



FCC CFR47 Part 15 Subpart B Certification Test Report

For the

Product : 3D Printer
Model : 1X
Multiple Model : 1X DP302
FCC ID : 2AB83-1X
Applicant : Sindoh Co., Ltd.
FCC Rule : CFR 47 Part 15 Subpart B

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-W1807-009**

Signature

A handwritten signature in black ink, appearing to read 'Choi, Young-min', written over a horizontal line.

Choi, Young-min / Technical Manager

Date: 2018-07-12

Test Laboratory: ENG Co., Ltd.

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Report No.: TR-W1807-009

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

Report Form_02 (Rev.0)

FCC/ISED CANADA TEST REPORT

Project Number : EA1806C-133
Test Report Number : TR-W1807-009
Type of Equipment : 3D Printer
Model Name : 1X
Multiple Model Name : 1X DP302
FCC ID : 2AB83-1X
Applicant : Sindoh Co., Ltd.
Address : 3, Seongsuiro24(isipsa)-gil, Seongdong-gu, Seoul 04797,
 Republic of Korea
Manufacturer : Sindoh Co., Ltd.
Address : 3, Seongsuiro24(isipsa)-gil, Seongdong-gu, Seoul 04797,
 Republic of Korea
Factory : SINDOH (QINGDAO) CO., LTD.
Address : 1008 Emeisan-road, Qingdao Economics & Technology
 Development Zone, 266555 Qingdao, Shandong,
 PEOPLE'S REPUBLIC OF CHINA
FCC Rule : CFR 47 Part 15 Subpart B §15.101 Class A Peripheral Device
ISED Canada Standard: ICES-003 Issue 6 Class A
Total page of Report : 75 pages
Date of Receipt : 2018-06-18
Date of Issue : 2018-07-12
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

2018-07-12

Date

Reviewed by Choi, Young-min / Technical Manager

Signature

2018-07-12

Date

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Release Control Record

Issue Report No.	Issued Date	Details/Revisions
TR-W1807-009	2018-07-12	Initial Release

1. TEST SUMMARY

1.1 Test standards and results

The EUT (Equipment Under Test) has been tested according to the following specifications:

AGENCY NAME	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 Canada	ICES-003 Issue 6 Section 6.1, Class A	AC Power Line Conducted Emission	PASS
	ICES-003 Issue 6 Section 6.2, Class A	Radiated Emission	PASS

ENG Co., Ltd tested the EUT in accordance with the requirements set forth in the above FCC and ISED Canada Rules and Regulation and the EUT met all of the requirements of the standard.

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, Gonjam-eup, Gwangju-si, Gyeonggi-do 12813, Korea. Description details of test facilities were submitted to the ISED, Canada, accredited as a Conformity Assessment Body (CAB) by the FCC, designated by the RRA (Radio Research Agency), and accredited by KOLAS (Korea Laboratory Accreditation Scheme) in Korea and approved by TUV Rheinland and TUV SÜD according to the requirement of ISO 17025.

Laboratory Qualification	Registration No.	Mark
FCC	KR0160	
ISED (Canada)	IC 12721A-1	
RRA	KR0160	
TUV Rheinland	UA 50314109-0002	
TUV SÜD	CARAT 18 03 94465 003	
Korean Agency for Technology and Standards	KT733	

2. EUT (Equipment Under Test) Description

2.1 General Description

The Sindoh Co., Ltd., Model 1X (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	Fused Filament Fabrication
Max. Print Length(mm)	W(max):228, D(max):200, H(max):300
Print Layer Thickness Setting	0.05~0.4 mm
Basic Nozzle diameter	0.4 mm
Filament width	1.75 mm
Printable materials	PLA, ABS, FLEXIBLE
Printable color	White, Black, Gray, Red, Yellow, Green, Blue, Pink(PLA), Purple(PLA)
Bed leveling	Auto measuring + Manual leveling
Print Head	One Nozzle
Continuous Nozzle Usage/ Maximum Temperature	Recommended Temperature(Nozzle): PLA 200 °C, ABS 230 °C, Flexible 225 °C / Max 250 °C
Continuous Bed Usage/ Maximum Temperature	Recommended Temperature(Bed): PLA 60 °C, ABS 90 °C, Flexible 60 °C / Max 100 °C
Recommended printing speed / maximum speed	40 mm/s Recommended / 200 mm/s max
Electrical Rating	100 - 240 V~, 50/60 Hz, 3.0 A
Power	300 W
Dimensions	454 (W) x 468 (D) x 571 (H)
Weight	26 kg (excluding cartridge)
Interface	USB Device, USB Host, WiFi, Ethernet
Cartridge	Auto Load / Unload
Contained Wi-Fi Module in the EUT	Model: TWFM-M311D Manufacturer: LG Innotek Co., Ltd. FCC ID: 2AB83-TWFM-M311D/ IC: 2514A-TWFMM311D

2.2 Additional Model

Model Name	Model Difference
1X	Basic Model
1X DP302	Identical to the basic model except for the model designation only.
Note: The manufacturer has declared to all the additional model names into basic model name without any further evaluation by ENG Co., Ltd.	

2.3 Description of supported units

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

Description	Model No.	FCC ID	Serial No	Manufacturer.
3D Printer (EUT) *	1X	2AB83-1X	N/A	Sindoh Co., Ltd.
Notebook PC	TRN-C125	DoC	N/A	HP
Adapter for Notebook PC	HSTNN-CA40	N/A	N/A	CHICONY Power Technology
Mouse	M-U0026	DOC	N/A	Logitech
AP	AW-A1	N/A	ABRE400975NT	Unicorn Information System
Adapter for AP	K02-1201000	N/A	N/A	Shenzhen KeYu Power Supply Technology Co., Ltd.
USB Memory Stick	8GB-WJ004	DoC	N/A	SHENZHEN CHENGE ELECTRONICS CO., LTD.

2.4 Cable Description

Test Mode	Ports Name	Shielded (Y/N)	Ferrite Bead (Y/N)	Length (m)	Connected to
Mode #1 - #5	AC IN	N	N	1.8	AC Mains
	USB Host	-	-	-	USB Memory Stick
	LAN	N	N	3.0	Notebook PC
	USB Device	Y	N	1.5	
Mode #6 - #9	AC IN	N	N	1.8	AC Mains
	USB Host	-	-	-	USB Memory Stick
	USB Device	Y	N	1.5	Line terminated
	LAN	N	N	3.0	

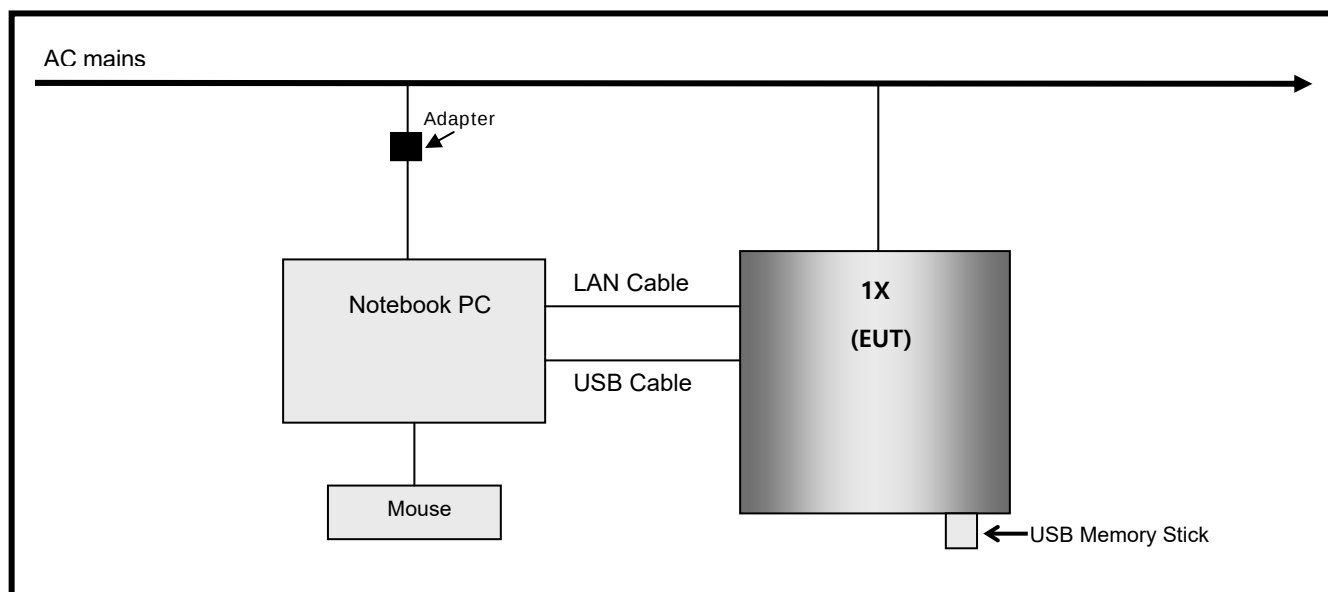
2.5 Mode of operation during the test

For finding worse case configuration and operating mode, the EUT was operated as following test mode.

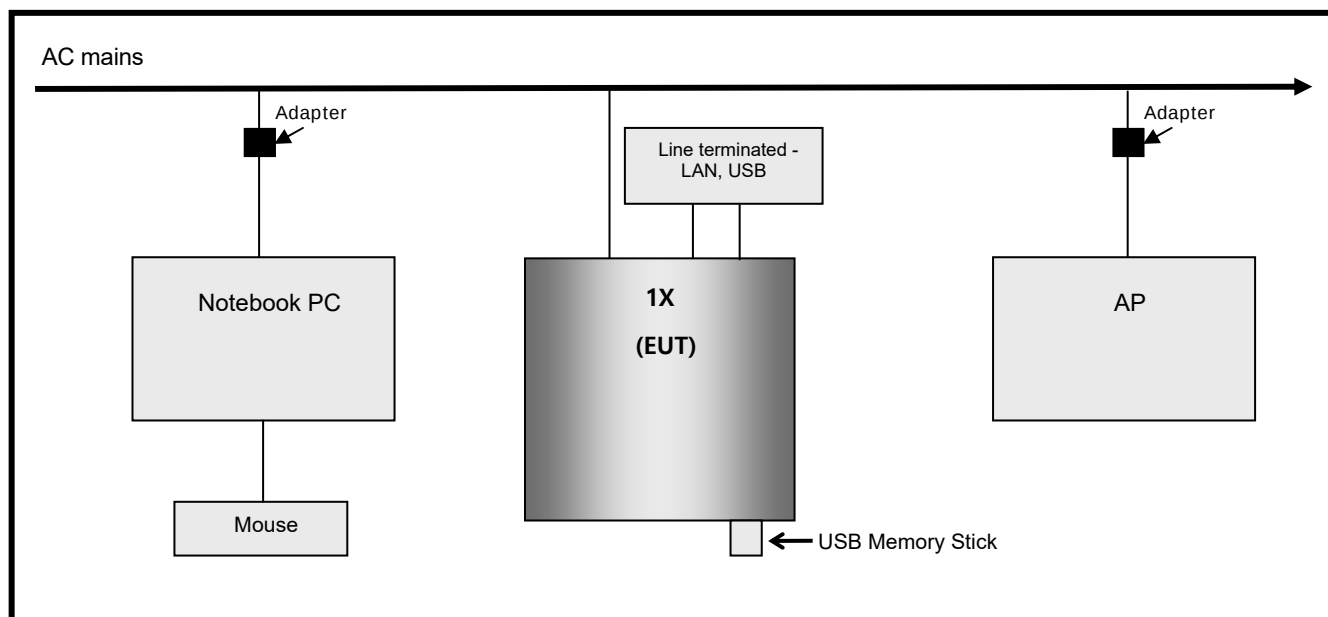
Test Mode	Description
# 1	The EUT was operated in standby mode
# 2	Printing mode using USB cable between the EUT and a Notebook PC
# 3	Printing mode using USB memory stick
# 4	Printing mode using Ethernet speed, 100 Mbps
# 5	Printing mode using Ethernet speed, 1 000 Mbps
# 6	Printing mode using Wi-Fi function, 802.11 b
# 7	Printing mode using Wi-Fi function, 802.11 g
# 8	Printing mode using Wi-Fi function, 802.11 n-20
# 9	Printing mode using Wi-Fi function, 802.11 n-40

2.6 Test Setup Drawing

[Mode #1 ~ #5]



[Mode #6 - #9]



2.7 EUT Modifications

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

3. EMISSION TESTS

3.1 AC Power Line Conducted Emission

3.1.1 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 $50\ \Omega/50\ \mu\text{H} + 5\ \Omega$ 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.

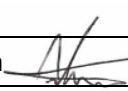
Used Software for measurement is EMC 32 supplied by Rohde&Schwarz.

3.1.2 Measurement uncertainty

Frequency range	Uncertainty
150 kHz ~ 30 MHz	2.00 dB

The measurement uncertainties are given with 95 % confidence.

3.1.3 Test Result

Date of Test	2018-07-10 ~ 07-11		
Temperature	(23.2 ~ 25.7) °C	Relative humidity	52.4 ~ 53.0 % 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 ~ #9		
Test Result	Pass	Tested By	Kim, Kwang-hyun 

3.1.4 Sample Calculated Example

At 5.31 MHz

QP Limit = 60.0 dB μ V

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

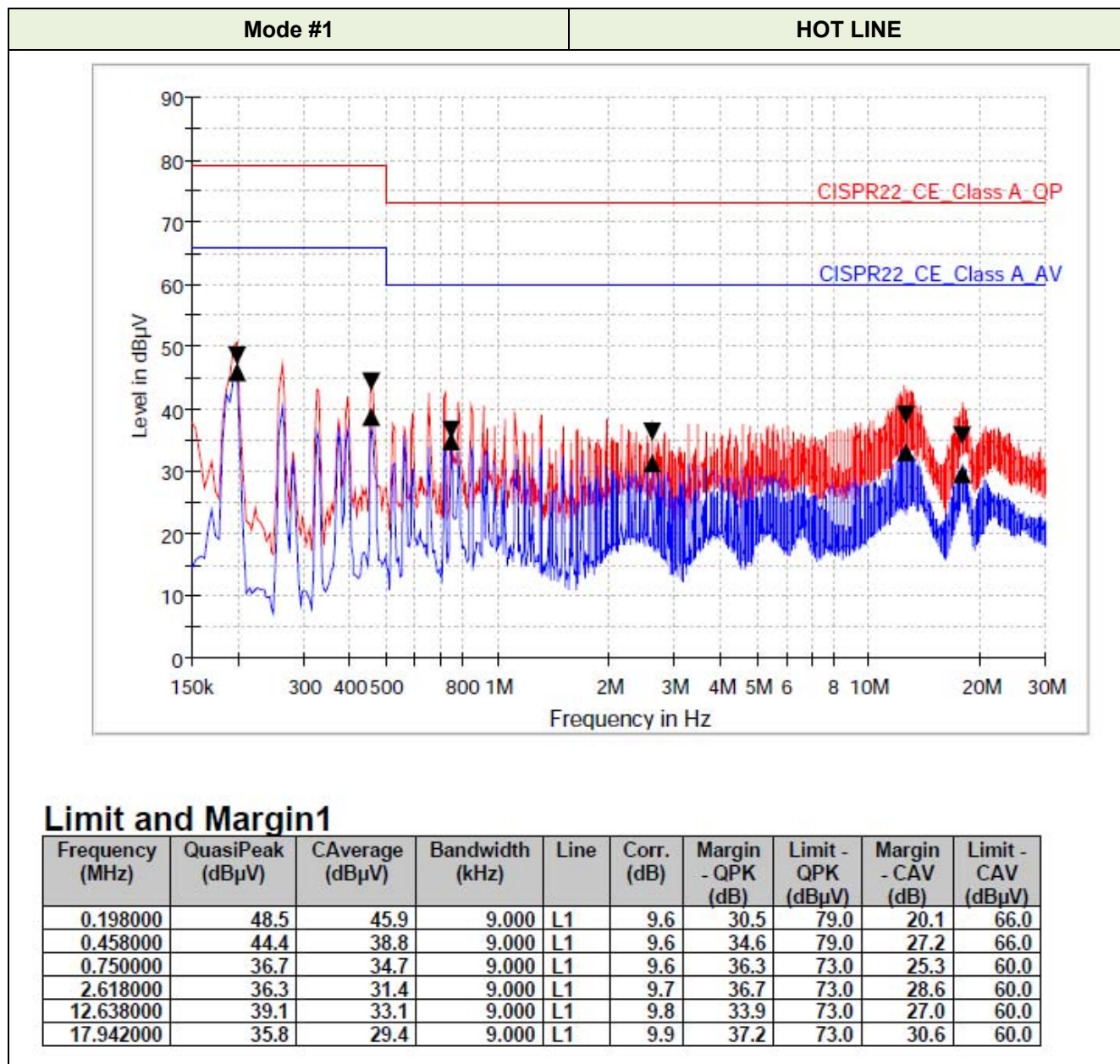
Q.P Reading from the Test receiver = 20.8 dB μ V

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

Therefore Q.P Margin = 60 - 20.8 = 39.2

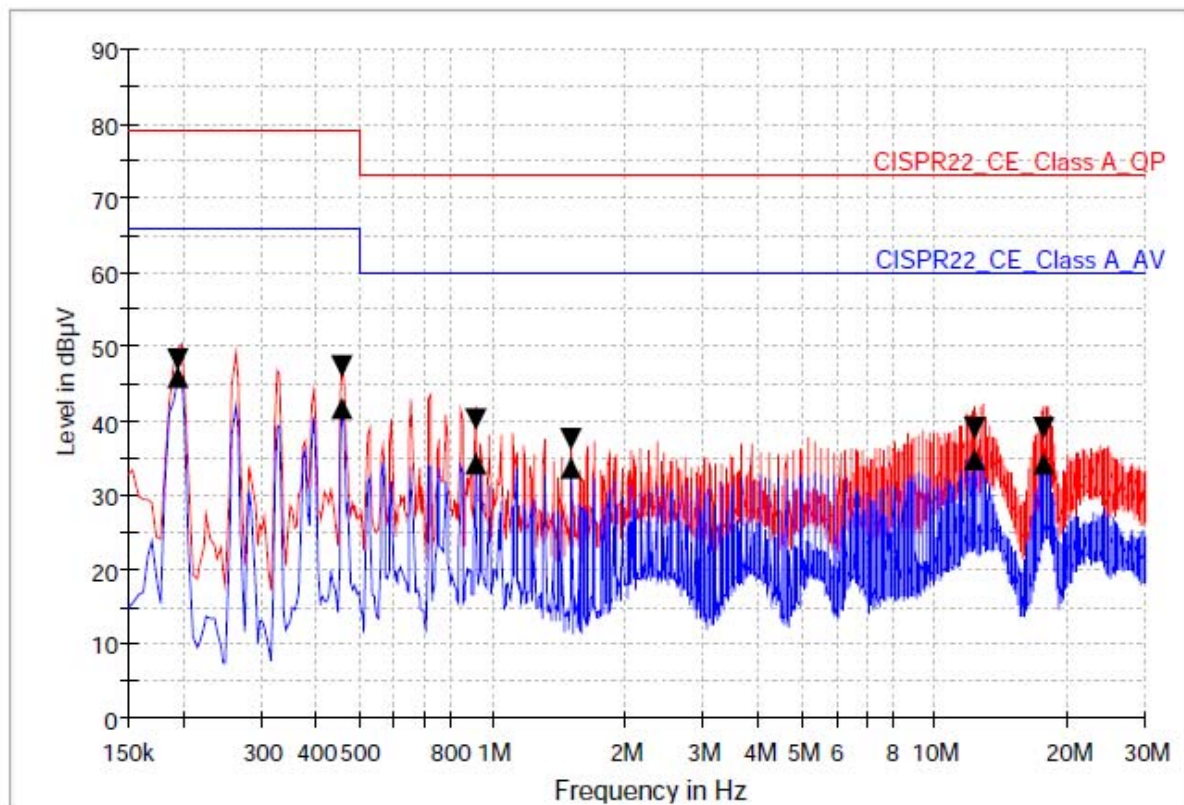
so the EUT has 39.2 dB margin at 5.31 MHz

3.1.5 Test Data



Mode #1

NEUTRAL LINE

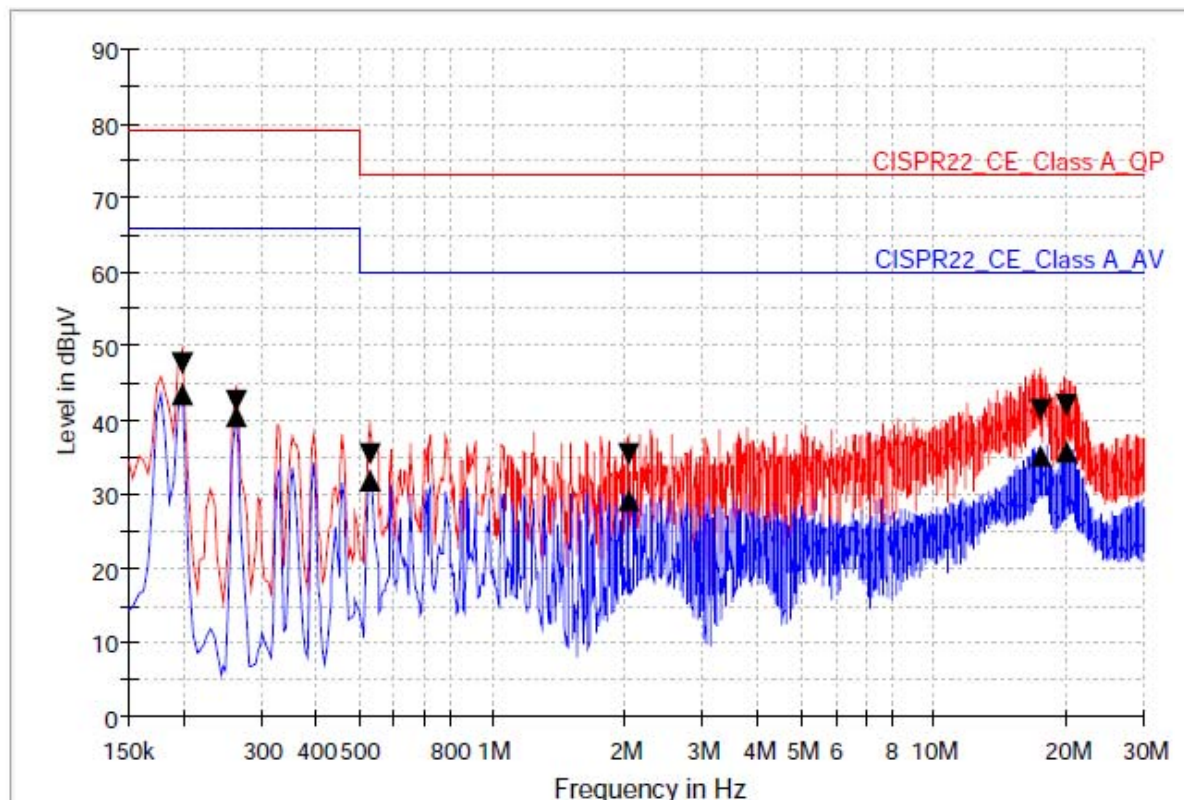


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.194000	48.2	46.0	9.000	N	9.6	30.8	79.0	20.0	66.0
0.458000	47.3	41.7	9.000	N	9.6	31.7	79.0	24.3	66.0
0.918000	40.2	34.3	9.000	N	9.6	32.8	73.0	25.7	60.0
1.506000	37.6	33.7	9.000	N	9.6	35.4	73.0	26.3	60.0
12.334000	39.0	34.7	9.000	N	9.8	34.0	73.0	25.3	60.0
17.694000	39.1	34.2	9.000	N	9.9	33.9	73.0	25.8	60.0

Mode #2

HOT LINE

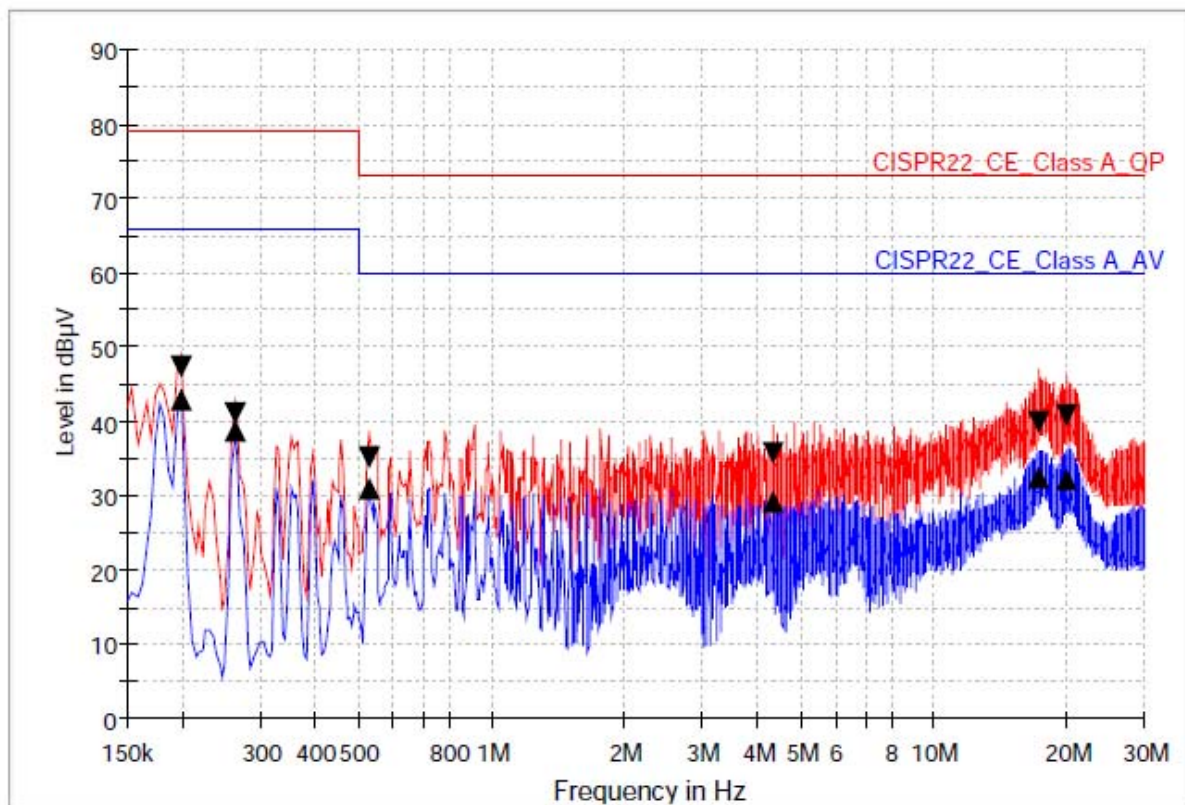


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.198000	47.8	43.5	9.000	L1	9.6	31.2	79.0	22.5	66.0
0.262000	42.7	40.4	9.000	L1	9.6	36.3	79.0	25.6	66.0
0.526000	35.5	31.8	9.000	L1	9.6	37.6	73.0	28.2	60.0
2.030000	35.3	29.3	9.000	L1	9.6	37.7	73.0	30.7	60.0
17.486000	41.5	35.2	9.000	L1	9.9	31.5	73.0	24.8	60.0
20.042000	42.0	35.9	9.000	L1	9.9	31.0	73.0	24.1	60.0

Mode #2

NEUTRAL LINE

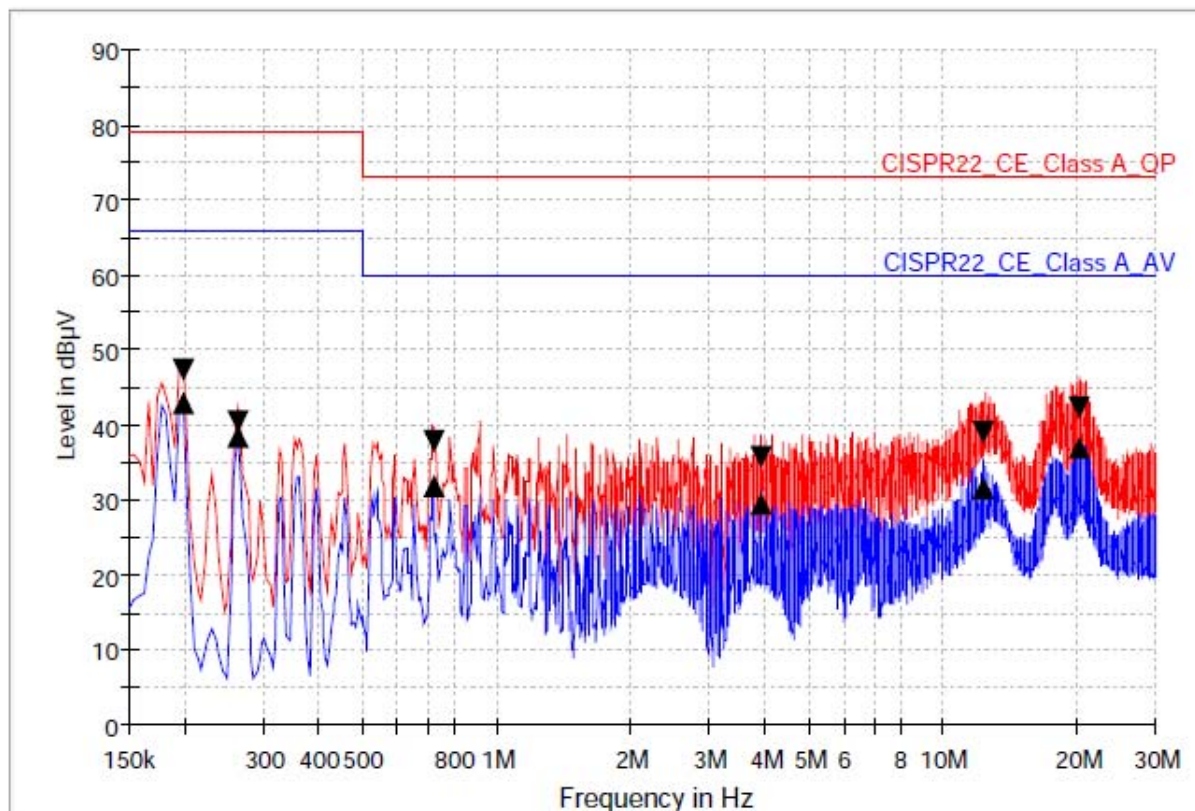


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.198000	47.4	42.8	9.000	N	9.6	31.6	79.0	23.2	66.0
0.262000	41.3	38.6	9.000	N	9.6	37.7	79.0	27.4	66.0
0.526000	35.2	30.9	9.000	N	9.6	37.8	73.0	29.1	60.0
4.322000	35.6	29.3	9.000	N	9.7	37.4	73.0	30.7	60.0
17.362000	39.8	32.5	9.000	N	9.9	33.2	73.0	27.5	60.0
20.046000	40.7	32.2	9.000	N	9.9	32.3	73.0	27.8	60.0

Mode #3

HOT LINE

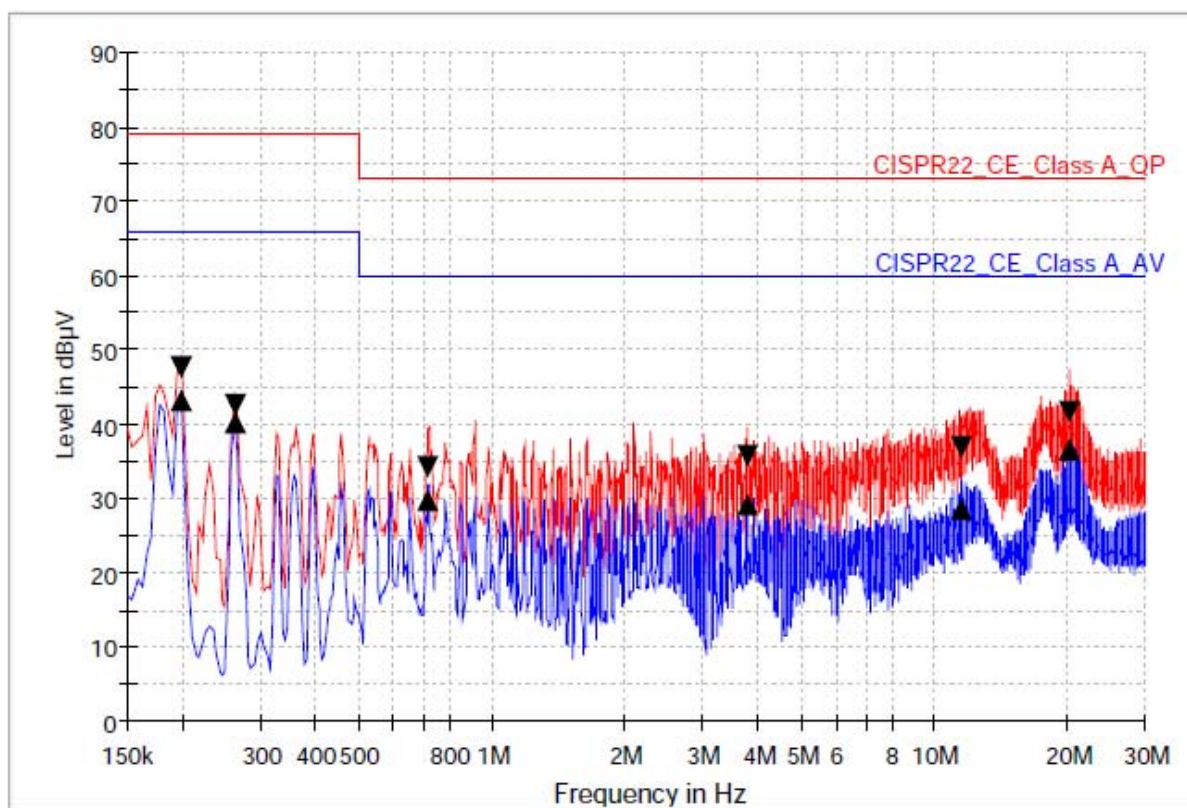


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.198000	47.3	42.8	9.000	L1	9.6	31.7	79.0	23.2	66.0
0.262000	40.7	38.5	9.000	L1	9.6	38.3	79.0	27.5	66.0
0.722000	37.8	31.8	9.000	L1	9.6	35.2	73.0	28.2	60.0
3.930000	35.8	29.6	9.000	L1	9.7	37.2	73.0	30.4	60.0
12.318000	39.2	31.7	9.000	L1	9.8	33.8	73.0	28.3	60.0
20.234000	42.3	36.8	9.000	L1	9.9	30.7	73.0	23.2	60.0

Mode #3

NEUTRAL LINE

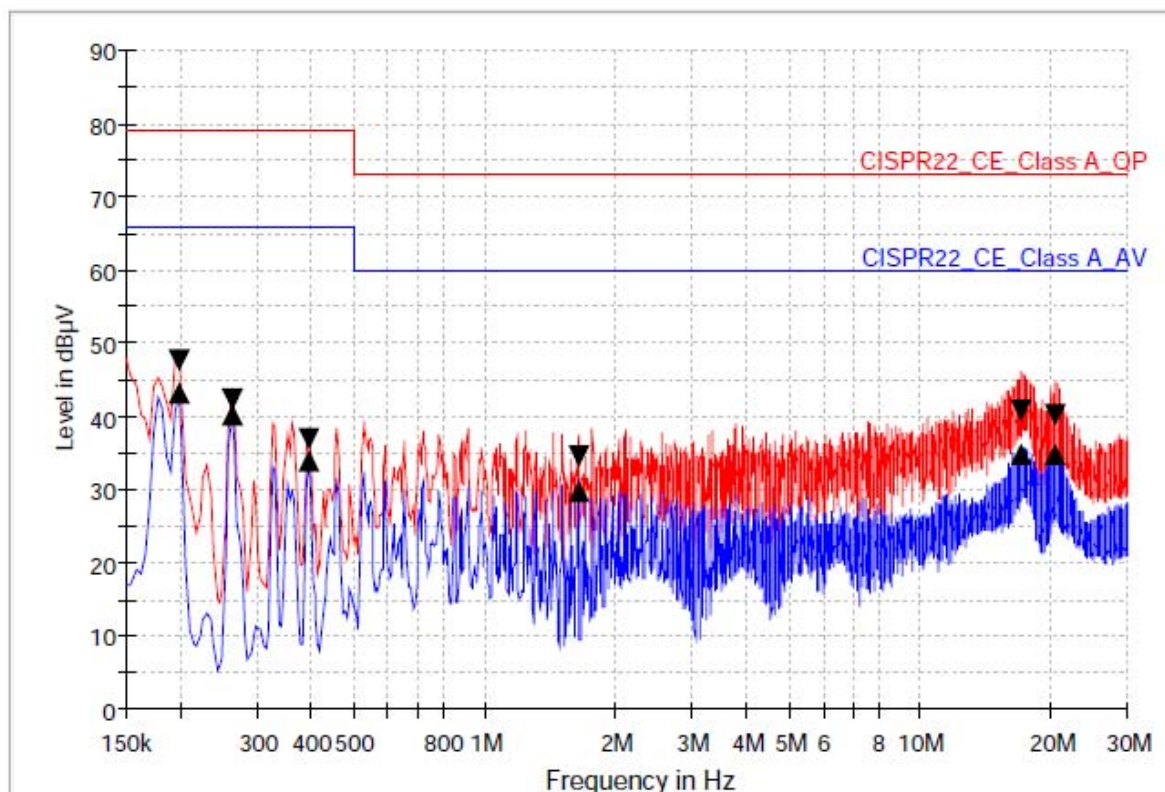


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.198000	47.6	43.2	9.000	N	9.6	31.4	79.0	22.8	66.0
0.262000	42.6	40.3	9.000	N	9.6	36.4	79.0	25.7	66.0
0.718000	34.2	29.9	9.000	N	9.6	38.8	73.0	30.1	60.0
3.798000	35.7	29.1	9.000	N	9.7	37.3	73.0	30.9	60.0
11.594000	36.9	28.7	9.000	N	9.8	36.1	73.0	31.3	60.0
20.298000	41.9	36.8	9.000	N	9.9	31.1	73.0	23.2	60.0

Mode #4

HOT LINE

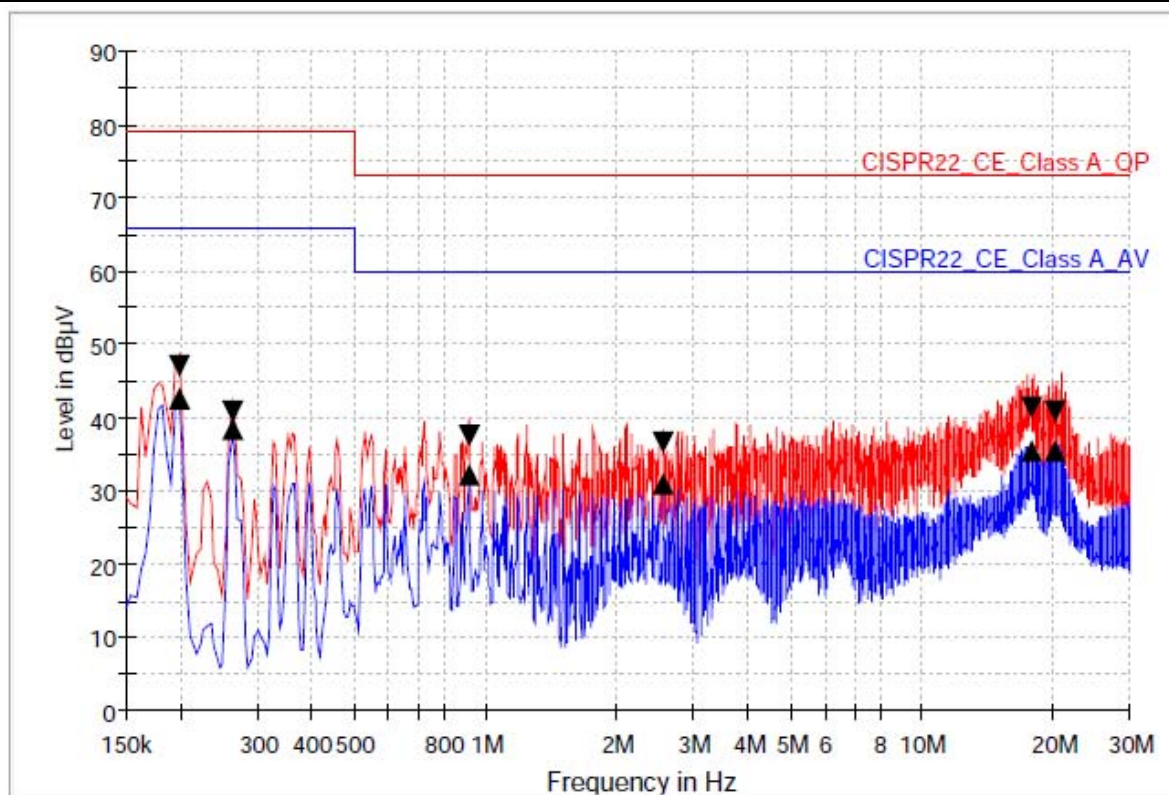


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.198000	47.5	43.1	9.000	L1	9.6	31.5	79.0	22.9	66.0
0.262000	42.2	40.1	9.000	L1	9.6	36.8	79.0	25.9	66.0
0.394000	36.8	34.0	9.000	L1	9.6	42.2	79.0	32.0	66.0
1.638000	34.5	29.9	9.000	L1	9.6	38.5	73.0	30.1	60.0
17.158000	40.9	35.0	9.000	L1	9.9	32.1	73.0	25.0	60.0
20.430000	40.2	34.8	9.000	L1	9.9	32.8	73.0	25.2	60.0

Mode #4

NEUTRAL LINE

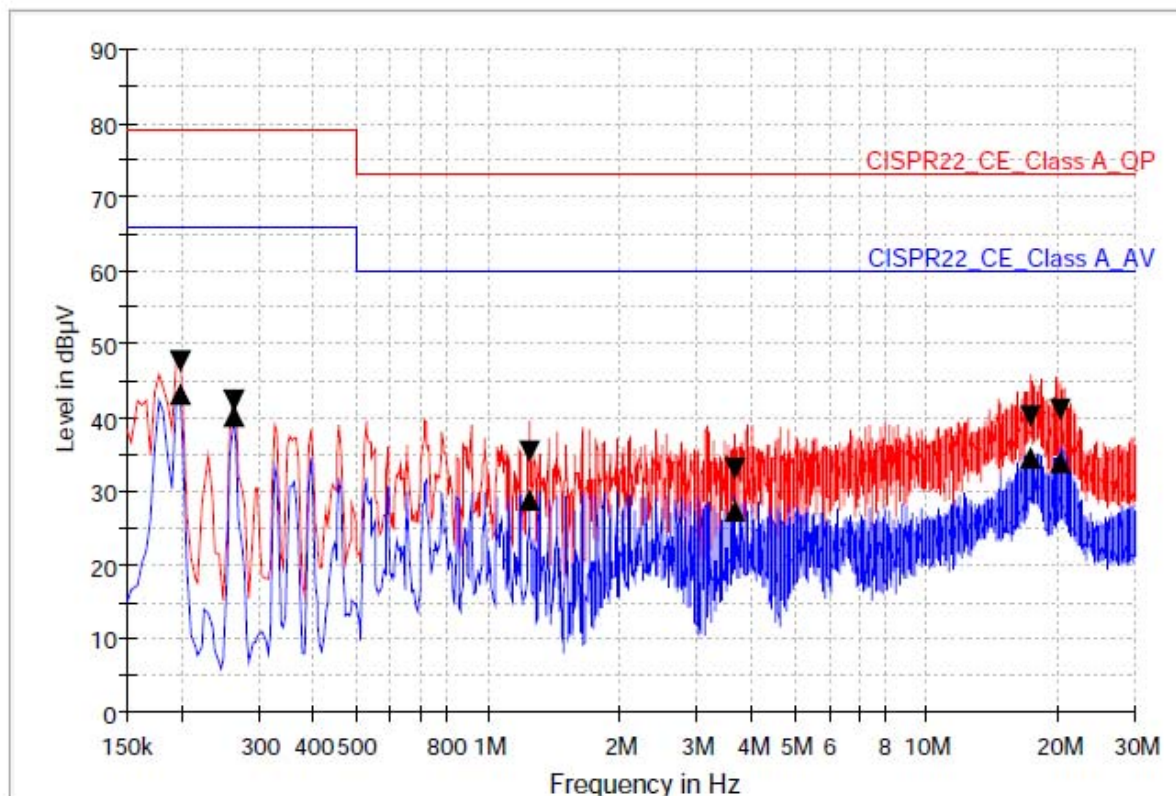


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.198000	47.2	42.6	9.000	N	9.6	31.8	79.0	23.4	66.0
0.262000	40.9	38.4	9.000	N	9.6	38.1	79.0	27.6	66.0
0.914000	37.5	32.2	9.000	N	9.6	35.5	73.0	27.8	60.0
2.554000	36.7	30.9	9.000	N	9.7	36.3	73.0	29.1	60.0
17.878000	41.4	35.3	9.000	N	9.9	31.6	73.0	24.7	60.0
20.298000	40.9	35.6	9.000	N	9.9	32.1	73.0	24.4	60.0

Mode #5

HOT LINE

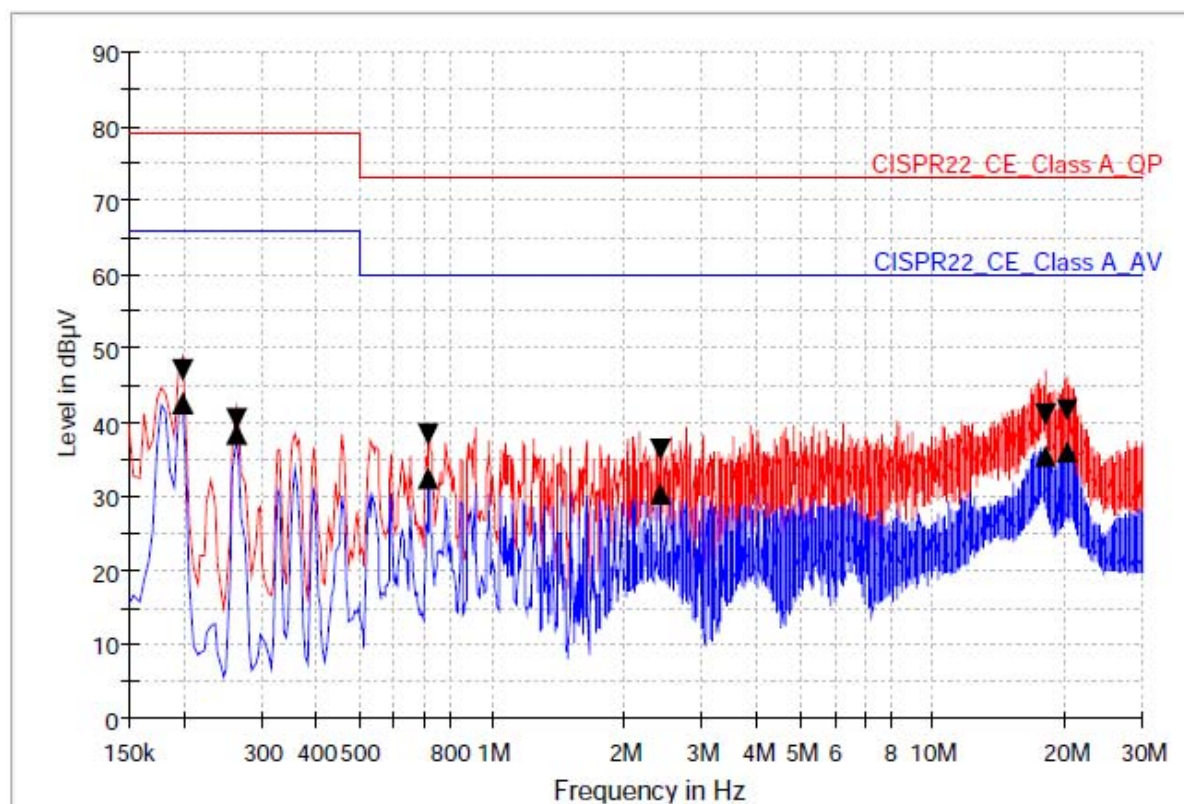


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.198000	47.6	43.2	9.000	L1	9.6	31.4	79.0	22.8	66.0
0.262000	42.4	40.2	9.000	L1	9.6	36.6	79.0	25.8	66.0
1.246000	35.4	28.8	9.000	L1	9.6	37.6	73.0	31.2	60.0
3.670000	33.1	27.4	9.000	L1	9.7	39.9	73.0	32.6	60.0
17.354000	40.2	34.4	9.000	L1	9.9	32.8	73.0	25.6	60.0
20.174000	41.0	34.1	9.000	L1	9.9	32.0	73.0	25.9	60.0

Mode #5

NEUTRAL LINE

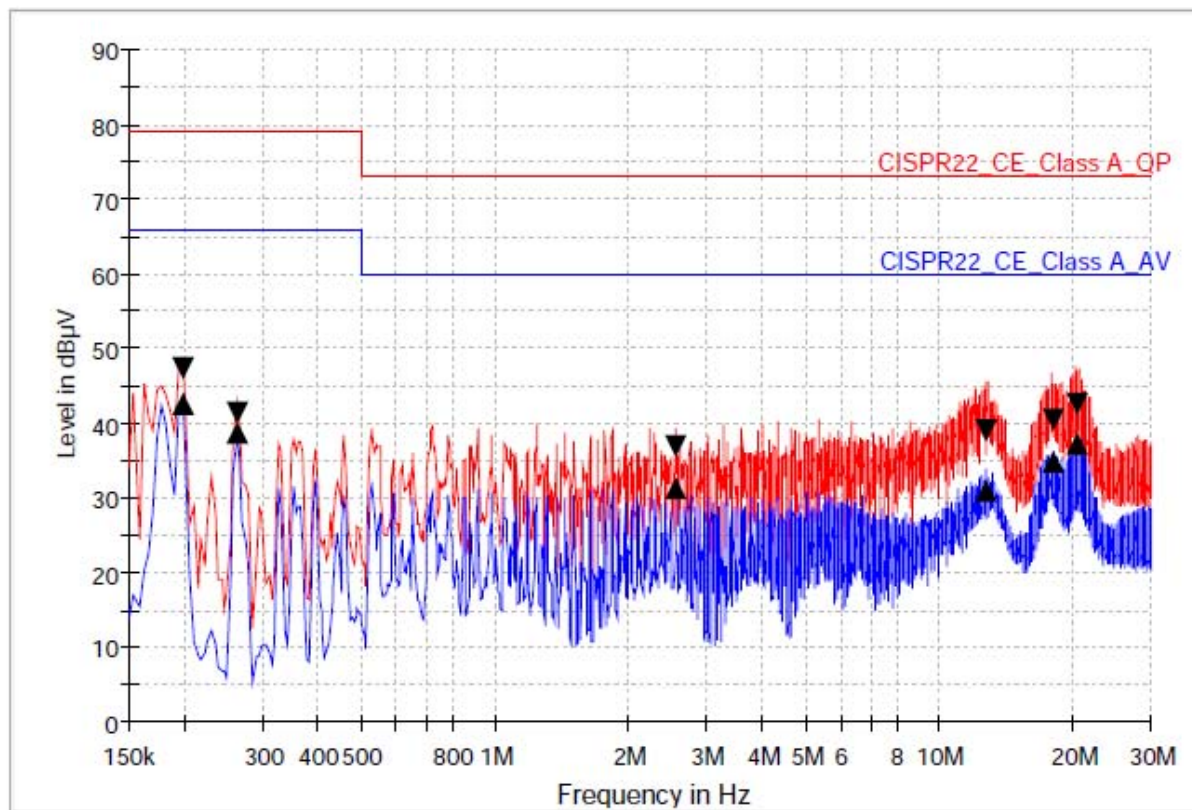


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.198000	47.2	42.7	9.000	N	9.6	31.8	79.0	23.3	66.0
0.262000	40.7	38.4	9.000	N	9.6	38.3	79.0	27.6	66.0
0.718000	38.5	32.4	9.000	N	9.6	34.5	73.0	27.6	60.0
2.422000	36.5	30.4	9.000	N	9.7	36.5	73.0	29.6	60.0
18.006000	41.0	35.3	9.000	N	9.9	32.0	73.0	24.7	60.0
20.302000	41.6	36.0	9.000	N	9.9	31.4	73.0	24.0	60.0

Mode #6

HOT LINE

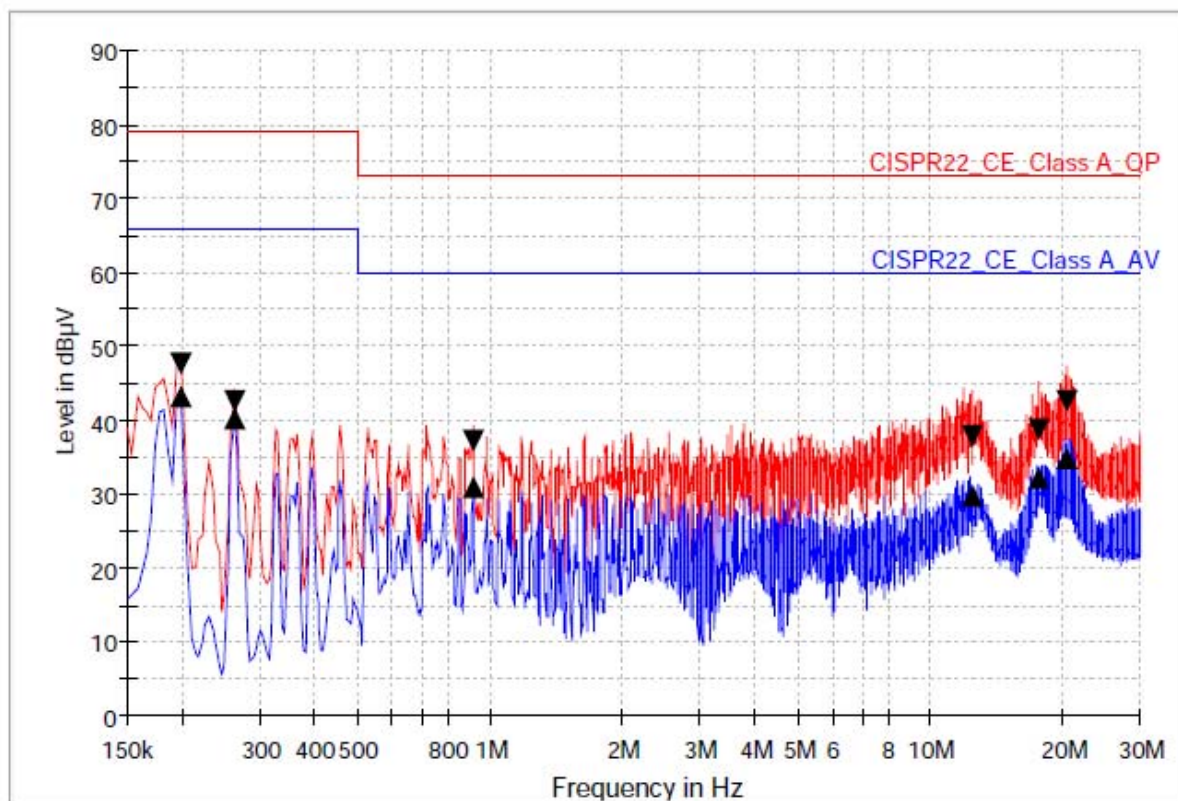


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.198000	47.3	42.8	9.000	L1	9.6	31.7	79.0	23.2	66.0
0.262000	41.4	38.6	9.000	L1	9.6	37.6	79.0	27.4	66.0
2.554000	36.9	31.2	9.000	L1	9.7	36.1	73.0	28.8	60.0
12.702000	39.0	31.1	9.000	L1	9.8	34.0	73.0	28.9	60.0
18.006000	40.6	34.8	9.000	L1	9.9	32.4	73.0	25.2	60.0
20.494000	42.6	37.2	9.000	L1	10.0	30.4	73.0	22.8	60.0

Mode #6

NEUTRAL LINE

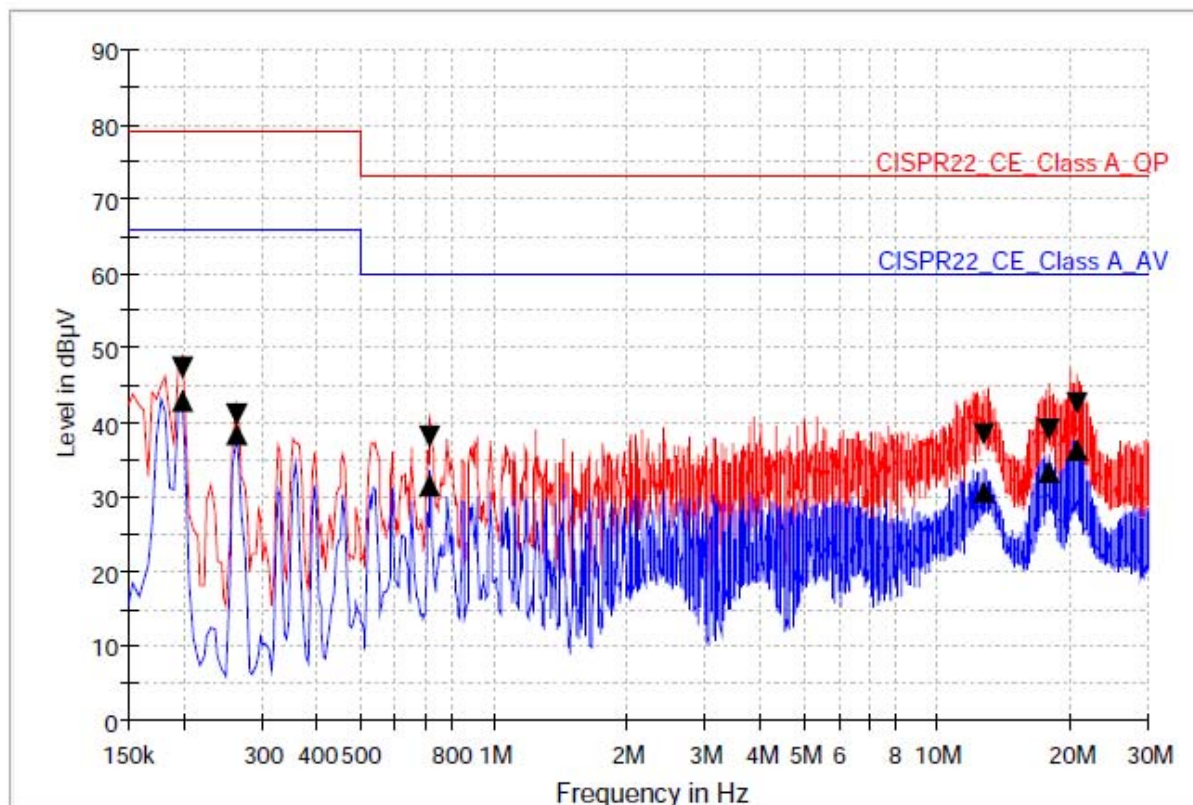


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.198000	47.6	43.2	9.000	N	9.6	31.4	79.0	22.8	66.0
0.262000	42.5	40.2	9.000	N	9.6	36.5	79.0	25.8	66.0
0.918000	37.3	31.0	9.000	N	9.6	35.7	73.0	29.0	60.0
12.510000	37.9	29.7	9.000	N	9.8	35.1	73.0	30.3	60.0
17.750000	38.6	32.0	9.000	N	9.9	34.4	73.0	28.0	60.0
20.370000	42.5	35.0	9.000	N	9.9	30.5	73.0	25.0	60.0

Mode #7

HOT LINE

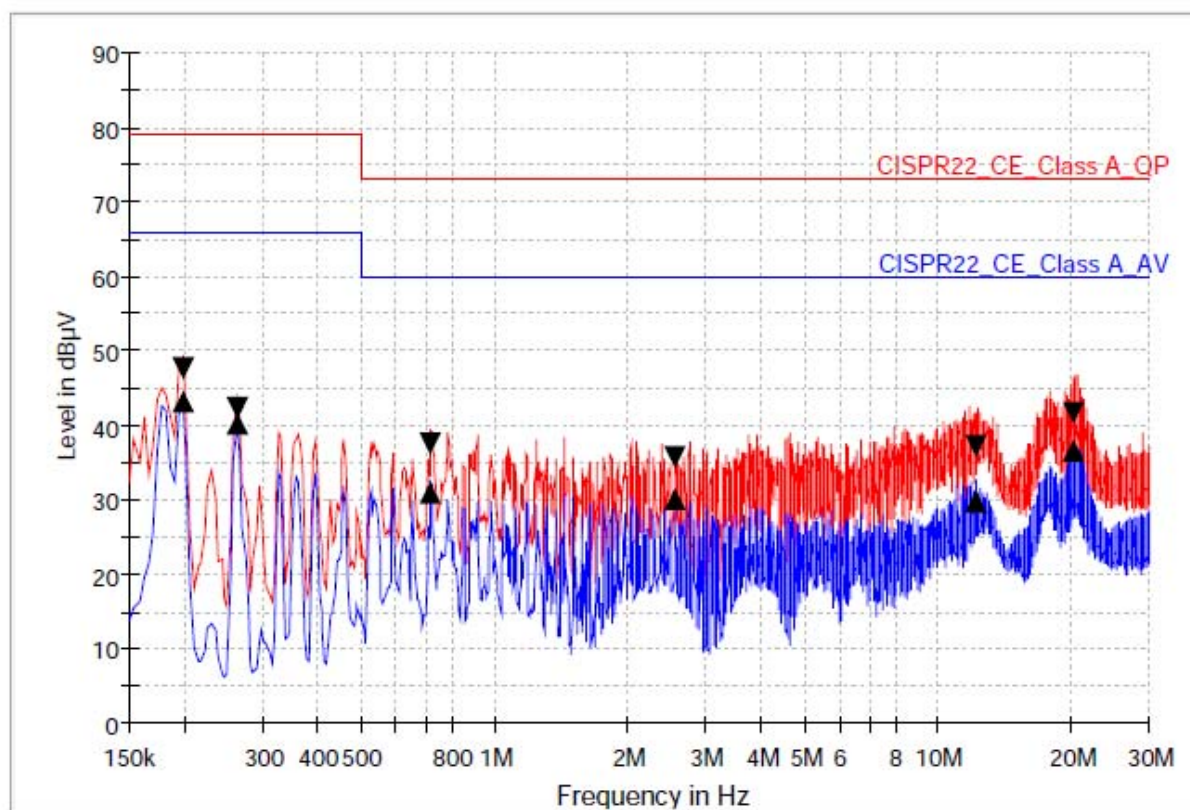


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.198000	47.3	42.8	9.000	L1	9.6	31.7	79.0	23.2	66.0
0.262000	41.0	38.6	9.000	L1	9.6	38.0	79.0	27.4	66.0
0.718000	38.1	31.5	9.000	L1	9.6	34.9	73.0	28.5	60.0
12.714000	38.4	30.8	9.000	L1	9.8	34.6	73.0	29.2	60.0
17.938000	38.9	33.4	9.000	L1	9.9	34.1	73.0	26.6	60.0
20.694000	42.7	36.3	9.000	L1	10.0	30.3	73.0	23.7	60.0

Mode #7

NEUTRAL LINE

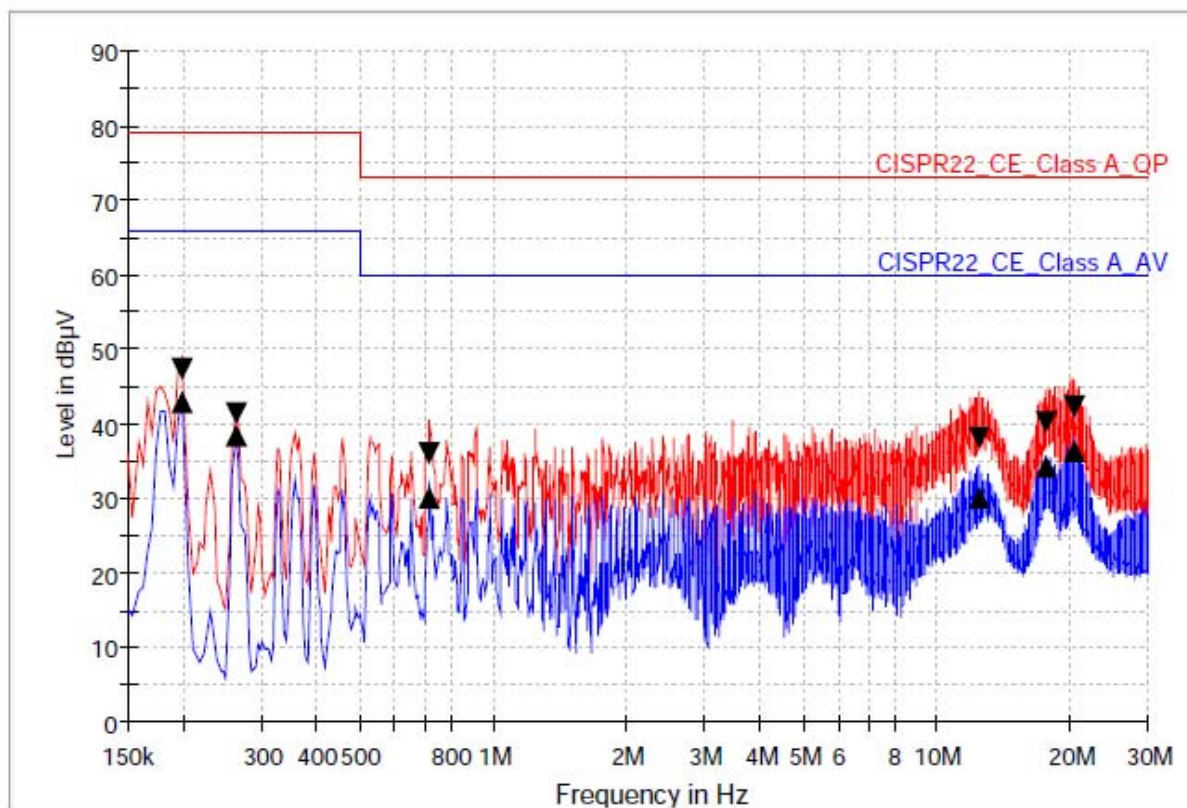


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.198000	47.6	43.2	9.000	N	9.6	31.4	79.0	22.8	66.0
0.262000	42.4	40.2	9.000	N	9.6	36.6	79.0	25.8	66.0
0.718000	37.7	31.1	9.000	N	9.6	35.3	73.0	28.9	60.0
2.554000	35.7	30.2	9.000	N	9.7	37.3	73.0	29.8	60.0
12.146000	37.2	29.8	9.000	N	9.8	35.8	73.0	30.2	60.0
20.234000	41.8	36.6	9.000	N	9.9	31.2	73.0	23.4	60.0

Mode #8

HOT LINE

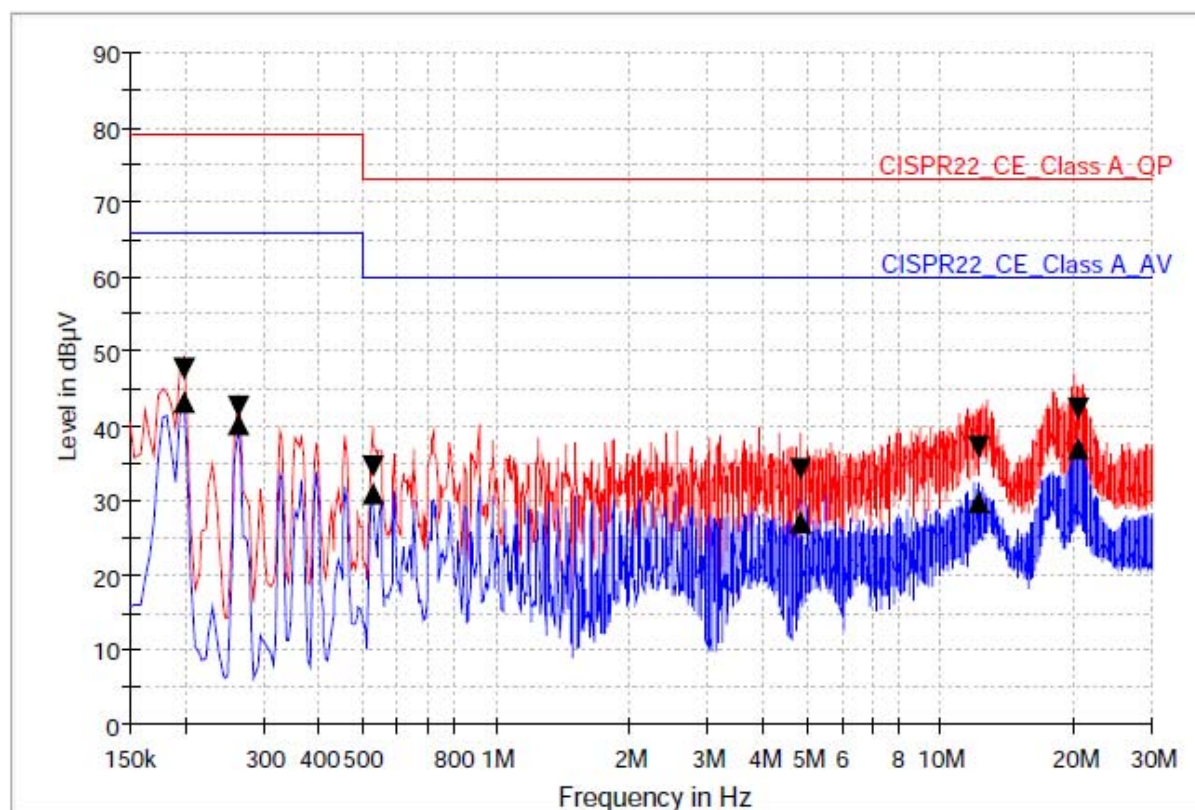


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.198000	47.3	42.8	9.000	L1	9.6	31.7	79.0	23.2	66.0
0.262000	41.3	38.6	9.000	L1	9.6	37.7	79.0	27.4	66.0
0.718000	36.1	30.2	9.000	L1	9.6	36.9	73.0	29.8	60.0
12.502000	38.1	30.1	9.000	L1	9.8	34.9	73.0	29.9	60.0
17.746000	40.3	34.3	9.000	L1	9.9	32.7	73.0	25.7	60.0
20.562000	42.3	36.4	9.000	L1	10.0	30.7	73.0	23.6	60.0

Mode #8

NEUTRAL LINE

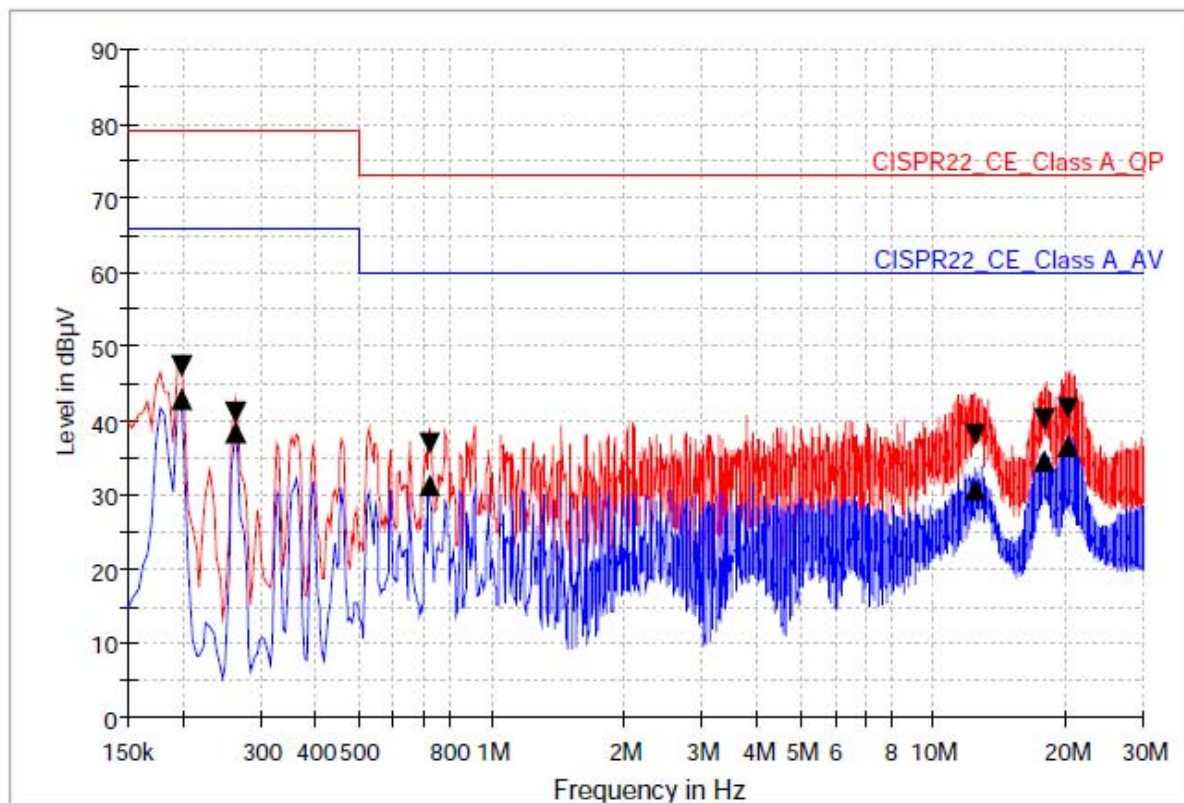


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.198000	47.6	43.3	9.000	N	9.6	31.4	79.0	22.7	66.0
0.262000	42.5	40.3	9.000	N	9.6	36.5	79.0	25.7	66.0
0.526000	34.5	31.1	9.000	N	9.6	38.5	73.0	28.9	60.0
4.842000	34.3	27.1	9.000	N	9.7	38.7	73.0	32.9	60.0
12.154000	37.1	29.7	9.000	N	9.8	35.9	73.0	30.3	60.0
20.430000	42.2	37.0	9.000	N	9.9	30.8	73.0	23.0	60.0

Mode #9

HOT LINE

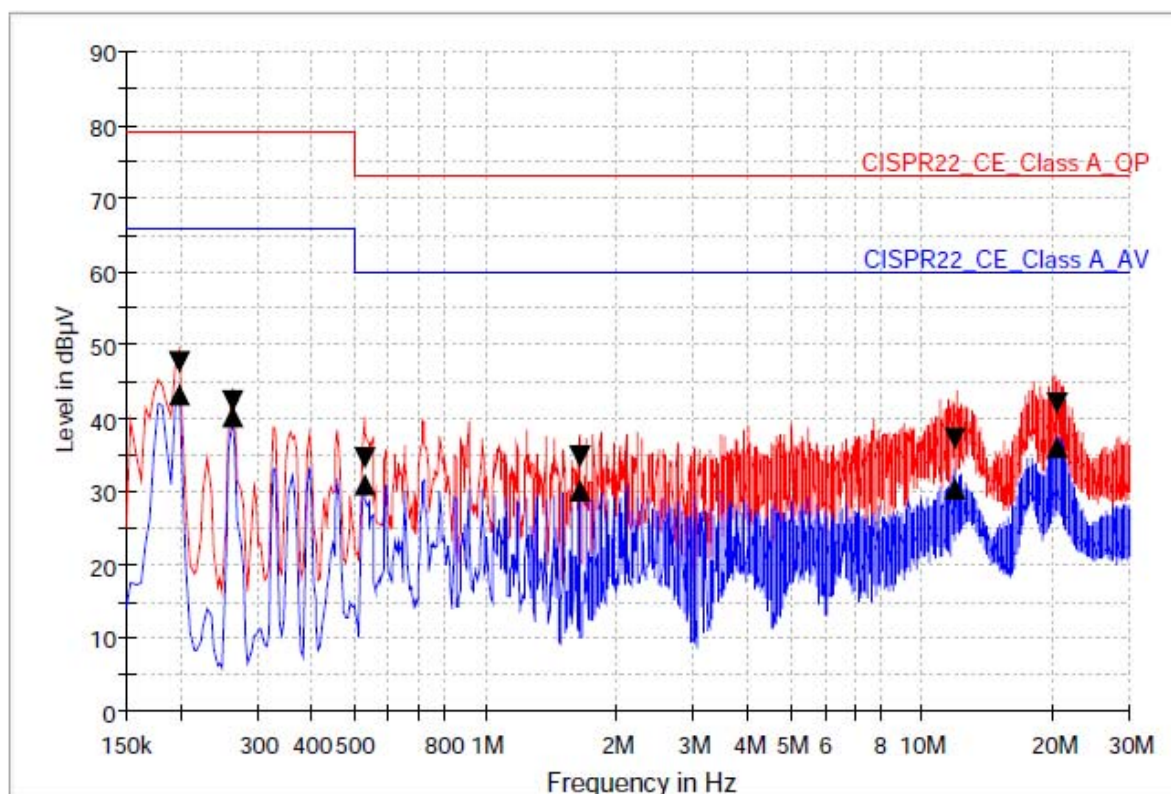


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)	Margin - CAV (dB)	Limit - CAV (dBμV)
0.198000	47.3	42.8	9.000	L1	9.6	31.7	79.0	23.2	66.0
0.262000	41.0	38.6	9.000	L1	9.6	38.0	79.0	27.4	66.0
0.722000	37.1	31.2	9.000	L1	9.6	35.9	73.0	28.8	60.0
12.490000	38.1	30.6	9.000	L1	9.8	34.9	73.0	29.4	60.0
17.942000	40.1	34.4	9.000	L1	9.9	32.9	73.0	25.6	60.0
20.298000	41.8	36.7	9.000	L1	9.9	31.2	73.0	23.3	60.0

Mode #9

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)
0.198000	47.6	43.2	9.000	N	9.6	31.4	79.0	22.8	66.0
0.262000	42.4	40.2	9.000	N	9.6	36.6	79.0	25.8	66.0
0.526000	34.4	31.0	9.000	N	9.6	38.6	73.0	29.0	60.0
1.638000	34.9	30.1	9.000	N	9.6	38.1	73.0	29.9	60.0
11.962000	37.2	30.3	9.000	N	9.8	35.8	73.0	29.7	60.0
20.498000	41.9	36.2	9.000	N	10.0	31.1	73.0	23.8	60.0

3.2 Radiated Emission

3.2.1 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 3 m.

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

Used Software for measurement is manufactured by TSJ.

3.2.2 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.

3.2.3 Measurement uncertainty

Frequency range	Uncertainty
Below 1 000 MHz	4.66 dB
Above 1 000 MHz	4.79 dB

The measurement uncertainties are given with 95 % confidence.

3.2.4 Test result

Date of Test	2018-07-09			
Temperature	23.5 °C		Relative humidity	51.9 % 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	2018-07-09 ~ 07-10			
Temperature	(22.7 ~ 24.4) °C		Relative humidity	52.4 ~ 52.6 % 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 ~ #9			
Test Result	Pass	Tested By	Kim, Kwang-hyun 	

3.2.5 Sample Calculated Example

At 80 MHz

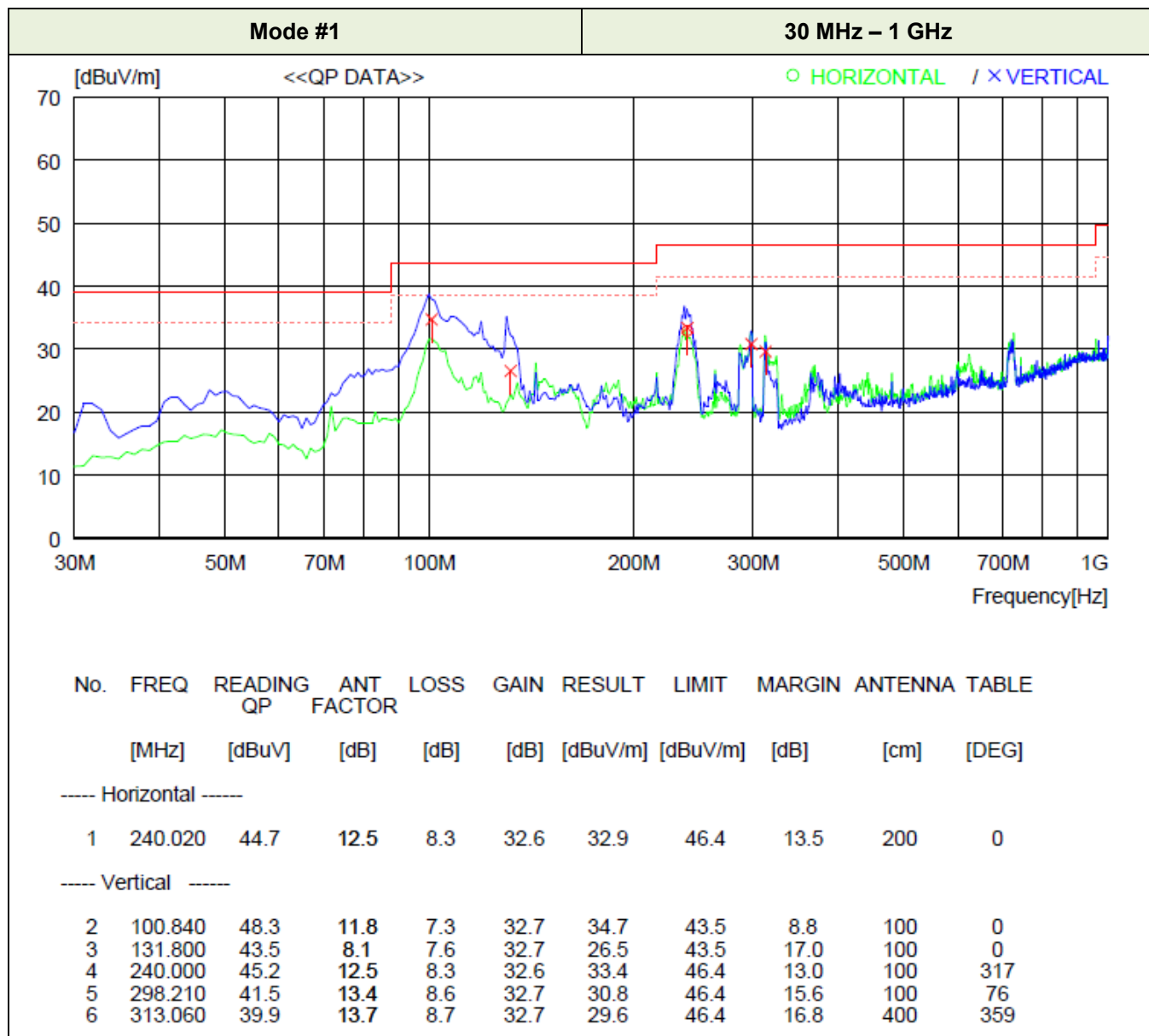
Limit = 40.0 dB μ V/m

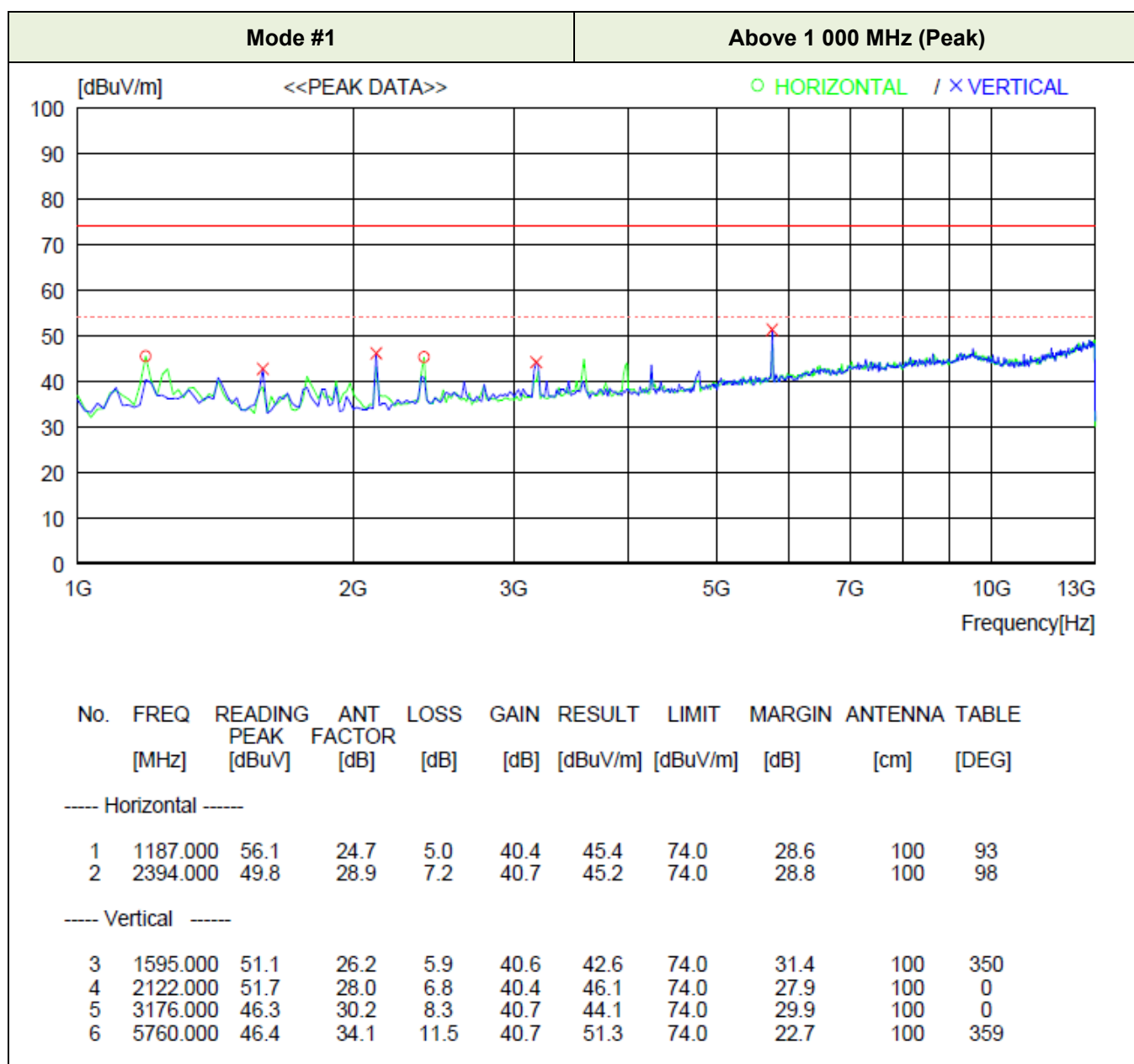
Result = Receiver reading value + Antenna Factor + Cable Loss - Pre-amplifier gain = 30 dB μ V/m

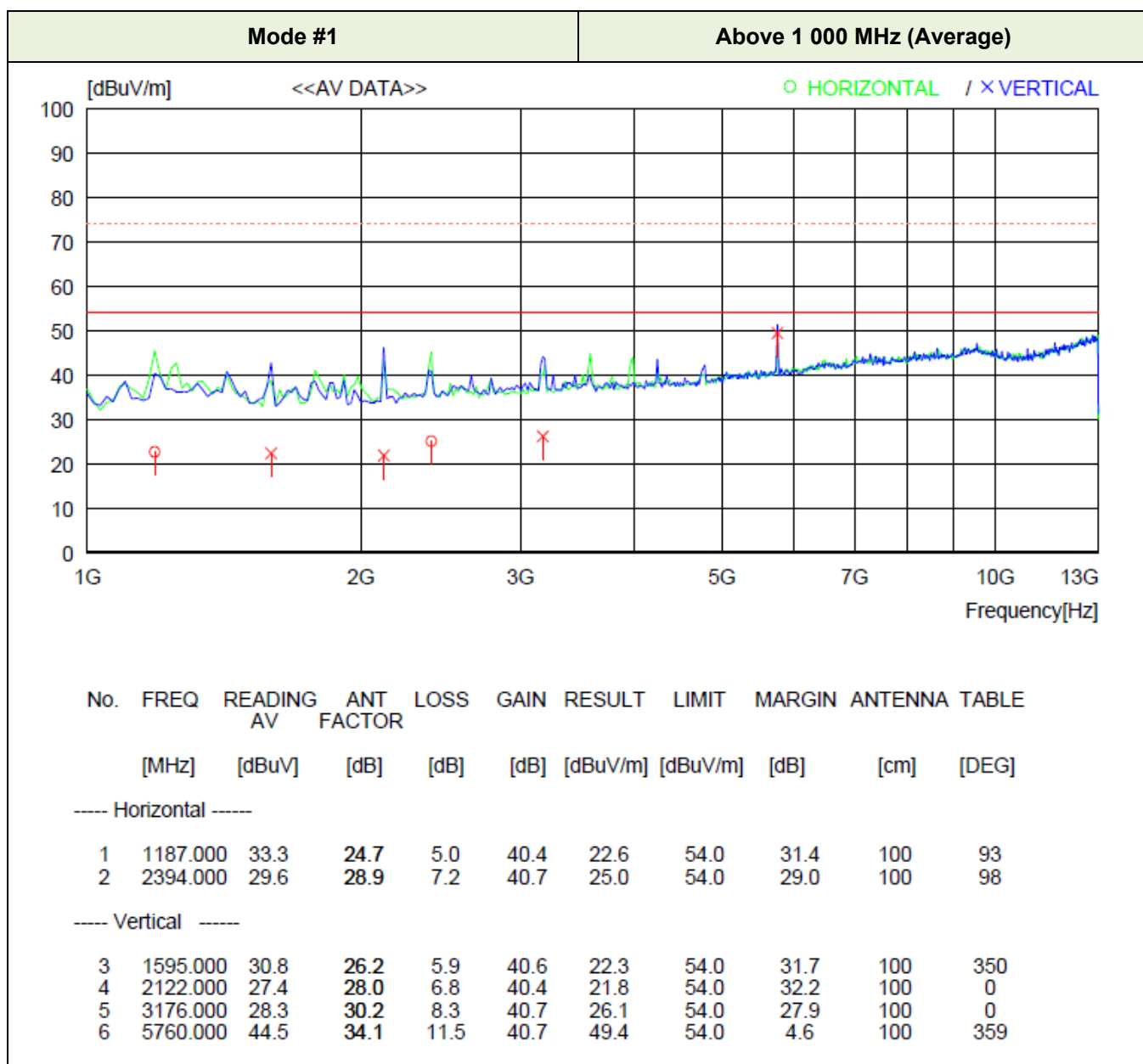
Margin = Limit - Result = 40 - 30 = 10

so the EUT has 10.0 dB margin at 80 MHz

3.2.6 Test Data

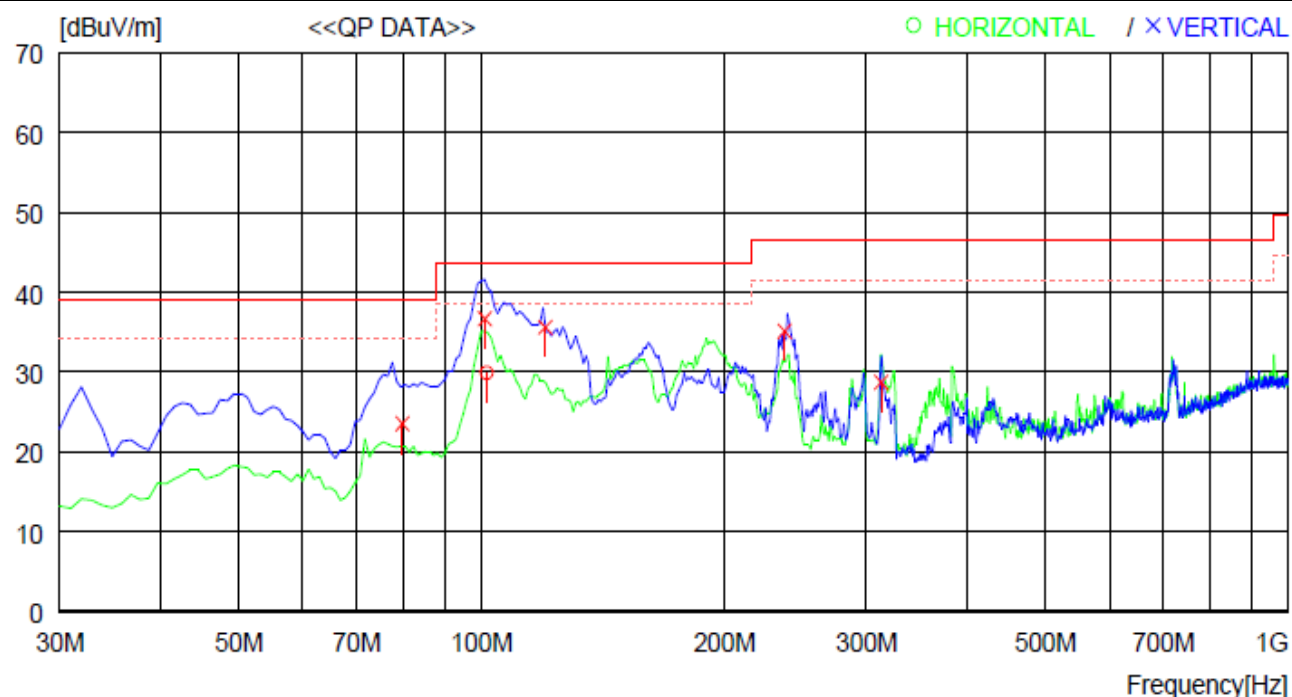




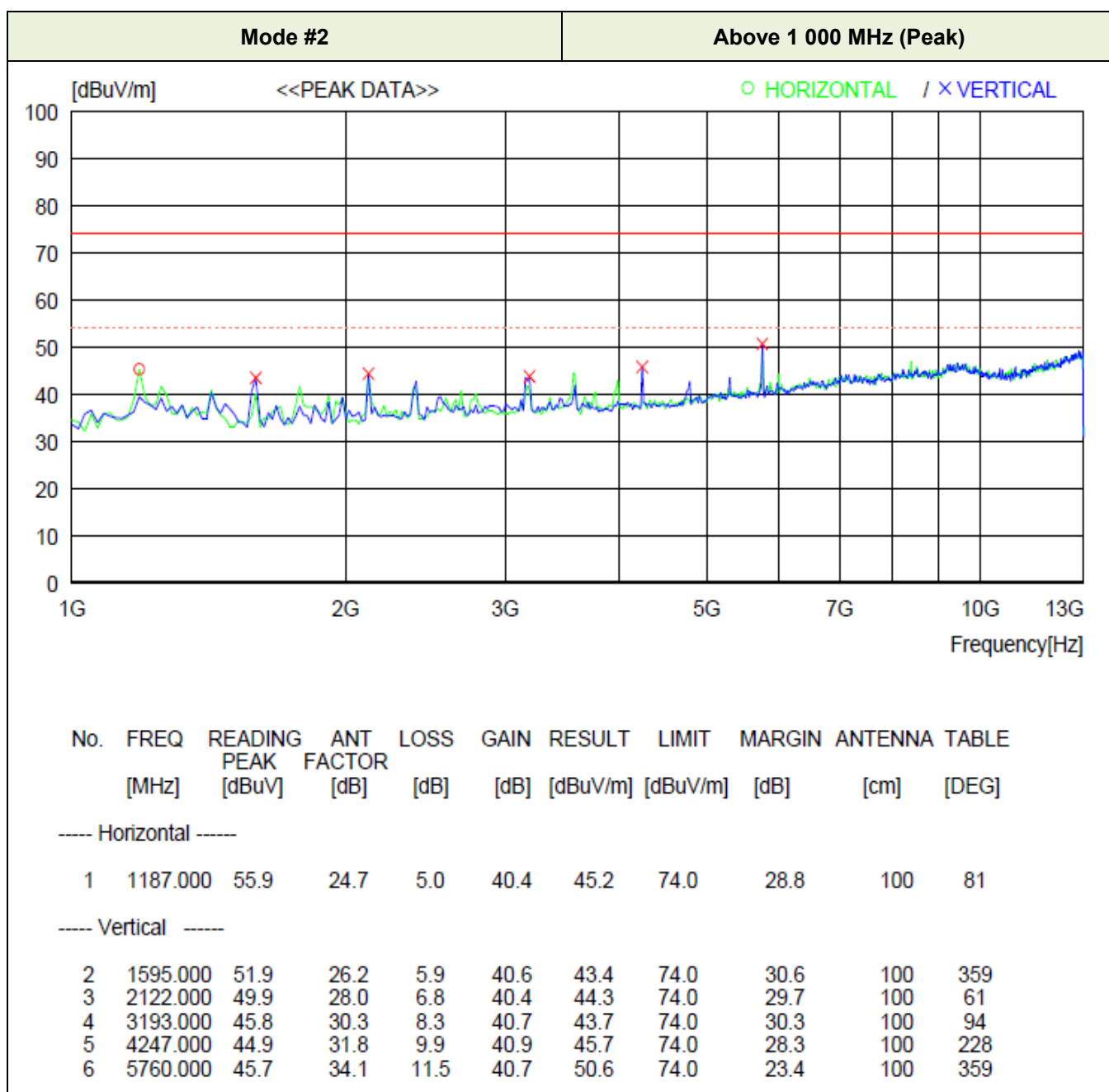


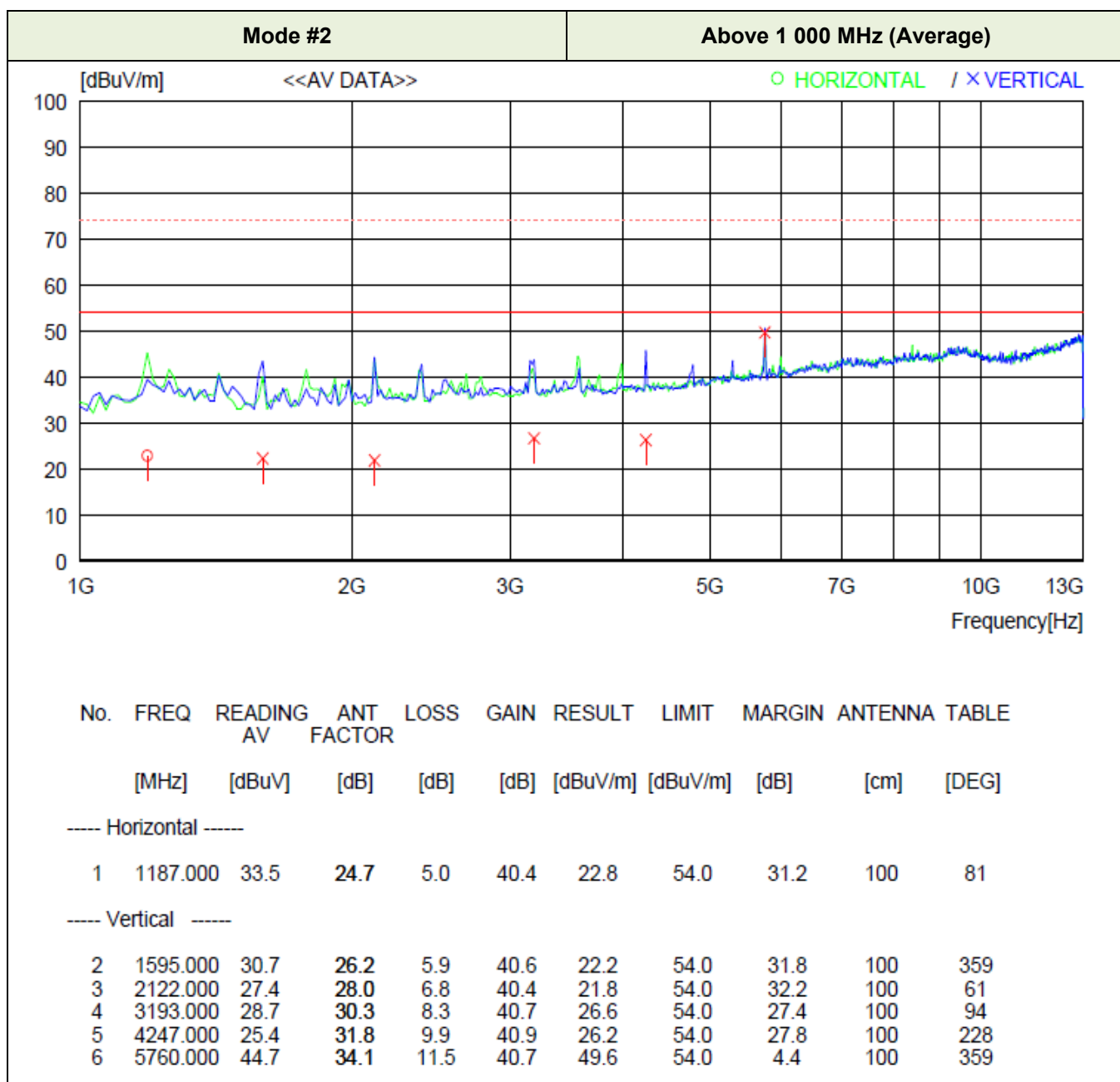
Mode #2

30 MHz – 1 GHz



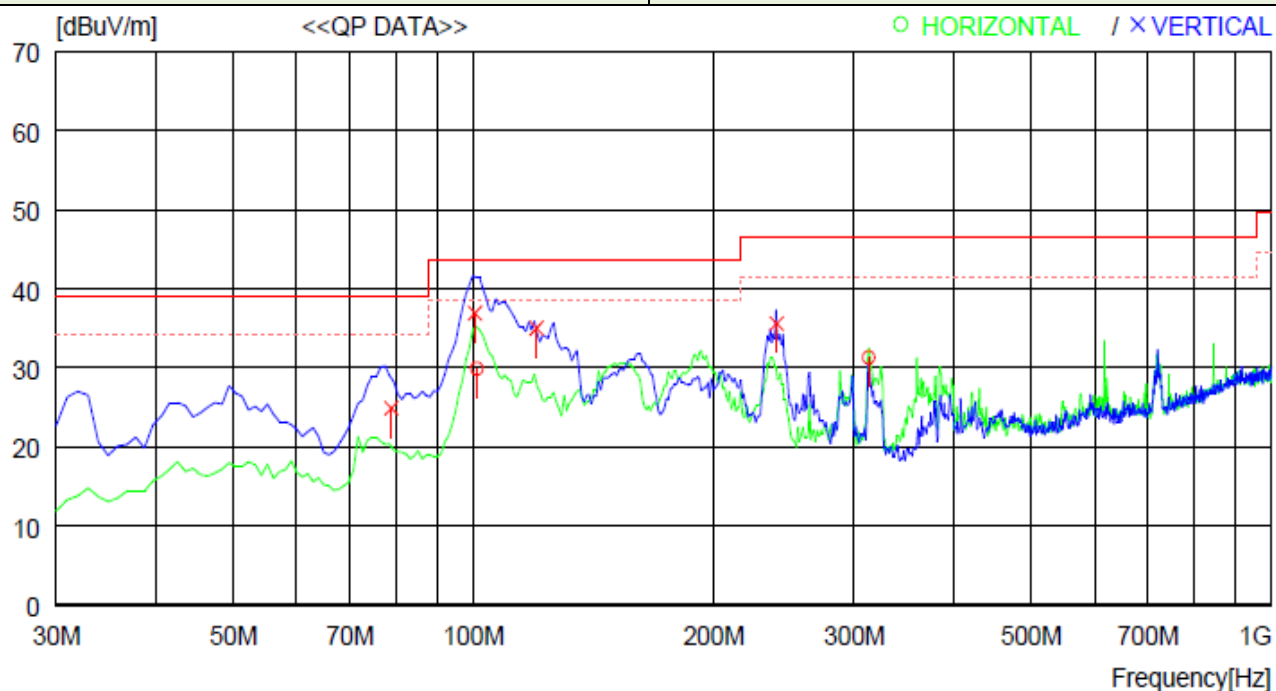
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	101.500	43.6	11.7	7.3	32.7	29.9	43.5	13.6	400	331
----- Vertical -----										
2	79.820	42.3	6.7	7.2	32.7	23.5	39.1	15.6	200	330
3	101.010	50.3	11.8	7.3	32.7	36.7	43.5	6.8	100	310
4	120.010	51.9	8.9	7.5	32.7	35.6	43.5	7.9	100	306
5	237.640	46.9	12.5	8.3	32.6	35.1	46.4	11.3	100	359
6	313.050	39.0	13.7	8.7	32.7	28.7	46.4	17.7	400	0



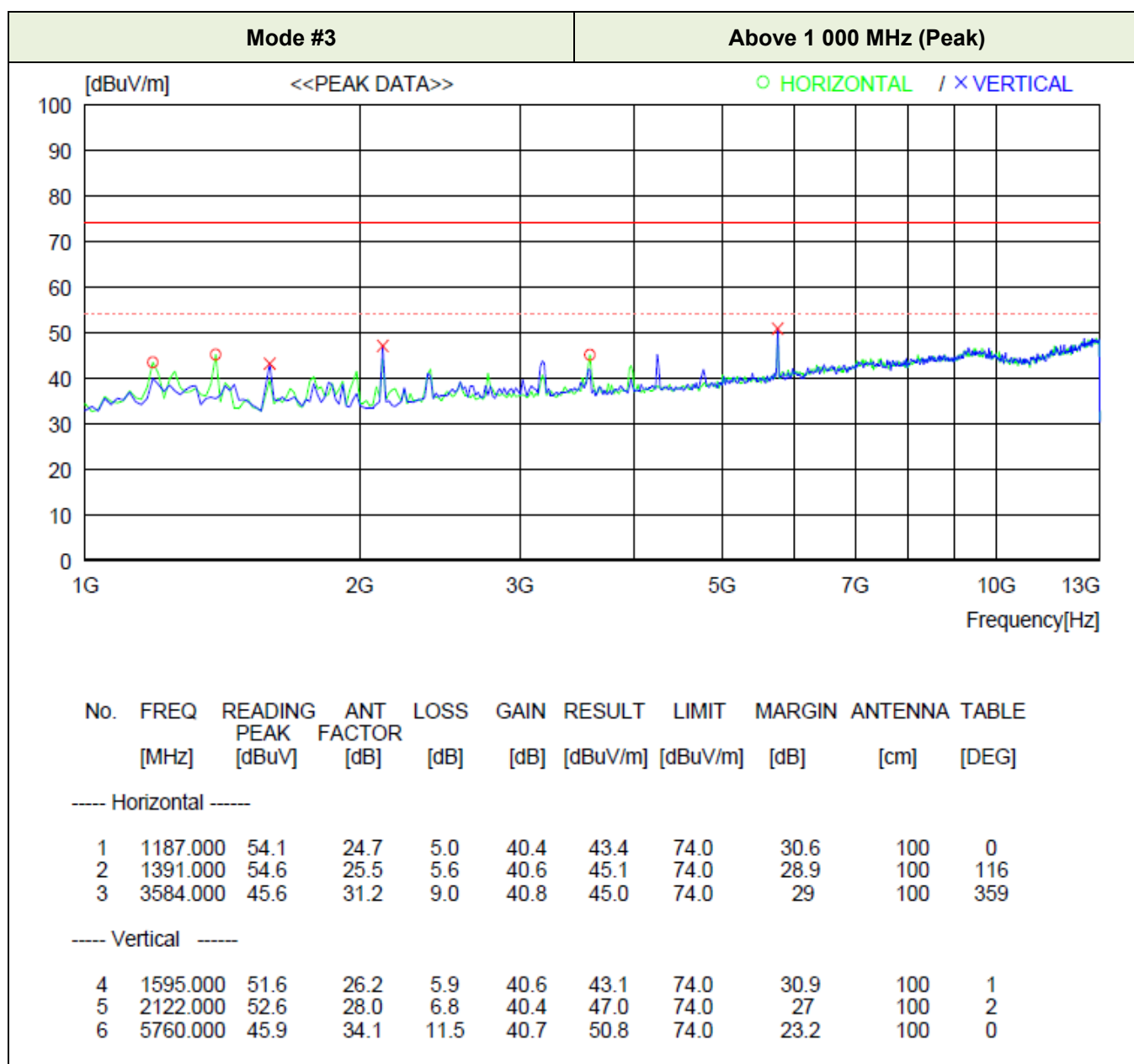


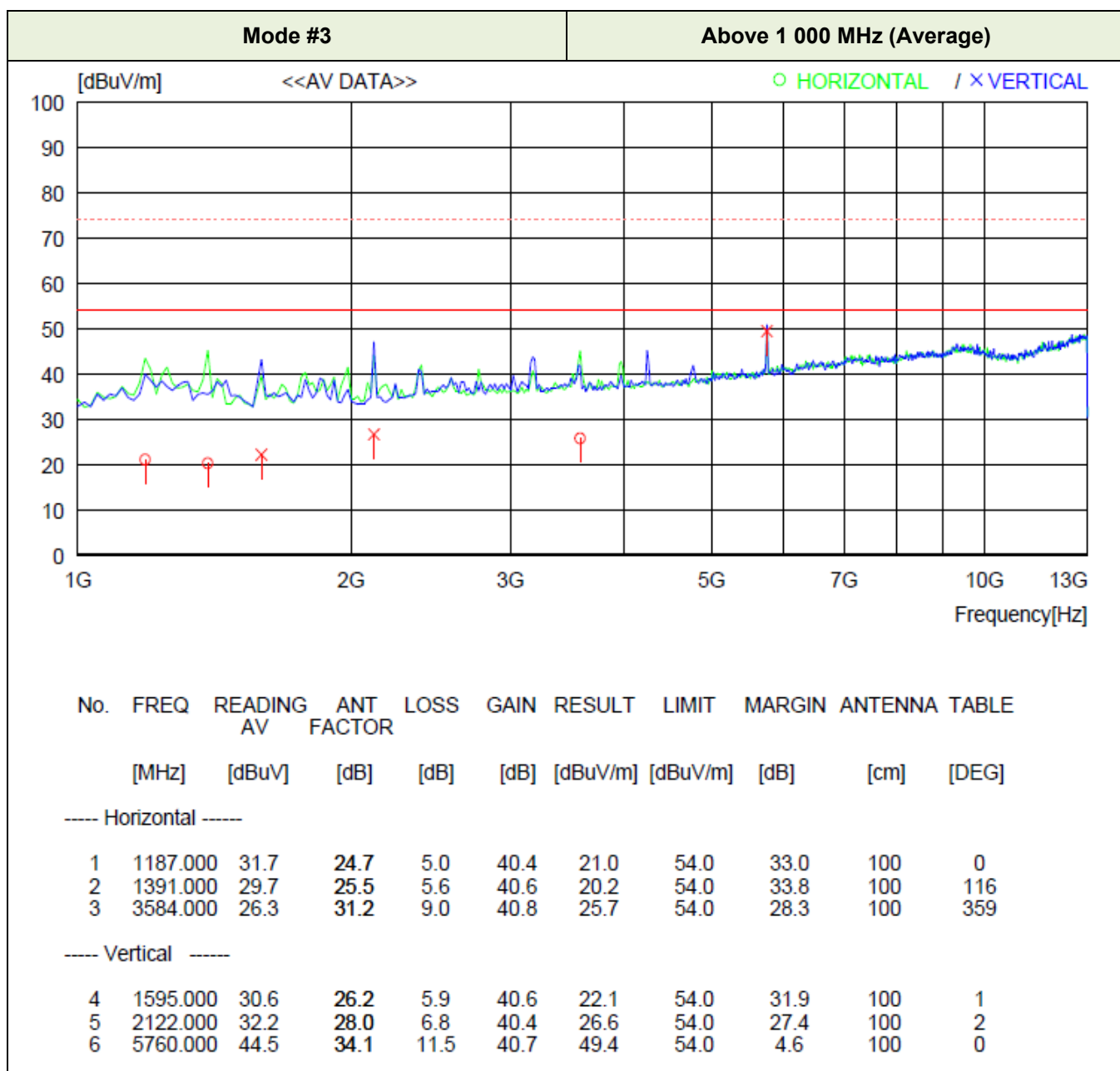
Mode #3

30 MHz – 1 GHz



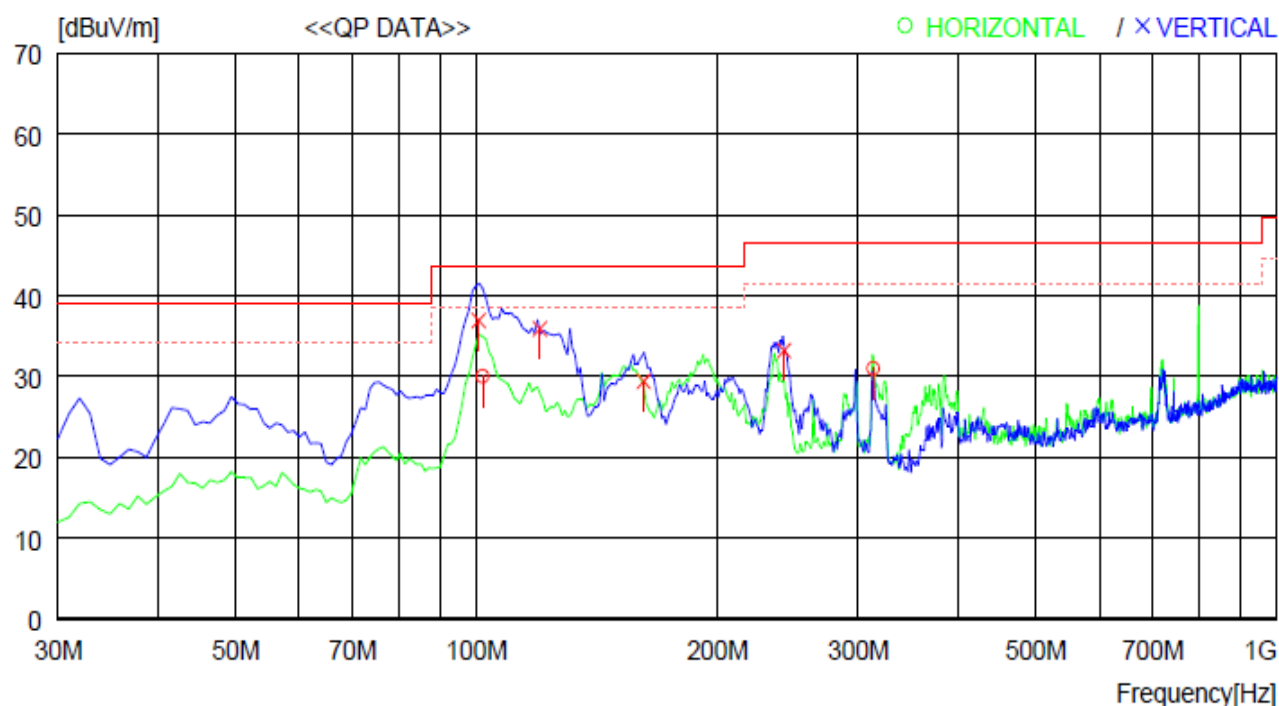
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP [dBuV]	FACTOR [dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
---- Horizontal ----										
1	101.080	43.5	11.8	7.3	32.7	29.9	43.5	13.6	400	358
2	313.100	41.6	13.7	8.7	32.7	31.3	46.4	15.1	200	0
---- Vertical ----										
3	78.930	43.5	6.9	7.2	32.7	24.9	39.1	14.2	200	305
4	100.520	50.5	11.8	7.3	32.7	36.9	43.5	6.6	100	0
5	120.010	51.3	8.9	7.5	32.7	35.0	43.5	8.5	100	334
6	240.010	47.4	12.5	8.3	32.6	35.6	46.4	10.8	100	294



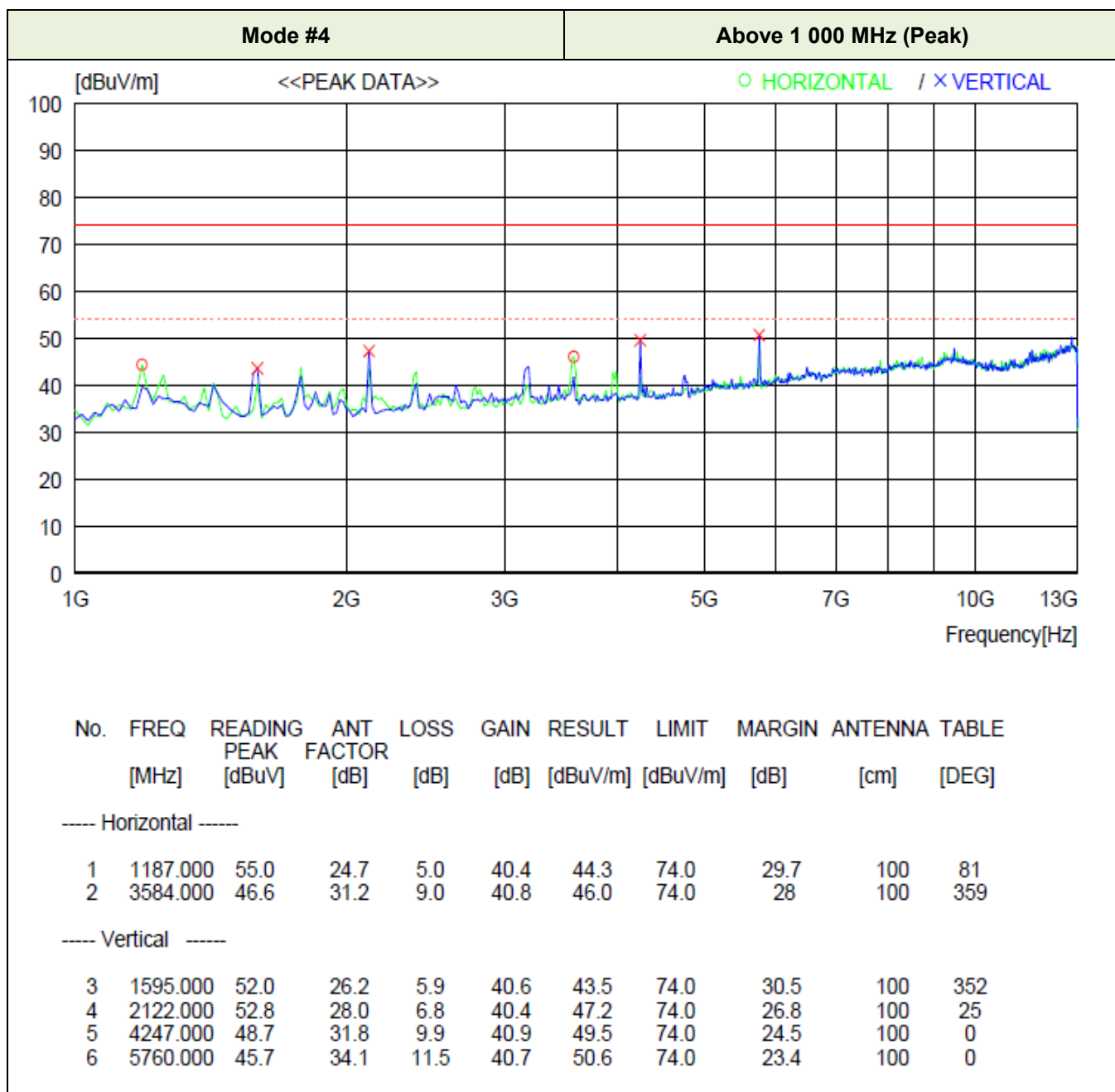


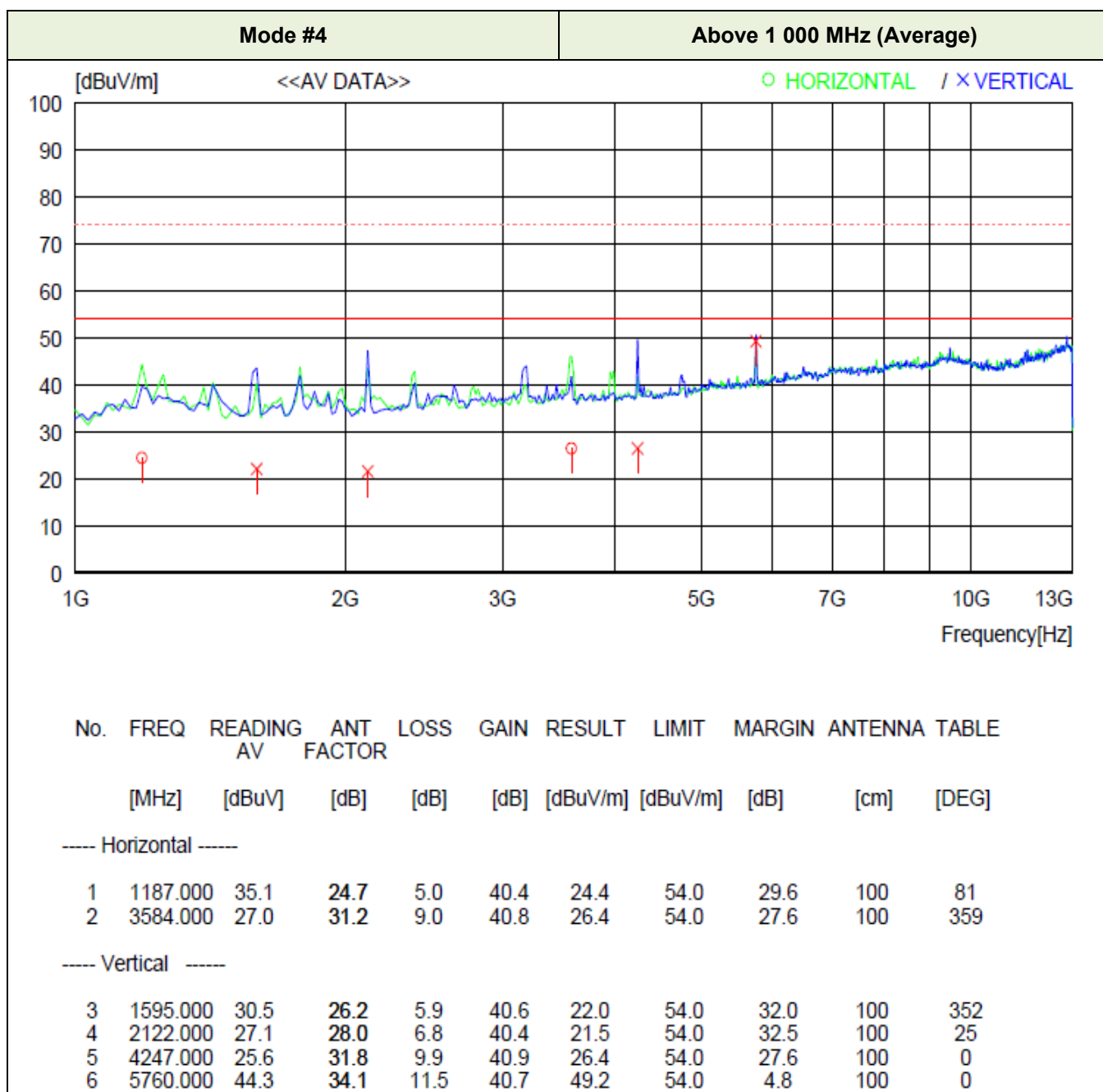
Mode #4

30 MHz – 1 GHz



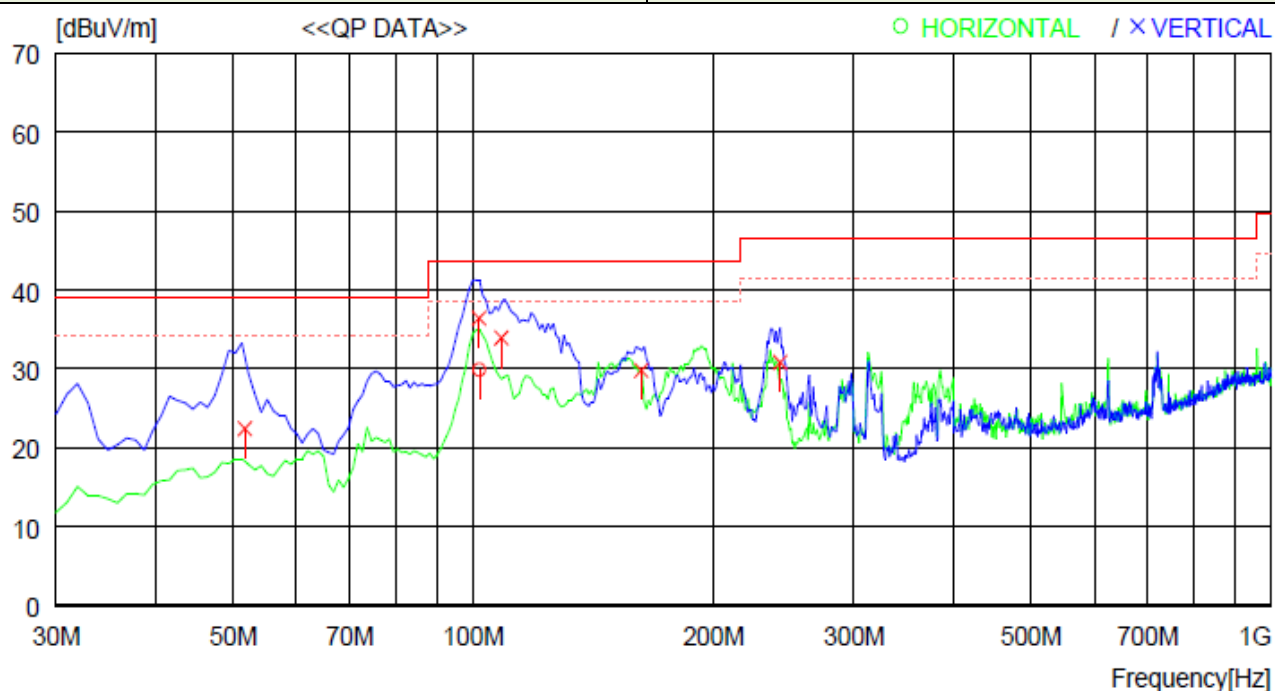
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
---- Horizontal ----										
1	101.770	43.7	11.7	7.3	32.7	30.0	43.5	13.5	400	339
2	313.120	41.3	13.7	8.7	32.7	31.0	46.4	15.4	200	0
---- Vertical ----										
3	100.680	50.5	11.8	7.3	32.7	36.9	43.5	6.6	100	345
4	120.000	52.2	8.9	7.5	32.7	35.9	43.5	7.6	100	0
5	161.830	45.9	8.4	7.8	32.7	29.4	43.5	14.1	100	0
6	242.340	44.9	12.6	8.3	32.6	33.2	46.4	13.2	100	0



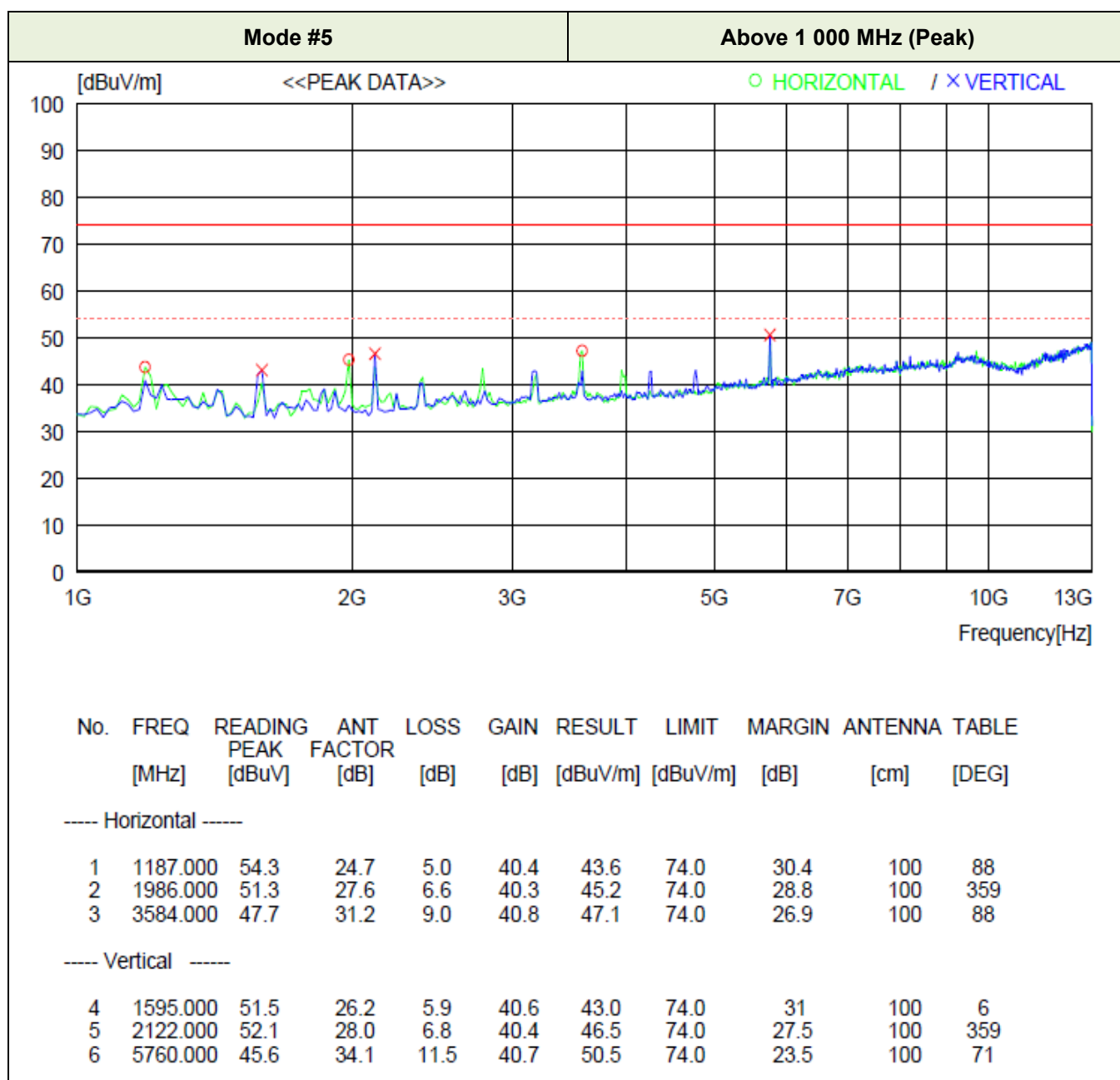


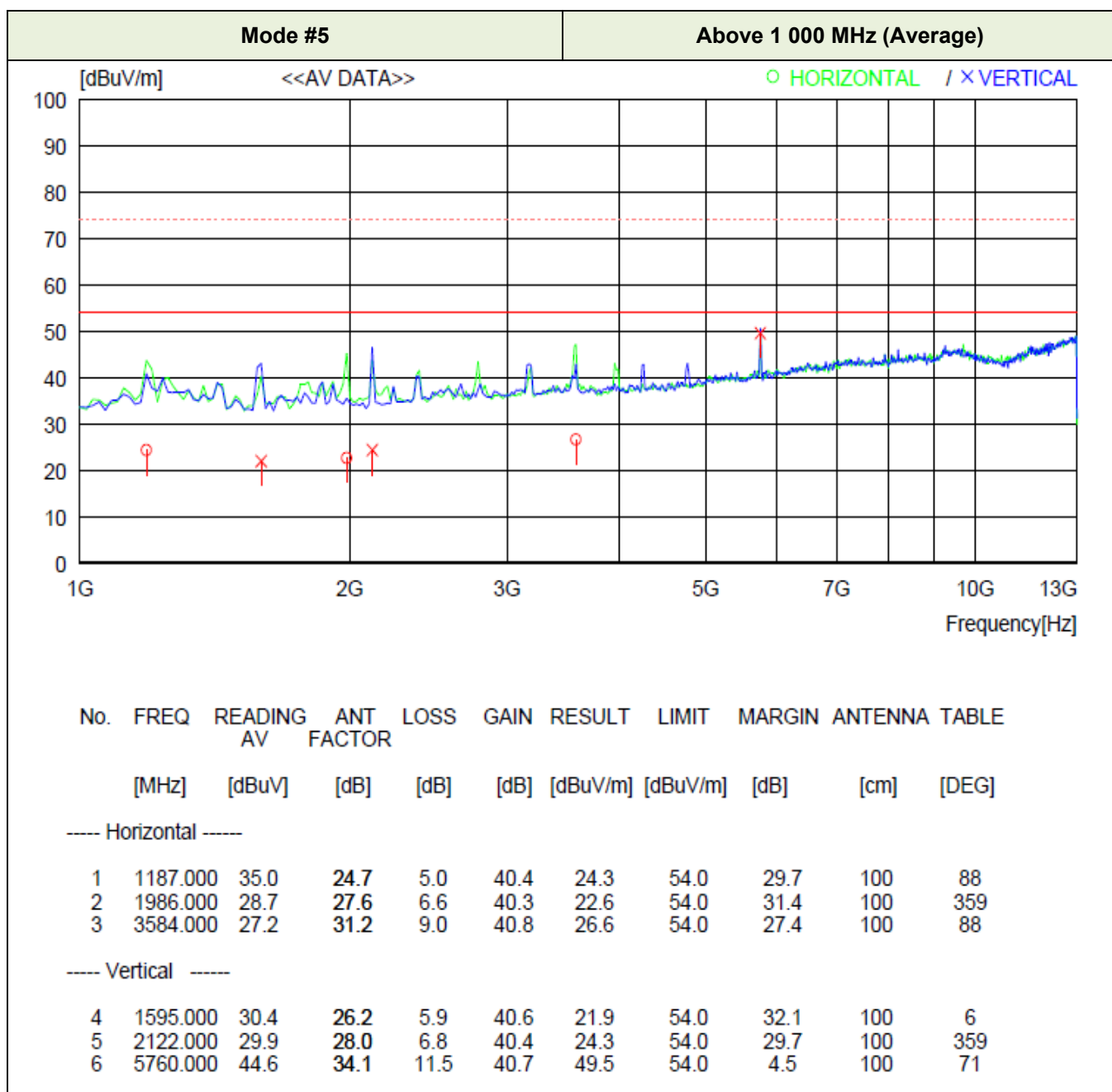
Mode #5

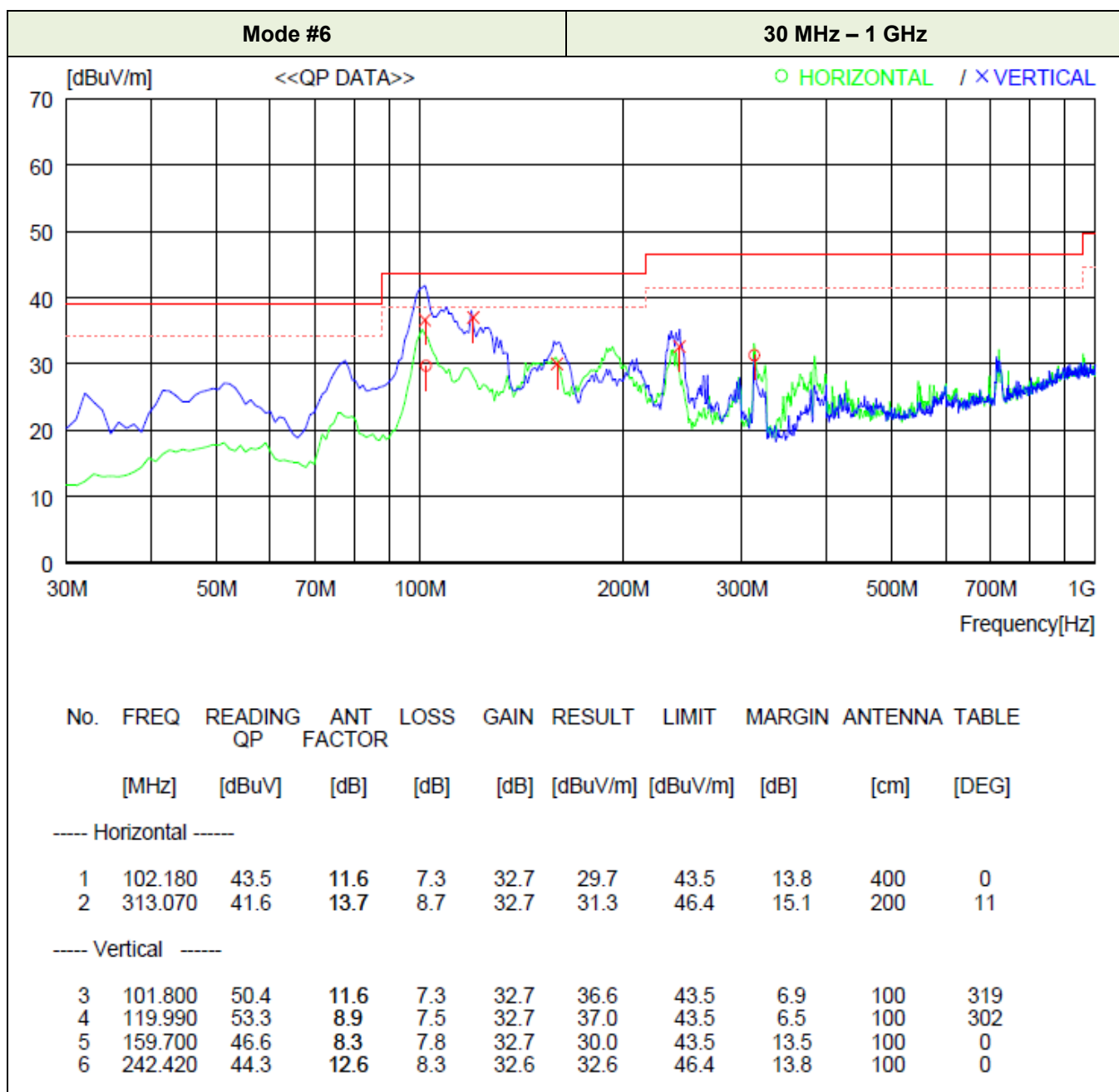
30 MHz – 1 GHz

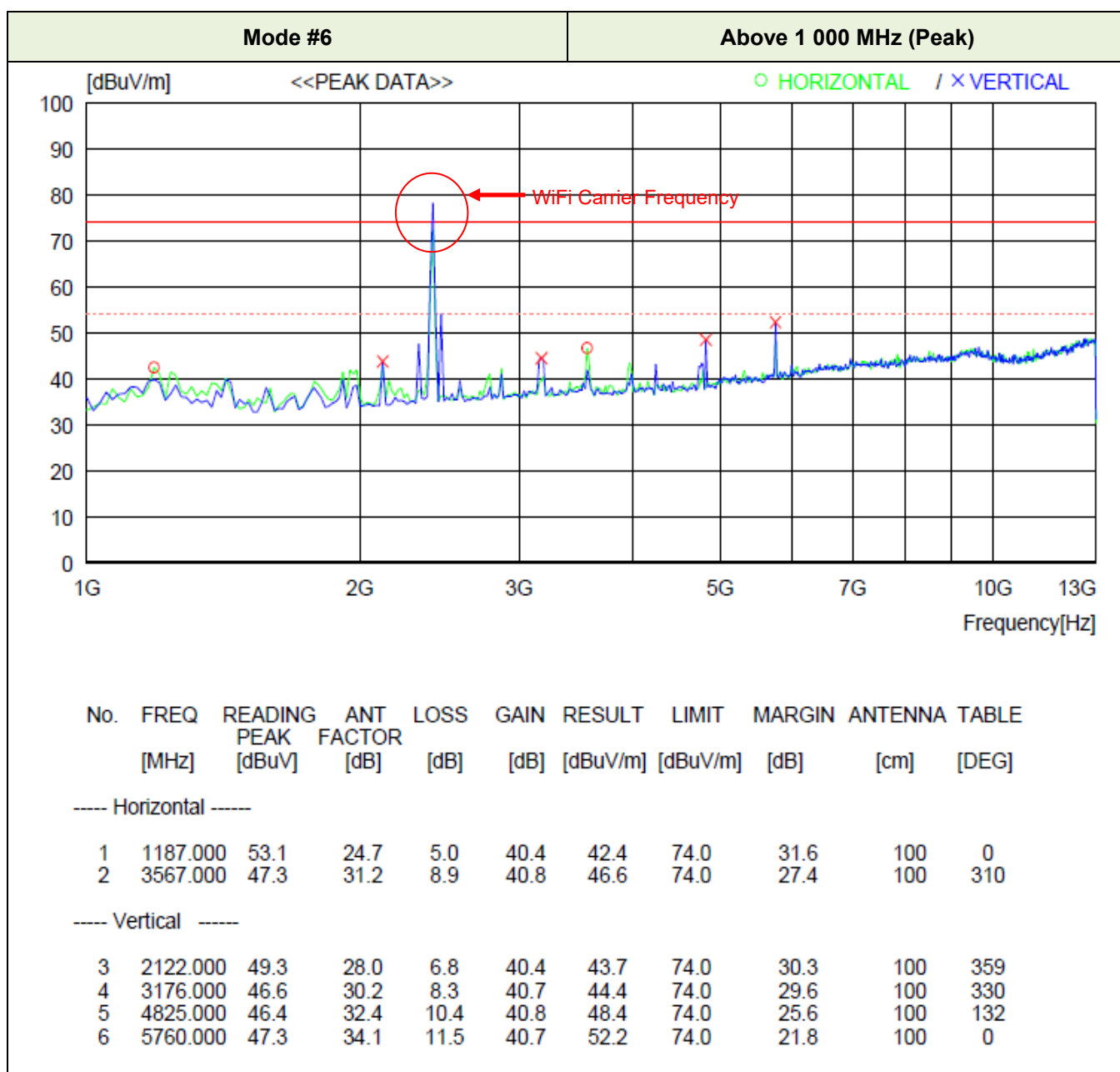


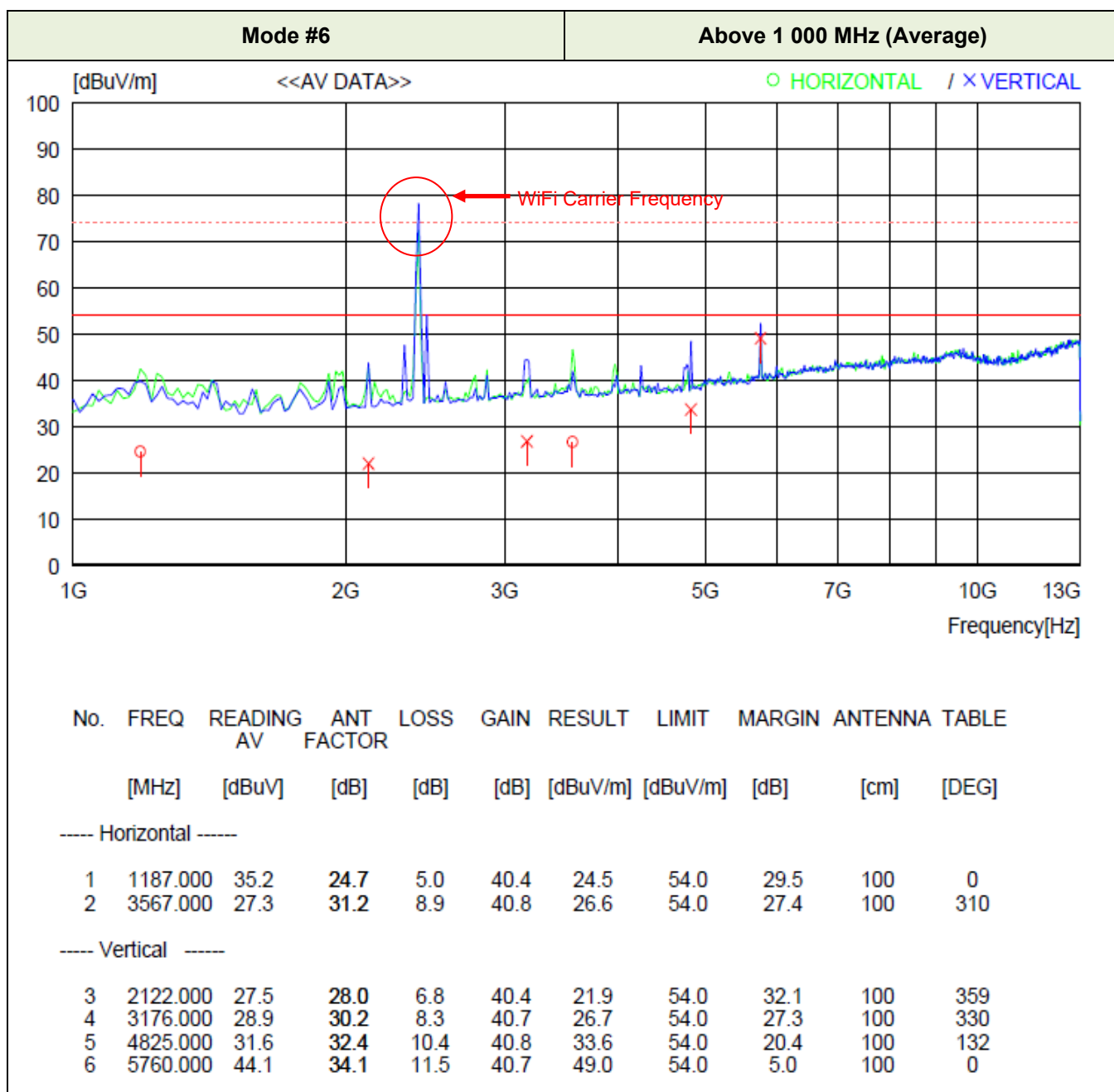
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP [dBuV]	FACTOR [dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
---- Horizontal ----										
1	101.850	43.7	11.6	7.3	32.7	29.9	43.5	13.6	400	0
---- Vertical ----										
2	51.770	34.3	13.9	6.9	32.7	22.4	39.1	16.7	300	0
3	101.710	50.1	11.7	7.3	32.7	36.4	43.5	7.1	100	0
4	108.500	48.6	10.6	7.4	32.7	33.9	43.5	9.6	100	0
5	162.420	46.3	8.4	7.8	32.7	29.8	43.5	13.7	100	3
6	242.450	42.5	12.6	8.3	32.6	30.8	46.4	15.6	100	38





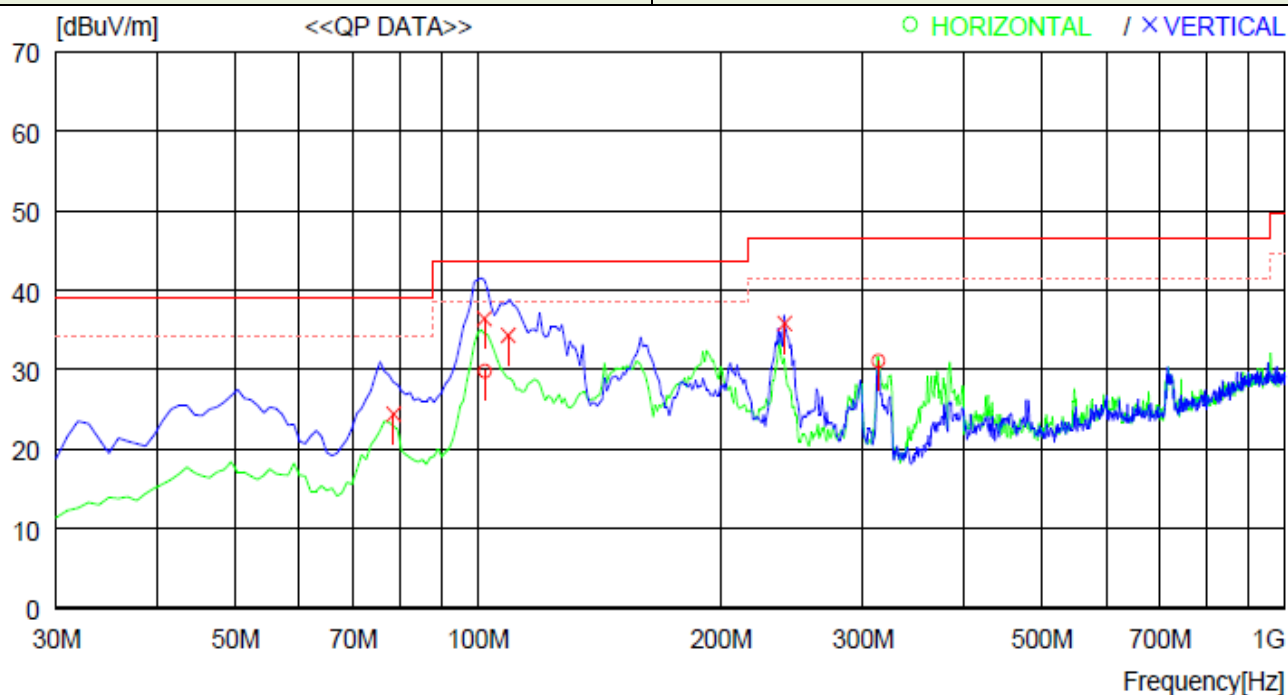




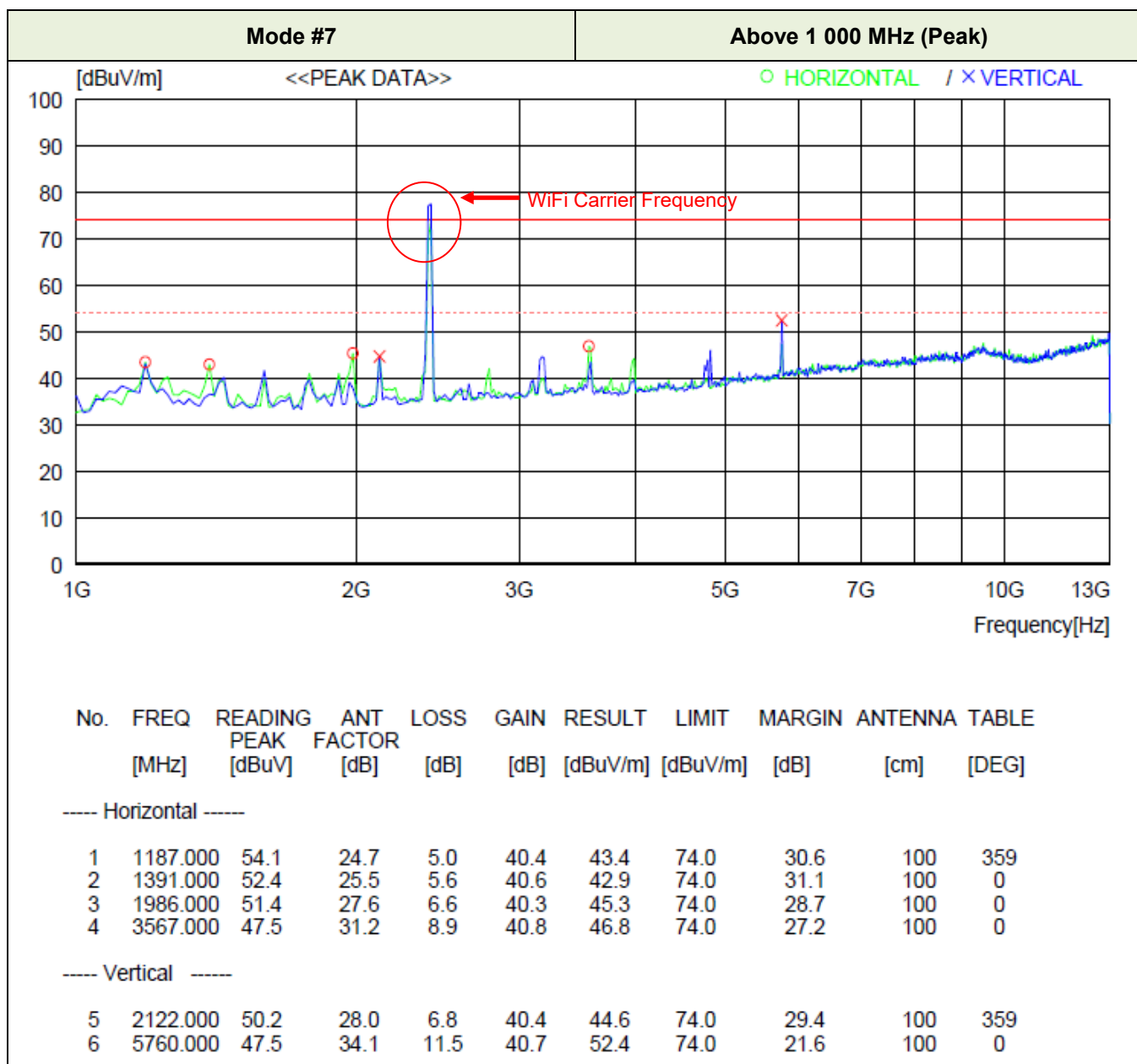


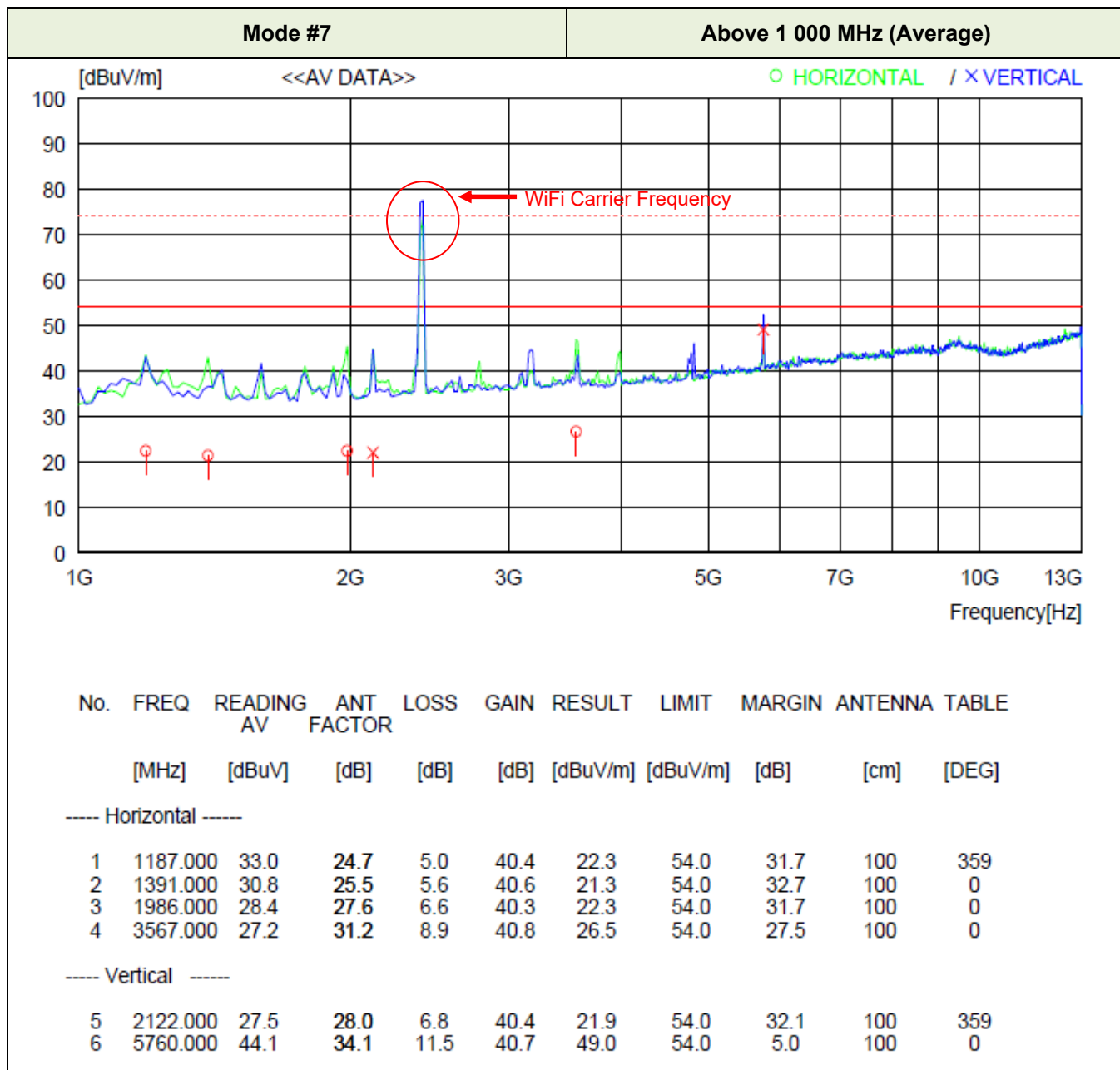
Mode #7

30 MHz – 1 GHz



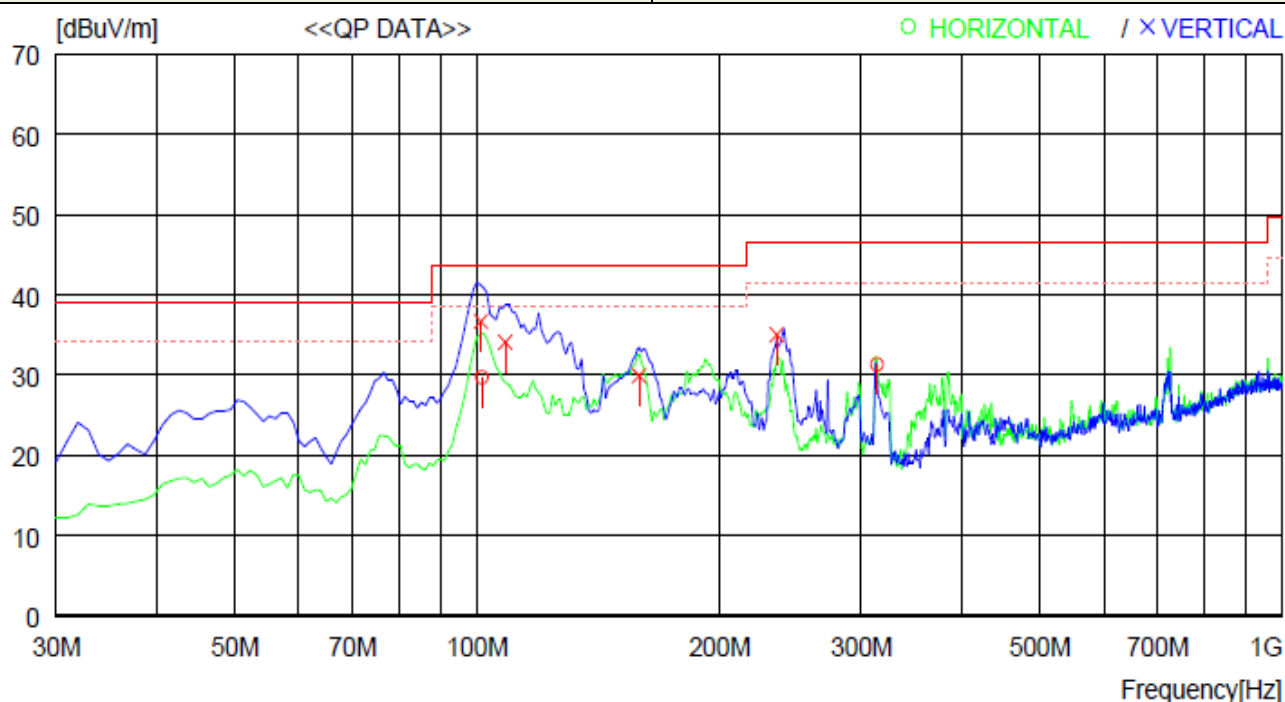
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
---- Horizontal ----										
1	101.970	43.6	11.6	7.3	32.7	29.8	43.5	13.7	400	318
2	313.470	41.3	13.8	8.7	32.7	31.1	46.4	15.3	200	349
---- Vertical ----										
3	78.600	42.9	7.0	7.2	32.7	24.4	39.1	14.7	200	303
4	101.840	50.2	11.6	7.3	32.7	36.4	43.5	7.1	100	0
5	108.990	49.0	10.6	7.4	32.7	34.3	43.5	9.2	100	317
6	239.990	47.6	12.5	8.3	32.6	35.8	46.4	10.6	100	60



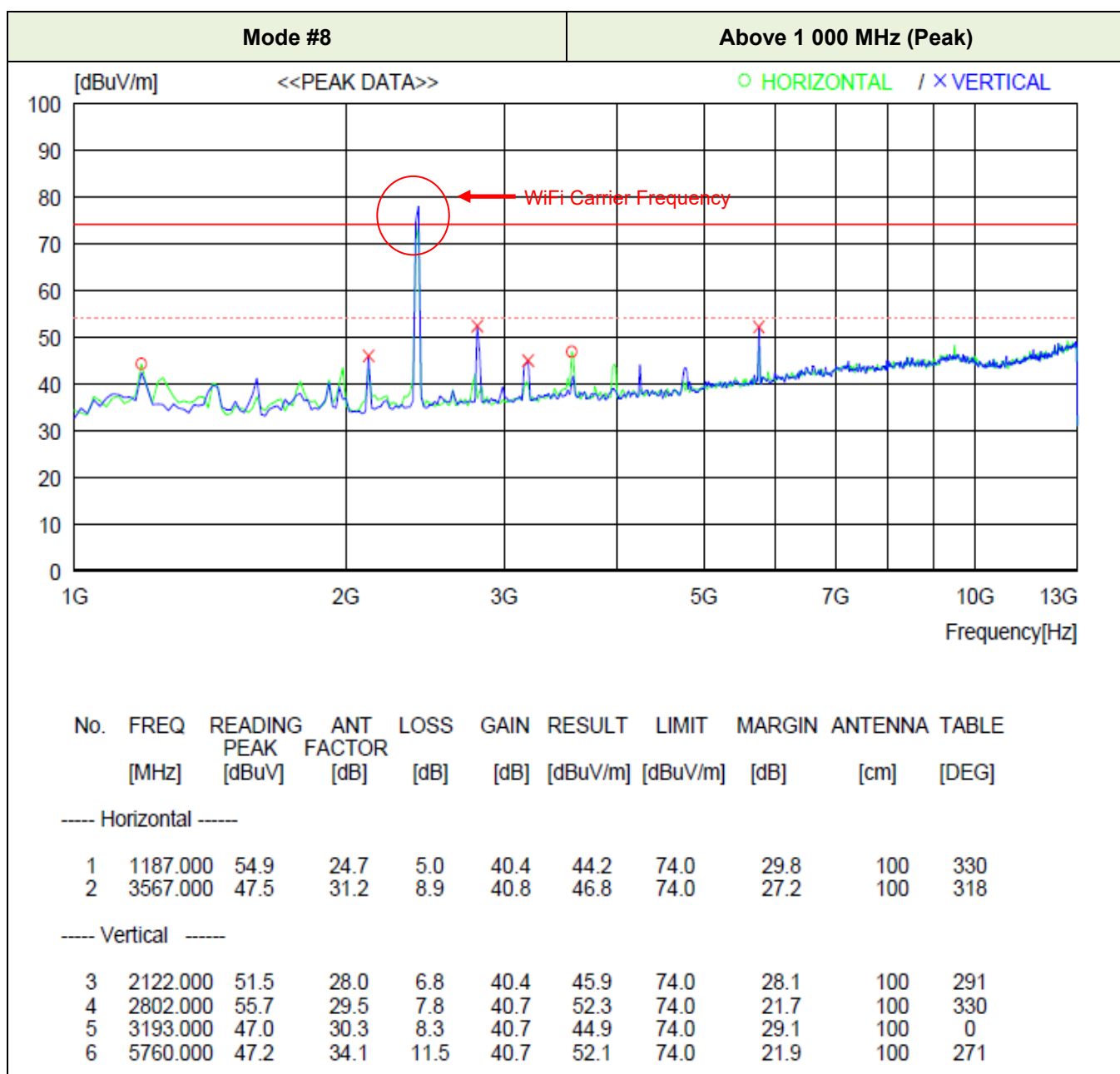


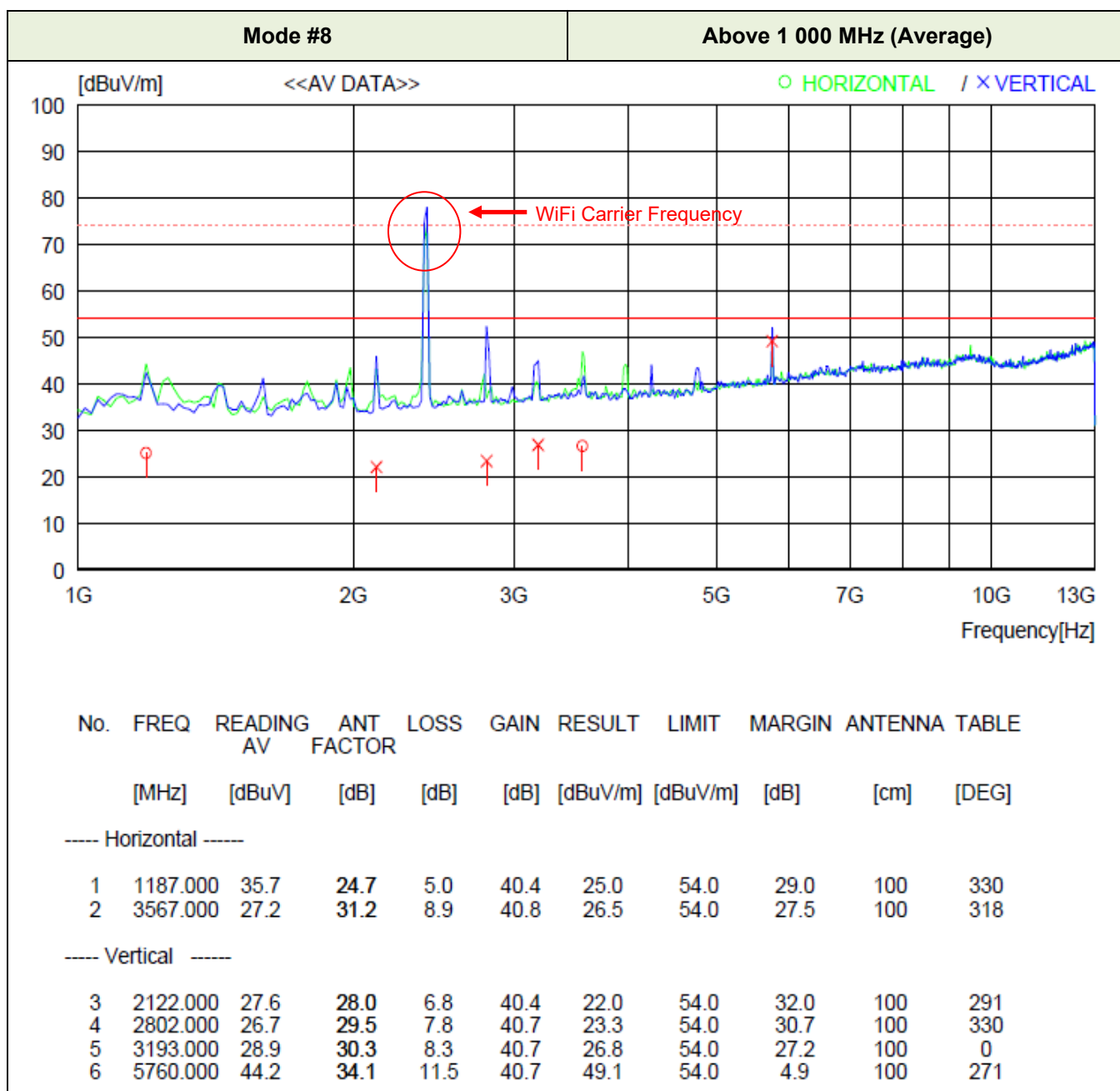
Mode #8

30 MHz – 1 GHz



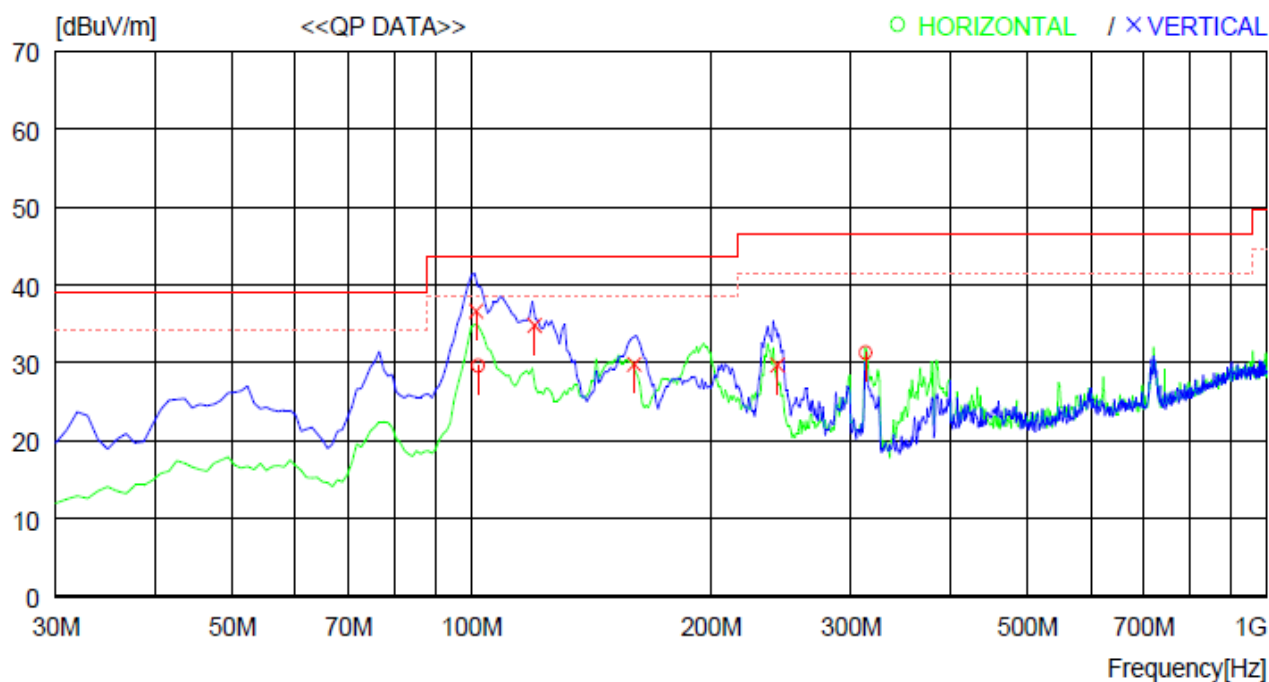
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
---- Horizontal ----										
1	101.470	43.4	11.7	7.3	32.7	29.7	43.5	13.8	400	7
2	313.760	41.5	13.8	8.7	32.7	31.3	46.4	15.1	200	0
---- Vertical ----										
3	101.110	50.3	11.8	7.3	32.7	36.7	43.5	6.8	100	326
4	108.390	48.8	10.6	7.4	32.7	34.1	43.5	9.4	100	354
5	158.910	46.5	8.3	7.8	32.7	29.9	43.5	13.6	100	3
6	235.770	46.9	12.4	8.3	32.6	35.0	46.4	11.4	100	0



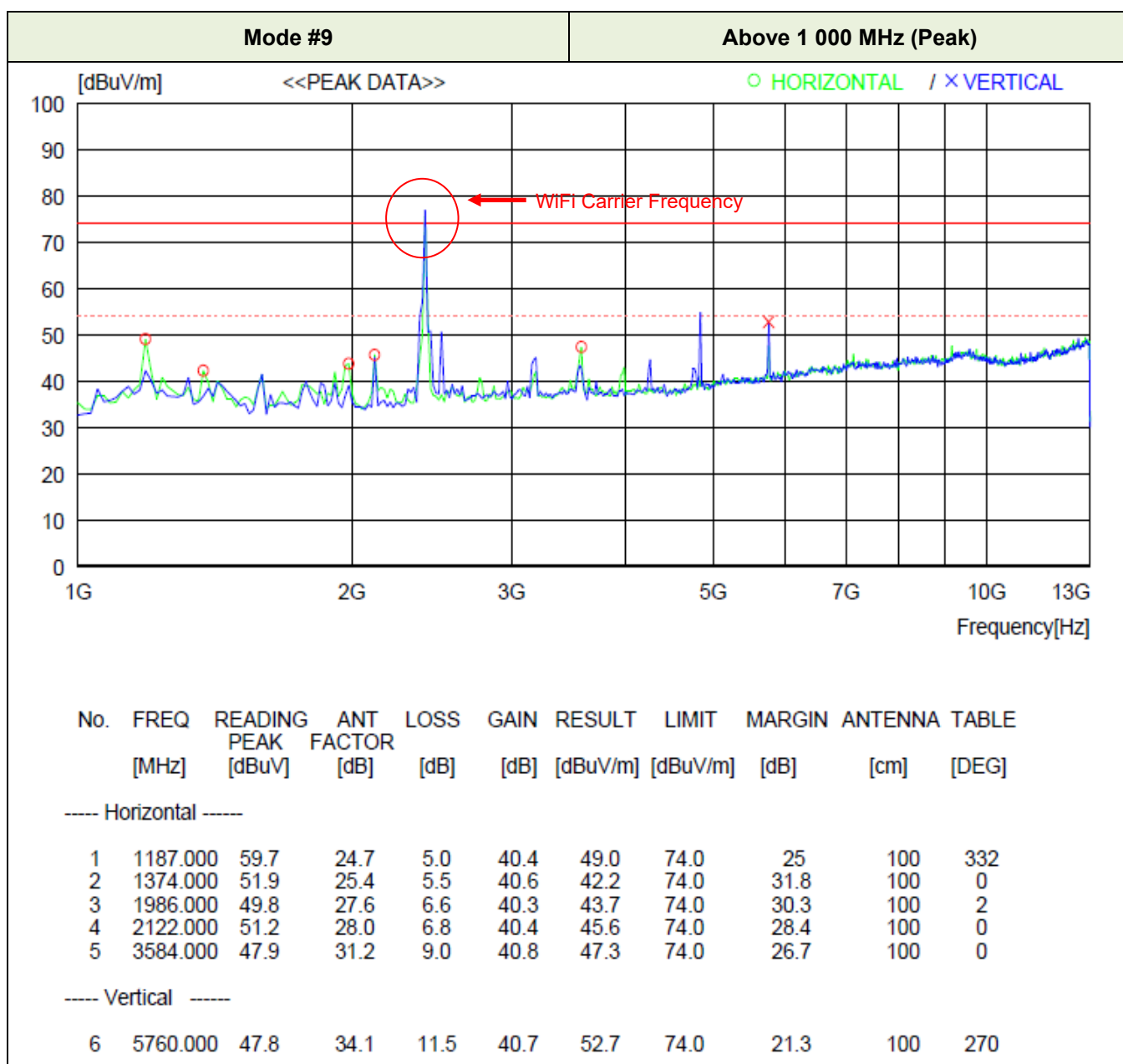


Mode #9

30 MHz – 1 GHz

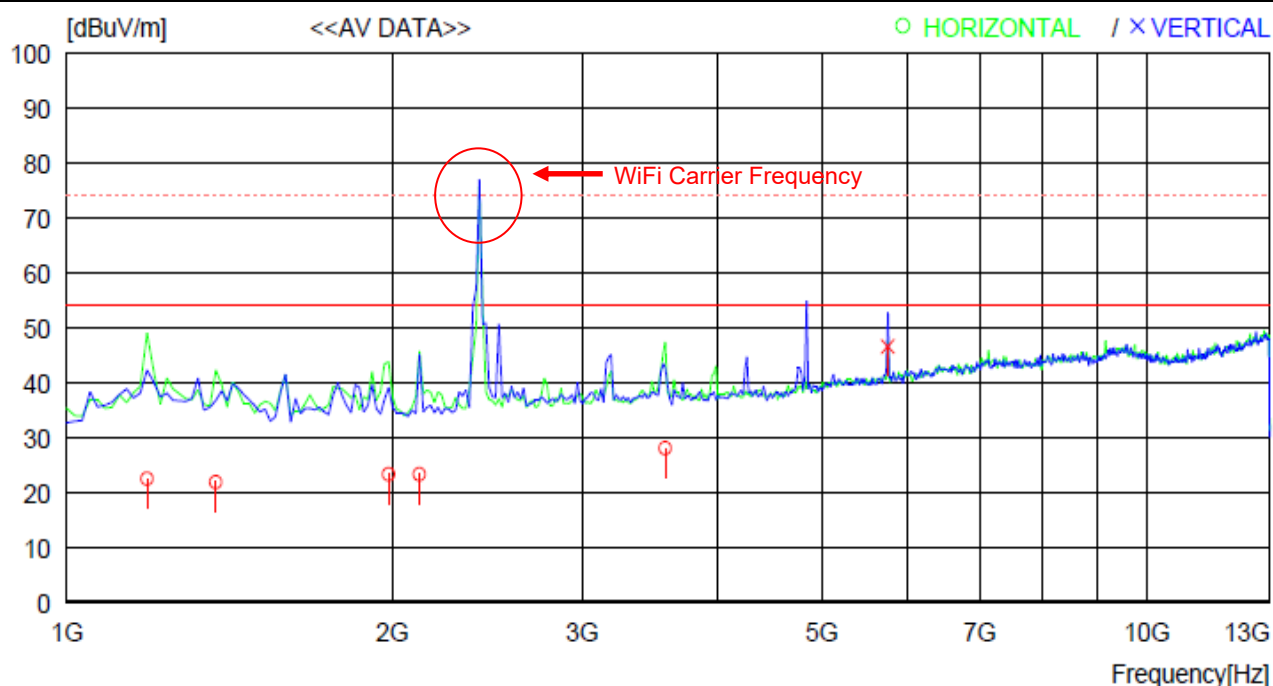


No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
---- Horizontal ----										
1	101.890	43.4	11.6	7.3	32.7	29.6	43.5	13.9	400	35
2	313.080	41.6	13.7	8.7	32.7	31.3	46.4	15.1	200	359
---- Vertical ----										
3	101.330	50.3	11.7	7.3	32.7	36.6	43.5	6.9	100	304
4	120.050	51.1	8.9	7.5	32.7	34.8	43.5	8.7	100	312
5	160.180	46.4	8.3	7.8	32.7	29.8	43.5	13.7	100	357
6	242.510	41.4	12.6	8.3	32.6	29.7	46.4	16.7	100	35



Mode #9

Above 1 000 MHz (Average)



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	AV	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	1187.000	33.1	24.7	5.0	40.4	22.4	54.0	31.6	100	332
2	1374.000	31.5	25.4	5.5	40.6	21.8	54.0	32.2	100	0
3	1986.000	29.3	27.6	6.6	40.3	23.2	54.0	30.8	100	2
4	2122.000	28.8	28.0	6.8	40.4	23.2	54.0	30.8	100	0
5	3584.000	28.6	31.2	9.0	40.8	28.0	54.0	26.0	100	0
----- Vertical -----										
6	5760.000	41.6	34.1	11.5	40.7	46.5	54.0	7.5	100	270

Appendix I - Test Instrumentation

Name of Equipment	Model Number	Manufacturer	Serial Number	Last Cal. (Interval)	USE
For EMISSION					
EMI Test Receiver	ESCI 7	Rohde & Schwarz	100722	2018-02-12(1Y)	■
Test Receiver	ESIB 26	Rohde & Schwarz	100298	2018-01-18(1Y)	□
LISN	ENV4200	Rohde & Schwarz	100203	2018-01-18(1Y)	□
LISN	ENV216	Rohde & Schwarz	100110	2017-07-28(1Y)	■
LISN	LS16C	AFJ	16011403310	2017-07-28(1Y)	■
LISN	NNLK8121	SchwarzBeck	8121-163	2017-08-04(1Y)	□
Voltage Probe	TK9420	Schwarzbeck	9420-165	2018-01-18(1Y)	□
Loop Antenna	HFH2-Z2	Rohde & Schwarz	100341	2017-06-15(2Y)	□
8-Wire ISN CAT 3	CAT3 8158	Schwarzbeck	CAT3 8158 #70	2018-01-22(1Y)	□
8-Wire ISN CAT 5	CAT5 8158	Schwarzbeck	CAT5 8158 #126	2018-01-22(1Y)	□
8-Wire ISN CAT 6	NTFM 8158	Schwarzbeck	NTFM 8158 #95	2018-01-22(1Y)	□
Test Receiver	ESU	Rohde & Schwarz	100303	2018-01-18(1Y)	■
TRILog Broadband Antenna	VULB9163	Schwarzbeck	9163-799	2017-10-23(2Y)	■
DOPPEL STEG HORN Antenna	HF 907	Rohde & Schwarz	102426	2017-01-06(2Y)	■
Preamp (1-18) GHz	SCU 18D	Rohde & Schwarz	19006450	2018-04-23(1Y)	■
Preamp 9 kHz-1 GHz	310N	Sonoma Instrument	344015	2018-01-18(1Y)	■
Attenuators	6 dB	Rohde & Schwarz	272.4110.50	2018-01-18(1Y)	■
Antenna Master (Below 1 GHz)	MA4000-EP	INNCO SYSTEM	4600814	N/A	■
Antenna Master (Above 1 GHz)	MA4000-XP-ET	INNCO SYSTEM	N/A	N/A	■
Turn Table	DT3000-3t	INNCO SYSTEM	1310814	N/A	■
CO3000 Controller (Below 1 GHz)	CO3000-4PORT	INNCO SYSTEM	CO3000/806/34130 814/L	N/A	■
CO3000 Controller (Above 1 GHz)	CO3000-4PORT	INNCO SYSTEM	CO3000/807/34130 814/L	N/A	■
Digital Power Analyzer For Harmonic & Flicker	DPA 500	EM Test	V0713102356	2018-01-25(1Y)	□
AC Power Source	ACS 500	EM Test	V0713102357	2017-08-04(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.