



TEST REPORT

Date: 2014-12-24

Report No.: 60.870.14.021.03F

Applicant: Systech Electronics Ltd.
26/F Lever Tech Centre, 69-71 King Yip Street, Kwun Tong,
Kowloon, Hong Kong.

Description of Samples: Model name: Wireless Scanner Mouse
Brand name: **D + O I**™
Model no.: Zcan Wireless
FCCID: 2ABQ3-SSM003M

Date Samples Received: 2014-11-24

Date Tested: 2014-11-24 to 2014-12-24

Investigation Requested: FCC Part 15 Subpart C, Section 15.249

Conclusions: The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Remarks: ----

Checked by: Approved by:-

Ray Cheung
Project Engineer
Wireless & Telecom department

Jeff Pong
Operation Manager
Wireless & Telecom department



CONTENT:

Cover	Page 1 of 21
Content	Page 2 of 21
<u>1.0 General Details</u>	
1.1 Test Laboratory	Page 3 of 21
1.2 Applicant Details	Page 3 of 21
1.3 Equipment Under Test [EUT]	Page 4 of 21
1.4 Equipment Modification	Page 4 of 21
1.5 Related Submittal(s) Grants	Page 4 of 21
<u>2.0 Technical Details</u>	
2.1 Investigations Requested	Page 5 of 21
2.2 Test Standards and Results Summary	Page 5 of 21
<u>3.0 Test Methodology</u>	
3.1 Radiated Emission	Page 6 of 21
3.2 Field Strength Calculation	Page 6 of 21
3.3 Conducted Emission	Page 6 of 21
<u>4.0 Test Results</u>	
4.1 Field Strength of Fundamental and Harmonics	Page 7-9 of 21
4.2 Spurious Radiated Emission	Page 10-14 of 21
4.3 Out of Band Emissions	Page 15-16 of 21
4.4 Bandwidth Measurement	Page 17-19 of 21
4.5 Conducted Emission	Page 20 of 21
<u>5.0 List of Measurement Equipments</u>	Page 21 of 21
<u>Appendix A</u>	
Photos of Test Setup	
<u>Appendix B</u>	
External EUT Photos	
<u>Appendix C</u>	
Internal EUT Photos	



1.0 General Details

1.1 Test Laboratory

STC (Dongguan) Company Ltd.
68 Fumin Nan Rd, Dalang, Dongguan, Guangdong, PRC.

Tested by:

A blue ink signature of the name "John Zhi".

John Zhi

1.2 Applicant Details

Applicant

Systech Electronics Ltd.
26/F Lever Tech Centre, 69 – 71 King Yip Street,
Kwun Tong, Kowloon, Hong Kong.

Manufacturer

K-Mark Industrial Ltd.
Flat A, 7/F., Mai On Ind. Bldg., 17 – 21, Kung Yip
Sy., Kwai Chung, Hong Kong.



1.3 Equipment Under Test [EUT]

Description of EUT

Model Name:	Wireless Scanner Mouse
Brand Name:	D + O i ™
Model No.:	Zcan Wireless
FCC ID:	2ABQ3-SSM003M
Rating:	DC 3.7V 650mAh Li-ion battery
Antenna Type:	PCB Antenna
Antenna Gain:	0 dBi
Operated Frequency:	2402 MHz to 2479 MHz
Modulation:	DSSS
No. of Channel:	78
Channel Separation:	1 MHz
Channel List:	2402; 2403; 2404; 2405; 2406; 2407; 2408; 2409; 2410; 2411; 2412; 2413; 2414; 2415; 2416; 2417; 2418; 2419; 2420; 2421; 2422; 2423; 2424; 2425; 2426; 2427; 2428; 2429; 2430; 2431; 2432; 2433; 2434; 2435; 2436; 2437; 2438; 2439; 2440; 2441; 2442; 2443; 2444; 2445; 2446; 2447; 2448; 2449; 2450; 2451; 2452; 2453; 2454; 2455; 2456; 2457; 2458; 2459; 2460; 2461; 2462; 2463; 2464; 2465; 2466; 2467; 2468; 2469; 2470; 2471; 2472; 2473; 2474; 2475; 2476; 2477; 2478; 2479
Accessories and Auxiliary Equipment:	ThinkPad Notebook
EUT Exercising Software:	None

General Operation of EUT

The Equipment Under Test (EUT) is a Mouse of the Wireless Mouse System which operated at 2.4GHz.

1.4 Equipment Modification

No modification was made to the tested unit by TÜV SÜD Hong Kong Ltd.

1.5 Related Submittal(s) Grants

This is a single application of certification for this transmitter.



2.0 Technical Details

2.1 Investigations Requested

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2012 and ANSI C63.4: 2009.

2.2 Test Standards and Results Summary Tables

EMISSION Results Summary				
Test Condition	FCC Test Requirement	Test Result		
		Pass	Failed	N/A
Field Strength of Fundamental and Harmonics	Part 15.249 (a),(e)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spurious Radiated Emission	Part 15.249 (d) Part 15.209 Part 15.205	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Out of Band Emissions	Part 15.249 (d)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bandwidth Measurement	Part 15.215 (c)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conducted Emission	Part 15.207	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Note: N/A - Not Applicable



3.0 Test Methodology

3.1 Radiated Emission

The sample was placed 0.8m above the ground plane on a standard emission test site *. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

3.2 Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

$$FS = R + \text{System Factor}$$

$$\text{System Factor} = AF + CF + FA - PA$$

Where FS = Net Field Strength in dBuV/m at 3 meters.

R = Reading of Spectrum Analyzer / Test Receiver in dBuV.

AF = Antenna Factor in dB.

CF = Cable Attenuation Factor in dB.

FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

3.3 Conducted Emissions

The EUT was placed on a non-metallic table 0.8m above the horizontal metal reference place and 0.4m from a vertical ground plane which is connected to the horizontal metal ground plane. Meanwhile, the AC main of EUT was connected to the distance of 0.8m line impedance stabilization network (LISN) during measurement.

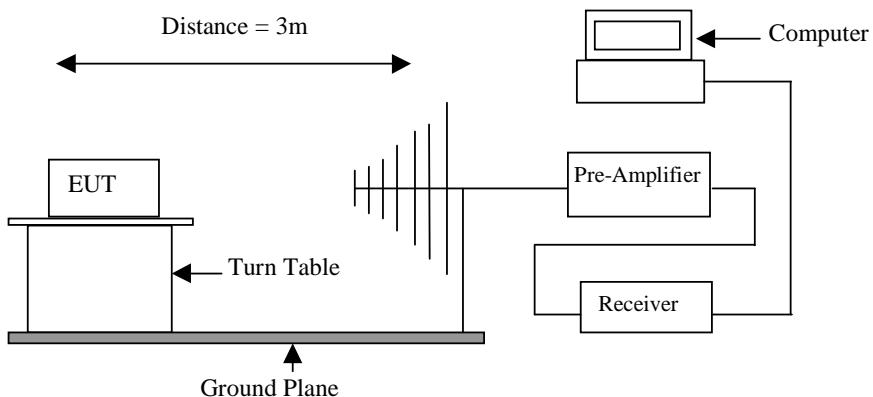
Initial measurements were performed in quasi-peak and average detection modes by the test receiver, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

4.0 Test Results

4.1 Field Strength of Fundamental and Harmonics

Test Requirement:	FCC part 15 section 15.249(a)(e)
Test Method:	ANSI C63.4:2009
Test Date:	2014-12-11
Mode of Operation:	Transmitting mode.
Detector Function:	Quasi-peak (Below 1000 MHz) Average and Peak (Above 1000 MHz)
Measurement BW:	120 kHz (Below 1000 MHz) 1 MHz (Above 1000 MHz)

Test Setup:





Results: PASS

Field Strength of Fundamental and Harmonics									
Channel	Value	Emissions Frequency	E-Field Polarity	Reading	System Factor	Field Strength at 3m	Limit	Delta to Limit	Remarks
		MHz		dB μ V/m	dB	dB μ V/m	dB μ V/m	dB μ V/m	
Lowest	PK	2402.00	H	52.10	36.80	88.90	114.00	-25.10	Fund.
	AV			44.60	36.80	81.40	94.00	-12.60	Fund.
	PK	2402.00	V	54.60	36.80	91.40	114.00	-22.60	Fund.
	AV			49.30	36.80	86.10	94.00	-7.90	Fund.
Middle	PK	2440.00	H	52.50	36.80	89.30	114.00	-24.70	Fund.
	AV			46.00	36.80	82.80	94.00	-11.20	Fund.
	PK	2440.00	V	54.90	36.80	91.70	114.00	-22.30	Fund.
	AV			49.50	36.80	86.30	94.00	-7.70	Fund.
Highest	PK	2479.00	H	52.20	36.80	89.00	114.00	-25.00	Fund.
	AV			44.30	36.80	81.10	94.00	-12.90	Fund.
	PK	2479.00	V	54.40	36.80	91.20	114.00	-22.80	Fund.
	AV			49.00	36.80	85.80	94.00	-8.20	Fund.
	PK	4804.00	H	12.50	42.40	54.90	74.00	-19.10	Harmonic
	AV			-2.60	42.40	39.80	54.00	-14.20	Harmonic
	PK		V	13.60	41.50	55.10	74.00	-18.90	Harmonic
	AV			-1.10	41.50	40.40	54.00	-13.60	Harmonic
	PK	7206.00	H	8.50	46.20	54.70	74.00	-19.30	Harmonic
	AV			-6.00	46.20	40.20	54.00	-13.80	Harmonic
	PK		V	29.90	25.10	55.00	74.00	-19.00	Harmonic
	AV			-4.30	45.10	40.80	54.00	-13.20	Harmonic

Remark : - (*) Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).

- All emission more than 20 below the limit which does not be mentioned in the report
- Calculated measurement uncertainty: $\pm 3.28\text{dB}$


Limits of Field Strength for Fundamental and Harmonics Frequency [Section 15.249 (a)]:

Fundamental Frequency [MHz]	Field Strength of Fundamental		Field Strength of Harmonics	
	[mV/m]	[dB μ V/m]	[μ V/m]	[dB μ V/m]
902 – 928	50	94	500	54
2400 – 2483.5	50	94	500	54

Compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

Limit Requirement under Section 15.249 (e) :

According to section 15.249 (e), for frequencies above 1000MHz, the above field strength limits is based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20dB under any condition of modulation.

Limit for Radiated Emission [Section 15.209]:

Frequency (MHz)	Field Strength [μ V/m]	Field Strength [dB μ V/m]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

Radiated emissions, which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209.

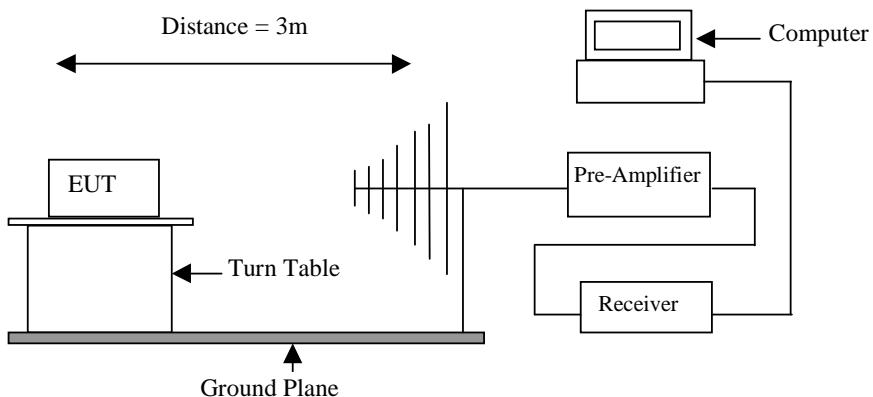
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.



4.2 Spurious Radiated Emission

Test Requirement:	FCC part 15 section 15.249(d),15.209
Test Method:	ANSI C63.4:2009
Test Date:	2014-12-11
Mode of Operation:	Transmitting Mode
Detector Function:	Quasi-peak (Below 1000 MHz) Average and Peak (Above 1000 MHz)
Measurement BW:	120 kHz (Below 1000 MHz) 1 MHz (Above 1000 MHz)

Test Setup:




Results: PASS

Communication mode

Frequency (MHz)	Detector Type	Antenna	Result (dB μ V/m)	Limit (dB μ V/m)	Margin
31.19	QP	H	30.58	40.00	-9.42
202.25	QP	H	32.85	43.50	-10.65
269.81	QP	H	34.25	46.00	-11.75
377.50	QP	H	36.96	46.00	-9.04
60.44	QP	V	25.42	40.00	-14.58
166.56	QP	V	32.73	43.50	-10.77
196.75	QP	V	31.20	43.50	-12.30
378.94	QP	V	35.39	46.00	-10.61

Charging mode

Frequency (MHz)	Detector Type	Antenna	Result (dB μ V/m)	Limit (dB μ V/m)	Margin
159.13	QP	H	29.15	43.50	-14.35
233.19	QP	H	33.28	46.00	-12.72
323.56	QP	H	33.32	46.00	-12.68
377.50	QP	H	37.50	46.00	-8.50
54.19	QP	V	26.18	40.00	-13.82
166.19	QP	V	31.77	43.50	-11.73
199.38	QP	V	30.97	43.50	-12.53
378.89	QP	V	35.96	46.00	-10.04

Note:

- No further spurious emissions found between 30MHz and lowest internal used / generated frequency.
- The result shown the worst case of the operating frequency.
- All emission more than 20 below the limit which does not be mentioned in the report.
- Result data graph is shown at the next pages for reference.
- No significant emissions noise floors were detected above 1 GHz without the operating frequency.

Remark : - (*) Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).

- Calculated measurement uncertainty: $\pm 3.28\text{dB}$.



Limit of Outside of the Specified Bands [Section 15.249 (d)]

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 for Radiated Emission [Section 15.209]:

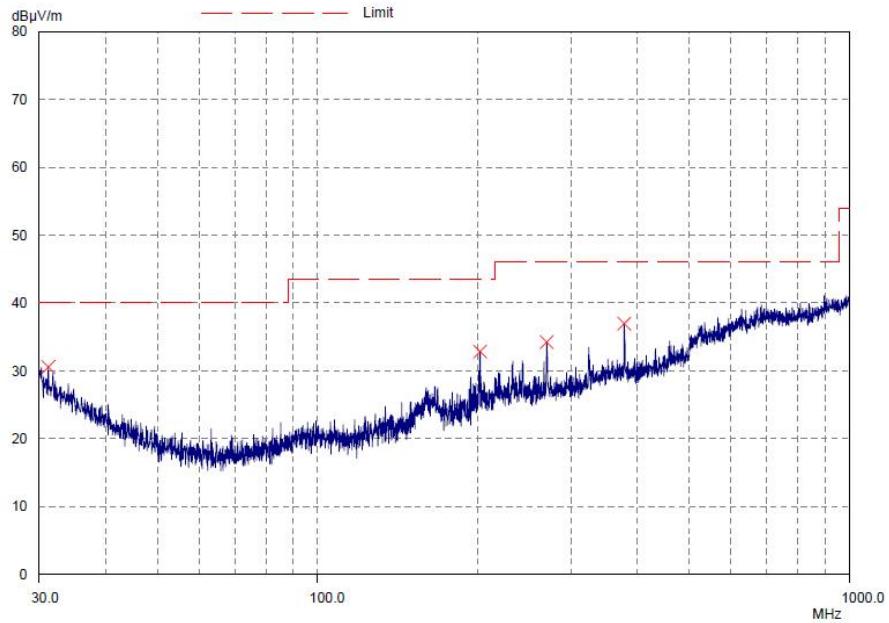
Frequency (MHz)	Field Strength [μ V/m]	Field Strength [dB μ V/m]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

Radiated emissions, which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209.

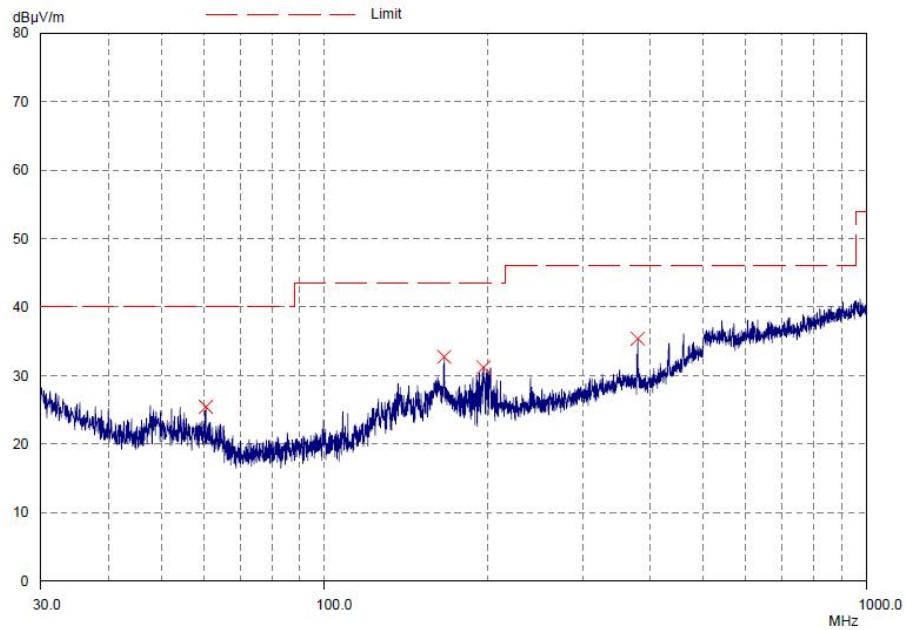
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.



Horizontal (Communication mode)

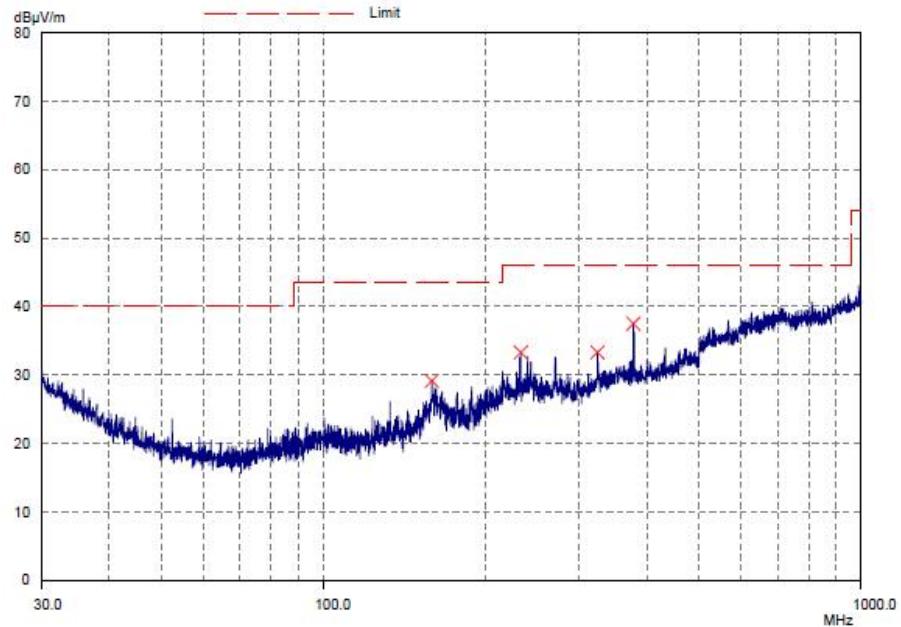


Vertical (Communication Mode)

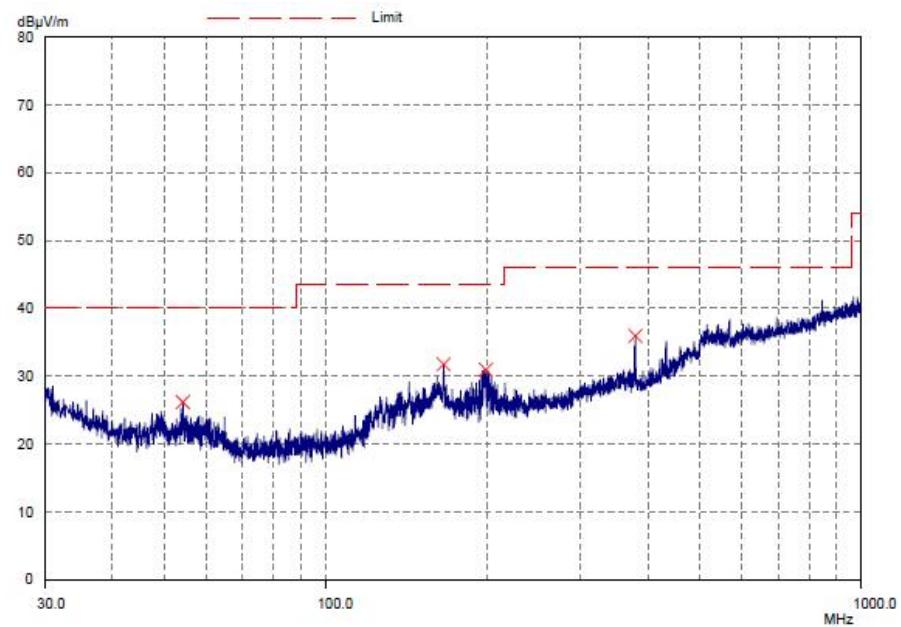




Horizontal (Charging mode)



Vertical (Charging Mode)





4.3 Out of Band Emissions

Test Requirement:	FCC part 15 section 15.249 (d)
Test Method:	ANSI C63.4:2009
Test Date:	2014-12-13
Mode of Operation:	Transmitting mode.
Detector Function:	Peak

Results: PASS

Refer to the data graph, the lower and higher edge of the specified frequency bands fulfill the general radiated emission limits in section 15.209. Therefore, the EUT meets the requirement of section 15.249 (d).

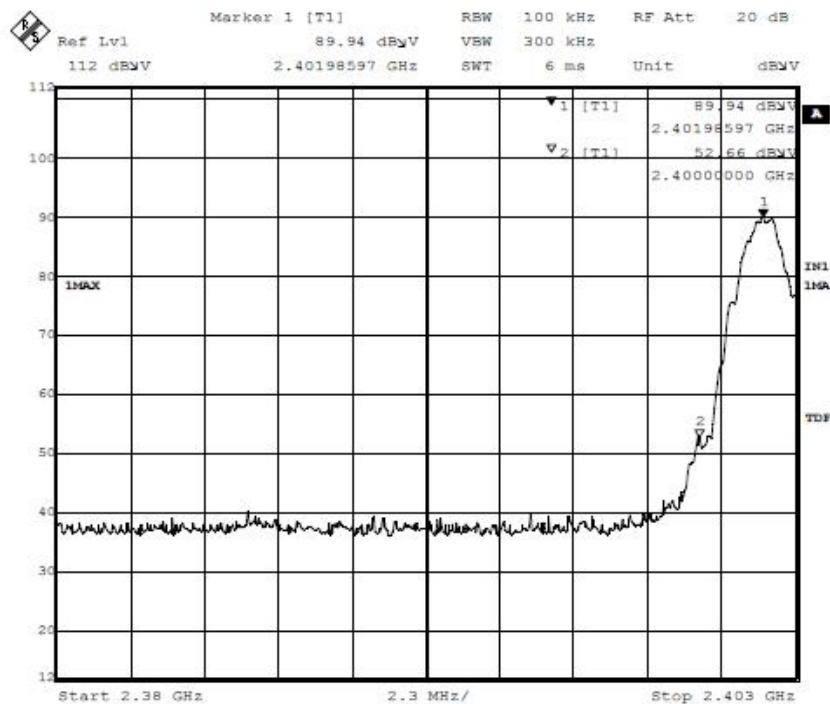
Limit for Out of Band Emissions [Section 15.249 (d)]

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.

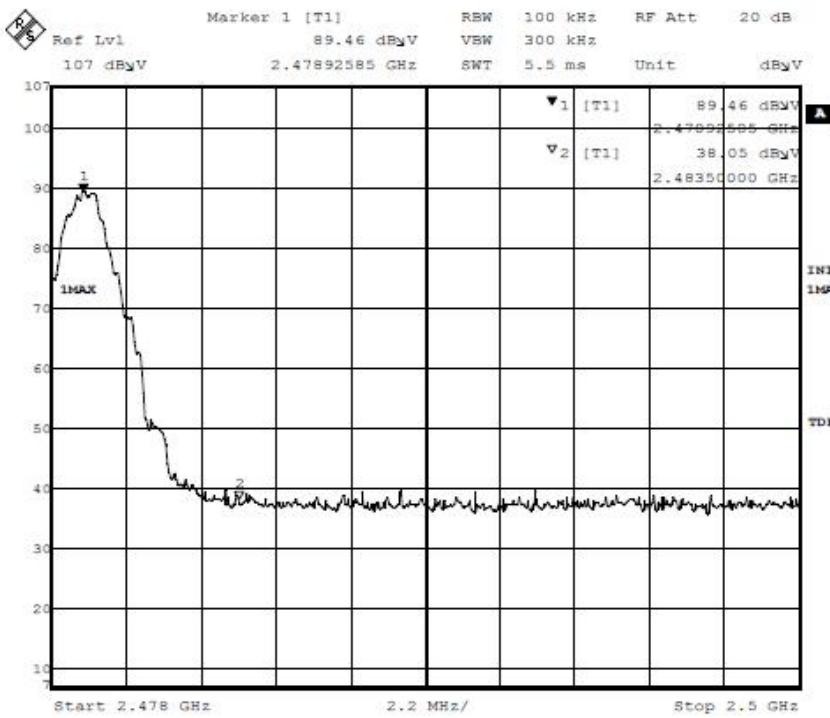
Test Result: Result data graph is shown at the next pages for reference.



Lowest Channel



Highest Channel





4.4 Bandwidth Measurement

Test Requirement: FCC part 15 section 15.215 (c)
Test Method: ANSI C63.4:2009
Test Date: 2014-12-13
Mode of Operation: Transmitting mode.
Detector Function: Peak

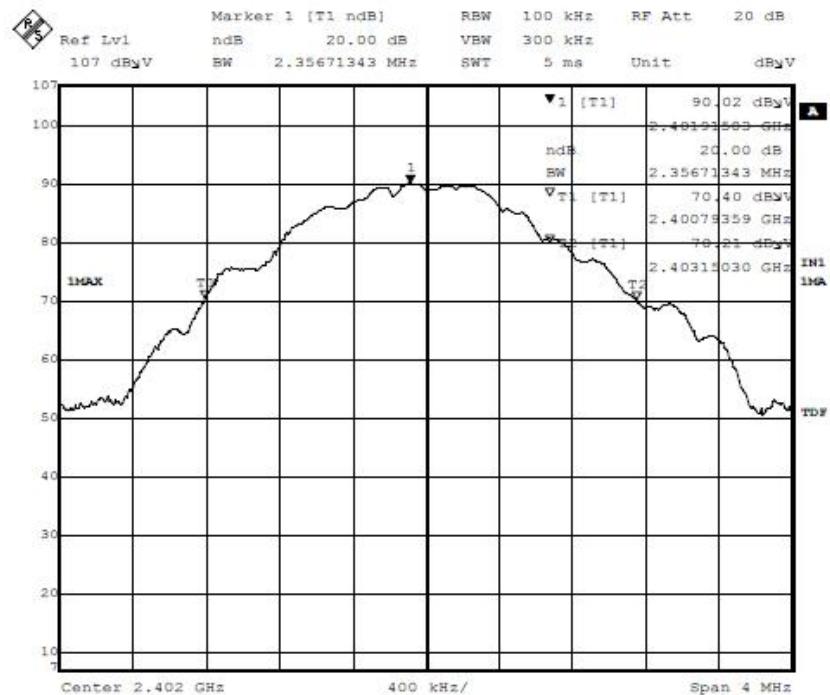
Results: PASS

Refer to the data graph, the 20dB points of Low Channel, Mid Channel and High Channel. All channels within the operation bandwidth when equipment is operated. Therefore, the EUT meets the requirement of section 15.215(c).

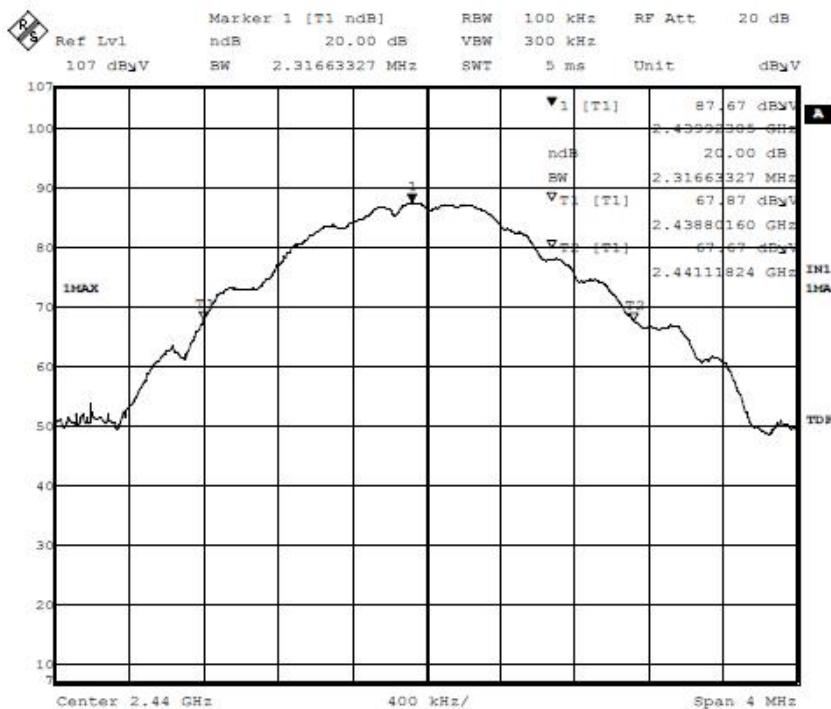
Limit for Bandwidth [Section 15.215 (c)]

The 20dB bandwidth of the emission shall be within the frequency band designated in the rule section under which the equipment is operated.

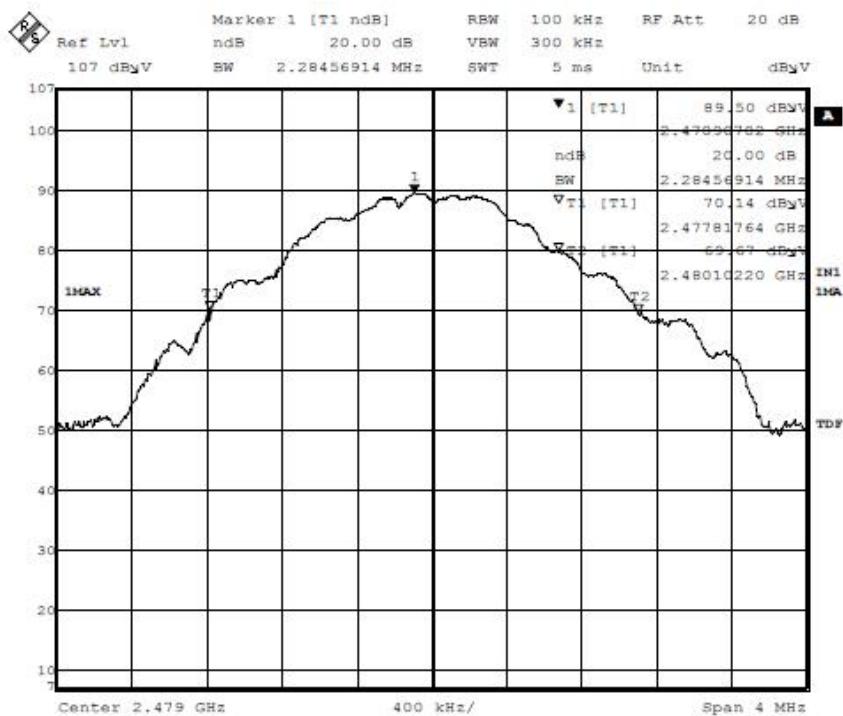
Test Result: Result data graph is shown at the next pages for reference.



Low Channel – Bandwidth 2.357MHz



Mid Channel – Bandwidth 2.311MHz

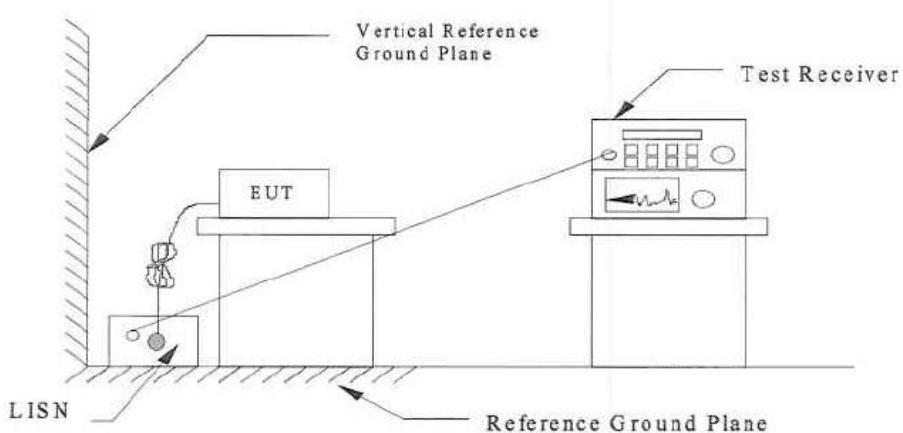


High Channel – Bandwidth 2.292 MHz

4.5 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement: FCC part 15 Section 15.207 Class B
 Test Method: ANSI C63.4:2009
 Test Date: ---
 Mode of Operation: ---
 Detector Function: Quasi-peak, average
 Measurement BW: 9 kHz

Test Setup:



Result: N/A

Remark: This test not applicable for battery operated device.

Limits for Conducted Emission [Section 15.207]:

Frequency Range [MHz]	Quasi-Peak Limit [dB μ V]	Average Limit [dB μ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Remarks:

Calculated measurement uncertainty: ± 2.8 dB



5.0 List of Measurement Equipment

Radiated Emission and Bandwidth Emissions

Manufacturer	Description	Model no.	Serial no.	CAL due
ETS.LINDGREN	FACT-3 EMC CHAMBER	FACT-3	3803N/A	N/A
Agilent	Spectrum Analyzer	E4440A	US41421290	Jul. 16 2015
R&S	EMI Test Receiver	ESIB26	100388	Jun 10, 2015
ETS.LINDGREN	BICONILOG ANTENNA	3142C	00060439	Nov 29, 2015
ETS.LINDGREN	DOUBLE-RIDGEN WAVEGUIDE	3117	00075933	NoV 15 2015
CHENGDU AINFO INC	STANDARD GAIN HORN ANTENNA (18GHz – 26.5Ghz)	JXTXLB-42-15-C-KF	J2021100721 001	Jan 25, 2015

Conducted Emissions

Manufacturer	Description	Model no.	Serial no.	CAL due
ETS.LINDGREN	SHIELDING ROOM	RFD-100	3802	N/A
R&S	EMI Test Receiver	ESIB26	100388	Jun 10, 2015
R&S	LISN	ESH3-Z5	100102	Mar 21, 2015
R&S	LISN	ENV216	100261	Jun 10, 2015

N/A Not Applicable or Not Available