

Radio Test Report

Test Report Reference: MDE_KROHN_2601_JRL_01_REV01

on

Level Probing Radar Optiwave 15xx series

according to:

Japanese Radio Law (ARIB_STD-T111)

79 GHz BAND HIGH-RESOLUTION RADAR

Technical standard of the Japanese Radio Law regulated by Ministry of Internal Affairs and Communications (MIC). Article 49 ff.

Target wireless equipment

Radio equipment under Article 49-14, item 15 of the Ordinance Regulating Radio Equipment

Characteristics test method

Ministry of Internal Affairs and Communications Notification No. 88 of 2004, Appendix 22-14

Test Laboratory:

7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany



Deutsche
Akkreditierungsstelle
D-PL-12140-01-00

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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1 Result Overview

General Requirements

ARIB_STD-T111					
Test Case				Test Status	Final Result
No	Description	ARIB STD/ Clause No	Article Reference Clause No	Status	
1	Radar format	T111 / 3.1.1	--	--	--
2	Type of waves	T111 / 3.1.2	--	--	--
3	Frequency	T111 / 3.1.3	OR:49-14, Table 1, Note 34 NT: No. 507 of 2011 NT: No. 432 of 2016	declared*)	--

Transmitter

ARIB_STD-T111					
Test Case				Test Status	Final Result
No	Description	ARIB STD/ Clause No	Article Reference Clause No	Status	
4	Antenna power	T111 / 3.2.1	RE: Article 4-4, Paragraph 2, Item 6 RE: Article 6, Paragraph 2(11) NT: No. 42 of 1989 NT: No. 430 of 2016	tested	passed
5	Antenna power tolerance	T111 / 3.2.2	OR: Article 14 Table 9	tested	passed
6	Frequency tolerance	T111 / 3.2.3	OR: Article 5, Table 1, Note 34(2) NT: No. 507 of 2011 NT: No. 432 of 2016	N/A	N/A
7	Permissible value of occupied bandwidth	T111 / 3.2.4	OR: Article 6, Table 2, No. 28 NT: No. 669 of 2006 NT: No. 431 of 2016	tested	passed
8	Permissible levels of unwanted emission intensity	T111 / 3.2.5	OR: Article 7, Table 3, No. 57	tested	passed

Receiver

ARIB_STD-T111					
Test Case				Test Status	Final Result
No	Description	ARIB STD/ Clause No	Article Reference Clause No	Status	
9	Limit on incidentally produced emissions	T111 / 3.3.1	OR: Article 24, Paragraph 13, Item 2 NT: No. 507 of 2011 NT: No. 432 of 2016	N/A#)	--

Controller

ARIB_STD-T111					
Test Case				Test Status	Final Result
No	Description	ARIB STD/ Clause No	Article Reference Clause No	Status	
10	Interference prevention function	T111 / 3.4.1	RE: Article 6-2, Item 5 OR: Article 9-4, Item 7	Declared*)	--

Antenna

ARIB_STD-T111					
Test Case				Test Status	Final Result
No	Description	ARIB STD/ Clause No	Article Reference Clause No	Status	
11	Antenna structure	T111 / 3.5.1	--	not specified	--
12	Antenna gain	T111 / 3.5.2	OR: Article 49-14, Item 13(b)	declared	--
13	Antenna polarisation	T111 / 3.5.3	--	not specified	--
14	Antenna configuration	T111 / 3.5.4	--	not specified	

Housing

ARIB_STD-T111					
Test Case				Test Status	Final Result
No	Description	ARIB STD/ Clause No	Article Reference Clause No	Status	
15	Housing	T111 / 3.6	OR: Article 49-14, Item 13(a)	declared	--

ARIB_STD-T111					
Test Case				Test Status	Final Result
No	Description	ARIB STD/ Clause No	Article Reference Clause No	Status	
16	Marking in relation to technical regulations conformity certification	T111 / 3.7	OTRCC: Article 8 & Article 20	declared*)	--

Key to columns:

#)	Declared by the manufacturer. The EUT has no stand-by mode. Results of "Permissible levels of unwanted emission intensity" reused
*)	Declared by the manufacturer. This declaration is not part of this test report.
OR	Ordinance Regulating Radio Equipment
RE	Regulations for Enforcement of the Radio Law
NT	Notification of the Ministry of Internal Affairs and Communication (MIC)
OTRCC	Ordinance concerning Technical Regulations Conformity Certification
No	A unique identifier for one row of the table which may be used to identify a requirement.
Description	A textual reference to the requirement.
ARIB STD/ Clause No	Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.
N/A	Test Case not applicable
N/P	Test Case not performed

2 List of measurements

Japanese Radio Law ARIB_STD-T111

Clause

RE: Article 4-4, Paragraph 2, Item 6
 RE: Article 6, Paragraph 2(11)
 NT: No. 42 of 1989
 NT: No. 430 of 2016

Antenna Power

OP-Mode

Measurement Method, Radio Technology, OBW
 Radiated, FMCW Radar, 77 – 81 GHz, 4.0 GHz

Setup

S01_AK01

Result

Passed

Japanese Radio Law ARIB_STD-T111

Clause

OR: Article 14 Table 9

Tolerance Antenna Power

OP-Mode

Measurement Method, Radio Technology, OBW
 Radiated, FMCW Radar, 77 – 81 GHz, 4.0 GHz

Setup

S01_AK01

Result

Passed

Japanese Radio Law ARIB_STD-T111

Clause

OR: Article 6, Table 2, No. 28
 NT: No. 669 of 2006
 NT: No. 431 of 2016

Permissible value of occupied bandwidth

OP-Mode

Measurement Method, Radio Technology, OBW
 Radiated, FMCW Radar, 77 – 81 GHz, 4.0 GHz

Setup

S01_AK01

Result

Passed

Japanese Radio Law ARIB_STD-T111

Clause

OR: Article 7, Table 3, No. 57

Permissible levels of unwanted emission intensity

OP-Mode

Measurement Method, Radio Technology, Frequency Range, OBW
 Radiated, FMCW Radar, 77 – 81 GHz, 30 MHz – 1 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 1 GHz – 26 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 26 GHz – 40 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 40 GHz – 60 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 60 GHz – 90 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 90 GHz – 110 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 30 MHz – 1 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 1 GHz – 26 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 26 GHz – 40 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 40 GHz – 60 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 60 GHz – 90 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 90 GHz – 110 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 30 MHz – 1 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 1 GHz – 26 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 26 GHz – 40 GHz, 4.0 GHz
 Radiated, FMCW Radar, 77 – 81 GHz, 40 GHz – 60 GHz, 4.0 GHz

Setup

S01_AK01
 S01_AK01
 S01_AK01
 S01_AK01
 S01_AK01
 S01_AK01
 S01_CB01
 S01_CB01
 S01_CB01
 S01_CB01
 S01_CB01
 S01_CB01
 S01_CB01
 S01_DB01
 S01_DB01
 S01_DB01
 S01_DB01

Result

Passed
 Passed
 Passed
 Passed
 Passed
 Passed
 Passed
 Passed
 Passed
 Passed
 Passed
 Passed
 Passed
 Passed
 Passed

Japanese Radio Law
ARIB_STD-T111
Clause

OR: Article 7, Table 3, No. 57

Permissible levels of unwanted emission intensity

OP-Mode

Measurement Method, Radio Technology, Frequency Range, OBW

Radiated, FMCW Radar, 77 – 81 GHz, 30 MHz – 1 GHz, 4.0 GHz

Setup

S01_AK01

Result

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 60 GHz – 90 GHz, 4.0 GHz

S01_DB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 90 GHz – 110 GHz, 4.0 GHz

S01_DB01

Passed

Japanese Radio Law
ARIB_STD-T111
Clause

OR: Article 24, Paragraph 13, Item 2

NT: No. 507 of 2011

NT: No. 432 of 2016

Limit on incidentally produced emissions

OP-Mode

Measurement Method, Radio Technology, Frequency Range

Radiated, FMCW Radar, 77 – 81 GHz, 30 MHz – 1 GHz, 4.0 GHz

Setup

S01_AK01

Result

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 1 GHz – 26 GHz, 4.0 GHz

S01_AK01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 26 GHz – 40 GHz, 4.0 GHz

S01_AK01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 40 GHz – 60 GHz, 4.0 GHz

S01_AK01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 60 GHz – 90 GHz, 4.0 GHz

S01_AK01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 90 GHz – 110 GHz, 4.0 GHz

S01_AK01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 30 MHz – 1 GHz, 4.0 GHz

S01_CB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 1 GHz – 26 GHz, 4.0 GHz

S01_CB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 26 GHz – 40 GHz, 4.0 GHz

S01_CB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 40 GHz – 60 GHz, 4.0 GHz

S01_CB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 60 GHz – 90 GHz, 4.0 GHz

S01_CB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 90 GHz – 110 GHz, 4.0 GHz

S01_CB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 1 GHz – 26 GHz, 4.0 GHz

S01_DB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 26 GHz – 40 GHz, 4.0 GHz

S01_DB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 40 GHz – 60 GHz, 4.0 GHz

S01_DB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 60 GHz – 90 GHz, 4.0 GHz

S01_DB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 90 GHz – 110 GHz, 4.0 GHz

S01_DB01

Passed

Radiated, FMCW Radar, 77 – 81 GHz, 1 GHz – 26 GHz, 4.0 GHz

S01_DB01

Passed

COMMENT: The EUT is a radar device which does not have a receive only mode, therefore the measurements "Permissible levels of unwanted emission intensity" are reused.

Japanese Radio Law
ARIB_STD-T111
Clause

OR: Article 49-14, Item 13(b)

Antenna Gain

OP-Mode

Measurement Method, Radio Technology

Radiated, FMCW Radar, 77 - 81 GHz

Setup

-

Result

Passed



Japanese Radio Law
ARIB_STD-T111

Clause
OR: Article 49-14, Item 13(a)

Housing

OP-Mode

Technology Group

(Tank) Level Probing Radar

Setup

S01_AK01

Result

Passed

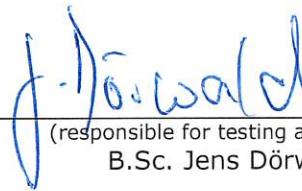
3 Revision History

Report version control			
Version	Release date	Change Description	Version validity
initial	2026-04-13	-	invalid
REV01	2026-04-20	update of calibration table	valid

COMMENT: -



(responsible for accreditation scope)
Dipl.-Ing. Marco Kullik



(responsible for testing and report)
B.Sc. Jens Dörwald



7 layers GmbH, Borsigstr. 11
40880 Ratingen, Germany
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4 Administrative Data:

4.1 Testing Laboratory

Company Name: 7layers GmbH

Address: Borsigstr. 11
40880 Ratingen
Germany

Laboratory accreditation no: DAkkS D-PL-12140-01-00

Responsible for accreditation scope: Dipl.-Ing. Marco Kullik

Report Template Version: 2023-04-20

4.2 Project Data

Responsible for testing and report: B.Sc. Jens Dörwald

Date of Report: 2026-04-20

Testing Period: 2026-02-23 to 2026-03-25

4.3 Applicant Data

Company Name: KROHNE Messtechnik GmbH

Address: Ludwig-Krohne Str. 5
47058 Duisburg
Germany

Contact Person: Mr. Charalambos Ouzounis

4.4 Manufacturer Data

Company Name: KROHNE Messtechnik GmbH

Address: Am Schürmannshütt 19
47411 Moers
Germany

Contact Person: Mr. Charalambos Ouzounis

5 Test object Data

5.1 General Description of Radio Device

Kind of Device product description	Level Probing Radar with BLE
Product name	Optiwave 15xx series
Type	DN40
Declared EUT data by the supplier	
Voltage / Battery Type	DC
Voltage high	36.0 VDC
Voltage low	12.0 VDC
Voltage normal	24.0 VDC
Temperature high	+80 °C
Temperature low	-40 °C
Temperature normal	20 °C
Antenna type / gain	Integral / 26.8 dBi
Rated Output Power	Conducted: - OBW: 4.0 GHz; 0.000008 W (-21.0 dBm) Radiated: - OBW: 4.0 GHz; 0.0040 W (6.0 dBm)
Operational frequency range	77.0 – 81.0 GHz
Nominal channel bandwidth	4.0 GHz
Type of modulation	FMCW

5.2 Tested Radio Devices

Sample Name	Sample Code	Description
EUT ak01	DE1153004ak01	
Sample Parameter	Value	
HW Version	Converter: 4008475901j HMI: 4009669601a	
SW Version	Converter: V0.00.01P27 HMI: V0.00.01P31	
Serial No.	-	
Comment	device with MMI	

Sample Name	Sample Code	Description
EUT cb01	DE1153004cb01	
Sample Parameter	Value	
HW Version	Converter: 4008475901j	
SW Version	Converter: V0.00.01P27	
Serial No.	-	
Comment	device with standard enclosure	

Sample Name	Sample Code	Description
EUT db01	DE1153004db01	
Sample Parameter	Value	
HW Version	Converter: 4008475901j	
SW Version	Converter: V0.00.01P27	
Serial No.	-	
Comment	IP68	

5.3 Tested Ancillary Equipment

Device	Details (Manufacturer, Type Model, OUT Code)	Reason for using
-	-	-

5.4 General description of auxiliary equipment

Device	Details (Manufacturer, Type Model, HW, SW, S/N)	Description
-	-	-

5.5 Used setups

Setup	Combination of EUTs, auxiliary and ancillary equipment	Description
S01_AK01	EUT ak01	-
S01_CB01	EUT cb01	-
S01_DB01	EUT db01	-

6 Test Results

6.1 Antenna Power

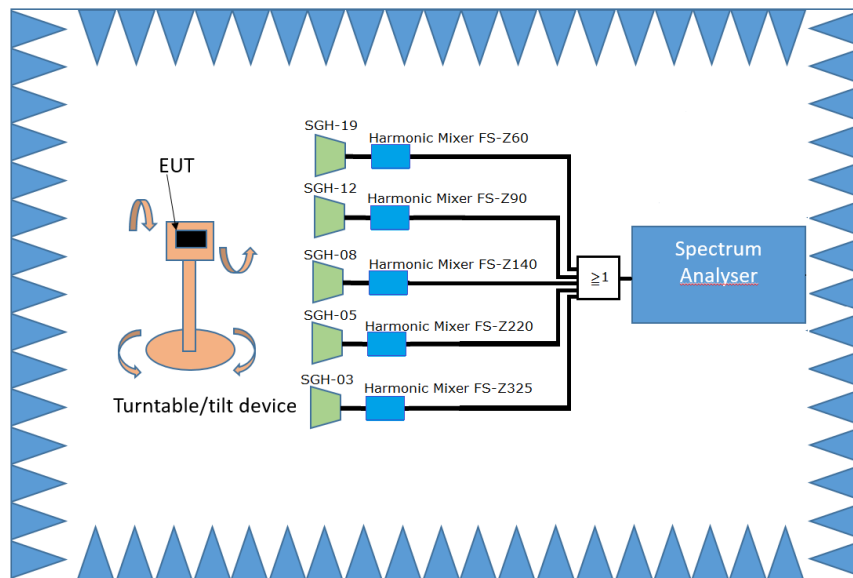
CLAUSE :

RE: Article 4-4, Paragraph 2, Item 6

RE: Article 6, Paragraph 2(11)

Test Setup:

The radiated test was performed with the following setup:



Test Setup (40 GHz - 320 GHz)

Measurement settings:

- Center Frequency: 79 GHz
- Span: 6 GHz
- RBW: 40 MHz
- VBW: 40 MHz
- Detector: RMS
- Sweeppoints: 1001
- Sweep time: 10 s
- Mode: Maxhold
- Measurement Method: Channel Power measurement function of the spectrum analyser used. *)
- Measurement distance: 1 m

*) Deviation from measurement standard: Here is an average wattmeter described for the measurement.

Measurement procedure:

A maximum search with the EUT antenna faced to measurement antenna has been performed for vertical and horizontal polarisation of the measurement antenna.

6.1.1 Limits: T111 / 3.2.1

- RE: Article 4-4, Paragraph 2, Item 6
- RE: Article 6, Paragraph 2(11)
- NT: No. 42 of 1989
- NT: No. 430 of 2016

State	Antenna Power
OBW $\geq$ 2 GHz	$\leq$ 0.01 W (+10 dBm) (Average)
OBW < 2 GHz	$\leq$ 5 μ W/MHz (-23 dBm/MHz) (RMS)

6.1.2 Test Case Details:

Ambient temperature: 24 °C
Air Pressure: 1010 hPa
Humidity: 48 %

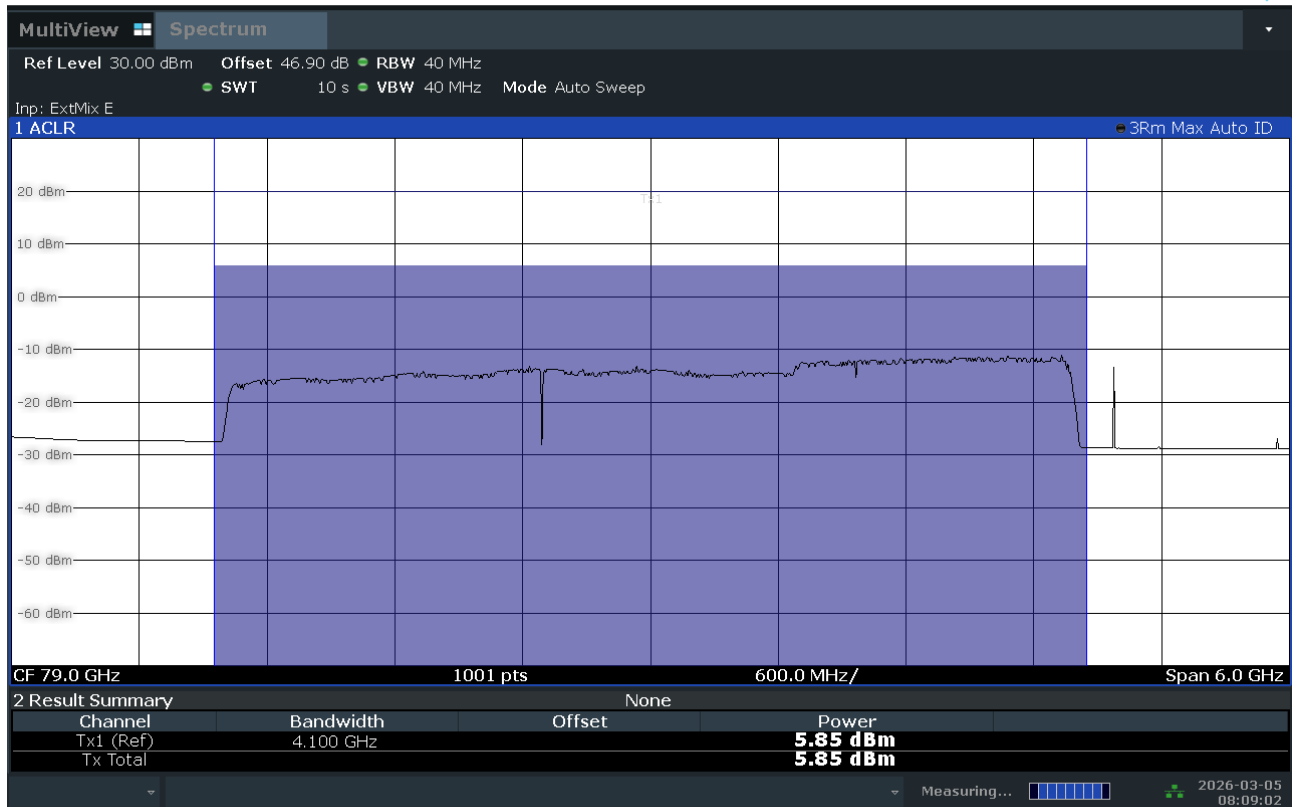
Frequency Range 77.0 - 81.0 GHz							
Operating Bandwidth	Radiated Channel Power [dBm]	Radiated Channel Power [W]	Antenna Gain [dBi]	Conducted Channel Power [dBm]	Conducted Channel Power [W]	Limit Conducted Channel Power [W]	Margin to Limit [W]
4.0 GHz	5.85	0.0039	26.8	-20.95	0.000008	0.010000	0.009992

Comments:

- The test was performed under normal temperature conditions.
- Detailed analyser settings can be found in the measurement plots.
- The measurement was performed radiated.
- The conducted channel power was calculated by subtracting the maximum antenna gain from the radiated channel power.

6.1.3 Measurement plots:

Measurement Method = Radiated, Radio Technology = FMCW Radar,
OBW = 4.0 GHz
(S01_AK01)



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TEST EQUIPMENT USED:

- Radiated Emissions

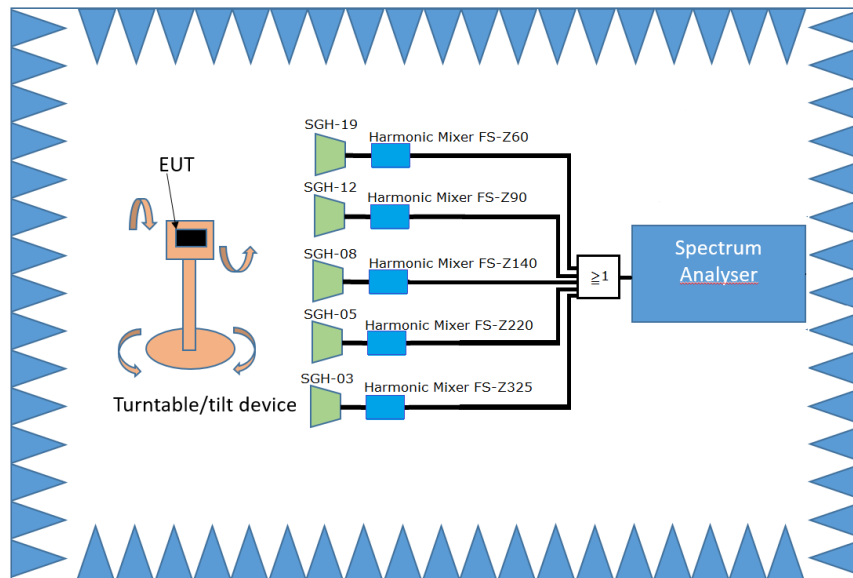
6.2 Tolerance Antenna Power

CLAUSE: OR: Article 14 Table 9

The test results of test case Antenna Power were used for this test case.

Test Setup:

The radiated test was performed with the following setup:



Test Setup (40 GHz - 320 GHz)

Measurement settings:

- Center Frequency: 79 GHz
- Span: 6 GHz
- RBW: 40 MHz
- VBW: 40 MHz
- Detector: Peak *)
- Sweptime: 10 s
- Mode: Maxhold
- Measurement Method: Channel Power measurement function of the spectrum analyser used. *)

*) Deviation from measurement standard: Here is an average wattmeter described for the measurement.

6.2.1 Limits: T111 / 3.2.1

- OR: Article 14 Table 9

OR Article 14.9

State	Tolerance for Antenna Power
All systems	$-70 \% \leq P_{ANT} \leq +50 \%$

6.2.2 Test Case Details:

Ambient temperature: 24 °C
Air Pressure: 1010 hPa
Humidity: 48 %

Frequency Range 77.0 - 81.0 GHz						
Operating Bandwidth	Rated Radiated Channel Output Power [W]	Measured Radiated Channel Output Power [W]	Minimum Output Power (-70%) [W]	Maximum Output Power (+50%) [W]	Margin to Lower Limit [W]	Margin to Upper Limit [W]
4.0 GHz	0.0040	0.0039	0.0028	0.0060	0.0011	0.0021

Comments:

- The test was performed under normal temperature conditions.
- Detailed analyser settings can be found in the measurement plots.
- The measurement was performed radiated.
- Measurement results from the tests case "ANTENNA POWER" were used.

TEST EQUIPMENT USED:

- Radiated Emissions

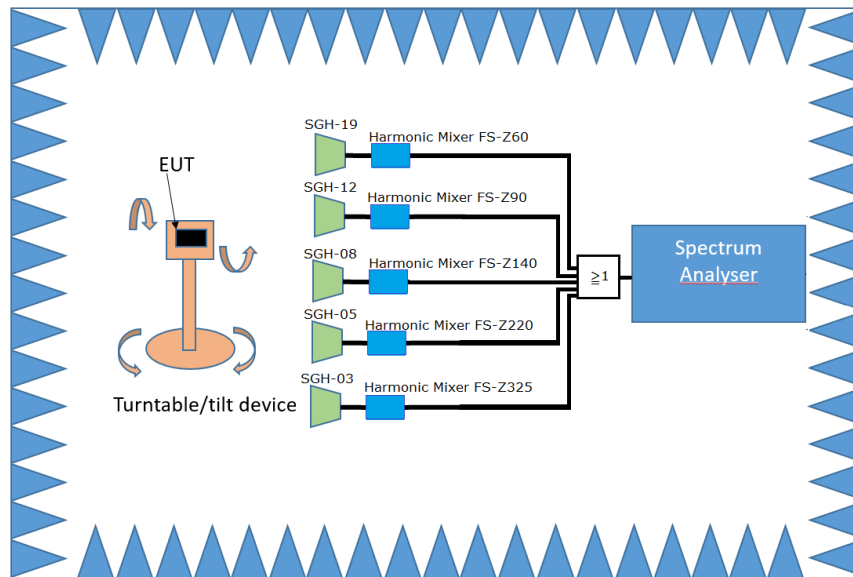
6.3 Permissible value of occupied bandwidth

CLAUSE:

OR: Article 6, Table 2, No. 28

Test Setup:

The radiated test was performed with the following setup:



Test Setup (40 GHz - 320 GHz)

Measurement settings:

- Center Frequency: 79 GHz
- Span: 6 GHz
- RBW: 1 MHz
- VBW: 1 MHz
- Detector: Peak
- Sweptime: 10 s
- Sweep points: 1000
- Mode: Maxhold
- Measurement Method: delta markers of the analyser used

See Analyser plots for details.

6.3.1 Limits: T111 / 3.2.1

- OR: Article 6, Table 2, No. 28
- NT: No. 669 of 2006
- NT: No. 431 of 2016

State	Occupied bandwidth
All devices	≤ 4 GHz

6.3.2 Test Case Details:

Ambient temperature: 23 °C
Air Pressure: 1015 hPa
Humidity: 48 %

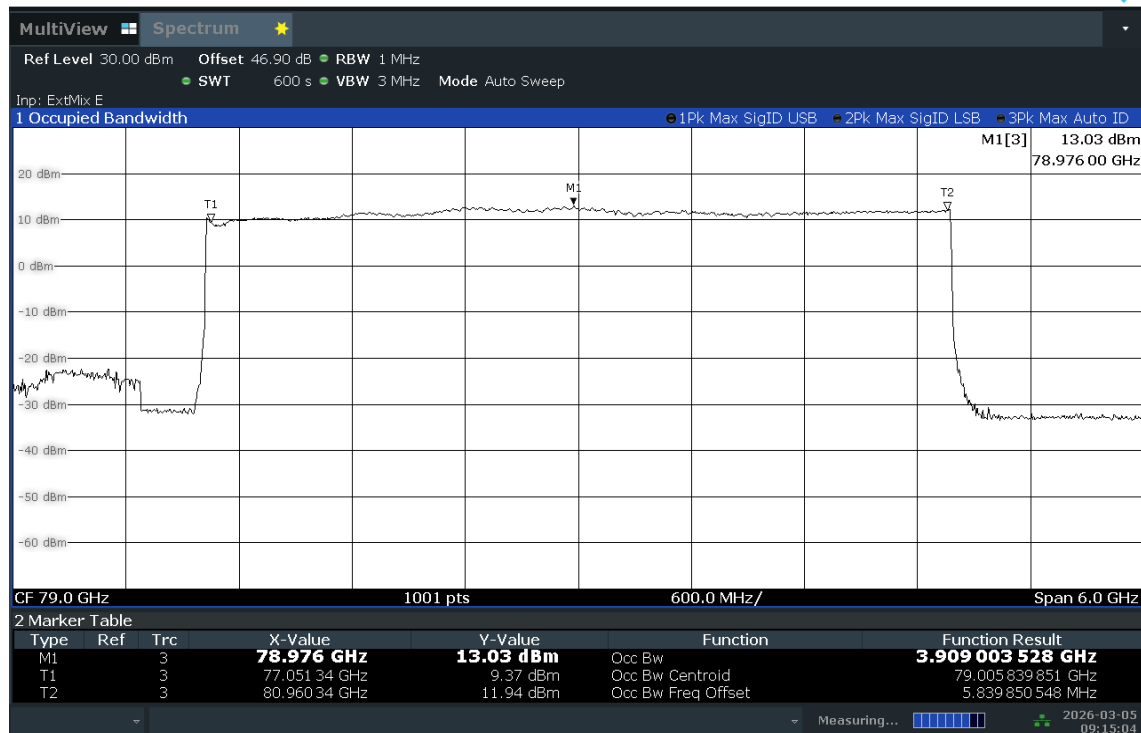
Frequency Range: 77.0 - 81.0 GHz						
Operating Bandwidth	Frequency fc [GHz]	Lower 99 % Frequency fL [GHz]	Upper 99 % Frequency fH [GHz]	Occupied Bandwidth [GHz]	Limit Occupied Bandwidth [GHz]	Margin to Limit [GHz]
4.0 GHz	78.976	77.0513	80.9603	3.909	4.000	0.091

Comments:

- The test was performed under normal temperature conditions.
- Detailed analyser settings can be found in the measurement plots.
- The measurement was performed radiated.

6.3.3 Measurement plots:

Measurement Method = Radiated, Radio Technology = FMCW Radar,
 OBW = 4.0 GHz
 (S01_AK01)



09:15:05 AM 03/05/2026

TEST EQUIPMENT USED:

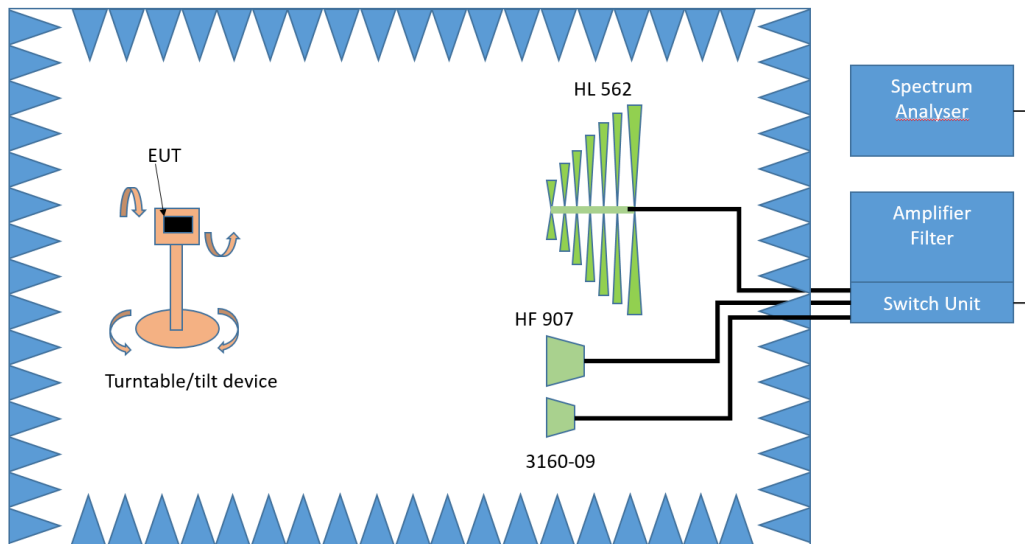
- Radiated Emissions

6.4 Permissible Level of unwanted emissions intensity **CLAUSE** OR: Article 7, Table 3, No. 57

Test Setup:

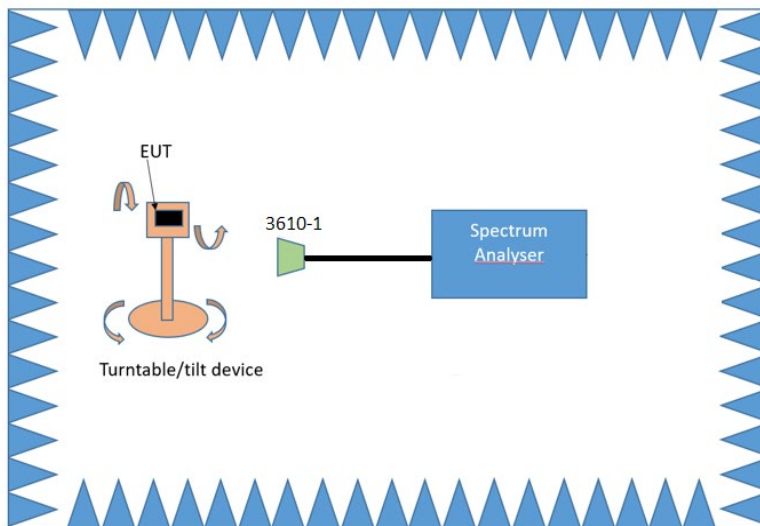
The test was performed with the following setups:

Frequency range: 30 MHz – 26 GHz



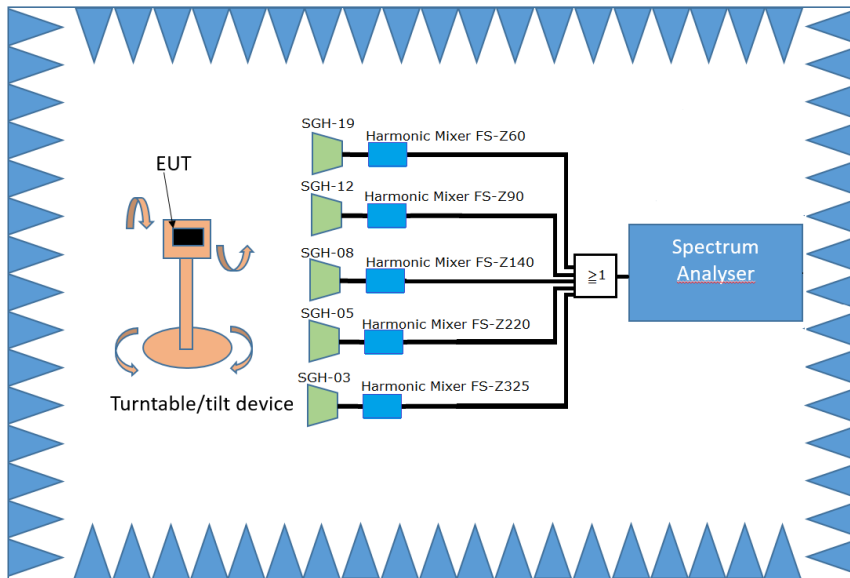
Test Setup; Spurious Emission Radiated (FAC)

Frequency range: 26 GHz – 40 GHz



Test Setup (26 - 40 GHz)

Frequency range: 40 GHz – 110 GHz



Test Setup (40 GHz - 320 GHz)

Measurement settings:

- Measurement is split into four sweeps:
- RBW: 1 MHz
- VBW: 3 MHz
- Detector: Max Peak
- Sweptime: coupled
- Trace: Maxhold
- Allow the trace to stabilize

6.4.1 Limits: T111 / 3.2.5

- OR: Article 7, Table 3, No. 57

State	Frequency range	Limit [dBm/MHz]
All- Systems Transmitter Operating	Out-of-band • 72.5 GHz to 77.0 GHz • 81.0 GHz to 85.5 GHz	100 μ W (- 10 dBm) in any arbitrary 1 MHz bandwidth
	Spurious • 30 MHz to 72.5 GHz • 85.5 GHz to 110.0 GHz	50 μ W (- 13 dBm) in any arbitrary 1 MHz bandwidth

6.4.2 Test Case Details:

Ambient temperature: 25- 27 °C
Relative humidity: 48 %
Air Pressure: 990 - 1000 hPa

Frequency [MHz]	Spurious Level Peak Detector [dBm]	Spurious Level Peak Detector [μ W]	RBW [kHz]	Limit [μ W]	Margin to Limit [μ W]
-	-	-	1000	-	>3/4 Limit

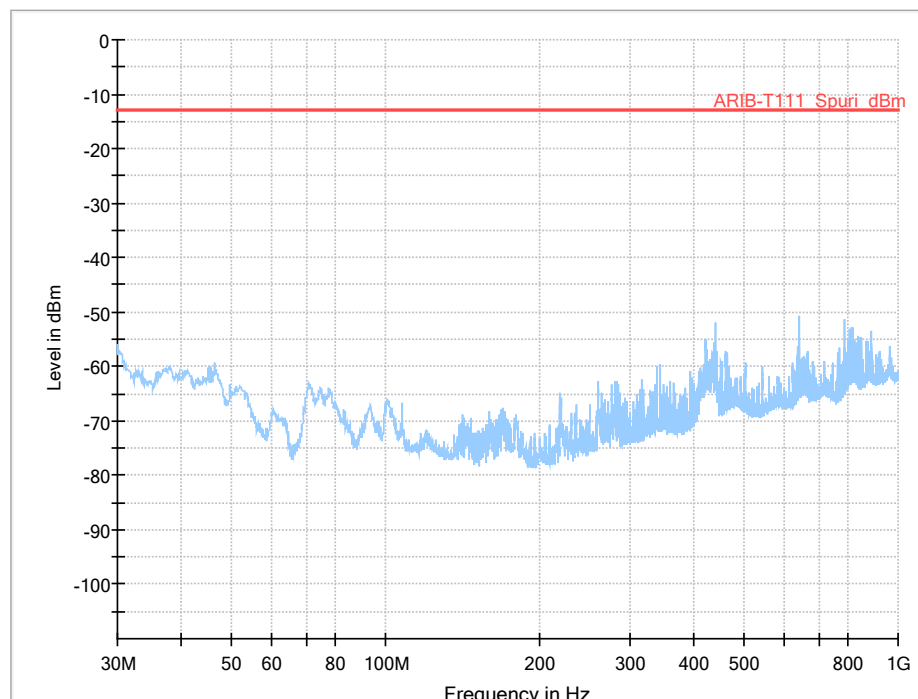
Comments:

All tests are performed under normal temperature conditions.

- At least spurious emission that exceeds the limit values given in the table below or that come within 6 dB below these values are listed in the table above.
- Such values have not been found.
- Because no antenna mast with automatic polarisation control is available above 26 GHz, are two plots per measurement provide. The plots in the frequency below 26 GHz show the worst-case values of both measurement polarisations

6.4.3 Measurement plots:

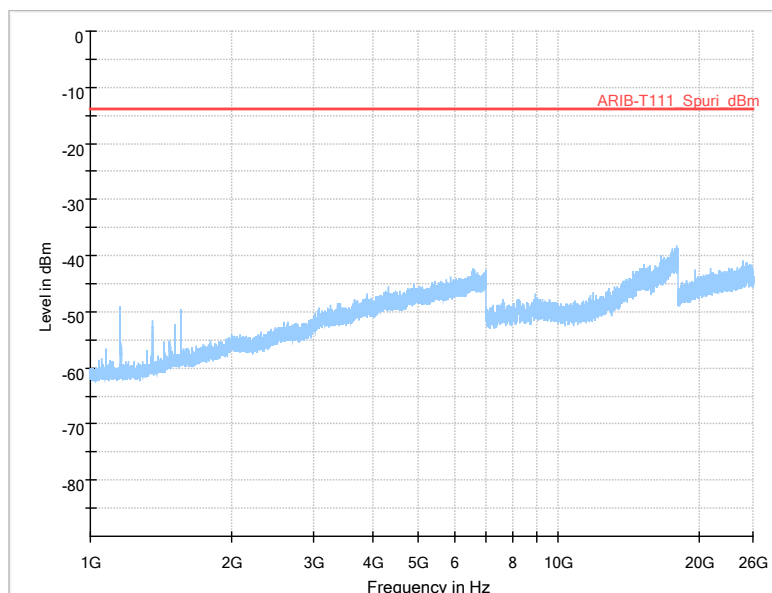
Measurement Method = Radiated, Radio Technology = FMCW Radar,
 Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
 Measurement range 30 MHz – 1 GHz
 (S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

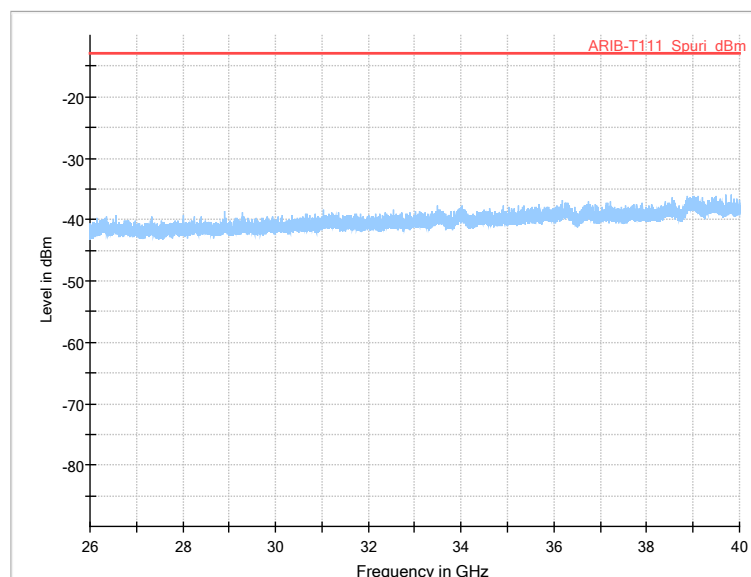
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 1 GHz – 26 GHz
(S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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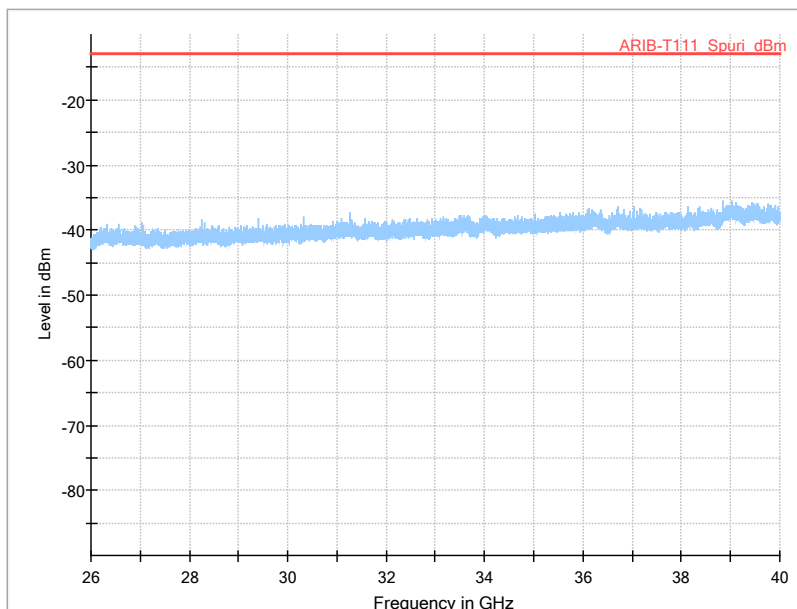
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 26 GHz – 40 GHz, Antenna = horizontal
(S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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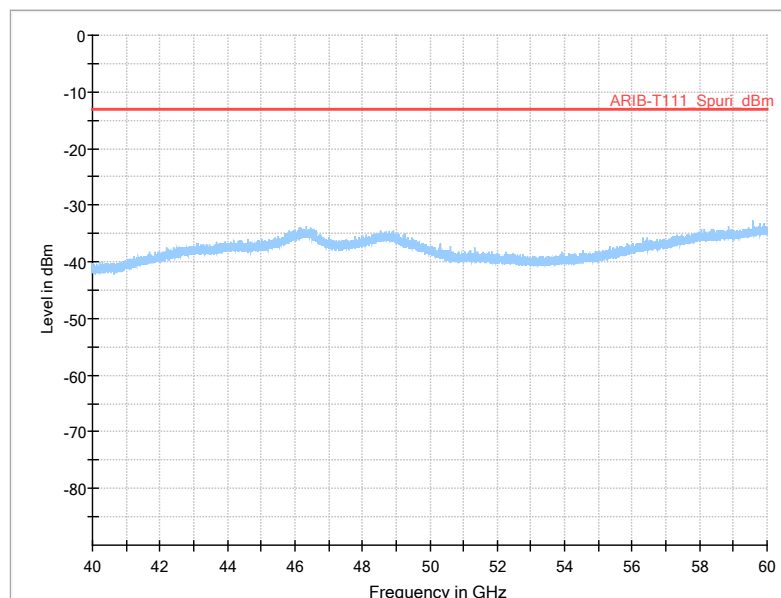
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 26 GHz – 40 GHz, Antenna = vertical
(S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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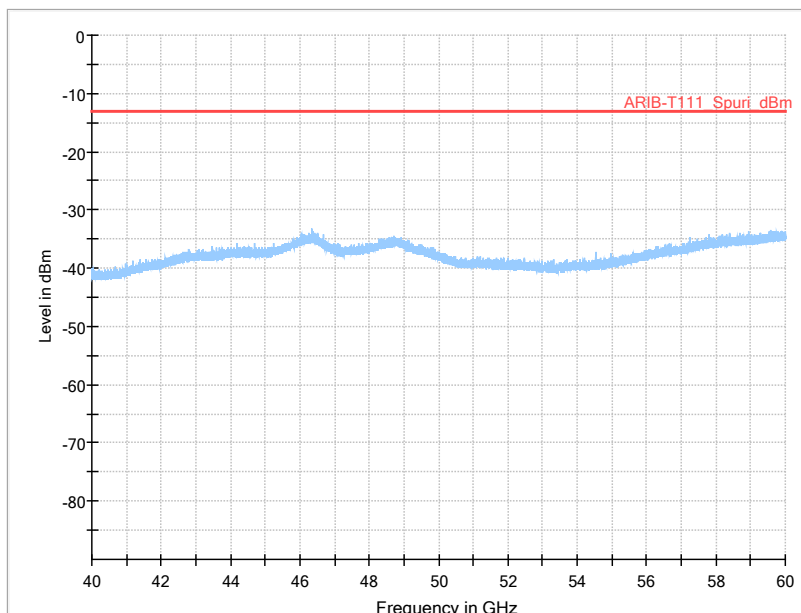
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 40 GHz – 60 GHz, Antenna = horizontal
(S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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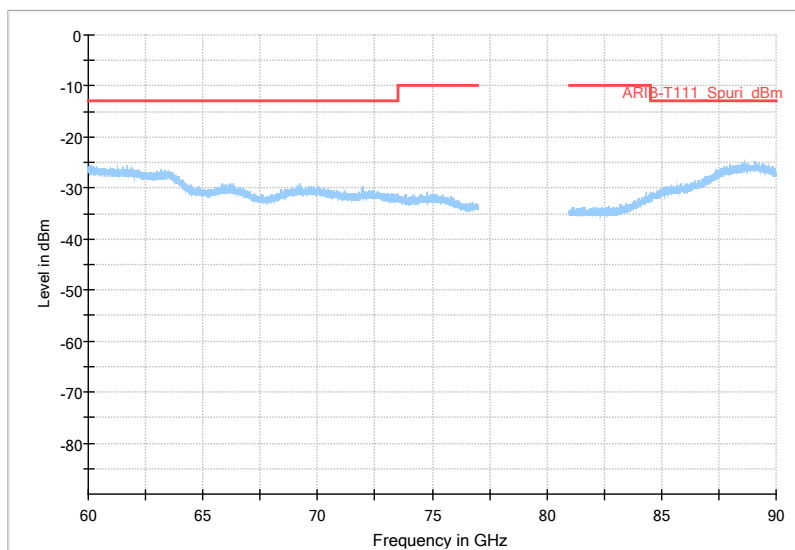
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 40 GHz – 60 GHz, Antenna = vertical
(S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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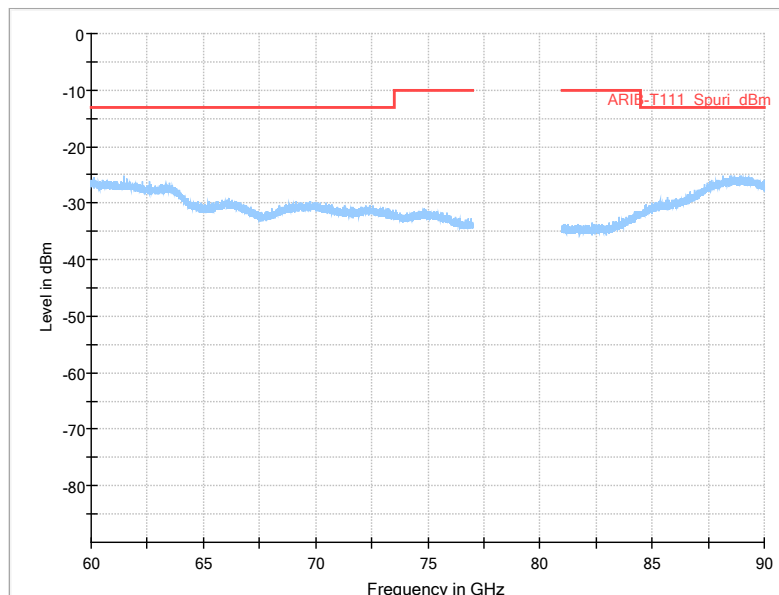
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 60 GHz – 90 GHz, Antenna = horizontal
(S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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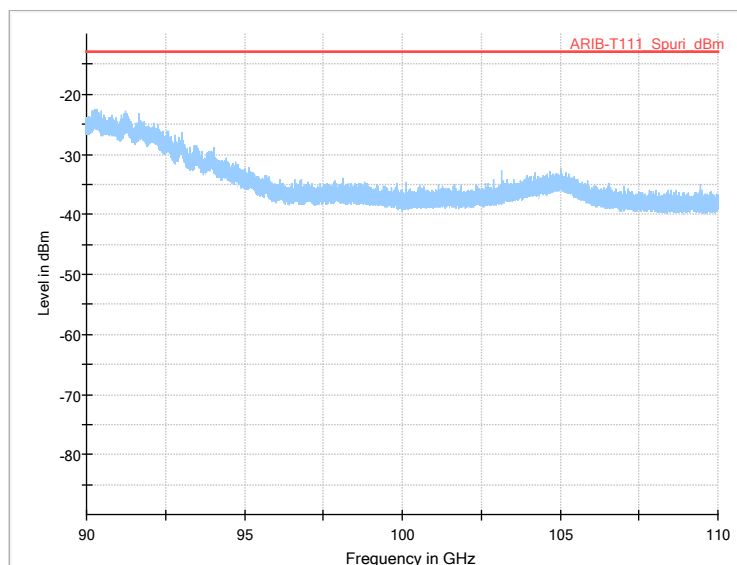
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 60 GHz – 90 GHz, Antenna = vertical
(S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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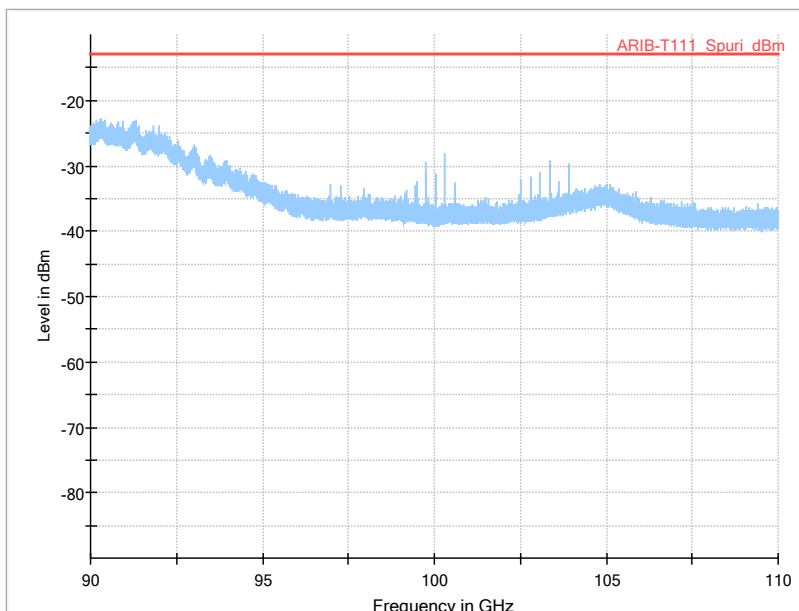
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 90 GHz – 110 GHz, Antenna = horizontal
(S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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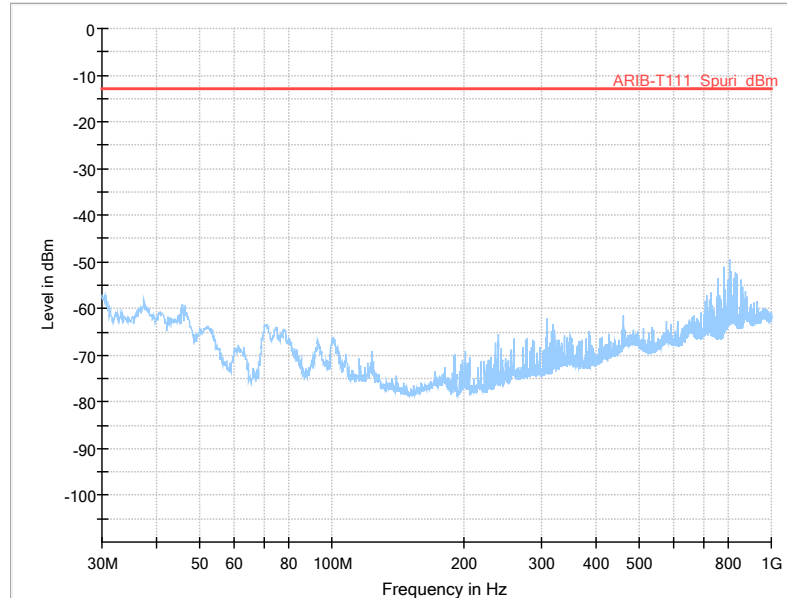
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 - 81 GHz, OBW = 4.0 MHz
Measurement range 90 GHz - 110 GHz, Antenna = vertical
(S01_AK01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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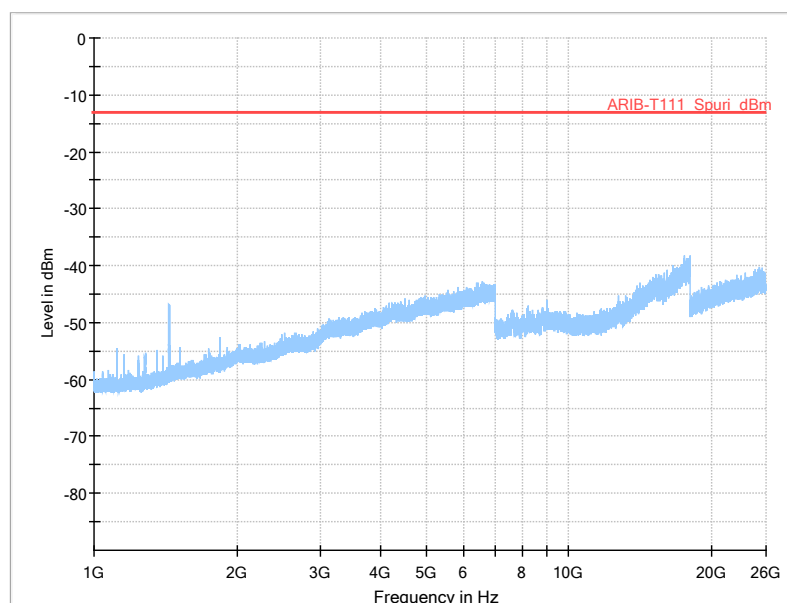
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 30 MHz – 1 GHz
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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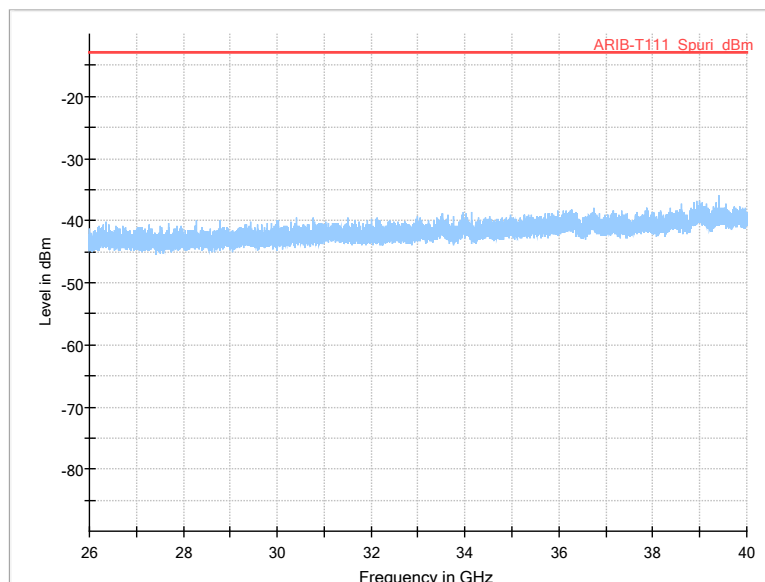
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 1 GHz – 26 GHz
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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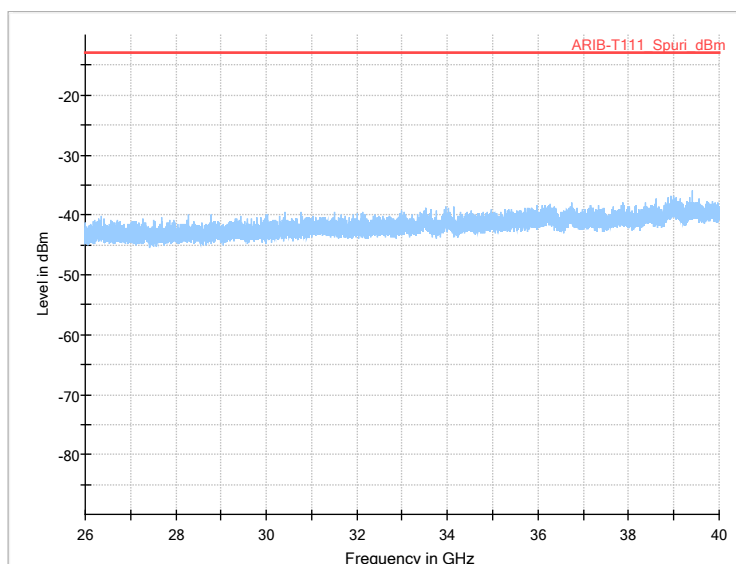
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 26 GHz – 40 GHz, Antenna = horizontal
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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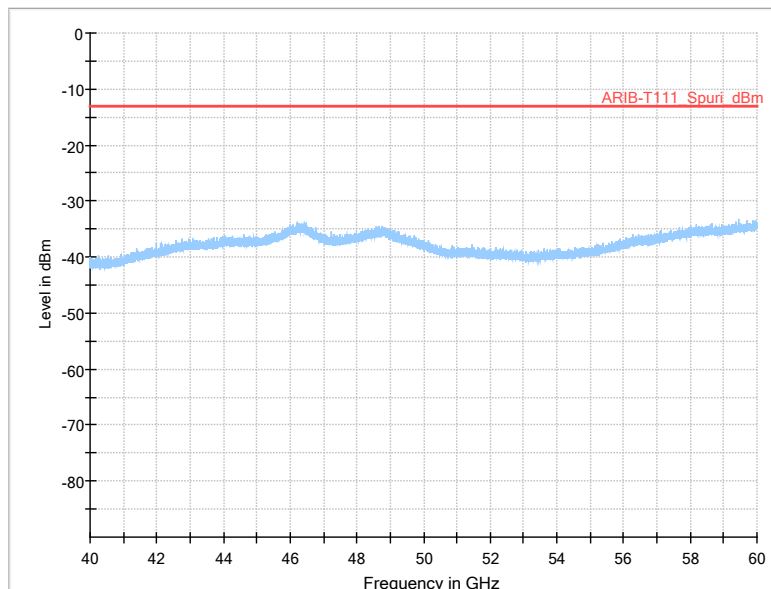
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 26 GHz – 40 GHz, Antenna = vertical
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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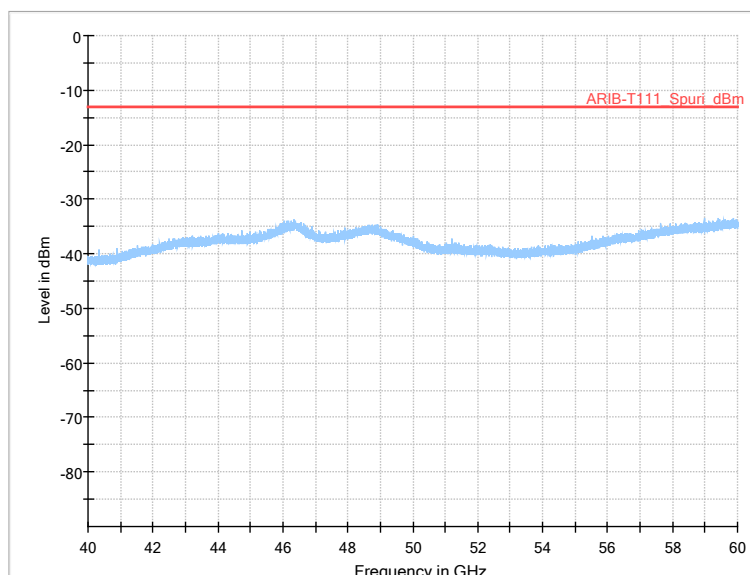
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 40 GHz – 60 GHz, Antenna = horizontal
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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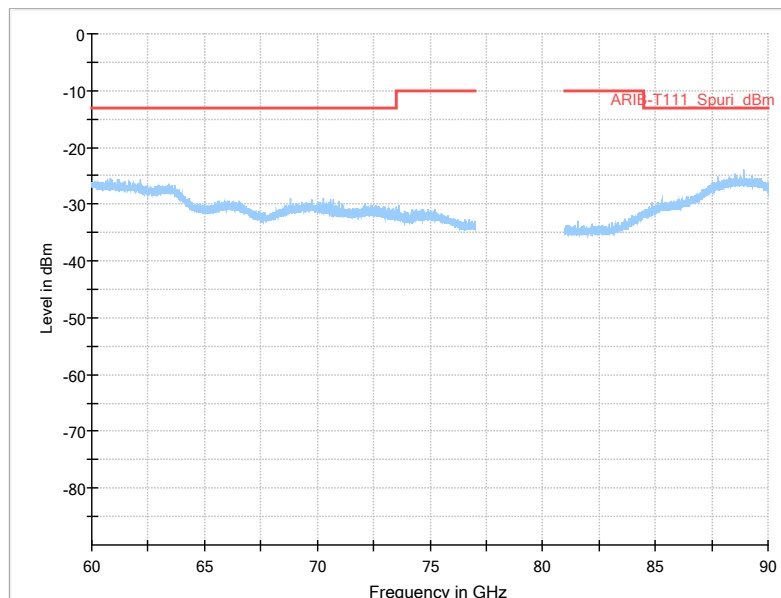
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 40 GHz – 60 GHz, Antenna = vertical
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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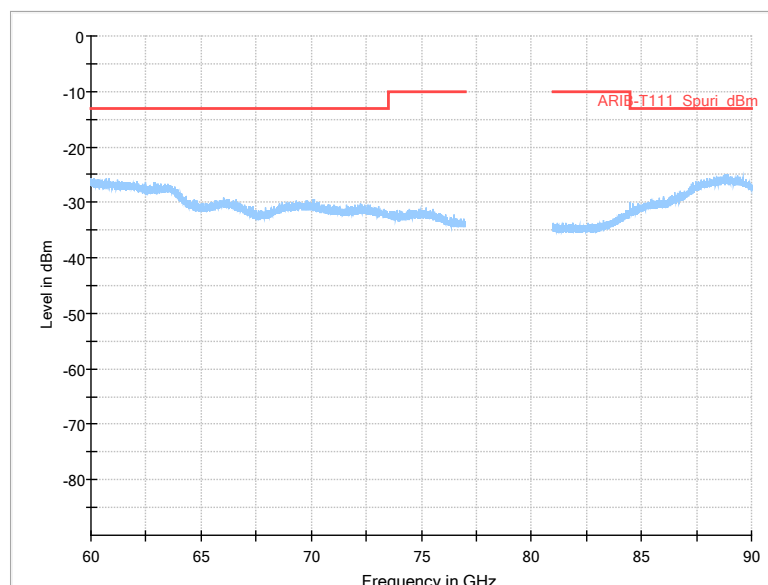
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 60 GHz – 90 GHz, Antenna = horizontal
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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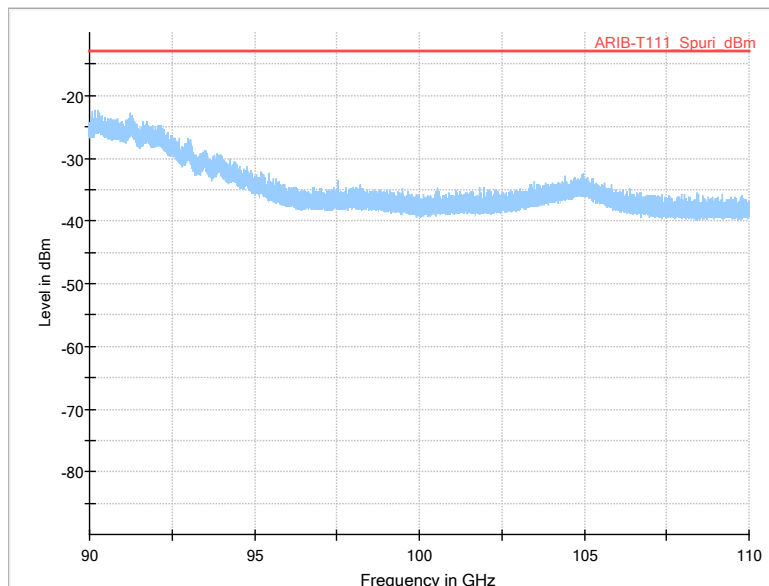
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 60 GHz – 90 GHz, Antenna = vertical
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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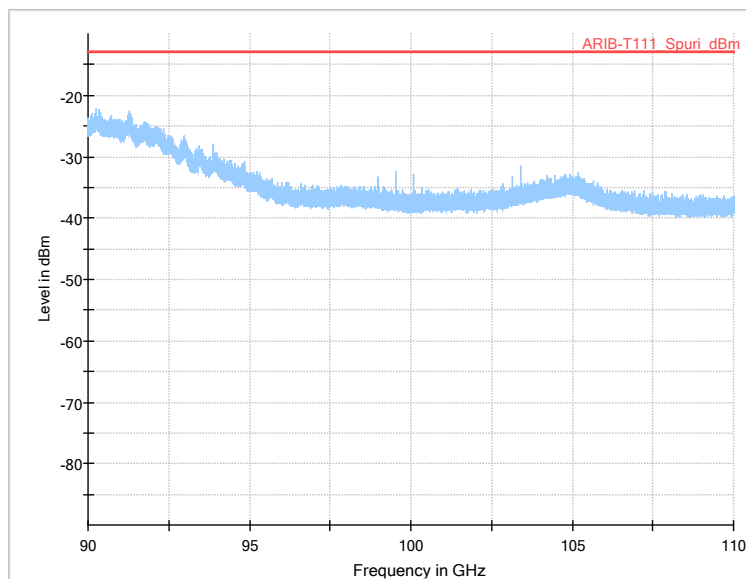
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 90 GHz – 110 GHz, Antenna = horizontal
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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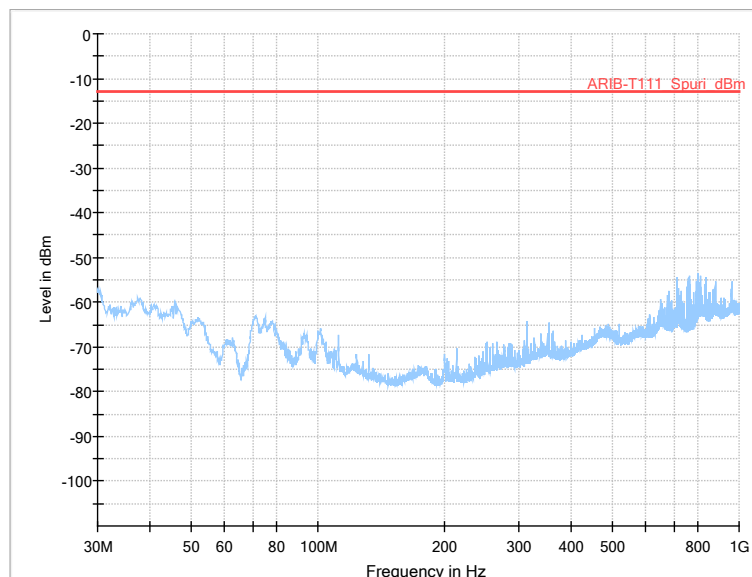
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 90 GHz – 110 GHz, Antenna = vertical
(S01_CB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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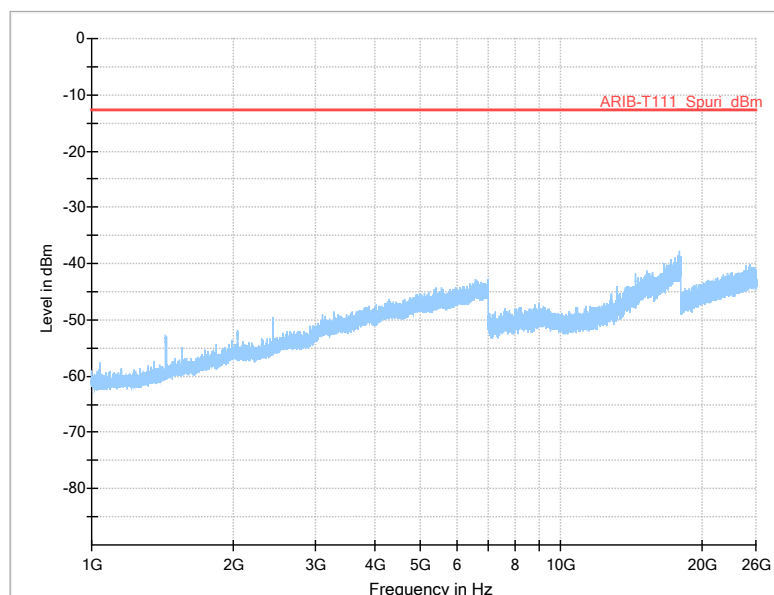
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 30 MHz – 1 GHz
(S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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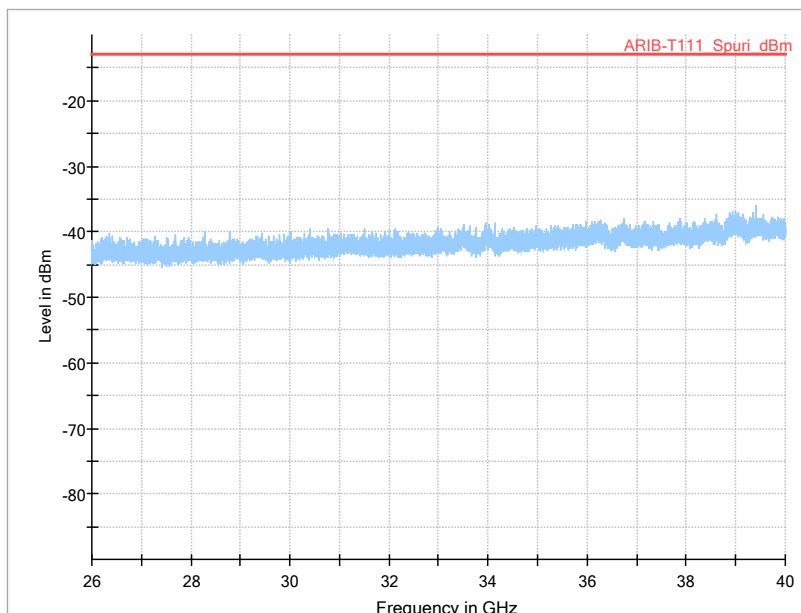
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 1 GHz – 26 GHz
(S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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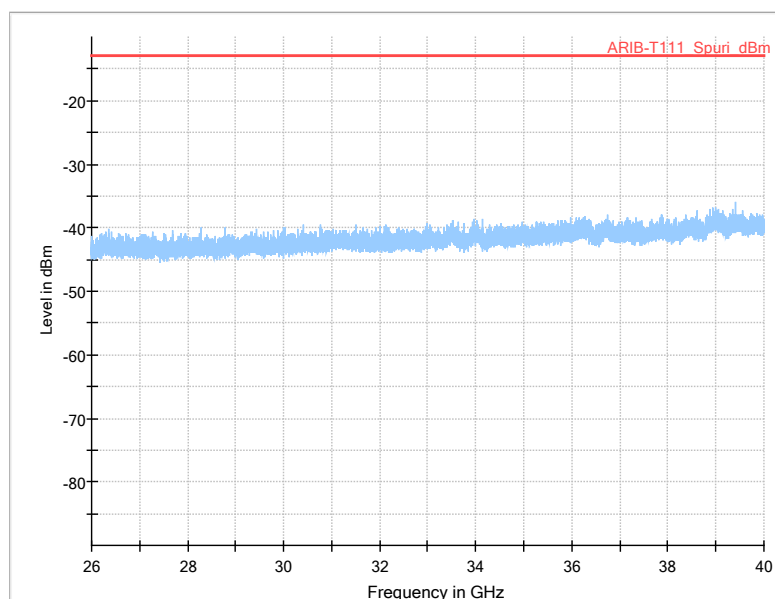
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 26 GHz – 40 GHz, Antenna = horizontal
(S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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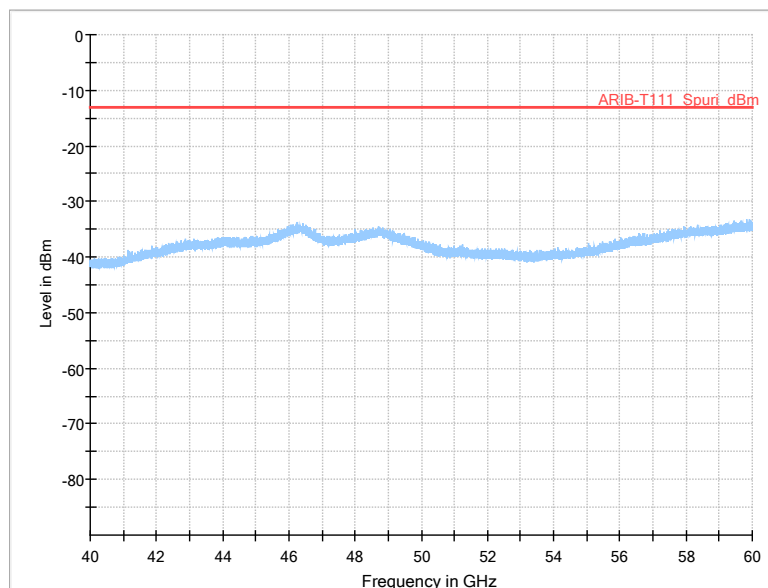
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 26 GHz – 40 GHz, Antenna = vertical
(S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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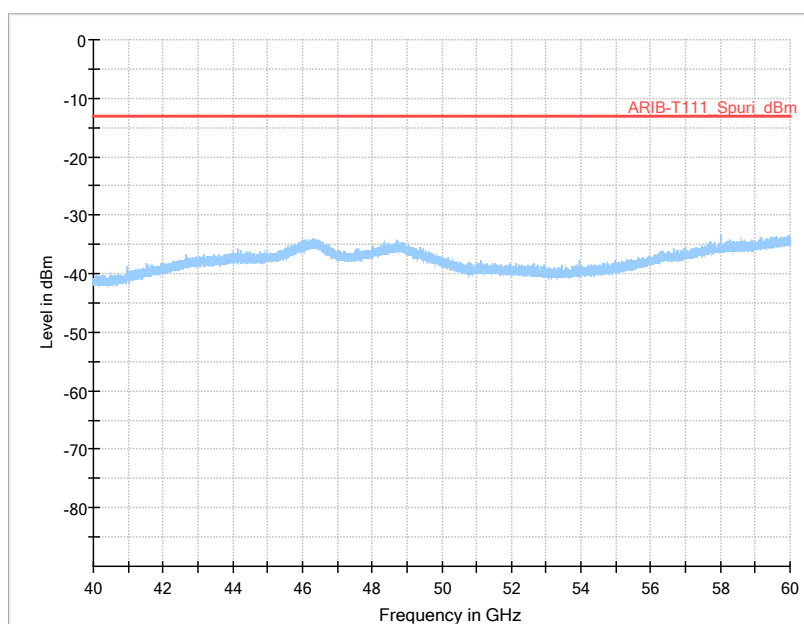
Measurement Method = Radiated, Radio Technology = FMCW Radar,
 Frequency Range = 77 - 81 GHz, OBW = 4.0 MHz
 Measurement range 40 GHz - 60 GHz, Antenna = horizontal
 (S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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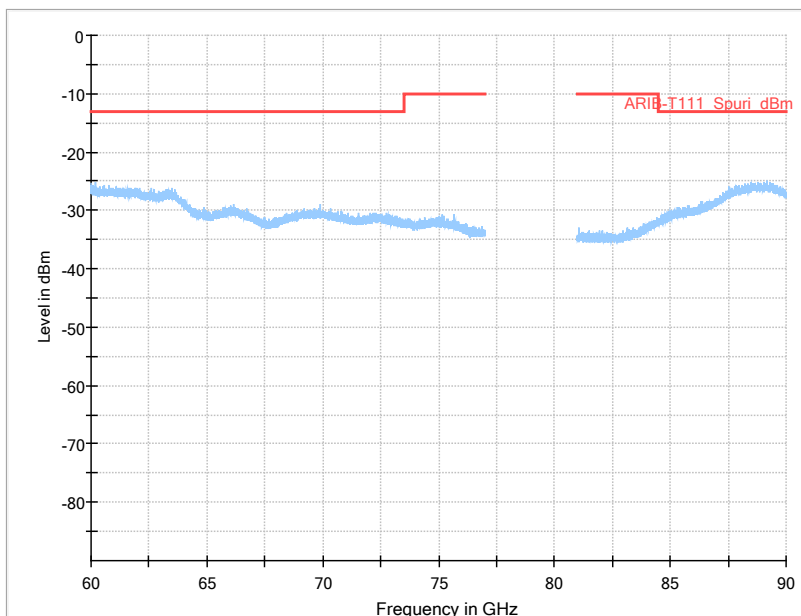
Measurement Method = Radiated, Radio Technology = FMCW Radar,
 Frequency Range = 77 - 81 GHz, OBW = 4.0 MHz
 Measurement range 40 GHz - 60 GHz, Antenna = vertical
 (S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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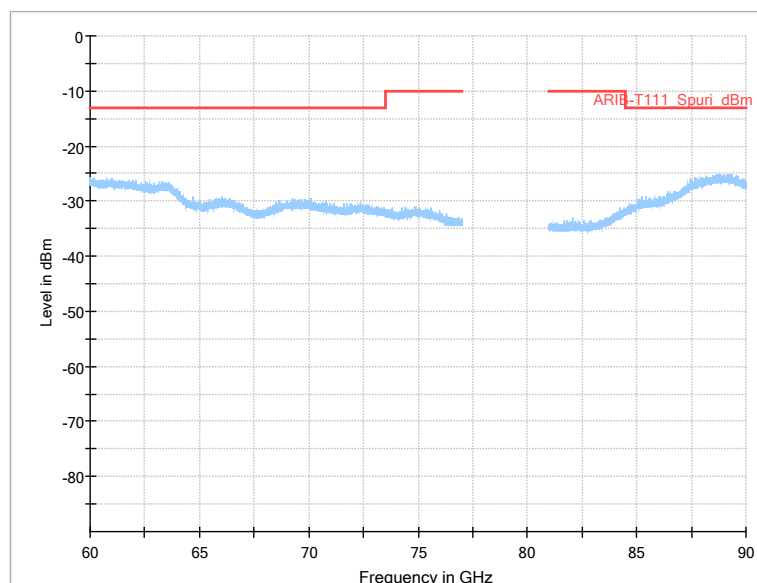
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 - 81 GHz, OBW = 4.0 MHz
Measurement range 60 GHz - 90 GHz, Antenna = horizontal
(S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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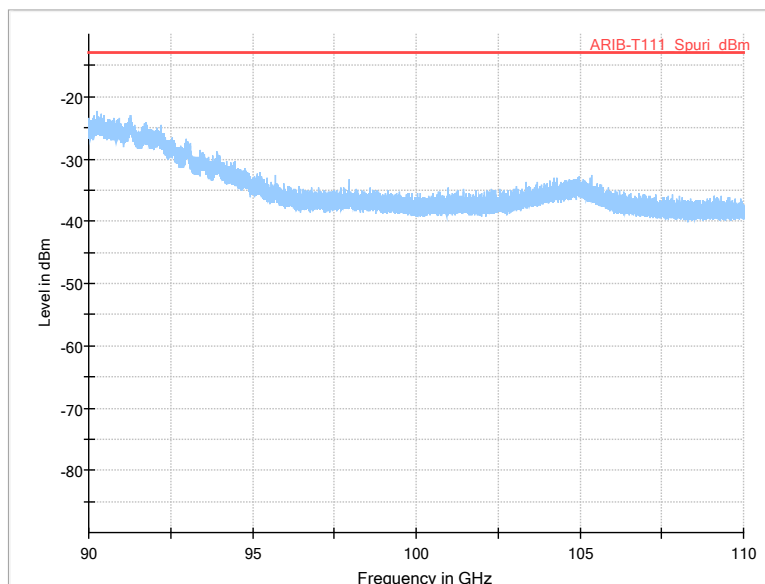
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 - 81 GHz, OBW = 4.0 MHz
Measurement range 60 GHz - 90 GHz, Antenna = vertical
(S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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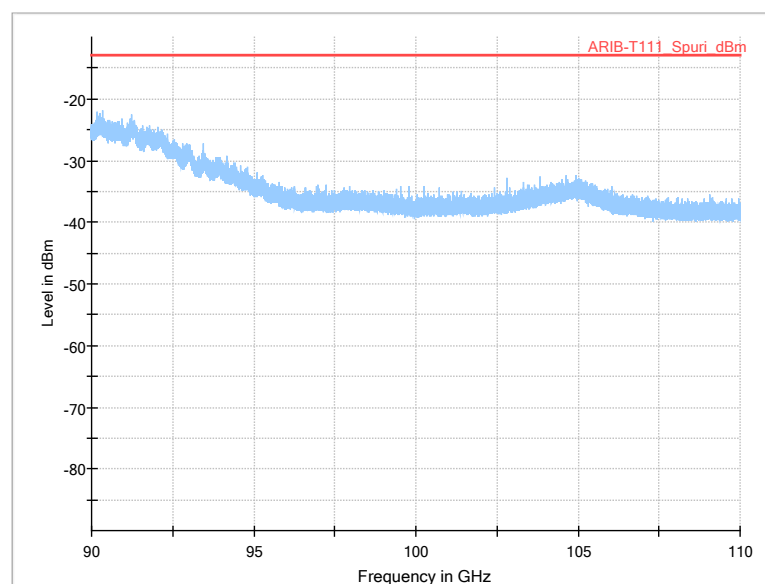
Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 90 GHz – 110 GHz, Antenna = horizontal
(S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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Measurement Method = Radiated, Radio Technology = FMCW Radar,
Frequency Range = 77 – 81 GHz, OBW = 4.0 MHz
Measurement range 90 GHz – 110 GHz, Antenna = vertical
(S01_DB01)



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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TEST EQUIPMENT USED:

- Radiated Emissions

6.5 Antenna Gain

CLAUSE:
OR: Article 49-14, Item 13(b)

Test Setup: --

6.5.1 Limits: T111 / 3.5.2

- OR: Article 49-14, Item 13(b)

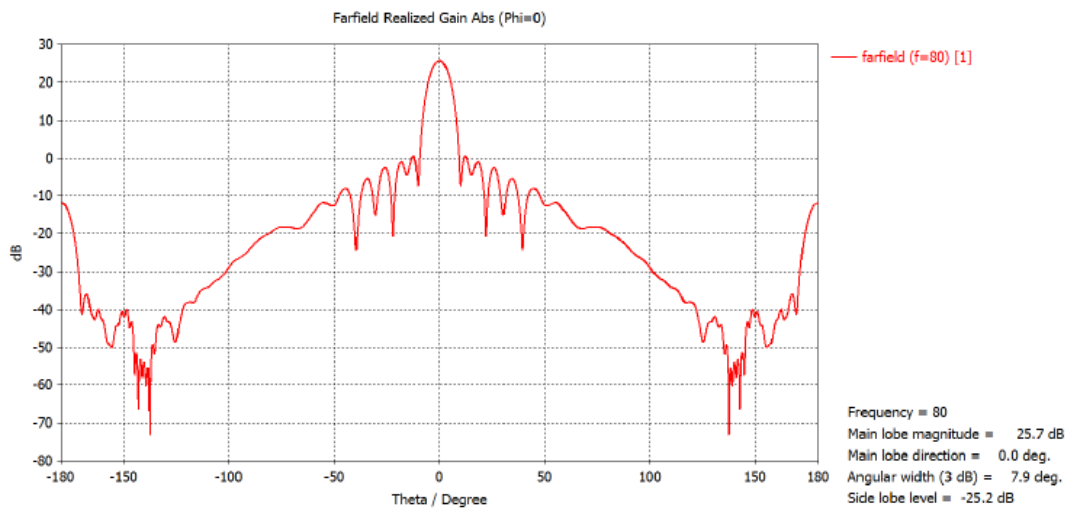
State	Antenna Gain at max. permitted antenna power (dBi)
For all systems	< 35

6.5.2 Test Case Details:

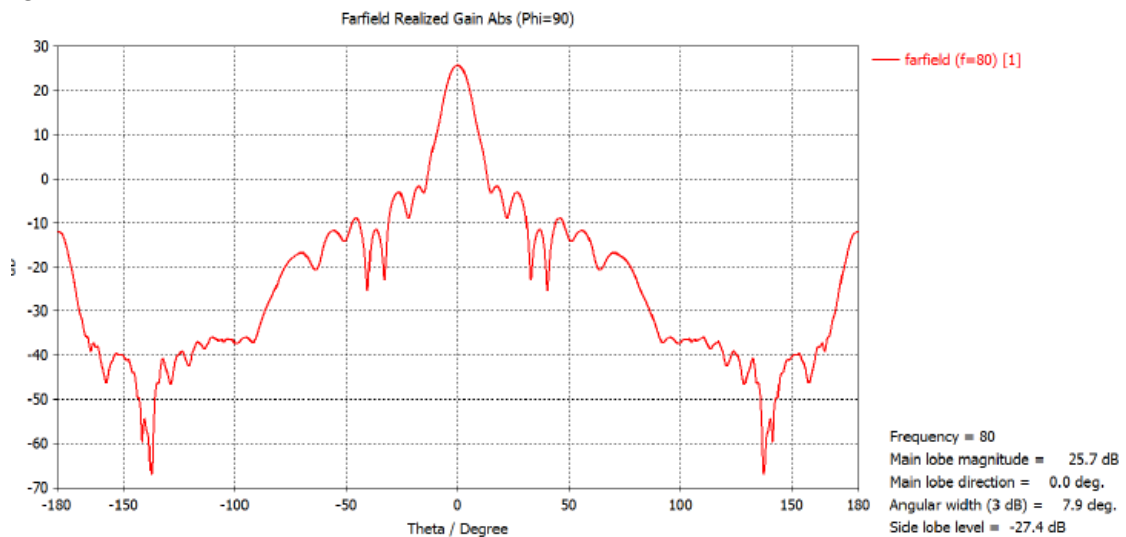
Comments: -

These antenna pattern diagrams are provided by the applicant.

E-plane:



H-plane:



6.6 Housing

CLAUSE:

OR: Article 49-14, Item 13(a)

Test Setup:

Visual inspection of cabinet by the test laboratory and / or declaration by applicant.

6.6.1 Limits: T111 / 3.6

- OR: Article 49-14, Item 13(a)

State	
For all systems	The radio equipment shall be contained in a single-unit housing that cannot be opened easily. This requirement, however, does not apply to the antenna(s).

6.6.2 Test Case Details:

Description of Protection against being opened easily
Declaration by applicant: Please see external document "Procedure to open the device_Level Radar TLRx500".

Comments:

None.

7 Test Equipment used for tests

All listed calibrations in the table below were performed in an ISO 17025 accredited laboratory – accredited by a local accreditation organisation - which is an ILAC member. Therefore, it is a type (c) calibration.

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	Opus10 TPR (8253.00)	ThermoAirpressure Datalogger 13	Lufft Mess- und Regeltechnik GmbH	ID 13936	2026-02	2028-02
1.2	FS-Z60	Harmonic Mixer 40 - 60 GHz	Rohde & Schwarz Messgerätebau GmbH	100178	2023-06	2026-06
1.3	FS-Z220	Harmonic Mixer 140 - 220 GHz	Rohde & Schwarz Messgerätebau GmbH	101005	2023-05	2026-05
1.4	FS-Z325	Harmonic Mixer 220 - 325 GHz	Rohde & Schwarz Messgerätebau GmbH	101006	2023-05	2026-05
1.5	SGH-05	Standard Gain / Pyramidal Horn Antenna (140 - 220 GHz)	Millitech	075	N/A	N/A
1.6	AMF-7D00101800-30-10P-R	Broadband Amplifier 100 MHz - 18 GHz	Miteq		N/A ^{*)}	N/A ^{*)}
1.7	ASP 1.2/1.8-10 kg	Antenna Mast	Maturo GmbH	-	N/A	N/A
1.8	Anechoic Chamber 03	FAR, 8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	N/A	N/A
1.9	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785	N/A ^{*)}	N/A ^{*)}
1.10	FSW 43	Signal Analyzer	Rohde & Schwarz	102013	2025-09	2027-09
1.11	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronik GmbH	00083069	N/A	N/A
1.12	SGH-19	Standard Gain / Pyramidal Horn Antenna (40 - 60 GHz)	Millitech	093	N/A	N/A
1.13	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09	N/A ^{*)}	N/A ^{*)}
1.14	WRCD1879.8-0.2/40-10EE	Notch Filter Ultra Stable	Wainwright Instruments GmbH	16	N/A ^{*)}	N/A ^{*)}
1.15	JS4-00102600-42-5A	Broadband Amplifier 30 MHz - 26 GHz	Miteq	619368	N/A ^{*)}	N/A ^{*)}
1.16	IT 1.5 WI	Turn Table	Maturo GmbH	-	N/A	N/A
1.17	HL 562 ULTRALOG	Biconical-log-per Antenna (30 MHz - 3 GHz)	Rohde & Schwarz GmbH & Co. KG	830547/003	2025-04	2028-04

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.18	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronik GmbH	00086675	N/A	N/A
1.19	MA4985-XP-ET	Bore Sight Antenna Mast	innco systems GmbH	none	N/A	N/A
1.20	SGH-08	Standard Gain / Pyramidal Horn Antenna (90 - 140 GHz)	Millitech	064	N/A	N/A
1.21	SGH-12	Standard Gain / Pyramidal Horn Antenna (60 - 90 GHz)	Millitech	326	N/A	N/A
1.22	JUN-AIR Mod. 6-15	Air Compressor	JUN-AIR Deutschland GmbH	612582	N/A	N/A
1.23	FS-Z140	Harmonic Mixer 90 -140 GHz	Rohde & Schwarz Messgerätebau GmbH	101007	2023-05	2026-05
1.24	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709	N/A	N/A
1.25	SGH-03	Standard Gain / Pyramidal Horn Antenna (220 - 325 GHz)	Millitech	060	N/A	N/A
1.26	FS-Z90	Harmonic Mixer 60 - 90 GHz	Rohde & Schwarz Messgerätebau GmbH	101686	2023-06	2026-06
1.27	Innco Systems CO3000	Controller for bore sight mast SAC	innco systems GmbH	CO3000/967/39371016/L	N/A	N/A
1.28	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2024-10	2027-10
1.29	Temperature Chamber KWP 120/70	Temperature Chamber KWP 120/70	Weiss	59226012190010	2024-07	2026-07

The calibration interval is the time interval between "Last Calibration" and "Calibration Due" N/A*) -> internally validated before use.

8 Photo Report

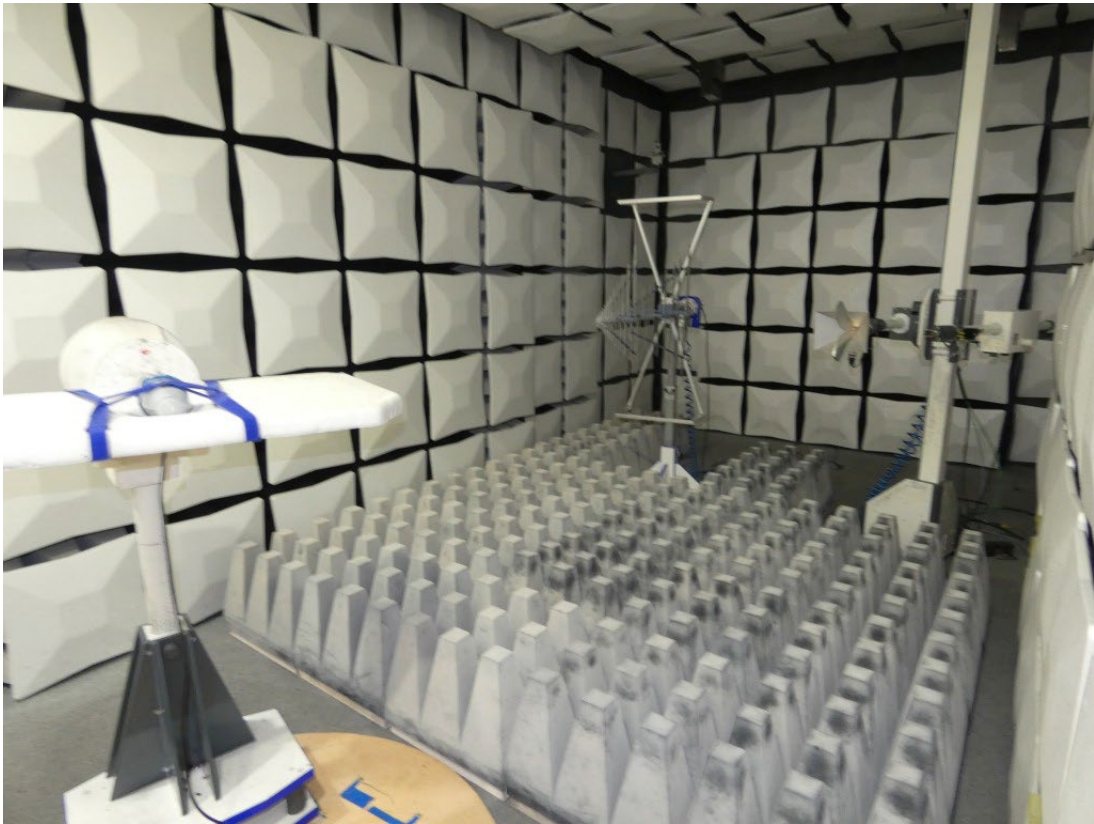


Photo: Test setup: Radiated Emission up to 26 GHz (EUT ak01)

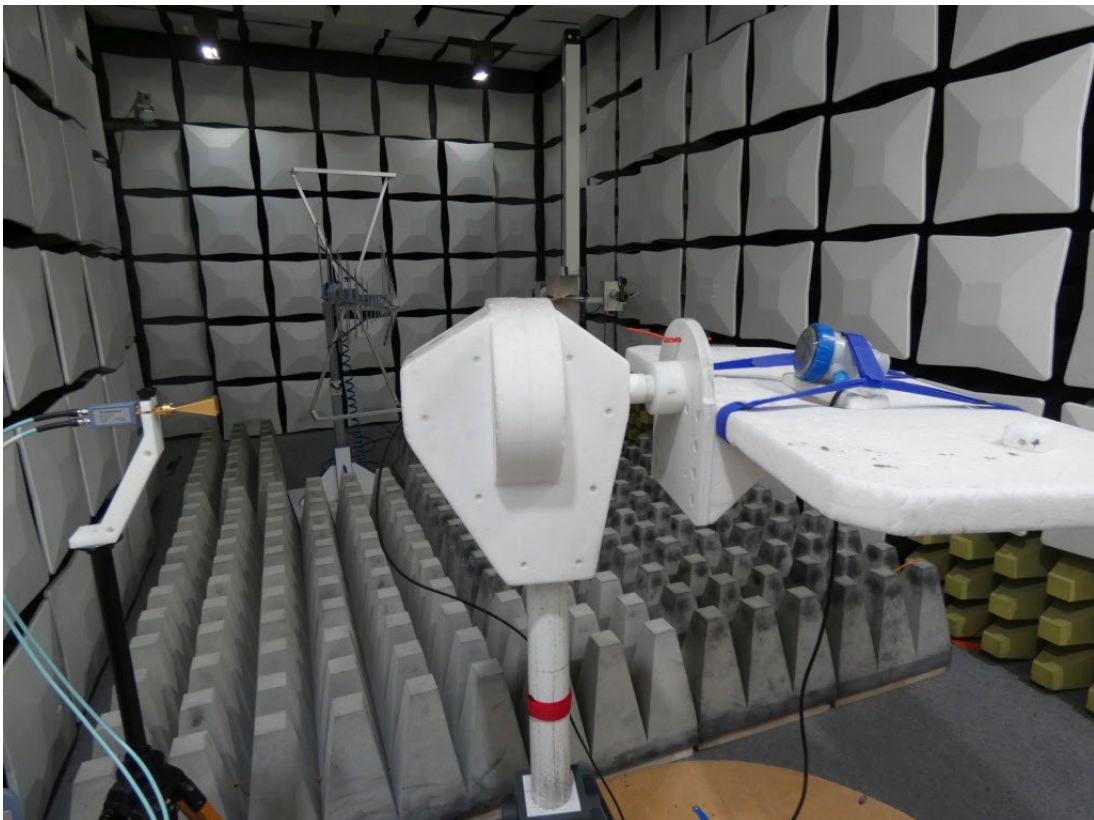


Photo: Test setup: Radiated Emission above 26 GHz (ak01)



Photo: Test setup: Radiated Emission up to 26 GHz (EUT cb01)

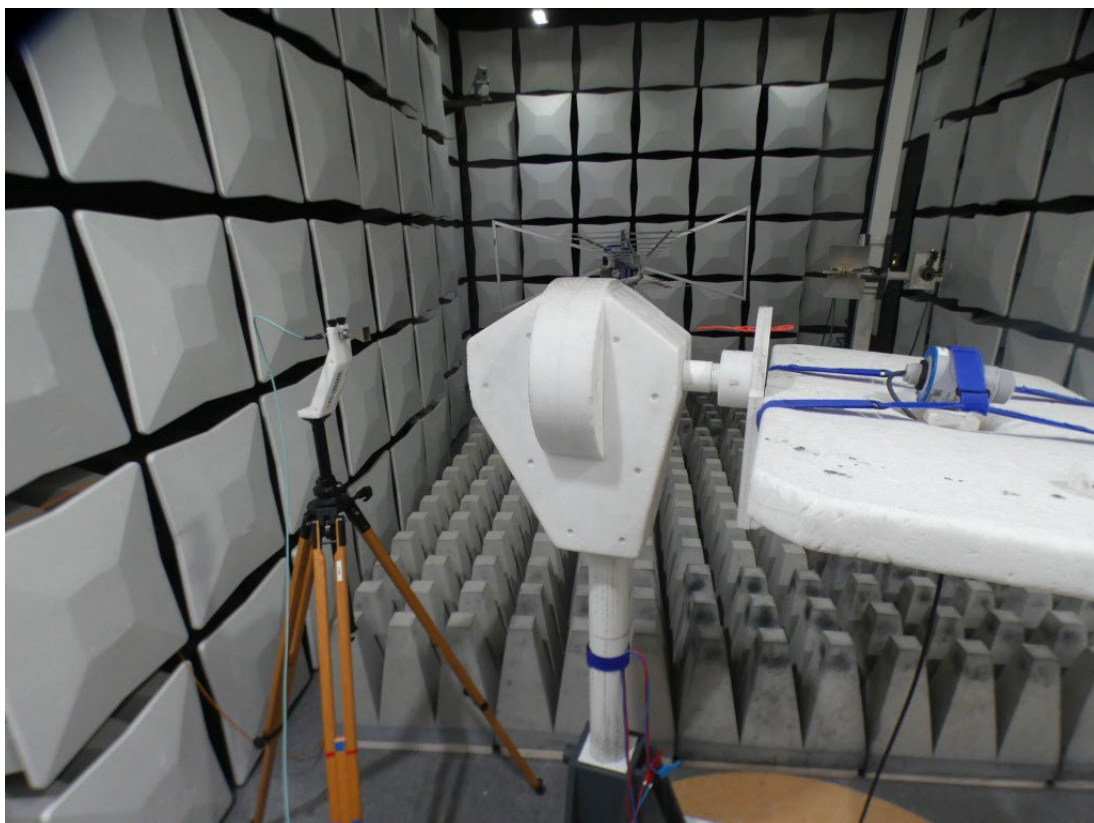


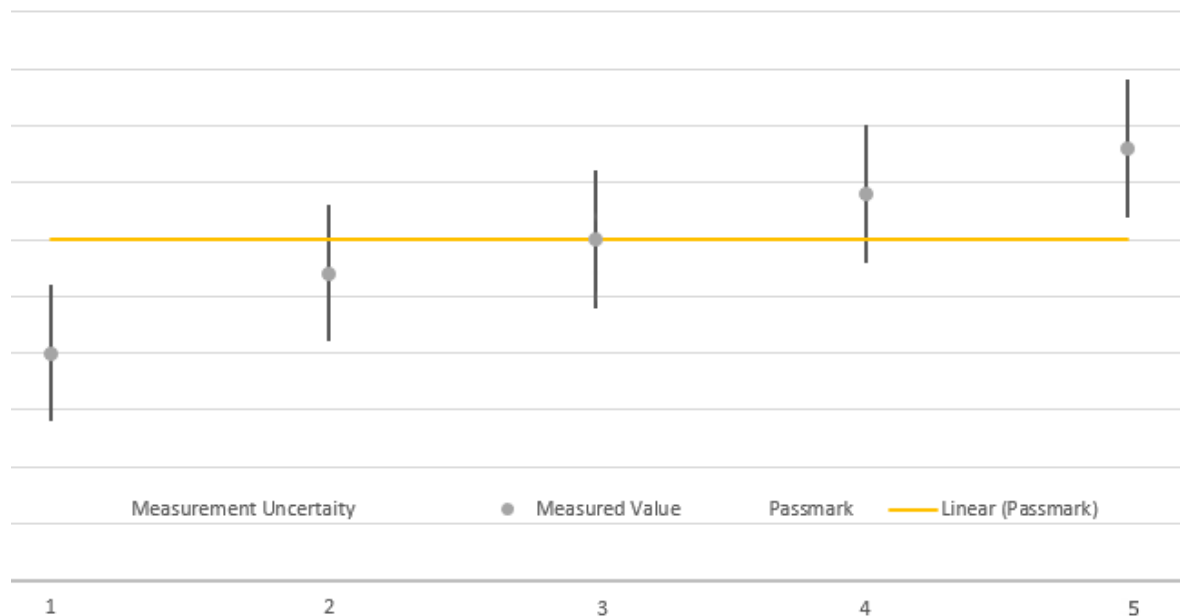
Photo: Test setup: Radiated Emission above 26 GHz (EUT db01)

9 Measurement Uncertainties

Measurement Uncertainties

Parameter	Uncertainty
Occupied channel Bandwidth	$\pm 5\%$
All emissions, radiated	$\pm 4.5 \text{ dB}$
Temperature	$\pm 0.3 \text{ }^{\circ}\text{C}$
Humidity	$\pm 3\%$
DC and low frequency voltages	$\pm 1.5\% + 2 \text{ digits}$
Time	$\pm 5\%$
Duty Cycle	$\pm 5\%$

The measurement uncertainties for all parameters are calculated with an expansion factor (coverage factor) $k = 1.96$. This means, that the true value is in the corresponding interval with a probability of 95 %.



The verdicts in this test report are given according to the above diagram:

Case	Measured Value	Uncertainty Range	Verdict
1	below pass mark	below pass mark	Passed
2	below pass mark	within pass mark	Passed
3	on pass mark	within pass mark	Passed
4	above pass mark	within pass mark	Failed
5	above pass mark	above pass mark	Failed

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so called shared risk principle.

*****END OF REPORT*****