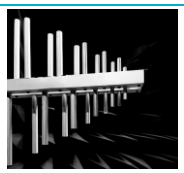
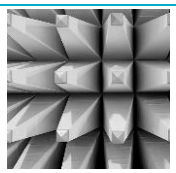




CTC advanced
member of RWTÜV group

TEST REPORT

Test report no.: 1-4406/17-02-02-A

DAkkS 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

Scheidt & Bachmann GmbH
Breite Str. 132
41238 Mönchengladbach / GERMANY
Phone: +49 2166 266 1293
Fax: +49 2166 266 701
Contact: Nils Hündgen
e-mail: huendgen.nils@scheidt-bachmann.de

Manufacturer

Scheidt & Bachmann GmbH
Breite Str. 132
41238 Mönchengladbach / GERMANY

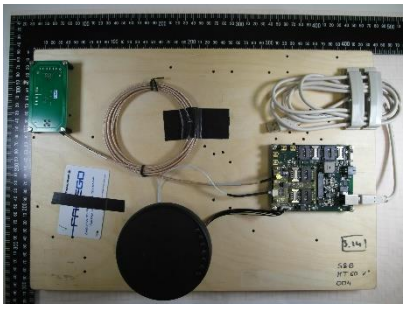
Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
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:	**RFID Reader**
Model name:	**FareGo SCR**
FCC ID:	**O5K-SCR2**
IC:	**8312A-SCR2**
Frequency:	13.56 MHz
Technology tested:	RFID
Antenna:	2 external antennas
Power supply:	12.0 V DC by external power supply
Temperature range:	-20°C to +55°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:

cn=Christoph Schneider, o=CTC advanced GmbH, ou=SND-161128, email=Christoph.Schneider@ctcadvanced.com, c=DE
2017.08.30 15:22:42 +02'00'

Christoph Schneider
Lab Manager
Radio Communications & EMC

Test performed:

Digital unterschrieben von David Lang
DN: cn=David Lang, o=CTC advanced GmbH, ou=LNG-161129, email=david.lang@ctcadvanced.com, c=DE
Datum: 2017.08.30 15:15:44 +02'00'

David Lang
Lab Manager
Radio Communications & EMC

1 Table of contents

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.

This test report replaces the test report with the number 1-4406/17-02-02 and dated 2017-08-30

2.2 Application details

Date of receipt of order:	2017-08-17
Date of receipt of test item:	2017-08-18
Start of test:	2017-08-21
End of test:	2017-08-21
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 - 210 Issue 9	August 2016	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

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}	+22 °C during room temperature tests +55 °C during high temperature tests -20 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	12.0 V DC by external power supply 13.8 V 10.2 V

5 Test item

5.1 General description

Kind of test item	:	RFID Reader
Type identification	:	FareGo SCR
HMN	:	-/-
PMN	:	Smartcard Reader 2.0
HVIN	:	03740300
FVIN	:	07337130
S/N serial number	:	-/-
HW hardware status	:	03740300
SW software status	:	07337130
Frequency band	:	13.56 MHz
Type of radio transmission Use of frequency spectrum	: :	modulated carrier
Type of modulation	:	ASK
Number of channels	:	1
Antenna	:	2 external antennas
Power supply	:	12 V DC by external power supply
Temperature range	:	-20°C to +55°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: 1-4406/17-02-01_AnnexB
1-4406/17-02-01_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).

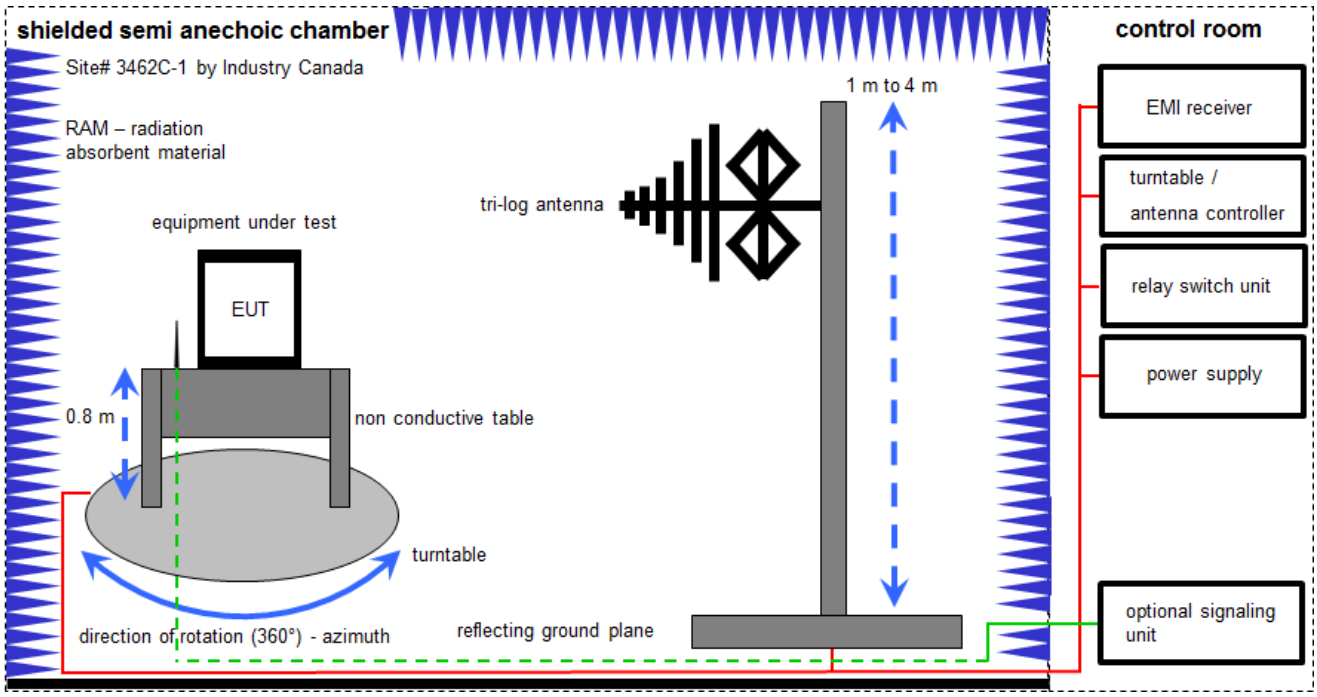
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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
vlkl!	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 30 MHz 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

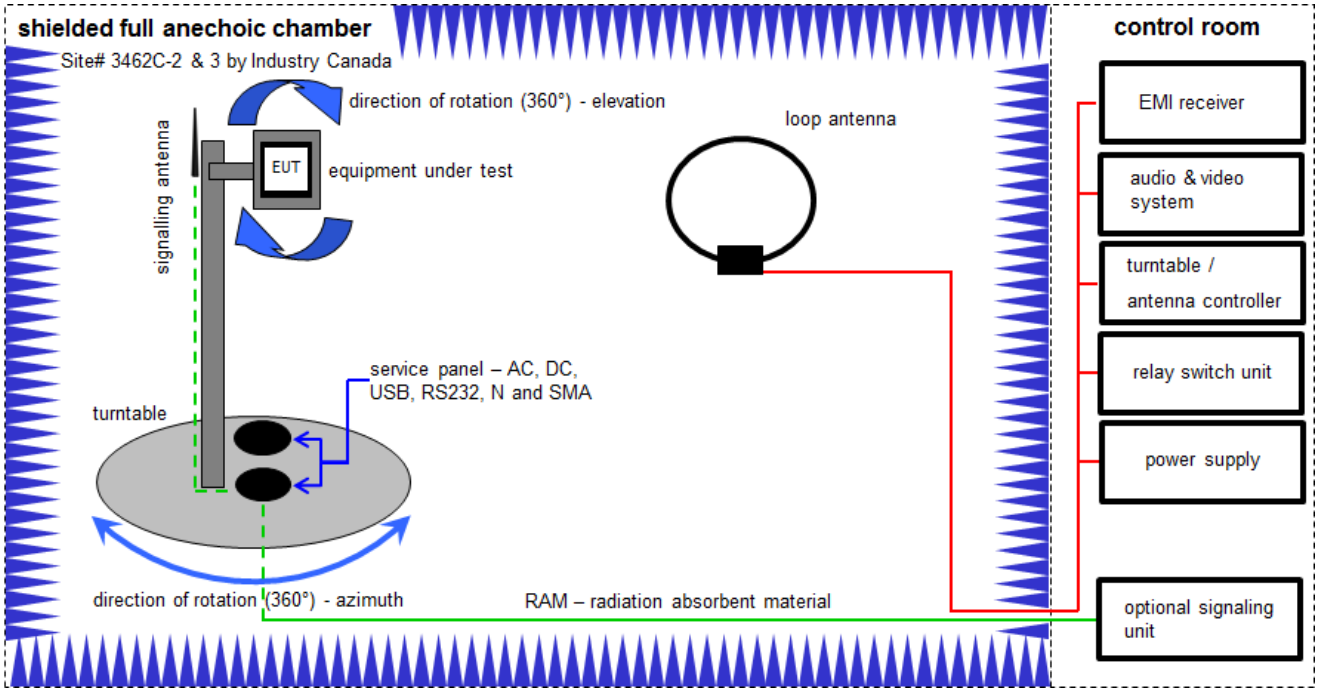
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	01.02.2017	31.01.2018
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	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
5	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
6	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
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

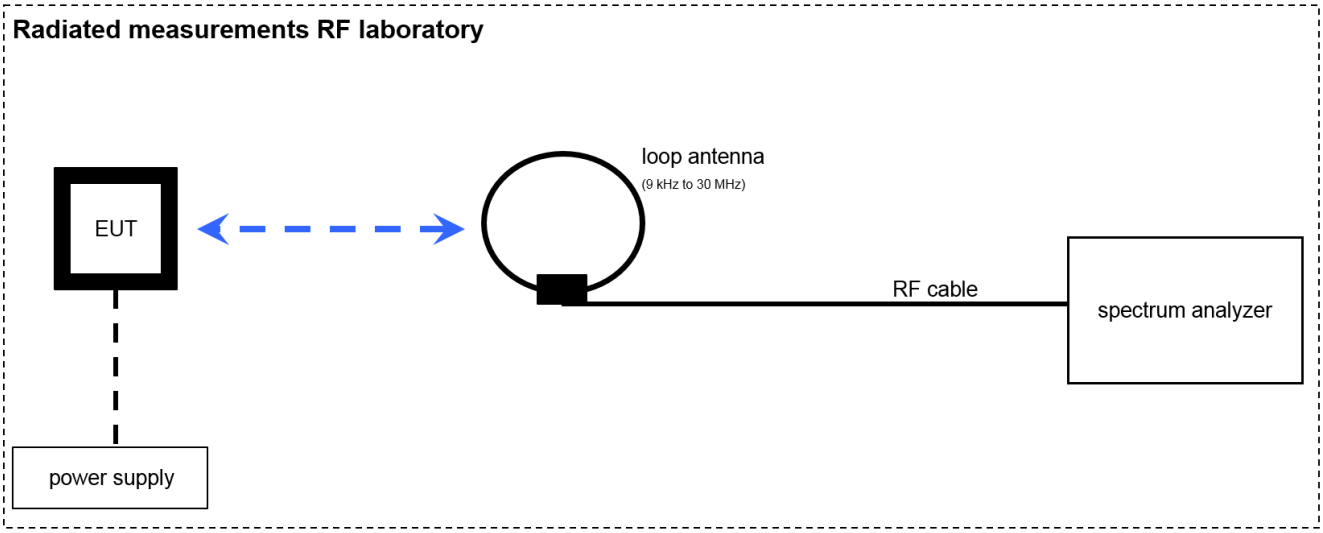
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
2	A	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
3	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	31.01.2017	30.01.2018
4	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
5	A	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
6	A	PC	ExOne	F+W		300004703	ne	-/-	-/-
7	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	k	07.07.2017	06.07.2019

6.3 Radiated measurements RF laboratory



Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Spectrum Analyzer 9kHz to 30GHz - 140..+30dBm	FSP30	R&S	100886	300003575	k	24.01.2017	23.01.2019
2	A	RF-Cable DFS-Tester No. 1	Enviroflex 316 D	Huber & Suhner	Batch no. 1560522	400001257	ev	-/-	-/-
3	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	k	07.07.2017	06.07.2019

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.

Note: According to ANSI C63.4 a test site with no reference ground plane shall take precedence to show the compliance with the standard. In contrast to a semi-anechoic chamber with conductive ground, the EUT distance to the ground in a fully anechoic chamber is irrelevant because it is a reflection-reduced environment at any distance to the ground structure, so in this case a height of 1.5 m was used.

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 ± 45° 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

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	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!	2017-08-30	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	C	NC	NA	NP	Remark
RSS Gen Issue 4	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.225 (a) RSS 210 Issue 9	Field strength of the fundamental	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 & § 15.225 (b-d)	Field strength of the harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.109	Receiver spurious emissions and cabinet radiations	Nominal	Nominal	☐	☐	☒	☐	No stand-alone receiver mode.
§15.107 §15.207	Conducted limits	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.225 (a) RSS 210 Issue 9	Frequency tolerance	Normal & extreme conditions	Normal & extreme conditions	☒	☐	☐	☐	-/-

Note:

C Compliant
NC Not compliant
NA Not applicable
NP Not performed

10 Additional comments

Reference documents:	Customer Questionnaire “O5K-SCR2_Customer Questionnaire”; Setup instructions: O5K-SCR2_Inbetriebnahmeanleitung Rev 1.0; issued 2017-07-02.
Special test descriptions:	None
Configuration descriptions:	All test performed with two different antennas selected via the sbsctoolsuite software provided by the manufacturer.

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
Measurement uncertainty:	See chapter 8

Limit:

IC
for RSP-100 test report coversheet only

Result:

Antenna 1

99% emission bandwidth
576 kHz

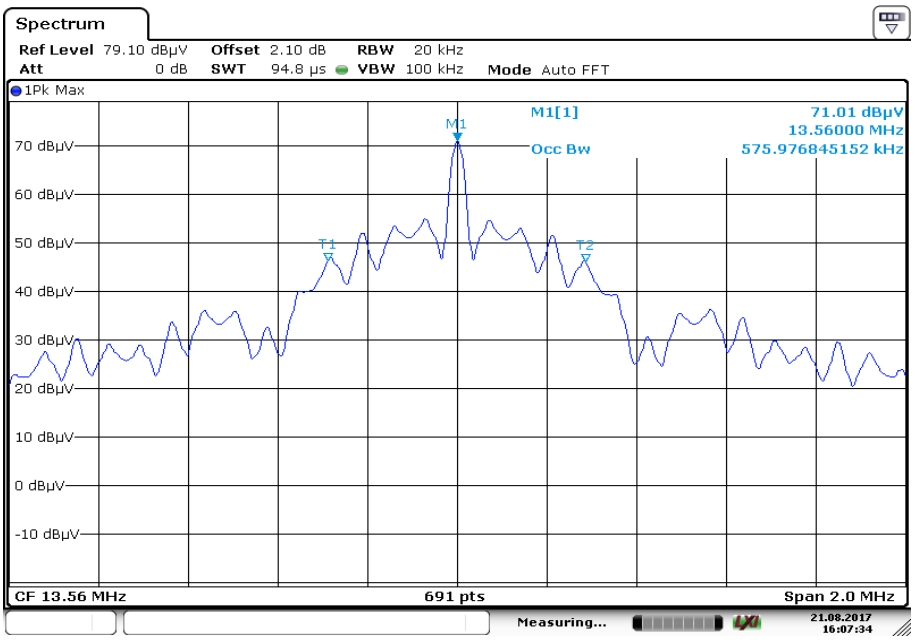
Antenna 2

99% emission bandwidth
576 kHz

Plot:

Antenna 1

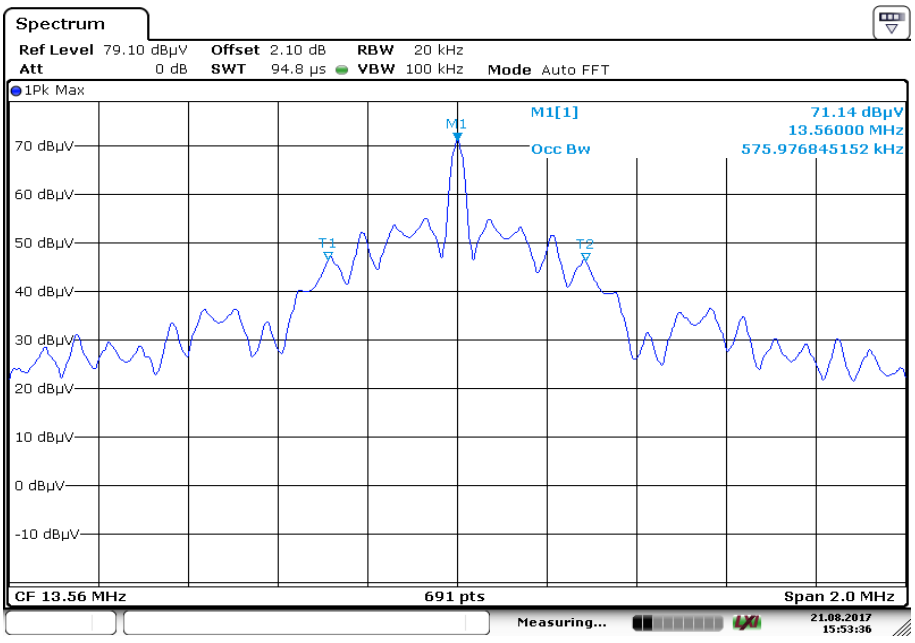
Plot 1: 99 % emission bandwidth



Date: 21.AUG.2017 16:07:34

Antenna 2

Plot 2: 99 % emission bandwidth



Date: 21.AUG.2017 15:53:36

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
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	$FS_{limit} = FS_{max} - 40\log\left(\frac{d_{nearfield}}{d_{measure}}\right) - 20\log\left(\frac{d_{limit}}{d_{near\,field}}\right)$ 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 $d_{near\,field}$ is the λ/2π distance $d_{measure}$ is the distance of the measurement point from EUT d_{limit} is the reference limit distance	-21.4 from 3m to 30m

Result:

Antenna 1

Field strength of the fundamental		
Frequency	13.56 MHz	
Distance	@ 3 m	@ 30 m
Measured / calculated value	71.1 dBµV/m	49.7 dBµV/m

Antenna 2

Field strength of the fundamental		
Frequency	13.56 MHz	
Distance	@ 3 m	@ 30 m
Measured / calculated value	71.1 dBµV/m	49.7 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 (RSE above 30 MHz), 6.2 (RSE below 30 MHz)
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:

Antenna 1

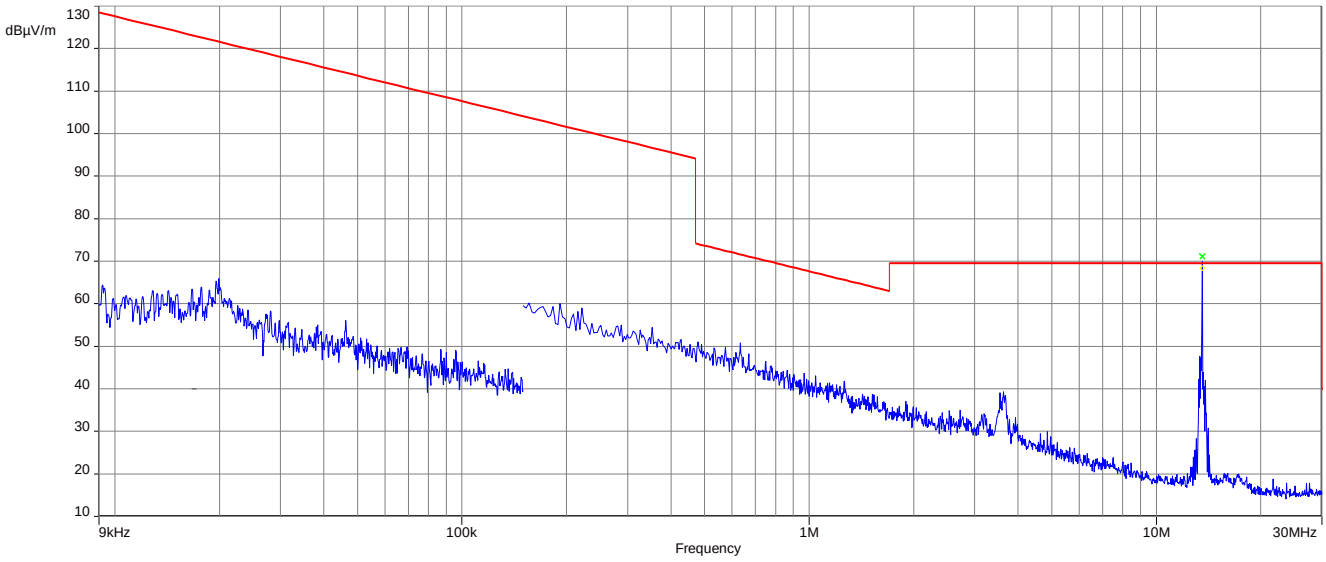
Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value (dBµV/m @ 3m)
All emissions below 30 MHz > 20dB below limit (except carrier)			
For emissions above 30 MHz see table below plot.			

Antenna 2

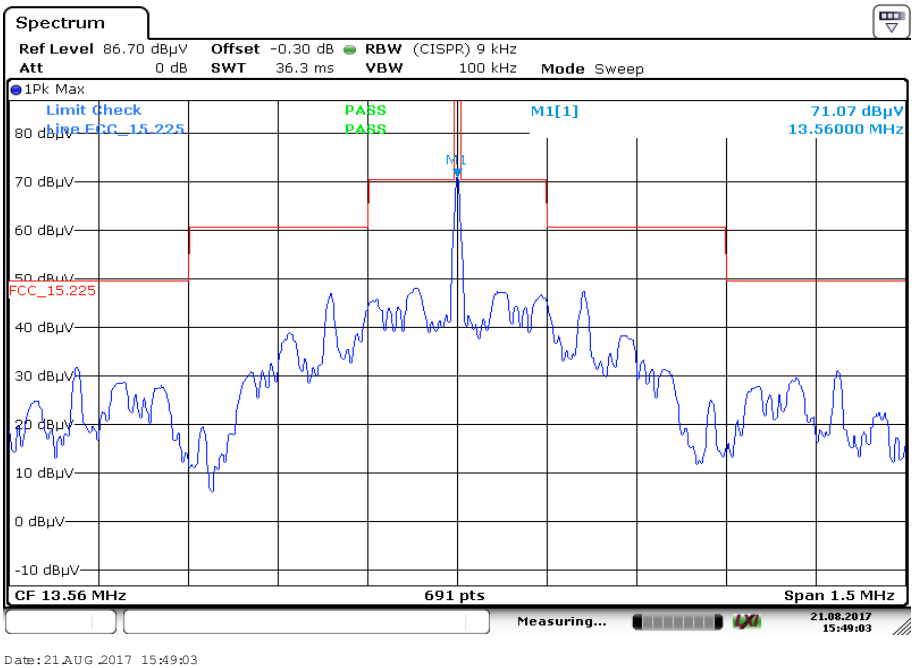
Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value (dBµV/m @ 3m)
All emissions below 30 MHz > 20dB below limit (except carrier)			
For emissions above 30 MHz see table below plot.			

Plots: Antenna 1

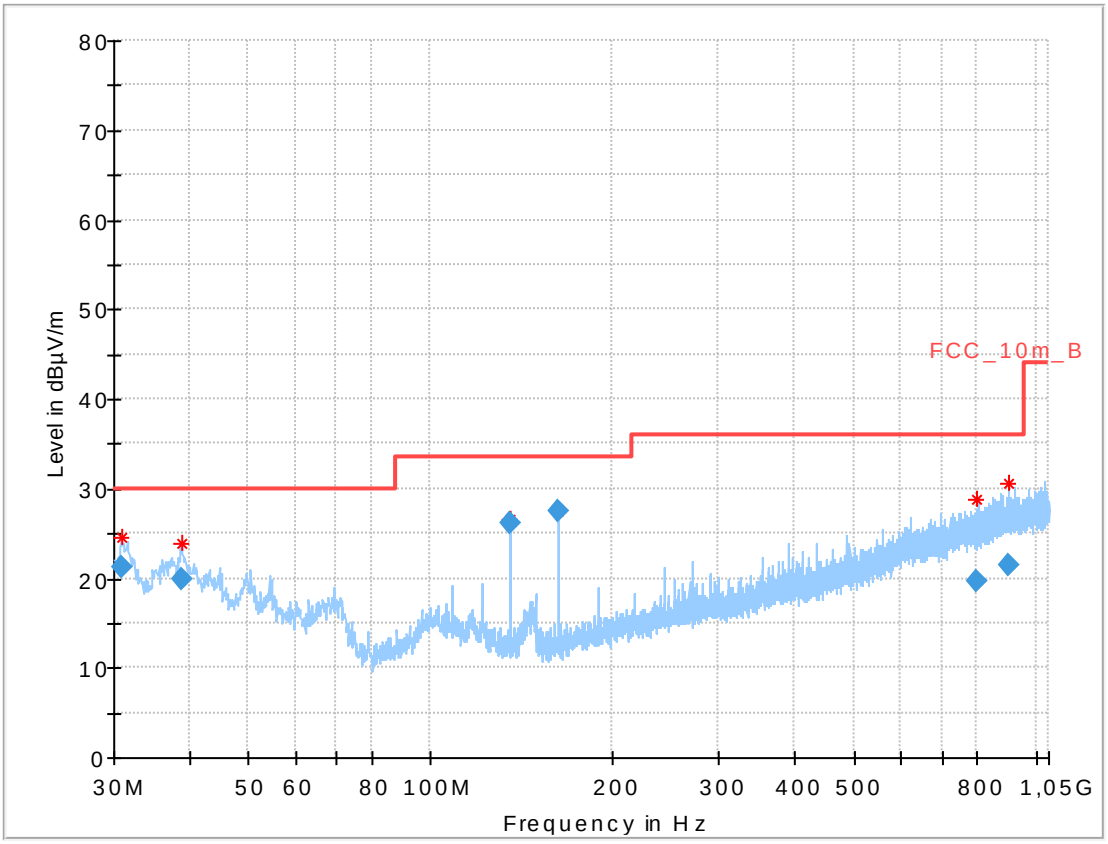
Plot 1: 9 kHz – 30 MHz, magnetic emissions



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



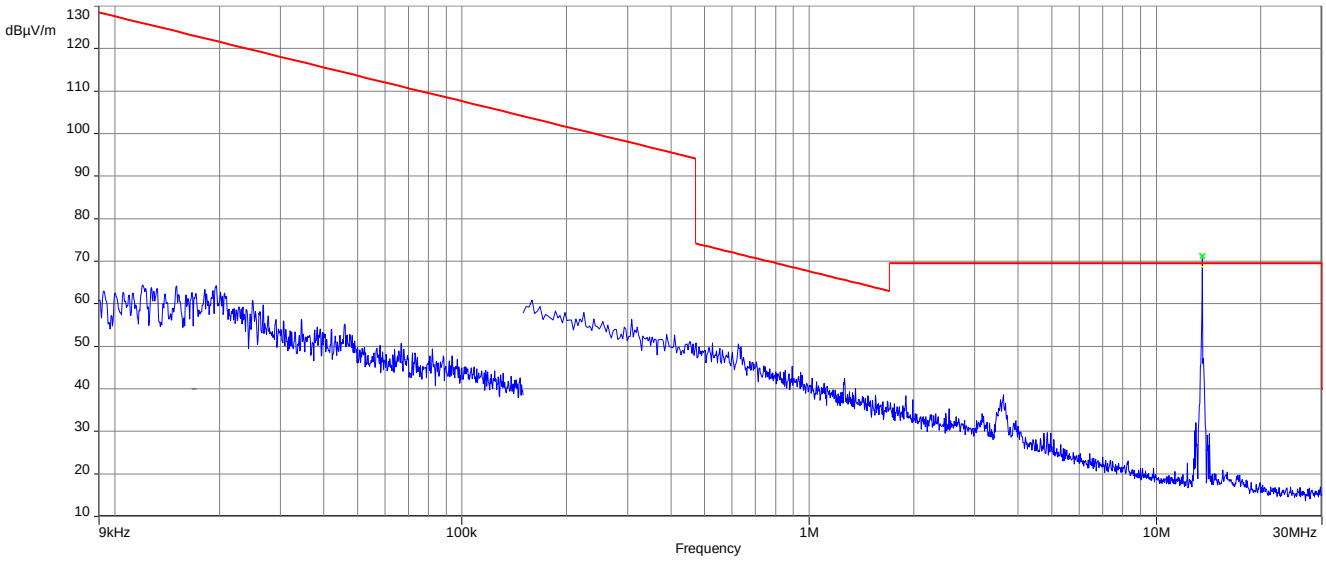
Plot 3: 30 MHz – 1 GHz, vertical and horizontal polarisation



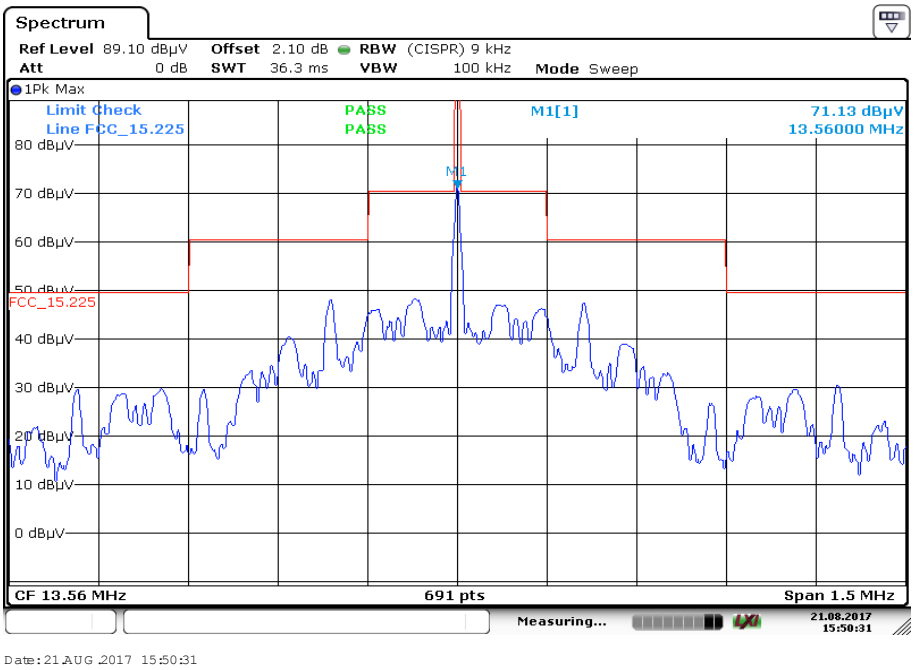
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.004	21.26	30.0	8.74	1000	120	101.0	V	280.0	12.0
38.716	19.94	30.0	10.06	1000	120	98.0	V	-8.0	13.1
135.591	26.20	33.5	7.30	1000	120	98.0	V	280.0	9.2
162.715	27.45	33.5	6.05	1000	120	98.0	V	80.0	9.8
801.255	19.62	36.0	16.38	1000	120	98.0	V	260.0	22.8
903.576	21.45	36.0	14.55	1000	120	170.0	V	190.0	24.2

Antenna 2

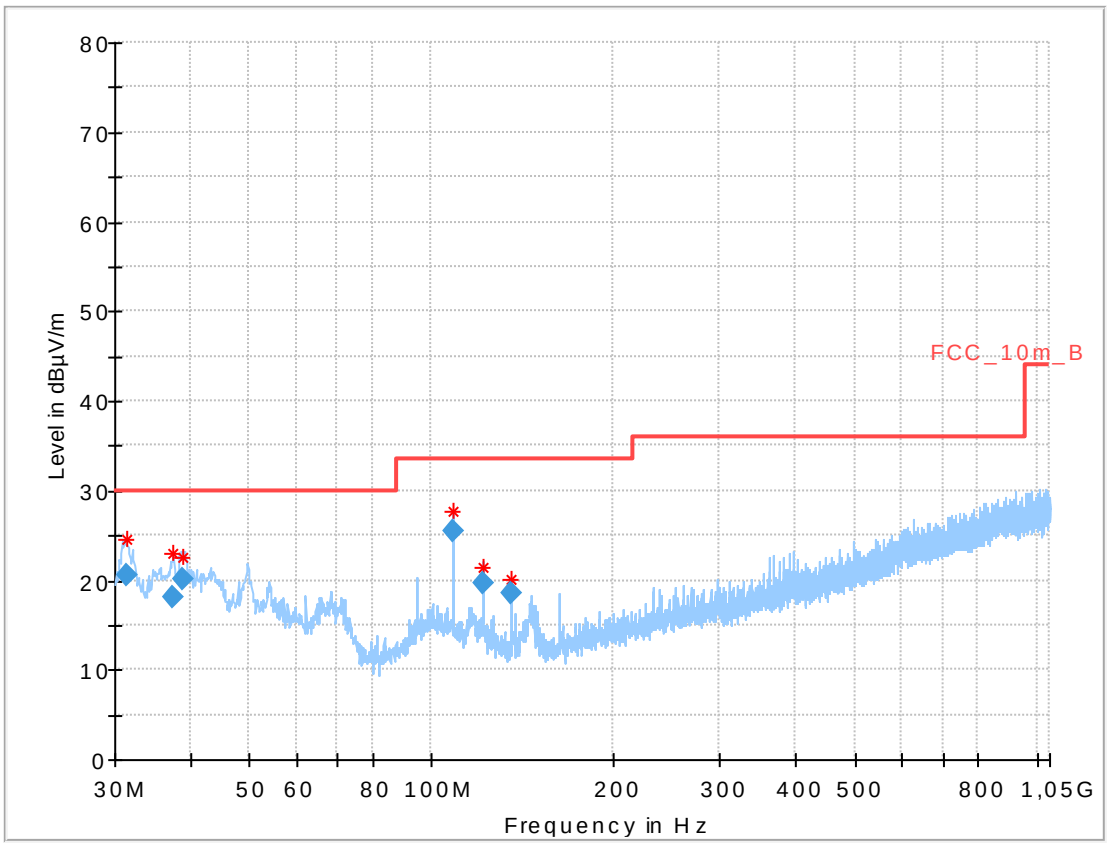
Plot 1: 9 kHz – 30 MHz, magnetic emissions



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



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)
31.321	20.66	30.0	9.34	1000	120	101.0	V	-10.0	12.1
37.550	18.00	30.0	12.00	1000	120	98.0	V	261.0	12.9
38.717	20.14	30.0	9.86	1000	120	98.0	V	10.0	13.1
108.467	25.52	33.5	7.98	1000	120	170.0	V	171.0	11.3
122.048	19.71	33.5	13.79	1000	120	170.0	V	190.0	10.1
135.603	18.52	33.5	14.98	1000	120	101.0	V	280.0	9.2

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
Measurement uncertainty:	See chapter 8

Limit:

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

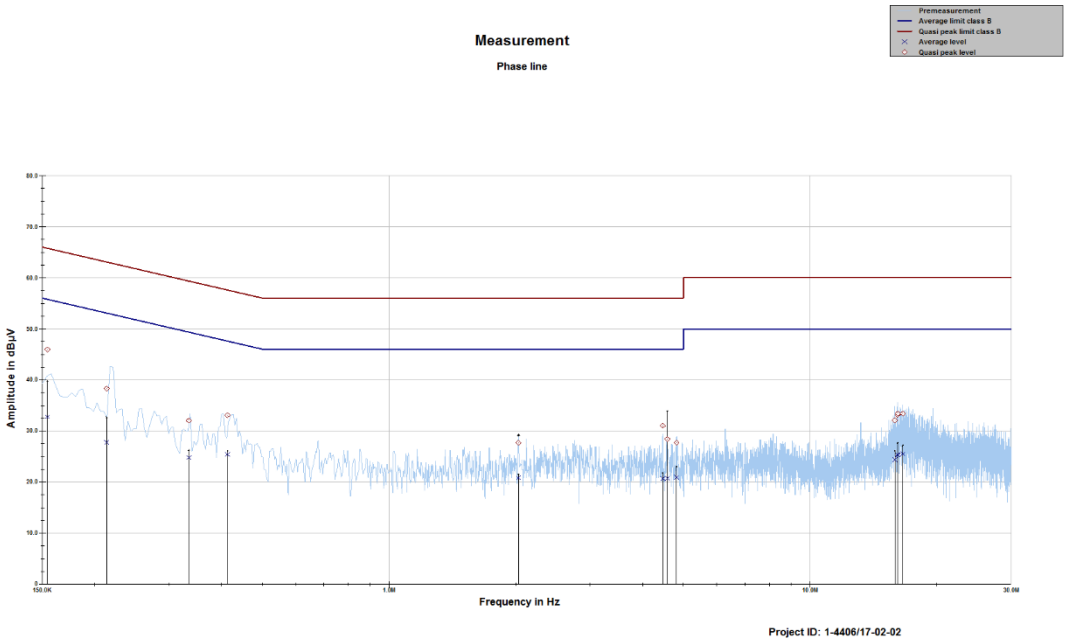
Result:

Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value

Plots:

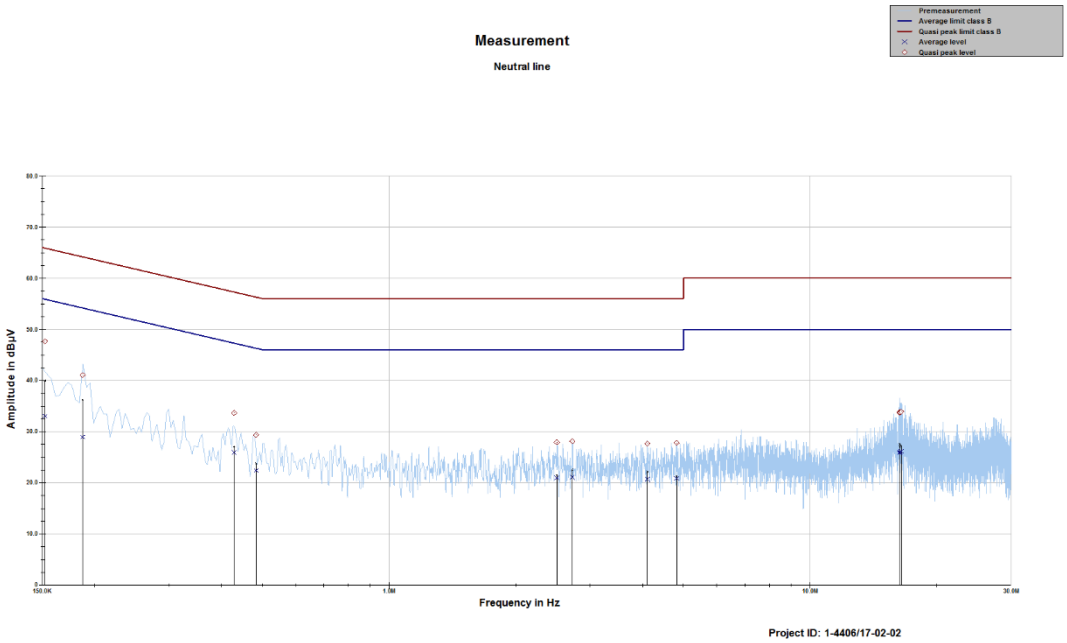
Antenna 1

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
0.154247	45.98	19.79	65.768	32.77	23.11	55.879
0.213185	38.30	24.78	63.080	27.76	26.43	54.195
0.334156	32.05	27.30	59.347	24.78	25.95	50.738
0.412607	33.10	24.50	57.596	25.43	23.07	48.497
2.026861	27.69	28.31	56.000	20.82	25.18	46.000
4.463983	31.04	24.96	56.000	20.69	25.31	46.000
4.576390	28.44	27.56	56.000	20.74	25.26	46.000
4.813602	27.73	28.27	56.000	20.92	25.08	46.000
15.877489	32.09	27.91	60.000	24.38	25.62	50.000
16.107515	33.16	26.84	60.000	25.36	24.64	50.000
16.149742	33.41	26.59	60.000	25.29	24.71	50.000
16.593107	33.41	26.59	60.000	25.51	24.49	50.000

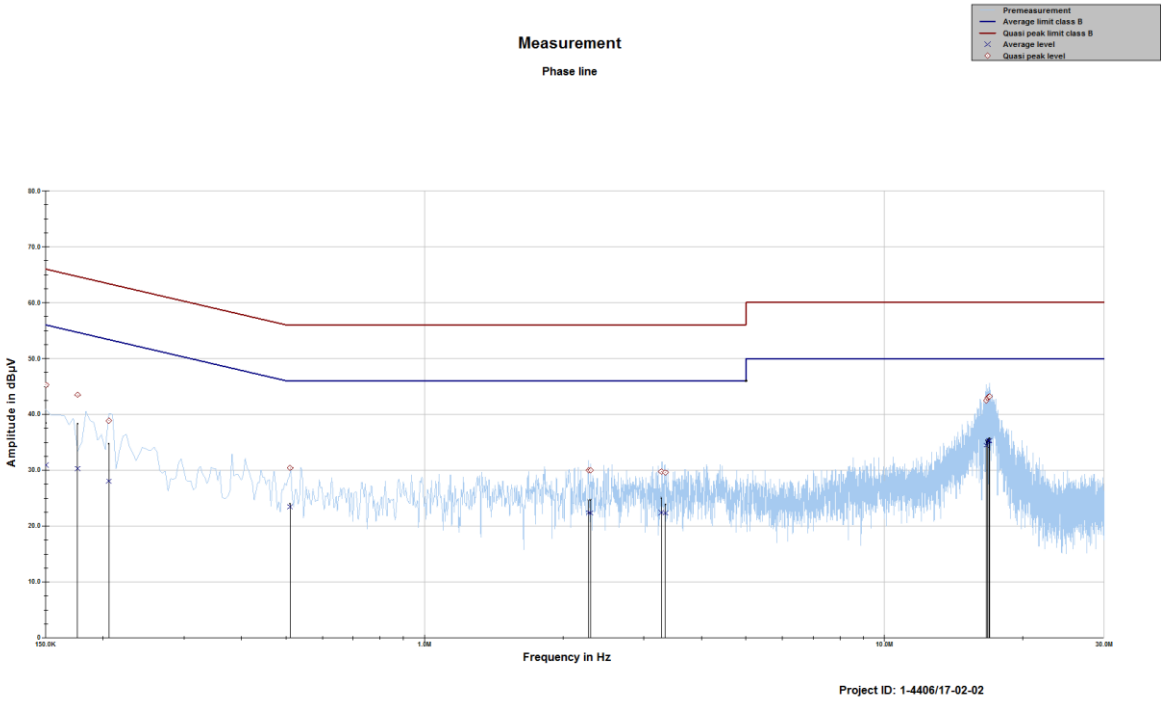
Plot 2: 150 kHz to 30 MHz, neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.152190	47.68	18.20	65.880	33.04	22.90	55.937
0.186977	41.07	23.10	64.170	28.96	25.99	54.944
0.428073	33.65	23.64	57.290	25.93	22.13	48.055
0.482782	29.35	26.94	56.291	22.41	24.09	46.492
2.499616	27.92	28.08	56.000	20.96	25.04	46.000
2.721433	28.12	27.88	56.000	21.10	24.90	46.000
4.102965	27.67	28.33	56.000	20.73	25.27	46.000
4.815983	27.83	28.17	56.000	20.87	25.13	46.000
16.289301	33.77	26.23	60.000	25.88	24.12	50.000
16.308689	33.69	26.31	60.000	25.95	24.05	50.000
16.322309	33.77	26.23	60.000	25.96	24.04	50.000
16.444955	33.92	26.08	60.000	26.13	23.87	50.000

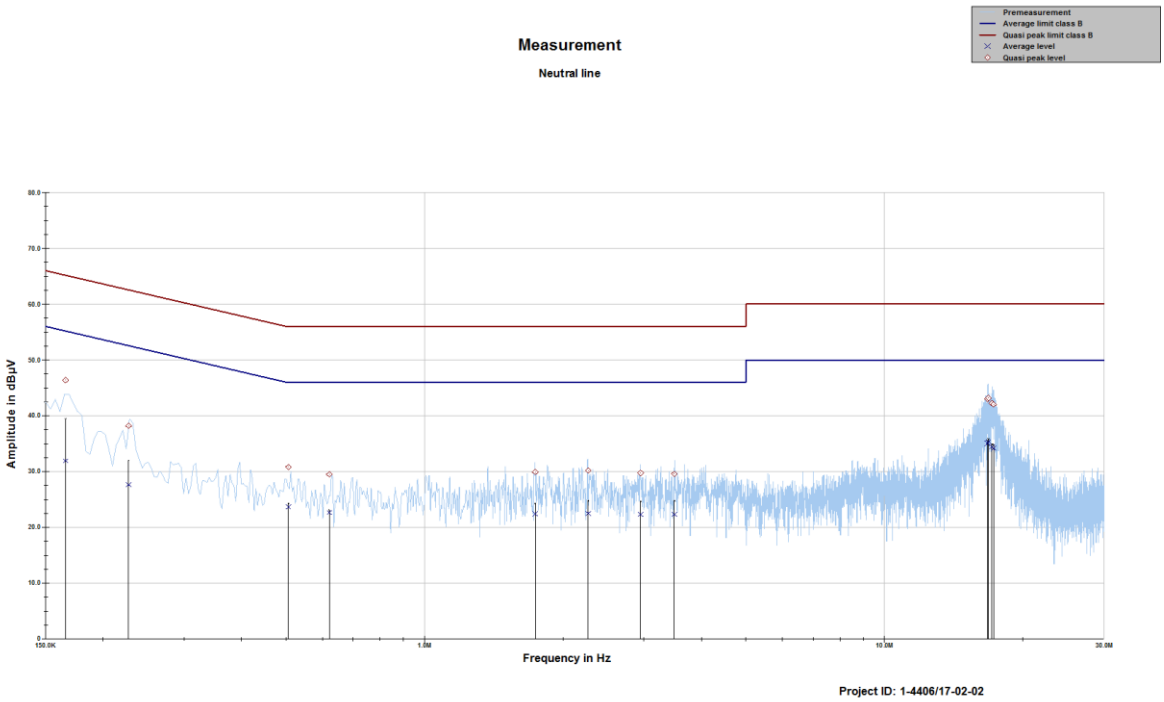
Antenna 2

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
0.150259	45.28	20.71	65.986	30.94	25.05	55.993
0.176126	43.49	21.17	64.666	30.29	24.96	55.254
0.205844	38.87	24.51	63.371	28.05	26.36	54.404
0.510046	30.42	25.58	56.000	23.45	22.55	46.000
2.274652	30.01	25.99	56.000	22.42	23.58	46.000
2.296150	30.01	25.99	56.000	22.31	23.69	46.000
3.274098	29.75	26.25	56.000	22.45	23.55	46.000
3.338962	29.61	26.39	56.000	22.33	23.67	46.000
16.635047	42.48	17.52	60.000	34.48	15.52	50.000
16.756267	42.95	17.05	60.000	34.96	15.04	50.000
16.853734	43.17	16.83	60.000	35.25	14.75	50.000
16.913204	43.22	16.78	60.000	35.30	14.70	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
0.165809	46.36	18.81	65.168	31.92	23.63	55.548
0.227323	38.17	24.38	62.547	27.65	26.14	53.791
0.505961	30.81	25.19	56.000	23.65	22.35	46.000
0.621092	29.50	26.50	56.000	22.65	23.35	46.000
1.740842	29.90	26.10	56.000	22.43	23.57	46.000
2.269808	30.19	25.81	56.000	22.49	23.51	46.000
2.948196	29.75	26.25	56.000	22.33	23.67	46.000
3.492077	29.58	26.42	56.000	22.32	23.68	46.000
16.747030	43.00	17.00	60.000	35.06	14.94	50.000
16.818880	43.18	16.82	60.000	35.33	14.67	50.000
17.125951	42.25	17.75	60.000	34.42	15.58	50.000
17.252562	42.01	17.99	60.000	34.16	15.84	50.000

11.5 Frequency error

Measurement:

The maximum detected field strength for the spurious.

Measurement parameters	
Detector:	Peak detector
Resolution bandwidth:	10 Hz / 100 Hz
Video bandwidth:	> RBW
Trace mode:	Max hold
Used equipment:	See chapter 6.4
Measurement uncertainty:	See chapter 8

Limit:

FCC & IC
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) Carrier frequency stability shall be maintained to ±0.01% (±100 ppm)

Result: Temperature variation (measured with antenna 1)

Frequency tolerance			
Measured frequency (MHz)	Frequency error (kHz)	Conditions	Result
13.5598	-0.2	-20 °C & 100% voltage	compliant
13.5598	-0.2	-10 °C & 100% voltage	compliant
13.5598	-0.2	0 °C & 100% voltage	compliant
13.5598	-0.2	+10 °C & 100% voltage	compliant
13.5598	-0.2	+20 °C & 100% voltage	compliant
13.5597	-0.3	+30 °C & 100% voltage	compliant
13.5597	-0.3	+40 °C & 100% voltage	compliant
13.5597	-0.3	+50 °C & 100% voltage	compliant

Result: Voltage variation (measured with antenna 1)

Frequency tolerance			
Measured frequency (MHz)	Frequency error (kHz)	Conditions	Result
13.5598	-0.2	+20 °C & 85% voltage	compliant
13.5598	-0.2	+20 °C & 100% voltage	compliant
13.5598	-0.2	+20 °C & 115% voltage	compliant

12 Observations

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

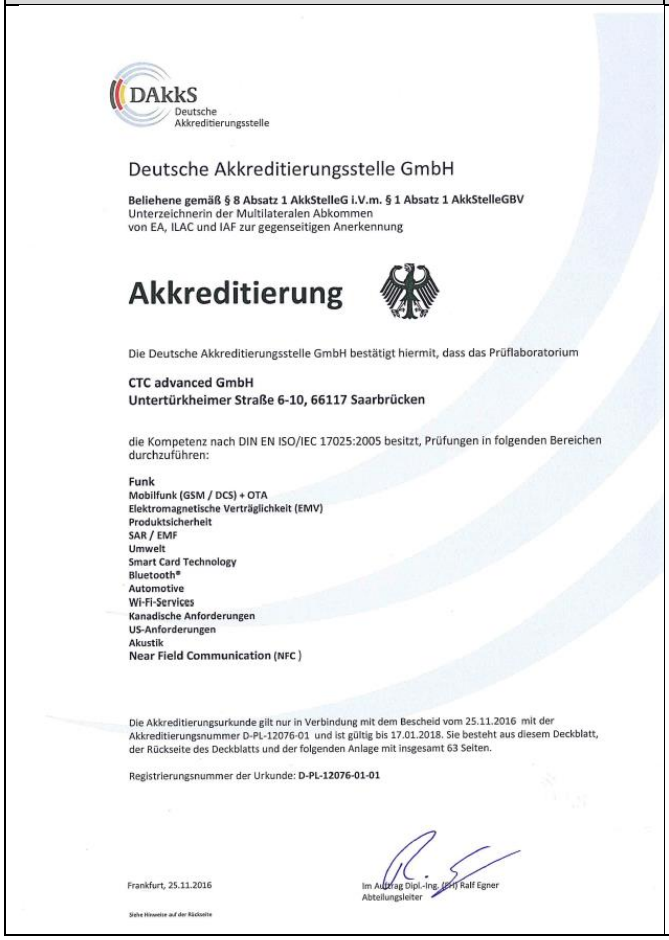
Annex A Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications 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
GNSS	Global Navigation Satellite System
C/N_0	Carrier to noise-density ratio, expressed in dB-Hz

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2017-08-30
A	Applicant and Manufacturer information revised; PMN added	2017-08-30

Annex C Accreditation Certificate

first page	last page
	

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