

CTC advanced
member of RWTÜV group



BNetzA-CAB-02/21-102

TEST REPORT

Test Report No.: 1-6302/18-01-04_C



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing Laboratory

CTC advanced GmbH
Untertürkheimer Straße 6 – 10
66117 Saarbrücken/Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: <http://ctcadvanced.com>
e-mail: mail@ctcadvanced.com

Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

Applicant

New Japan Radio Co., Ltd.
Microwave Division Quality Assurance Section
1-1, Fukuoka 2-Chome
Fujimino-City Saitama, 356-8510/Japan
Phone: +81-49-278-1472
Fax: +81-49-266-6037
Contact: Yuji Kita
e-mail: kitayuji@njr.co.jp

Manufacturer

New Japan Radio Co.,Ltd.
1-1, Fukuoka 2-Chome
Fujimino-City Saitama, 356-8510, Japan

Test Standard/s

FCC - Title 47 CFR
Part 15

2018-12

FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 -
Radio frequency devices

ICES-003, Issue 6

2017-04

Interference-Causing Equipment Standard Digital Apparatus

Test Item

Kind of test item: VSAT Receiver
Model name: 1505982-0002 (NJR2830M)
FCC ID: 2ACUJR2830M
IC: ICES-3 (A) /NMB-3 (A)
S/N serial number: A00005A88
A00039A7X
HW hardware status: see chapter 6.2
SW software status: - / -
Power Supply: DC 10V - 15V

This test report is electronically signed and valid without handwritten signature. The public keys can be requested at the test laboratory to verify the electronic signatures.

Test Report authorised:

Test performed:

Hans-Joachim Wolsdorfer
Radio Communications & EMC

Uli Kraus
Radio Communications & EMC

1 Table of contents

1	Table of contents	2
2	General information	3
2.1	Notes and disclaimer	3
2.2	Application details	4
3	Test standard/s:	4
4	Test Environment	4
5	Test Laboratories sub-contracted	4
6	Information about Test Conditions	5
6.1	Test Item	5
6.2	EUT: Type, S/N etc. and Short Descriptions Used in this Test Report	5
6.3	Auxiliary Equipment (AE): Type, S/N etc. and Short Descriptions	6
6.4	EUT Set-up(s)	6
6.5	EUT Operating Modes	6
7	Summary of Test Results	7
7.1	Emission	7
7.2	Measurement and Test Set-up	8
7.3	Measurement uncertainty	8
8	Detailed test results - Emission	9
8.1	Conducted Emission	9
8.2	Electromagnetic Radiated Emissions (Distance 10 m)	16
8.3	Electromagnetic Radiated Emissions 1GHz - 18GHz (Distance 3 m)	23
8.4	Electromagnetic Radiated Emissions 18GHz - 40GHz (Distance 3 m)	28
9	Test equipment and ancillaries used for tests	35
10	Observations	37
Annex A	Document history	38
Annex B	Further information	38

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CTC advanced GmbH.

The testing service provided by CTC advanced GmbH has been rendered under the current "General Terms and Conditions for CTC advanced GmbH".

CTC advanced GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the CTC advanced GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the CTC advanced GmbH test report include or imply any product or service warranties from CTC advanced GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CTC advanced GmbH.

All rights and remedies regarding vendor's products and services for which CTC advanced GmbH has prepared this test report shall be provided by the party offering such products or services and not by CTC advanced GmbH. In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronical signatures, the public keys can be requested at the testing laboratory.

This test report replaces the test report with the number 1-6302_18-01-04_B and dated 2019-01-14

2.2 Application details

Date of receipt of order: 2018-09-19
Date of receipt of test item: 2018-09-24
Start of test: 2018-09-28
End of test: 2018-12-10
Person(s) present during the test: - / -

3 Test standard/s:

Test Standard	Version	Test Standard Description
FCC - Title 47 CFR Part 15	2018-12	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
ICES-003, Issue 6	2017-04	Interference-Causing Equipment Standard Digital Apparatus
ANSI C63.4	2014-01	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

4 Test Environment

Temperature: 20°C – 25°C
Relative humidity content: 30 % - 50 %
Air pressure: 1020 hPa
Power supply: 230 V / 50 Hz

5 Test Laboratories sub-contracted

6 Information about Test Conditions

6.1 Test Item

Kind of test item :	VSAT Receiver		
Type identification :	1505982-0002 (NJR2830M)		
Equipment classification:	Equipment for fixed use		
Environment classification:	Residential, commercial and light industry		
Supply voltage :	DC 10V - 15V		
Ports :	Description	Direction	Length
(maximum cable lengths declared by manufacturer)	DC power port	Input	> 3m
	Signal/control port: RF input	Input	> 3m
	Signal/control port: RF output	output	> 3m
Is mounting position / usual operating position defined?			
Additional information:			
- the radio part of this device with FCC ID: 2ACUJR2830M and IC ICES-3 (A) /NMB-3 (A) is not part of this test report			

6.2 EUT: Type, S/N etc. and Short Descriptions Used in this Test Report

short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	Die-casting device	1505982-0002 (NJR2830M)	A00005A88	Rev. C	- / -
EUT B	Machining device	1505982-0002 (NJR2830M)	A00039A7X	Rev. 2	- / -

*) EUT short description is used to simplify the identification of the EUT in this test report.

6.3 Auxiliary Equipment (AE): Type, S/N etc. and Short Descriptions

AE description*)	Auxiliary equipment	Type	S/N serial number	HW hardware status	SW software status
AE A	switching power supply	7M09	- / -	- / -	- / -

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

6.4 EUT Set-up(s)

EUT set-up no.*)	Combination of EUT and AE	Remarks
set. 1	EUT A	---
set. 2	EUT A + AE A	only conducted emission
set. 3	EUT B	---
set. 4	EUT B + AE A	only conducted emission

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

6.5 EUT Operating Modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	active	---

*) EUT operating mode no. is used to simplify the test report.

7 Summary of Test Results

No deviations from the technical specifications were ascertained
 There were deviations from the technical specifications ascertained

7.1 Emission

7.1.1 Enclosure

EMI Phenomenon	Frequency range	Basic standard	Result
Radiated Interference Field Strength	30 - 1000 MHz	FCC Part 15 Class B	passed
Radiated Interference Field Strength	> 1 GHz	FCC Part 15 Class B	passed

7.1.2 AC Mains Power Input/Output Ports

EMI Phenomenon	Frequency range	Basic standard	Result
Conducted interference voltage	0,15– 30 MHz	FCC Part 15 Class B	passed

Remarks:

NA1	Not tested because not required by used standard
NA2	Test not applicable because port does not exists
NA3	Test not applicable because port only for services
NA4	Test not applicable because port lengths not longer than 3m
NA5	Not tested because not required by customer
NA6	Not tested because used frequency < 108 MHz
NA7	Not tested because the device is for vehicular use

7.2 Measurement and Test Set-up

Note: The test configuration is in accordance with the requirements given in the standards in point 3

7.3 Measurement uncertainty

The uncertainty of the measurement equipment fulfils CISPR 16 and the related European and national standards.

The semi anechoic chamber fulfils the requirements of CISPR 16-1 (ANSI C63.4) for a test volume of 4m Ø.

The table below shows the measurement uncertainties for each measurement method. The expended uncertainty (k=2 or 95%) was calculated with worst case values.

Measurement Method	Frequency area Impulse duration time	Description	Expanded uncertainty (k=2 or 95%)
Radiated Emission FCC part 15 B, ANSI C63.4	30 MHz – 18 GHz	- / -	± 4.28 dB
Conducted Emission FCC part 15 B, ANSI C63.4	9 kHz – 30 MHz	- / -	± 3.49 dB

8 Detailed test results - Emission

8.1 Conducted Emission

8.1.1 Instrumentation for Test (see equipment list)

G 1	G 2	F 21									
-----	-----	------	--	--	--	--	--	--	--	--	--

8.1.2 Test Plan

EUT set-up	set 2 + set 4		
Operating mode	Port / Line	Limit	Result
op 1	AC power line	FCC part 15 B Class B	passed

Remark :	Powered by external power supply (115V / 60Hz)
----------	--

8.1.3 Conducted Limits (Power-Line)

Frequency- range	FCC part 15 B Class B		FCC part 15 B Class A	
	Quasi-Peak (dB μ V)	Average (dB μ V)	Quasi-Peak (dB μ V)	Average (dB μ V)
0,15 MHz - 0,5 MHz	66-56	56-46	79	66
0,5 MHz - 5 MHz	56	46	73	60
5 MHz -30 MHz	60	50	73	60

8.1.4 Calibration Information

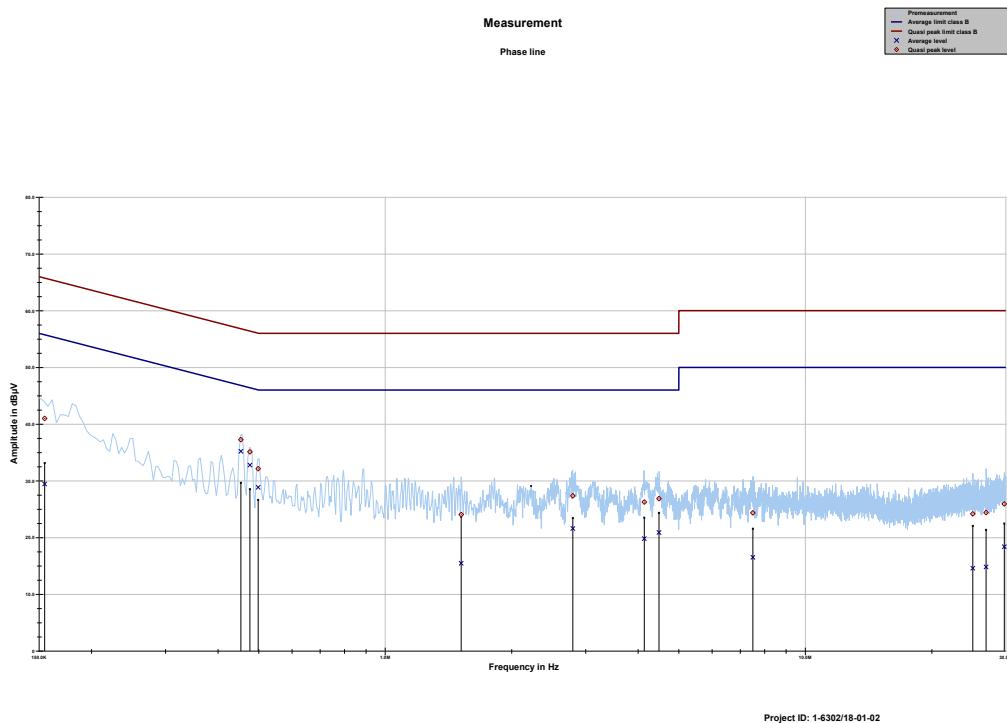
Device	Serial number	ICT Number	Calibration valid until	Calibration interval
Agilent MXE EMI Receiver with RF Filter Unit	3617A00170	3000004405	12 / 2018	12 month
VISN ESH 3-Z5	893045/004	300000584	12 / 2018	24 month

Remarks: All emission components and the shielded room were checked weekly

Cable loss: 0.6 to 2.4 dB (150kHz to 30 MHz)

8.1.5 Test Results of Main

set 2:



Phase line tbl

Project ID: 1-6302/18-01-02

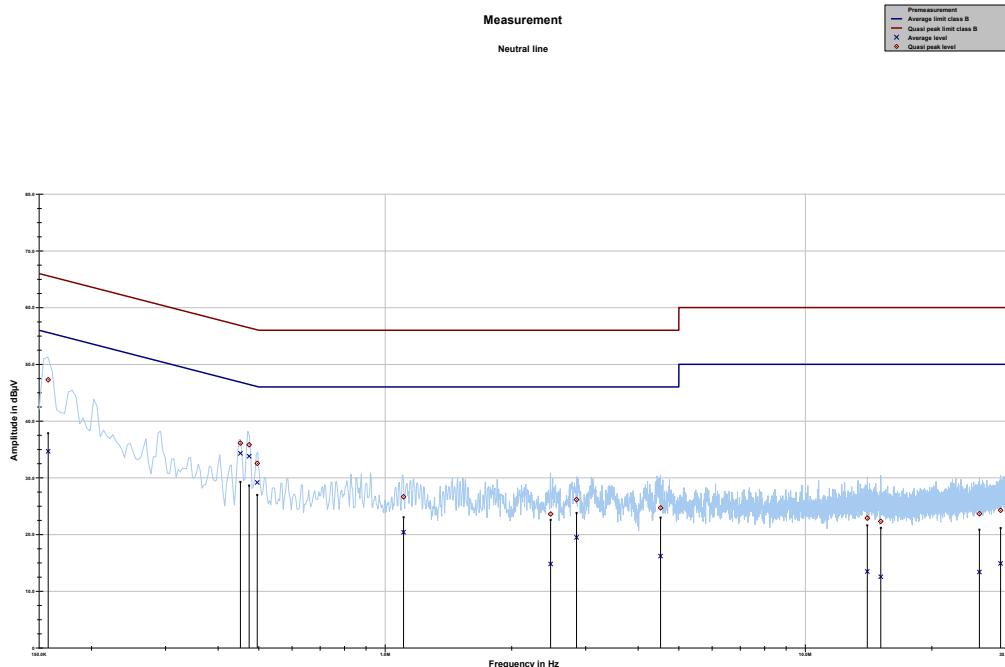
Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dB μ V	dB	dB μ V	dB μ V	dB	dB μ V
0.154664	41.00	24.74	65.746	29.45	26.41	55.867
0.453455	37.25	19.56	56.812	35.21	12.12	47.330
0.476526	35.12	21.28	56.399	32.77	13.90	46.671
0.498529	32.13	23.89	56.024	28.86	17.18	46.042
1.516994	24.05	31.95	56.000	15.47	30.53	46.000
2.797105	27.37	28.63	56.000	21.60	24.40	46.000
4.137437	26.27	29.73	56.000	19.82	26.18	46.000
4.485455	26.87	29.13	56.000	20.90	25.10	46.000
7.500571	24.37	35.63	60.000	16.52	33.48	50.000
25.037392	24.18	35.82	60.000	14.59	35.41	50.000
26.932914	24.41	35.59	60.000	14.82	35.18	50.000
29.764975	25.93	34.07	60.000	18.38	31.62	50.000

Project ID - 1-6302/18-01-02

EUT - 1505982-0002 (NJR2830M)

Serial Number - A00005A88

Operating mode - active



Neutral line tbl

Project ID: 1-6302/18-01-02

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dB μ V	dB	dB μ V	dB μ V	dB	dB μ V
0.157729	47.27	18.31	65.583	34.67	21.11	55.779
0.452422	36.11	20.72	56.831	34.30	13.06	47.359
0.474574	35.82	20.62	56.433	33.80	12.93	46.726
0.495966	32.53	23.53	56.067	29.16	16.95	46.115
1.105673	26.64	29.36	56.000	20.41	25.59	46.000
2.476304	23.60	32.40	56.000	14.81	31.19	46.000
2.853941	26.15	29.85	56.000	19.49	26.51	46.000
4.524474	24.70	31.30	56.000	16.19	29.81	46.000
14.047966	22.88	37.12	60.000	13.48	36.52	50.000
15.120399	22.32	37.68	60.000	12.55	37.45	50.000
25.968058	23.66	36.34	60.000	13.37	36.63	50.000
29.157912	24.27	35.73	60.000	14.89	35.11	50.000

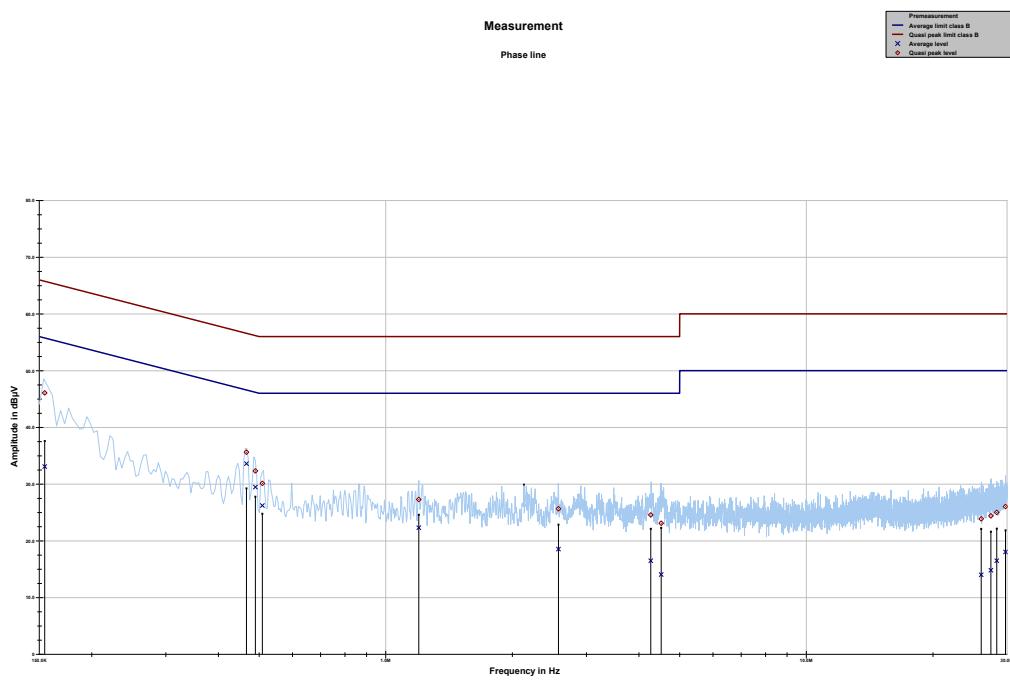
Project ID - 1-6302/18-01-02

EUT - 1505982-0002 (NJR2830M)

Serial Number - A00005A88

Operating mode - active

set 4:

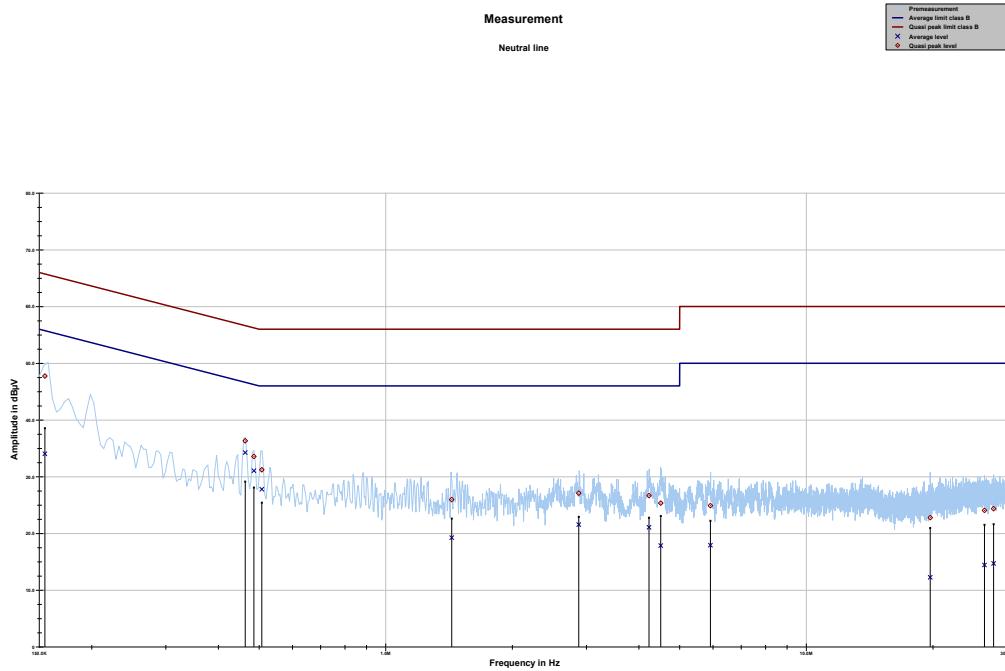


Phase line tbl

Project ID: 1-6302/18-1

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.154654	46.07	19.68	65.746	33.08	22.78	55.867
0.466597	35.61	20.96	56.574	33.60	13.36	46.954
0.489880	32.31	23.86	56.170	29.47	16.82	46.289
0.508933	30.13	25.87	56.000	26.22	19.78	46.000
1.198810	27.28	28.72	56.000	22.31	23.69	46.000
2.574825	25.65	30.35	56.000	18.54	27.46	46.000
4.267956	24.56	31.44	56.000	16.49	29.51	46.000
4.519135	23.10	32.90	56.000	14.05	31.95	46.000
26.060300	23.86	36.14	60.000	14.01	35.99	50.000
27.480728	24.40	35.60	60.000	14.81	35.19	50.000
28.367645	25.00	35.00	60.000	16.48	33.52	50.000
29.767771	26.04	33.96	60.000	18.03	31.97	50.000

Project ID - 1-6302/18-1
 EUT - 1505982-0002 (NJR2830M)
 Serial Number - A00039A7X
 Operating mode - active



Neutral line tbl

Project ID: 1-6302/18-1

Frequency MHz	Quasi peak level dBµV	Margin quasi peak dB	Limit QP dBµV	Average level dBµV	Margin average dB	Limit AV dBµV
0.154805	47.74	18.00	65.738	34.04	21.82	55.863
0.463436	36.33	20.30	56.631	34.25	12.79	47.045
0.485888	33.58	22.66	56.238	31.06	15.34	46.403
0.507479	31.21	24.79	56.000	27.78	18.22	46.000
1.435564	25.97	30.03	56.000	19.26	26.74	46.000
2.877460	27.10	28.90	56.000	21.56	24.44	46.000
4.226453	26.67	29.33	56.000	21.07	24.93	46.000
4.507662	25.35	30.65	56.000	17.86	28.14	46.000
5.917251	24.90	35.10	60.000	17.93	32.07	50.000
19.710448	22.78	37.22	60.000	12.26	37.74	50.000
26.525514	24.06	35.94	60.000	14.43	35.57	50.000
27.882379	24.36	35.64	60.000	14.71	35.29	50.000

Project ID - 1-6302/18-1
 EUT - 1505982-0002 (NJR2830M)
 Serial Number - A00039A7X
 Operating mode - active

8.1.6 Signal strength calculation

Calculation formula:

$$SS = UR + CF + VC$$

List of abbreviations:

SS	►	signal strength
UR	►	voltage at the receiver
CF	►	loss of the cable and filter (passband filter 130 kHz – 30 MHz)
VC	►	correction factor of the ISN (ESH3-Z5)

List with correction factors:

Frequency [MHz]	CF [dB]	VC [dB]
0,150	9,80	1,42
1,000	9,80	0,41
5,000	9,90	0,32
10,000	9,90	0,23
15,000	10,00	0,39
20,000	10,00	1,19
25,000	10,20	1,55
30,000	10,30	1,31

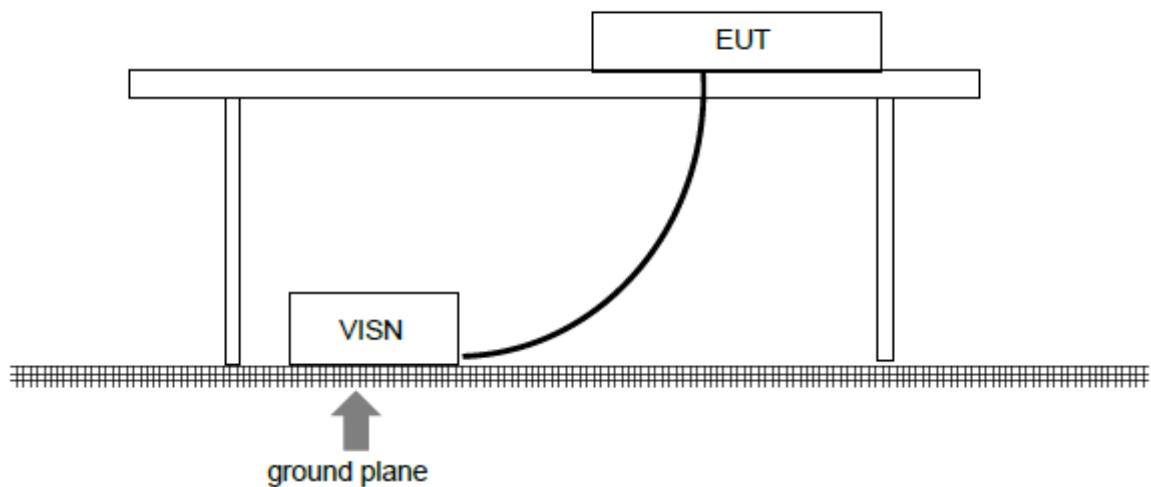
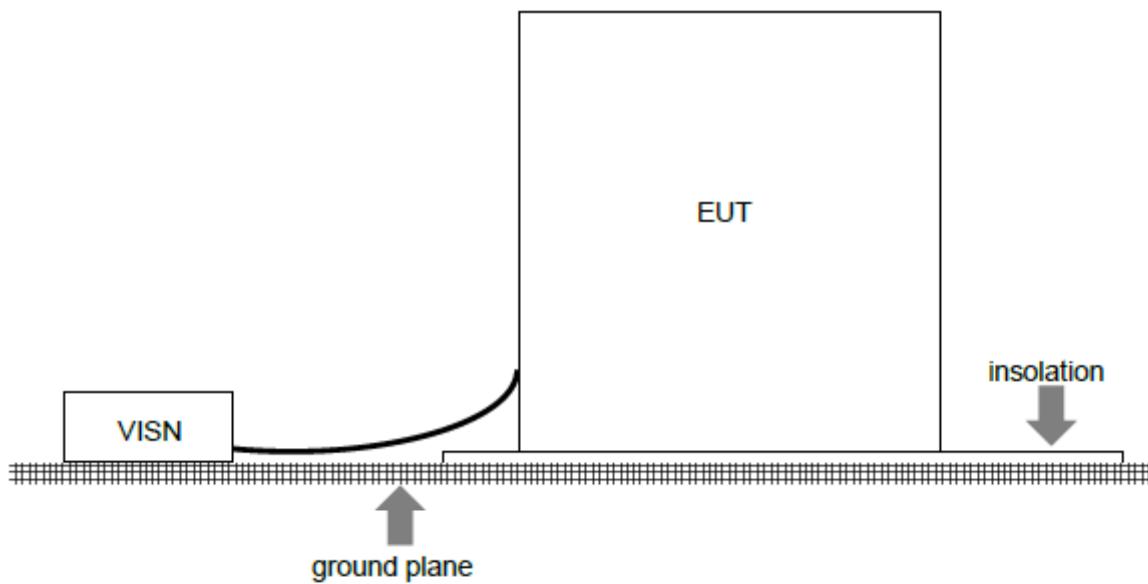
Example calculation:

For example at 10,000 000 MHz the measured Voltage (UR) is 37,62 dB μ V, the loss of the cable and filter (CF) is 9,90 dB and the correction factor of the ISN (VC) is 0,23 dB the final result will be calculated:

$$SS [\text{dB}\mu\text{V}] = 37,62 [\text{dB}\mu\text{V}] + 9,90 [\text{dB}] + 0,23 [\text{dB}] = 47,75 [\text{dB}\mu\text{V}] (244,06 \mu\text{V})$$

8.1.7 Test Set-up

According to EMC basic standard **ANSI C 63.4**



8.2 Electromagnetic Radiated Emissions (Distance 10 m)

8.2.1 Instrumentation for Test (see equipment list)

F 1	F 2	F 4b	F 5	F 6	F 7	F 8	F 28				
-----	-----	------	-----	-----	-----	-----	------	--	--	--	--

8.2.2 Test Plan

EUT set-up	set 1 + set 3		
Operating mode	Application	Limit	Result
op 1	Enclosure	FCC part 15 Class B	passed

Remarks: Powered by external DC power supply

8.2.3 Radiated Limits

Frequency- range	FCC part 15 B Class B	FCC part 15 B Class A
30 MHz – 88 MHz	30 dB μ V/m	39,1 dB μ V/m
88 MHz – 216 MHz	33,5 dB μ V/m	43,5 dB μ V/m
216 MHz – 960 MHz	36 dB μ V/m	46,4 dB μ V/m
above 960 MHz	44 dB μ V/m	49,5 dB μ V/m
	* This values are recalculated from the class B limits at 3 m antenna distance in §15.109 (g 2) of the FCC rules	.

8.2.4 Calibration Information

Device	Serial number	ICT Number	Calibration valid until	Calibration interval
ESCI 3 Receiver	100083/003	300003312	12/2018	12 month
Trilog Antenna	9163-371	300003854	11/2019	24 month

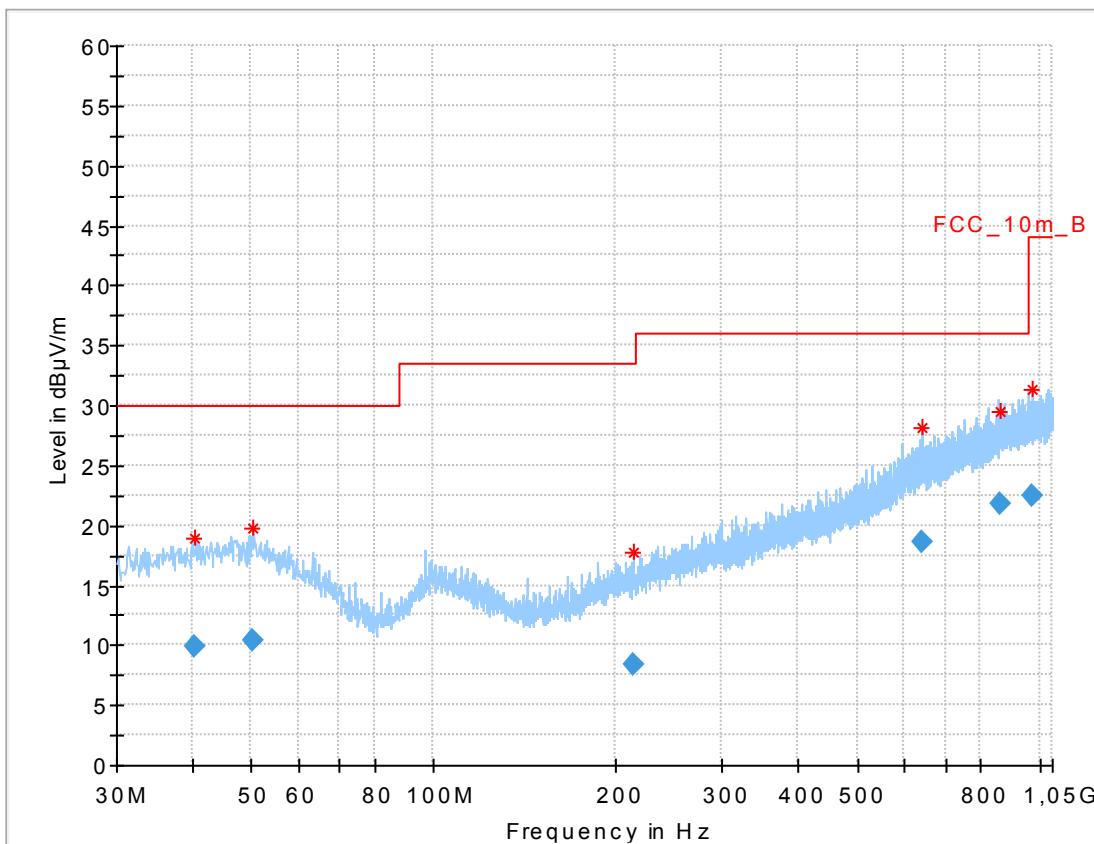
Remarks:
System check of all relevant devices and the chamber (weekly)

8.2.5 Test Results

set 1:

Common Information

EUT: 1505982-0002 (NJR2830M)
 Serial number: A00005A88
 Test description: FCC part 15 class B @ 10 m
 Operating condition: active
 Operator name: Wolsdorfer
 Comment: DC 13V



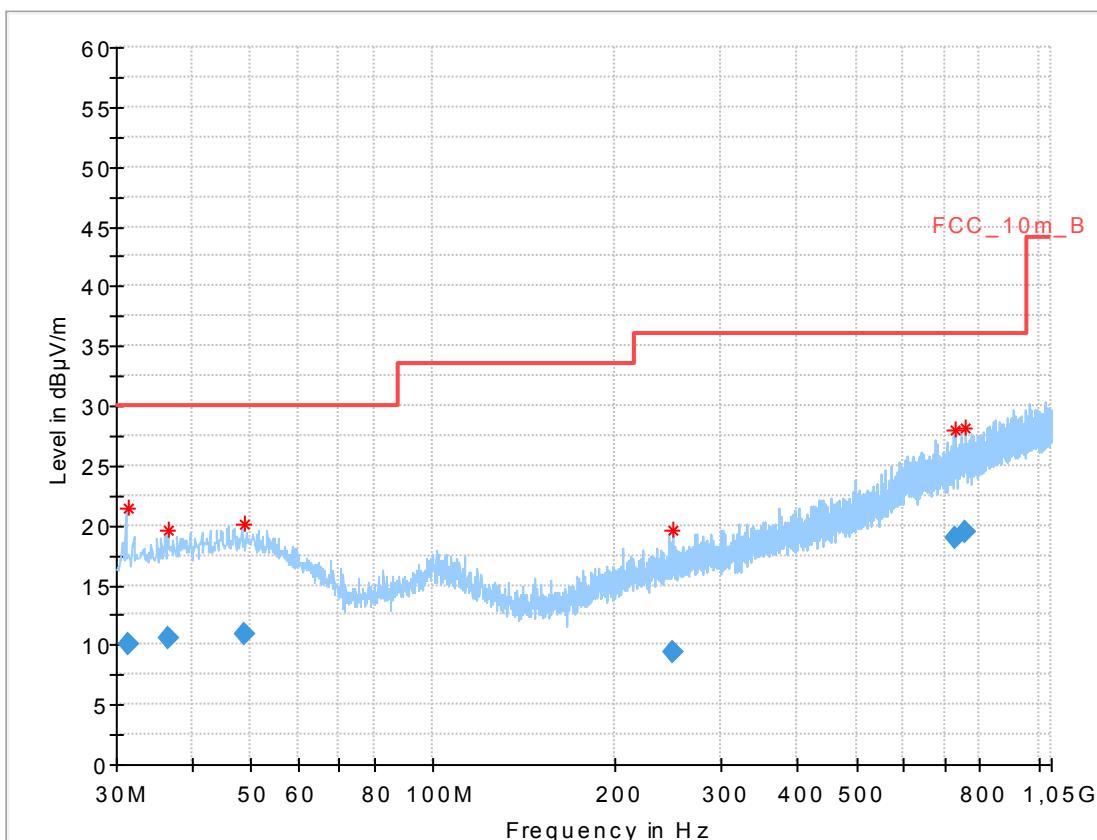
Final Result

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.279	9.91	30.0	20.09	1000	120	388.0	H	60.0	13.5
50.303	10.31	30.0	19.69	1000	120	187.0	V	-6.0	14.0
214.360	8.43	33.5	25.07	1000	120	391.0	V	31.0	12.5
639.383	18.62	36.0	17.38	1000	120	200.0	V	330.0	21.2
863.279	21.75	36.0	14.25	1000	120	394.0	V	330.0	24.1
976.283	22.40	36.0	13.60	1000	120	400.0	H	166.0	25.1

set 3:

Common Information

EUT: 1505982-0002 (NJR2830M)
 Serial number: A00039A7X
 Test description: FCC part 15 class B @ 10 m
 Operating condition: active
 Operator name: Wolsdorfer
 Comment: DC 13V



Final_Result

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.391	10.12	30.0	19.88	1000	120	170.0	H	-36.0	13
36.670	10.63	30.0	19.37	1000	120	203.0	V	250.0	14
48.860	10.82	33.5	19.18	1000	120	100.0	H	179.0	15
249.484	9.33	36.0	26.67	1000	120	200.0	H	270.0	14
728.805	19.01	36.0	16.99	1000	120	276.0	V	157.0	22
757.361	19.40	36.0	16.60	1000	120	100.0	H	181.0	22

8.2.6 Hardware Set-up

Subrange 1**Frequency Range:**

30 MHz - 2 GHz

Receiver:Receiver [ESCI 3]
@ GPIB0 (ADR 20), SN 100083/003, FW 4.42**Signal Path:**without Notch
FW 1.0**Antenna:**VULB 9163
SN 9163-295, FW ---
Correction Table (vertical): VULP6113
Correction Table (horizontal): VULP6113
Correction Table (vertical): Cable_EN_1GHz (1005)
Correction Table (horizontal): Cable_EN_1GHz (1005)**Antenna Tower:**Tower [EMCO 2090 Antenna Tower]
@ GPIB0 (ADR 8), FW REV 3.12**Turntable:**Turntable [EMCO Turntable]
@ GPIB0 (ADR 9), FW REV 3.12**Software version**

EMC32 V10.30.0

8.2.7 Sequence of testing

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 nonconducting 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.

Premereasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8.2.8 Signal strength calculation

Calculation formula:

$$SS = U_R + CL + AF$$

List of abbreviations:

SS	►	signal strength
U_R	►	voltage at the receiver
CL	►	loss of the cable
AF	►	antenna factor

List with correction factors:

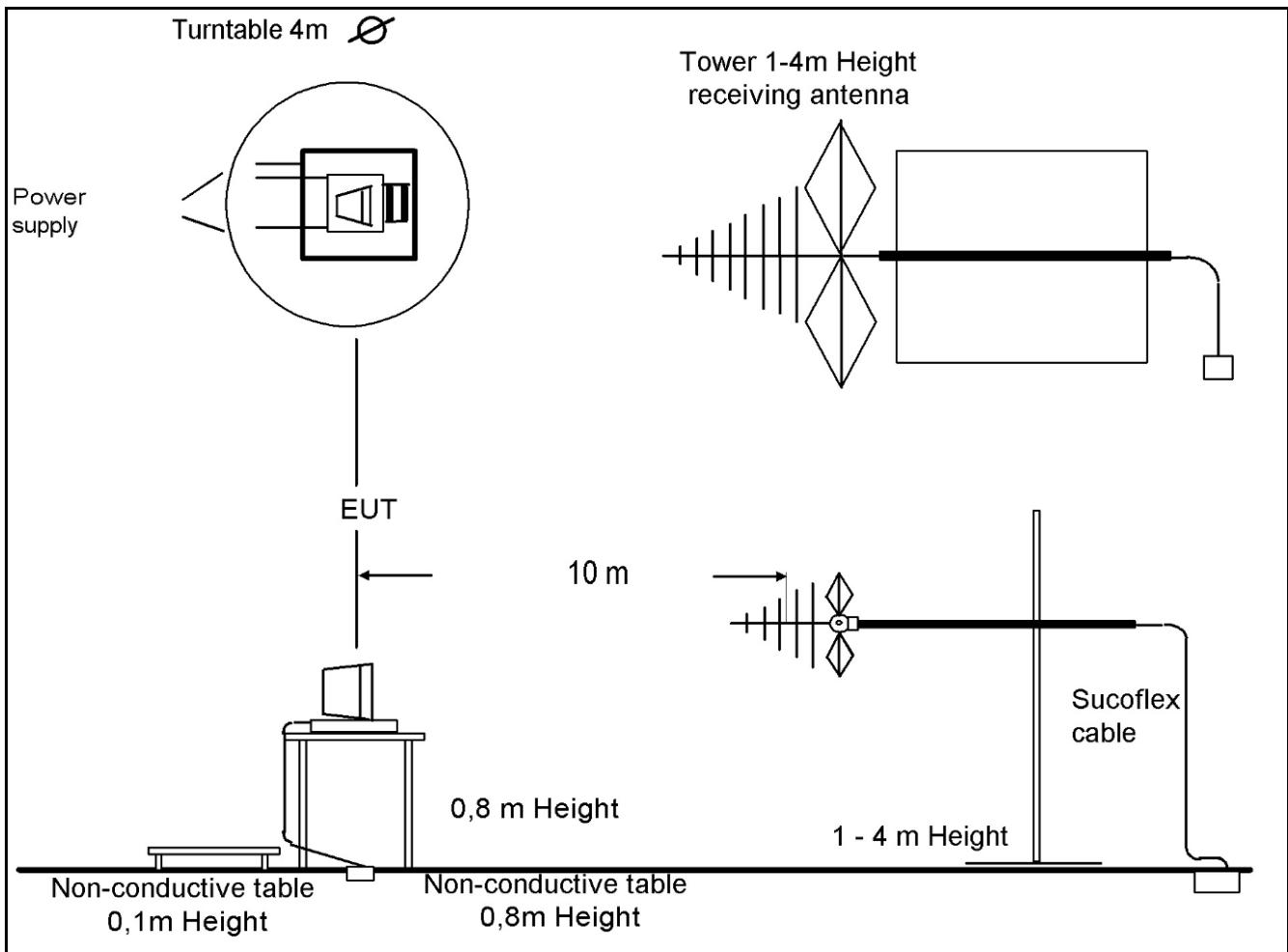
Frequency [MHz]	CL [dB]	AF [1/m]
30,000	0,20	12,30
100,000	0,60	11,30
200,000	1,10	10,60
300,000	1,30	13,20
400,000	1,60	15,30
500,000	1,90	16,80
600,000	2,00	18,80
700,000	2,20	20,30
800,000	2,30	21,50
900,000	2,40	22,80
1000,000	2,50	23,30

Example calculation:

For example at 500,000 000 MHz the measured Voltage (U_R) is 12,35 dB μ V, the loss of the cable (CL) is 1,90 dB and the antenna factor (AF) is 16,80 dB (m $^{-1}$) the final result will be calculated:

$$SS \text{ [dB}\mu\text{V/m]} = 12,35 \text{ [dB}\mu\text{V]} + 1,90 \text{ [dB]} + 16,80 \text{ [dB (m}^{-1}\text{)]} = 31,05 \text{ [dB}\mu\text{V/m]} (35,69 \mu\text{V/m})$$

8.2.9 Test Set-up



8.3 Electromagnetic Radiated Emissions 1GHz - 18GHz (Distance 3 m)

8.3.1 Instrumentation for Test (see equipment list)

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	07.07.2017	06.07.2019
2	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	n. a.	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	31.01.2017	30.01.2018
4	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
5	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
6	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
7	n. a.	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
8	n. a.	PC	ExOne	F+W		300004703	ne	-/-	-/-
9	n. a.	Highpass Filter (Chebyshev)	WHKX10-4432.5-4925-18000-40SS	Wainwright	1	300005028	ev	-/-	-/-
10	n. a.	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-

8.3.2 Test Plan

EUT set-up	set 1 + set 3		
Operating mode	Application	Limit	Result
op 1	Enclosure	FCC part 15 class B	passed

Remarks: Powered by external power supply (DC 13V)

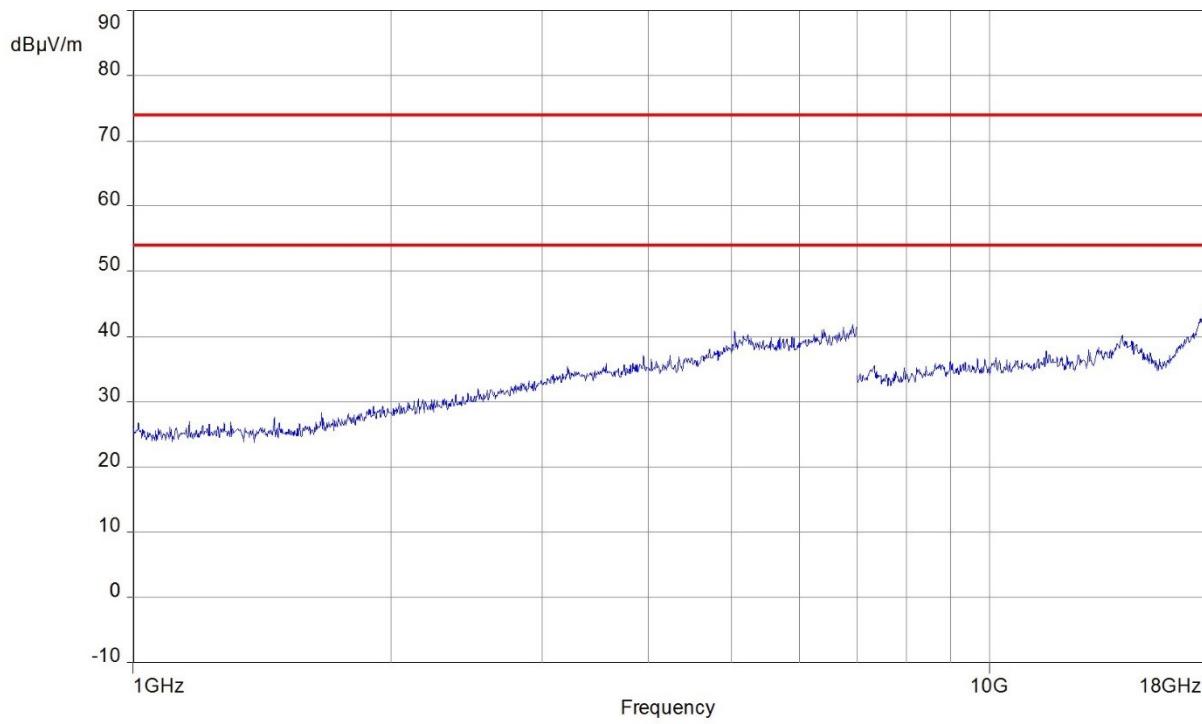
8.3.3 Radiated Limits

Frequency- range above 1GHz	47CFR15: (FCC part 15 B) Class B	47CFR15: (FCC part 15 B) Class A *
	54 dB μ V/m	59,5 dB μ V/m

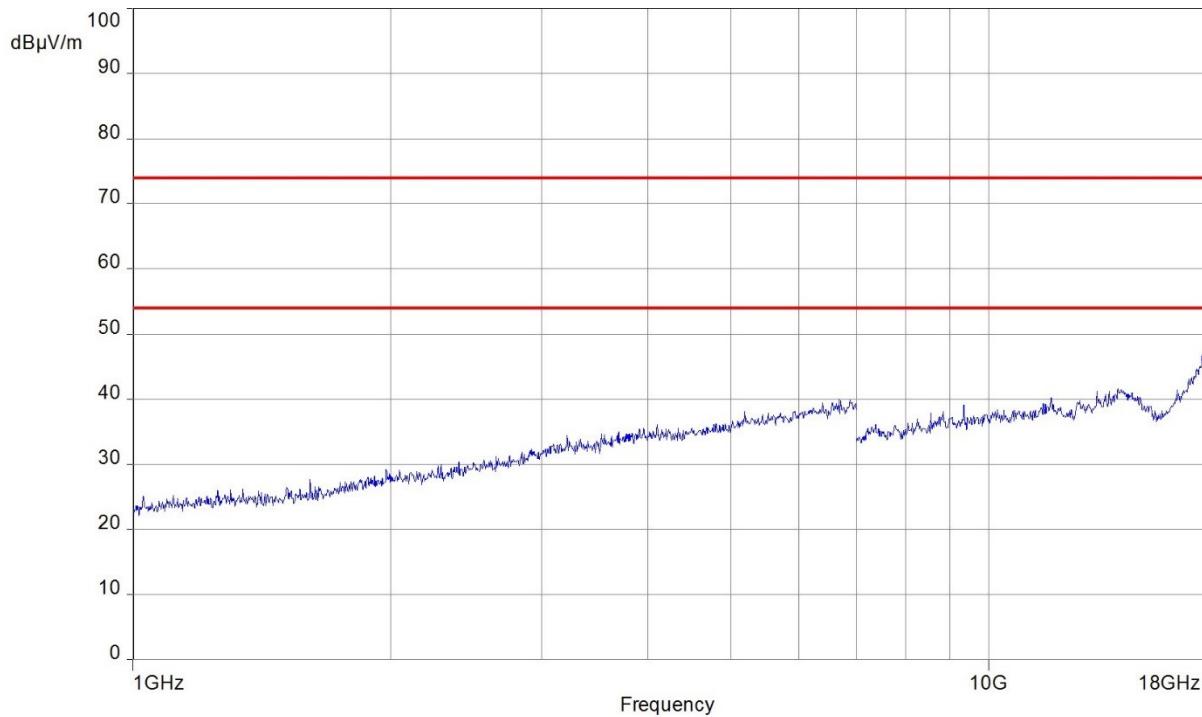
* This values are recalculated from the class A limits at 10 m antenna distance in §15.109 (g 2) of the FCC rules.

8.3.4 Test Results

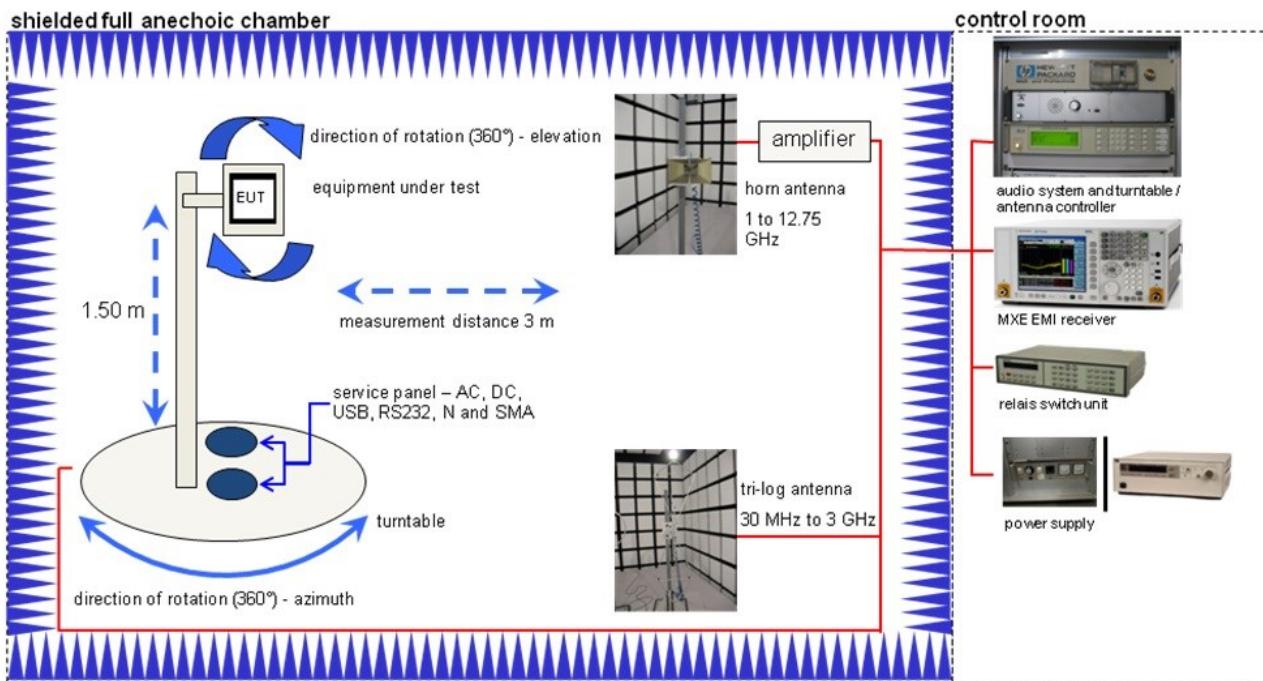
set 1 - 1GHz – 18 GHz



set 3 - 1GHz – 18 GHz



8.3.5 Hardware Set-up



8.3.6 Sequence of testing

- 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.

Premasurement

- 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.

8.3.7 Signal strength calculation

FS = UR + CA + AF

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

Example calculation:

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

8.4 Electromagnetic Radiated Emissions 18GHz - 40GHz (Distance 3 m)

8.4.1 Instrumentation for Test (see equipment list)

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1		Std. Gain Horn Antenna 26.5-40.0 GHz	V637	Narda	7911	300000510	ne	13.12.2017	12.12.2019
2		Std. Gain Horn Antenna 18.0-26.5 GHz	638	Narda		300000486	ne	13.12.2017	12.12.2019
3		Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	ev	-/-	-/-
4		Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	k	03.01.2019	02.01.2021
5		Netzgerät	LA30/1BA-1	Zentro	2027	300000194	ev	-/-	-/-

8.4.2 Test Plan

EUT set-up	set 1 + set 3		
Operating mode	Application	Limit	Result
op 1	Enclosure	FCC part 15 class B	passed

Remarks:	The measured values are recalculated from 5m to 3m distance Powered by external power supply (DC 13V)
-----------------	--

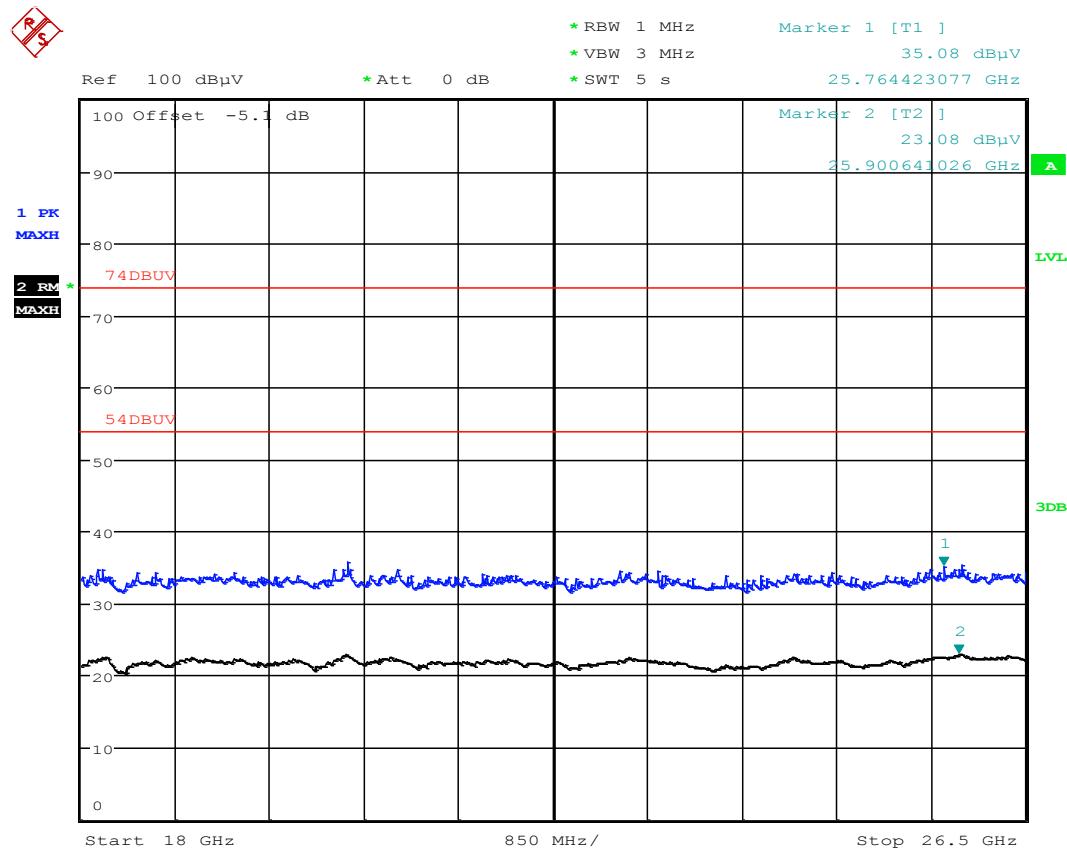
8.4.3 Radiated Limits

Frequency- range above 1GHz	47CFR15: (FCC part 15 B) Class B	47CFR15: (FCC part 15 B) Class A *
	54 dB μ V/m	59,5 dB μ V/m

* This values are recalculated from the class A limits at 10 m antenna distance in §15.109 (g 2) of the FCC rules.

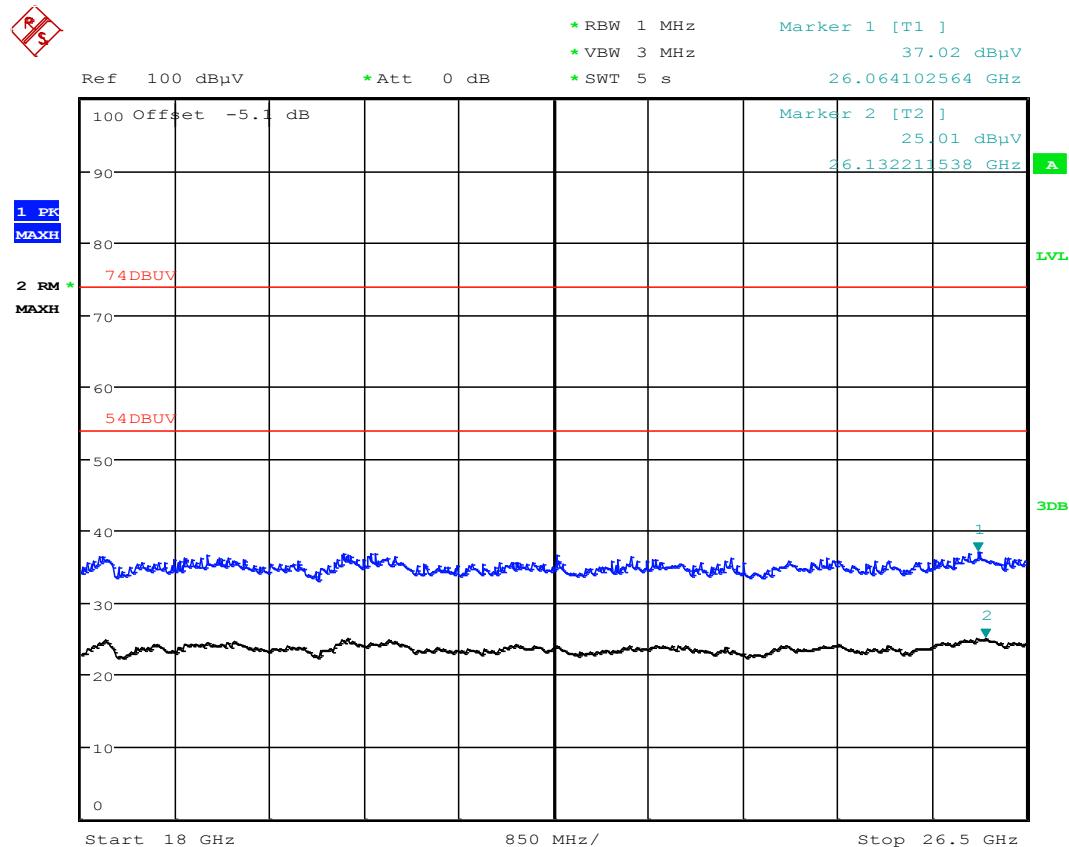
8.4.4 Test Results

set 1 - 18GHz – 26 GHz



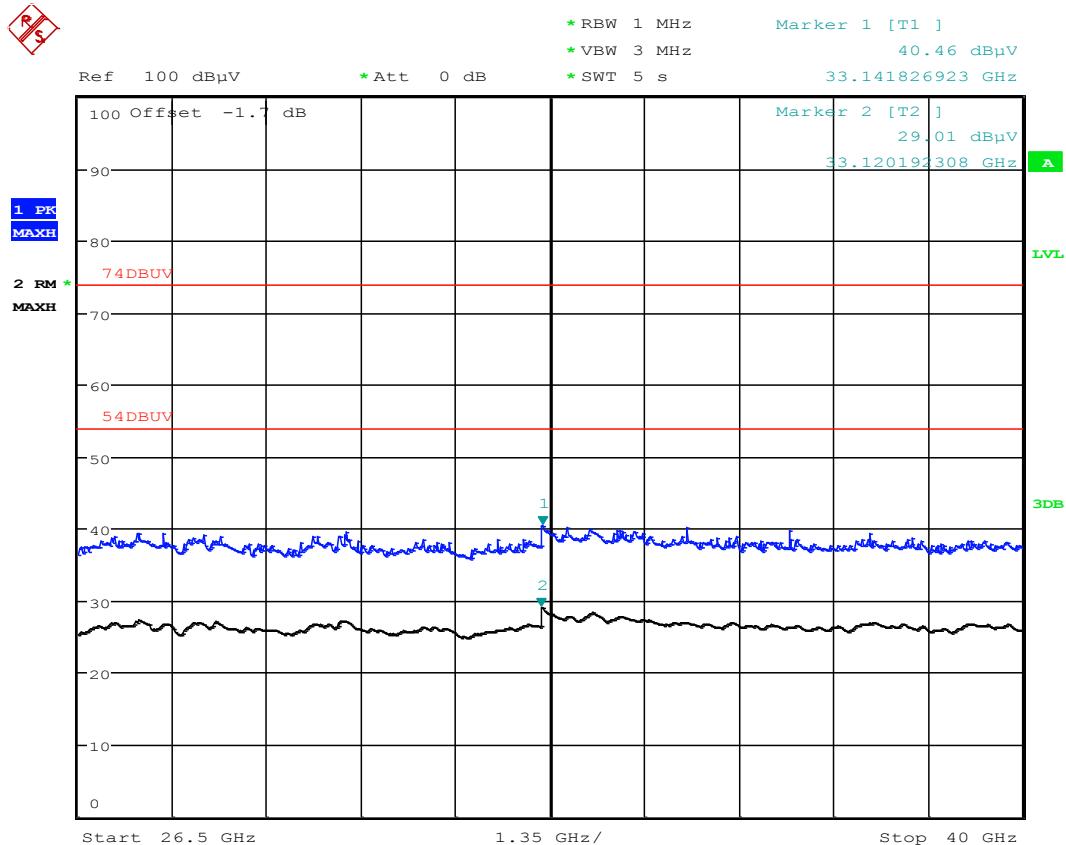
Date: 5.DEC.2018 16:28:48

set 3 - 18GHz – 26 GHz



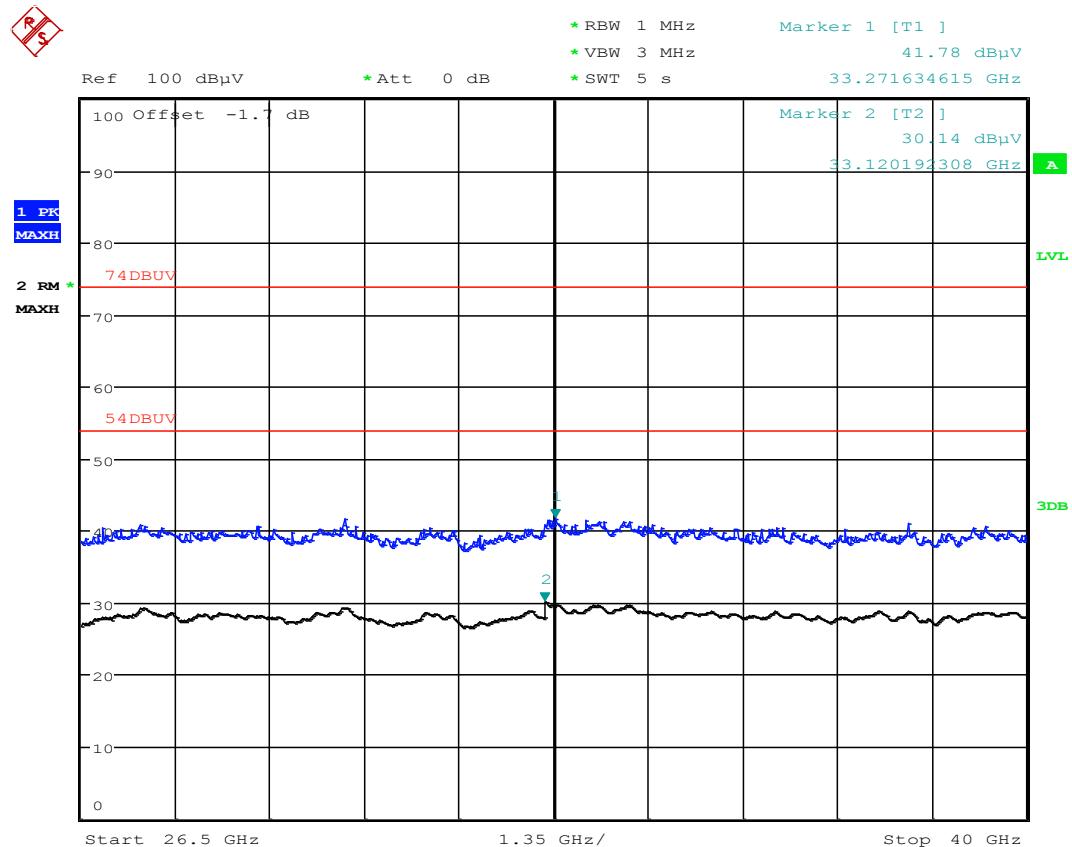
Date: 14.JAN.2019 14:33:39

set 1 - 26GHz – 40GHz



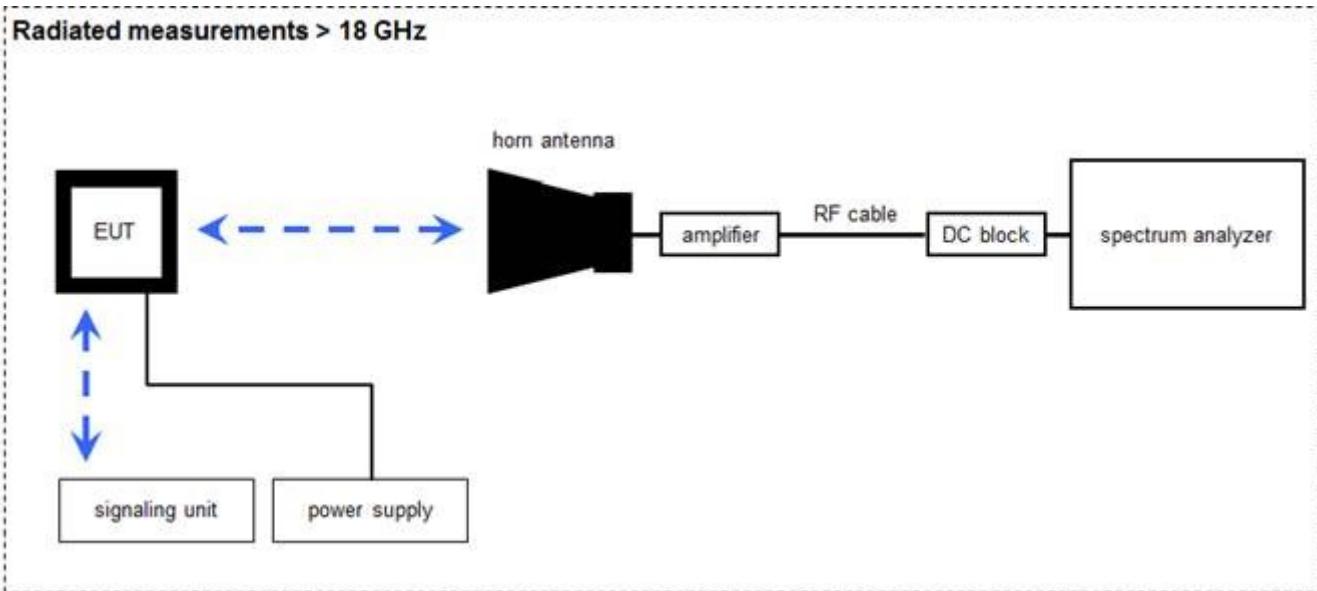
Date: 5.DEC.2018 16:26:49

set 3 - 26GHz – 40GHz



Date: 14.JAN.2019 14:35:21

8.4.5 Hardware Set-up



8.4.6 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

9 Test equipment and ancillaries used for tests

To simplify the identification of the test equipment and/or ancillaries which were used, the reporting of the relevant test cases only refer to the test item number as specified in the table below.

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
Radiated emission in chamber F					
F-1	Control Computer	F+W		2934939v001	300005258
F-2	Trilog-Antenna	Schwarzbeck	VULB 9163	9163-371	300003854
F-3a	Amplifier	Veritech Microwave Inc.	0518C-138	- / -	- / -
F-4b	Switch	Netgear	GS108P	26V12A3H50336	300000368
F-5	EMI Test receiver	R&S	ESCI	100083	300003312
F-6	Turntable Interface- Box	EMCO / ETS- LINDGREN	Model 105637	44583	300003747
F-7	Tower/Turntable Controller	EMCO / ETS- LINDGREN	Model 2090	64672	300003746
F-8	Tower	EMCO / ETS- LINDGREN	Model 2175	64762	300003745
F-9	Ultra Notch-Filter Rejected band Ch. 62	WRCD		9	
Radiated immunity in chamber F					
F-10	Control Computer	F+W		FW0502032	300003303
F-11	Signal Generator	R&S	SMB 100A	1406.6000k02- 113856	300005266
F-13	RF-Amplifier	Bonn	BLWA 0860- 250/100D	035491	300003210
F-14	Stacked Logper Antenna	Schwarzbeck	STLP9128 E	9128 E 013	300003408
F-14a	Bicon-Antenna	EMCO	3109	8906-2309	300000575
F-14b	Bicon-Antenna	Schwarzbeck	Balun VHBD 9134 elements BBFA 9146	3011 0057	300005385
F-15	RF-Amplifier	ar	1000LM20	20562	-/-
F-16	Directional Coupler	ar	DC7144A	312786	300003411
F-16a	Directional coupler	emv	DC 2000	9401-1677	300000592
F-18	Power Meter	R&S	NRP2	104973	300005114
F-19	Power sensor	R&S	NRP-Z91	103332	300005114-1
F-20	Power sensor	R&S	NRP-Z91	103333	300005114-2
F-35	RF- Amplifier	Bonn	BLMA 2060-5	097392A	300003908
F-36	Stacked Microwave Log.-Per. Antenna	Schwarzbeck	STLP9149	9149-044	300003919
Harmonics and flicker in front of chamber F					
F-21	Flicker and Harmonics Test System	Spitzenberger & Spies	PHE4500/B I PHE4500/B II	B5983 B5984	300003314
F-28	Power Supply	Hewlett Packard	6032 A	2920 A 04466	300000580
Radiated emission in chamber F > 1GHz					
F-29	Horn antenna	Schwarzbeck	BBHA 9120 B	188	300003896
F-30	Amplifier	ProNova	0518C-138	005	F 024
F-31	Amplifier	Miteq	42-00502650-28-5A	1103782	300003379
F-32	Horn antenna	Emco	3115	9709-5289	300000213
F-33	Spectrum Analyzer	R&S	FSU26	200809	300003874
F-34	Loop antenna	EMCO	6502	8905-2342	300000256

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
Conducted emission in chamber G					
G-1	EMI Receiver	Agilent	MXE (N9038A)	MY51210197	300004405
G-2	V-ISN	Rohde & Schwarz	ESH 3-Z5	892475/017	300002209
G-2a	V-ISN	Rohde & Schwarz	ESH 2-Z5	892602/024	300000587
G-3	2-Wire ISN	Schaffner	ISN T200	19075	300003422
G-4	4-Wire ISN	Schaffner	ISN T400	22325	300003423
G-5	Shielded wire ISN	Schaffner	ISN ST08	22583	300003433
G-6	Unshielded 8 wire ISN	Teseq	ISN T800	26113	300003833
G-7	Unshielded 8 wire ISN	Teseq	ISN T8-Cat. 6	26374	300003851
G-8	RF Current probe	Solar	9134-1	100254	300004163
G-9	V-ISN	Schaffner	ISN PLC-150	21579	300003318
G-10	V-ISN	Schaffner	ISN PLC-25-30	21584	300003319
G 10a	PLC Filter	TESEQ	Filter PLC	23436	300003598
G 10b	Coupling unit 75 Ohm	Fiedler	AC	----	300003272.04
Conducted immunity in chamber G					
G-11	Signal generator	R&S	SMG	8610647025	300000204.01
G-12	RF-Amplifier	BONN	BSA 0125-75	066502-01	300003545
G-13	Power Meter	R&S	URV 5	837723/025	300002844.01
G-14	Power Sensor	R&S	URV 5-Z2	832874/021	300002239
G-15	Directional coupler	emv	DC 2000	9401-1677	300000592
G-16	Attenuator 6dB	Alan	50HP6-100 N	121048 0348	300003148
G-17	EM-Injection Clamp	FCC	203i	232	300000626
G-18	CDN	FCC	FCC-801-M3-16	237	300000627
G-19	CDN	FCC	FCC-801-T2	78	300000629
G-20	CDN	FCC	FCC-801-AF 2	62	300000630
G-21	CDN	FCC	FCC-801-AF 4	61	300000631
G-22	CDN	FCC	FCC-801-M1	2027	300002761
G-23	CDN	TESEQ	CDN M016S	38741	300004847
G-23a	CDN	TESEQ	CDN M516A	35049	300004848
G-24	transformer for 50Hz Loop Antenna	EM-Test	MC2630	0200-10	300002659.01
G-25	50Hz Loop Antenna	EM-Test	MS 100	none	300002659
Surge, Burst, Dips and Interruptions in chamber G					
G-26	Hybrid-Generator	EM-Test	UCS 500N7	P1506148835	300005070
G-27	Motor Variac	EM-Test	MV 2616	0600-01	300002658
G-28	Capacitive Coupling Clamp	MWB	KKS 100	---	300000589
G-29a	Coupling Decoupling Network	EMC-Partner	CDN-2000-06-32	158	300004108
G-29	Coupling Decoupling Network	EMC-Partner	CDN-UTP8 ED3	1503	300004752
ESD in chamber G					
G-30	ESD generator	Schlöder	SESD 30000	511333	300005097
Emission on bench in chamber G					
G-31	Absorbing Clamp	R&S	MDS-21	832 231/006	300000527
generic in chamber G					
G-32	power supply	Hewlett Packard	6038A	2848A06673	300001512
Conducted interference in chamber G					
G 33	Signal generator	R&S	AFGU	862490/032	300001201
G 34	Audio amplifier	Crown 5002VZ	MACRO-TECH 5002VZ	8001641218	300004094
G 35	Shunt	Schwarzbeck	Shunt 9570	9570118	300004107
G 36	Coupling network	EM-Test	CN 200N1	P1322118851	300004742

10 Observations

No observations, exceeding those reported with the single test cases, have been made.

Annex A Document history

Version	Applied changes	Date of release
- / -	Initial release	2019-01-10
_A	EUT name changed	2019-01-14
_B	EUT B added	2019-01-15
_C	EUT information update	2019-01-24

Annex B Further information**Glossary**

DUT	-	Device under Test
EMC	-	Electromagnetic Compatibility
EUT	-	Equipment under Test
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	not applicable
S/N	-	Serial Number
SW	-	Software