
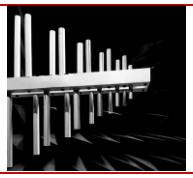
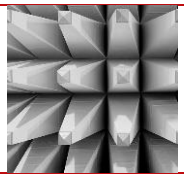

CETECOM™
CETECOM ICT Services
consulting - testing - certification

TEST REPORT

Test report no.: 1-1450/16-01-10-A

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.cetecom.com
e-mail: ict@cetecom.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

Mobotix AG
Kaiserstraße
67722 Langmeil / GERMANY
Phone: +49 6302 9816-0
Fax:
Contact: Thomas Kern
e-mail: thomas.kern@mobotix.com
Phone: +49 6302-9816-0

Manufacturer

Mobotix AG
Kaiserstraße
67722 Langmeil / GERMANY

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS-310, Issue 4	Licence-exempt Radio Apparatus: Category II Equipment

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**Motion detector**
Model name:	**MX-Proximity-Box**
FCC ID:	**YYRPROXCE**
Frequency:	24.000 – 24.250 GHz
Antenna:	Integrated patch antenna
Power supply:	36 V to 57 V DC by external power supply
Temperature range:	-20°C to +60°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:

M. Walla

Digital unterschrieben von Meheza Walla
DN: cn=Meheza Walla, o=CETECOM ICT Services GmbH, ou=WAL-151005, email=Meheza.Walla@cetecom.com, c=DE
Datum: 2016.10.12 09:18:14 +02'00'

Meheza Walla
Lab Manager
Radio Communications & EMC

Test performed:

Geraldy Karsten

DN: cn=Karsten Geraldy, o=CETECOM ICT Services GmbH, ou=GER-151201, email=karsten.geraldy@cetecom.com, c=DE
Datum: 2016.10.12 09:17:08 +02'00'

Karsten Geraldy
Lab Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

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This test report replaces the test report with the number 1-1450/16-01-10 and dated 2016-09-06.

2.2 Application details

Date of receipt of order:	2016-03-03
Date of receipt of test item:	2016-07-21
Start of test:	2016-07-21
End of test:	2016-07-29
Person(s) present during the test:	Mr. Kern and Mr. Audergon

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-310, Issue 4	2015-07	Licence-exempt Radio Apparatus: Category II Equipment

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +60 °C during high temperature tests -20 °C during low temperature tests
Relative humidity content	:		35 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{max} V_{min}	48 V DC by external power supply -/- V -/- V

5 Test item

5.1 General description

Kind of test item	:	Motion detector
Type identification	:	MX-Proximity-Box
S/N serial number	:	4
HW hardware status	:	2V0
SW software status	:	0.0.0.14
Frequency band	:	24.000 – 24.250 GHz
Type of radio transmission Use of frequency spectrum	: :	modulated carrier
Type of modulation	:	FSK
Number of channels	:	1
Antenna	:	Integrated patch antenna
Power supply	:	36 V to 57 V DC by external power supply
Temperature range	:	-20°C to +60°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 following documents: 1-1450/16-01-01_AnnexE
1-1450/16-01-01_AnnexF
1-1450/16-01-01_AnnexG

6 Test laboratories sub-contracted

None

7 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).

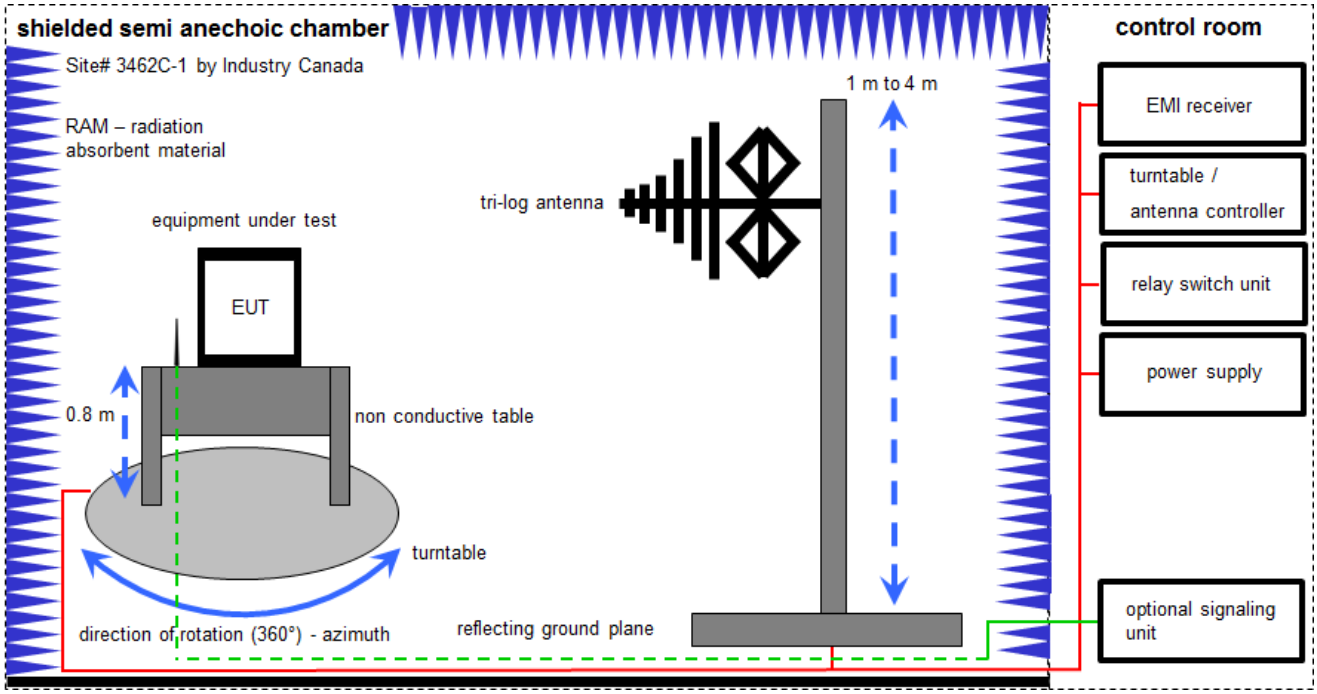
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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

7.1 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 confirmed with 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

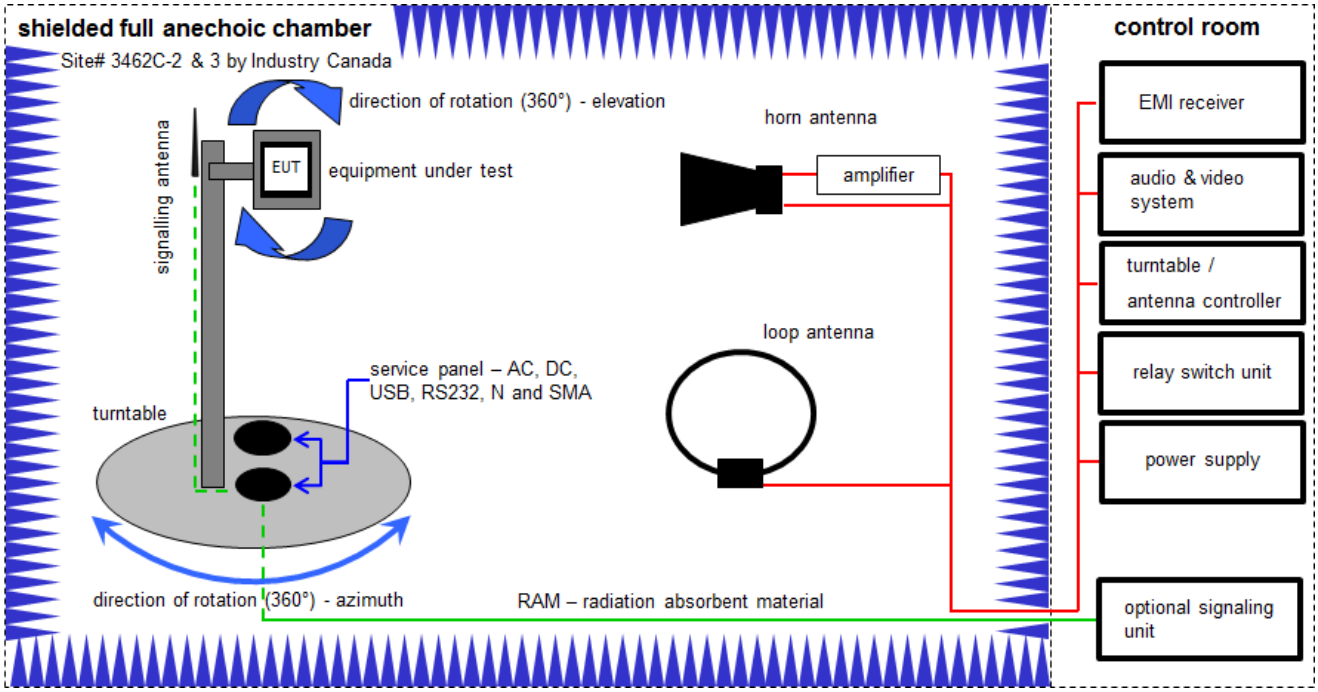
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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.	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne		
3	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	08.03.2016	08.03.2017
4	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
5	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
6	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
7	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
8	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018
9	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	29.01.2016	29.01.2017
10	Double Ridge Broadband Horn Antenna 1-10 GHz	BBHA9120 B	Schwarzbeck	188	300003896	k	20.05.2015	20.05.2017

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter / 1 meter

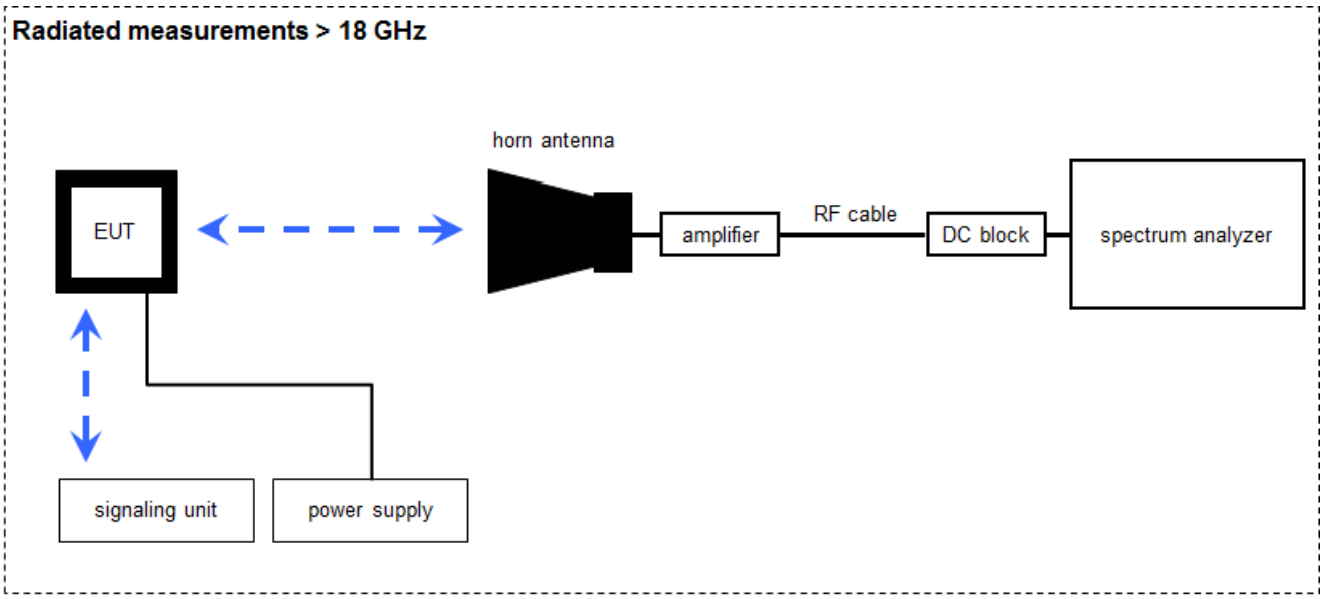
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

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

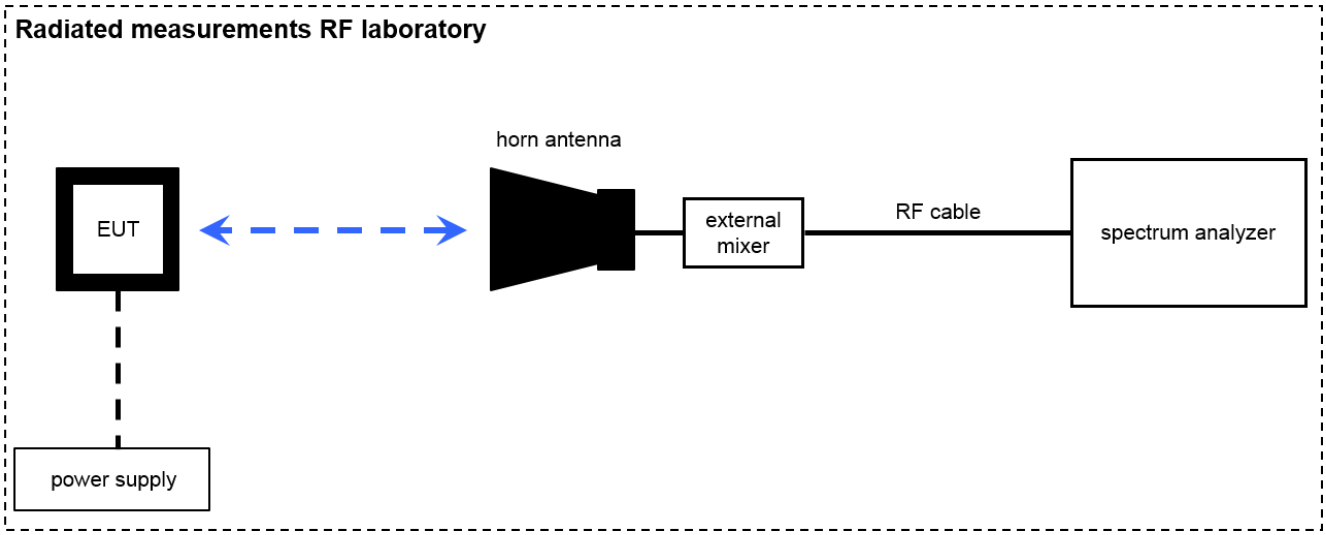
Equipment table:

No.	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
2	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKl!	20.05.2015	20.05.2017
3	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	Variable isolating transformer	MPL IEC625 Bus Variable isolating transformer	Erfi	91350	300001155	ne	-/-	-/-
6	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
7	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne	-/-	-/-
8	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev	-/-	-/-
9	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev	-/-	-/-
10	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
11	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKl!	29.10.2014	29.10.2017
12	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
13	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	04.09.2015	04.09.2016

7.3 Radiated measurements > 18 GHz



7.4 Radiated measurements > 50 GHz



OP = AV + D - G
(OP-rad. output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain)

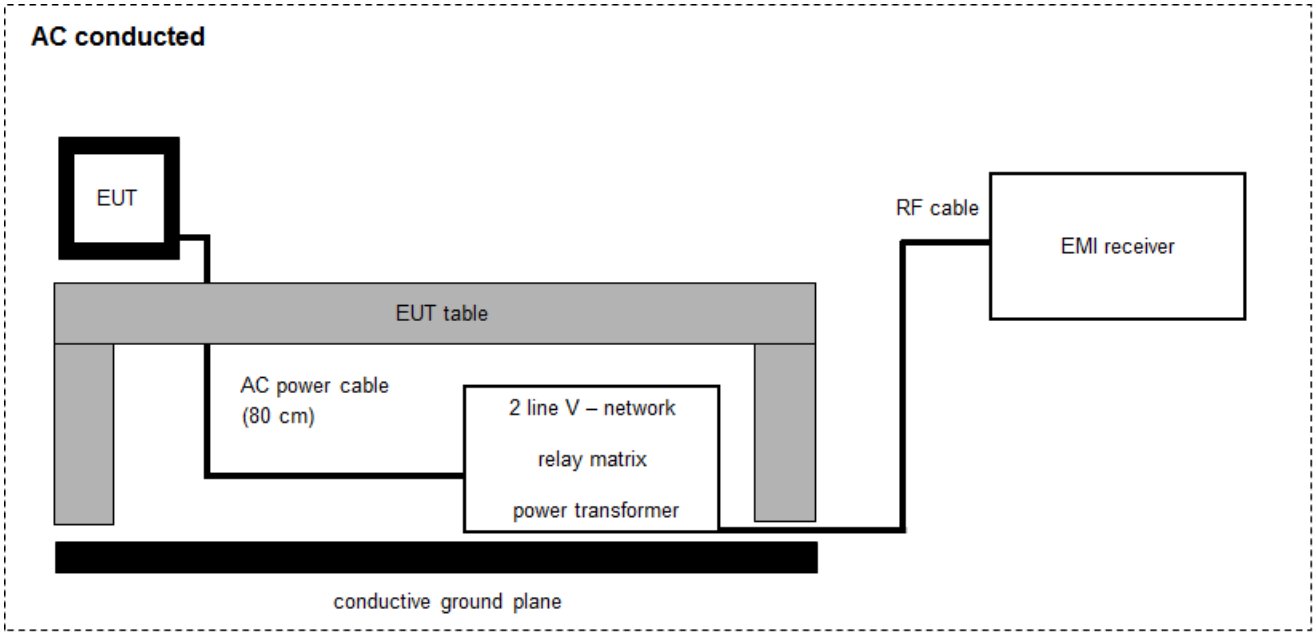
Example calculation:
OP [dBm] = -54.0 [dBm] + 64.0 [dB] - 20.0 [dBi] = -10 [dBm] (100 µW)

Note: conversion loss of mixer is already included in analyzer value.

Equipment table:

No.	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	Std. Gain Horn Antenna 39.3-59.7 GHz	2424-20	Flann	75	300001979	ne		
2	Std. Gain Horn Antenna 49.9-75.8 GHz	2524-20	Flann	*	300001983	ne		
3	Std. Gain Horn Antenna 73.8-112 GHz	2724-20	Flann	*	300001988	ne		
4	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	14.08.2015	14.08.2017
5	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda		300000486	k	10.09.2015	10.09.2017
6	Std. Gain Horn Antenna 26.5 to 40.0 GHz	V637	Narda	82-16	300000510	k	14.08.2015	14.08.2017
7	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	Ve	02.10.2014	02.10.2016
8	Harmonic Mixer 2-Port, 50-75 GHz	FS-Z75	R&S	100099	300003949	k	09.03.2016	09.03.2017
9	Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	ev		
10	Harmonic Mixer 3-Port, 75-110 GHz	FS-Z110	R&S	101411	300004959	k	09.03.2006	09.03.2017

7.5 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 [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	893045/004	300000584	k	02.02.2016	02.02.2017
2	n. a.	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	04.02.2016	04.02.2017
3	n. a.	software	SPS_PHE 1.4f	Spitzenberger & Spiess	B5981; 5D1081;B5979	300000210	ne	-/-	-/-

8 Sequence of testing

8.1 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.

8.2 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.

8.3 Sequence of testing radiated spurious 1 GHz to 18 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 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 is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector 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 maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, 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.

8.4 Sequence of testing radiated spurious above 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- 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.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

8.5 Sequence of testing radiated spurious above 50 GHz with external mixers

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- 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.
- The measurement distance is as appropriate for far field (e.g. 0.25 m).
- The EUT is set into operation.

Premeasurement

- The test antenna with external mixer is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.
- Caution is taken to reduce the possible overloading of the external mixer.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- As external mixers may generate false images care is taken to ensure that any emission measured by the spectrum analyzer does indeed originate in the EUT. Signal identification feature of spectrum analyzer is used to eliminate false mixer images (i.e., it is not the fundamental emission or a harmonic falling precisely at the measured frequency).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

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	47 CFR Part 15 RSS-310, Issue 4	see table!	2016-10-12	-/-

Test specification clause	Test case	Temperature	Voltage	Pass	Fail	NA	NP	Results (max.)
§15.249(a) RSS-310, 3.10	Field strength of emissions (wanted signal)	Nominal	Nominal	☒	☐	☐	☐	104.8 dBµV
§2.1049	Occupied bandwidth (99% bandwidth)	Nominal	Nominal	☒	☐	☐	☐	1.7 MHz
§15.209(a) / §15.249 (c)(d)(e) RSS-Gen	Field strength of emissions (spurious)	Nominal	Nominal	☒	☐	☐	☐	complies
§15.207(a) ICES-003	Conducted emissions < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	complies

Note:
NA = Not Applicable; NP = Not Performed

10 Measurement results

10.1 Field strength of emissions (wanted signal)

Description:

Measurement of the maximum radiated field strength of the wanted signal.

Measurement:

Measurement parameter	
Detector:	Pos-Peak
Sweep time:	See plots
Video bandwidth:	Auto
Resolution bandwidth:	1 MHz
Span:	See plots
Trace-Mode:	Max-Hold

Limits:

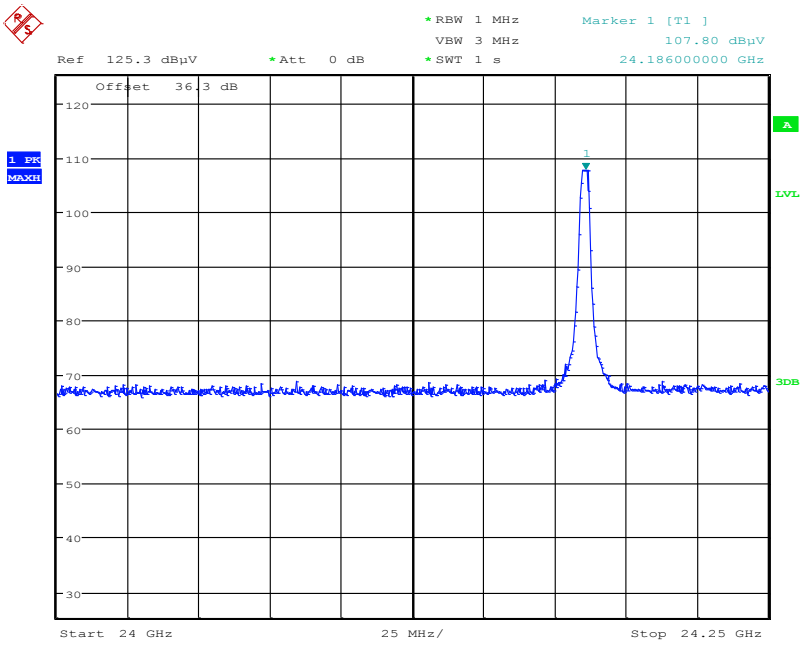
FCC		IC
CFR Part 15.249(a)		RSS-310, 3.10
Field strength of emissions		
The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:		
Frequency [GHz]	Field Strength [mV/m // dBµV/m]	Measurement distance
24.000 – 24.250	250 // 108	3

Results:

Test condition t = 22 °C	Maximum field strength		
	Frequency [GHz]	Field strength E [mV/m] @ 3 m	Field strength e [dBµV/m] @ 3 m
U_{DC} = 48 V	24.185	173.8	104.8
Measurement uncertainty	± 3 dB		

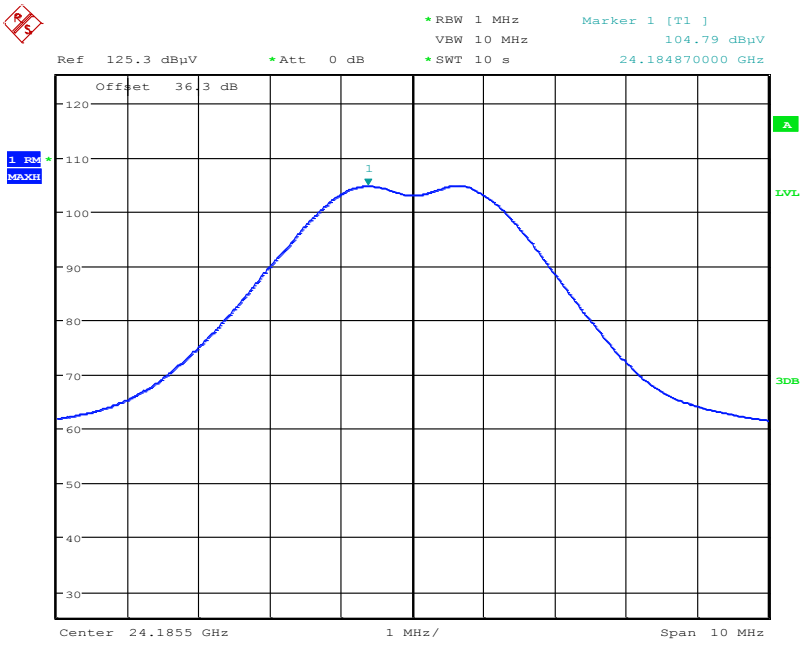
Verdict: complies

Plot 1: Pos-Peak measurement



Date: 25.JUL.2016 11:47:11

Plot 2: Mean measurement



Date: 25.JUL.2016 11:48:39

10.2 Occupied bandwidth (99% bandwidth)

Description:

Measurement of the 99% bandwidth of the wanted signal.

Measurement:

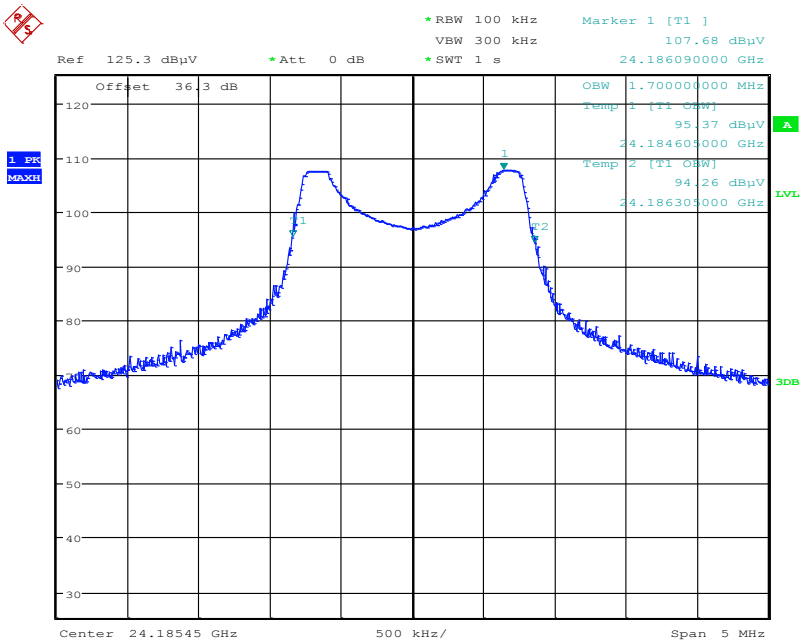
Measurement parameter	
Detector:	Pos-Peak
Sweep time:	1 s
Video bandwidth:	100 kHz
Resolution bandwidth:	300 kHz
Span:	5 MHz
Trace-Mode:	Max-Hold

Results:

Test condition t = 22 °C	Occupied bandwidth		
	Frequency [GHz]	Occupied bandwidth [MHz]	see plot no.
U_{DC} = 48 V	24.185	1.7	3
Measurement uncertainty	span/1000		

Verdict: complies

Plot 3:


RBW 100 kHz
VBW 300 kHz
SWT 1 s
Marker 1 [T1]
107.68 dBµV
24.186090000 GHz
Ref 125.3 dBµV
Att 0 dB
Offset 36.3 dB
OBW 1.700000000 MHz
Temp 1 [T1 OBW]
95.37 dBµV
24.184605000 GHz
Temp 2 [T1 OBW]
94.26 dBµV
24.186305000 GHz
1 PK
MAXH
A
LVL
3DB
120
110
100
90
80
70
60
50
40
30
Center 24.18545 GHz
500 kHz/
Span 5 MHz
Date: 25.JUL.2016 11:46:17

10.3 Field strength of emissions (radiated spurious)

Description:

Measurement of the radiated spurious emissions in transmit mode.

Measurement:

Measurement parameter	
Detector:	Pos-Peak / Quasi-Peak
Sweep time:	Auto
Video bandwidth:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Frequency range:	30 MHz to 100 GHz
Trace-Mode:	Max-Hold

Limits:

FCC		IC
CFR Part 15.209(a)		RSS - GEN
Radiated Spurious Emissions		
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

FCC	IC
CFR Part 15.245(b)	RSS-310, 3.10

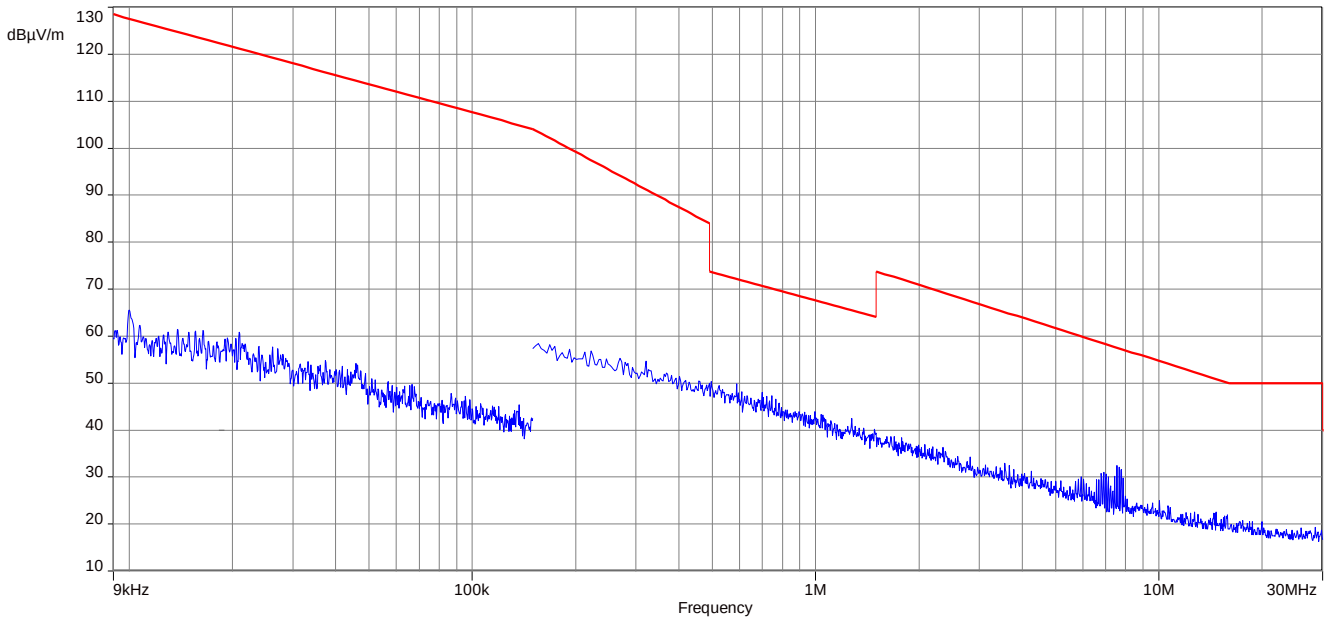
Field strength of harmonics		
The field strength of harmonics from intentional radiators shall comply with the following:		
Frequency [GHz]	Field Strength [mV/m // dBµV/m]	Measurement distance
24.000 – 24.250	25 // 88	3

Results:

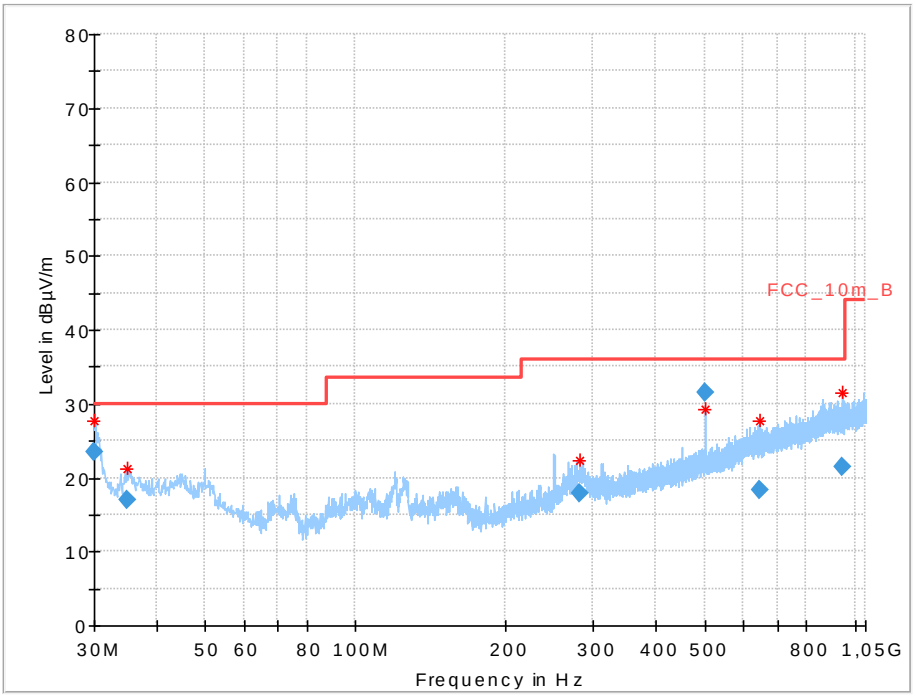
TX Spurious Emissions Radiated [dBµV/m]								
Lowest			Middle			Highest		
F [GHz]	Detector	Level [dBµV/m]	F [GHz]	Detector	Level [dBµV/m]	F [GHz]	Detector	Level [dBµV/m]
No critical peaks found						No critical peaks found		
			48.4	AVG	56.0			
			72.6	AVG	49.4			
Measurement uncertainty			± 3 dB					

Verdict: complies

Plot 4: 9 kHz - 30 MHz

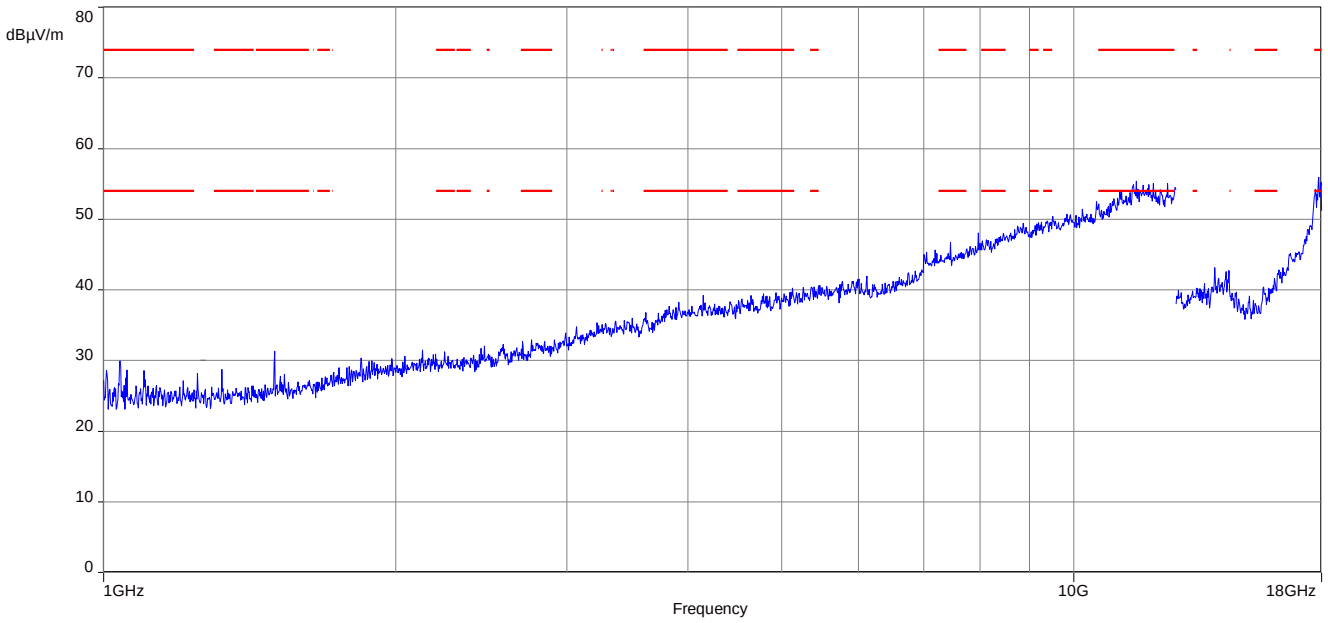


Plot 5: 30 MHz to 1 GHz, horizontal / vertical polarization

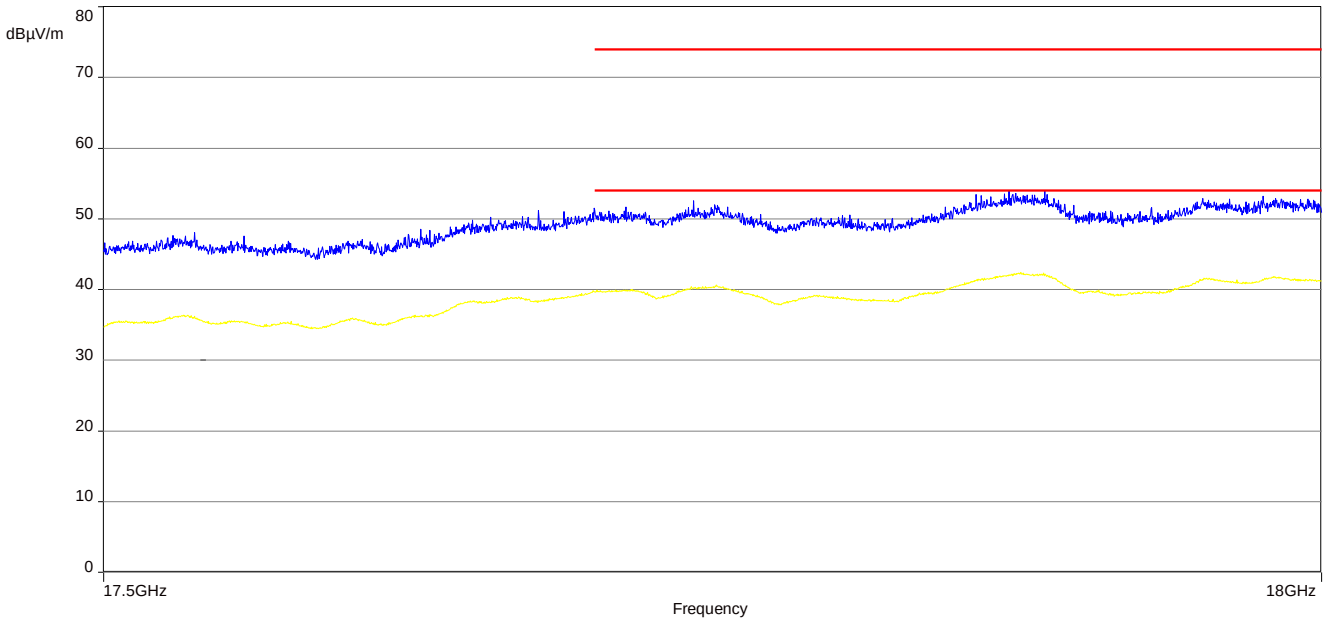


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.090119	23.57	30.00	6.43	1000.0	120.000	98.0	V	146.0	13.3
34.977600	16.94	30.00	13.06	1000.0	120.000	101.0	V	246.0	13.8
281.291700	17.83	36.00	18.17	1000.0	120.000	98.0	V	131.0	14.1
499.977600	31.54	36.00	4.46	1000.0	120.000	185.0	H	322.0	18.7
643.118700	18.32	36.00	17.68	1000.0	120.000	185.0	V	61.0	21.1
941.726700	21.49	36.00	14.51	1000.0	120.000	185.0	V	161.0	24.2

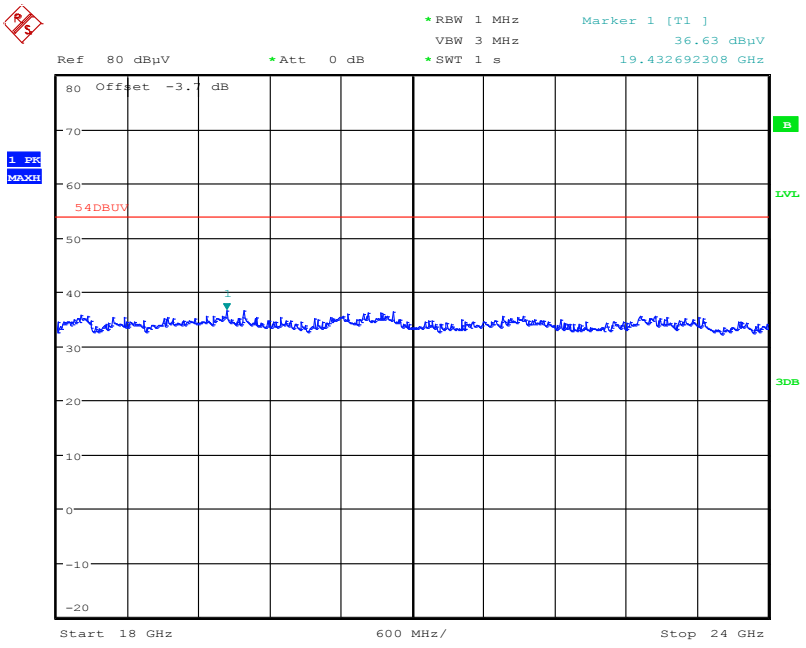
Plot 6: 1.0 GHz to 18.0 GHz (Pos-Peak), horizontal / vertical polarization



Plot 7: 17.5 GHz to 18.0 GHz (Pos-Peak and AVG), horizontal / vertical polarization

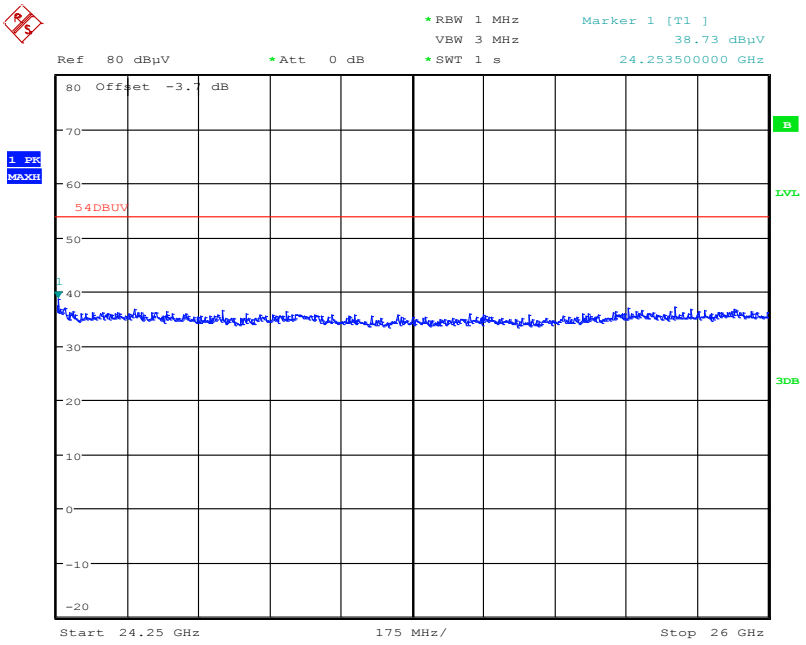


Plot 8: 18.0 GHz to 24.0 GHz, horizontal / vertical polarization



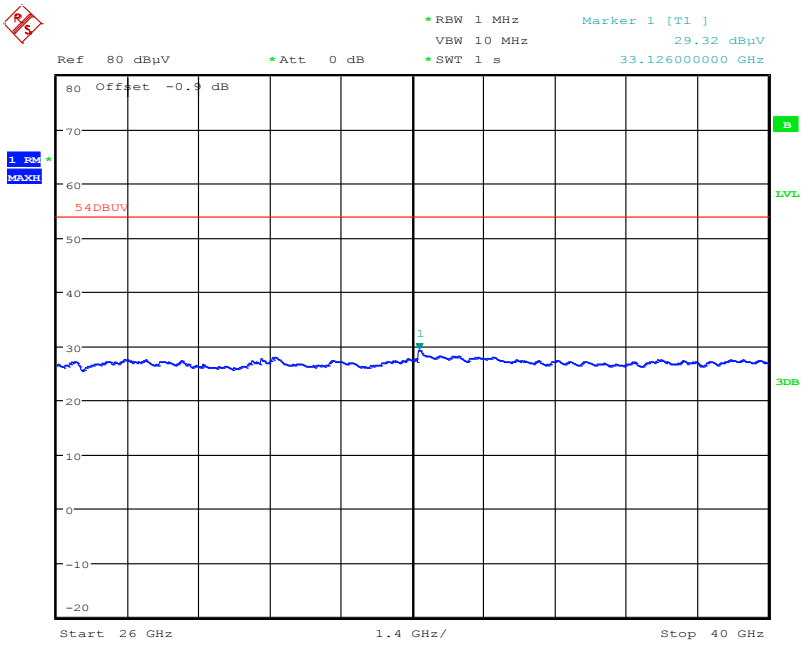
Date: 21.JUL.2016 12:03:55

Plot 9: 24.25 GHz to 26.0 GHz, horizontal / vertical polarization



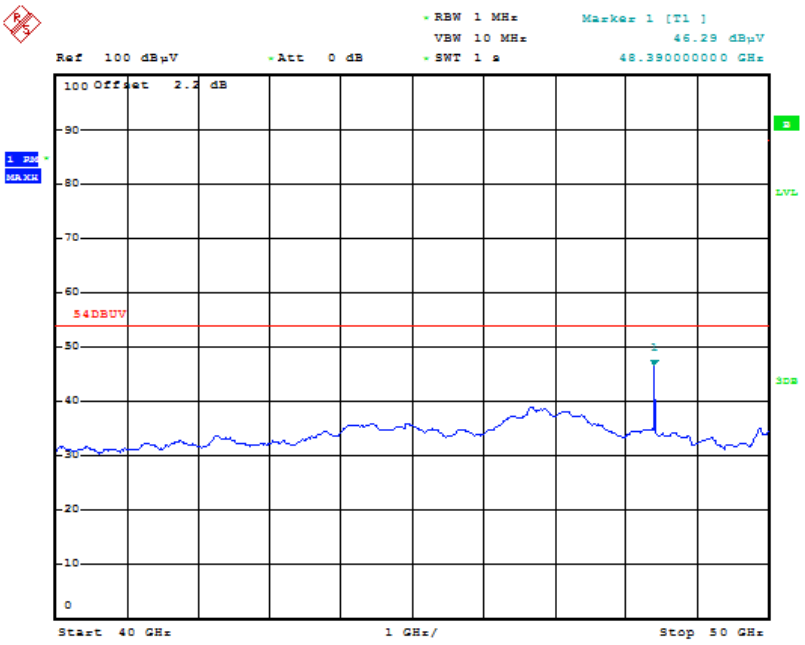
Date: 21.JUL.2016 11:37:24

Plot 10: 26.0 GHz to 40.0 GHz, horizontal / vertical polarization



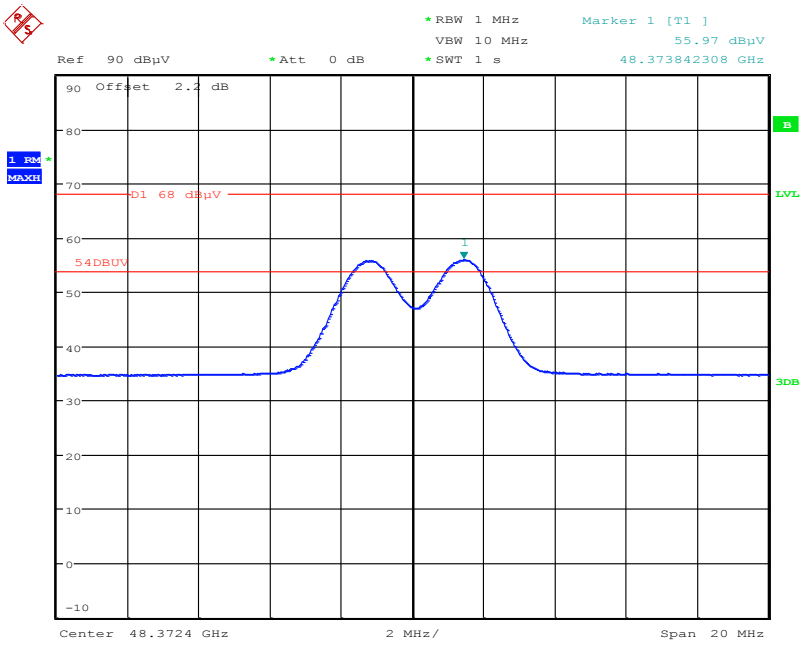
Date: 21.JUL.2016 11:21:06

Plot 11: 40.0 GHz to 50.0 GHz, horizontal / vertical polarization



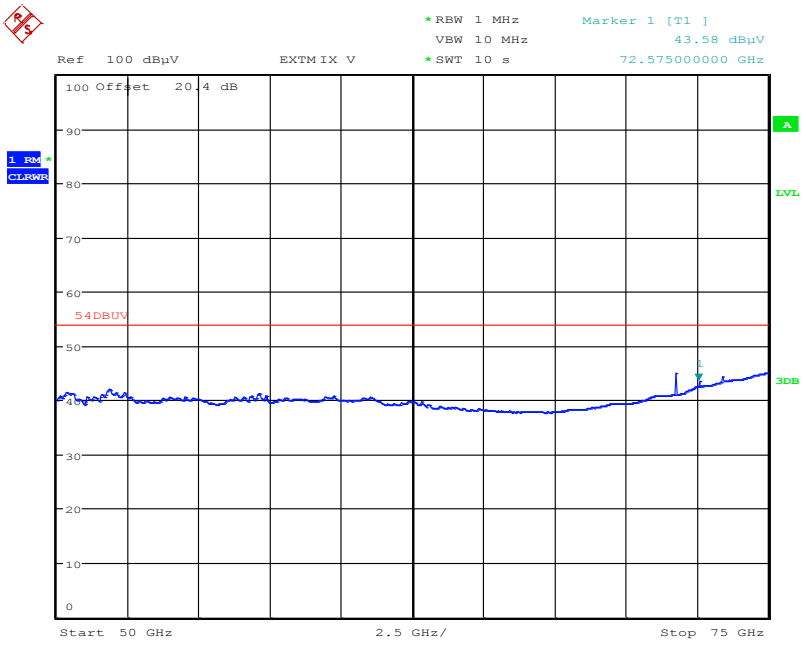
Date: 21.JUL.2016 11:09:35

Plot 12: 48.4 GHz (2nd harmonic), horizontal / vertical polarization



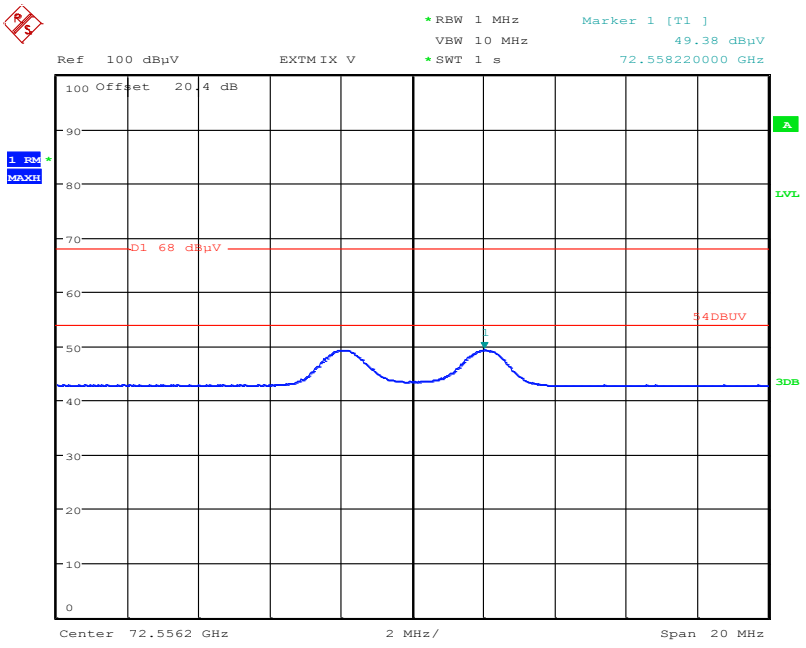
Date: 21.JUL.2016 13:32:17

Plot 13: 50 GHz to 75 GHz, horizontal / vertical polarization



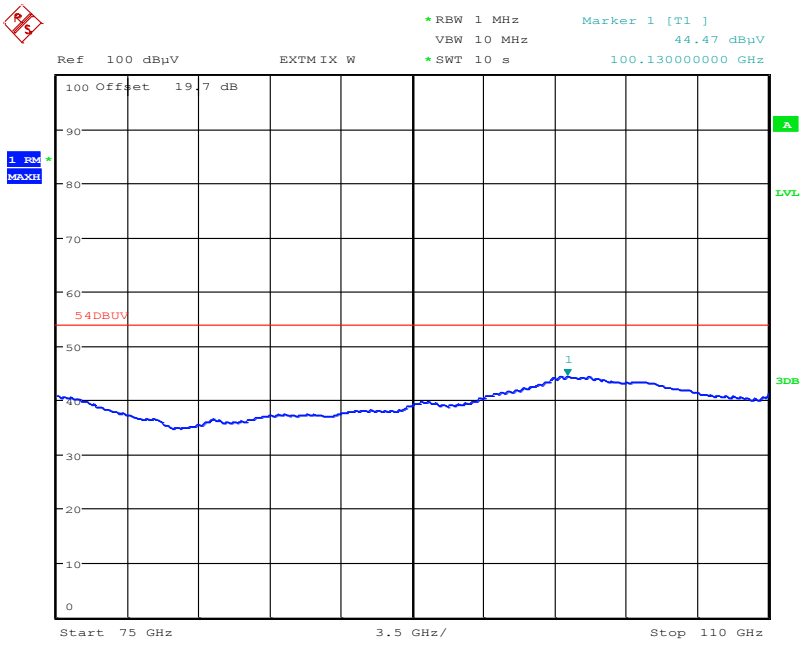
Date: 21.JUL.2016 16:21:32

Plot 14: 72.6 GHz (3rd harmonic), horizontal / vertical polarization



Date: 21.JUL.2016 13:59:52

Plot 15: 75 GHz to 110 GHz, horizontal / vertical polarization



Date: 21.JUL.2016 16:41:55

10.4 Conducted spurious emissions < 30 MHz

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

Measurement:

Measurement parameter	
Detector:	Pos-Peak / Quasi-Peak / Average
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max-Hold

Limits:

FCC		IC
CFR Part 15.207(a)		ICES-003, Issue 4
Conducted Spurious Emissions < 30 MHz		
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

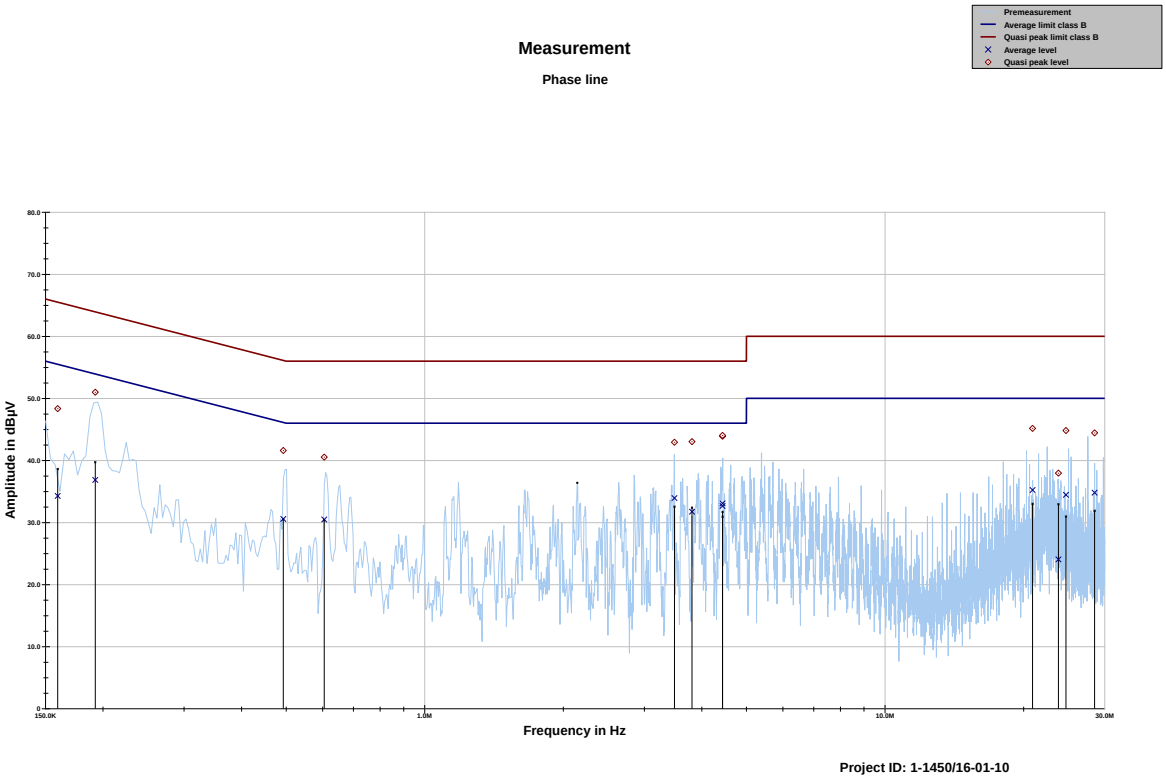
*Decreases with the logarithm of the frequency

Results:

See next pages!

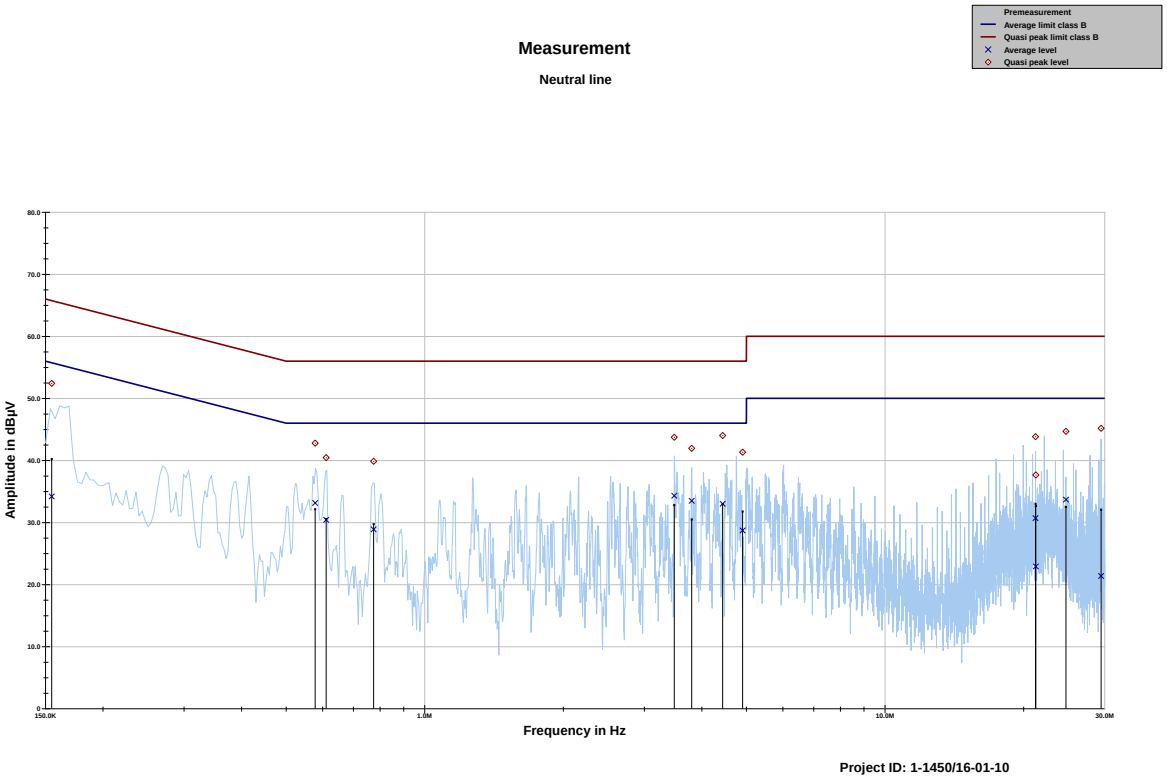
Verdict: **complies**

Plot 16: Phase line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.159527	48.34	17.15	65.489	34.29	21.44	55.728
0.192454	50.99	12.94	63.930	36.86	17.93	54.787
0.493051	41.60	14.52	56.116	30.57	15.63	46.199
0.605007	40.53	15.47	56.000	30.50	15.50	46.000
3.489048	42.93	13.07	56.000	33.93	12.07	46.000
3.808098	43.03	12.97	56.000	31.73	14.27	46.000
4.436337	43.91	12.09	56.000	32.66	13.34	46.000
4.438006	44.02	11.98	56.000	33.09	12.91	46.000
20.920707	45.17	14.83	60.000	35.23	14.77	50.000
23.809547	37.95	22.05	60.000	24.06	25.94	50.000
24.728871	44.81	15.19	60.000	34.47	15.53	50.000
28.533028	44.43	15.57	60.000	34.80	15.20	50.000

Plot 17: Neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.154739	52.42	13.32	65.742	34.21	21.66	55.865
0.578175	42.79	13.21	56.000	33.15	12.85	46.000
0.610934	40.46	15.54	56.000	30.43	15.57	46.000
0.774467	39.87	16.13	56.000	28.90	17.10	46.000
3.485839	43.73	12.27	56.000	34.32	11.68	46.000
3.802131	41.95	14.05	56.000	33.49	12.51	46.000
4.439741	44.01	11.99	56.000	33.01	12.99	46.000
4.905711	41.31	14.69	56.000	28.71	17.29	46.000
21.229756	43.83	16.17	60.000	30.70	19.30	50.000
21.263357	37.66	22.34	60.000	22.92	27.08	50.000
24.721168	44.68	15.32	60.000	33.68	16.32	50.000
29.479905	45.18	14.82	60.000	21.37	28.63	50.000

11 Document history

Version	Applied changes	Date of release
	Initial release – DRAFT	2016-07-29
	minor changes based on applicant's comments	2016-09-06
	FCC ID changed	2016-10-12

12 Further information

Glossary

AVG - Average
DUT - Device under test
EMC - Electromagnetic Compatibility
EN - European Standard
EUT - Equipment under test
ETSI - European Telecommunications Standard Institute
FCC - Federal Communication Commission
FCC ID - Company Identifier at FCC
HW - Hardware
IC - Industry Canada
Inv. No. - Inventory number
N/A - Not applicable
PP - Positive peak
QP - Quasi peak
S/N - Serial number
SW - Software
PMN - Product marketing name
HMN - Host marketing name
HVIN - Hardware version identification number
FVIN - Firmware version identification number

13 Accreditation Certificate

Front side of certificate

DAkkS
Deutsche
Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

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

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

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SAR / EMF
Umwelt
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WI-FI-Services
Kanadische Anforderungen
US-Anforderungen
Akustik
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Registrierungsnummer der Urkunde: **D-PL-12076-01-01**

Frankfurt, 04.05.2016

Im Auftrag Dipl.-Ing. (FH) Ralf Egner
Abteilungsleiter

Siehe Hinweise auf der Rückseite

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