

Prüfbericht - Nr.: 15054317 001 <i>Test Report No.:</i>			Seite 1 von 23 <i>Page 1 of 23</i>		
Auftraggeber: <i>Client:</i>			Zolar Technology& Mfg. Co. Inc. 6033, #19 shawson Drive. Mississauga, ON L5T 1H8		
Gegenstand der Prüfung: <i>Test item:</i>			Wireless Foot Control		
Bezeichnung: <i>Identification:</i>		Photon	Serien-Nr.: <i>Serial No.:</i>		N/A
Wareneingangs-Nr.: <i>Receipt No.:</i>		153188767	Eingangsdatum: <i>Date of receipt:</i>		28.02.2012
Prüfart: <i>Testing location:</i>		Refer to section 1.1			
Prüfgrundlage: <i>Test specification:</i>		FCC Part 15 RSS-210 (Issue 8):2010 RSS-Gen (Issue 3):2010			
Prüfresultat: <i>Test Result:</i>		Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test item passed the test specification(s).</i>			
Prüflaboratorium: <i>Testing Laboratory:</i>		TÜV Rheinland (Shanghai) Co., Ltd.			
geprüft/ tested by:			kontrolliert/ reviewed by:		
08.08.2012 Shi Li/PE			08.08.2012 Rene Charton/TC		
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>
Sonstiges/ Other Aspects: FCC ID: OY6-FTCON280411 IC: 10545A-ZFC280411 All the test data using original test data in 13.12.2010 to 16.12.2010. The test results were revalidated and the device is still in compliance with current applicable Industry Canada standards.					
Abkürzungen:			Abbreviations:		
P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet			P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested		
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>					

TEST SUMMARY

2.2.1 ANTENNA REQUIREMENTS FCC 15.203, FCC 15.204 AND RSS-GEN 7.1.2

Result:

Passed

4.1.1 CONDUCTED EMISSION

Result:

N/A

4.2.1 RADIATED EMISSION (FUNDAMENTAL)

Result:

Passed

4.2.2 RADIATED EMISSION (HARMONICS & SPURIOUS)

Result:

Passed

4.2.3 RADIATED EMISSION IN RESTRICTED BAND

Result:

Passed

4.3 EMISSION BANDWIDTH

Result:

N/A

4.4 DUTY CYCLE

Result:

N/A

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1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland (Shanghai) Co., Ltd.
Address: 10-15/F, Huatsing Building, No. 88, Lane 777, West Guangzhong Road, Zhabei District, Shanghai 200072, P.R. China
(FCC registration No.: 657274; IC site No.: 2932F-1)

The used test equipments are in accordance with CISPR 16-1 series standards for measurement of radio interference.

1.2 List of Test and Measurement Instruments

Table 1: List of test and measurement equipment

No.	Equipment	Model	Serial no.	Cal. due date
1.	3m modified semi-anechoic chamber	SAC	N/A	22.11.2012
2.	EMI test receiver	ESCI	100280	21.05.2013
3.	Broadband antenna	BTA-H	040005H	28.07.2013
4.	Spectrum analyzer	FSP30	100192	21.05.2013
5.	Double ridged broadband horn antenna	BBHA 9120D	9120D-433	15.05.2013
6.	Broadband coaxial preamplifier	BBV 9718	9718-012	15.05.2013

2 General Product Information

2.1 Product Function and Intended Use

The equipment under test (EUT) is a wireless foot control operating at 2410-2473MHz for medical use. Refer to user manual for details.

2.2 Ratings and System Details

Rated voltage	: DC 1.5V (powered by AA battery 1×1.5V)
Protection class	: III
FCC classification	: DXX
Frequency range	: 2410 - 2473MHz
Number of channel	: 64
Channel spacing	: 1MHz
Type of antenna	: Integral antenna
Antenna info	: Antenna gain: 0dBi Antenna connector: PCB antenna
Modulation type	: GFSK

2.2.1 Antenna Requirements FCC 15.203, FCC 15.204 and RSS-GEN 7.1.2

Result:	Passed
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The EUT use an internal antenna which is not user accessible. Therefore it complies with the requirements specified by FCC 15.203, FCC 15.204 and RSS-GEN 7.1.2.

2.3 Independent Operation Modes

The tests were performed at the lowest operating frequency (2410 MHz), middle operating frequency (2442 MHz) and the highest operating frequency (2473 MHz).

For further information refer to user manual.

2.4 Submitted Documents

The submitted documents are listed as follow:

- Circuit diagram
- Block diagram
- User manual
- Label artwork

2.5 Related Submittal(s) Grants

This is a single application for certification of the transmitter.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible emission level. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

3.2 Test Operation and Test Software

Test operation should refer to test methodology.

- There was no special software to exercise the device.

3.3 Special Accessories and Auxiliary Equipment

None.

3.4 Countermeasures to achieve EMC Compliance

The test sample, which has been tested, contained the noise suppression parts as described in the circuit diagram or the Technical Construction File. No additional measures were employed to achieve compliance.

4 Test Result

4.1 Emission in the Frequency Range up to 30 MHz

4.1.1 Conducted Emission

Result:	N/A
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Test specification : FCC Part 15 Section 15.207;
RSS-GEN 7.2.4

Measuring frequency range : 0.15-30MHz

The sample is powered by built-in battery and cannot be connected to the mains supply.
Therefore, no conducted emission test was performed.

4.2 Emission in the Frequency Range above 30 MHz

4.2.1 Radiated Emission (Fundamental)

Result:	Passed
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Date of testing : 16.12.2010
 Test specification : FCC Part 15 Section 15.209 & 15.249(a);
 RSS-210 A2.9
 Test method : ANSI C63.10-2009
 Measurement location : Semi anechoic chamber
 Measurement distance : 3m
 Detector : Peak & Average
 Measurement BW : 1MHz
 Supply voltage : DC 1.5V
 Ambient condition : Temperature: 23°C; Relative humidity: 43%

Limit Section 15.249(a) & RSS-210 A2.9 (measurement distance: 3m),

Frequency (MHz)	Field strength of Fundamental (millivolt/meter)	Field strength (dBµV/m)
2400-2483.5	50	114 (Peak) 94 (Average)

The radiated emission measurement was made at 3m. The EUT was placed on a nonconductive turntable 0.8m above the ground plane.

The field strength level was established by adding the meter reading of the EMI test receiver or frequency analyzer to the factors associated with antenna correction factor & cable loss. In addition, pulse correction factor (duty cycle) $K_E = -40\text{dB}$ derived from clause 4.4 of this report was used to calculate the average level.

The equation is expressed as follows:

$$FS = R + AF + CF + (K_E)$$

Where FS = Field strength level in dBµV/m;

R = Reading of EMI test receiver in dBµV;

AF = Antenna factor in dB/m;

CF = Cable attenuation factor in dB;

K_E = Pulse correction factor (for calculating average levels only).

In the following table for measurement results, Correction factor (Corr.) = AF + CF.

Table 2: Radiated emission results (Fundamental), Peak, 2410MHz

Frequency (MHz)	Peak level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Antenna height (cm)	Angle (deg)	Polarization
2410.00	88.1	114.0	25.9	155.0	150.0	H
2410.00	88.1	114.0	25.9	110.0	0.0	V

Note: The pulse correction factor (duty cycle) for calculate average level is -40dB, and average limit is 20dB below peak limit. Therefore, the average levels are deemed to comply with average limit.

Table 3: Radiated emission results (Fundamental), Peak, 2442MHz

Frequency (MHz)	Peak level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Antenna height (cm)	Angle (deg)	Polarization
2444.50	83.1	114.0	30.9	110.0	-90.0	H
2443.00	87.8	114.0	26.2	110.0	10.0	V

Note: The pulse correction factor (duty cycle) for calculate average level is -40dB, and average limit is 20dB below peak limit. Therefore, the average levels are deemed to comply with average limit.

Table 4: Radiated emission results (Fundamental), Peak, 2473MHz

Frequency (MHz)	Peak level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Antenna height (cm)	Angle (deg)	Polarization
2473.00	85.9	114.0	28.1	110.0	177.0	H
2473.00	85.7	114.0	28.3	110.0	0.0	V

Note: The pulse correction factor (duty cycle) for calculate average level is -40dB, and average limit is 20dB below peak limit. Therefore, the average levels are deemed to comply with average limit.

4.2.2 Radiated Emission (Harmonics & Spurious)

Result:
Passed

Date of testing : 13.12.2010 - 16.12.2010
 Test specification : FCC Part 15 Section 15.209 & 15.249(a);
 RSS-210 A2.9
 Test method : ANSI C63.10-2009
 Measurement location : Semi anechoic chamber
 Measurement distance : 3m
 Detector : Quasi-peak (30MHz-1GHz)
 Peak & Average (1-25GHz)
 Measurement BW : 120 kHz (30MHz-1GHz)
 1MHz (above 1GHz)
 Supply voltage : DC 1.5V
 Measuring frequency range : 30MHz-25000MHz
 Ambient condition : Temperature: 23°C; Relative humidity: 43%

Limit Section 15.249(a) & RSS-210 A2.9 (measurement distance: 3m),

Frequency (MHz)	Field strength of Harmonics (microvolt/meter)	Field strength (dBμV/m)
2400-2483.5	500	74 (Peak) 54 (Average)

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 to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Limit Section 15.209 & RSS-210 table 2,

The field strength of radiated emissions from intentional radiators:

Frequency (MHz)	Field strength (microvolt/meter)	Field strength (dBμV/m)	Measurement distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3
Above 1000		74.0 (Peak) 54.0 (Average)	3

The radiated emission measurement was made at 3m. The EUT was placed on a nonconductive turntable 0.8m above the ground plane. The spectrum was examined from 30MHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz).

The field strength level was established by adding the meter reading of the EMI test receiver or frequency analyzer to the factors associated with antenna correction factor & cable loss. In addition, pulse correction factor (duty cycle) $K_E = -40\text{dB}$ derived from clause 4.4 of this report was used to calculate the average level.

The equation is expressed as follows:

$$FS = R + AF + CF + (K_E)$$

Where FS = Field strength level in $\text{dB}\mu\text{V/m}$;

R = Reading of EMI test receiver in $\text{dB}\mu\text{V}$;

AF = Antenna factor in dB/m ;

CF = Cable attenuation factor in dB ;

K_E = Pulse correction factor (for calculating average levels only).

In the following table for measurement results, Correction factor (Corr.) = AF + CF.

Table 5: Radiated emission results (Spurious), 30MHz - 1GHz, Quasi-peak

Frequency (MHz)	QP level ($\text{dB}\mu\text{V/m}$)	Limit ($\text{dB}\mu\text{V/m}$)	Margin (dB)	Antenna height (cm)	Angle (deg)	Polarization
31.45	24.3	40.0	15.7	100.0	180.0	H
38.00	22.1	40.0	17.9	100.0	180.0	H
393.81	20.0	46.0	26.0	100.0	180.0	H
30.65	24.9	40.0	15.1	100.0	180.0	V
34.97	23.5	40.0	16.5	100.0	180.0	V
694.88	19.4	46.0	26.6	100.0	180.0	V

Table 6: Radiated emission results (Harmonics & Spurious), 1-25GHz, Peak, 2410MHz

Frequency (MHz)	Peak level ($\text{dB}\mu\text{V/m}$)	Limit ($\text{dB}\mu\text{V/m}$)	Margin (dB)	Antenna height (cm)	Angle (deg)	Polarization
4820.50	62.6	74.0	11.4	150.0	0.0	H
7231.00	64.3	74.0	9.7	155.0	150.0	H
4820.50	57.8	74.0	16.2	110.0	0.0	V
7231.00	53.5	74.0	20.5	110.0	-83.0	V

Note: The pulse correction factor (duty cycle) for calculate average level is -40dB , and average limit is 20dB below peak limit. Therefore, the average levels are deemed to comply with average limit.

Table 7: Radiated emission results (Harmonics & Spurious), 1-25GHz, Peak, 2442MHz

Frequency (MHz)	Peak level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Antenna height (cm)	Angle (deg)	Polarization
4885.00	57.2	74.0	16.8	110.0	180.0	H
7327.00	60.2	74.0	13.8	110.0	180.0	H
4885.00	50.1	74.0	23.9	110.0	15.0	V
7327.00	54.3	74.0	19.7	110.0	50.0	V

Note: The pulse correction factor (duty cycle) for calculate average level is -40dB, and average limit is 20dB below peak limit. Therefore, the average levels are deemed to comply with average limit.

Table 8: Radiated emission results (Harmonics & Spurious), 1-25GHz, Peak, 2473MHz

Frequency (MHz)	Peak level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Antenna height (cm)	Angle (deg)	Polarization
4946.50	55.0	74.0	19.0	110.0	0.0	H
7420.00	53.0	74.0	21.0	110.0	180.0	H
4946.50	58.9	74.0	15.1	110.0	0.0	V
7420.00	52.1	74.0	21.9	110.0	180.0	V

Note: The pulse correction factor (duty cycle) for calculate average level is -40dB, and average limit is 20dB below peak limit. Therefore, the average levels are deemed to comply with average limit.

4.2.3 Radiated Emission in Restricted Band

Result:
Passed

Date of testing : 16.12.2010
 Test specification : FCC Part 15 Section 15.209 & 15.205;
 RSS-210 A2.9
 Test method : ANSI C63.10-2009
 Measurement location : Semi anechoic chamber
 Measurement distance : 3m
 Detector : Peak & Average (1-25GHz)
 Measurement BW : 1MHz
 Supply voltage : DC 1.5V
 Measuring frequency range : 30-25000MHz
 Ambient condition : Temperature: 23°C; Relative humidity: 43%

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 to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

The field strength of emissions appearing within restricted band shall not exceed the limits shown below.

The field strength of radiated emissions from intentional radiators:

Frequency (MHz)	Field strength (microvolt/meter)	Field strength (dBμV/m)	Measurement distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3
Above 1000		74.0 (Peak) 54.0 (Average)	3

The radiated emission measurement was made at 3m. The EUT was placed on a nonconductive turntable 0.8m above the ground plane. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

Emissions are measured using following settings:
 Peak: Peak detector with RBW=1MHz, VBW=1MHz.

Note: The pulse correction factor (duty cycle) for calculate average level is -40dB, and average limit is 20dB below peak limit. Therefore, the average levels are deemed to comply with average limit.

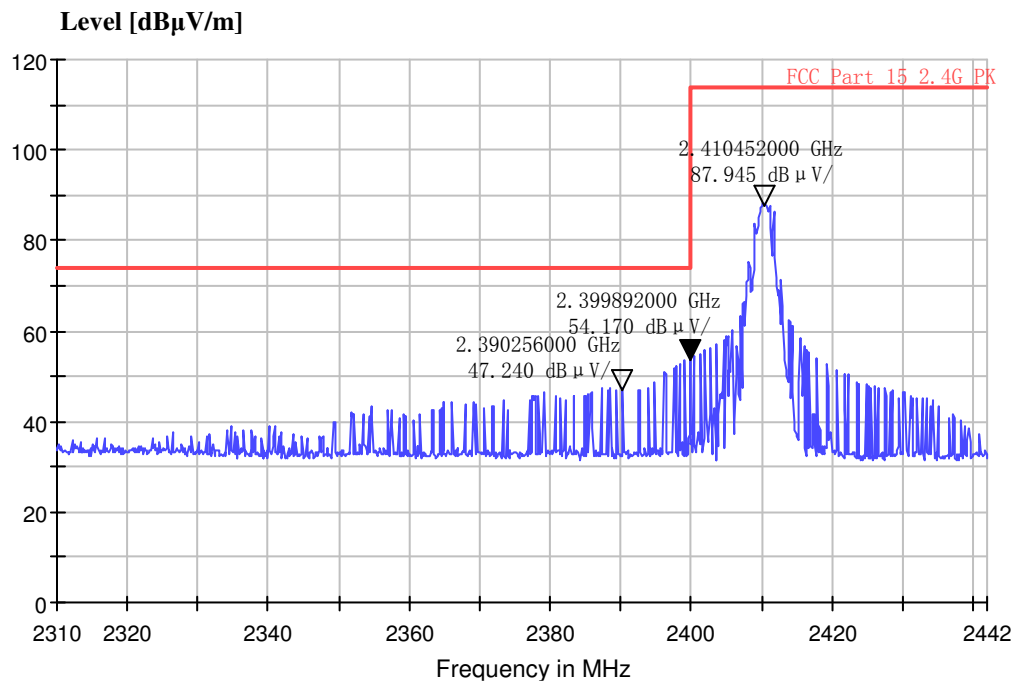
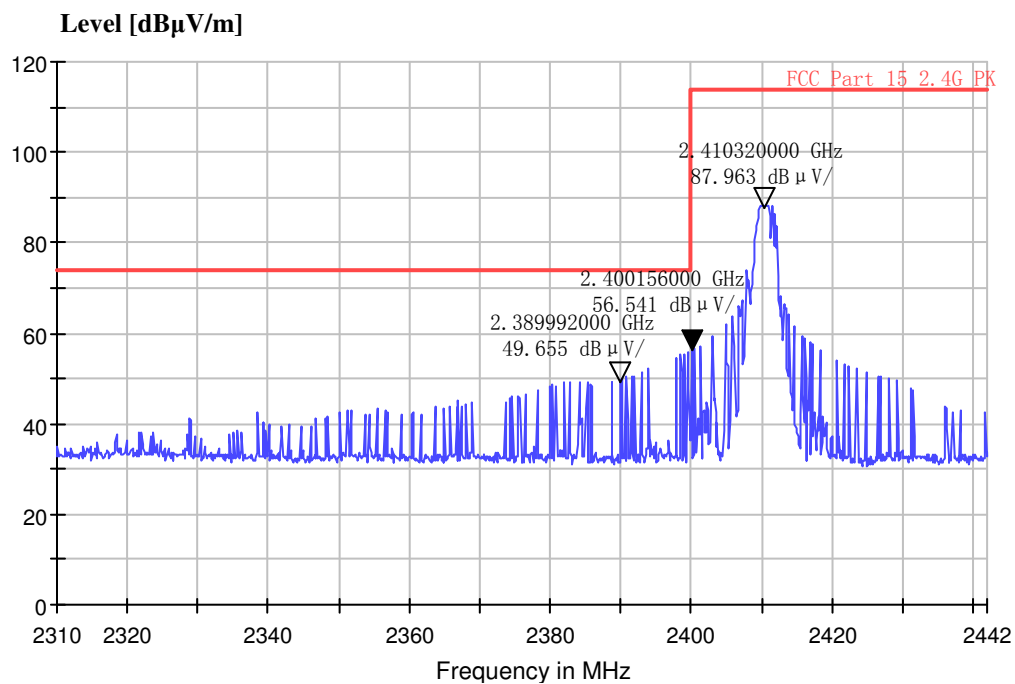
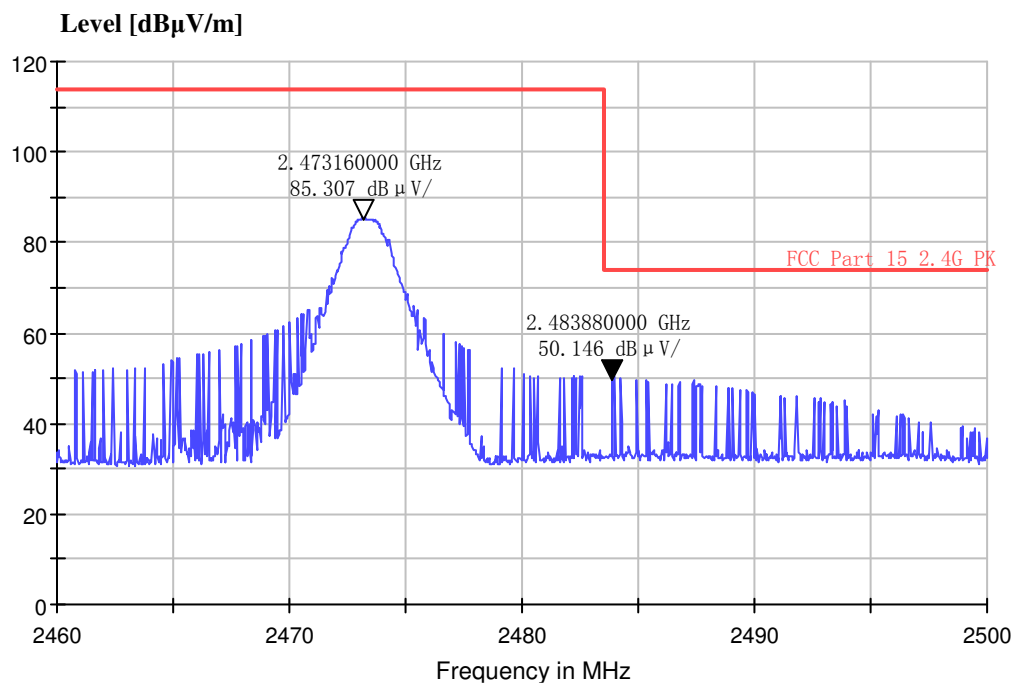
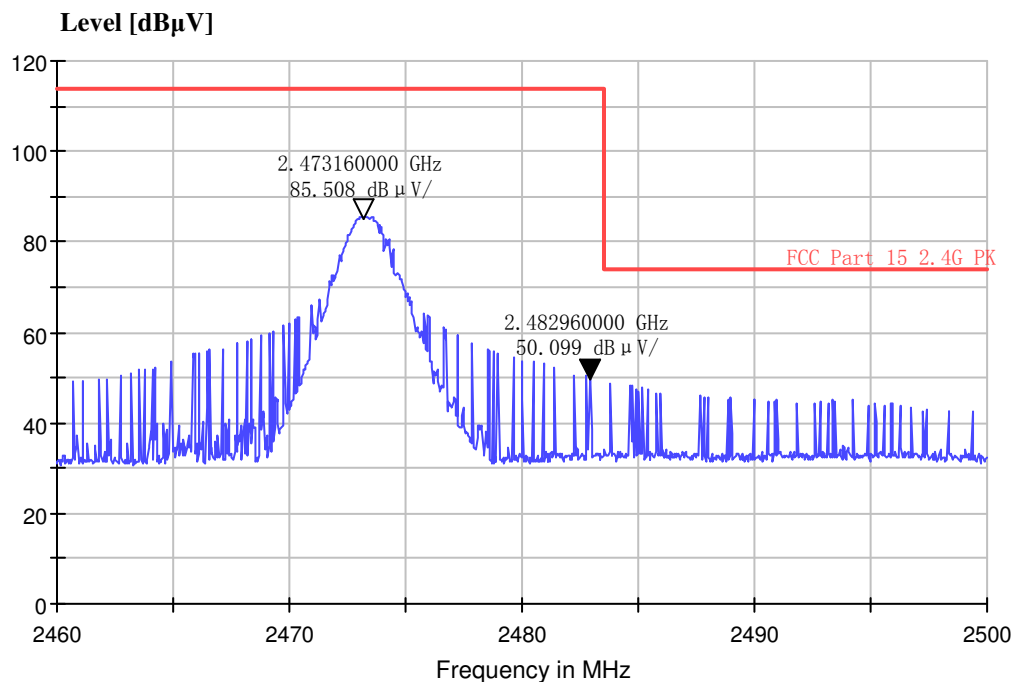
Figure 1: Radiated emission in restricted band, 2410MHz, Horizontal

Figure 2: Radiated emission in restricted band, 2410MHz, Vertical


Figure 3: Radiated emission in restricted band, 2473MHz, Horizontal

Figure 4: Radiated emission in restricted band, 2473MHz, Vertical


4.3 Emission Bandwidth

Result:
Passed

Date of testing : 14.12.2010
 Test specification : FCC Part 15 Section 15.215(c) & RSS-210 A2.9
 Ambient condition : Temperature: 23°C; Relative humidity: 43%

Table 9: Emission bandwidth measurement result

Frequency (MHz)	Max Peak (MHz)	20dB bandwidth F1 (MHz)	20dB bandwidth F2 (MHz)	Measured bandwidth (MHz)
2410	2410.10	2409.28	2411.68	2.40
2442	2442.14	2441.00	2443.58	2.58
2473	2473.14	2472.08	2474.72	2.64

The following figure was that measured by spectrum analyzer.

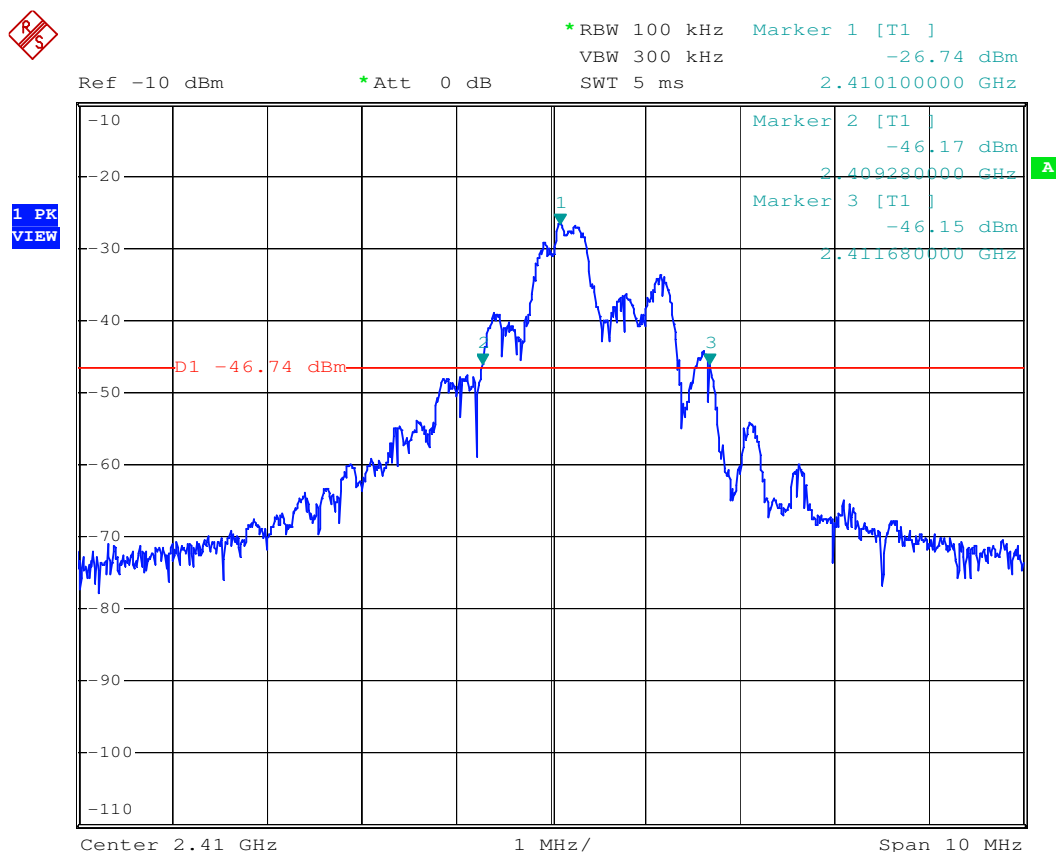
Figure 5: Spectral diagram, emission bandwidth measurement, 2410MHz


Figure 6: Spectral diagram, emission bandwidth measurement, 2442MHz

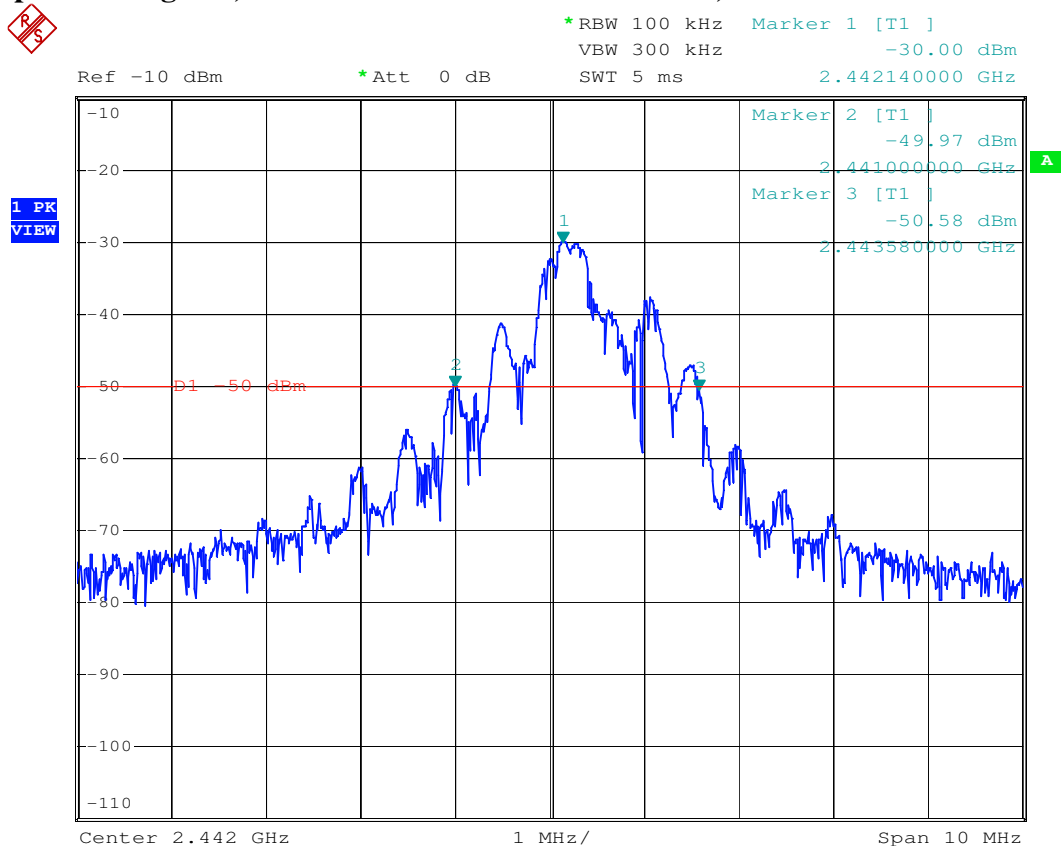
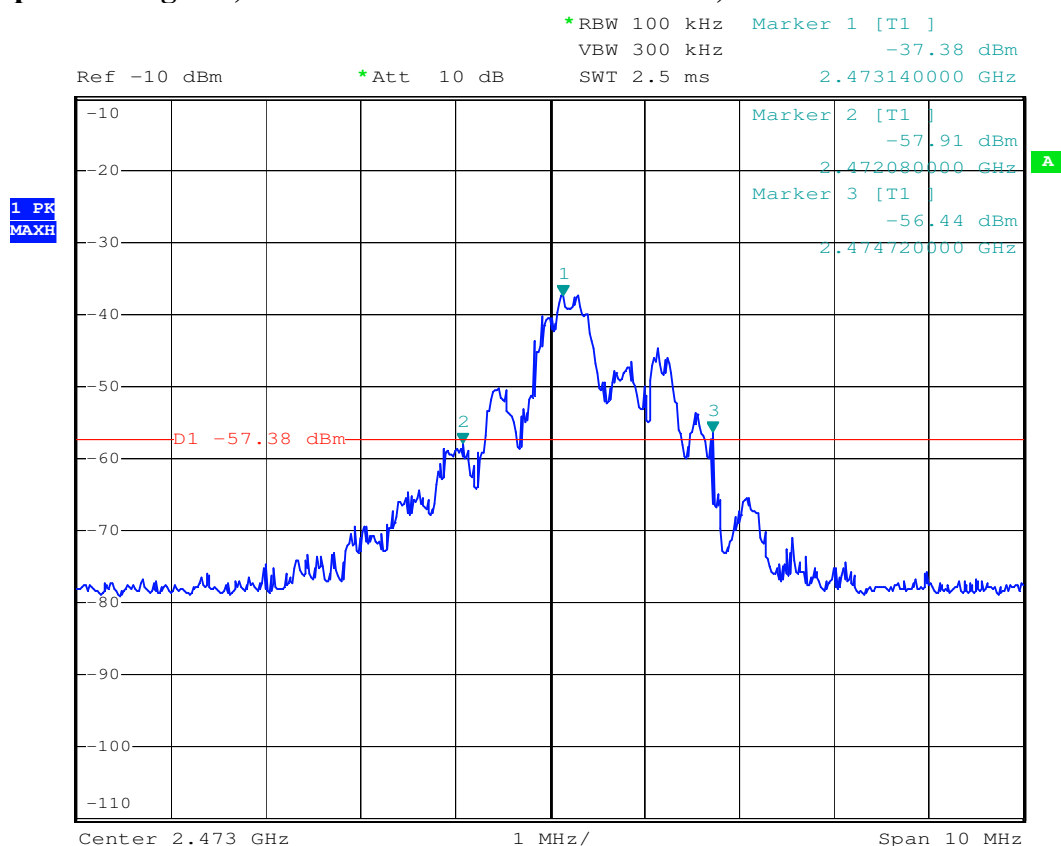


Figure 7: Spectral diagram, emission bandwidth measurement, 2473MHz



4.4 Duty Cycle

Result:**N/A**

Date of testing : 08.12.2010
Ambient condition : Temperature: 24°C; Relative humidity: 42%

The duty cycle factor, expressed in dB, is arrived by taking the following formula:

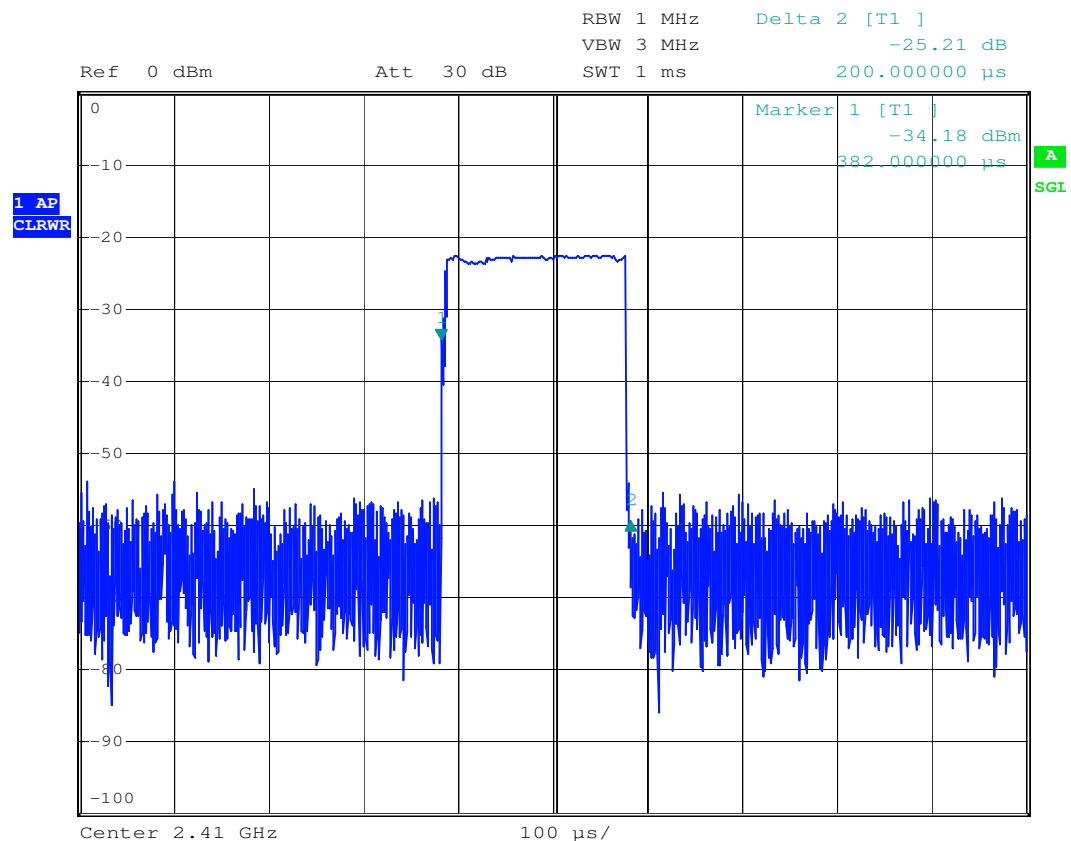
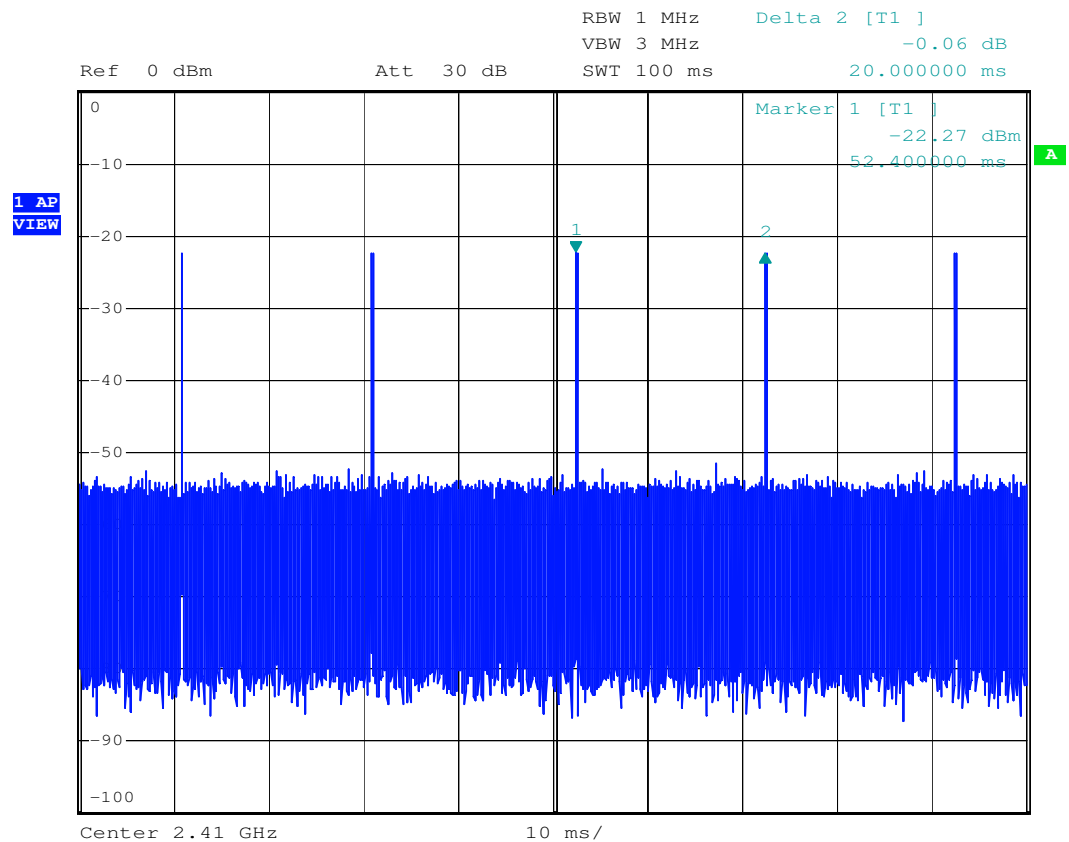
$$K_E = 20 \log [(t_{iB})/T_w]$$

K_E : pulse operation correction factor (dB);
 t_{iB} : pulse duration for one pulse (µsec);
 T_w : a period of the pulse track (msec);

Table 10: Duty cycle measurement result

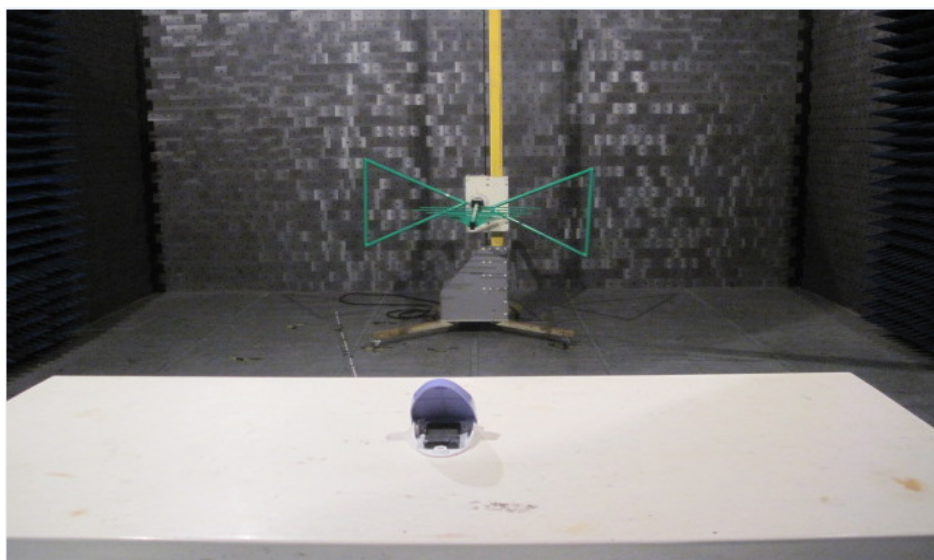
T_w (msec)	t_{iB} (µsec)	K_E (dB / %)
20	200	-40 / 1

The following figures were those measured by spectrum analyzer.

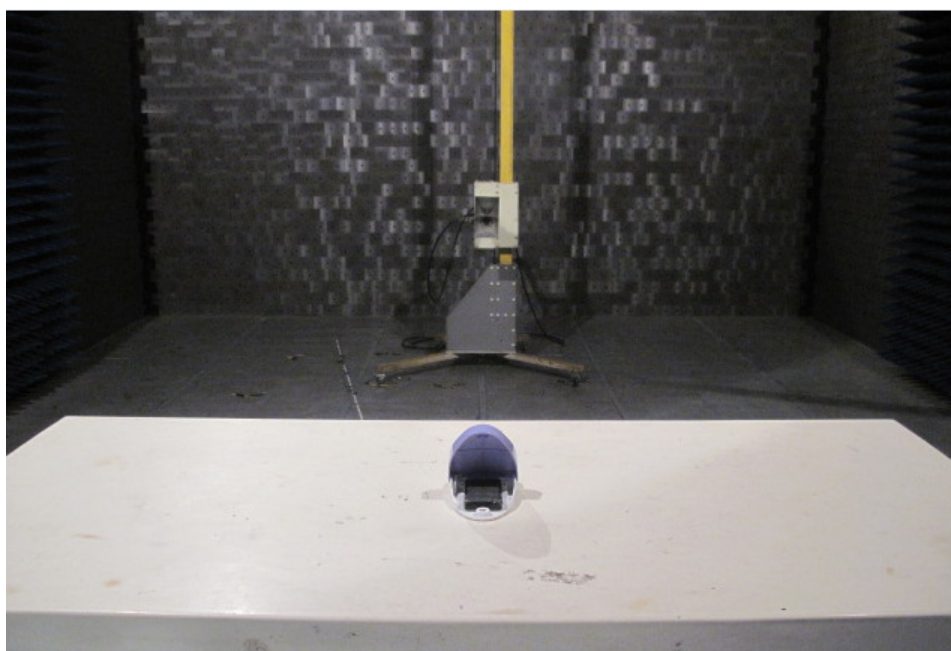
Figure 8: Duty cycle measurement result


5 Photographs of the Test Set-Up

Photograph 1: Set-up for radiated emission

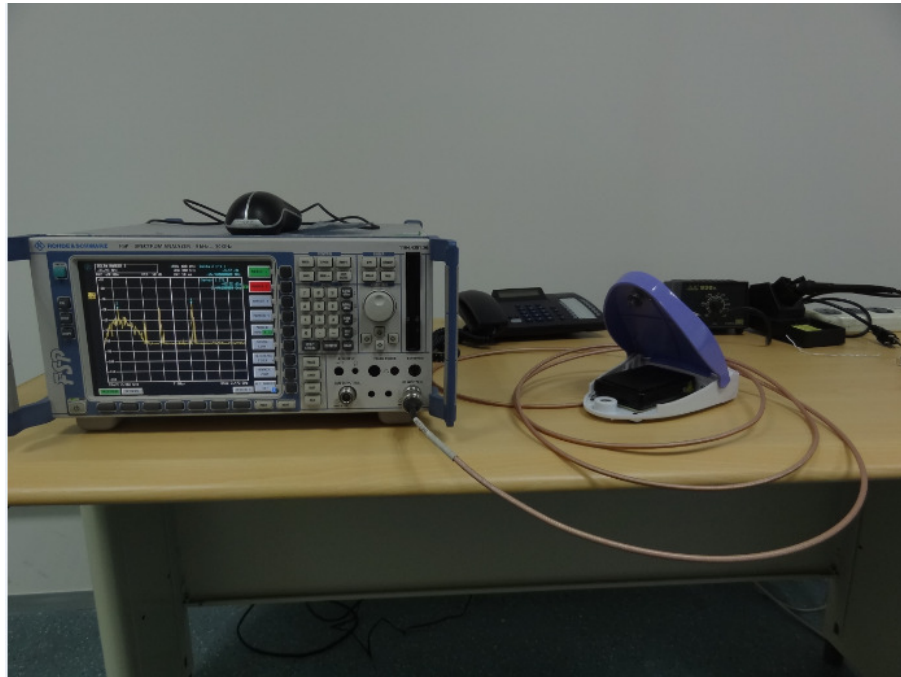


below 1G



above 1G

Photograph 2: Set-up for emission bandwidth & duty cycle



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