
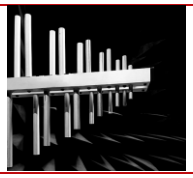
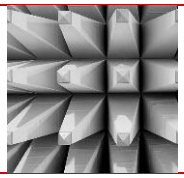

CETECOM™
CETECOM ICT Services
consulting - testing - certification

TEST REPORT

Test report no.: 1-1877/16-01-05

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

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
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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

indurad GmbH
Belvedereallee 5
52070 Aachen / GERMANY
Phone: + 49 241 538070-0
Fax: + 49 241 538070-99
Contact: Matthias Rabel
e-mail: matthias.rabel@indurad.com
Phone: + 49 241 538070-28

Manufacturer

indurad GmbH
Belvedereallee 5
52070 Aachen / GERMANY

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 – Radio frequency devices
RSS – 251 Issue 1	Field Disturbance Sensors in the Bands 46.7-46.9 GHz (Vehicular Radar) and 76-77 GHz (Vehicular and Airport Fixed Radar)

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

Test Item

Kind of test item:	**Collision avoidance proximity and field disturbance radar**
Model name:	**iLDR**
FCC ID:	**2AJRS-iLDR**
IC:	**21407-iLDR**
Frequency:	76.0 - 77.0 GHz
Antenna:	DN50 / DN80 / DN100 (Lense type) DN150 (Parabolic Type)
Power Supply:	24 V.DC from power supply
Temperature Range:	-40 °C to +80 °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:

Geraldy Karsten
DN: cn=Karsten Geraldy, o=CETECOM ICT Services GmbH, ou=GER-151201, email=karsten.geraldy@cetecom.com, c=DE
Datum: 2016.09.26 12:10:45 +02'00'

Karsten Geraldy
Lab Manager
Radio Communications & EMC

Test performed:

M. Walla
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DN: cn=Meheza Walla, o=CETECOM ICT Services GmbH, ou=WAL-151005, email=Meheza.Walla@cetecom.com, c=DE
Datum: 2016.09.26 11:41:10 +02'00'

Meheza Walla
Lab Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

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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:	2016-05-17
Date of receipt of test item:	2016-05-17
Start of test:	2016-05-17
End of test:	2016-06-15
Person(s) present during the test:	Mr Ouczarek David / Mr. Rabel Matthias

3 Test standard/s and guideline/s

Test standard	Date	Test standard description
47 CFR Part 15	2015-10	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 – Radio frequency devices
RSS-251	2014-11	Field Disturbance Sensors in the Bands 46.7-46.9 GHz (Vehicular Radar) and 76-77 GHz (Vehicular and Airport Fixed Radar)
FCC 12-72	2012-07-05	Report and Order Amendment of Sections 15.35 and 15.253 of the Commission's Rules Regarding Operation of Radar Systems in the 76-77 GHz Band Amendment of Section 15.253 of the Commission's Rules to Permit Fixed Use of Radar in the 76-77 GHz Band

4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+80 °C during high temperature tests
	T_{min}	-40 °C during low temperature tests
Relative humidity content:		55 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	24 V DC from power supply

5 Test item

5.1 General Description

Kind of test item		**Collision avoidance proximity and field disturbance radar**
Type identification		**iLDR**
PMN		**iLDR**
HVIN		**iLDR-DN150-E1-C1** **iLDR-DN100-E1-C1** **iLDR-DN080-E1-C1** **iLDR-DN050-E1-C1**
FVIN		**E3**
HMN		**Not applicable**
S/N serial number	:	**d34a05 / 4b8631 / b4ab7f / 749fa9**
HW hardware status	:	**-/-**
SW software status	:	**-/-**
Frequency band	:	**76.0 GHz - 77.0 GHz**
Type of modulation	:	**FMCW**
Number of channels	:	**1**
Antenna	:	**DN50 / DN80 / DN100 (Lense type)** **DN150 (Parabolic Type)**
Power supply	:	**24 V.DC from power supply**
Temperature range	:	**-40 °C to +80 °C**

5.2 Additional information

DN100 antenna was used for the e.i.r.p and the OBW measurements. The Spurious emissions were performed with the DNA150 as worst case maximal antenna gain.

Antenna	Maximum gain
DN50 (Lense Type)	29.0 dBi
DN80 (Lense Type)	33.0 dBi
DN100 (Lense Type)	35.0 dBi
DN150 (Parabolic Type)	39.0 dBi

Special test software was used to change from normal operation mode to stopped mode (low / mid / high) as required by CFR 47 Part 15.31 (c).

Frequencies: low frequency: 76.02 GHz
mid frequency: 76.50 GHz
high frequency:76.98 GHz

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 documents: 1-1877/16-01-01_AnnexA
1-1877/16-01-01_AnnexB
1-1877/16-01-01_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).

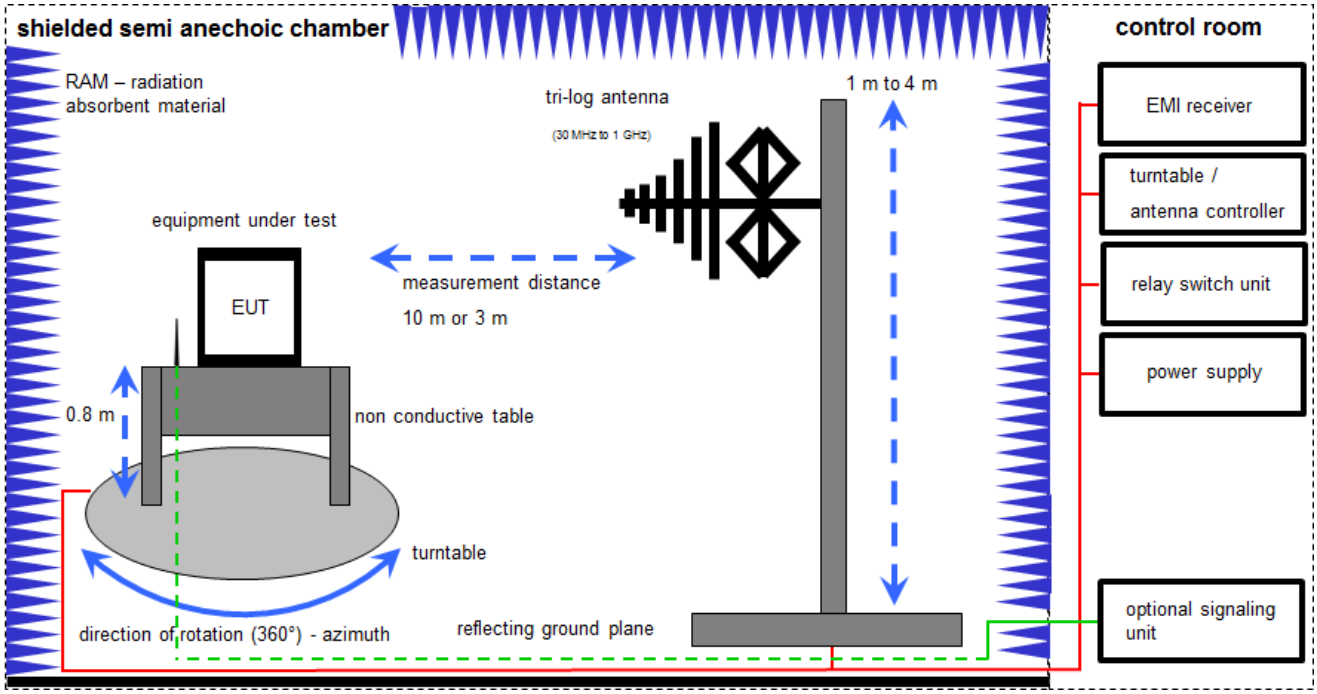
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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
vlkI!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

6.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are 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.



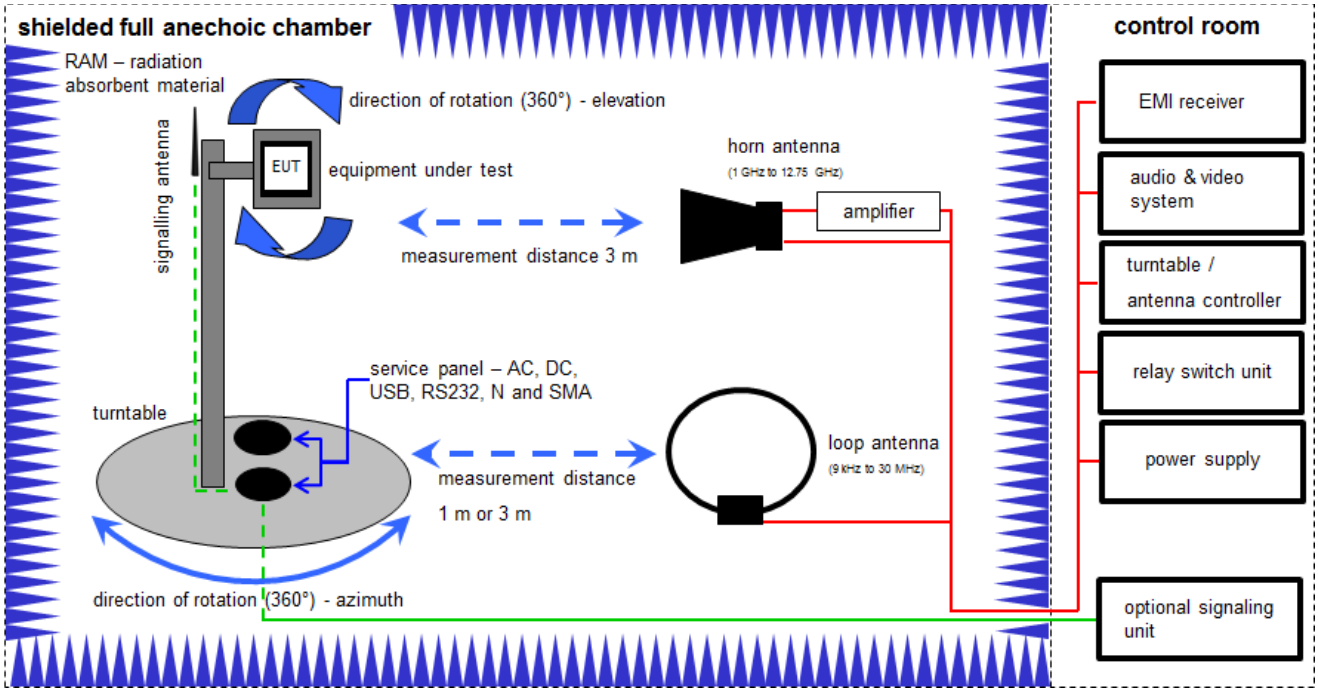
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Switch / Control Unit	3488A	HP		300000929	ne		
2	n. a.	Directional Coupler	101020010	Krytar	70215	300002840	ev		
3	n. a.	DC-Blocker	8143	Inmet Corp.	none	300002842	ne		
4	n. a.	Powersplitter	6005-3	Inmet Corp.		300002841	ev		
5	n. a.	Temperature Test Chamber	VT 4002	Heraeus Voetsch	5856604682001 0	300003019	ev	03.09.2015	03.09.2017
6	n. a.	System DC Power Supply	N5767A	Agilent Technologies	US14J1569P	300004851	vlKI!	04.09.2014	04.09.2016
7	n. a.	Signal Analyzer 30GHz	FSV30	R&S	103170	300004855	k	25.01.2016	25.01.2017
8	n. a.	Power Sensor	NRP-Z81	R&S	100010	300003780	k	25.01.2016	25.01.2017
9	AC2-C01	RF-Cable	ST18/SMAm/SMAm/ 72	Huber & Suhner	Batch no. 605505	400001187	ev		
10	AC2-C02	RF-Cable	Sucoflex 104	Huber & Suhner	147636/4	400001188	ev		

6.2 Shielded fully anechoic chamber



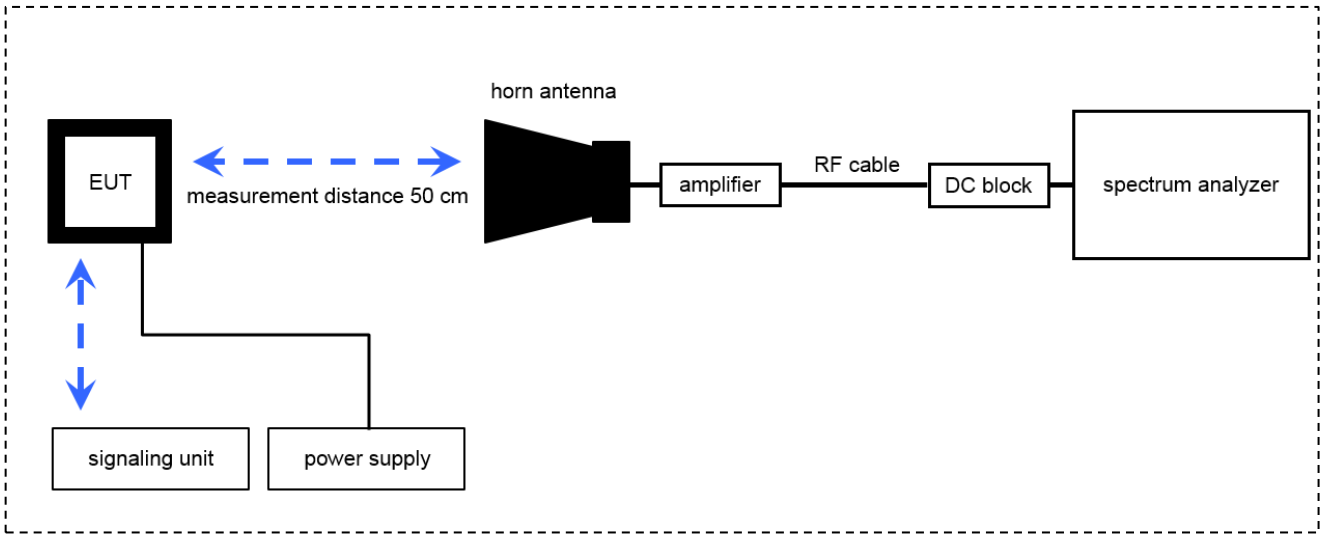
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

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

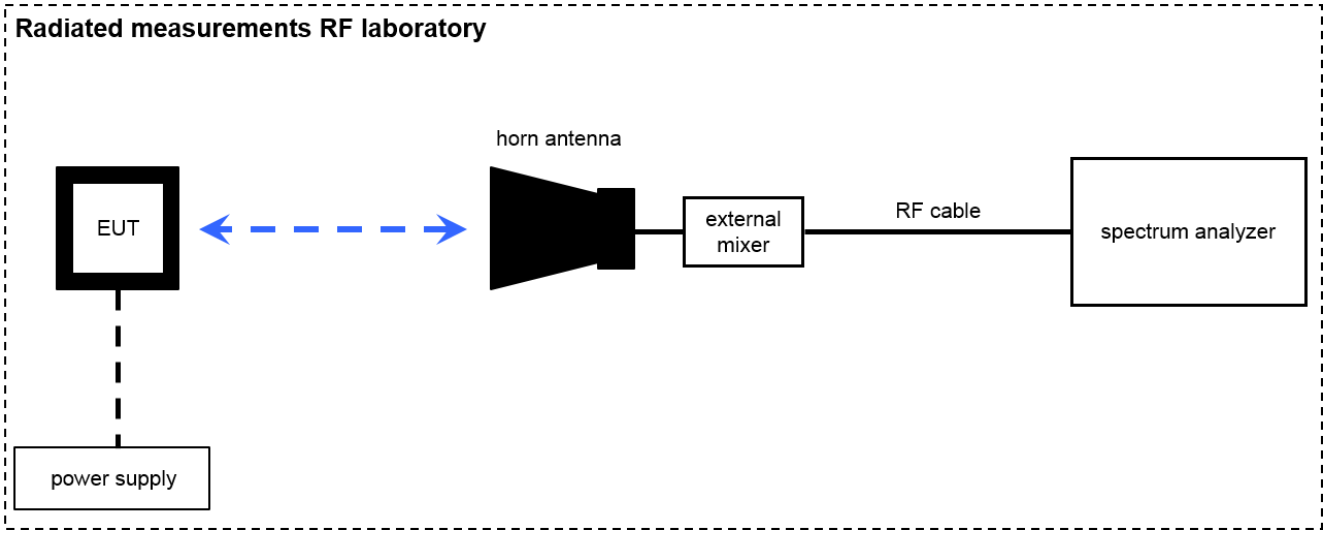
Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
2	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKl!	20.05.2015	20.05.2017
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
4	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne		
5	9	Variable isolating transformer	MPL IEC625 Bus Variable isolating transformer	Erfi	91350	300001155	ne		
6	90	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
7	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
8	n. a.	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
9	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
10	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
11	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKl!	29.10.2014	29.10.2017
12	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne		
13	n. a.	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	04.09.2015	04.09.2016

6.3 Radiated measurements > 18 GHz



6.4 Radiated measurements > 50 GHz



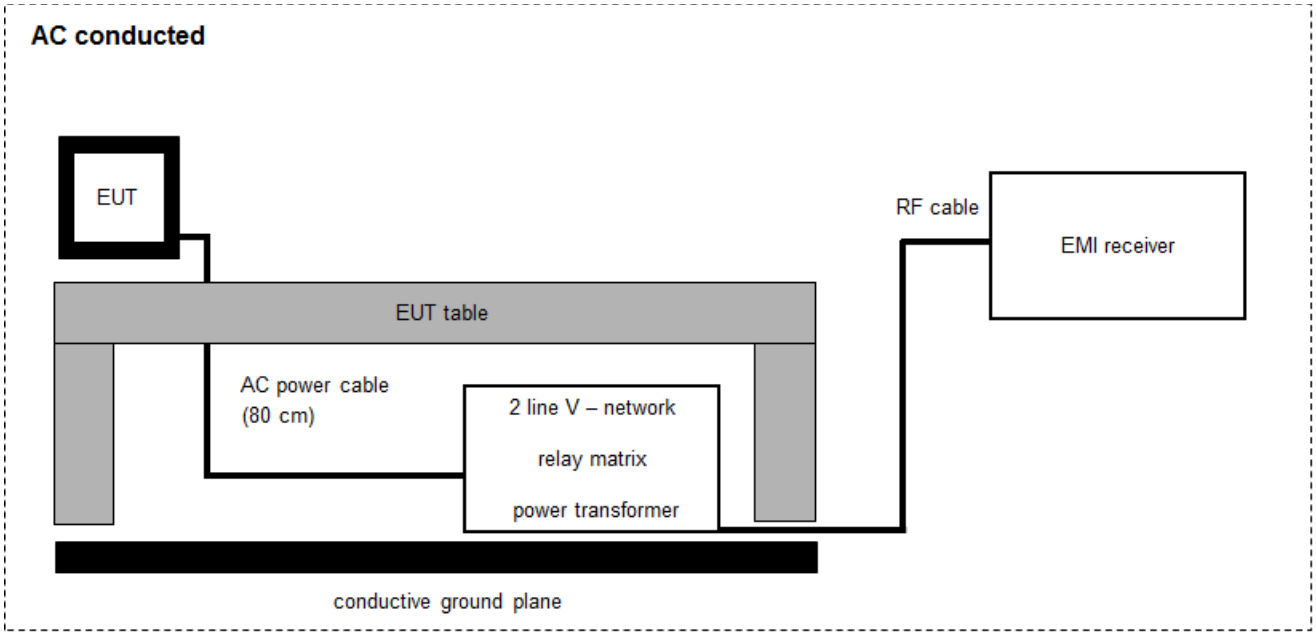
OP = AV + D - G
(OP-rad. output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain)

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.

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A023	Std. Gain Horn Antenna 39.3-59.7 GHz	2424-20	Flann	75	300001979	ne		
2	A025	Std. Gain Horn Antenna 49.9-75.8 GHz	2524-20	Flann	*	300001983	ne		
3	A028	Std. Gain Horn Antenna 73.8-112 GHz	2724-20	Flann	*	300001991	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	A031	Std. Gain Horn Antenna 26.5 to 40.0 GHz	V637	Narda	82-16	300000510	k	14.08.2015	14.08.2017
7	n. a.	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	Ve	02.10.2014	02.10.2016
8	n. a.	Harmonic Mixer 2-Port, 50-75 GHz	FS-Z75	R&S	100099	300003949	k	09.03.2016	09.03.2017
9	n. a.	PXA Spectrum Analyzer 3Hz to 50GHz	N9030A PXA Signal Analyzer	Agilent Technologies	US51350267	300004338	k	09.02.2016	09.02.2017
10	n. a.	Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	ev		
11	n. a.	Harmonic Mixer 3-Port, 75-110 GHz	FS-Z110	R&S	101411	300004959	k	12.05.2016	12.05.2017
12	n. a.	Waveguide Harmonic Mixer, 75-110 GHz	M1970W	KEYSIGHT	MY51430848	300005115	k	25.02.2016	25.02.2018
13	n. a.	Waveguide Harmonic Mixer, 50-80 GHz	M1970V	KEYSIGHT	MY51390914	300005116	k	05.02.2016	05.02.2018
14	n. a.	Std. Gain Horn Antenna 73.8-112 GHz	2724-20	Flann	*	300001991	ne		
15	n. a.	Std. Gain Horn Antenna 114-173 GHz	2924-20	Flann	*	300001999	ne		
16	n. a.	Std. Gain Horn Antenna 145-220 GHz	3024-20	Flann	*	300002000	ne		
17	n. a.	Spectrum Analyzer Mixer 2-Port, 75-110 GHz	SAM-110-7	Radiometer Physics GmbH	002	300004155	ne		
18	n. a.	Spectrum Analyzer Mixer 3-Port, 110-170 GHz	SAM-170	Radiometer Physics GmbH	100014	300004156	ne		
19	n. a.	Spectrum Analyzer Mixer 3-Port, 140-220 GHz	SAM-220	Radiometer Physics GmbH	200001	300004157	ne		
20	n. a.	Spectrum Analyzer Mixer 3-Port, 220-325 GHz	SAM-325	Radiometer Physics GmbH	100002	300004158	ne		
21	n. a.	Temperature Test Chamber	T-40/50	CTS GmbH	053031	300003592	ev	03.09.2015	03.09.2017

6.5 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	Manufact.	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.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
3	n. a.	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	04.02.2016	04.02.2017

7 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Spectrum bandwidth	span/1000
Conducted output power	± 3 dB
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 dB

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 50.0 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-251	see below	2016-09-26	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Results (max.)
§15.253 (d)(1)(2) RSS-251 Issue 1 5.2.2	Power density	Nominal Extreme	Nominal Extreme	☒	☐	☐	☐	Normal mode Peak: 35.5 dBm AVG: .25.8 dBm
§1.1310	MPE Calculation	Nominal Extreme	Nominal Extreme	☒	☐	☐	☐	0.076 mW/cm²
§2.1049 RSS-251 Issue 1 5.1	Occupied bandwidth (99% bandwidth)	Nominal Extreme	Nominal Extreme	☒	☐	☐	☐	940 MHz
§15.253 (d) §15.253 (e) §15.209 (a) RSS-251 Issue 1 5.3	Field strength of emissions (radiated spurious)	Nominal	Nominal	☒	☐	☐	☐	complies
§§15.253 (f) RSS-251 Issue 1 5.4	Frequency stability	Nominal Extreme	Nominal Extreme	☒	☐	☐	☐	complies

Note:
NA = Not Applicable; NP = Not Performed
MD = see Manufacturer's Documentation

10 Test results

10.1 Power density

Description:

Measurement results:

- **Antenna DN100 (measured)**

TEST CONDITIONS (T_{nom} / V_{nom})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	31.3	20.9
low frequency	30.4	27.3
mid frequency	31.1	27.9
high frequency	32.9	29.7

TEST CONDITIONS (T_{min} / V_{min}-V_{max})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	31.5	21.8
low frequency	31.9	28.3
mid frequency	31.4	28.1
high frequency	33.5	30.4

TEST CONDITIONS (T_{max} / V_{min}-V_{max})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	31.3	20.8
low frequency	31.8	27.9
mid frequency	32.5	29.5
high frequency	34.1	31.4

- **Antenna DN150 (calculated)**

TEST CONDITIONS (T_{nom} / V_{nom})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	35.3	24.9
low frequency	34.4	31.3
mid frequency	35.1	31.9
high frequency	36.9	33.7

TEST CONDITIONS (T_{min} / V_{min}-V_{max})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	35.5	25.8
low frequency	35.9	32.3
mid frequency	35.4	32.1
high frequency	37.5	34.4

TEST CONDITIONS (T_{max} / V_{min}-V_{max})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	35.3	24.8
low frequency	35.8	31.9
mid frequency	36.5	33.5
high frequency	38.1	35.4

- **Antenna DN80 (calculated)**

TEST CONDITIONS (T_{nom} / V_{nom})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	29.3	18.9
low frequency	28.4	25.3
mid frequency	29.1	25.9
high frequency	30.9	27.7

TEST CONDITIONS (T_{min} / V_{min}-V_{max})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	29.5	19.8
low frequency	29.9	26.3
mid frequency	29.4	26.1
high frequency	31.5	28.4

TEST CONDITIONS (T_{max} / V_{min}-V_{max})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	29.3	18.8
low frequency	29.8	25.9
mid frequency	30.5	27.5
high frequency	32.1	29.4

- **Antenna DN50 (calculated)**

TEST CONDITIONS (T_{nom} / V_{nom})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	25.3	14.9
low frequency	24.4	21.3
mid frequency	25.1	21.9
high frequency	26.9	23.7

TEST CONDITIONS (T_{min} / V_{min}-V_{max})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	25.5	15.8
low frequency	25.9	22.3
mid frequency	25.4	22.1
high frequency	27.5	24.4

TEST CONDITIONS (T_{max} / V_{min}-V_{max})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
Normal mode	25.3	14.8
low frequency	25.8	21.9
mid frequency	26.5	23.5
high frequency	28.1	25.4

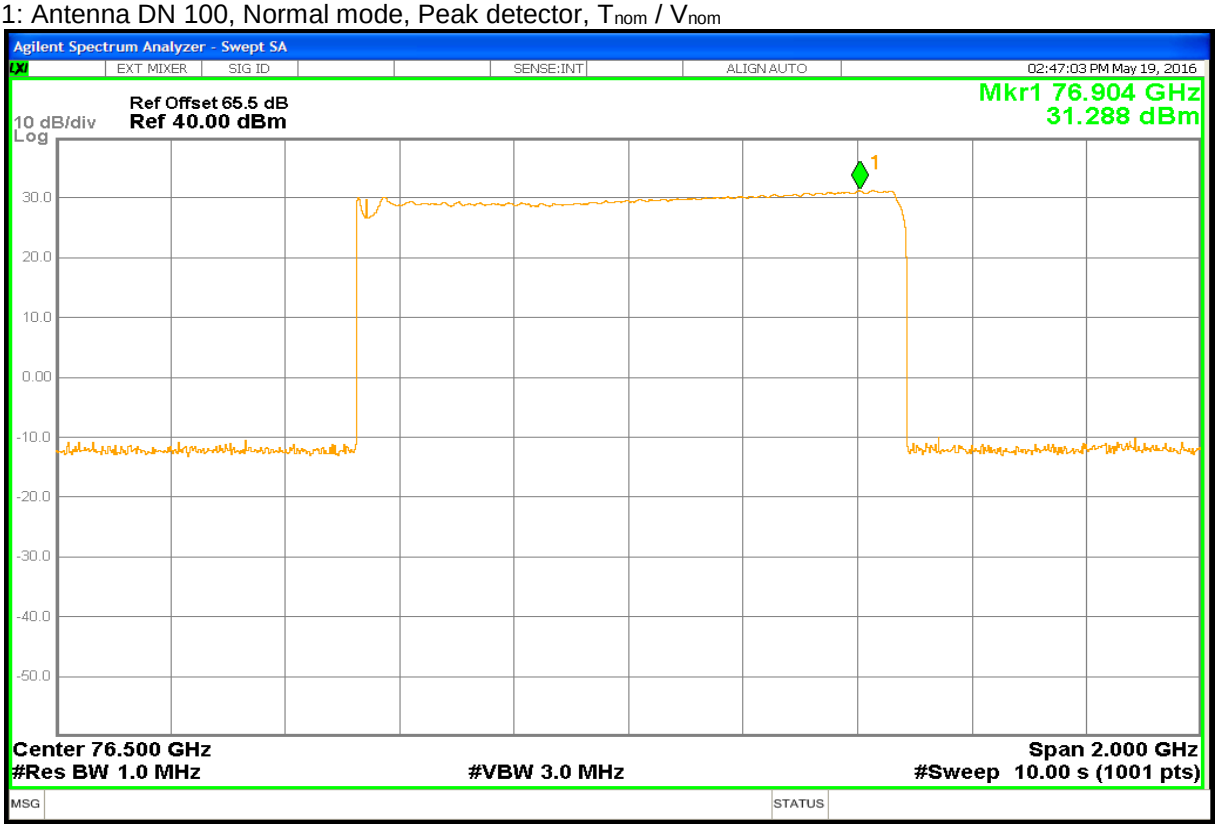
Limits: **FCC §15.253 (d) (1) (2)**

Limits: **RSS-251 / 5.2.2**

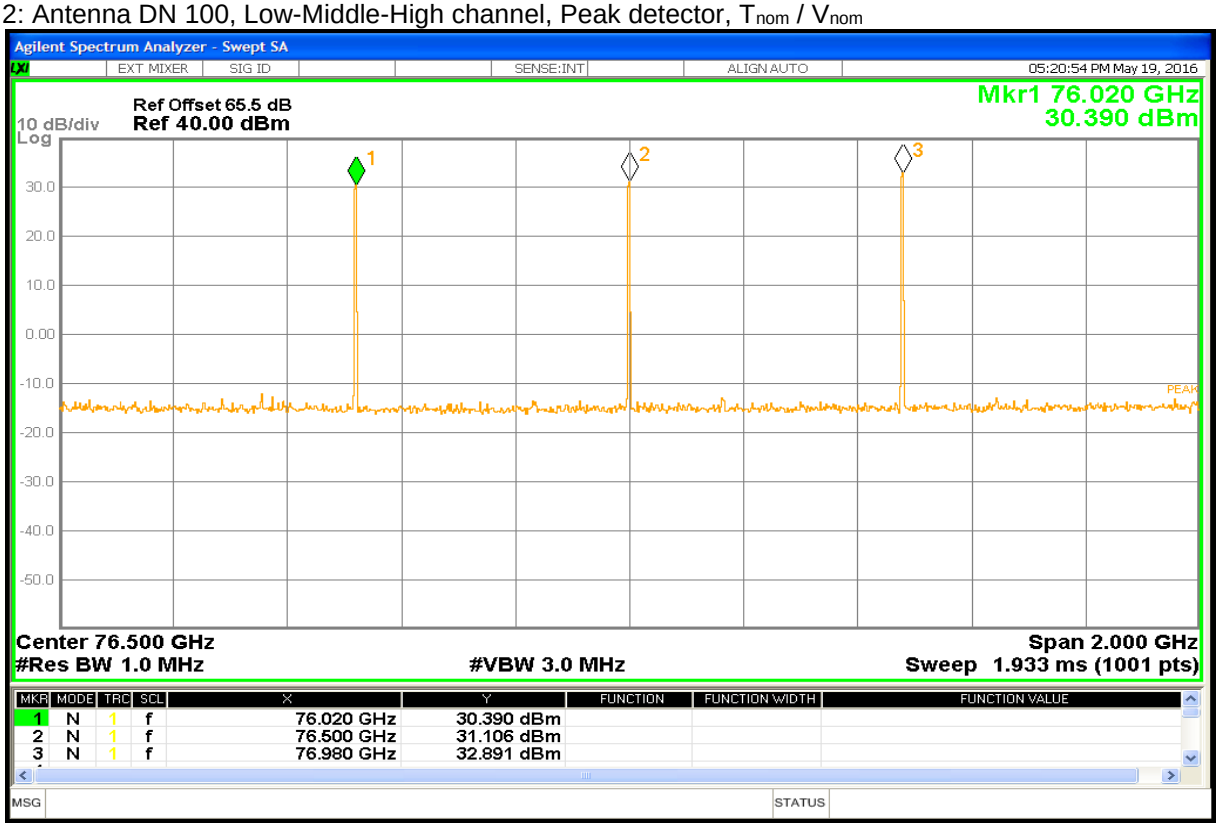
Frequency	Measurement distance	Power Density ➔ EIRP
76.0 - 77.0 GHz	3.0 m	88 µW/cm² → 50 dBm (Average) 279 µW/cm² → 55 dBm (PEAK)

Result: **The measurement is passed.**

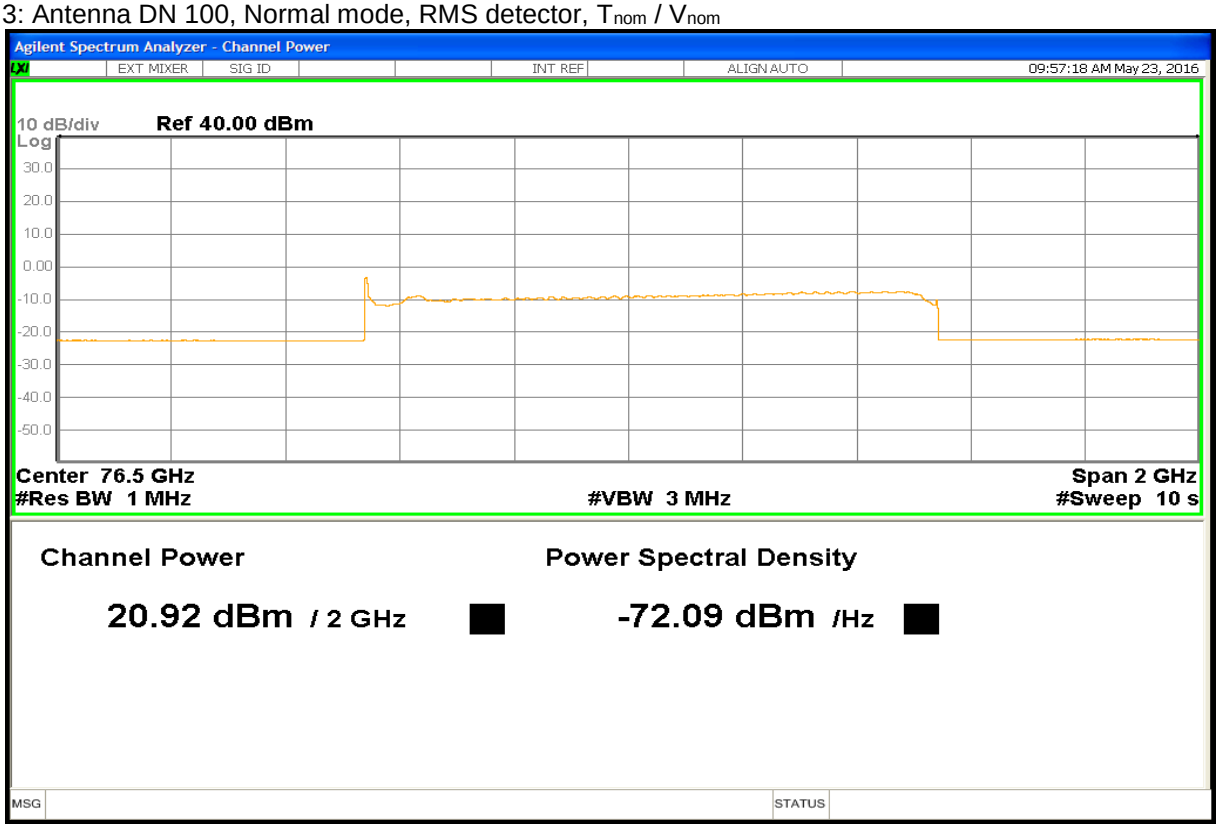
Plot 1: Antenna DN 100, Normal mode, Peak detector, T_{nom} / V_{nom}



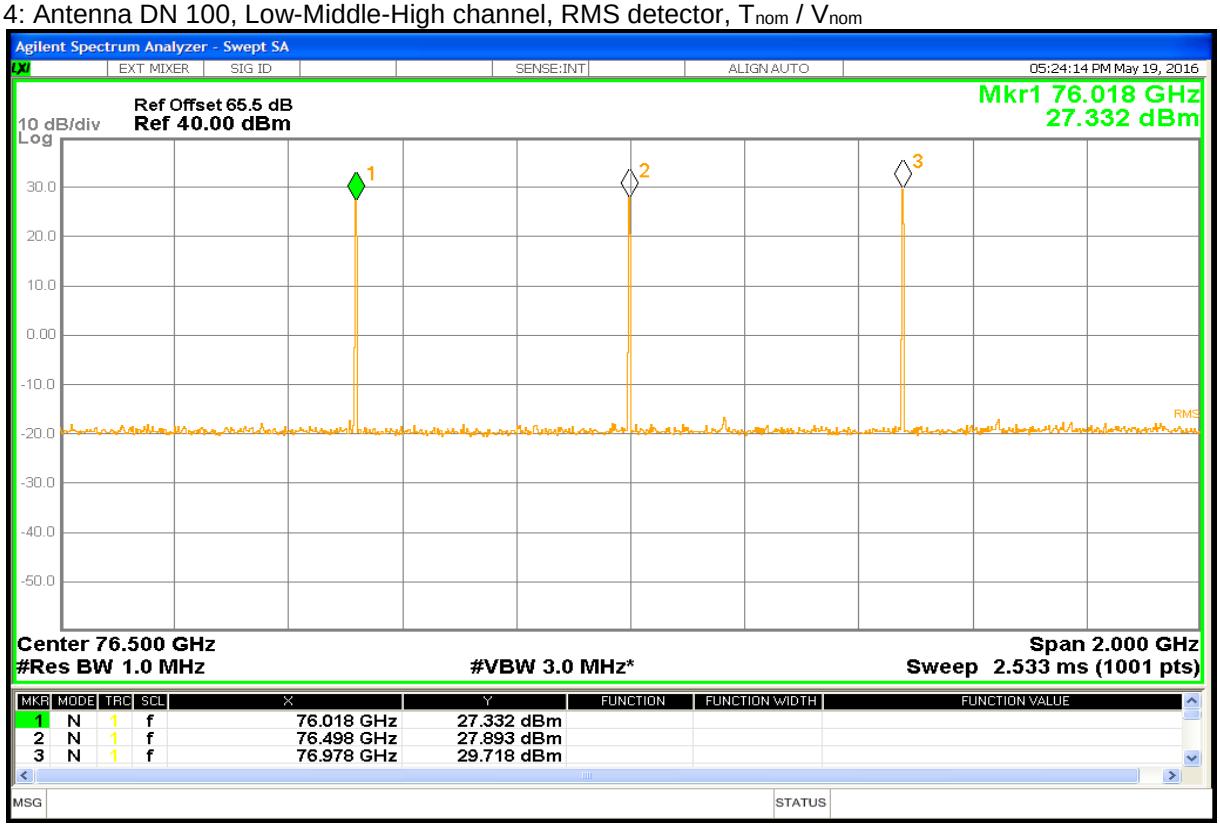
Plot 2: Antenna DN 100, Low-Middle-High channel, Peak detector, T_{nom} / V_{nom}



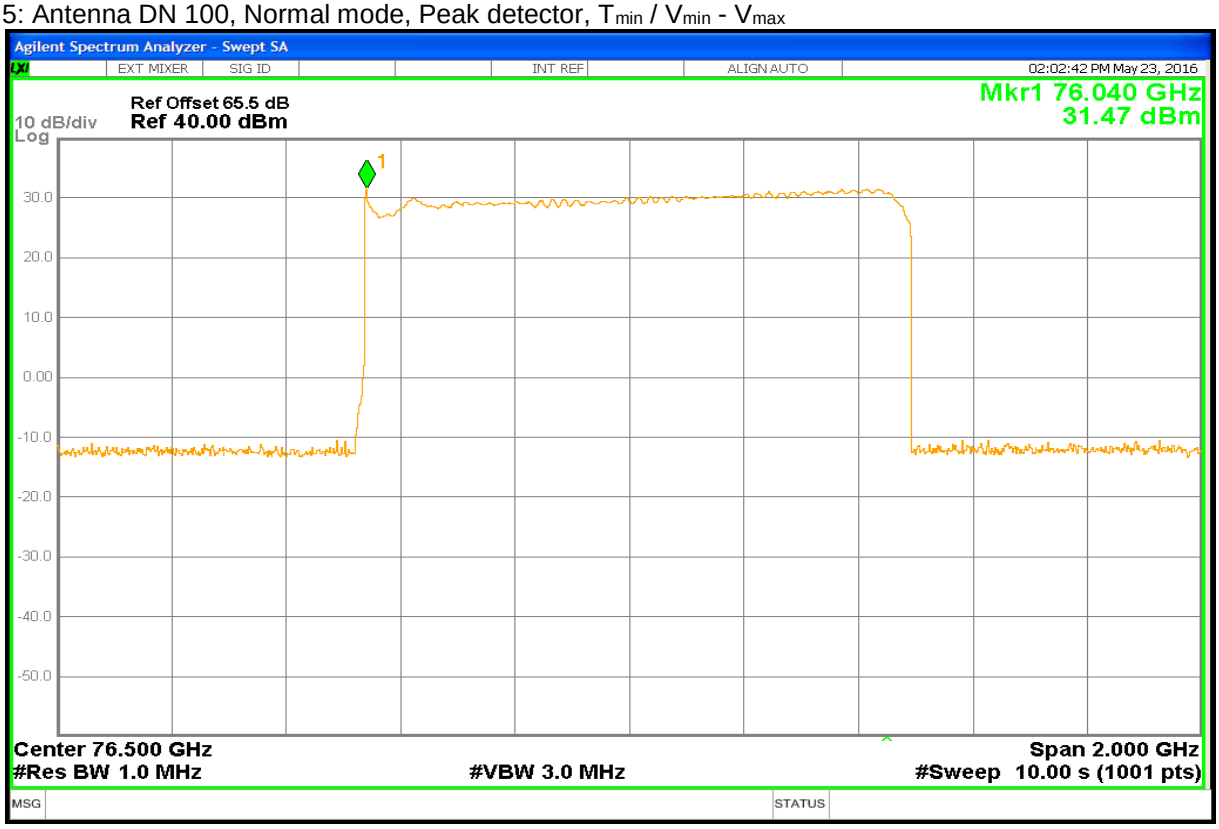
Plot 3: Antenna DN 100, Normal mode, RMS detector, T_{nom} / V_{nom}



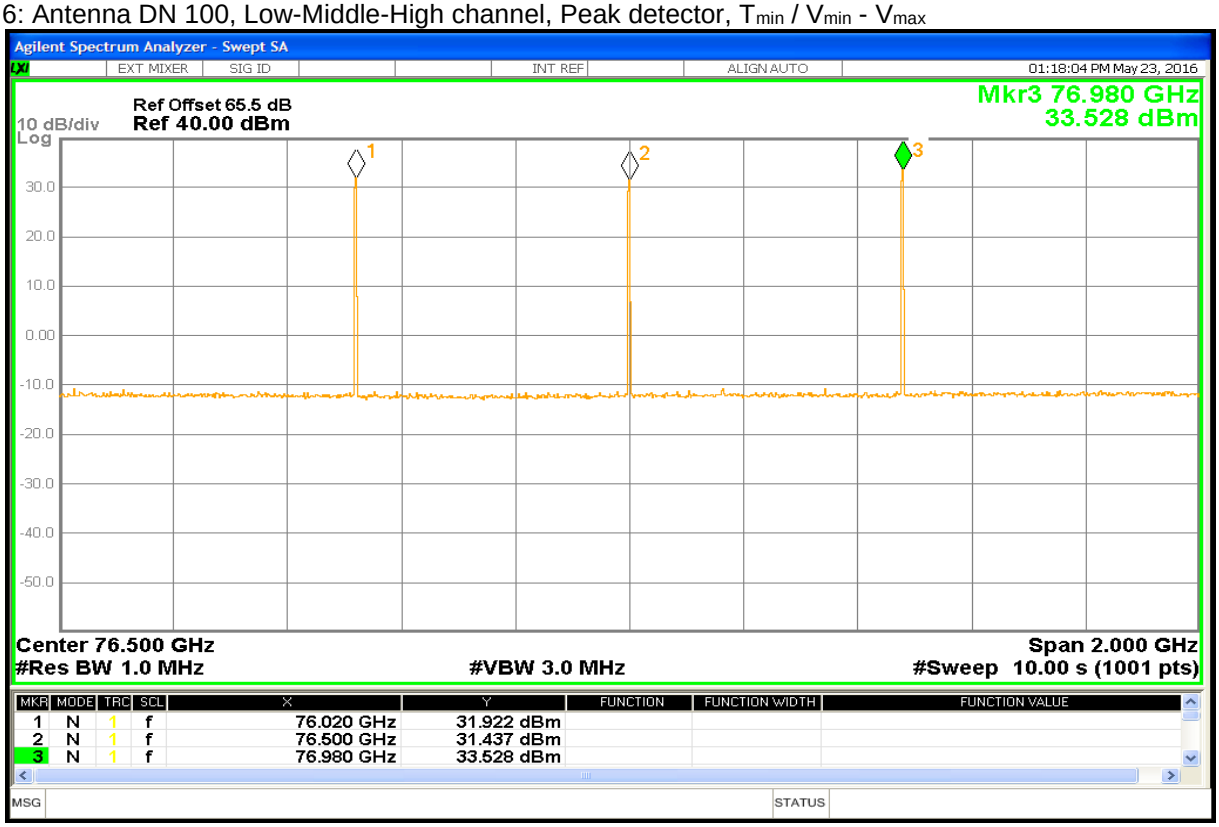
Plot 4: Antenna DN 100, Low-Middle-High channel, RMS detector, T_{nom} / V_{nom}



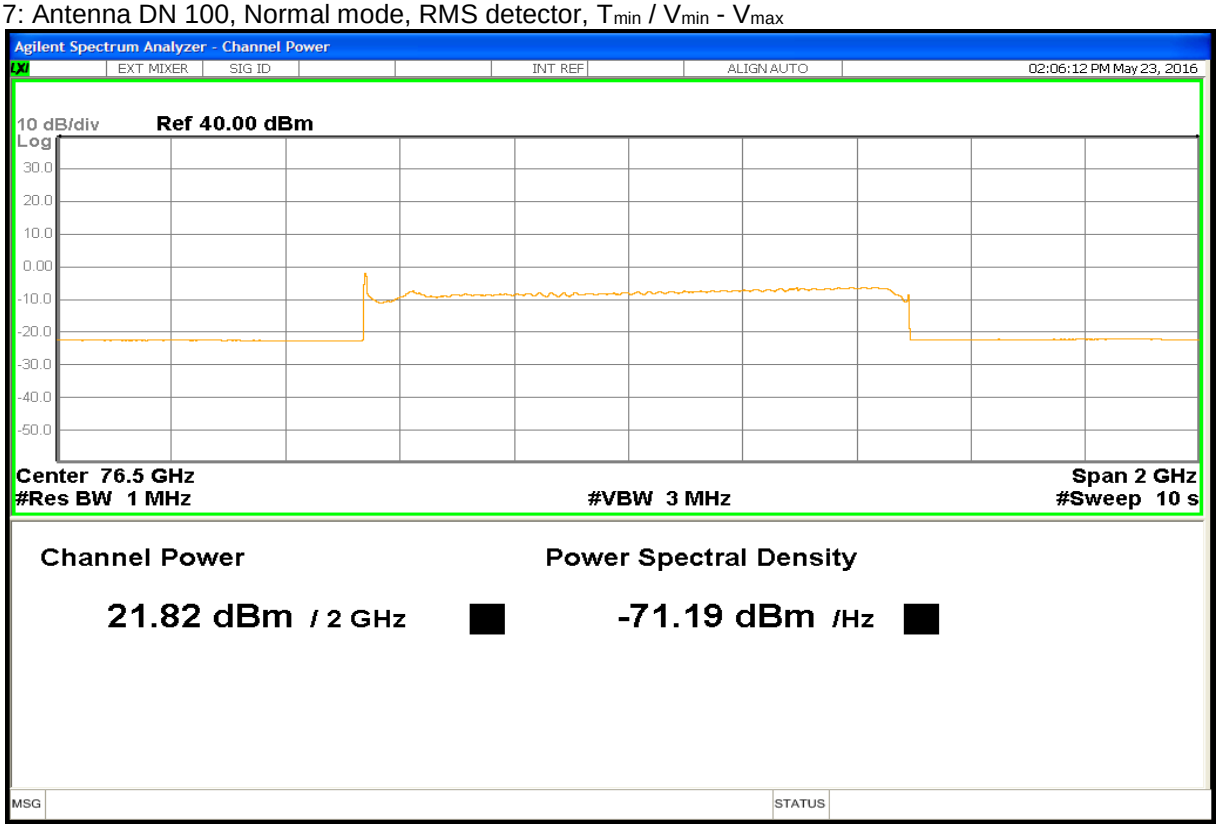
Plot 5: Antenna DN 100, Normal mode, Peak detector, T_{min} / V_{min} - V_{max}



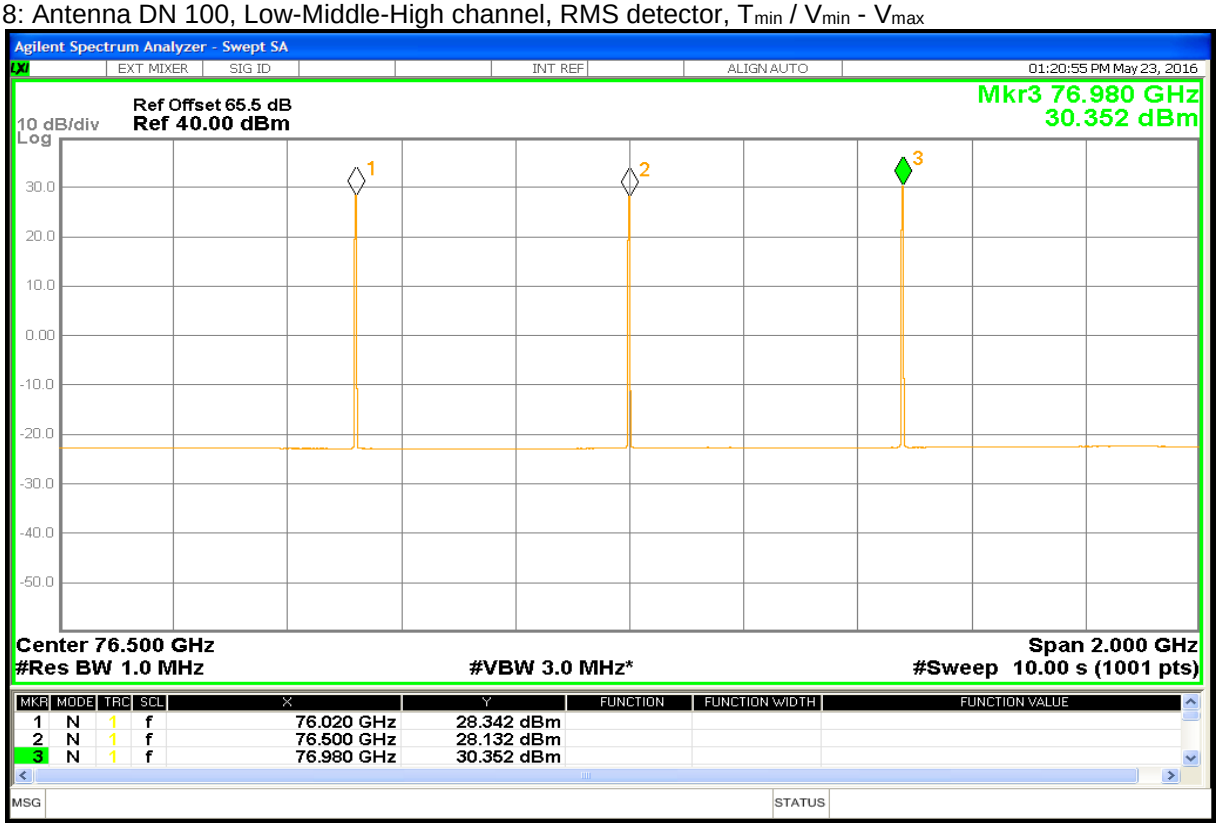
Plot 6: Antenna DN 100, Low-Middle-High channel, Peak detector, T_{min} / V_{min} - V_{max}



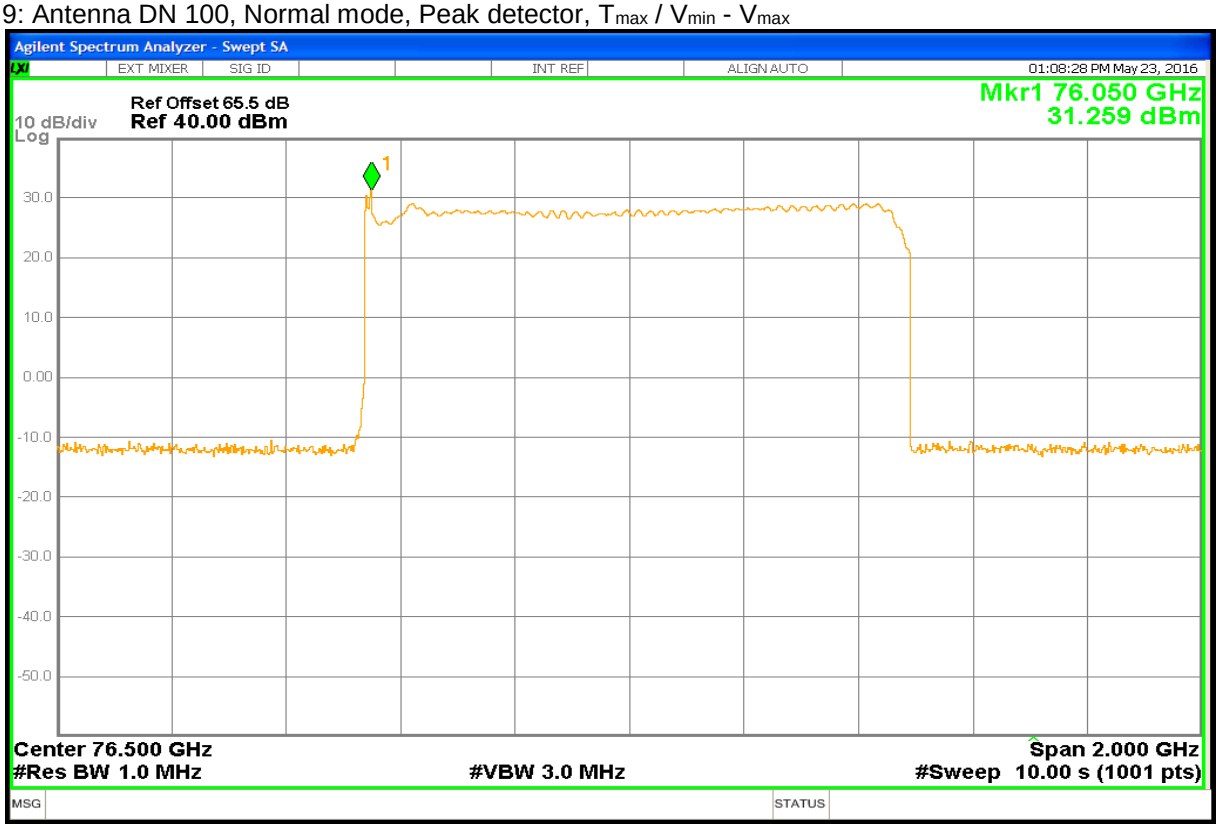
Plot 7: Antenna DN 100, Normal mode, RMS detector, T_{min} / V_{min} - V_{max}



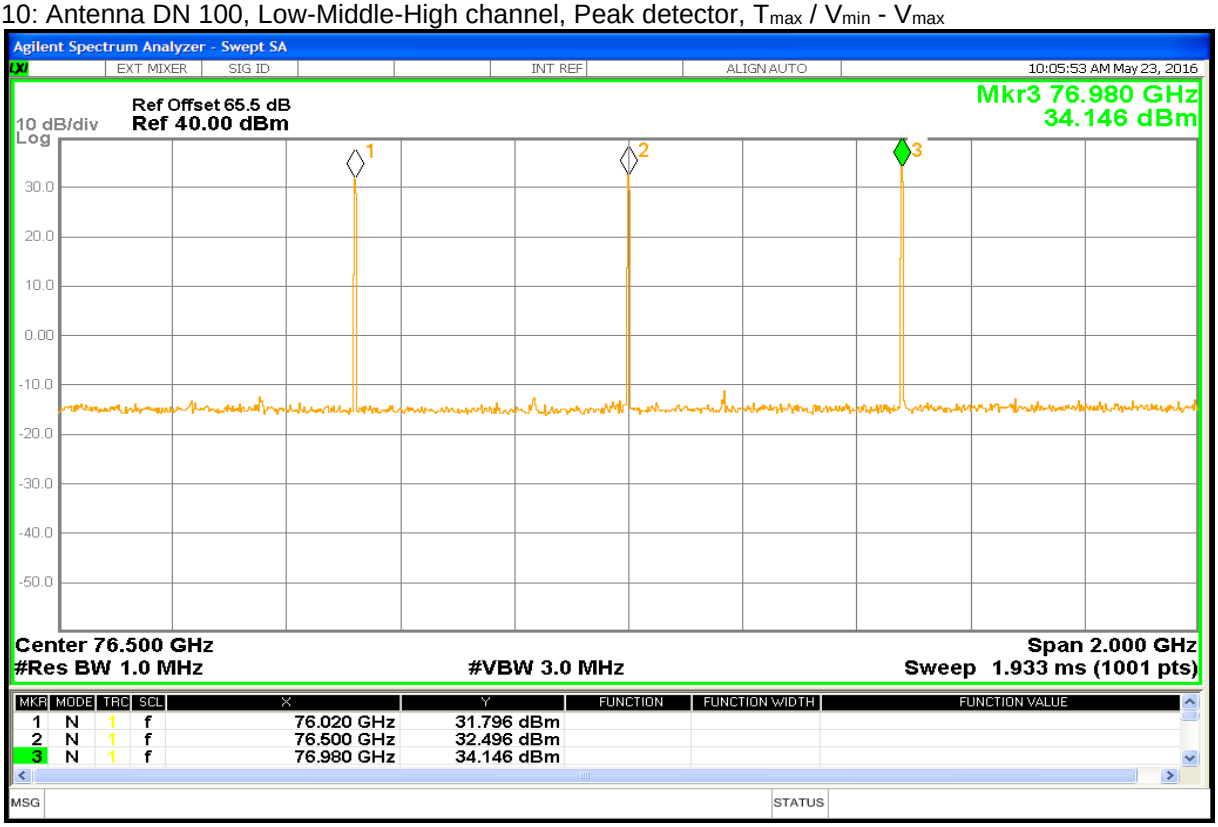
Plot 8: Antenna DN 100, Low-Middle-High channel, RMS detector, T_{min} / V_{min} - V_{max}



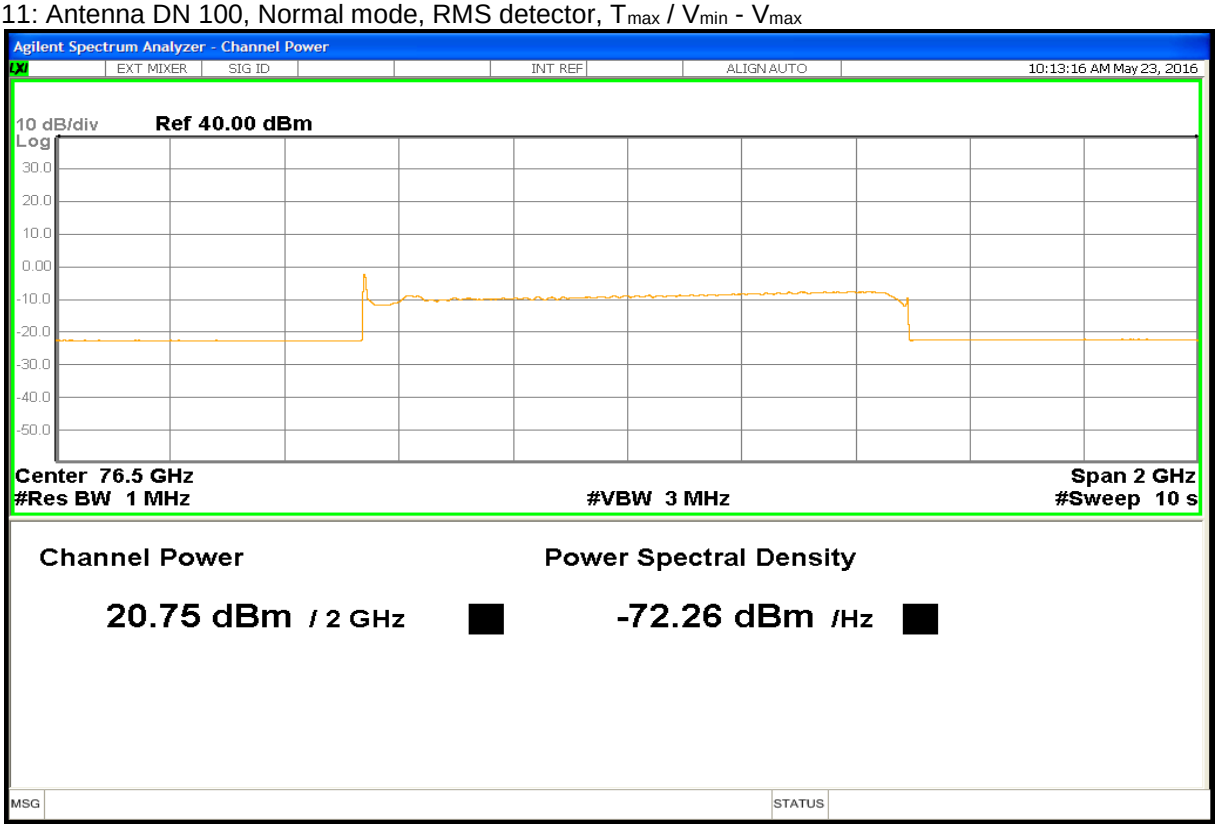
Plot 9: Antenna DN 100, Normal mode, Peak detector, T_{max} / V_{min} - V_{max}



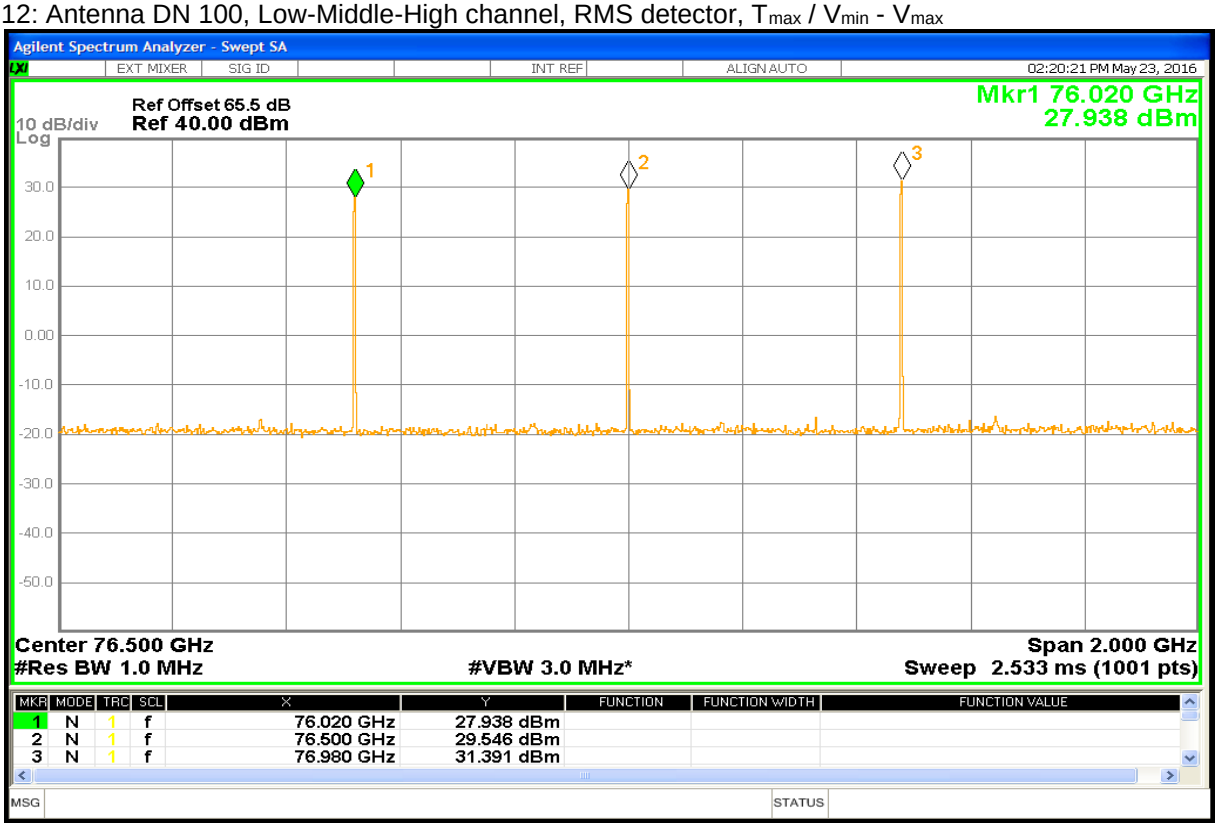
Plot 10: Antenna DN 100, Low-Middle-High channel, Peak detector, T_{max} / V_{min} - V_{max}



Plot 11: Antenna DN 100, Normal mode, RMS detector, T_{max} / V_{min} - V_{max}



Plot 12: Antenna DN 100, Low-Middle-High channel, RMS detector, T_{max} / V_{min} - V_{max}



10.2 Maximum Permissible Exposure (MPE)

MPE Calculation:

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

PD = Power Density (mW/cm2)
OP = DUT Output Power (dBm)
AG = DUT Antenna Gain (dBi)
d = MPE Distance (cm)

Note: OP [mW], AG as lin.factor

§ 1.1310 Radiofrequency radiation exposure limits.

The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, ''Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation.''

NOTE TO INTRODUCTORY PARAGRAPH: These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in ''Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,'' NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3.
Copyright NCRP, 1986, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, exposure limits for field strength and power density are also generally based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ''IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,'' ANSI/IEEE C95.1–1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

[61 FR 41016, Aug. 7, 1996]

Results:

Refer to 10.1, the normal mode maximum average radiated power is 25.8 dBm = 380.2 mW (at T_{min} / V_{min} - V_{max})

d = 20 cm

➔ PD = 0.076 mW/cm^2

Limits: **FCC §1.1310 (B)**

Frequency [GHz]	Power Density [mW / cm^2]
1.500 GHz – 100.000 GHz	1 mW / cm^2

Result: **The measurement is passed.**

10.3 Occupied bandwidth

Definition:

The width of the frequency band which is just sufficient such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the total mean power of a given emission.

Measurement results:

Test conditions	99 % Occupied bandwidth [MHz]
T_{nom} / V_{nom}	938
T_{min} / V_{min} - V_{max}	935
T_{max} / V_{min} - V_{max}	940

Limits: **FCC §2.1049**

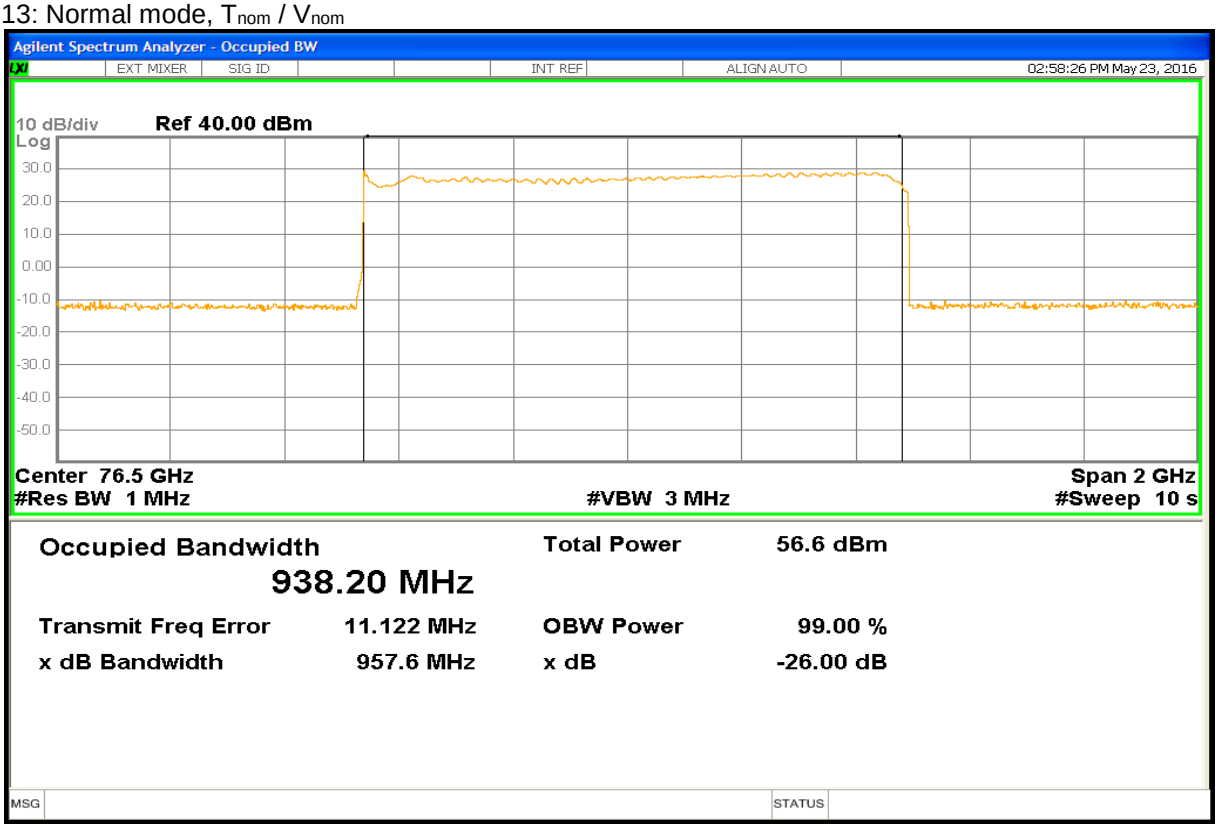
Frequency range	f(lowest) > 76.0 GHz	f(highest) < 77.0 GHz

Limits: **RSS-251 Issue 1 / 5.1**

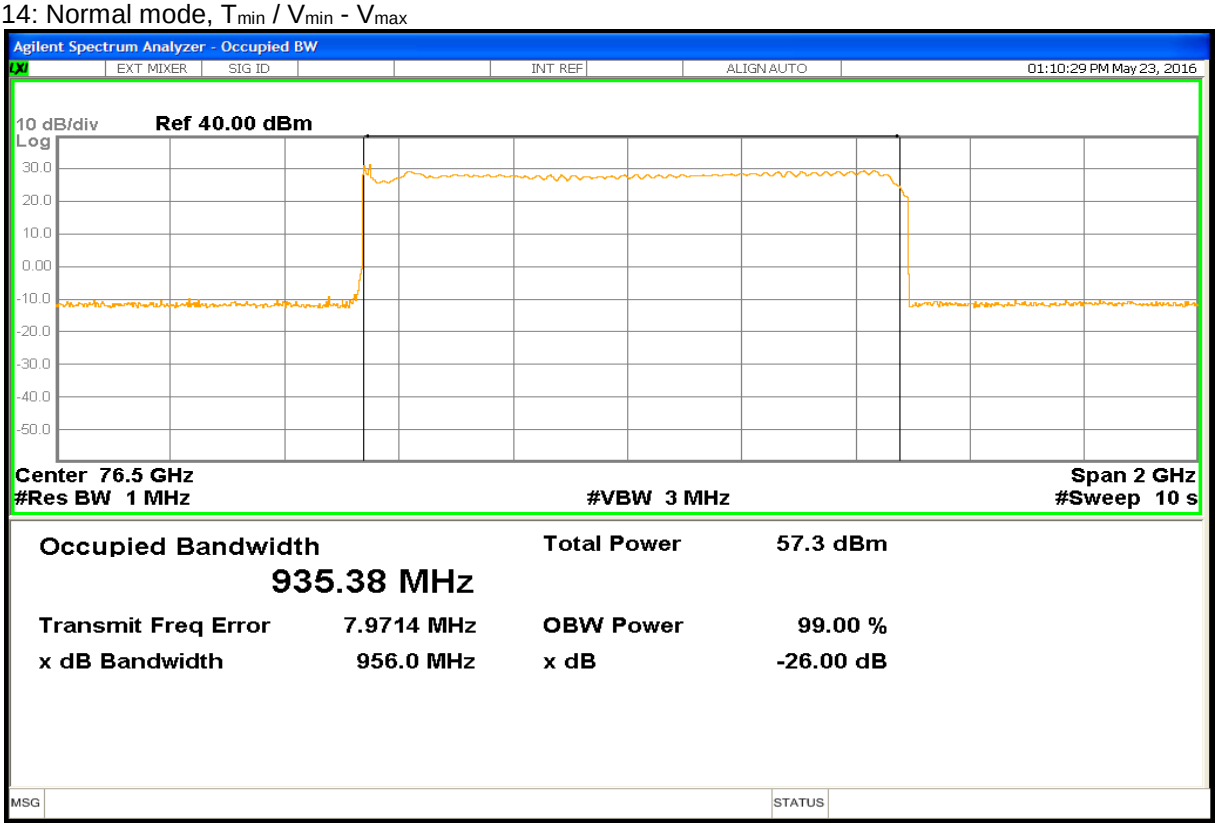
Frequency range	f(lowest) > 76.0 GHz	f(highest) < 77.0 GHz

Result: **The measurement is passed.**

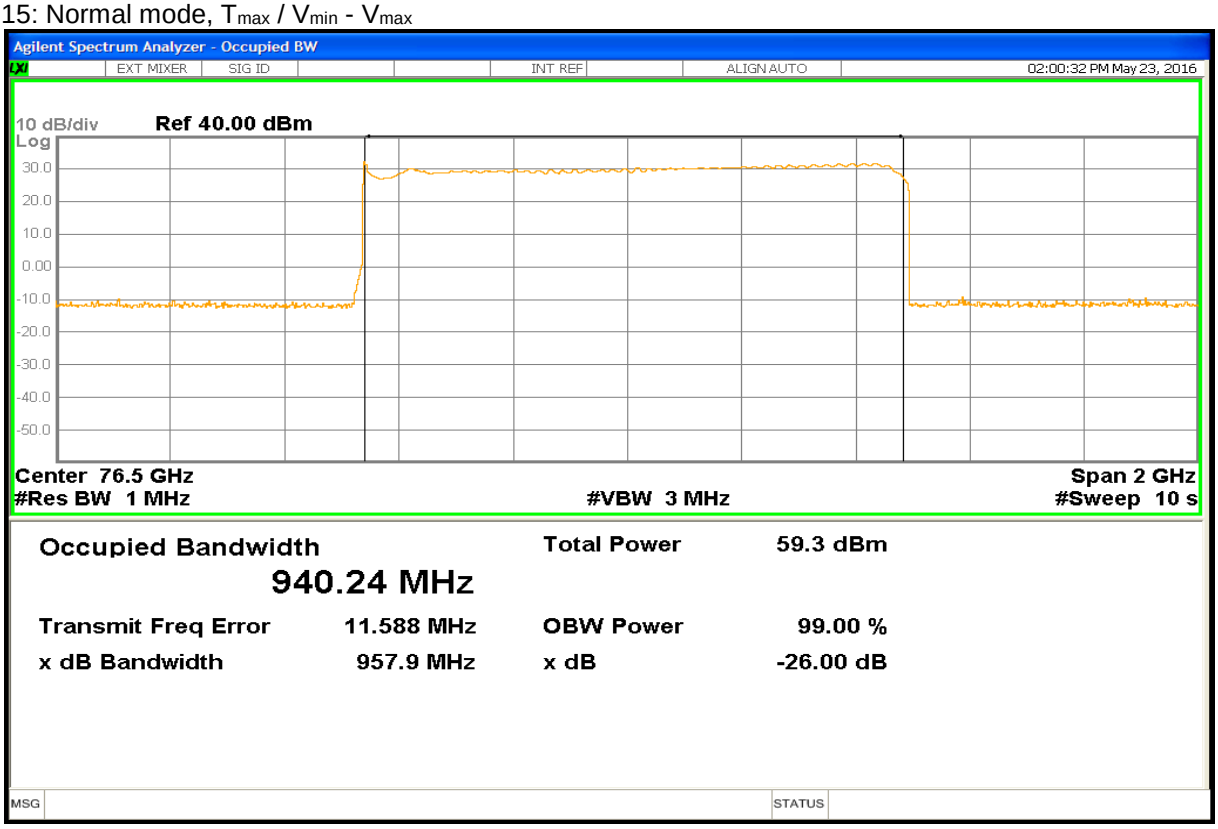
Plot 13: Normal mode, T_{nom} / V_{nom}



Plot 14: Normal mode, T_{min} / V_{min} - V_{max}



Plot 15: Normal mode, T_{max} / V_{min} - V_{max}



10.4 Field strength of emissions (radiated spurious)

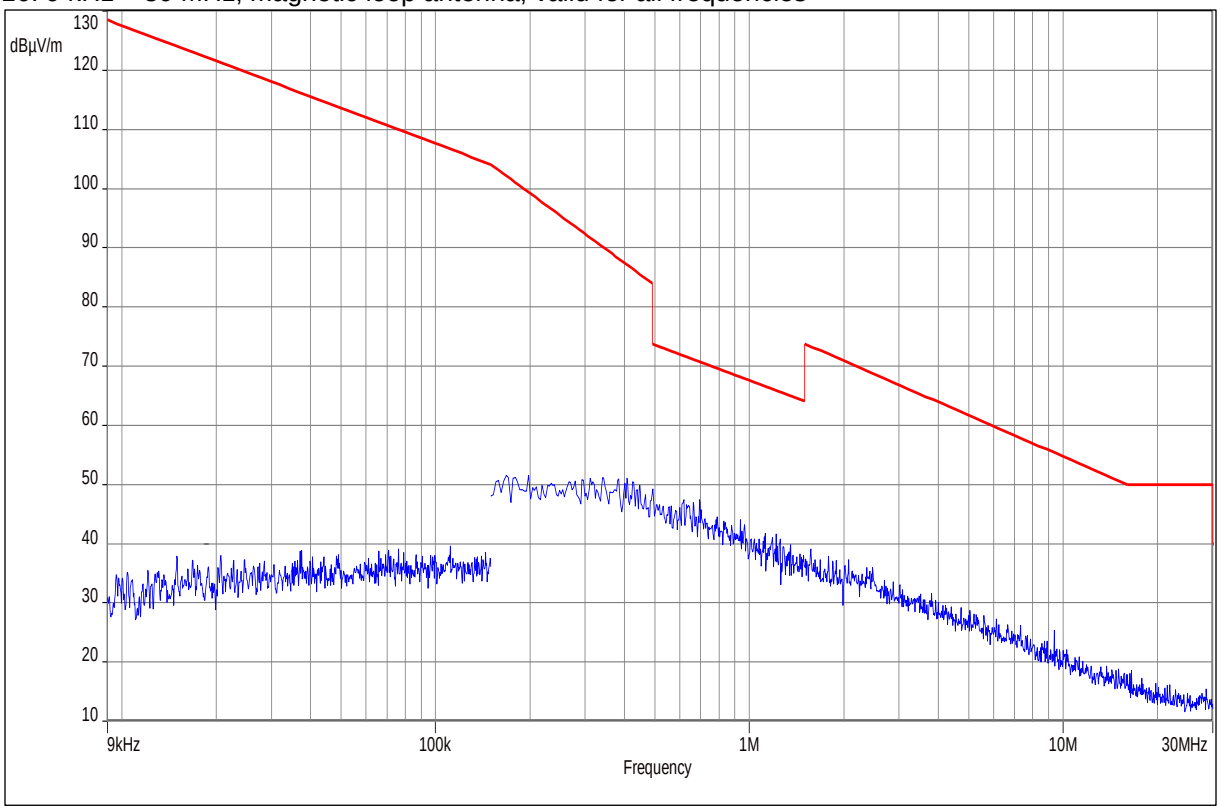
Description:

Measurement of the radiated spurious emissions in transmit mode.

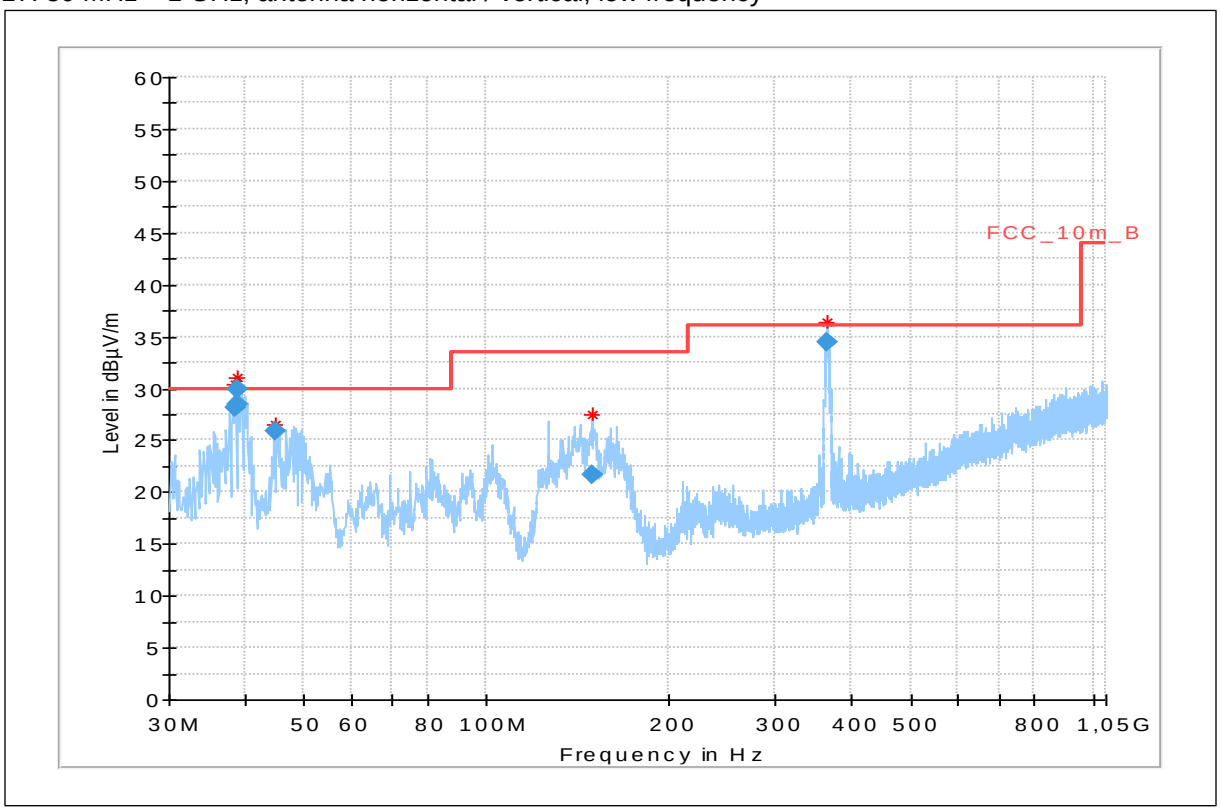
Measurement:

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 235 GHz
Trace-Mode:	Max Hold

Plot 16: 9 kHz – 30 MHz, magnetic loop antenna, valid for all frequencies

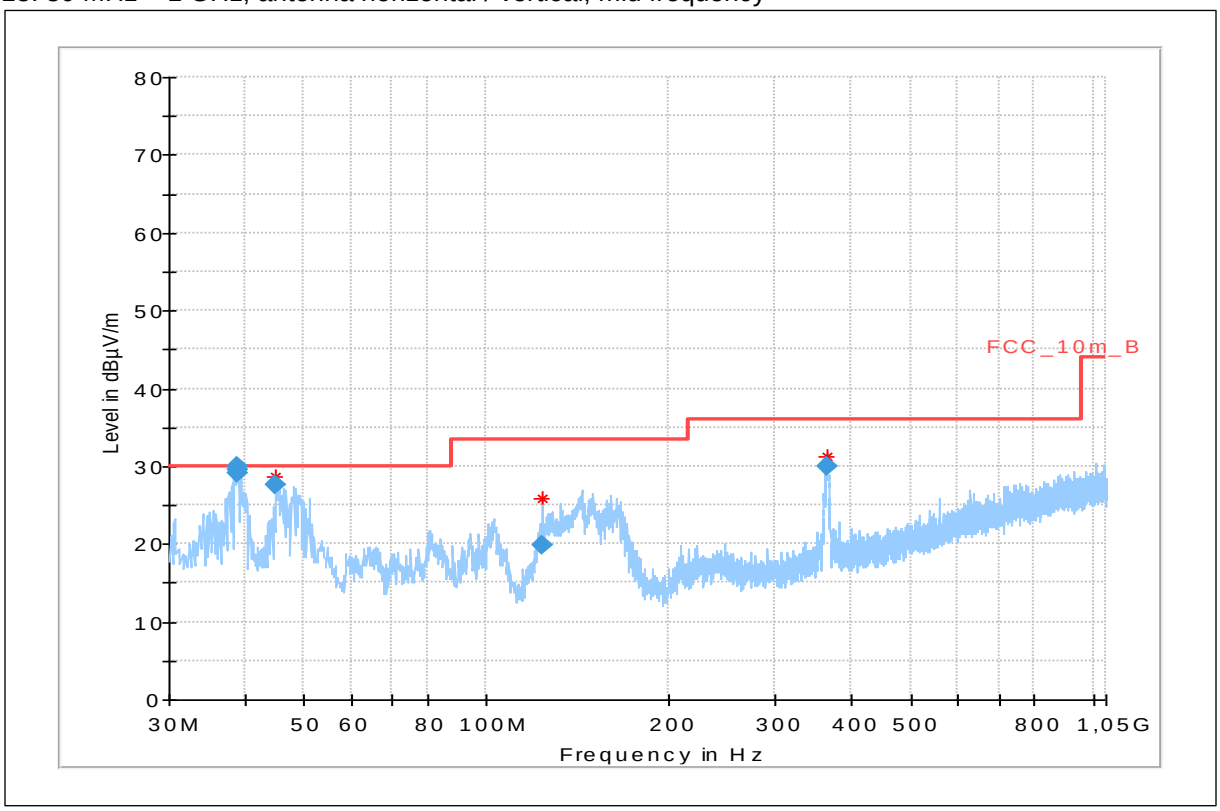


Plot 17: 30 MHz – 1 GHz, antenna horizontal / vertical, low frequency



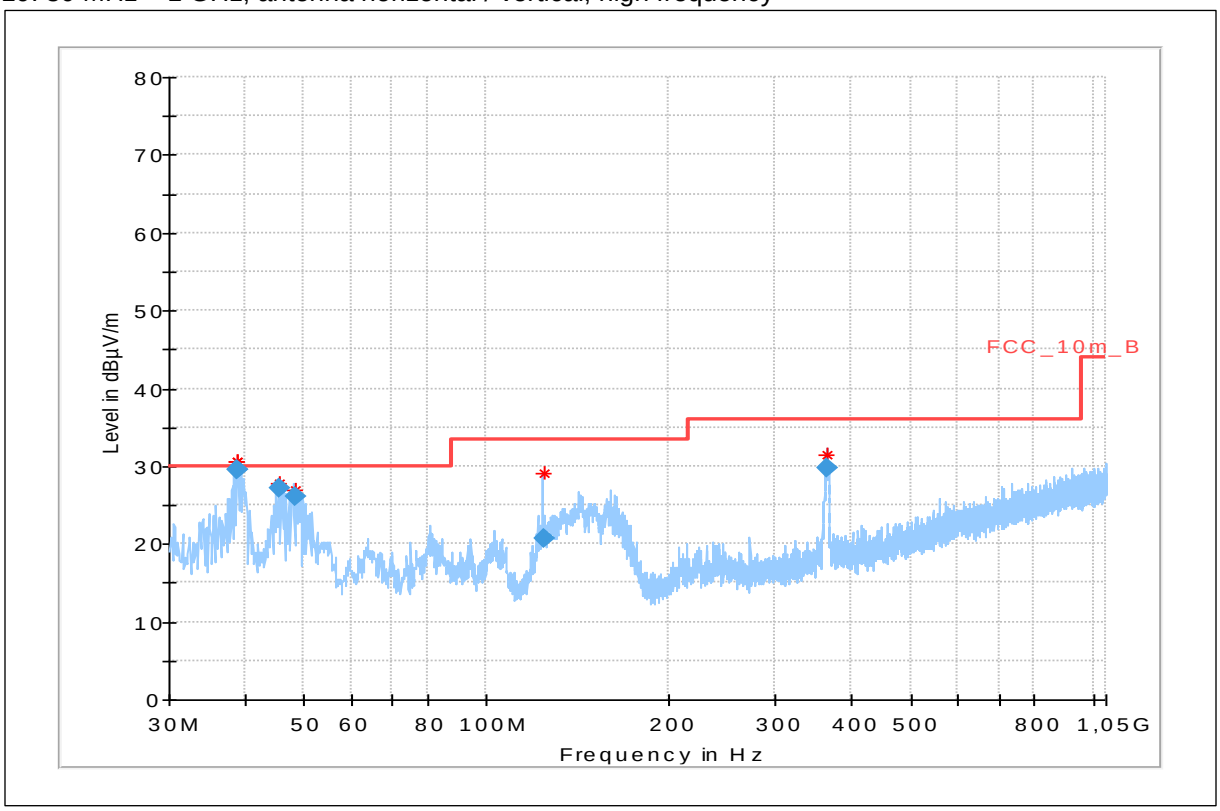
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.515350	28.06	30.00	1.94	1000.0	120.000	173.0	V	275.0	14.0
38.958600	28.43	30.00	1.57	1000.0	120.000	173.0	V	97.0	14.0
38.973150	29.94	30.00	0.06	1000.0	120.000	100.0	V	53.0	14.0
45.073950	25.85	30.00	4.15	1000.0	120.000	100.0	V	185.0	13.8
149.218050	21.74	33.50	11.76	1000.0	120.000	174.0	V	230.0	8.9
364.841250	34.41	36.00	1.59	1000.0	120.000	272.0	H	282.0	16.3

Plot 18: 30 MHz – 1 GHz, antenna horizontal / vertical, mid frequency



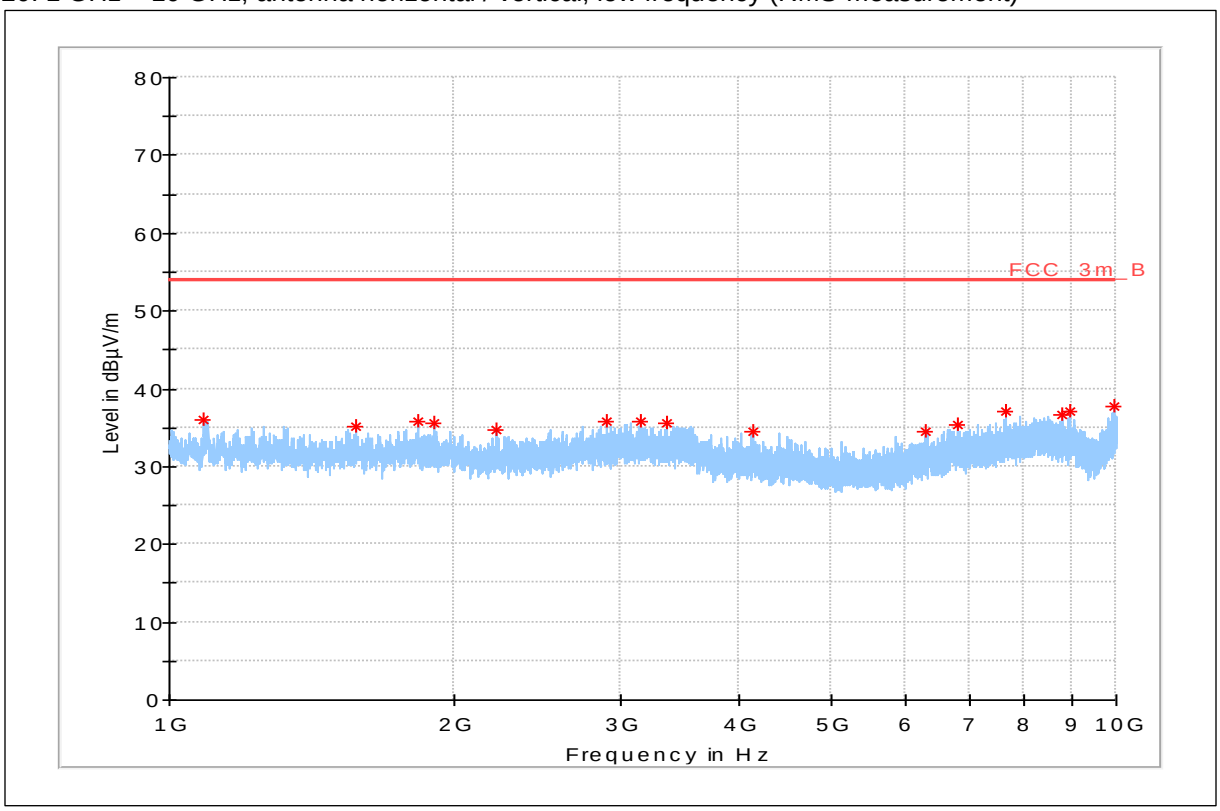
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.921250	29.88	30.00	0.12	1000.0	120.000	98.0	V	10.0	14.0
38.943300	29.53	30.00	0.47	1000.0	120.000	98.0	V	280.0	14.0
38.958000	29.20	30.00	0.80	1000.0	120.000	101.0	V	80.0	14.0
45.035100	27.61	30.00	2.39	1000.0	120.000	98.0	V	280.0	13.8
123.822450	19.85	33.50	13.65	1000.0	120.000	170.0	V	190.0	9.9
363.879150	30.02	36.00	5.98	1000.0	120.000	98.0	V	170.0	16.3

Plot 19: 30 MHz – 1 GHz, antenna horizontal / vertical, high frequency

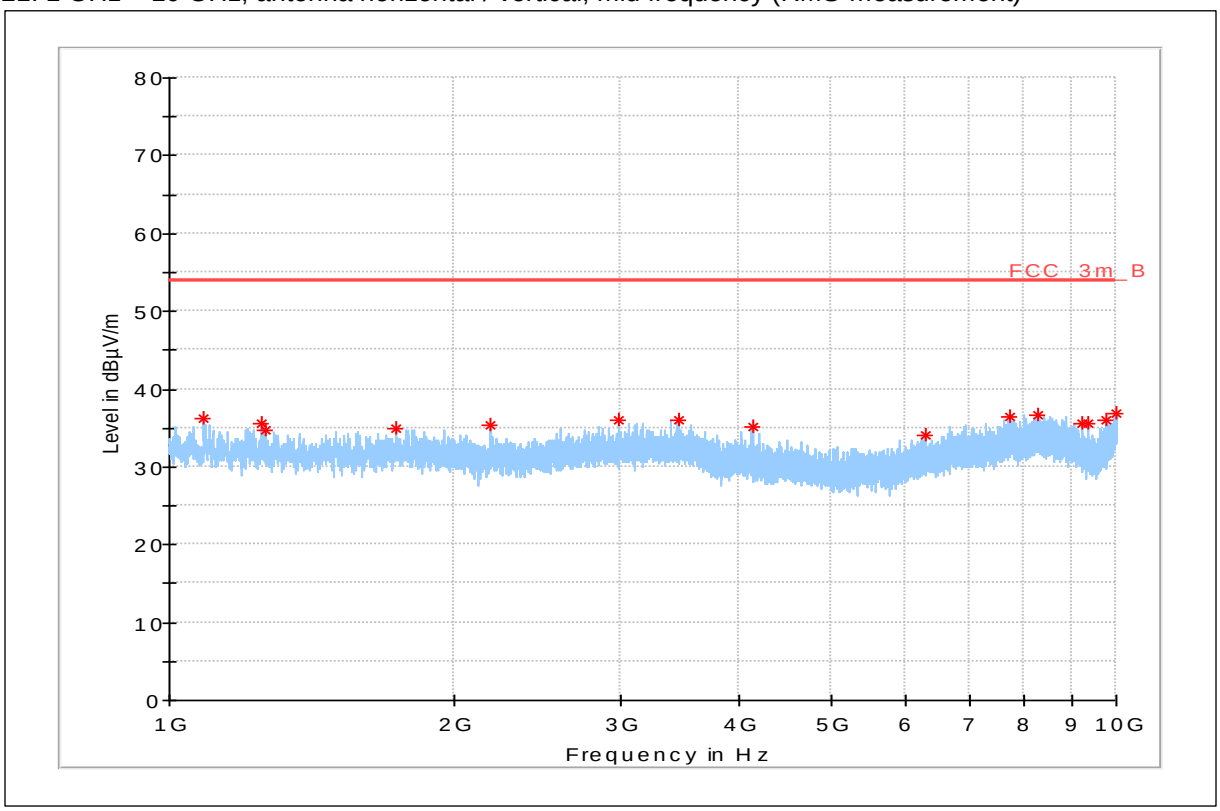


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.914500	29.64	30.00	0.36	1000.0	120.000	98.0	V	280.0	14.0
38.931750	29.55	30.00	0.45	1000.0	120.000	98.0	V	260.0	14.0
45.509700	27.10	30.00	2.90	1000.0	120.000	98.0	V	280.0	13.7
48.573150	26.08	30.00	3.92	1000.0	120.000	98.0	V	190.0	13.0
124.186800	20.67	33.50	12.83	1000.0	120.000	101.0	V	190.0	9.8
363.808650	29.66	36.00	6.34	1000.0	120.000	98.0	V	170.0	16.3

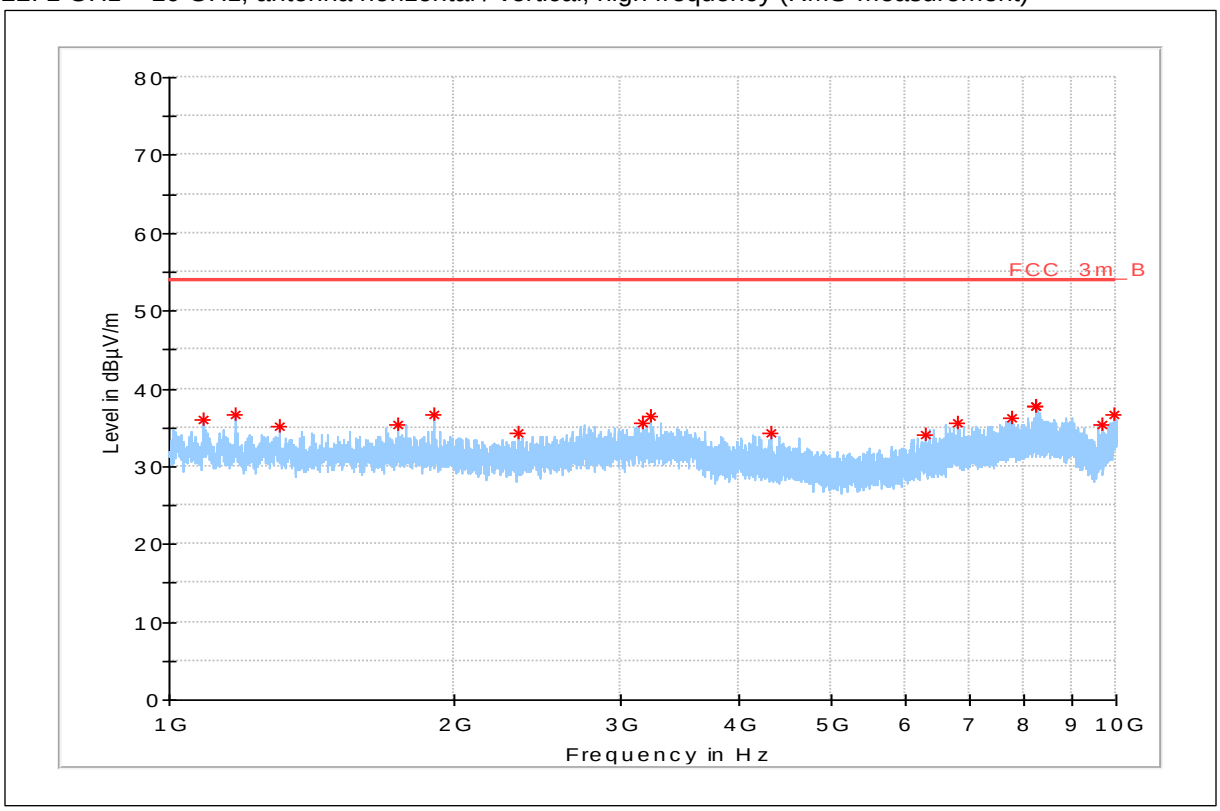
Plot 20: 1 GHz – 10 GHz, antenna horizontal / vertical, low frequency (RMS-measurement)



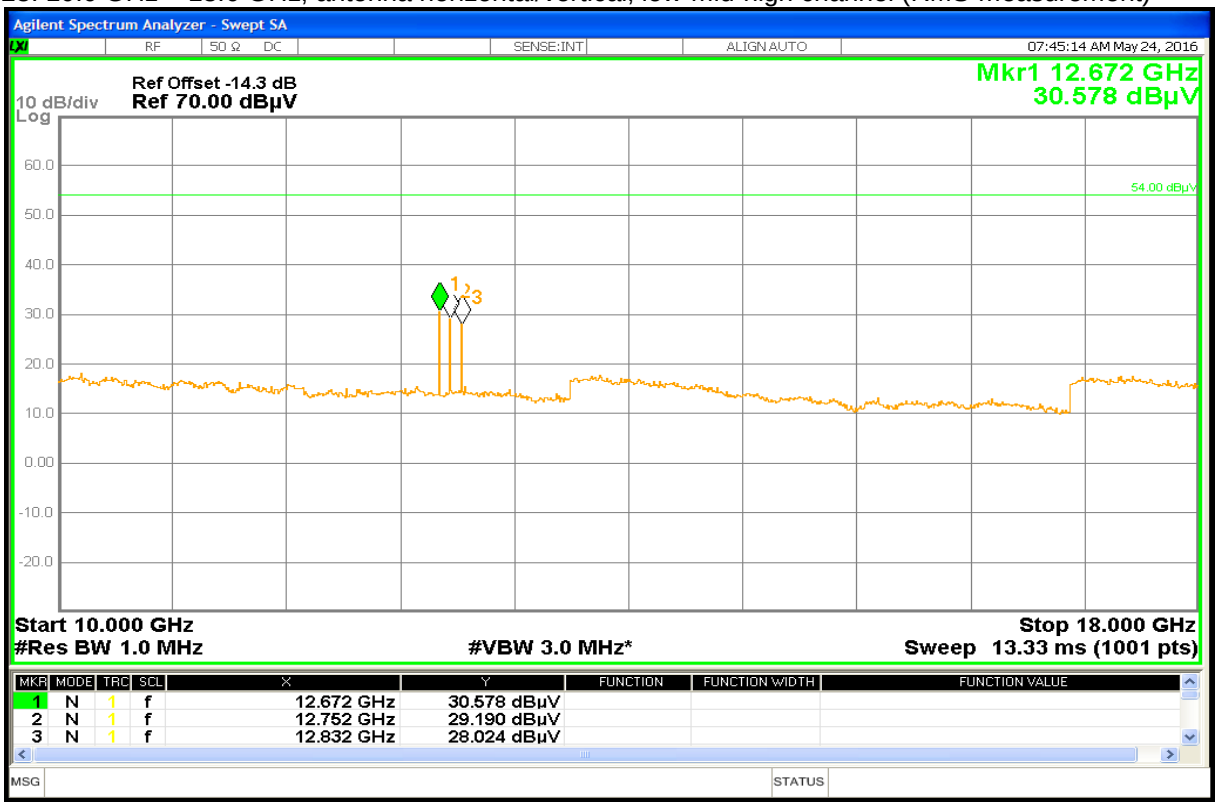
Plot 21: 1 GHz – 10 GHz, antenna horizontal / vertical, mid frequency (RMS-measurement)



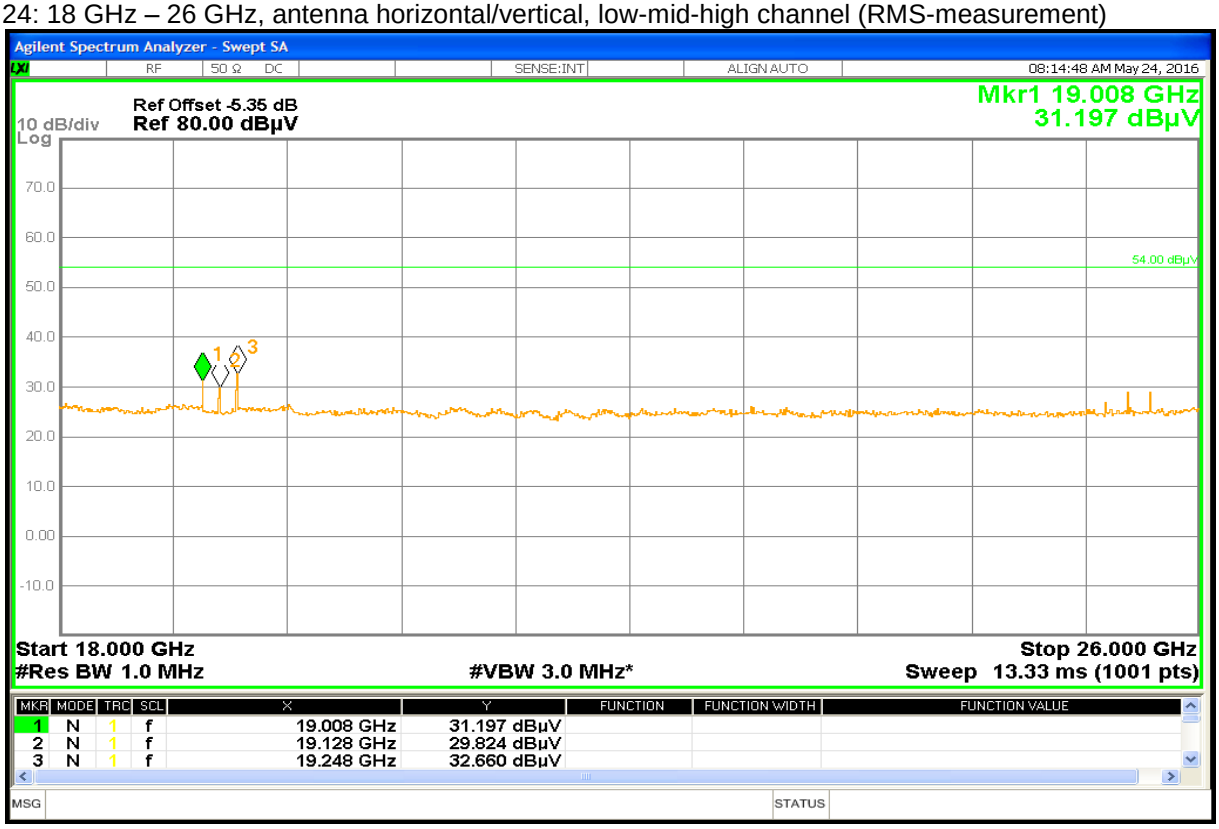
Plot 22: 1 GHz – 10 GHz, antenna horizontal / vertical, high frequency (RMS-measurement)



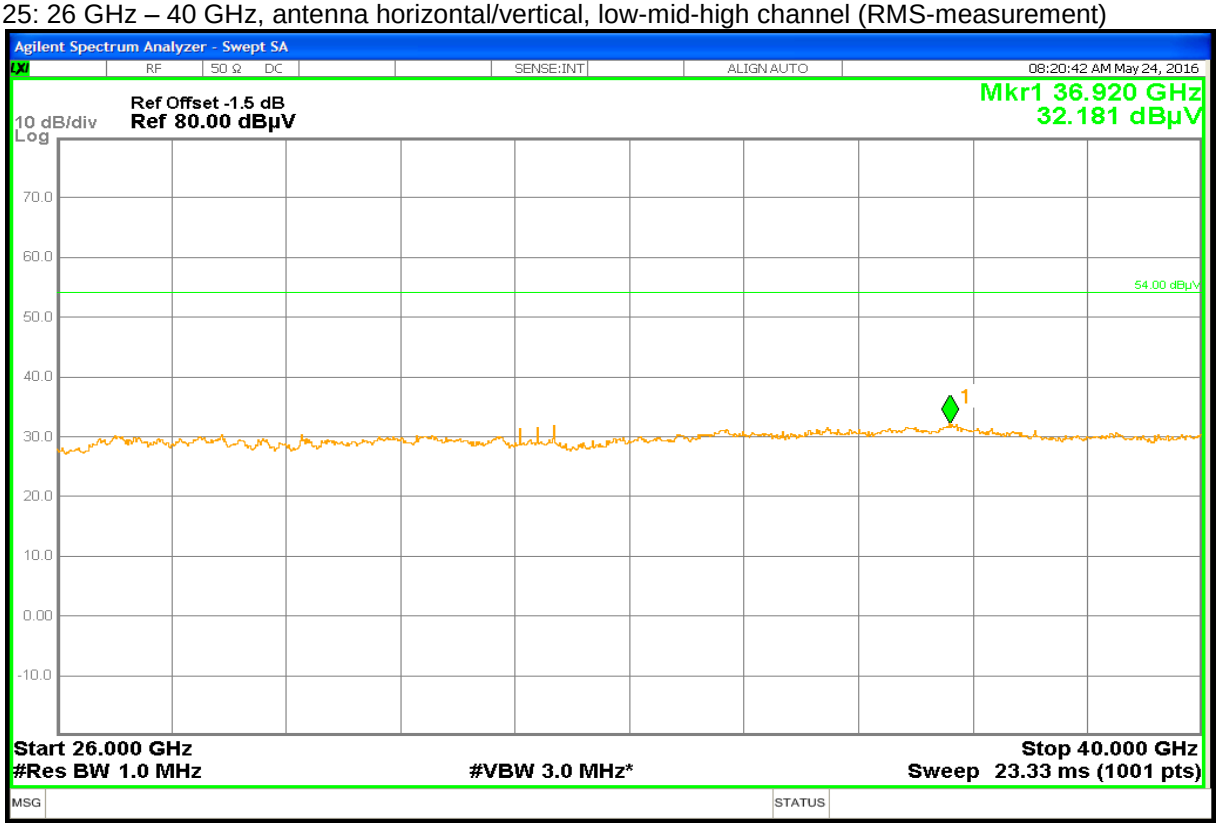
Plot 23: 10.0 GHz – 18.0 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)



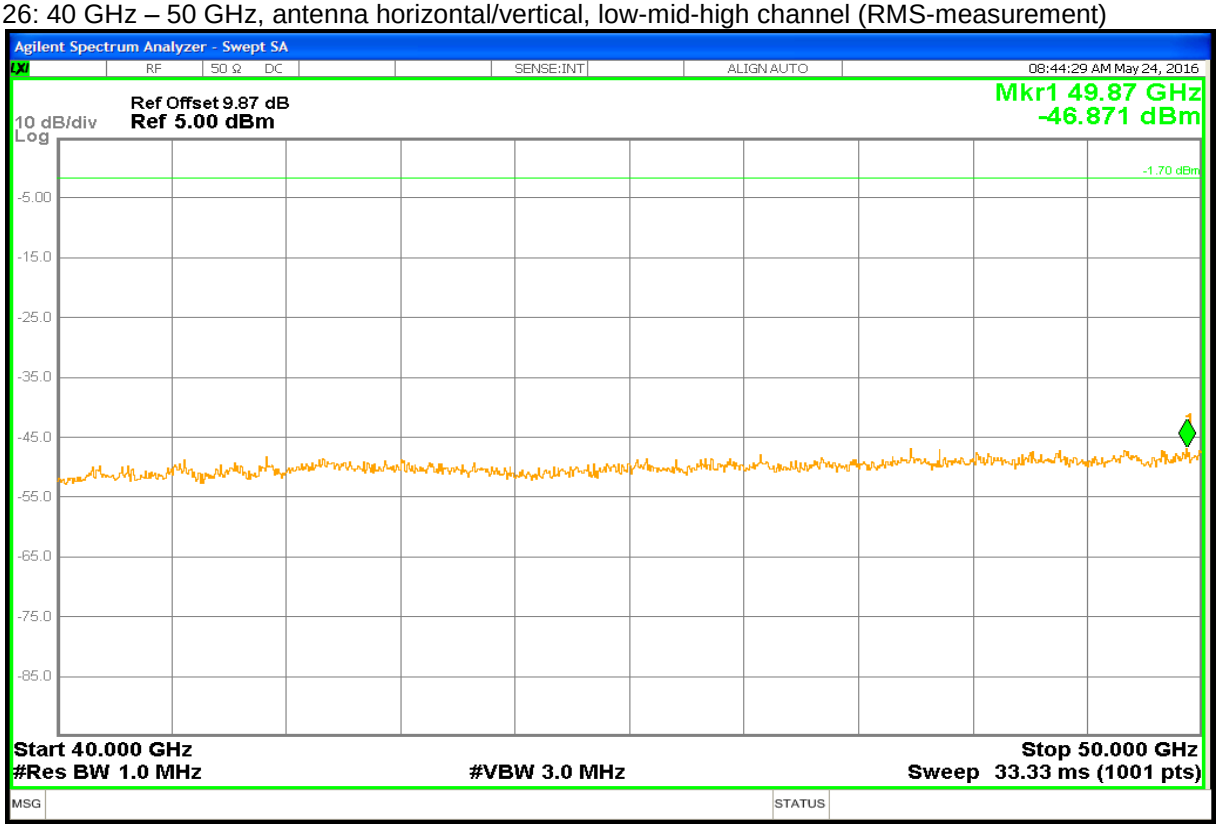
Plot 24: 18 GHz – 26 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)



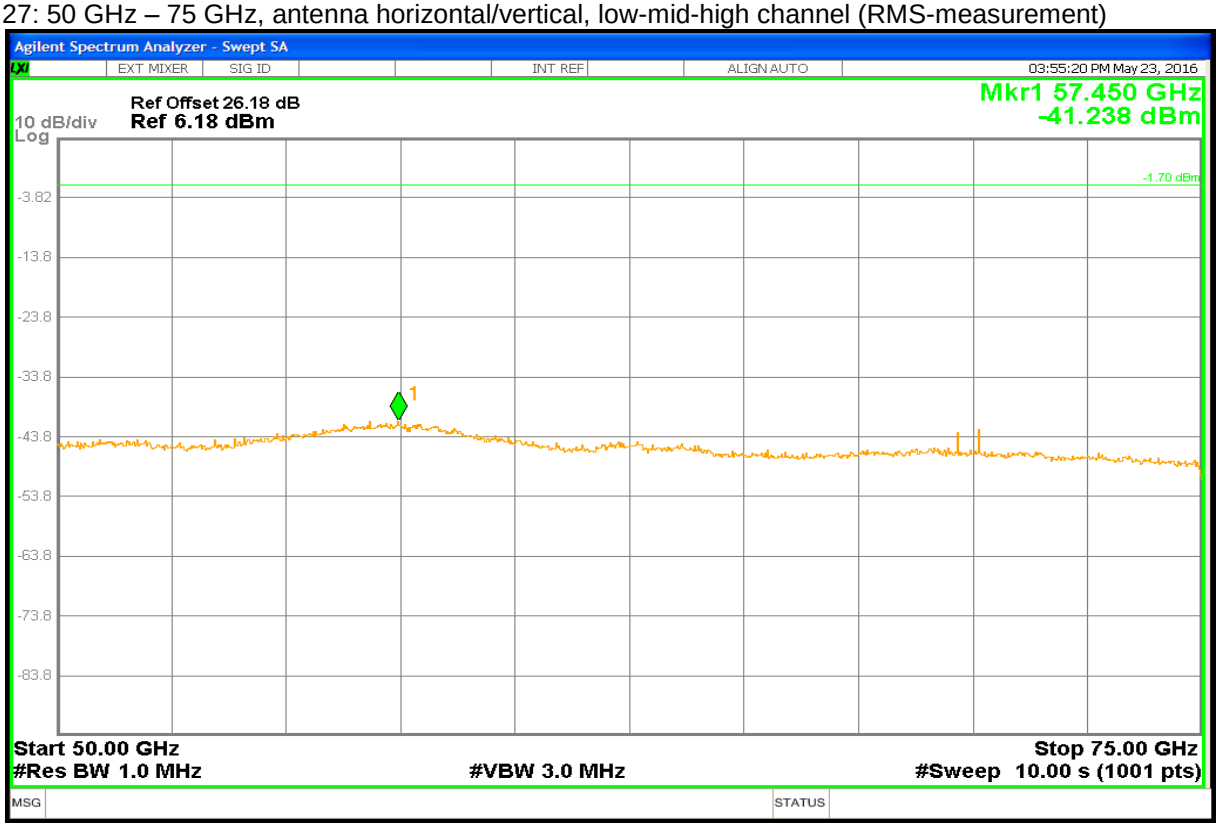
Plot 25: 26 GHz – 40 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)



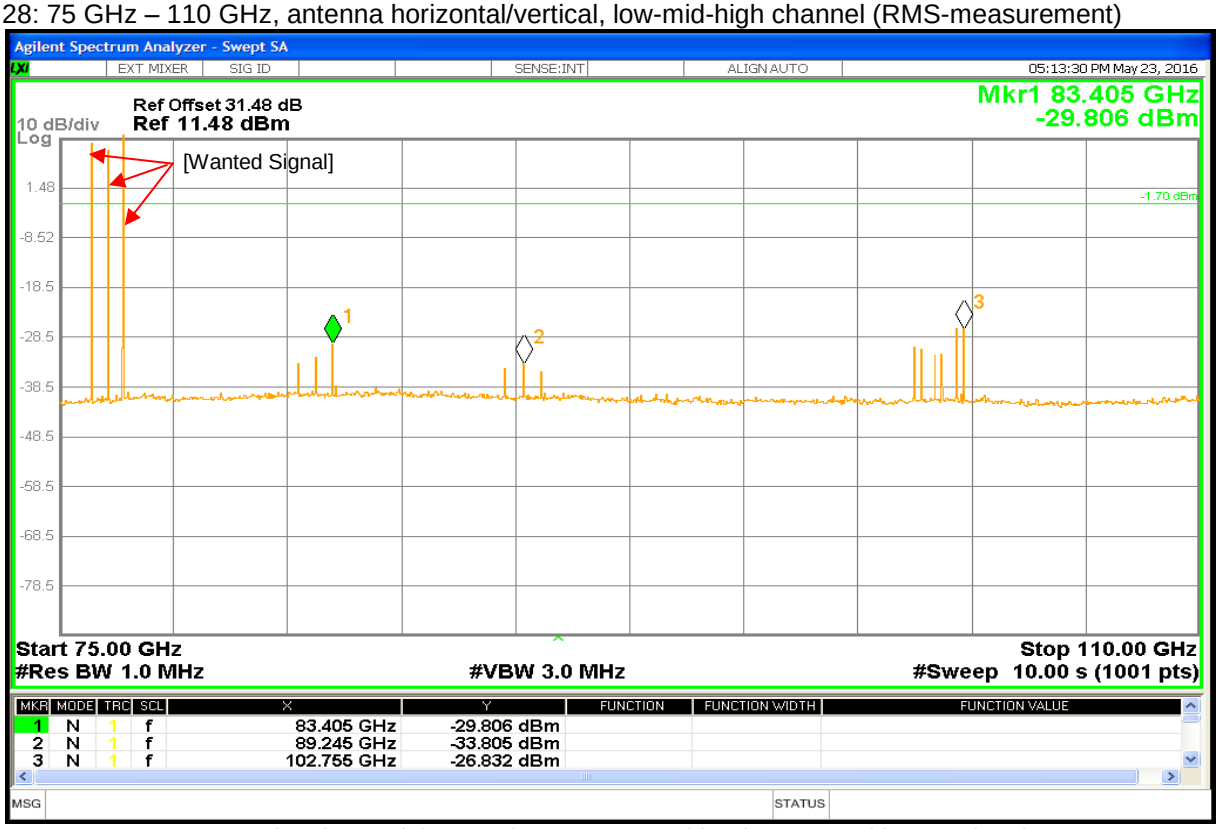
Plot 26: 40 GHz – 50 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)



Plot 27: 50 GHz – 75 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)

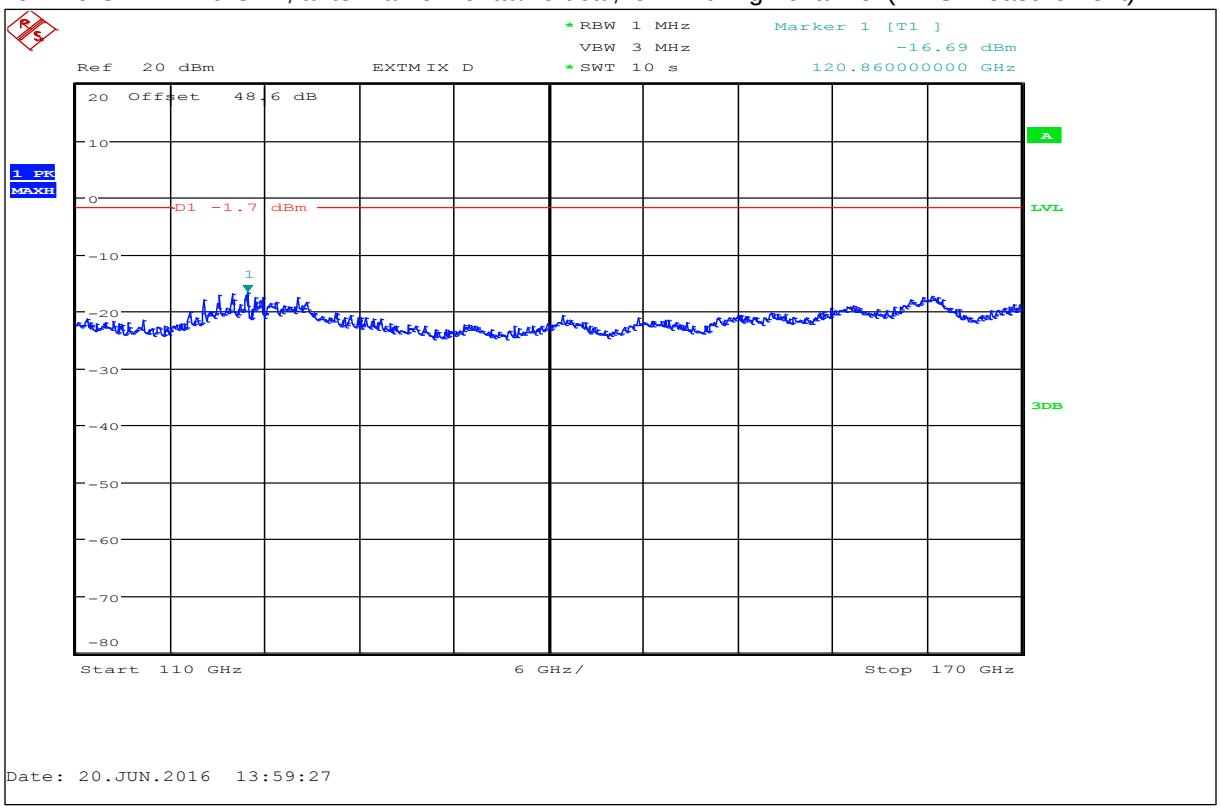


Plot 28: 75 GHz – 110 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)

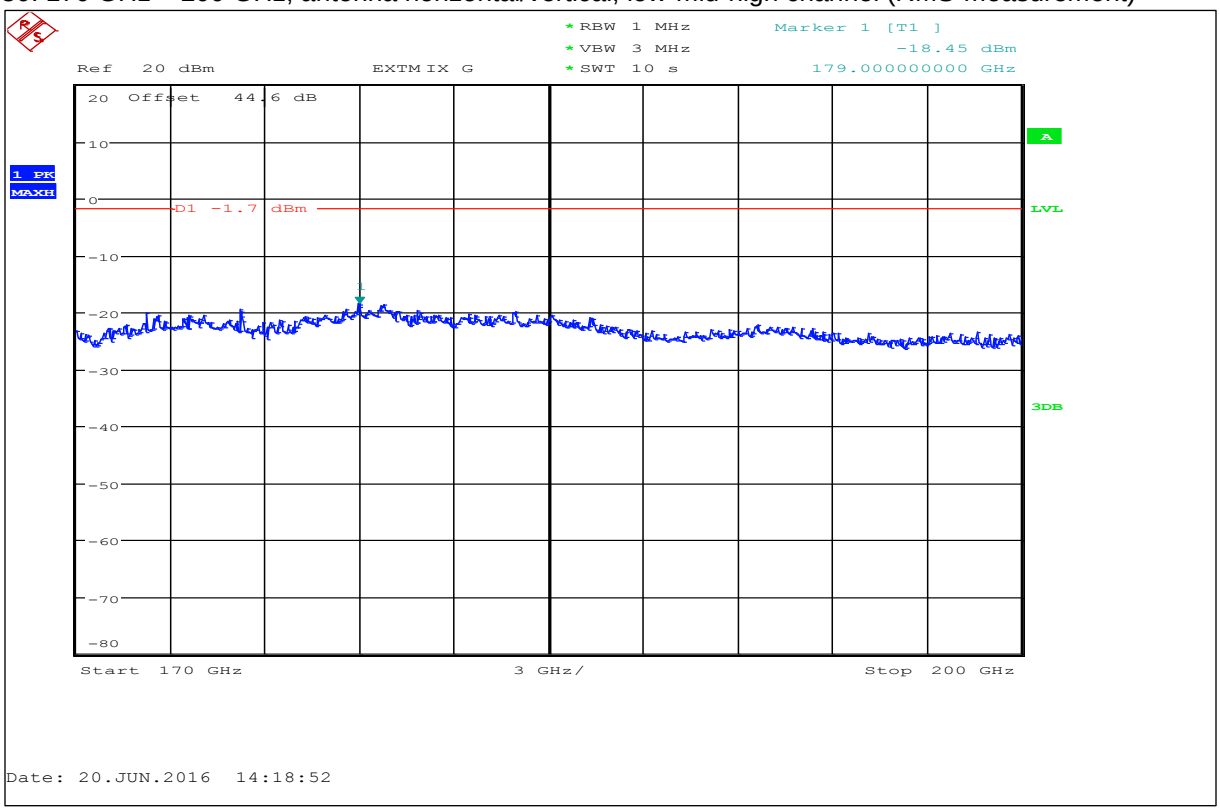


Note: Peaks show mixing products generated by the external harmonic mixer

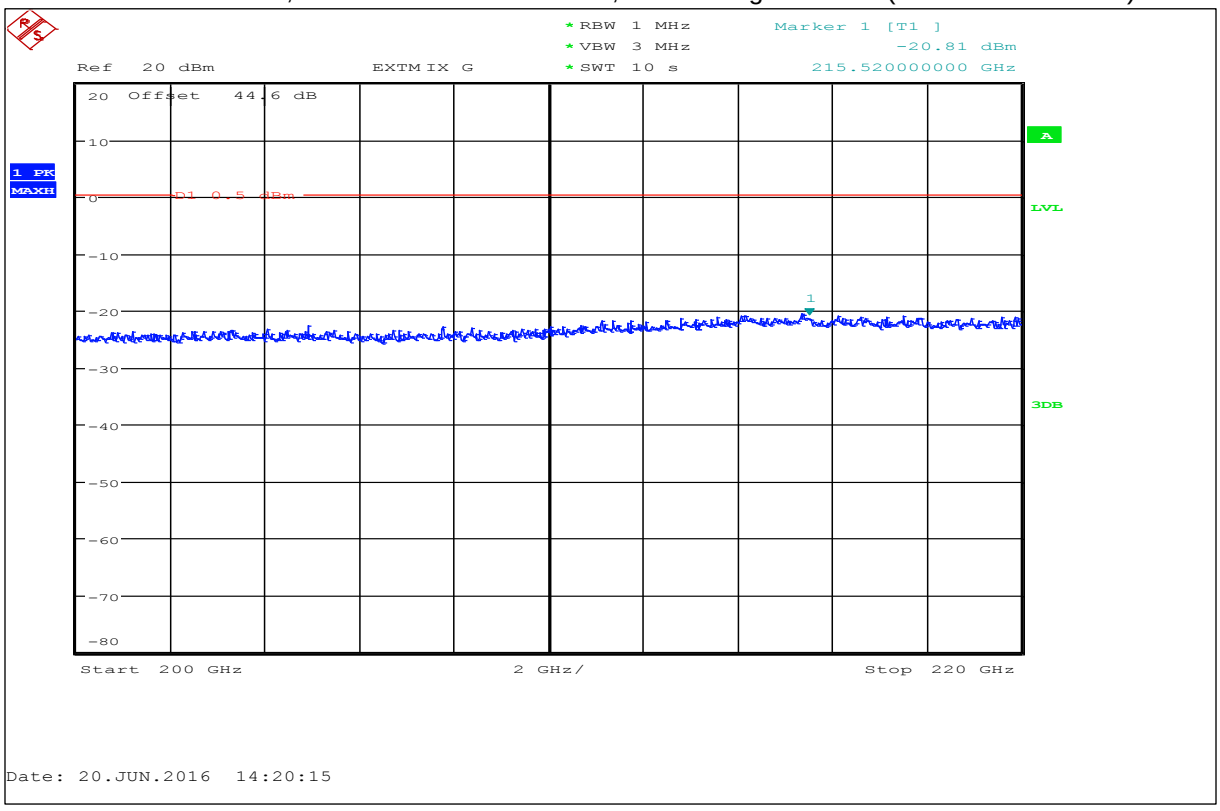
Plot 29: 110 GHz – 170 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)



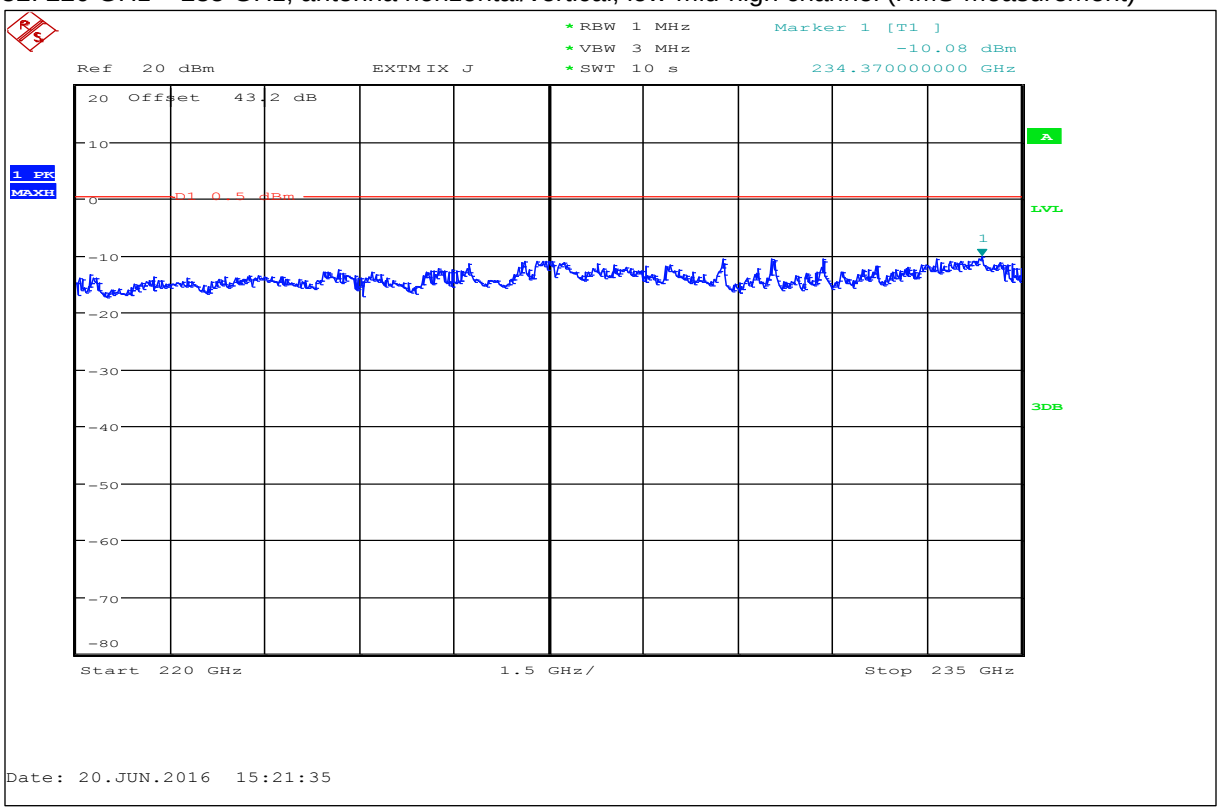
Plot 30: 170 GHz – 200 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)



Plot 31: 200 GHz – 220 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)



Plot 32: 220 GHz – 235 GHz, antenna horizontal/vertical, low-mid-high channel (RMS-measurement)



Results:

TX Spurious Emissions Radiated [dBµV/m]								
Low frequency			Mid frequency			High frequency		
F [GHz]	Detector	Level [dBµV/m]	F [GHz]	Detector	Level [dBµV/m]	F [GHz]	Detector	Level [dBµV/m]
See plots			See plots			See plots		
Measurement uncertainty			± 3 dB					

Limits: **FCC §15.253 / 15.209 / 15.205**

FCC		
CFR Part 15.253 (d) (e) / CFR Part 15.209 (a) / CFR Part 15.205		
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
960 – 40 000	54.0	3

Limits: **FCC §15.253 (e) (2) (ii) + (3)**

Limits: **RSS-251 Issue 1 / 5.3**

Frequency Range [GHz]	Measurement distance	Power Density
40 – 200	3.0 m	600 pW/cm^2 → -1.7 dBm
200 – 231	3.0 m	1000 pW/cm^2 → +0.5 dBm

Result: **The measurement is passed.**

10.5 Frequency stability

- **Low frequency**

TEST CONDITIONS	Carrier Frequency
(T_{nom} / V_{nom})	76.020
(T_{min} / $V_{min-max}$)	76.020
(T_{max} / $V_{min-max}$)	76.020

- **Mid frequency**

TEST CONDITIONS	Carrier Frequency
(T_{nom} / V_{nom})	76.500
(T_{min} / $V_{min-max}$)	76.500
(T_{max} / $V_{min-max}$)	76.500

- **High frequency**

TEST CONDITIONS	Carrier Frequency
(T_{nom} / $V_{min-max}$)	76.980
(T_{min} / $V_{min-max}$)	76.980
(T_{max} / $V_{min-max}$)	76.980

- **Normal mode**

Test Conditions	Transmitter Frequency Range (GHz)		f_H-f_L (MHz)
	f_L	f_H	
-40 °C / V_{nom}	76.050 000	76.962 000	912
-30 °C / V_{nom}	76.050 000	76.962 000	912
-20 °C / V_{nom}	76.050 000	76.962 000	912
-10 °C / V_{nom}	76.040 000	76.978 000	938
0 °C / V_{nom}	76.040 000	76.978 000	938
10 °C / V_{nom}	76.040 000	76.978 000	938
20 °C / V_{nom}	76.040 000	76.978 000	938
30 °C / V_{nom}	76.040 000	76.978 000	938
40 °C / V_{nom}	76.040 000	76.978 000	938
50 °C / V_{nom}	76.042 000	76.968 000	926
60 °C / V_{nom}	76.042 000	76.968 000	926
70 °C / V_{nom}	76.042 000	76.968 000	926
80 °C / V_{nom}	76.042 000	76.968 000	926
deviation based on 20 °C	±19.0 MHz (±132 ppm)	±16.0 MHz (±208 ppm)	

Limits: **FCC §15.253 (f)**

Limits: **RSS-251 Issue 1 / 5.1**

Frequency range	f(lowest) > 76.0 GHz	f(highest) < 77.0 GHz

Result: **The measurement is passed.**

10.6 Conducted limits

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
Resolution bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

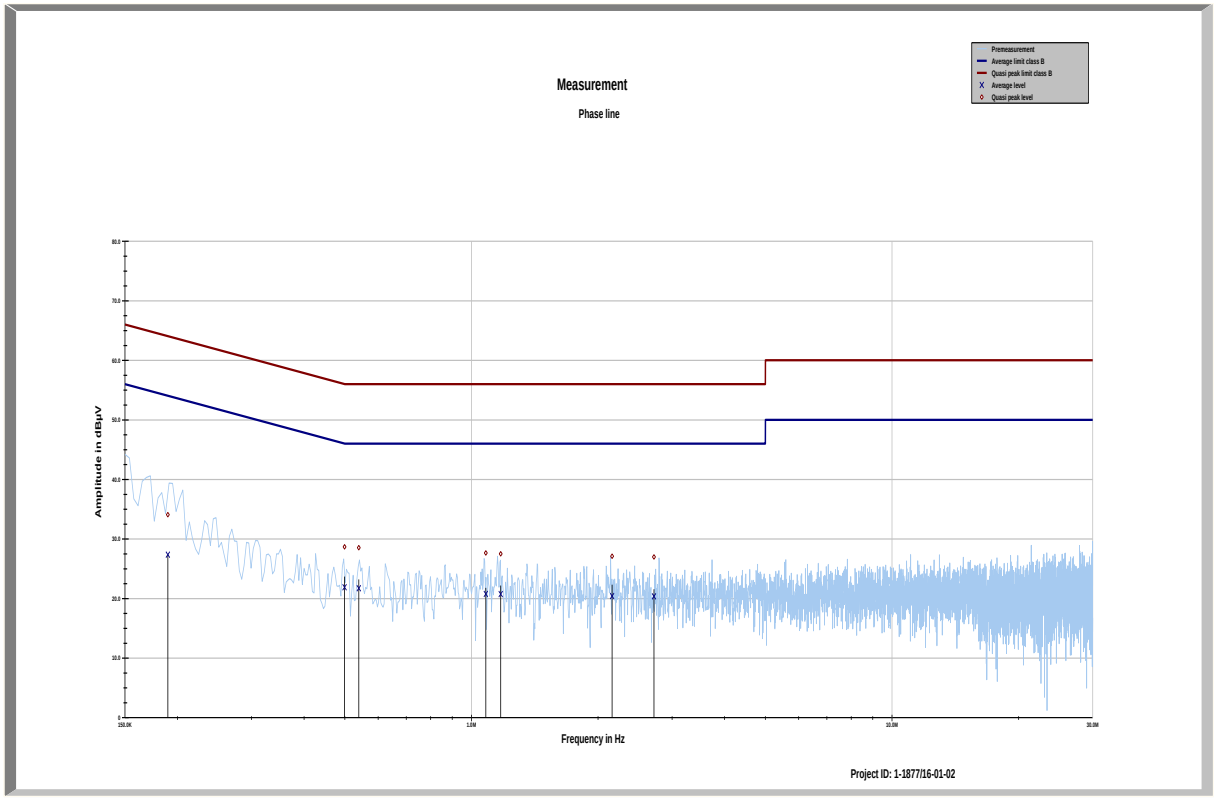
Limits:

FCC §15.107 / §15.207 / RSS-Gen, 8.8		
Conducted limits		
Frequency of Emission (MHz)	**Conducted Limit (dBµV)**	
	Quasi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 - 30	60	50

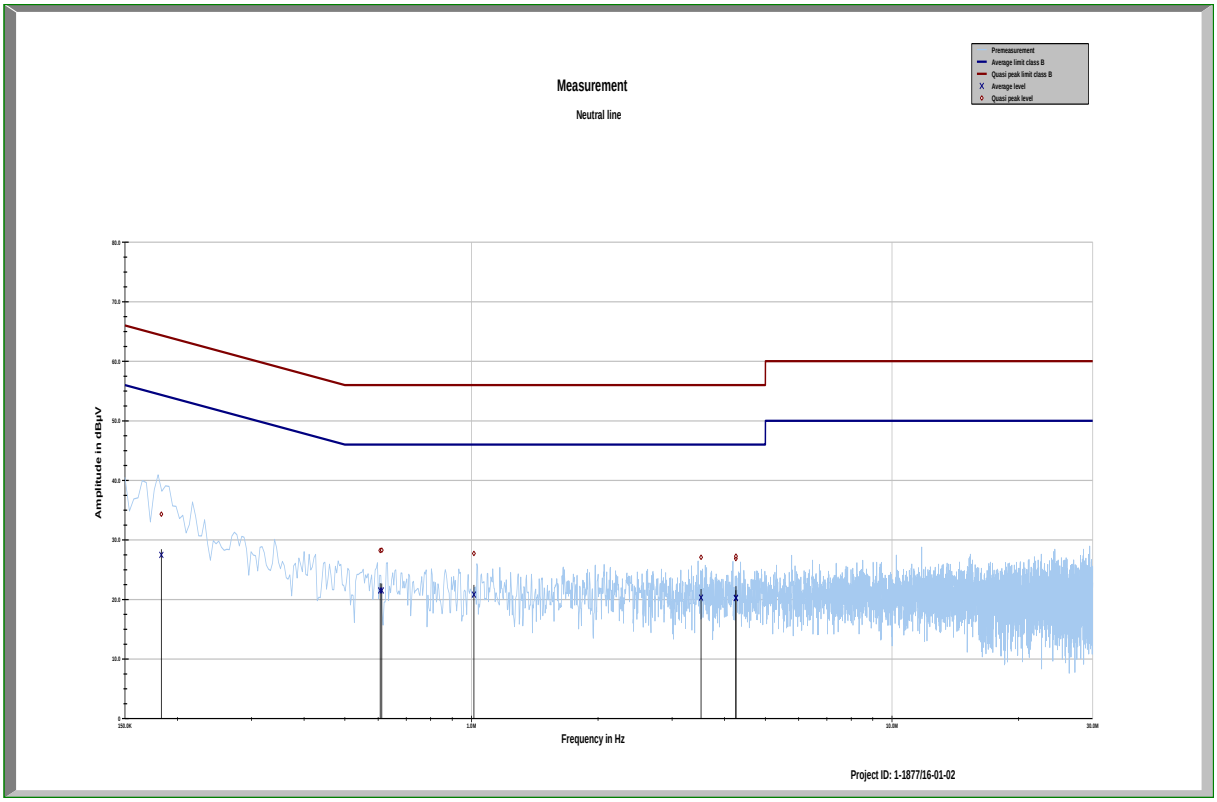
*Decreases with the logarithm of the frequency

Verdict: **Complies**

Plot 33: Phase line



Plot 34: Neutral line



Annex A Document history

Version	Applied changes	Date of release
	Initial release - DRAFT	2016-07-08
	Initial release	2016-09-26

Annex B 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

Annex C 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:

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 Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

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

Back side of certificate

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
Spittelmarkt 10
10117 Berlin

Standort Frankfurt am Main
Europa-Allee 52
60327 Frankfurt am Main

Standort Braunschweig
Bundesallee 100
38116 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate Weiterverbreitung des Deckblattes durch die umseitig genannte Konformitätsbewertungsstelle in unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

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 European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.

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.