# FCC Part 15C
# Measurement and Test Report

**For**

**Shenzhen King Song Sports Equipment Co., Ltd**

**5th Floor, Bld.A, Taiyufeng Industry Park, Queshan Road, Dalang Street,**

**Longhua, Shenzhen**

**FCC ID: 2ADW6KS**

| | |
|---|---|
| **FCC Rule(s):** | FCC Part 15.247 |
| **Product Description:** | Self-balancing Unicycle |
| **Tested Model:** | KS |
| **Report No.:** | SEMD1507053I-2 |
| **Tested Date:** | 2015-07-13 to 2015-07-28 |
| **Issued Date:** | 2015-07-28 |
| **Tested By:** | Jong Wang / Engineer |
| **Reviewed By:** | Lahm Peng / EMC Manager |
| **Approved & Authorized By:** | Jandy so / PSQ Manager |

**Prepared By:**

**Shenzhen SEM.Test Technology Co., Ltd.**
1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C.（518101）
Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

# TABLE OF CONTENTS

# 1. GENERAL INFORMATION

**Client Information**

| | |
|---|---|
| Applicant: | Shenzhen King Song Sports Equipment Co., Ltd |
| Address of applicant: | 5th Floor, Bld.A, Taiyufeng Industry Park, Queshan Road, Dalang Street, Longhua, Shenzhen |
| Manufacturer: | Shenzhen King Song Sports Equipment Co., Ltd |
| Address of manufacturer: | 5th Floor, Bld.A, Taiyufeng Industry Park, Queshan Road, Dalang Street, Longhua, Shenzhen |

| **General Description of EUT** | |
|---|---|
| Product Name: | Self-balancing Unicycle |
| Brand Name: | King Song |
| Model No.: | KS |
| Rated Voltage: | DC 60V battery |
| Rated Current: | JY-672200<br>Input: AC 100-240V; Output: DC 67.2V/2A Max |
| | |
| *Note: The test data is gathered from a production sample provided by the manufacturer.* | |

| **Technical Characteristics of EUT** | |
|---|---|
| Bluetooth Version: | V4.0 (BLE mode) |
| Frequency Range: | 2402-2480MHz |
| RF Output Power: | 3.247dBm (Conducted) |
| Data Rate: | GFSK |
| Modulation: | 25Mbps |
| Quantity of Channels: | 40 |
| Channel Separation: | 2MHz |
| Type of Antenna: | PCB |
| Antenna Gain: | 0dBi |
| Lowest Internal Frequency: | 8MHz |

## 1.2 Test Standards

The following report is prepared on behalf of the Shenzhen King Song Sports Equipment Co.,Ltd. in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 558074 D01 V03r03 for digital transmission systems shall be performed also.

## 1.4 Test Facility

**FCC – Registration No.: 934118**

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

**Industry Canada (IC) Registration No.: 11464A**

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

**CNAS Registration No.: L4062**

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

## 1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

| **Test Mode List** | | |
|---|---|---|
| Test Mode | Description | Remark |
| TM1 | GFSK(BLE) | 2402MHz, 2442MHz, 2480MHz |

| **EUT Cable List and Details** | | | |
|---|---|---|---|
| Cable Description | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| / | / | / | / |

| **Special Cable List and Details** | | | |
|---|---|---|---|
| Cable Description | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| / | / | / | / |

| **Auxiliary Equipment List and Details** | | | |
|---|---|---|---|
| Description | Manufacturer | Model | Serial Number |
| / | / | / | / |

## 1.6 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal Date | Due Date |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4407B | MY41440400 | 2015-06-17 | 2016-06-16 |
| Spectrum Analyzer | Rohde & Schwarz | FSP | 836079/035 | 2015-06-17 | 2016-06-16 |
| EMI Test Receiver | Rohde & Schwarz | ESVB | 825471/005 | 2015-06-17 | 2016-06-16 |
| Amplifier | Agilent | 8447F | 3113A06717 | 2015-06-17 | 2016-06-16 |
| Amplifier | C&D | PAP-1G18 | 2002 | 2015-06-17 | 2016-06-16 |
| Broadband Antenna | Schwarz beck | VULB9163 | 9163-333 | 2015-06-17 | 2016-06-16 |
| Horn Antenna | ETS | 3117 | 00086197 | 2015-06-17 | 2016-06-16 |
| Horn Antenna | ETS | 3116B | 00088203 | 2015-06-17 | 2016-06-16 |
| Loop Antenna | Schwarz beck | FMZB 1516 | 9773 | 2015-06-17 | 2016-06-16 |
| EMI Test Receiver | Rohde & Schwarz | ESPI | 101611 | 2015-06-17 | 2016-06-16 |
| L.I.S.N | Schwarz beck | NSLK8126 | 8126-224 | 2015-06-17 | 2016-06-16 |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100911 | 2015-06-17 | 2016-06-16 |

# 2. SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test Item | Result |
|---|---|---|
| § 2.1093 | RF Exposure | Compliant |
| § 15.203; § 15.247(b)(4)(i) | Antenna Requirement | Compliant |
| § 15.207(a) | Conducted Emission | Compliant |
| § 15.247(e) | Power Spectral Density | Compliant |
| § 15.247(a)(2) | 6 dB Bandwidth | Compliant |
| § 15.247(b)(3) | RF Output Power | Compliant |
| § 15.209(a) | Radiated Emission | Compliant |
| § 15.247(d) | Band Edge (Out of Band Emissions) | Compliant |

N/A: not applicable

# 3. RF Exposure

## 3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

## 3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

# 4. Antenna Requirement

## 4.1 Standard Applicable

According to FCC Part 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.

## 4.2 Evaluation Information

This product has a PCB antenna, fulfill the requirement of this section.

# 5. Power Spectral Density

## 5.1 Standard Applicable

According to 15.247(a)(1)(iii), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## 5.2 Test Procedure

According to the KDB 558074 D01 V03r03, the test method of power spectral density as below:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 × RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

## 5.3 Environmental Conditions

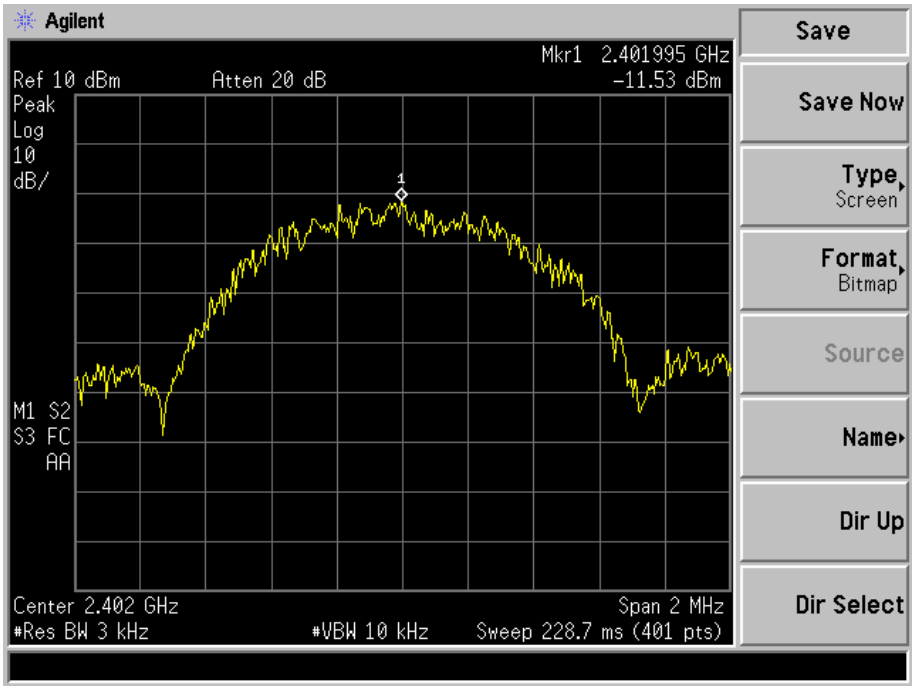
| | |
|---|---|
| Temperature: | 26° C |
| Relative Humidity: | 54% |
| ATM Pressure: | 1011 mbar |

## 5.4 Summary of Test Results/Plots

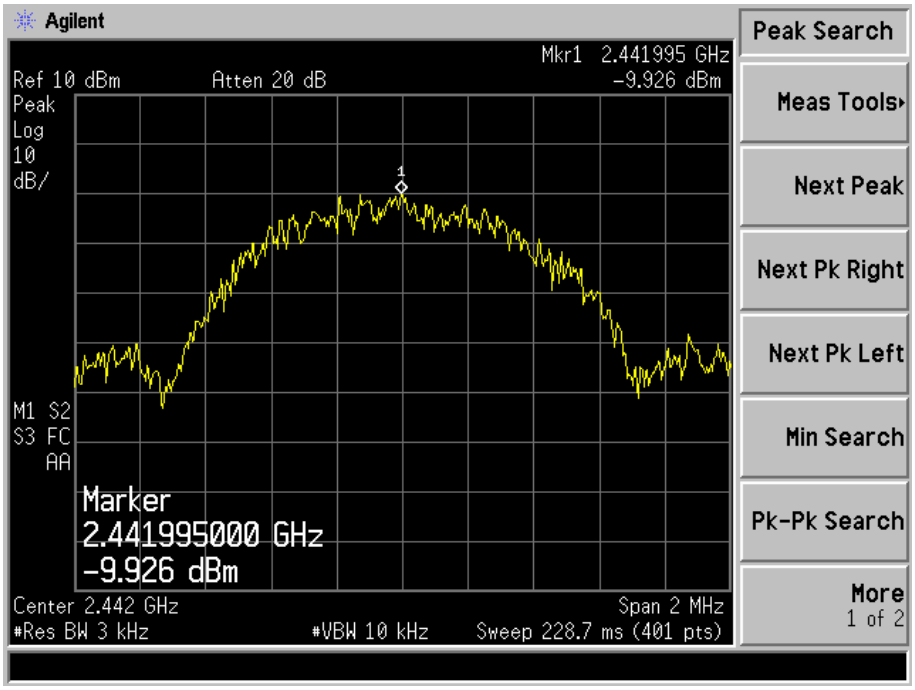
| Test Mode | Test Channel MHz | Power Spectral Density dBm/3kHz | Limit dBm/3kHz |
|---|---|---|---|
| GFSK(BLE) | 2402 | -11.53 | 8 |
| | 2442 | -9.926 | 8 |
| | 2480 | -9.197 | 8 |

Please refer to the following test plots:

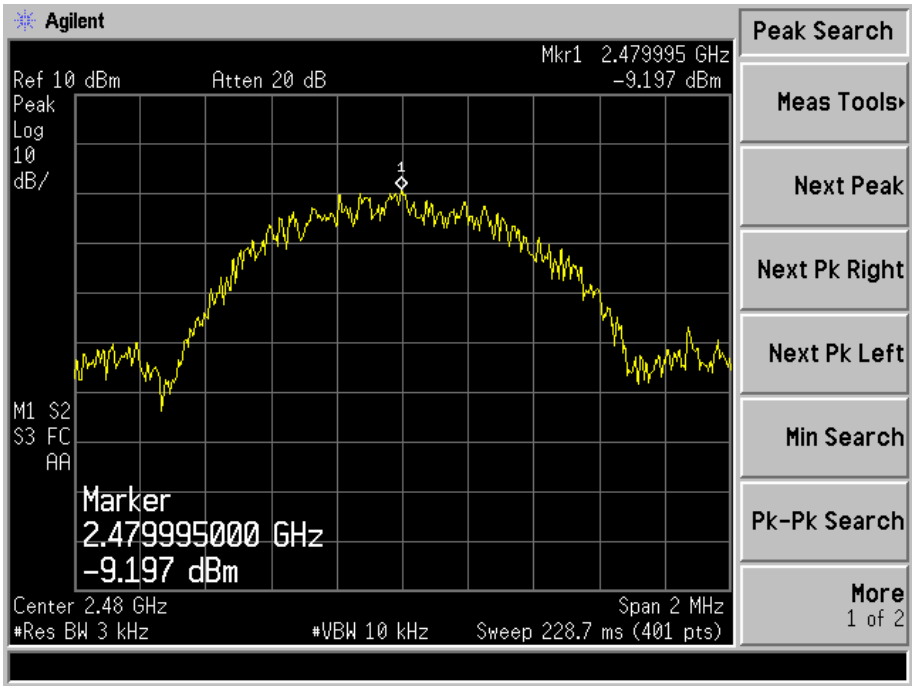
Low Channel




Middle Channel



High Channel



# 6. 6dB Bandwidth

## 6.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

## 6.2 Test Procedure

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

## 6.3 Environmental Conditions

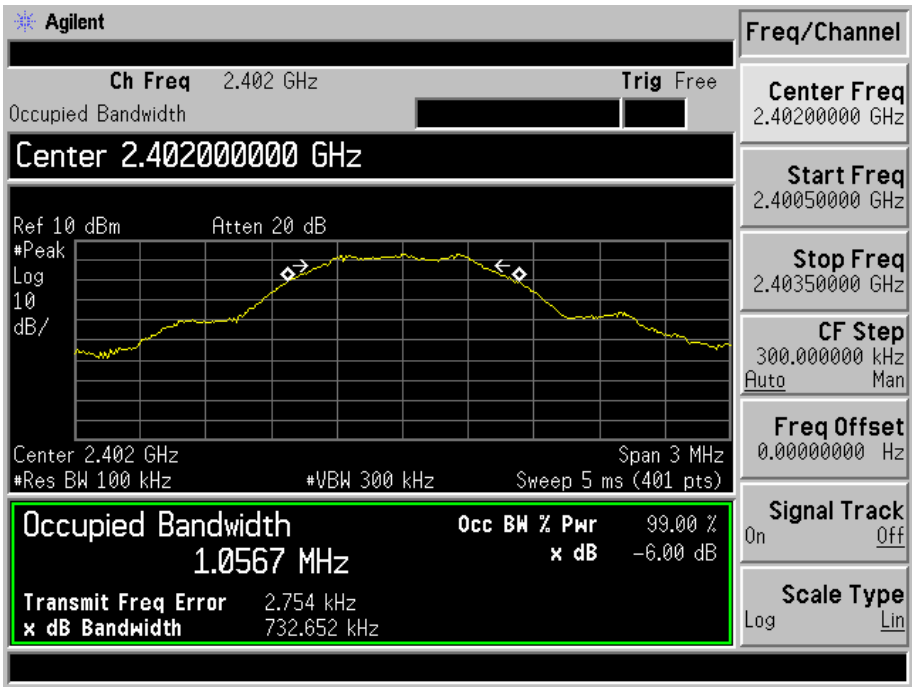
| | |
|---|---|
| Temperature: | 25° C |
| Relative Humidity: | 53% |
| ATM Pressure: | 1018 mbar |

## 6.4 Summary of Test Results/Plots

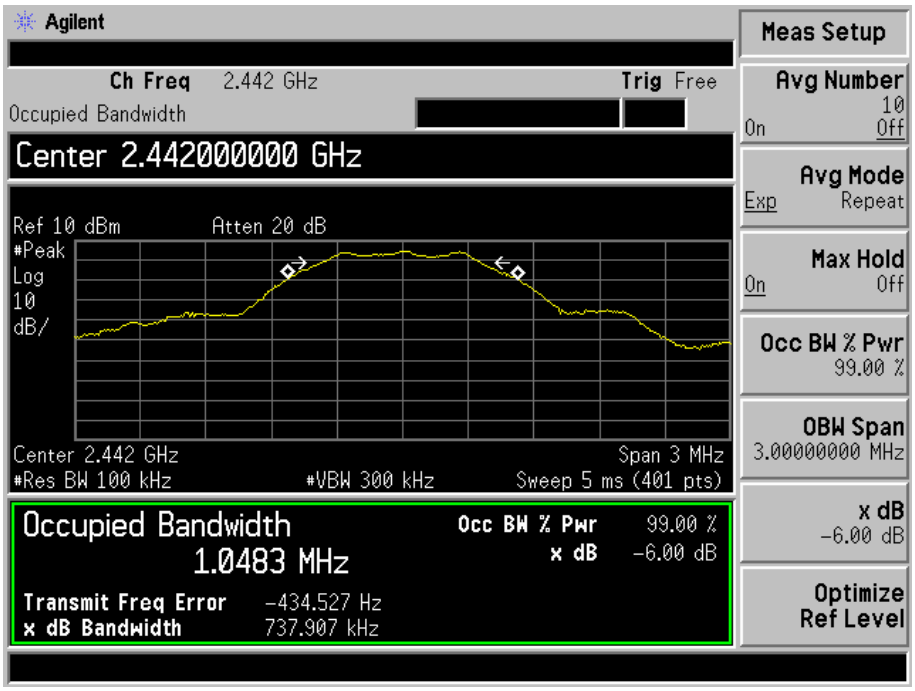
| Test Mode | Test Channel MHz | 6 dB Bandwidth kHz | 99% Bandwidth kHz | Limit kHz |
|---|---|---|---|---|
| GFSK(BLE) | 2402 | 732.652 | 1056.7 | >500 |
| | 2442 | 737.907 | 1048.3 | >500 |
| | 2480 | 730.872 | 1052.0 | >500 |

Please refer to the following test plots:

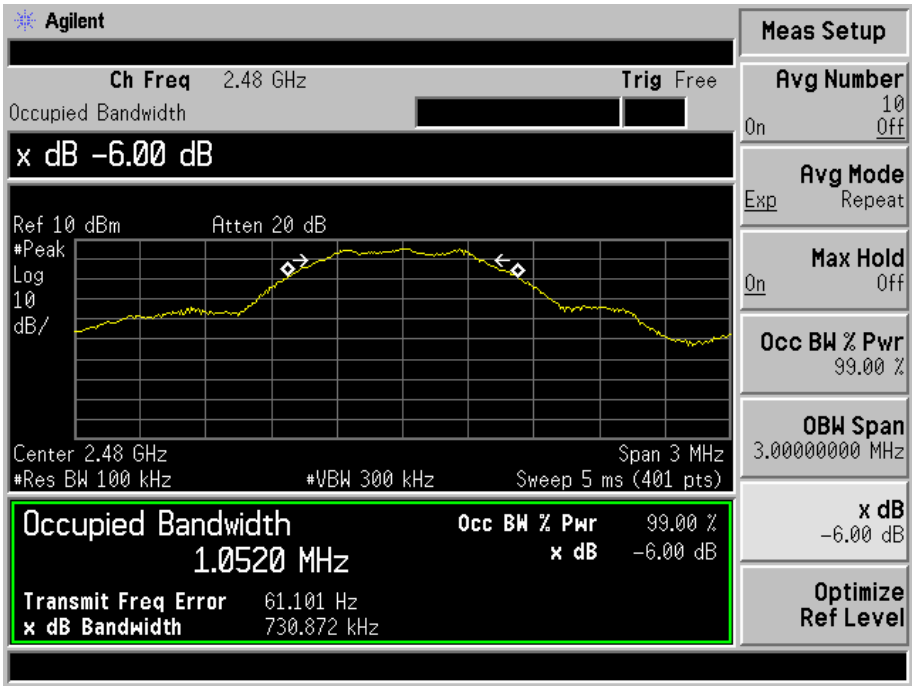
For BLE
Low Channel:




Middle Channel:



High Channel:



# 7. RF Output Power

## 7.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

## 7.2 Test Procedure

According to section 15.247(b)-power output of the KDB-558074 D01 V03r03 section 9.1.1, this procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

a) Set the RBW ⩾ DTS bandwidth.
b) Set VBW ⩾ 3 × RBW.
c) Set span ⩾ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

## 7.3 Environmental Conditions

| | |
|---|---|
| Temperature: | 26° C |
| Relative Humidity: | 57% |
| ATM Pressure: | 1011 mbar |

## 7.4 Summary of Test Results/Plots

| Test Mode | Frequency MHz | Reading dBm | Output Power mW | Limit mW |
|---|---|---|---|---|
| GFSK(BLE) | 2402 | 1.315 | 1.35 | 1000 |
| | 2442 | 2.695 | 1.86 | 1000 |
| | 2480 | 3.247 | 2.11 | 1000 |

For Simultaneous Transmission

| Test mode | Max. Output Power mW | Max. Output Power mW | Total Power mW |
|---|---|---|---|
| BT 4.0 module GFSK+BT2.0 | 2.63 | 0.48 | 3.11 |
| BT 4.0 module Pi/4 QDPSK+BT2.0 | 2.34 | 0.48 | 2.82 |
| BT 4.0 module 8DPSK+BT2.0 | 2.29 | 0.48 | 2.77 |
| BT 4.0 module BLE+BT2.0 | 2.11 | 0.48 | 2.59 |

*Note: the antenna gain of 0dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.*

# 8. Field Strength of Spurious Emissions

## 8.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ±5.10 dB.

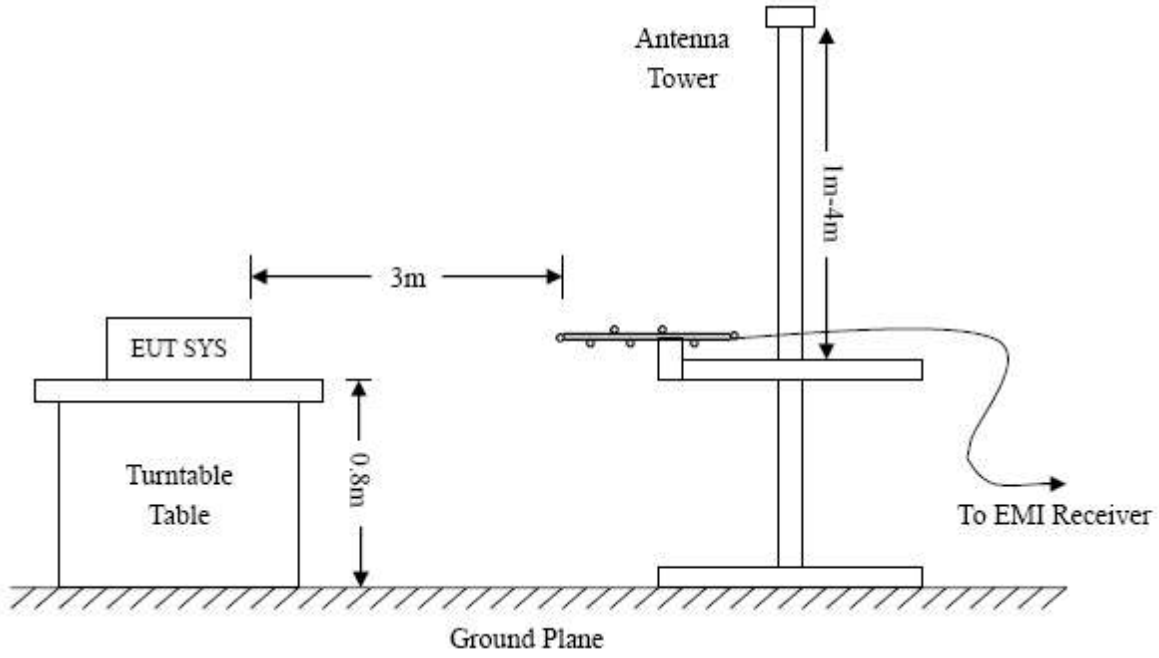
## 8.2 Standard Applicable

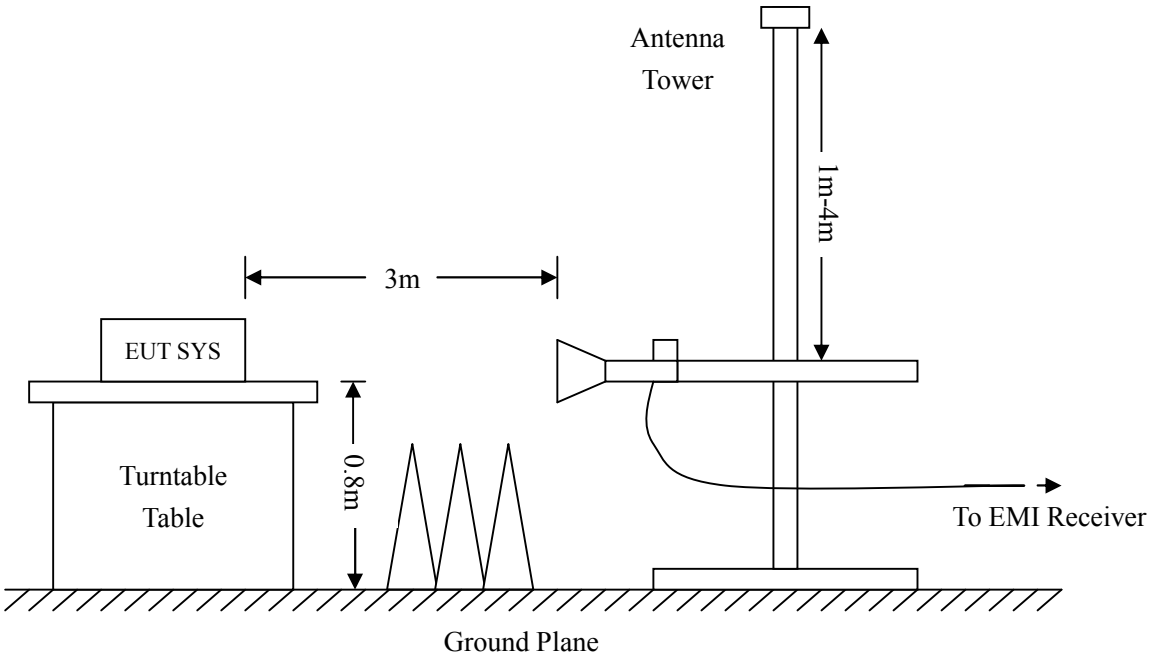
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

## 8.3 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.




| | | |
|---|---|---|
| Frequency :9kHz-30MHz | Frequency :30MHz-1GHz | Frequency :Above 1GHz |
| RBW=10KHz, | RBW=120KHz, | RBW=1MHz, |
| VBW =30KHz | VBW=300KHz | VBW=3MHz(Peak), 10Hz(AV) |
| Sweep time= Auto | Sweep time= Auto | Sweep time= Auto |
| Trace = max hold | Trace = max hold | Trace = max hold |
| Detector function = peak | Detector function = peak, QP | Detector function = peak, AV |

## 8.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCC Part 15 Limit

## 8.5 Environmental Conditions

| | |
|---|---|
| Temperature: | 25 °C |
| Relative Humidity: | 52% |
| ATM Pressure: | 1012 mbar |

## 8.6 Summary of Test Results/Plots

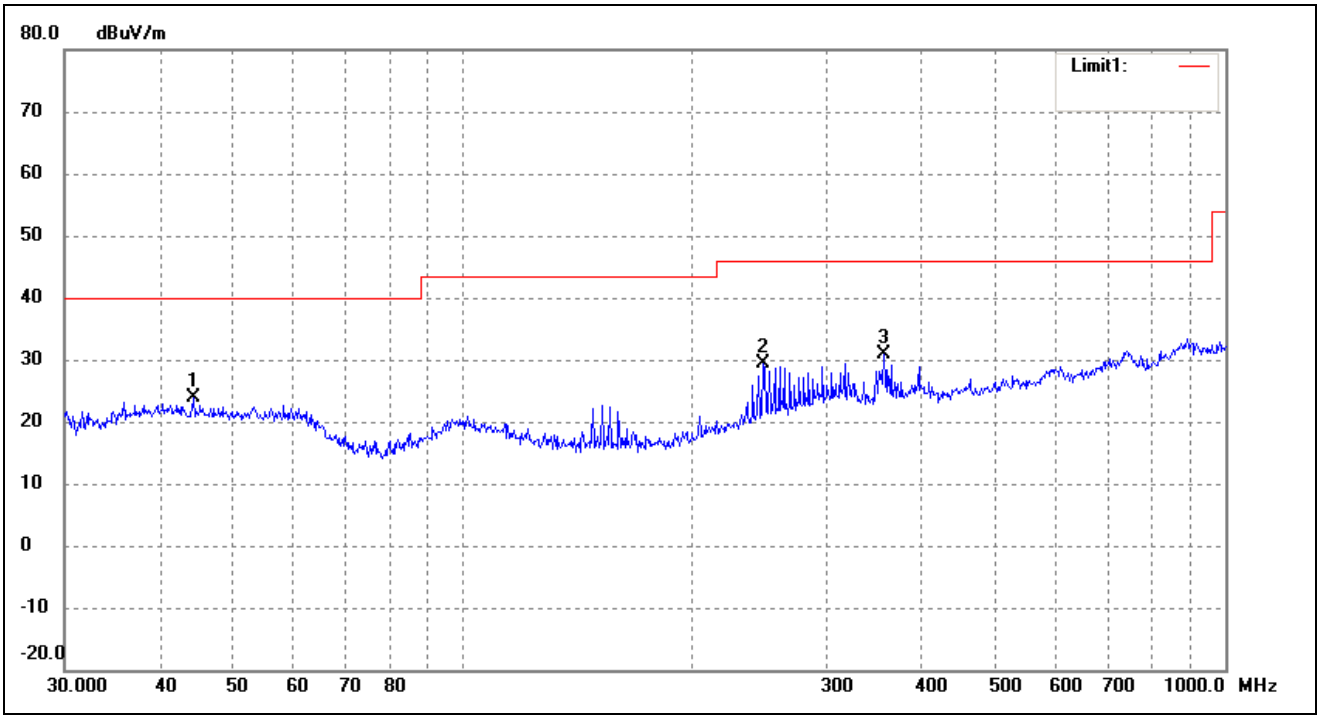
According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

*Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*

**Plot of Radiated Emissions Test Data**

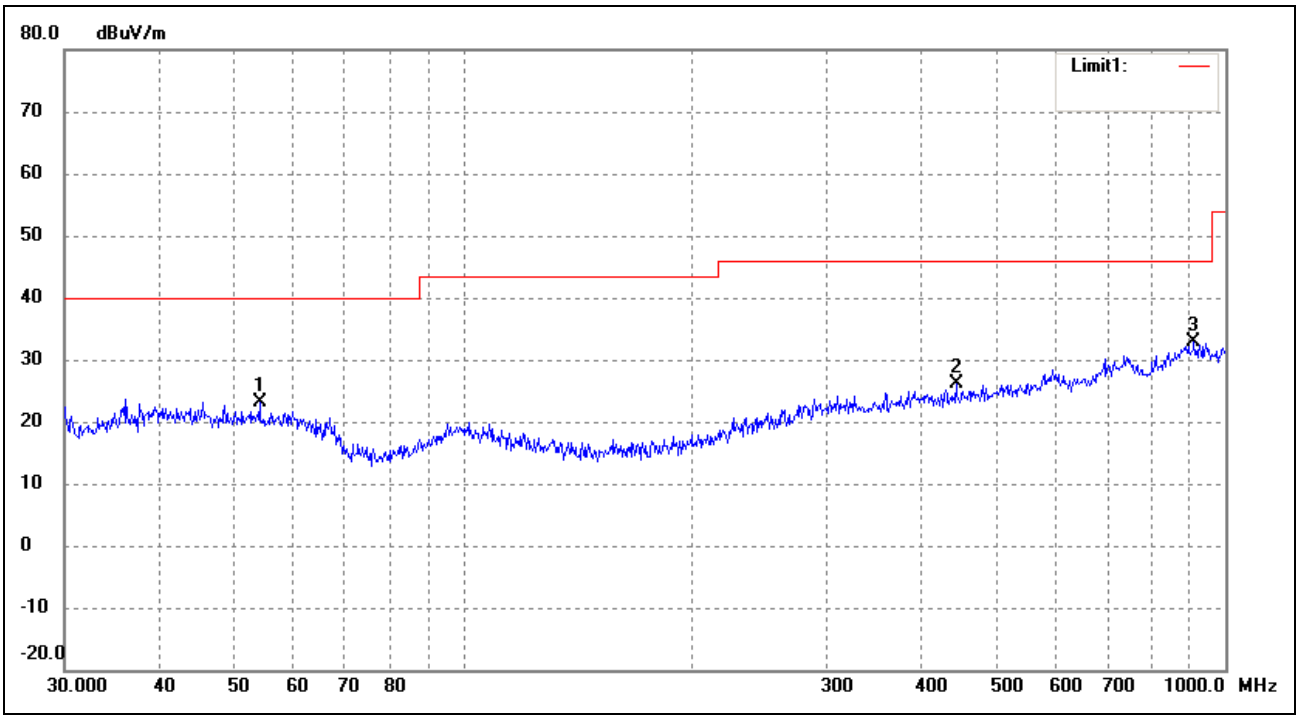
*EUT:* *Self-balancing Unicycle*
*Tested Model:* *KS*
*Operating Condition:* *Transmitting-Low channel (2402MHz)*
*Comment:* *DC 60V*

*Test Specification:* *Horizontal*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ° ) | (cm) | |
| 1 | 44.2752 | 16.06 | 7.83 | 23.89 | 40.00 | -16.11 | 51 | 100 | peak |
| 2 | 247.6819 | 22.70 | 6.61 | 29.31 | 46.00 | -16.69 | 162 | 200 | peak |
| 3 | 356.6758 | 21.70 | 9.15 | 30.85 | 46.00 | -15.15 | 208 | 200 | peak |

*Test Specification:* *Vertical*

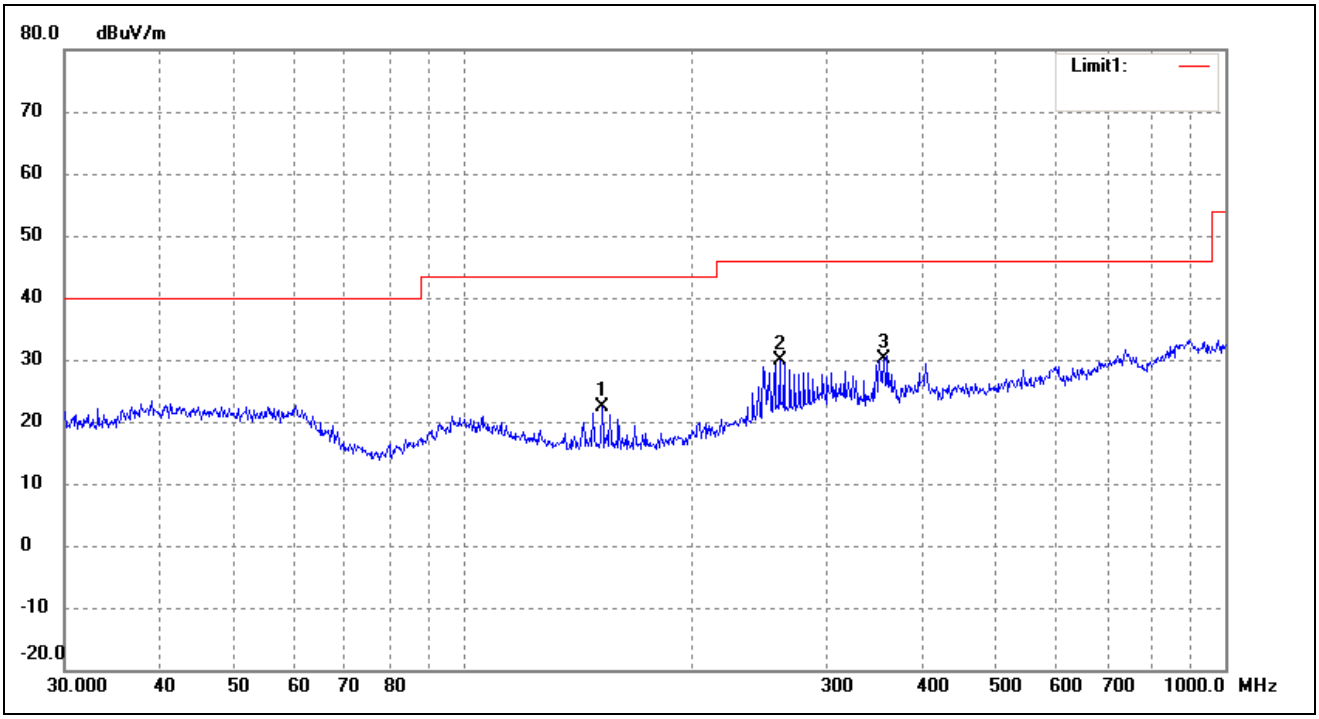



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ° ) | (cm) | |
| 1 | 54.0711 | 15.91 | 7.31 | 23.22 | 40.00 | -16.78 | 49 | 100 | peak |
| 2 | 443.2943 | 15.97 | 10.12 | 26.09 | 46.00 | -19.91 | 137 | 100 | peak |
| 3 | 909.6667 | 16.31 | 16.68 | 32.99 | 46.00 | -13.01 | 246 | 100 | peak |

**Plot of Radiated Emissions Test Data**

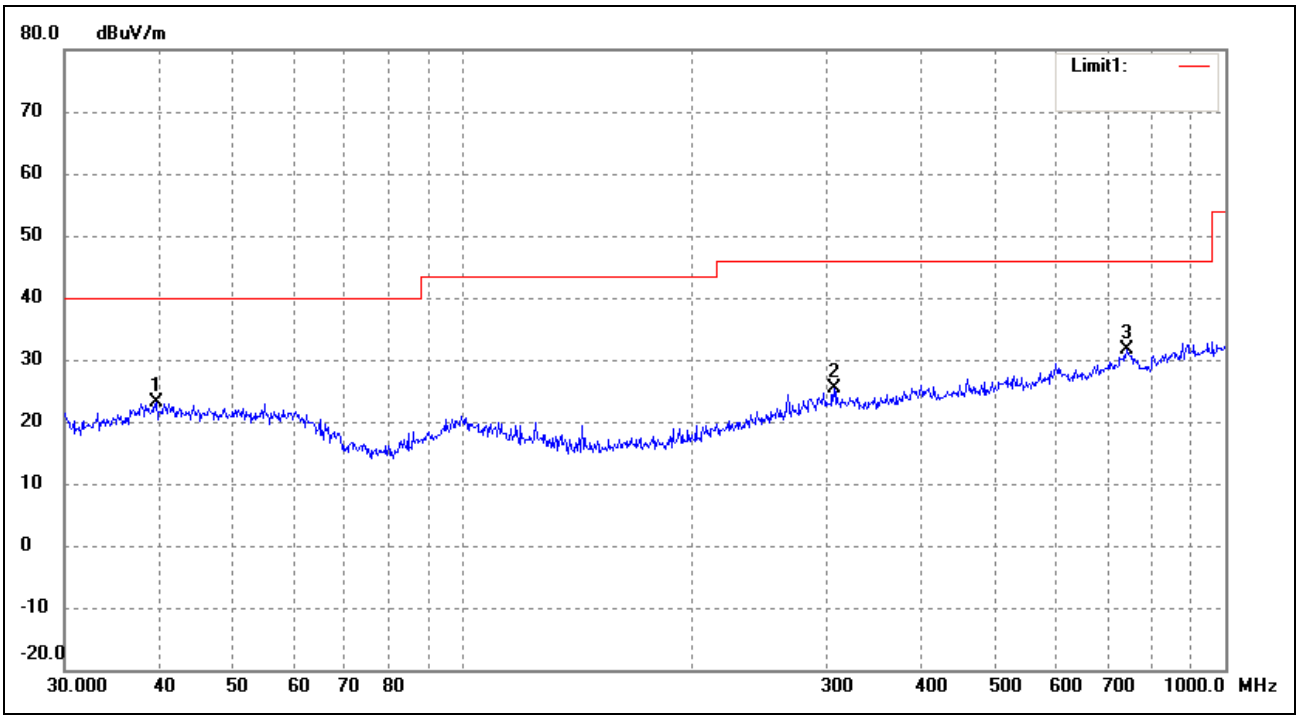
*EUT:* *Self-balancing Unicycle*
*Tested Model:* *KS*
*Operating Condition:* *Transmitting-Low channel (2442MHz)*
*Comment:* *DC 60V*

*Test Specification:* *Horizontal*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ° ) | (cm) | |
| 1 | 152.1297 | 19.81 | 2.53 | 22.34 | 43.50 | -21.16 | 75 | 200 | peak |
| 2 | 260.1444 | 22.77 | 7.04 | 29.81 | 46.00 | -16.19 | 139 | 100 | peak |
| 3 | 356.6758 | 20.92 | 9.15 | 30.07 | 46.00 | -15.93 | 214 | 200 | peak |

*Test Specification:* *Vertical*

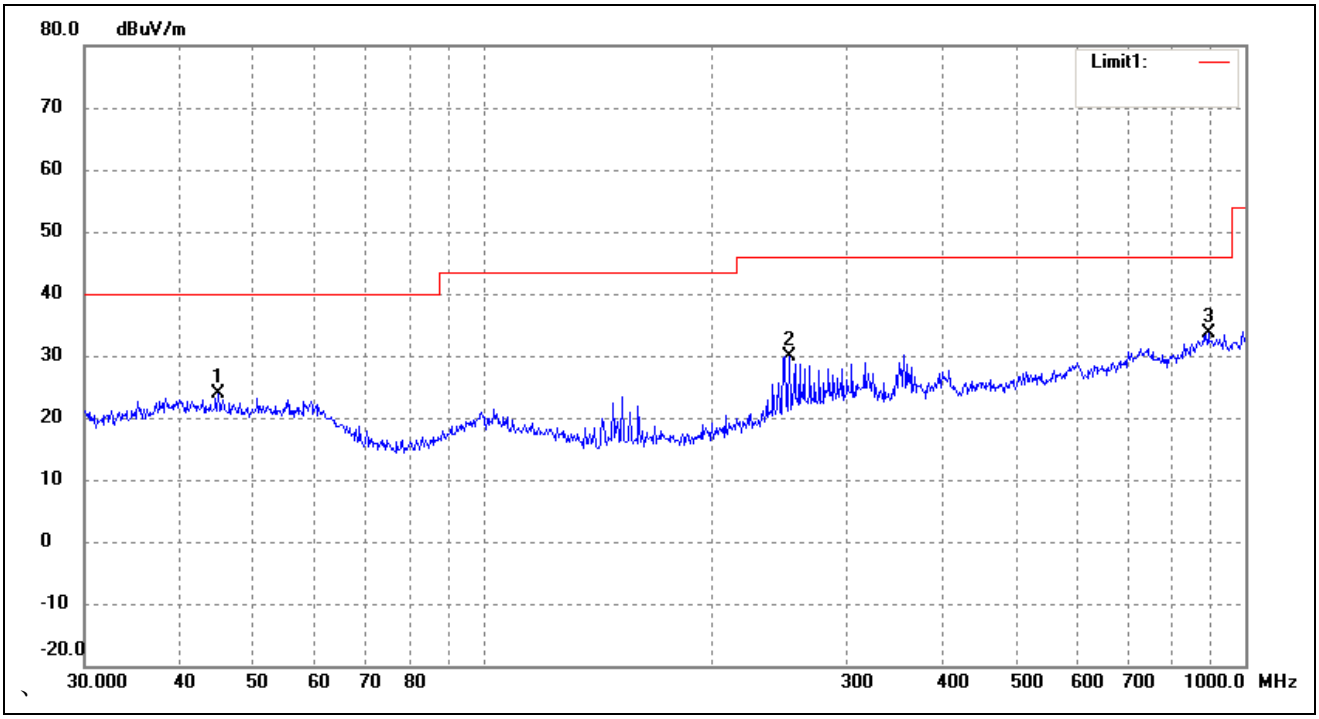



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ° ) | (cm) | |
| 1 | 39.5757 | 14.88 | 8.13 | 23.01 | 40.00 | -16.99 | 23 | 100 | peak |
| 2 | 306.7537 | 16.06 | 9.21 | 25.27 | 46.00 | -20.73 | 194 | 100 | peak |
| 3 | 742.2587 | 16.09 | 15.45 | 31.54 | 46.00 | -14.46 | 275 | 100 | peak |

**Plot of Radiated Emissions Test Data**

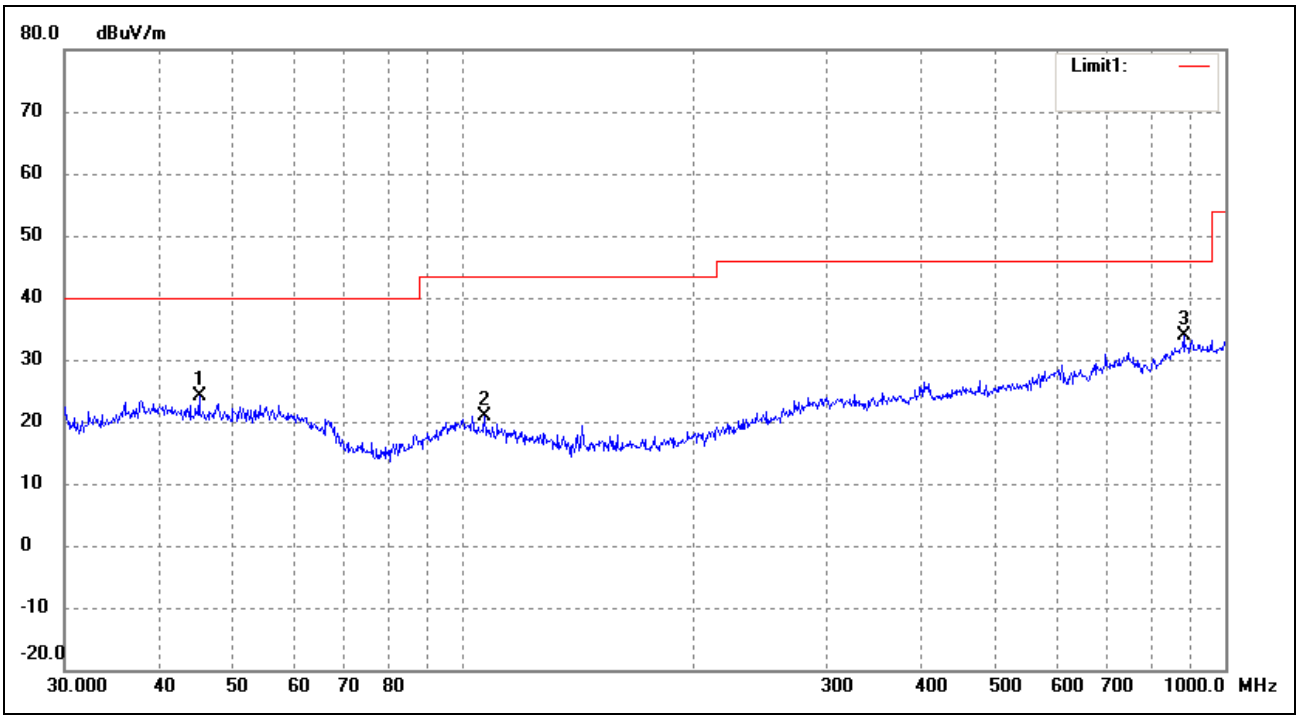
*EUT:* *Self-balancing Unicycle*
*Tested Model:* *KS*
*Operating Condition:* *Transmitting-Low channel (2480MHz)*
*Comment:* *DC 60V*

*Test Specification:* *Horizontal*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ° ) | (cm) | |
| 1 | 44.9006 | 16.14 | 7.77 | 23.91 | 40.00 | -16.09 | 39 | 200 | peak |
| 2 | 252.0627 | 23.08 | 6.76 | 29.84 | 46.00 | -16.16 | 163 | 100 | peak |
| 3 | 893.8567 | 16.82 | 16.85 | 33.67 | 46.00 | -12.33 | 279 | 200 | peak |

*Test Specification:* *Vertical*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ° ) | (cm) | |
| 1 | 45.0583 | 16.32 | 7.75 | 24.07 | 40.00 | -15.93 | 33 | 200 | peak |
| 2 | 106.7587 | 15.43 | 5.42 | 20.85 | 43.50 | -22.65 | 69 | 200 | peak |
| 3 | 881.4067 | 17.04 | 16.82 | 33.86 | 46.00 | -12.14 | 167 | 200 | peak |

*Spurious Emissions Above 1GHz*

*Transmitting: BLE mode:*

| Frequency | Reading | Correct | Result | Limit | Margin | Polar | Detector |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | H/V | |
| Low Channel-2402MHz | | | | | | | |
| 4804 | 40.00 | 0.53 | 40.53 | 74.00 | -33.47 | H | PK |
| 4804 | 28.51 | 0.53 | 29.04 | 54.00 | -24.96 | H | AV |
| 7206 | 28.50 | 3.66 | 32.16 | 74.00 | -41.84 | H | PK |
| 7206 | 17.04 | 3.66 | 20.70 | 54.00 | -33.30 | H | AV |
| 4804 | 43.00 | 0.53 | 43.53 | 74.00 | -30.47 | V | PK |
| 4804 | 28.56 | 0.53 | 29.09 | 54.00 | -24.91 | V | AV |
| 7206 | 28.00 | 3.66 | 31.66 | 74.00 | -42.34 | V | PK |
| 7206 | 17.04 | 3.66 | 20.70 | 54.00 | -33.30 | V | AV |
| Middle Channel-2442MHz | | | | | | | |
| 4884 | 40.04 | 0.66 | 40.70 | 74.00 | -33.30 | H | PK |
| 4884 | 30.00 | 0.66 | 30.66 | 54.00 | -23.34 | H | AV |
| 7326 | 29.17 | 3.76 | 32.93 | 74.00 | -41.07 | H | PK |
| 7326 | 18.00 | 3.76 | 21.76 | 54.00 | -32.24 | H | AV |
| 4884 | 40.50 | 0.66 | 41.16 | 74.00 | -32.84 | V | PK |
| 4884 | 31.00 | 0.66 | 31.66 | 54.00 | -22.34 | V | AV |
| 7326 | 29.00 | 3.76 | 32.76 | 74.00 | -41.24 | V | PK |
| 7326 | 18.52 | 3.76 | 22.28 | 54.00 | -31.72 | V | AV |
| High Channel-2480MHz | | | | | | | |
| 4960 | 40.67 | 0.77 | 41.44 | 74.00 | -32.56 | H | PK |
| 4960 | 29.07 | 0.77 | 29.84 | 54.00 | -24.16 | H | AV |
| 7440 | 31.35 | 3.85 | 35.20 | 74.00 | -38.80 | H | PK |
| 7440 | 19.25 | 3.85 | 23.40 | 54.00 | -30.60 | H | AV |
| 4960 | 40.00 | 0.77 | 40.77 | 74.00 | -33.23 | V | PK |
| 4960 | 31.69 | 0.77 | 32.46 | 54.00 | -21.54 | V | AV |
| 7440 | 31.05 | 3.85 | 34.90 | 74.00 | -39.10 | V | PK |
| 7440 | 19.50 | 3.85 | 23.35 | 54.00 | -30.65 | V | AV |

*Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 3$^{th}$ Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
*The measurements greater than 20dB below the limit from 9kHz to 30MHz..*

# 9. Out of Band Emissions

## 9.1 Standard Applicable

According to §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

## 9.2 Test Procedure

According to the KDB 558074 D01 v03r03, the band-edge radiated test method as follows:

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz for low bandedge, 2460MHz to 2500MHz for the high bandedge)
RBW = 1MHz, VBW = 1MHz for peak value measured
RBW = 1MHz, VBW = 10Hz for average value measured
Sweep = auto; Detector function = peak/average; Trace = max hold
All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated bandedge measurements.

According to the KDB 558074 D01 V03r03, the conducted spurious emissions test method as follows:
1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW ≥ 300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

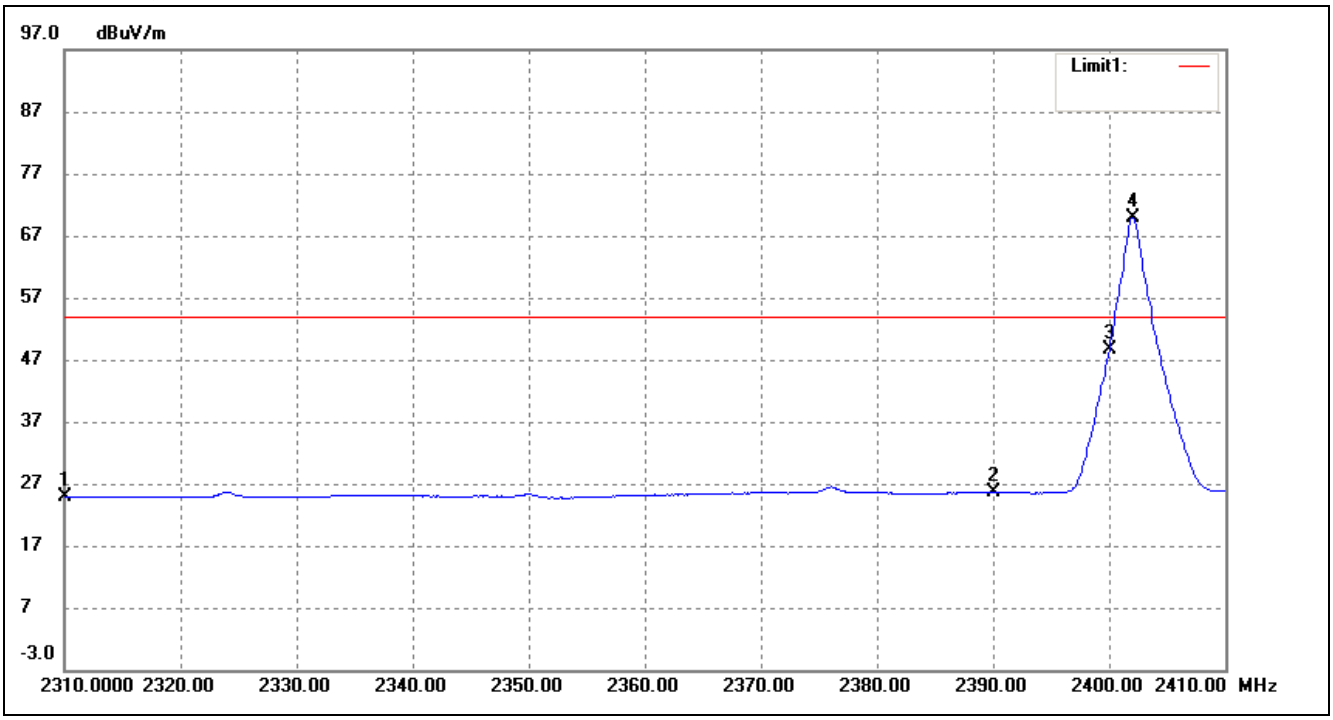
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1. Report the three highest emissions relative to the limit.

## 9.3 Environmental Conditions

| | |
|---|---|
| Temperature: | 23°C |
| Relative Humidity: | 54% |
| ATM Pressure: | 1011 mbar |

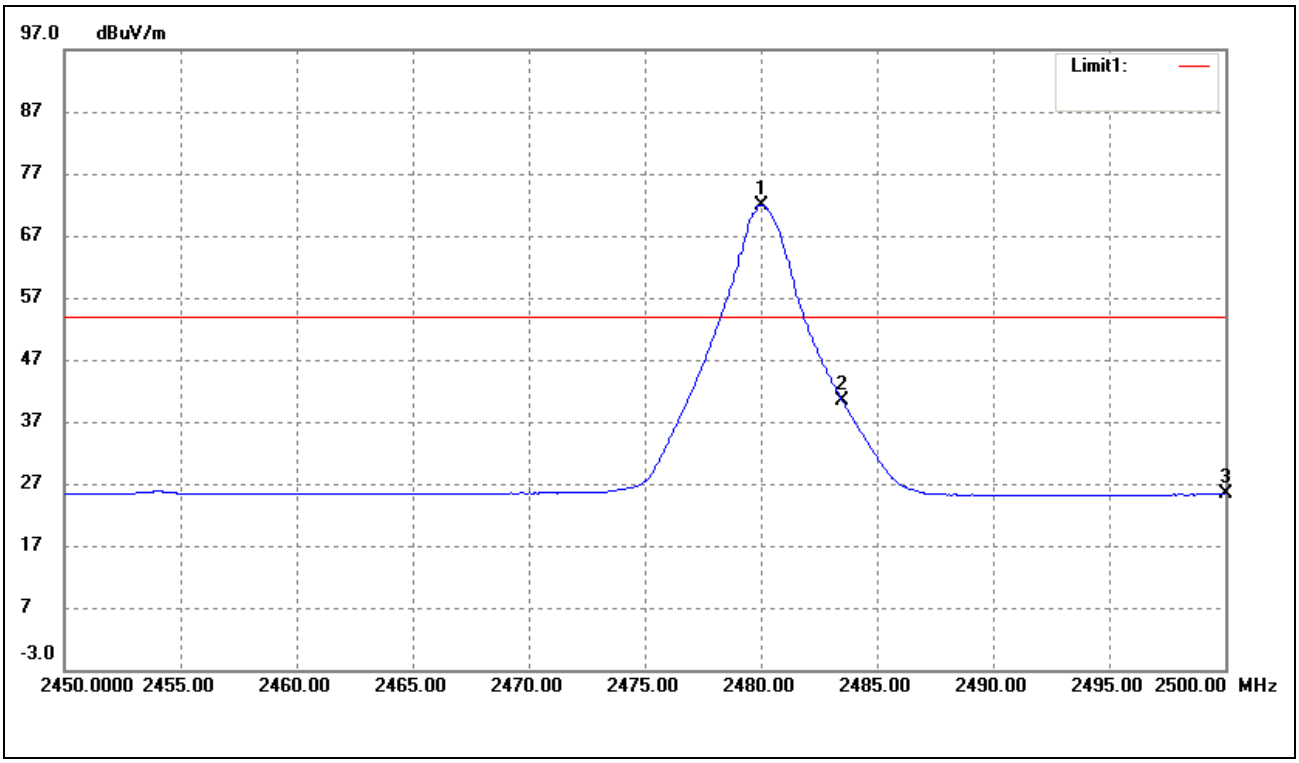
## 9.4 Summary of Test Results/Plots

Bandedge (Radiated)
Lowest Bandedge-BLE
Horizontal (Worst case)




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2310.000 | 28.61 | -3.71 | 24.90 | 54.00 | -29.10 | Average Detector |
| | 2310.000 | 41.03 | -3.71 | 37.32 | 74.00 | -36.68 | Peak Detector |
| 2 | 2390.000 | 29.18 | -3.54 | 25.64 | 54.00 | -28.36 | Average Detector |
| | 2390.000 | 41.18 | -3.54 | 37.64 | 74.00 | -36.36 | Peak Detector |
| 3 | 2400.000 | 52.16 | -3.51 | 48.65 | Delta =21.29 dBc | | Average Detector |
| 4 | 2402.100 | 73.45 | -3.51 | 69.94 | | | Average Detector |

Highest Bandedge-BLE
Horizontal (Worst case)




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2480.000 | 75.30 | -3.33 | 71.97 | / | / | Average Detector |
| | 2480.000 | 94.54 | -3.33 | 91.21 | / | / | Peak Detector |
| 2 | 2483.500 | Delta = 52.32 dBc | | 19.65 | 54.00 | -34.35 | Average Detector |
| | 2483.500 | | | 38.89 | 74.00 | -35.11 | Peak Detector |
| 3 | 2500.000 | 28.55 | -3.28 | 25.27 | 54.00 | -28.73 | Average Detector |
| | 2500.000 | 41.84 | -3.28 | 38.56 | 74.00 | -35.44 | Peak Detector |

# 10. Conducted Emissions

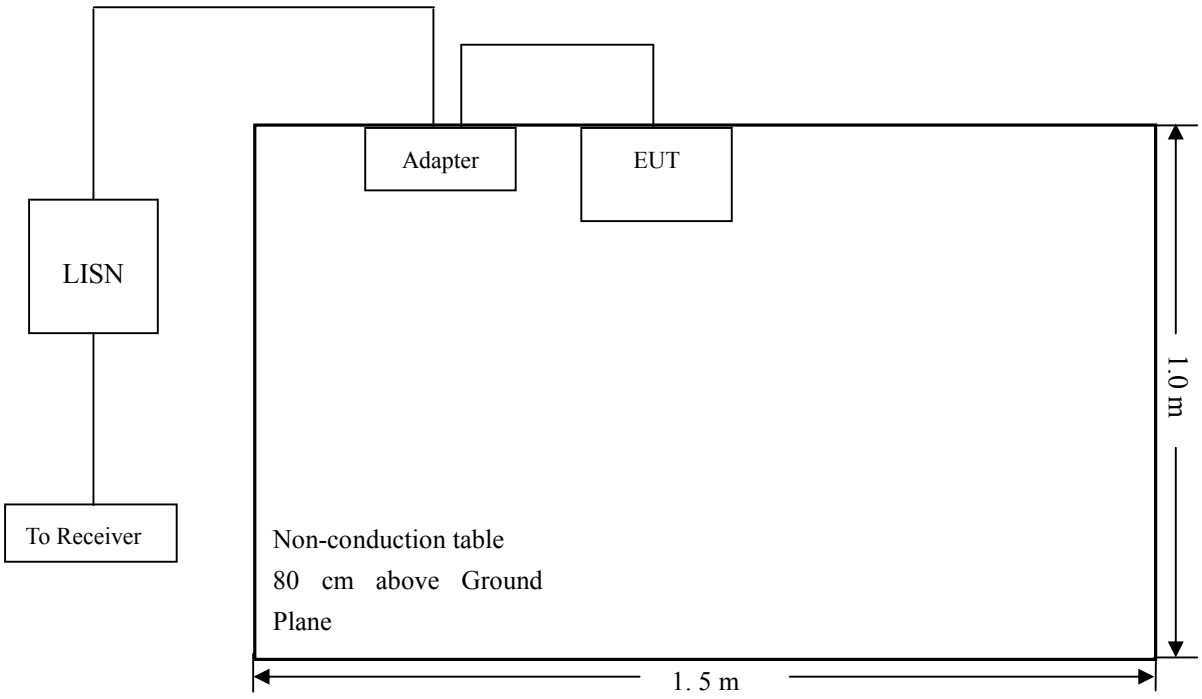
## 10.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ± 2.88 dB.

## 10.2 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

## 10.3 Basic Test Setup Block Diagram




## 10.4 Environmental Conditions

| | |
|---|---|
| Temperature: | 25 °C |
| Relative Humidity: | 52% |
| ATM Pressure: | 1012 mbar |

## 10.5 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz
Quasi-Peak Adapter Mode ..... Normal

## 10.6 Summary of Test Results/Plots

According to the data in section 10.7, the EUT complied with the FCC Part 15.207 Conducted margin for this device, with the *worst* margin reading of:

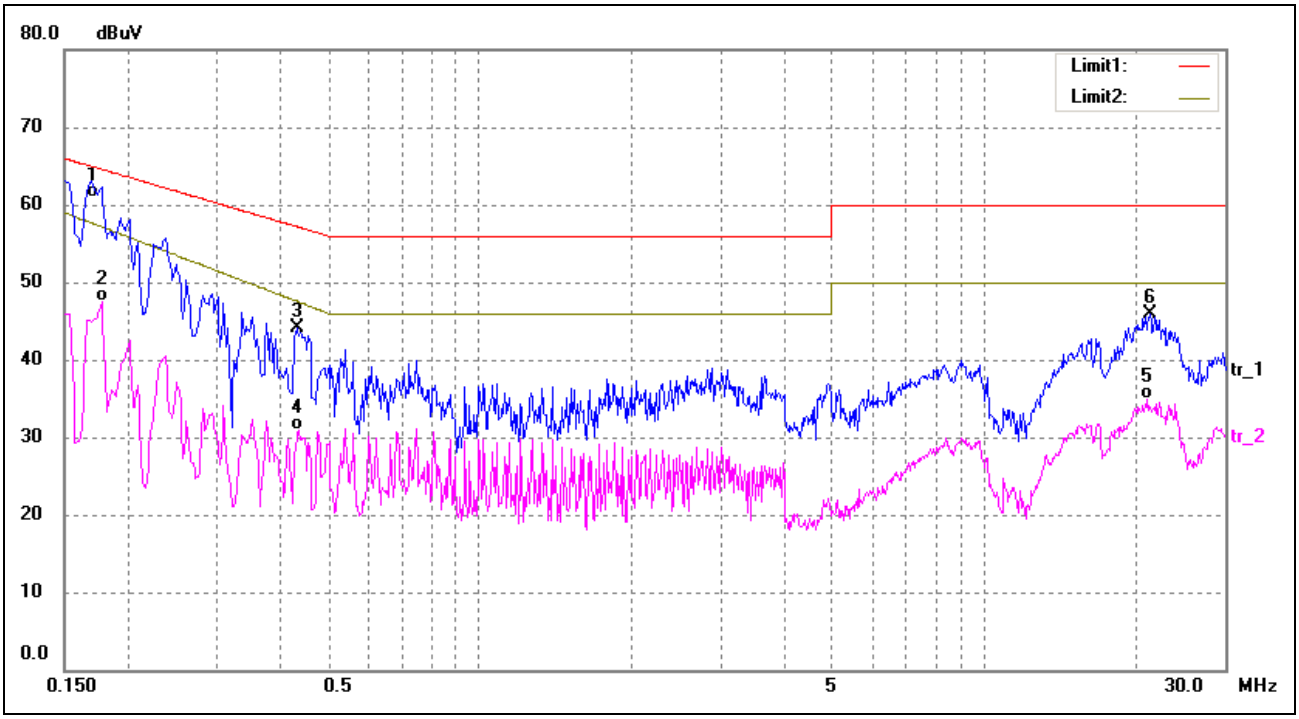
**-4.06 dB** at **0.1700 MHz** in the **Neutral** mode, **QP** detector, **0.15-30MHz**

## 10.7 Conducted Emissions Test Data

**Plot of Conducted Emissions Test Data**

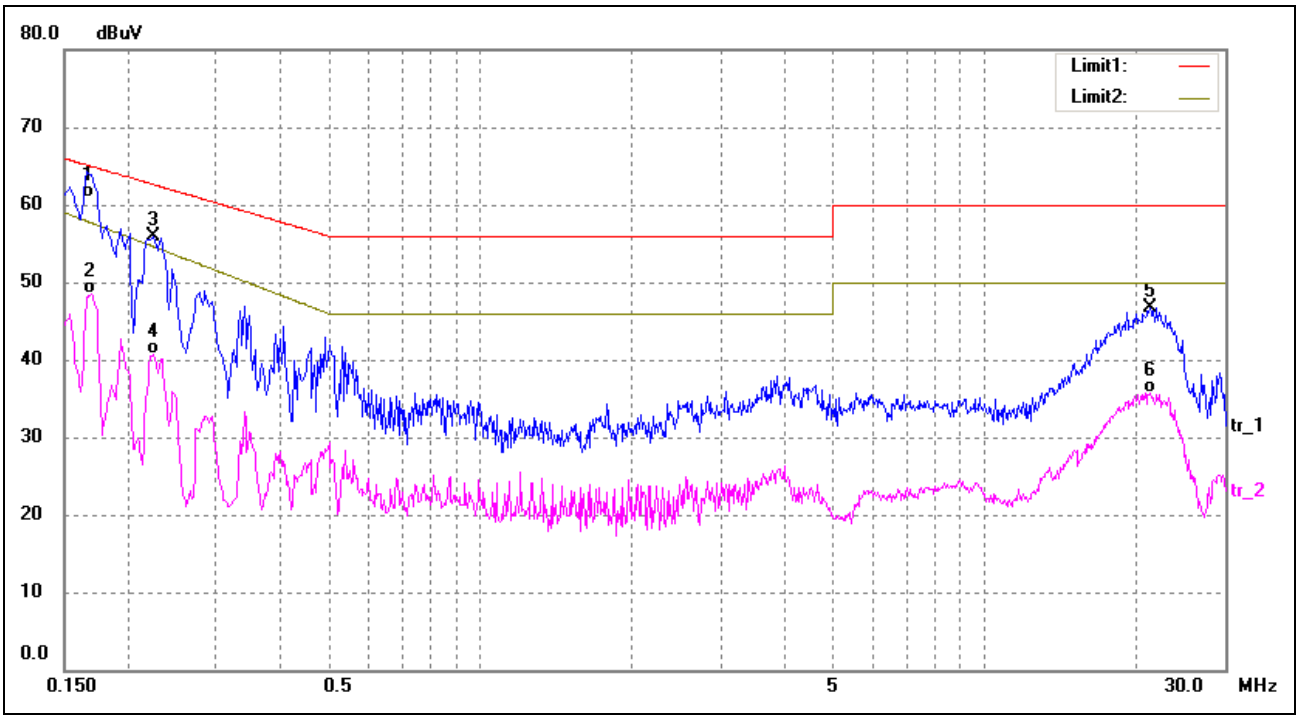
*EUT:* *Self-balancing Unicycle*
*Tested Model:* *KS*
*Operating Condition:* *BT Transmitting*
*Comment:* *AC 120V/60Hz; Adapter DC 67.2V*

*Test Specification:* *Neutral*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Detector |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dB/m) | (dBuV) | (dBuV) | (dB) | |
| 1* | 0.1700 | 51.40 | 9.50 | 60.90 | 64.96 | -4.06 | QP |
| 2 | 0.1780 | 37.92 | 9.50 | 47.42 | 57.15 | -9.73 | AVG |
| 3 | 0.4340 | 34.67 | 9.50 | 44.17 | 57.18 | -13.01 | peak |
| 4 | 0.4380 | 21.38 | 9.50 | 30.88 | 47.43 | -16.55 | AVG |
| 5 | 21.0459 | 22.96 | 12.00 | 34.96 | 50.00 | -15.04 | AVG |
| 6 | 21.3220 | 33.82 | 12.00 | 45.82 | 60.00 | -14.18 | peak |

*Test Specification:* *Line*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Detector |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dB/m) | (dBuV) | (dBuV) | (dB) | |
| 1* | 0.1660 | 51.31 | 9.50 | 60.81 | 65.15 | -4.34 | QP |
| 2 | 0.1700 | 38.98 | 9.50 | 48.48 | 57.64 | -9.16 | AVG |
| 3 | 0.2260 | 46.42 | 9.50 | 55.92 | 62.59 | -6.67 | peak |
| 4 | 0.2260 | 31.23 | 9.50 | 40.73 | 54.57 | -13.84 | AVG |
| 5 | 21.2900 | 34.73 | 12.00 | 46.73 | 60.00 | -13.27 | peak |
| 6 | 21.2900 | 23.77 | 12.00 | 35.77 | 50.00 | -14.23 | AVG |

******* END OF REPORT *******