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consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-1450/16-01-06



DAkkS
Deutsche
Akreditierungsstelle
D-PL-12076-01-01

Testing laboratory

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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

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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-210, Issue 8

Licence-exempt Radio Apparatus (All Frequency Bands): Category I 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: YYRPROX

IC: 9357A-PROX

Frequency: 24.075 – 24.175 GHz

Antenna: Integrated patch antenna

Power supply: 36 V to 57 V DC by external power supply

Temperature range: -30°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:

Meheza Walla
Lab Manager
Radio Communications & EMC

Test performed:

Karsten Gerald
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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. CETECOM ICT Services 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.

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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:	2016-03-03
Date of receipt of test item:	2016-03-14
Start of test:	2016-03-14
End of test:	2016-06-17
Person(s) present during the test:	-/-

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 8	2010-12	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

4 Test environment

Temperature	:	T _{nom}	+22 °C during room temperature tests
		T _{max}	-/- °C during high temperature tests
		T _{min}	-/- °C during low temperature tests
Relative humidity content	:		45 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V _{nom}	48 V DC via external POE-Adapter and camera module
		V _{max}	-/- V
		V _{min}	-/- V

5 Test item

5.1 General description

Kind of test item	:	Motion detector
Type identification	:	MX-Proximity-Box
HMN	:	-/-
PMN	:	MX-Proximity-Box
HVIN	:	MX-Proximity-Box
FVIN	:	-/-
S/N serial number	:	2
HW hardware status	:	2V0
SW software status	:	0.0.0.14
Frequency band	:	24.075 – 24.175 GHz
Type of radio transmission	:	modulated carrier
Use of frequency spectrum	:	
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	:	-30°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 test report: 1-1450/16-01-01_AnnexA
 1-1450/16-01-01_AnnexB
 1-1450/16-01-01_AnnexD

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).

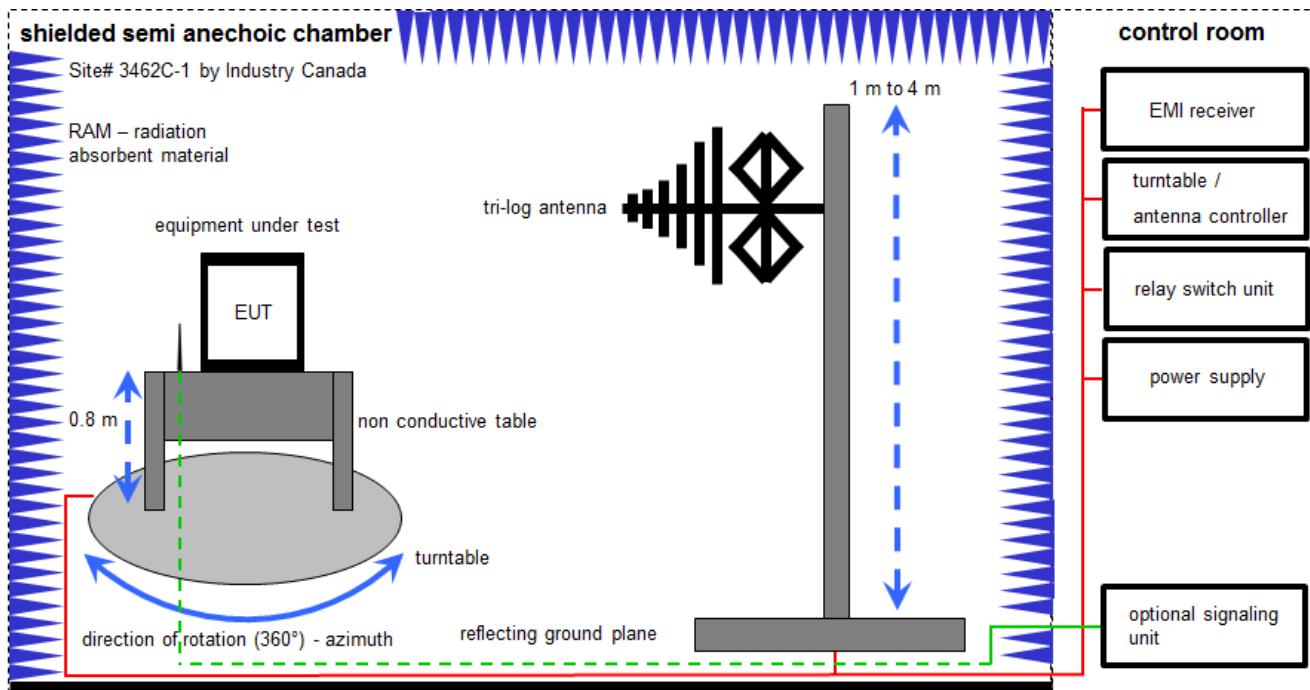
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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)

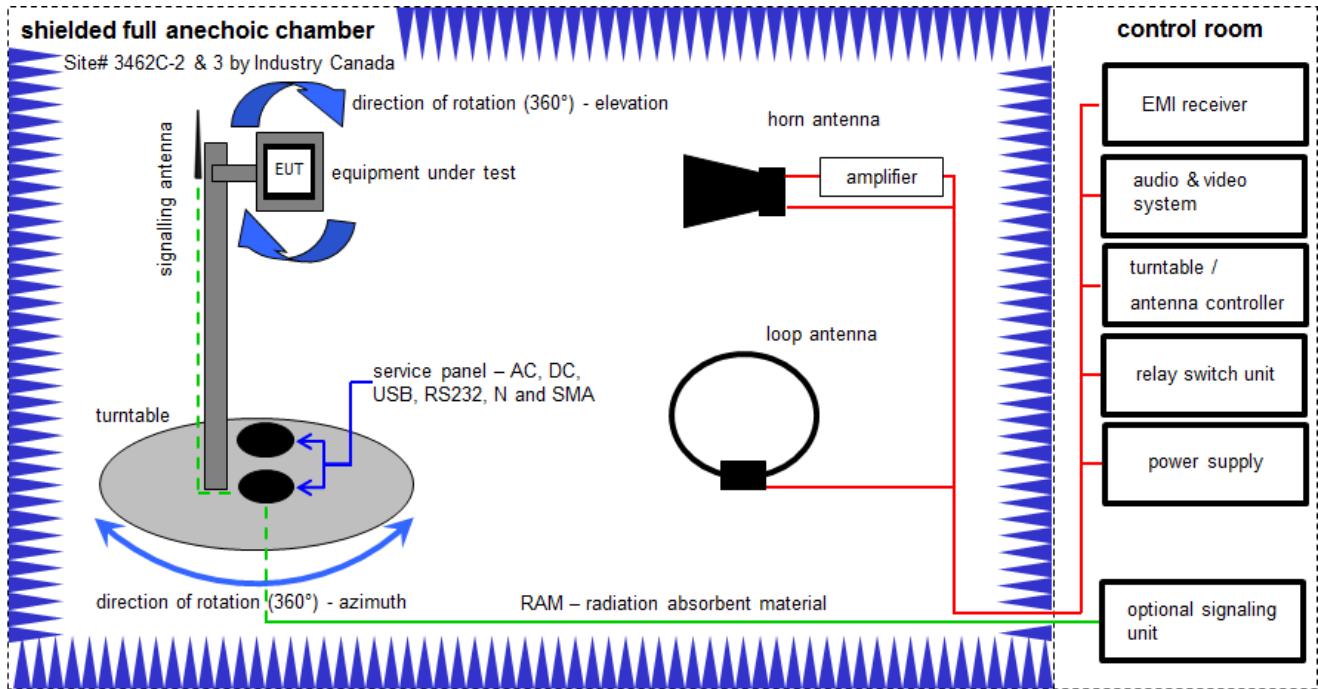
Example calculation:

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

Equipment table:

No.	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)

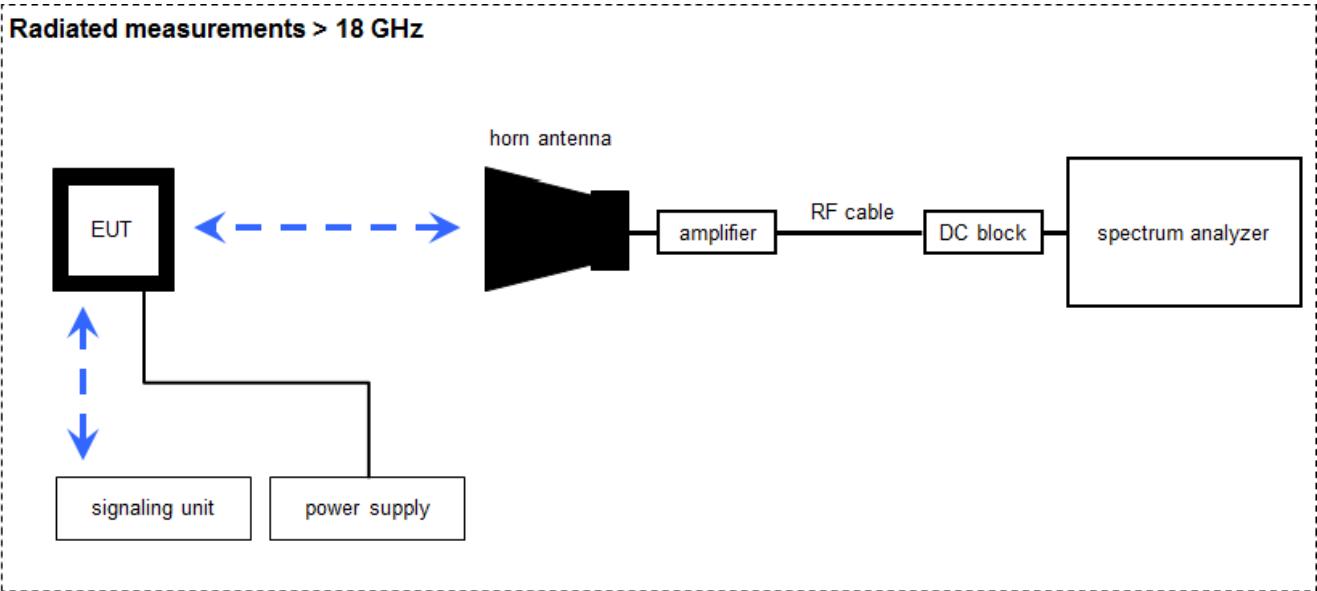
Example calculation:

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

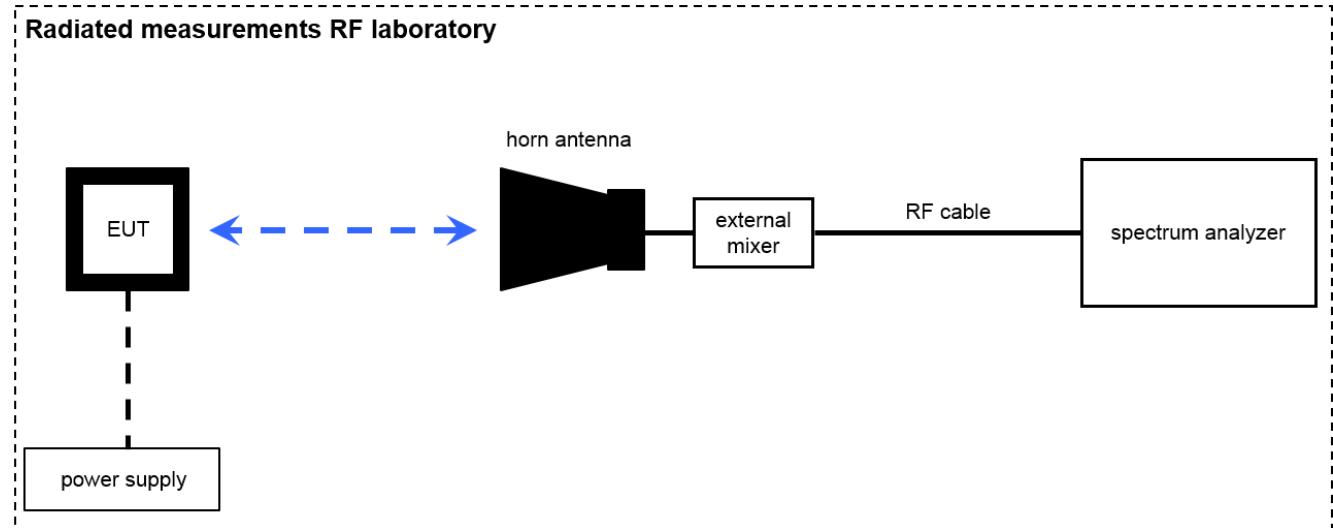
Equipment table:

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	vIKI!	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	vIKI!	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:

$$OP [dBm] = -54.0 [dBm] + 64.0 [dB] - 20.0 [dBi] = -10 [dBm] (100 \mu W)$$

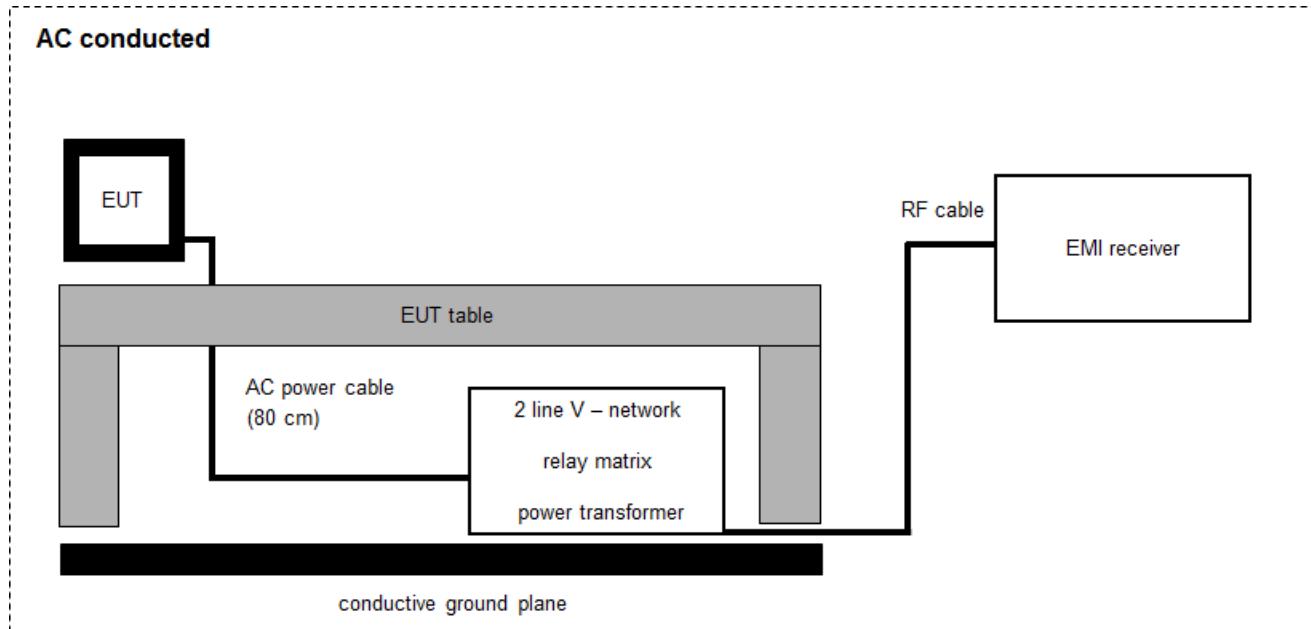
Note: conversion loss of mixer is already included in analyzer value.

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	PXA Spectrum Analyzer 3Hz to 50GHz	N9030A PXA Signal Analyzer	Agilent Technologies	US51350267	300004338	k	09.02.2016	09.02.2017
8	Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	ev		
9	Waveguide Harmonic Mixer, 75-110 GHz	M1970W	KEYSIGHT	MY51430848	300005115	k	25.02.2016	25.02.2018
10	Waveguide Harmonic Mixer, 50-80 GHz	M1970V	KEYSIGHT	MY51390914	300005116	k	05.02.2016	05.02.2018

7.5 AC conducted

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 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	892475/017	300002209	k	17.06.2014	17.06.2016
2	n. a.	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	06.03.2015	06.03.2016
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 $\pm 45^\circ$ 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.

8.3 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

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	47 CFR Part 15 RSS 210, Issue 8, Annex 7	Passed	2016-07-08	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Results (max.)
§15.245(b) RSS 210 / A7.1	Field strength of emissions (wanted signal)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	110.5 dB μ V
§2.1049	Occupied bandwidth (99% bandwidth)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.3 MHz
§15.209(a) / §15.245(b) (1)(2)(3) RSS 210 / A7.4	Field strength of emissions (spurious)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.207(a) ICES-003	Conducted emissions < 30 MHz	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	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:	Auto
Video bandwidth:	Auto
Resolution bandwidth:	1 MHz
Span:	max. 100 MHz
Trace-Mode:	Max Hold

Limits:

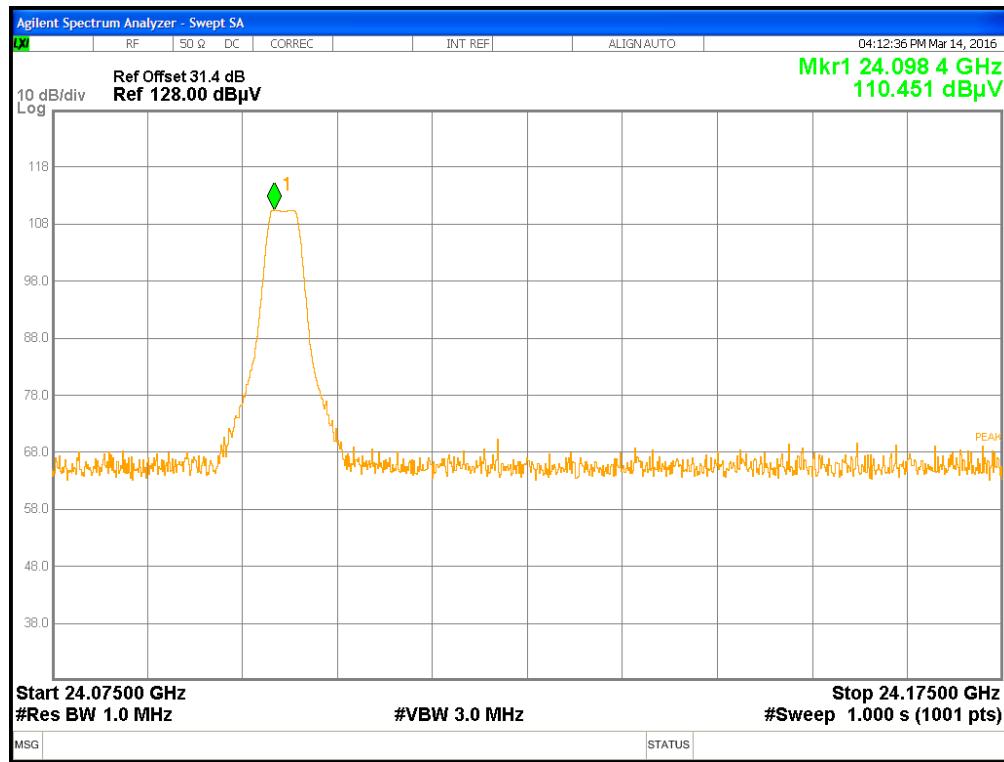
FCC	IC	
CFR Part 15.245(b)	RSS - 210, Annex 7	
Field strength of emissions		
The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:		
Frequency [GHz]	Field Strength [mV/m // dB μ V/m]	Measurement distance
24.075 – 24.175	2500 // 128	3

Result:

Test condition t = 22 °C	Maximum field strength		
	Frequency [GHz]	Field strength E [mV/m] @ 3 m	Field strength e [dB μ V/m] @ 3 m
U _{DC} = 5 V	24.098	335	110.5
Measurement uncertainty	± 3 dB		

Result: The measurement is passed.

Plot 1:



10.2 Occupied bandwidth (99% bandwidth)

Description:

Measurement of the 99% bandwidth of the wanted signal.

Measurement:

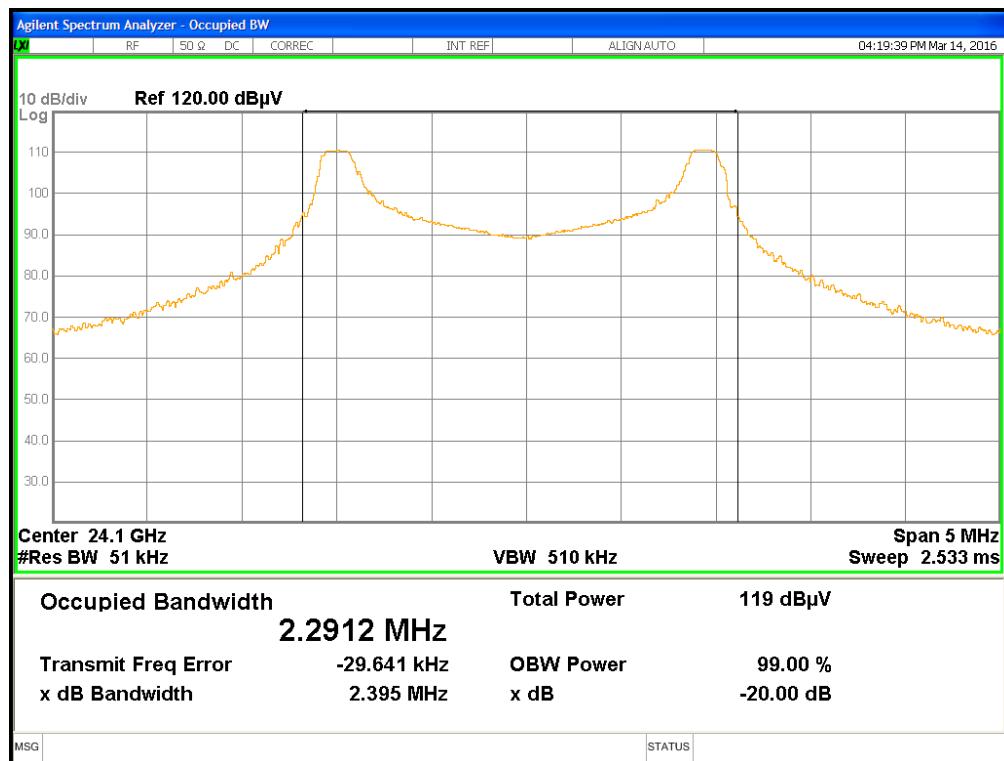
Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	51 kHz
Resolution bandwidth:	510 kHz
Span:	5 MHz
Trace-Mode:	Max Hold

Results:

Test condition $t = 22^\circ\text{C}$	Occupied bandwidth		
	Frequency [GHz]	Occupied bandwidth [MHz]	see plot no.
$U_{\text{DC}} = 5 \text{ V}$	24.1	2.3	2
Measurement uncertainty	$\pm 3 \text{ dB}$		

Result: The measurement is passed.

Plot 2:



10.3 Field strength of emissions (radiated spurious)

Description:

Measurement of the radiated spurious emissions in transmit mode.

Measurement:

Measurement parameter	
Detector:	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 (dB μ V/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

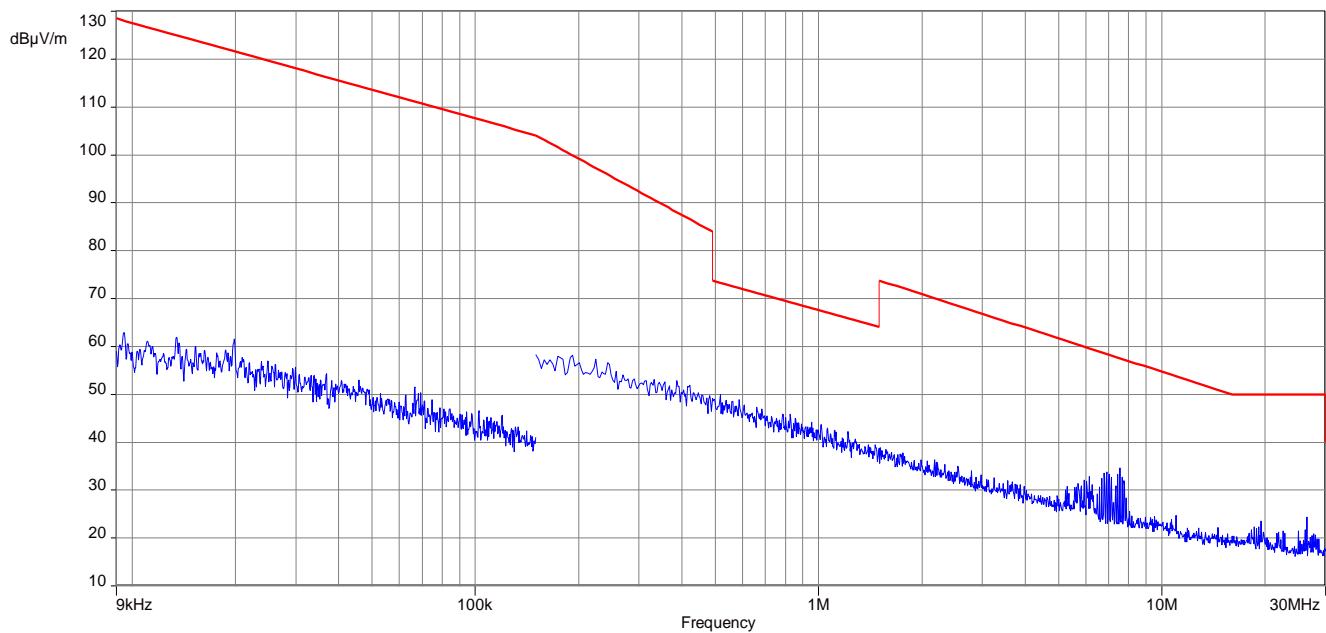
FCC	IC	
CFR Part 15.245(b)	RSS - 210, Annex 7	
Field strength of harmonics		
The field strength of harmonics from intentional radiators shall comply with the following:		
Frequency [GHz]	Field Strength [mV/m // dB μ V/m]	Measurement distance
24.075 – 24.175	25 // 88	3

Results:

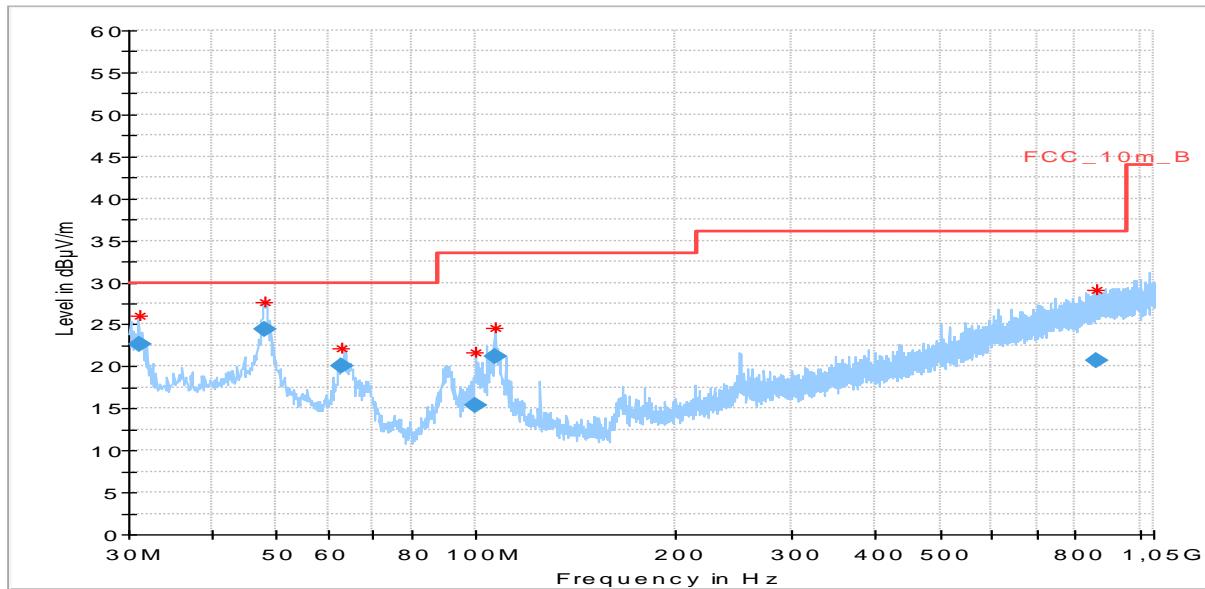
TX Spurious Emissions Radiated [dB μ V/m]								
Lowest			Middle			Highest		
F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]
No critical peaks found						No critical peaks found		
			48.2	AVG	84.1			
			72.3	AVG	70.5			
Measurement uncertainty			± 3 dB					

Result: The measurement is passed.

Plot 3: 9 kHz - 30 MHz

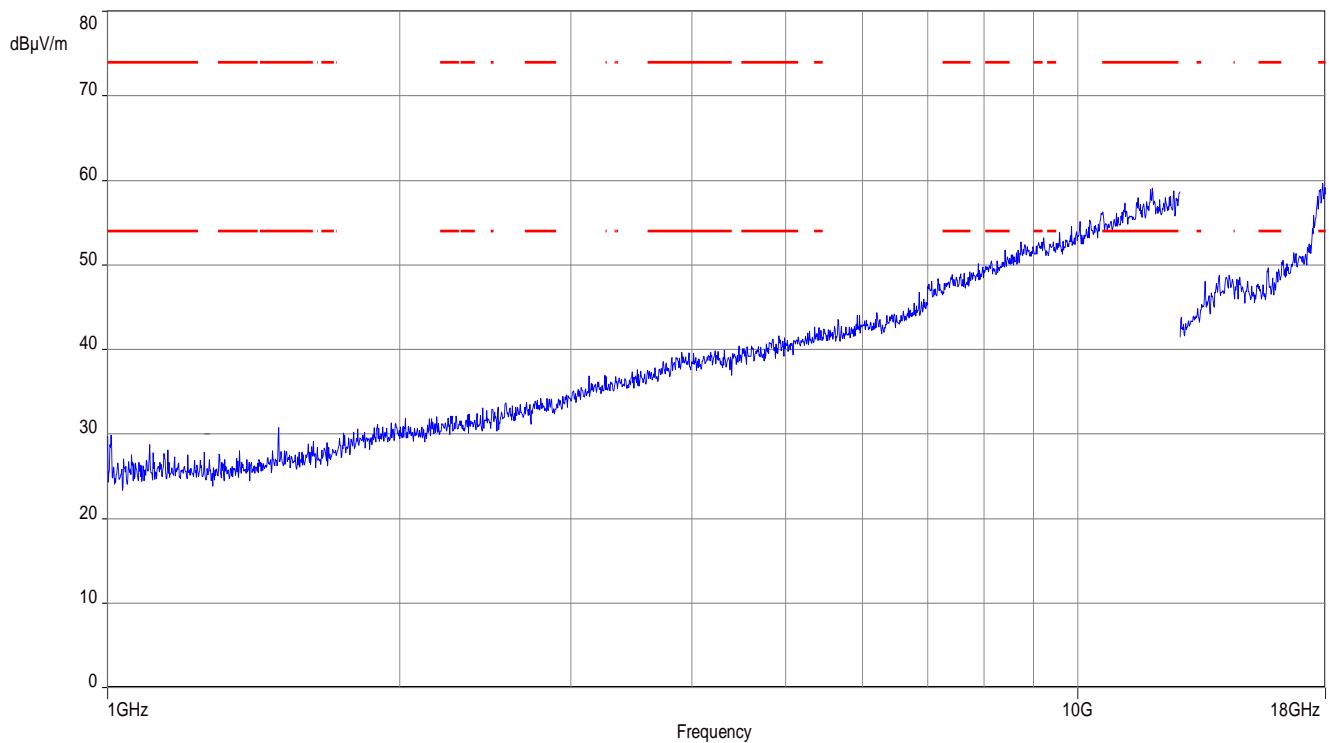


Plot 4: 30 MHz to 1 GHz, horizontal / vertical polarization

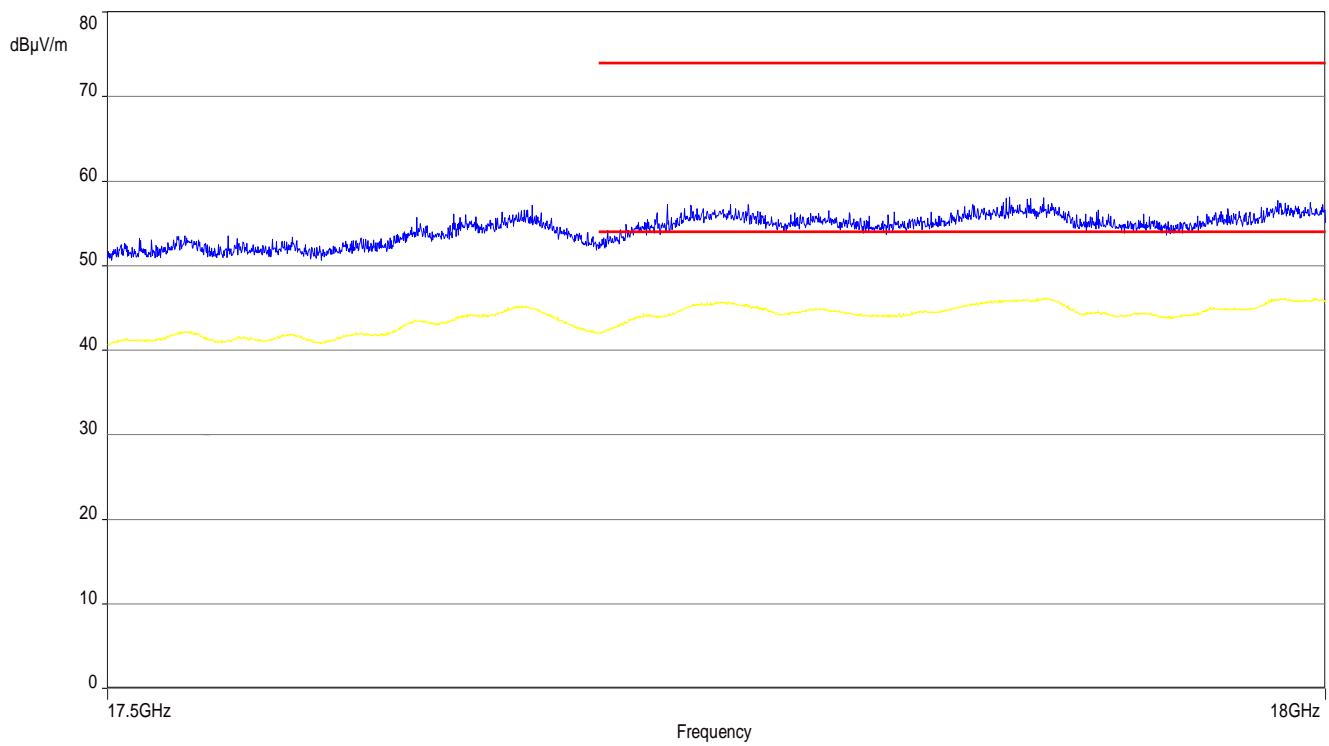


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.059750	22.60	30.00	7.40	1000.0	120.000	103.0	V	117.0	13.4
48.115650	24.50	30.00	5.50	1000.0	120.000	98.0	V	175.0	13.1
63.015600	20.01	30.00	9.99	1000.0	120.000	273.0	V	130.0	9.9
100.047750	15.42	33.50	18.08	1000.0	120.000	173.0	V	297.0	12.2
106.692600	21.16	33.50	12.34	1000.0	120.000	102.0	V	296.0	11.5
859.957200	20.73	36.00	15.27	1000.0	120.000	200.0	H	122.0	23.6

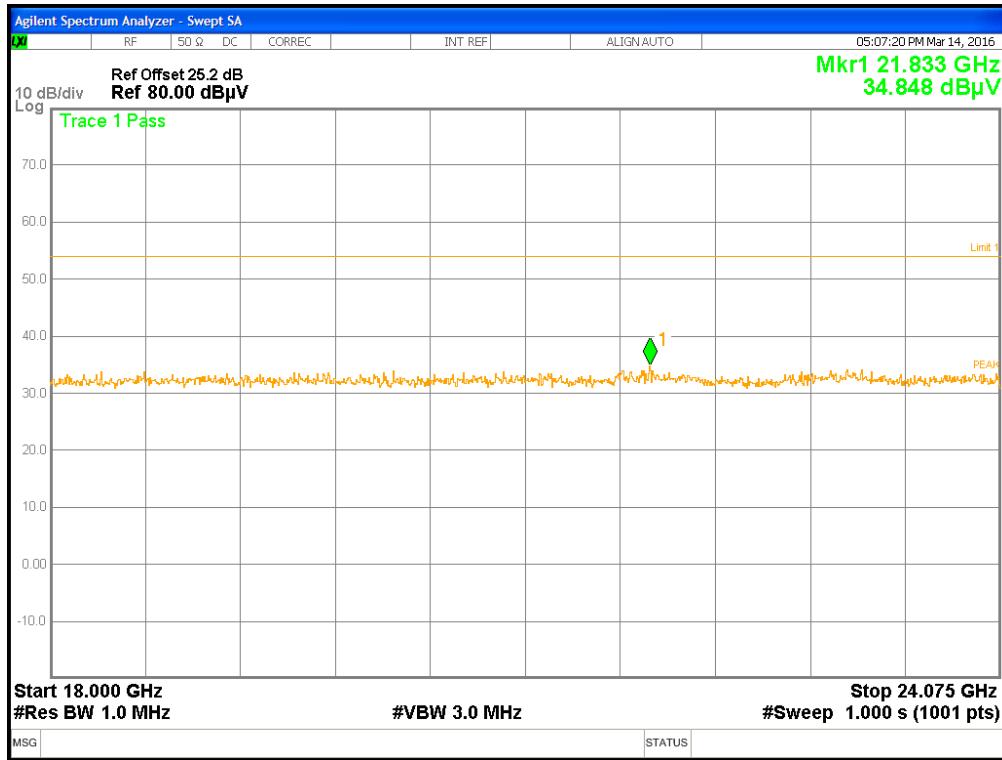
Plot 5: 1.0 GHz to 18.0 GHz (Pos-Peak), horizontal / vertical polarization



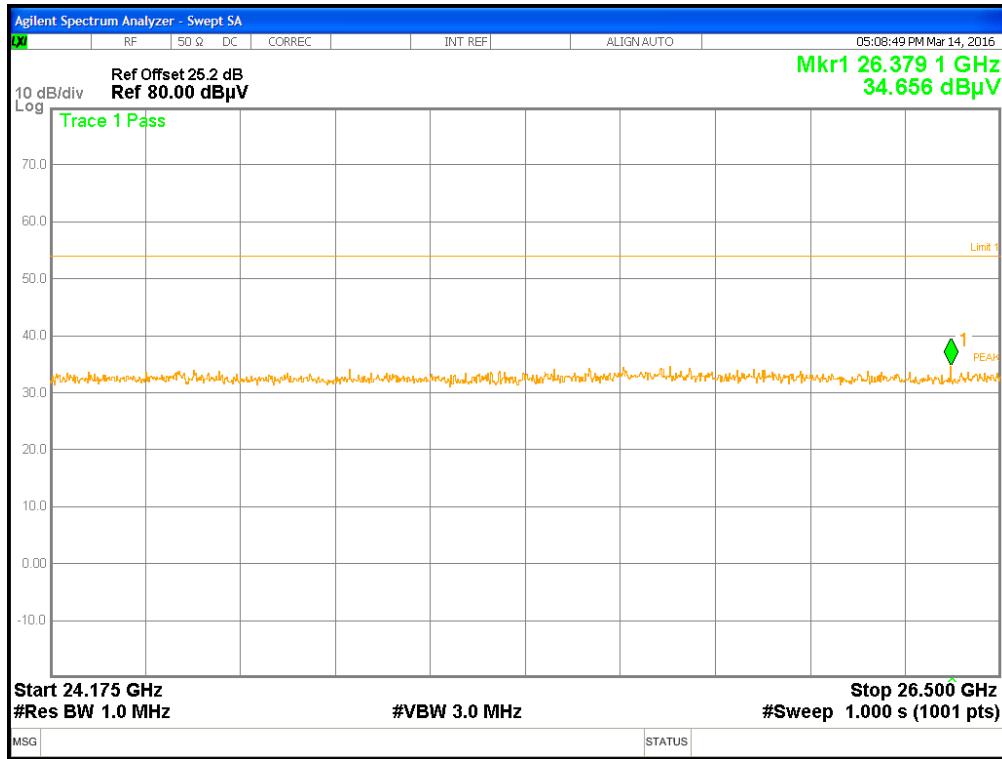
Plot 6: 17.5 GHz to 18.0 GHz (Pos-Peak and AVG), horizontal / vertical polarization



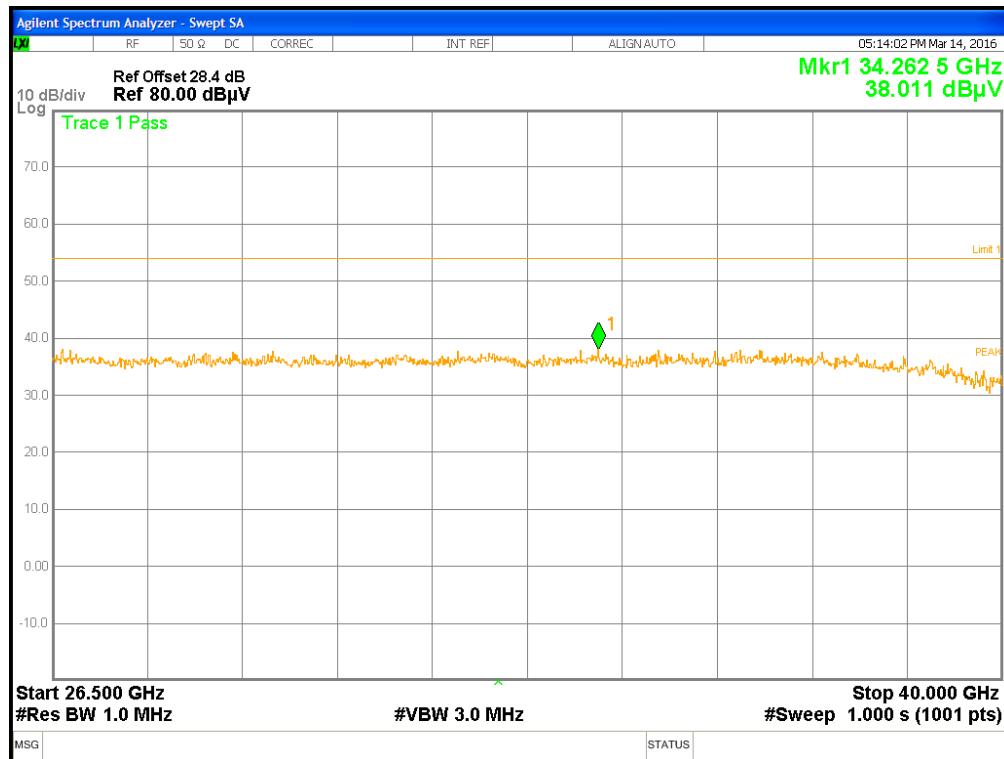
Plot 7: 18.0 GHz to 24.075 GHz, horizontal / vertical polarization



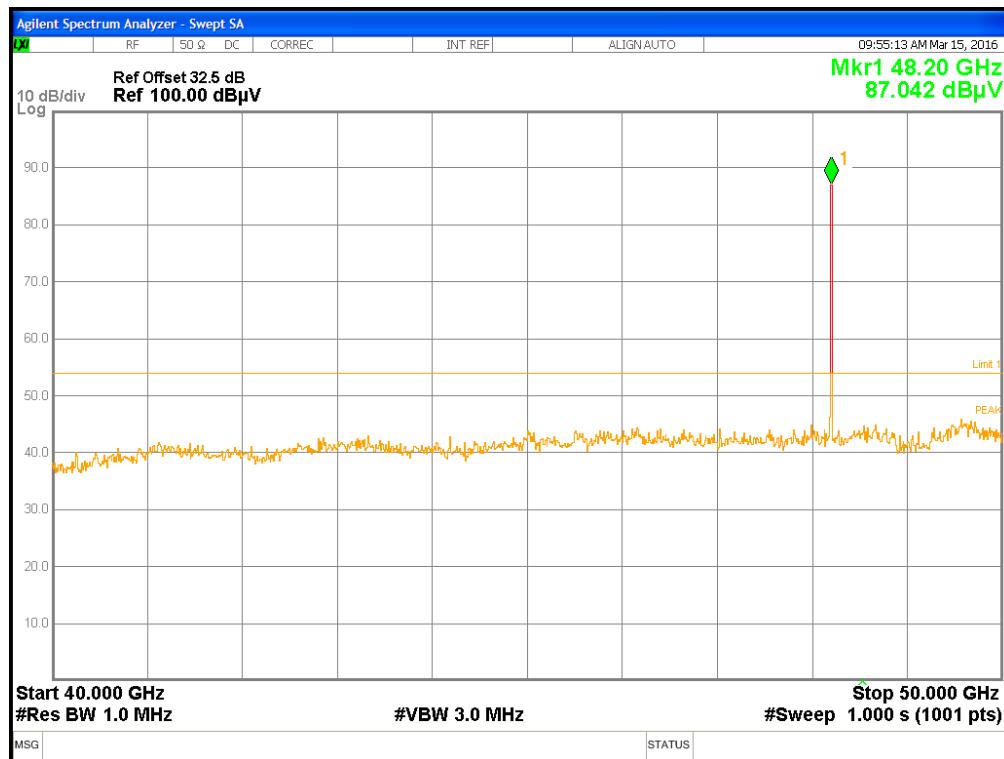
Plot 8: 24.175 GHz to 26.5 GHz, horizontal / vertical polarization

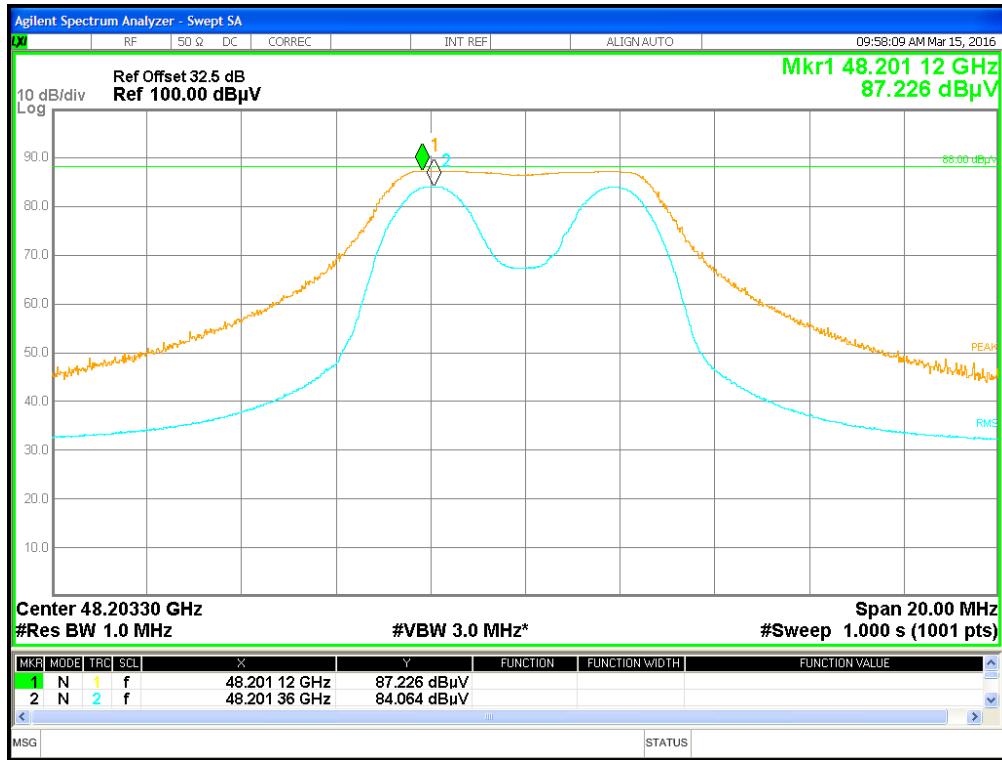


Plot 9: 26.5 GHz to 40.0 GHz, horizontal / vertical polarization

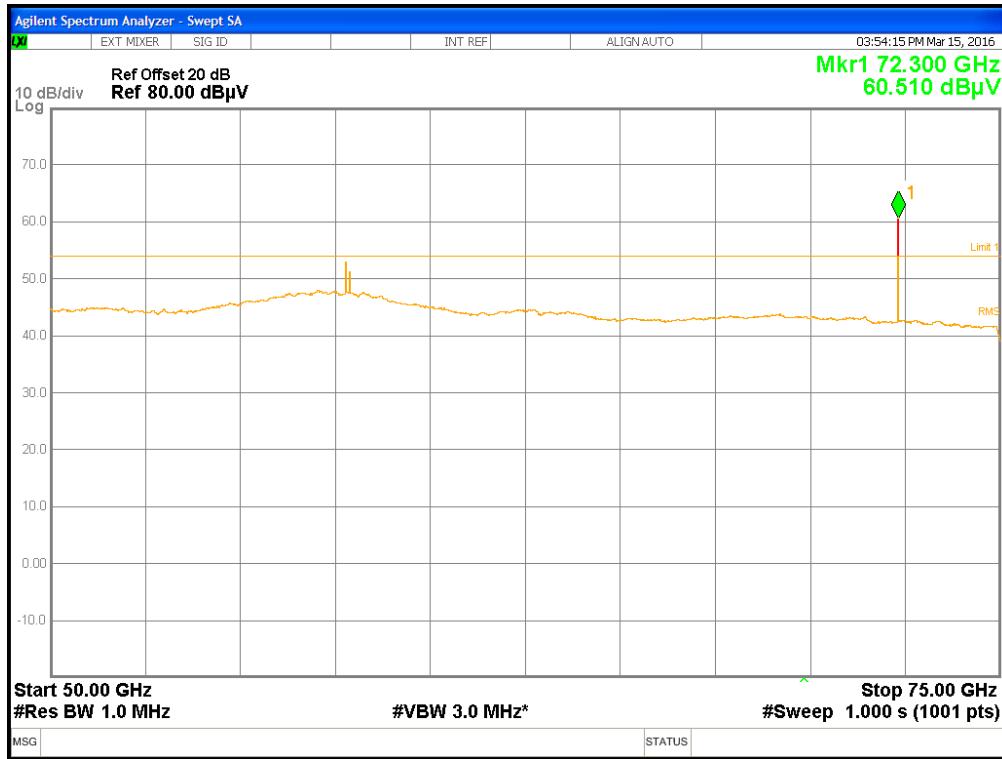


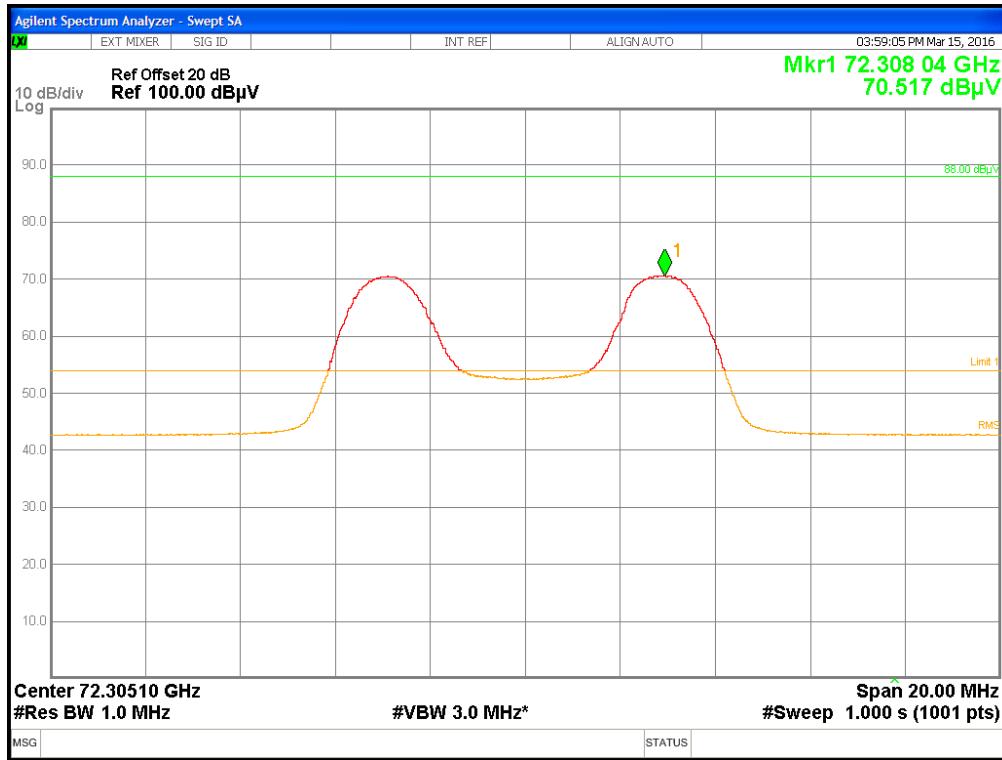
Plot 10: 40.0 GHz to 50.0 GHz, horizontal / vertical polarization



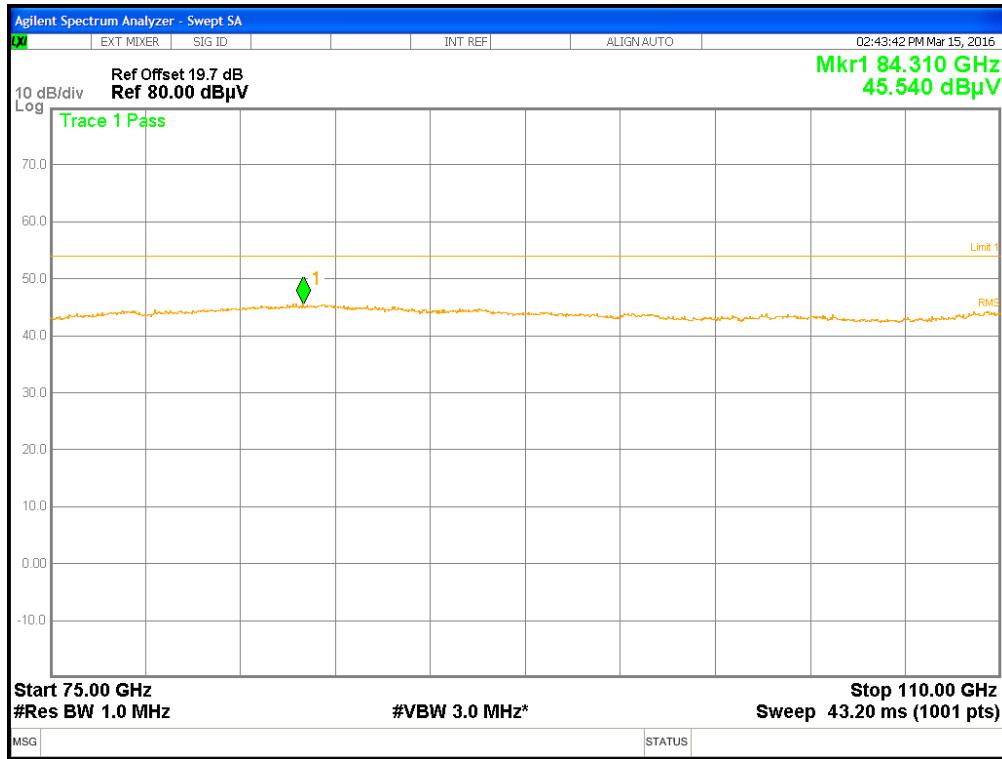
Plot 11: 48.2 GHz (2nd harmonic), horizontal / vertical polarization

Plot 12: 50 GHz to 75 GHz, horizontal / vertical polarization



Plot 13: 72.3 GHz (3rd harmonic), horizontal / vertical polarization

Plot 14: 75 GHz to 110 GHz, horizontal / vertical polarization



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:	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 (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

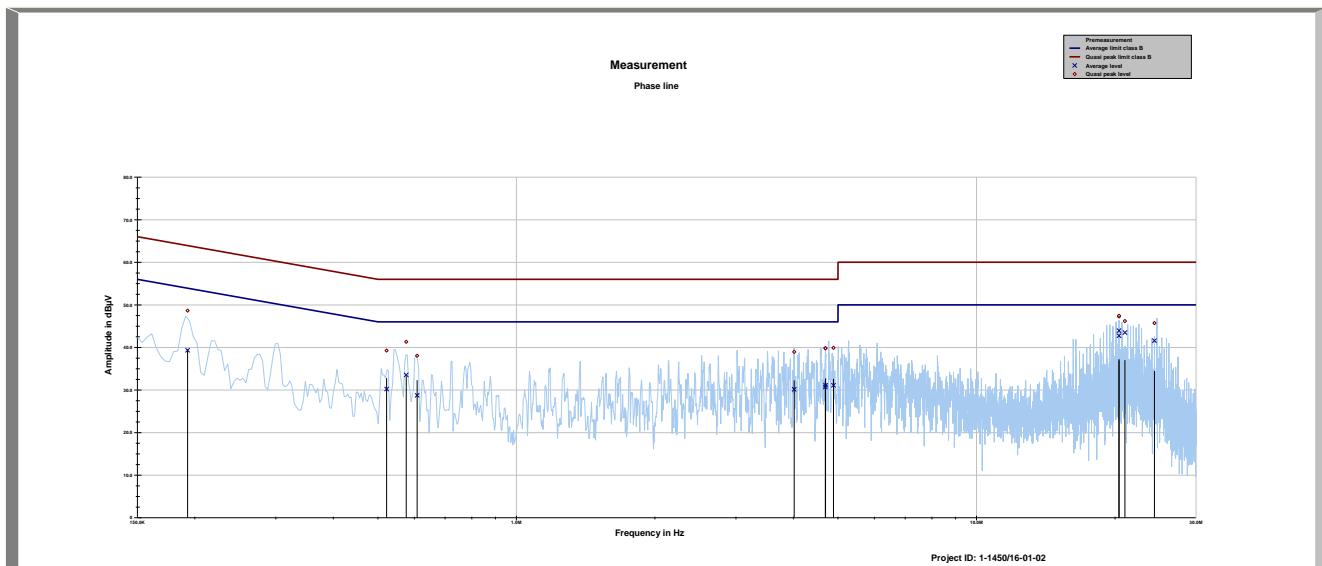
*Decreases with the logarithm of the frequency

Results:

Conducted Spurious Emissions < 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
No critical peaks found		
Measurement uncertainty		± 3 dB

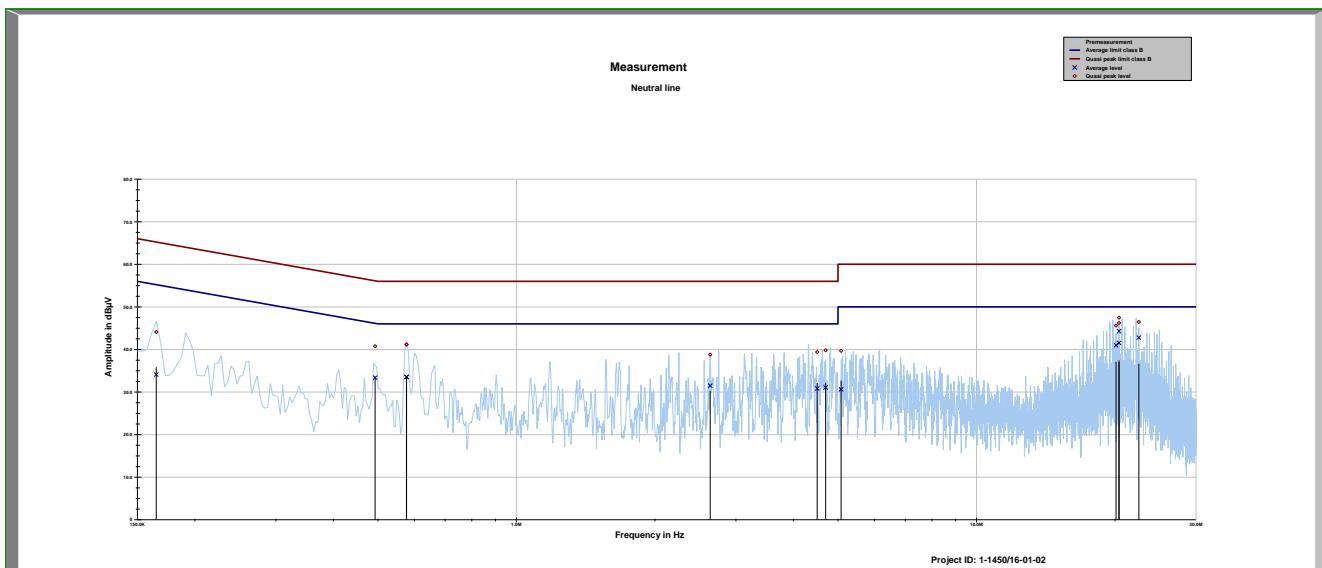
Result: The measurement is passed.

Plot 15: Phase line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.192830	48.63	15.28	63.914	39.33	15.45	54.776
0.522242	39.26	16.74	56.000	30.22	15.78	46.000
0.576092	41.31	14.69	56.000	33.55	12.45	46.000
0.608375	38.04	17.96	56.000	28.75	17.25	46.000
4.014713	38.95	17.05	56.000	30.15	15.85	46.000
4.692583	39.80	16.20	56.000	30.69	15.31	46.000
4.696439	39.81	16.19	56.000	31.13	14.87	46.000
4.887600	39.91	16.09	56.000	31.12	14.88	46.000
20.402372	47.27	12.73	60.000	43.94	6.06	50.000
20.407565	47.42	12.58	60.000	42.76	7.24	50.000
21.012409	46.19	13.81	60.000	43.50	6.50	50.000
24.365758	45.71	14.29	60.000	41.57	8.43	50.000

Plot 16: Neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dB μ V	dB	dB μ V	dB μ V	dB	dB μ V
0.164876	44.09	21.13	65.215	34.09	21.49	55.575
0.492925	40.74	15.38	56.118	33.36	12.84	46.202
0.576593	41.16	14.84	56.000	33.52	12.48	46.000
0.576929	41.14	14.86	56.000	33.55	12.45	46.000
2.637671	38.77	17.23	56.000	31.49	14.51	46.000
4.506170	39.38	16.62	56.000	30.82	15.18	46.000
4.698966	39.82	16.18	56.000	31.05	14.95	46.000
5.079561	39.66	20.34	60.000	30.60	19.40	50.000
20.103492	45.63	14.37	60.000	40.98	9.02	50.000
20.406006	47.45	12.55	60.000	44.27	5.73	50.000
20.408377	46.24	13.76	60.000	41.53	8.47	50.000
22.536312	46.46	13.54	60.000	42.77	7.23	50.000

11 Document history

Version	Applied changes	Date of release
	Initial release – DRAFT	2016-07-06
	minor editorial changes based on applicant's comments	2016-07-08

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

Back side of certificate



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:

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)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 04.05.2016 mit der
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Registrierungsnummer der Urkunde: D-PL-12076-01-01

Frankfurt, 04.05.2016
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Im Auftrag Dipl.-Ing. (FH) Ralf Egner
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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 (Abl. L 218 vom 9. Juli 2008, S. 30).
Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der
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der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen
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Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Note:

The current certificate including annex can be received from CETECOM ICT Services GmbH on request.