# FCC Test Report

| | |
|---|---|
| Product Name | Detachable Keyboard |
| Model No. | GZ700G Mobile Dock |
| FCC ID | MSQ-GZ700KB |

| | |
|---|---|
| Applicant | ASUSTeK Computer Inc |
| Address | 4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan |

| | |
|---|---|
| Date of Receipt | Dec. 20, 2018 |
| Issued Date | April 08, 2019 |
| Report No. | 18C0278R-RFUSP15V00 |
| Report Version | V1.0 |

Testing Laboratory
3023

# Test Report

Issued Date: April 08, 2019
Report No.: 18C0278R-RFUSP15V00

| | |
|---|---|
| Product Name | Detachable Keyboard |
| Applicant | ASUSTeK Computer Inc |
| Address | 4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan |
| Manufacturer | ASUSTeK Computer Inc |
| Model No. | GZ700G Mobile Dock |
| EUT Rated Voltage | DC 3.85V by Battery, DC 5V by USB |
| EUT Test Voltage | DC 5V by USB |
| Trade Name | ASUS |
| Applicable Standard | FCC CFR Title 47 Part 15 Subpart C: 2016<br>ANSI C63.4: 2014, ANSI C63.10: 2013 |
| Test Result | Complied |

Documented By : Rita Huang

( Senior Adm. Specialist / Rita Huang )

Tested By : Jason Tuan

( Engineer / Jason Tuan )

Approved By :

( Director / Vincent Lin )

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# 1. GENERAL INFORMATION

## 1.1. EUT Description

| | |
|---|---|
| Product Name | Detachable Keyboard |
| Trade Name | ASUS |
| Model No. | GZ700G Mobile Dock |
| FCC ID | MSQ-GZ700KB |
| Frequency Range | 2402~2480MHz |
| Channel Control | Auto |
| Antenna Type | PIFA Antenna |
| Channel Number | 40 |
| Type of Modulation | GFSK |

**Antenna List**

| No. | Manufacturer | Part No. | ASUS No. | Antenna Type | Peak Gain |
|---|---|---|---|---|---|
| 1 | INPAQ | WAG-P-LA-00-012 | 14008-03420500 | PIFA Antenna | -0.8 dBi for 2.4 GHz |

Note: The antenna of EUT is conform to FCC 15.203

Center Frequency of Each Channel

| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---|---|---|---|---|---|---|---|
| Channel 00: | 2402 MHz | Channel 01: | 2404 MHz | Channel 02: | 2406 MHz | Channel 03: | 2408 MHz |
| Channel 04: | 2410 MHz | Channel 05: | 2412 MHz | Channel 06: | 2414 MHz | Channel 07: | 2416 MHz |
| Channel 08: | 2418 MHz | Channel 09: | 2420 MHz | Channel 10: | 2422 MHz | Channel 11: | 2424 MHz |
| Channel 12: | 2426 MHz | Channel 13: | 2428 MHz | Channel 14: | 2430 MHz | Channel 15: | 2432 MHz |
| Channel 16: | 2434 MHz | Channel 17: | 2436 MHz | Channel 18: | 2438 MHz | Channel 19: | 2440 MHz |
| Channel 20: | 2442 MHz | Channel 21: | 2444 MHz | Channel 22: | 2446 MHz | Channel 23: | 2448 MHz |
| Channel 24: | 2450 MHz | Channel 25: | 2452 MHz | Channel 26: | 2454 MHz | Channel 27: | 2456 MHz |
| Channel 28: | 2458 MHz | Channel 29: | 2460 MHz | Channel 30: | 2462 MHz | Channel 31: | 2464 MHz |
| Channel 32: | 2466 MHz | Channel 33: | 2468 MHz | Channel 34: | 2470 MHz | Channel 35: | 2472 MHz |
| Channel 36: | 2474 MHz | Channel 37: | 2476 MHz | Channel 38: | 2478 MHz | Channel 39: | 2480 MHz |

Note:

1. The EUT is a Detachable Keyboard with a built-in 2.4GHz GFSK transceiver.
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
3. These tests are conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.249 for spread spectrum devices.

| | |
|---|---|
| Test Mode | Mode 1: Transmit |

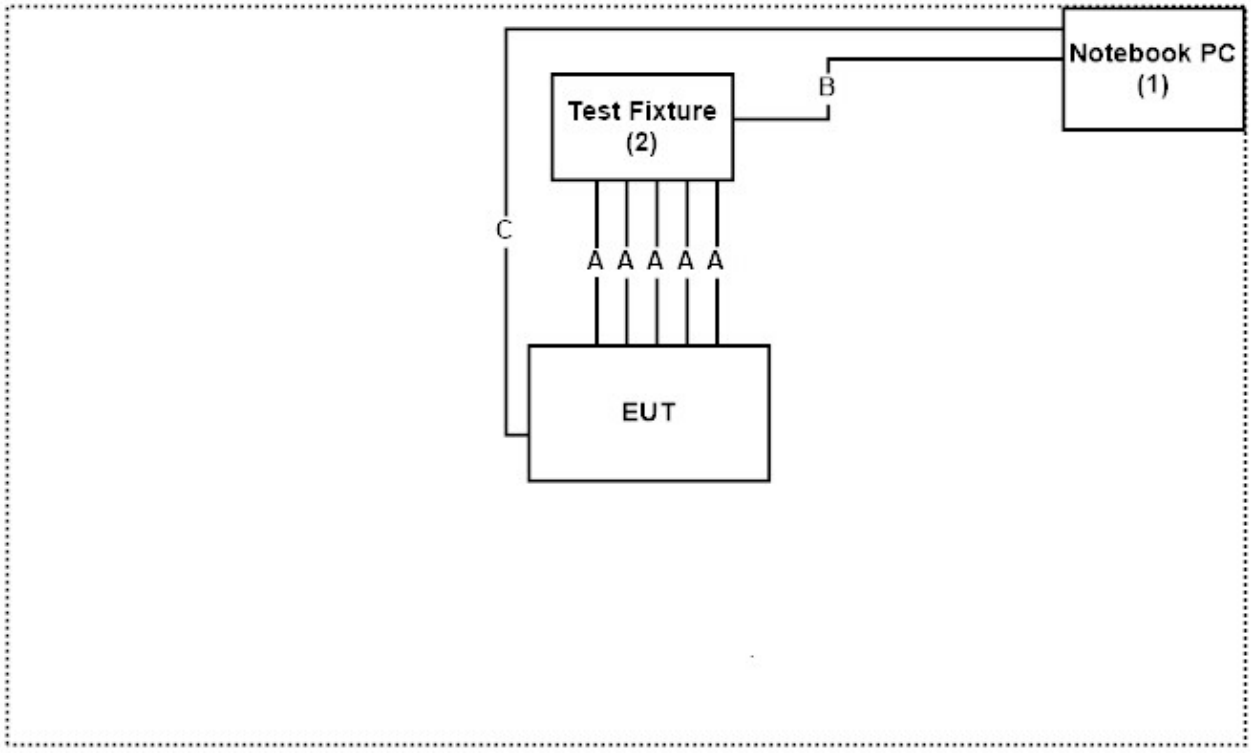
## 1.3. Tested System Datails

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

| Product | | Manufacturer | Model No. | Serial No. | Power Cord |
|---|---|---|---|---|---|
| 1 | Notebook PC | DELL | Latitude 5491 | 1PL56S2 | Non-Shielded, 0.8m |
| 2 | Test Fixture | TEXAS INSTRVMENTS | N/A | N/A | N/A |

| Signal Cable Type | | Signal cable Description |
|---|---|---|
| A | Signal Cable | Non-Shielded, 0.1m, five PCS. |
| B | USB Cable | Non-Shielded, 1.5m |
| C | USB Cable | Non-Shielded, 1.0m |

## 1.4. Configuration of Test System



## 1.5. EUT Exercise Software

(1) Setup the EUT as shown in Section 1.4.
(2) Execute “SmartRF_Studio_7-2.11.0” program on the EUT.
(3) Configure the test mode and the test channel
(4) start the continuous Transmit.
(5) Verify that the EUT works properly.

## 1.6. Test Facility

Ambient conditions in the laboratory:

| Items | Required (IEC 68-1) | Actual |
|---|---|---|
| Temperature (°C) | 15-35 | 20-35 |
| Humidity (%RH) | 25-75 | 50-65 |
| Barometric pressure (mbar) | 860-1060 | 950-1000 |

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:
http://www.dekra.com.tw/english/about/certificates.aspx?bval=5
The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en.aspx

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd
Site Address: No.5-22, Ruishukeng, Linkou Dist., New Taipei City 24451, Taiwan, R.O.C.
TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : info.tw@dekra.com

FCC Accreditation Number: TW3023

## 1.7. List of Test Equipment

**For Conducted measurements /CB3/SR8**

| | Equipment | Manufacturer | Model No. | Serial No. | Cali. Date | Due. Date |
|---|---|---|---|---|---|---|
| | Temperature Chamber | WIT GROUP | TH-1S-B | EQ-201-00146 | 2019/02/26 | 2020/02/25 |
| X | Spectrum Analyzer | Agilent | N9010A | MY53470892 | 2018/09/27 | 2019/09/26 |
| X | Peak Power Analyzer | Keysight | 8990B | MY51000410 | 2018/08/01 | 2019/07/31 |
| X | Wideband Power Sensor | Keysight | N1923A | MY56080003 | 2018/07/25 | 2019/07/24 |
| X | Wideband Power Sensor | Keysight | N1923A | MY56080004 | 2018/07/25 | 2019/07/24 |
| X | EMI Test Receiver | R&S | ESCS 30 | 100369 | 2018/11/19 | 2019/11/18 |
| X | LISN | R&S | ENV216 | 101105 | 2019/03/30 | 2020/03/29 |
| X | LISN | R&S | ESH3-Z5 | 836679/014 | 2019/04/02 | 2020/04/01 |
| X | Coaxial Cable | DEKRA | RG 400 | LC018-RG | 2018/06/21 | 2019/06/20 |

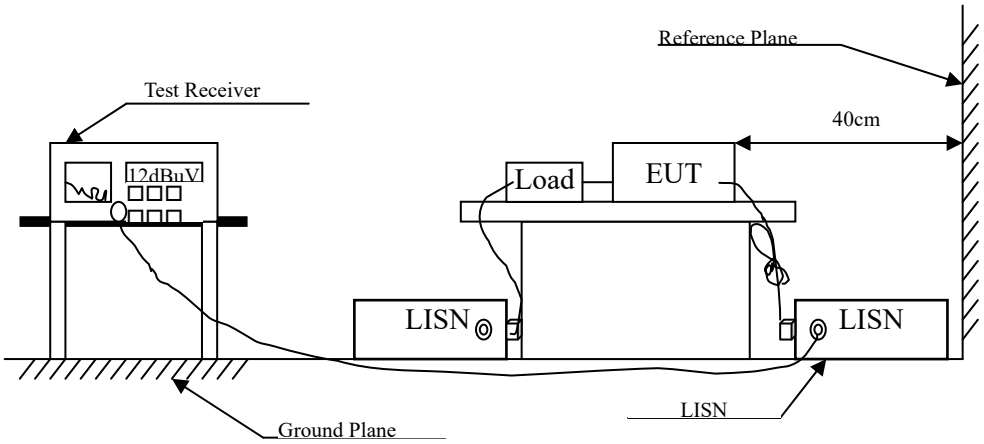
**For Radiated measurements /Site3/CB8**

| | Equipment | Manufacturer | Model No. | Serial No. | Cali. Date | Due. Date |
|---|---|---|---|---|---|---|
| X | Spectrum Analyzer | R&S | FSP40 | 100170 | 2019/03/12 | 2020/03/11 |
| X | Loop Antenna | Teseq | HLA6121 | 37133 | 2018/10/13 | 2019/10/12 |
| X | Bilog Antenna | Schaffner Chase | CBL6112B | 2707 | 2018/06/24 | 2019/06/23 |
| X | Coaxial Cable | DEKRA | RG 214 | LC003-RG | 2018/06/14 | 2019/06/13 |
| X | Pre-Amplifier | Jet-Power | JPA-10M1G33 | 170101000330010 | 2018/06/14 | 2019/06/13 |
| X | Horn Antenna | ETS-Lindgren | 3117 | 00135205 | 2018/05/03 | 2019/05/02 |
| X | Horn Antenna | SCHWARZBECK | 9120D | 576 | 2018/12/18 | 2019/12/17 |
| X | Pre-Amplifier | EMCI | EMC012630SE | 980210 | 2018/04/10 | 2019/04/09 |
| X | Horn Antenna | Com-Power | AH-840 | 101043 | 2019/01/19 | 2020/01/18 |
| X | Amplifier + Cable | EMCI | EMC184045SE | 980370 | 2019/03/21 | 2020/03/20 |
| X | Filter | MICRO-TRONICS | BRM50702 | G270 | 2018/08/06 | 2019/08/05 |
| X | Filter | MICRO-TRONICS | BRM50716 | G196 | 2018/08/06 | 2019/08/05 |

Note:
1. All equipments are calibrated every one year.
2. The test instruments marked with “X” are used to measure the final test results.
3. Test Software version :QuieTek EMI 2.0 V2.1.113.

## 2. Conducted Emission

### 2.1. Test Setup



## 2.2. Limits

| FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit | | |
|---|---|---|
| Frequency MHz | Limits | |
| | QP | AV |
| 0.15 - 0.50 | 66-56 | 56-46 |
| 0.50-5.0 | 56 | 46 |
| 5.0 - 30 | 60 | 50 |

Remarks: In the above table, the tighter limit applies at the band edges.

## 2.3. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

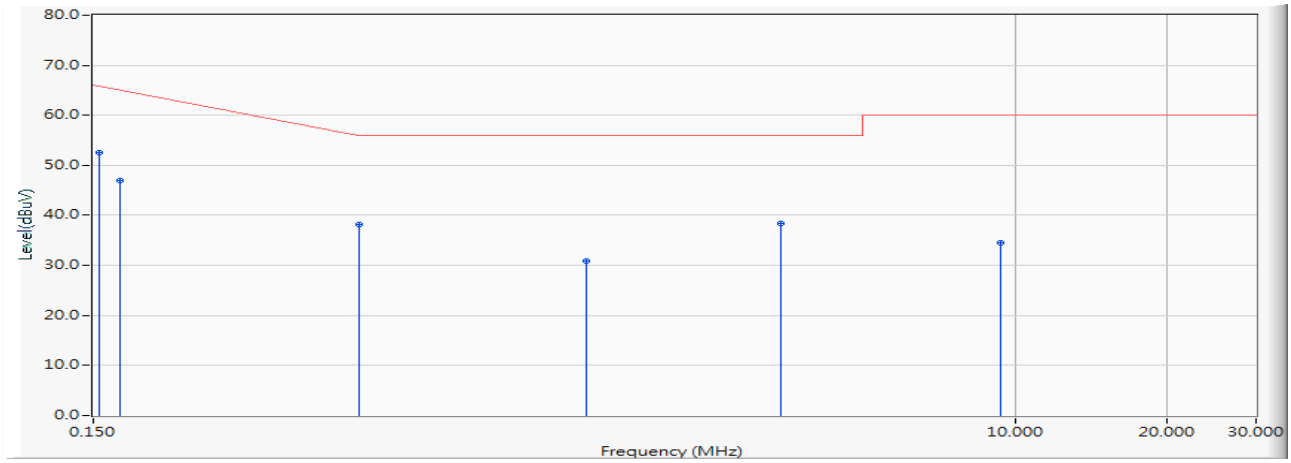
## 2.4. Uncertainty

± 2.26 dB

## 2.5. Test Result of Conducted Emission

Product : Detachable Keyboard
Test Item : Conducted Emission Test
Test Date : 2018/11/30
Test Mode : Mode 1: Transmit (2440MHz)

Line 1



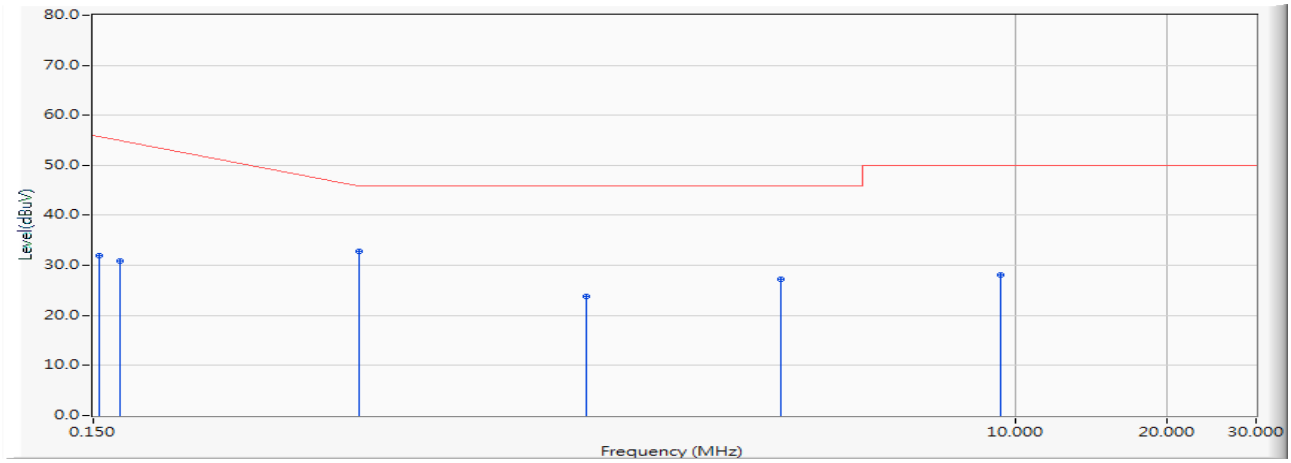

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV) | Margin (dB) | Limit (dBuV) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | * | 0.154 | 9.748 | 42.800 | 52.548 | -13.338 | 65.886 | QUASIPEAK |
| 2 | | 0.170 | 9.743 | 37.230 | 46.973 | -18.456 | 65.429 | QUASIPEAK |
| 3 | | 0.505 | 9.750 | 28.370 | 38.120 | -17.880 | 56.000 | QUASIPEAK |
| 4 | | 1.416 | 9.798 | 21.180 | 30.978 | -25.022 | 56.000 | QUASIPEAK |
| 5 | | 3.431 | 9.868 | 28.620 | 38.488 | -17.512 | 56.000 | QUASIPEAK |
| 6 | | 9.345 | 10.050 | 24.500 | 34.550 | -25.450 | 60.000 | QUASIPEAK |

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Detachable Keyboard
Test Item : Conducted Emission Test
Test Date : 2018/11/30
Test Mode : Mode 1: Transmit (2440MHz)

Line 1



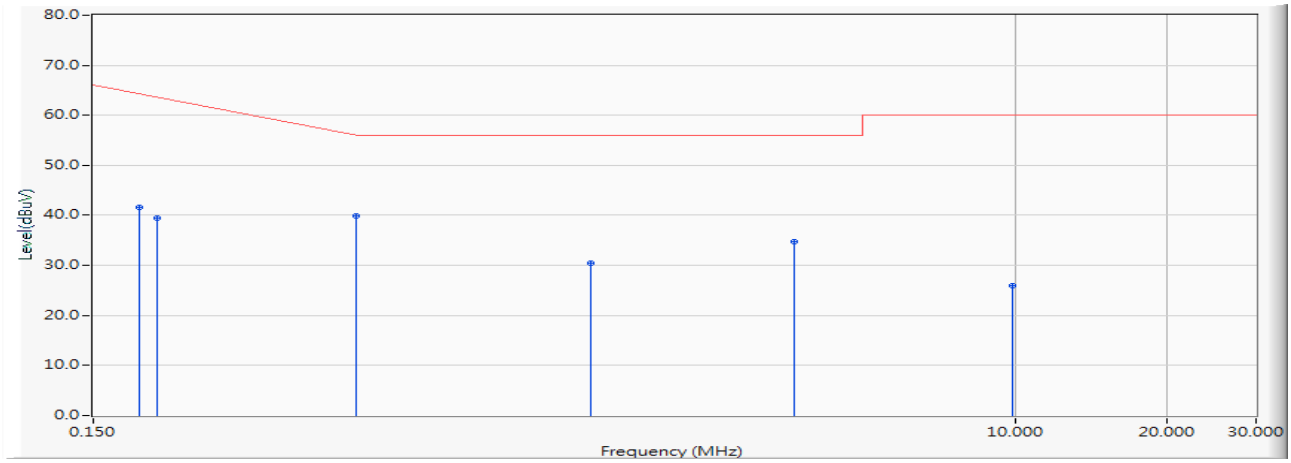

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV) | Margin (dB) | Limit (dBuV) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0.154 | 9.748 | 22.300 | 32.048 | -23.838 | 55.886 | AVERAGE |
| 2 | | 0.170 | 9.743 | 21.060 | 30.803 | -24.626 | 55.429 | AVERAGE |
| 3 | * | 0.505 | 9.750 | 23.140 | 32.890 | -13.110 | 46.000 | AVERAGE |
| 4 | | 1.416 | 9.798 | 13.990 | 23.788 | -22.212 | 46.000 | AVERAGE |
| 5 | | 3.431 | 9.868 | 17.320 | 27.188 | -18.812 | 46.000 | AVERAGE |
| 6 | | 9.345 | 10.050 | 18.040 | 28.090 | -21.910 | 50.000 | AVERAGE |

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Conducted Emission Test |
| Test Date | : | 2018/11/30 |
| Test Mode | : | Mode 1: Transmit (2440MHz) |

Line 2



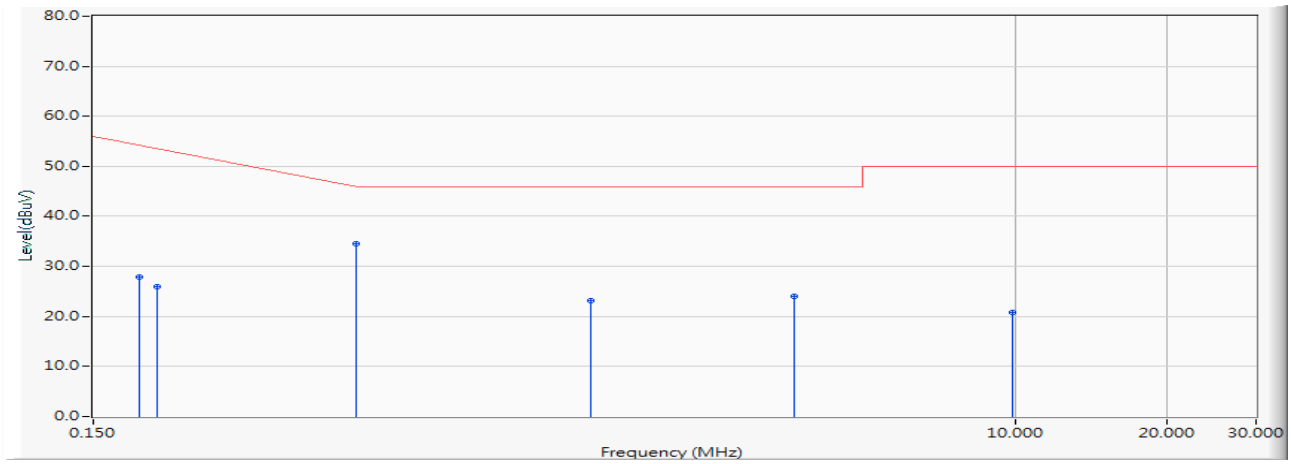

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV) | Margin (dB) | Limit (dBuV) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0.185 | 9.737 | 31.960 | 41.697 | -23.303 | 65.000 | QUASIPEAK |
| 2 | | 0.201 | 9.738 | 29.720 | 39.458 | -25.085 | 64.543 | QUASIPEAK |
| 3 | * | 0.498 | 9.740 | 30.210 | 39.950 | -16.107 | 56.057 | QUASIPEAK |
| 4 | | 1.451 | 9.789 | 20.600 | 30.389 | -25.611 | 56.000 | QUASIPEAK |
| 5 | | 3.658 | 9.873 | 24.800 | 34.673 | -21.327 | 56.000 | QUASIPEAK |
| 6 | | 9.865 | 10.089 | 15.850 | 25.939 | -34.061 | 60.000 | QUASIPEAK |

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Detachable Keyboard
Test Item : Conducted Emission Test
Test Date : 2018/11/30
Test Mode : Mode 1: Transmit (2440MHz)

Line 2




| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV) | Margin (dB) | Limit (dBuV) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0.185 | 9.737 | 18.120 | 27.857 | -27.143 | 55.000 | AVERAGE |
| 2 | | 0.201 | 9.738 | 16.120 | 25.858 | -28.685 | 54.543 | AVERAGE |
| 3 | * | 0.498 | 9.740 | 24.730 | 34.470 | -11.587 | 46.057 | AVERAGE |
| 4 | | 1.451 | 9.789 | 13.460 | 23.249 | -22.751 | 46.000 | AVERAGE |
| 5 | | 3.658 | 9.873 | 14.200 | 24.073 | -21.927 | 46.000 | AVERAGE |
| 6 | | 9.865 | 10.089 | 10.770 | 20.859 | -29.141 | 50.000 | AVERAGE |

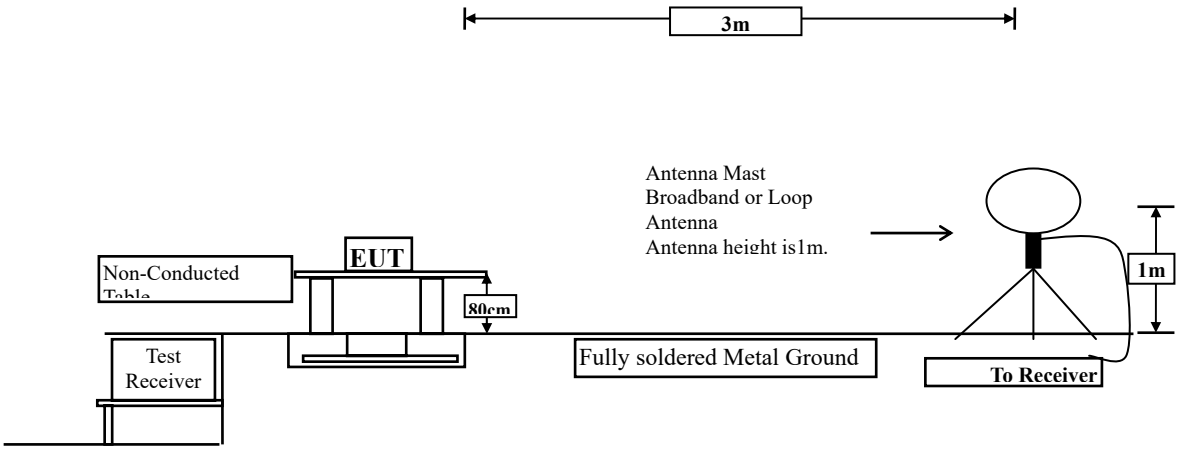
Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

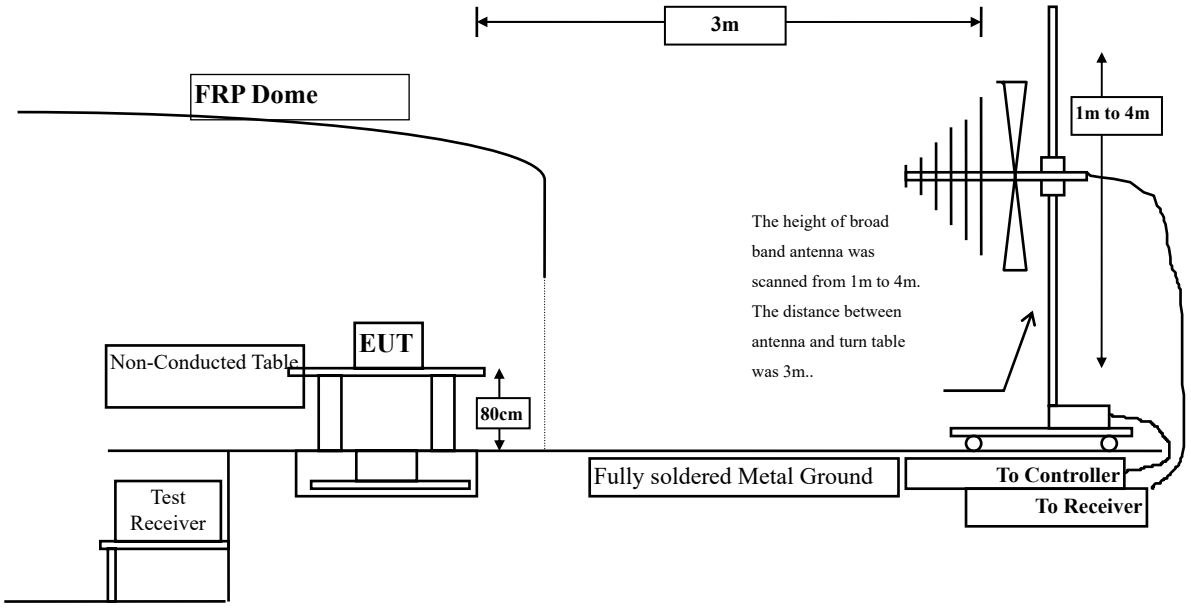
# 3. Radiated Emission

## 3.1. Test Setup

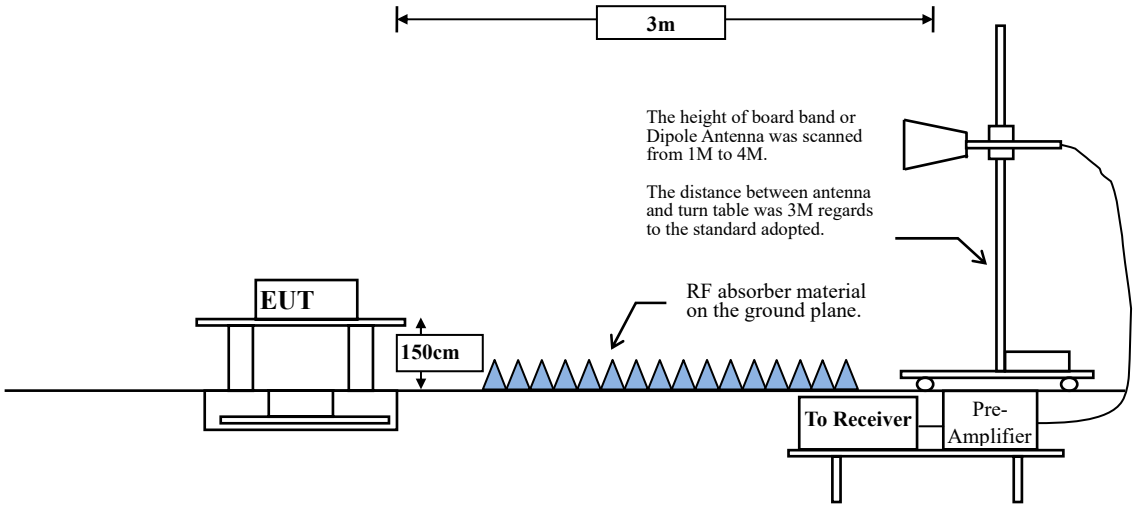
Radiated Emission Under 30MHz




Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



## 3.2. Limits

➢ **Fundamental and Harmonics Emission Limits**

| FCC Part 15 Subpart C Paragraph 15.249 Limits | | | | |
|---|---|---|---|---|
| Frequency MHz | Field Strength of Fundamental | | Field Strength of Harmonics | |
| | (mV/m @3m) | (dBuV/m @3m) | (uV/m @3m) | (dBuV/m @3m) |
| 902-928 | 50 | 94 | 500 | 54 |
| 2400-2483.5 | 50 | 94 | 500 | 54 |
| 5725-5875 | 50 | 94 | 500 | 54 |

Remarks : 1. RF Voltage (dBuV/m) = 20 log RF Voltage (uV/m)

2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

➢ **General Radiated Emission Limits**

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

| FCC Part 15 Subpart C Paragraph 15.209(a) Limits | | |
|---|---|---|
| Frequency MHz | Field strength (microvolts/meter) | Measurement distance (meter) |
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

Remarks: E field strength (dBuV/m) = 20 log E field strength (uV/m)

## 3.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested compliance to FCC 47CFR 15.249 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground,when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

The measurement frequency range form 9kHz - 10th Harmonic of fundamental was investigated.

## 3.4. Uncertainty

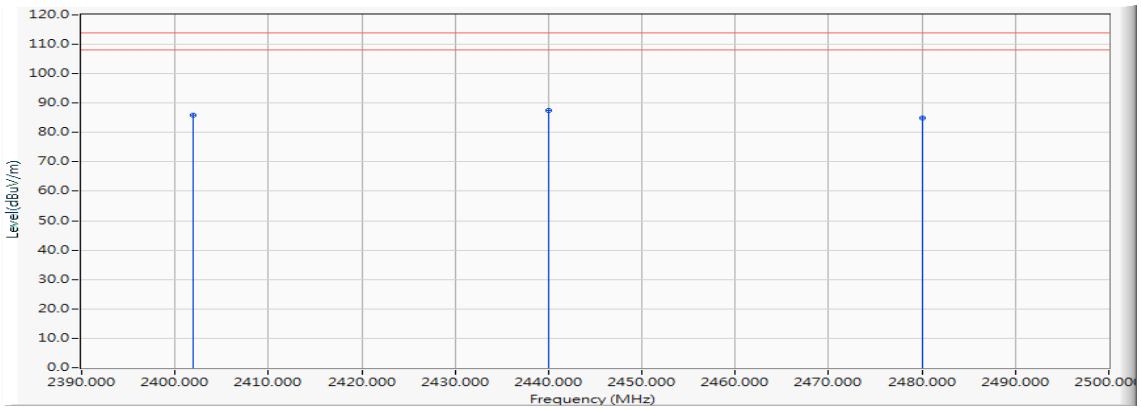
± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

## 3.5. Test Result of Radiated Emission

Product : Detachable Keyboard
Test Item : Fundamental Radiated Emission
Test Site : No.3OATS
Test Date : 2019/01/07
Test Mode : Mode 1: Transmit

**Horizontal – Peak Detector:**




| Frequency MHz | Correct Factor dB | Reading Level dBuV | Measurement Level dBuV/m | Margin dB | Limit dBuV/m |
|---|---|---|---|---|---|
| 2402.000 | -2.657 | 88.660 | 86.003 | -27.997 | 114.000 |
| 2440.000 | -2.636 | 89.990 | 87.353 | -26.647 | 114.000 |
| 2480.000 | -2.605 | 87.670 | 85.065 | -28.935 | 114.000 |

Note:

1. Measurement Level = Reading Level + Correct Factor.
2. Correct Factor = Antenna Factor + Cable Loss – PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

**Average Detector:**

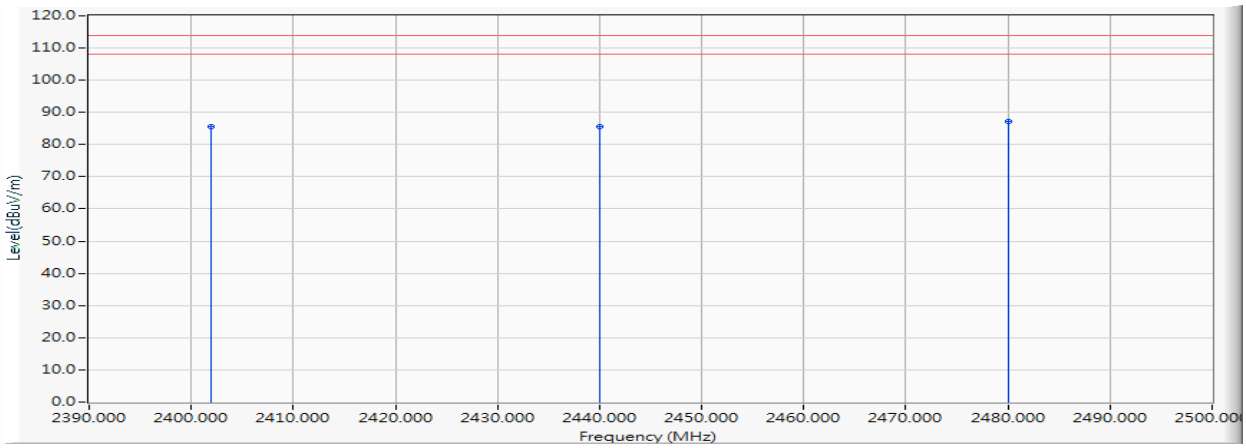
| Frequency MHz | Peak Measurement dBuV/m | Duty Cycle Correct Factor dB | Measurement Level dBuV/m | Margin dB | Limit dBuV/m |
|---|---|---|---|---|---|
| **Horizontal Average Detector:** | | | | | |
| 2402.000 | 86.003 | -21.830 | 64.173 | -29.827 | 94.000 |
| 2440.000 | 87.353 | -21.830 | 65.523 | -28.477 | 94.000 |
| 2480.000 | 85.065 | -21.830 | 63.235 | -30.765 | 94.000 |

Note:

1. Average Measurement=Peak Measurement + Duty Cycle Correct Factor
2. The Duty Cycle is refer to section 5.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Fundamental Radiated Emission |
| Test Site | : | No.3OATS |
| Test Date | : | 2019/01/07 |
| Test Mode | : | Mode 1: Transmit |

**Vertical - Peak Detector:**




| Frequency MHz | Correct Factor dB | Reading Level dBuV | Measurement Level dBuV/m | Margin dB | Limit dBuV/m |
|---|---|---|---|---|---|
| 2402.000 | -4.171 | 89.590 | 85.419 | -28.581 | 114.000 |
| 2440.000 | -4.099 | 89.810 | 85.711 | -28.289 | 114.000 |
| 2480.000 | -3.978 | 91.100 | 87.122 | -26.878 | 114.000 |

Note:

1. Measurement Level = Reading Level + Correct Factor.
2. Correct Factor = Antenna Factor + Cable Loss – PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

**Average Detector:**

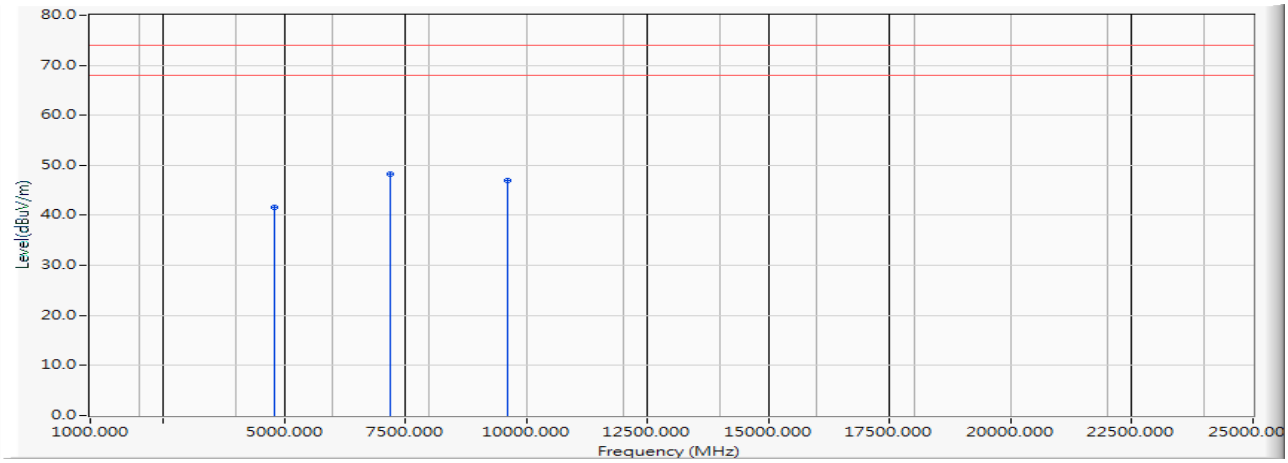
| Frequency MHz | Peak Measurement dBuV/m | Duty Cycle Correct Factor dB | Measurement Level dBuV/m | Margin dB | Limit dBuV/m |
|---|---|---|---|---|---|
| **Vertical Average Detector:** | | | | | |
| 2402.000 | 89.59 | -21.830 | 67.760 | -26.240 | 94.000 |
| 2440.000 | 89.8 | -21.830 | 67.970 | -26.030 | 94.000 |
| 2480.000 | 91.1 | -21.830 | 69.270 | -24.730 | 94.000 |

Note:

1. Average Measurement=Peak Measurement + Duty Cycle Correct Factor
2. The Duty Cycle is refer to section 5.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Harmonic Radiated Emission Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2018/12/24 |
| Test Mode | : | Mode 1: Transmit (2402MHz) |

Horizontal



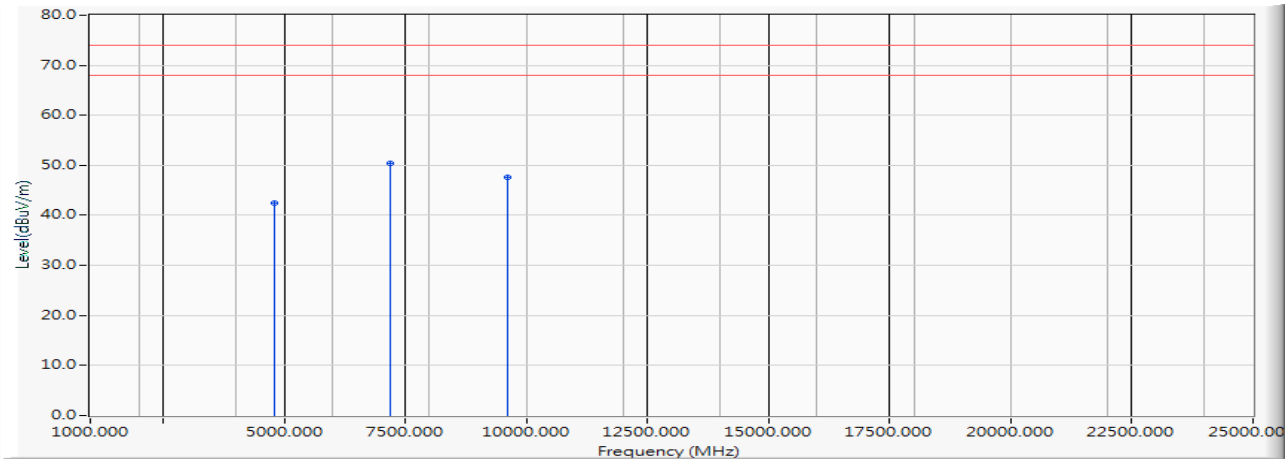

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 4804.000 | 2.511 | 39.138 | 41.648 | -32.352 | 74.000 | PEAK |
| 2 | * | 7206.000 | 9.511 | 38.686 | 48.197 | -25.803 | 74.000 | PEAK |
| 3 | | 9608.000 | 10.394 | 36.581 | 46.975 | -27.025 | 74.000 | PEAK |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Harmonic Radiated Emission Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2018/12/24 |
| Test Mode | : | Mode 1: Transmit (2402MHz) |

Vertical



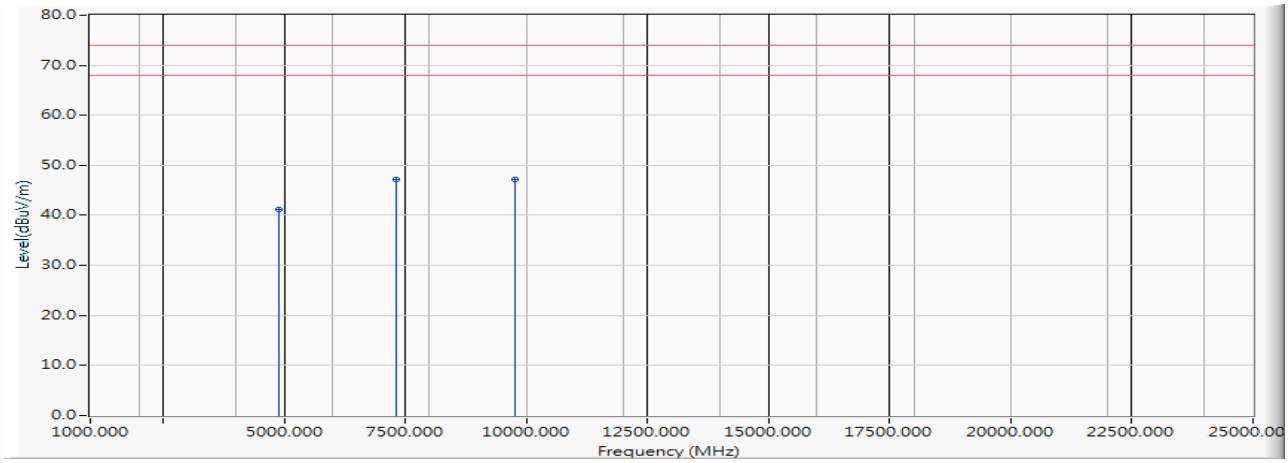

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 4804.000 | 2.923 | 39.445 | 42.367 | -31.633 | 74.000 | PEAK |
| 2 | * | 7206.000 | 9.988 | 40.481 | 50.470 | -23.530 | 74.000 | PEAK |
| 3 | | 9608.000 | 10.847 | 36.845 | 47.692 | -26.308 | 74.000 | PEAK |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Harmonic Radiated Emission Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2018/12/24 |
| Test Mode | : | Mode 1: Transmit (2440 MHz) |

Horizontal



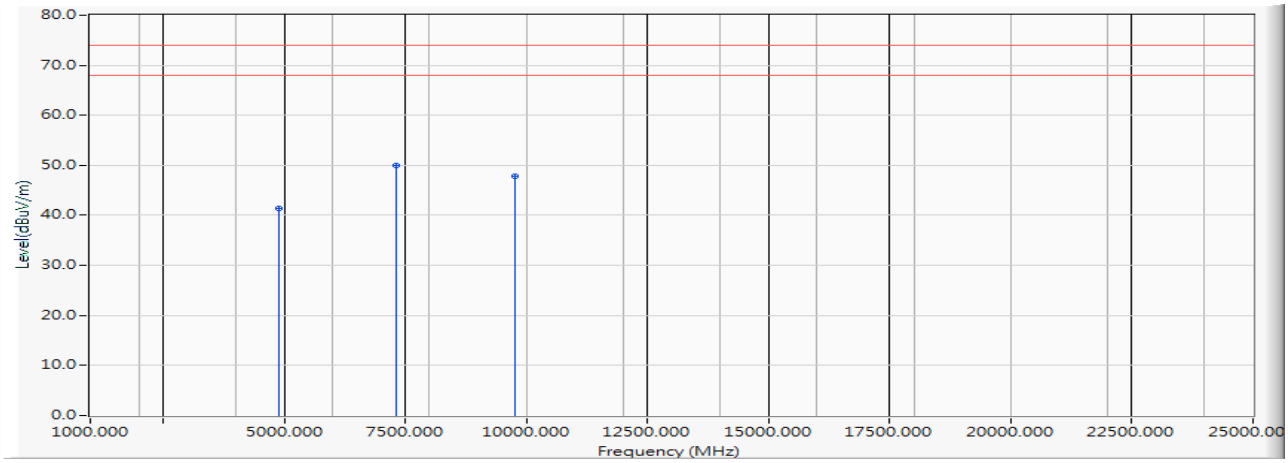

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 4880.000 | 2.038 | 39.124 | 41.162 | -32.838 | 74.000 | PEAK |
| 2 | * | 7320.000 | 9.699 | 37.406 | 47.105 | -26.895 | 74.000 | PEAK |
| 3 | | 9760.000 | 9.665 | 37.416 | 47.081 | -26.919 | 74.000 | PEAK |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Harmonic Radiated Emission Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2018/12/24 |
| Test Mode | : | Mode 1: Transmit (2440 MHz) |

Vertical



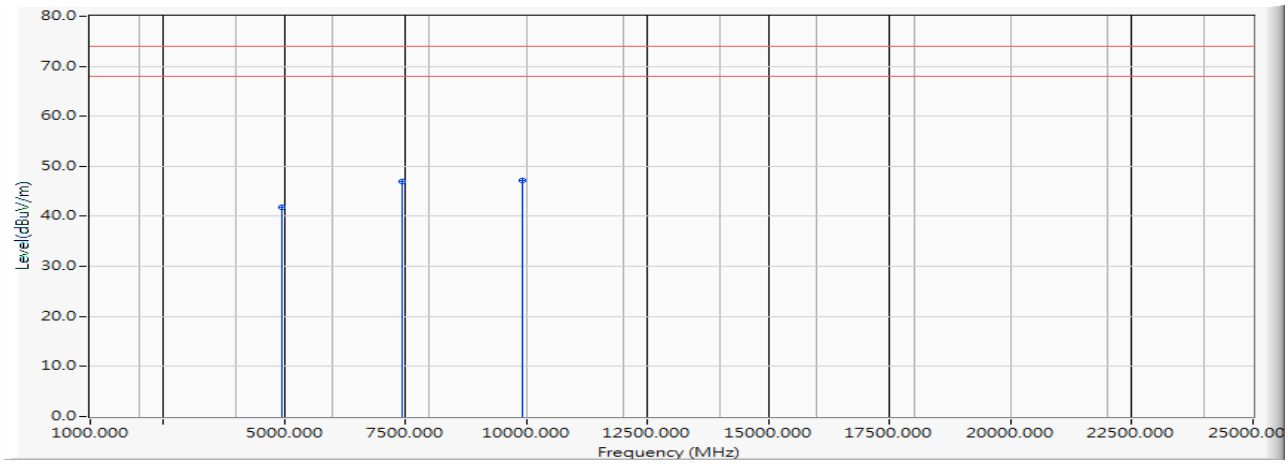

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 4880.000 | 2.499 | 38.987 | 41.486 | -32.514 | 74.000 | PEAK |
| 2 | * | 7320.000 | 10.303 | 39.651 | 49.954 | -24.046 | 74.000 | PEAK |
| 3 | | 9760.000 | 10.299 | 37.485 | 47.785 | -26.215 | 74.000 | PEAK |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Harmonic Radiated Emission Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2018/12/24 |
| Test Mode | : | Mode 1: Transmit (2480 MHz) |

Horizontal



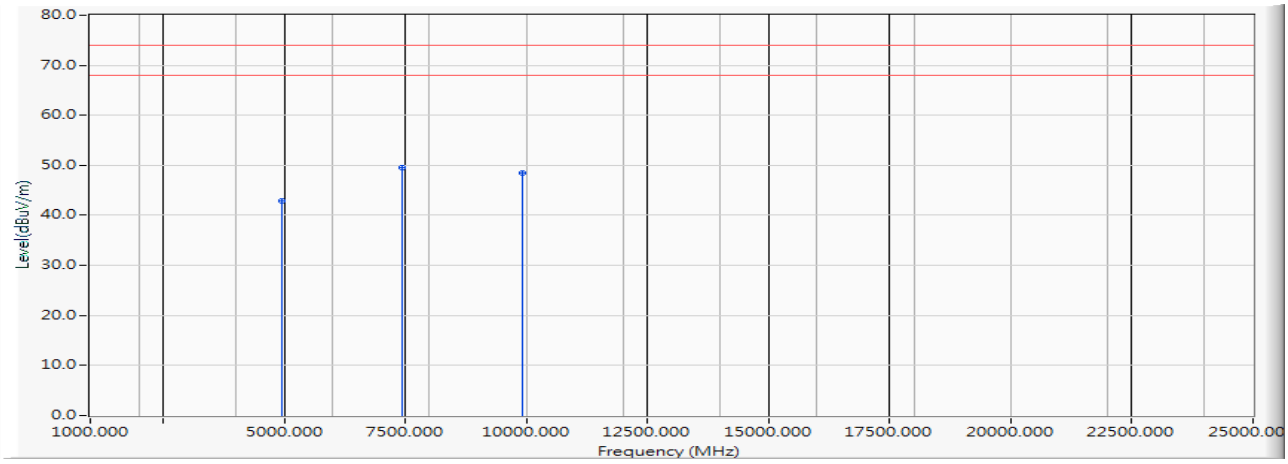

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 4960.000 | 2.582 | 39.262 | 41.844 | -32.156 | 74.000 | PEAK |
| 2 | | 7440.000 | 10.555 | 36.407 | 46.962 | -27.038 | 74.000 | PEAK |
| 3 | * | 9920.000 | 10.206 | 37.034 | 47.240 | -26.760 | 74.000 | PEAK |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Harmonic Radiated Emission Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2018/12/24 |
| Test Mode | : | Mode 1: Transmit (2480 MHz) |

Vertical



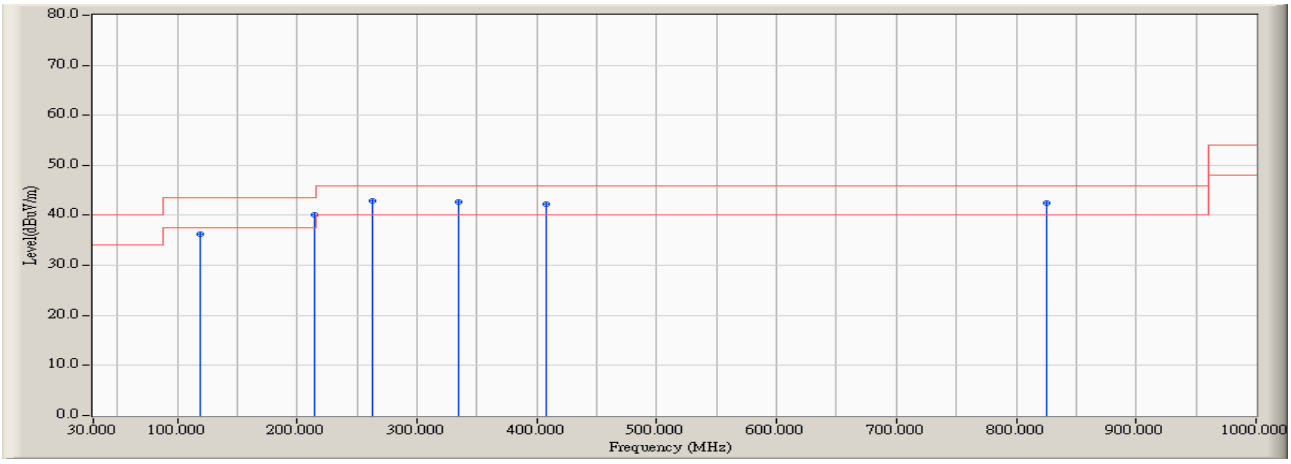

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 4960.000 | 3.398 | 39.476 | 42.875 | -31.125 | 74.000 | PEAK |
| 2 | * | 7440.000 | 11.214 | 38.251 | 49.465 | -24.535 | 74.000 | PEAK |
| 3 | | 9920.000 | 11.245 | 37.304 | 48.549 | -25.451 | 74.000 | PEAK |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | General Radiated Emission Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2018/12/26 |
| Test Mode | : | Mode 1: Transmit (2440 MHz) |

Horizontal



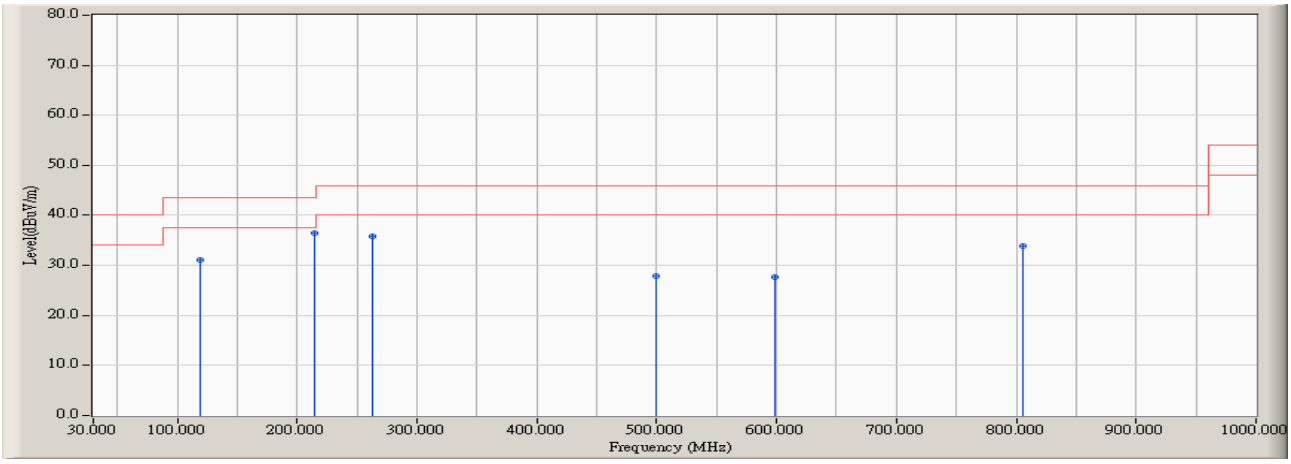

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 118.606 | -8.725 | 44.995 | 36.270 | -7.230 | 43.500 | QUASIPEAK |
| 2 | | 214.984 | -8.030 | 48.231 | 40.201 | -3.299 | 43.500 | QUASIPEAK |
| 3 | * | 263.173 | -5.221 | 48.098 | 42.877 | -3.123 | 46.000 | QUASIPEAK |
| 4 | | 334.679 | -2.765 | 45.549 | 42.784 | -3.216 | 46.000 | QUASIPEAK |
| 5 | | 407.740 | 1.730 | 40.620 | 42.350 | -3.650 | 46.000 | QUASIPEAK |
| 6 | | 825.897 | 7.861 | 34.691 | 42.552 | -3.448 | 46.000 | QUASIPEAK |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | General Radiated Emission Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2018/12/26 |
| Test Mode | : | Mode 1: Transmit (2440 MHz) |

Vertical



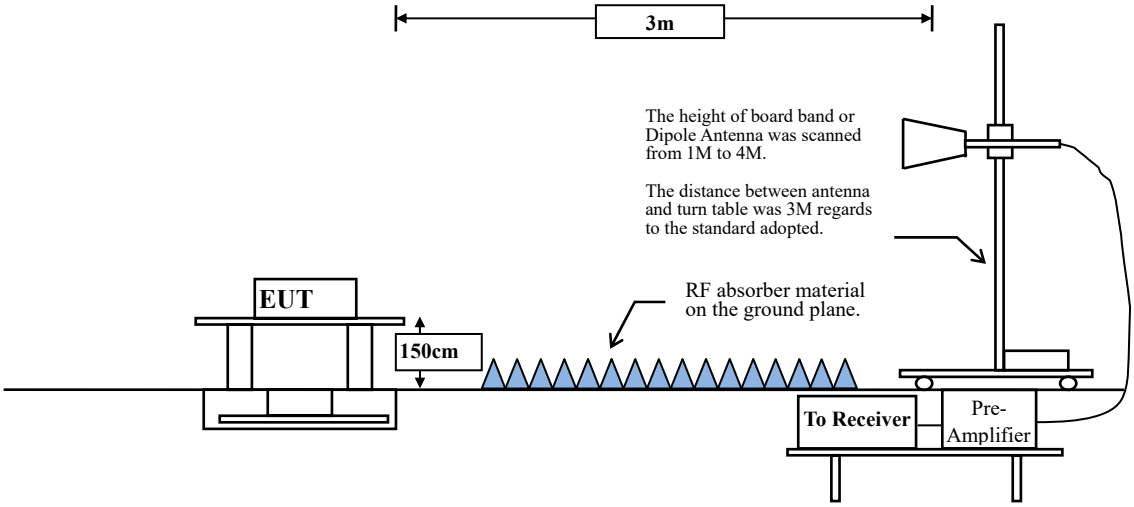

| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 118.606 | -6.987 | 37.995 | 31.008 | -12.492 | 43.500 | QUASIPEAK |
| 2 | * | 214.984 | 0.127 | 36.372 | 36.498 | -7.002 | 43.500 | QUASIPEAK |
| 3 | | 263.173 | -1.907 | 37.752 | 35.845 | -10.155 | 46.000 | QUASIPEAK |
| 4 | | 499.455 | 1.242 | 26.598 | 27.840 | -18.160 | 46.000 | QUASIPEAK |
| 5 | | 598.942 | 3.866 | 23.842 | 27.708 | -18.292 | 46.000 | QUASIPEAK |
| 6 | | 805.689 | 6.165 | 27.746 | 33.911 | -12.089 | 46.000 | QUASIPEAK |

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

# 4. Band Edge

## 4.1. Test Setup



## 4.2. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 50 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

## 4.3. Test Procedure

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.
The bandwidth setting below 1GHz and above 1GHz on the field strength meter is 120 kHz and 1MHz, respectively.

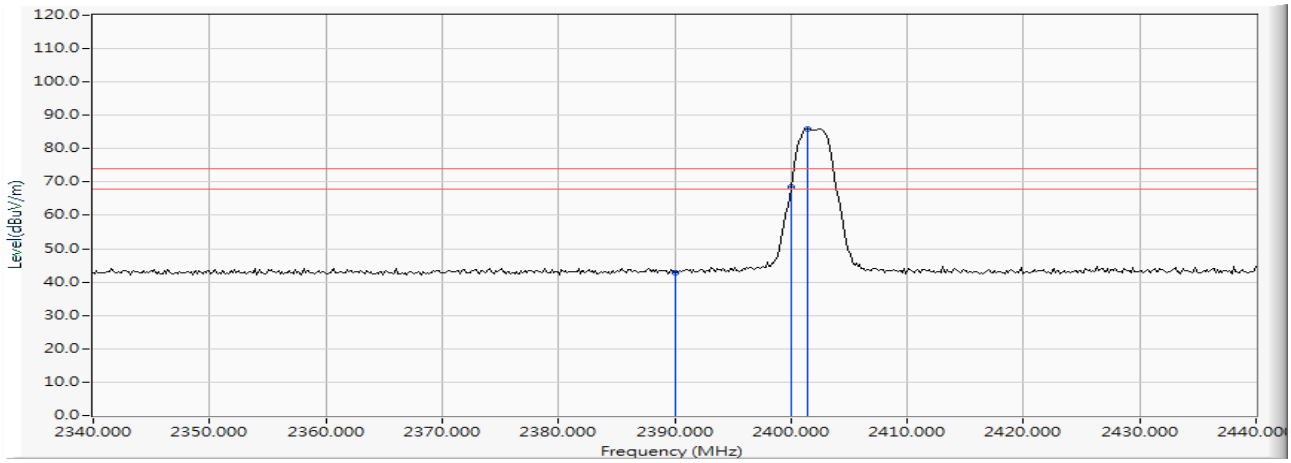
## 4.4. Uncertainty

± 4.08 dB above 1GHz
± 4.22 dB below 1GHz

## 4.5. Test Result of Band Edge

Product : Detachable Keyboard
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Date : 2019/01/07
Test Mode : Mode 1: Transmit (2402MHz)

Horizontal




| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 2390.000 | -2.687 | 45.546 | 42.859 | -31.141 | 74.000 | PEAK |
| 2 | | 2400.000 | -2.660 | 71.071 | 68.411 | -5.589 | 74.000 | PEAK |
| 3 | * | 2401.449 | -2.658 | 88.626 | 85.968 | 11.968 | 74.000 | PEAK |

Note:
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. " * ", means this data is the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection.

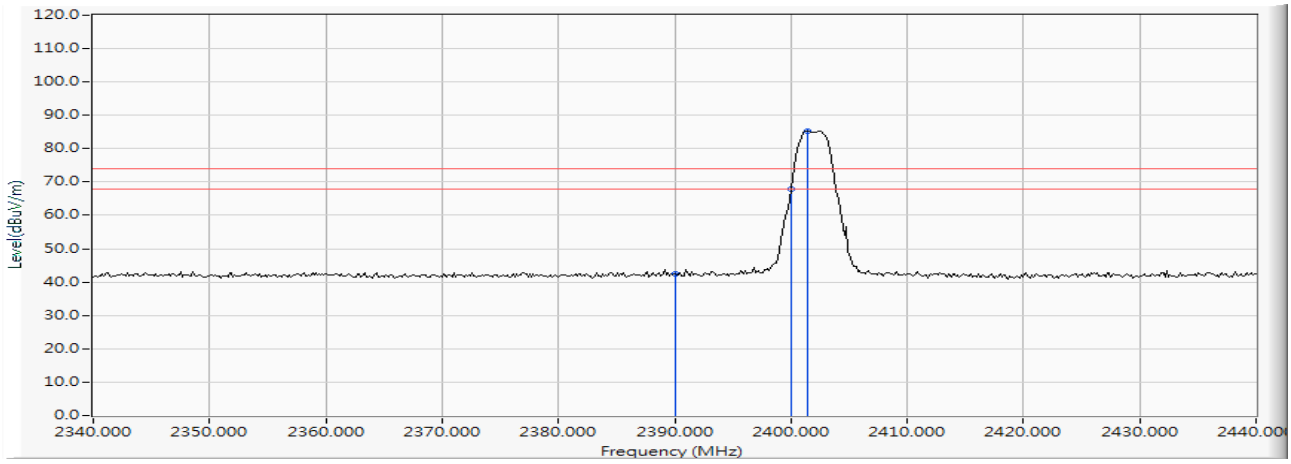
**Average Detector:**

| Frequency MHz | Peak Measurement dBµV/m | Duty Cycle Factor dB | Measurement Level dBµV/m | Margin dB | Limit dBµV/m | Result Pass |
|---|---|---|---|---|---|---|
| **Horizontal** | | | | | | |
| **Average Detector:** | | | | | | |
| 2400.000 | 68.411 | -21.830 | 46.581 | -7.419 | 54.000 | Pass |

Note:
1. Average Measurement=Peak Measurement + Duty Cycle Correct Factor
2. The Duty Cycle is refer to section 5.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Band Edge Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2019/01/07 |
| Test Mode | : | Mode 1: Transmit (2402MHz) |

**Vertical**




| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | | 2390.000 | -4.159 | 46.619 | 42.460 | -31.540 | 74.000 | PEAK |
| 2 | | 2400.000 | -4.171 | 72.200 | 68.029 | -5.971 | 74.000 | PEAK |
| 3 | * | 2401.449 | -4.171 | 89.437 | 85.266 | 11.266 | 74.000 | PEAK |

Note:
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. " * ", means this data is the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection.

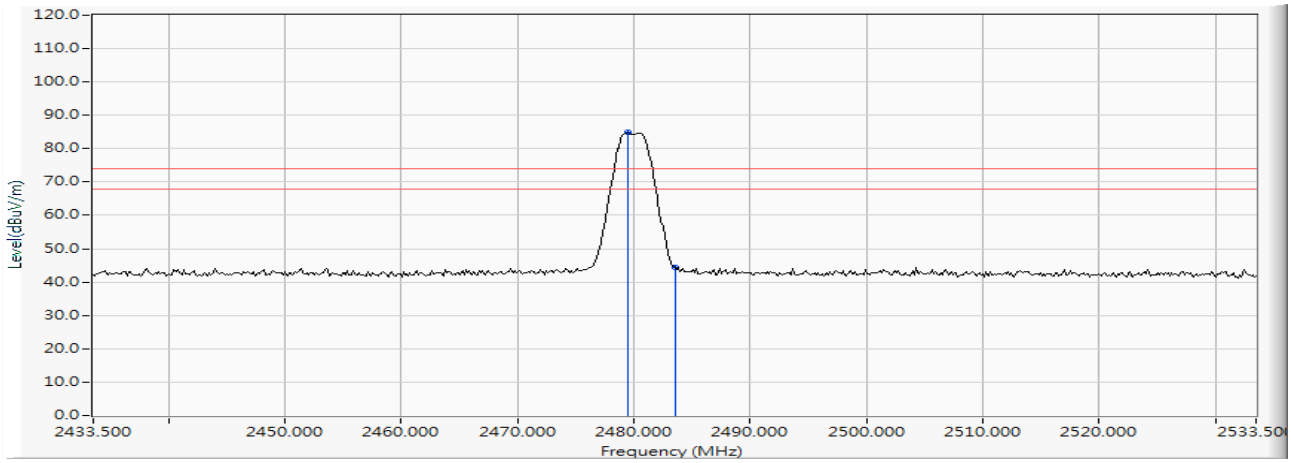
**Average Detector:**

| Frequency | Peak Measurement | Duty Cycle Factor | Measurement Level | Margin | Limit | Result Pass |
|---|---|---|---|---|---|---|
| MHz | dBµV/m | dB | dBµV/m | dB | dBµV/m | |
| **Vertical** | | | | | | |
| **Average Detector:** | | | | | | |
| 2400.000 | 68.029 | -21.830 | 46.199 | -7.801 | 54.000 | Pass |

Note:
1. Average Measurement=Peak Measurement + Duty Cycle Correct Factor
2. The Duty Cycle is refer to section 5.

| | | |
|---|---|---|
| Product | : | Detachable Keyboard |
| Test Item | : | Band Edge Data |
| Test Site | : | No.3 OATS |
| Test Date | : | 2019/01/07 |
| Test Mode | : | Mode 1: Transmit (2480MHz) |

Horizontal




| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | * | 2479.442 | -2.606 | 87.379 | 84.774 | 10.774 | 74.000 | PEAK |
| 2 | | 2483.500 | -2.601 | 47.031 | 44.429 | -29.571 | 74.000 | PEAK |

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. " * ", means this data is the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection.

**Average Detector:**

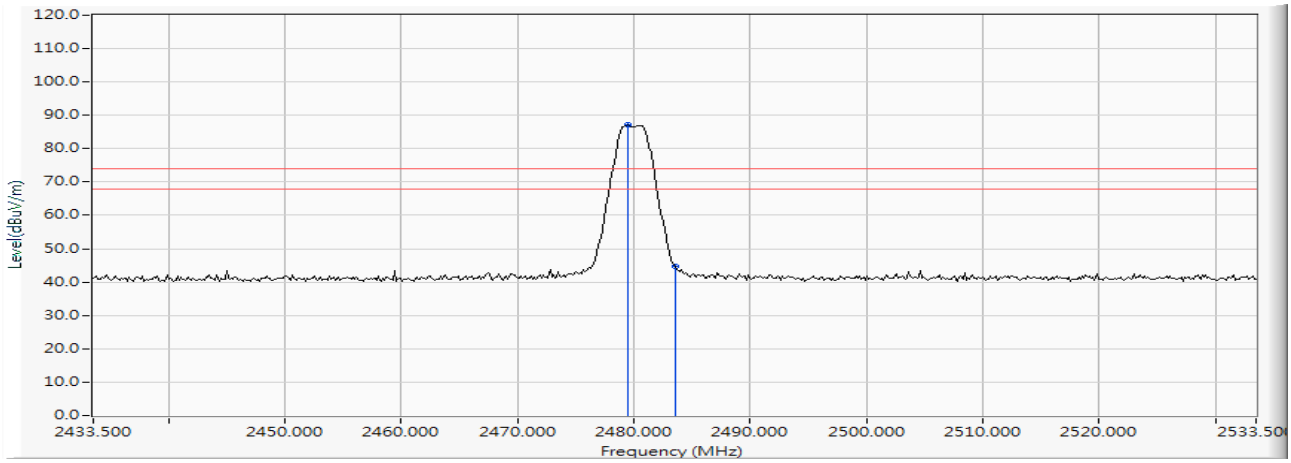
| Frequency | Peak Measurement | Duty Cycle Factor | Measurement Level | Margin | Limit | Result Pass |
|---|---|---|---|---|---|---|
| MHz | dBµV/m | dB | dBµV/m | dB | dBµV/m | |
| **Horizontal** | | | | | | |
| **Average Detector:** | | | | | | |
| 2483.5 | 44.429 | -21.830 | 22.599 | -31.401 | 54.000 | Pass |

Note:

1. Average Measurement=Peak Measurement + Duty Cycle Correct Factor
2. The Duty Cycle is refer to section 5.

Product : Detachable Keyboard
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Date : 2019/01/07
Test Mode : Mode 1: Transmit (2480MHz)

**Vertical**




| | | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Measure Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Detector Type |
|---|---|---|---|---|---|---|---|---|
| 1 | * | 2479.442 | -3.980 | 91.007 | 87.027 | 13.027 | 74.000 | PEAK |
| 2 | | 2483.500 | -3.966 | 48.586 | 44.619 | -29.381 | 74.000 | PEAK |

Note:
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. " * ", means this data is the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection.

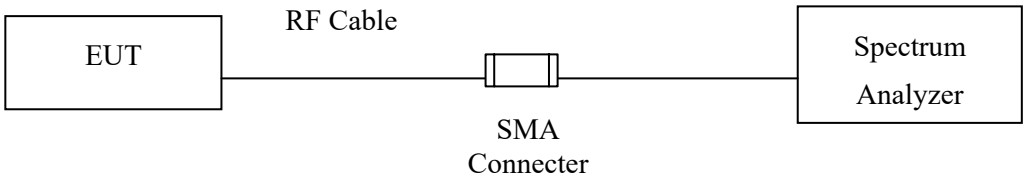
**Average Detector:**

| Frequency MHz | Peak Measurement dBµV/m | Duty Cycle Factor dB | Measurement Level dBµV/m | Margin dB | Limit dBµV/m | Result Pass |
|---|---|---|---|---|---|---|
| **Vertical** | | | | | | |
| **Average Detector:** | | | | | | |
| 2483.5 | 48.586 | -21.830 | 26.756 | -27.244 | 54.000 | Pass |

Note:
1. Average Measurement=Peak Measurement + Duty Cycle Correct Factor
2. The Duty Cycle is refer to section 5.

## 5. Duty Cycle

### 5.1. Test Setup

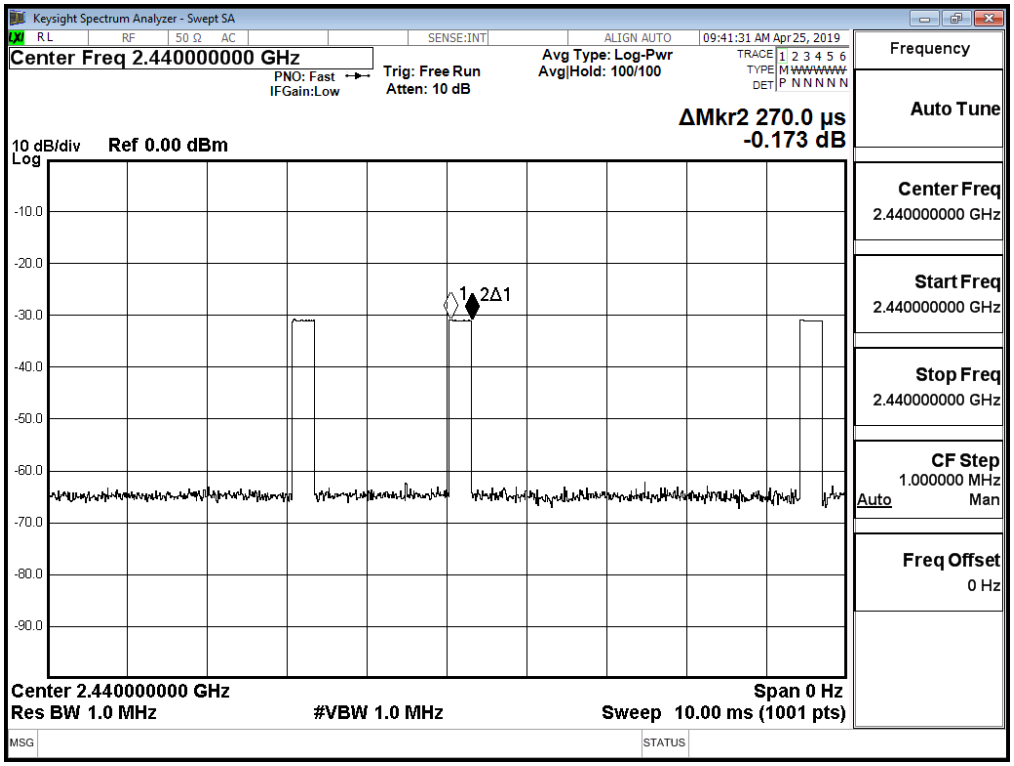



### 5.2. Uncertainty

± 150Hz

## 5.3. Test Result of Duty Cycle

Product : Detachable Keyboard
Test Item : Duty Cycle Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit




Time on of 100ms= 8.1 ms

Duty Cycle= 8.1ms / 100ms= 0.081

Duty Cycle correction factor= 20 LOG 0.081= -21.83 dB

| | | |
|---|---|---|
| **Duty Cycle correction factor** | **-21.83** | **dB** |

## 6. EMI Reduction Method During Compliance Testing

No modification was made during testing.