TEST REPORT

OF

FCC Part 15 Subpart C §15.209

FCC ID: PPXWT-100WU

Equipment Under Test	:	Wireless Charging Pad
Model Name	:	WT-100WU
Applicant	:	RFTECH
Manufacturer	:	RFTECH
Date of Test(s)	:	2015. 03. 03 ~ 2015. 03. 06
Date of Issue	:	2015. 03. 18

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Patrick Kang** **Date:** **2015. 03. 18**

Approved By: **Hyunchae You** **Date:** **2015. 03. 18**

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1. General Information

1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 435-837

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.

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1.2. Details of applicant

Applicant : RFTECH
Address : 60, Jugyang-Daero 1763beon-gil, Wonsam-Myeon, Cheoin-Gu, Yongin-si, Gyeonggi-Do, Korea 449-871
Contact Person : Hwang, Dong-Hyuk
Phone No. : +82 31 327 0346

1.3. Description of EUT

Kind of Product	Wireless Charging Pad
Model Name	WT-100WU
Power Supply	DC 5 V
Frequency Range	115 ㎑ ~ 205 ㎑
Operating Conditions	-10 ℃ ~ 50 ℃
Maximum Field strength	79.10 ㏈㎶/m at 3 m (-0.90 ㏈㎶/m at 300 m)
Antenna Type	Inductive loop coil antenna

1.4. Declarations by the manufacturer

- Operation temperature : -10 ℃ ~ 50 ℃

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1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Spectrum Analyzer	R&S	FSV30	100768	Mar. 27, 2014	Annual	Mar. 27, 2015
Signal Generator	R&S	SMBV100A	255834	Jun. 25, 2014	Annual	Jun. 25, 2015
Mobile Test Unit	R&S	CMW500	144035	Mar. 03, 2015	Annual	Mar. 03, 2016
Preamplifier	H.P.	8447F	2944A03909	Aug. 27, 2014	Annual	Aug. 27, 2015
Test Receiver	R&S	ESCI 7	100911	Dec. 24, 2014	Annual	Dec. 24, 2015
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Jul. 29, 2013	Biennial	Jul. 29, 2015
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	396	Jun. 07, 2013	Biennial	Jun. 07, 2015
Two-Line V-Network	R&S	ENV216	100190	Dec. 25, 2014	Annual	Dec. 25, 2015
Antenna Master	INN-CO	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	INN-CO	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Shield Room	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N/A	N.C.R.	N/A	N.C.R.

1.6. Sample calculation

Where relevant, the following sample calculation is provided:

Field strength level (dBμV/m) = Measured level (dBμV) + Antenna factor (dB) + Cable loss (dB) – amplifier gain (dB)

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1.7. Worst case of test configurations

In order to check all kinds of possible configurations, EUT was evaluated with appropriate client and under each charging condition as below table.

EUT configuration	Charging current (㎃)	Mobile phone	Description
Charging Mode[1)] with resistive load	144		Maximum resistive load
	354		Medium resistive load
	650		Minimum resistive load
Charging Mode[2)] with client device (FCC ID : A3LSMN9005)		SM-N9005	Less than 1 % of battery
		SM-N9005	Less than 50 % of battery
		SM-N9005	100 % full charging of battery

1) Test Jig was used during the test to satisfy each current status by using resistive loads.
Output voltage = DC 5 V, Output current = 144 ㎃ / 354 ㎃ / 650 ㎃
- (Maximum load) 34.72 Ω = 5 V / 0.144 A
- (Medium load) 14.12 Ω = 5 V / 0.354 A
- (Minimum load) 7.69 Ω = 5 V / 0.650 A

2) PC device with client device was investigated each battery status and compared in two operating configurations.

Battery status during charging condition
- Less than 1 % of battery
- Less than 50 % of battery
- 100 % of battery

Galaxy Note 3 (SM-N9005)

Plot#1 – less than 1 % of battery

Plot#2 – less than 50 % of battery

Plot#3 – 100 % of battery

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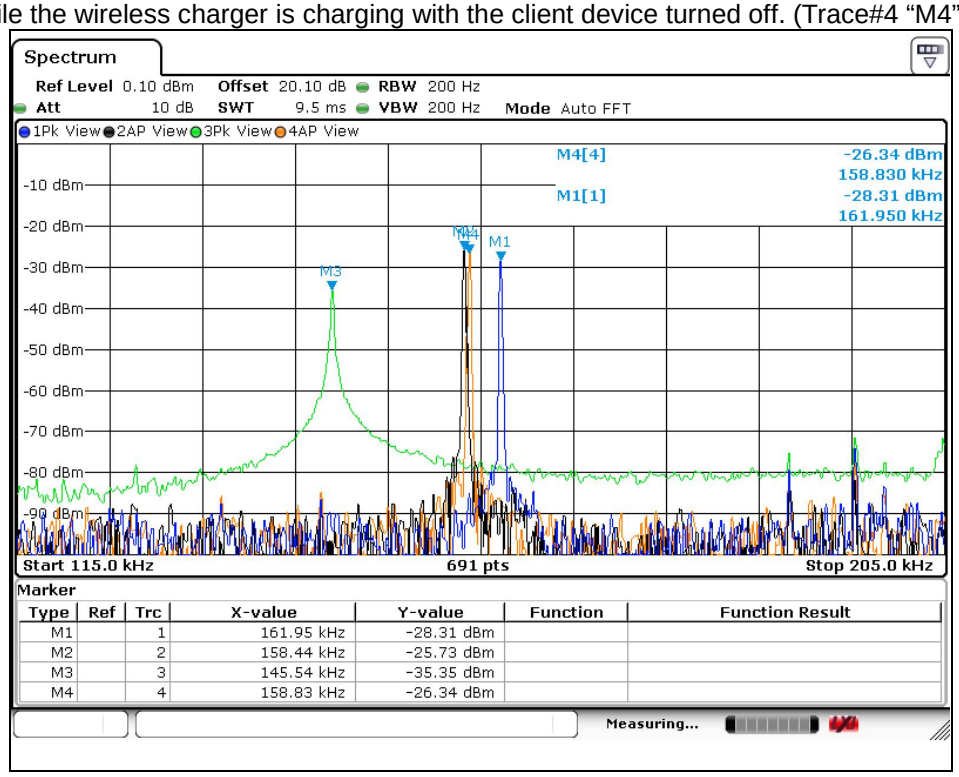
Operating configurations :

Galaxy Note 3 (SM-N9005)

- While the client device was in airplane mode (Trace#1 “M1”)
- While the client device was connected to an active data connection (Trace#2 “M2”)
  The device was tested under all modes and bands like 2G and 3G.
  In the result, **GSM1900 / GPRS / 1 TX** was found in **Middle channel**.
- While the wireless charger is charging without the client device. (Trace#3 “M3”)
- While the wireless charger is charging with the client device turned off. (Trace#4 “M4”)



Plot – fundamental emission comparison

- The level of Trace#2 was more than Trace#1, 3 and 4 so Trace#2 was selected.
- Trace#2 as **GSM1900 / GPRS / 1 TX** which was found in **Middle channel** should be tested with the client device as a worst case.

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1.8. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15 Subpart C §15.209		
Section in FCC 15 Subpart C	**Test Item**	**Result**
15.209 15.209(a)	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied
2.1049	Occupied Bandwidth and 20 dB Bandwidth	Complied
15.207	Transmitter AC Power Line Conducted Emission	Complied

1.9. Test Report Revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL008486	2015. 03. 09	Initial
1	F690501/RF-RTL008486-1	2015. 03. 18	The peak results of Fundamental was added.

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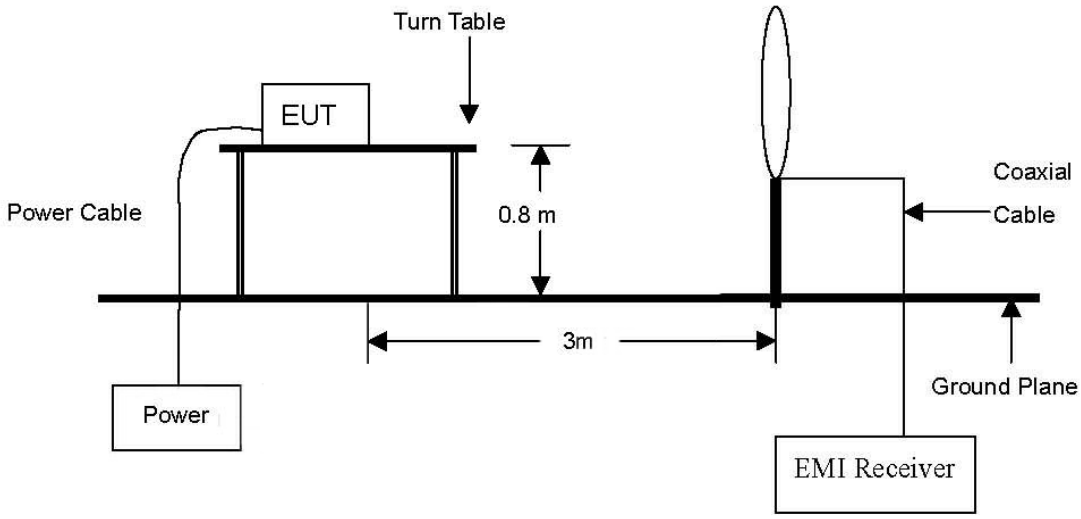
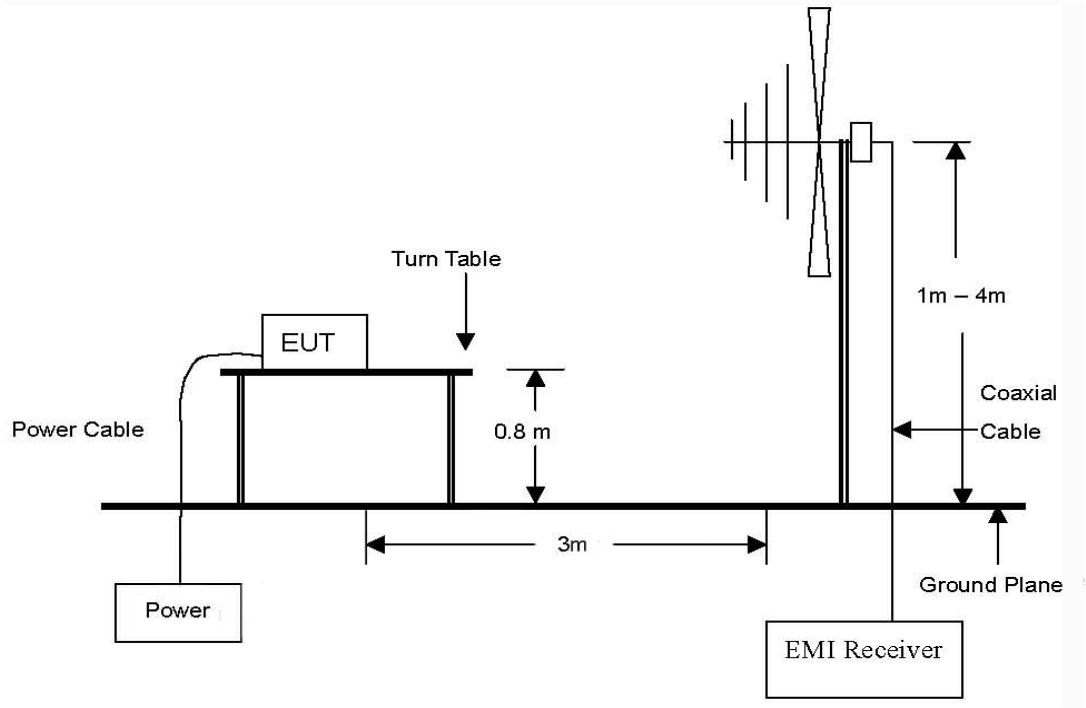
2. Field Strength of Fundamental

2.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.



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2.2. Limit

2.2.1. Radiated emission limits, general requirements

According to §15.209 (a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (㎒)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241

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2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2009

2.3.1. Test Procedures for emission from 9 ㎑ to 30 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
d. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from 30 ㎒ to 1 000 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

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2.4. Test Result

Ambient temperature : (24 ± 1) ℃
Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical. The field strength of spurious emission was measured in one orthogonal EUT position (x-axis). Definition of DUT for a orthogonal plane was described in the test setup photo.

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 300 m	Limit (dBμV/m)	Margin (dB)
Charging mode with resistive load (144 ㎃ status)									
0.165	56.30	Peak	H	20.02	0.08	76.40	-3.60	43.25	46.85
0.165	56.10	Average	H	20.02	0.08	76.20	-3.80	23.25	27.05
Charging mode with resistive load (354 ㎃ status)									
0.164	60.10	Peak	H	20.02	0.08	80.20	0.20	43.31	43.11
0.164	59.00	Average	H	20.02	0.08	79.10	-0.90	23.31	24.21
Charging mode with resistive load (650 ㎃ status)									
0.162	59.40	Peak	H	20.02	0.08	79.50	-0.50	43.41	43.91
0.162	58.40	Average	H	20.02	0.08	78.50	-1.50	23.41	24.91
Charging mode with client (less than 1 % battery status)									
0.172	53.00	Peak	H	20.02	0.08	73.10	-6.90	42.89	49.79
0.172	52.10	Average	H	20.02	0.08	72.20	-7.80	22.89	30.69
Charging mode with client (less than 50 % battery status)									
0.166	54.70	Peak	H	20.02	0.08	74.80	-5.20	43.20	48.40
0.166	53.80	Average	H	20.02	0.08	73.90	-6.10	23.20	29.30
Charging mode with client (100 % battery status)									
0.173	52.80	Peak	H	20.02	0.08	72.90	-7.10	42.84	49.94
0.173	52.10	Average	H	20.02	0.08	72.20	-7.80	22.84	30.64

Note:
1. According to §15.31 (f)(2) 300 m Result(dBμV/m) = 3 m Result(dBμV/m) – 40log(300/3) (dBμV/m)
2. According to §15.209 (d), the measurements were tested by using Quasi peak detector except for the frequency bands 9 – 90 ㎑, 110 – 490 ㎑ and above 1 ㎓ in these three bands on measurements employing an average detector.
3. The limit above was calculated based on table of §15.209 (a).

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3. Spurious Emission

3.1. Test Setup

Same as section 2.1 of this report

3.2. Limit

Same as section 2.2 of this report

3.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2009

3.3.1. Test Procedures for emission from 9 ㎑ to 30 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
d. The test-receiver system was set to quasi-peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

3.3.2. Test Procedures for emission from 30 ㎒ to 1 000 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

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3.4. Test Result

Ambient temperature : (24 ± 1) ℃
Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

A. Charging mode with resistive load (144 ㎃ status)

-Below 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 30 m or 300 m	Limit (dBμV/m)	Margin (dB)
0.080	3.50	Average	H	20.07	0.07	23.64	-56.36	29.54	85.90
0.099	7.00	Quasi peak	H	20.03	0.07	27.10	-52.90	27.69	80.59
0.497	34.20	Quasi peak	H	20.13	0.11	54.44	14.44	33.68	19.24
0.827	25.21	Quasi peak	H	20.21	0.14	45.56	5.56	29.25	23.69

-Above 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m) at 3 m	Limit (dBμV/m)	Margin (dB)
57.40	40.36	Peak	V	13.33	-26.79	26.90	40.00	13.10
67.83	39.32	Peak	H	11.18	-26.70	23.80	40.00	16.20
98.51	41.42	Peak	H	14.37	-26.29	29.50	43.50	14.00
146.52	37.51	Peak	H	9.44	-25.95	21.00	43.50	22.50
Above 200.000	Not detected	-	-	-	-	-	-	-

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B. Charging mode with resistive load (354 ㎃ status)

-Below 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 30 m or 300 m	Limit (dBμV/m)	Margin (dB)
0.068	4.40	Average	H	20.09	0.06	24.55	-55.45	30.95	86.40
0.091	12.40	Quasi peak	H	20.05	0.07	32.52	-47.48	28.42	75.90
0.557	33.20	Quasi peak	H	20.14	0.12	53.46	13.46	32.69	19.23
0.931	22.20	Quasi peak	H	20.23	0.15	42.58	2.58	28.23	25.65
1.303	15.30	Quasi peak	H	20.22	0.17	35.69	-4.31	25.31	29.62

-Above 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m) at 3 m	Limit (dBμV/m)	Margin (dB)
30.97	44.46	Peak	V	12.69	-27.05	30.10	40.00	9.90
35.21	33.49	Peak	H	15.18	-26.97	21.70	40.00	18.30
48.19	40.27	Peak	V	14.62	-26.89	28.00	40.00	12.00
142.40	38.14	Peak	H	9.55	-25.99	21.70	43.50	21.80
Above 200.000	Not detected	-	-	-	-	-	-	-

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C. Charging mode with resistive load (650 ㎃ status)

-Below 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 30 m or 300 m	Limit (dBμV/m)	Margin (dB)
0.072	4.60	Average	H	20.08	0.06	24.74	-55.26	30.46	85.72
0.089	2.10	Average	H	20.05	0.07	22.22	-57.78	28.62	86.40
0.543	32.20	Quasi peak	H	20.14	0.11	52.45	12.45	32.91	20.46
0.905	23.20	Quasi peak	H	20.23	0.15	43.58	3.58	28.47	24.89
1.266	17.60	Quasi peak	H	20.23	0.17	38.00	-2.00	25.56	27.56

-Above 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m) at 3 m	Limit (dBμV/m)	Margin (dB)
35.46	41.65	Peak	H	15.22	-26.97	29.90	40.00	10.10
48.55	43.58	Peak	V	14.61	-26.89	31.30	40.00	8.70
54.61	34.70	Peak	H	15.30	-26.80	23.20	40.00	16.80
218.42	35.06	Peak	H	12.19	-25.25	22.00	46.00	24.00
219.51	37.51	Peak	V	12.54	-25.25	24.80	46.00	21.20
363.92	33.69	Peak	H	15.92	-24.81	24.80	46.00	21.20
Above 400.000	Not detected	-	-	-	-	-	-	-

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D. Charging mode with client device (less than 1 % battery status)

-Below 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 30 m or 300 m	Limit (dBμV/m)	Margin (dB)
0.037	8.90	Average	H	20.20	0.06	29.16	-50.84	36.24	87.08
0.074	3.30	Average	H	20.08	0.06	23.44	-56.56	30.22	86.78
0.545	27.20	Quasi peak	H	20.14	0.11	47.45	7.45	32.88	25.43
0.911	17.70	Quasi peak	H	20.23	0.15	38.08	-1.92	28.41	30.33

-Above 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m) at 3 m	Limit (dBμV/m)	Margin (dB)
61.40	47.73	Peak	V	12.54	-26.77	33.50	40.00	6.50
144.82	40.88	Peak	H	9.49	-25.97	24.40	43.50	19.10
169.07	40.25	Peak	H	10.20	-25.65	24.80	43.50	18.70
217.45	43.01	Peak	V	12.45	-25.26	30.20	46.00	15.80
221.45	42.71	Peak	V	12.63	-25.24	30.10	46.00	15.90
374.35	34.96	Peak	H	16.27	-24.83	26.40	46.00	19.60
Above 400.000	Not detected	-	-	-	-	-	-	-

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E. Charging mode with client device (less than 50 % battery status)

-Below 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 30 m or 300 m	Limit (dBμV/m)	Margin (dB)
0.039	8.80	Average	H	20.19	0.06	29.05	-50.95	35.78	86.73
0.075	9.20	Average	H	20.08	0.06	29.34	-50.66	30.10	80.76
0.498	32.00	Quasi peak	H	20.13	0.11	52.24	12.24	33.66	21.42
0.831	21.50	Quasi peak	H	20.21	0.14	41.85	1.85	29.21	27.36

-Above 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m) at 3 m	Limit (dBμV/m)	Margin (dB)
31.33	43.59	Peak	V	12.75	-27.04	29.30	40.00	10.70
60.31	41.66	Peak	V	12.83	-26.79	27.70	40.00	12.30
213.33	38.90	Peak	V	12.27	-25.27	25.90	43.50	17.60
217.45	36.81	Peak	H	12.15	-25.26	23.70	46.00	22.30
600.00	35.27	Peak	H	20.00	-24.77	30.50	46.00	15.50
Above 700.000	Not detected	-	-	-	-	-	-	-

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F. Charging mode with client device (100 % battery status)

-Below 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 30 m or 300 m	Limit (dB㎶/m)	Margin (dB)
0.079	3.80	Average	H	20.07	0.07	23.94	-56.06	29.65	85.71
0.081	2.50	Average	H	20.06	0.07	22.63	-57.37	29.43	86.80
0.580	30.00	Quasi peak	H	20.15	0.12	50.27	10.27	32.34	22.07
0.742	21.50	Quasi peak	H	20.19	0.13	41.82	1.82	30.20	28.38

-Above 30 ㎒

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB㎶/m) at 3 m	Limit (dB㎶/m)	Margin (dB)
31.09	44.39	Peak	H	12.71	-27.00	30.10	40.00	9.90
52.67	39.80	Peak	V	14.10	-26.80	27.10	40.00	12.90
140.94	37.81	Peak	V	9.59	-26.00	21.40	43.50	22.10
172.35	36.22	Peak	H	10.28	-25.60	20.90	43.50	22.60
218.30	35.01	Peak	H	12.49	-25.20	22.30	46.00	23.70
Above 300.000	Not detected	-	-	-	-	-	-	-

Note:

1. According to §15.31 (f)(2) 300 m Result(dB㎶/m) = 3 m Result(dB㎶/m) – 40log(300/3) (dB㎶/m)
2. 30 m Result(dB㎶/m) = 3 m Result(dB㎶/m) – 40log(30/3) (dB㎶/m)
3. According to field strength table of general requirement in §15.209 (a), field strength limits below 1.705 ㎒ were calculated as below.
   - 9 ㎑ to 490 ㎑ : 20log(2 400 / F (㎑)) at 300 m (dB㎶/m)
   - 490 ㎑ to 1 705 ㎑ : 20log(24 000 / F (㎑)) at 30 m (dB㎶/m)
4. According to §15.209 (d), the measurements were tested by using Quasi peak detector except for the frequency bands 9 – 90 ㎑, 110 – 490 ㎑ and above 1 ㎓ in these three bands on measurements employing an average detector.
5. Above 30 ㎒ measurements are using peak detector.

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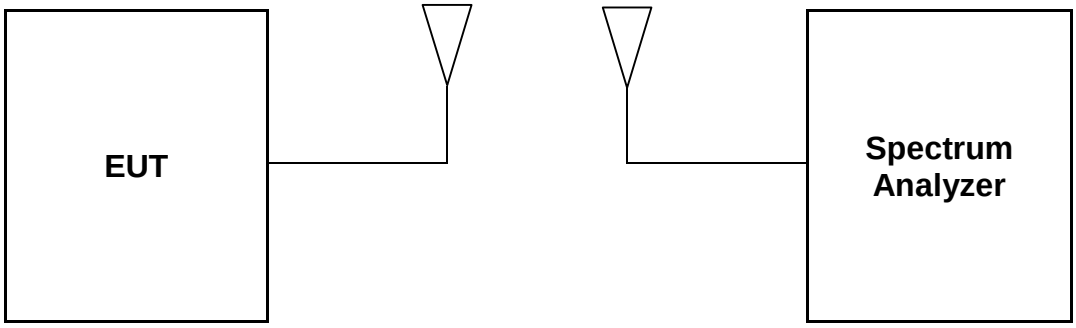
4. 20 ㎧ Bandwidth

4.1. Test Setup



4.2. Limit

None; for reporting purposed only

4.3. Test Procedure

a. Span = approximately 2 to 3 times the 20 ㎧ bandwidth, RBW = greater than 1 % of the 20 ㎧ bandwidth, VBW = RBW, Sweep = auto, Detector = peak, Trace = max hold.
b. The marker-to-peak function to set the mark to the peak of the emission. Use the marker-delta function to measure 20 ㎧ down one side of the emission. Reset the function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is 20 ㎧ bandwidth of the emission.

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4.4. Test Result

Ambient temperature : (24 ± 1) ℃
Relative humidity : 47 % R.H.

EUT status	20 dB Bandwidth (㎑)	Limit
With client device (100 % of battery)	0.355	Reporting proposed only
with resistive load (650 ㎃)	0.333	

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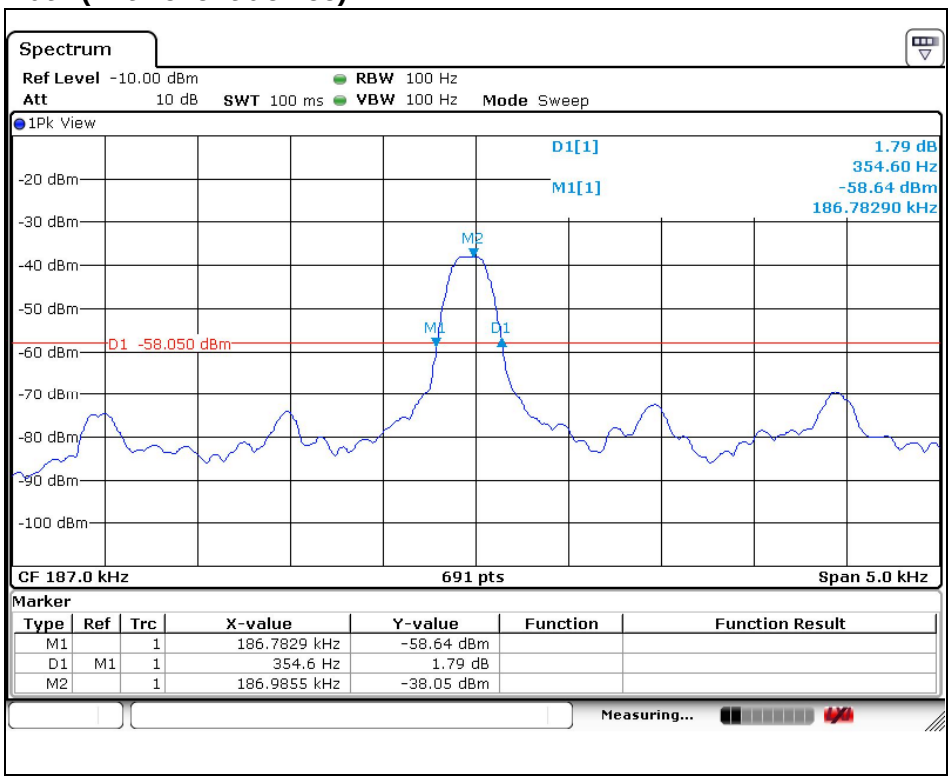
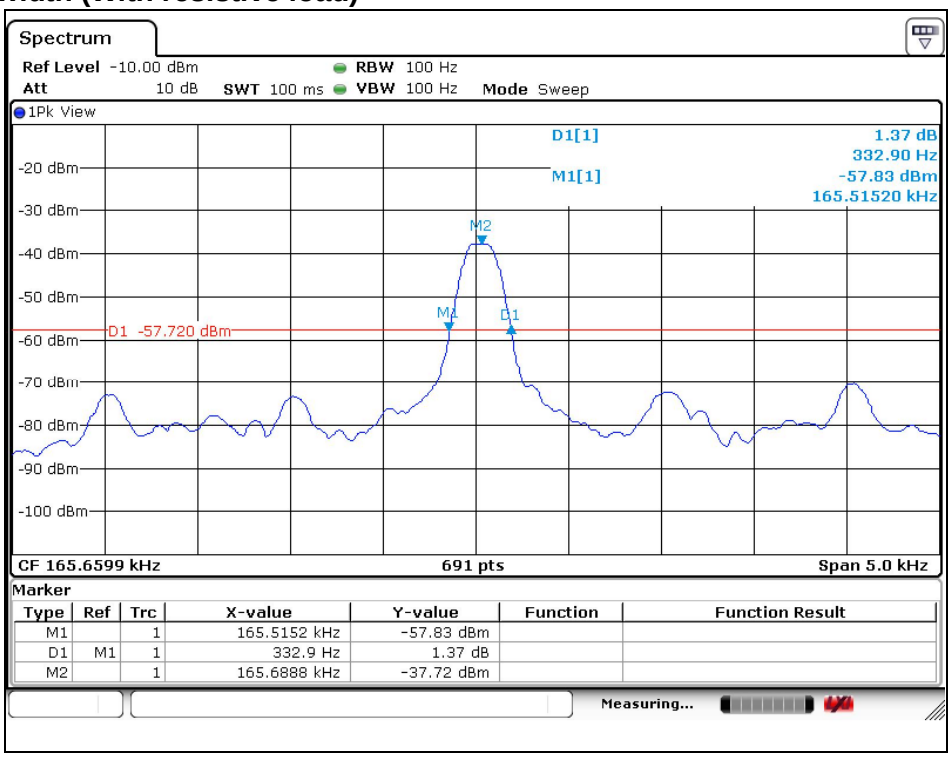
20 dB Bandwidth (With client device)



20 dB Bandwidth (With resistive load)



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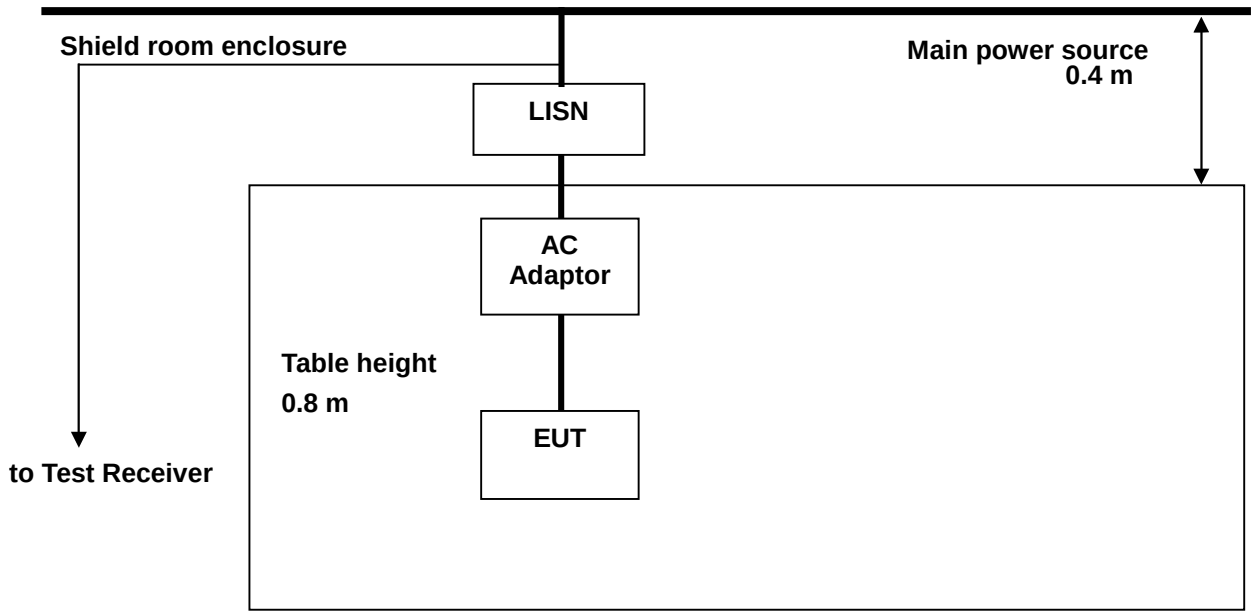
5. Transmitter AC Power Line Conducted Emission

5.1. Test Setup



5.2. Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 μH /50 ohm line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

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5.3. Test Procedures

AC conducted emissions from the EUT were measured according to the dictates of ANSI C63.4:2009

1. The test procedure is performed in a 6.5 m × 3.6 m× 3.6 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W)× 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

NOTE;

1. Line (H): Hot, Line (N): Neutral
2. Traces shown in plot made using a peak detector and average detector
3. The limit for Class B device(s) from 150 ㎑ to 30 ㎒ are specified in Section of the Title 47 CFR.
4. Deviations to the Specifications: None.

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5.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Ambient temperature : (24 ± 1) ℃
Relative humidity : 47 % R.H.

Frequency range : 0.15 ㎒ – 30 ㎒
Measured Bandwidth : 9 ㎑

A. Charging mode with resistive load (Charging current 144 ㎃ status)

FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.17	30.20	14.00	N	64.96	54.96	34.76	40.96
0.58	18.00	14.90	N	56.00	46.00	38.00	31.10
1.04	14.30	11.30	N	56.00	46.00	41.70	34.70
1.31	15.10	13.10	N	56.00	46.00	40.90	32.90
13.97	24.40	20.10	N	60.00	50.00	35.60	29.90
21.80	25.40	19.00	N	60.00	50.00	34.60	31.00
0.17	31.20	14.80	H	64.96	54.96	33.76	40.16
0.39	17.60	11.90	H	58.06	48.06	40.46	36.16
0.58	19.70	14.80	H	56.00	46.00	36.30	31.20
1.31	20.50	16.70	H	56.00	46.00	35.50	29.30
13.72	26.70	20.00	H	60.00	50.00	33.30	30.00
22.07	27.00	21.00	H	60.00	50.00	33.00	29.00

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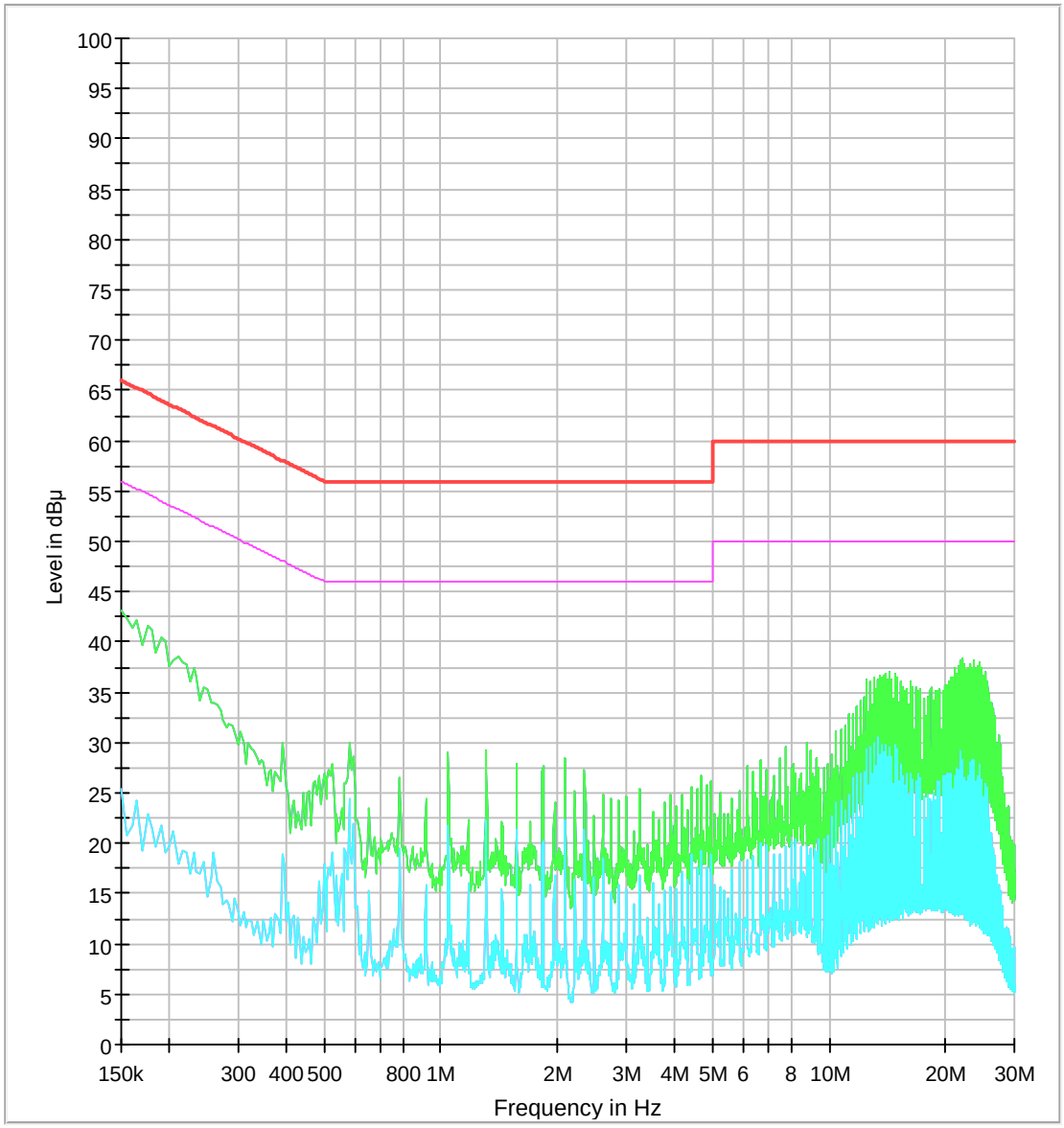
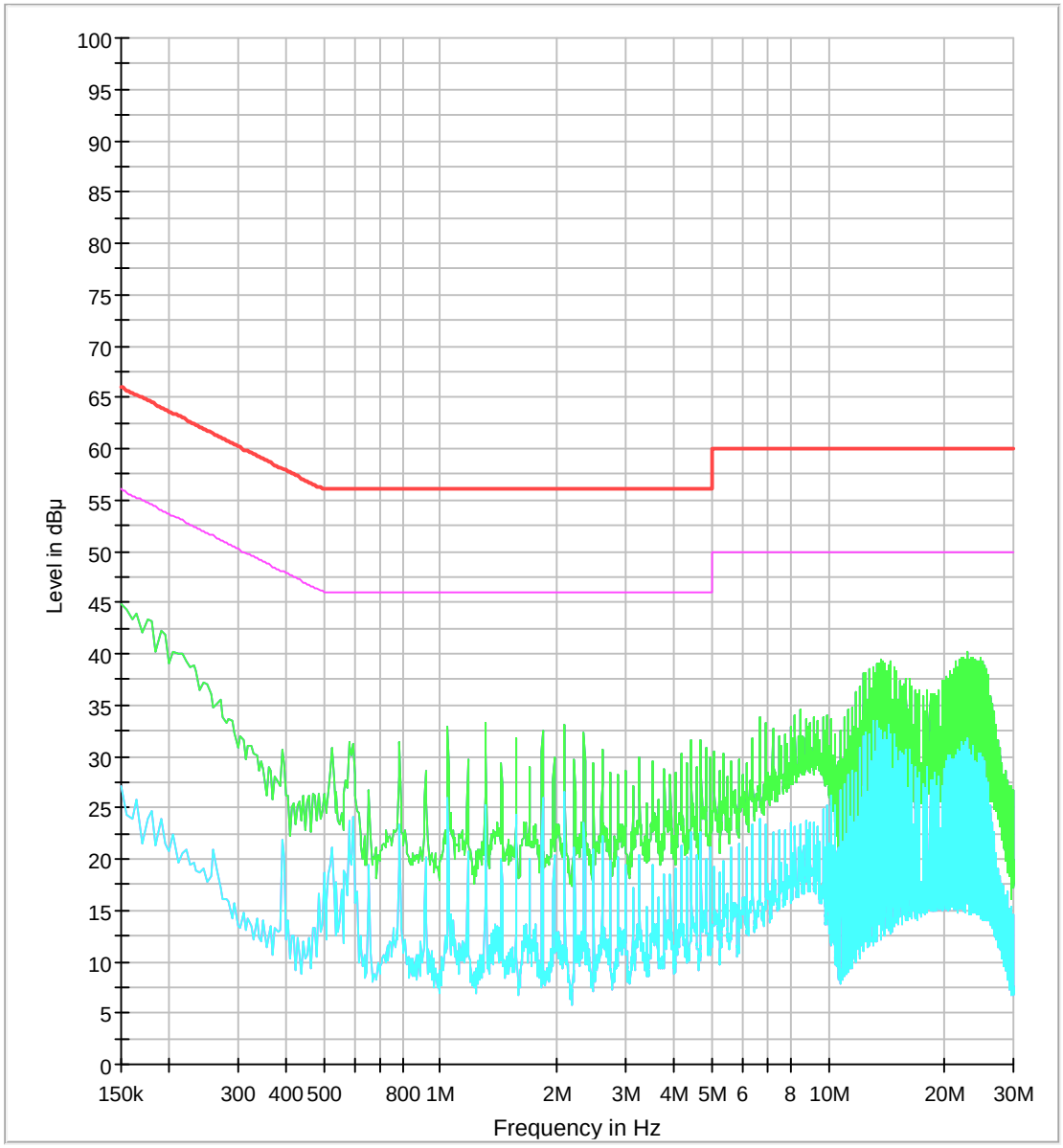
Test mode: (Neutral)



Test mode: (Hot)



B. Charging mode with resistive load (Charging current 354 ㎃ status)

FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.16	33.90	18.70	N	65.46	55.46	31.56	36.76
0.59	15.30	9.00	N	56.00	46.00	40.70	37.00
3.14	14.20	11.70	N	56.00	46.00	41.80	34.30
4.85	16.20	12.80	N	56.00	46.00	39.80	33.20
13.84	20.80	13.60	N	60.00	50.00	39.20	36.40
22.10	16.00	5.90	N	60.00	50.00	44.00	44.10
0.16	33.00	16.60	H	65.46	55.46	32.46	38.86
0.57	20.00	11.20	H	56.00	46.00	36.00	34.80
1.14	16.40	10.50	H	56.00	46.00	39.60	35.50
3.43	20.80	15.30	H	56.00	46.00	35.20	30.70
13.83	26.30	21.50	H	60.00	50.00	33.70	28.50
22.39	26.20	21.90	H	60.00	50.00	33.80	28.10

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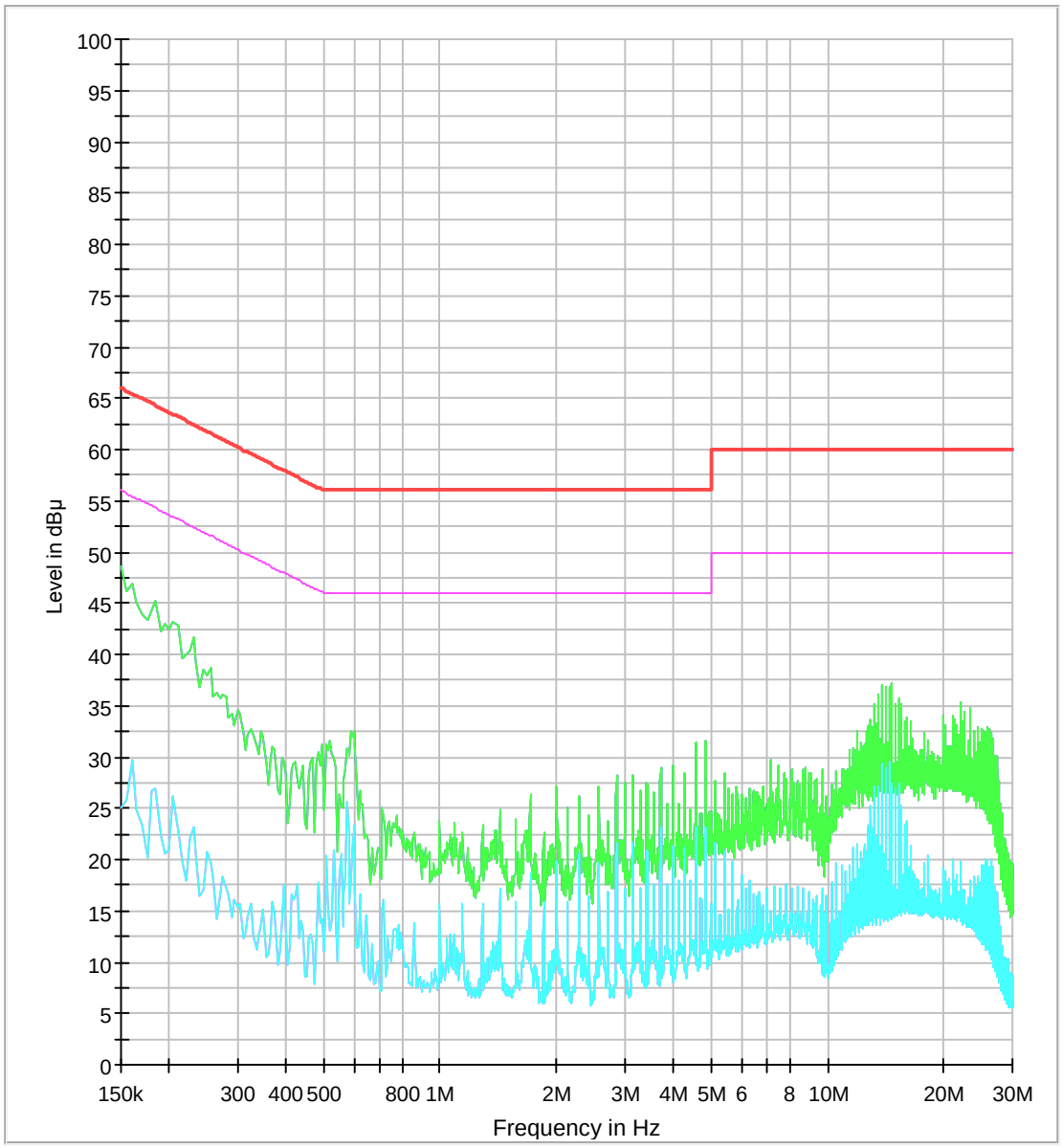
Test mode: (Neutral)



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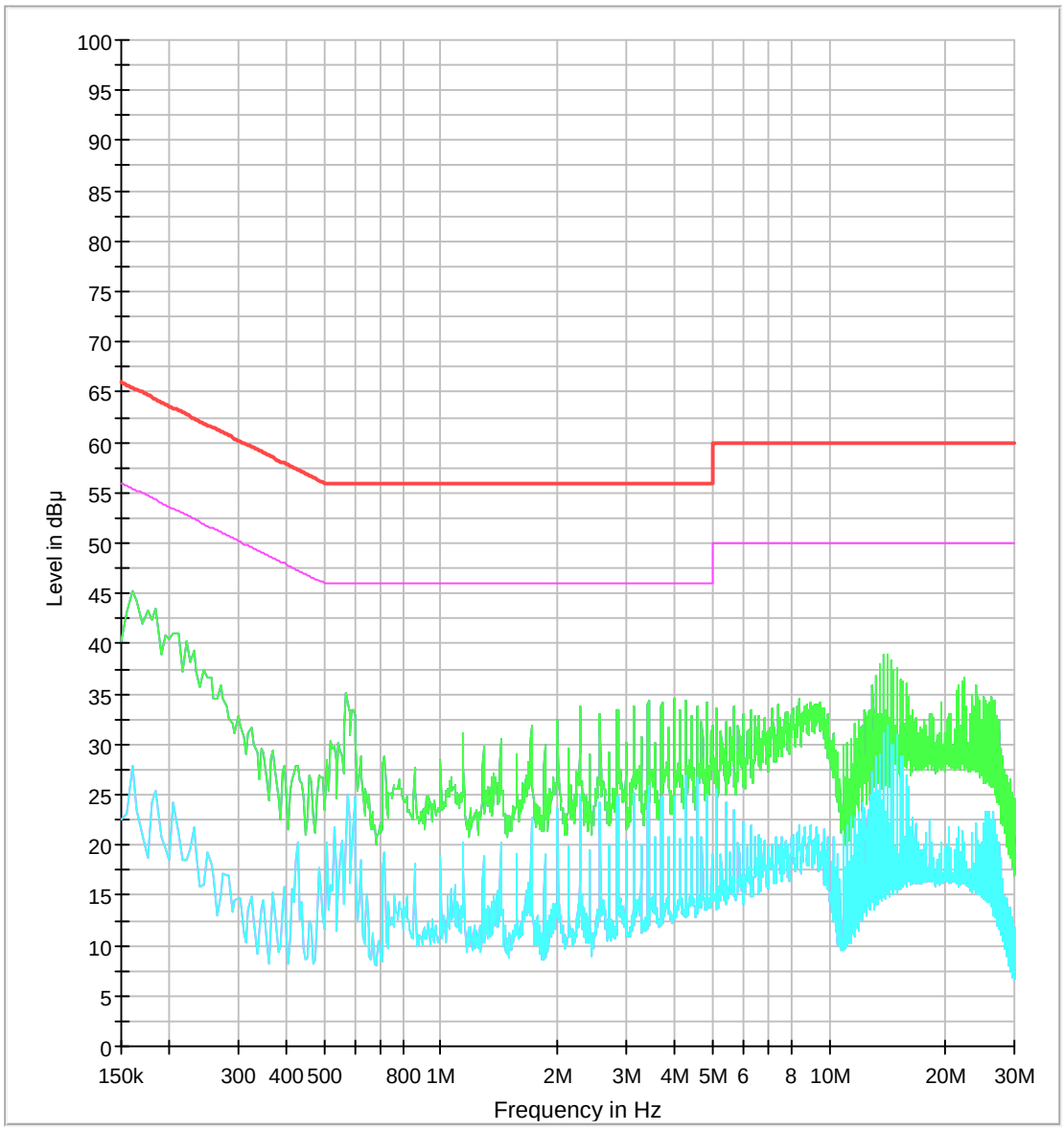
Test mode: (Hot)



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C. Charging mode with resistive load (Charging current 650 ㎃ status)

FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	30.60	16.20	N	66.00	56.00	35.40	39.80
0.57	18.90	16.00	N	56.00	46.00	37.10	30.00
0.95	8.70	4.70	N	56.00	46.00	47.30	41.30
2.03	10.60	5.80	N	56.00	46.00	45.40	40.20
13.91	22.60	16.20	N	60.00	50.00	37.40	33.80
25.79	23.20	14.20	N	60.00	50.00	36.80	35.80
0.15	32.80	18.50	H	66.00	56.00	33.20	37.50
0.41	17.20	11.10	H	57.65	47.65	40.45	36.55
0.58	18.50	13.10	H	56.00	46.00	37.50	32.90
2.70	18.60	13.10	H	56.00	46.00	37.40	32.90
14.45	26.00	20.80	H	60.00	50.00	34.00	29.20
25.52	25.70	17.60	H	60.00	50.00	34.30	32.40

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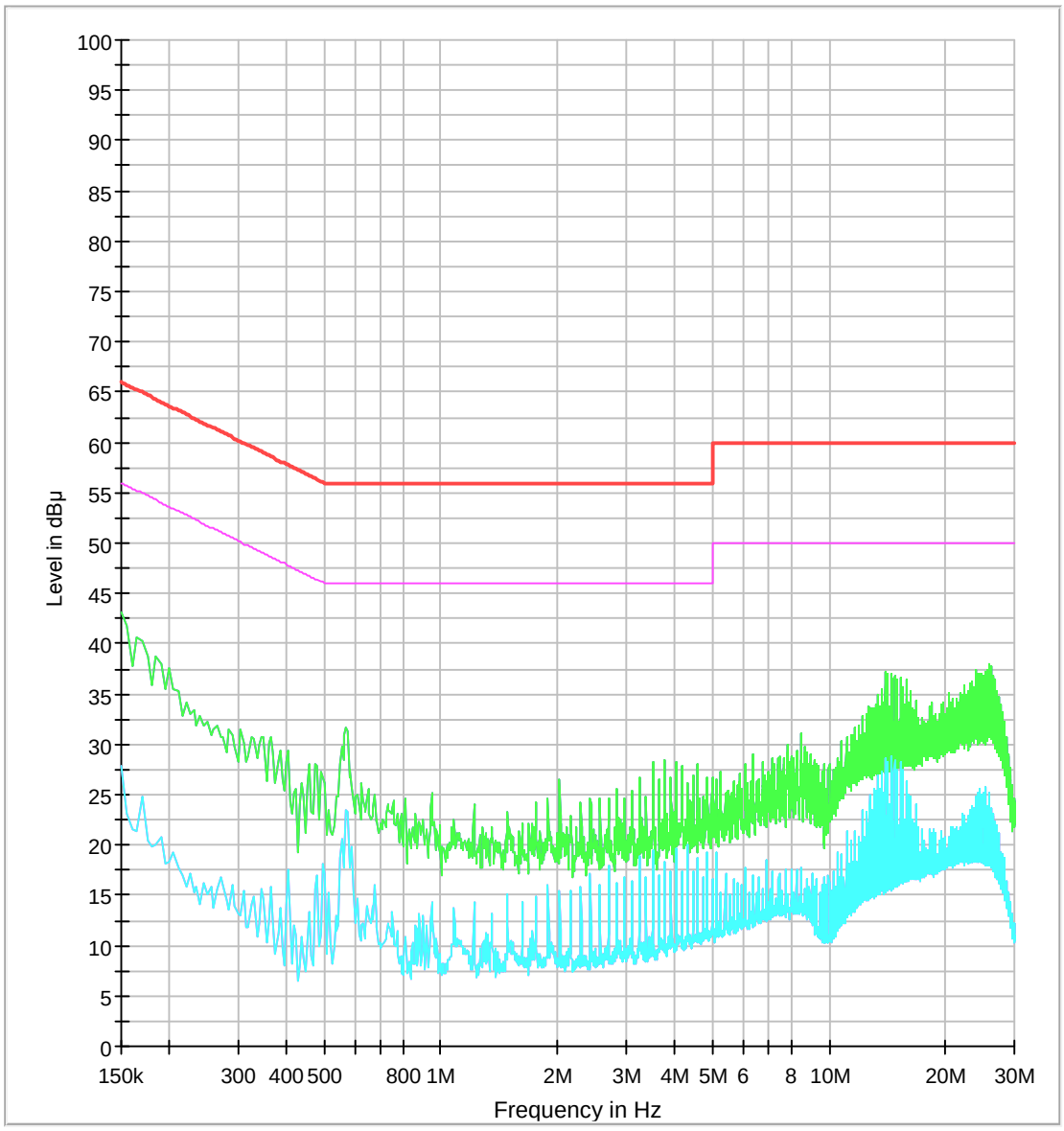
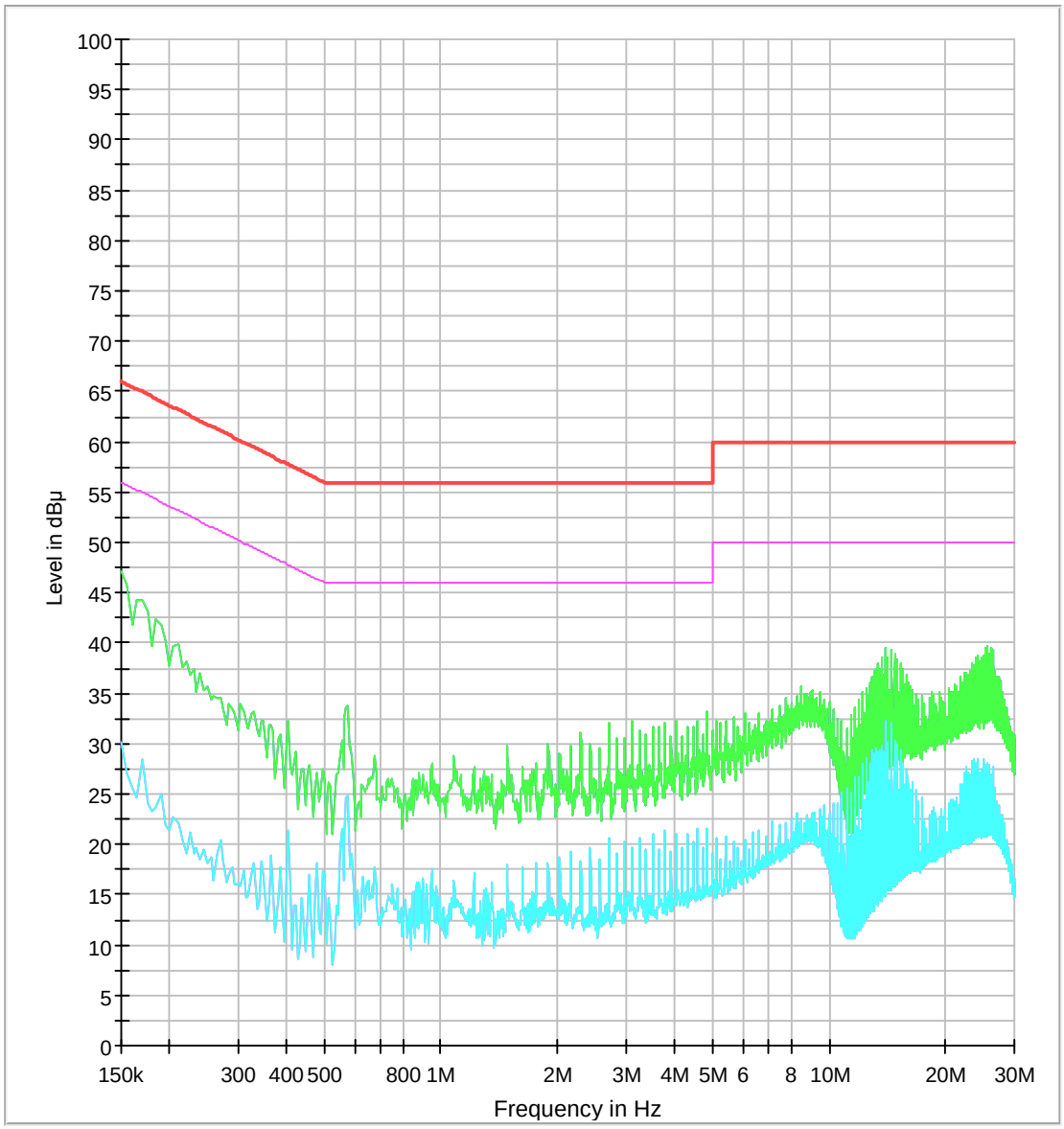
Test mode: (Neutral)



Test mode: (Hot)



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D. Charging mode with client device (less than 1 % battery status)

FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(MHz)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	32.60	23.20	N	66.00	56.00	33.40	32.80
0.22	28.80	15.70	N	62.82	52.82	34.02	37.12
0.61	18.40	14.20	N	56.00	46.00	37.60	31.80
3.40	13.50	10.10	N	56.00	46.00	42.50	35.90
13.75	26.60	22.60	N	60.00	50.00	33.40	27.40
25.88	25.70	16.50	N	60.00	50.00	34.30	33.50
0.15	35.70	21.70	H	66.00	56.00	30.30	34.30
0.19	32.80	18.80	H	64.04	54.04	31.24	35.24
0.59	32.60	17.80	H	56.00	46.00	23.40	28.20
2.06	10.30	5.30	H	56.00	46.00	45.70	40.70
13.55	16.50	8.00	H	60.00	50.00	43.50	42.00
21.76	14.80	6.70	H	60.00	50.00	45.20	43.30

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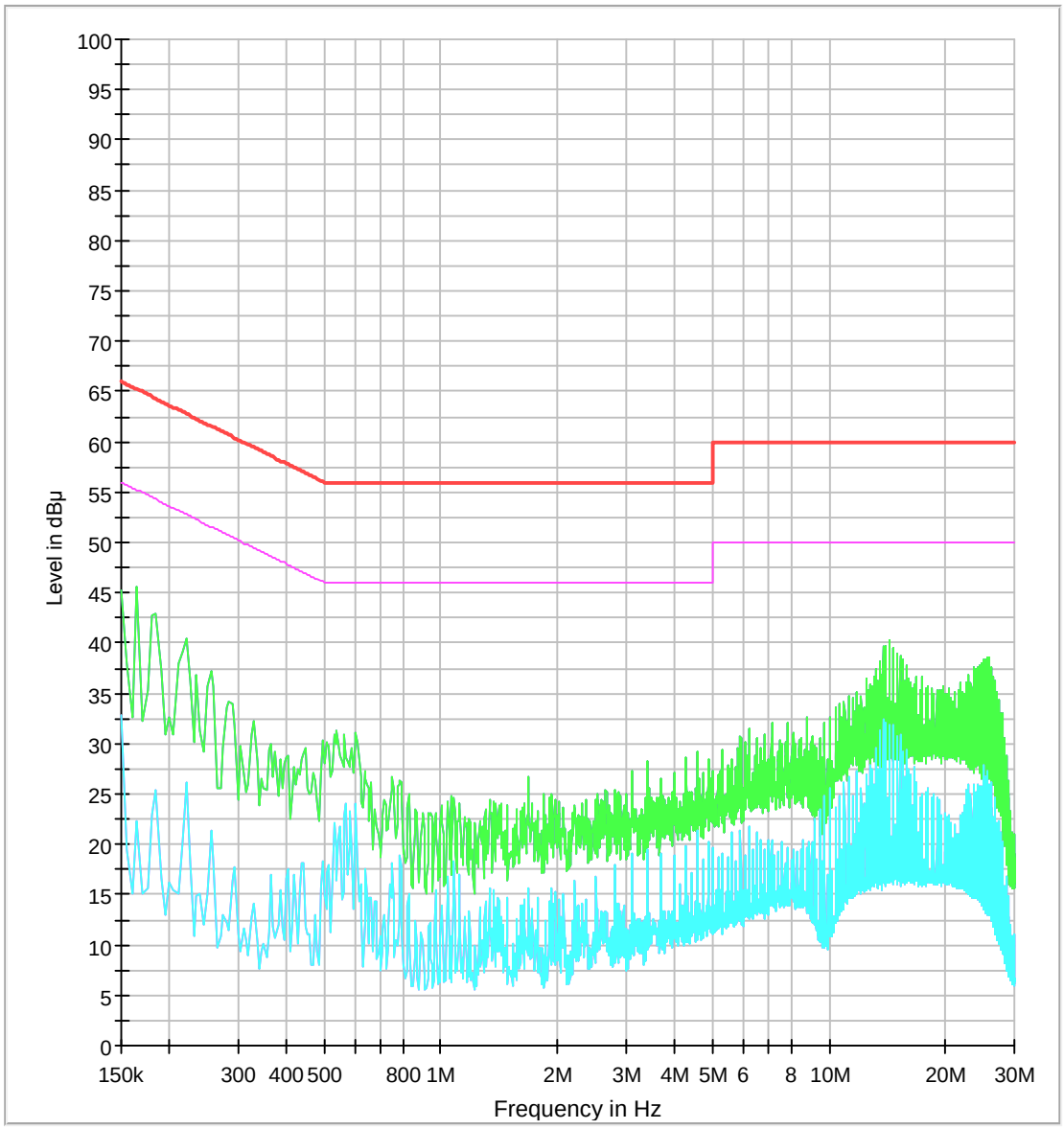
Test mode: (Neutral)



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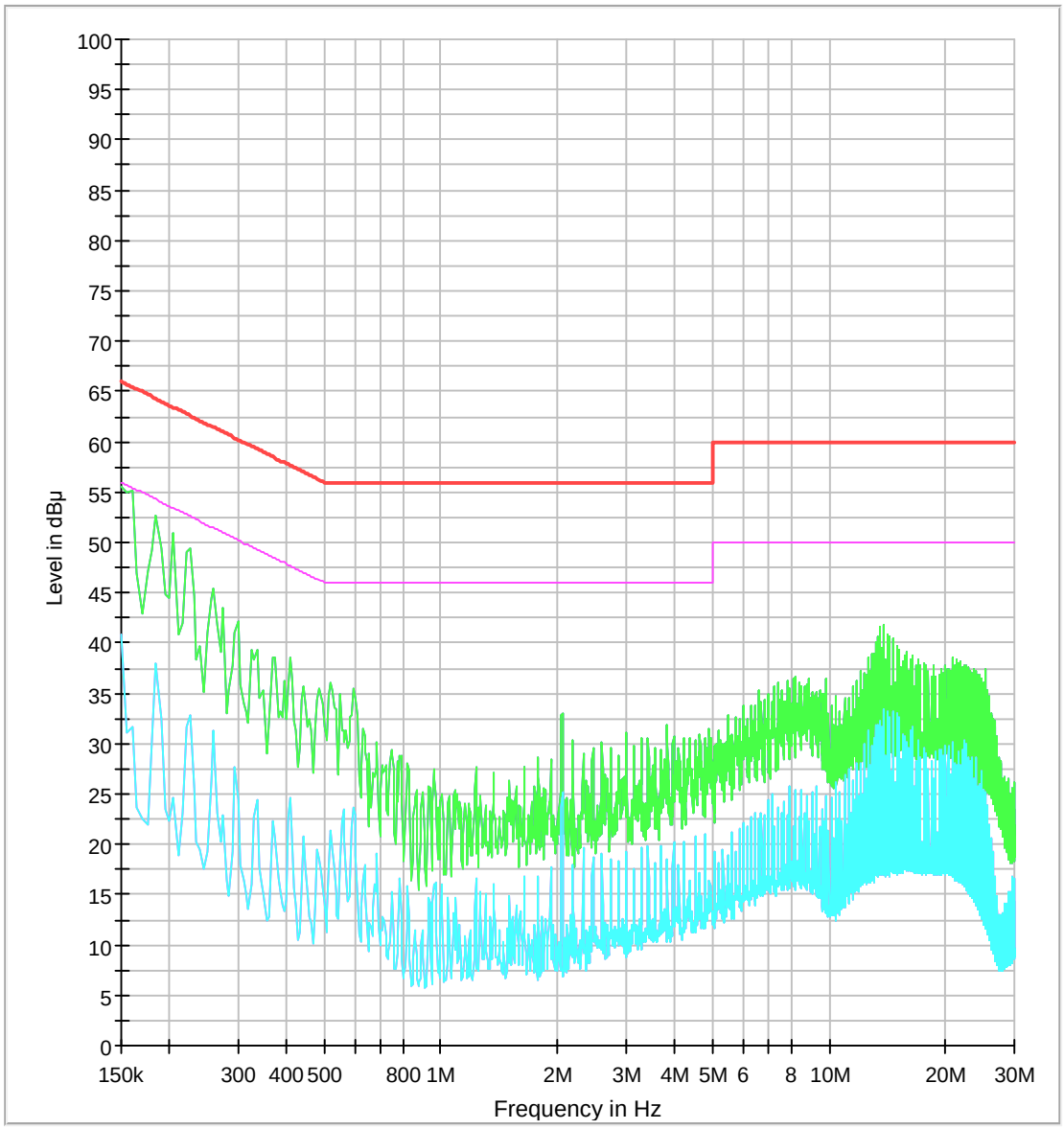
Test mode: (Hot)



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E. Charging mode with client device (less than 50 % battery status)

FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(MHz)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.18	26.60	13.30	N	64.49	54.49	37.89	41.19
0.23	25.00	11.50	N	62.45	52.45	37.45	40.95
0.54	17.80	10.30	N	56.00	46.00	38.20	35.70
4.55	16.10	11.10	N	56.00	46.00	39.90	34.90
13.93	26.40	21.00	N	60.00	50.00	33.60	29.00
25.37	24.20	15.70	N	60.00	50.00	35.80	34.30
0.15	33.70	24.80	H	66.00	56.00	32.30	31.20
0.19	30.70	15.90	H	64.04	54.04	33.34	38.14
0.59	21.20	10.30	H	56.00	46.00	34.80	35.70
2.50	17.60	9.60	H	56.00	46.00	38.40	36.40
13.64	28.70	23.90	H	60.00	50.00	31.30	26.10
25.66	24.20	16.80	H	60.00	50.00	35.80	33.20

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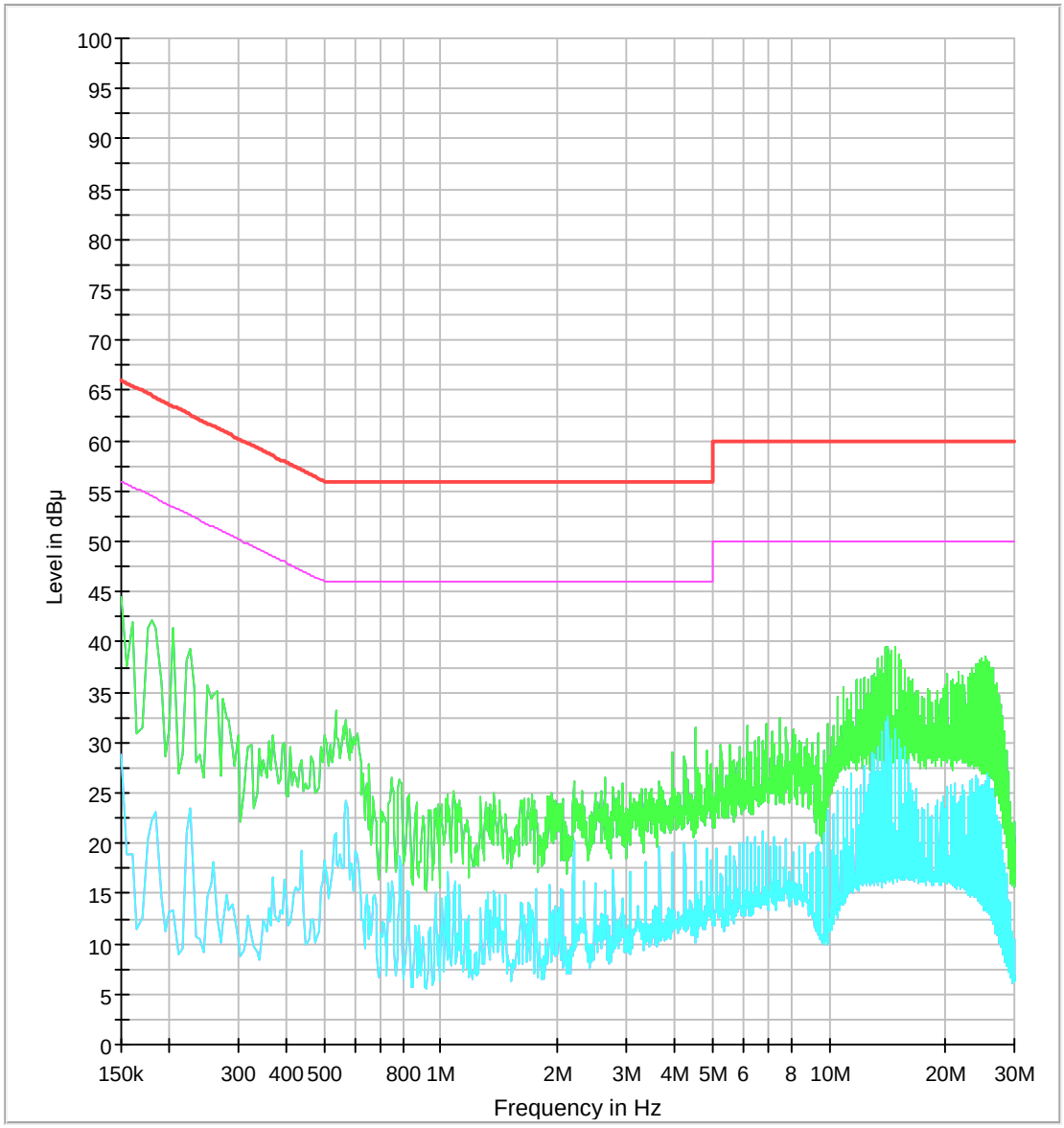
Test mode: (Neutral)



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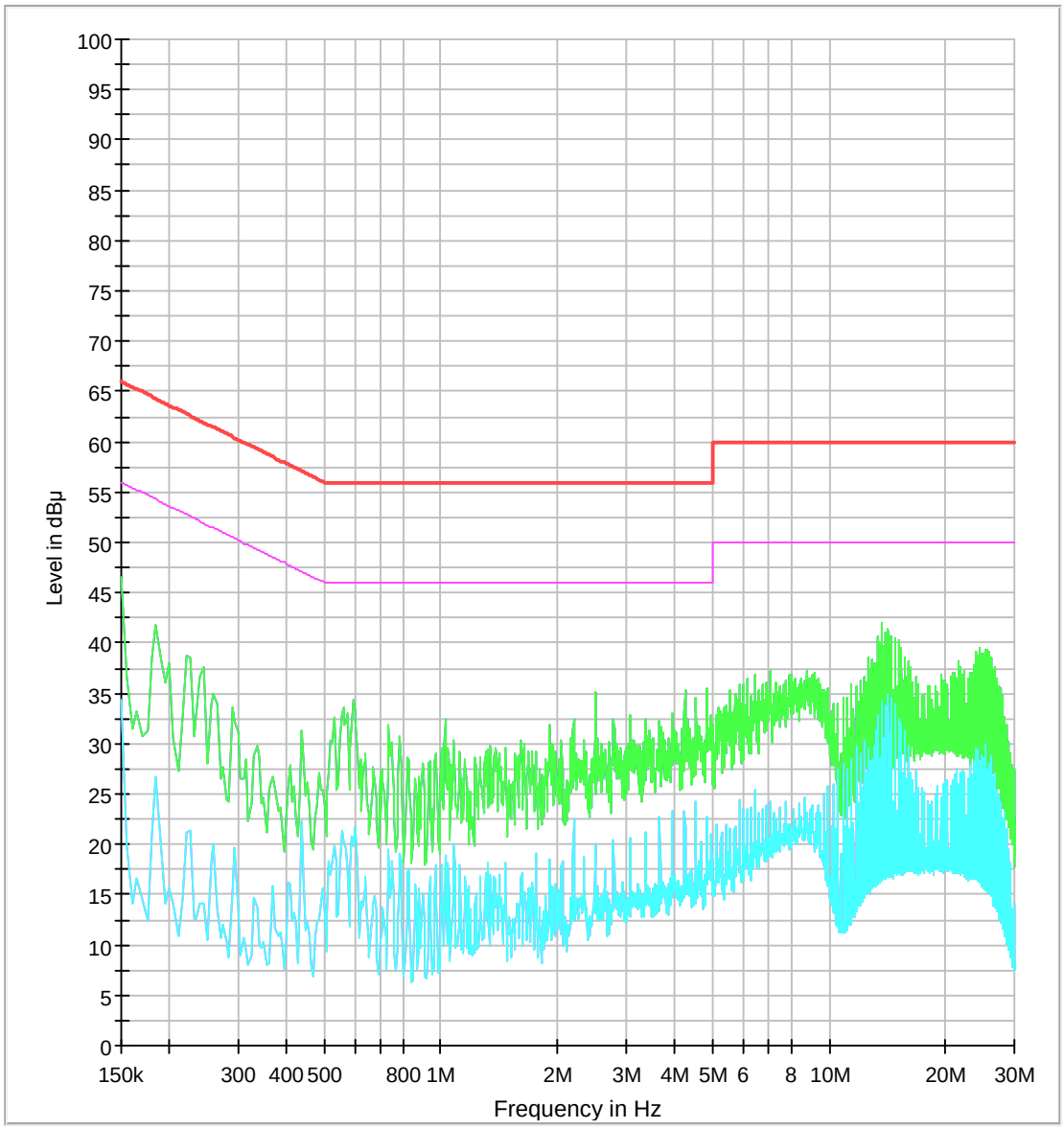
Test mode: (Hot)



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F. Charging mode with client device (100 % battery status)

FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(MHz)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.16	26.70	10.90	N	65.73	55.73	39.03	44.83
0.26	16.70	2.60	N	61.27	51.27	44.57	48.67
0.59	16.80	9.10	N	56.00	46.00	39.20	36.90
1.39	7.90	3.70	N	56.00	46.00	48.10	42.30
13.56	23.90	18.00	N	60.00	50.00	36.10	32.00
21.33	22.30	17.40	N	60.00	50.00	37.70	32.60
0.19	27.40	22.10	H	64.04	54.04	36.64	31.94
0.56	21.50	14.70	H	56.00	46.00	34.50	31.30
4.51	19.10	12.80	H	56.00	46.00	36.90	33.20
8.57	16.90	9.60	H	60.00	50.00	43.10	40.40
13.56	18.50	11.80	H	60.00	50.00	41.50	38.20
20.98	15.70	12.80	H	60.00	50.00	44.30	37.20

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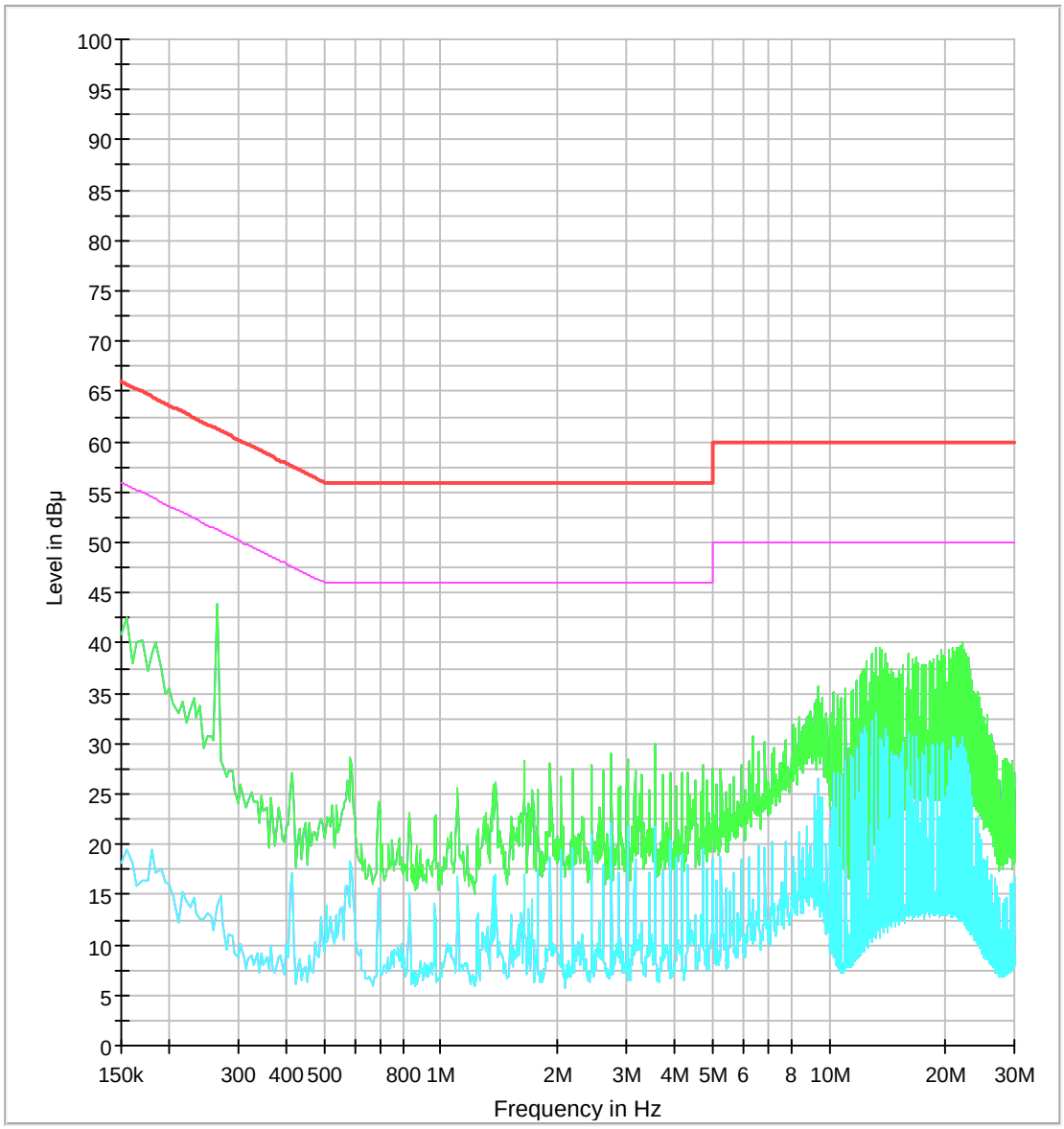
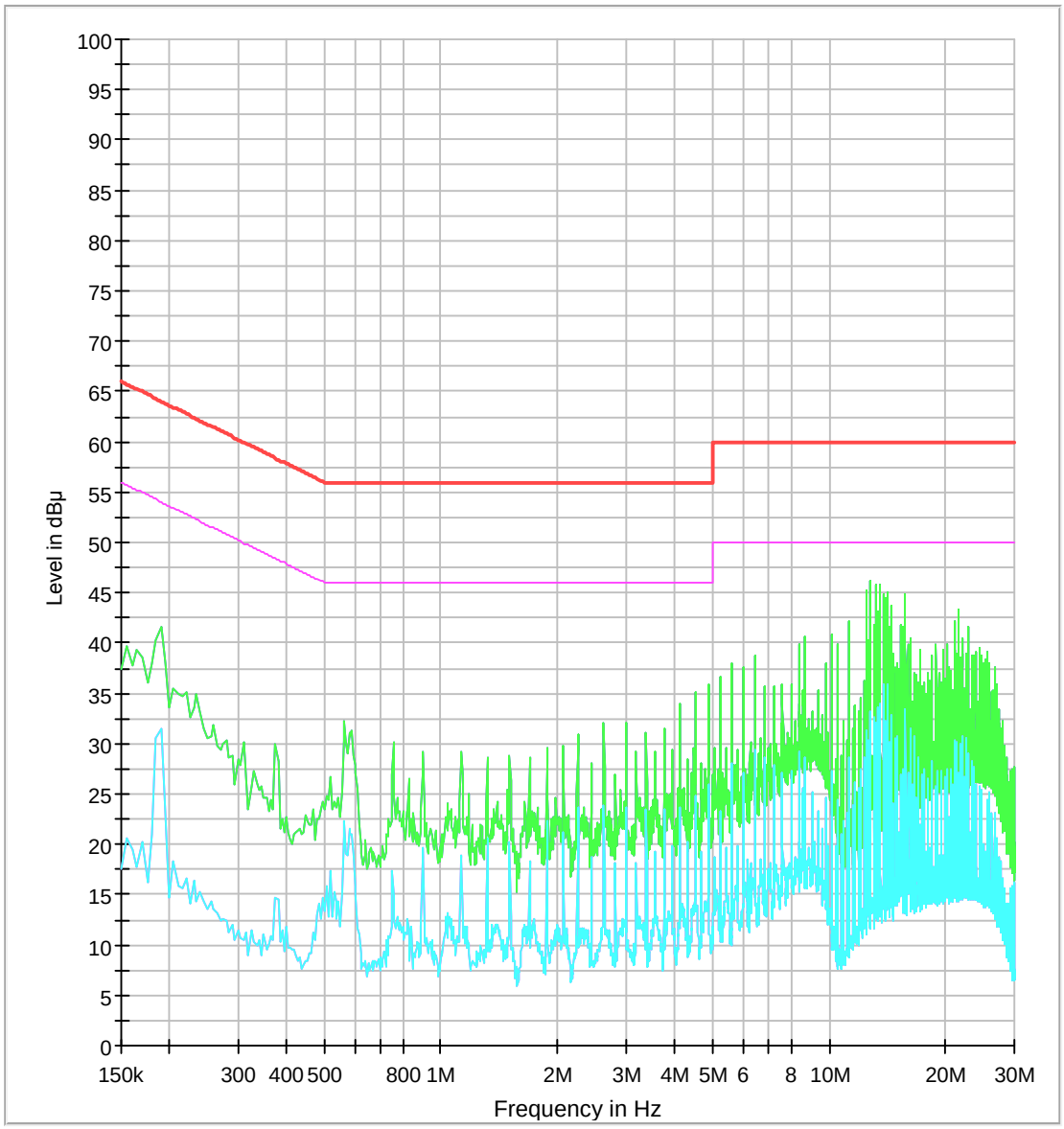
Test mode: (Neutral)



Test mode: (Hot)



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