

# TEST REPORT

**DT&C Co., Ltd.**

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si,  
Gyeonggi-do, Korea  
Tel : 031-321-2664, Fax : 031-321-1664

Report No : DRTFCC1512-0252  
Pages:(1) / (16) page

**1. Customer**

• Name : BLUEBIRD INC.

• Address : (Dogok-dong, SEI Tower 13,14) 39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea

**2. Use of Report : FCC Original Grant****3. Product Name (FCC ID): Enterprise Handheld Computer (SS4EF400)****4. Date of Test : 2015-11-04 ~ 2015-11-17****5. Test Method Used : FCC Part 15.225****6. Testing Environment : See appended test report****7. Test Result : ☒ Pass ☐ Fail**

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by	Technical Manager
	Name : Hoonpyo Lee (Signature)	Name : WonJung Lee (Signature)

2015 . 12 . 09 .

DT&C Co., Ltd.

## Test Report Version

Test Report No.	Date	Description
DRTFCC1512-0252	Dec, 09. 2015	Initial issue

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## 1. General Information

### 1.1. Testing Laboratory

**DT&C Co., Ltd.**

FCC test site number 165783

42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

[www.dtnc.net](http://www.dtnc.net)

Telephone : + 82-31-321-2664

FAX : + 82-31-321-1664

### 1.2. Details of Applicant

Applicant : BLUEBIRD INC.

Address : (Dogok-dong, SEI Tower 13,14) 39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea

Contact person : Jaeho Lee

### 1.3. Description of EUT

<b>FCC Equipment Class</b>	Low Power Communications Device Transmitter(DXX)
<b>EUT</b>	Enterprise Handheld Computer
<b>Model Name</b>	EF400
<b>Serial Number</b>	Identical prototype
<b>Hardware version</b>	Rev0.2
<b>Software version</b>	R1.03
<b>Power Supply</b>	Li-ion Battery: DC 3.8 V
<b>Frequency Band</b>	13.56 MHz
<b>Modulation Type</b>	ASK
<b>Channel(s)</b>	1
<b>Antenna type</b>	Loop Antenna

## 2. Information about test items

### 2.1 Test mode

Test mode1	Continuous transmitting mode
Test mode2	-

Note: For this test mode, a test program was supported by manufacturer.

### 2.2 Support equipments

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-

### 2.3 Tested frequency

Channel	TX Frequency(MHz)	RX Frequency(MHz)
Lowest	13.56	13.56
Middle	-	-
Highest	-	-

### 2.4 Tested environment

Temperature	: 23 ~ 25 °C
Relative humidity content	: 41 ~ 45 % R.H.
Details of power supply	: DC 3.8 V

### 2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing  
→ None

## 3. Antenna requirements

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.”

The antenna is attached to the battery cover, and antenna is coupled use the special tension. Therefore this E.U.T Complies with the requirement of §15.203

## 4. Test report

### 4.1 Summary of tests

FCC part section(s)	RSS section(s)	Parameter	Limit	Test condition	Status Note 1
2.1049	-	20 dB Bandwidth	-	Radiated	C
-	RSS-Gen [ 6.6 ]	Occupied Bandwidth	-		NA
15.225 (a)	RSS-210 [ A2.6 (a) ]	In-Band Emissions	15,848 $\mu\text{V/m}$ @ 30 m 13.553 – 13.567 MHz		C
15.225 (b)	RSS-210 [ A2.6 (b) ]	In-Band Emissions	334 $\mu\text{V/m}$ @ 30 m 13.410 – 13.553 MHz 13.567 – 13.710 MHz		C
15.225 (c)	RSS-210 [ A2.6 (c) ]	In-Band Emissions	106 $\mu\text{V/m}$ @ 30 m 13.110 – 13.410 MHz 13.710 – 14.010 MHz		C
15.225 (d) 15.209	RSS-210 [ A2.6 (d) ]	Out-of Band Emissions	Emissions outside of the specified band (13.110-14.010 MHz) must meet the radiated limits detailed in 15.209		C
15.225 (e)	RSS-210 [ A2.6 ]	Frequency Stability	$\pm 0.01$ % of operating frequency	Temp & Humid Test Chamber	C
15.207	RSS-Gen [ 8.8 ]	AC Conducted Emissions	FCC Part 15.207	AC Line Conducted	C
15.203	RSS-Gen [ 6.7 ]	Antenna Requirements	FCC Part 15.203	-	C

Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable

Note 2: Semi anechoic chamber registration number is 678747

The sample was tested according to the following specification:  
ANSI C-63.10-2013

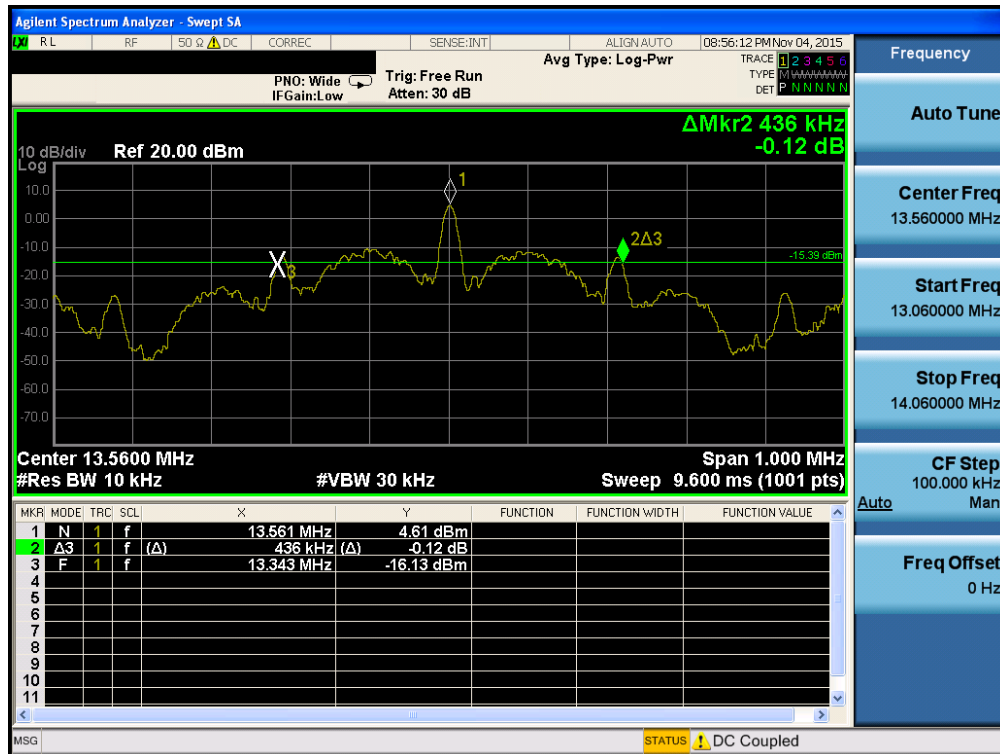
## 4.2 Transmitter requirements

### 4.2.1 20dB bandwidth

#### - Procedure:

The 20 dB Bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

#### - Measurement Data: **Comply**



#### - Minimum Standard: NA

#### **4.2.2 Occupied bandwidth**

**- Procedure:**

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3 x RBW.

**- Measurement Data:** **NA**

**- Minimum Standard:** **NA**



### 4.2.3 In-band emissions

#### - Procedure:

The EUT was placed on a 0.8 m high non-conductive table inside a 10 m semi anechoic chamber. An antenna was placed at 3 m distance from the EUT. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions. A loop antenna was used for this test item.

And the loop antenna was rotated about vertical axis.

#### - Measurement Data: **Comply**

Tested Frequency : 13.56 MHz  
Measurement Distance : 3 Meters

Test Frequency Band [MHz]	Freq. [MHz]	EUT Posi.	Reading Level [dBuV]	T.F	Field Strength @3 m [dBuV/m]	Field Strength @30 m [dBuV/m]	Limit [dBuV/m]	Margin [dB]
13.110 ~ 13.410	13.346	Y	10.60	19.95	30.55	-9.45	40.51	49.96
13.410 ~ 13.553	13.481	Y	12.00	19.95	31.95	-8.05	50.47	58.52
13.553 ~ 13.567	13.561	Y	29.60	19.95	49.55	9.55	84.00	74.45
13.567 ~ 13.710	13.640	Y	14.10	19.96	34.06	-5.94	50.47	56.41
13.710 ~ 14.010	13.771	Y	13.10	19.97	33.07	-6.93	40.51	47.44

**Note 1.** This test item was performed using a loop antenna.

**Note 2.** This test item was performed at 3 m and the data were extrapolated to the specified measurement distance of 30 m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in §15.31(f)2.

▪ Extrapolation Factor =  $20 \log_{10}(30/3)^2 = 40 \text{ dB}$

**Note 3.** All data were recorded using a spectrum analyzer employing a peak detector.

If PK results were meet Quasi-peak limit, Quasi-peak measurements were omitted.

**Note 4.** Sample Calculation.

Margin = Limit – Field Strength @ 30 m / Field Strength @ 30 m = Field Strength @ 3 m – 40 dB

Field Strength @ 3 m = Reading + T.F / T.F = AF + CL – AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

#### - Minimum Standard: Part 15.225(a), (b), (c)& RSS-210 [ A2.6(a), (b), (c) ]

Frequency Band [MHz]	Limit	
	[uV/m]	[dBuV/m]
13.553-13.567	15,848	84.00
13.410-13.553 13.567-13.710	334	50.47
13.110-13.410 13.710-14.010	106	40.51

#### 4.2.4 Out-of-band emissions

##### - Procedure:

The EUT was tested from 9 kHz up to the 1 GHz excluding the band 13.110-14.010 MHz. All measurements were recorded with spectrum analyzer employing a peak detector for emissions below 30 MHz. Above 30 MHz a Quasi-peak detector was used. All out-of-band emissions must not exceed the limits §15.209. A loop antenna was used for searching for emissions below 30 MHz.

##### - Measurement Data: **Comply**

Tested Frequency : 13.56 MHz  
Measurement Distance : 3 Meters

Frequency [MHz]	EUT Posi.	ANT Pol	Reading [dBuV]	T.F [dB/m]	Distance factor	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
0.519	Y	N/A	27.9	19.01	40	6.91	33.3	26.39
0.630	X	N/A	26.7	19.05	40	5.75	31.6	25.85
2.008	Z	N/A	14.8	19.21	40	-5.99	29.5	35.49
3.647	Y	N/A	11.2	19.33	40	-9.47	29.5	38.97
32.061	Y	H	25.5	-4.52	0	20.98	40	19.02
955.829	Y	H	24.8	4.08	0	28.88	46	17.12

**Note 1.** All measurements were recorded using a spectrum analyzer employing a peak detector for below 30 MHz and a Quasi-peak detector for above 30 MHz.

**Note 2.** Both Vertical and Horizontal polarities of the receiver antenna were evaluated with the worst case emissions being reported. For 30 MHz below the loop antenna was rotated about vertical axis.

**Note 3.** No other spurious and harmonic emissions were reported greater than listed emissions above table.

##### **Note 4.** Sample calculation

Margin = Limit – Field Strength

Field Strength = Reading + T.F – Distance factor

T.F = AF + CL – AG

Distance factor =  $20\log(\text{Measurement distance} / \text{The measured distance})^2$

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

##### - Minimum Standard: Part 15.209, 225(d) & RSS-210[ A2.6 (d) ]

##### • FCC Part 15.209(a):

Frequency [MHz]	Field Strength [uV/m]	Measurement Distance [Meters]
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	200	3

\*\* Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

##### • FCC Part 15.209(b):

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

#### 4.2.5 Frequency Stability

**- Procedure:**

Part 15.225 requires that devices operating in the 13.553 – 13.567 MHz shall maintain the carrier frequency within 0.01 % of the operating frequency over the temperature variation of -20 degrees to + 50 degrees C at normal supply voltage.

**- Measurement Data: Comply**

Operating Frequency : 13,560,000 Hz

VOLTAGE (%)	POWER (V <sub>DC</sub> )	TEMP (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	3.80	+20(ref)	13,560,936	936	0.006902
100%		-20	13,560,988	988	0.007286
100%		-10	13,560,971	971	0.007160
100%		0	13,560,957	957	0.007057
100%		+10	13,560,948	948	0.006991
100%		+20	13,560,936	936	0.006902
100%		+30	13,560,935	935	0.006895
100%		+40	13,560,936	936	0.006902
100%		+50	13,560,940	940	0.006932
115%	4.37	+20	13,560,935	935	0.006895
85%	3.23	+20	13,560,936	936	0.006902

**- Minimum Standard: Part 15. 225(e) & RSS-210 [ A2.6 ]**

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01$ % of the operating frequency.
---

#### 4.2.6 AC Line Conducted Emissions

##### - Test Requirements and limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

\* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

##### Test Configuration

See test photographs for the actual connections between EUT and support equipment.

##### TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

- **Measurement Data: Comply** (refer to the next page)

## Measurement Data

### Results of Conducted Emission

DTNC

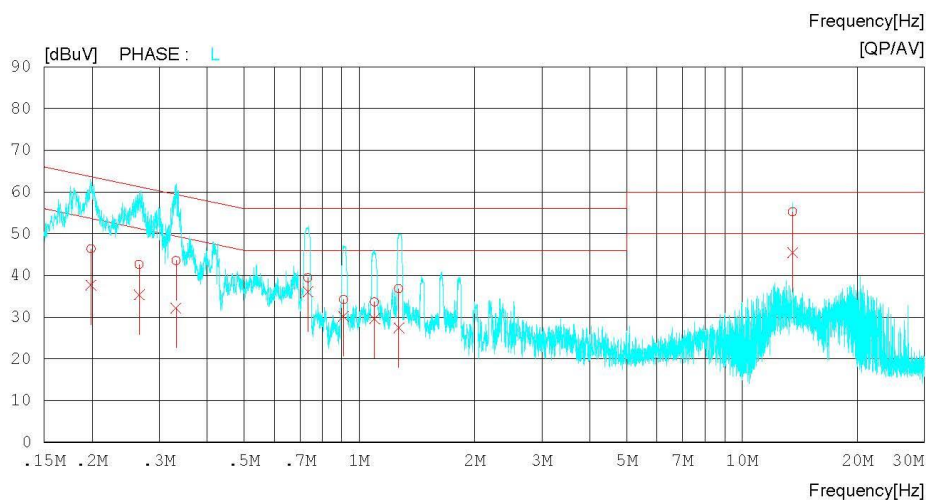
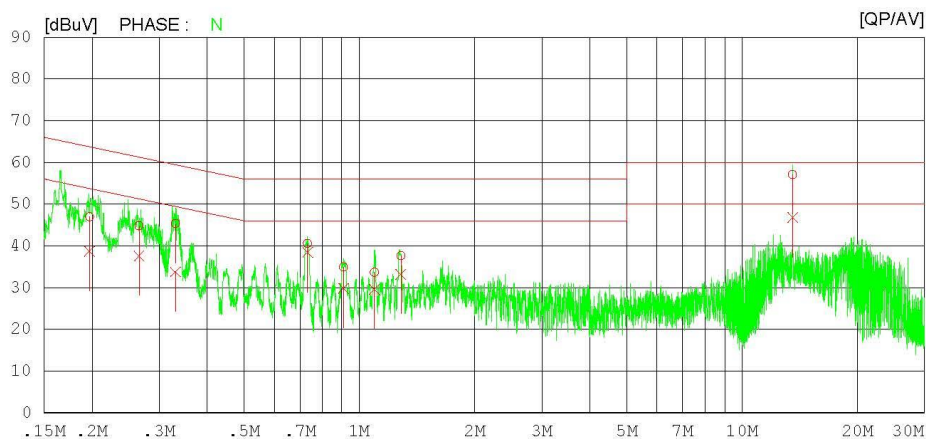
Date : 2015-11-17

Order No. :  
Model No. : EF400  
Serial No. :  
Test Condition : NFC

Reference No. :  
Power Supply : 120 V 60 Hz  
Temp/Humi. : 23 'C 41 % R.H.  
Operator : H. P. Lee

Memo :

LIMIT : FCC P15.207 QP  
FCC P15.207 AV



## Measurement Data

### Results of Conducted Emission

DTNC

Date : 2015-11-17

Order No. :  
 Model No. : EF400  
 Serial No. :  
 Test Condition : NFC

Reference No. :  
 Power Supply : 120 V 60 Hz  
 Temp/Humi. : 23 'C 41 % R.H.  
 Operator : H. P. Lee

Memo :

LIMIT : FCC P15.207 QP  
 FCC P15.207 AV

NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19728	36.8	28.6	10.1	46.9	38.7	63.7	53.7	16.8	15.0	N
2	0.26550	34.7	27.5	10.1	44.8	37.6	61.3	51.3	16.5	13.7	N
3	0.33085	35.3	23.7	10.1	45.4	33.8	59.4	49.4	14.0	15.6	N
4	0.73287	30.4	28.3	10.1	40.5	38.4	56.0	46.0	15.5	7.6	N
5	0.90848	24.8	19.7	10.1	34.9	29.8	56.0	46.0	21.1	16.2	N
6	1.09380	23.4	19.5	10.2	33.6	29.7	56.0	46.0	22.4	16.3	N
7	1.28360	27.5	23.0	10.2	37.7	33.2	56.0	46.0	18.3	12.8	N
8	13.56280	46.5	36.2	10.6	57.1	46.8	60.0	50.0	2.9	3.2	N
9	0.19870	36.2	27.6	10.1	46.3	37.7	63.7	53.7	17.4	16.0	L
10	0.26596	32.5	25.2	10.1	42.6	35.3	61.2	51.2	18.6	15.9	L
11	0.33149	33.4	22.1	10.1	43.5	32.2	59.4	49.4	15.9	17.2	L
12	0.73437	29.2	25.9	10.1	39.3	36.0	56.0	46.0	16.7	10.0	L
13	0.90860	24.0	20.1	10.1	34.1	30.2	56.0	46.0	21.9	15.8	L
14	1.09640	23.4	19.4	10.2	33.6	29.6	56.0	46.0	22.4	16.4	L
15	1.26720	26.5	17.2	10.2	36.7	27.4	56.0	46.0	19.3	18.6	L
16	13.56220	44.4	34.7	10.8	55.2	45.5	60.0	50.0	4.8	4.5	L

# **APPENDIX**

## **TEST EQUIPMENT FOR TESTS**

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent	N9020A	15/01/19	16/01/19	MY48011146
DC Power Supply	SM techno	SDP30-5D	15/01/06	16/01/06	305DLJ204
Vector Signal Generator	Rohde Schwarz	SMBV100A	15/01/06	16/01/06	255571
Multimeter	Rohde Schwarz	34401A	15/06/25	16/06/25	3146A13475
Temp & Humi Test Chamber	JISICO	KR-100/J-RHC2	15/09/10	16/09/10	30604493/021031
Amplifier	HP	8447E	15/01/06	16/01/06	2945A02865
Loop Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
BILOG Antenna	Schwarzbeck	CBL6112B	14/04/10	16/04/10	2737
EMI TEST RECEIVER	Rohde Schwarz	ESU	15/01/06	16/01/06	100014
Thermohygrometer	BODYCOM	BJ5478	15/05/08	16/05/08	120612-1
EMI TEST RECEIVER	Rohde Schwarz	ESCI	15/02/25	16/02/25	100364
SINGLE-PHASE MASTER	NF	4420	15/09/09	16/09/09	3049354420023
ARTIFICIAL MAINS NETWORK	Narda S.T.S. / PMM	PMM L2-16B	15/06/26	16/06/26	000WX20305