



Neutron Engineering Inc.

Radio Test Report

FCC ID: XM6LAEWI002

This report concerns (check one) : ☒ Original Grant ☐ Class I Change

Issued Date : Apr. 09, 2010
Project No. : R1003002
Equipment : Wireless Bike Indicator
Model Name : WIP-2400

Applicant : LINEARITY ELECTRONICS CO., LTD.
Address : 5F., No.349, Yangguang St., NeiHu
District, Taipei City 11491, Taiwan
(R.O.C.)

Tested by:
Neutron Engineering Inc. EMC Laboratory
Date of Test:
Mar. 16, 2010 ~ Mar. 29, 2010

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Declaration

Neutron represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**) of **R.O.C.**, or National Institute of Standards and Technology (**NIST**) of **U.S.A.**

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Neutron's laboratory quality assurance procedures are in compliance with the **ISO Guide 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.



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1. CERTIFICATION

Equipment : Wireless Bike Indicator
Brand Name : LINEARITY
Model No. : WIP-2400
Applicant : LINEARITY ELECTRONICS CO., LTD.
Date of Test : Mar. 16, 2010 ~ Mar. 29, 2010
Standards : FCC Part15, Subpart C(15.249) / ANCI C63.4 : 2003

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-FCCP-1-R1003002) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of NVLAP and TAF according to the ISO-17025 quality assessment standard and technical standard(s).



2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15, Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	
15.249	Radiated Spurious Emission	PASS	

NOTE:

(1) "N/A" denotes test is not applicable in this Test Report



2.1 TEST FACILITY

The test facilities used to collect the test data in this report is **CB08(FCC R.N.: 614388)** at the location of 1F., No. 61, Ln. 77, Sing-ai Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)

Neutron's test firm number is 95335

2.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95%** ◦

The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

A. Conducted Measurement :

Test Site	Method	Measurement Frequency Range	U , (dB)	NOTE
C01	ANSI	150 KHz ~ 30MHz	1.94	

B. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U , (dB)	NOTE
OS-01	ANSI	30MHz ~ 200MHz	V	2.86	
		30MHz ~ 200MHz	H	2.56	
		200MHz ~ 1,000MHz	V	2.88	
		200MHz ~ 1,000MHz	H	2.98	
OS-02	ANSI	30MHz ~ 200MHz	V	2.48	
		30MHz ~ 200MHz	H	2.16	
		200MHz ~ 1,000MHz	V	2.50	
		200MHz ~ 1,000MHz	H	2.66	

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our U_{lab} values in CISPR 16-4-2 terminology.

Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called U_{CISPR} , as follows:

Conducted Disturbance (mains port) – 150 kHz – 30 MHz : 3.6 dB

Radiated Disturbance (electric field strength on an open area test site or alternative test site) – 30 MHz – 1000 MHz : 5.2 dB

It can be seen that our U_{lab} values are smaller than U_{CISPR} .



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	Wireless Bike Indicator	
Brand Name	LINEARITY	
Model No.	WIP-2400	
OEM Brand	N/A	
Model Difference	N/A	
Product Description	The EUT is Wireless Bike Indicator.	
	Operation Frequency:	2443MHz
	Modulation Type:	2FSK
	Number Of Channel	1CH
	Antenna Designation:	Please refer to the Note 3.
	Antenna Gain(Peak)	Please refer to the Note 3.
	Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.	
Channel List	Please refer to the Note 2.	
Power Source	Supply From Battery	
Power Rating	DC 4.2V	
Connecting I/O Port(s)	Please refer to the User's Manual	
Products Covered	NA	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.

Channel List	
Channel	Frequency (MHz)
01	2443

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Printed Antenna	N/A	-2.04



3.2 DESCRIPTION OF TEST MODES

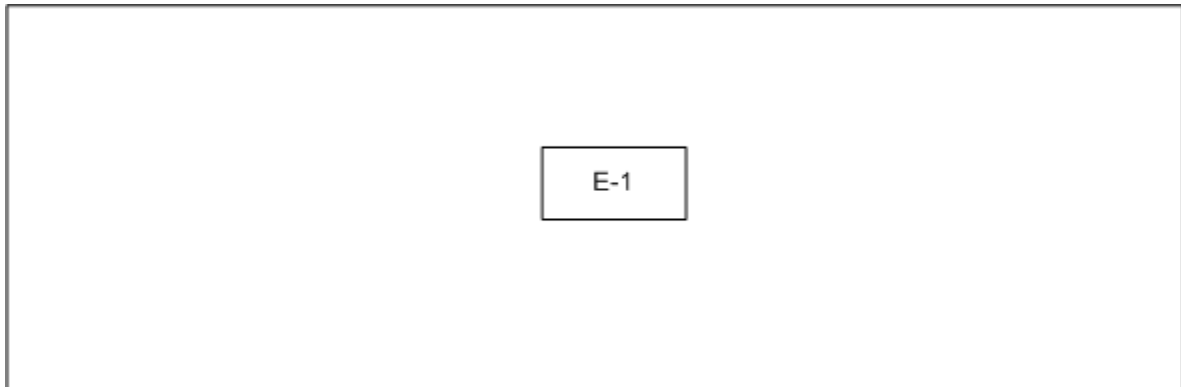
To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Test Mode	Description
Mode 1	CH01

For Radiated Test	
Final Test Mode	Description
Mode 1	CH01



3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED





3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	Wireless Bike Indicator	LINEARITY	WIP-2400	XM6LAEWI002	N/A	EUT

Item	Shielded Type	Ferrite Core	Length	Note
N/A				

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.



4. EMC EMISSION TEST

4.1 RADIATED EMISSION MEASUREMENT

4.1.1 RADIATED EMISSION LIMITS (FCC 15.209)

requencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Harmonic emissions limits comply with below 54 dBuV/m at 3m. Other emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 15.209(a) limit in the table below has to be followed.

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RADIATED EMISSION MEASUREMENT (FCC 15.209)

FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
Above 1000	80	60	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15B.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RADIATED EMISSION MEASUREMENT (FCC Part 15.249)

FCC Part15 (15.249) , Subpart C	
Limit	Frequency Range (MHz)
Field strength of fundamental 50000 μ V/m (94 dB μ V/m) @ 3 m	2400-2483.5
Field strength of harmonics 500 μ V/m (54 dB μ V/m) @ 3 m	Above 2483.5

**4.1.2 MEASUREMENT INSTRUMENTS LIST**

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Sep. 10, 2010
2	Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-546	Jun. 04, 2010
3	Microwave Pre_amplifier	Agilent	8449B	3008A01714	Apr. 20, 2010
4	Microflex Cable	N/A	N/A	1m	May. 20, 2010
5	Microflex Cable	AISI	S104-SMAP-1	10m	Aug. 23, 2010
6	Microflex Cable	N/A	N/A	3m	Aug. 23, 2010
7	Test Cable	N/A	LMR-400	966_12m	Jun. 18, 2010
8	Test Cable	N/A	LMR-400	966_3m	Jun. 18, 2010
9	Pre-Amplifier	EMC	EMC-330	980001	Jun. 04, 2010
10	Log-Bicon Antenna	Schwarzbeck	VULB9168-352	9168-352	Jun. 17, 2010

Remark: " N/A" denotes No Model No. / Serial No. and No Calibration specified.

4.1.3 TEST PROCEDURE

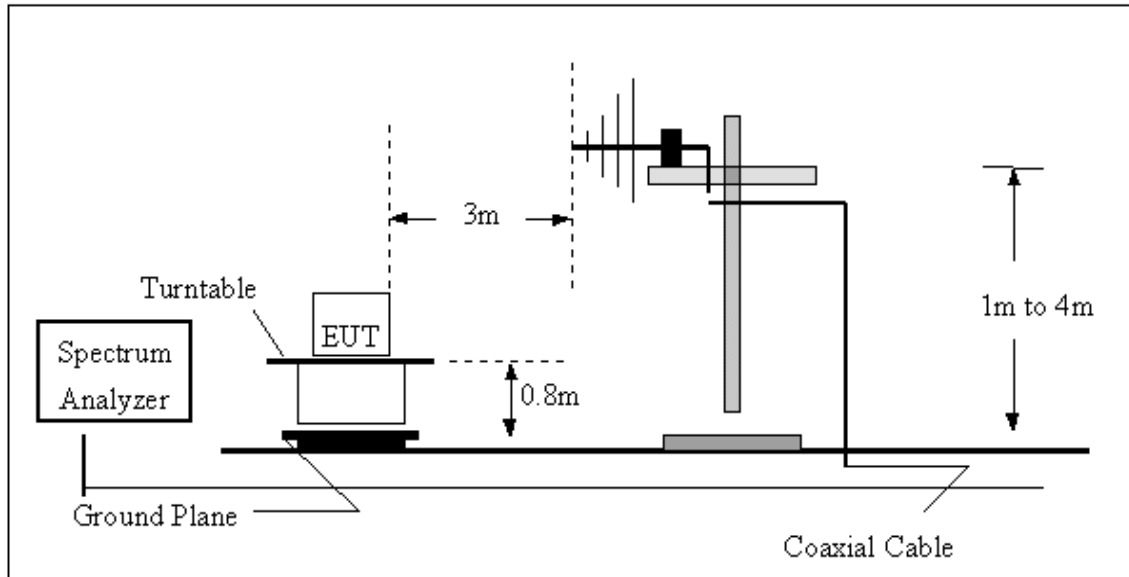
- The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.1.4 DEVIATION FROM TEST STANDARD

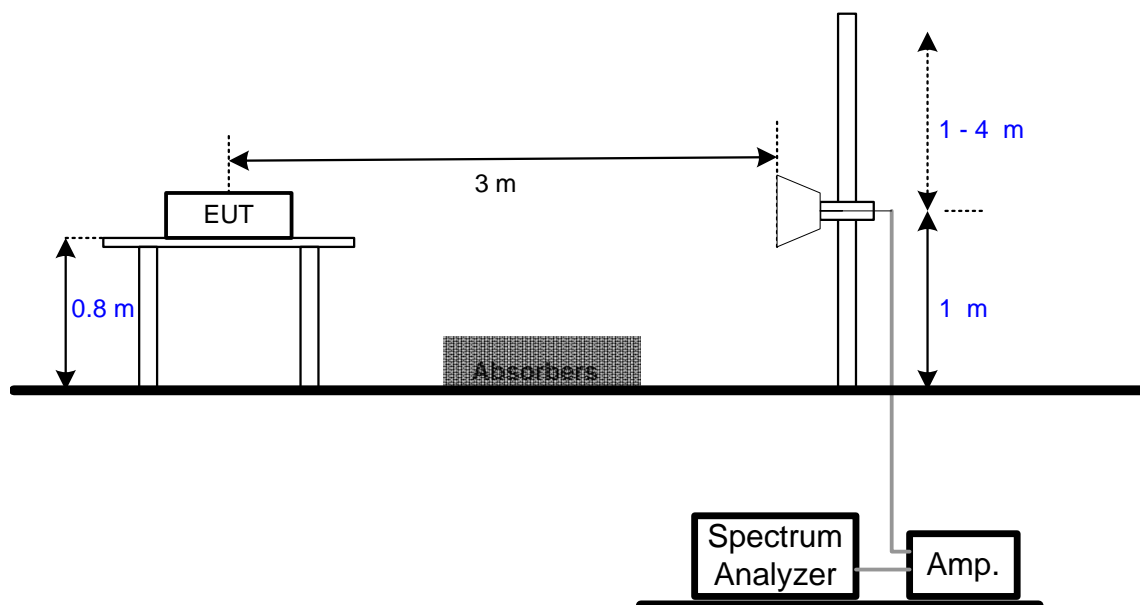
No deviation

4.1.5 TEST SETUP

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



4.1.6 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operation condition was tested and used to collect the included data.



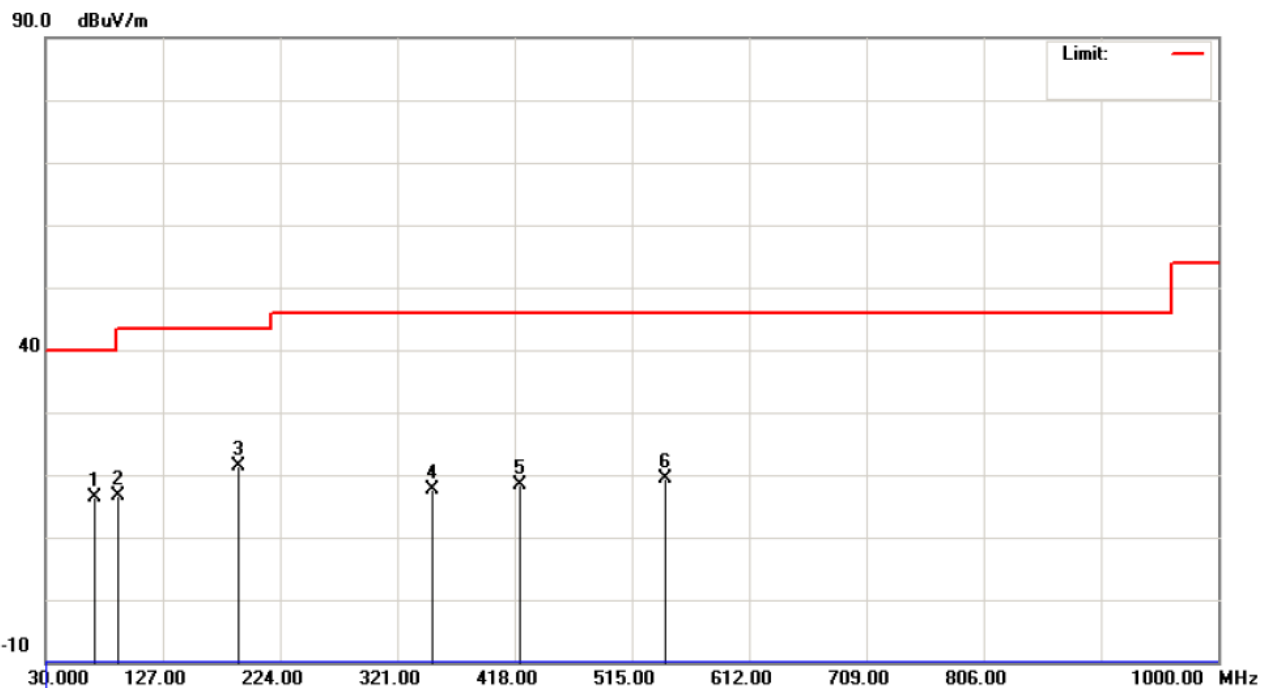
4.1.7 TEST RESULTS-BETWEEN 30MHz – 1000MHz

EUT :	Wireless Bike Indicator	Model No. :	WIP-2400
Temperature :	23°C	Relative Humidity :	54%
Test Power :	DC 1.5V		
Test Mode :	CH01		

Freq. (MHz)	Ant. H/V	Reading(RA) (dBuV)	Corr.Factor(CF) (dB)	Measured(FS) (dBuV/m)	Limits(QP) (dBuV/m)	Margin (dB)	Note
70.74	V	39.77	-23.49	16.28	40.00	- 23.72	
90.14	V	41.42	-24.75	16.67	43.50	- 26.83	
189.08	V	44.50	-23.14	21.36	43.50	- 22.14	
350.10	V	36.97	-19.42	17.55	46.00	- 28.45	
421.88	V	36.21	-17.71	18.50	46.00	- 27.50	
542.16	V	34.71	-15.42	19.29	46.00	- 26.71	

Remark :

- (1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120KHz ; SPA setting in RBW=120KHz, VBW =120KHz, Swp. Time = 0.3 sec./MHz ◦
- (2) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform ◦
- (3) Measuring frequency range from 30MHz to 1000MHz ◦
- (4) If the peak scan value is under the limit for more than 20dB, the signal will not show in table ◦



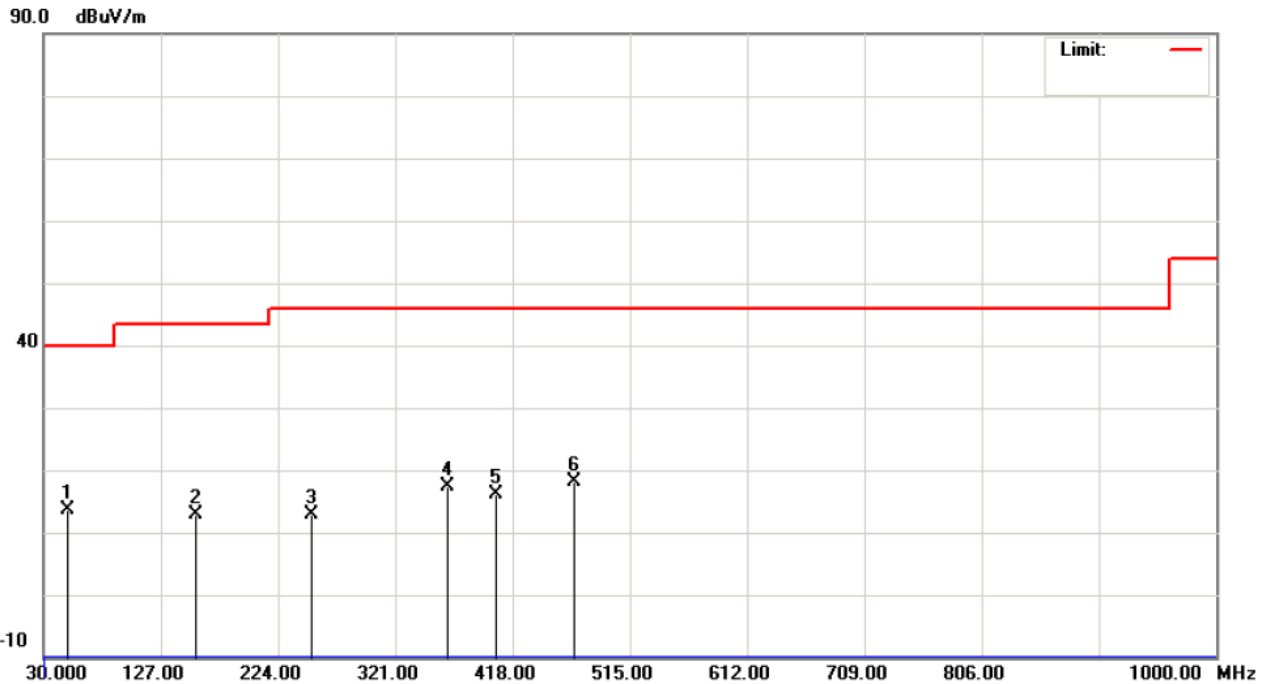


EUT :	Wireless Bike Indicator	Model No. :	WIP-2400
Temperature :	23°C	Relative Humidity :	54%
Test Power :	DC 1.5V		
Test Mode :	CH01		

Freq. (MHz)	Ant. H/V	Reading(RA) (dBuV)	Corr.Factor(CF) (dB)	Measured(FS) (dBuV/m)	Limits(QP) (dBuV/m)	Margin (dB)	Note
49.40	H	34.43	-20.73	13.70	40.00	- 26.30	
156.10	H	32.46	-19.70	12.76	43.50	- 30.74	
251.16	H	34.91	-21.96	12.95	46.00	- 33.05	
363.68	H	36.59	-19.13	17.46	46.00	- 28.54	
404.42	H	34.47	-18.23	16.24	46.00	- 29.76	
468.44	H	34.71	-16.66	18.05	46.00	- 27.95	

Remark :

- (1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120KHz ; SPA setting in RBW=120KHz, VBW=120KHz, Swp. Time = 0.3 sec./MHz ◦
- (2) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform ◦
- (3) Measuring frequency range from 30MHz to 1000MHz ◦
- (4) If the peak scan value is under the limit for more than 20dB, the signal will not show in table ◦





4.1.8 TEST RESULTS-ABOVE 1000MHz

EUT :	Wireless Bike Indicator	Model No. :	WIP-2400
Temperature :	23°C	Relative Humidity :	54%
Test Power :	DC 1.5V		
Test Mode :	CH01		

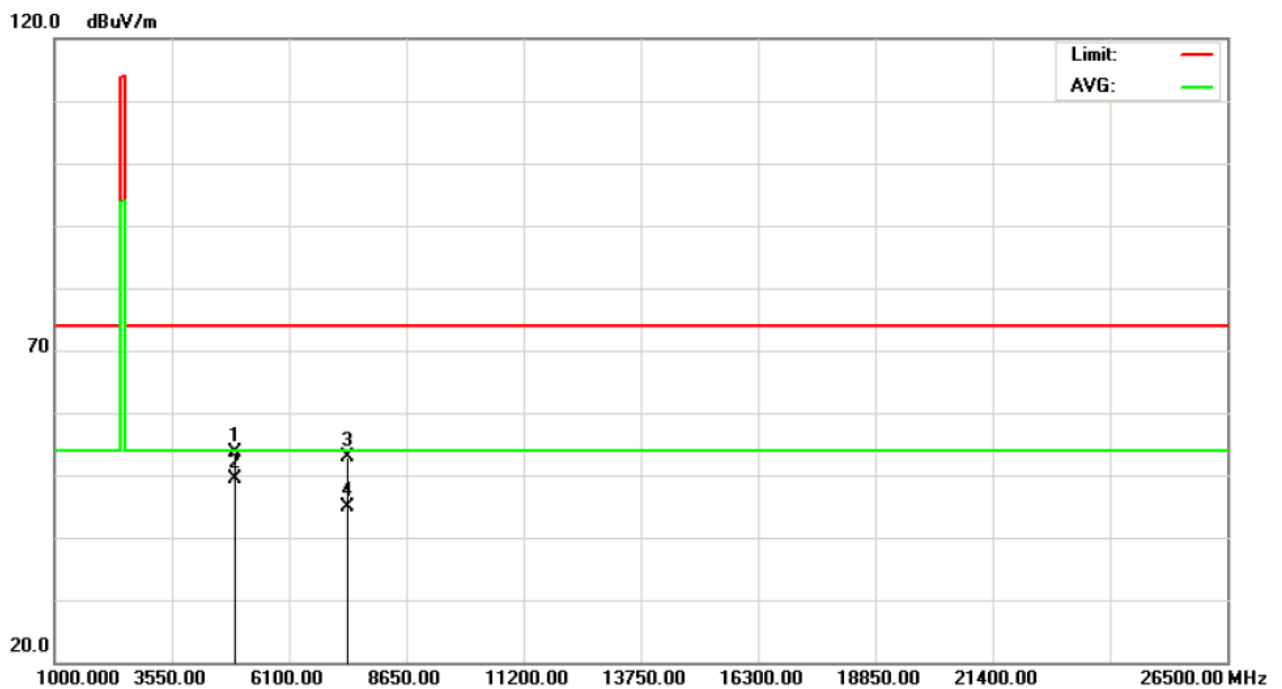
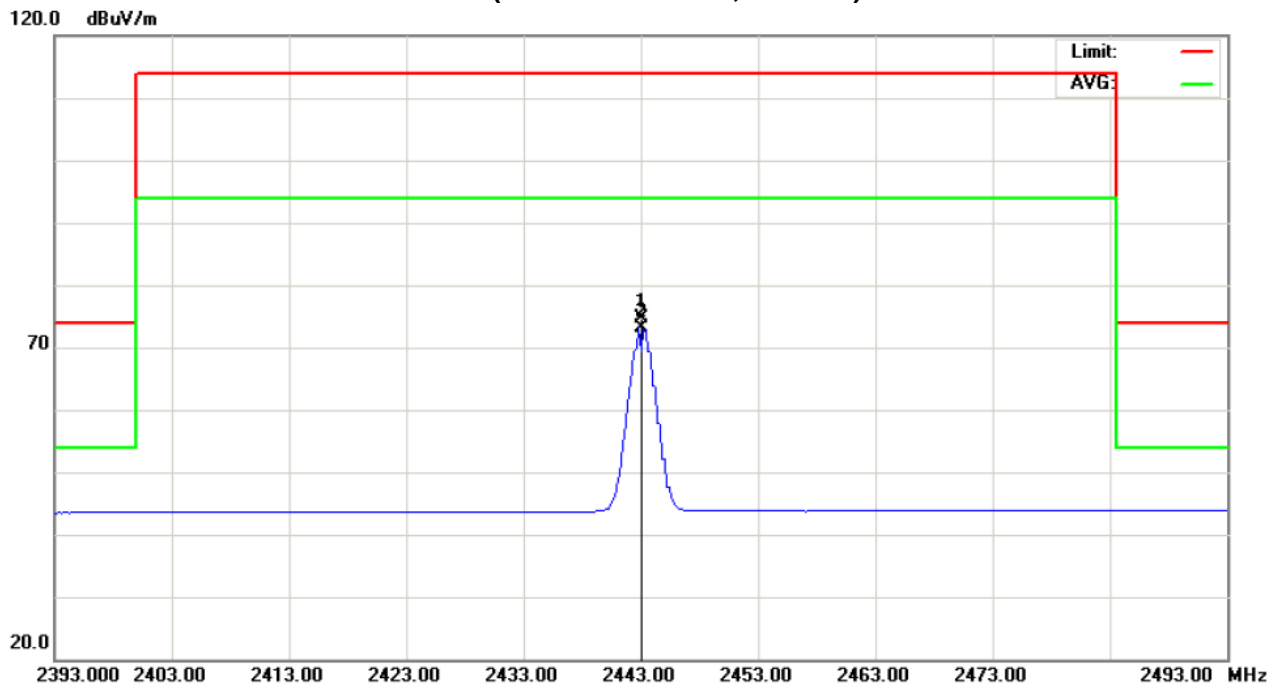
Freq. (MHz)	Ant.Pol. H/V	Reading		Ant./CF CF(dB)	Act.		Limit		Note
		Peak (dBuV)	AV (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Peak (dBuV/m)	AV (dBuV/m)	
2443.00	V								X/F
4886.13	V	49.61	45.44	3.94	53.55	49.38	74.00	54.00	X/H
7329.17	V	43.70	35.70	9.17	52.87	44.87	74.00	54.00	X/H

Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform ◦
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency ◦ "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)
- (3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission ◦
- (4) Data of measurement within this frequency range shown " * " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (6) EUT Orthogonal Axes :
 "X" - denotes Laid on Table ; "Y" - denotes Vertical Stand ; "Z" - denotes Side Stand



Orthogonal Axes : Z
CH01 (Above 1000 MHz, Vertical)





EUT :	Wireless Bike Indicator	Model No. :	WIP-2400
Temperature :	23°C	Relative Humidity :	54%
Test Power :	DC 1.5V		
Test Mode :	CH01		

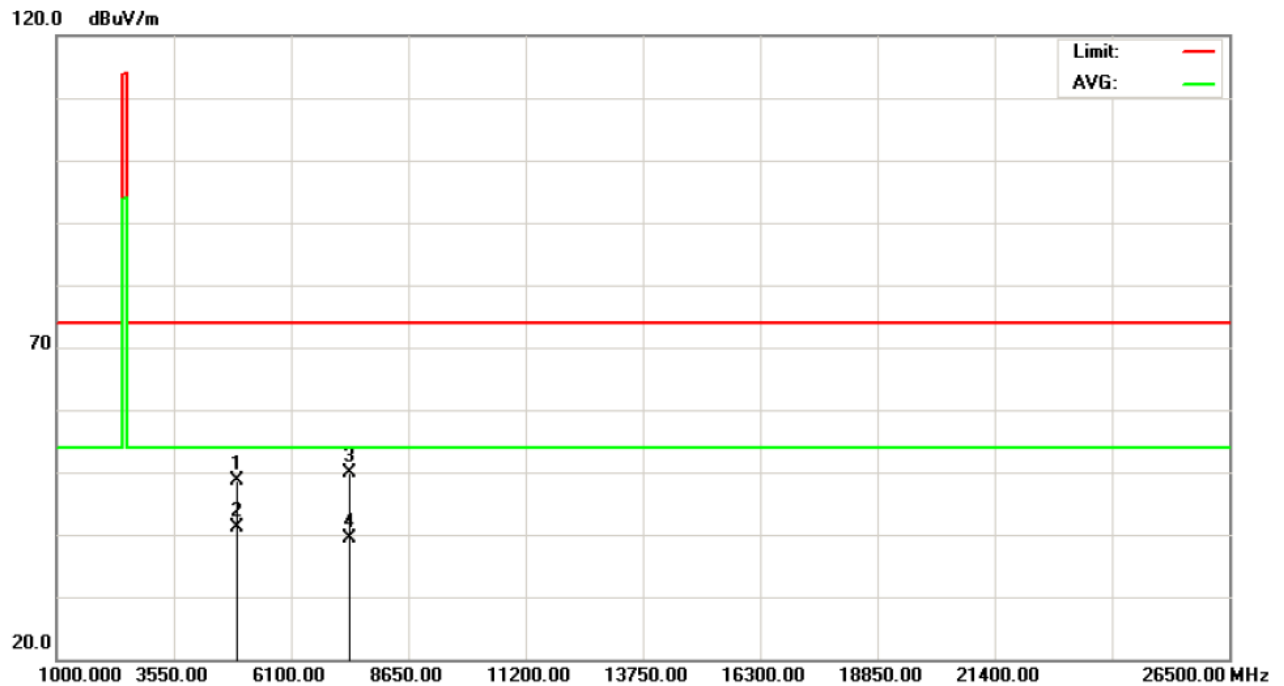
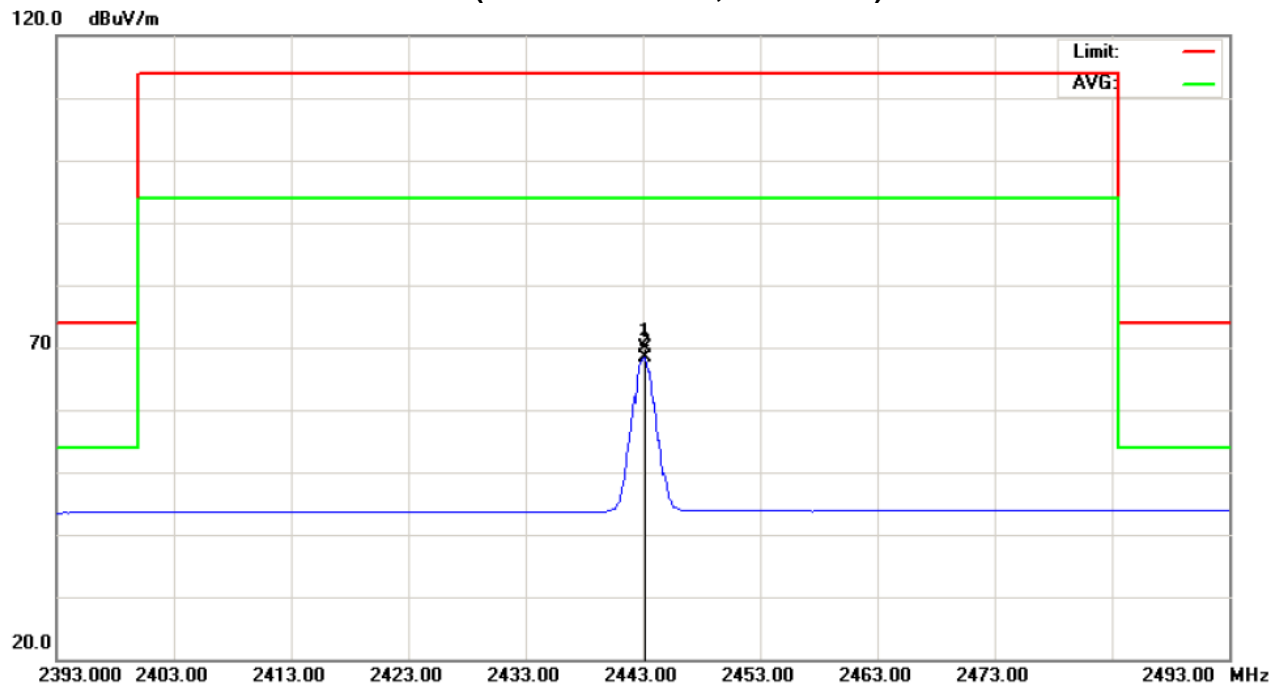
Freq. (MHz)	Ant.Pol. H/V	Reading		Ant./CF CF(dB)	Act.		Limit		Note
		Peak (dBuV)	AV (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Peak (dBuV/m)	AV (dBuV/m)	
2443.00	H								X/F
4886.05	H	44.59	37.11	3.94	48.53	41.05	74.00	54.00	X/H
7329.27	H	40.72	30.30	9.17	49.89	39.47	74.00	54.00	X/H

Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform ◦
- (2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency ◦ "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)
- (3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission ◦
- (4) Data of measurement within this frequency range shown " * " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (6) EUT Orthogonal Axes :
 "X" - denotes Laid on Table ; "Y" - denotes Vertical Stand ; "Z" - denotes Side Stand



Orthogonal Axes : Z
CH01 (Above 1000 MHz, Horizontal)





4.1.9 TEST RESULTS-2402MHz – 2480MHz

EUT :	Wireless Bike Indicator	Model No. :	WIP-2400
Temperature :	23°C	Relative Humidity :	54%
Test Power :	DC 4.2V		
Test Mode :	TX CH 2443MHz		

Freq. (MHz)	Ant.Pol. (H/V)	Reading		Ant./CF CF(dB)	Actual FS		Limit3m		Note
		Peak (dBuV)	AV (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Peak (dBuV/m)	AV (dBuV/m)	
2443.00	V	42.40	41.08	32.13	74.53	73.21	114.00	94.00	CH01
2443.20	H	37.75	36.37	32.13	69.88	68.50	114.00	94.00	CH01

Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform ◦
- (2) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission ◦
- (3) Data of measurement within this frequency range shown “ * ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (4) EUT Orthogonal Axes :
“X” - denotes Laid on Table ; “Y” - denotes Vertical Stand ; “Z” - denotes Side Stand