



# FCC Test Report

Report No: FCS202305122W01

Issued for

Applicant:	Guangzhou Zhongxiao Maoyi Youxiangongsi
Address:	Nanshajie Chenghuijie 2hao 810fang Guangzhou Guangdong CN 510000
Product Name:	Science Kit
Brand Name:	CYOEST
Model Name:	CAR21
Series Model:	XLCAR2,TANK02,TANK01,XLCAR3,NWCAR2,NWC AR3,NWCAR4, NWCAR5,NWCAR6
FCC ID:	2A5C9-CAR21
<b>Issued By: Flux Compliance Service Laboratory</b> Add: Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan Tel: 769-27280901 Fax:769-27280901 <a href="http://www.FCS-lab.com">http://www.FCS-lab.com</a>	

**TEST RESULT CERTIFICATION**

Applicant's Name .....: Guangzhou Zhongxiao Maoyi Youxiangongsi  
Address.....: Nanshajie Chenghuijie Zhao 810fang Guangzhou Guangdong CN 510000  
Manufacture's Name .....: Guangzhou Zhongxiao Trading Co. · Ltd.  
Address.....: Room 810,No.2 Chenghui Street, Nansha Street, Nansha district, Guangzhou City,Guangdong Province, China

**Product Description**

Product Name .....: Science Kit  
Brand Name .....: CYOEST  
Model Name .....: CAR21  
Series Model.....: XLCAR2,TANK02,TANK01,XLCAR3,NWCAR2,NWCAR3,NWCAR4,NWCAR5,NWCAR6  
Test Standards.....: FCC Rules and Regulations Part 15 Subpart C, Section 231  
Test Procedure.....: ANSI C63.10:2013

This device described above has been tested FCS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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**Date of Test..... :**

Date (s) of performance of tests : May 12. 2023 ~ May 17. 2023

Date of Issue .....: May 17. 2023

Test Result.....: Pass

Tested by

:

*Scott Shen*

\_\_\_\_\_  
(Scott Shen)

Reviewed by

:

*Duke Qian*

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(Duke Qian)

Approved by

:

*Jack Wang*

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(Jack Wang)

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**Revision History**

Rev.	Issue Date	Effect Page	Contents
00	May 17. 2023	All	Initial Issue

## 1. SUMMARY OF TEST RESULTS

FCC Part 15.231, Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	--
15.209, 15.231(b)	Radiated Emission	PASS	--
15.231(a) (1)	Transmitter time	PASS	--
15.231(c)	20dB Bandwidth	PASS	
15.231	Duty cycle	PASS	--
15.203	Antenna Requirement	PASS	--

## NOTE:

(1) "N/A" denotes test is not applicable in this Test Report

(2) All tests are according to ANSI C63.10-2013

### 1.1 TEST FACTORY

Company Name:	Flux Compliance Service Laboratory
Address:	Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Telephone:	+86-769-27280901
Fax:	+86-769-27280901
FCC Test Firm Registration Number: 514908 Designation number: CN0127 A2LA accreditation number: 5545.01	

### 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately **95 %**.

No.	Item	Uncertainty
1	RF output power, conducted	$\pm 0.71$ dB
2	Unwanted Emissions, conducted	$\pm 2.98$ dB
3	Conducted Emission (9KHz-150KHz)	$\pm 4.13$ dB
4	Conducted Emission (150KHz-30MHz)	$\pm 4.74$ dB
5	All emissions, radiated (<1G) 30MHz-1000MHz	$\pm 3.2$ dB
6	All emissions, radiated (1GHz -18GHz)	$\pm 3.66$ dB
7	All emissions, radiated (18GHz -40GHz)	$\pm 4.31$ dB

## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Science Kit
Trade Name	CYOEST
Model Name	CAR21
Series Model	XLCAR2,TANK02,TANK01,XLCAR3,NWCAR2,NWCAR3,NWCAR4, NWCAR5,NWCAR6
Model Difference	Only different of model name.
Frequency	433.92MHZ
Modulation	OOK
Antenna type	External antenna
Battery	DC 3V from AAA battery
Hardware version number	V1.0
Software version number	V1.0
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	CYOEST	CAR21	External Antenna	N/A	0 dBi	Antenna

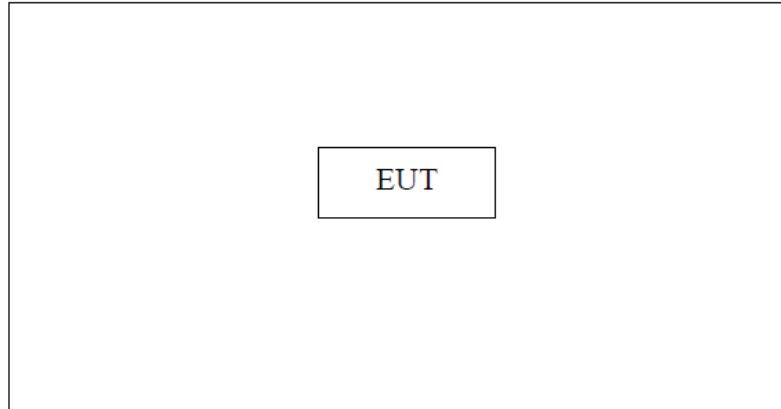
### 2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

This sample triggers the emission frequency via the remote control.



## Configuration and peripherals



### Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature range: 21-25°C

Humidity range: 40-75%

Pressure range: 86-106kPa

### 2.3 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

#### Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

#### Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

## 2.4 EQUIPMENTS LIST

### Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESRP 3	FCS-E001	2022.08.30	2023.08.29
Signal Analyzer	R&S	FSV40-N	FCS-E012	2022.08.30	2023.08.29
Active loop Antenna	ZHINAN	ZN30900C	FCS-E013	2022.08.30	2023.08.29
Bilog Antenna	SCHWARZBECK	VULB 9168	FCS-E002	2022.08.30	2023.08.29
Horn Antenna	SCHWARZBECK	BBHA 9120D	FCS-E003	2022.08.30	2023.08.29
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	FCS-E018	2022.08.30	2023.08.29
Pre-Amplifier(0.1M-3G Hz)	EMCI	EM330N	FCS-E004	2022.08.30	2023.08.29
Pre-Amplifier (1G-18GHz)	N/A	TSAMP-0518SE	FCS-E014	2022.08.30	2023.08.29
Pre-Amplifier (18G-40GHz)	TERA-MW	TRLA-0400	FCS-E019	2022.08.30	2023.08.29
Temperature & Humidity	HTC-1	victor	FCS-E005	2022.08.30	2023.08.29

### Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESPI	FCS-E020	2022.08.30	2023.08.29
LISN	R&S	ENV216	FCS-E007	2022.08.30	2023.08.29
LISN	ETS	3810/2NM	FCS-E009	2022.08.30	2023.08.29
Temperature & Humidity	HTC-1	victor	FCS-E008	2022.08.30	2023.08.29

### RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
Spectrum Analyzer	Keysight	N9020A	FCS-E015	2022.08.30	2023.08.29
Spectrum Analyzer	Agilent	E4447A	MY50180039	2022.08.30	2023.08.29
Spectrum Analyzer	R&S	FSV-40	101499	2022.08.30	2023.08.29

### 3. RADIATED EMISSION MEASUREMENT

#### 3.1 LIMIT

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part 15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed

#### LIMITS OF RADIATED EMISSION MEASUREMENT (0.009mhz - 1000mhz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

#### LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

#### LIMITS OF FIELD STRENGTH OF THE FUNDAMENTAL SIGNAL

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
433.92	100.83	80.83

Note: (1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector

(2) At frequencies below 30MHz, measurement may be performed at a distance closer then that specified, and the limit at closer measurement distance can be extrapolated by below formula:  
 $Limit_{3m}(dBuV/m) = Limit_{300m}(dBuV/m) + 40Log(300m/3m) = Limit_{300m}(dBuV/m) + 80$   
 $Limit_{3m}(dBuV/m) = Limit_{30m}(dBuV/m) + 40Log(30m/3m) = Limit_{30m}(dBuV/m) + 40$

#### (3) Limit for this EUT

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions include fundamental emission shall not exceed FCC 15.231 section (b) limit of comply with FCC 15.209 limit which permit higher emission level.

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters =  $56.81818(F) - 6136.3636$ ; for the band 260-470 MHz, uV/m at 3 meters =  $41.6667(F) - 7083.3333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

### 3.2 TEST PROCEDURE

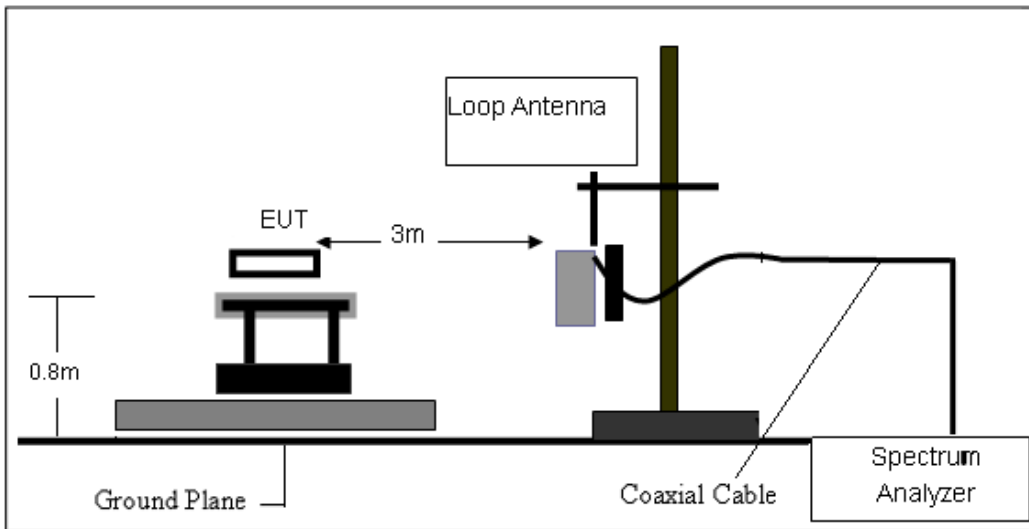
- a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- b. The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then QuasiPeak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

**Note:**

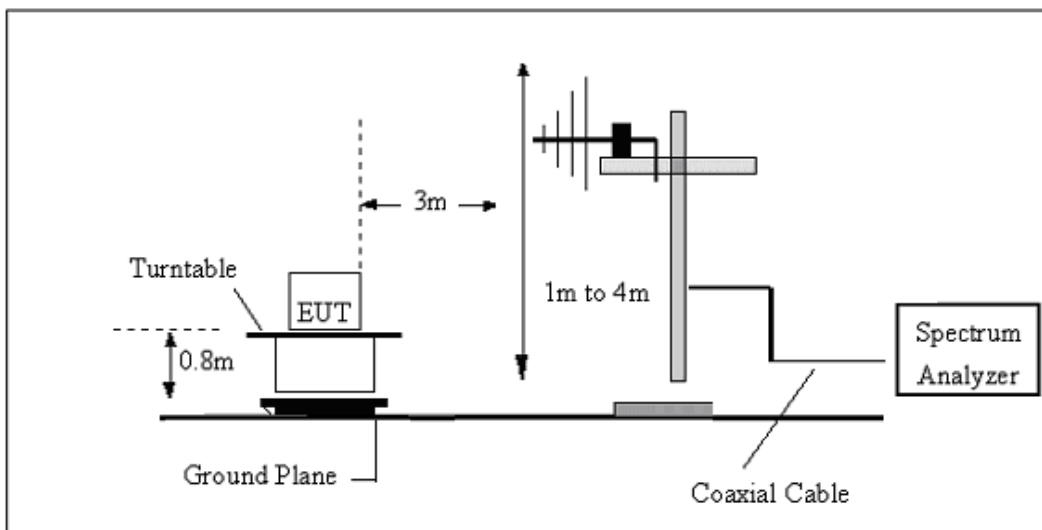
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

### 3.3 TEST SETUP

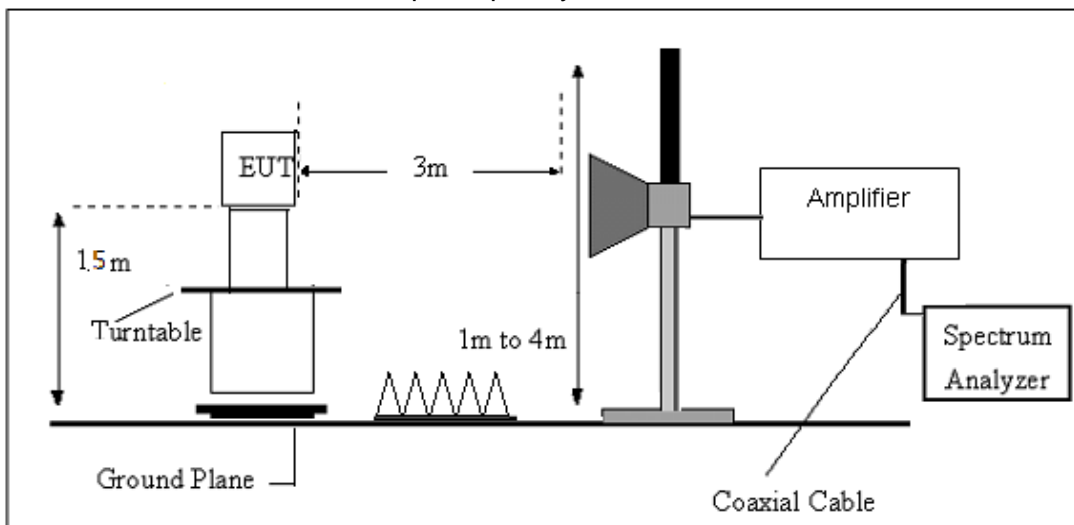
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



### 3.4 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Mode:	ASK	Test Voltage:	DC 3V

For field strength of the fundamental signal

#### Peak

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
433.92	85.63	17.53	3.02	29.43	76.75	100.83	-24.08	Horizontal
433.92	87.75	17.53	3.02	29.43	78.87	100.83	-21.96	Vertical

#### Avg

Frequency (MHz)	Peak Value (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
433.92	76.75	-13.66	63.09	80.83	-17.74	Horizontal
433.92	78.87	-13.66	65.21	80.83	-15.62	Vertical

#### Remarks:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *Average value = Peak value + Duty cycle factor*

For spurious emission

(9KHz-30MHz)

Freq.	Reading	Limit	Margin	State	Test Result
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	
--	--	--	--	--	PASS
--	--	--	--	--	PASS

#### Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log(\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

(30MHZ-1000MHZ)

Temperature:	23.5°C	Relative Humidity:	60%
Test Voltage:	DC 3V	Phase:	Horizontal
Test Mode:	TX		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	84.4100	43.37	-22.35	21.02	40.00	-18.98	peak
3	460.1200	33.61	-9.43	24.18	46.00	-21.82	peak
4	648.8600	30.67	-4.90	25.77	46.00	-20.23	peak
5	867.0840	47.12	-0.51	46.61	60.83	-14.22	peak
6	988.3100	29.08	2.15	31.23	54.00	-22.77	peak

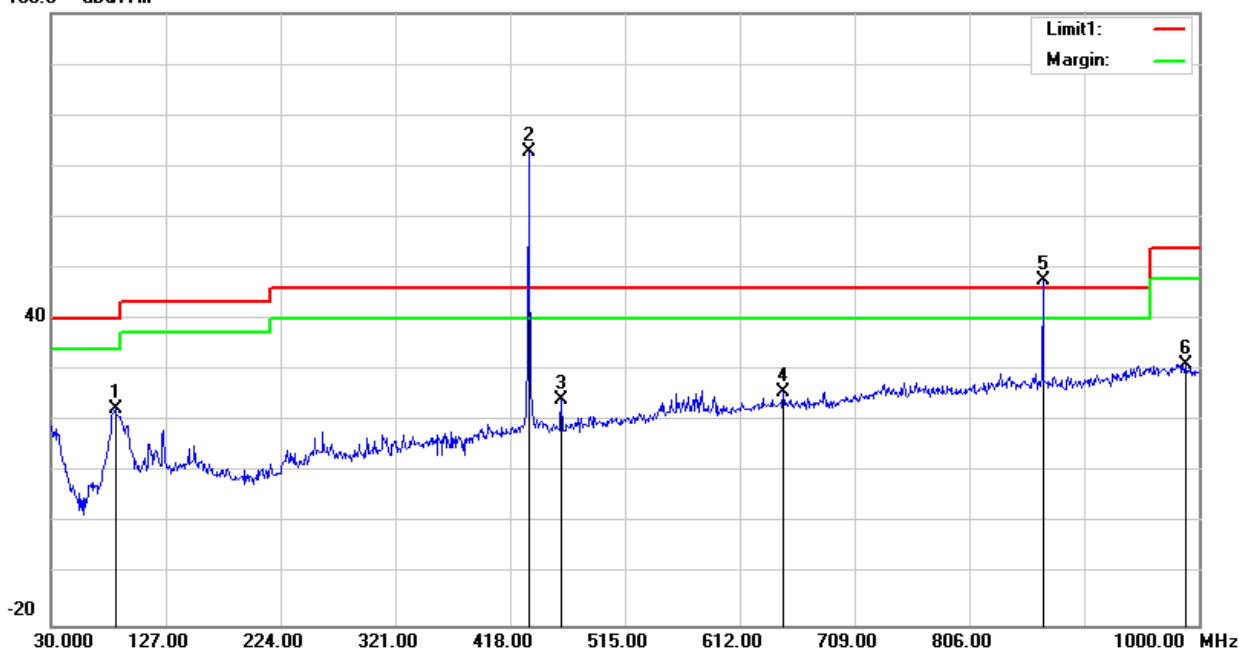
Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2	433.9200	83.01	-10.13	/	72.88	100.83	-27.95	peak
2	433.9200	83.01	-10.13	3.3	69.58	80.83	-11.35	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) - Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)

100.0 dBuV/m





Temperature:	22.7°C	Relative Humidity:	61%
Test Voltage:	DC 3V	Phase:	Vertical
Test Mode:	TX		

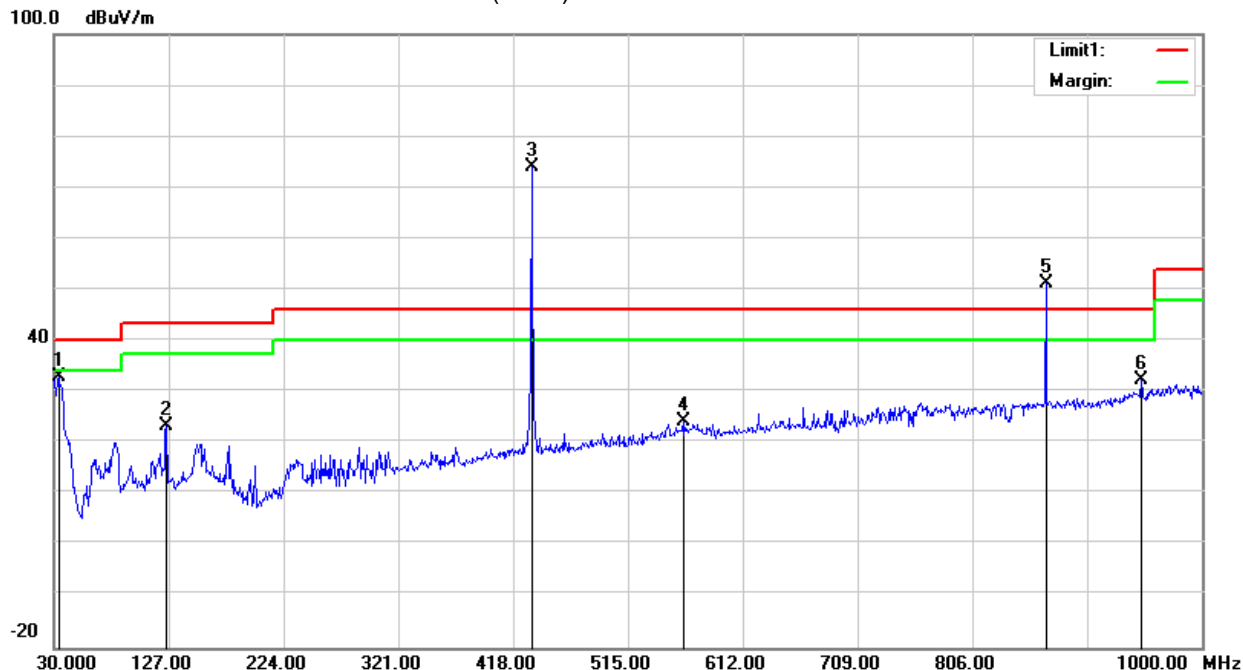
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	33.81	47.82	-14.8	33.02	40	-6.98	peak
2	125.06	41.65	-18.22	23.43	43.5	-20.07	peak
4	561.52	29.88	-5.51	24.37	46	-21.63	peak
5	867.84	50.63	-0.51	50.12	60.83	-10.71	peak
6	948.43	30.56	1.56	32.12	46	-13.88	peak

Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
3	433.9200	83.87	-10.13	/	73.74	100.83	-27.09	peak
3	433.9200	83.87	-10.13	3.3	70.44	80.83	-10.39	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result = Reading + Factor - Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)



**(Above ~ 1GHz)**

Frequency	Reading	Detector	Amplifier	Loss	Antenna Factor	Corrected Factor	Corrected Amplitude	FCC Part 15.231/15.209/205		RX
								Limit	Margin	Antenna Polar
(MHz)	(dBμV/m)	(PK/QP/AV)	(dB)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(H/V)
1301.86	64.12	PK	45.1	4.0	25.1	-16.00	48.12	74	-25.88	H
1301.86	63.38	PK	45.1	4.0	25.1	-16.00	47.38	74	-26.62	V
1735.69	64.01	PK	44.1	5.3	25	-13.80	50.21	74	-23.79	H
1735.69	65.88	PK	44.1	5.3	25	-13.80	52.08	74	-21.92	V
2169.78	62.86	PK	43.8	5.4	25.9	-12.47	50.39	74	-23.61	H
2169.78	62.67	PK	43.8	5.4	25.9	-12.47	50.20	74	-23.80	V
2603.42	58.12	PK	44.4	6.0	27.6	-10.77	47.35	74	-26.65	H
2603.42	58.79	PK	44.4	6.0	27.6	-10.77	48.02	74	-25.98	V

**Remarks:**

1. Above 2.6 GHz the amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. The peak value is less than the AV limit, so AV data does not need to be tested.

## 4. TRANSMITTER TIME

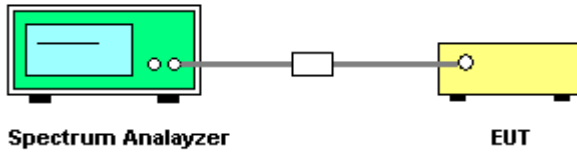
### 4.1 LIMIT

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released

### 4.2 TEST PROCEDURE

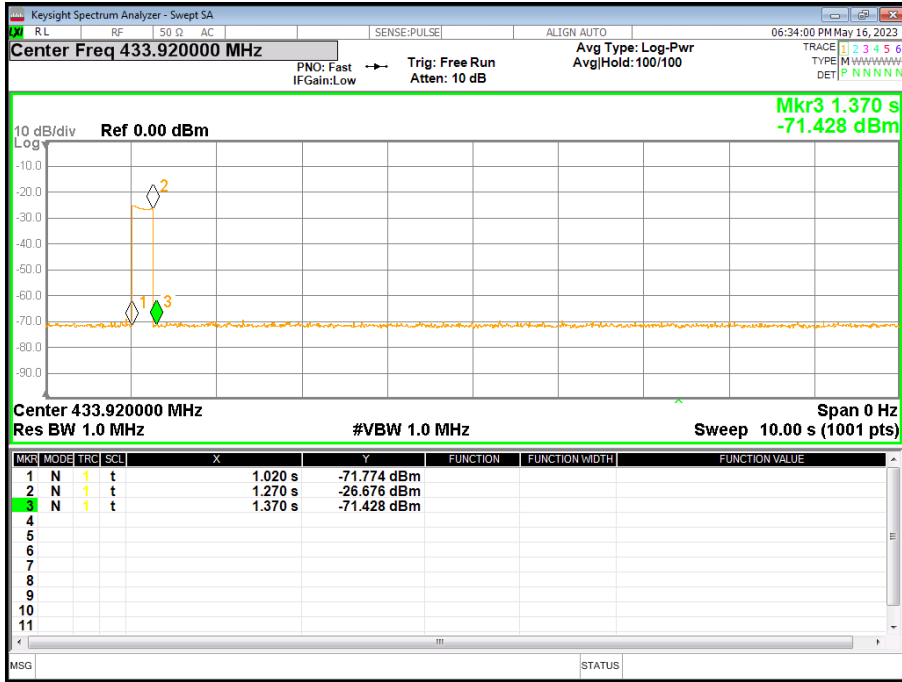
- a. The EUT' s RF signal was coupled to spectrum analyzer by antenna connected to spectrum analyzer.
- b. Set the spectrum to zero span mode, and centered of EUT frequency.
- c. Measure the stop transmitting time after release EUT button

### 4.3 TEST SETUP



4.4 TEST RESULTS

Activation time	Limit(Sec)	Result
0.35 s	5 s	Pass



- Mark 1: Hold down the Key (Start transmitting)
- Mark 2: Loose the Key
- Mark 3: Stop transmitting

Activation time= Mark 3- Mark 1=1.370-1.020=0.35 s

## 5. 20 DB BANDWIDTH TEST

### 5.1 LIMIT

The bandwidth of the emission shall be no wider than 0.25% of the center frequency of devices operation above 70MHz and below 900MHz.

### 5.2 TEST PROCEDURE

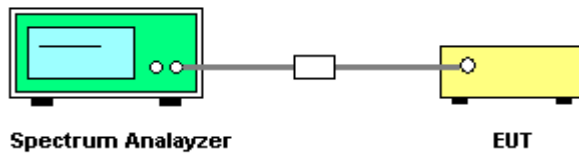
Connect EUT' s antenna output to spectrum analyzer by RF cable.

a.

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 10kHz RBW and 30kHz VBW. The 20dB bandwidth is defined as the total spectrum the

b. power of which is higher than peak power minus 20dB

### 5.3 TEST SETUP

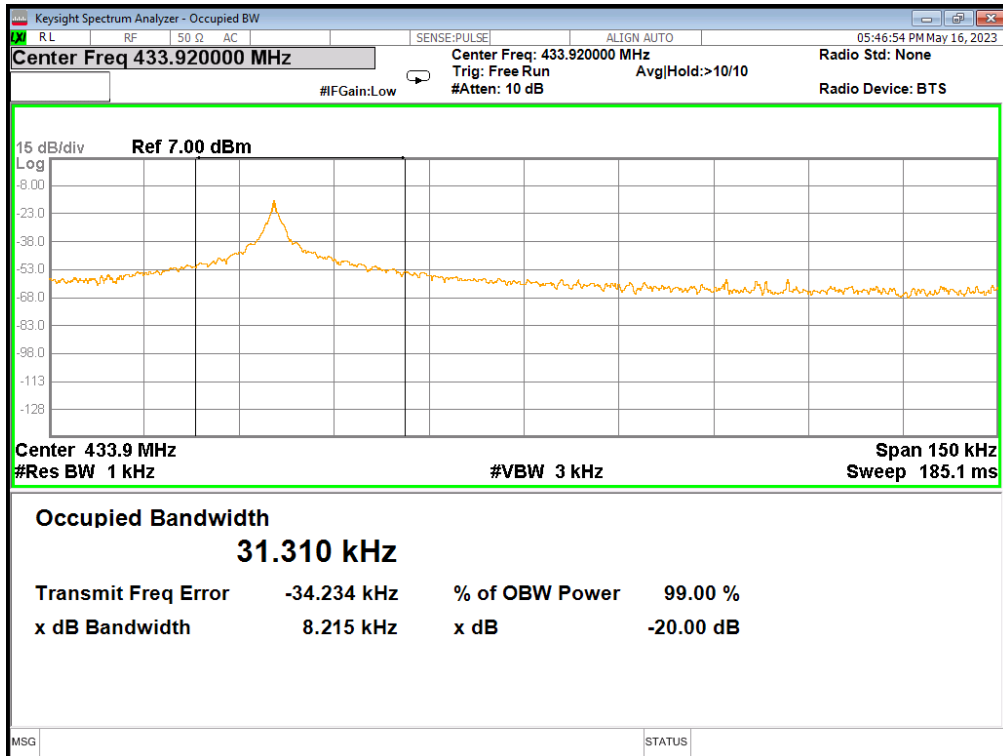


5.4 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	OOK	Test Voltage:	DC 3V

Centre Frequency	Measurement		
	20dB Bandwidth (KHz)	Limit(kHz)	Frequency Range (MHz)
433.92	8.215	1085	PASS

433.92MHz



## 6. DUTY CYCLE

### 6.1 LIMIT

None: for reporting purposes only.

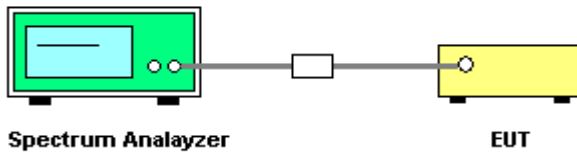
### 6.2 TEST PROCEDURE

Set the Centre frequency of the spectrum analyzer to the transmitting frequency;

- a. Set the span=0MHz, RBW=1 MHz, VBW=1 MHz, Sweep time=150ms;

Trace mode = Single hold

### 6.3 TEST SETUP



6.4 TEST RESULTS

FCC Part15.231(a)	
Total On interval in a complete pulse train(ms)	68.36
Length of a complete pulse train(ms)	100
Duty Cycle (%)	68.36%
Duty Cycle Correction Factor(dB)	3.30

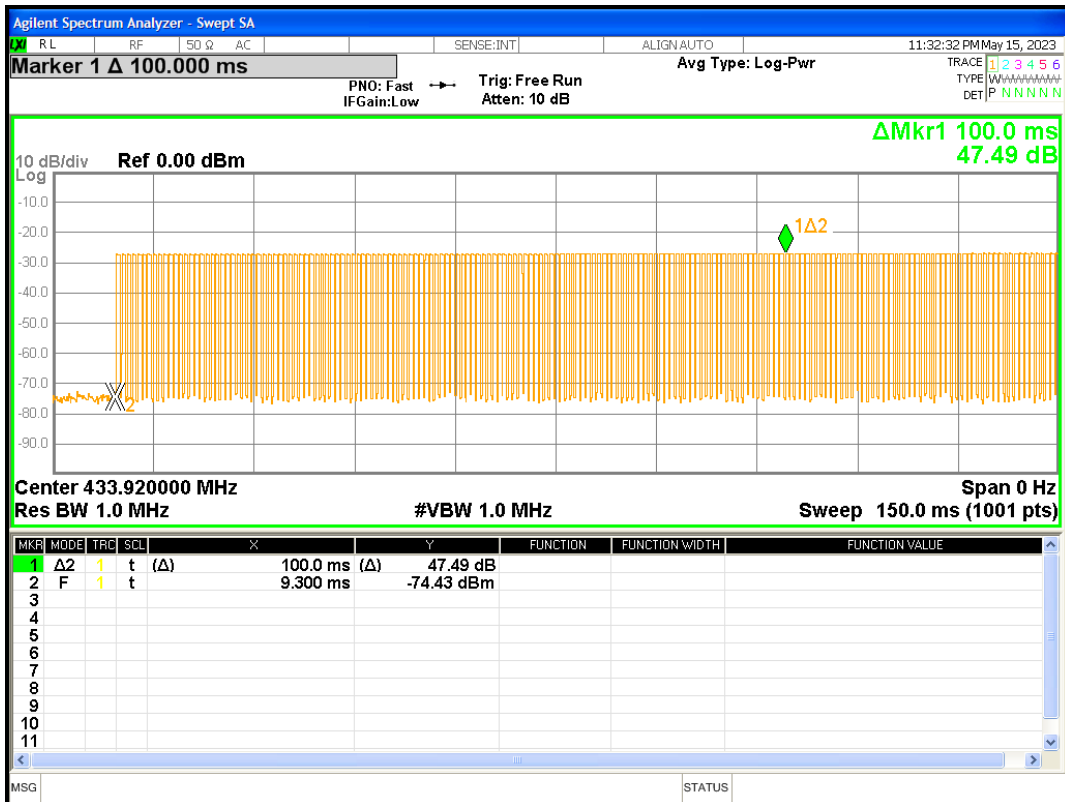
Refer to the duty cycle plot (as below), This device meets the FCC requirement. Length of a complete pulse train

Remark:FCC part15.35(c) required that a complete pulse train is more than 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

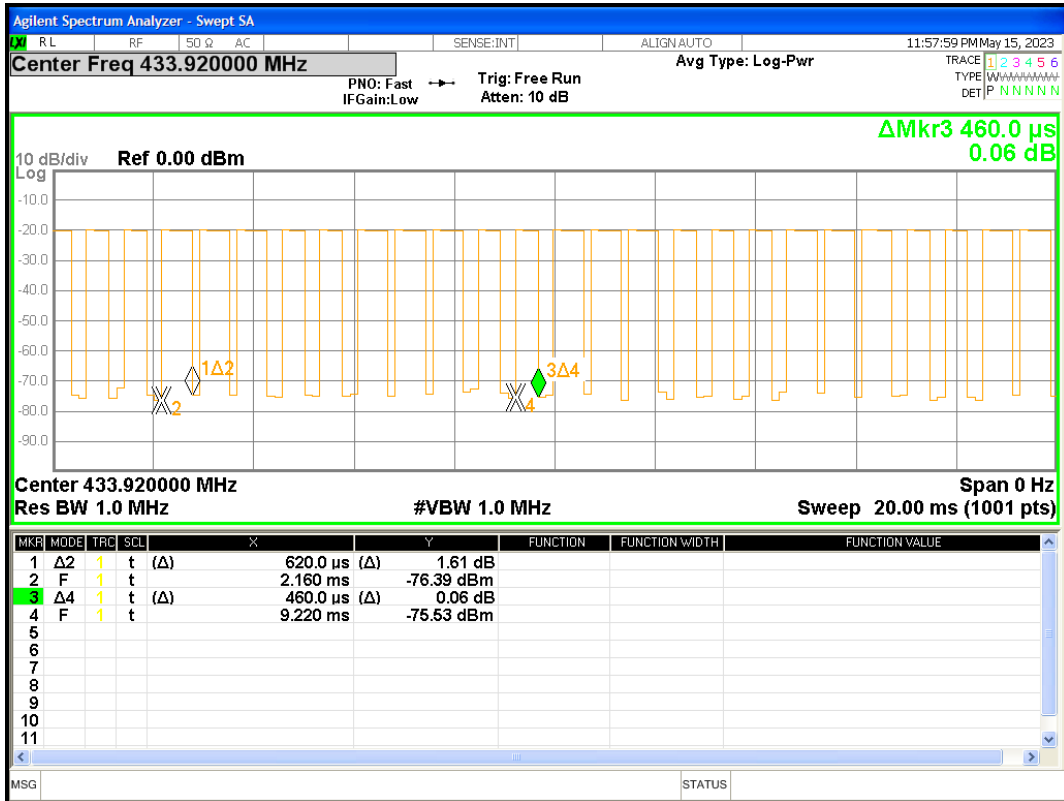
Note: Number of pulse train 1 = 61, Time of single pulse train 1 = 0.46ms;

Number of pulse train 2 = 65, Time of single pulse train 2 = 0.62ms;

Total on interval in a complete pulse train= Number of pulse train 1x Time of single pulse train 1+ Number of pluse train 2x Time of single pulse train 2=61x0.46+65x0.62=68.36ms







## 7 ANTENNA REQUIREMENT

### 7.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### 7.2 EUT ANTENNA

The antennas used for this product are External antenna and other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmitter antenna is 0dBi.

\*\*\*\*\*END OF THE REPORT\*\*\*\*\*