

Prüfbericht-Nr.: Test Report No.:	CN22HP1X 001	Auftrags-Nr.: Order No.:	244425224	Seite 1 von 22 Page 1 of 22
Kunden-Referenz-Nr.: Client Reference No.:	1288983	Auftragsdatum: Order date.:	2022-05-24	
Auftraggeber: Client:	IKEA of Sweden AB Box 702, SE-343 81 Älmhult, Sweden			
Prüfgegenstand: Test item:	Self-ballasted LED lamp			
Bezeichnung / Typ-Nr.: Identification / Type No.:	LED2104R3			
Auftrags-Inhalt: Order content:	TÜV Rheinland EMC service			
Prüfgrundlage: Test specification:	FCC 47 CFR Part 15, Subpart B:2020 Class B ICES-005:2018			
Wareneingangsdatum: Date of receipt:	2022-05-29	Refer to the EUT photos file		
Prüfmuster-Nr.: Test sample No.:	A003269737-001			
Prüfzeitraum: Testing period:	Refer to test report			
Ort der Prüfung: Place of testing:	Refer to clause 1.1			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: / tested by: Jessie Xu		genehmigt von: / authorized by: Hexiong Liu		
Datum: / Date: 2022-08-04 <i>Jessie Xu</i>		Datum: / Date: 2022-08-04 <i>Hexiong Liu</i>		
Stellung: / Position: Project manager		Stellung: / Position: Department manager		
Sonstiges / Other:	FCC ID: FHO-LED2104R3 Test Firm Registration Number: 958801			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: P(ass) = passed a.m. test specifications(s) F(ail) = failed a.m. test specifications(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

V05

Prüfbericht - Nr.: CN22HP1X 001

Test Report No.:

Seite 2 von 22

Page 2 of 22

TEST SUMMARY

5.1.1 CONDUCTED EMISSION

*Result:**Passed*

5.2.1 RADIATED EMISSION (30-1000 MHz)

*Result:**Passed*

5.2.2 RADIATED EMISSION (1-18 GHz)

*Result:**Passed*

Contents

1	TEST SITES	4
1.1	TEST FACILITIES	4
2	GENERAL PRODUCT INFORMATION	5
2.1	PRODUCT FUNCTION AND INTENDED USE	5
2.2	RATINGS AND SYSTEM DETAILS	5
2.3	INDEPENDENT OPERATION MODES	5
2.4	DESCRIPTION OF INTERCONNECTING CABLES	5
2.5	NOISE GENERATING AND NOISE SUPPRESSING PARTS	5
2.6	HIGHEST FREQUENCY GENERATED OR USED IN THE DEVICE OR ON WHICH THE DEVICE OPERATES OR TUNES	5
2.7	SUBMITTED DOCUMENTS	5
3	TEST SET-UP AND OPERATION MODES	6
3.1	PRINCIPLE OF CONFIGURATION SELECTION	6
3.2	EQUIPMENT AND CABLE ARRANGEMENT	6
3.3	TEST SOFTWARE	7
3.4	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	7
3.5	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE	7
4	CONFORMITY DECISION RULE	8
5	TEST RESULTS EMISSION	9
5.1	EMISSION IN THE FREQUENCY RANGE UP TO 30 MHz	9
5.1.1	Conducted emission	9
5.2	EMISSION IN THE FREQUENCY RANGE ABOVE 30 MHz	13
5.2.1	Radiated emission (30-1000 MHz)	13
5.2.2	Radiated Emission (1-18 GHz)	16
6	PHOTOGRAPHS OF THE TEST SET-UP	21
7	LIST OF TEST AND MEASUREMENT INSTRUMENTS	21
8	LIST OF FIGURES	22

Prüfbericht - Nr.: CN22HP1X 001
Test Report No.:

Seite 4 von 22
Page 4 of 22

1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland (Shanghai) Co., Ltd.

Address: No.177, 178, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, China

The used test equipment is in accordance with CISPR 16-1 series standards for measurement of radio interference.

Refer to Clause 7 for test and measurement instruments.

Prüfbericht - Nr.: CN22HP1X 001
Test Report No.:Seite 5 von 22
Page 5 of 22

2 General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is the ordinary self-ballasted LED lamp for lighting and similar use. For the further information, refer to the user's manual.

2.2 Ratings and System Details

Rated input	:	AC 120 V, 60 Hz
Rated power	:	3.3 W

2.3 Independent Operation Modes

The basic operation modes are: "ON" and "OFF" with dimming function.

2.4 Description of interconnecting cables

N/A

2.5 Noise Generating and Noise Suppressing Parts

Refer to the circuit diagram for further information.

2.6 Highest frequency generated or used in the device or on which the device operates or tunes

The highest frequency used in the EUT is 2.4 GHz.

2.7 Submitted Documents

Circuit diagram, user's manual and rating label.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible emission level. The test conditions were adapted accordingly in reference to the instructions for use.

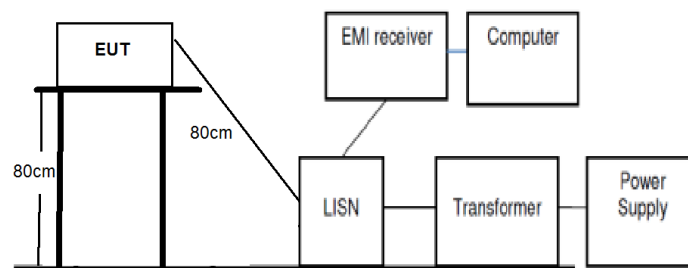
Refer to the related paragraph of this report.

The sequence of testing:

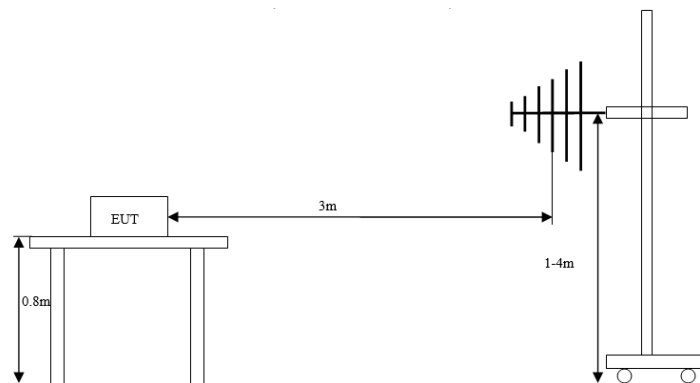
1. Radiated emission tests were performed on 2022-06-21~2022-06-22.
2. Conducted emission tests were performed on 2022-06-20.

3.2 Equipment and cable arrangement

Block diagram for both conducted emission and radiated emission tests is as follows:



(Conducted emission)



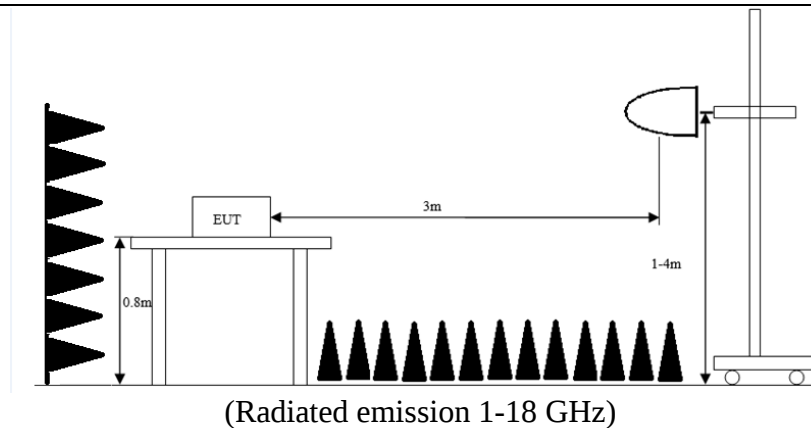
(Radiated emission 30-1000 MHz)

Prüfbericht - Nr.: CN22HP1X 001

Test Report No.:

Seite 7 von 22

Page 7 of 22



Also refer to photographs on clause 6 for test setups for both conducted emission test and radiated emission test.

3.3 Test Software

No special test software was used during the tests.

3.4 Special Accessories and Auxiliary Equipment

During the tests, the zigbee remote control was used for dimming.

3.5 Countermeasures to achieve EMC Compliance

No other special measure is employed to achieve the requirement.

Prüfbericht - Nr.: CN22HP1X 001
Test Report No.:**Seite 8 von 22**
Page 8 of 22

4 Conformity Decision Rule

For all EMI tests included in this report, as measurement uncertainties are less than the values U_{CISPR} given in CISPR 16-4-2, compliance with the limits is determined by comparing measurement results directly with corresponding limits without taking into consideration of measurement uncertainties.

5 Test Results EMISSION

5.1 Emission in the Frequency Range up to 30 MHz

5.1.1 Conducted emission

Result:		Passed
Date of testing	: 2022-06-20	
Test procedure	: FCC 47 CFR Part 15, Subpart B:2020, ICES-005:2018, ANSI C63.4-2014 and CISPR 16-2-1	
Frequency range	: 0.15 – 30 MHz	
Limits	: Quasi-peak limit: 0.15 – 0.5 MHz, 66 to 56 dB μ V (decrease with the logarithm of frequency); 0.5 – 5 MHz, 56 dB μ V; 5 – 30 MHz, 60 dB μ V Average limit: 0.15 – 0.5 MHz, 56 to 46 dB μ V (decrease with the logarithm of frequency); 0.5 – 5 MHz, 46 dB μ V; 5 – 30 MHz, 50 dB μ V	
Bandwidth of EMI receiver for final measurement	: 9 kHz	
Measurement time for final measurement	: 1 s	
Kind of test site	: Shielded room	
Input voltage	: AC 120 V, 60 Hz	
Operational mode	: Power on and dimming	
Ambient condition	: Temperature: 21.3 °C; Relative humidity: 56.3 %	
Expanded measurement uncertainty ($k=2$)	: 3.39 dB	

The measurement setup was made according to ANSI C63.4-2014 in a shielded room.

The measurement equipment like test receivers, quasi-peak detector and artificial mains network (AMN) are in compliance with CISPR 16-1 series standards.

The tested object was set-up on a wooden support. The EUT was set 0.8 m away from the AMN. The cord longer than necessary to be connected to the AMN was folded forth and back parallel so as to form a bundle with a length between 0.3 m and 0.4 m.

The disturbance voltage test was performed on the neutral line and phase line of the power supply of the EUT respectively.

The following figures and tables were those measured by an automatic measuring system. Both quasi-peak and average measurements were performed. In the following spectral diagram, “*” means Quasi-Peak Value and “*” means Average Value results.

Prüfbericht - Nr.: CN22HP1X 001

Test Report No.:

Seite 10 von 22

Page 10 of 22

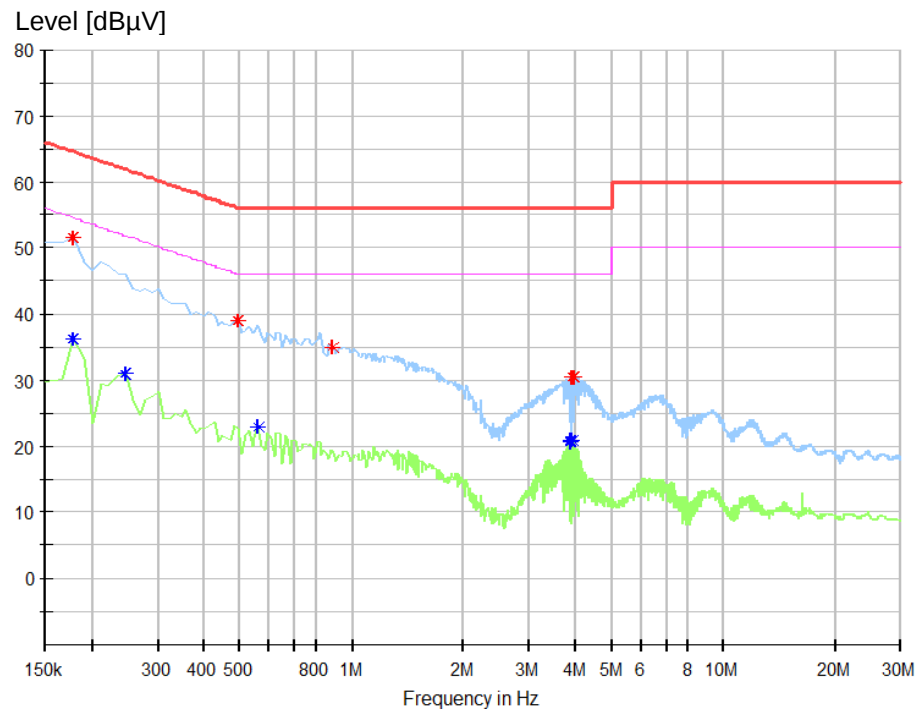
Notes on following tables of conducted emission results and conversions:

Level (dB μ V): final measurement results by using quasi-peak detector and average detector

Transd (dB): transducer factor including cable loss, insertion loss of artificial mains network and gain of pre-amplifier (if used)

Margin: Limit (dB μ V) - Level (dB μ V)

Figure 1: Spectral Diagrams, Conducted Emission, 150 kHz – 30 MHz, L



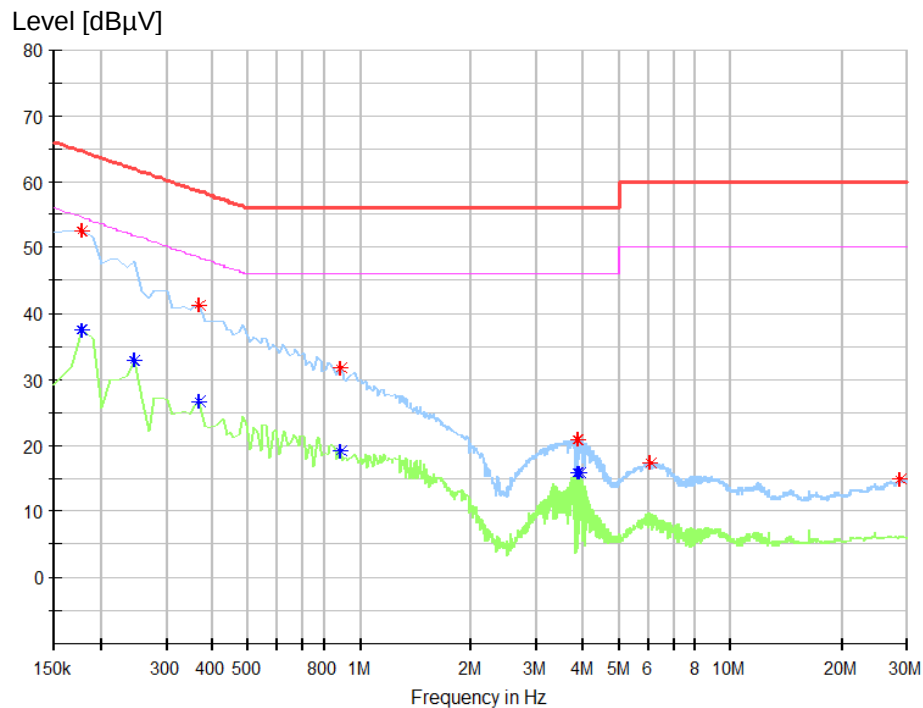
Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Line
3.901875	30.38	56.00	25.62	L1
3.935625	30.49	56.00	25.51	L1
3.969375	30.56	56.00	25.44	L1
0.886875	35.03	56.00	20.97	L1
0.493125	39.04	56.12	17.08	L1
0.178125	51.50	64.57	13.08	L1

Final Average measurement result:

Frequency (MHz)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line
0.178125	36.36	54.57	18.21	L1
0.245625	31.00	51.90	20.90	L1
0.560625	22.92	46.00	23.08	L1
3.856875	20.63	46.00	25.37	L1
3.890625	20.91	46.00	25.09	L1
3.935625	20.91	46.00	25.09	L1

Figure 2: Spectral Diagrams, Conducted Emission, 150 kHz – 30 MHz, N



Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Line
28.786875	14.90	60.00	45.10	N
6.073125	17.50	60.00	42.50	N
3.868125	20.83	56.00	35.17	N
0.886875	31.66	56.00	24.34	N
0.369375	41.40	58.52	17.11	N
0.178125	52.72	64.57	11.85	N

Final Average measurement result:

Frequency (MHz)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line
0.178125	37.57	54.57	17.00	N
0.245625	33.07	51.90	18.83	N
0.369375	26.66	48.52	21.86	N
0.886875	19.26	46.00	26.74	N
3.868125	16.01	46.00	29.99	N
3.901875	15.96	46.00	30.04	N

5.2 Emission in the Frequency Range above 30 MHz

5.2.1 Radiated emission (30-1000 MHz)

Result:	Passed
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Date of testing	: 2022-06-21
Test procedure	: FCC 47 CFR Part 15, Subpart B:2020, ICES-005:2018, ANSI C63.4-2014 and CISPR 16-2-3
Product classification	: Class B
Frequency range	: 30 – 1000 MHz
Limits	: Quasi-peak limits (3 m distance): 30 – 88 MHz, 40 dB μ V/m; 88 – 216 MHz, 43.5 dB μ V/m; 216 – 1000 MHz, 46 dB μ V/m (see Note)
Bandwidth of EMI receiver for final measurement	: 120 kHz
Measurement time for final measurement	: 1 s
Kind of test site	: Semi-anechoic chamber
Input voltage	: AC 120 V, 60 Hz
Operational mode	: Power on and dimming
Ambient condition	: Temperature: 22.1 °C; Relative humidity: 58.3 %
Expanded measurement uncertainty (k=2)	: 5.49 dB

The radiated disturbance test was carried out in a semi-anechoic chamber. The test distance from the receiving antenna to the EUT is 3 m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on an 80 cm wooden support above the reference ground plane. The wooden support was rotated 360° around and the height of the antenna was varied from 1 m to 4 m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

The following figures and tables were those measured by an automatic measurement system. A preview test was firstly performed with peak detector. The final test was performed with quasi-peak at those critical frequencies during the preview test. In the following spectral diagram, “x” means quasi-peak test results.

Note: The class B limits of ICES-005:2018 is stricter than those FCC 47 CFR Part 15, Subpart B:2020 for 3 m test distance. Therefore, the former limits are used in following figures and tables.

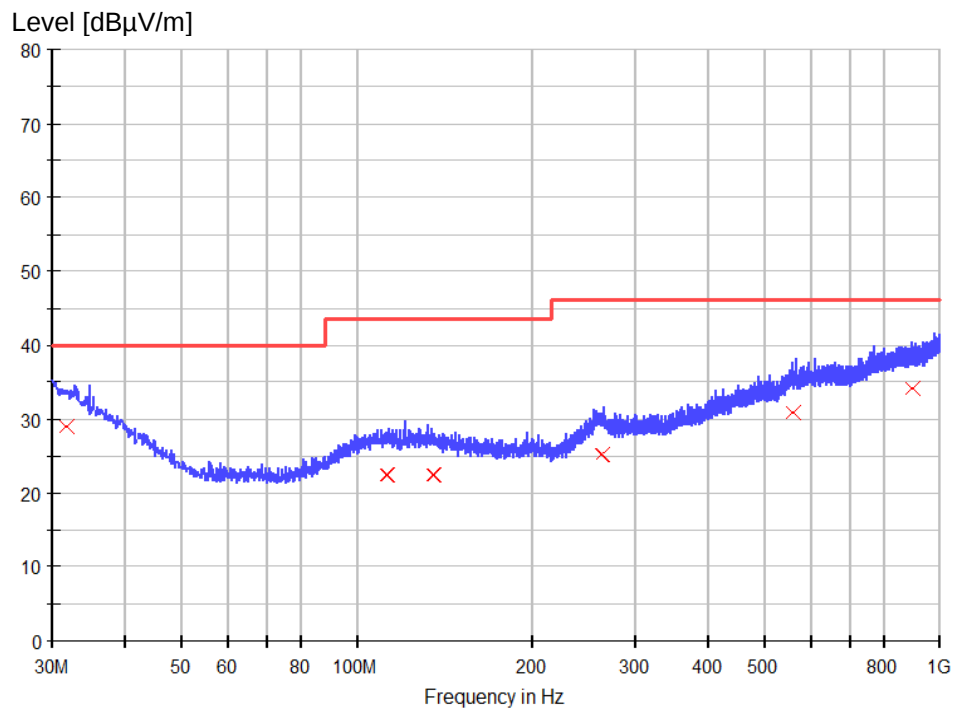
Notes on following tables of radiated emission results and conversions:

QuasiPeak (dB μ V/m): final measurement results by using quasi-peak detector

Corr. (dB): correction factor including: antenna factor, cable loss, and gain of pre-amplifier (if used)

Margin: Limit (dB μ V/m) - QuasiPeak (dB μ V/m)

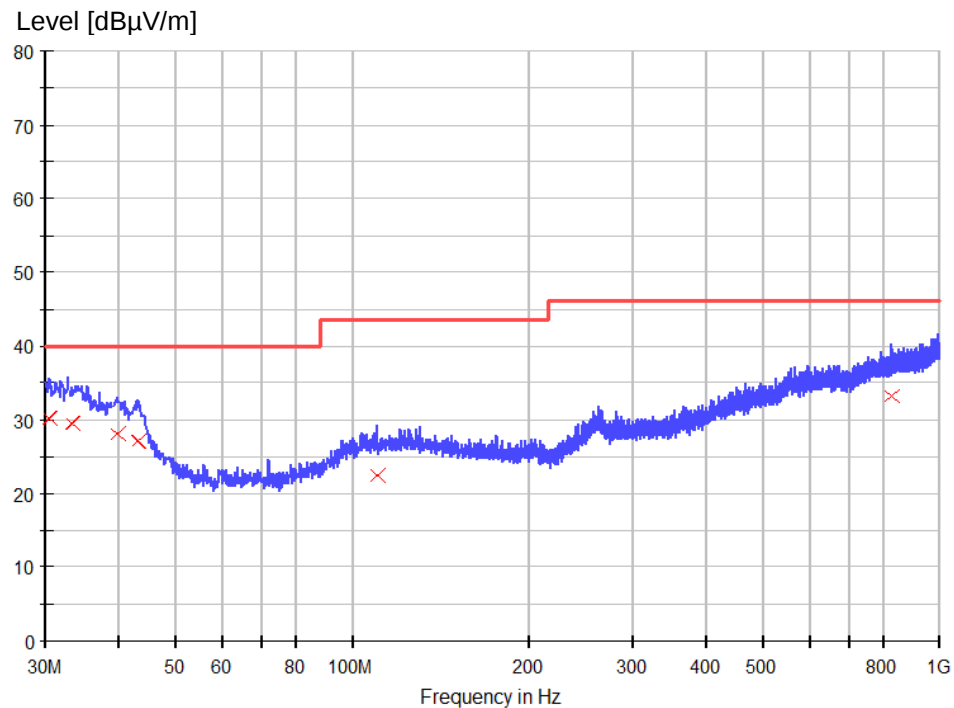
Figure 3: Spectral Diagrams, Radiated Emission, 30 MHz – 1000 MHz, Horizontal polarization



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBμV/m)
31.576250	29.1	1000.0	120.000	100.0	H	12.0	24.7	10.9	40.0
112.086250	22.6	1000.0	120.000	100.0	H	55.0	18.5	20.9	43.5
135.608750	22.4	1000.0	120.000	100.0	H	158.0	18.4	21.1	43.5
262.557500	25.3	1000.0	120.000	135.0	H	120.0	20.7	20.7	46.0
556.225000	30.8	1000.0	120.000	150.0	H	90.0	26.4	15.2	46.0
893.906250	34.1	1000.0	120.000	120.0	H	40.0	28.3	11.9	46.0

Figure 4: Spectral Diagrams, Radiated Emission, 30 MHz – 1000 MHz, Vertical polarization



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBμV/m)
30.485000	30.1	1000.0	120.000	100.0	V	120.0	25.2	9.9	40.0
33.152500	29.5	1000.0	120.000	100.0	V	56.0	23.7	10.5	40.0
39.821250	28.0	1000.0	120.000	100.0	V	33.0	20.1	12.0	40.0
42.973750	27.1	1000.0	120.000	100.0	V	44.0	18.2	12.9	40.0
109.661250	22.5	1000.0	120.000	100.0	V	15.0	18.5	21.0	43.5
827.582500	33.2	1000.0	120.000	100.0	V	70.0	27.5	12.8	46.0

5.2.2 Radiated Emission (1-18 GHz)

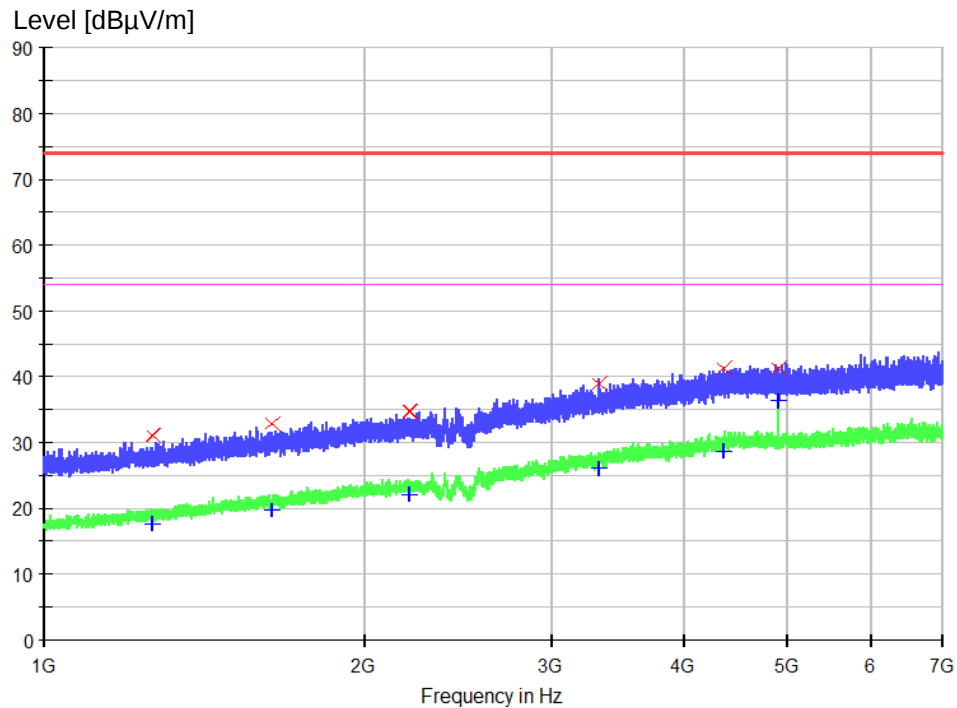
Result:
Passed

Date of testing	: 2022-06-22
Port	: Enclosure
Test procedure	: FCC 47 CFR Part 15, Subpart B:2020, ANSI C63.4-2014 and CISPR 16-2-3
Product classification	: Class B
Limit	: MaxPeak limits (3 m distance): 1–18 GHz, 74 dB μ V/m Average limits (3 m distance): 1–18 GHz, 54 dB μ V/m
Frequency range	: 1 GHz – 18 GHz (Note: The highest frequency in the EUT is 2.4 GHz. According to FCC Part 15 subpart B §15.33 (b) (1) the upper frequency for radiated emission measurement is 18 GHz.
Kind of test site	: Semi-anechoic chamber with RF absorber material on the ground plane
Test distance	: 3 m
Test voltage	: AC 120 V, 60 Hz
Operational mode	: Power on and dimming
Ambient condition	: Temperature: 22.1 °C; Relative humidity: 58.3 %
Expanded measurement uncertainty ($k=2$)	: 5.17 dB (1 GHz~6 GHz) 5.12 dB (6 GHz~18 GHz)

The radiated disturbance test was carried out in an anechoic room. The test distance from the receiving antenna to the EUT is 3 m. The normalized site attenuation of the Semi-anechoic chamber with RF absorber material on the ground plane chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on a 80 cm high support. And the support was rotated 360° around and the height of the antenna was varied from 1 m to 4 m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

The following figures and tables were those measured by an automatic measurement system. The final test was performed with peak detector and average detector at those critical frequencies during the preview test. In the following figure, “× (red)” means measurement results with peak detector and “+ (blue)” means measurement results with average detector.

Figure 5: Spectral Diagrams and measurement results, 1 GHz – 7 GHz, horizontal polarization



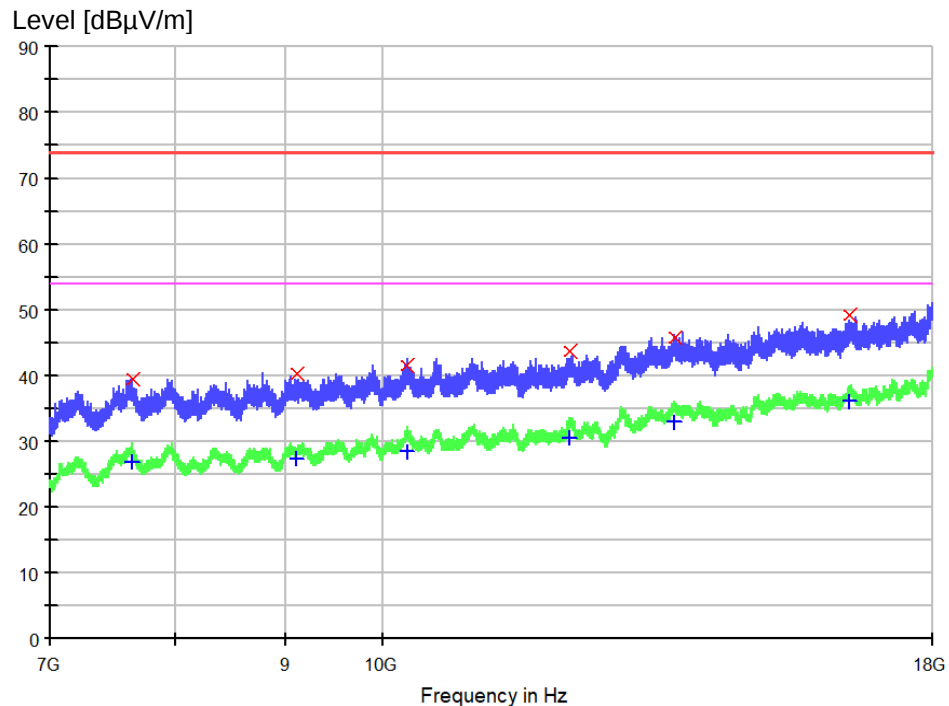
Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBμV/m)
1262.31250	30.9	1000.0	1000.000	100.0	H	36.0	-20.8	43.1	74.0
1634.50000	32.8	1000.0	1000.000	100.0	H	45.0	-18.1	41.2	74.0
2201.31250	34.8	1000.0	1000.000	100.0	H	0.0	-15.4	39.2	74.0
3318.06250	39.1	1000.0	1000.000	100.0	H	0.0	-10.3	34.9	74.0
4351.56250	41.4	1000.0	1000.000	100.0	H	13.0	-6.9	32.6	74.0
4902.62500	41.3	1000.0	1000.000	100.0	H	120.0	-6.6	32.7	74.0

Final average measurement result:

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBμV/m)
1262.31250	17.6	1000.0	1000.000	100.0	H	36.0	-20.8	36.4	54.0
1634.50000	19.6	1000.0	1000.000	100.0	H	45.0	-18.1	34.4	54.0
2201.31250	22.1	1000.0	1000.000	100.0	H	0.0	-15.4	31.9	54.0
3318.06250	26.2	1000.0	1000.000	100.0	H	0.0	-10.3	27.8	54.0
4351.56250	28.6	1000.0	1000.000	100.0	H	13.0	-6.9	25.4	54.0
4902.62500	36.2	1000.0	1000.000	100.0	H	120.0	-6.6	17.8	54.0

Figure 6: Spectral Diagrams and measurement results, 7 GHz – 18 GHz, horizontal polarization



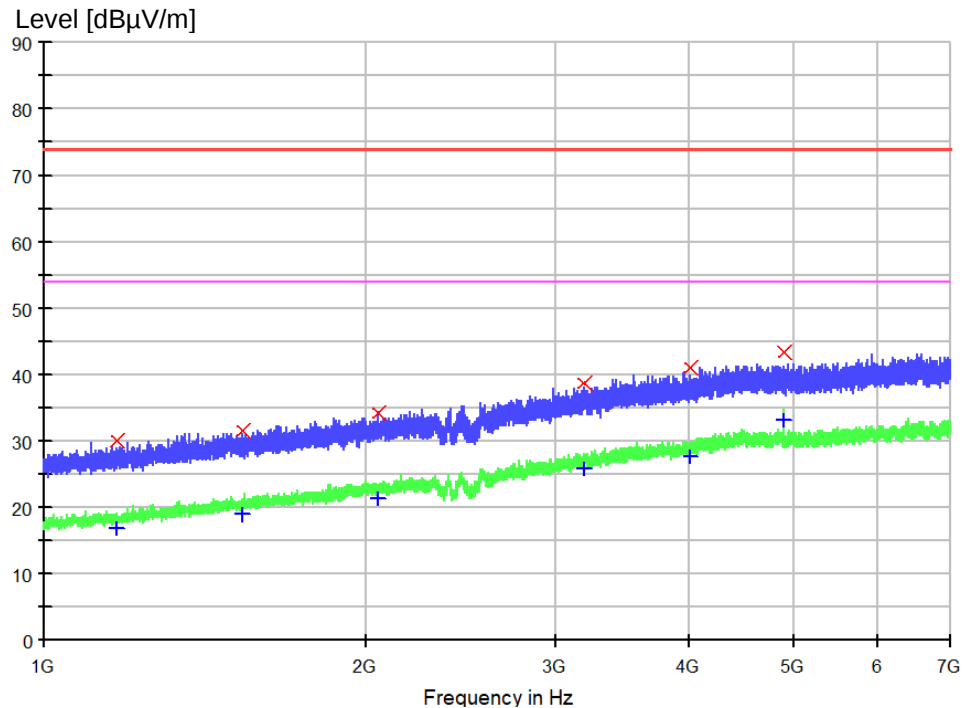
Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth h (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBμV/m)
7639.375000	39.6	1000.0	1000.000	100.0	H	180.0	-3.1	34.4	74.0
9107.875000	40.3	1000.0	1000.000	100.0	H	180.0	-1.1	33.7	74.0
10267.343750	41.5	1000.0	1000.000	100.0	H	180.0	0.4	32.5	74.0
12210.906250	43.8	1000.0	1000.000	100.0	H	180.0	1.8	30.2	74.0
13658.093750	45.7	1000.0	1000.000	100.0	H	180.0	3.5	28.3	74.0
16473.062500	49.3	1000.0	1000.000	100.0	H	180.0	7.3	24.7	74.0

Final average measurement result:

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBμV/m)
7639.375000	27.0	1000.0	1000.000	100.0	H	180.0	-3.1	27.0	54.0
9107.875000	27.3	1000.0	1000.000	100.0	H	180.0	-1.1	26.7	54.0
10267.343750	28.5	1000.0	1000.000	100.0	H	180.0	0.4	25.5	54.0
12210.906250	30.5	1000.0	1000.000	100.0	H	180.0	1.8	23.5	54.0
13658.093750	32.8	1000.0	1000.000	100.0	H	180.0	3.5	21.2	54.0
16473.062500	36.1	1000.0	1000.000	100.0	H	180.0	7.3	17.9	54.0

Figure 7: Spectral Diagrams and measurement results, 1 GHz – 7 GHz, vertical polarization



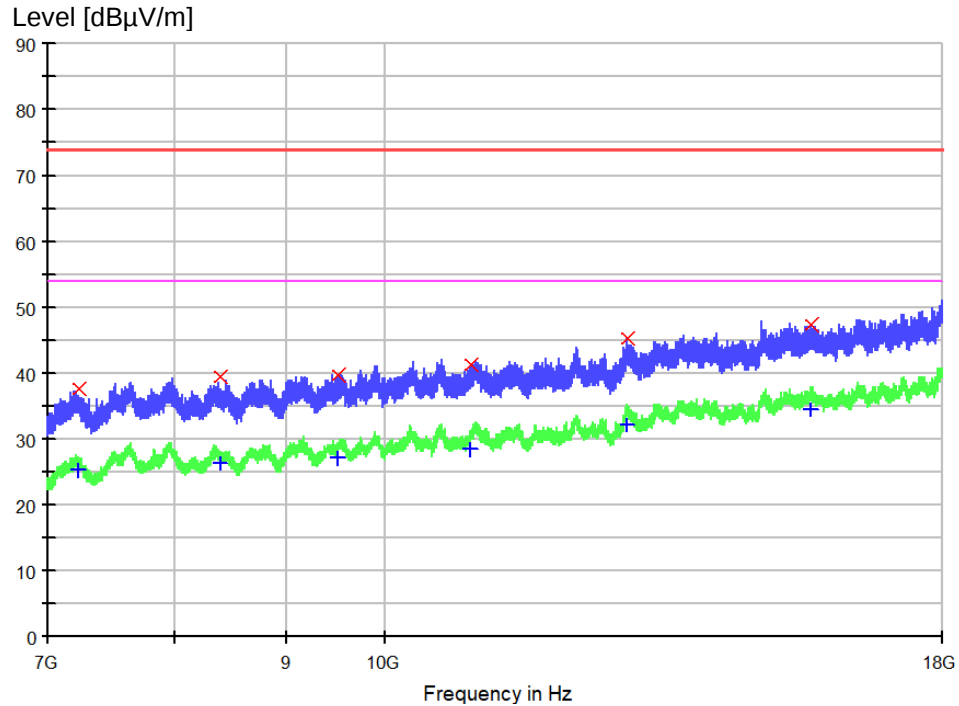
Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBμV/m)
1169.50000	30.1	1000.0	1000.000	100.0	V	12.0	-21.4	43.9	74.0
1531.93750	31.7	1000.0	1000.000	100.0	V	46.0	-18.7	42.3	74.0
2049.81250	34.1	1000.0	1000.000	100.0	V	90.0	-16.0	39.9	74.0
3183.06250	38.7	1000.0	1000.000	100.0	V	58.0	-10.9	35.3	74.0
4016.87500	41.0	1000.0	1000.000	100.0	V	33.0	-8.3	33.0	74.0
4902.62500	43.4	1000.0	1000.000	100.0	V	0.0	-6.6	30.6	74.0

Final average measurement result:

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBμV/m)
1169.500000	16.9	1000.0	1000.000	100.0	V	12.0	-21.4	37.1	54.0
1531.937500	19.0	1000.0	1000.000	100.0	V	46.0	-18.7	35.0	54.0
2049.812500	21.4	1000.0	1000.000	100.0	V	90.0	-16.0	32.6	54.0
3183.062500	25.7	1000.0	1000.000	100.0	V	58.0	-10.9	28.3	54.0
4016.875000	27.6	1000.0	1000.000	100.0	V	33.0	-8.3	26.4	54.0
4902.625000	33.2	1000.0	1000.000	100.0	V	0.0	-6.6	20.8	54.0

Figure 8: Spectral Diagrams and measurement results, 7 GHz – 18 GHz, vertical polarization



Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBμV/m)
7221.375000	37.6	1000.0	1000.000	100.0	V	180.0	-3.9	36.4	74.0
8393.218750	39.4	1000.0	1000.000	100.0	V	180.0	-2.4	34.6	74.0
9515.218750	39.9	1000.0	1000.000	100.0	V	180.0	-0.7	34.1	74.0
10940.750000	41.3	1000.0	1000.000	100.0	V	180.0	0.9	32.7	74.0
12913.875000	45.3	1000.0	1000.000	100.0	V	180.0	3.5	28.7	74.0
15675.562500	47.4	1000.0	1000.000	100.0	V	180.0	6.5	26.6	74.0

Final average measurement result:

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBμV/m)
7221.375000	25.2	1000.0	1000.000	100.0	V	180.0	-3.9	28.8	54.0
8393.218750	26.4	1000.0	1000.000	100.0	V	180.0	-2.4	27.6	54.0
9515.218750	27.1	1000.0	1000.000	100.0	V	180.0	-0.7	26.9	54.0
10940.750000	28.5	1000.0	1000.000	100.0	V	180.0	0.9	25.5	54.0
12913.875000	32.0	1000.0	1000.000	100.0	V	180.0	3.5	22.0	54.0
15675.562500	34.5	1000.0	1000.000	100.0	V	180.0	6.5	19.5	54.0

Prüfbericht - Nr.: CN22HP1X 001
Test Report No.:Seite 21 von 22
Page 21 of 22

6 Photographs of the Test Set-Up

Refer to the test setup file.

7 List of Test and Measurement Instruments

Equip.	Description	Model	Manufacturer	Last Date DD.MM.YYYY	Due Date DD.MM.YYYY
9023229	EMI test receiver	ESR3	Rohde&Schwarz	22.03.2021	31.08.2022
G1811403	Artificial mains network	ENV216	Rohde&Schwarz	04.11.2021	04.11.2022
G1824248	Dual display multimeter	F45	Fluke	18.09.2020	18.09.2022
G1811378	3m modified semi-anechoic chamber	SAC3	Frankonia	27.06.2019	31.08.2022
G1811402	EMI test receiver	ESCI	Rohde&Schwarz	01.09.2021	01.09.2022
G1811425	Bilog antenna	CBL 6112D	Teseq	10.03.2020	10.03.2023
G1811417	Log periodic antenna	HL050	Rohde&Schwarz	10.03.2020	10.03.2023
G1822702	Spectrum analyser	FSV40	Rohde&Schwarz	04.11.2021	04.11.2023
G1825371	Preamplifier	EMC051845SE	Taiwan EMC	14.05.2021	14.05.2023
G1824845	EMC measurement software	EMC32 (Ver 10.20.01)	Rohde&Schwarz	N/A	N/A

Prüfbericht - Nr.: CN22HP1X 001

Test Report No.:

Seite 22 von 22

Page 22 of 22

8 List of Figures

Figure 1: Spectral Diagrams, Conducted Emission, 150 kHz – 30 MHz, L.....	11
Figure 2: Spectral Diagrams, Conducted Emission, 150 kHz – 30 MHz, N	12
Figure 3: Spectral Diagrams, Radiated Emission, 30 MHz – 1000 MHz, Horizontal polarization.....	14
Figure 4: Spectral Diagrams, Radiated Emission, 30 MHz – 1000 MHz, Vertical polarization.....	15
Figure 5: Spectral Diagrams and measurement results, 1 GHz – 7 GHz, horizontal polarization	17
Figure 6: Spectral Diagrams and measurement results, 7 GHz – 18 GHz, horizontal polarization	18
Figure 7: Spectral Diagrams and measurement results, 1 GHz – 7 GHz, vertical polarization.....	19
Figure 8: Spectral Diagrams and measurement results, 7 GHz – 18 GHz, vertical polarization.....	20

End of test report