TEST REPORT

Testing Laboratory:
SK Tech Co., Ltd.
88, Geulgaeul-ro, 81beon-gil,
Wabu-eup, Namyangju-si,
Gyeonggi-do, Korea
TEL: +82-31-576-2204
FAX: +82-31-576-2205

Test Report Number: SKT-RFC-200005
Date of issue: December 14, 2020

Applicant:	**LINE Friends Corporation** 5F, 98, Hannam-daero, Yongsan-gu, Seoul, Korea
Manufacturer:	**Shenzhen Zhiyu Innovation Electronic Technology Co.,Ltd** 7th Floor, Building A, Lilan Technology Park, West Section of High-tech Park, Jiazitang Community, Gongming Street, Shenzhen, Guangdong, China
Product:	WIRELESS CHARGER
Model:	**BT21 WIRELESS CHARGER**
FCC ID:	2AQTS-LINEBT21WC
Project number:	SKTEU20-1269
EUT received:	November 11, 2020

Applied standards:	ANSI C63.10-2013 and ANSI C63.4-2014
Rule parts:	FCC Part 15 Subpart C - Intentional radiators
Equipment Class:	**DCD - Part 15 Low Power Transmitter Below 1705kHz**

Remarks to the standards:	None

The above equipment has been tested by SK Tech Co., Ltd., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product or system, which was tested.

Wonsik Ham / **Testing Engineer**

Jongsoo Yoon / **Technical Manager**

Revision History of Test Report

Rev.	Revisions	Effect page	Approved by	Date
-	Initial issue	All	Jongsoo Yoon	Dec. 14, 2020

TABLE OF CONTENTS

1 Summary of test results 4

2 Description of equipment under test (EUT) 5

3 Test and measurement conditions 6
3.1. Test configuration (arrangement of EUT) 6
3.2. Description of support units (accessory equipment) 6
3.3. Interconnection and I/O cables 7
3.4. Measurement Uncertainty (*U*) 7
3.5. Test date 7

4 Facilities and accreditations 8
4.1. Facilities 8
4.2. Accreditations 8
4.3. List of test and measurement instruments 8

5 Test and measurements 9
5.1. Antenna requirement 9
5.2. Radiated emissions 10
5.3. AC power line Conducted emissions 20

1 Summary of test results

Requirement	CFR 47 Section	Result
Antenna Requirement	15.203	Meets the requirements
Radiated Emissions	15.209(a)	Meets the requirements
AC power line Conducted emissions	15.207(a)	Meets the requirements

2 Description of equipment under test (EUT)

Product:	WIRELESS CHARGER
Model:	BT21 WIRELESS CHARGER
Serial number:	None (prototype)

Model differences:

Model name	Difference	Tested (checked)
BT21 WIRELESS CHARGER	fully tested model that was provided by the applicant	☒

Technical data:

Power source	DC 5 V or DC 9 V
Local Oscillator or X-Tal	None
Transmit Frequency	110 kHz – 205 kHz
Antenna Type	Integral loop coil antenna
Type of Modulation	None
RF Output power	76.0 dBμV/m(PEAK) (measured @ 3m)

I/O port	Type	Q'ty	Remark
DC input	USB Type C	1	

Modification of EUT during the compliance testing: none

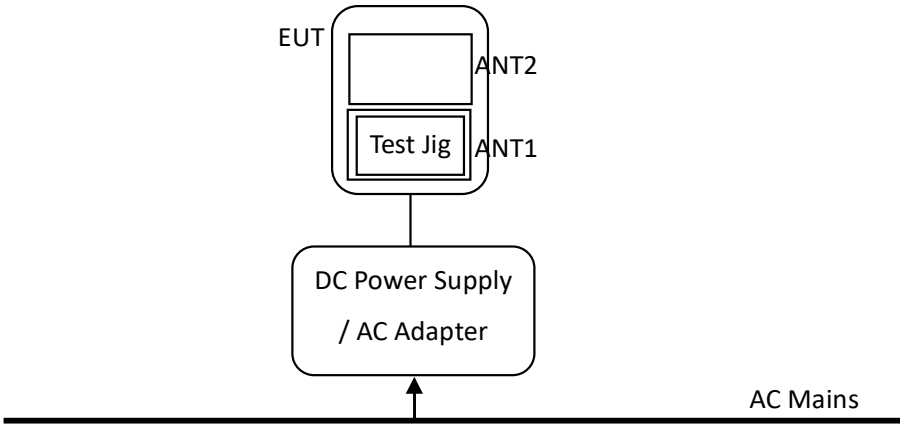
3 Test and measurement conditions

3.1. Test configuration (arrangement of EUT)

The EUT was operated from DC Power Supply (5 V or 9 V).
There are two transmit antennas (ANT1, ANT2) inside the EUT.
Depending on the position of the Client(receiver), the antenna is selected through the switching circuit (COIL-SEL1 and COIL-SEL2) and the power is transmitted to one antenna.

A Test Jig(receiver) was used for the test. The pre-test was performed for the transmitting frequency and transmitting antenna by changing the position of the Test Jig(receiver), in order to find the worst case.

After the pre-test, the final measurements were performed under the worst case; ANT (1), the axis of the EUT (Y), the frequency of the EUT (148 kHz), and the power of the Test Jig(receiver) (7.5 W/10 W).



3.2. Description of support units (accessory equipment)

The following support units or accessories were used to form a representative test configuration during the tests.

#	Equipment	Manufacturer	Model No.	Serial No.
1	DC Power Supply	HP	6633A	2838A-01000
2	Test Jig	N/A	N/A	N/A
3	AC Adapter (for EUT)	SOLUAM VINA COMPANY LIMTED	EP-TA20KWK	R37N423HZT4SE3

Note: *AC Adapter was used instead of DC Power supply for AC power line Conducted emissions.*

3.3. Interconnection and I/O cables

The following support units or accessories were used to form a representative test configuration during the tests.

#	Start		End		Cable	
	Name	I/O port	Name	I/O port	length (m)	shielded (Y/N)
1	EUT	DC Input	DC Power Supply	DC Output	2.0	N
2	EUT	-	Test Jig	-	-	-
3	DC Power Supply	AC Input	AC Mains	AC Mains	1.0	N
4	AC Adapter (for EUT)	AC Input	AC Mains	AC Mains	1.0	N

Note: *1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3.4. Measurement Uncertainty (*U*)

Measurement Item	Combined Standard Uncertainty *Uc*	Expanded Uncertainty $U = k \times Uc$ ($k = 2$)
Conducted emissions	1.4 ± dB	2.8 ± dB
Radiated emissions (9 kHz to 30 MHz)	1.45 ± dB	2.9 ± dB
Radiated emissions (30 MHz to 1000 MHz)	2.5 ± dB	5.0 ± dB

3.5. Test date

Date Tested	November 27, 2020 – December 3, 2020

4 Facilities and accreditations

4.1. Facilities

All of the measurements described in this report were performed at SK Tech Co., Ltd
Site I: 88, Geulgaeul-ro 81beon-gil, Wabu-eup, Namyangju-si, Gyeonggi-do, Korea
Site II: 124-8, Geulgaeul-ro, Wabu-eup, Namyangju-si, Gyeonggi-do, Korea

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-4. The sites comply with the Normalized Site Attenuation requirements given in ANSI C63.4, and site VSWR requirements specified in CISPR 16-1-4. The measuring apparatus and ancillary equipment conform to CISPR 16-1 series.

4.2. Accreditations

The laboratory has been also notified to FCC by RRA as a Conformity Assessment Body, and designated to perform compliance testing on equipment subject to Supplier's Declaration of Conformity (SDoC) and Certification under Parts 15 and 18 of the FCC Rules.

Designation No.	KR0007

4.3. List of test and measurement instruments

No	Description	Model	Manufacturer	Serial No.	Cal. due	Use
1	EMI Test Receiver	ESR26	Rohde&Schwarz	101441	2021.07.24	☒
2	EMI Test Receiver	ESIB40	Rohde&Schwarz	100277	2021.02.25	
3	Pre-amplifier (30 MHz - 1 GHz)	MLA-10K01-B01-27	TSJ	2005350	2021.06.08	☒
4	Pre-amplifier (1 GHz - 18 GHz)	MLA-100M18-B02-38	TSJ	1539546	2021.02.03	
5	Attenuator (6dB)	18N5W	API Technology	-	2021.07.06	☒
6	Loop Antenna	HFH2-Z2E	Rohde&Schwarz	100883	2021.12.20	☒
7	BILOG Broadband Antenna	VULB9168	Schwarzbeck	9168-230	2021.07.06	☒
8	DC Power Supply	6633A	HP	2838A-01000	2021.06.09	☒
9	Signal Generator	SMB100A	R & S	180704	2021-02-25	
10	Digital Thermo-Hygrometer	608-H1	Testo	-	2021.06.11	☒
11	EMI Test Receiver	PMM9010F	Narda	020WW40105	2021.06.08	☒
12	Pulse limiter	ESH3-Z2	Rohde&Schwarz	100604	2021.06.08	☒
13	AMN (LISN)	ENV 216	Rohde&Schwarz	102047	2021.02.03	☒
14	AMN (LISN)	FCC-LISN-50-32-2-01-480V	FCC	141455	2021.06.08	

5 Test and measurements

5.1. Antenna requirement

5.1.1 Regulation

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

5.1.2 Result: PASS

The EUT has an Internal loop antenna and meets the requirements of this section.

5.2. Radiated emissions

5.2.1 Regulation

FCC 47CFR15 - 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 (MHz)	Field strength limit (μV/m)	Field strength limit (dBμV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F (kHz) = 266.7 - 4.9	48.5 - 13.8	300
0.490 - 1.705	24000/F (kHz) = 49.0 - 14.1	33.8 - 23.0	30
1.705 - 30.0	30	29.5	30
30 - 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3

* The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector. For the frequency bands 9 - 90 kHz, 110 - 490 kHz and above 1000 MHz, the radiated emission limits are based on measurements employing an average detector.

* The lower limit shall apply at the transition frequencies.

5.2.2 Measurement Procedure

The EUT repeatedly transmitted RF signals and the following measurement procedure specified in ANSI C63.10-2013 was used

Radiated Emissions Test, 9 kHz to 30 MHz (Magnetic Field Test)

(a) The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 3 meters according to Section 15.31(f)(2).

(b) The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table.

(c) Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.

(d) To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

(e) The EUT was situated in three orthogonal planes (if appropriate).

Radiated Emissions Test, above 30 MHz

(a) The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.

(b) The EUT was placed on the top of the 0.8-meter height (or 1.5 meter height for above 1 GHz), 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.

(c) The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1000 MHz using the Bilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.

(d) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
(e) The EUT was situated in three orthogonal planes (if appropriate).

5.2.3 Calculation of the field strength limits below 30 MHz

(a) No special calculation for obtaining the field strength in dBμV/m is necessary, because the EMI receiver and the active loop antenna operate as a system, where the reading gives directly the field strength result (dBμV/m). The antenna factors and cable losses are already taken into consideration.
(b) For test distance other than what is specified, but fulfilling the requirements of section 15.31 (f) (2) the field strength is calculated by adding additionally an extrapolation factor of 40dB/decade (inverse linear distance for field strength measurements).
(c) All following emission measurements were performed using the test receiver's average, peak, and quasi-peak detector function with specified bandwidth.
(d) The basic equation is as follows;

FS= RA + DF

Where

FS = Field strength in dBμV/m

RA = Receiver Amplitude in dBμV/m

DF = Distance Extrapolation Factor in dB

Where DF = $40\log(D_{TEST} / D_{SPEC})$ where D_{TEST} = Test Distance and D_{SPEC} = Specified Distance

DF = 40log(3m/300m) = -80 dB, for frequency band: 0.009 to 0.490 MHz

DF = 40log(3m/30m) = -40 dB, for frequency band: 0.490 to 30 MHz

Measurement software: TEPTO-DV/RE_Version: 3.1.0044

5.2.4 Test Results: PASS

Table 1: Pre-test results below 30 MHz measured at 3 m distance

Transmitting antenna: ANT1

Input voltage / Output power	Axis	Transmitting Frequency (kHz)	Pol. (V/H)	Reading (dBμV)	AF (dB/m)	Cable Loss (dB)	Actual (dBμV/m)
				PK			PK
DC 5 V / 5 W	X	112	H	51.24	20.2	0.1	71.54
		128	H	51.83	20.2	0.1	72.13
		148	H	53.88	20.2	0.1	74.18
		112	V	46.18	20.2	0.1	66.48
		128	V	45.85	20.2	0.1	66.15
		148	V	47.83	20.2	0.1	68.13
	Y	112	H	51.13	20.2	0.1	71.43
		128	H	52.01	20.2	0.1	72.31
		148	H	54.20	20.2	0.1	74.50
		112	V	46.25	20.2	0.1	66.55
		128	V	47.02	20.2	0.1	67.32
		148	V	49.01	20.2	0.1	69.31
	Z	112	H	45.32	20.2	0.1	65.62
		128	H	48.31	20.2	0.1	68.61
		148	H	50.20	20.2	0.1	70.50
		112	V	36.33	20.2	0.1	56.63
		128	V	40.85	20.2	0.1	61.15
		148	V	42.52	20.2	0.1	62.82
DC 5 V / 7.5 W	X	112	H	52.21	20.2	0.1	72.51
		128	H	52.74	20.2	0.1	73.04
		148	H	54.68	20.2	0.1	74.98
		112	V	47.40	20.2	0.1	67.70
		128	V	46.86	20.2	0.1	67.16
		148	V	48.56	20.2	0.1	68.86
	Y	112	H	51.85	20.2	0.1	72.15
		128	H	52.84	20.2	0.1	73.14
		148	H	55.26	20.2	0.1	**75.56**
		112	V	47.45	20.2	0.1	67.75
		128	V	47.86	20.2	0.1	68.16
		148	V	50.05	20.2	0.1	70.35
	Z	112	H	46.15	20.2	0.1	66.45
		128	H	49.07	20.2	0.1	69.37
		148	H	51.06	20.2	0.1	71.36
		112	V	37.18	20.2	0.1	57.48
		128	V	42.06	20.2	0.1	62.36
		148	V	44.02	20.2	0.1	64.32
DC 9 V / 10 W	X	112	H	53.09	20.2	0.1	73.39
		128	H	53.63	20.2	0.1	73.93
		148	H	55.31	20.2	0.1	75.61
		112	V	48.34	20.2	0.1	68.64
		128	V	48.04	20.2	0.1	68.34
		148	V	49.65	20.2	0.1	69.95
	Y	112	H	52.85	20.2	0.1	73.15
		128	H	53.78	20.2	0.1	74.08
		148	H	55.99	20.2	0.1	**76.29**
		112	V	48.49	20.2	0.1	68.79
		128	V	48.85	20.2	0.1	69.15
		148	V	51.49	20.2	0.1	71.79
	Z	112	H	46.89	20.2	0.1	67.19
		128	H	49.95	20.2	0.1	70.25
		148	H	52.04	20.2	0.1	72.34
		112	V	38.56	20.2	0.1	58.86
		128	V	43.40	20.2	0.1	63.70
		148	V	45.06	20.2	0.1	65.36

Transmitting antenna: ANT2

Input voltage / Output power	Axis	Transmitting Frequency (kHz)	Pol. (V/H)	Reading (dBμV)	AF (dB/m)	Cable Loss (dB)	Actual (dBμV/m)
				PK			PK
DC 5 V / 5 W	X	112	H	50.03	20.2	0.1	70.33
		128	H	49.76	20.2	0.1	70.06
		148	H	50.81	20.2	0.1	71.11
		112	V	43.47	20.2	0.1	63.77
		128	V	43.21	20.2	0.1	63.51
		148	V	45.21	20.2	0.1	65.51
	Y	112	H	50.16	20.2	0.1	70.46
		128	H	49.60	20.2	0.1	69.90
		148	H	51.49	20.2	0.1	71.79
		112	V	44.15	20.2	0.1	64.45
		128	V	45.06	20.2	0.1	65.36
		148	V	46.97	20.2	0.1	67.27
	Z	112	H	44.26	20.2	0.1	64.56
		128	H	45.53	20.2	0.1	65.83
		148	H	47.63	20.2	0.1	67.93
		112	V	33.43	20.2	0.1	53.73
		128	V	37.72	20.2	0.1	58.02
		148	V	38.30	20.2	0.1	58.60
DC 5 V / 7.5 W	X	112	H	51.30	20.2	0.1	71.60
		128	H	51.29	20.2	0.1	71.59
		148	H	51.30	20.2	0.1	71.60
		112	V	45.76	20.2	0.1	66.06
		128	V	44.74	20.2	0.1	65.04
		148	V	45.91	20.2	0.1	66.21
	Y	112	H	49.54	20.2	0.1	69.84
		128	H	50.29	20.2	0.1	70.59
		148	H	52.21	20.2	0.1	**72.51**
		112	V	46.18	20.2	0.1	66.48
		128	V	45.73	20.2	0.1	66.03
		148	V	47.78	20.2	0.1	68.08
	Z	112	H	44.89	20.2	0.1	65.19
		128	H	46.25	20.2	0.1	66.55
		148	H	49.55	20.2	0.1	69.85
		112	V	34.87	20.2	0.1	55.17
		128	V	39.47	20.2	0.1	59.77
		148	V	40.24	20.2	0.1	60.54
DC 9 V / 10 W	X	112	H	50.51	20.2	0.1	70.81
		128	H	51.61	20.2	0.1	71.91
		148	H	52.85	20.2	0.1	73.15
		112	V	46.31	20.2	0.1	66.61
		128	V	46.92	20.2	0.1	67.22
		148	V	47.89	20.2	0.1	68.19
	Y	112	H	49.95	20.2	0.1	70.25
		128	H	51.59	20.2	0.1	71.89
		148	H	52.36	20.2	0.1	**72.66**
		112	V	44.69	20.2	0.1	64.99
		128	V	46.90	20.2	0.1	67.20
		148	V	49.07	20.2	0.1	69.37
	Z	112	H	44.38	20.2	0.1	64.68
		128	H	47.57	20.2	0.1	67.87
		148	H	50.83	20.2	0.1	71.13
		112	V	36.70	20.2	0.1	57.00
		128	V	41.15	20.2	0.1	61.45
		148	V	43.59	20.2	0.1	63.89

V/H: Vertical / Horizontal polarization

Actual (dBμV/m) = Reading + AF + Cable Loss

Table 2: Final measured results (below 30 MHz)

(Input voltage: DC 5 V, Output power: 7.5 W, Axis: Y-axis, Operating frequency: 148 kHz)

Freq. (kHz)	RBW (kHz)	Pol. (V/H)	Reading (dBµV)			AF (dB/m)	Cable Loss (dB)	Actual (dBµV/m)			Limit (at 3m) (dBµV/m)			Margin (dB)		
			PK	AV	QP			PK	AV	QP	PK	AV	QP	PK	AV	QP
148	0.2	H	55.4	55.2	-	20.2	0.1	75.7	75.5	-	124.2	104.2	-	48.5	28.7	-
296	9	H	26.9	26.7	-	20.1	0.1	47.1	46.9	-	118.2	98.2	-	71.1	51.3	-
443	9	H	23.5	23.2	-	20.1	0.1	43.7	43.4	-	114.7	94.7	-	71.0	51.3	-
14041	9	V	-	-	14.8	20.6	0.5	-	-	35.9	-	-	69.5	-	-	33.6

(Input voltage: DC 9 V, Output power: 10 W, Axis: Y-axis, Operating frequency: 148 kHz)

Freq. (kHz)	RBW (kHz)	Pol. (V/H)	Reading (dBµV)			AF (dB/m)	Cable Loss (dB)	Actual (dBµV/m)			Limit (at 3m) (dBµV/m)			Margin (dB)		
			PK	AV	QP			PK	AV	QP	PK	AV	QP	PK	AV	QP
148	0.2	H	55.7	55.5	-	20.2	0.1	76.0	75.8	-	124.2	104.2	-	48.2	28.4	-
296	9	H	28.5	28.3	-	20.1	0.1	48.7	48.5	-	118.2	98.2	-	69.5	49.7	-
444	9	H	25.2	24.9	-	20.1	0.1	45.4	45.1	-	114.7	94.7	-	69.3	49.6	-
13947	9	V	-	-	18.2	20.6	0.5	-	-	39.3	-	-	69.5	-	-	30.2

V/H: Vertical / Horizontal polarization

Actual (dBµV/m) = Reading + AF + Cable Loss

Margin (dB) = Limit – Actual

Note: These test results were measured at the 3 m distance.

Table 3: Final measured results (above 30 MHz)

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

(Input voltage: DC 5 V, Output power: 7.5 W, Axis: Y-axis, Operating frequency: 148 kHz)

Frequency (MHz)	RBW (kHz)	Pol. (V/H)	Height (m)	Reading (dBμV)	AMP (dB)	AF (dB/m)	CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
43.973	120	V	1.00	40.2	30.6	19.7	0.9	30.2	40.0	9.8
74.625	120	H	2.00	42.1	30.4	16.4	1.2	29.3	40.0	10.7
94.968	120	H	4.00	43.3	30.3	14.2	1.3	28.5	43.5	15.0
283.173	120	H	1.00	37.7	30.0	18.8	2.3	28.8	46.0	17.2
394.944	120	H	1.00	35.7	30.2	21.5	2.7	29.7	46.0	16.3

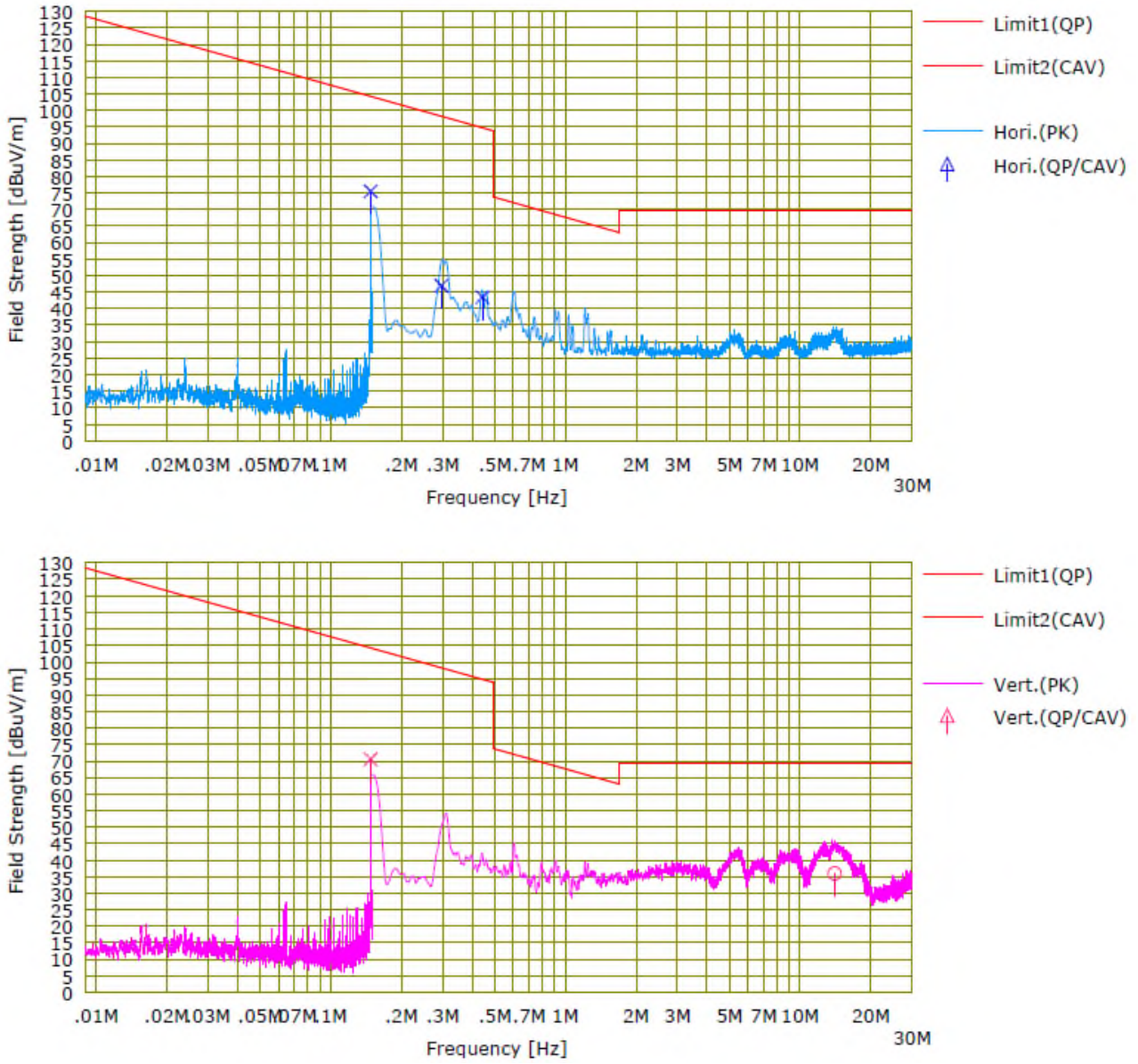
(Input voltage: DC 9 V, Output power: 10 W, Axis: Y-axis, Operating frequency: 148 kHz)

Frequency (MHz)	RBW (kHz)	Pol. (V/H)	Height (m)	Reading (dBμV)	AMP (dB)	AF (dB/m)	CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
44.163	120	V	2.00	38.3	30.6	19.7	0.9	28.3	40.0	11.7
74.426	120	H	4.00	42.5	30.4	16.5	1.2	29.8	40.0	10.2
87.136	120	H	3.00	43.4	30.3	14.1	1.3	28.5	40.0	11.5
157.952	120	H	2.00	37.3	30.0	18.9	1.7	27.9	43.5	15.6
397.410	120	H	1.00	35.7	30.2	21.5	2.7	29.7	46.0	16.3

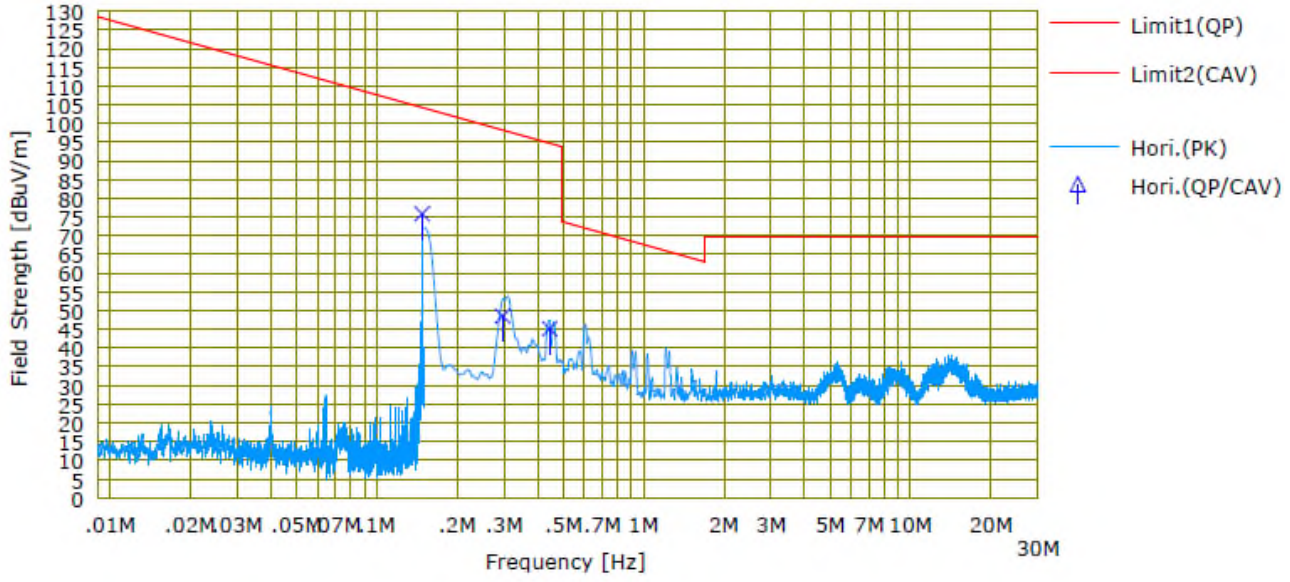
V/H: Vertical / Horizontal polarization
AMP, AF and CL: pre-amplifier gain, antenna factor and cable loss including an attenuator/filter if used
Actual = Reading - AMP + AF + CL
Margin = Limit - Actual

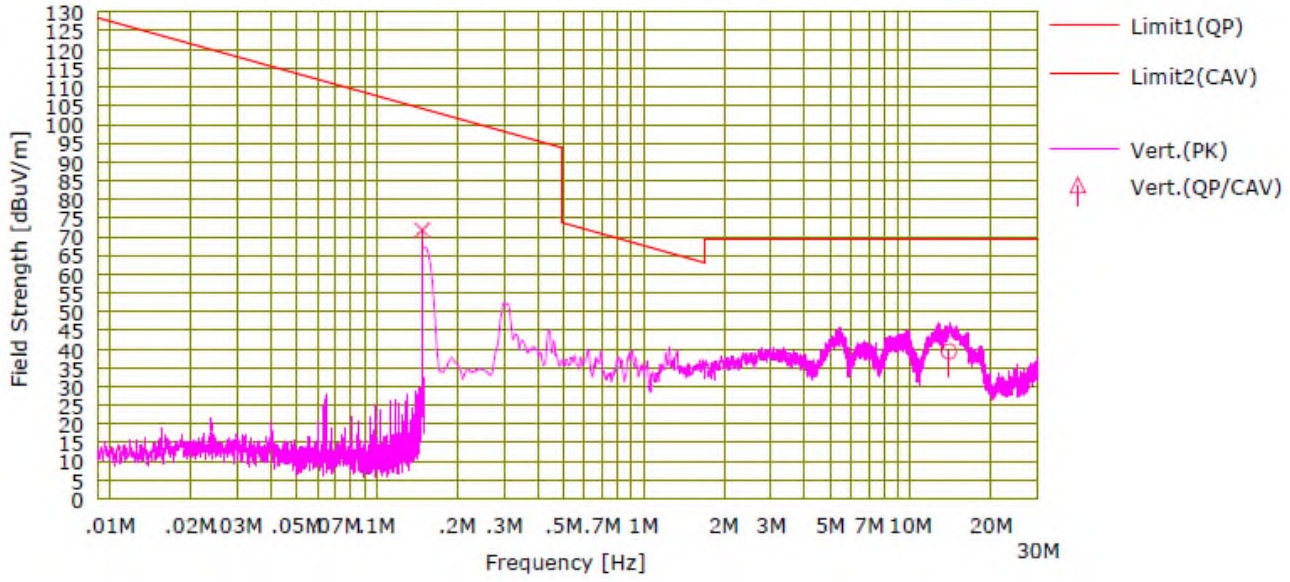
Figure 1. Emission plot for the preliminary radiated measurements
The worst-case plots were attached.

Measurement frequency range: 9 kHz ~ 30 MHz
(Input voltage: DC 5 V, Output power: 7.5 W, Axis: Y-axis, Operating frequency: 148 kHz)

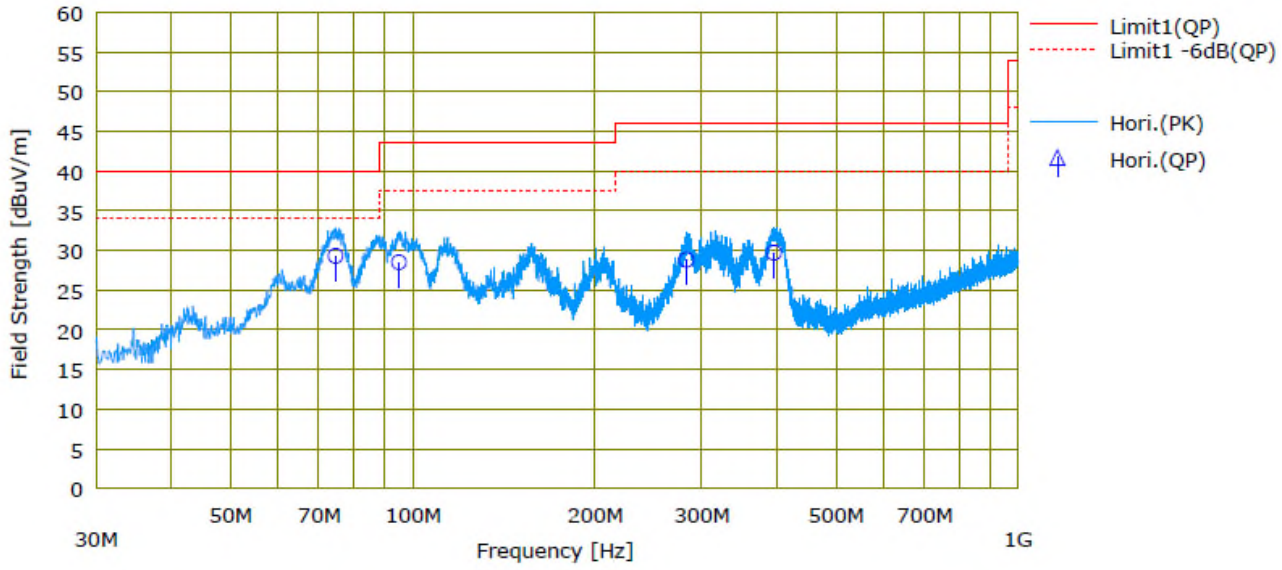


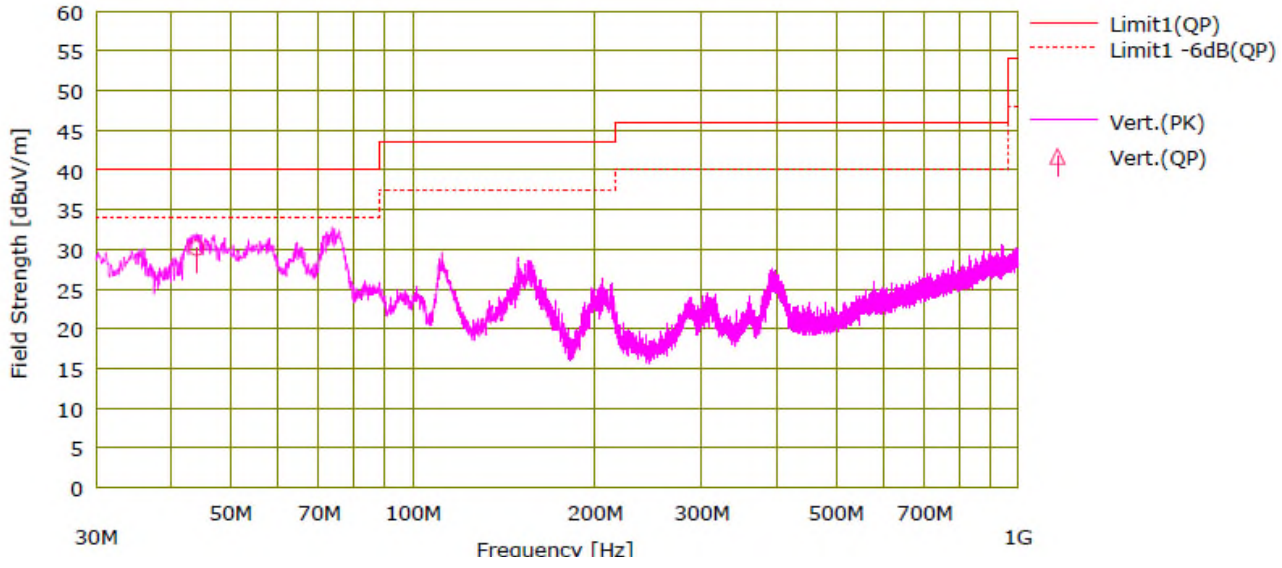
Measurement frequency range: 9 kHz ~ 30 MHz
(Input voltage: DC 9 V, Output power: 10 W, Axis: Y-axis, Operating frequency: 148 kHz)



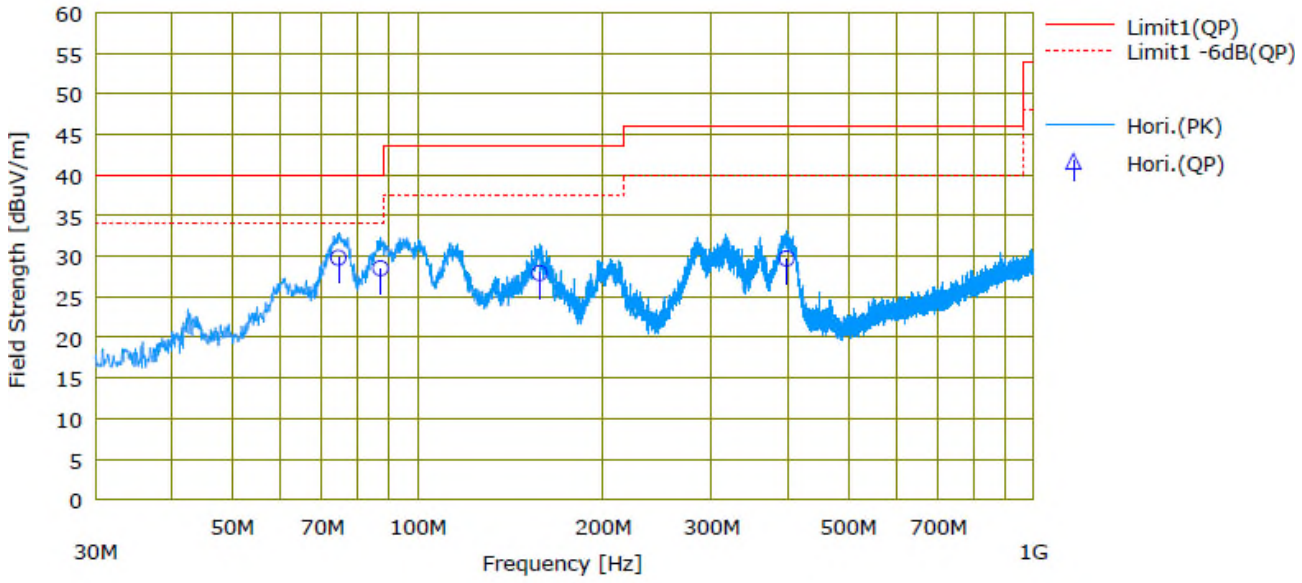


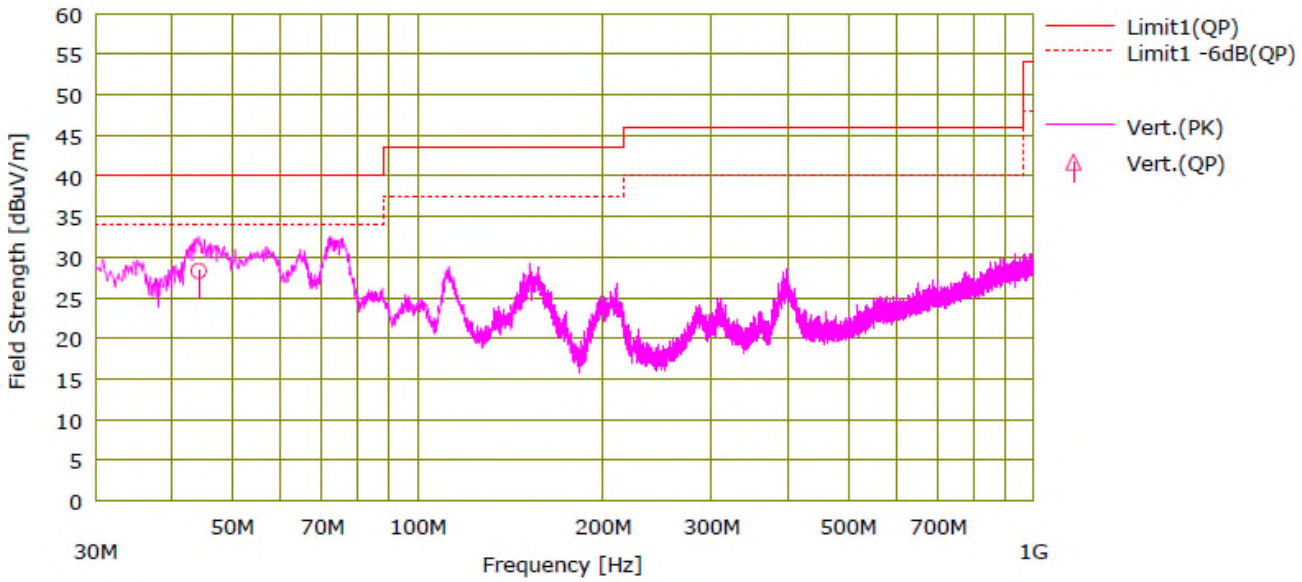
Measurement frequency range: 30 MHz ~ 1 GHz
(Input voltage: DC 5 V, Output power: 7.5 W, Axis: Y-axis, Operating frequency: 148 kHz)





Measurement frequency range: 30 MHz ~ 1 GHz
(Input voltage: DC 9 V, Output power: 10 W, Axis: Y-axis, Operating frequency: 148 kHz)





5.3. AC power line Conducted emissions

5.3.1 Regulation

FCC 47CFR15 – 15.207(a)

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 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

5.3.2 Test Procedure

1. The EUT and supporting equipment including all I/O cables were set up as per the test configuration to simulate typical usage. If the EUT is a table top system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane. If the EUT is a floor standing equipment, it is placed on the ground plane, which has about 10 mm non-conductive covering to insulate the EUT from the ground plane.
2. Each current-carrying conductor of the EUT power cord(s), except the ground (safety) conductor(s) was individually connected through a 50 Ω/50 μH line impedance stabilization network (LISN) to the input power mains. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to peak mode, quasi-peak mode and average mode within a bandwidth of 9 kHz.

Measurement software: PMM Emission Suite_Version: 2.31

5.3.3 Test Results: **PASS**

Table 4: Measured values of the Conducted Emissions – (Input voltage: DC 5 V, Output power: 7.5 W, Operating frequency: 148 kHz)

Frequency (MHz)	Line (L/N)	CF (dB)	CL (dB)	Actual (dBμV)		Limit (dBμV)		Margin (dB)	
				QP	AV	QP	AV	QP	AV
0.3831	L	9.63	9.94	45.44	41.47	58.21	48.21	12.77	6.74
0.4670	L	9.63	9.94	46.14	35.62	56.57	46.57	10.43	10.95
0.4772	N	9.65	9.94	45.19	34.79	56.39	46.39	11.20	11.60
0.8964	L	9.64	9.96	47.06	43.02	56.00	46.00	8.94	2.98
1.4097	L	9.64	9.97	47.94	43.50	56.00	46.00	8.06	2.50
1.9189	L	9.65	9.99	47.06	42.46	56.00	46.00	8.94	3.54
3.2052	L	9.65	10.03	47.13	42.30	56.00	46.00	8.87	3.70
3.7144	L	9.66	10.04	47.60	42.79	56.00	46.00	8.40	3.21
4.2257	L	9.66	10.06	47.04	41.68	56.00	46.00	8.96	4.32
6.0212	N	9.70	10.10	45.71	40.15	60.00	50.00	14.29	9.85
6.5386	L	9.69	10.11	46.66	41.25	60.00	50.00	13.34	8.75
13.0662	N	9.76	10.22	46.27	37.89	60.00	50.00	13.73	12.11
13.0703	L	9.72	10.22	46.18	38.58	60.00	50.00	13.82	11.42
13.5836	N	9.76	10.23	46.18	37.31	60.00	50.00	13.82	12.69

Note: *1) L/N: Line / Neutral*
2) CF and CL: correction factor (LISN) and cable loss including the insertion loss of Pulse Limiter
3) Actual = Final measured values after containing CF and CL
4) Margin = Limit - Actual

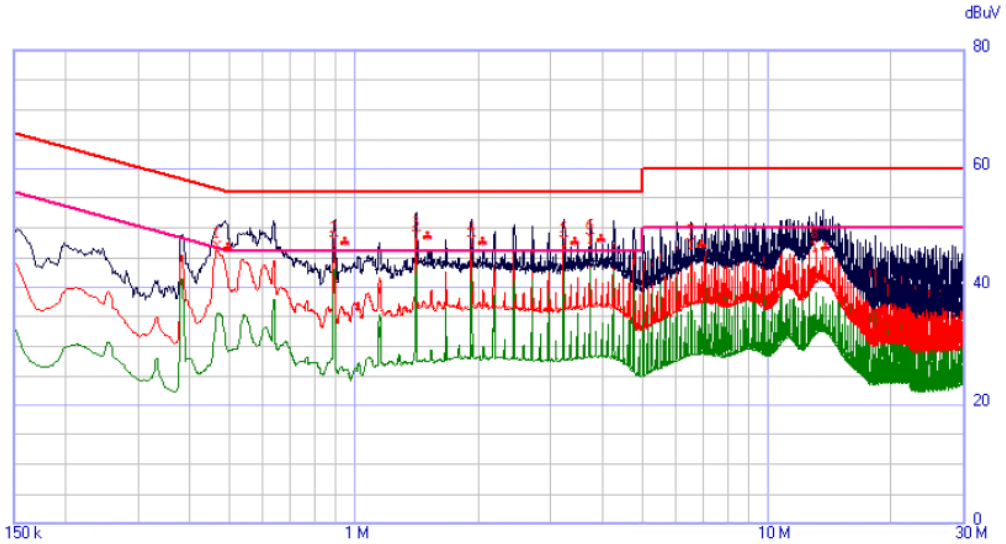
5.3.3 Test Results: **PASS**

Table 5: Measured values of the Conducted Emissions – (Input voltage: DC 9 V, Output power: 10 W, Operating frequency: 148 kHz)

Frequency (MHz)	Line (L/N)	CF (dB)	CL (dB)	Actual (dBμV)		Limit (dBμV)		Margin (dB)	
				QP	AV	QP	AV	QP	AV
0.3750	L	9.63	9.94	45.66	38.97	58.39	48.39	12.73	9.42
0.6244	L	9.63	9.94	43.95	38.36	56.00	46.00	12.05	7.64
4.1275	L	9.66	10.05	45.43	39.64	56.00	46.00	10.57	6.36
4.3750	N	9.68	10.06	44.84	39.47	56.00	46.00	11.16	6.53
7.3811	L	9.69	10.12	47.37	41.70	60.00	50.00	12.63	8.30
8.8801	L	9.70	10.15	47.60	41.66	60.00	50.00	12.40	8.34
9.1255	N	9.73	10.15	47.12	40.90	60.00	50.00	12.88	9.10
9.1316	L	9.70	10.15	47.70	41.64	60.00	50.00	12.30	8.36
9.3791	L	9.71	10.16	47.60	41.52	60.00	50.00	12.40	8.48
9.6286	L	9.71	10.16	47.39	41.09	60.00	50.00	12.61	8.91
10.6306	N	9.74	10.18	46.99	40.28	60.00	50.00	13.01	9.72
10.8781	N	9.75	10.18	47.32	40.24	60.00	50.00	12.68	9.76
11.1296	N	9.75	10.19	47.71	40.53	60.00	50.00	12.29	9.47
11.3791	N	9.75	10.19	47.50	40.28	60.00	50.00	12.50	9.72
11.3832	L	9.72	10.19	47.63	40.77	60.00	50.00	12.37	9.23
11.6265	L	9.72	10.20	47.40	40.09	60.00	50.00	12.60	9.91
13.3812	N	9.76	10.22	47.35	38.97	60.00	50.00	12.65	11.03

Note: *1) L/N: Line / Neutral*
2) CF and CL: correction factor (LISN) and cable loss including the insertion loss of Pulse Limiter
3) Actual = Final measured values after containing CF and CL
4) Margin = Limit - Actual

Figure 2. Plot of the Conducted Emissions
(Input voltage: DC 5 V, Output power: 7.5 W, Operating frequency: 148 kHz)
Line – PE



SKTEU20-1269_FCC-Mode 2_L_000

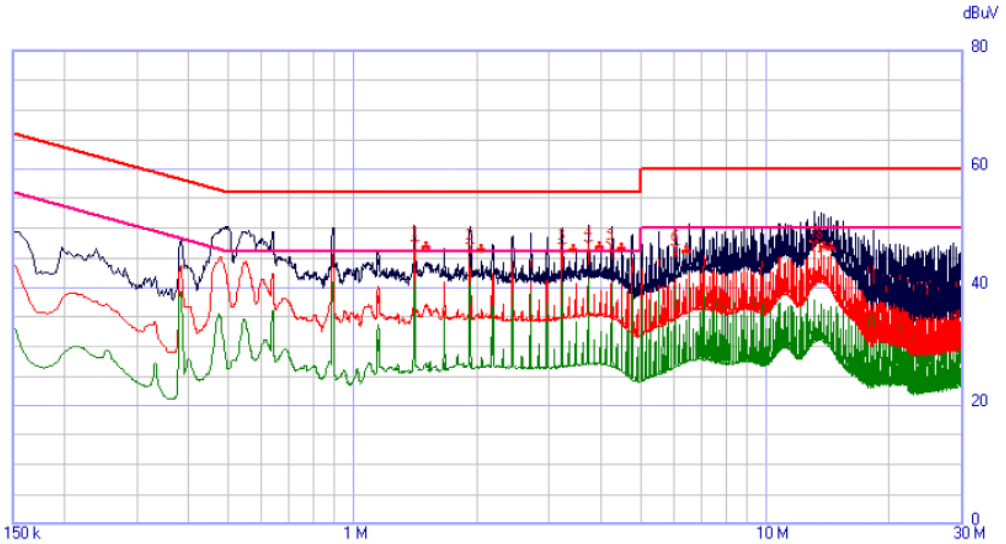
	Start [MHz]	Stop [MHz]	Step	Detector	Hold Time	RBW	Min Att	Pre Amp	Pre Sel	Prompt start	Ancillary
1	0.15	30	AUTO (2.045 kHz)	P Q C 32_QP_B 32_CAV_B	1500 ms	9 kHz	10	OFF	ON	...	...

Ancillary = General
Nr. of Worst = 3
Limits:
32_QP_B
32_CAV_B

Factors:
ENV 216_L_2020.02.03
CL_Pule Limiter_2020.06.08

Peak
QPeak
C-Avg

Neutral – PE



SKTEU20-1269_FCC-Mode 2_N_000

	Start [MHz]	Stop [MHz]	Step	Detector	Hold Time	RBW	Min Att	Pre Amp	Pre Sel	Prompt start	Ancillary
1	0.15	30	AUTO (2.045 kHz)	P Q C 32_QP_B 32_CAV_B	1500 ms	9 kHz	10	OFF	ON	...	...

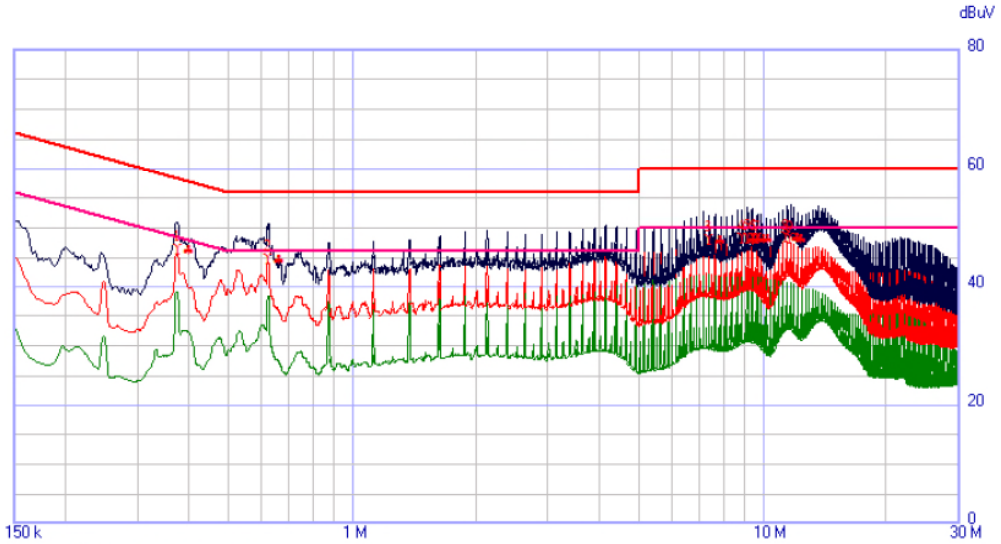
Ancillary = General
Nr. of Worst = 3
Limits:
32_QP_B
32_CAV_B

Factors:
ENV 216_L_2020.02.03
CL_Pule Limiter_2020.06.08

Peak
QPeak
C-Avg

(Input voltage: DC 9 V, Output power: 10 W, Operating frequency: 148 kHz)

Line – PE



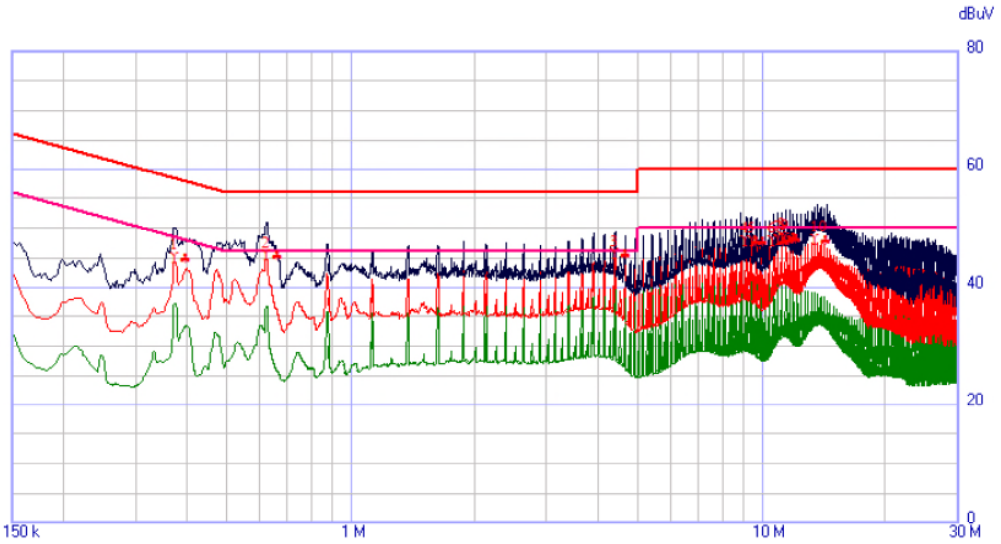
	Start [MHz]	Stop [MHz]	Step	Detector	Hold Time	RBW	Min Att	Pre Amp	Pre Sel	Prompt start	Ancillary
1	0.15	30	AUTO (2.045 kHz)	P Q C 32_QP_B 32_CAV_B	1500 ms	9 kHz	10	OFF	ON	...	...

Ancillary = General
Nr. of Worst = 3
Limits:
32_QP_B
32_CAV_B

Factors:
ENV 216_L_2020.02.03
CL_Pule Limiter_2020.06.08

Peak
QPeak
C-Avg

Neutral – PE



	Start [MHz]	Stop [MHz]	Step	Detector	Hold Time	RBW	Min Att	Pre Amp	Pre Sel	Prompt start	Ancillary
1	0.15	30	AUTO (2.045 kHz)	P Q C 32_QP_B 32_CAV_B	1500 ms	9 kHz	10	OFF	ON	...	...

Ancillary = General
Nr. of Worst = 3
Limits:
32_QP_B
32_CAV_B

Factors:
ENV 216_L_2020.02.03
CL_Pule Limiter_2020.06.08

Peak
QPeak
C-Avg