

# ***FCC TEST REPORT***

**FCC ID** : ZVH-KIANO4  
**Applicant** : Learning Platforms Company Limited  
**Address** : Rm. 401-402, Block 4, Animation Park, Yuehai Rd., Nanhai St., Nanshan  
Dist., Shenzhen, Guangdong, China

**Equipment Under Test (EUT) :**

Product Name : Bluetooth Keyboard  
Model No. : Kiano4

**Standards** : FCC CFR47 Part 15 Section 15.247:2009

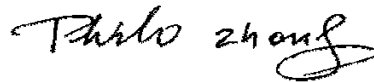
**Date of Test** : August 15, 2011 ~ August 17, 2011

**Date of Issue** : August 21, 2011

**Test Engineer** : Hunk yan



**Reviewed By** : Philo zhong



<b>Test Result</b>	<b>: PASS</b>
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**Prepared By:**

**Waltek Services (Shenzhen) Co., Ltd.**

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- ✧ The sample detailed above has been tested to the requirements of Council Directives ANSI C63.4:2003. The test results have been reviewed against the Directives above and found to meet their essential requirements.

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Reference No.: WT11084056-D-E-F

**2 Test Summary**

<b>FCC Part 15 Requirements</b>		
<b>Test Items</b>	<b>Test Requirement</b>	<b>Result</b>
Radiated Spurious Emissions (9KHz to 25GHz)	15.205(a) 15.209 15.247(d)	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

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## 4 General Information

### 4.1 Client Information

**Applicant** : Learning Platforms Company Limited

**Address of Applicant** : Rm. 401-402, Block 4, Animation Park, Yuehai Rd., Nanhai St.,  
Nanshan Dist., Shenzhen, Guangdong, China

**Manufacturer** : SHEN ZHEN SHENG MEI DE ELECTRONIC CO., LTD.

**Address of Manufacturer** : Building 29, No.2 Industrial District, Maanshan Village, Nanhuan road  
293, Shajing Town , Baoan District, Shenzhen city, China

### 4.2 General Description of E.U.T.

**Product Name** : Bluetooth Keyboard

**Model No.** : Kiano4

### 4.3 Details of E.U.T.

**Technical Data** : Input: DC 5.0V, 150mA (Charging mode)  
Internal Li-polymer Battery: 3.7V

**Operation Frequency** : 2402MHz ~ 2480MHz

**Antenna Gain** : 0dBi

### 4.4 Description of Support Units

The EUT has been tested as an independent unit.

### 4.5 Standards Applicable for Testing

The customer requested FCC tests for a Bluetooth Keyboard. The standards used were FCC CFR47 Part 15 Section 15.247, and Section 15.209.

#### 4.6 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: IC7760A**

Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A, August 3, 2010.

- **FCC – Registration No.: 880581**

Waltek Services(Shenzhen) 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. Registration 880581, May 26, 2011.

#### 4.7 Test Location

All the tests were performed at:

Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd.,Songgang Street, Baoan District, Shenzhen, China

## 5 Equipment Used during Test

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
EMC Analyzer	Agilent/ E7405A	MY45114943	W2008001	9k-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	Wws20081596	±1dB
Active Loop Antenna 9kHz-30MHz	Beijing Dazhi / ZN30900A	-	-	9kHz-30MHz	Aug. 2, 2011	Aug. 1, 2012		±1dB
Trilog Broadband Antenne	SCHWARZB ECK MESS-ELEKTROM / VULB9163	336	W2008002	30-3000 MHz	Aug. 2, 2011	Aug. 1, 2012	-	±1dB
Broad-band Horn Antenna	SCHWARZB ECK MESS-ELEKTROM / BBHA 9120D(1201)	667	W2008003	1-18GHz	Aug. 2, 2011	Aug. 1, 2012	-	f<10 GHz: ±1dB 10GHz<f<18 GHz: ±1.5dB
Broadband Preamplifier	SCHWARZB ECK MESS-ELEKTROM / BBV 9718	9718-148	W2008004	0.5-18GHz	Aug. 2, 2011	Aug. 1, 2012	-	±1.2dB
10m Coaxial Cable with N-male Connectors	SCHWARZB ECK MESS-ELEKTROM / AK 9515 H	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-	-
10m 50 Ohm Coaxial Cable	SCHWARZB ECK MESS-ELEKTROM / AK 9513	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-	-
Positioning Controller	C&C LAB/ CC-C-IF	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-	-
Color Monitor	SUNSP0/ SP-14C	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-	-
Test Receiver	ROHDE&SCHWARZ/ ESPI	101155	W2005001	9k-3GHz	Aug. 2, 2011	Aug. 1, 2012	Wws20080942	±1dB
EMI Receiver	Beijingkehuan	KH3931	-	9k-1GHz	Aug. 2, 2011	Aug. 1, 2012	-	-
Two-Line V-Network	ROHDE&SCHWARZ/ ENV216	100115	W2005002	50Ω/50μH	Aug. 2, 2011	Aug. 1, 2012	Wws20080941	±10%
Digital Power Analyzer	Em Test AG/Switzerland/ DPA 500	V0745103095	W2008012	Power: 2000VA Vol_range: 0-300V Freq_range	Aug. 2, 2011	Aug. 1, 2012	Wwd20081185	Voltage distinguish:0.025% Power_freq distinguish:0

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Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
				: 10-80Hz				
Power Source	Em Test AG/Switzerland/ ACS 500	V0745103096	W2008013	Vol-range: 0-300V Power_freq : 10-80Hz				.02Hz
RF Generator	TESEQ GmbH/ NSG4070	25781	W2008008	Fraq-range: 9K-1GHz RF voltage: -60 dBm- +10dBm	Aug. 2, 2011	Aug. 1, 2012	Wws20081890	Power_freq distinguish0.1Hz RFelectricity distinguish 0.1 B
CDN M-Type	TESEQ GmbH/ CDN M016	25112	W2008009	Voltage correct factor 9.5 dB	Aug. 2, 2011	Aug. 1, 2012	Wwc20082396	150K-80MHz: $\pm 1$ dB 80-230MHz:-2-+3dB
EM-Clamp	TESEQ GmbH/ KEMZ 801	25453	W2008010	Freq_range : 0.15-1000 MHz	Aug. 2, 2011	Aug. 1, 2012	Wwc20082397	0.3-400 MHz: $\pm 4$ dB Other freq: $\pm 5$ dB
Attenuator 6dB	TESEQ GmbH/ ATN6050	25365	-	-	Aug. 2, 2011	Aug. 1, 2012	Wws20081597	-
All Modules Generator	SCHAFFNER/ R/6150	34579	W2008006	voltage:200V -4.4KV Pulse current: 100A-2.2KA	Aug. 2, 2011	Aug. 1, 2012	Wwc20082401	voltage: $\pm 10\%$ Pulse current: $\pm 10\%$
Capacitive Coupling Clamp	SCHAFFNER/ R/ CDN 8014	25311	-	-	Aug. 2, 2011	Aug. 1, 2012	Wwc20082398	-
Signal and Data Line Coupling Network	SCHAFFNER/ R/ CDN 117	25627	W2008011	1.2/50 $\mu$ S	Aug. 2, 2011	Aug. 1, 2012	Wwc20082399	-
AC Power Supply	TONGYUN/ DTDGC-4	-	-	-	Aug. 2, 2011	Aug. 1, 2012	Wws20080944	-

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## **6 Conducted Emission**

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: Base on ANSI C63.4:2003

Test Result: N/A

Remark: The EUT is powered by 3.7V Li-polymer Battery, so this test is not applicable.



## 7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: Base on ANSI C63.4:2003

Test Result: PASS

Frequency Range: 9KHz to 25GHz

Measurement Distance: 3m

15.209 Limit: 49.5dBuV/m between 1.705MHz & 30MHz  
 40.0 dBuV/m between 30MHz & 88MHz  
 43.5 dBuV/m between 88MHz & 216MHz  
 46.0 dBuV/m between 216MHz & 960MHz  
 54.0 dBuV/m above 960MHz

15.247 (d) Limit: (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.

Test mode: The EUT was tested in continuously Transmit mode.

### EUT Operation :

#### Operating Environment:

Temperature: 25.5 °C

Humidity: 51 % RH

Atmospheric Pressure: 1012 mbar

### Measurement Uncertainty

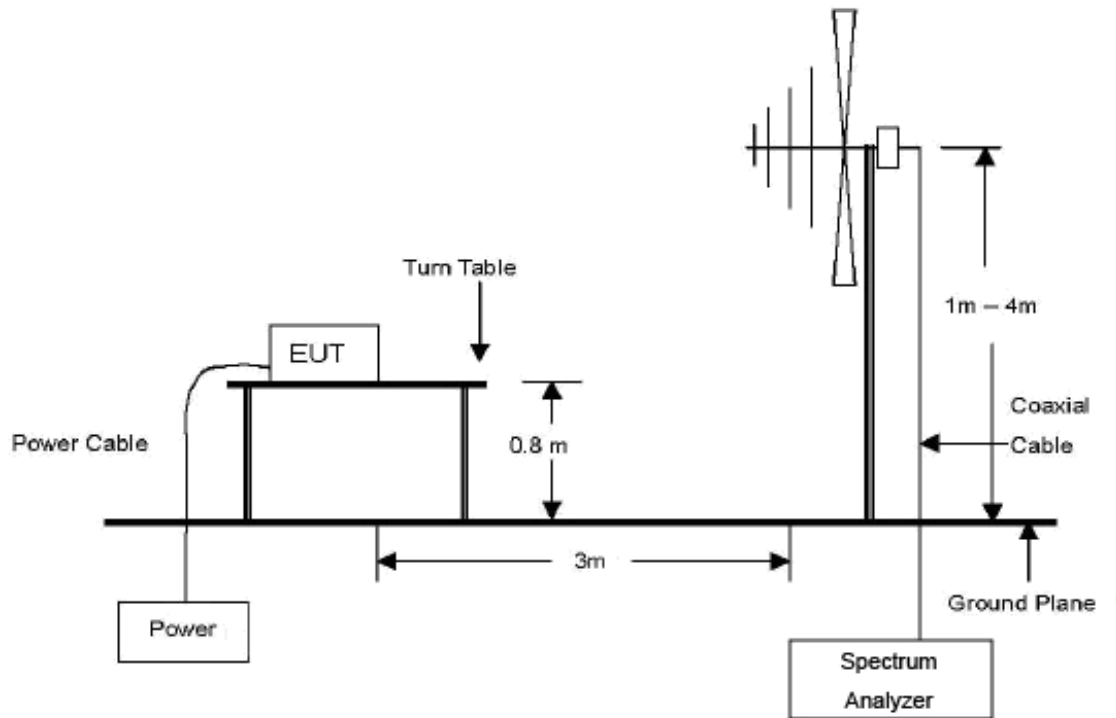
All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Waltek EMC Lab is  $\pm 5.03\text{dB}$ .

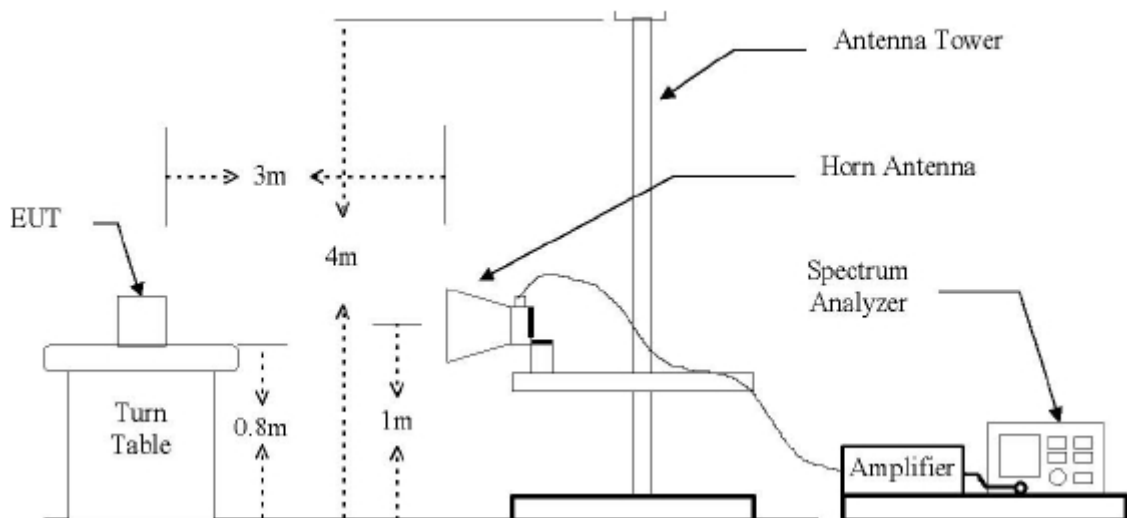
**Test Setup**

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4:2003.

The diagram below shows the test setup that is utilized to make the measurements for emission from 9KHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 25 GHz Emissions.



**Spectrum Analyzer Setup**

According to FCC Part15 Rules, the system was tested 9KHz to 25000MHz.

**9KHz ~ 30MHz**

Start Frequency ..... 9KHz  
 Stop Frequency ..... 30MHz  
 Sweep Speed..... Auto  
 IF Bandwidth..... 10KHz  
 Video Bandwidth..... 10KHz  
 Resolution Bandwidth..... 10KHz

**30MHz ~ 1GHz**

Start Frequency ..... 30 MHz  
 Stop Frequency ..... 1000MHz  
 Sweep Speed..... Auto  
 IF Bandwidth..... 120 KHz  
 Video Bandwidth..... 100KHz  
 Quasi-Peak Adapter Bandwidth ..... 120 KHz  
 Quasi-Peak Adapter Mode ..... Normal  
 Resolution Bandwidth ..... 100KHz

**Above 1GHz**

Start Frequency ..... 1000 MHz  
 Stop Frequency ..... 25000MHz  
 Sweep Speed..... Auto  
 IF Bandwidth..... 120 KHz  
 Video Bandwidth..... 1MHz  
 Quasi-Peak Adapter Bandwidth ..... 120 KHz  
 Quasi-Peak Adapter Mode ..... Normal  
 Resolution Bandwidth ..... 1MHz

### Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X(normal uses) axis positioning. And all the modes was tested in the report.Only the worst case is shown in the report.

### Corrected Amplitude & Margin Calculation

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

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

### Summary of Test Results

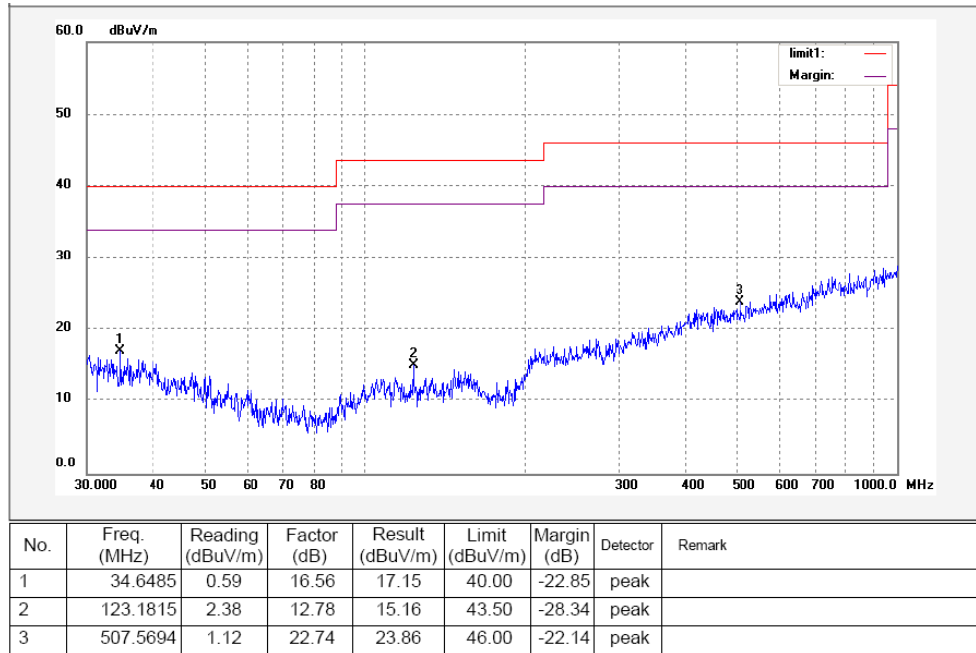
According to the data in this section, the EUT complied with the FCC CFR47 Part 15 Section 15.209 & 15.247 standards.

**Test mode: continuously receive mode**

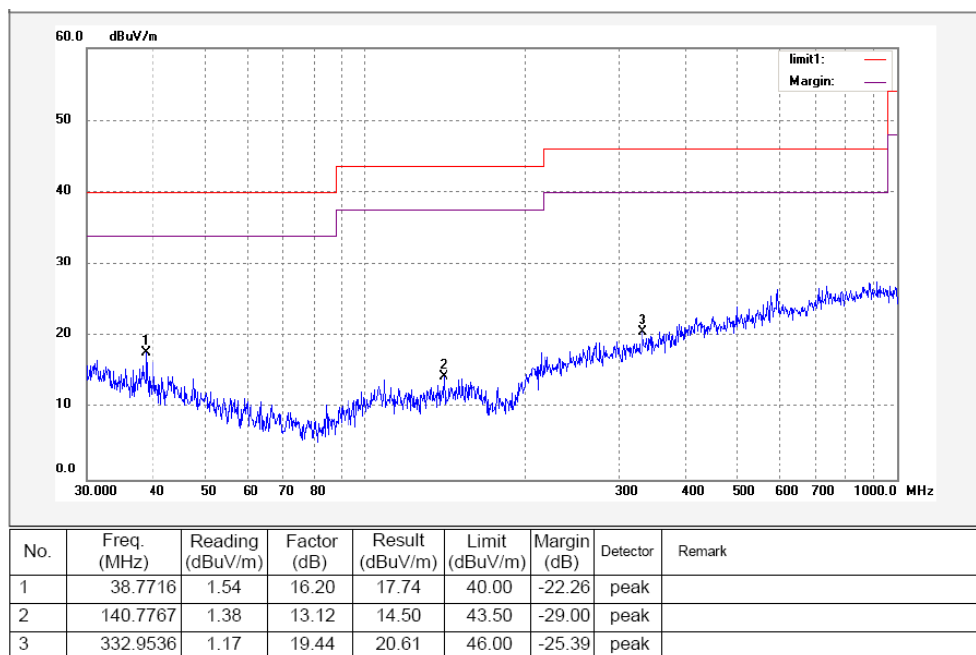
Remark: the EUT was pretested at the high, middle and low channel, and the worse case was the low Channel, so the data show was the low channel only. Because the emissions below 30MHz are more than 20dB below the limit, the data is not show in the report.

Test Frequency : 30MHz ~ 1000MHz

Antenna polarization: Vertical



Antenna polarization: Horizontal



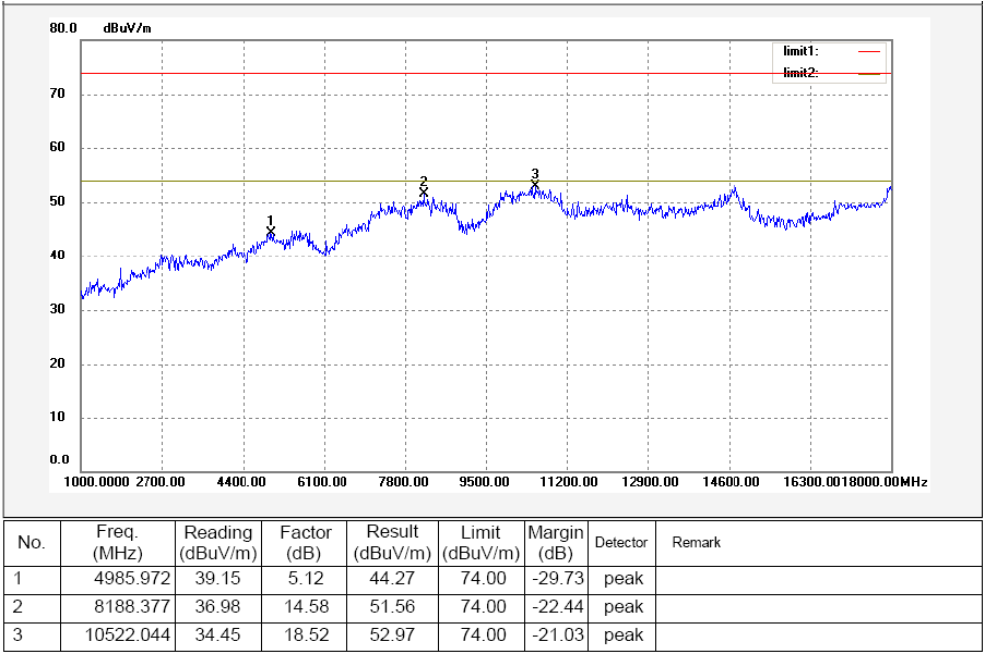
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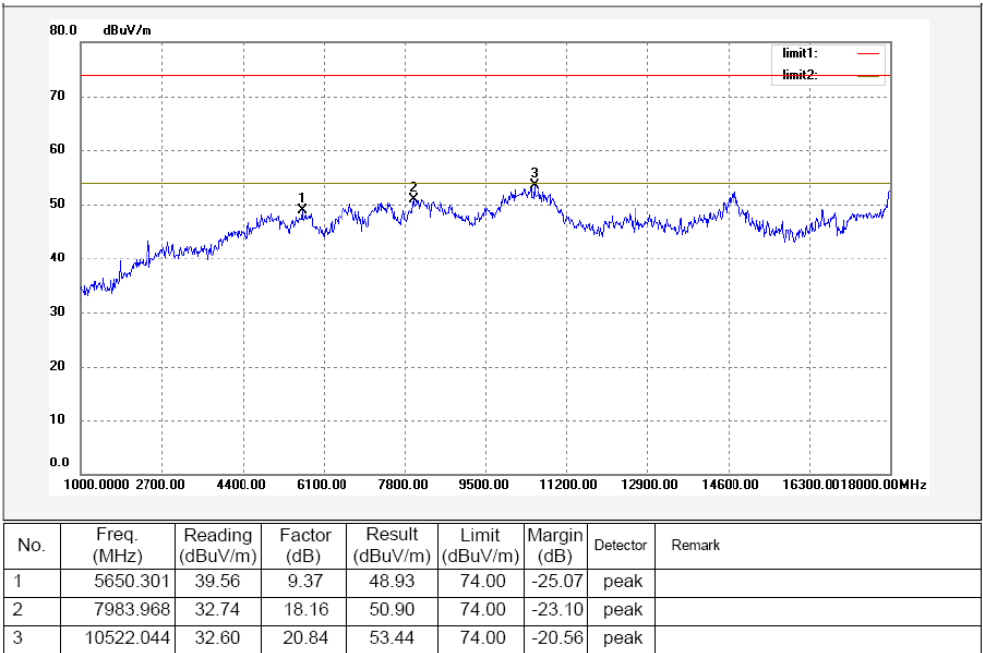
Test Frequency: Above 1GHz radiation test data:

Remark: above 18GHz, the test signal below the noise level, so the data was not performed.

Antenna polarization: Vertical



Antenna polarization: Horizontal



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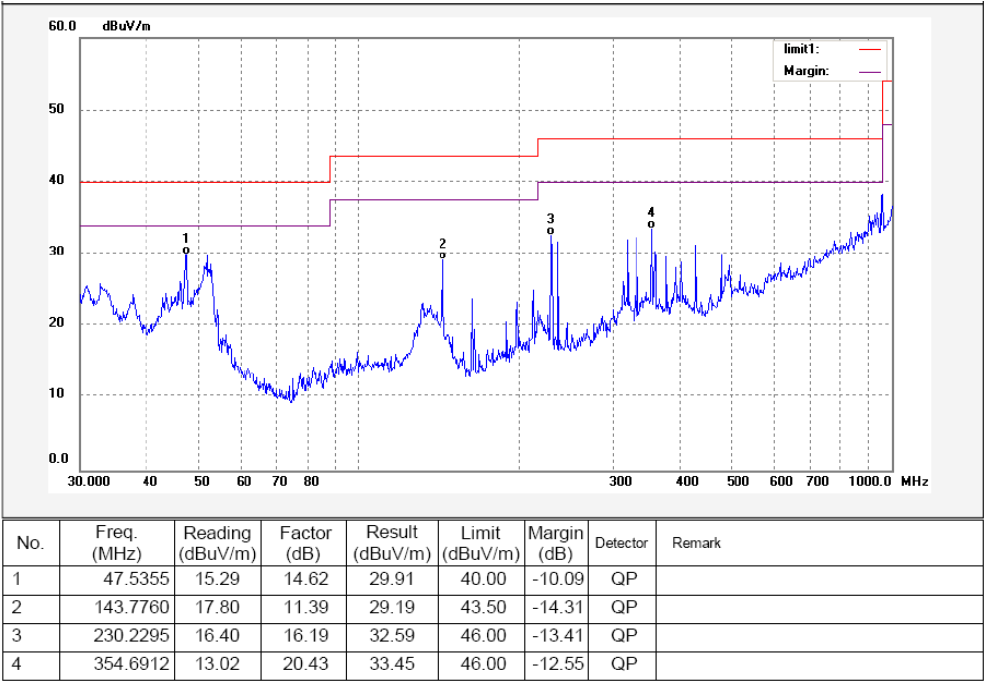
Reference No.: WT11084056-D-E-F

Test mode: continuously transmit mode

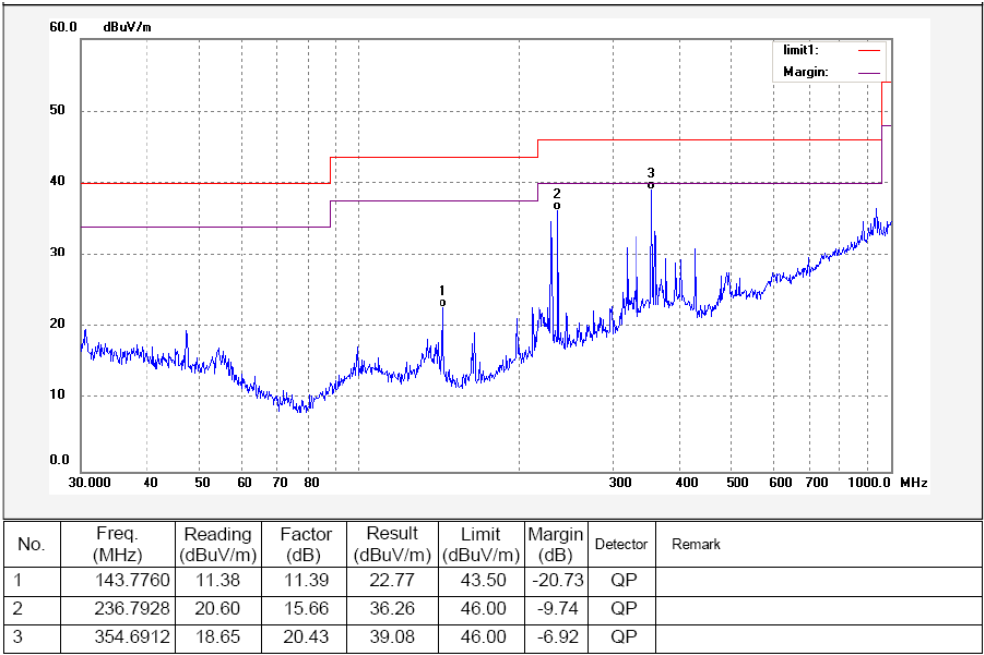
Remark: the EUT was pretested at the high, middle and low channel, and the worse case was the low Channel, so the data show was the low channel only. Because the emissions below 30MHz are more than 20dB below the limit, the data is not show in the report.

Test Frequency : 30MHz ~ 1000MHz

Antenna polarization: Vertical



Antenna polarization: Horizontal



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Test Frequency: 1GHz ~ 25GHz

And the below is the Fundamental and Harmonic

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
Low frequency							
2402.00	AV	Vertical	92.37		(Fund.)	1.2	150
4804.00	AV	Vertical	36.21	54.00	-17.79	1.2	0
7206.00	AV	Vertical	35.17	54.00	-18.83	1.5	120
9608.00	AV	Vertical	33.65	54.00	-20.35	1.8	60
12010.00	AV	Vertical	32.21	54.00	-21.79	1.6	90
14412.00	AV	Vertical	35.75	54.00	-18.25	1.4	120
16814.00	AV	Vertical	29.14	54.00	-24.86	1.7	100
19216.00	AV	Vertical	26.43	54.00	-27.57	1.5	180
21618.00	AV	Vertical	33.20	54.00	-20.80	1.6	120
24020.00	AV	Vertical	25.16	54.00	-28.84	1.2	135
2402.00	AV	Horizontal	87.52		(Fund.)	1.2	120
4804.00	AV	Horizontal	34.50	54.00	-19.50	1.2	150
7206.00	AV	Horizontal	29.87	54.00	-24.13	1.5	120
9608.00	AV	Horizontal	30.44	54.00	-23.56	1.2	180
12010.00	AV	Horizontal	31.71	54.00	-22.29	1.5	135
14412.00	AV	Horizontal	28.26	54.00	-25.74	1.2	120
16814.00	AV	Horizontal	25.42	54.00	-28.58	1.5	180
19216.00	AV	Horizontal	28.05	54.00	-25.95	1.8	60
21618.00	AV	Horizontal	23.31	54.00	-30.69	1.2	90
24020.00	AV	Horizontal	24.16	54.00	-29.84	1.5	90
2402.00	PK	Vertical	103.34		(Fund.)	1.5	180
4804.00	PK	Vertical	55.74	74.00	-18.26	1.8	30
7206.00	PK	Vertical	52.17	74.00	-21.83	1.6	110
9608.00	PK	Vertical	54.63	74.00	-19.37	1.4	100
12010.00	PK	Vertical	49.73	74.00	-24.27	1.2	90
14412.00	PK	Vertical	56.28	74.00	-17.72	1.2	60
16814.00	PK	Vertical	50.31	74.00	-23.69	1.4	90
19216.00	PK	Vertical	51.18	74.00	-22.82	1.2	120
21618.00	PK	Vertical	49.50	74.00	-24.50	1.7	120
24020.00	PK	Vertical	43.12	74.00	-30.88	1.4	135
2402.00	PK	Horizontal	98.54		(Fund.)	1.8	180
4804.00	PK	Horizontal	52.13	74.00	-21.87	1.8	60
7206.00	PK	Horizontal	50.44	74.00	-23.56	1.8	120
9608.00	PK	Horizontal	51.26	74.00	-22.74	1.2	180
12010.00	PK	Horizontal	49.12	74.00	-24.88	1.2	90
14412.00	PK	Horizontal	43.31	74.00	-30.69	1.5	90
16814.00	PK	Horizontal	47.52	74.00	-26.48	1.8	150

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19216.00	PK	Horizontal	42.19	74.00	-31.81	1.5	150
21618.00	PK	Horizontal	45.02	74.00	-28.98	1.2	120
24020.00	PK	Horizontal	40.40	74.00	-33.60	1.2	180
Middle frequency							
2441.00	AV	Vertical	91.47		(Fund.)	1.5	0
4882.00	AV	Vertical	36.03	54.00	-17.97	1.2	90
7323.00	AV	Vertical	34.24	54.00	-19.76	1.0	90
9764.00	AV	Vertical	30.15	54.00	-23.85	1.2	0
12205.00	AV	Vertical	34.74	54.00	-19.26	1.2	0
14646.00	AV	Vertical	28.56	54.00	-25.44	1.2	150
17087.00	AV	Vertical	30.36	54.00	-23.64	1.5	0
19528.00	AV	Vertical	27.15	54.00	-26.85	1.5	0
21969.00	AV	Vertical	25.28	54.00	-28.72	1.8	180
24410.00	AV	Vertical	29.37	54.00	-24.63	1.2	90
2441.00	AV	Horizontal	85.52		(Fund.)	1.0	120
4882.00	AV	Horizontal	32.50	54.00	-21.50	1.0	90
7323.00	AV	Horizontal	33.71	54.00	-20.29	1.5	270
9764.00	AV	Horizontal	28.62	54.00	-25.38	1.2	120
12205.00	AV	Horizontal	26.31	54.00	-27.69	1.2	150
14646.00	AV	Horizontal	30.21	54.00	-23.79	1.4	180
17087.00	AV	Horizontal	29.44	54.00	-24.56	1.6	135
19528.00	AV	Horizontal	24.12	54.00	-29.88	1.4	90
21969.00	AV	Horizontal	25.17	54.00	-28.83	1.2	150
24410.00	AV	Horizontal	23.35	54.00	-30.65	1.7	120
2441.00	PK	Vertical	102.14		(Fund.)	1.0	0
4882.00	PK	Vertical	57.26	74.00	-16.74	1.1	90
7323.00	PK	Vertical	55.37	74.00	-18.63	1.4	100
9764.00	PK	Vertical	51.23	74.00	-22.77	1.3	120
12205.00	PK	Vertical	54.47	74.00	-19.53	1.7	180
14646.00	PK	Vertical	47.14	74.00	-26.86	1.2	0
17087.00	PK	Vertical	50.39	74.00	-23.61	1.4	0
19528.00	PK	Vertical	45.20	74.00	-28.80	1.5	120
21969.00	PK	Vertical	49.19	74.00	-24.81	1.5	135
24410.00	PK	Vertical	42.25	74.00	-31.75	1.2	120
2441.00	PK	Horizontal	94.72		(Fund.)	1.0	0
4882.00	PK	Horizontal	52.33	74.00	-21.67	1.7	45
7323.00	PK	Horizontal	54.06	74.00	-19.94	1.6	90
9764.00	PK	Horizontal	48.17	74.00	-25.83	1.5	60
12205.00	PK	Horizontal	50.92	74.00	-23.08	1.4	150
14646.00	PK	Horizontal	46.32	74.00	-27.68	1.2	150
17087.00	PK	Horizontal	43.51	74.00	-30.49	1.1	120
19528.00	PK	Horizontal	46.20	74.00	-27.80	1.5	150
21969.00	PK	Horizontal	47.43	74.00	-26.57	1.1	0

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24410.00	PK	Horizontal	42.11	74.00	-31.89	1.6	135
High frequency							
2480.00	AV	Vertical	89.96		(Fund.)	1.0	0
4960.00	AV	Vertical	33.35	54.00	-20.65	1.2	45
7440.00	AV	Vertical	34.14	54.00	-19.86	1.2	120
9920.00	AV	Vertical	30.56	54.00	-23.44	1.4	60
12400.00	AV	Vertical	28.15	54.00	-25.85	1.5	135
14880.00	AV	Vertical	30.16	54.00	-23.84	1.8	120
17360.00	AV	Vertical	29.41	54.00	-24.59	1.1	100
19840.00	AV	Vertical	24.33	54.00	-29.67	1.1	60
22320.00	AV	Vertical	21.57	54.00	-32.43	1.4	0
24800.00	AV	Vertical	24.65	54.00	-29.35	1.5	60
2480.00	AV	Horizontal	83.69		(Fund.)	1.0	0
4960.00	AV	Horizontal	30.24	54.00	-23.76	1.8	120
7440.00	AV	Horizontal	28.57	54.00	-25.43	1.2	60
9920.00	AV	Horizontal	31.12	54.00	-22.88	1.5	100
12400.00	AV	Horizontal	29.36	54.00	-24.64	1.2	60
14880.00	AV	Horizontal	26.21	54.00	-27.79	1.2	120
17360.00	AV	Horizontal	29.02	54.00	-24.98	1.4	100
19840.00	AV	Horizontal	21.53	54.00	-32.47	1.8	100
22320.00	AV	Horizontal	22.47	54.00	-31.53	1.3	100
24800.00	AV	Horizontal	21.09	54.00	-32.91	1.6	10
2480.00	PK	Vertical	97.84		(Fund.)	1.0	0
4960.00	PK	Vertical	52.20	74.00	-21.80	1.2	60
7440.00	PK	Vertical	53.14	74.00	-20.86	1.8	90
9920.00	PK	Vertical	49.87	74.00	-24.13	1.5	180
12400.00	PK	Vertical	46.23	74.00	-27.77	1.4	60
14880.00	PK	Vertical	47.52	74.00	-26.48	1.2	60
17360.00	PK	Vertical	44.33	74.00	-29.67	1.2	135
19840.00	PK	Vertical	42.61	74.00	-31.39	1.2	120
22320.00	PK	Vertical	40.39	74.00	-33.61	1.6	60
24800.00	PK	Vertical	41.54	74.00	-32.46	1.4	90
2480.00	PK	Horizontal	92.19		(Fund.)	1.1	60
4960.00	PK	Horizontal	50.51	74.00	-23.49	1.4	90
7440.00	PK	Horizontal	48.26	74.00	-25.74	1.5	60
9920.00	PK	Horizontal	45.37	74.00	-28.63	1.3	0
12400.00	PK	Horizontal	47.35	74.00	-26.65	1.2	135
14880.00	PK	Horizontal	42.26	74.00	-31.74	1.7	0
17360.00	PK	Horizontal	48.36	74.00	-25.64	1.8	180
19840.00	PK	Horizontal	40.21	74.00	-33.79	1.5	60
22320.00	PK	Horizontal	41.54	74.00	-32.46	1.8	120
24800.00	PK	Horizontal	43.31	74.00	-30.69	1.0	60

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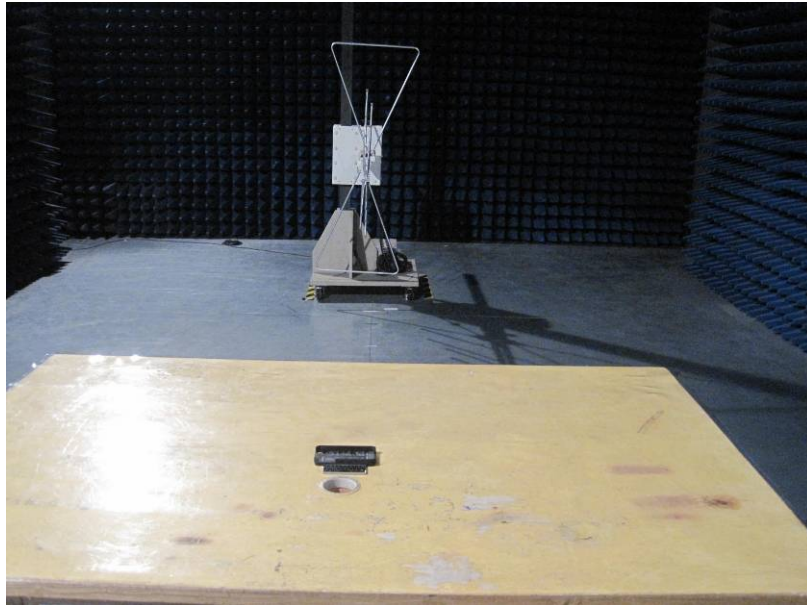
Reference No.: WT11084056-D-E-F

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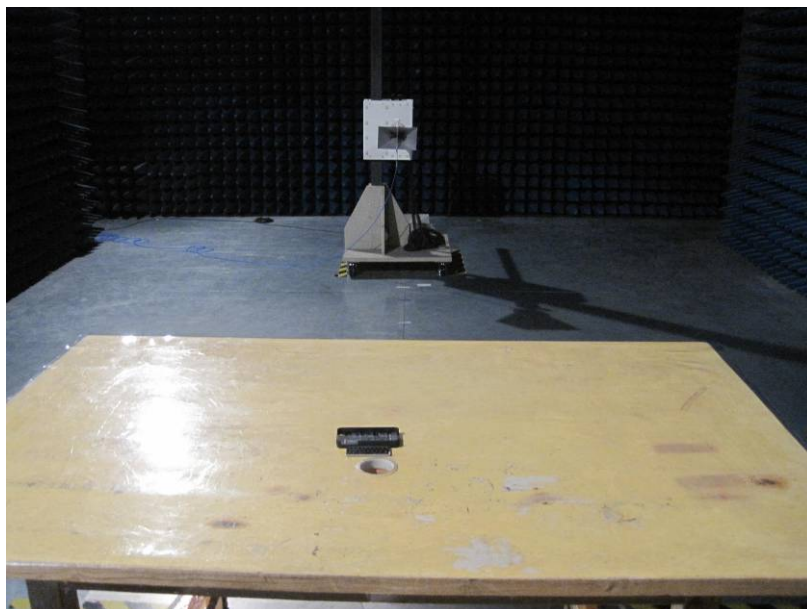
FCC ID: ZVH-KIANO4

**Photograph – Radiation Spurious Emission Test Setup**

Below 1GHz



Above 1GHz



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## 8 Radiated Emissions which fall in the restricted bands

Test Requirement:	Section 15.247(d) 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)).
Test Method:	Base on ANSI C63.4:2003
Measurement Distance:	3m
Limit:	40.0 dBuV/m between 30MHz & 88MHz; 43.5 dBuV/m between 88MHz & 216MHz; 46.0 dBuV/m between 216MHz & 960MHz; 54.0 dBuV/m above 960MHz. 74.0 dBuV/m for peak above 1GHz 54.0 dBuV/m for AVG above 1GHz
Detector:	For Peak value: RBW = 1 MHz for $f \geq 1$ GHz VBW $\geq$ RBW; Sweep = auto Detector function = peak Trace = max hold For AVG value: RBW = 1 MHz for $f \geq 1$ GHz VBW = 10Hz; Sweep = auto Detector function = AVG Trace = max hold

### Test Result:

#### 1. Low Channel

Frequency (MHz)	Peak Emission Level (dBuV/m)	AVG Emission Level (dBuV/m)
2390	50.24	38.24
2483.5	36.16	27.51

#### 2. High Channel

Frequency (MHz)	Peak Emission Level (dBuV/m)	AVG Emission Level (dBuV/m)
2390	37.23	26.43
2483.5	49.22	36.43

## 9 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247  
 Test Method: Based on FCC Part 15.247  
 Test Mode: Test in fixing operating frequency at low, Middle, high channel.

### Test Procedure:

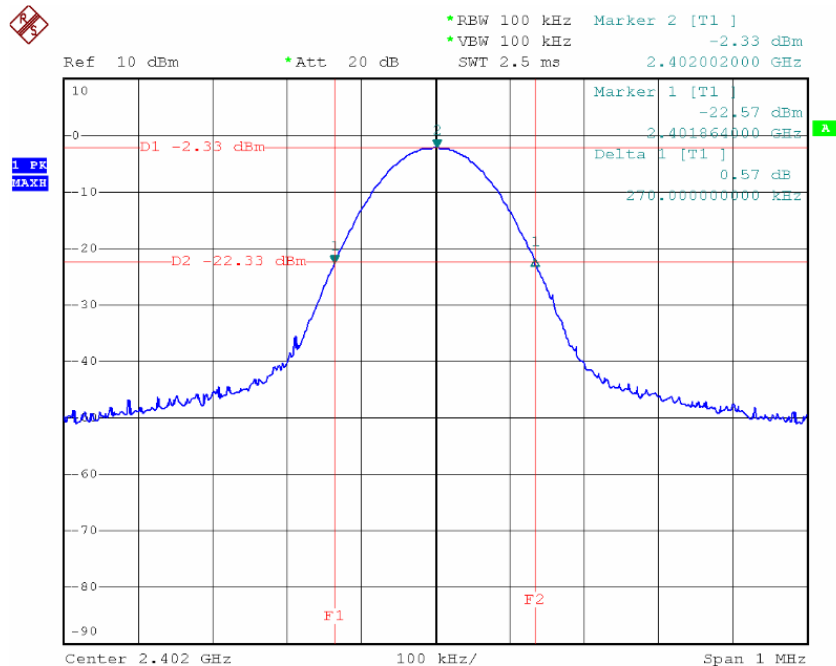
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: Span = 1MHz, RBW = 100kHz, VBW = 100kHz

### Test Result:

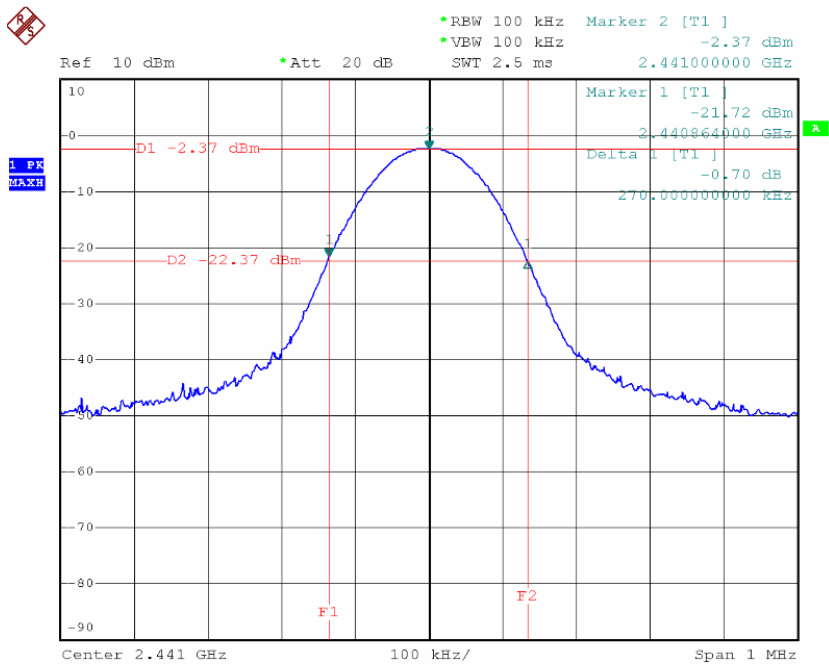
Test Channel	Bandwidth
Low	270kHz
Middle	270kHz
High	270kHz

Test result plot as follows:

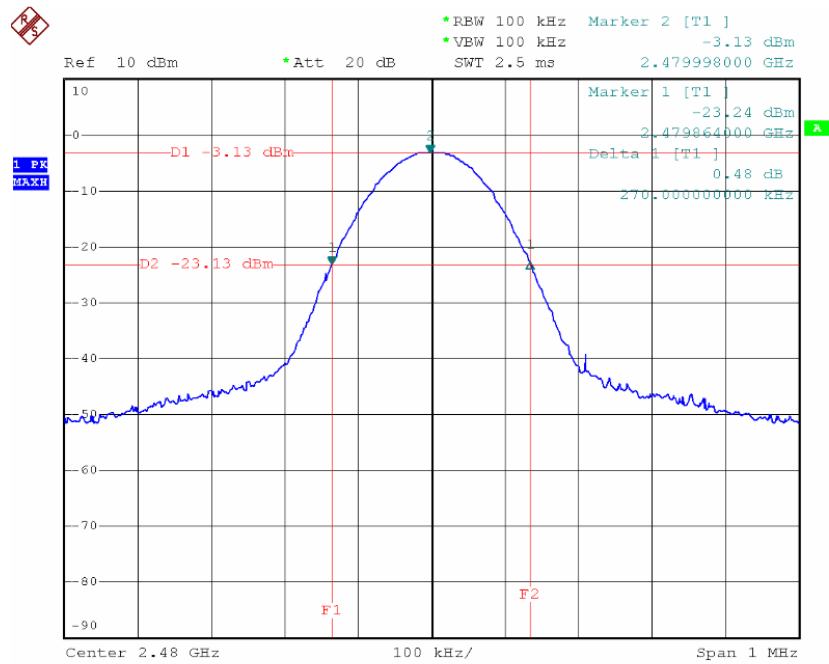
Low Channel



Middle Channel



High Channel



## 10 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on ANSI C63.4:2003
Test Limit:	Regulation 15.247 (b)(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts. Refer to the result “Number of Hopping Frequency” of this document. The 1 watts (30 dBm) limit applies.
Test mode:	Test in fixing frequency transmitting mode.

### Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1 MHz. VBW = 1 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

### Test Result:

Test Channel	Output Power (dBm)	Limit (dBm)
Low	-2.26	30
Middle	-2.29	30
High	-3.12	30

## 11 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on FCC Part 15.247
Test Limit:	Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
Test Mode:	Test in hopping transmitting operating mode.

### Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

### Test Result:

Test Channel	Separation (MHz)	Result
Low	1.002	PASS
Middle	1.002	PASS
High	1.002	PASS

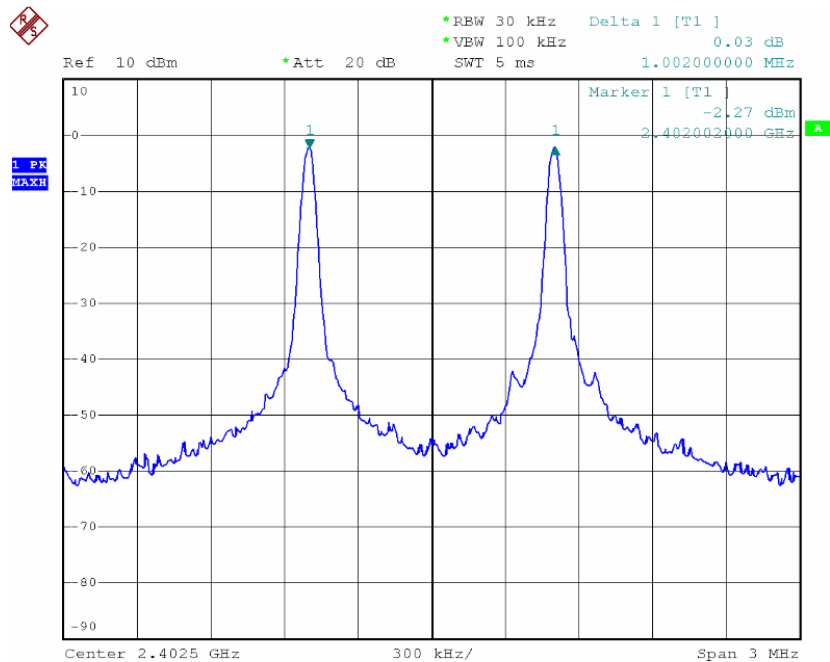


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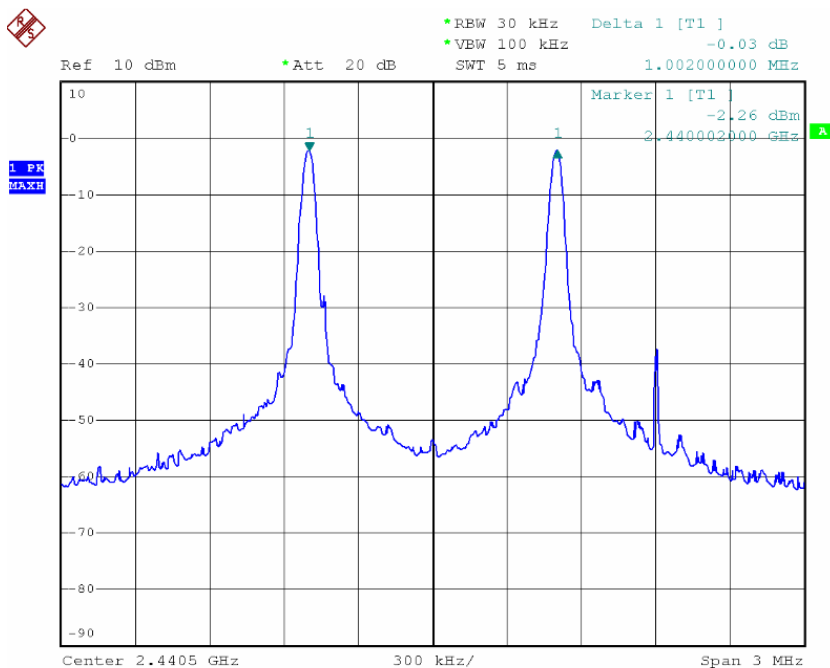
FCC ID: ZVH-KIANO4

Test result plot as follows:

Low Channel:



Middle Channel

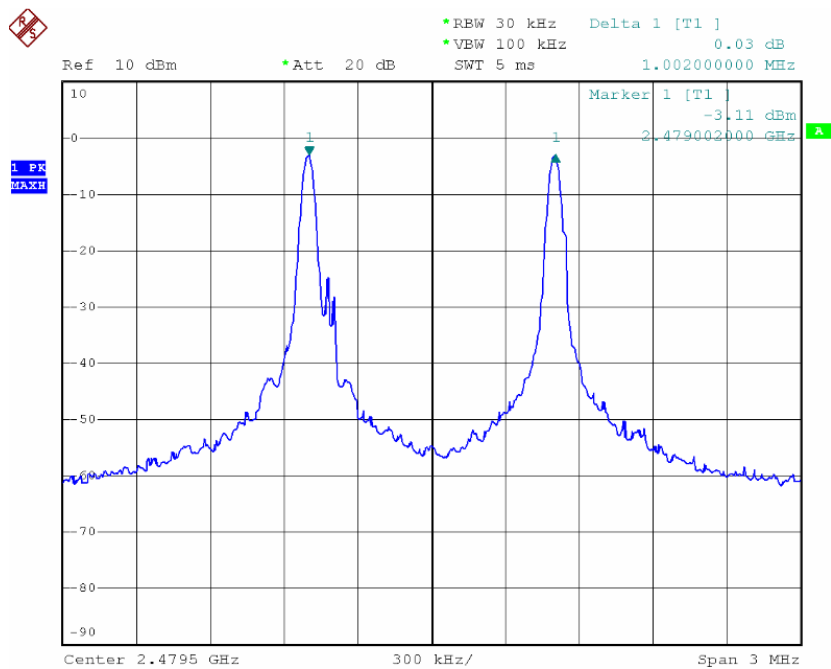


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High Channel

FCC ID: ZVH-KIANO4



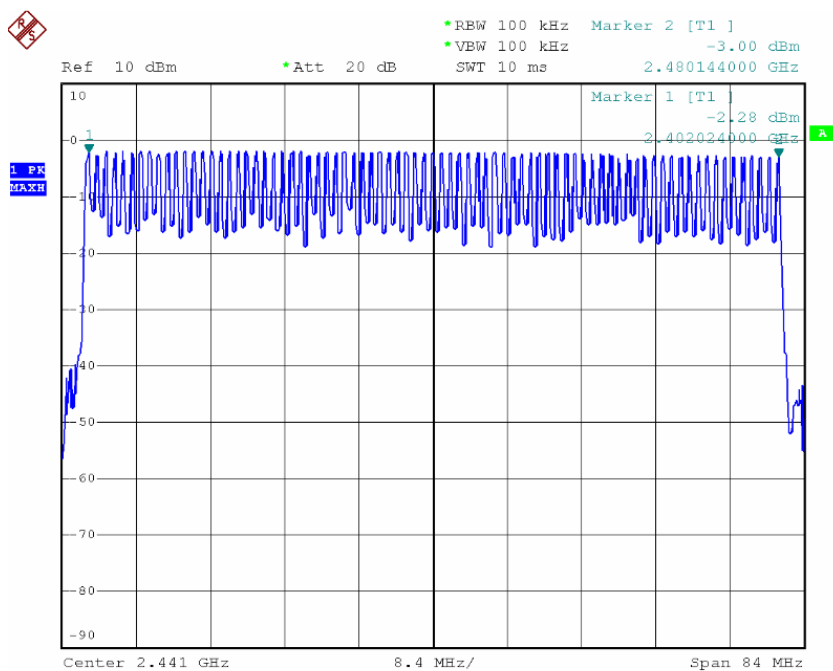
## 12 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on FCC Part 15.247
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

### Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 100 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Center Frequency = 2441MHz, Span = 84MHz. Submit the test result graph.

**Test Result: Total Channels are 79 Channels.**



## 13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on FCC Part 15.247
Test Limit:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

### Test Procedure:

- 1.Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
- 2.Set spectrum analyzer span = 0. centered on a hopping channel;
- 3.Set RBW = 1MHz and VBW = 1MHz.Sweep = as necessary to capture the entire dwell time per hopping channel.
- 4.Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

### Test Result:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period

The test period:  $T = 0.4(s) * 79 = 31.6 (s)$

DH5 Packet permit maximum  $1600 / 79 / 6$  hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum  $1600 / 79 / 4$  hops per second in each channel (3 time slots RX, 1 time slot TX).

DH1 Packet permit maximum  $1600 / 79 / 2$  hops per second in each channel (1 time slot RX, 1 time slot TX). So,the Dwell Time can be calculated as follows:

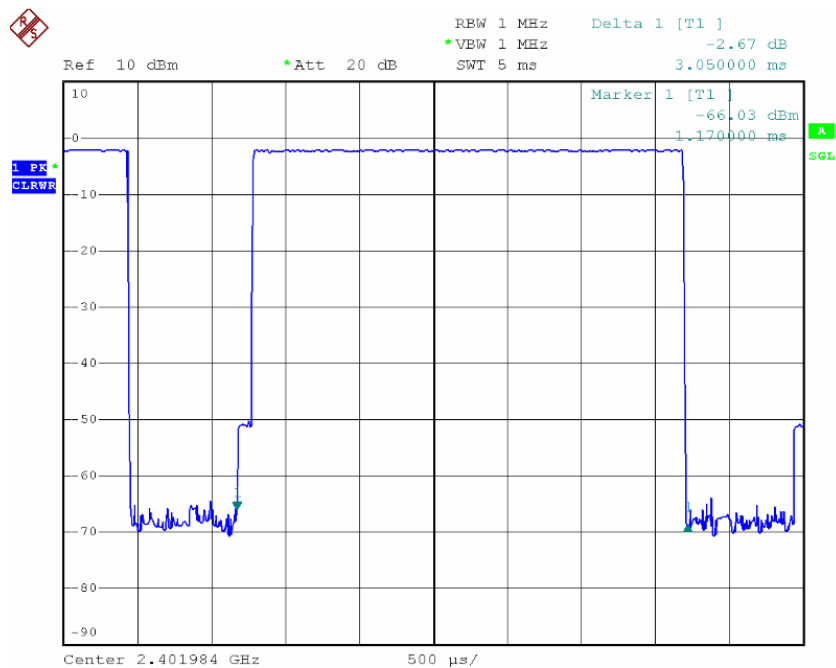
Data Packet	Dwell Time(s)
DH5	$1600/79/6*31.6*(\text{MkrDelta})/1000$
DH3	$1600/79/4*31.6*(\text{MkrDelta})/1000$
DH1	$1600/79/2*31.6*(\text{MkrDelta})/1000$

**Note :** Mkr Delta is once pulse time .

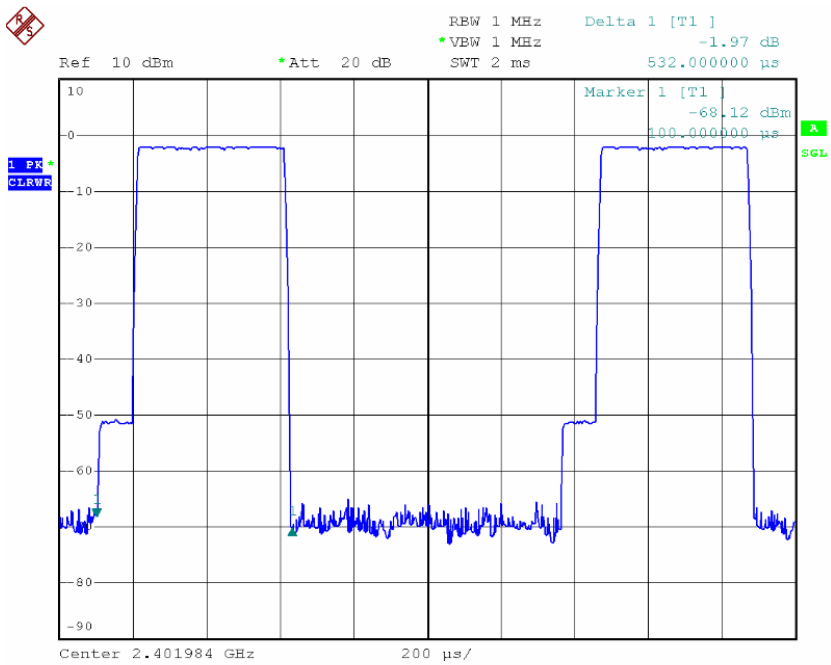
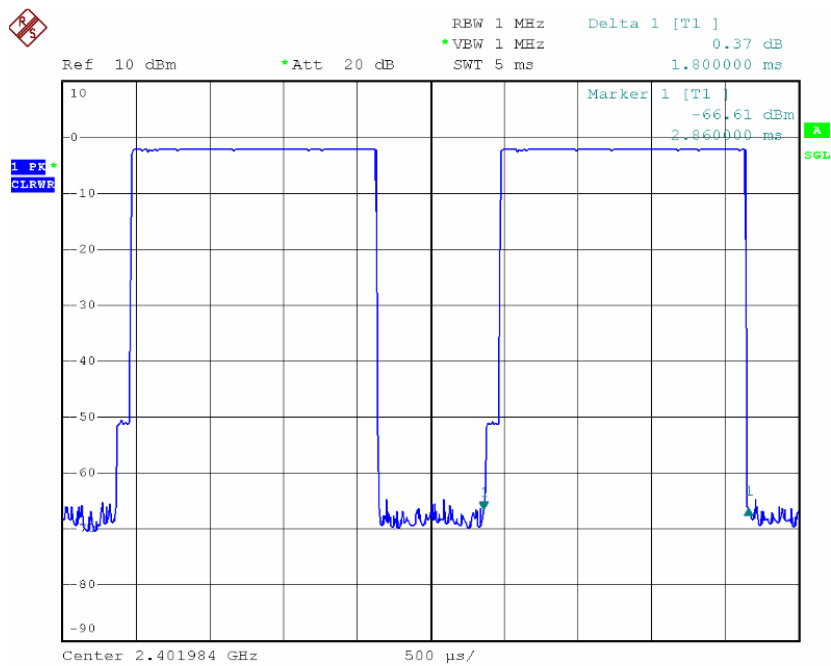
### Low Channel: 2402MHz

Dwell time of each occupation in this channel as follows:

Data Packet	Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
DH5	2402 MHz	3.050	0.325	0.400	Pass
DH3	2402 MHz	1.800	0.288	0.400	Pass
DH1	2402 MHz	0.532	0.170	0.400	Pass



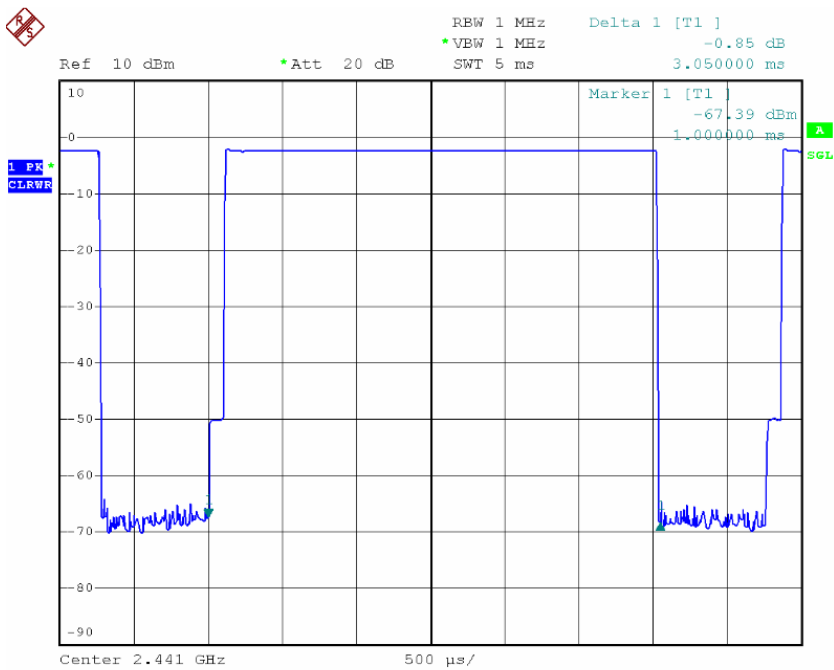
(DH5)



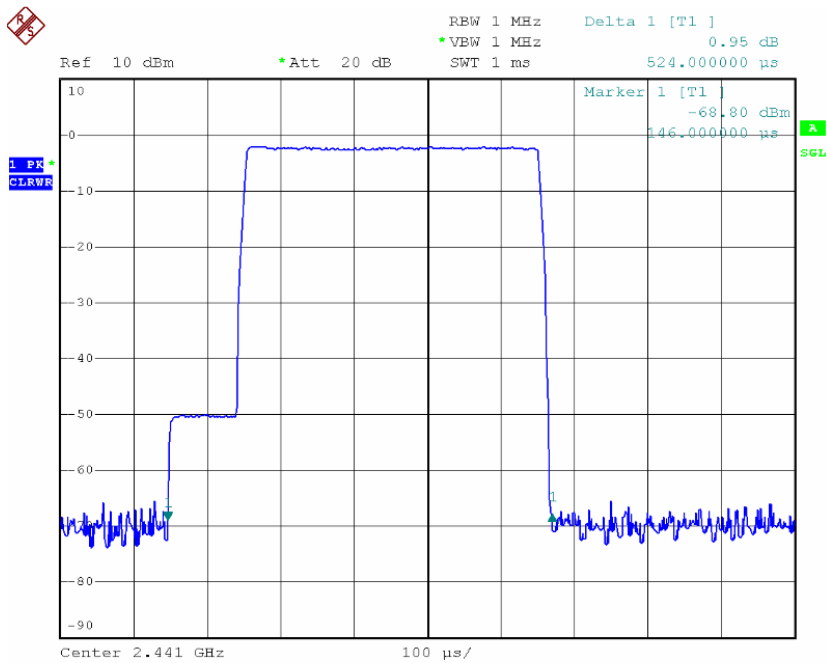
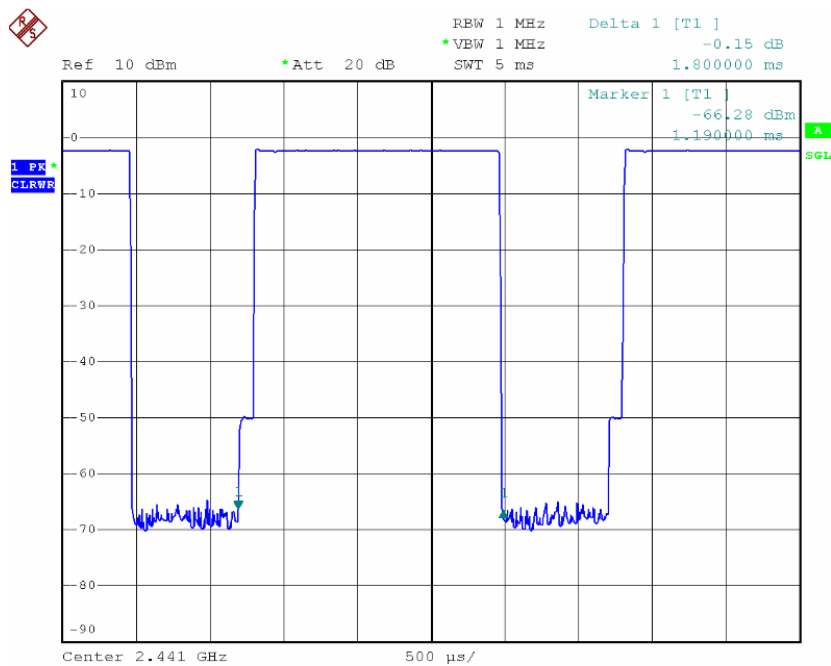
Low Channel: 2441MHz

Dwell time of each occupation in this channel as follows:

Data Packet	Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
DH5	2441 MHz	3.050	0.325	0.400	Pass
DH3	2441 MHz	1.800	0.288	0.400	Pass
DH1	2441 MHz	0.524	0.168	0.400	Pass



(DH5)





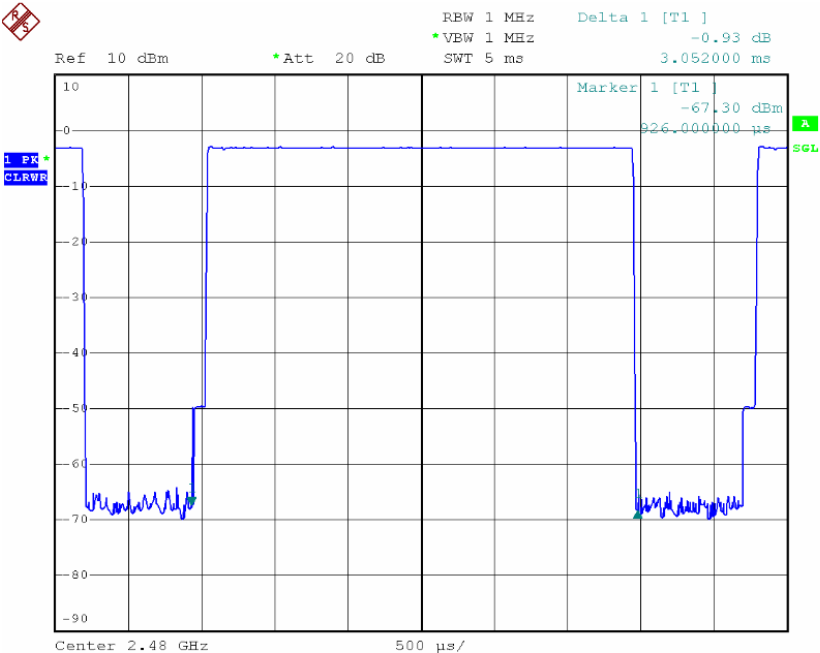
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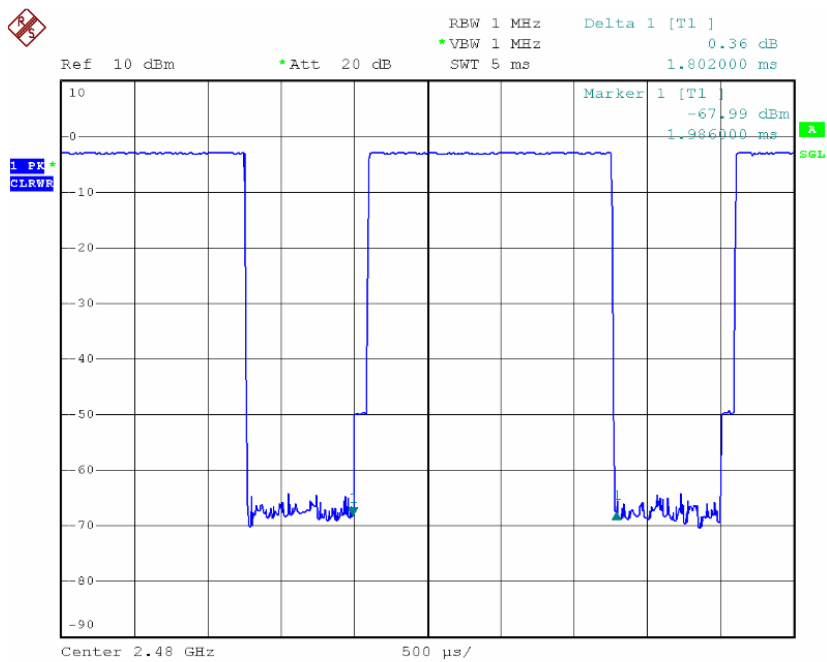
Low Channel: 2480MHz

Dwell time of each occupation in this channel as follows:

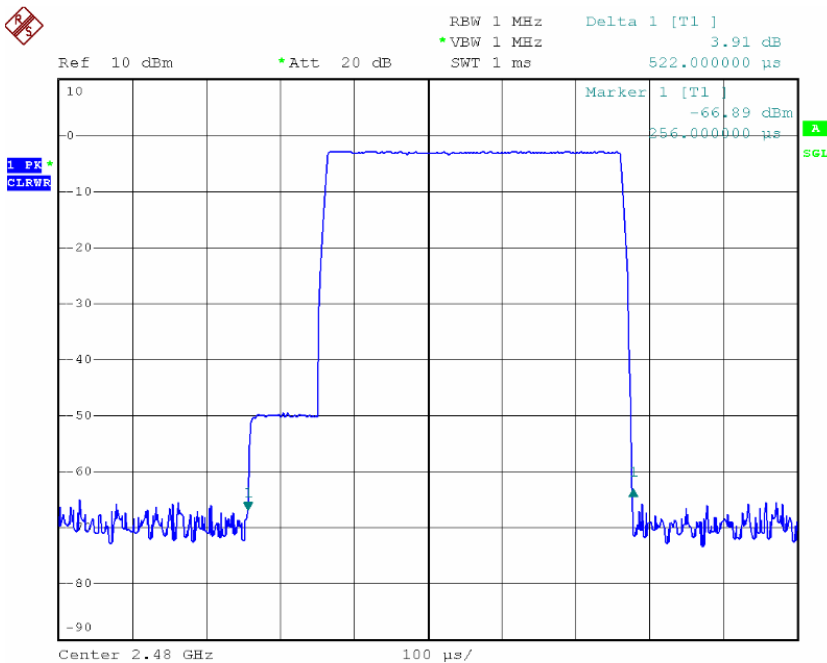
Data Packet	Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
DH5	2480 MHz	3.052	0.326	DH5	Pass
DH3	2480 MHz	1.802	0.288	DH3	Pass
DH1	2480 MHz	0.522	0.167	DH1	Pass



(DH5)



(DH3)



(DH1)

## 14 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has a permanent antenna, fulfill the requirement of this section.

## 15 RF Exposure

Test Requirement: FCC Part 1.1307  
 Test Method: Based on FCC Part 15.247  
 Test Mode: The EUT work in test mode(Tx).

### Requiments:

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

### The procedures / limit

#### (A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

#### (B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; \*Plane-wave equivalent power density

**MPE Calculation Method**

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

**E** = Electric field (V/m)

**P** = Peak RF output power (W)

**G** = EUT Antenna numeric gain (numeric)

**d** = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
0	1	-2.26	0.594	0.000118	1	Complies
0	1	-2.29	0.590	0.000117	1	Complies
0	1	-3.12	0.488	0.000097	1	Complies

## 16 Photographs - Constructional Details

### 16.1 Product View



### 16.2 EUT – Front View



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### 16.3 EUT – Back View



### 16.4 EUT – Open View1



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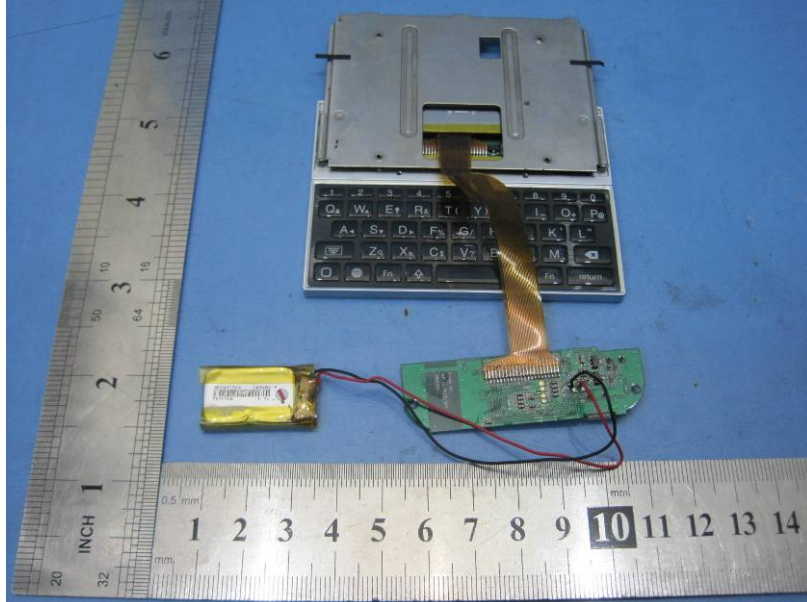
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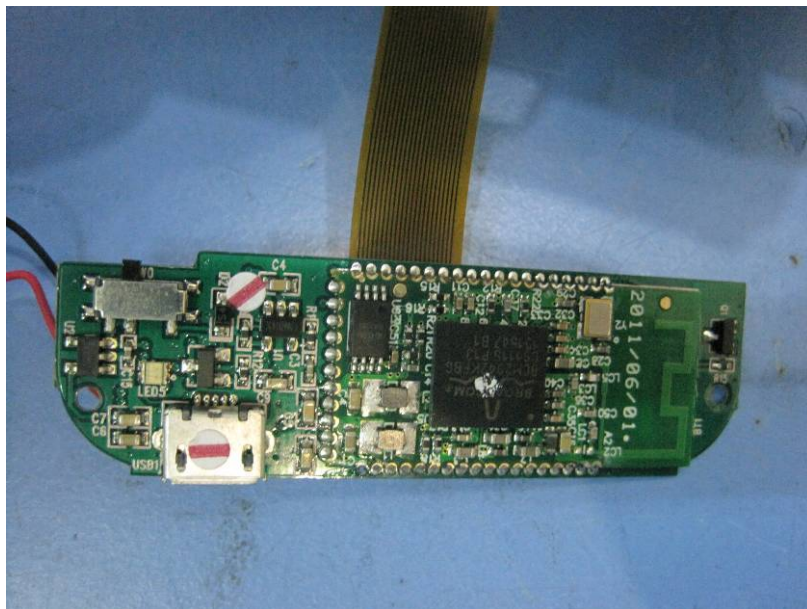
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FCC ID: ZVH-KIANO4

## 16.5 EUT – Open View2



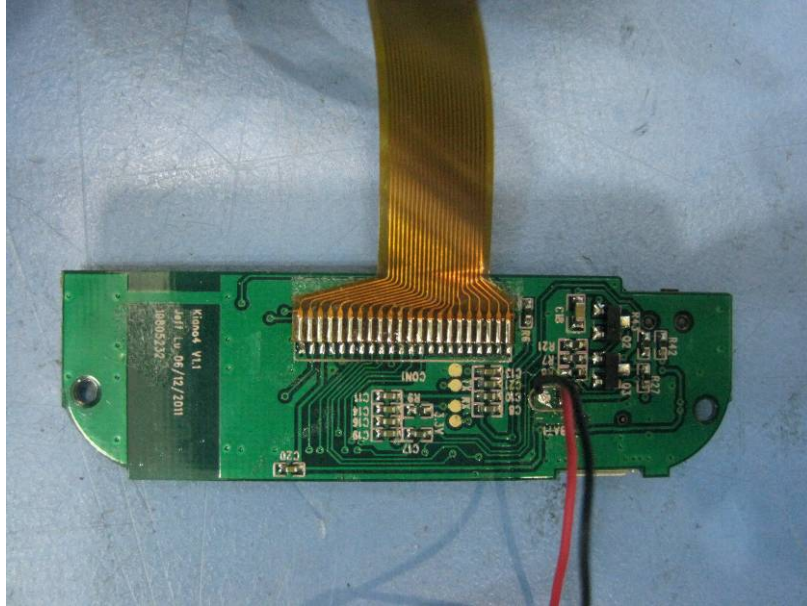
## 16.6 PCB – Front View



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Reference No.: WT11084056-D-E-F

## 16.7 PCB – Back View





## 17 FCC Label

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

