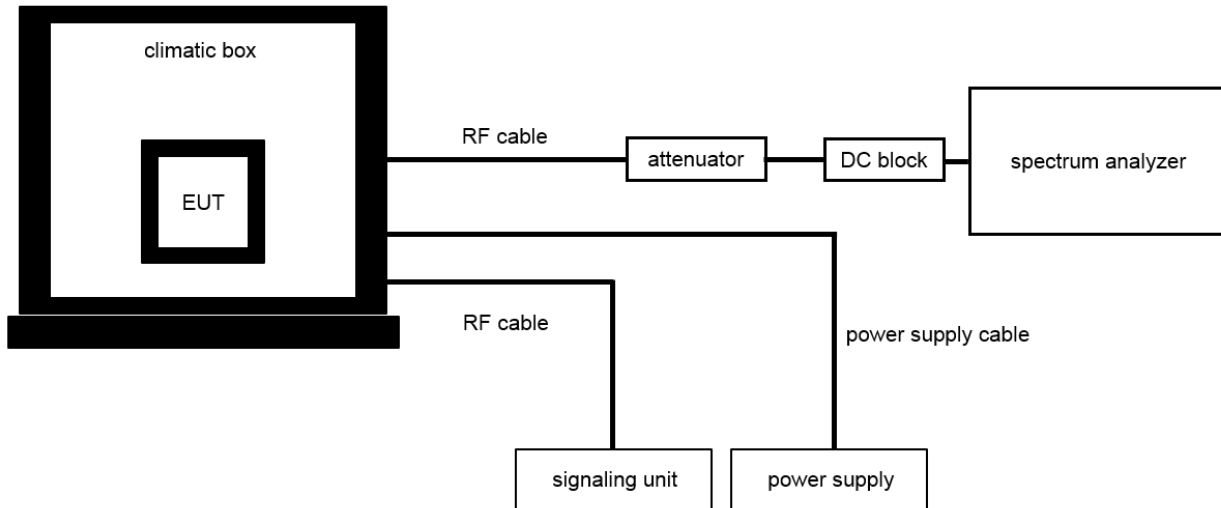
Example calculation:

$$FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	31.01.2017	30.01.2018
2	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
3	A	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO	-/-	300004682	ne	-/-	-/-
4	A	PC	ExOne	F+W	-/-	300004703	ne	-/-	-/-
5	A	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO	2210	300001015	k	07.07.2017	06.07.2019
6	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
7	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
8	A	Switch / Control Unit	3488A	HP	-/-	300000199	ne	-/-	-/-

6.3 RF measurements normal and extreme conditions



OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

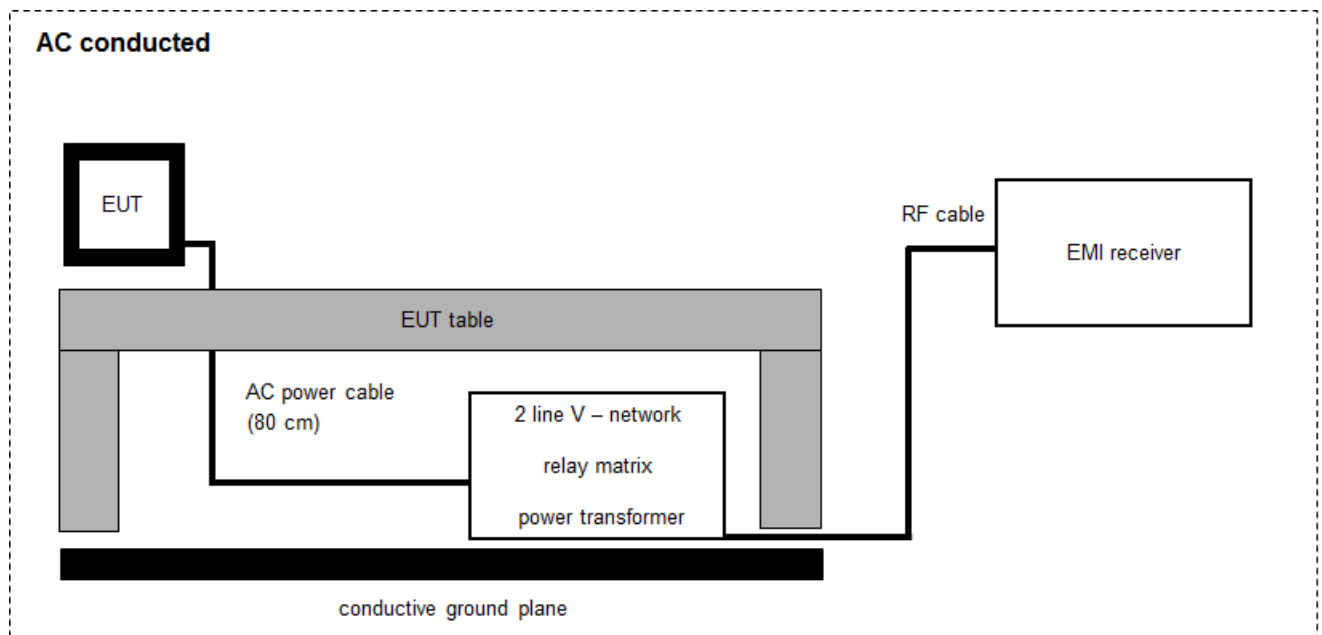
Example calculation:

OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC Power Supply, 60V, 10A	6038A	HP	2752A04866	300001161	Ve	21.01.2015	21.01.2018
2	A	Climatic Box	VT 4011	Voetsch Industrietechnik	-/-	300005363	ev	01.06.2017	31.05.2019
3	A	Hygro-Thermometer	-/-, 5-45C, 20-100rF	Thies Clima	-/-	400000112	ev	07.09.2015	07.09.2017
4	A	Loop Antenna	-/-	ZEG TS Steinfurt	-/-	400001208	ev	-/-	-/-
5	A	Signal- and Spectrum Analyzer	FSW26	R&S	101455	300004528	k	25.01.2017	24.01.2018

6.4 AC conducted



$$FS = UR + CF + VC$$

(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:

$$FS [dB\mu V/m] = 37.62 [dB\mu V/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] (244.06 \mu V/m)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	893045/004	300000584	k	31.01.2017	30.01.2018
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	k	27.11.2006	-/-
3	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
4	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	08.04.2008	-/-
5	A	Power Supply	NGSM 32/10	R&S	3939	400000192	vKII	31.01.2017	30.01.2020
6	A	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	16.08.2016	16.08.2017

7 Sequence of testing

7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Occupied bandwidth	± used RBW
Field strength of the fundamental	± 3 dB
Field strength of the harmonics and spurious	± 3 dB
Receiver spurious emissions and cabinet radiations	± 3 dB
Conducted limits	± 2.6 dB

9 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input type="checkbox"/>	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210 Issue 9 RSS Gen Issue 4	See table!	2017-08-18	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	C	NC	NA	NP	Remark
RSS Gen Issue 4	Occupied bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.225 (a) RSS 210 Issue 9	Field strength of the fundamental	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.209 & § 15.225 (b-d)	Field strength of the harmonics and spurious	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.109	Receiver spurious emissions and cabinet radiations	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	-/-
§15.107 §15.207	Conducted limits	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.225 (a) RSS 210 Issue 9	Frequency tolerance	Normal & extreme conditions	Normal & extreme conditions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-

Note:

- C Compliant
- NC Not compliant
- NA Not applicable
- NP Not performed

10 Additional comments

- Reference documents: None
- Special test descriptions: None
- Configuration descriptions: None

11 Measurement results

11.1 Occupied bandwidth

Measurement:

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

Measurement parameters	
Detector:	Peak
Resolution bandwidth:	1 % – 5 % of the occupied bandwidth
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Analyser function:	99 % power function
Used equipment:	See chapter 6.3 A
Measurement uncertainty:	See chapter 8

Limit:

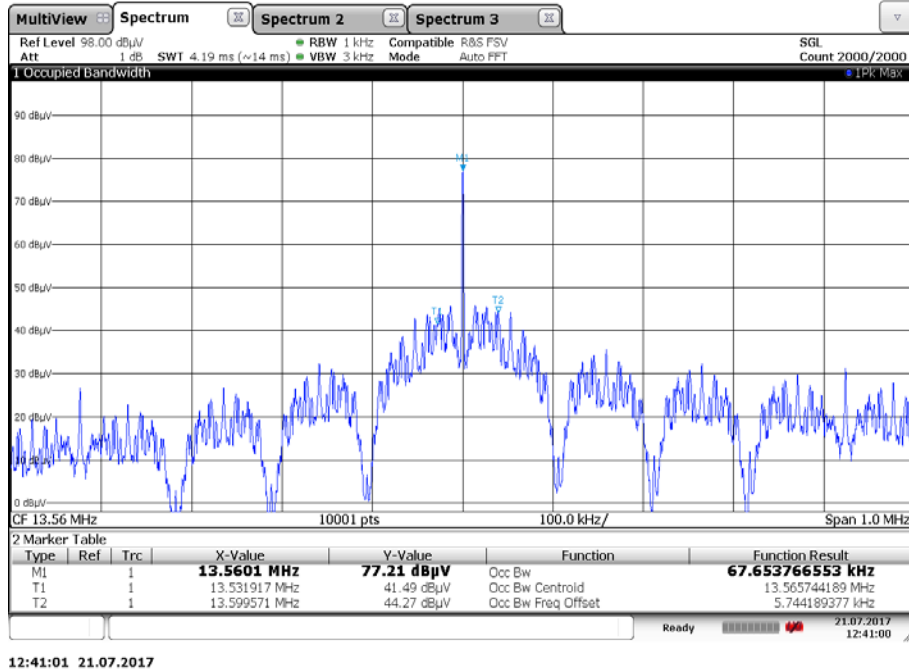
IC
for RSP-100 test report coversheet only

Result:

99% emission bandwidth
67.65 kHz

Plot:

Plot 1: 99 % emission bandwidth



11.2 Field strength of the fundamental

Measurement:

The maximum detected field strength for the carrier signal.

Measurement parameters	
Detector:	Quasi peak / peak (worst case)
Resolution bandwidth:	120 kHz
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Used equipment:	See chapter 6.2 A
Measurement uncertainty:	See chapter 8

Limit:

FCC & IC		
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
13.553 to 13.567	15,848 (84 dBµV/m)	30

Recalculation:

According to ANSI C63.10		
Frequency	Formula	Correction value
13.56 MHz	$FS_{\text{limit}} = FS_{\text{max}} - 40 \log\left(\frac{d_{\text{nearfield}}}{d_{\text{measure}}}\right) - 20 \log\left(\frac{d_{\text{limit}}}{d_{\text{nearfield}}}\right)$ <p> FS_{limit} is the calculation of field strength at the limit distance, expressed in dBµV/m FS_{max} is the measured field strength, expressed in dBµV/m $d_{\text{nearfield}}$ is the $\lambda/2\pi$ distance d_{measure} is the distance of the measurement point from EUT d_{limit} is the reference limit distance </p>	-21.4 from 3m to 30m

Result:

Field strength of the fundamental		
Frequency	13.56 MHz	
Distance	@ 3 m	@ 30 m
Measured / calculated value	85.3 dBµV/m	63.9 dBµV/m

11.3 Field strength of the harmonics and spurious

Measurement:

The maximum detected field strength for the harmonics and spurious.

Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz < F < 30 MHz: 9 kHz 30 MHz < F < 1 GHz: 120 kHz
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz < F < 30 MHz: 100 kHz 30 MHz < F < 1 GHz: 300 kHz
Trace mode:	Max hold
Used equipment:	See chapter 6.1 A
Measurement uncertainty:	See chapter 8

Limit:

FCC & IC		
Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30 (29.5 dBµV/m)	30
30 – 88	100 (40 dBµV/m)	3
88 – 216	150 (43.5 dBµV/m)	3
216 – 960	200 (46 dBµV/m)	3

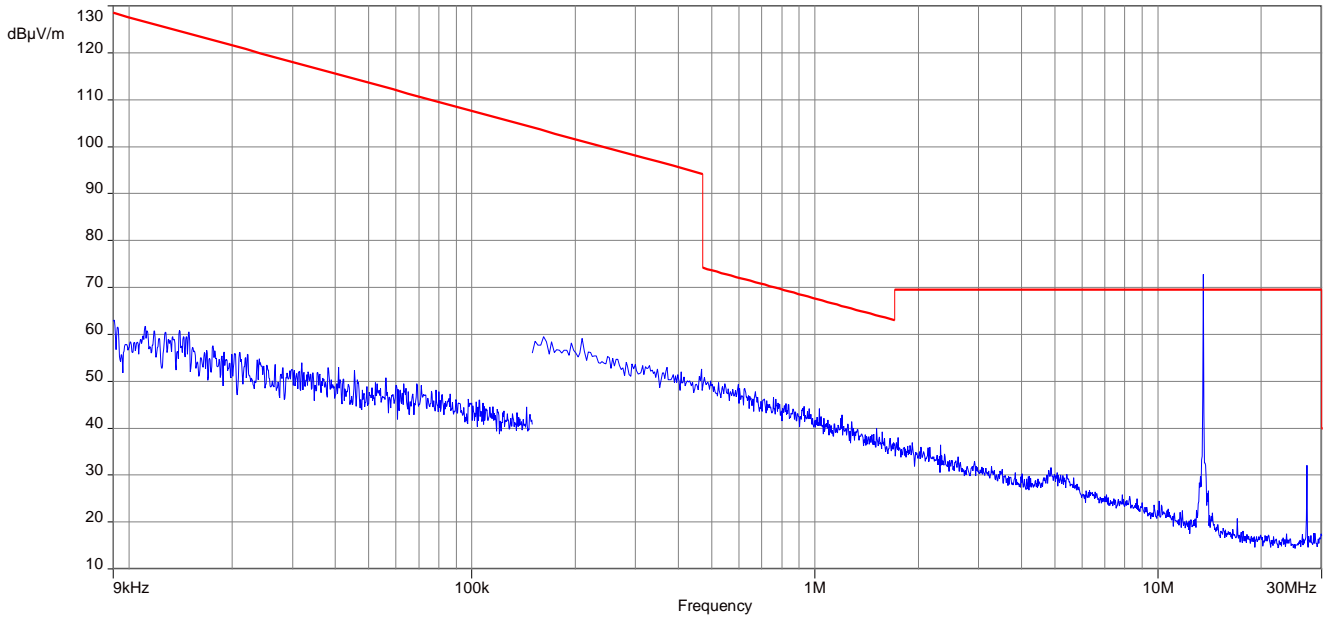
Note: For a reduced measurement distance, please take a look at the limit line and the ANSI C63.10-2013 sub clause 6.4 radiated emissions from unlicensed wireless devices below 30 MHz.

Result:

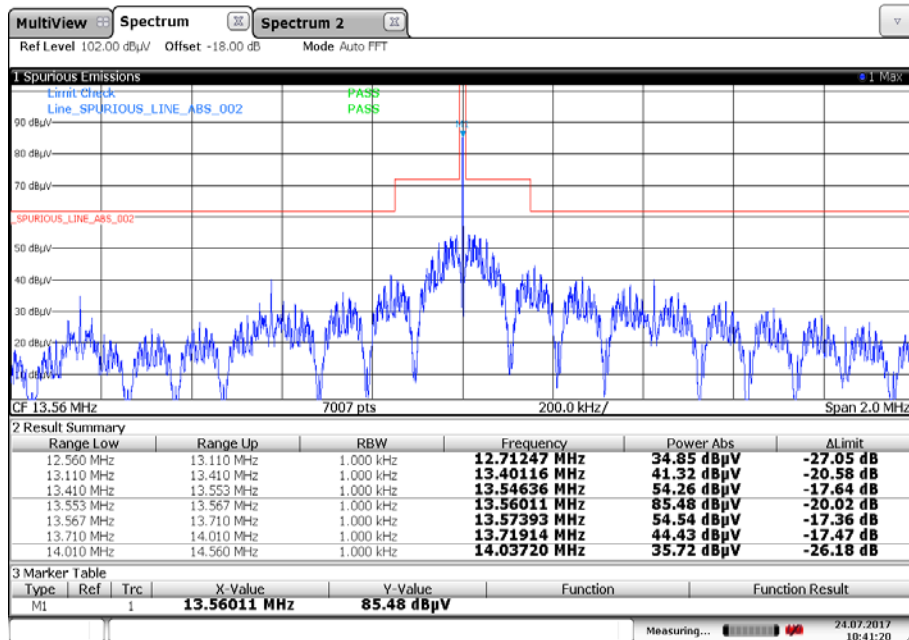
Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value (dBµV/m @ 3m)
All detected emissions are more than 20 dB below the spurious limit.			

Plots:

Plot 1: 9 kHz – 30 MHz, magnetic emissions

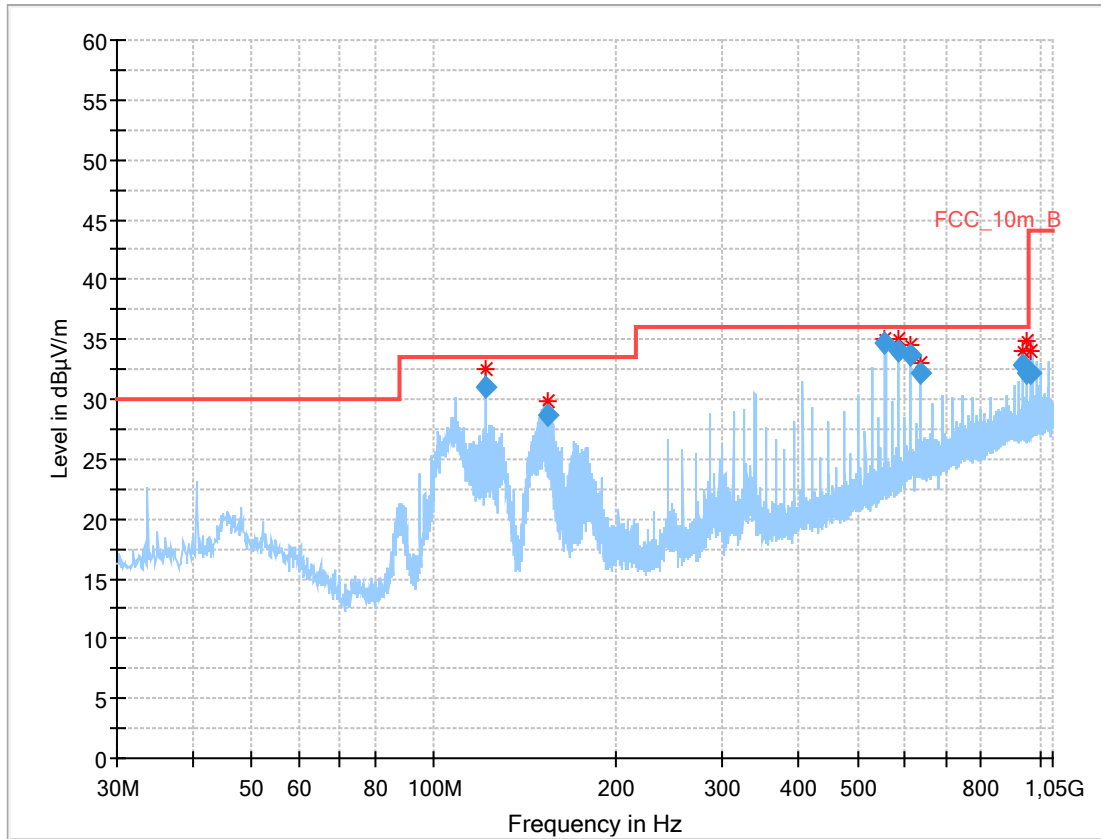


Plot 2: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)



10:41:21 24.07.2017

Plot 3: 30 MHz – 1 GHz, vertical and horizontal polarisation



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
122.032200	31.08	33.50	2.42	1000.0	120.000	103.0	V	165.0	10.1
154.320300	28.60	33.50	4.90	1000.0	120.000	98.0	V	95.0	9.4
555.961350	34.70	36.00	1.30	1000.0	120.000	103.0	H	323.0	19.5
583.083150	33.95	36.00	2.05	1000.0	120.000	168.0	H	301.0	20.3
610.206150	33.65	36.00	2.35	1000.0	120.000	103.0	H	301.0	20.8
637.329750	32.10	36.00	3.90	1000.0	120.000	101.0	H	230.0	21.0
935.638950	32.84	36.00	3.16	1000.0	120.000	98.0	H	240.0	24.3
949.210500	32.18	36.00	3.82	1000.0	120.000	98.0	H	31.0	24.3
962.763150	32.10	44.00	11.90	1000.0	120.000	98.0	H	50.0	24.5

11.4 Conducted limits

Measurement:

Measurement of the conducted spurious emissions for an intentional radiator that is designed to be connected to the public utility (AC) power line.

Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Trace mode:	Max hold
Used equipment:	See chapter 6.4 A
Measurement uncertainty:	See chapter 8

Limit:

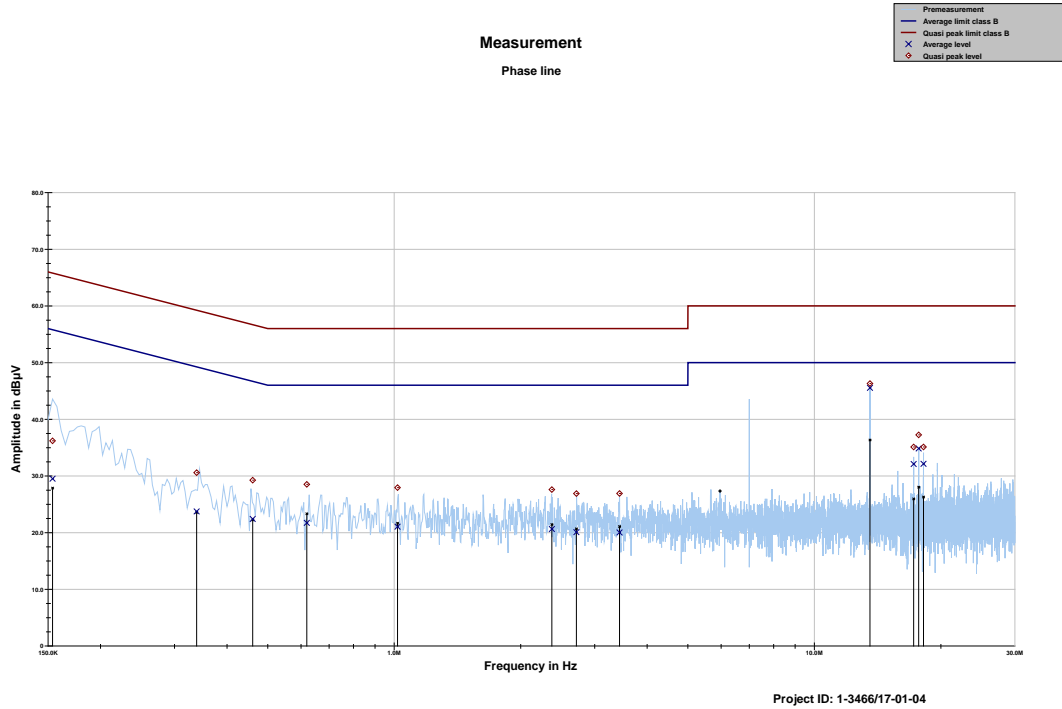
FCC & IC		
Frequency (MHz)	Quasi-peak (dB μ V/m)	Average (dB μ V/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

Result:

Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value
See table below the plots!			

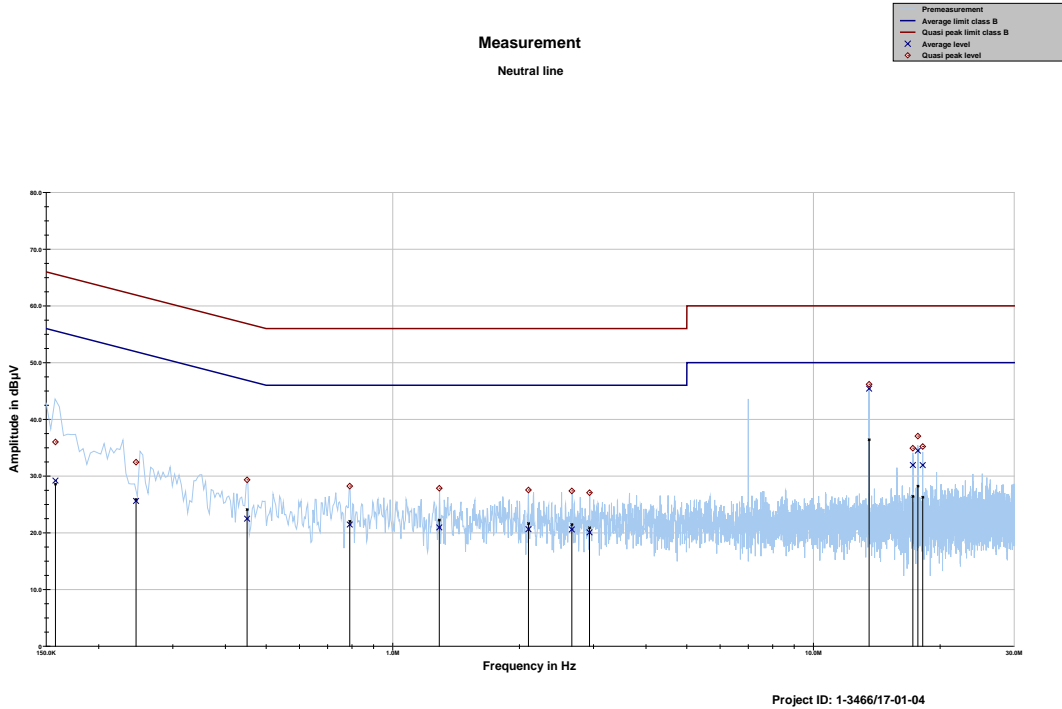
Plots:

Plot 1: 150 kHz to 30 MHz, phase line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.153764	36.19	29.60	65.794	29.51	26.38	55.892
0.338643	30.59	28.65	59.236	23.74	26.87	50.610
0.460462	29.25	27.44	56.684	22.41	24.72	47.130
0.619370	28.51	27.49	56.000	21.72	24.28	46.000
1.018543	27.94	28.06	56.000	21.05	24.95	46.000
2.371999	27.59	28.41	56.000	20.63	25.37	46.000
2.713750	26.89	29.11	56.000	20.08	25.92	46.000
3.438068	26.90	29.10	56.000	20.03	25.97	46.000
13.559985	46.30	13.70	60.000	45.55	4.45	50.000
17.226396	35.11	24.89	60.000	32.11	17.89	50.000
17.706450	37.24	22.76	60.000	34.84	15.16	50.000
18.183854	35.11	24.89	60.000	32.14	17.86	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.157770	36.01	29.57	65.581	29.20	26.58	55.778
0.245291	32.46	29.46	61.915	25.61	27.67	53.277
0.450366	29.33	27.54	56.868	22.49	24.93	47.418
0.790111	28.24	27.76	56.000	21.45	24.55	46.000
1.289668	27.86	28.14	56.000	20.95	25.05	46.000
2.101952	27.55	28.45	56.000	20.64	25.36	46.000
2.664919	27.38	28.62	56.000	20.59	25.41	46.000
2.934887	27.07	28.93	56.000	20.08	25.92	46.000
13.560638	46.19	13.81	60.000	45.42	4.58	50.000
17.226285	34.91	25.09	60.000	31.94	18.06	50.000
17.707215	37.05	22.95	60.000	34.48	15.52	50.000
18.185308	35.20	24.80	60.000	31.93	18.07	50.000

11.5 Frequency error

Measurement:

The maximum detected field strength for the spurious.

Measurement parameters	
Detector:	Peak detector
Resolution bandwidth:	10 Hz
Video bandwidth:	> RBW
Trace mode:	Max hold
Used equipment:	See chapter 6.3 A
Measurement uncertainty:	See chapter 8

Limit:

FCC & IC
<p>The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. (± 1.356 kHz)</p> <p>Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm)</p>

Result: Temperature variation

Frequency tolerance			
Measured frequency (MHz)	Frequency error (kHz)	Conditions	Result
13.560106	0.21	-20 °C & 100% voltage	compliant
13.560140	0.23	-10 °C & 100% voltage	compliant
13.560148	0.22	0 °C & 100% voltage	compliant
13.560141	0.23	+10 °C & 100% voltage	compliant
13.560124	0.21	+20 °C & 100% voltage	compliant
13.560105	0.21	+30 °C & 100% voltage	compliant
13.560091	0.22	+40 °C & 100% voltage	compliant
13.560094	0.21	+50 °C & 100% voltage	compliant
13.560165	0.22	+70 °C & 100% voltage	not required

Result: Voltage variation

Frequency tolerance			
Measured frequency (MHz)	Frequency error (kHz)	Conditions	Result
13.560113	0.21	+20 °C & 85% voltage	compliant
13.560115	0.21	+20 °C & 100% voltage	compliant
13.560114	0.21	+20 °C & 115% voltage	compliant

12 Observations

No observations except those reported with the single test cases have been made.

Annex A Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
ETSI	European Telecommunications Standard Institute
EN	European Standard
FCC	Federal Communication Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2017-08-18

Annex C Accreditation Certificate

first page	last page			
 <p>Deutsche Akkreditierungsstelle GmbH</p> <p>Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV Unterzeichnerin der Multilateralen Abkommen von EA, ILAC und IAF zur gegenseitigen Anerkennung</p> <p>Akkreditierung </p> <p>Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium CTC advanced GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken</p> <p>die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:</p> <ul style="list-style-type: none"> Funk Mobilfunk (GSM / DCS) + OTA Elektromagnetische Verträglichkeit (EMV) Produktsicherheit SAR / EMF Umwelt Smart Card Technology Bluetooth® Automotive Wi-Fi-Services Kanadische Anforderungen US-Anforderungen Akustik Near Field Communication (NFC) <p>Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 25.11.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.</p> <p>Registrierungsnummer der Urkunde: D-PL-12076-01-01</p> <p>Frankfurt, 25.11.2016</p> <p> Im Auftrag Dipl.-Ing. Ralf Egner Abteilungsleiter</p> <p><small>Siehe Hinweise auf der Rückseite</small></p>	<p>Deutsche Akkreditierungsstelle GmbH</p> <table border="0"> <tr> <td>Standort Berlin Spittelmarkt 10 10117 Berlin</td> <td>Standort Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main</td> <td>Standort Braunschweig Bundesallee 100 38116 Braunschweig</td> </tr> </table> <p>Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAkKS). Ausgenommen davon ist die separate Weiterverbreitung des Deckblattes durch die uneinseitig genannte Konformitätsbewertungsstelle in unveränderter Form.</p> <p>Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkKS bestätigten Akkreditierungsbereich hinausgehen.</p> <p>Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abt. L 218 vom 9. Juli 2008, S. 30). Die DAkKS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.</p> <p>Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden: EA: www.european-accreditation.org ILAC: www.ilac.org IAF: www.iaf.nu</p>	Standort Berlin Spittelmarkt 10 10117 Berlin	Standort Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main	Standort Braunschweig Bundesallee 100 38116 Braunschweig
Standort Berlin Spittelmarkt 10 10117 Berlin	Standort Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main	Standort Braunschweig Bundesallee 100 38116 Braunschweig		

Note: The current certificate including annex is published on the website (link see below) of the Accreditation Body DAkKS or may be received by CTC advanced GmbH on request

<http://www.dakks.de/as/ast/d/D-PL-12076-01-01.pdf>

<http://www.dakks.de/as/ast/d/D-PL-12076-01-02.pdf>