



TEST REPORT

of

FCC Part 15 Subpart B&C §15.249 / RSS-210 Issue 8, RSS-Gen Issue 3

FCC ID/IC Certification : A3LSM3PRC / 649E-SM3PRC

Equipment Under Test : 2.4 GHz Wireless USB dongle
Model Name : AA-SM3PRCV
Serial No. : N/A
Applicant : SAMSUNG ELECTRONICS CO., LTD.
Manufacturer : Areson Technology Corp.
Date of Test(s) : 2011.06.16 ~ 2011.06.23
Date of Issue : 2011.06.23

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

Tested By:

Date

2011.06.23

Duke Ko

Approved By:

Date

2011.06.23

Charles Kim

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1. General information

1.1 Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040
www.kr.sgs.com/ee

Telephone : +82 +31 428 5700
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1.2 Details of applicant

Applicant : SAMSUNG ELECTRONICS CO.,LTD.
Address : 416, Maetan-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea
Contact Person : Lee, Sang Cheong
Phone No. : +82 +10 8000 0700

1.3. Description of EUT

Kind of Product	2.4 GHz Wireless USB dongle
Model Name	AA-SM3PRCV
Serial Number	N/A
Power Supply	DC 5 V (from PC USB port)
Frequency Range	2 402 ~ 2 472 MHz
Modulation Technique	GFSK
Number of Channels	16
Antenna Type	Connector Type
Antenna Gain	1.8 dBi
H/W version	Rev 1.0
S/W version	Rev 1.0

1.4 Details of modification

-N/A

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1.5. Test equipment list

Equipment	Manufacturer	Model	S/N	Cal Due.
Signal Generator	R & S	SMR40	100272	Jul. 15, 2011
Spectrum Analyzer	R & S	FSP40	100007	Jul. 15, 2011
Power Meter	Agilent	E4416A	GB4129123	Mar. 30, 2012
Power Sensor	Agilent	E9327A	US40441371	Mar. 30, 2012
Attenuator	Agilent	8495B	MY42140907	Apr. 01, 2012
High Pass Filter	Wainwright	WHK3.0/18G-10SS	344	Sep. 29, 2011
Preamplifier	H.P.	8447F	2944A03909	Jul. 05, 2011
Preamplifier	Agilent	8449B	3008A01932	Mar. 31, 2012
Test Receiver	R & S	ESU26	100109	Feb. 21, 2012
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	Jul. 22, 2011
Horn Antenna	R & S	HF 906	100326	Oct. 08, 2011
Antenna Master	EMCO	1050	N.C.R	N.C.R.
Turn Table	Daeil EMC	DI-1500	N.C.R	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N.C.R	N.C.R.
Two-Line V-Network	R & S	ENV216	100190	Jan. 06, 2012
Test Receiver	R & S	ESHS10	863365/018	Jul. 13, 2011
Anechoic Chamber	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N.C.R	N.C.R
Horn Antenna	R & S	BBHA9170	BBHA9170431	Mar. 17, 2012

1.6. Support equipment

Equipment	Manufacturer	Type	S/N
Notebook PC	LG IBM	2366	99-LZLR2

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1.7. Summary of test results

The EUT has been tested according to the following specifications:

APPLIED STANDARD:FCC Part15, RSS-210,RSS-Gen			
Section in FCC 15	Section in RSS-210 RSS-Gen	Test Item	Result
15.209(a) 15.249(a) 15.249(d) 15.205	A2.9(a),(b)	Fundamental, Spurious emission and edge band radiated emission	Complied
15.109(a)	RSS-Gen 6	Receiver Radiated Spurious Emission	Complied
-	A8.1(1)	Occupied Bandwidth	Complied
15.207	RSS-Gen 7.2.2	Transmitter AC Power Line Conducted Emission	Complied
15.107	RSS-Gen 7.2.2	Receiver AC Power Line Conducted Emission	Complied
1.1307(b)(1)	RSS-Gen 5.5/ RSS-102	Maximum Permissible Exposure (Exposure of Humans to RF Fields)	Complied

1.8. Test report revision

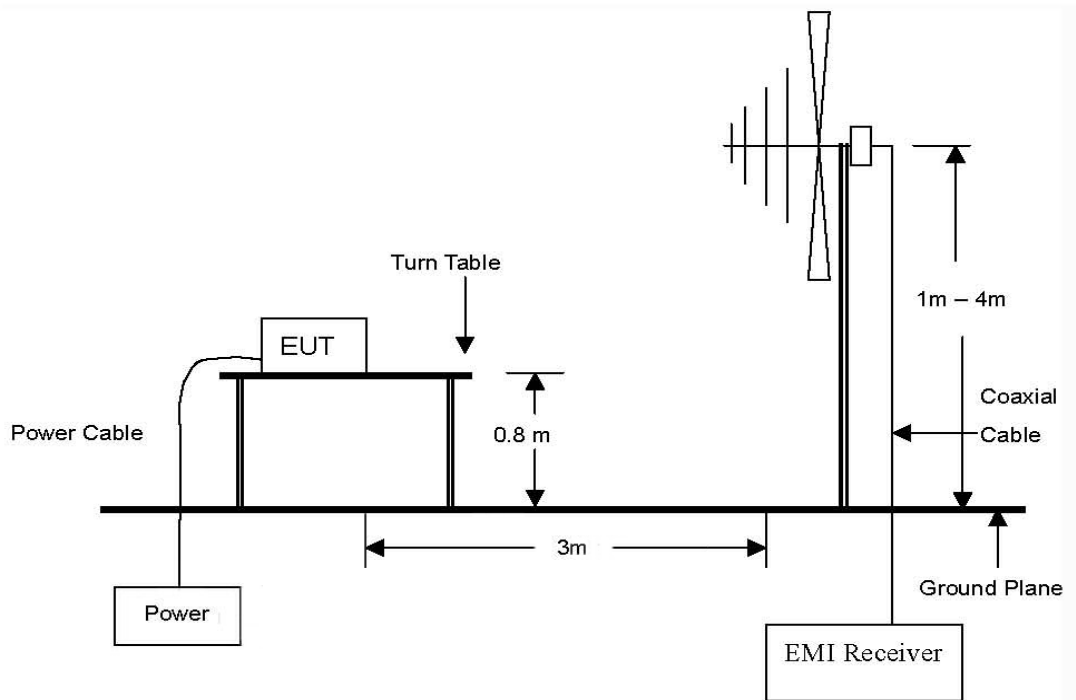
Revision	Report number	Description
0	F690501/RF-RTL004770	Initial

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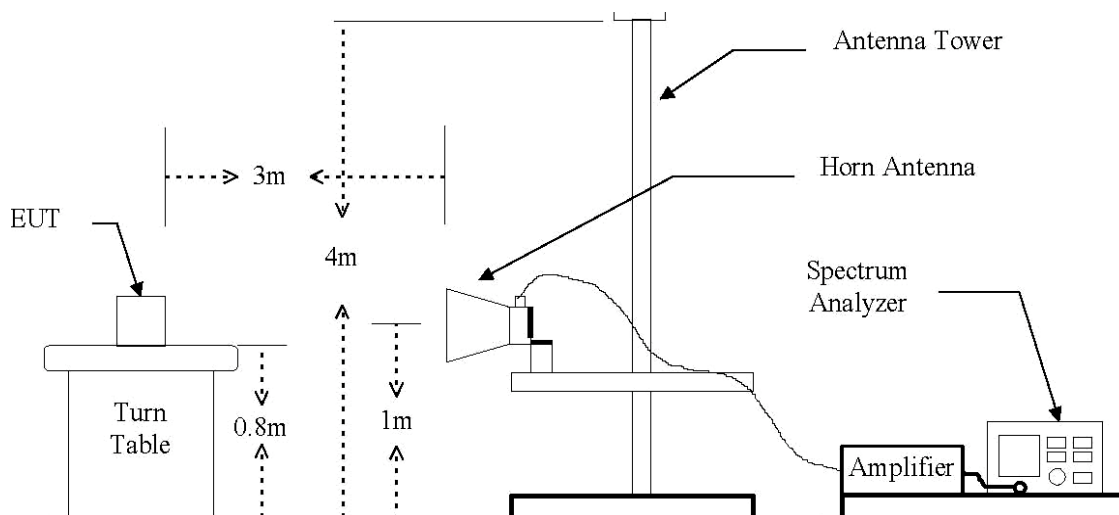
2. Fundamental, Spurious emission and edge band radiated emission

2.1. Test setup

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



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 24 GHz Emissions.



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2.2. Test procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. 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 polarization of the antenna are set to make the measurement.
4. 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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. If the emission level of the EUT in peak mode was 10 dB 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 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Note :

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

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2.3. Limit

In the section 15.249(a) :

Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (mV/m)	Field strength of harmonics (μ V/m)
902 ~ 928 MHz	50	500
2 400 ~ 2 483.5 MHz	50	500
5 725 ~ 5 875 MHz	50	500
24.0 ~ 24.25 GHz	250	2 500

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:

Fundamental frequency (MHz)	Field strength (μ V/m)	Measurement distance (m)
30 ~ 88	100*	3
88 ~ 216	150*	3
216 ~960	200*	3
Above 960	500	3

Remark:

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 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

In the above emission table, the tighter limit applies at the band edges.

Fundamental frequency (MHz)	Field strength (μ V/m at 3 meter)	Field strength (dB μ V/m at 3 meter)
30 ~ 88	100	40
88 ~ 216	150	43.5
216 ~960	200	46
Above 960	500	54

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2.4. Test result

Ambient temperature : (24 ± 2) °C

Relative humidity : 47 % R.H.

2.4.1. Below 1 GHz

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Below 1 000.00	Not detected	-	-	-	-	-	-	-

Remark

1. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.
2. All spurious emission at channels are almost the same below 1 GHz, so that the channel was chosen at representative in final test.

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2.4.2. Above 1 GHz

A. Low Channel (2 402 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2 402	59.08	Peak	V	28.07	6.26	93.41	114.00	20.59
2 402	23.64	Average	V	28.07	6.26	57.97	94.00	36.03
*2 390	30.68	Peak	V	28.09	6.23	65.00	74.00	9.00
*2 390	11.15	Average	V	28.09	6.23	45.47	54.00	8.53

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
4 803.90	48.53	Peak	V	32.59	-25.03	56.09	74.00	17.91
4 803.90	31.93	Average	V	32.59	-25.03	39.49	54.00	14.51
Above 4 900.00	Not detected	-	-	-	-	-	-	-

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B. Middle Channel (2 432 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2 432	58.60	Peak	V	28.01	6.28	92.89	114.00	21.11
2 432	23.40	Average	V	28.01	6.28	57.69	94.00	36.31

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
4 863.58	48.46	Peak	V	32.82	-25.30	55.98	74.00	18.02
4 863.58	32.10	Average	V	32.82	-25.30	39.62	54.00	14.38
Above 4 900.00	Not detected	-	-	-	-	-	-	-

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C. High Channel (2 472 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2 472	58.10	Peak	V	28.05	6.33	92.48	114.00	21.52
2 472	23.56	Average	V	28.05	6.33	57.94	94.00	36.06
*2 483.5	29.66	Peak	V	28.09	6.36	64.11	74.00	9.89
*2 483.5	11.26	Average	V	28.09	6.36	45.71	54.00	8.29

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
4 944.51	49.33	Peak	V	33.19	-24.56	57.96	74.00	16.04
4 944.51	32.19	Average	V	33.19	-24.56	40.82	54.00	13.18
Above 5 000.00	Not detected	-	-	-	-	-	-	-

Remarks ;

1. "*" means the restricted band.
2. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.
3. Measuring frequencies from 1 MHz to the 10th harmonic of highest fundamental Frequency.
4. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
5. Average test would be performed if the peak result were greater than the average limit.
6. Actual = Reading + AF - Amp Gain + CL

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3. Receiver Radiated spurious emissions

3.1. Test setup - Same as clause 4.1.

3.1.1. Receiver Radiated Spurious Emissions - Same as clause 4.1.1.

3.2. Limit

According to RSS-Gen(6), all spurious emissions shall comply with the limits of Table.

Frequency (MHz)	Distance (Meters)	Radiated (dB μ V/m)	Radiated (μ V/m)
30 - 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

3.3. Test Procedures - Same as clause 4.3.

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

3.3.1. Test Procedures for Radiated Spurious Emissions- Same as clause 2.3.1.

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3.4. Test Results

Ambient temperature : (24 ± 2) °C
Relative humidity : 47 % R.H.

3.4.1. Spurious Radiated Emission

The frequency spectrum from 30 MHz to 1000 MHz was investigated. Emission levels are not reported much

lower than the limits by over 30 dB. All reading values are peak values.

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Below 1 000.00	Not detected	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-

Remark

1. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes. Worst case is zx-plane..
2. All spurious emission at channels are almost the same below 1 GHz, so that the channel was chosen at representative in final test.

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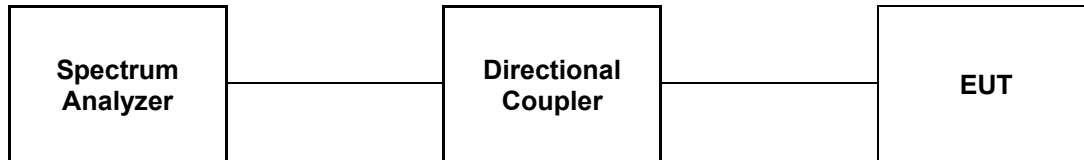
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4. Occupied Bandwidth

4.1. Test Setup



4.2. Limit

Limit: Not Applicable

4.3. Test Procedure

1. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW = 30 kHz, VBW = 100 kHz, Span = 5 MHz.

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4.4. Test Results

Ambient temperature : (24 ± 2) °C
Relative humidity : 47 % R.H.

Operation Mode	Channel	Channel Frequency (MHz)	99 % Bandwidth (MHz)
GFSK	Low	2 402	2.11
	Middle	2 432	2.26
	High	2 472	2.37

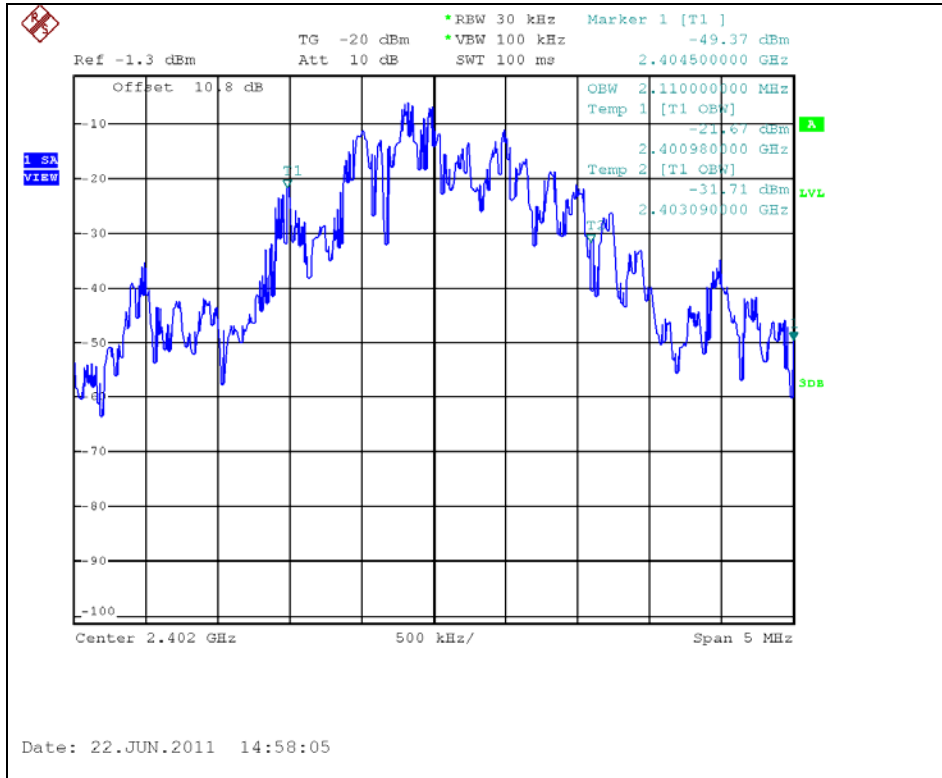
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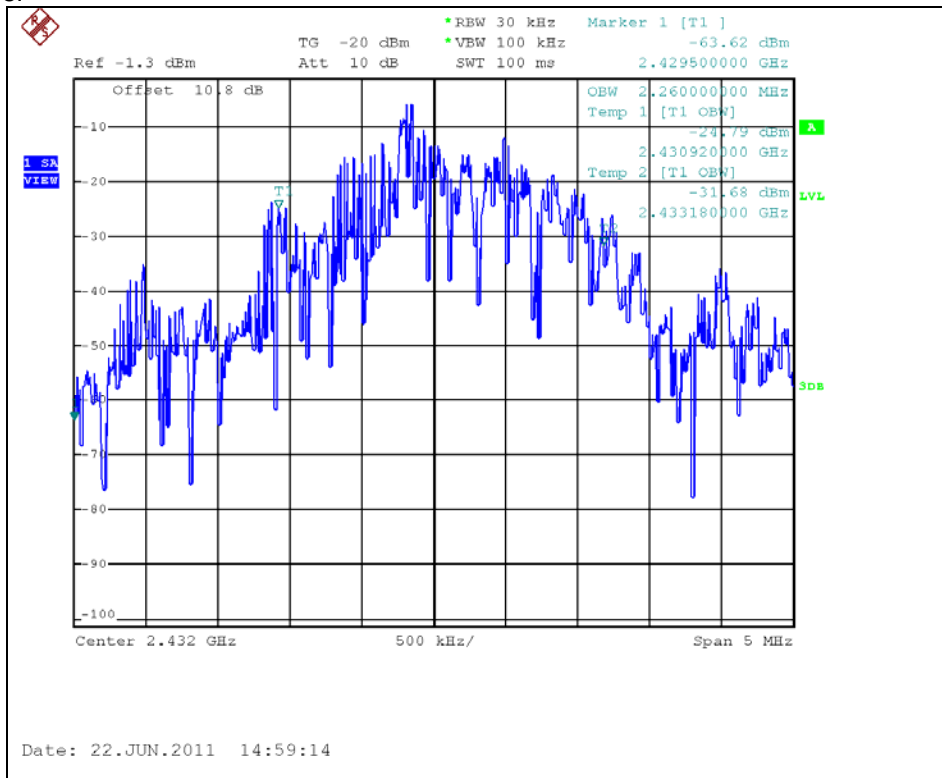
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Low Channel

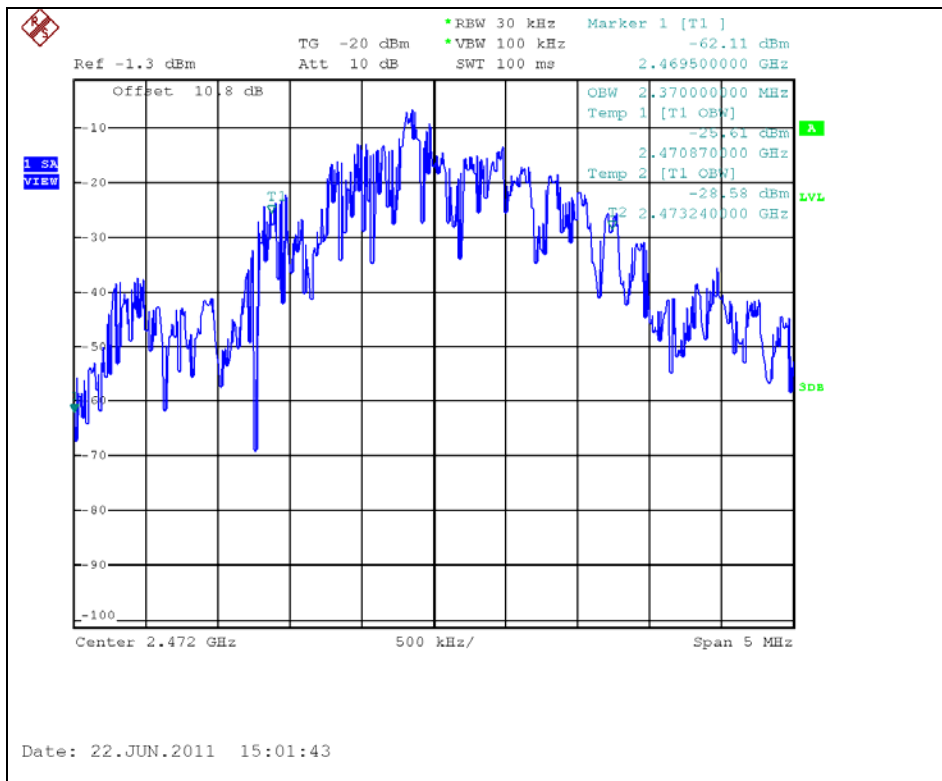


Middle Channel



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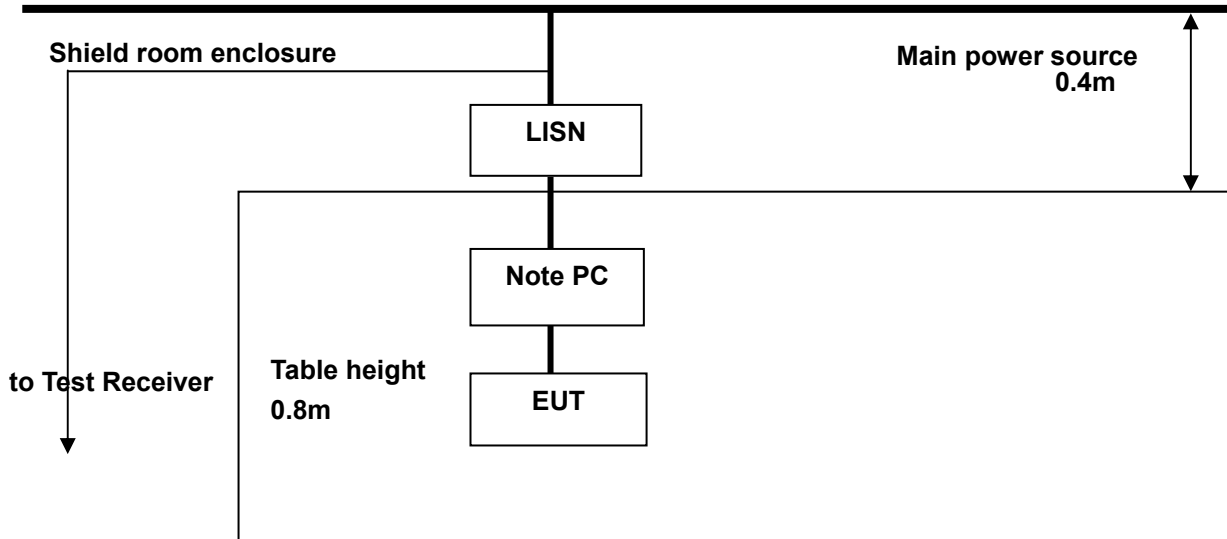
High Channel



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5. Transmitter AC Power Line Conducted Emission

5.1. Test setup



5.2. Limit

The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radio communication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network.

Frequency of Emission (MHz)	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

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5m × 3.6m × 3.6m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0m(W)× 1.5m(L) and 0.8m 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.

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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 ± 2) °C
Relative humidity : 47 % R.H.
Frequency range : 0.15 MHz – 30 MHz
Measured Bandwidth 9 kHz

Freq. (MHz)	Level(dB uV)		Line	Limit(dB uV)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	30.4	21.7	H	66.0	56.0	35.6	34.3
0.22	24.5	17.7	H	63.0	53.0	38.5	35.3
1.30	17.1	16.7	H	56.0	46.0	38.9	29.3
1.93	26.3	15.7	H	56.0	46.0	29.7	30.3
12.84	20.5	13.9	H	60.0	50.0	39.5	36.1
0.15	48.2	32.4	N	66.0	56.0	17.9	23.7
0.21	36.6	30.1	N	63.4	53.4	26.9	23.4
1.91	25.2	14.7	N	56.0	46.0	30.8	31.3
13.56	16.9	11.2	N	60.0	50.0	43.1	38.8

Note ;

Line (H) : Hot

Line (N) : Neutral

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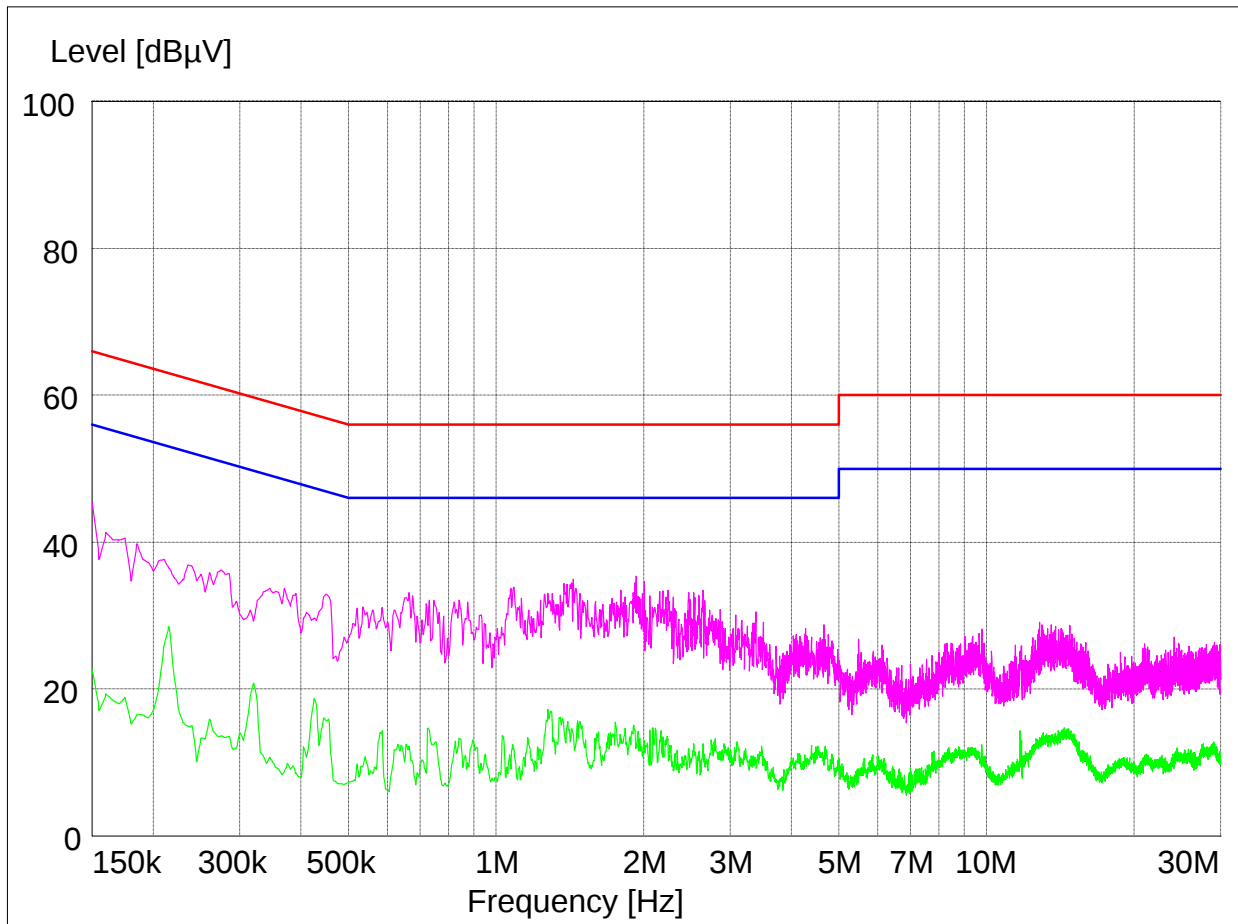
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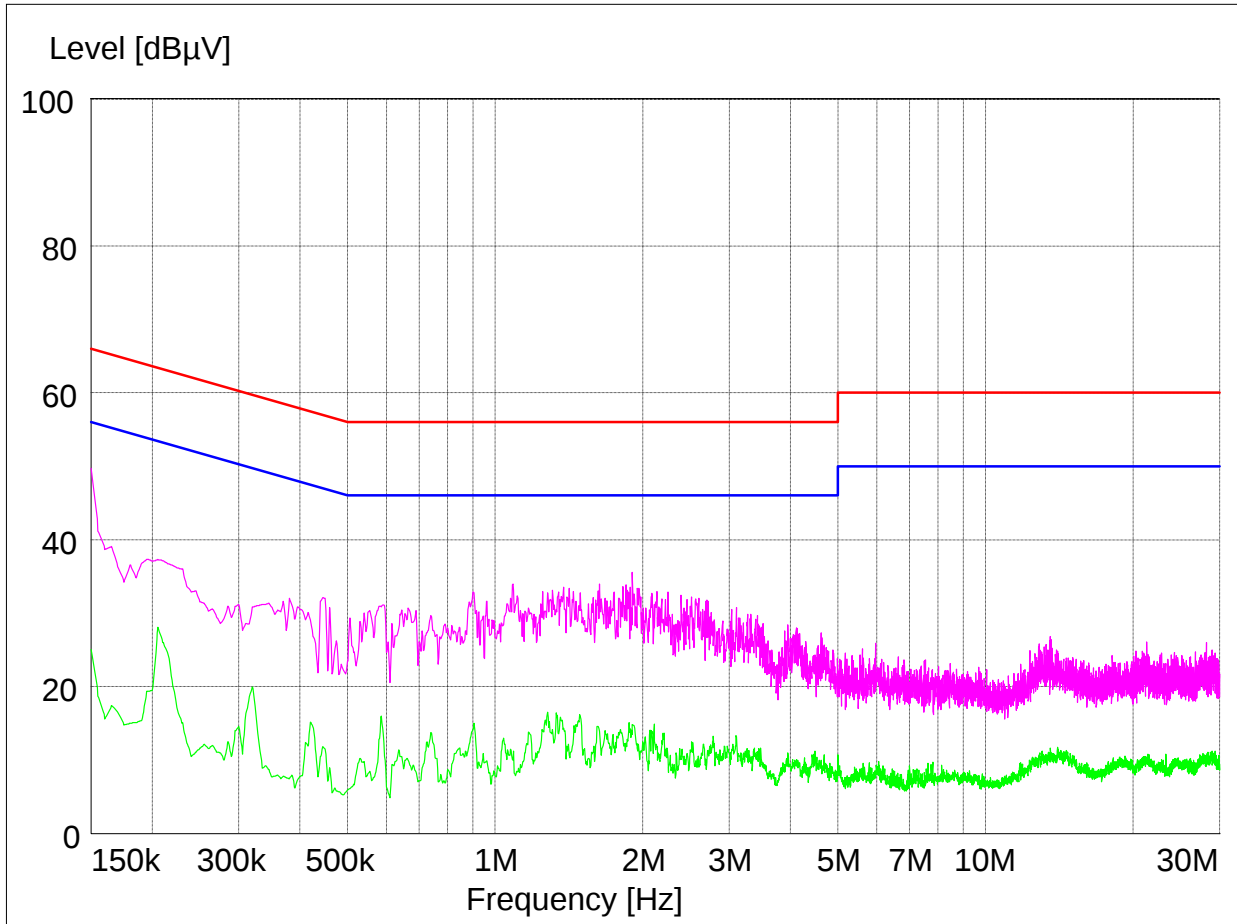
Plot of conducted power line

Test mode : (Hot)



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Test mode : (Neutral)



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6. Receiver AC Power Line Conducted Emission

6.1. Test Setup- Same as clause 4.1.

6.2. Limit - Same as clause 4.2.

6.3. Test Procedures- Same as clause 4.3.

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6.4. Test Results

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

Ambient temperature : (24 ± 2) °C
Relative humidity : 47 % R.H.
Frequency range : 0.15 MHz – 30 MHz
Measured Bandwidth : 9 kHz

FREQ. (MHz)	LEVEL(dBuV)		LINE	LIMIT(dBuV)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	50.8	35.6	H	66.0	56.0	15.2	20.4
0.21	36.1	29.0	H	63.4	53.4	27.3	24.4
1.84	24.7	13.9	H	56.0	46.0	31.3	32.1
9.51	19.7	11.9	H	60.0	50.0	40.3	38.1
0.15	47.6	32.2	N	66.0	56.0	18.5	23.9
0.21	36.6	30.1	N	63.2	53.2	26.7	23.2
0.46	29.9	16.5	N	56.8	46.8	26.9	30.3
1.85	26.4	14.2	N	56.0	46.0	29.6	31.8
22.72	16.3	11.4	N	60.0	50.0	43.7	38.6

Note ;

Line (H) : Hot

Line (N) : Neutral

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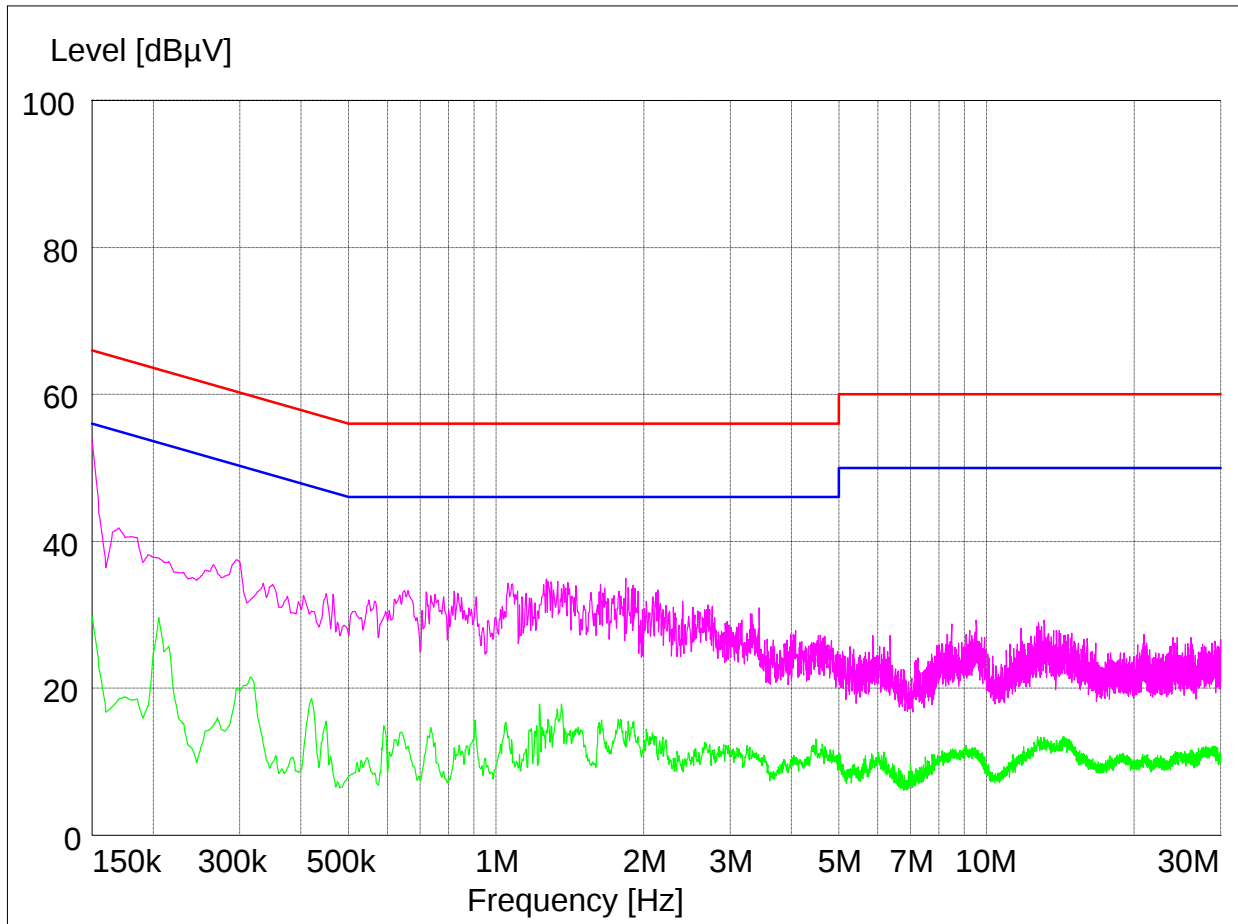
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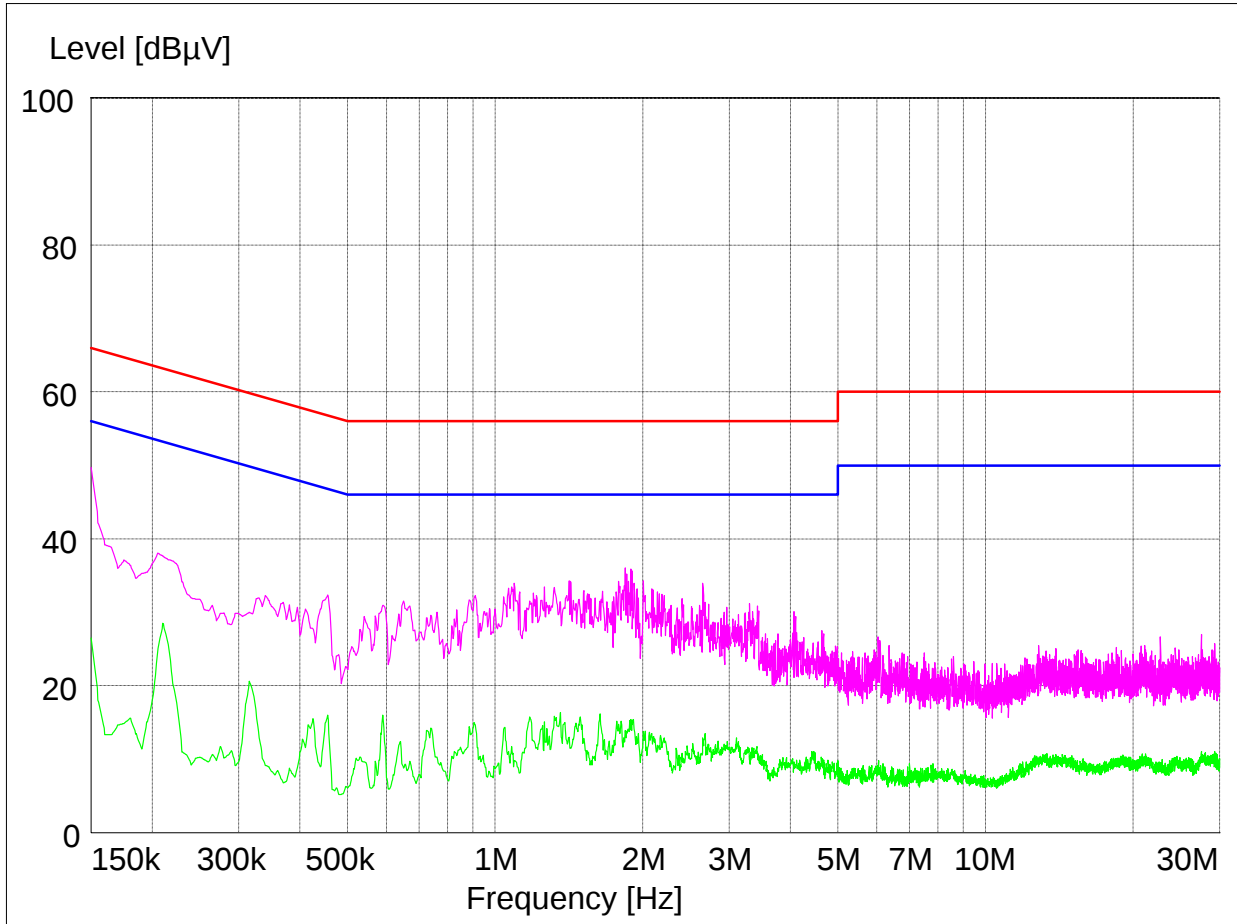
Plot of Conducted Power line

Test mode : (Hot)



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Test mode : (Neutral)



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7. RF Exposure Evaluation

7.1. Environmental evaluation and exposure limit according to FCC CFR 47 part 1, 1.1307(b), 1.1310

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational /Control Exposures				
300 – 1 500	--	--	F/300	6
1 500 – 100 000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300 – 1 500	--	--	F/1500	6
<u>1 500 – 100 000</u>	--	--	<u>1</u>	<u>30</u>

7.1.1. Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

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7.1.2. Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data
Test Mode : Normal Operation

7.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	2 402	-16.99	1.8	0.000 006	1
Middle	2 432	-17.15	1.8	0.000 006	1
High	2 472	-17.78	1.8	0.000 005	1

Note :

1. The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit of 1 mW/cm² .

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