



CMA Testing and Certification Laboratories

廠商會檢定中心

TEST REPORT

Report No. : AT0035788(9) Date : 29 May 2015

Application No. : LT024333(4)

Applicant : Asian Express Holdings Limited
4F,-4, No.669 Jingping Rd., Zhonghe City, TaiPei county 235
Taiwan R.O.C, Taiwan

Client : Asian Express Holdings Limited
Rm804 Sino Centre,582-592 Nathan Road,
Mongkok, Kowloon, Hong Kong.

Sample Description : One(1) item of submitted sample stated to be

Sample Description	Model No.
Small Laser Force (recharge)	TK-0520 / TK-0521

Sample registration No. : RT019378-006
Radio Frequency : 2402MHz – 2480 MHz Transceiver
Rating : 3.7V rechargeable battery
: USB 5V to DC 3.7V adaptor
No. of submitted sample : Four (4) set(s)

Date Received : 23 Apr 2015, 05 May 2015
Test Period : 06 May 2015 to 15 May 2015.
Test Requested : FCC Part 15 Certificate,

Test Method : 47 CFR Part 15 (10-1-12 Edition), ANSI C63.4 – 2009

Test Engineer : Mr. LEUNG Shu-kan, Ken

Test Result : See attached sheet(s) from page 2 to 34.

Conclusion : The submitted sample was found to comply with requirement of FCC Part 15
Subpart B and C.

For and on behalf of
CMA Industrial Development Foundation Limited

Authorized Signature : _____

Mr. WONG Lap-pong, Andrew
Manager
Electrical Division

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FCC ID: VLE0521-R



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Remark : All two models are the same in circuitry and components; and therefore model TK-0521 was chosen to be the representative of the test sample. The difference between the tested model and the declared model(s) is/are the Model no. and Color



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1 General Information

1.1 General Description

The equipment under test (EUT) is a tank for Small Laser League (Recharge). The EUT is power by 3.7V rechargeable battery. It operates at 2402MHz – 2480MHz. When it switches on and received radio signal, it will take the corresponding action.

The brief circuit description is listed as follows:

- IC5 and its associated circuit act as MCU and RF circuit
- X1 and its associated circuit act as oscillator
- IC4 and its associated circuit act as motor control
- U1 and its associated circuit act as power regulator



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1.2 Location of the test site

FCC Registered Test Site Number: 552221

Radiated emissions measurements are investigated and taken pursuant to the procedures of ANSI C63.4 – 2009. A Semi-Anechoic Chamber Testing Site is set up for investigation and located at:

Ground Floor, Yan Hing Centre,
9 – 13 Wong Chuk Yeung Street,
Fo Tan, Shatin,
New Territories,
Hong Kong.

Conducted emissions measurements are investigated and also taken pursuant to the procedures of ANSI C63.4 – 2009. A shielded room is located at :

Ground Floor, Yan Hing Centre,
9 – 13 Wong Chuk Yeung Street,
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1.3 List of measuring equipment

Equipment	Manufacturer	Model No.	Serial No.	Calibration Due Date	Calibration Period
EMI Test Receiver	R&S	ESCI	100152	28 Aug 2015	1Year
Spectrum Analyzer	R&S	FSV40	100628	02 Feb 2016	1Year
Broadband Antenna	Schaffner	CBL6112B	2718	19 Feb 2016	2Years
Loop Antenna	EMCO	6502	00056620	28 Oct 2015	2Years
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-531	24 Nov 2016	2Years
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170442	24 Nov 2016	2Years
Broadband Pre-Amplifier	Schwarzbeck	BBV 9718	9718-119	18 Jun 2015	2Years
Broadband Pre-Amplifier	Schwarzbeck	BBV 9719	9719-010	17 Jun 2015	2Years
LISN	R&S	ENV216	101232	13 Nov 2015	1Year
Coaxial Cable	Schaffner	RG 213/U	N/A	19 Feb 2016	1Years
Coaxial Cable	Suhner	RG 214/U	N/A	19 Feb 2016	1Years
Coaxial Cable	Suhner	Sucoflex_104	N/A	24 Nov 2016	2Years

1.4 Support equipment

Adaptor: A1299 (Supplied by CMA)



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1.5 Measurement Uncertainty

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Radiated emissions

Frequency	Uncertainty (U_{lab})
30MHz ~ 200MHz (Horizontal)	4.63dB
30MHz ~ 200MHz (Vertical)	4.65dB
200MHz ~ 1000MHz (Horizontal)	4.45dB
200MHz ~ 1000MHz (Vertical)	4.41dB

Conducted emissions

Frequency	Uncertainty (U_{lab})
150kHz~30MHz	2.47dB



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2 Description of the radiated emission test

2.1 Test Procedure

Radiated emissions measurements are investigated and taken pursuant to the procedures of ANSI C63.4 – 2009.

The equipment under test (EUT) was placed on a non-conductive turntable with dimensions of 1.5m x 1m and 0.8m high above the ground. 3m from the EUT, a broadband antenna mounting on the mast received the signal strength. The turntable was rotated to maximize the emission level. The antenna was then moving along the mast from 1m up to 4m until no more higher value was found. Both horizontal and vertical polarization of the antenna were placed and investigated.

For below 30MHz, a loop antenna with its vertical plane is placed 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1 m above the ground.

For 30MHz to 1GHz, broadband antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. And the reference point of antenna shall be 1 m above the ground.

For above 1GHz, horn antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. Preamplifier and High Pass filter was used for measurements. The reference point of antenna shall be 1 m above the ground.

The device was rotated through three orthogonal to determine which attitude and configuration produce the highest emission during measurement for Radiated Emission measurement.



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2.2 Test Result

Subpart C

Peak Detector data were measured unless otherwise stated.

“#” means emissions appear within the restricted bands shall follow the requirement of 15.205.

The frequencies from fundamental up to that tenth harmonics were investigated, and emissions more 20dB below limit were not reported. Thus, those highest emissions were presented in next page (section 2.3).

It was found that the EUT meet the FCC requirement.

Subpart B

The emissions meet the requirement of section 15.109 are based on measurements employing the CISPR quasi-peak detector below 1000MHz and average detector for frequencies above 1000MHz.

“#” means emissions appear within the restricted bands shall follow the requirement of 15.205.

The frequencies from 30MHz to 1000MHz were investigated, and emissions more 20dB below limit were not reported. Thus, those highest emissions were presented in next page (section 2.3).

It was found that the EUT meet the FCC requirement.



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2.3 Radiated Emission Measurement Data

Radiated emission

pursuant to

the requirement of FCC Part 15 subpart C

Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	25	° C
Relative humidity:	70	%

Measurement: Peak RBW: 1MHz VBW: 3MHz Operation Mode: Transmission

Testing frequency range: 9kHz to 25GHz

Channel	Frequency (MHz)	Polarity (H/V)	Reading at 3m (dBμV)	Transducer Factor (dB/m)	Field Strength at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
Low	2401.847	H	73.7	- 4.1	69.6	114.0	- 44.4
	#4803.557	H	39.9	3.8	43.7	74.0	- 30.3
	#4803.727	V	41.0	3.8	44.8	74.0	- 29.2
Middle	2439.775	H	74.9	- 4.1	70.8	114.0	- 43.2
	#4880.645	V	38.4	3.8	42.2	74.0	- 31.8
	#4880.680	H	39.4	3.8	43.2	74.0	- 30.8
High	2480.333	V	74.9	- 4.3	70.6	114.0	- 43.4
	#4959.551	H	37.5	4.1	41.6	74.0	- 32.4
	#4960.714	V	40.0	4.1	44.1	74.0	- 29.9

Remark: Other emissions more than 20dB below the limit are not reported.

Peak measurement values are lower than average limit, therefore average measurement is not necessary



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2.3 Radiated Emission Measurement Data (Con't)

Radiated emission

pursuant to

the requirement of FCC Part 15 subpart C

Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	25	° C
Relative humidity:	70	%

Detector: Quasi-peak

RBW: 120kHz

VBW: 300kHz

Testing frequency range: 9kHz to 25GHz

Operation mode: Transmission

Frequency (MHz)	Polarity (H/V)	Reading at 3m (dBμV)	Antenna Factor and Cable Loss (dB/m)	Field Strength at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
51.733	H	6.5	10.0	16.5	40.0	- 23.5
101.642	H	7.3	12.6	19.9	43.5	- 23.6
143.875	H	7.4	13.2	20.6	43.5	- 22.9
196.405	H	7.4	11.3	18.7	43.5	- 24.8
#241.206	H	8.5	12.7	21.2	46.0	- 24.8
#280.908	H	8.2	15.1	23.3	46.0	- 22.7
#326.929	H	8.5	16.5	25.0	46.0	- 21.0

Remark: Other emissions more than 20dB below the limit are not reported.



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2.3 Radiated Emission Measurement Data (Con't)

Radiated emission

pursuant to

the requirement of FCC Part 15 subpart B

Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	25	° C
Relative humidity:	70	%

Detector: Quasi-peak

RBW: 120kHz

VBW: 300kHz

Testing frequency range: 9kHz to 25GHz

Operation mode: Receiving

Frequency (MHz)	Polarity (H/V)	Reading at 3m (dBμV)	Antenna Factor and Cable Loss (dB/m)	Field Strength at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
51.118	H	6.7	10.0	16.7	40.0	- 23.3
87.587	H	6.3	10.8	17.1	43.5	- 26.4
#124.043	H	7.4	13.8	21.2	43.5	- 22.3
158.620	H	6.5	13.2	19.7	43.5	- 23.8
198.972	H	7.5	11.3	18.8	46.0	- 24.7
#240.529	H	8.4	12.7	21.1	46.0	- 24.9
289.154	H	8.5	15.1	23.6	46.0	- 22.4

Remark: Other emissions more than 20dB below the limit are not reported.



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2.3 Radiated Emission Measurement Data (Con't)

Radiated emission

pursuant to

the requirement of FCC Part 15 subpart B

Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	25	° C
Relative humidity:	70	%

Detector: Quasi-peak

RBW: 120kHz

VBW: 300kHz

Testing frequency range: 9kHz to 25GHz

Operation mode: Charging

Frequency (MHz)	Polarity (H/V)	Reading at 3m (dBμV)	Antenna Factor and Cable Loss (dB/m)	Field Strength at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
54.330	H	5.6	10.0	15.6	40.0	- 24.4
94.021	H	6.2	12.2	18.4	43.5	- 25.1
#128.539	H	7.2	13.8	21.0	43.5	- 22.5
165.667	H	7.2	12.1	19.3	43.5	- 24.2
211.716	H	6.8	11.6	18.4	43.5	- 25.1
#251.407	H	7.4	15.1	22.5	46.0	- 23.5
291.720	H	8.6	15.1	23.7	46.0	- 22.3

Remark: Other emissions more than 20dB below the limit are not reported.



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3 Description of the Line-conducted Test

3.1 Test Procedure

Conducted emissions measurements are investigated and also taken pursuant to the procedures of ANSI C63.4 – 2009. The EUT was setup as described in the procedures, and both lines were measured.

3.2 Test Result

The EUT connected to adaptor for charging

It was found that the EUT met the FCC requirement.

3.3 Graph and Table of Conducted Emission Measurement Data

For electronic filing, the document is saved with filename TestRpt2.pdf.



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4 Photograph

4.1 Photographs of the Test Setup for Radiated Emission and Conducted Emission

For electronic filing, the photos are saved with filename VLE0521-R TSup.pdf.

4.2 Photographs of the External and Internal Configurations of the EUT

For electronic filing, the photos are saved with filename VLE0521-R ExPho.pdf and VLE0521-R InPho.pdf.



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5 Supplementary document

The following document were submitted by applicant, and for electronic filing, the document are saved with the following filenames:

Document	Filename
ID Label/Location	LabelSmp.jpg
Block Diagram	BlkDia.pdf
Schematic Diagram	Schem.pdf
Users Manual	UserMan.pdf
Operational Description	OpDes.pdf

5.1 Bandwidth

The plot saved in TestRpt3.pdf shows the fundamental emission is confined in the specified band. It shows the 20dB bandwidth met the 15.215 requirement for frequency band 2400 to 2483.5 MHz.

The plot saved in TestRpt4.pdf shows the band edge is fulfil 15.209 requirement.



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6 Appendices

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A2	Photos of the set-up of Conducted Emissions	2	pages
A3	Photos of External Configurations	1	page
A4	Photos of Internal Configurations	2	pages
A5	ID Label/Location	1	page
A6	Conducted Emission Measurement Data	3	pages
A7	Band Edge	2	pages
A8	20dB Bandwidth Plot	2	pages



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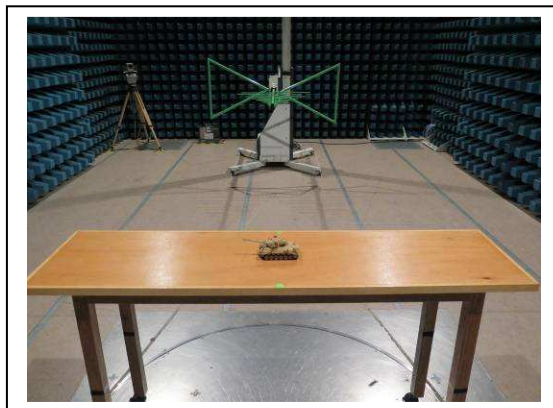
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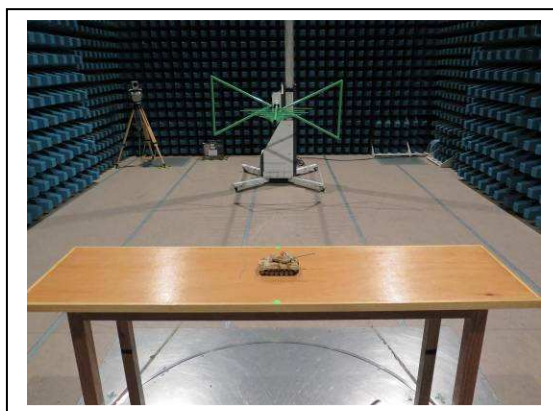
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Date : 29 May 2015

A1. Photos of the set-up of Radiated Emissions



(Front view, 30MHz – 1GHz)



(Back view, 30MHz – 1GHz)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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Report No. : AT0035788(9)

Date : 29 May 2015

A1. Photos of the set-up of Radiated Emissions



(Front view, 9kHz – 30MHz)



(Back view, 9kHz – 30MHz)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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Date : 29 May 2015

A1. Photos of the set-up of Radiated Emissions



(Front view, 1GHz – 25GHz)



(Back view, above 1GHz – 25GHz)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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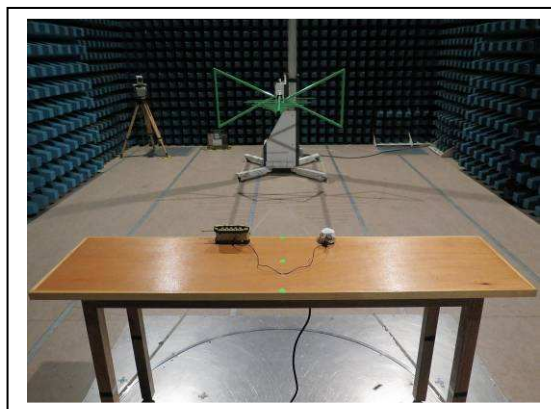
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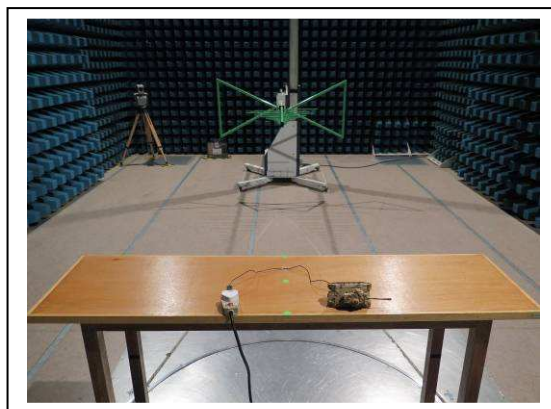
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Date : 29 May 2015

A1. Photos of the set-up of Radiated Emissions



(Front view, Charging)



(Back view, charging)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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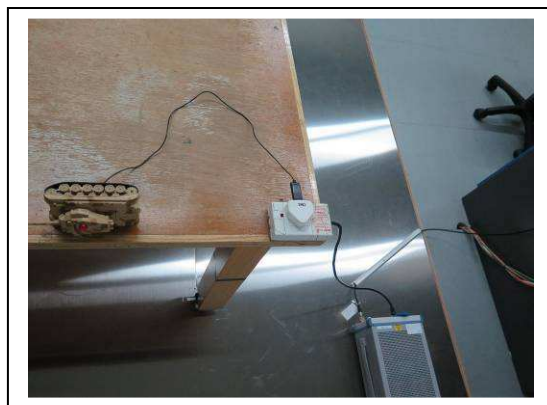
Report No. : AT0035788(9)

Date : 29 May 2015

A2. Photos of the set-up of Conducted Emission



(front view)



(rear view)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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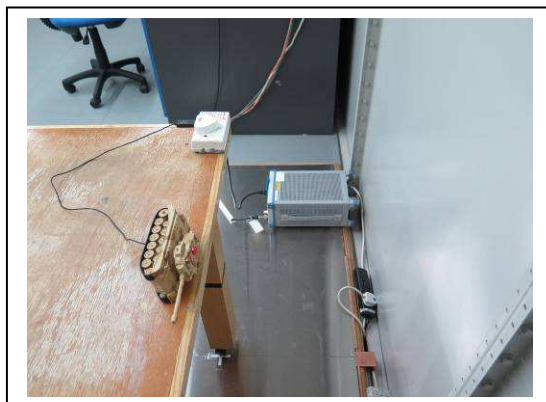
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Date : 29 May 2015

A2. Photos of the set-up of Conducted Emission



(side view)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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A3 Photos of External Configurations



(External Configuration 1)



(External Configuration 2)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew

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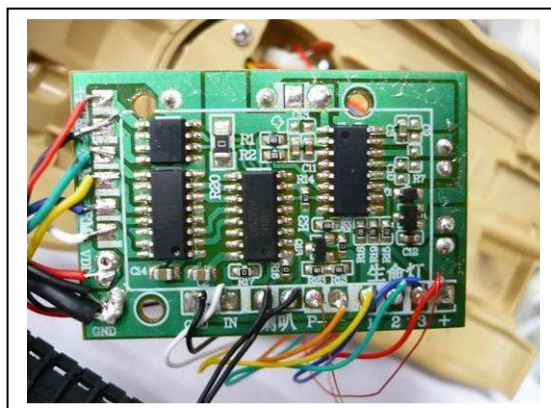
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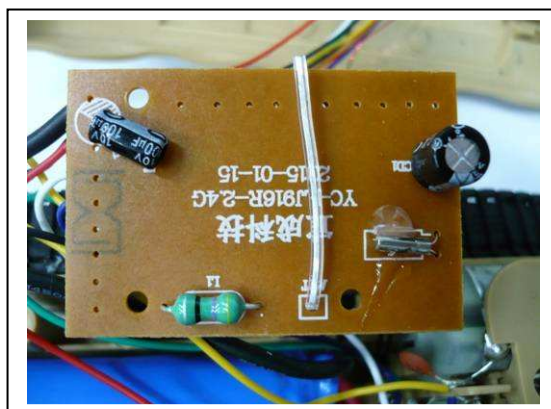
Report No. : AT0035788(9)

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A4. Photos of Internal Configurations



Internal Configuration 1



Internal Configuration 2

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



CMA Testing and Certification Laboratories

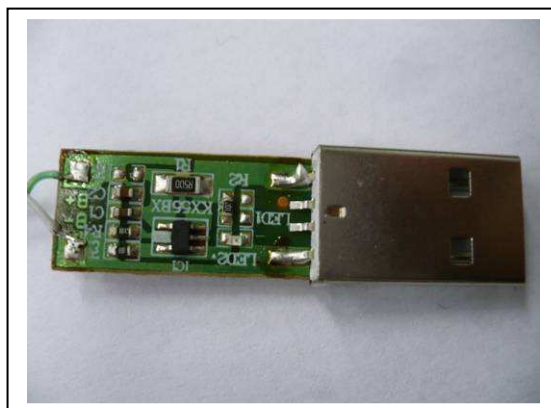
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A4. Photos of Internal Configurations



Internal Configuration 3



Internal Configuration 4

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew

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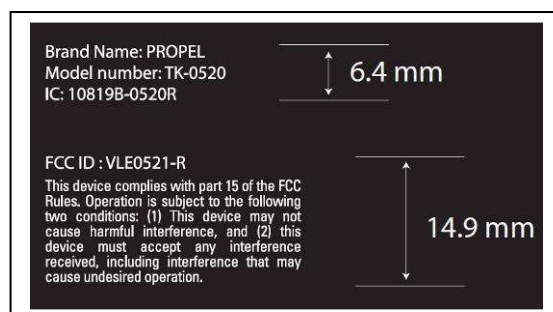
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A5. ID Label / Location



ID Label 1



ID Label 2

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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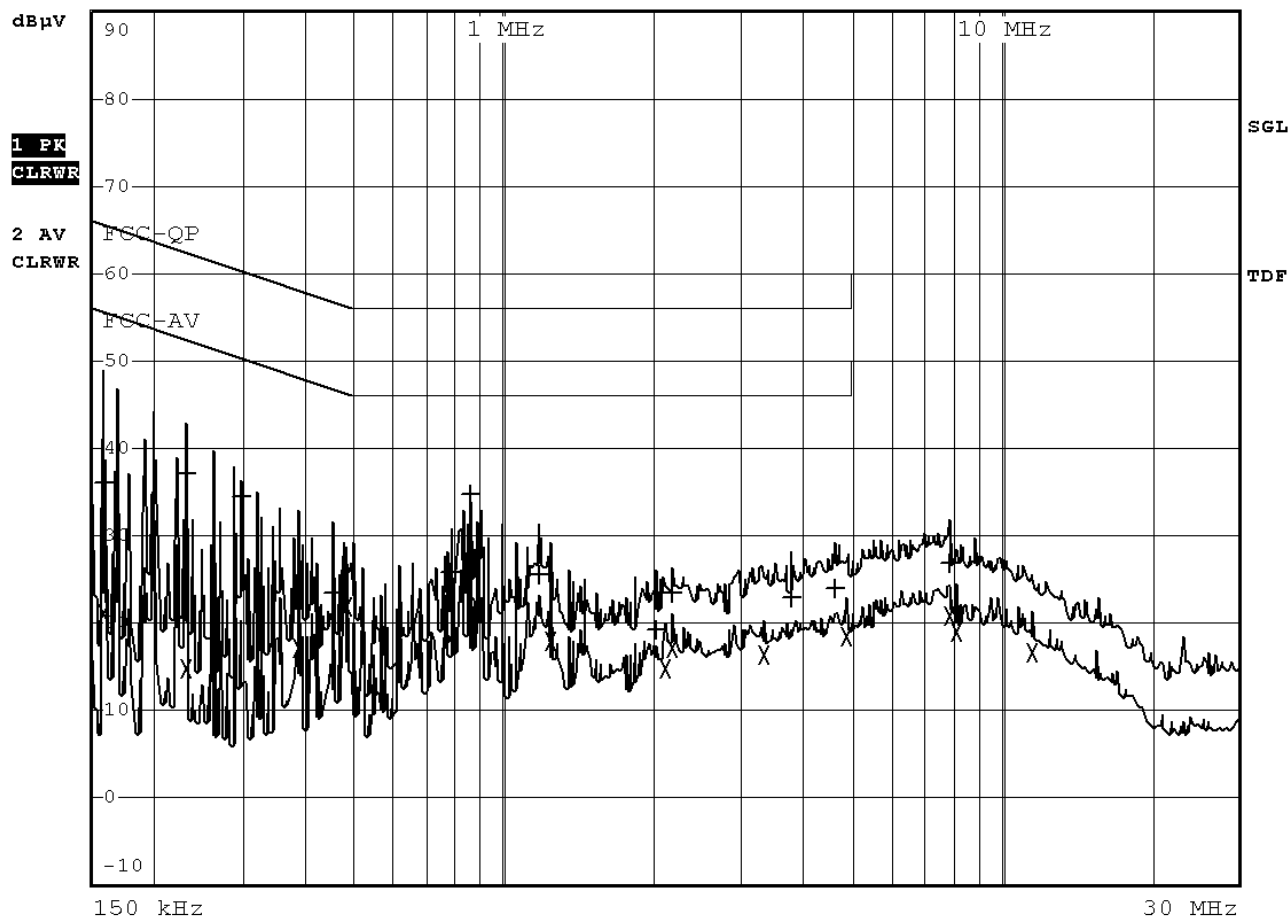
A6. Conducted Emission Measurement Date



RBW 9 kHz

MT 1 s

Att 10 dB AUTO PREAMP OFF



Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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A6. Conducted Emission Measurement Date

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	FCC-QP			
Trace2:	FCC-AV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV		DELTA LIMIT dB
1 Quasi Peak	159 kHz	36.08	L1 gnd	-29.42
2 Average	159 kHz	21.20	L1 gnd	-34.31
1 Quasi Peak	231 kHz	37.06	N gnd	-25.34
2 Average	231 kHz	14.85	N gnd	-37.55
1 Quasi Peak	298.5 kHz	34.37	L1 gnd	-25.90
2 Average	388.5 kHz	17.05	L1 gnd	-31.04
1 Quasi Peak	456 kHz	23.58	L1 gnd	-33.18
2 Average	487.5 kHz	21.85	L1 gnd	-24.35
1 Quasi Peak	783.5 kHz	25.87	L1 gnd	-30.12
2 Average	783.5 kHz	18.24	N gnd	-27.75
1 Quasi Peak	855.5 kHz	34.64	L1 gnd	-21.35
2 Average	882.5 kHz	21.84	L1 gnd	-24.15
1 Quasi Peak	1.184 MHz	25.43	N gnd	-30.56
2 Average	1.238 MHz	18.07	L1 gnd	-27.92
1 Quasi Peak	2.039 MHz	19.37	L1 gnd	-36.62
2 Average	2.12 MHz	14.71	L1 gnd	-31.28
1 Quasi Peak	2.192 MHz	23.36	N gnd	-32.63
2 Average	2.192 MHz	17.18	L1 gnd	-28.82
2 Average	3.3575 MHz	16.50	N gnd	-29.50
1 Quasi Peak	3.7805 MHz	23.01	N gnd	-32.98

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



CMA Testing and Certification Laboratories

廠商會檢定中心

TEST REPORT

Report No. : AT0035788(9)

Date : 29 May 2015

A6 Conducted Emission Measurement Date

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	FCC-QP			
Trace2:	FCC-AV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dB μ V		DELTA LIMIT dB
1 Quasi Peak	4.658 MHz	24.11	N gnd	-31.88
2 Average	4.874 MHz	18.34	N gnd	-27.65
1 Quasi Peak	7.8485 MHz	26.77	N gnd	-33.22
2 Average	7.8485 MHz	20.75	N gnd	-29.24
2 Average	8.132 MHz	18.98	N gnd	-31.01
2 Average	11.5835 MHz	16.62	N gnd	-33.37

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew

FCC ID: VLE0521-R

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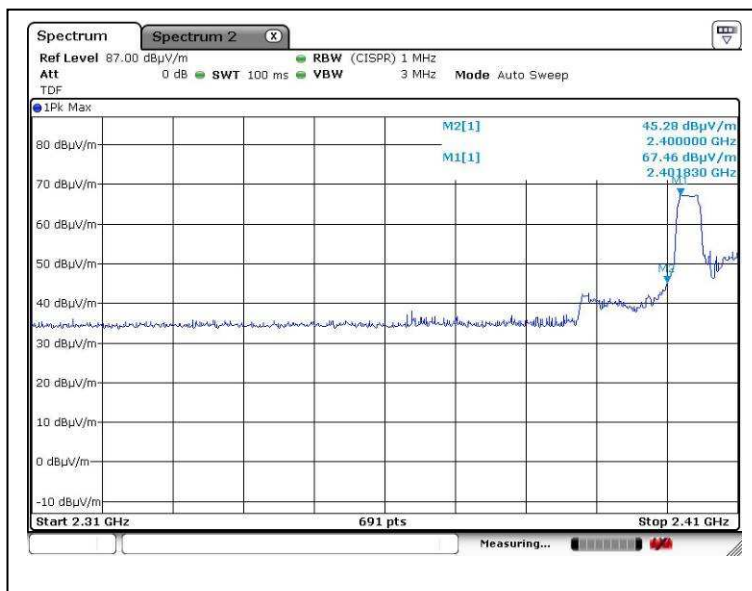
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TEST REPORT

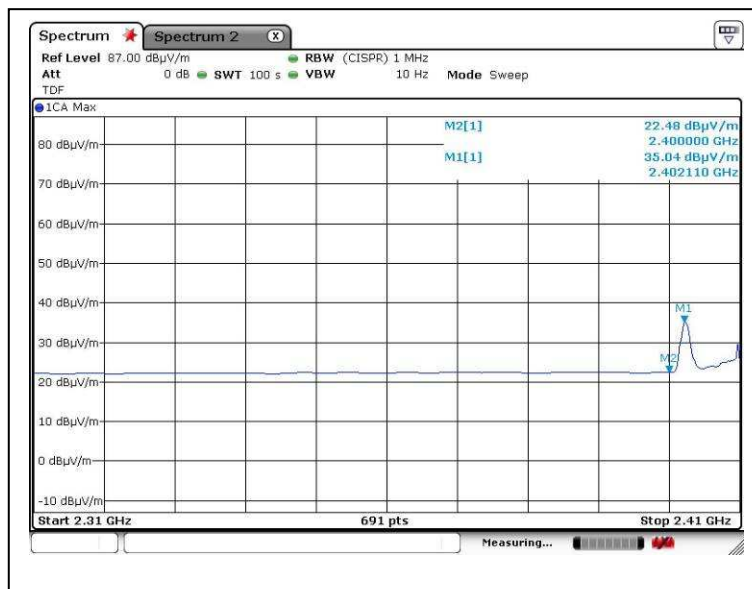
Report No. : AT0035788(9)

Date : 29 May 2015

A7. Band Edge



Lower edge (Peak measurement)



Lower edge (Average measurement)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew

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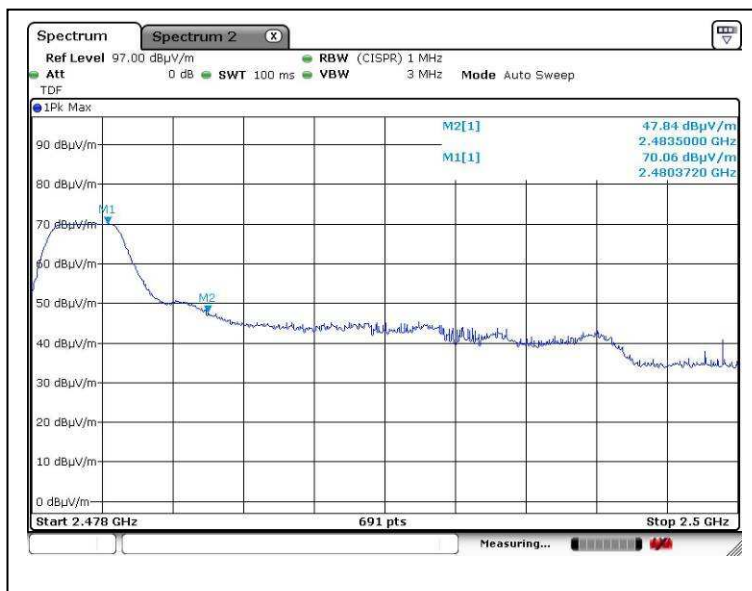
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TEST REPORT

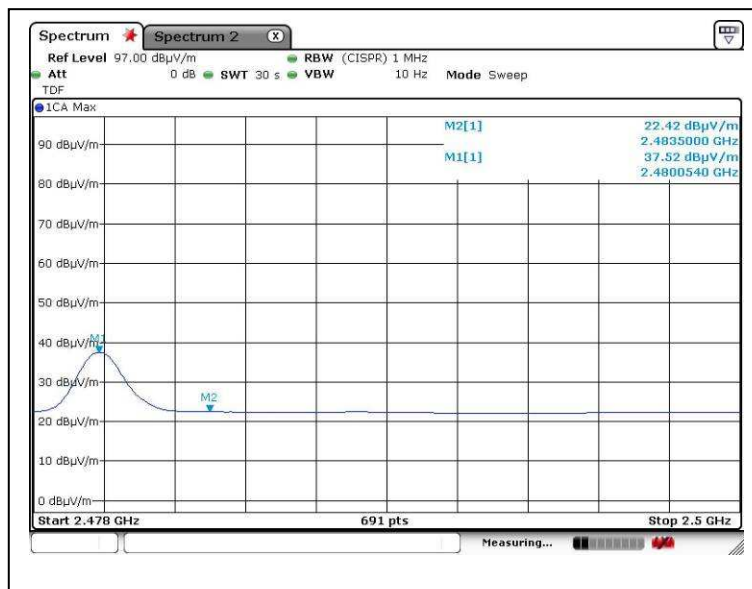
Report No. : AT0035788(9)

Date : 29 May 2015

A7. Band Edge



Higher edge (Peak measurement)



Higher edge (Average measurement)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew

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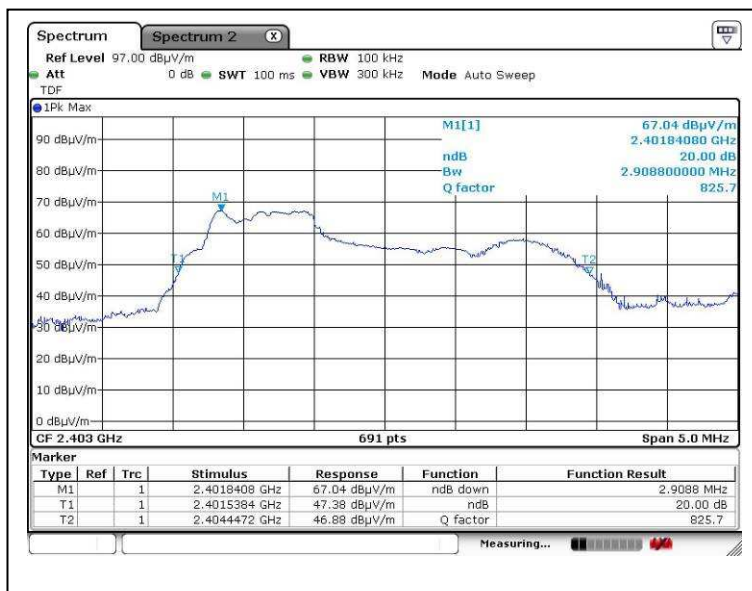
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TEST REPORT

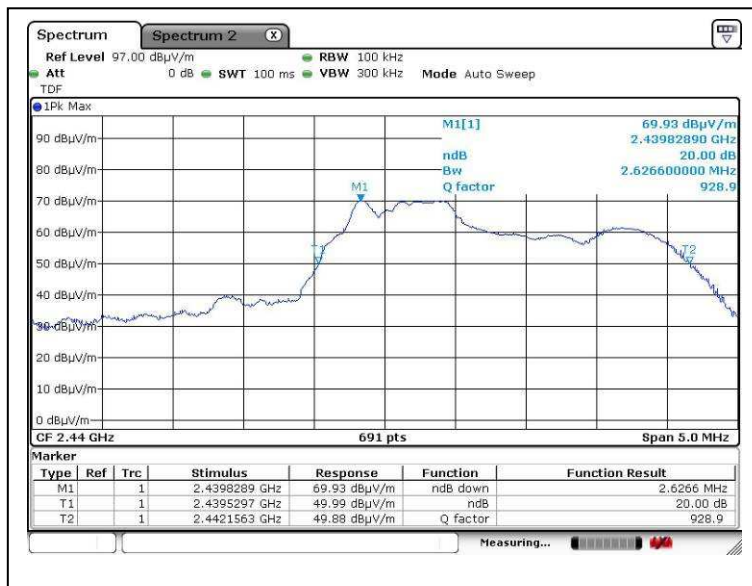
Report No. : AT0035788(9)

Date : 29 May 2015

A8. 20dB Bandwidth Plot



Bandwidth 1 (2402MHz)



Bandwidth 2 (2440MHz)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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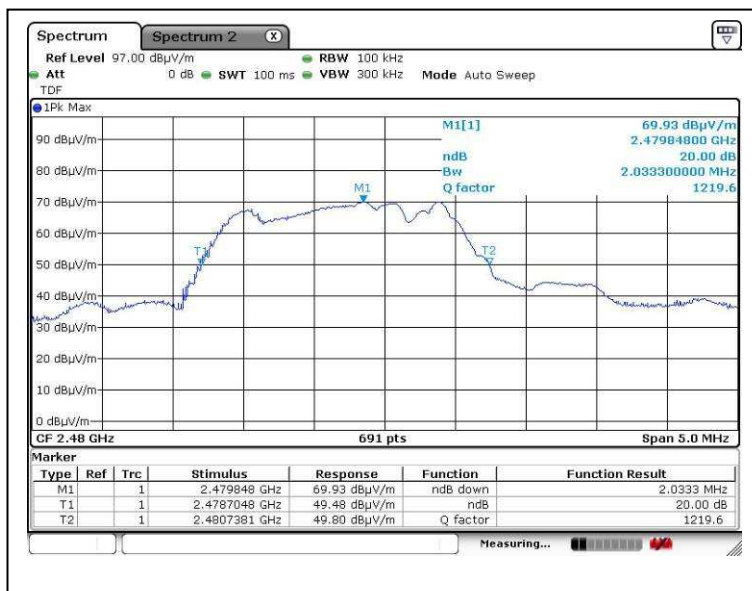
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TEST REPORT

Report No. : AT0035788(9)

Date : 29 May 2015

A8. 20dB Bandwidth Plot



Bandwidth 3 (2480MHz)

***** End of Report *****

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew

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