RF TEST REPORT

Test Equipment	:	Emergency Stop Receiver
Model Name	:	QWI046
Product Code	:	300611-03034
FCC ID	:	2BHL8-QWI046
IC	:	32779-QWI046
Date of receipt	:	2024-09-20
Test duration	:	2024-09-30 ~ 2024-11-08
Date of issue	:	2024-11-21

Applicant : DAS Co., Ltd

61, Jipyeongseonsandan 3-gil, Gimje-si, Jeollabuk-do, Korea

Test Laboratory : Lab-T, Inc.

2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si
Gyeonggi-do, 17036, Korea

Test specification	:	FCC Part 15 Subpart C 15.249 RSS-210 Issue 10 A1(2020-04) RSS-GEN Issue 5 A2(2021-02)
Test result	:	Pass

The above equipment was tested by Lab-T Testing Laboratory for compliance with the requirements of FCC,IC Rules and Regulations.
The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose.
This test report shall not be reproduced except in full, without the written approval of Lab-T, Inc
This test report is not related to KOLAS.

Tested by:

Engineer
HyunWoo Lee

Reviewed by:

Technical Manager
SangHoon Yu

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1. Revision history

Test Report No.	Date	Description
TRRFCC24-0017	2024-11-05	Initial issue
TRRFCC24-0017(1)	2024-11-08	20 dB Channel Bandwidth Corrected
TRRFCC24-0017(2)	2024-11-21	Product Code Added

2. Information

2.1 Applicant Information

Applicant name	DAS Co., Ltd
Address	61, Jipyeongseonsandan 3-gil, Gimje-si, Jeollabuk-do, Korea
Telephone No.	+82-63-548-9420
Person in charge	Doosik Joo / rnd3@das-co.com
Manufacturer	DAS Co., Ltd
Address	61, Jipyeongseonsandan 3-gil, Gimje-si, Jeollabuk-do, Korea

2.2 Test Laboratory information

Corporate name	Lab-T, Inc.
Representative	Duke (Jongyoung) Kim
Address	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Telephone	+82-31-322-6767
Fax	+82-31-322-6768
E-mail	info@lab-t.net
FCC Designation No.	KR0159

2.3 Test Site

Test Site	used	Address
Building L	☒	2182-40 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Building T	☒	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Building A	☐	2182-44 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)

3. Information About Test Equipment

3.1 Equipment Information

Equipment type	Emergency Stop Receiver
Model name	QWI046
Variant model name	-
Frequency range	921.1 MHz
Modulation type	FSK
Power supply	DC 24 V
H/W version	1.0
S/W version	1.0

Note 1 : The above EUT information was declared by the manufacturer.

3.2 Antenna Information

Type	Model No.	Gain	Note
Dipole Antenna	WE17-LR-05A	1.378 dBi	-

3.3 Test Frequency

Test mode	Test frequency (MHz)
FSK	921.1

3.4 Tested Companion Device Information

Type	Manufacturer	Model	Note
-	-	-	-

3.5 Operating conditions for the EUT

Firmware state		N/A
Test software name(version)		SmartRF Studio 7 (2.28.0)
Test power setting		-5
Serial number (Setup mode)	EUT #1	#1

4. Test Report

4.1 Summary

FCC Part 15 & RSS-GEN Issue 5 A2 & RSS-210 Issue 10 A1				
FCC Rule	IC Rule	Parameter	Clause	Status
Transmitter Requirements				
15.203	-	Antenna Requirement	4.3.1	C
15.215	-	20 dB Channel Bandwidth	4.3.2	C
-	RSS-GEN 6.7	Occupied Bandwidth	4.3.2	C
15.249(a) 15.249(d) 15.205(a) 15.209(a)	RSS-210 B.10(a) RSS-210 B.10(b) RSS-GEN 8.9 RSS-GEN 8.10	Field Strength of Emissions Spurious Emission, Band Edge and Restricted bands	4.3.3	C
15.207(a)	RSS-GEN 8.8	Conducted Emissions	4.3.4	N/A note2
NOTE 1 : C = Comply N/C = Not Comply N/T = Not Tested N/A = Not Applicable NOTE 2 : This device only uses DC power.				

* The general test methods used to test this device is ANSI C63.10:2020

4.2 Measurement Uncertainty

Mesurement items	Expanded Uncertainty	
Occupied Channel Bandwidth	6.95 kHz	(The confidence level is about 95 %, *k*=2)
Conducted Spurious Emissions	0.47 dB	(The confidence level is about 95 %, *k*=2)
Radiated Spurious Emissions (1 GHz under)	4.78 dB	(The confidence level is about 95 %, *k*=2)
Radiated Spurious Emissions (Above 1 GHz)	5.96 dB	(The confidence level is about 95 %, *k*=2)

4.3 Transmitter Requirements

4.3.1 Antenna Requirement

4.3.1.1 Regulation

Accoding to §15.203 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.

4.3.1.2 Result

Comply
(The antenna of this EUT is Dipole Antenna Type. Please refer to the external photo. Therefore this EUT Complies with the requirement of §15.203)

4.3.2 20 dB Bandwidth and Occupied Bandwidth

4.3.2.1 Regulation

Accoding to §15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

According to RSS-210 A.1.3 The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

4.3.2.2 Measurement Procedure

ANSI C63.10 § 6.9.2 Occupied bandwidth 20dB Relative procedure
ANSI C63.10 § 6.9.3 Occupied bandwidth 99% procedure

4.3.2.3 Result

Comply (measurement data : refer to the next page)

4.3.2.4 Measurement data

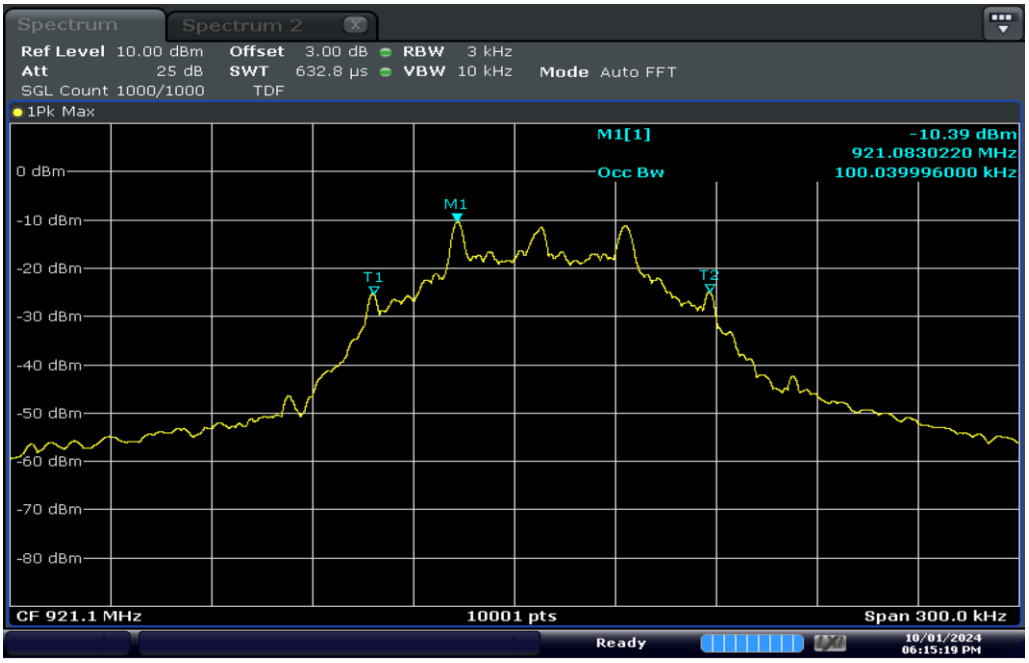
Test mode : FSK

Frequency (MHz)	20 dB Bandwidth (kHz)	Occupied Bandwidth (99 % Bandwidth)(kHz)
921.1	102.71	100.03

4.3.2.5 Test Plot

FSK(20 dB Bandwidth)

FSK(99% Occupied Bandwidth)



4.3.3 Spurious Emission, Band Edge, and Restricted bands

4.3.3.1 Regulation

According to §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:

According to RSS-210 B.10(a) The field strength of fundamental and harmonic emissions measured at 3 m shall not exceed the limits in table.

Fundamental Frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
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	2500

(1) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05-24.25 GHz band subject to the following conditions:

(i) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.

(2) Field strength limits are specified at a distance of 3 meters.

(3) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

(4) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

(5) Emissions radiated outside of the specified frequency bands, except for harmonicemissions, shall be attenuated by at least 50 dB below the level of the fundamentalemissions or to the general field strength limits listed in RSS-Gen, whichever is lessstringent.

According to §15.209(a) and RSS-GEN 8.9 Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall notexceed the field strength levels specified in the following table:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	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 shallnot 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., §§15.231 and 15.241.

According to §15.205(a),(b) only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 – 4 400	Above 38.6
13.36 - 13.41			

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurement

According to §RSS-GEN 8.10 Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.

MHz	MHz	MHz	GHz
0.009 - 0.110	13.36 - 13.41	960 – 1 427	9.0 - 9.2
0.495 - 0.505	16.42 - 16.423	1 435 – 1 626.5	9.3 - 9.5
2.173 5 - 2.190 5	16.694 75 - 16.695 25	1 645.5 – 1 646.5	10.6 - 12.7
4.125 - 4.128	16.804 25 - 16.804 75	1 660 – 1 710	13.25 - 13.4
3.020 -3.026	25.5 - 25.67	1 718.8 – 1 722.2	14.47 - 14.5
4.177 25 - 4.177 75	37.5 - 38.25	2 200 – 2 300	15.35 - 16.2
4.207 25 - 4.207 75	73 - 74.6	2 310 – 2 390	17.7 - 21.4
5.677 - 5.683	74.8 - 75.2	2 483.5 – 2 500	22.01 - 23.12
6.215 - 6.218	108 - 138	2 655 – 2 900	23.6 - 24.0
6.267 75 - 6.268 25	149.9 - 150.05	3 260 – 3 267	31.2 - 31.8
6.311 75 - 6.312 25	156.524 75 - 156.525 25	3 332 – 3 339	36.43 - 36.5
8.291 - 8.294	156.7 - 156.9	3 345.8 – 3 358	Above 38.6
8.362 - 8.366	162.012 5 - 167.17	3 500 – 4 400	
8.376 25 - 8.386 75	167.72 - 173.2	4 500 - 5 150	
8.414 25 - 8.414 75	240 - 285	5 350 - 5 460	
12.29 - 12.293	322 - 335.4	7 250 - 7 750	
12.519 75 - 12.520 25	399.9 - 410	8 025 - 8 500	
12.576 75 - 12.577 25	608 - 614		

4.3.3.2 Measurement Procedure

1) The preliminary and final radiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 meters.
2) The EUT was placed on the top of the 0.8 m height or 1.5 m non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3) The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1 000 MHz using the TRILOG broadband antenna, and from 1 000 MHz to 26 500 MHz using the horn antenna.
4) 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.

NOTE1 : The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
NOTE2 : The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
NOTE3 : The 0.8 m height is for below 1 GHz testing, and 1.5 m is for above 1 GHz testing

4.3.3.3 Note

- Below 1GHz

Note 1 : “F” : Fundamental, “S” : Spurious
Note 2 : Loss : Cable loss - Amp gain
Note 3 : Result : Reading + Ant Factor + Loss
Note 4 : Measured distance : 3 m

- Above 1GHz

Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor
Note 2 : Peak Result : Reading + Factor
Note 3 : Measured distance : 1 m, Distance Factor = 20log(1 / 3) = -9.54

4.3.3.4 Result

Comply (measurement data : refer to the next page)

4.3.3.5 Measurement data_Radiated Spurious Emissions

Test mode : Below 1 GHz (FSK)

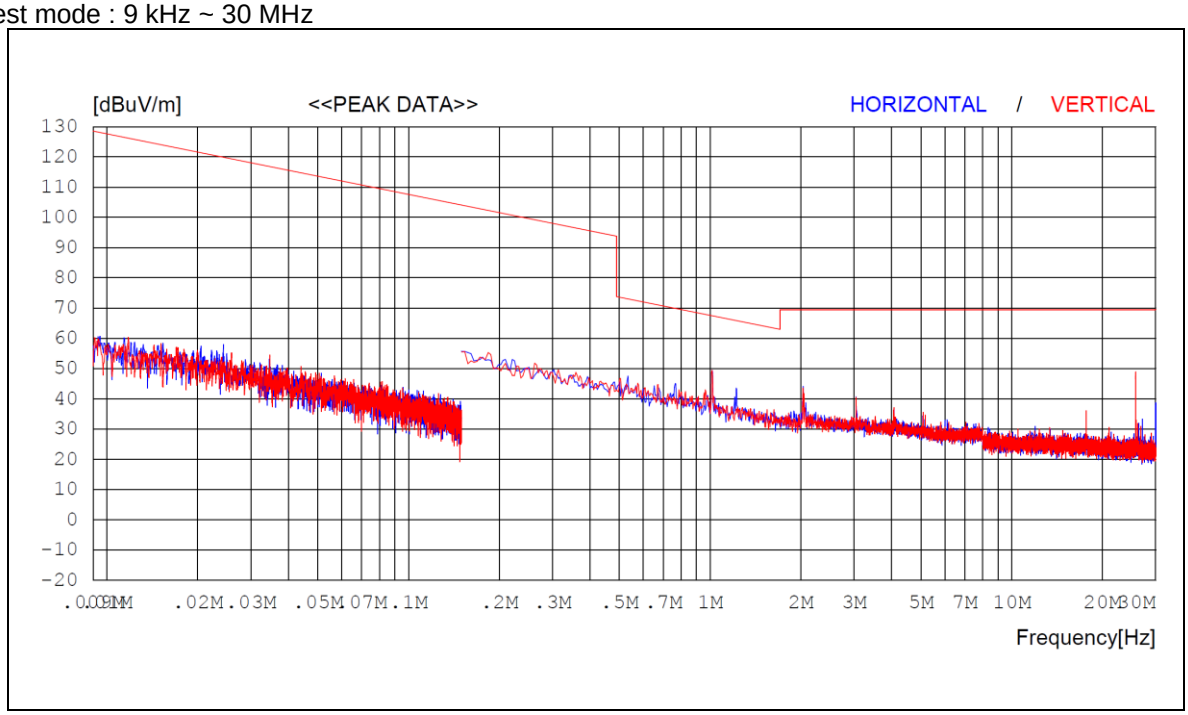
Frequency (MHz)	Detector	Note1	Pol. (V/H)	Reading (dBμV)	Ant Factor (dB)	Loss (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
921.10	QP	F	H	87.60	3.50	0.00	91.10	94.00	2.90
921.10	QP	F	V	80.10	3.50	0.00	83.60	94.00	10.40
268.01	QP	S	H	45.50	18.30	-27.20	36.60	46.00	9.40
268.61	QP	S	V	38.40	18.30	-27.20	29.50	46.00	16.50
305.35	QP	S	H	33.80	19.50	-27.00	26.30	46.00	19.70

Test mode : Above 1 GHz (FSK)

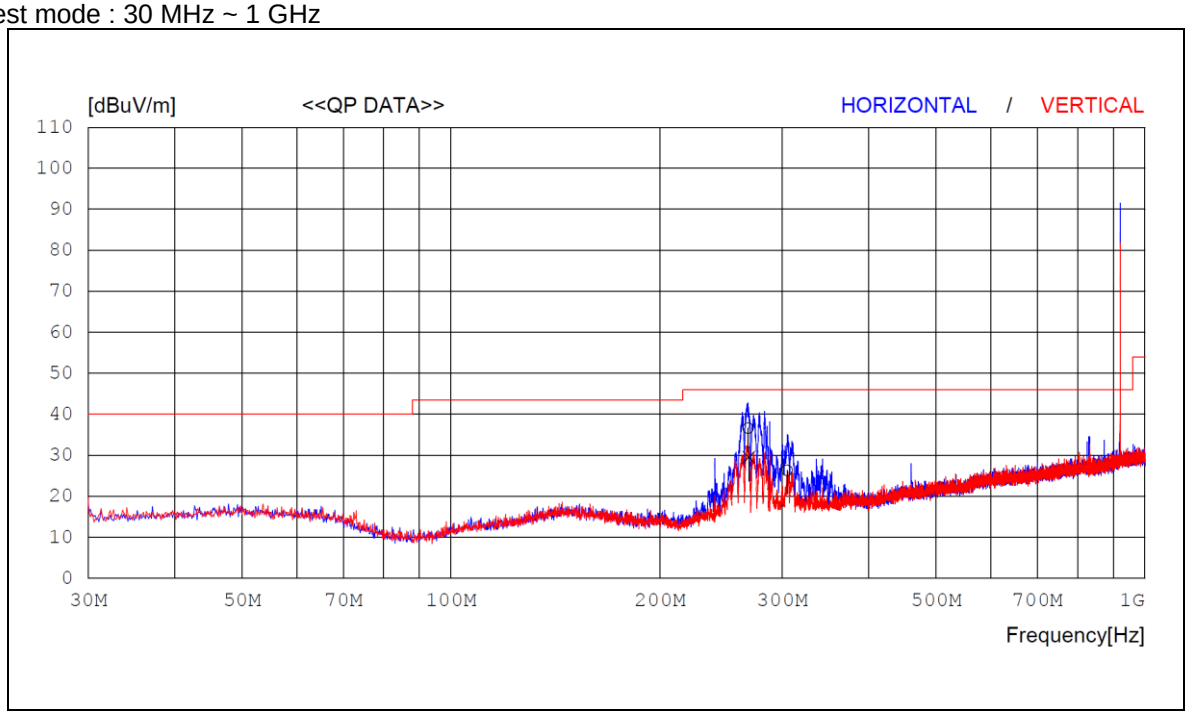
Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 841.08	PK	H	57.70	-6.74	50.96	74.00	23.04
	AV	H	43.50	-6.74	36.76	54.00	17.24
1 841.11	PK	V	61.10	-6.74	54.36	74.00	19.64
	AV	V	45.20	-6.74	38.46	54.00	15.54

4.3.3.6 Measurement Plot_Radiated Spurious Emissions

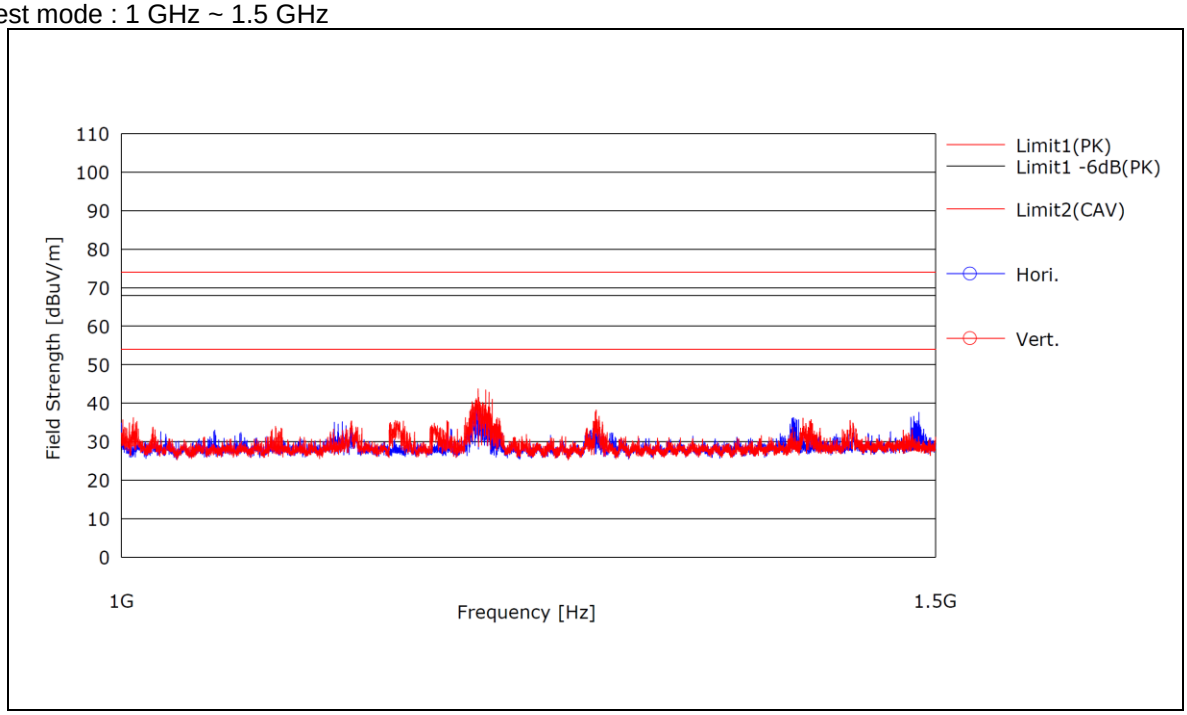
Test mode : 9 kHz ~ 30 MHz



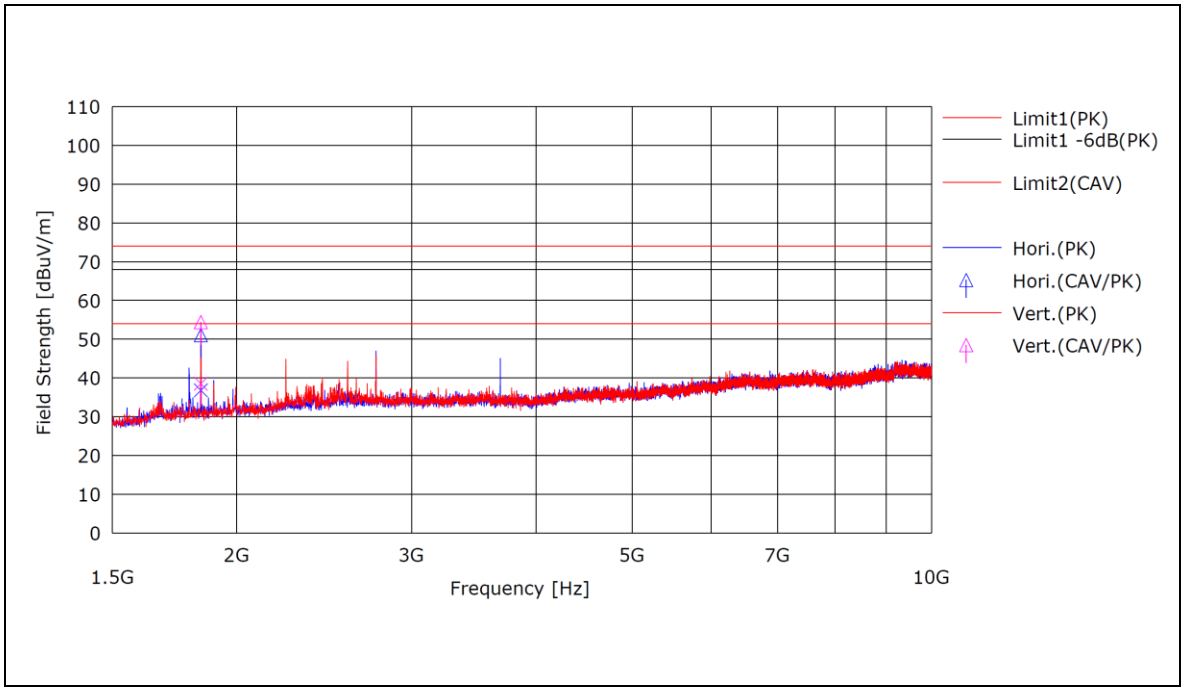
Test mode : 30 MHz ~ 1 GHz



Test mode : 1 GHz ~ 1.5 GHz

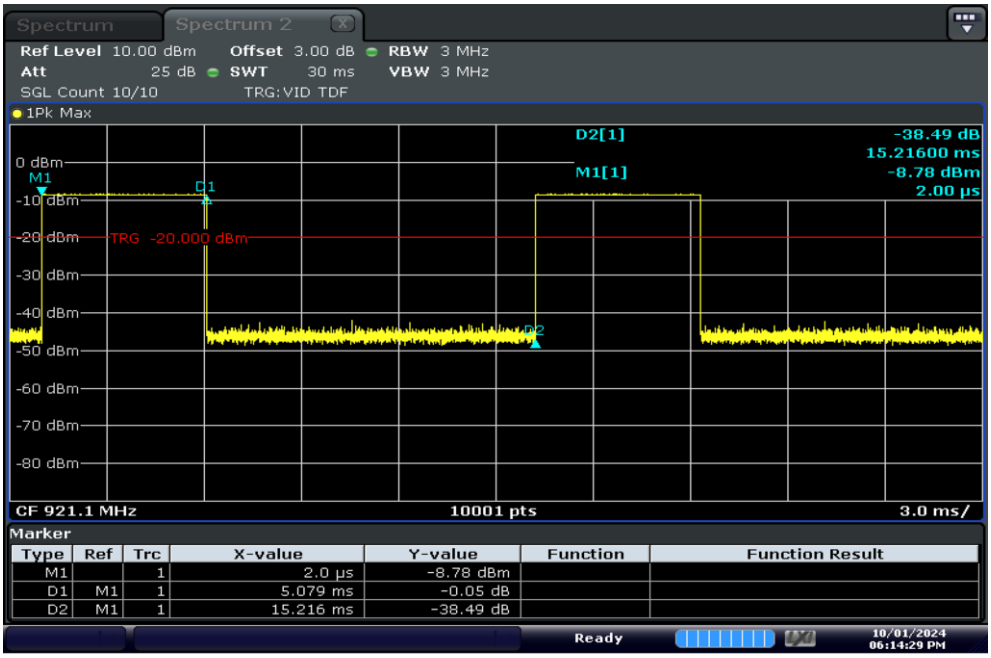


Test mode : 1.5 GHz ~ 10 GHz



4.3.3.7 Measurement Data_Duty Cycle

Test Mode : FSK



4.3.4 Conducted Emission

4.3.4.1 Regulation

According to §15.207(a), and RSS-GEN §8.8 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 50 μH/50 Ω 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.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

4.3.4.2 Measurement Procedure

1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5 m away from the side wall of the shielded room.

2) Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω/50 μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.

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 is 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 amplitude within a bandwidth of 10 kHz or to QUASIPEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

4.3.4.3 Result

Not Applicable (This device only uses DC power.)

APPENDIX I

TEST EQUIPMENT USED FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

Equipment	Manufacturer	Model	Serial No.	Cal. Date (yy.mm.dd)	Next Cal.Date (yy.mm.dd)
FSV Signal Analyzer	ROHDE&SCHWARZ	FSV30	103370	2023-10-11	2024-10-11
				2024-10-10	2025-10-10
Power Supply	KIKUSUI	PWX1500L	SM002050	2024-08-12	2025-08-12
ATTENUATOR	INMET	26A-3	TR006	2023-10-11	2024-10-11
				2024-10-10	2025-10-10
Digital MultiMeter	HP	34401A	US36025428	2024-01-04	2025-01-04
Signal Generator	ROHDE&SCHWARZ	SMB100A	178384	2023-10-11	2024-10-11
				2024-10-10	2025-10-10
EMI Test Receiver	ROHDE&SCHWARZ	ESU40	100445	2024-09-04	2025-09-04
BiLog Antenna	Schwarzbeck	VULB9168	00821	2023-03-29	2025-03-29
Attenuator	JFW	50F-006	6 dB-3	2024-04-01	2025-04-01
Preamplifier	TSJ	MLA-10k01-b01-27	1870367	2024-04-01	2025-04-01
Antenna Mast(10 m)	TOKIN	5977	-	-	-
Antenna Mast(10 m)	Innco	MA4640-XPET-0800	578	-	-
Controller(10 m)	TOKIN	5909L	141909L-1	-	-
Controller(10 m)	Innco	CO3000	40040217	-	-
Turn Table(10 m)	TOKIN	5983-1.5	-	-	-
Active Loop H-Field	ETS	6502	00150598	2023-06-27	2025-06-27
Double Ridege Horn Antenna	ETS	3117	00168719	2024-08-05	2025-08-05
PREAMPLIFIER	Agilent	8449B	3008A02110	2024-01-08	2025-01-08
High pass filter	Wainwright Instruments GmbH	WHK10-1290-1500-10000-60SS	1	2024-08-09	2025-08-09
RF Cable	Radiall	1800920922000KE	CON-R008	2024-07-26	2025-01-26