

TEST REPORT



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9871
Fax: +82-31-624-9501

Report No. :
CTK-2017-01506
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1. Client

- Name : Suntech International Ltd.
- Address : B-1506, Great Valley, 32, 9-Gil, Digital-Ro, Geumcheon-Gu, Seoul, KOREA
- Date of Receipt : 2017-07-21

2. Manufacturer

- Name : Suntech International Ltd.
- Address : B-1506, Great Valley, 32, 9-Gil, Digital-Ro, Geumcheon-Gu, Seoul, KOREA

3. Use of Report : For FCC Verification Report and IC Report

4. Test Sample / Model: SigFox IOT Device / ST730

5. Date of Test : 2017-07-26 to 2017-07-28

6. FCC ID : WA2-ST730

7. Certification Number IC : 21484-ST730

8. Test Standard(method) used : FCC Part 15 Subpart B / ICES-003 Issue 6

9. Testing Environment: refer to 10 pages to 18 pages

10. Test Results : refer to 11 pages to 18 pages

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	Approved by
	Yoon Yeong Deuck: (Signature) EMC Test Engineer	Lee Eunwon: (Signature) Technical Manager

2017-08-10

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REPORT REVISION HISTORY

Date	Revision	Page No
2017-08-10	Issued (CTK-2017-01506)	All

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1.0 General Product Description

No.	ITEM		APPLICATION	
1	Test Sample		SigFox IOT Device	
2	Model		ST730	
3	Variant Model		-	
4	Dimensions (W x L x H)		50 mm x 75 mm x 24 mm	
5	Mobility		<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor-standing <input type="checkbox"/> Built-in <input checked="" type="checkbox"/> Portable	
6	Maximum Clock Frequency		8 MHz	
7	Electrical Ratings	AC/DC ADAPTER	Input:	AC 100 V – AC 240 V, 50 Hz / 60 Hz
			Output:	DC 3.7 V, 1.5 A
		EUT	Input:	DC 3.7 V, 1.5 A
			Output:	-
8	Test Voltage / Frequency		Voltage:	AC 120 V
			Frequency:	60 Hz

1.1 Model Differences

Not applicable

1.2 Device Modifications

The following modifications were necessary for compliance:

Not applicable

1.3 EUT Configuration(s)

See Appendix A for individual test set-up configuration(s). The following peripheral devices and/or interface cables were connected during the measurement:

Peripheral Devices

Device	Model No.	Serial No.	Manufacturer
AC/DC ADAPTER	-	-	-
Gigabit Router	DIR-825	F3WR1A3002631	D-LINK CORPORATION
EMI Test Receiver	ESCI7	100816	Rohde & Schwarz

Cable Description

No.	From		To		Type of Cable		
	Device	I/O Port	Device	I/O Port	Length (m)	Shielded or Unshielded	Ferrite Core [Y/N]
1	EUT	2.4 GHz Wifi Communication	Gigabit Router	2.4 GHz Wifi Communication	-	-	-
2		G-Wave 900 MHz Communication	EMI Test Receiver	G-Wave 900 MHz Communication	-	-	-
3		DC IN	AC/DC ADAPTER	DC OUT	1.2	U	N
4	AC/DC ADAPTER	AC POWER	AC Mains	-	-	-	-

* Shielded or Unshielded : Unshielded=U, Shielded=S

1.4 Test Software

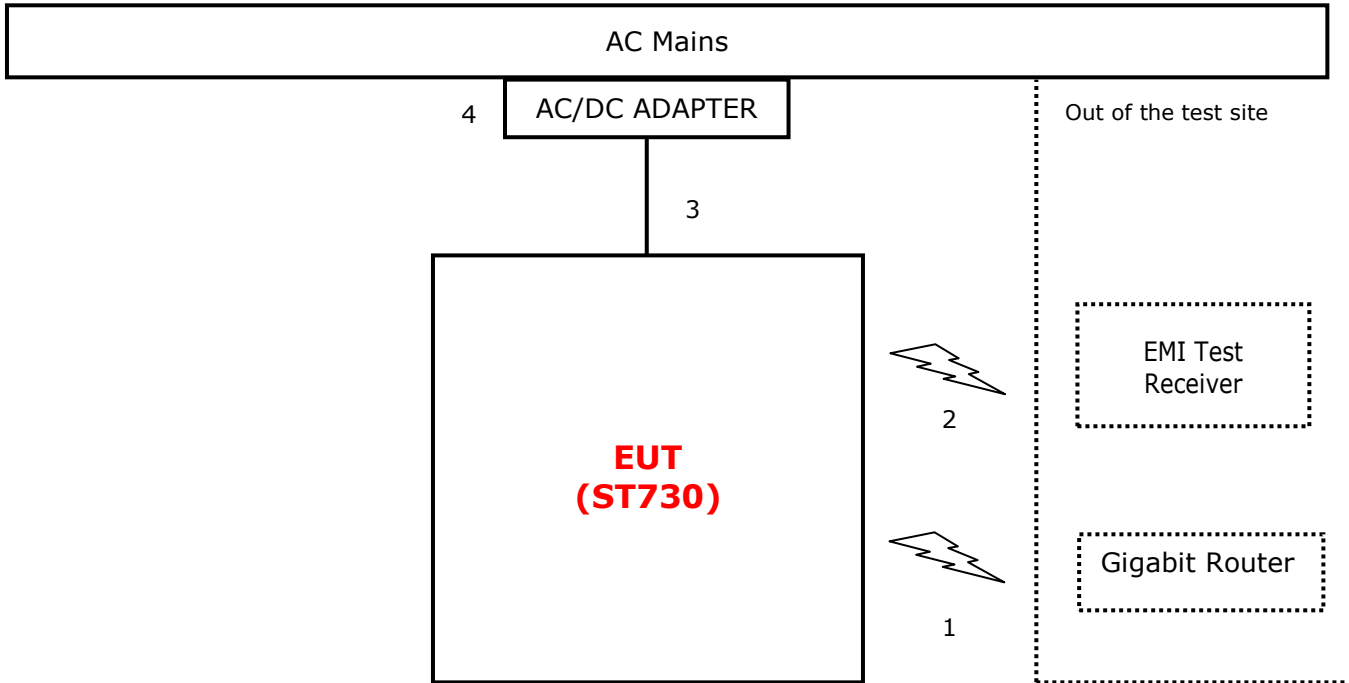
- EMC Test V 1.0
- Display Test Patterns – V1.5
- Ping.exe
- Not applicable

1.5 EUT Operating Mode(s)

Equipment under test was operated during the measurement under the following condition s:

- Charging + G-wave 900 MHz + Wifi 2.4 GHz mode

1.6 Configuration





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1.7 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.8 Test Facility

The measurement facility is located at (Ho-dong) 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.9 Measurement Procedure

Preliminary AC power line conducted emissions tests were performed shielded room. To find worst mode, several typical mode and typical cable position were tested.

Final AC power line conducted emissions test was performed shielded room. (location is same as Preliminary test)

Based on the preliminary tests of the EUT, final test was proceeded worst case test mode and cable configuration.

Preliminary radiated emissions test were performed Semi-Anechoic Chamber or anechoic chamber (Distance of antenna and EUT was 3 m). To find worst mode, several typical mode and typical cable position were tested and peak level and frequency were recorded.

Final radiated emissions test was performed Semi-Anechoic Chamber.





Based on the preliminary tests of the EUT, final test was proceeded worst case test mode and cable configuration.

* Measurement procedures was In accordance with ANSI C63.4-2014 7.3.3, 7.3.4, 8.3.1.1, 8.3.1.2, 8.3.2.1, 8.3.2.2

Note #1: These results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations.

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1.10 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	KR0025 (805871)	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	MSIP	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	KR0025	
CANADA	IC	ICES-003, Issue 6 EMI (Electromagnetic Interference / Emission)	8737A-2	

1.11 Measurement Uncertainty

Compliance of the product is based on the measured value.

However, the measurement uncertainty is included for information purposes.

The measurement uncertainties given below are based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

Measurement Type	Frequency Range	Expanded Uncertainty
Conducted Emission of Mains Ports	150 kHz to 30 MHz	2.62 dB (C.L.: Approx. 95 %, $k=2$)
Radiated Emission	30 MHz to 1 000 MHz	4.54 dB (C.L.: Approx. 95 %, $k=2$)
Radiated Emission	1 GHz Above	4.98 dB (C.L.: Approx. 95 %, $k=2$)

2.0 EMC Test Regulations/Standards

The tests were performed according to following regulations:

Applied standard	Title	Applied	Test Result
FCC Part 15 Subpart B ICES-003 Issue 6 <input checked="" type="checkbox"/> Class A <input type="checkbox"/> Class B	Conducted Voltage Emissions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> MET <input type="checkbox"/> NOT MET
	Radiated Electric Field Emissions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> MET <input type="checkbox"/> NOT MET



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3.0 Results of Individual Test

3.1 Conducted Voltage Emissions of Mains ports

Test Date

2017-07-28

Test Location

Shielded Room

Test Equipment

Name of Equipment	Model No.	Manufacturer	Serial No.	Due Date	Applied
EMI Test Receiver	ESCI3	Rohde & Schwarz	100032	2018-02-02	<input checked="" type="checkbox"/>
LISN	ENV216	Rohde & Schwarz	101235	2018-05-09	<input type="checkbox"/>
LISN	ENV216	Rohde & Schwarz	101236	2017-08-02	<input checked="" type="checkbox"/>
EMI Test Receiver	ESR7	Rohde & Schwarz	101088	2018-05-10	<input type="checkbox"/>
LISN	ENV216	Rohde & Schwarz	101151	2017-11-01	<input type="checkbox"/>
LISN	ESH3-Z5	Rohde & Schwarz	100207	2017-11-01	<input type="checkbox"/>
EMI Test Receiver	ESU40	Rohde & Schwarz	100336	2018-05-12	<input type="checkbox"/>
LISN	ENV216	Rohde & Schwarz	101760	2018-02-03	<input type="checkbox"/>
LISN	NNLK 8121	SCHWARZBECK	8121-644	2018-05-09	<input type="checkbox"/>
Pulse Limiter	VTSD 9561-F	SCHWARZBECK	9561-F064	2018-05-08	<input type="checkbox"/>
LISN	ENV216	Rohde & Schwarz	101150	2018-02-03	<input type="checkbox"/>

Test Software

ESCI7, ESCI3 : EMC32 Ver. 8.50.0

ESR7 : EMC32 Ver. 8.53.0

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Setting

IF Band Width: 9 kHz

Climate Condition

Temperature: (25 ± 1) °C

Relative Humidity: (46 ± 1) %

Atmospheric Pressure: 98 kPa



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Test Result

The requirements are: MET NOT MET

Test Mode	Frequency (MHz)	Measured Data (dB μ V)	Margin (dB)	Remark
Charging + G-wave 900 MHz + Wifi 2.4 GHz mode	0.420 000	45.1	20.9	CAverage

The Result is calculated by using the following formula;

- * Result = Limit – Margin (Result included the correction factor)
- * Correction factor = Cable Loss + Insertion loss of LISN



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Test Data

[Line: L1]

EMI Auto Test(7)

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Test Report

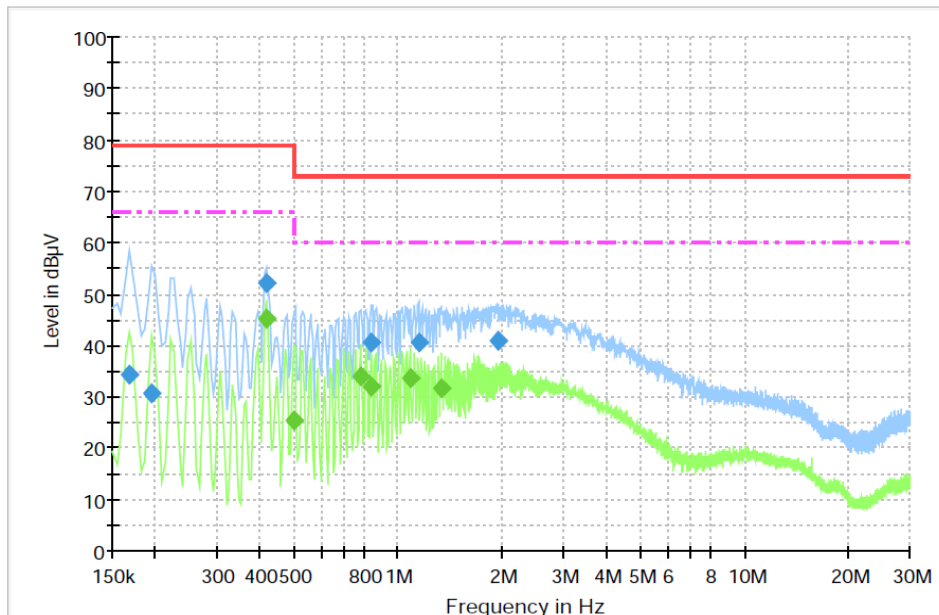
Common Information

Test Model Name: ST730
Test Mode: Charging + G-wave 900Mhz+WiFi2.4Ghz
Manufacturer: Suntech International Ltd.
Tester: Yoon Yeong Deuck

Hardware Setup: EMI conducted\Voltage with ENV216_FO(101236) - [EMI conducted]

Subrange 1
Frequency Range: 150 kHz - 30 MHz
Receiver: ESCI 3 [ESCI 3]
@ GPIB0 (ADR 21), SN 100032/003, FW 4.42
Signal Path: ESCI 3-ENV216 FO(101236)
FW 1.0
Correction Table: 3CE Cable Loss
LISN: ENV216 FO(101236)
Correction Table (Line 0): ENV216_FO_N(101236)
Correction Table (Line 1): ENV216_FO_L1(101236)

3CE_Class A_L1



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EMI Auto Test(7)

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Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.168000	34.3	1000.0	9.000	On	L1	10.0	44.7	79.0
0.195000	30.8	1000.0	9.000	On	L1	10.0	48.2	79.0
0.420000	52.2	1000.0	9.000	On	L1	10.0	26.8	79.0
0.838500	40.6	1000.0	9.000	On	L1	9.9	32.4	73.0
1.149000	40.7	1000.0	9.000	On	L1	9.8	32.3	73.0
1.945500	40.8	1000.0	9.000	On	L1	9.7	32.2	73.0

Final Result 2

Frequency (MHz)	CAverage (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.420000	45.1	1000.0	9.000	On	L1	10.0	20.9	66.0
0.501000	25.5	1000.0	9.000	On	L1	10.0	34.5	60.0
0.780000	34.0	1000.0	9.000	On	L1	9.9	26.0	60.0
0.838500	32.1	1000.0	9.000	On	L1	9.9	27.9	60.0
1.086000	33.8	1000.0	9.000	On	L1	9.8	26.2	60.0
1.338000	31.6	1000.0	9.000	On	L1	9.8	28.4	60.0

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[Line : Neutral]

EMI Auto Test(7)

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Test Report

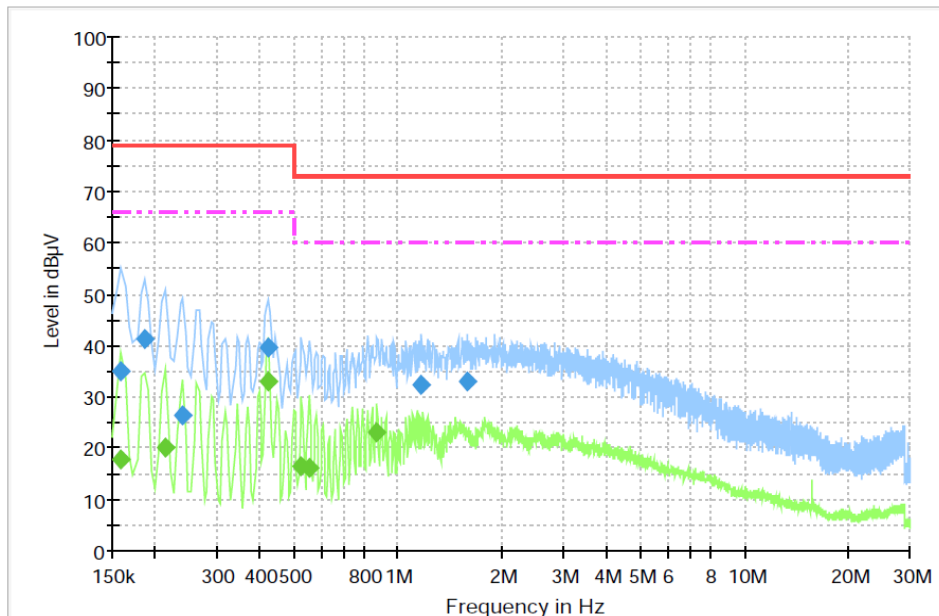
Common Information

Test Model Name: ST730
Test Mode: Charging + G-wave 900Mhz+WiFi2.4Ghz
Manufacturer: Suntech International Ltd.
Tester: Yoon Yeong Deuck

Hardware Setup: EMI conducted\Voltage with ENV216_FO(101236) - [EMI conducted]

Subrange 1
Frequency Range: 150 kHz - 30 MHz
Receiver: ESCI 3 [ESCI 3]
@ GPIB0 (ADR 21), SN 100032/003, FW 4.42
Signal Path: ESCI 3-ENV216 FO(101236)
FW 1.0
Correction Table: 3CE Cable Loss
LISN: ENV216 FO(101236)
Correction Table (Line 0): ENV216_FO_N(101236)
Correction Table (Line 1): ENV216_FO_L1(101236)

3CE_Class A_N



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EMI Auto Test(7)

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Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.159000	35.0	1000.0	9.000	On	N	9.9	44.0	79.0
0.186000	41.4	1000.0	9.000	On	N	9.9	37.6	79.0
0.240000	26.4	1000.0	9.000	On	N	9.8	52.6	79.0
0.424500	39.5	1000.0	9.000	On	N	10.0	39.5	79.0
1.171500	32.5	1000.0	9.000	On	N	9.8	40.5	73.0
1.590000	32.9	1000.0	9.000	On	N	9.7	40.1	73.0

Final Result 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.159000	18.0	1000.0	9.000	On	N	9.9	48.0	66.0
0.213000	20.1	1000.0	9.000	On	N	9.9	45.9	66.0
0.424500	33.0	1000.0	9.000	On	N	10.0	33.0	66.0
0.528000	16.4	1000.0	9.000	On	N	10.0	43.6	60.0
0.555000	16.3	1000.0	9.000	On	N	10.0	43.7	60.0
0.870000	23.2	1000.0	9.000	On	N	9.9	36.8	60.0

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3.2 Radiated Electric Field Emissions (Below 1 GHz)

Test Date

2017-07-26

Test Location

10 m SAC (test distance : 10 m, 3 m)

Test Equipment

Name of Equipment	Model No.	Manufacturer	Serial No.	Due Date	Applied
EMI Test Receiver	ESCI7	Rohde & Schwarz	100814	2017-11-01	<input checked="" type="checkbox"/>
Bilog Antenna	CBL6111C	Schaffner	2551	2018-05-13	<input checked="" type="checkbox"/>
6dB Attenuator	DNF	Rohde & Schwarz	272.4110.50-2	2017-11-01	<input checked="" type="checkbox"/>
Amplifier	310	Sonoma Instrument Co.	291721	2018-02-02	<input checked="" type="checkbox"/>

Test Software

TOYO EMI software Ver. 5.1.0

Frequency Range of Measurement

30 MHz to 1 GHz

Instrument Setting

IF Band Width: 120 kHz

Climate Condition

Temperature: (24 ± 1) °C

Relative Humidity: (46 ± 1) %

Atmospheric Pressure: 98 kPa

Test Result

The requirements are: MET NOT MET

Test Mode	Frequency (MHz)	Measured Data (dBμV/m)	Margin (dB)	Remark
Charging + G-wave 900 MHz + Wifi 2.4 GHz mode	830.465	31.8	14.7	Quasi-peak

The Result is calculated by using the following formula;

* Result = Reading + Correction factor

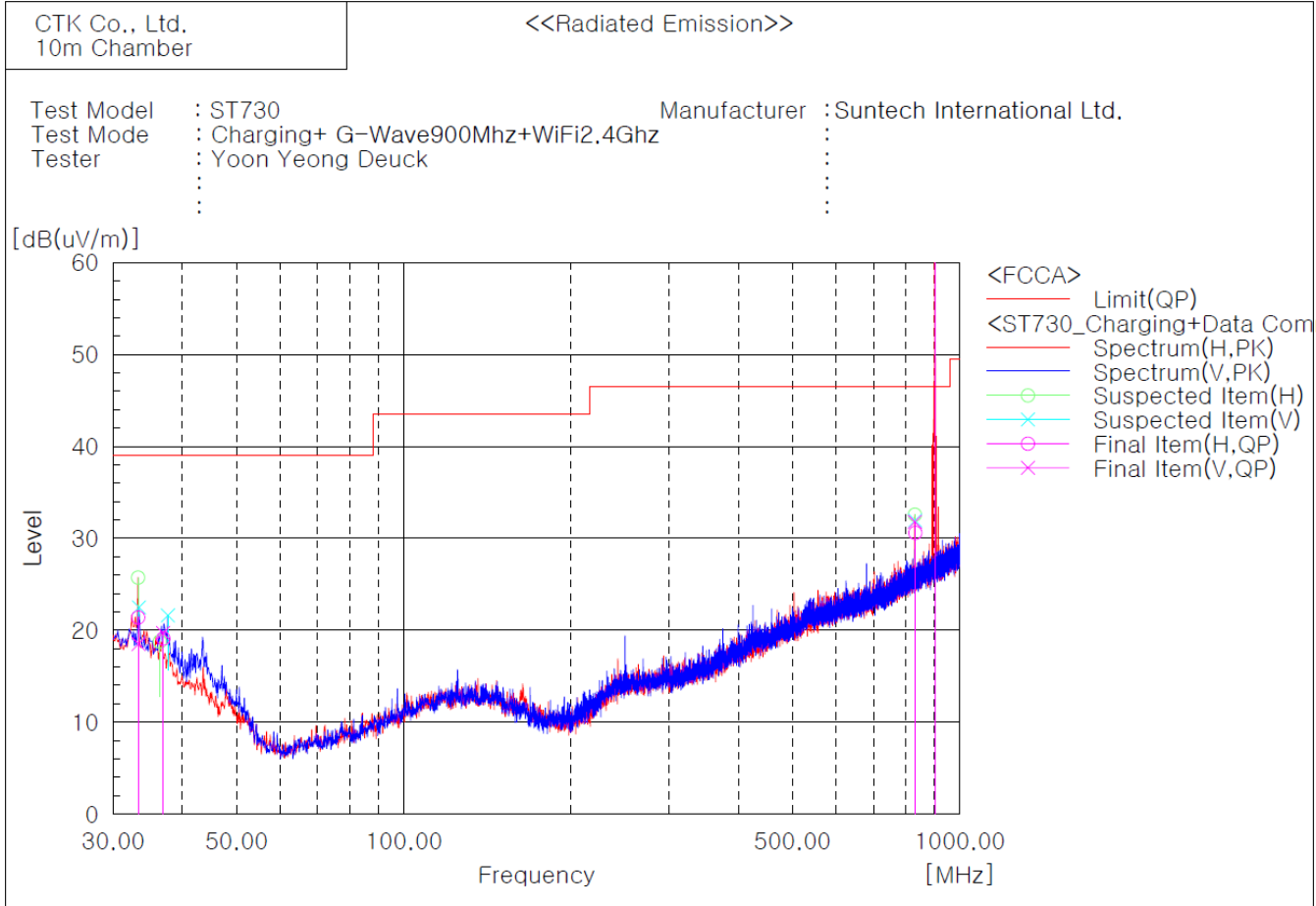
* Correction factor = Antenna Factor + Cable Loss + 6 dB attenuator – Amp Gain



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Test Data



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	33.308	H	28.7	-7.3	21.4	39.0	17.6	399.0	59.0
2	33.330	V	25.8	-7.3	18.5	39.0	20.5	300.0	137.0
3	36.892	V	28.5	-8.8	19.7	39.0	19.3	200.0	171.0
4	36.969	H	27.9	-8.8	19.1	39.0	19.9	200.0	216.0
5	830.465	V	27.0	4.8	31.8	46.5	14.7	200.0	301.0
6	832.080	H	25.8	4.8	30.6	46.5	15.9	300.0	301.0
7	902.272	H	77.4	6.4	83.8	46.5	-37.3	200.0	59.0

※ G-Wave 900MHz frequency (No. 7) is excluded from test result.



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3.3 Radiated Electric Field Emissions (Above 1 GHz)

Test Date

2017-07-28

Test Location

3 m SAC

Test Equipment

Name of Equipment	Model No.	Manufacturer	Serial No.	Due Date	Applied
EMI Test Receiver	ESU40	Rohde & Schwarz	100336	2018-05-12	<input checked="" type="checkbox"/>
Double Ridged Guide Antenna	3117	ETS-Lindgren	00154525	2017-09-02	<input checked="" type="checkbox"/>
Preamplifier	8449B	Agilent Technologies	3008A02011	2017-12-01	<input checked="" type="checkbox"/>

Test Software

TOYO EMI software Ver. 5.1.0

Frequency Range of Measurement

1 GHz to 13 GHz

Instrument Setting

IF Band Width: 1 MHz

Climate Condition

Temperature: (25 ± 1) °C
Relative Humidity: (46 ± 1) %
Atmospheric Pressure: 98 kPa

Test Result

The requirements are: MET NOT MET

Test Mode	Frequency (MHz)	Measured Data (dBµV/m)	Margin (dB)	Remark
Charging + G-wave 900 MHz + Wifi 2.4 GHz mode	10 459.359	31.7	27.8	Average

The Result is calculated by using the following formula;

* Result = Reading + Correction factor

* Correction factor = Antenna Factor + Cable Loss- Amp Gain

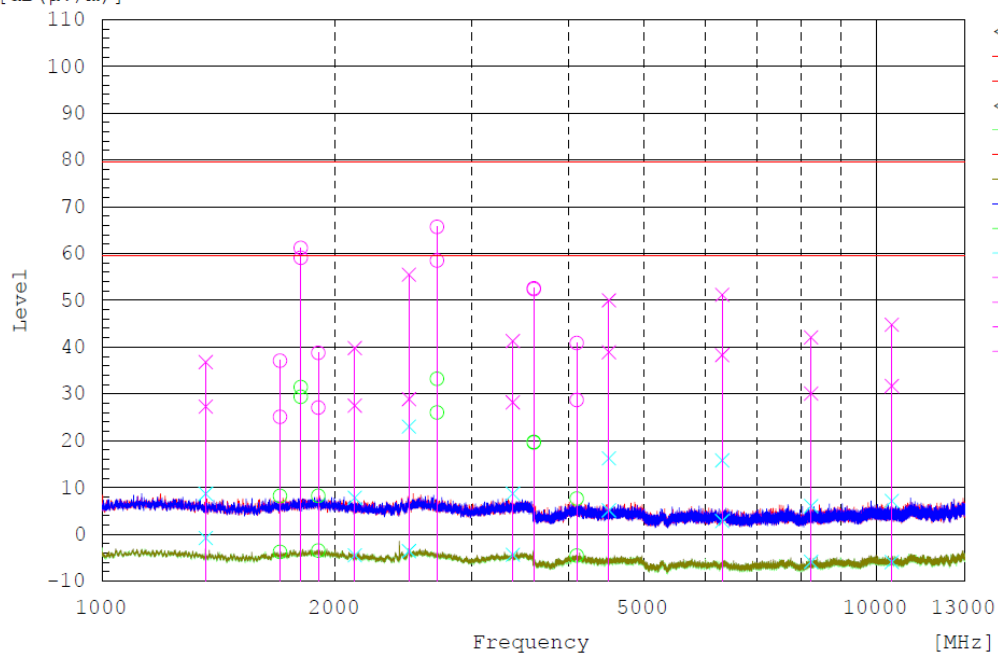


Test Data

<<CTK Co. Ltd.>>

Model Name : ST730
 Manufacturer : Suntech International Ltd.
 Mode : Charging + G-wave900Mhz+Wifi2.4Ghz
 Model Type :
 :
 :
 :

[dB (μV/m)]



Final Result

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	1360.000	V	35.6	45.1	-8.3	27.3	36.8	59.5	79.5	32.2	42.7	236.3	116.6
2	1696.480	H	31.7	43.7	-6.6	25.1	37.1	59.5	79.5	34.4	42.4	464.0	56.3
3	1804.480	H	64.8	66.9	-5.7	59.1	61.2	59.5	79.5	0.4	18.3	234.3	11.9
4	1901.440	H	31.8	43.5	-4.7	27.1	38.8	59.5	79.5	32.4	40.7	355.3	334.5
5	2119.360	V	30.5	42.8	-3.0	27.5	39.8	59.5	79.5	32.0	39.7	224.2	12.5
6	2488.960	V	31.0	57.6	-2.1	28.9	55.5	59.5	79.5	30.6	24.0	100.0	94.8
7	2706.400	H	60.7	67.9	-2.2	58.5	65.7	59.5	79.5	1.0	13.8	464.0	291.6
8	3389.920	V	29.6	42.7	-1.4	28.2	41.3	59.5	79.5	31.3	38.2	355.3	343.4
9	3608.320	H	53.3	53.5	-0.9	52.4	52.6	59.5	79.5	7.1	26.9	100.0	146.2
10	4099.360	H	28.3	40.5	0.4	28.7	40.9	59.5	79.5	30.8	38.6	234.3	11.9
11	4510.720	V	37.7	48.8	1.2	38.9	50.0	59.5	79.5	20.6	29.5	344.8	323.0
12	6315.520	V	35.2	48.1	3.1	38.3	51.2	59.5	79.5	21.2	28.3	225.9	288.4
13	8228.800	V	26.1	38.1	4.0	30.1	42.1	59.5	79.5	29.4	37.4	99.8	51.9
14	10459.359	V	25.3	38.4	6.4	31.7	44.8	59.5	79.5	27.8	34.7	355.3	201.6

※ Harmonic frequencies of G-Wave 900MHz (No. 3, 7, 9, 11, 12) and operating frequencies (Wifi 2.4 GHz (No. 6)) are excluded from test result.



CTK Co., Ltd.
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CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9871

Fax: +82-31-624-9501

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APPENDIX A - Test Setup Photos and Configuration



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9871
Fax: +82-31-624-9501

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Conducted Voltage Emissions of Mains Ports

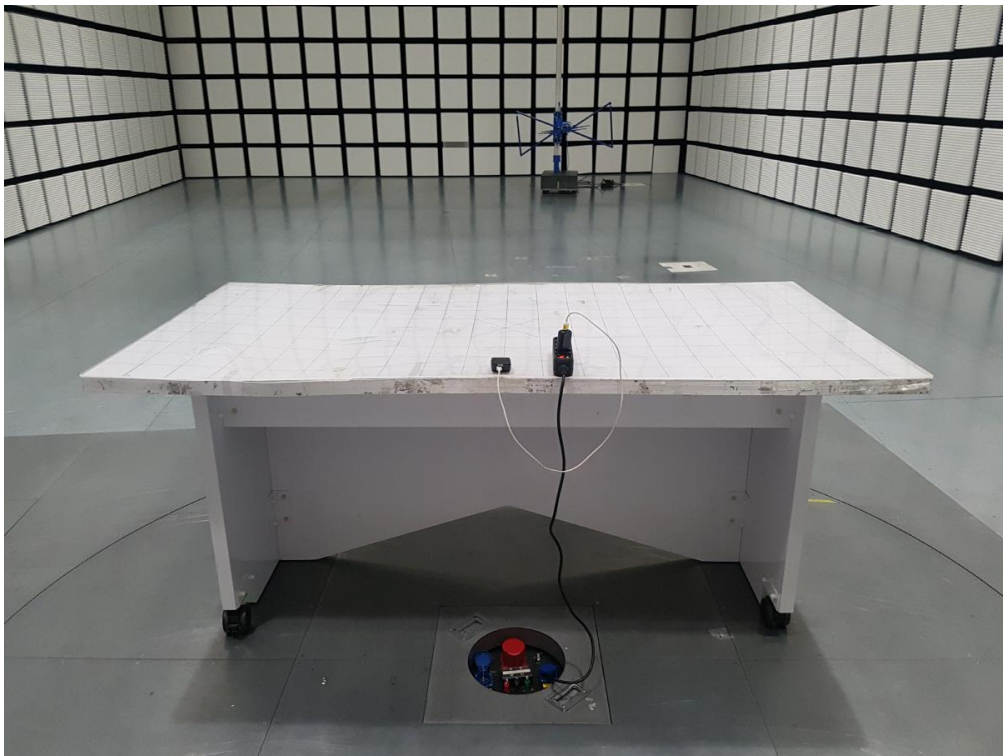




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(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9871
Fax: +82-31-624-9501

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Radiated Electric Field Emissions (Below 1 GHz)

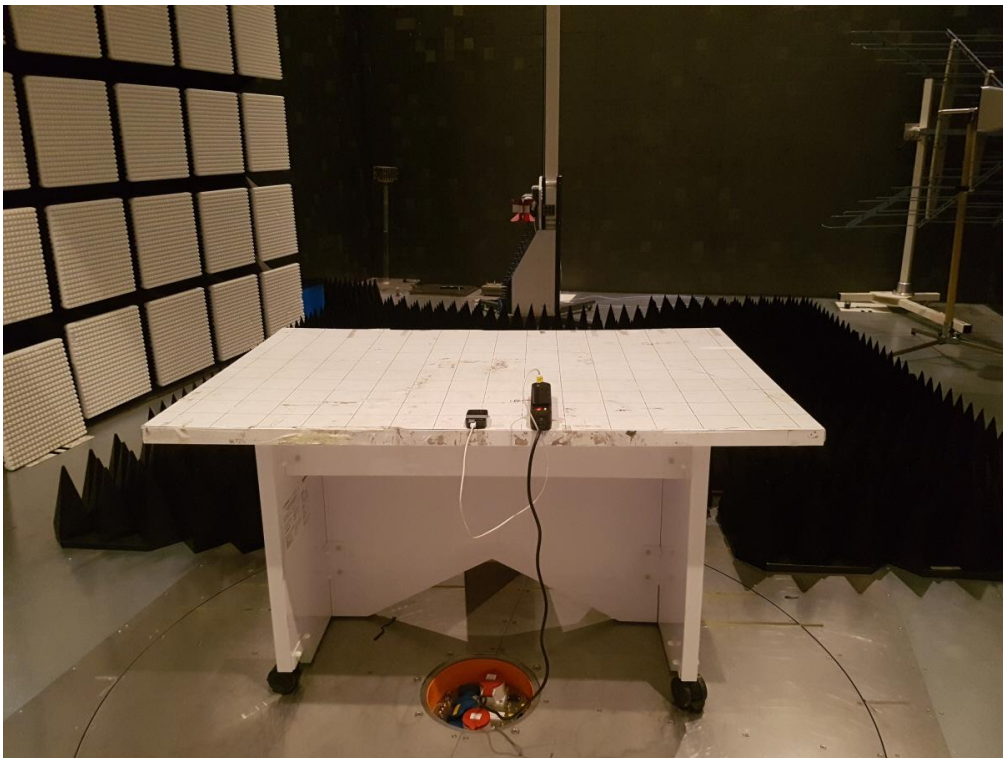
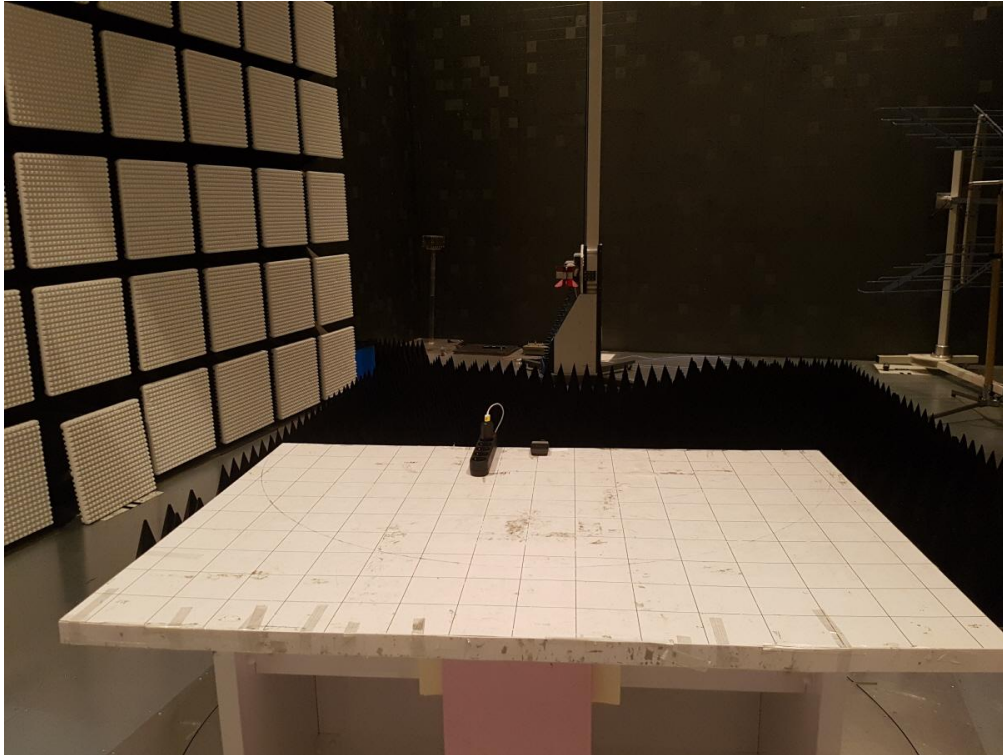




CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9871
Fax: +82-31-624-9501

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Radiated Electric Field Emissions (Above 1 GHz)





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The Prime Leader of Global Regulatory Certification

CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9871
Fax: +82-31-624-9501

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APPENDIX B – EUT Photographs



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9871
Fax: +82-31-624-9501

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EUT External Photographs



EUT Internal Photographs





CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9871
Fax: +82-31-624-9501

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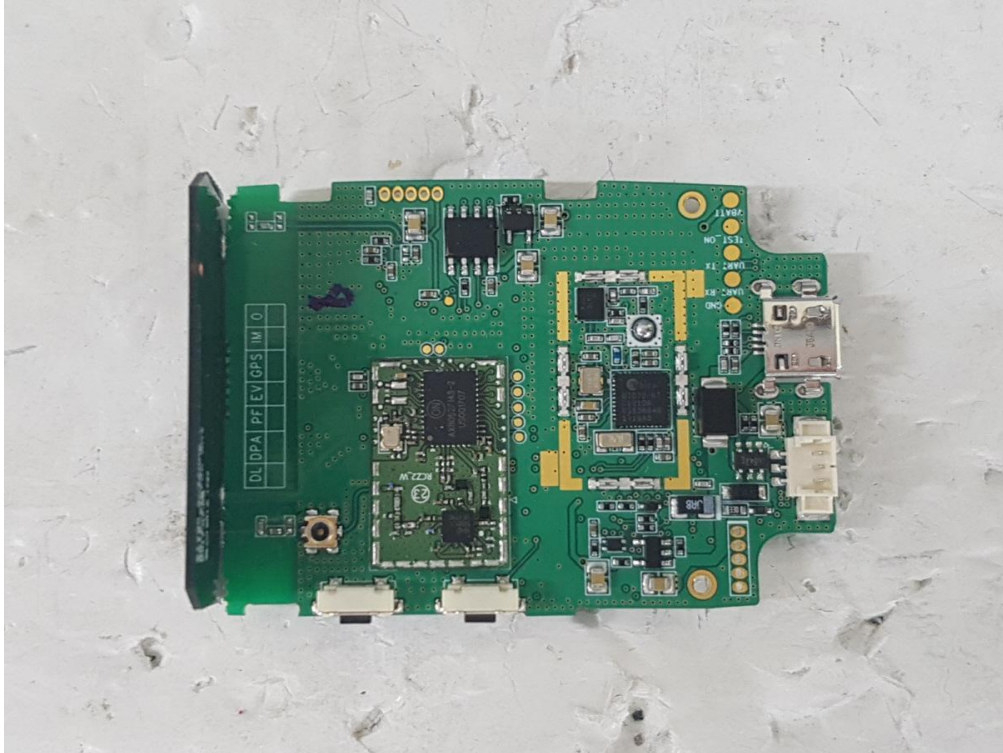




CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9871
Fax: +82-31-624-9501

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PCB





CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9871
Fax: +82-31-624-9501

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