

FCC TEST REPORT

Test report No.: EMC- FCC- R0230
FCC ID: TKWBS2-OMPW
Type of equipment: BioStation2
Model Name: BS2-OMPW
Applicant: Suprema
FCC Rule Part(s): FCC Part 15 Subpart C 15.225
Frequency Range: 13.559 2 MHz
Test result: Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.

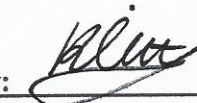
The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of receipt: 2015. 02. 16

Date of test: 2015. 03. 11 ~ 2015. 03. 18

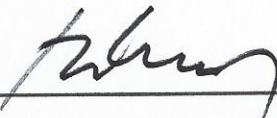
Issued date: 2015. 03. 26

Tested by:



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Approved by:



SON, MIN GI

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1. Client information

Applicant: Suprema
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Gyeonggi, 463-863
Telephone number: +82-31-710-5669
Facsimile number: +82-31-783-4516
Contact person: Lee Jae Won / bskim@suprema.co.kr

Manufacturer: Suprema
Address: 16F Parkview Office Tower, Jeongja-dong, Bundang-gu, Seongnam,
Gyeonggi, 463-863

2. Laboratory information

Address

EMC compliance Ltd.

80-5, Sin-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea

Telephone Number: 82-70-5008-1021 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: 231

FCC Site Designation No.: KR0040

FCC Site Registration No.: 687132

VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849

IC Site Registration No.: 8035A-2

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant:	Suprema
Address of Applicant	16F Parkview Office Tower, Jeongja-dong, Bundang-gu, Seongnam, Gyeonggi, 463-863
Manufacturer	Suprema
Address of Manufacturer	16F Parkview Office Tower, Jeongja-dong, Bundang-gu, Seongnam, Gyeonggi, 463-863
Type of equipment	BioStation2
Basic Model	BS2-OMPW
Serial number	N/A

3.2 General description

Operating Frequency	13.559 2 MHz
Frequency Range	13.559 2 MHz
Type of Modulation	ASK
Number of Channels	1 channel
Type of Antenna	FPC Antenna
Power supply	DC 12.0 V * , DC 48 V_PoE*
Operating temperature	-20 °C ~ 50 °C

*Declared by applicant

3.3 Test frequency

frequency	13.559 2 MHz
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4. Summary of test results

4.1 Standards & results

Rule Reference	Parameter	Status
15.203	Antenna Requirement	C
15.225 (a)	In-band Fundamental Emission	C
15.225 (b)	In-band Spurious Emission	C
15.225 (c)	In-band Spurious Emission	C
15.225 (d) 15.209	Out-of-band Spurious Emission	C
15.225 (e)	Frequency Stability Tolerance	C
15.207	Conducted Emissions	C
Note: C=complies NC= Not complies NT=Not tested NA=Not Applicable		

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = KU_c (K = 2)$	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+ 4.94 dB, - 5.06 dB
		+ 4.93 dB, - 5.05 dB
	300 MHz ~ 1 000 MHz:	+ 4.97 dB, - 5.08 dB
		+ 4.84 dB, - 4.96 dB
Conducted Emissions	9 kHz ~ 150 kHz:	± 3.75 dB
	150 kHz ~ 30 MHz:	± 3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According 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.

5.1.2 Result

-Complied

The FPC antenna is an integral antenna, and no antenna other than that furnished by the responsible party shall be used with the device.

5.2 In-band Fundamental Emission

5.2.1 Minimum Standard

15.225 (a) The field strength of any emission within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

5.2.2 Measurement Procedure

Test Procedure The Radiated Electric Field Strength intensity has been measured on semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9 kHz to 30 MHz at distance 3m The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

Frequency : From 30 MHz to 1 GHz at distance 3m The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

Measurements were performed with a QP, PK, and AV detector. The radiated emission measurements were made with the following detector function of the test receiver (below 1 GHz).

Frequency	9 - 90 kHz	90 - 110 kHz	150 - 490 kHz	490 kHz - 30 MHz	30 MHz -1 GHz
Detector type	PK/AV	QP	PK/AV	QP	QP
IF bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz

* Part 15 Section 15.31 (f)(2) (9 kHz - 30 MHz)

[Limit at 3m]=[Limit at 300m]-40 x log(3[m]/300[m])

[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

5.2.3 Test Result

- **Complies**

Voltage [v]	Frequency [MHz]	Reading [dB μ V]	Correction Factor [dB]	field strength dB μ V/m at 3 m	Limit dB μ V/m at 3 m	Margin [dB]
12.0	13.560 3	94.5	-11.9	82.6	124.0	29.5
48.0	13.560 3	94.5	-11.9	82.6	124.0	29.5

Note: Field strength limit was calculated with 40 dB/dec

5.3 In-band Spurious Emission

5.3.1 Regulation

15.225 (b) With in the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

15.225 (c) With in the bands 13.110-13.410 MHz and 13.710-14.010 MHz, the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

5.3.2 Test Result

- Complied

DC 12.0 V

Measurement Distance: 3 m

Frequency	Receiver Bandwidth	Reading	Pol.	Factor	Limit	Result	Margin
[MHz]	[kHz]	[dB(μV)]	[V/H]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
QP DATA.							
13.347	9	52.4	H	-11.9	80.5	40.5	40.0
13.552	9	79.1	H	-11.9	90.5	67.2	23.3
13.568	9	72.2	H	-11.9	90.5	60.3	30.2
13.773	9	56.5	H	-11.9	80.5	44.6	35.9

DC 48 V_PoE

Measurement Distance: 3 m

Frequency	Receiver Bandwidth	Reading	Pol.	Factor	Limit	Result	Margin
[MHz]	[kHz]	[dB(μV)]	[V/H]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
QP DATA.							
13.347	9	52.5	H	-11.9	80.5	40.6	39.9
13.552	9	79.1	H	-11.9	90.5	67.2	23.3
13.568	9	72.4	H	-11.9	90.5	60.5	30.0
13.773	9	56.5	H	-11.9	80.5	44.6	35.9

Margin (dB) = Limit – Actual

[Result] = Reading – Amp Gain + AF + CL

1. H = Horizontal, V = Vertical Polarization

2. AF/CL = Antenna Factor and Cable Loss

5.4 Out-of-band Spurious Emission

5.4.1 Regulation

15.225 (d) The Field Strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in 15.209

Frequency (MHz)	Field Strength ($\mu V/m$)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30(29.54 dB $\mu V/m$)	30
30.0-88.0	100(40 dB $\mu V/m$)	3
88-216	150(43.5 dB $\mu V/m$)	3
216-960	200 (46 dB $\mu V/m$)	3
Above 960	500 (53.98 dB $\mu V/m$)	3

5.4.2 Measurement Procedure

The spurious emissions from the EUT will be measured on an 10 m Anechoic chamber in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna.

The antenna was positioned 3, 10 or 30 meters horizontally from the EUT.

Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions.

In the case where larger measuring distances are required the results will extrapolated based on the values measuring on the closer distances according to Section 15.31 (f) (2) [2].

The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in dB $\mu V/m$, is arrived at by taking the reading from the EMI receiver (Level dB μV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit. The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: ResBW: 200 Hz

150 kHz – 30 MHz: ResBW: 9 kHz

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

The EUT was placed on the top of the 0.8 meter height, 1 x 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°. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1 000 MHz using the BILOG antenna. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 10 m chamber. The EUT was tested at a distance 3 meters. 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.

5.4.3 Test Result

-Complied

Measurement Distance: 3 m

DC 12.0 V

-Below 30 MHz

Frequency	Receiver Bandwidth	Reading	Pol.	Factor	Limit	Result	Margin
[MHz]	[kHz]	[dB(μV)]	[V/H]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
QP DATA.							
0.020	0.2	44.8	V	-11.5	127.7	33.3	94.4
0.493	9.0	49.8	V	-13	73.8	36.8	37.0
27.119	9.0	55.9	H	-11	69.5	44.9	24.6

-Above 30 MHz

Frequency	Receiver Bandwidth	Reading	Pol.	Factor	Limit	Result	Margin
[MHz]	[kHz]	[dB(μV)]	[V/H]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
QP DATA.							
40.670	120	40.9	V	-13.9	40.0	27.0	13.0
167.983	120	37.6	H	-18.3	43.5	19.3	24.2
252.009	120	50.8	V	-14.4	46.0	36.4	9.6
972.112	120	28.8	H	-0.7	54.0	28.1	25.9

Margin (dB) = Limit – Actual

[Result] = Reading – Amp Gain + AF + CL

1. H = Horizontal, V = Vertical Polarization
2. AF/CL = Antenna Factor and Cable Loss

* The spurious emission at the frequency does not fall in the restricted bands.

** The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

DC 48 V_PoE

-Below 30 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Factor [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA.							
0.020	0.2	44.1	V	-11.5	118.1	32.6	85.5
0.889	9.0	50.2	H	-13.1	73.8	37.1	36.7
27.119	9.0	53.5	H	-11.0	69.5	42.5	27.0

-Above 30 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Factor [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA.							
46.611	120	41.8	V	-13.3	40.0	28.5	11.5
89.170	120	39.4	V	-17.7	43.5	21.7	21.8
252.009	120	50.5	H	-14.4	46.0	36.1	9.9
971.991	120	29.6	H	-0.7	54.0	28.9	25.1

Margin (dB) = Limit – Actual

[Result] = Reading – Amp Gain + AF + CL

1. H = Horizontal, V = Vertical Polarization
2. AF/CL = Antenna Factor and Cable Loss

* The spurious emission at the frequency does not fall in the restricted bands.

** The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

5.5 Frequency tolerance

5.5.1 Regulation

15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.5.2 Test Result

- **Complied**

DC 12.0 V

VOLTAGE (%)	POWER (V)	TEMP (°C)	FREQ (Hz)	FREQ.DEV (Hz)	Deviation (%)
100	12	20	13 559 338	-138	-0.001 02
		-20	13 559 330	-130	-0.000 96
		-10	13 559 347	-147	-0.001 08
		0	13 559 348	-148	-0.001 09
		10	13 559 332	-132	-0.000 97
		20	13 559 303	-103	-0.000 76
		25	13 559 326	-126	-0.000 93
		30	13 559 342	-142	-0.001 05
		40	13 559 325	-125	-0.000 92
		50	13 559 336	-136	-0.001 00
85	10.2	20	13 559 332	-132	-0.000 97
115	13.8	20	13 559 319	-119	-0.000 88

DC 48 V_PoE

VOLTAGE (%)	POWER (V)	TEMP (°C)	FREQ (Hz)	FREQ.DEV (Hz)	Deviation (%)
100	48	20	13 559 325	-125	-0.000 92
		-20	13 559 338	-138	-0.001 02
		-10	13 559 343	-143	-0.001 05
		0	13 559 347	-147	-0.001 08
		10	13 559 338	-138	-0.001 02
		20	13 559 330	-130	-0.000 96
		25	13 559 327	-127	-0.000 94
		30	13 559 338	-138	-0.001 02
		40	13 559 342	-142	-0.001 05
		50	13 559 324	-124	-0.000 91
85	40.8	20	13 559 320	-120	-0.000 89
115	55.2	20	13 559 336	-136	-0.001 00

5.6 Conducted Emission

5.6.1 Regulation

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 50 μ H/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 (dB μ V)	
	Quasi-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.

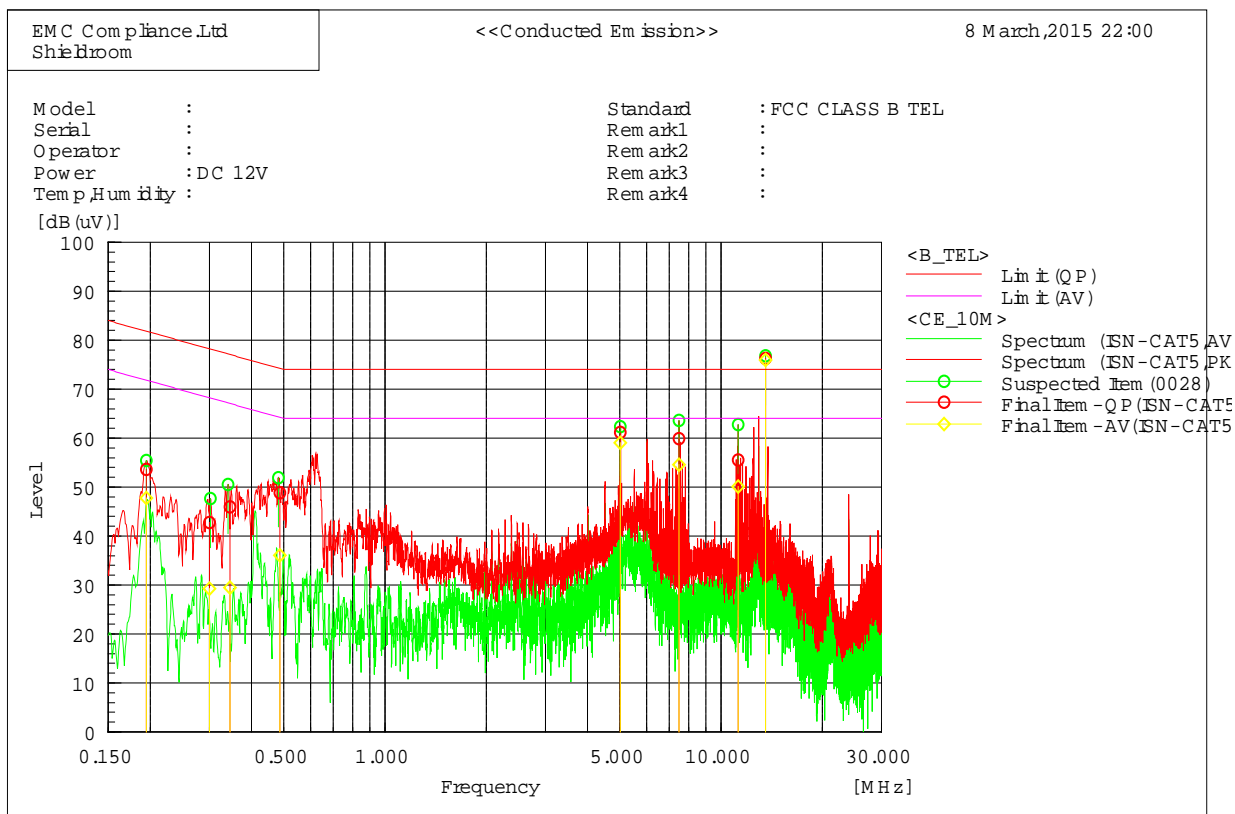
5.6.2 Measurement Procedure

- 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 1.5m 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 μ H 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 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 amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.6.3 Test Result

- Complied

Figure4. plot of Conducted Emission



Final Result

--- ISN-CAT5 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.1946	44.0	38.2	9.6	53.6	47.8	81.8	71.8	28.2	24.0
2	0.29983	33.3	19.8	9.5	42.8	29.3	78.2	68.2	35.4	38.9
3	0.34565	36.6	20.1	9.4	46.0	29.5	77.1	67.1	31.1	37.6
4	0.48595	39.4	26.7	9.4	48.8	36.1	74.2	64.2	25.4	28.1
5	5.01379	52.0	49.9	9.2	61.2	59.1	74.0	64.0	12.8	4.9
6	7.50025	50.6	45.3	9.3	59.9	54.6	74.0	64.0	14.1	9.4
7	11.24958	46.2	40.7	9.4	55.6	50.1	74.0	64.0	18.4	13.9
8	13.55922	66.9	66.5	9.4	76.3	75.9	74.0	64.0	-2.3	-11.9

6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	Spectrum Analyzer	R&S	FSV30	101437	15.12.11
■	Temp & Humid Chamber	ESPEC CORP.	SH-661	92004048	16.03.06
■	EMI Test Receiver	Schwarzbeck	ESR7	101078	16.02.16
■	DC Power Sensor	Agilent	66312A	SG43000104	16.03.10
■	Signal generator	R & S	SMR40	100007	15.06.10
■	Amplifier	Sonoma Instrument	310N	293004	15.09.25
■	Loop Antenna	R&S	HFH2-Z2	100355	15.06.19
■	Bi-Log Antenna	Schwarzbeck	VULB9163	552	16.05.14
■	Broadband Preamplifier	Schwarzbeck	BBV9718	216	15.04.22
■	Attenuator	HP	8491A	16861	15.07.01
■	Turn Table	Innco Systems	DT2000S-1t	79	-
■	Antenna Mast	Innco Systems	MA4000-EP	303	-