



FCC CFR 47 Part 15 Subpart B

CERTIFICATION TEST REPORT

For the

Applicant : Sindoh Co., Ltd.
Product : 3D Printer
FCC ID : 2AB83-A1SD
Model : A1SD
Multiple Model : Neo Speed 10, Neo Print 10, A1^{SD+}, A1^{WD}
FCC Rule : CFR 47 Part 15 Subpart B
ISED Canada Rule : ICES-003

We hereby certify that the above product has been tested by us with the listed rules and found in compliance with the regulation. The test data and results are issued on the test report no. **TR-W2101-003**

Signature


Choi, Young-min / Technical Manager

Date: 2021-01-06

Test Laboratory: ENG Co., Ltd.

It shall not be reproduced except in full, without the written approval of the ENG Co., Ltd. This document may be altered or revised by the ENG Co., Ltd. personnel only, and shall be noted in the revision section of the document. The test results in the report only apply to the tested sample.

Report No.: TR-W2101-003

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjam-eup, Gwangju-si, Gyeonggi-do, Korea 12813

Report Form_18 (Rev.0)

FCC & ISED Canada TEST REPORT

Project Number : EA2012C-018
Test Report Number : TR-W2101-003
Type of Equipment : 3D Printer
FCC ID : 2AB83-A1SD
Model Name : A1SD
Multiple Model Name : Neo Speed 10, Neo Print 10, A1^{SD+}, A1^{WD}
Applicant : Sindoh Co., Ltd.
Address : 3, Seongsu-ro24 (isipsa)-gil, Seongdong-gu, Seoul 04797,
Republic of Korea
Manufacturer : Sindoh Co., Ltd.
Address : 3, Seongsu-ro24 (isipsa)-gil, Seongdong-gu, Seoul 04797,
Republic of Korea
FCC Rule : FCC CFR 47 Part 15 Subpart B §15.101 Class A Device
ISED Canada Rule : ICES-003 Issue 6
Total page of Report : 68 pages
Date of Receipt : 2020-12-14
Date of Issue : 2021-01-06
Test Result : Pass

This test report only contains the result of a single test of the sample supplied for the examination.
It is not a generally valid assessment of the features of the respective products of the mass-production.

Prepared by Chu, Woo-sik / Senior Engineer


Signature

2021-01-06
Date

Reviewed by Choi, Young-min / Technical Manager


Signature

2021-01-06
Date

CONTENTS

Page

1. TEST SUMMARY	4
1.1 TEST STANDARDS AND RESULTS	4
1.2. TEST METHODOLOGY	4
1.3 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS	4
1.4 PURPOSE OF THE TEST	4
1.5 TEST FACILITY.....	5
2. EUT (EQUIPMENT UNDER TEST) DESCRIPTION.....	6
2.1 ADDITIONAL MODEL	6
3. TEST CONDITION.....	7
3.1 EQUIPMENT USED DURING TEST	7
3.2 CABLE DESCRIPTION	7
3.3 MODE OF OPERATION DURING THE TEST	8
3.4 TEST SETUP DRAWING.....	8
4. EUT MODIFICATIONS	9
5. EMISSION TESTS.....	10
5.1 AC POWER LINE CONDUCTED EMISSION	10
5.2 RADIATED EMISSION	27
APPENDIX I - TEST INSTRUMENTATION	45
APPENDIX II - TEST SETUP PHOTOS: AC POWER LINE CONDUCTED EMISSION TEST	46
APPENDIX III - TEST SETUP PHOTOS: RADIATED EMISSION TEST	48
APPENDIX IV - IDENTIFICATION LABEL	52

Release Control Record

Issue Report No.	Issued Date	Details/Revisions
TR-W2101-003	2021-01-06	Initial Release

1. TEST SUMMARY

1.1 Test standards and results

The sample submitted for evaluation (Hereafter refer to as the EUT) has been tested in accordance with the following specifications:

Agency	APPLICABLE SECTION	TEST DESCRIPTION	RESULTS
FCC	Part 15 Subpart B Section 15.107 (b)	AC Power Line Conducted Emission	PASS
	Part 15 Subpart B Section 15.109 (b)	Radiated Emission	PASS
ISED	ICES-003 Section 6.1 Table 2	AC Power Line Conducted Emission	PASS
	ICES-003 Section 6.2.1 Table 5	Radiated Emission	PASS

1.2. Test Methodology

FCC: ANSI C 63.4: 2014, FCC CFR 47 Part 2 and Part 15

ISED Canada: ICES-003.Issue 6

1.3 Additions, deviations, exclusions from standards








No additions, deviations or exclusions have been made from standard.

1.4 Purpose of the test

To determine whether the equipment under test fulfills the FCC and ISED Canada Rules, Regulation and standards stated in section 1.1 and 1.2.

1.5 Test Facility

The measurement facilities are located at 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do 12813, Korea. Our test facilities are accredited as a Conformity Assessment Body (CAB) by the FCC and ISED Canada, designated by the RRA (National Radio Research Agency), and accredited by KOLAS (Korea Laboratory Accreditation Scheme) in Korea and approved by TUV Rheinland, TUV SÜD and Korean Register of Shipping according to the requirement of ISO/IEC 17025.

Laboratory Qualification	Registration No.	Mark
FCC	KR0160	
ISED Canada	12721A	
RRA	KR0160	
TUV Rheinland	UA 50314109-0002	
TUV SÜD	CARAT 094465 0004 Rev.00	
Korean Agency for Technology and Standards	KT733	
KOREAN REGISTER OF SHIPPING	PCT40841-TL001	

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2. EUT (Equipment Under Test) DESCRIPTION

The Sindoh Co., Ltd., Model A1SD (referred to as the EUT in this report) is a 3D Printer, The product specification described herein was obtained from product data sheet or user's manual.

Printing Method	SLA (Stereo Lithography Apparatus)
Max. Print Length (mm)	W(max):110, D(max):80, H(max):180
Lamination thickness setting	25 μm ~ 100 μm
X-Y resolution	50 μm
LED wavelength	405 nm
LED output	150 W
Input Power Rating	100-240 V~, 50/60 Hz, 5.0 A
Dimensions	449 x 501 x 600 (W x D x H)
Weight	43.2 kg
Power	500 W
Port	USB Device, USB Host, WiFi, Ethernet
Contained RF Module	Model No: S904-SD-WF FCC ID: OZ5-S904-SD-WF IC: 21703-S904SDWF Manufacturer: Ohsung Electronics Co., Ltd.

2.1 Additional Model

Model Name	Model Difference
A1 ^{SD}	Basic Model
Neo Speed 10	Identical to the basic model except for the model designation and optional part
Neo Print 10	
A1 ^{SD+}	
A1 ^{WD}	
Note: The manufacturer has declared to all the additional model names into basic model name without any further evaluation by ENG Co., Ltd.	

3. TEST CONDITION

3.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description	Model No.	FCC ID	Serial No.	Manufacturer.
3D Printer (EUT)	A1SD	2AB83-A1SD	N/A	Sindoh Co., Ltd.
Notebook PC	TRN-C125	DoC	N/A	HP
Adapter for Notebook PC	HSTNN-CA40	DoC	N/A	CHICONY POWER TECHNOLOGY
Mouse	N/A	DoC	N/A	LOGITECH
USB Memory Stick	8GB-WJ004	DoC	N/A	SHENZHEN CHENGE ELECTRONICS CO.,LTD.
Access Point	AW-A1	-	ABRE400675NT	Unicorn Information System
Adapter for Access Point	KA02-1201000	DoC	N/A	Shenzhen Keyu Power Supply Technology Co., Ltd.

3.2 Cable Description

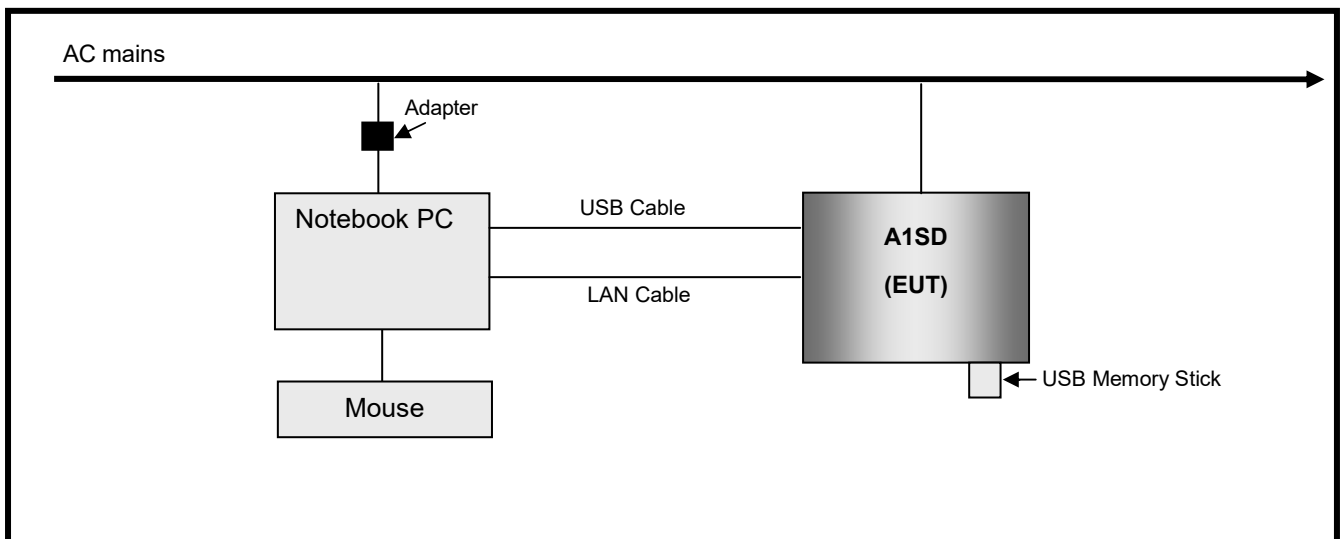
Test Mode	Description	Ports Name	Shielded (Y/N)	Ferrite Bead (Y/N)	Length (m)	Connected to
Mode #1 ~ Mode #4	3D Printer (EUT)	AC IN	N	N	1.5	AC Mains
		USB	-	-	-	USB Memory Stick
		USB	Y	N	1.5	Notebook PC
		LAN	N	N	3.0	Notebook PC
Mode #5 ~ Mode #8	3D Printer (EUT)	AC IN	N	N	1.5	AC Mains
		USB	-	-	-	USB Memory Stick
		USB	Y	N	1.5	Notebook PC
		LAN	N	N	3.0	Line terminated

3.3 Mode of operation during the test

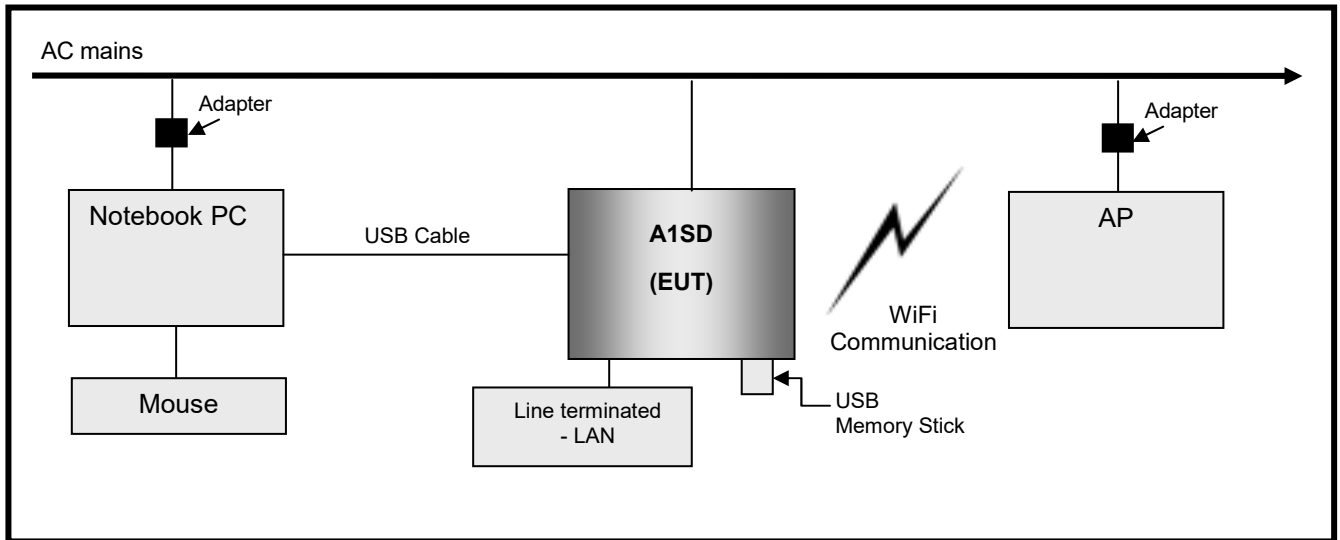
Test Mode	Description
# 1	Printing mode using USB function
# 2	Printing mode using Ethernet speed, 1 Gbps
# 3	Printing mode using Ethernet speed, 100 Mbps
# 4	Printing mode using USB memory stick
# 5	Printing mode using Wi-Fi function, 2.4 GHz(n40)
# 6	Printing mode using Wi-Fi function, 2.4 GHz(n20)
# 7	Printing mode using Wi-Fi function, 2.4 GHz(g)
# 8	Printing mode using Wi-Fi function, 2.4 GHz(b)

3.4 Test Setup Drawing

[Mode #1 ~ Mode #4]



[Mode #5 ~ Mode #8]



4. EUT MODIFICATIONS

- No EMC Relevant Modifications were performed by this test laboratory.

5. EMISSION TESTS

5.1 AC Power Line Conducted Emission

5.1.1 Test setup

The EUT and all supporting equipments were placed on a non-metallic table approximately 0.8 m above the ground plane.

Power was fed to the EUT through a 50 Ω/50 μH + 5 Ω Line Impedance Stabilization Network (LISN) and all supporting equipments were connected to another LISN. The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient noise. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.4: 2014 7.3.3 to determine the worse operating conditions.

The test set-up photos are included in appendix I.

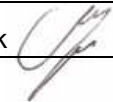
Used Software for measurement is EMC 32 supplied by Rohde&Schwarz.

5.1.2 Measurement uncertainty

Frequency range	Uncertainty
150 kHz ~ 30 MHz	2.17 dB

The measurement uncertainties are given with 95 % confidence.

5.1.3 Test Result

Date of Test	2020-12-14		
Temperature	(20.3 ± 0.3) °C	Relative humidity	(34.45 ± 0.35) % R.H.
Operating Input Voltage	120 Vac	Input Frequency	60 Hz
Frequency range	RBW	VBW	Detector Mode
0.15 MHz ~ 30 MHz	9 kHz	30 kHz	Peak , Q.P and/or Average
Test Mode	Mode #1 ~ Mode #8		
Test Result	Pass	Tested By	Chu, Woo-Sik 

5.1.4 Sample Calculated Example

At 5.31 MHz

QP Limit = 73.0 dBμV

Correction Factor (C. Factor) of LISN, Pulse Limiter and cable loss at 5.31 MHz = 9.7 dB

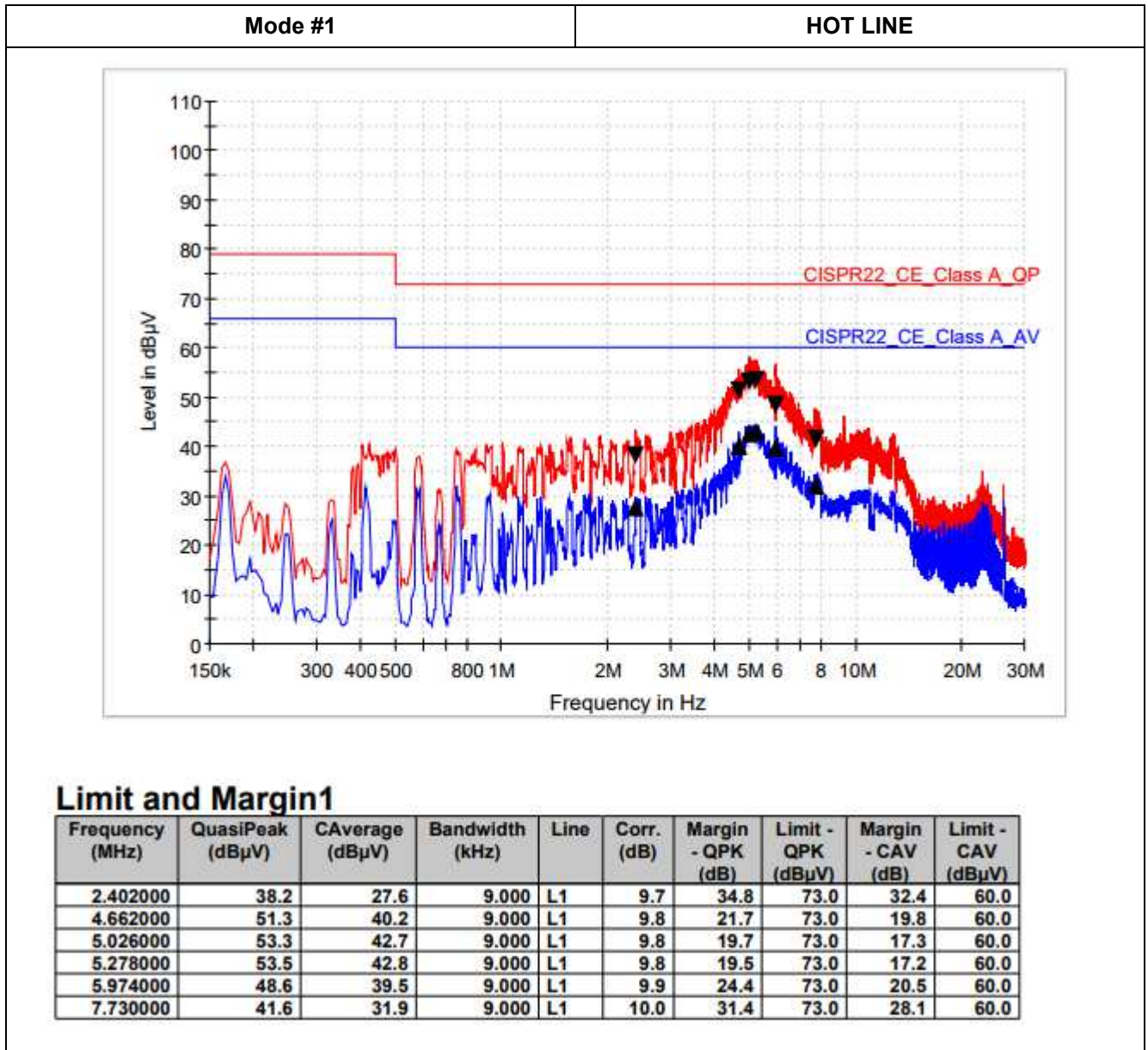
Q.P Reading from the Test receiver = 40.8 dBμV

(Calculated value for system losses by software EMC32 manufactured by Rohde & Schwarz)

Therefore Q.P Margin = 73 - 40.8 = 32.2

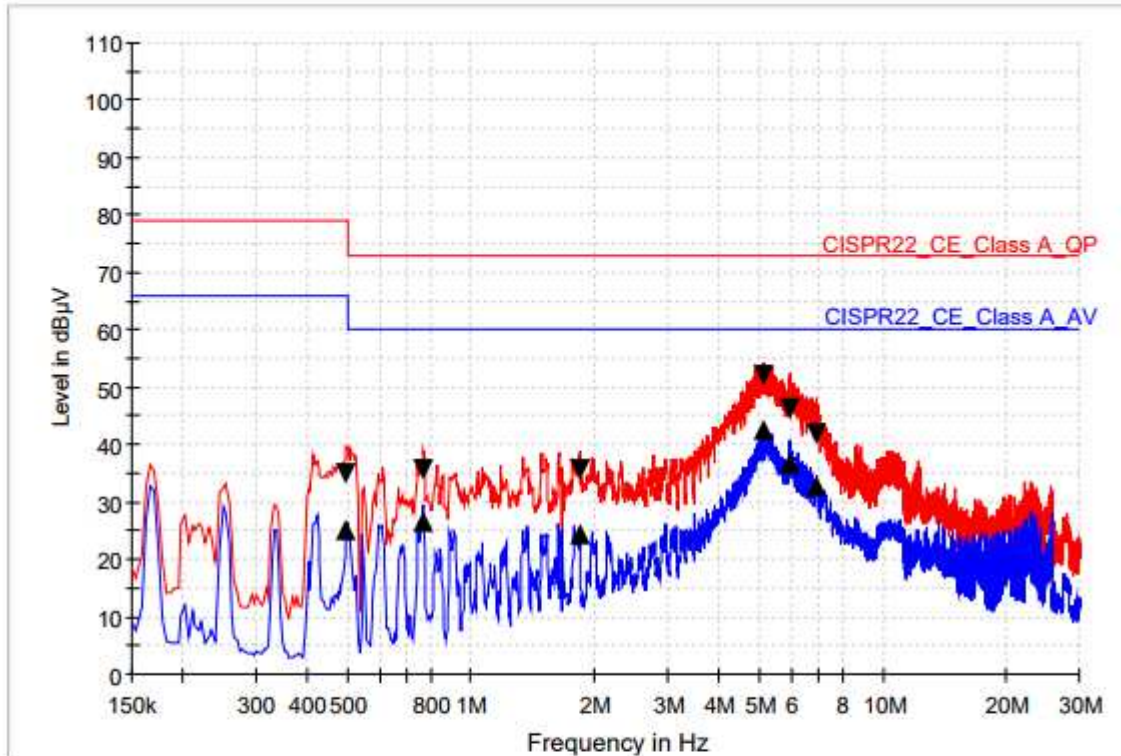
so the EUT has 32.2 dB margin at 5.31 MHz

5.1.5 Test Data



Mode #1

NEUTRAL LINE

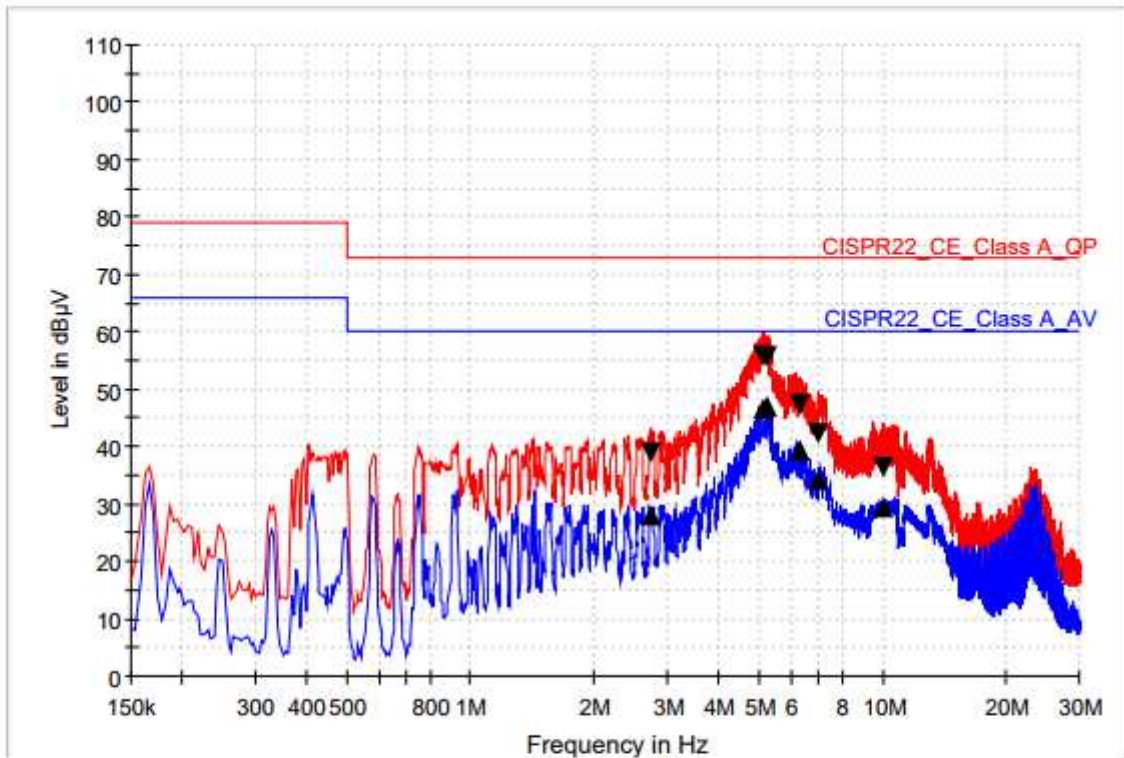


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.498000	35.1	25.2	9.000	N	9.7	43.9	79.0	40.8	66.0
0.766000	35.5	26.7	9.000	N	9.7	37.5	73.0	33.3	60.0
1.834000	35.6	24.6	9.000	N	9.7	37.4	73.0	35.4	60.0
5.134000	51.9	42.8	9.000	N	9.8	21.1	73.0	17.2	60.0
5.930000	46.2	36.7	9.000	N	9.9	26.8	73.0	23.3	60.0
6.934000	41.9	32.8	9.000	N	9.9	31.1	73.0	27.2	60.0

Mode #2

HOT LINE

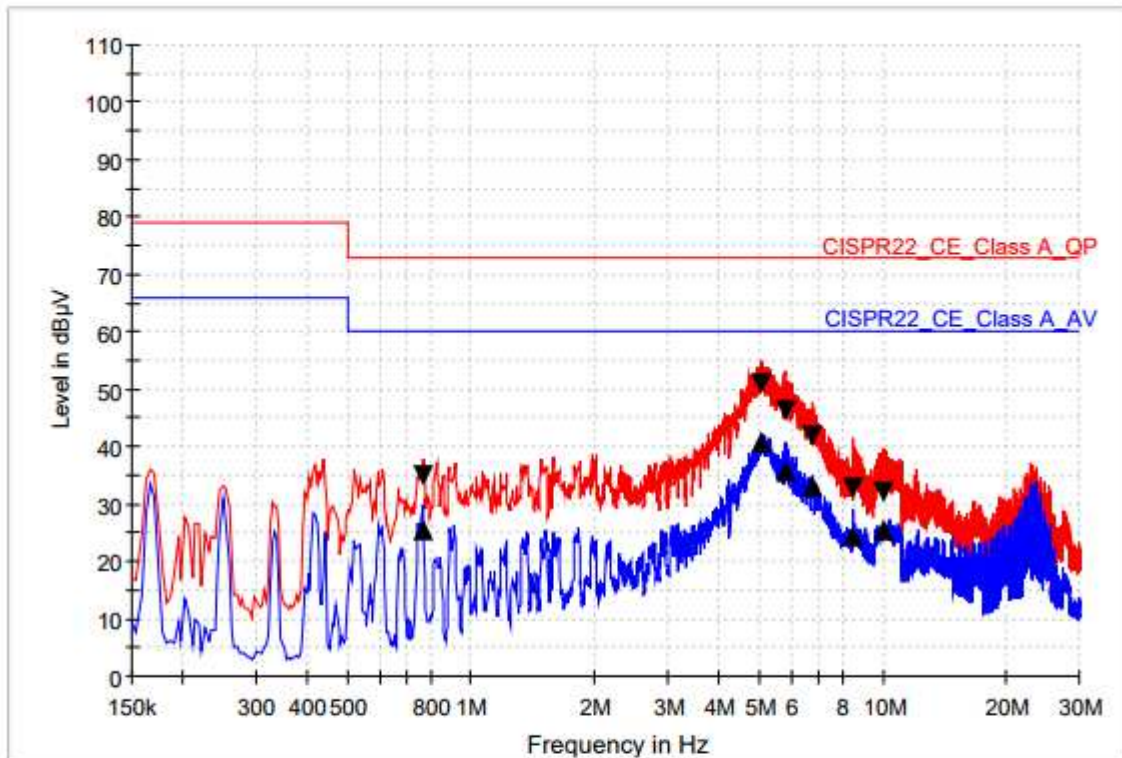


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
2.726000	38.9	28.0	9.000	L1	9.8	34.1	73.0	32.0	60.0
5.122000	55.8	46.6	9.000	L1	9.8	17.2	73.0	13.4	60.0
5.254000	55.6	47.2	9.000	L1	9.8	17.4	73.0	12.8	60.0
6.266000	47.4	39.2	9.000	L1	9.9	25.6	73.0	20.8	60.0
6.982000	42.2	34.4	9.000	L1	9.9	30.8	73.0	25.6	60.0
10.058000	36.3	29.4	9.000	L1	10.1	36.7	73.0	30.6	60.0

Mode #2

NEUTRAL LINE

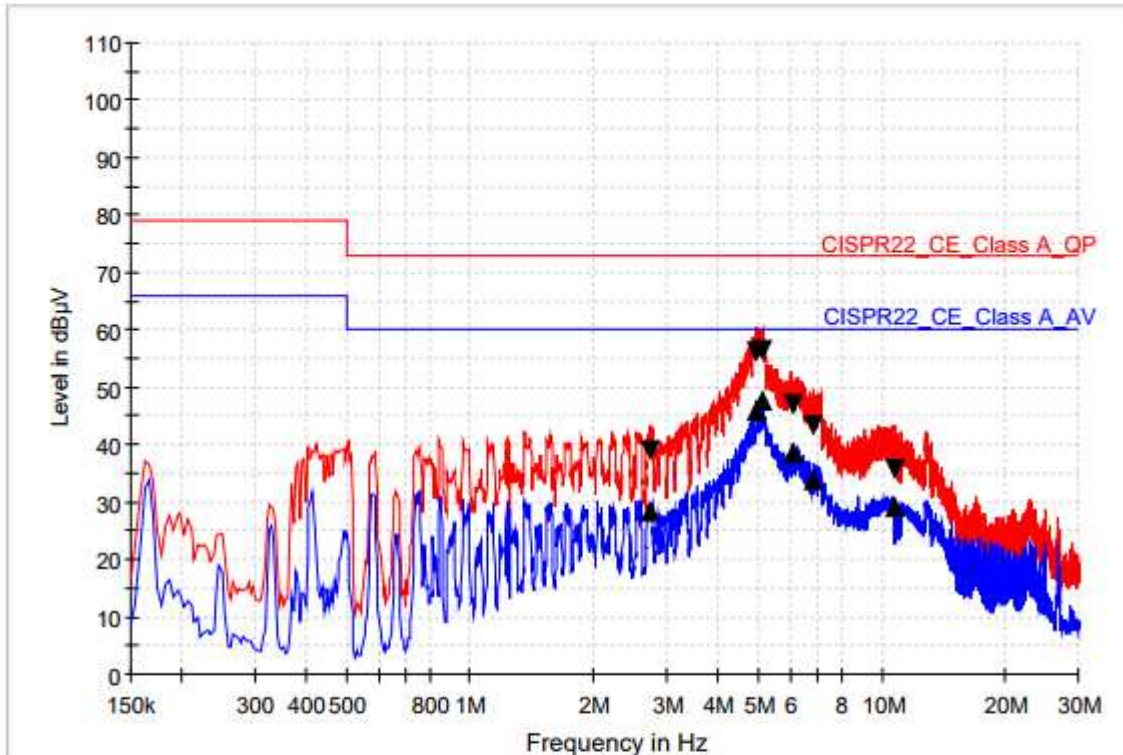


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.766000	34.9	25.5	9.000	N	9.7	38.1	73.0	34.5	60.0
5.082000	51.0	40.9	9.000	N	9.8	22.0	73.0	19.1	60.0
5.782000	46.3	35.8	9.000	N	9.9	26.7	73.0	24.2	60.0
6.774000	41.9	33.1	9.000	N	9.9	31.1	73.0	26.9	60.0
8.502000	32.6	24.6	9.000	N	10.0	40.4	73.0	35.4	60.0
10.026000	32.1	25.4	9.000	N	10.1	40.9	73.0	34.6	60.0

Mode #3

HOT LINE

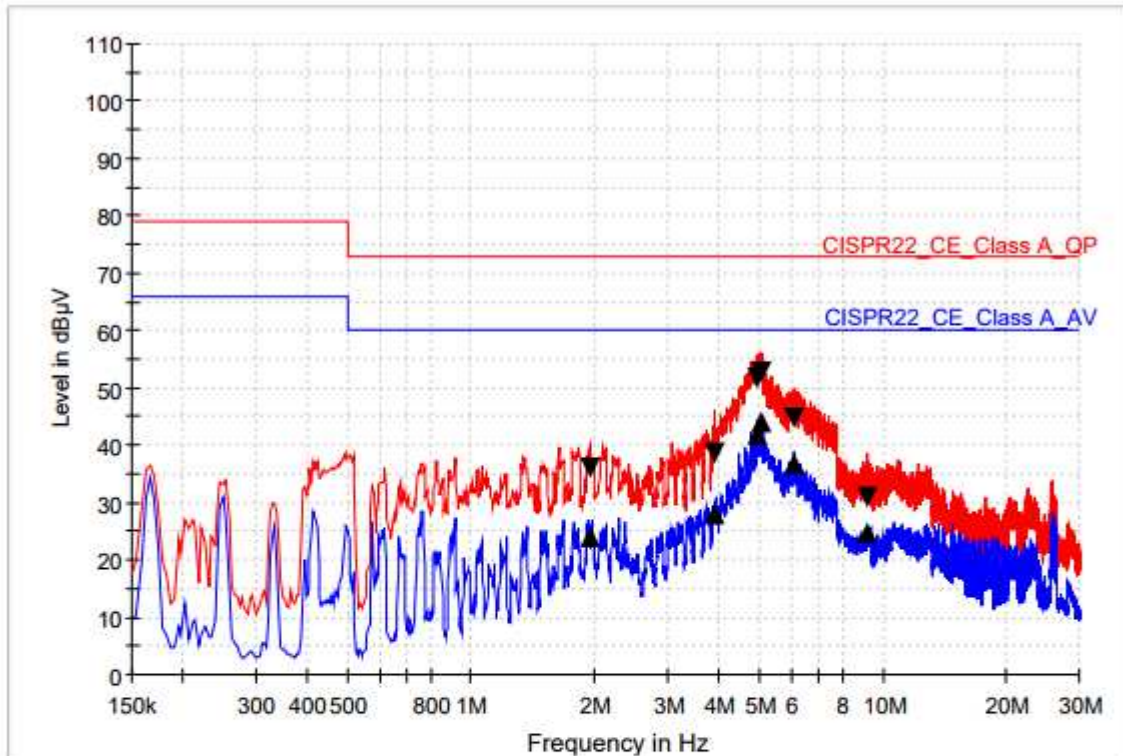


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
2.738000	39.2	28.4	9.000	L1	9.8	33.8	73.0	31.6	60.0
4.962000	56.1	46.0	9.000	L1	9.8	16.9	73.0	14.0	60.0
5.102000	56.6	47.7	9.000	L1	9.8	16.4	73.0	12.3	60.0
6.078000	47.0	38.5	9.000	L1	9.9	26.0	73.0	21.5	60.0
6.810000	43.4	34.0	9.000	L1	9.9	29.6	73.0	26.0	60.0
10.698000	35.8	29.2	9.000	L1	10.1	37.2	73.0	30.8	60.0

Mode #3

NEUTRAL LINE

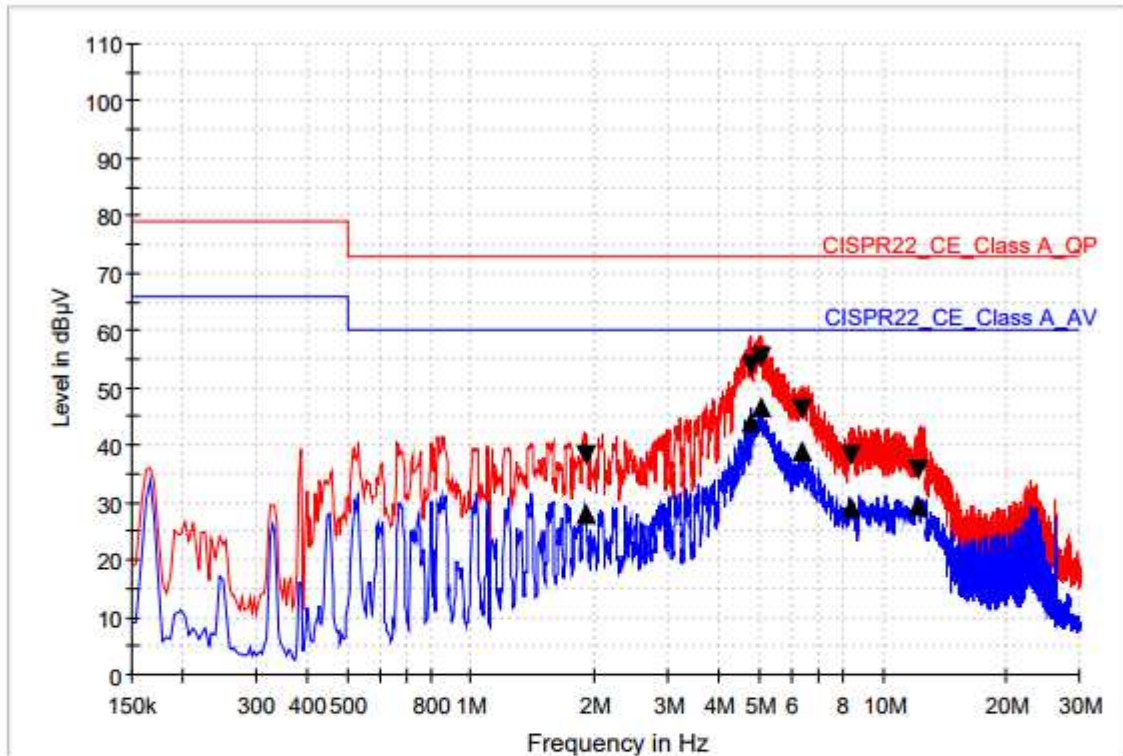


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
1.938000	35.9	23.9	9.000	N	9.7	37.1	73.0	36.1	60.0
3.902000	38.6	28.0	9.000	N	9.8	34.4	73.0	32.0	60.0
4.938000	51.6	41.8	9.000	N	9.8	21.4	73.0	18.2	60.0
5.094000	52.8	43.9	9.000	N	9.8	20.2	73.0	16.1	60.0
6.114000	44.9	36.8	9.000	N	9.9	28.1	73.0	23.2	60.0
9.190000	31.1	24.8	9.000	N	10.0	41.9	73.0	35.2	60.0

Mode #4

HOT LINE

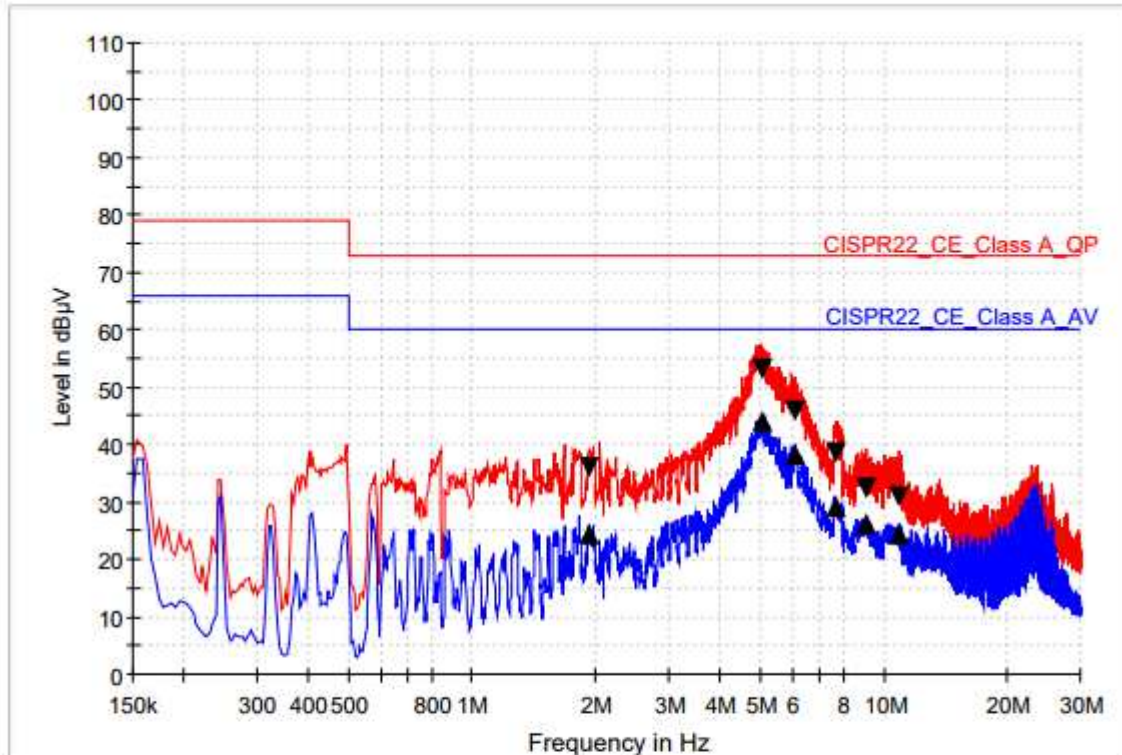


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
1.906000	38.4	28.2	9.000	L1	9.7	34.6	73.0	31.8	60.0
4.778000	54.1	44.0	9.000	L1	9.8	18.9	73.0	16.0	60.0
5.070000	55.5	46.7	9.000	L1	9.8	17.5	73.0	13.3	60.0
6.342000	46.3	38.9	9.000	L1	9.9	26.7	73.0	21.1	60.0
8.334000	38.1	29.3	9.000	L1	10.0	34.9	73.0	30.7	60.0
12.150000	35.7	29.5	9.000	L1	10.1	37.3	73.0	30.5	60.0

Mode #4

NEUTRAL LINE

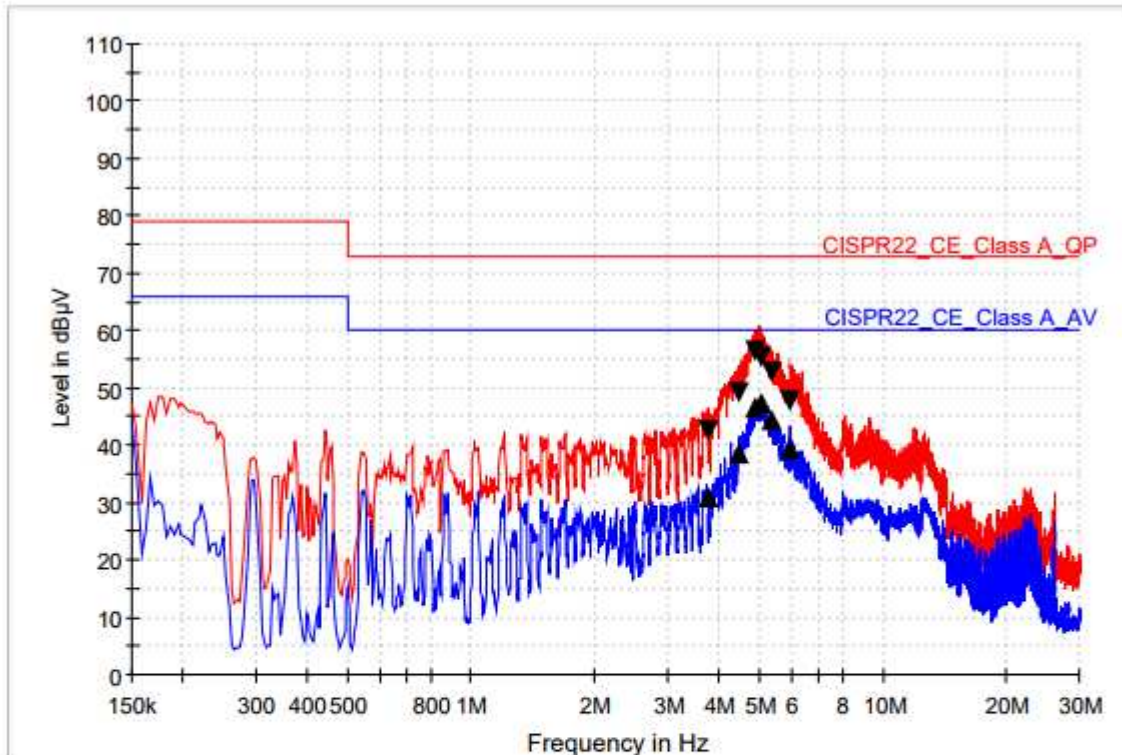


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
1.926000	36.1	24.3	9.000	N	9.7	36.9	73.0	35.7	60.0
5.082000	53.2	44.1	9.000	N	9.8	19.8	73.0	15.9	60.0
6.114000	45.9	38.2	9.000	N	9.9	27.1	73.0	21.8	60.0
7.670000	38.5	29.0	9.000	N	10.0	34.5	73.0	31.0	60.0
9.050000	32.6	26.3	9.000	N	10.0	40.4	73.0	33.7	60.0
10.862000	31.0	24.6	9.000	N	10.1	42.0	73.0	35.4	60.0

Mode #5

HOT LINE

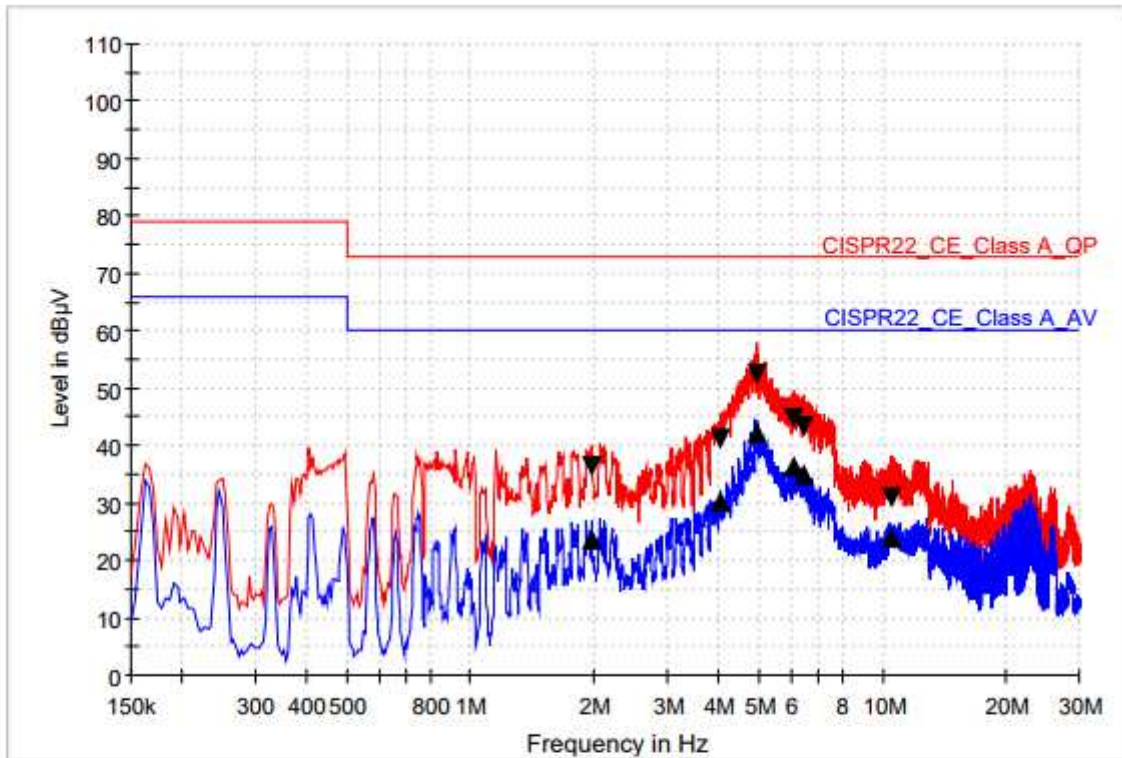


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
3.750000	42.5	30.8	9.000	L1	9.8	30.5	73.0	29.2	60.0
4.490000	49.2	38.7	9.000	L1	9.8	23.8	73.0	21.3	60.0
4.890000	56.4	46.7	9.000	L1	9.8	16.6	73.0	13.3	60.0
5.058000	55.2	47.2	9.000	L1	9.8	17.8	73.0	12.8	60.0
5.366000	52.9	44.3	9.000	L1	9.8	20.1	73.0	15.7	60.0
5.978000	47.7	39.2	9.000	L1	9.9	25.3	73.0	20.8	60.0

Mode #5

NEUTRAL LINE

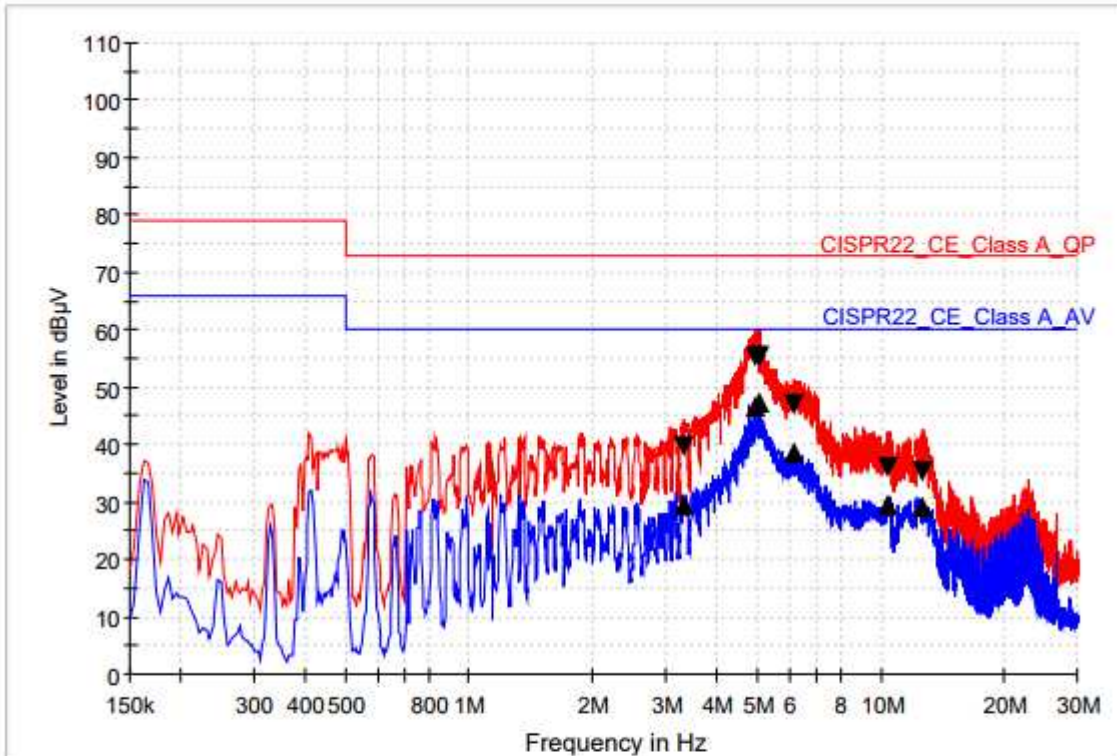


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
1.962000	36.4	23.5	9.000	N	9.7	36.6	73.0	36.5	60.0
4.058000	41.1	30.3	9.000	N	9.8	31.9	73.0	29.7	60.0
4.962000	52.5	42.4	9.000	N	9.8	20.5	73.0	17.6	60.0
6.074000	44.7	36.6	9.000	N	9.9	28.3	73.0	23.4	60.0
6.430000	43.4	35.0	9.000	N	9.9	29.6	73.0	25.0	60.0
10.566000	30.8	24.1	9.000	N	10.1	42.2	73.0	35.9	60.0

Mode #6

HOT LINE

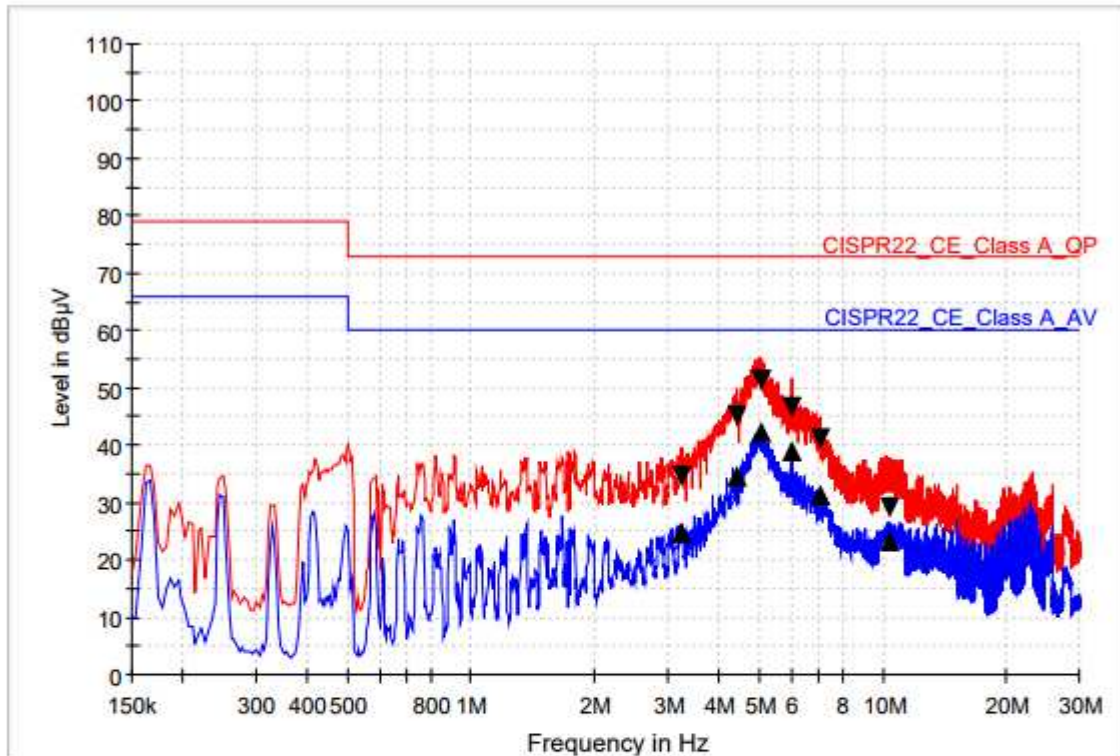


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
3.334000	39.7	29.4	9.000	L1	9.8	33.3	73.0	30.6	60.0
4.942000	55.3	46.8	9.000	L1	9.8	17.7	73.0	13.2	60.0
5.074000	55.2	47.3	9.000	L1	9.8	17.8	73.0	12.7	60.0
6.186000	46.8	38.7	9.000	L1	9.9	26.2	73.0	21.3	60.0
10.438000	35.9	29.3	9.000	L1	10.1	37.1	73.0	30.7	60.0
12.614000	35.5	29.2	9.000	L1	10.1	37.5	73.0	30.8	60.0

Mode #6

NEUTRAL LINE

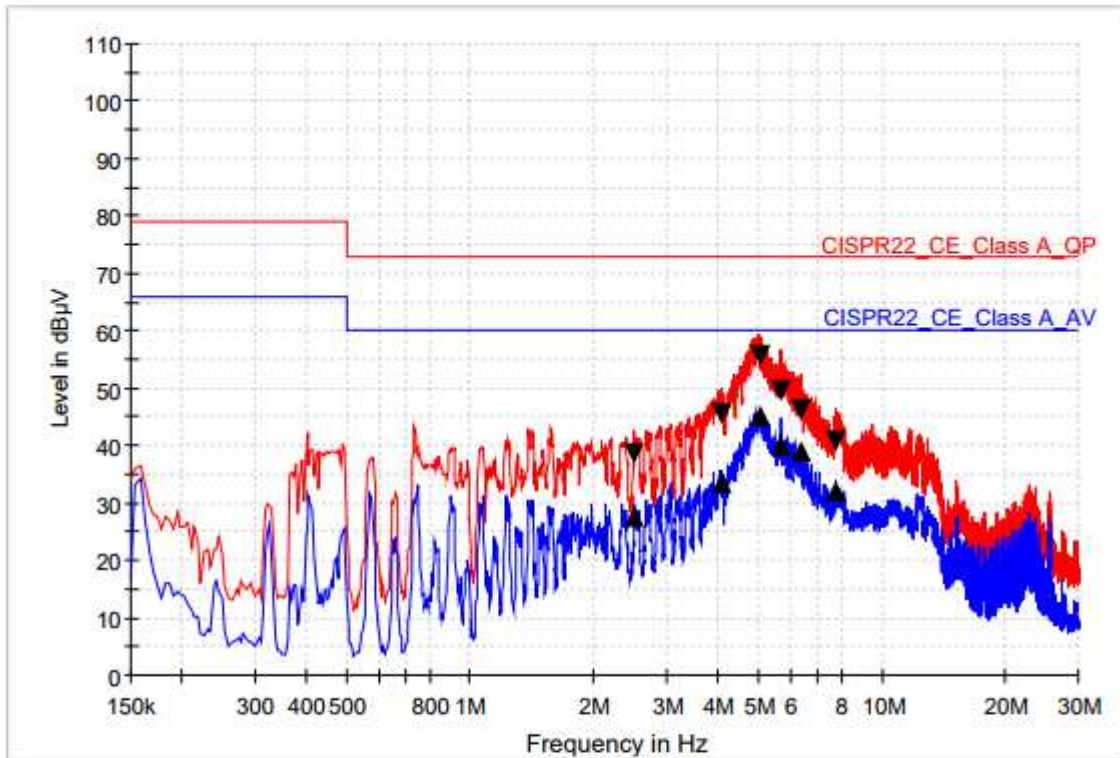


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
3.242000	34.5	24.8	9.000	N	9.8	38.5	73.0	35.2	60.0
4.418000	45.1	34.6	9.000	N	9.8	27.9	73.0	25.4	60.0
5.074000	51.3	42.2	9.000	N	9.8	21.7	73.0	17.8	60.0
5.998000	46.7	39.1	9.000	N	9.9	26.3	73.0	20.9	60.0
7.046000	41.3	31.2	9.000	N	9.9	31.7	73.0	28.8	60.0
10.438000	29.0	23.4	9.000	N	10.1	44.0	73.0	36.6	60.0

Mode #7

HOT LINE

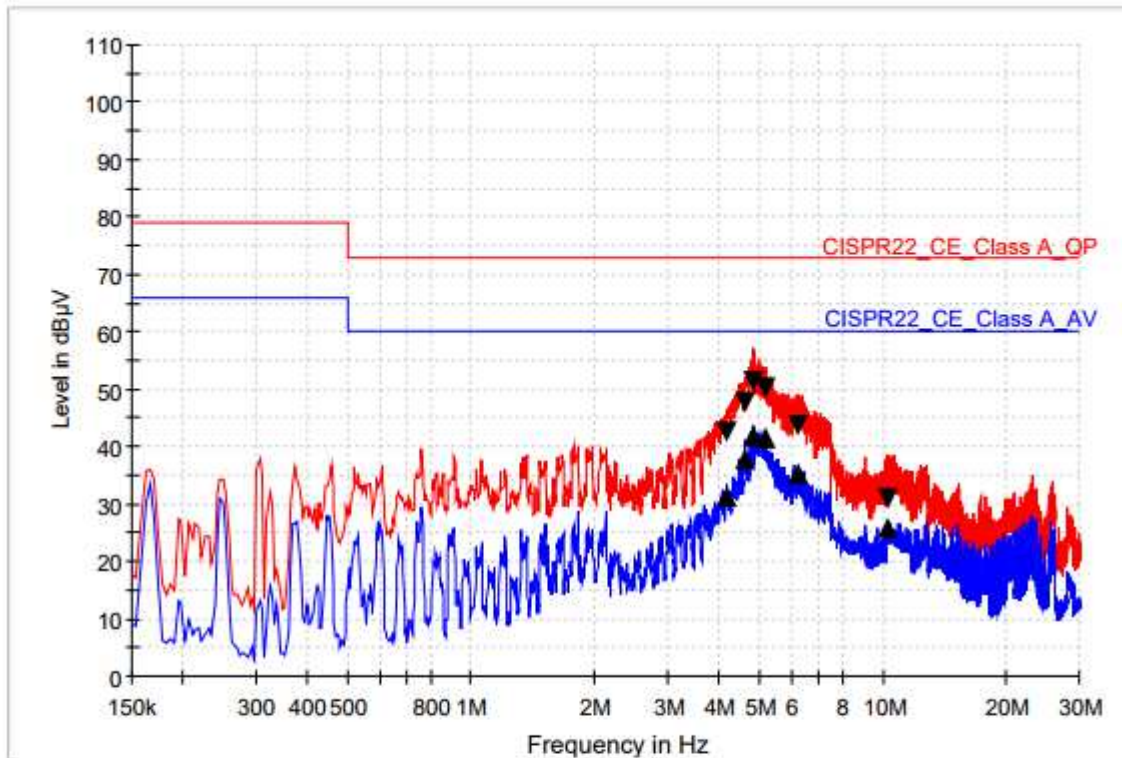


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
2.502000	38.5	27.5	9.000	L1	9.7	34.5	73.0	32.5	60.0
4.066000	45.4	33.6	9.000	L1	9.8	27.6	73.0	26.4	60.0
5.054000	55.9	45.0	9.000	L1	9.8	17.1	73.0	15.0	60.0
5.670000	49.5	39.9	9.000	L1	9.9	23.5	73.0	20.1	60.0
6.370000	46.2	38.8	9.000	L1	9.9	26.8	73.0	21.2	60.0
7.726000	40.9	31.9	9.000	L1	10.0	32.1	73.0	28.1	60.0

Mode #7

NEUTRAL LINE

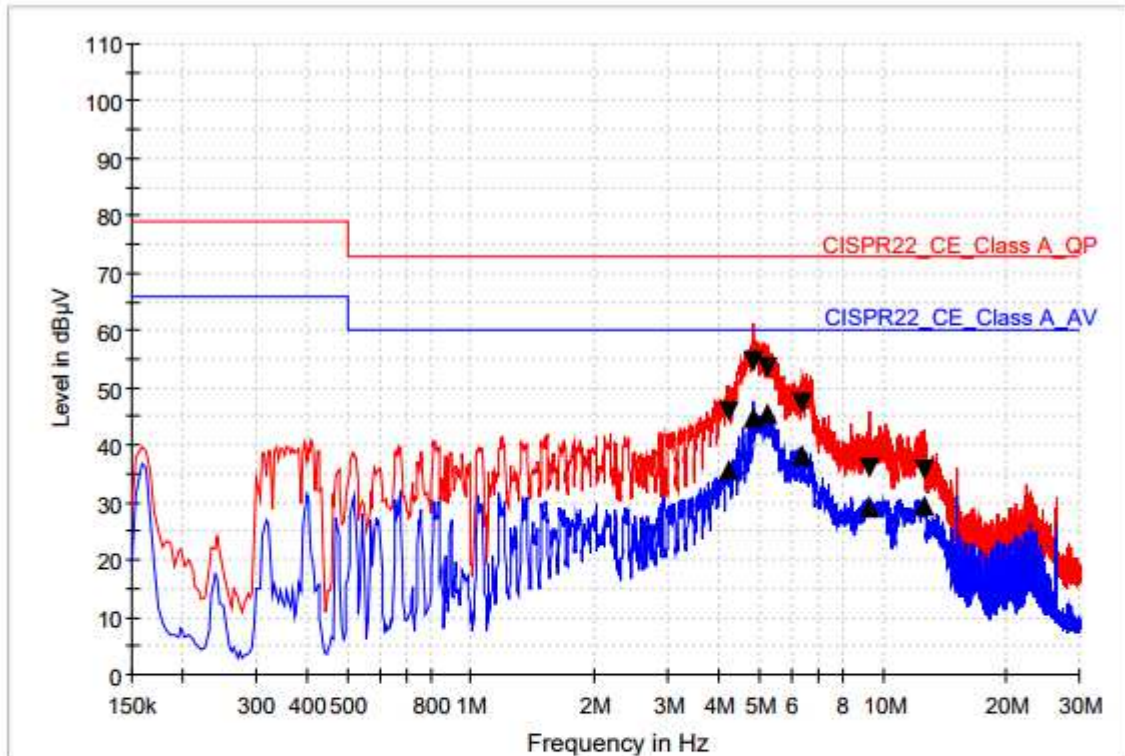


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
4.174000	42.5	31.4	9.000	N	9.8	30.5	73.0	28.6	60.0
4.626000	47.8	37.8	9.000	N	9.8	25.2	73.0	22.2	60.0
4.850000	51.2	41.8	9.000	N	9.8	21.8	73.0	18.2	60.0
5.194000	50.1	41.5	9.000	N	9.8	22.9	73.0	18.5	60.0
6.250000	43.7	35.2	9.000	N	9.9	29.3	73.0	24.8	60.0
10.302000	30.9	25.8	9.000	N	10.1	42.1	73.0	34.2	60.0

Mode #8

HOT LINE

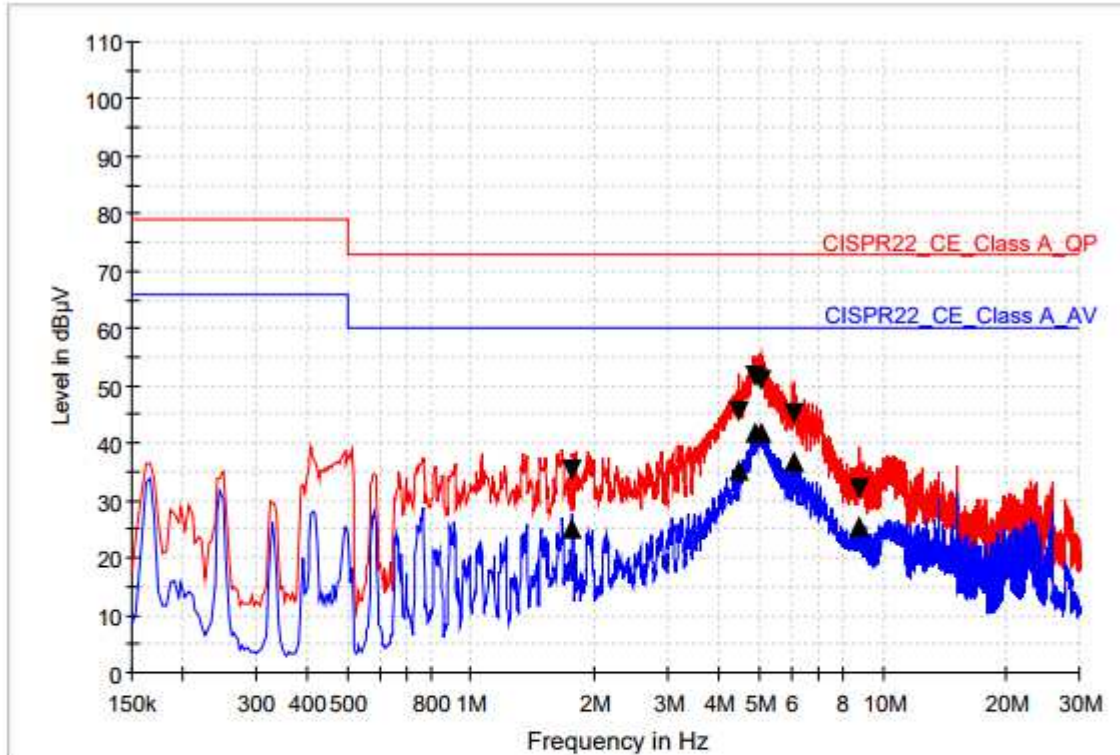


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
4.234000	46.0	35.6	9.000	L1	9.8	27.0	73.0	24.4	60.0
4.842000	54.6	44.6	9.000	L1	9.8	18.4	73.0	15.4	60.0
5.254000	53.7	45.5	9.000	L1	9.8	19.3	73.0	14.5	60.0
6.362000	47.4	38.2	9.000	L1	9.9	25.6	73.0	21.8	60.0
9.254000	36.0	29.1	9.000	L1	10.0	37.0	73.0	30.9	60.0
12.586000	35.5	29.5	9.000	L1	10.1	37.5	73.0	30.5	60.0

Mode #8

NEUTRAL LINE



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
1.766000	35.4	25.0	9.000	N	9.7	37.6	73.0	35.0	60.0
4.482000	45.4	35.3	9.000	N	9.8	27.6	73.0	24.7	60.0
4.878000	51.6	41.7	9.000	N	9.8	21.4	73.0	18.3	60.0
5.070000	51.0	42.0	9.000	N	9.8	22.0	73.0	18.0	60.0
6.062000	45.2	36.9	9.000	N	9.9	27.8	73.0	23.1	60.0
8.766000	32.1	25.3	9.000	N	10.0	40.9	73.0	34.7	60.0

5.2 Radiated Emission

5.2.1 Test setup

The radiated emissions measurements were in the 3/10 m, Semi Anechoic Chamber. The EUT and all local supporting equipments were placed on a non-conductive table approximately 0.8 m above the ground plane.

The frequency spectrum from 30 MHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33 was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

Preliminary radiated emission test was conducted using the procedure in ANSI C63.4: 2014 8.3.1.1 below 1 000 MHz, 8.3.1.2 above 1 GHz to determine the worse operating conditions

Measurement distance between the EUT and an antenna was as below table.

Frequency range (MHz)	Measurement Distance	
	Class B Device	Class A Device
Below 1 000 MHz	3 m	10 m
Above 1 000 MHz	3 m	3 m

The test set-up photos are included in appendix II.

Used Software for measurement is manufactured by TSJ and Rohde & Schwarz..

5.2.2 Measurement frequency range

Highest frequency generated or used in the device or on which the device operates or tunes	Upper Frequency of Measurement range (MHz)
Below 1.705 MHz	30
(1.705 ~ 108) MHz	1 000
(108 ~ 500) MHz	2 000
(500 ~ 1 000) MHz	5 000
Above 1 000 MHz	5th harmonic of the highest freq. or 40 GHz, whichever is lower


The measurement uncertainties are given with 95 % confidence.

5.2.3 Measurement uncertainty

Frequency range	Uncertainty
Below 1 000 MHz	4.30 dB
Above 1 000 MHz	4.67 dB

The measurement uncertainties are given with 95 % confidence.

5.2.4 Test result

Date of Test	2020-12-16			
Temperature	(20.75 ± 0.65) °C		Relative humidity	(44.75 ± 0.65) % R.H.
Operating Input Voltage	120 Vac		Input Frequency	60 Hz
Frequency range	RBW	VBW	Detector Mode	Measurement distance
Below 1 000 MHz	120 kHz	300 kHz	Peak or Q.P.	10 m
Date of Test	2020-12-17			
Temperature	(20.25 ± 0.25) °C		Relative humidity	(43.8 ± 0.4) % R.H.
Frequency range	RBW	VBW	Detector Mode	Measurement distance
Above 1 000 MHz	1 MHz	1 MHz or 10 Hz	Peak or Average	3 m
Test Mode	Mode #1 ~ Mode #8			
Test Result	Pass	Tested By	Chu, Woo-Sik	

5.2.5 Sample Calculated Example

At 80 MHz

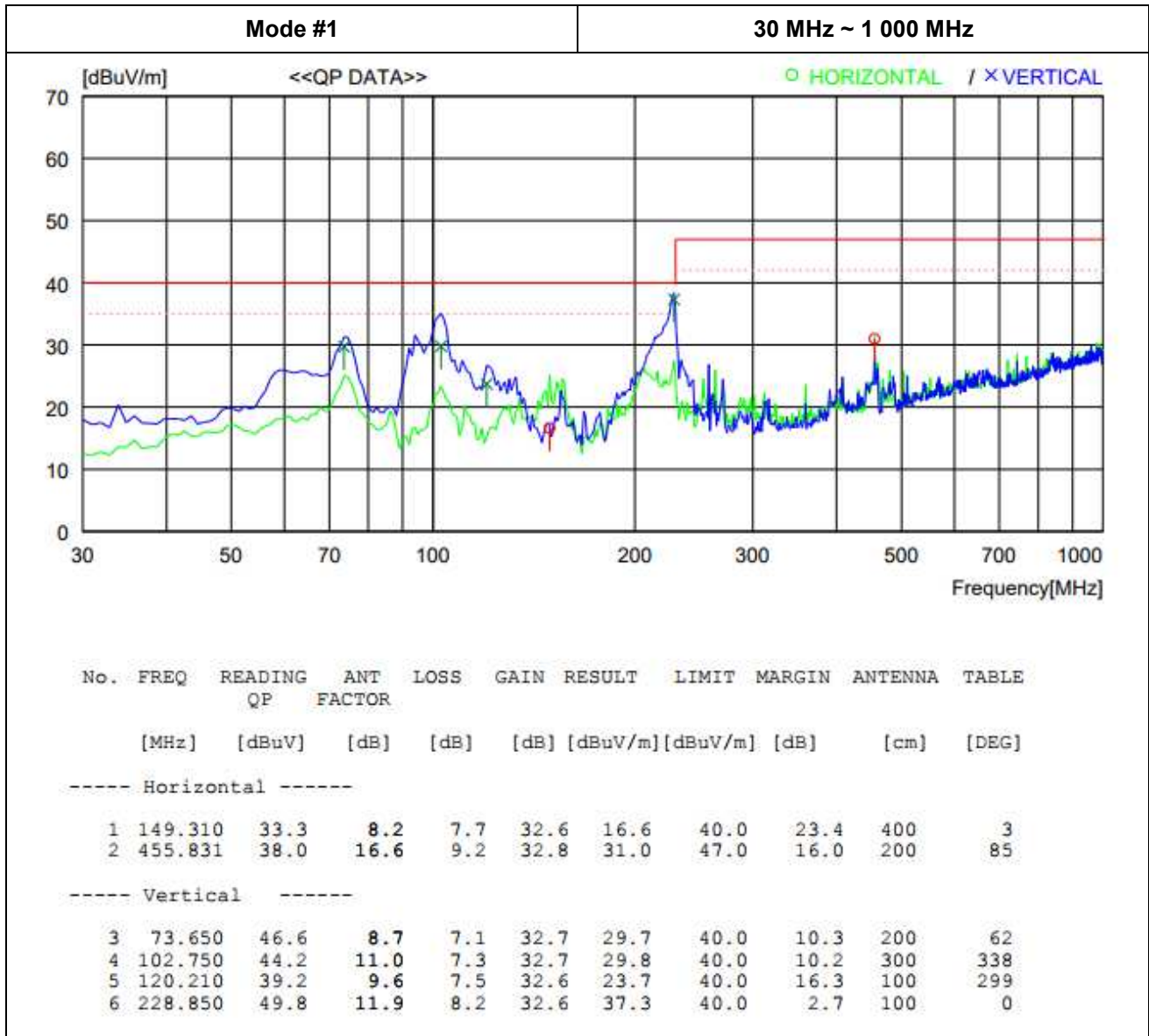
Limit = 39.1 dB μ V/m

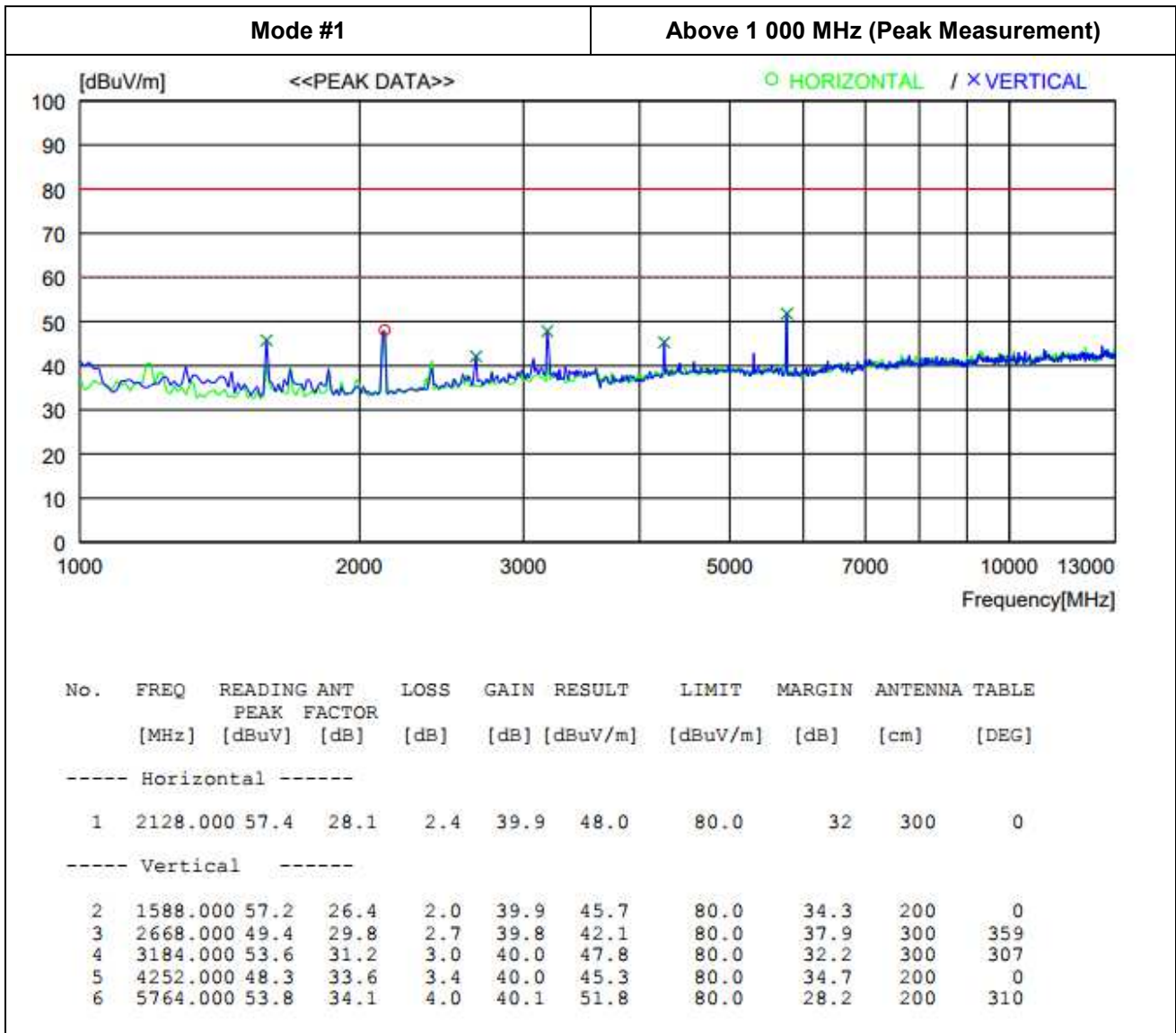
Result = Receiver reading value + Antenna Factor + Cable Loss - Pre-amplifier gain = 30 dB μ V/m

Margin = Limit - Result = 39.1 - 30 = 9.1

so the EUT has 9.1 dB margin at 80 MHz

5.2.6 Test Data

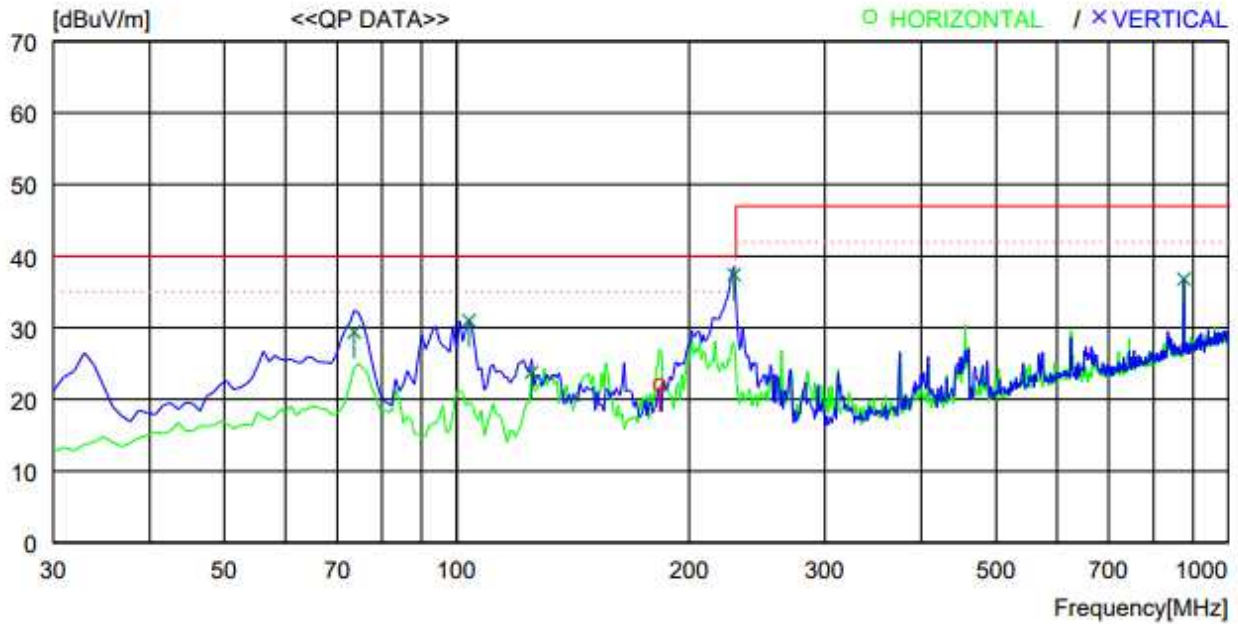




NOTE: Average mode was not measured, because peak values were under the average limit.

Mode #2

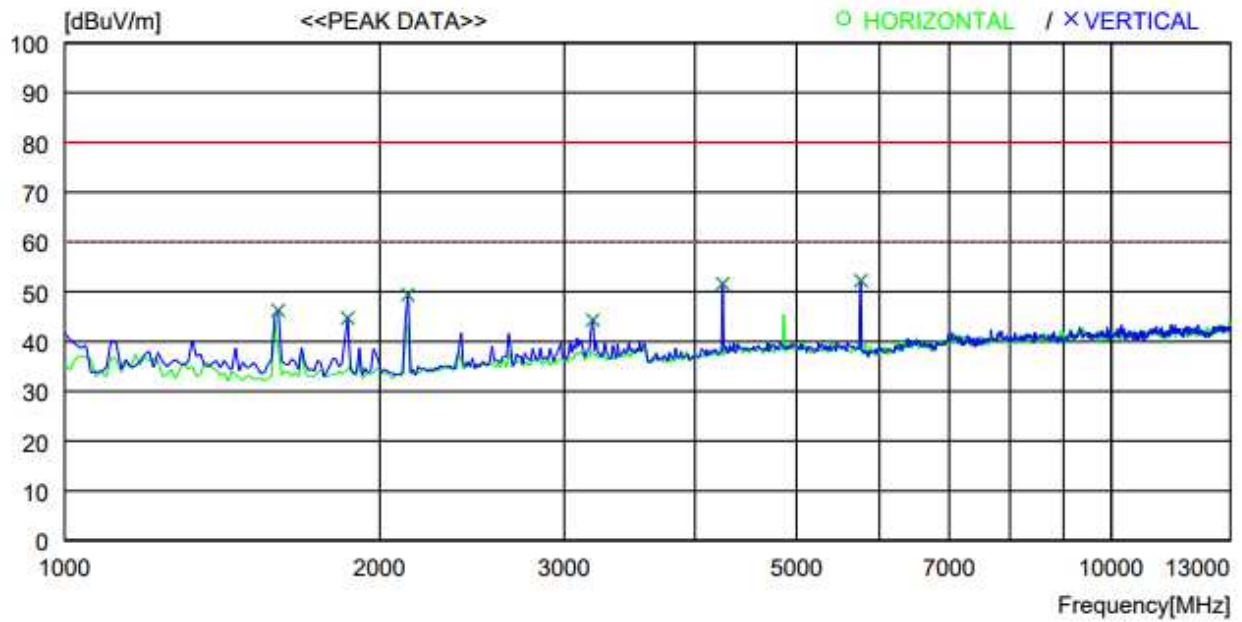
30 MHz ~ 1 000 MHz



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	183.260	37.3	9.4	7.9	32.6	22.0	40.0	18.0	400	359
----- Vertical -----										
2	73.650	46.3	8.7	7.1	32.7	29.4	40.0	10.6	200	82
3	103.720	45.5	10.9	7.3	32.7	31.0	40.0	9.0	100	354
4	125.060	39.7	9.2	7.5	32.6	23.8	40.0	16.2	100	253
5	228.850	49.9	11.9	8.2	32.6	37.4	40.0	2.6	100	79
6	875.830	36.7	21.8	10.8	32.5	36.8	47.0	10.2	200	0

Mode #2

Above 1 000 MHz (Peak Measurement)

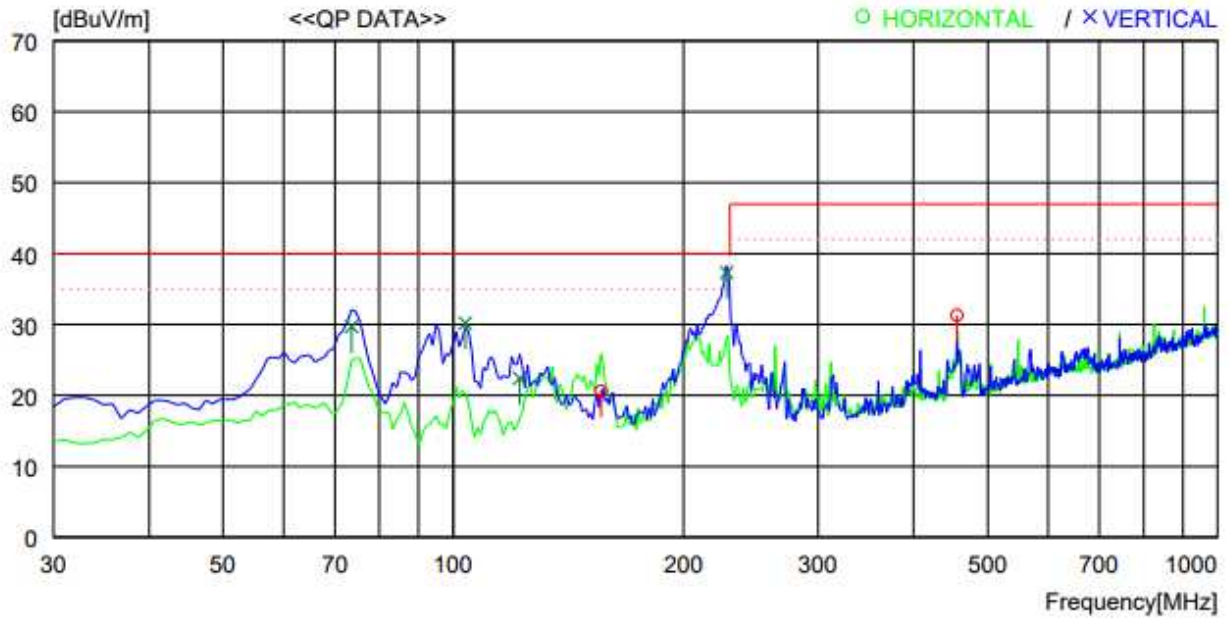


No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Vertical -----										
1	1600.000	57.5	26.5	2.1	39.9	46.2	80.0	33.8	200	0
2	1864.000	54.7	27.7	2.2	39.9	44.7	80.0	35.3	300	236
3	2128.000	58.8	28.1	2.4	39.9	49.4	80.0	30.6	300	359
4	3196.000	50.1	31.2	3.0	40.0	44.3	80.0	35.7	300	28
5	4252.000	54.6	33.6	3.4	40.0	51.6	80.0	28.4	300	359
6	5764.000	54.2	34.1	4.0	40.1	52.2	80.0	27.8	200	318

NOTE: Average mode was not measured, because peak values were under the average limit.

Mode #3

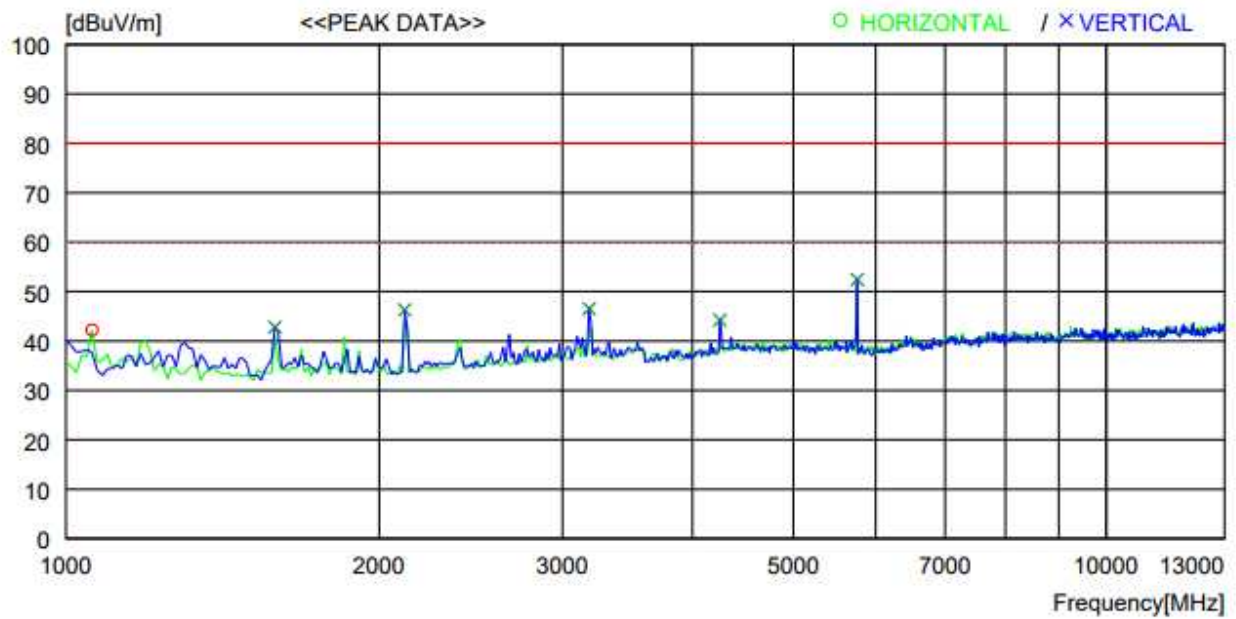
30 MHz ~ 1 000 MHz



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	156.100	37.1	8.4	7.7	32.6	20.6	40.0	19.4	400	0
2	455.831	38.3	16.6	9.2	32.8	31.3	47.0	15.7	200	0
----- Vertical -----										
3	73.650	46.6	8.7	7.1	32.7	29.7	40.0	10.3	200	359
4	103.720	44.7	10.9	7.3	32.7	30.2	40.0	9.8	100	18
5	122.150	38.0	9.5	7.5	32.6	22.4	40.0	17.6	100	290
6	227.880	49.8	11.9	8.2	32.6	37.3	40.0	2.7	100	73

Mode #3

Above 1 000 MHz (Peak Measurement)

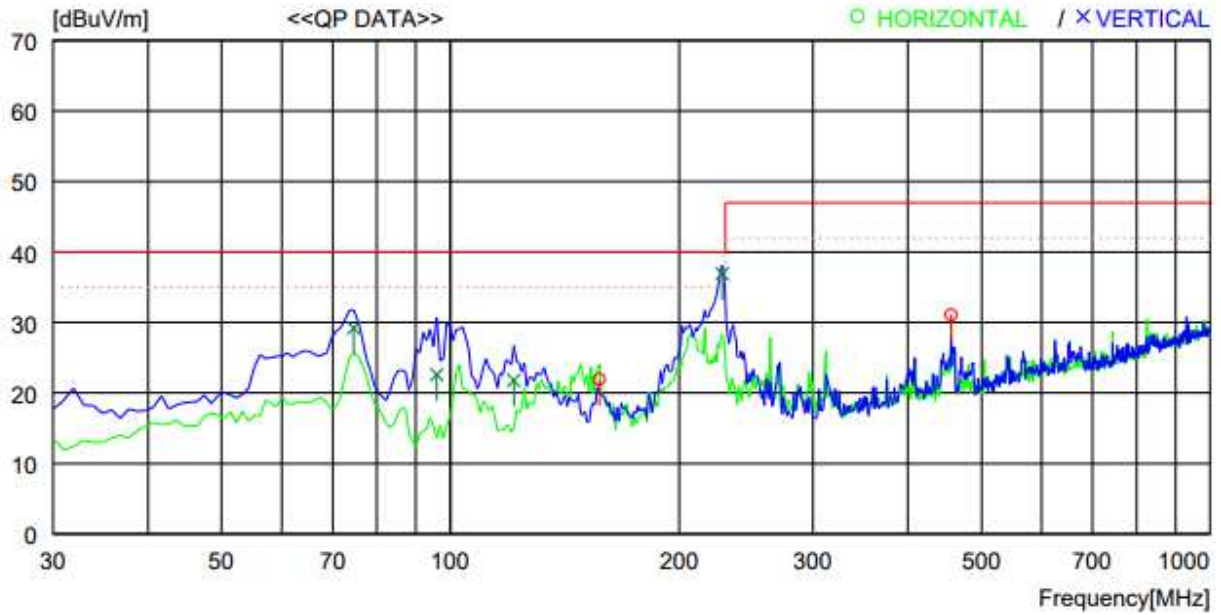


No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1060.000	56.3	24.2	1.7	40.0	42.2	80.0	37.8	300	314
----- Vertical -----										
2	1588.000	54.3	26.4	2.0	39.9	42.8	80.0	37.2	300	358
3	2116.000	55.6	28.2	2.4	39.9	46.3	80.0	33.7	300	358
4	3184.000	52.3	31.2	3.0	40.0	46.5	80.0	33.5	300	302
5	4252.000	47.2	33.6	3.4	40.0	44.2	80.0	35.8	300	78
6	5764.000	54.4	34.1	4.0	40.1	52.4	80.0	27.6	100	301

NOTE: Average mode was not measured, because peak values were under the average limit.

Mode #4

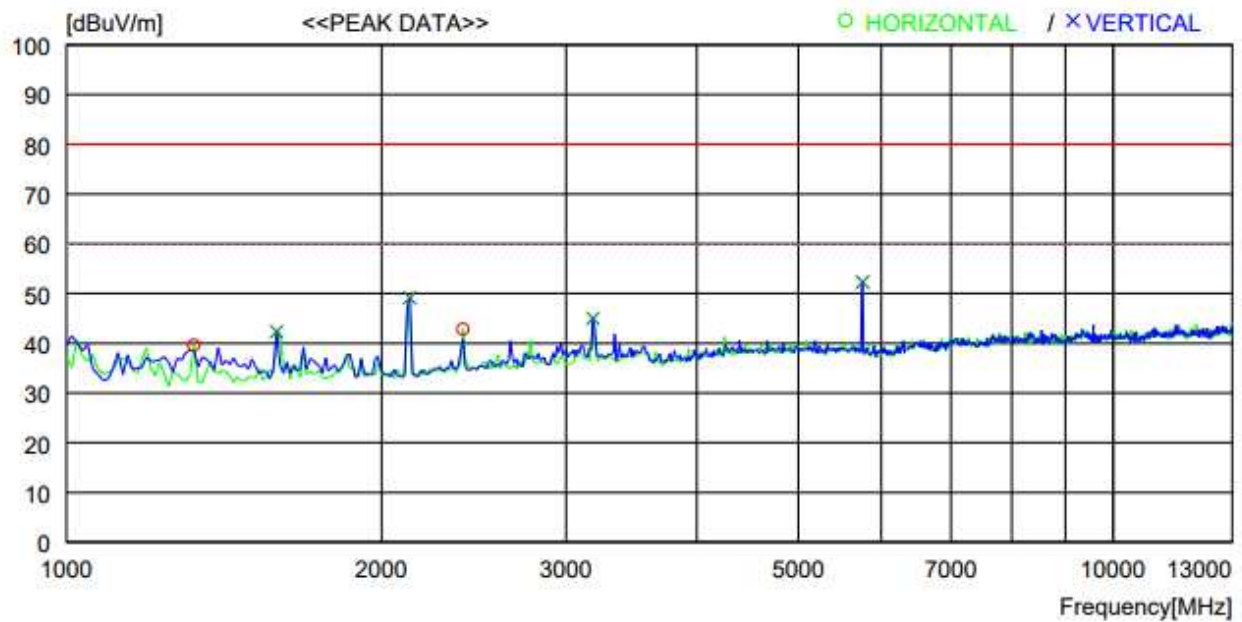
30 MHz ~ 1 000 MHz



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	157.070	38.4	8.4	7.7	32.6	21.9	40.0	18.1	400	0
2	455.831	38.1	16.6	9.2	32.8	31.1	47.0	15.9	200	0
----- Vertical -----										
3	74.620	46.4	8.4	7.1	32.7	29.2	40.0	10.8	200	359
4	95.960	37.3	10.7	7.3	32.7	22.6	40.0	17.4	100	0
5	121.180	37.3	9.6	7.5	32.6	21.8	40.0	18.2	100	0
6	227.880	49.4	11.9	8.2	32.6	36.9	40.0	3.1	100	79

Mode #4

Above 1 000 MHz (Peak Measurement)

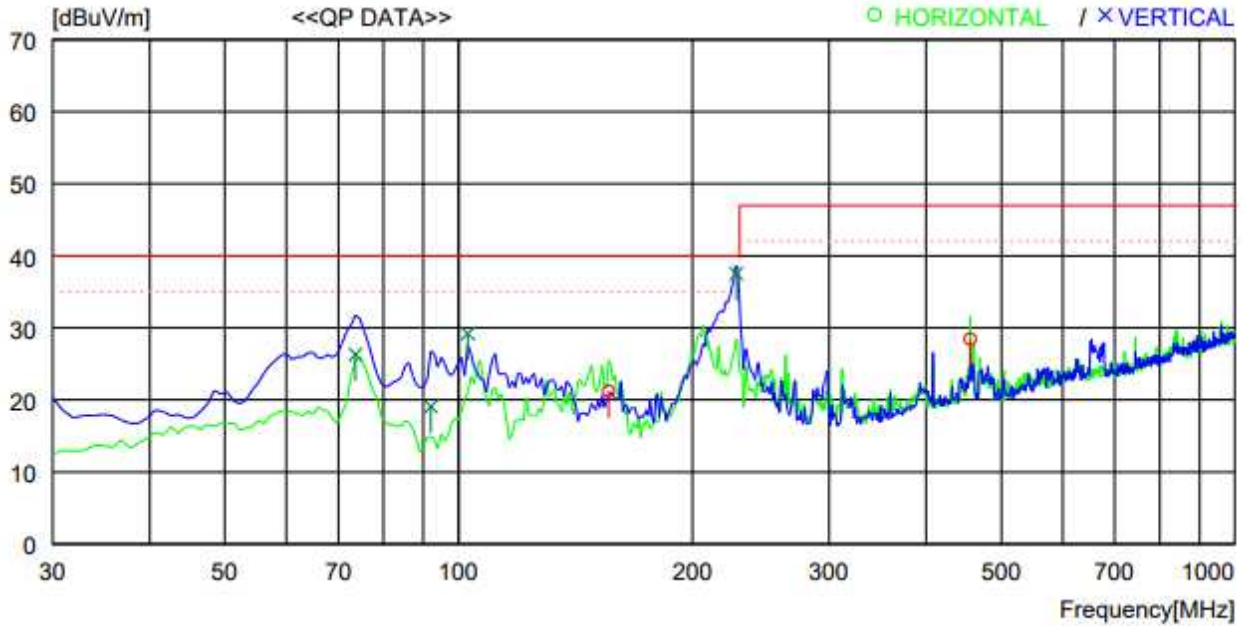


No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1324.000	53.1	24.5	1.9	39.9	39.6	80.0	40.4	153	292
2	2392.000	51.2	28.9	2.5	39.8	42.8	80.0	37.2	300	0
----- Vertical -----										
3	1588.000	53.8	26.4	2.0	39.9	42.3	80.0	37.7	300	307
4	2128.000	58.5	28.1	2.4	39.9	49.1	80.0	30.9	300	291
5	3184.000	50.8	31.2	3.0	40.0	45.0	80.0	35	300	359
6	5764.000	54.3	34.1	4.0	40.1	52.3	80.0	27.7	100	306

NOTE: Average mode was not measured, because peak values were under the average limit.

Mode #5

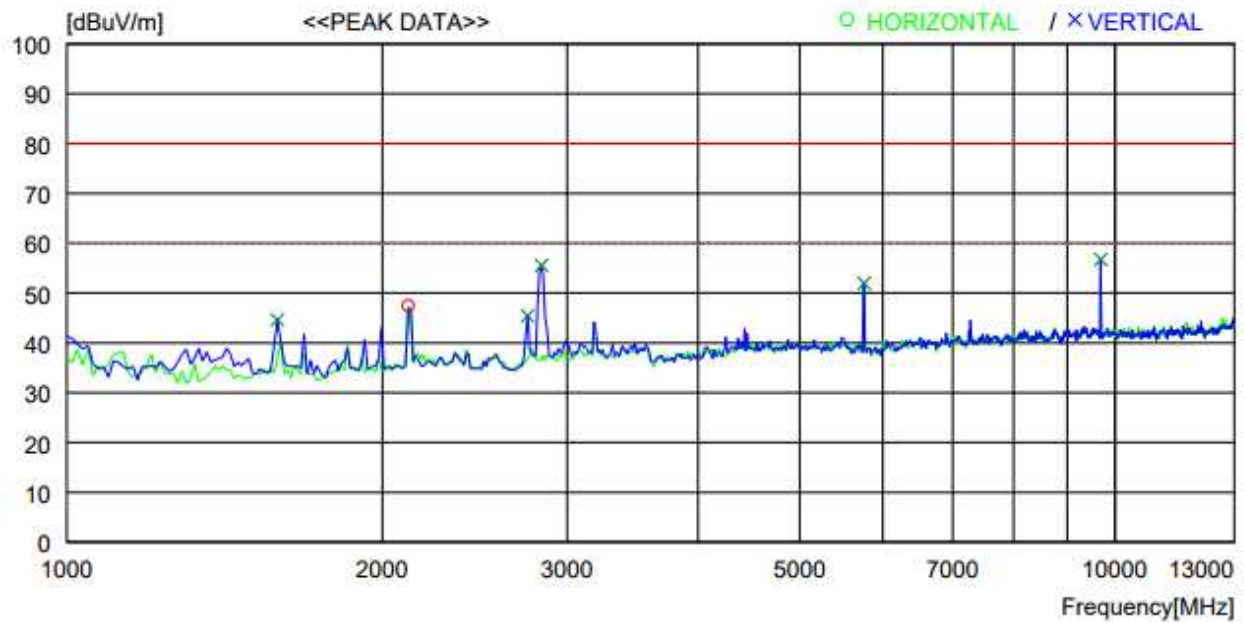
30 MHz ~ 1 000 MHz



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	156.100	37.7	8.4	7.7	32.6	21.2	40.0	18.8	400	0
2	455.831	35.4	16.6	9.2	32.8	28.4	47.0	18.6	200	0
----- Vertical -----										
3	73.650	43.2	8.7	7.1	32.7	26.3	40.0	13.7	200	45
4	92.080	34.4	10.2	7.2	32.7	19.1	40.0	20.9	200	359
5	102.750	43.6	11.0	7.3	32.7	29.2	40.0	10.8	100	354
6	227.880	50.0	11.9	8.2	32.6	37.5	40.0	2.5	100	76

Mode #5

Above 1 000 MHz (Peak Measurement)

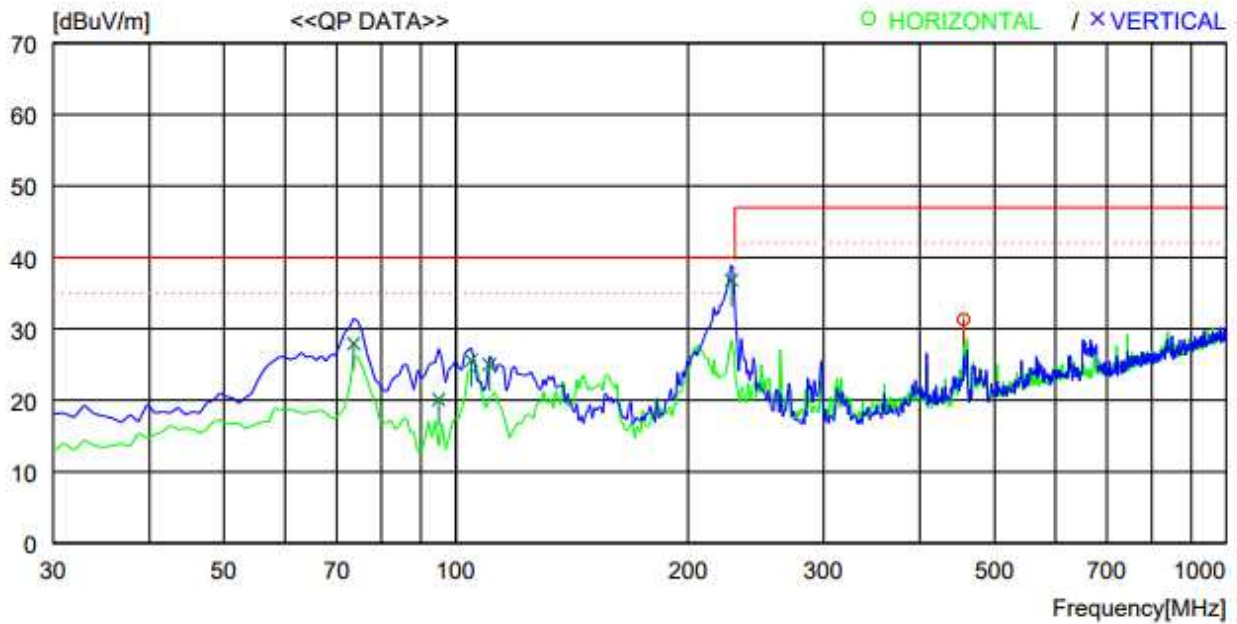


No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	2116.000	55.4	28.2	3.7	39.9	47.4	80.0	32.6	154	359
----- Vertical -----										
2	1588.000	55.5	26.4	2.6	39.9	44.6	80.0	35.4	300	20
3	2752.000	51.2	30.0	4.0	39.8	45.4	80.0	34.6	300	198
4	2836.000	61.1	30.2	4.0	39.8	55.5	80.0	24.5	200	309
5	5764.000	53.5	34.1	4.4	40.1	51.9	80.0	28.1	100	359
6	9688.000	54.2	37.2	5.8	40.5	56.7	80.0	23.3	200	278

NOTE: Average mode was not measured, because peak values were under the average limit.

Mode #6

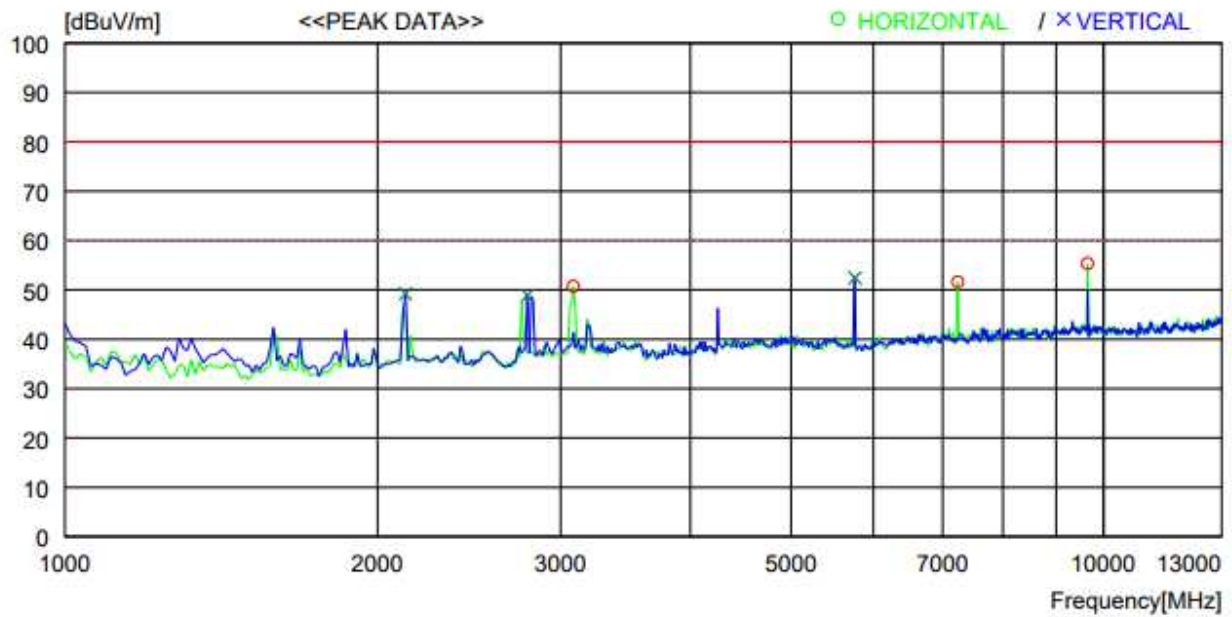
30 MHz ~ 1 000 MHz



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	455.831	38.3	16.6	9.2	32.8	31.3	47.0	15.7	200	74
----- Vertical -----										
2	73.650	44.8	8.7	7.1	32.7	27.9	40.0	12.1	400	359
3	94.990	35.0	10.5	7.3	32.7	20.1	40.0	19.9	200	15
4	104.690	40.2	10.8	7.3	32.7	25.6	40.0	14.4	100	0
5	110.510	39.9	10.4	7.4	32.7	25.0	40.0	15.0	100	81
6	227.880	49.3	11.9	8.2	32.6	36.8	40.0	3.2	100	81

Mode #6

Above 1 000 MHz (Peak Measurement)

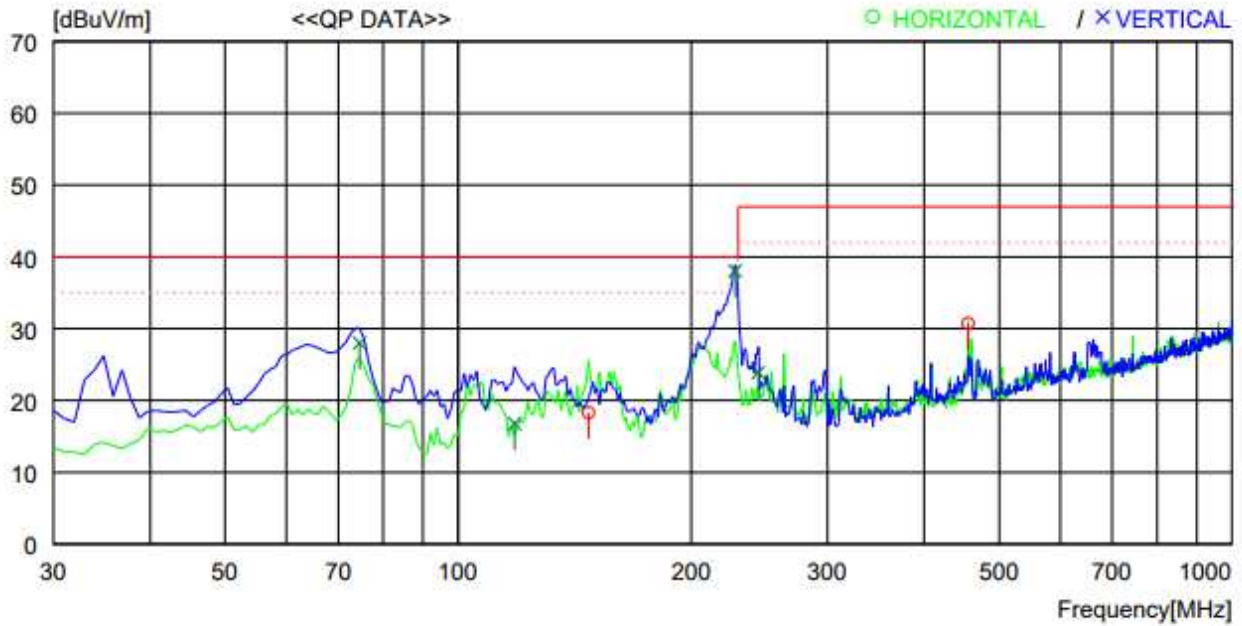


No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	3088.000	56.2	30.9	3.5	39.9	50.7	80.0	29.3	300	225
2	7240.000	50.7	35.7	4.9	39.7	51.6	80.0	28.4	300	0
3	9652.000	52.9	37.2	5.7	40.5	55.3	80.0	24.7	300	0
----- Vertical -----										
4	2128.000	57.2	28.1	3.8	39.9	49.2	80.0	30.8	300	359
5	2788.000	54.6	30.1	4.0	39.8	48.9	80.0	31.1	300	359
6	5764.000	54.0	34.1	4.4	40.1	52.4	80.0	27.6	200	0

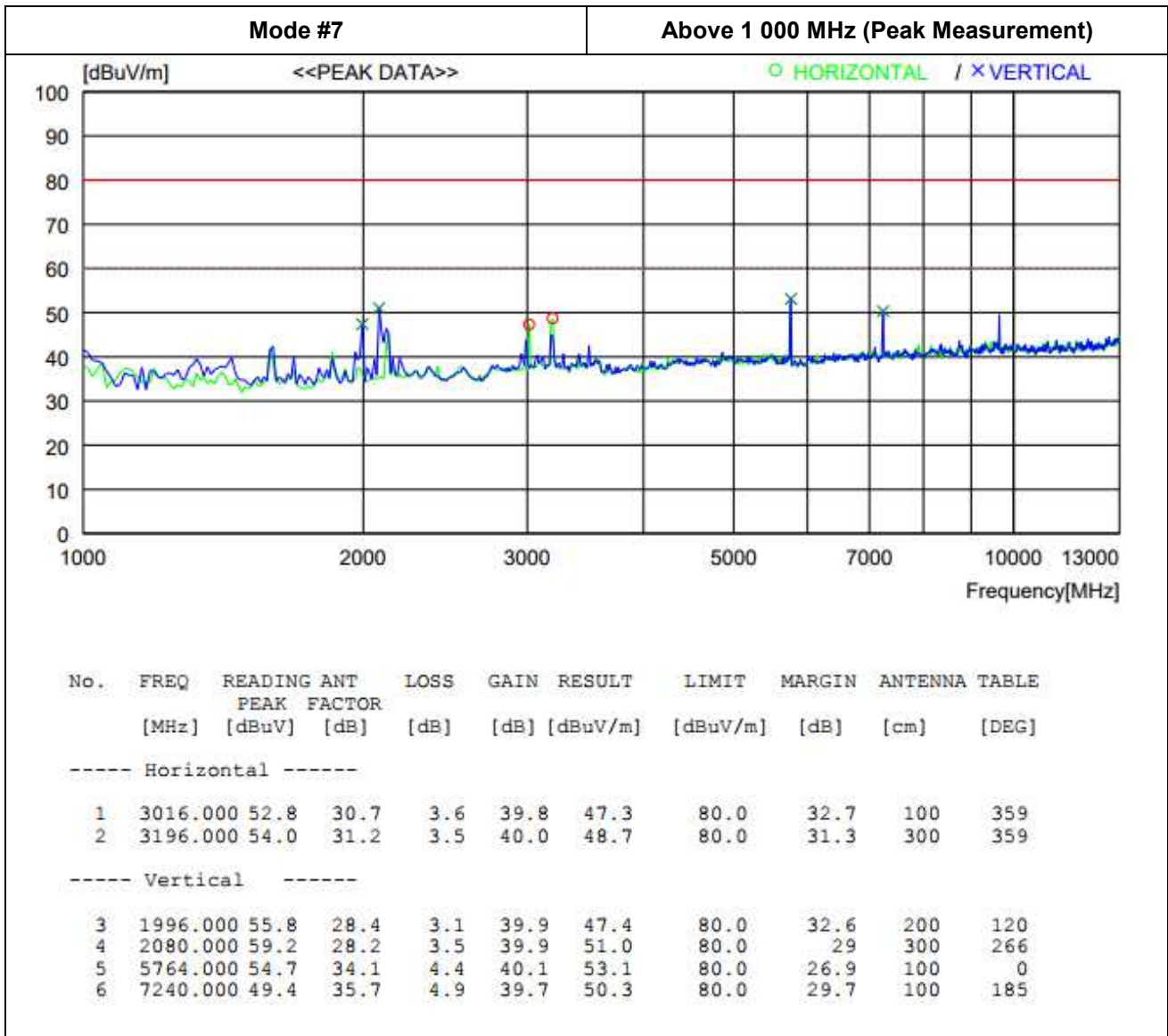
NOTE: Average mode was not measured, because peak values were under the average limit.

Mode #7

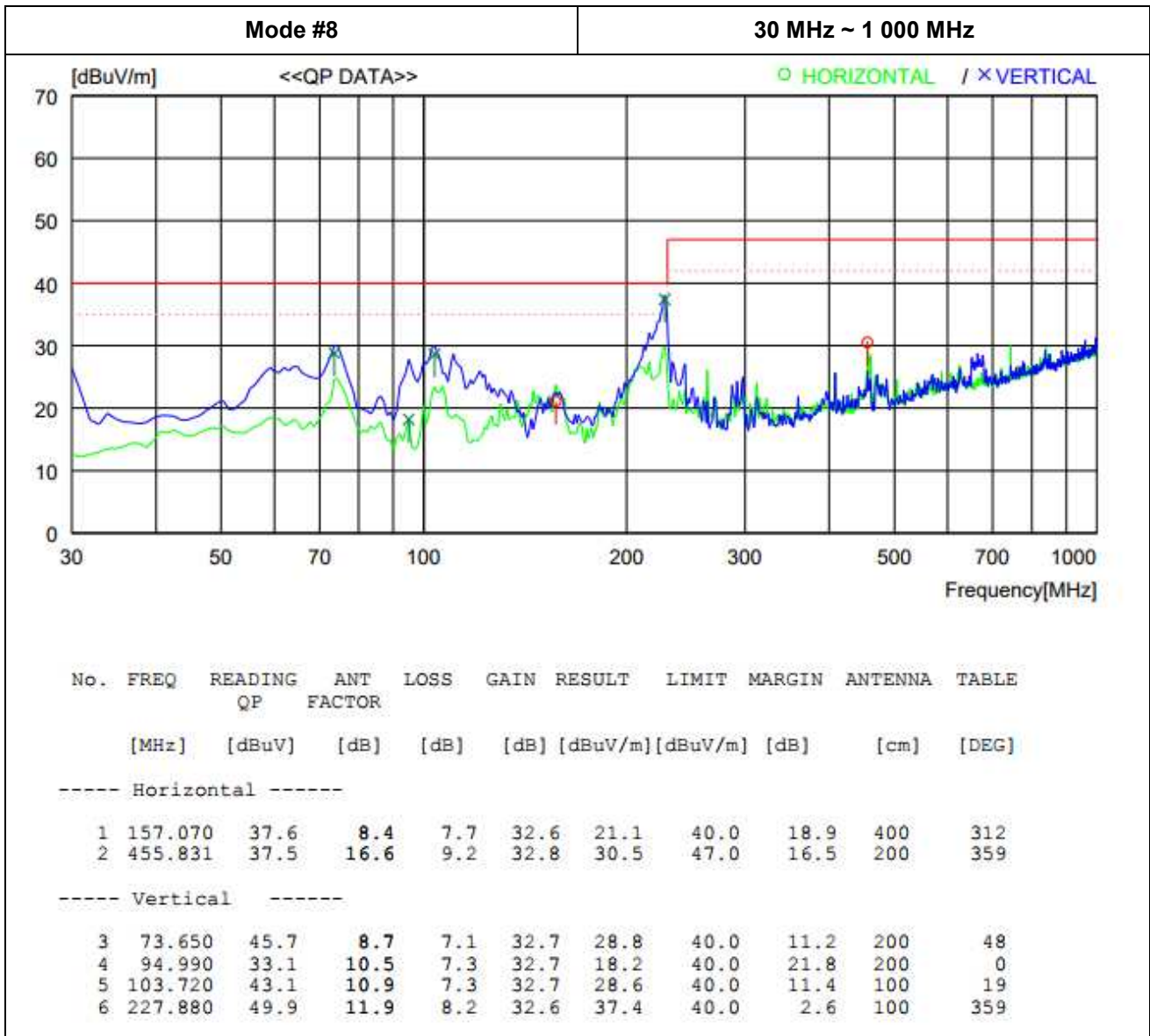
30 MHz ~ 1 000 MHz

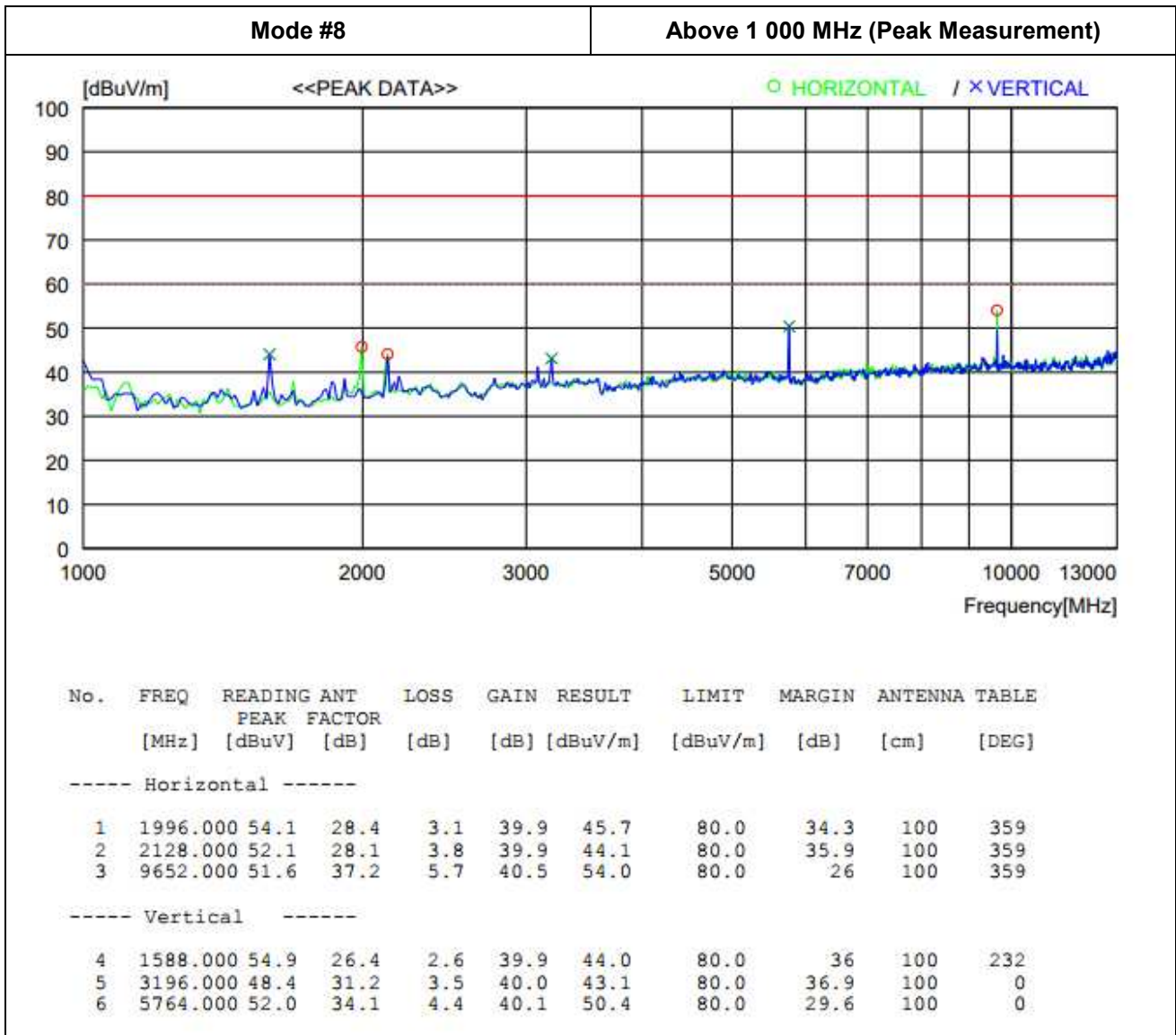


No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	147.370	35.1	8.1	7.7	32.6	18.3	40.0	21.7	400	0
2	455.831	37.7	16.6	9.2	32.8	30.7	47.0	16.3	200	87
----- Vertical -----										
3	74.620	45.2	8.4	7.1	32.7	28.0	40.0	12.0	200	0
4	118.270	32.2	9.8	7.4	32.6	16.8	40.0	23.2	100	359
5	227.880	50.5	11.9	8.2	32.6	38.0	40.0	2.0	100	78
6	244.370	36.0	12.3	8.2	32.6	23.9	47.0	23.1	100	342



NOTE: Average mode was not measured, because peak values were under the average limit.





NOTE: Average mode was not measured, because peak values were under the average limit.

Appendix I - Test Instrumentation

Name of Equipment	Model Number	Manufacturer	Serial Number	Last Cal. (Interval)	USE
For EMISSION					
Test Receiver	ESR7	Rohde & Schwarz	101543	2020-07-24 (1Y)	■
EMI Test Receiver	ESW	Rohde & Schwarz	101197	2020-01-21 (1Y)	□
LISN	ENV4200	Rohde & Schwarz	100203	2020-01-16 (1Y)	□
LISN	ENV216	Rohde & Schwarz	100110	2020-01-22 (1Y)	■
LISN	LS16C	AFJ	16011403310	2020-07-24 (1Y)	■
LISN	NNLK8121	SchwarzBeck	8121-163	2020-07-24 (1Y)	□
Voltage Probe	TK9420	Schwarzbeck	9420-165	2020-01-16 (1Y)	□
Loop Antenna	HFH2-Z2	Rohde & Schwarz	100341	2019-06-21 (2Y)	□
8-Wire ISN CAT 3	CAT3 8158	Schwarzbeck	CAT3 8158 #70	2020-01-21 (1Y)	□
8-Wire ISN CAT 5	CAT5 8158	Schwarzbeck	CAT5 8158 #126	2020-01-21 (1Y)	□
8-Wire ISN CAT 6	NTFM 8158	Schwarzbeck	NTFM 8158 #95	2020-01-21 (1Y)	□
Test Receiver	ESU	Rohde & Schwarz	100303	2020-01-21 (1Y)	■
TRILog Broadband Antenna	VULB9163	Schwarzbeck	9163-799	2019-11-12 (2Y)	■
DOPPEL STEG HORN Antenna	HF 907	Rohde & Schwarz	102426	2020-10-29 (2Y)	■
Preamp (1-18) GHz	SCU 18D	Rohde & Schwarz	19006450	2020-04-17 (1Y)	■
Preamp 9 kHz-1 GHz	310N	Sonoma Instrument	344015	2020-01-16 (1Y)	■
Attenuators	6 dB	Rohde & Schwarz	272.4110.50	2020-01-16 (1Y)	■
Antenna Master	MA4000-EP	INNCO SYSTEM	4600814	N/A	■
Antenna Master	MA4000-XP-ET	INNCO SYSTEM	N/A	N/A	■
Turn Table	DT3000-3t	INNCO SYSTEM	1310814	N/A	■
CO3000 Controller	CO3000-4PORT	INNCO SYSTEM	CO3000/806/34130 814/L	N/A	■
CO3000 Controller	CO3000-4PORT	INNCO SYSTEM	CO3000/807/34130 814/L	N/A	■
Digital Power Analyzer For Harmonic & Flicker	DPA 500	EM Test	V0713102356	2020-01-22 (1Y)	□
AC Power Source	ACS 500	EM Test	V0713102357	2020-07-24 (1Y)	□

The above measuring equipments have been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.