

FCC Test Report

Application No.: T31620280089EM

Applicant: SUPER TECHNOLOGY LTD.

Address: Suite #1203, Chinachem Golden Plaza,
77 Mody Road, Tsim Sha Tsui,
East KLN, Hong Kong.

Product Information:

Product Description: 2.4GHz Toy Car

Item No.: 00238

P.O./Ref. No.: CARS 3 – LIGHTNING MCQUEEN – HIGH PERFORMANCE RACER

Product Class : Low Power Communication Device –Tranceiver (2.4 GHz)

FCC ID: NVB16-R-2005

Requirement: CFR 47 FCC PART 15 SUBPART C, 2016
Intentional Radiators (Section 15.249)

Date of Receipt: 2016-12-28

Date of Test: 2017-01-04 to 2017-02-14

Date of Issue: 2017-02-15

Test Result :	PASS*
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In the configuration tested, the EUT complied with the requirements for the relevant clauses of Federal Communications Commission Rules as specified above.

Authorized Signature:



TSANG KA TING, Calvin

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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2 Test Summary

Test	Test Requirement	Test Method	Result
Conducted Emission (150KHz to 30MHz)	FCC PART 15, SUBPART C: 2016	ANSI C63.10:2013	N/A
Radiated Emission (9kMHz to 1GHz)	FCC PART 15, SUBPART C: 2016	ANSI C63.10:2013	PASS
Radiated Emission above 1 GHz	FCC PART 15, SUBPART C: 2016	ANSI C63.10:2013	PASS
Restricted-band band- edge measurements (Radiated Emission)	FCC PART 15, SUBPART C: 2016	ANSI C63.10:2013	PASS
20dB bandwidth	FCC PART 15, SUBPART C: 2016	ANSI C63.10:2013	PASS

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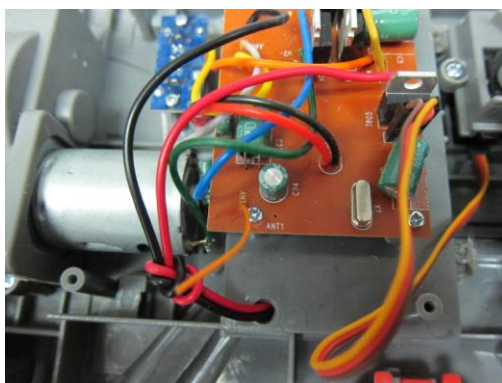
4 General Information

4.1 General Description of EUT

Product Description: 2.4GHz Toy Car
Item No.: 00238
Serial No.: --

4.2 Details of EUT

Power Supply: AC120V 60Hz (Adaptor no.: HYT-0841000) for battery charging
DC 7.2V (Rechargeable battery x 1)
Operating Frequency: 2410-2475MHz
Antenna Type: Unreplaceable internal Integral antenna



Modulation Type: GFSK

Test frequency tested are the lowest channel: 1 channel (2410MHz), middle channel: 2 channel (2443MHz) and highest channel: 3 channel (2475MHz)

Channel configuration method:

1. Hold the button and then power on the switch to enter test mode.
2. Press the button to change the channel from low to high frequency

4.3 Conditions of EUT

The received sample was under good condition.

4.4 Description of Support Units

1. All field strength measures in this test report were done by the sample which set the frequency fixed with continuous transmission

4.5 Standards Applicable for Testing

CFR 47, FCC Part 15, 2016
ANSI C63.10:2013

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4.6 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch E&E Lab,
No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China.
518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.7 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**
CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.
- **VCCI**
The 3m Semi-anechoic chamber, Full-anechoic Chamber and Shielded Room (7.5m x 4.0m x 3.0m) of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2197, G-416, T-1153 and C-2383 respectively.
- **FCC – Registration No.: 556682**
SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.
- **Industry Canada (IC)**
The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1.

4.8 Deviation from Standards

None.

4.9 Abnormalities from Standard Conditions

None.

4.10 Declaration of Family Grouping

None.

4.11 Abbreviations

N/A: Not Applicable

EUT: Equipment Under Test

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4.12 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Duty cycle	0.37%
2	Occupied Bandwidth	3%
3	RF conducted power	0.75dB
4	Conducted Spurious emissions	0.75dB
5	Radiated Spurious emission test	4.5dB (30MHz-1GHz)
		4.8dB (1GHz-25GHz)
6	Temperature test	1°C
7	Humidity test	3%
8	Supply voltages	1.5%
9	Time	3%

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5 Equipments Used during Test

RE in Chamber						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2016-05-13	2017-05-13
2	EMI Test Receiver	Agilent Technologies	N9038A	SEM004-05	2015-09-16	2016-09-16
3	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2014-11-01	2017-11-01
4	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEM003-11	2015-10-17	2018-10-17
5	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEM003-12	2014-11-24	2017-11-24
6	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2016-04-25	2017-04-25
7	Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A
8	DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2015-10-09	2016-10-09
9	Loop Antenna	Beijing Daze	ZN30401	SEM003-09	2015-05-13	2018-05-13

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RE in Chamber						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2016-05-13	2017-05-13
2	EMI Test Receiver	Rohde & Schwarz	ESIB26	SEM004-04	2016-04-25	2017-04-25
3	BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-02	2014-11-15	2017-11-15
4	Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2015-10-09	2016-10-09
5	Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2015-06-14	2018-06-14
6	Horn Antenna (18-26GHz)	ETS-Lindgren	3160	SEM003-12	2014-11-24	2017-11-24
7	Horn Antenna(26GHz-40GHz)	A.H.Systems, inc.	SAS-573	SEM003-13	2015-02-12	2018-02-12
8	Low Noise Amplifier	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2015-10-09	2016-10-09
9	Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A

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6 Test Results

6.1 Conducted Emissions Mains Terminals, 150kHz to 30MHz

Test Requirement: FCC Part15 C
Test Method: ANSI C63.10:2013
Test Date: Not Applicable

Remark:

This test is not applicable as the EUT is battery operated.

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6.2 Radiated Emissions, 9kHz to 1GHz

Test Requirement: FCC Part15 Subpart C Section 15.209 and 15.249(d)
Test Method: ANSI C63.10
Test Date: 2017-01-06
Frequency Range: The lowest frequency generated by EUT, 16MHz to 1GHz
Measurement Distance: 3m
Detector: Peak for pre-scan
(200Hz resolution bandwidth and 1kHz video bandwidth for measurement between 9kHz – 150kHz)
(9kHz resolution bandwidth and 100kHz video bandwidth for measurement between 150kHz – 30MHz)
(120kHz resolution bandwidth and 1MHz video bandwidth for measurement between 30MHz to 1GHz)
Quasi-Peak if maximised peak within 6dB of limit

Limit :

Frequency range MHz	Quasi-peak limits dB (µV/m)
0.009 – 0.490	-72.4 – 20logF(MHz)
0.490 – 1.705	-12.4 – 20logF(MHz)
1.705 – 30.0	-10.5
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960	54
Note: 1) At transitional frequencies the lower limit applies. 2) F is the frequency of the spurious emission measured in MHz. 3) Limit from 0.009 – 30 MHz is converted from measuring distance 300m or 30m to 3m with the formula provided in FCC Part 15, section 15.31(f)(2)	

6.2.1 EUT Operation

Operating Environment:

Temperature: 23 °C Humidity: 59 %

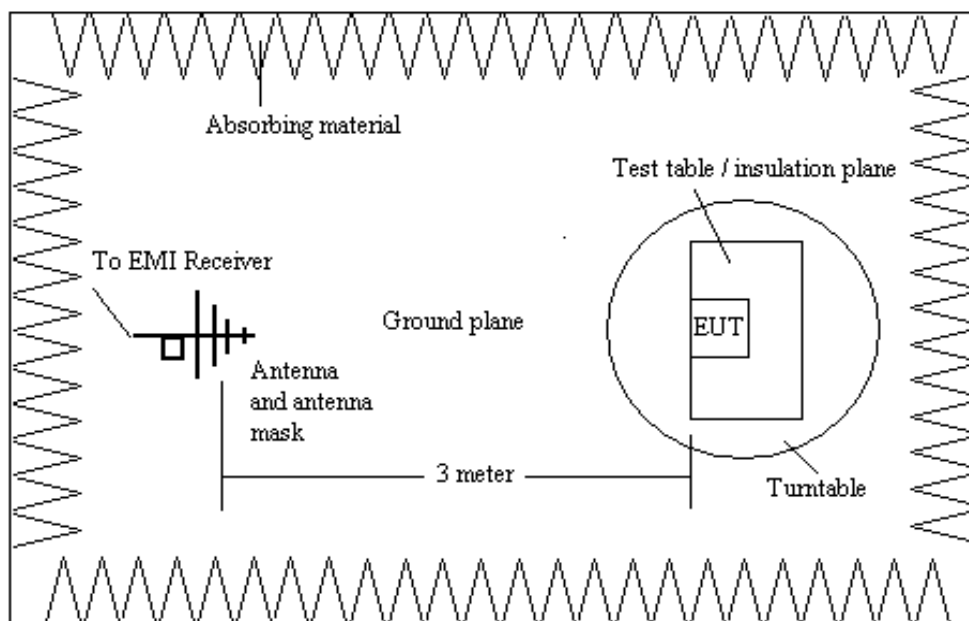
EUT Operation: Pre-test with Peak detector with the following mode(s):
1: Transmission in continuous transmitting mode
2: Test in lowest, middle and high frequency

Final test with Quasi-Peak detector with the following mode(s):
1: Transmission in continuous transmitting mode
2: Test in lowest, middle and high frequency

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6.2.2 Test Setup and Procedure



1. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
7. Test the EUT in the lowest channel, the middle channel, the Highest channel
8. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the Y axis positioning which it is worse case.
9. Repeat above procedures until all frequencies measured was complete.

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6.2.3 Measurement Data

Test results:

(1) Operation Frequency : 2410MHz

Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
30.250	H	19.1	4.3	23.4	40.0	-16.6
53.938	V	11.2	5.2	16.4	40.0	-23.6
121.313	H	11.4	5.6	17.0	43.5	-26.5
296.500	V	13.9	5.8	19.7	46.0	-26.3
498.438	V	18.8	5.8	24.6	46.0	-21.4
965.813	V	23.4	3.5	26.9	54.0	-27.1

(2) Operation Frequency : 2443MHz

Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
30.313	V	19.1	4.4	23.5	40.0	-16.5
64.000	V	9.7	9.0	18.7	40.0	-21.3
138.000	V	11.7	5.4	17.1	43.5	-26.4
292.188	H	13.7	5.8	19.5	46.0	-26.5
522.250	V	19.1	5.4	24.5	46.0	-21.5
941.688	V	23.1	3.5	26.6	46.0	-19.4

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(3) Operation Frequency : 2475MHz

Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
30.250	V	19.1	4.6	23.7	40.0	-16.3
47.500	V	12.6	5.2	17.8	40.0	-22.2
86.938	H	9.4	5.9	15.3	40.0	-24.7
128.438	V	11.6	5.5	17.1	43.5	-26.4
299.438	V	14.0	5.8	19.8	46.0	-26.2
661.500	V	20.6	5.1	25.7	46.0	-20.3

Note:

- 1) All readings are Quasi-Peak values.
- 2) Correction Factor = Antenna Factor + Cable Loss.
- 3) The above results were the worst case results with the EUT positioned in all 3 axis during the test. The EUT was positioned vertically and horizontally on the table for vertical and horizontal measurement respectively.
- 4) Other emissions more than 20dB below the limit are not shown on the above table and only worst six emissions below 1GHz are listed.

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6.3 Radiated Emissions above 1 GHz

Test Requirement: FCC Part15 Subpart C Section 15.209 & 15.249(a) & (d)
Test Method: ANSI C63.10
Test Date: 2017-01-06
Frequency Range: 1GHz – 26GHz
Measurement Distance: 3m
Detector: Peak for pre-scan (1MHz resolution bandwidth, 1MHz video bandwidth)
Average and Peak detector for final test

Limit :

Fundamental Frequency :

Frequency range MHz	Limits (Peak) dB (µV/m)	Limits (Average) dB (µV/m)
2400 to 2483.5	114	94

Spurious Emission :

Frequency range MHz	Limits (Peak) dB (µV/m)	Limits (Average) dB (µV/m)
Over 1000	74	54

6.3.1 EUT Operation

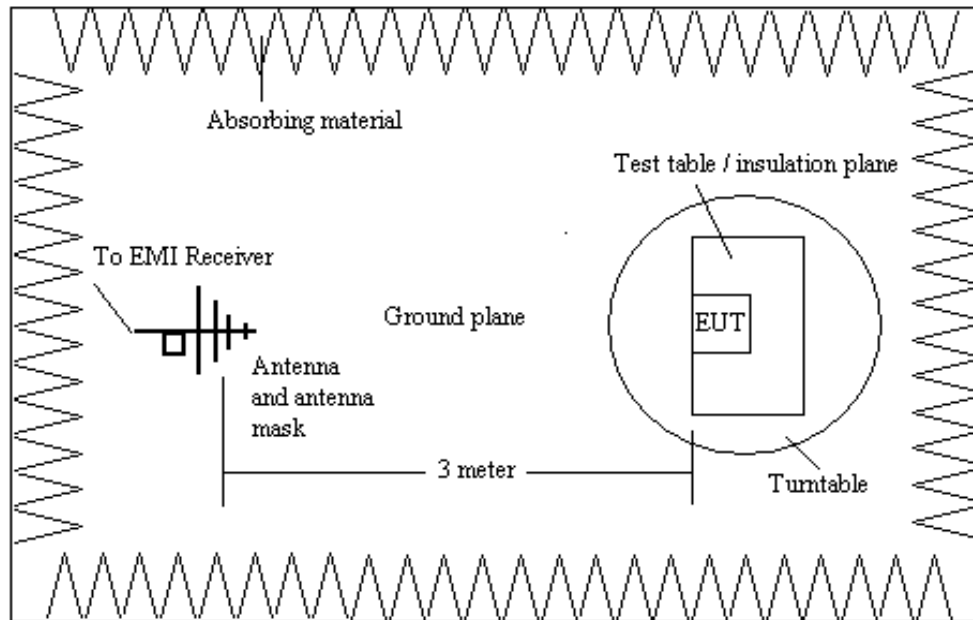
Operating Environment:

Temperature: 23 °C Humidity: 59 %

EUT Operation: Pre-test with Peak detector with the following mode(s):
1: Transmission in continuous transmitting mode
2: Test in lowest, middle and high frequency

Final test with Peak and Average detector with the following mode(s):
1: Transmission in continuous transmitting mode
2: Test in lowest, middle and high frequency

6.3.2 Test Setup and Procedure



1. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
7. Test the EUT in the lowest channel, the middle channel, the Highest channel
8. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the Y axis positioning which it is worse case.
9. Repeat above procedures until all frequencies measured was complete.

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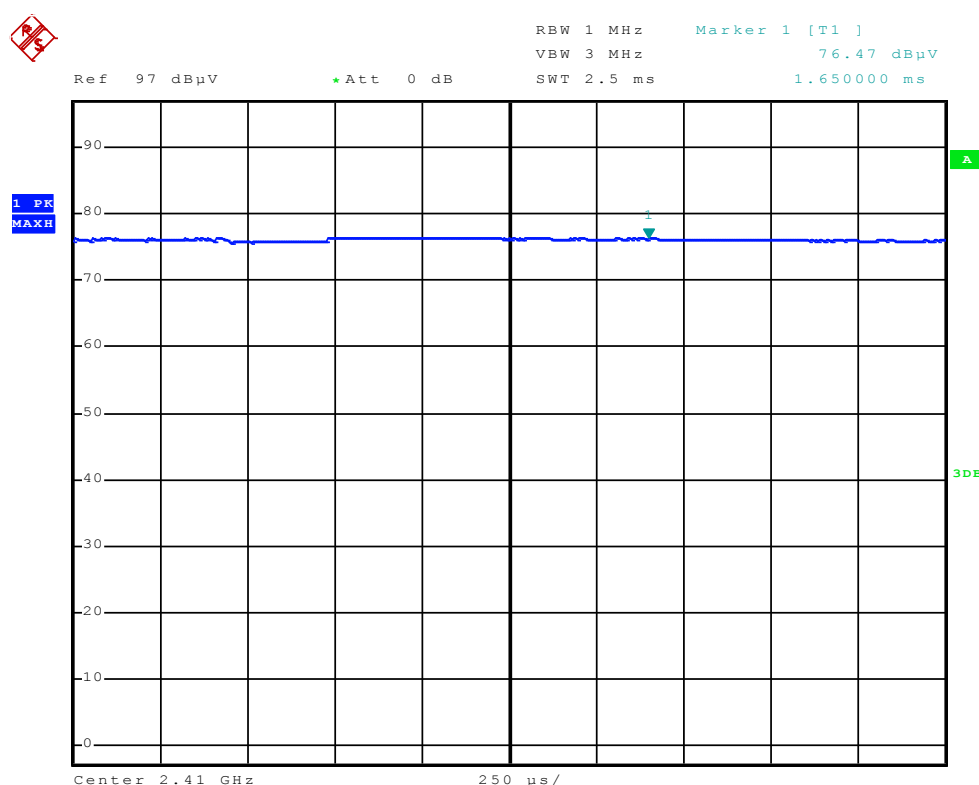
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6.3.3 Measurement Data

An initial pre-scan was performed in the 3m chamber using the spectrum analyser in peak detection mode. The EUT was measured with 2 orthogonal polarities and frequencies of average emissions from the EUT were measured as follows:

Emission at the fundamental frequency for the pulse modulated device was measured with the peak detector function of the test receiver and was properly adjusted for the duty cycle correction factor as pulse desensitization to calculate the average emission value.

Time Domain Plots (Fundamental frequency of Transmitter) :



According to above plot, the duty cycle of this device is 100%, pulsed operation according to C63.10 clause 7.5 is not employed and the average correction calculation is not applied on this report.

Hence, the average measurement is used below setting:

Dectector = peak

RBW = ≥ 1 MHz

VBW = ≥ 1 Hz

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Test results :

(1) Fundamental Frequency

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
2410.0	H	91.71	62.17	114	94	Pass
2410.0	V	91.98	61.64	114	94	Pass
2443.0	H	90.46	61.53	114	94	Pass
2443.0	V	91.77	62.92	114	94	Pass
2475.0	H	89.37	61.30	114	94	Pass
2475.0	V	91.51	63.13	114	94	Pass

(2) Spurious Emission

Operation Frequency : 2410.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
4194.000	H	41.90	26.46	74	54	Pass
4820.000	H	44.60	31.98	74	54	Pass
5693.000	H	45.50	30.52	74	54	Pass
7230.000	H	53.10	38.65	74	54	Pass
9640.000	H	51.00	36.33	74	54	Pass
12050.000	H	50.90	36.18	74	54	Pass

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Operation Frequency : 2443.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
4110.000	V	41.40	26.55	74	54	Pass
4886.000	V	45.90	29.90	74	54	Pass
5727.000	H	45.70	30.89	74	54	Pass
7329.000	H	51.70	38.69	74	54	Pass
9762.000	H	51.00	35.40	74	54	Pass
12195.000	V	51.30	36.25	74	54	Pass

Operation Frequency : 2475.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
3958.000	H	42.2	26.91	74	54	Pass
4950.000	V	46.4	30.02	74	54	Pass
6956.000	V	49.5	34.08	74	54	Pass
7425.000	V	51.5	37.22	74	54	Pass
9900.000	V	50.6	36.19	74	54	Pass
12375.000	H	52.0	36.97	74	54	Pass

Note:

- 1) The above results were the worst case results with the EUT positioned in all 3 axis during the test. The EUT was positioned vertically and horizontally on the table for vertical and horizontal measurement respectively.
- 2) Other emissions more than 20dB below the limit are not shown on the above table and only worst six emissions below 1GHz are listed.
- 3) There is not any other emission which falls in restricted bands which set out in Section 15.205 Restricted bands can be detected and reported.

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6.4 Restricted-band band-edge measurements (Radiated Emission)

Test Requirement: FCC Part15 Subpart C Section 15.215, 15.249(d)
Test Method: ANSI C63.10
Measurement Distance: 3m
Detector: (1MHz resolution bandwidth, 3MHz video bandwidth)
Average and Peak detector
Limit: 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 field strength limits listed in RSS-Gen, whichever is less stringent.

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test Date: 2017-01-06
EUT Operation: 1: Transmission with GFSK
Result: Pass

Test results : (Worst case: Transmissin with GFSK)

Operation frequency : 2410.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
2400.0	H	60.95	38.94	74	54	Pass

Operation frequency : 2475.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
2483.5	H	60.43	39.48	74	54	Pass

According to above bandedge measurement, emissions radiated outside of the specified frequency bands, (2400-2483.5)MHz except for harmonics, are below general field strength limits under 15.209 It is deemed to comply with section 15.215 and 15.249(d)

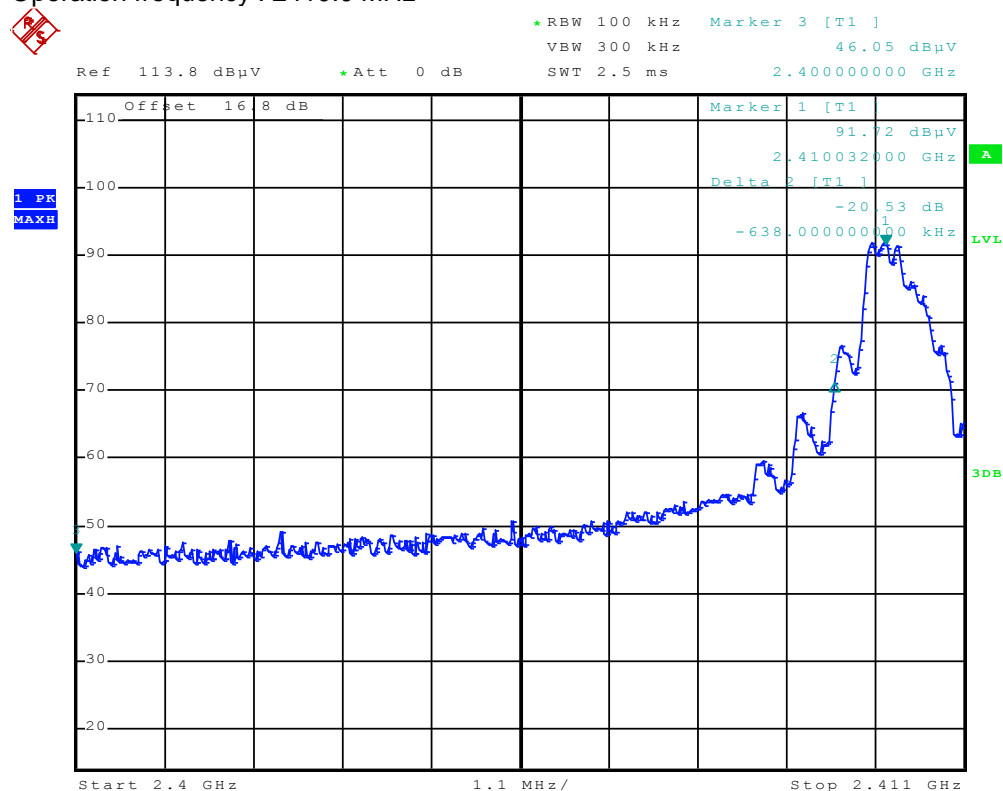
6.5 20 dB Bandwidth

Test Requirement: FCC Part15 Subpart C Section 15.215
Test Method: ANSI C63.10:2013
Test Date: 2017-02-14
EUT Operation: 1: Transmission with GFSK

Result: Pass

Test Plot : (Worst case: Transmission with GFSK)

Operation frequency : 2410.0 MHz

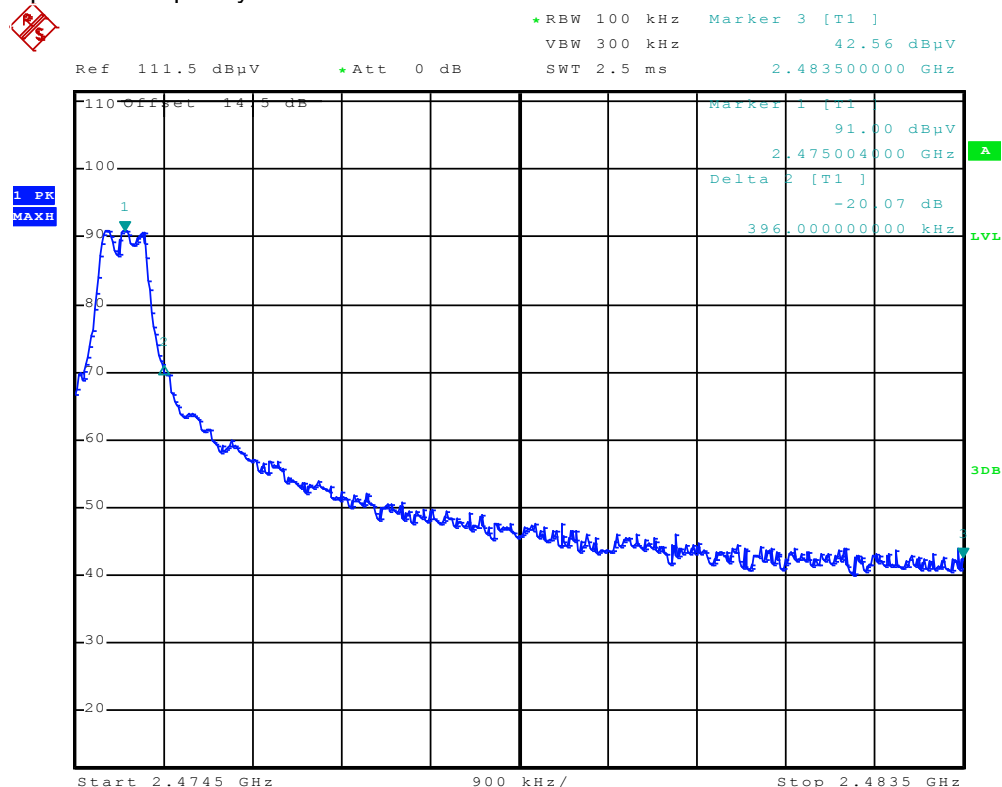


According to above plot, 20dB bandwidth falls in assigned band (2400-2483.5)MHz. It is deemed to comply with section 15.215

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Operation frequency : 2475.0 MHz



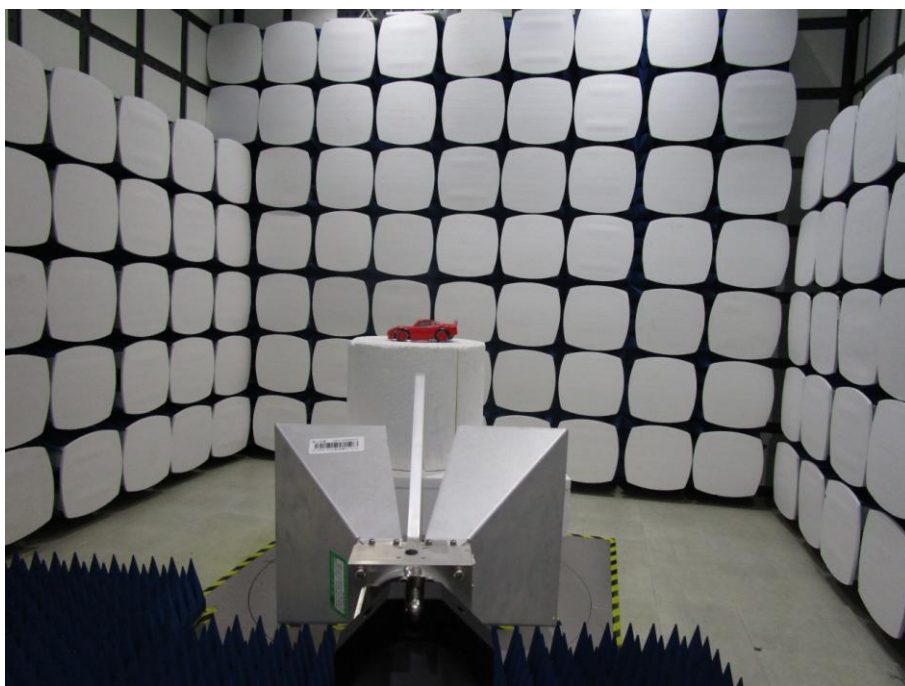
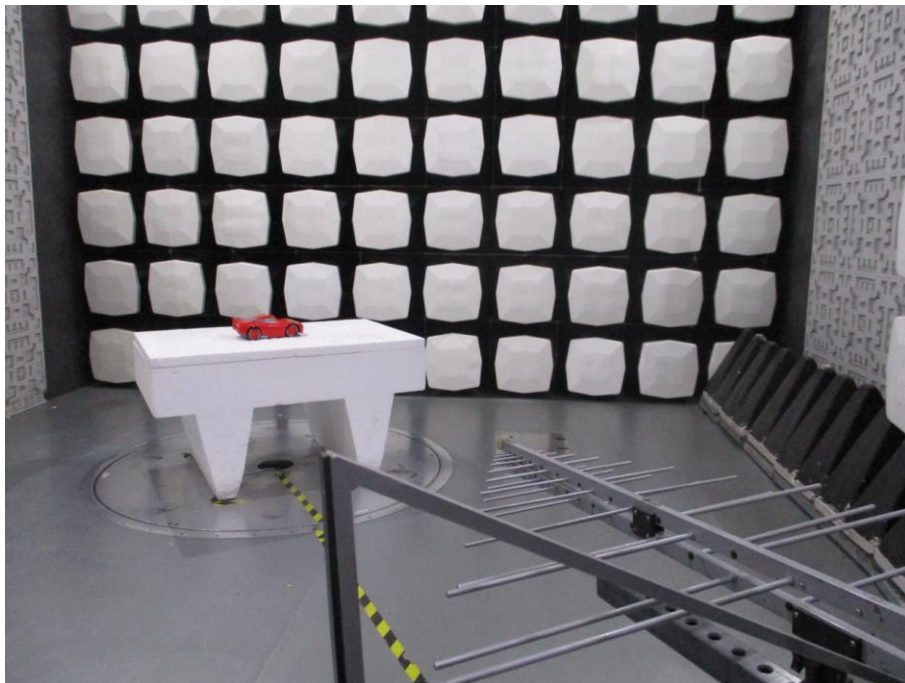
According to above plot, 20dB bandwidth falls in assigned band (2400-2483.5)MHz. It is deemed to comply with section 15.215

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7 Photographs

7.1 Radiatd Emission Test Setup



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7.2 EUT Constructional Details



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