



# TEST REPORT

<p><b>KCTL Inc.</b>                  65, Sinwon-ro, Yeongtong-gu,                  Suwon-si, Gyeonggi-do, 16677, Korea                  TEL: 82-31-285-0894 FAX: 82-505-299-8311  <a href="http://www.kctl.co.kr">www.kctl.co.kr</a></p>	<p>Report No.:                  KR18-SRF0034-B                  Page (1) of (21)</p>	
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**1. Client**

- Name : Suprema Inc.
- Address : 16F Parkview Office Tower, Jeongja-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea, 463-863
- Date of Receipt : 2018-02-26

**2. Use of Report** : -

**3. Name of Product and Model** : BioStar 2 / XPD2-MDB

**4. Manufacturer and Country of Origin** : Suprema Inc. / Korea

**5. FCC ID** : TKWXP2-MDB

**6. Date of Test** : 2018-03-15 to 2018-03-20

**7. Test Standards** : FCC Part 15 Subpart C, 15.209

**8. Test Results** : Refer to the test result in the test report

<p>Affirmation</p>	<p>Tested by                    Name : Dowon Ahn (Signature)</p>	<p>Technical Manager                    Name : Seungyong Kim (Signature)</p>
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2018-04-13

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As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

**REPORT REVISION HISTORY**

Date	Revision	Page No
2018-03-26	Originally issued	-
2018-04-11	Revised antenna requirement	9
2018-04-13	Added FCC Rule Reference for Conducted Emission and revised summary of results	16~17

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Report No.:  
KR18-SRF0034-B  
Page (3) of (21)



**[ Contents ]**

<b>1. Client information</b> .....	<b>4</b>
<b>2. Laboratory information</b> .....	<b>5</b>
<b>3. Description of E.U.T.</b> .....	<b>6</b>
3.1 Basic description.....	6
3.2 General description.....	6
3.3 Test frequency.....	7
3.4 Normal and extreme test conditions .....	7
<b>4. Summary of test results</b> .....	<b>8</b>
4.1 Standards & results.....	8
4.2 Uncertainty.....	8
<b>5. Test results</b> .....	<b>9</b>
5.1 Antenna Requirement.....	9
5.2 Field strength of Fundamental .....	10
5.3 Spurious Emission .....	13
5.4 Conducted Emission.....	16
5.5 Occupied Bandwidth.....	18
<b>6. Test equipment used for test</b> .....	<b>21</b>

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Report No.:  
KR18-SRF0034-B

Page (4) of (21)

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## 1. Client information

**Applicant:** Suprema Inc.  
**Address:** 16F Parkview Office Tower, Jeongja-dong, Bundang-gu,  
Seongnam-si, Gyeonggi-do, South Korea, 463-863  
**Telephone number:** +82 31 710 5669  
**Facsimile number:** +82 31 783 4516  
**Contact person:** MOUNGCHEOL LEE / [mclee@suprema.co.kr](mailto:mclee@suprema.co.kr)

**Manufacturer:** Suprema Inc.  
**Address:** 16F Parkview Office Tower, Jeongja-dong, Bundang-gu,  
Seongnam-si, Gyeonggi-do, South Korea, 463-863

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Report No.:  
KR18-SRF0034-B

Page (5) of (21)

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## 2. Laboratory information

### Address

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Telephone Number: 82 31 285 0894

Facsimile Number: 82 505 299 8311

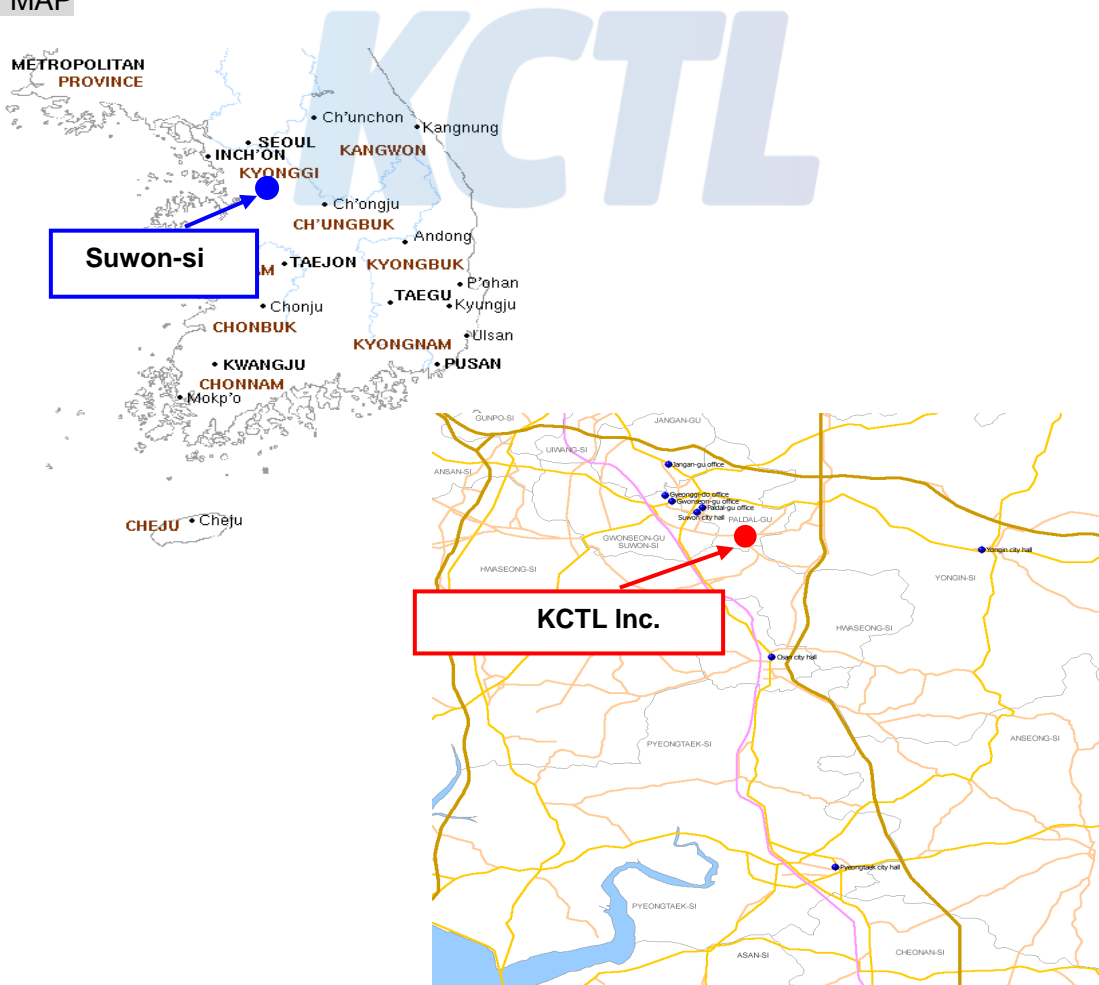
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

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

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

### **SITE MAP**



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Report No.:  
KR18-SRF0034-B

Page (6) of (21)



### 3. Description of E.U.T.

#### 3.1 Basic description

Applicant	Suprema Inc.
Address of Applicant	16F Parkview Office Tower, Jeongja-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea, 463-863
Manufacturer	Suprema Inc.
Address of Manufacturer	16F Parkview Office Tower, Jeongja-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea, 463-863
Type of equipment	BioStar 2
Basic Model	XPD2-MDB
Serial number	N/A

#### 3.2 General description

Frequency Range	2 402 MHz ~ 2 480 MHz (Bluetooth Low Energy), 13.56 MHz (NFC), 125 kHz (EM/HID Proxy)
Type of Modulation	GFSK MHz (Bluetooth Low Energy), ASK (NFC), ASK (EM/HID Proxy)
The number of channels	40 ch (Bluetooth Low Energy) 1 ch (NFC), 1 ch (EM/HID Proxy)
Type of Antenna	PCB Antenna (Bluetooth Low Energy), Loop Antenna (NFC), Coil Antenna (EM/HID Proxy)
Power supply	DC 12.00 V
Product SW/HW version	1.0.0 / V01A
Radio SW/HW version	1.0.0 / V01A
Test SW Version	N/A <sub>1)</sub>
RF power setting in TEST SW	N/A <sub>2)</sub>

Note<sub>1)</sub> : The above EUT information was declared by the manufacturer.

Note<sub>2)</sub> : N/A<sub>1)</sub> There is no test software used during the test.

N/A<sub>2)</sub> RF power setting was not able to alter during the test.

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Report No.:  
KR18-SRF0034-B

Page (7) of (21)

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### 3.3 Test frequency

Test Frequency [kHz]
125 kHz

### 3.4 Normal and extreme test conditions

Test condition	Temperature [°C]	Voltage [V]
NTNV	22	DC 12 V

Note 1 : N:Normal T:Temperature V:Voltage

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Report No.:  
KR18-SRF0034-B

Page (8) of (21)



## 4. Summary of test results

### 4.1 Standards & results

FCC Rule Reference	Parameter	Report Section	Test Result
15.203	Antenna Requirement	5.1	C
15.209(b)(3)	Field Strength of Fundamental	5.2	C
15.205(a), 15.209(a)	Spurious Emission	5.3	C
15.207(a)	Conducted Emissions	5.4	C
-	Occupied Bandwidth	5.5	C

Note : C = Complies, NC = Not complies, NT = Not tested, NA = Not Applicable

### 4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = kUc (k = 2)$	
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



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Report No.:  
KR18-SRF0034-B

Page (9) of (21)

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## 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 coil antenna is an internal antenna, and no antenna other than that furnished by the responsible party shall be used with the device.

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## 5.2 Field strength of Fundamental

### 5.2.1 Regulation

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: 83

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 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..

According to §15.231(b)

In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

\*\* linear interpolations

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz,  $\mu V/m$  at 3 meters =  $56.81818(F) - 6136.3636$ ; for the band 260-470 MHz,  $\mu V/m$  at 3 meters =  $41.6667(F) - 7083.3333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

## 5.2.2 Test procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

- 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 GHz, 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 GHz, 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 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.
- g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

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Report No.:  
KR18-SRF0034-B  
Page (12) of (21)



### 5.2.3 Test Result

- Complied

Frequency [MHz]	Resolution Bandwidth [kHz]	Pol. [V/H]	Reading [dB( $\mu$ V)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB( $\mu$ V/m)] at 3m	Result [dB( $\mu$ V/m)] at 300m Note 2)	Limit [dB( $\mu$ V/m)] at 300m	Margin [dB]
0.125	9	H	65.60	0.16	-32.76	19.6	-13.20	52.40	-27.60 Note 2)	105.67	53.27

Note 1) : Factor(dB) = Antenna Factor + Amp. Gain + Cable Loss

Note 2) :  $40 \log(3/300) = 80$  dB



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Report No.:  
KR18-SRF0034-B

Page (13) of (21)



## 5.3 Spurious Emission

### 5.3.1 Regulation

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: 83

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
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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 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..

According to §15.231(b)

In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

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70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

\*\* linear interpolations

### 5.3.2 Measurement Procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

- a. The EUT was placed on the top of a rotating table 0.8 meters, 1.5 meter 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 GHz, 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 GHz, 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 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.
- g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

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Report No.:  
KR18-SRF0034-B

Page (15) of (21)



### 5.3.3 Test Result

- Complied

Frequency [MHz]	Resolution Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Quasi-Peak DATA.</b>										
16.80	9	V	41.40	1.94	-32.67	19.43	-11.30	30.10	69.50	39.40
47.22	120	V	48.12	1.41	-30.49	15.34	-13.74	34.38	40.00	5.62
89.53	120	H	38.50	2.00	-34.43	14.72	-17.71	20.79	43.50	22.71
224.85	120	H	36.40	3.31	-34.31	16.74	-14.26	22.14	46.00	23.86
244.01	120	H	44.30	3.46	-34.79	17.85	-13.48	30.82	46.00	15.18
254.56	120	H	31.68	3.54	-35.01	18.29	-13.18	18.50	46.00	27.50
515.12	120	V	34.10	5.22	-35.79	23.50	-7.07	27.03	46.00	18.97

Note : Factor(dB) = Antenna Factor + Amp. Gain + Cable Loss



## 5.4 Conducted Emission

### 5.4.1 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 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)	
	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.

### 5.4.2 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 1.5m away from the side wall of the shielded room.
- 2) Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50µH 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 QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.



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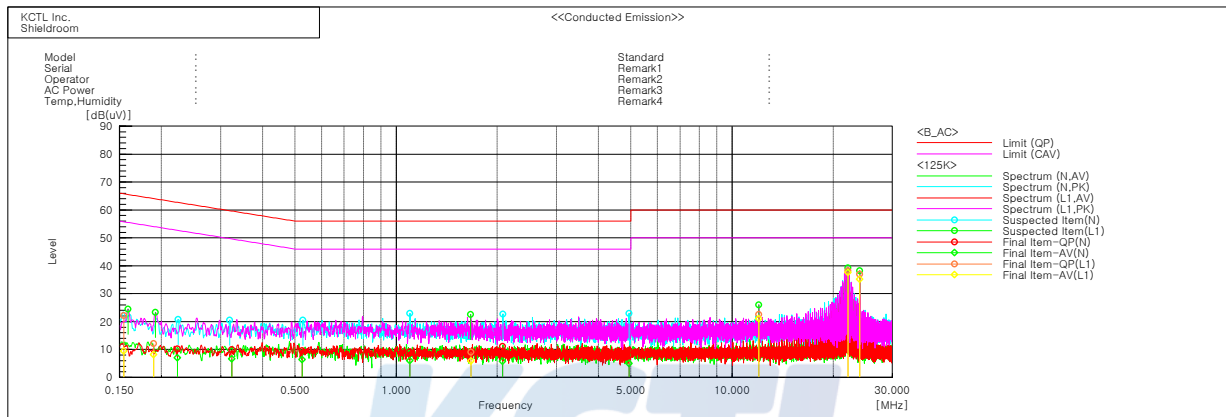
Report No.:  
 KR18-SRF0034-B  
 Page (17) of (21)



## 5.4.3 Test Result

- Complied

Figure 4. The plot of Conducted Emission



### Final Result

--- N 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	0.22321	1.0	-2.2	9.2	10.2	7.0	62.7	52.7	52.5	45.7
2	0.32354	0.3	-3.0	9.6	9.9	6.6	59.6	49.6	49.7	43.0
3	0.52419	-0.3	-3.5	9.8	9.5	6.3	56.0	46.0	46.5	39.7
4	1.09757	-0.6	-3.7	9.7	9.1	6.0	56.0	46.0	46.9	40.0
5	2.07394	1.4	-3.9	9.6	11.0	5.7	56.0	46.0	45.0	40.3
6	4.93106	-0.1	-4.7	9.7	9.6	5.0	56.0	46.0	46.4	41.0

--- L1 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	0.15431	12.4	-0.4	9.8	22.2	9.4	65.8	55.8	43.6	46.4
2	0.18959	2.2	-1.7	9.9	12.1	8.2	64.1	54.1	52.0	45.9
3	1.66733	-0.6	-3.7	9.6	9.0	5.9	56.0	46.0	47.0	40.1
4	12.00109	12.6	11.0	10.0	22.6	21.0	60.0	50.0	37.4	29.0
5	22.100	28.1	27.5	10.1	38.2	37.6	60.0	50.0	21.8	12.4
6	23.99841	26.8	25.0	10.1	36.9	35.1	60.0	50.0	23.1	14.9

## 5.5 Occupied Bandwidth

### 5.5.1 Regulation

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

### 5.5.2 Measurement procedure

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

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Report No.:  
KR18-SRF0034-B  
Page (19) of (21)



### 5.5.3 Test Result

- Complied

Voltage [V]	Frequency [kHz]	Occupied Bandwidth (99 % BW) [Hz]
DC 12.00	125	209.79

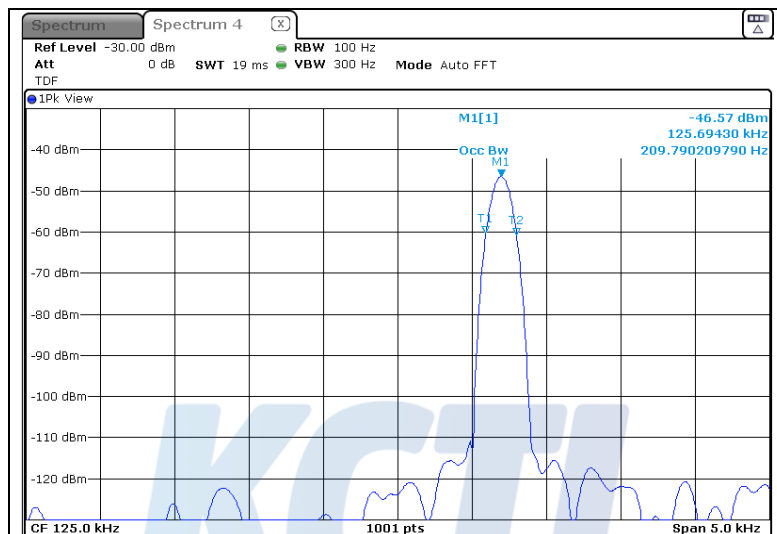
NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.



### 5.5.4 Test Plot

Figure 2. Plot of the Occupied Bandwidth (Conducted)

#### - Occupied Bandwidth



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Report No.:  
KR18-SRF0034-B

Page (21) of (21)



## 6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	SPECTRUM ANALYZER	R&S	FSV40	100988	19.01.05
■	DC Power Supply	AGILENT	E3632A	MY40016393	18.12.21
■	Signal Generator	R&S	SMR40	100007	18.05.15
■	Vector Signal Generator	R&S	SMBV100A	257566	19.01.05
■	Loop Antenna	R&S	HFH2-Z2	100355	18.05.10
■	Bilog Antenna	SCHWARZBECK	VULB9163	552	18.05.10
■	Attenuator	HP	8491B	22891	18.08.24
■	Amplifier	SONOMA	310N	344922	18.08.25
■	Amplifier	SONOMA	310N	186280	18.04.06
■	EMI Test Receiver	R&S	ESCI7	100732	18.08.24
■	EMI Test Receiver	R&S	ESCI7	100710	18.08.24
■	Turn Table	Innco Systems	DT2000	79	-
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000	79	-
■	Cable Assembly	Radiall	2301762000PJ	1724.66	-
■	Cable Assembly	Gigalane	RF-400	-	-
■	TWO-LINE V-NETWORK	R&S	ENV216	101352	18.08.25