

FCC ID TEST REPORT

for

TPMS Internal Sensor

Model: C03

FCC ID: 2AC5BC03

Prepared for: Eekom Auto Parts(Shanghai) Limited
Room 226, Building 2, No.526, Gaoxiang Road, Pudong,
Shanghai, China

Prepared by: Shenzhen TCT Testing Technology Co.,Ltd
1F, Building 1, Yibaolai Industrial Park, Qiaotou Village, Fuyong Town,
Baoan District, Shenzhen, Guangdong, China

TEL: +86-0755-27363339

FAX: +86-0755-27673332

Report Number: TCT140827E014

Date of Test: Aug. 27~Sept. 09, 2014

Date of Report: Sept. 10, 2014

The results detailed in this test report relate only to the specific sample(s) tested. It is the Application's responsibility to ensure that all production units are manufactured with equivalent EMC characteristics. This report is not to be reproduced except in full, without written approval from TCT Testing Technology.

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1.0 General Details

1.1 Test Lab Details

Name :	Shenzhen Tongce Testing Lab
Address:	1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China
Telephone:	13410377511
Fax:	--

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

FCC Registration Number: 572331

Shenzhen TCT Testing Technology Co., Ltd., Shenzhen EMC Laboratory: Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

Registration Number: 572331

Industry Canada (IC)

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

Registration Number IC: 10668A-1

1.2 Applicant Details

Applicant:	Eckom Auto Parts(Shanghai) Limited
Address:	Room 226, Building 2, No.526, Gaoxiang Road, Pudong, Shanghai, China
Telephone:	0769-86209968
Fax:	0769-86209967

Manufacturer:	Eckom Auto Parts(Shanghai) Limited
Address:	Room 226, Building 2, No.526, Gaoxiang Road, Pudong, Shanghai, China
Telephone:	0769-86209968
Fax:	0769-86209967

1.3 Description of EUT

Product:	TPMS Internal Sensor
Model No.:	C03
Additional Model No.:	C02, C01, C04, C05, T01, T02, T03, T04, T05
Brand Name:	N.A.
Rating:	DC 3V via battery The battery information: DC 3V Model: CR2050W
Operation Frequency:	433.92MHz
Modulation:	FSK
Antenna Designation:	An internal antenna and the gain is -3 dBi.

1.4 Statement:

All models above are identical in the circuit, PCB layout, internal structure, all of the housing are made of plastic material, and just the appearance are different, different model names are different for the marketing requirement.

1.5 Test Engineer

The sample tested by



Printed name: Jack Kang

2.0 Test equipments and Associated Equipment used during the test.

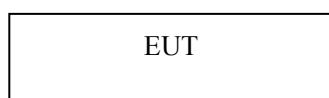
2.1 Test Equipments

Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	ROHDE&SCHWARZ	ESPI 3	100379	July 2, 2014	July 1, 2015
Spectrum Analyzer	ROHDE&SCHWARZ	FSEM	848597/001	July 3, 2014	July 2, 2015
Pre-amplifier	Teseq	LNA6900	--	July 3, 2014	July 2, 2015
Pre-amplifier	Agilent	8447D	83153007374	July 3, 2014	July 2, 2015
Pre-amplifier	Agilent	8449B	3008A01738	July 3, 2014	July 2, 2015
Loop antenna	A.R.A.	PLA-1030/B	1029	July 3, 2014	July 2, 2015
Ultra Broadband ANT	ROHDE&SCHWARZ	HL562	100157	July 3, 2014	July 2, 2015
Horn Antenna	ETS LINDGREN	3117	--	July 3, 2014	July 2, 2015
EMI Test Receiver	R&S	ESCS30	100139	July 2, 2014	July 1, 2015
LISN	AFJ	LS16C	16010222119	July 2, 2014	July 1, 2015

2.2 AE used during the test

Equipment type	Manufacturer	Model
N.A.		
N.A.		
N.A.		
N.A.		

2.3. Block Diagram of EUT Configuration



Note: New batteries are used for E.U.T during the test

3.0 Technical Details

3.1 Summary of test results

The EUT has been tested according to the following specifications

Requirement	CFR 47 Section	Result	Notes
Conduction Emission, 0.15MHz to 30MHz	15.207	PASS	N.A.
Radiation Emission	15.231(e), 15.205, 15.209, 15.35	PASS	Complies
Transmission time and silent time	15.23(e)	PASS	Complies
Occupied Bandwidth	15.231(c)	PASS	Complies

3.2 Test Standards

FCC Part 15:2012 Subpart C, Paragraph 15.231

4.0 EUT Modification

No modification by Shenzhen TCT Testing Technology Co., Ltd

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

No.	Item	MU
1.	Radio Frequency	$\pm 1 \times 10^{-9}$
2.	Temperature	$\pm 0.1^{\circ}\text{C}$
3.	Humidity	$\pm 1.0\%$
4.	RF power, conducted	$\pm 0.34\text{dB}$
5.	RF power density, conducted	$\pm 1.45\text{dB}$
6.	Spurious emissions, conducted	$\pm 3.70\text{dB}$
7.	All emissions, radiated	$\pm 4.50\text{dB}$

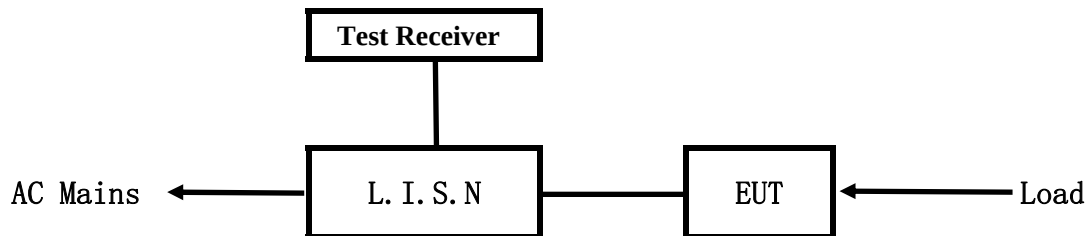
Note: 1) The EUT is powered by battery, and a New Battery was used during all tests.

2) Working transmission frequency: 433.92MHz

3) N.A. means Not Applicable.

6.0 Power Line Conducted Emission Test

6.1 Schematics of the test



EUT: Equipment Under Test

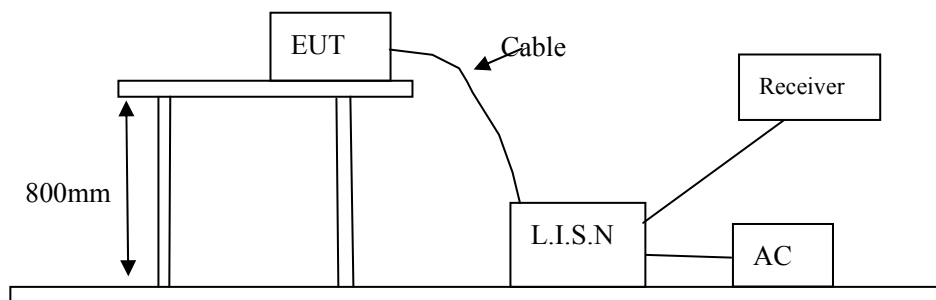
6.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.10-2009 and ANSI C63.4-2003.

The Frequency spectrum From 0.15MHz to 30MHz was investigated.

Test Voltage: 120V~, 60Hz

Block diagram of Test setup



6.3 EUT Operating Condition

Operating condition is according to ANSI C63.10 -2009 and ANSI C63.4-2003

- 1) Setup the EUT and simulators as shown on the following
- 2) Enable AF signal and confirm EUT active to normal condition

6.4 Test Equipment

Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
EMI Test Receiver	R&S	ESCS30	100139	July 2, 2014	July 1, 2015
LISN	AFJ	LS16C	16010222119	July 2, 2014	July 1, 2015

6.5 Conducted Emission Limit

Frequency(MHz)	Class A Limits (dB μ V)		Class B Limits (dB μ V)	
	Quasi-peak Level	Average Level	Quasi-peak Level	Average Level
0.15 ~ 0.50	79.0	66.0	66.0~56.0*	56.0~46.0*
0.50 ~ 5.00	73.0	60.0	56.0	46.0
5.00 ~ 30.00	73.0	60.0	60.0	50.0

Notes: 1) *Decreasing linearly with logarithm of frequency.
2) The tighter limit shall apply at the transition frequencies

6.6 Test specification:

Environmental conditions: Temperature: 26° C Humidity: 55% Atmospheric pressure: 103kPa

Frequency range: 0.15 MHz – 30 MHz

The test was carried out in the following operation mode(s):

--

6.7 Test result

N.A.

The requirements are FULFILLED

Remarks: The power supply of this equipment is a battery, so this test item is not applicable

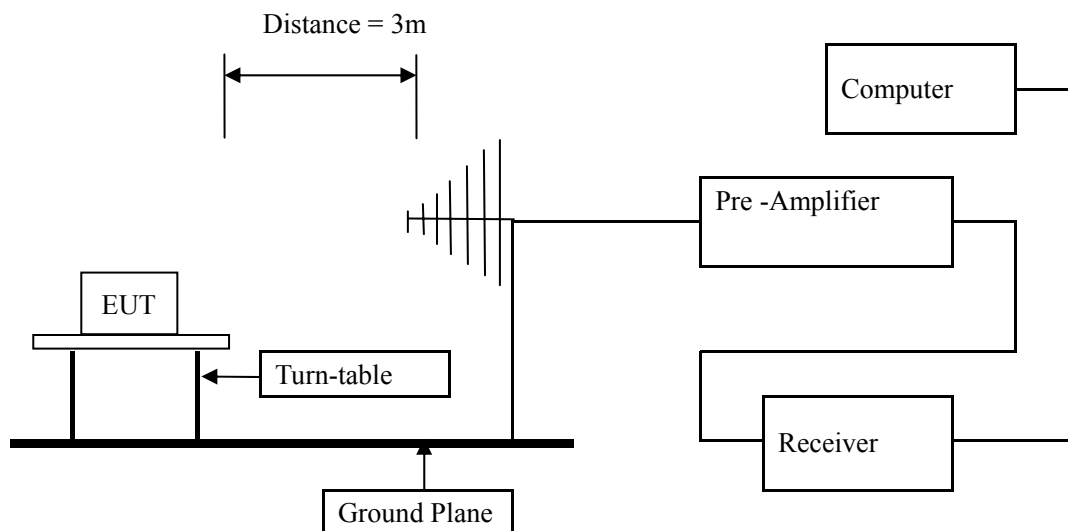
7.0 Radiated Emission Test

7.1 Test Method and test Procedure:

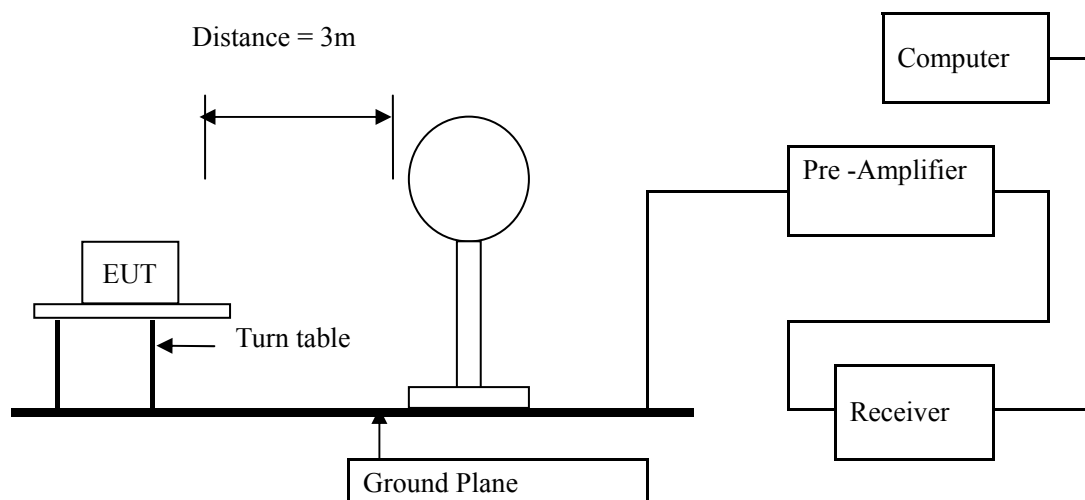
- 1) The EUT was tested according to ANSI C63.10 –2009 and ANSI C63.4-2003.
- 2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.10-2009 and ANSI C63.4-2003.
- 3) The frequency spectrum from 9kHz to 5GHz was investigated. All readings from 9kHz to 30MHz are quasi-peak values with a resolution bandwidth of 10 kHz, measured with loop antenna. All readings from 30MHz to 1 GHz are quasi-peak values with a resolution bandwidth of 120 kHz, measured with Bi-log antenna. All readings are above 1 GHz are peak values with a resolution bandwidth of 1 MHz, measured with horn antenna.
- 4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for above 30MHz each frequency. The antenna high is 1 m to find the maximum emission for each frequency below 30MHz
- 5) Tested distance: 3 meters
- 6) The antenna polarization: Vertical polarization and Horizontal polarization.
- 7) Each azimuth of E.U.T will be tested.

7.2 Block diagram of Test setup

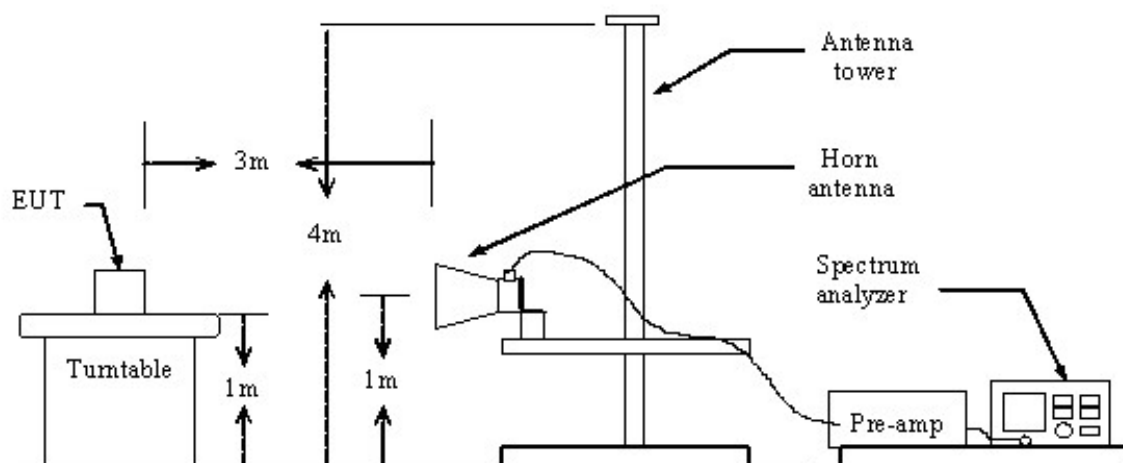
Block diagram of Test setup for frequency 30-1000MHz



Block diagram of Test setup for frequency below 30MHz



Block diagram of Test setup for frequency above 1GHz



7.3 Limit

According to 15.231(e) requirements, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following

Fundamental Frequency (MHz)	Filed Strength of Fundamental (microvolts/meter)	Filed Strength of Spurious Emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500	50 to 150
174-260	1,500	150
260-470	1,500 to 5,000	150 to 500
Above 470	5,000	500
*Linear interpolations		
[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, $\mu\text{V/m}$ at 3 meters = $22.7273(F) - 2454.5455$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $16.6667(F) - 2833.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]		

For this E.U.T

Working Frequency(MHz)	Filed Strength of Fundamental(dB $\mu\text{V/m}$)	Filed Strength of Spurious Emission(dB $\mu\text{V/m}$)
433.92	72.87	52.87
Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions.		

According to 15.35, on any frequency or frequencies below or equal to 1000 MHz, the limits Shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test.

According to 15.231(e) , The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

Frequencies in restricted band are complied to limit on Paragraph 15.209.

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
0.009-0.490	3	$20\log 2400/F$ (kHz) + 80
0.490-1.705	3	$20\log 24000/F$ (kHz) + 40
1.705-30	3	$20\log 30$ + 40
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

- Note:
- 1) RF Voltage (dBuV) = 20 log RF Voltage (uV)
 - 2) In the Above Table, the tighter limit applies at the band edges.
 - 3) Distance refers to the distance in meters between the measuring instrument antenna and the EUT
 - 4) The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.
 - 5) If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula $Ld1 = Ld2 * (d2/d1)$

7.4 Test Equipment

Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	ROHDE&SCHWARZ	ESPI 3	100379	July 2, 2014	July 1, 2015
Spectrum Analyzer	ROHDE&SCHWARZ	FSEM	848597/001	July 3, 2014	July 2, 2015
Pre-amplifier	Teseq	LAN6900	--	July 3, 2014	July 2, 2015
Pre-amplifier	Agilent	8447D	83153007374	July 3, 2014	July 2, 2015
Pre-amplifier	Agilent	8449B	3008A01738	July 3, 2014	July 2, 2015
Triple-loop antenna	ROHDE&SCHWARZ	HM020	843885/002	July 3, 2014	July 2, 2015
Ultra Broadband ANT	ROHDE&SCHWARZ	HL562	100157	July 3, 2014	July 2, 2015
Horn Antenna	ETS LINDGREN	3117	--	July 3, 2014	July 2, 2015

7.5 Test specification

Environmental conditions: Temperature 23° C Humidity: 50% Atmospheric pressure: 103kPa

7.6 Test result

Result: Pass

A Fundamental Radiated Emission

Frequency (MHz)	Emission Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)	Remark
433.92	79.06	H	92.87	Peak
433.92	72.80	V	92.87	Peak

Frequency (MHz)	Peak Emission Level@3m (dB μ V/m)	AV Factor (dB)	AV Emission Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)	Remark
433.92	79.06	-7.8	71.26	H	72.87	AV
433.92	72.80	-7.8	65.00	V	72.87	AV

B Harmonics and spurious Radiated Emission

Frequency (MHz)	Emission Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)	Remark
325.471	34.25	H	66.00	Peak
867.840	66.72	H	72.87	Peak
1302.610	54.61	H	74.00	Peak
325.471	31.05	V	66.00	Peak
867.840	61.43	V	72.87	Peak
1302.610	52.09	V	74.00	Peak

Frequency (MHz)	Peak Emission Level@3m (dB μ V/m)	AV Factor (dB)	AV Emission Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)	Remark
1302.610	54.61	-7.8	46.81	H	54.00	AV
1735.680	46.13	-7.8	38.33	H	52.87	AV
2169.600	38.72	-7.8	30.92	H	52.87	AV
1302.610	52.09	-7.8	44.29	V	54.00	AV
1735.680	43.26	-7.8	35.46	V	52.87	AV
2169.600	35.85	-7.8	28.05	V	52.87	AV

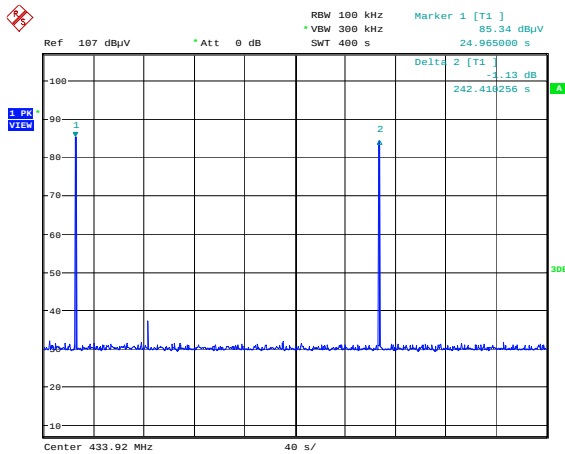
- Note:
- 1) Emission Level=Reading+ Cable loss+ Antenna factor-Amp factor
 - 2) Test Frequency form 9kHz to 5GHz, the emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement
 - 3) AV=Average
 - 4) AV Emission level = Peak Emissions level +AV Factor
 - 5) AV Factor = 20 log(Duty Cycle)

Duty cycle test data as follows

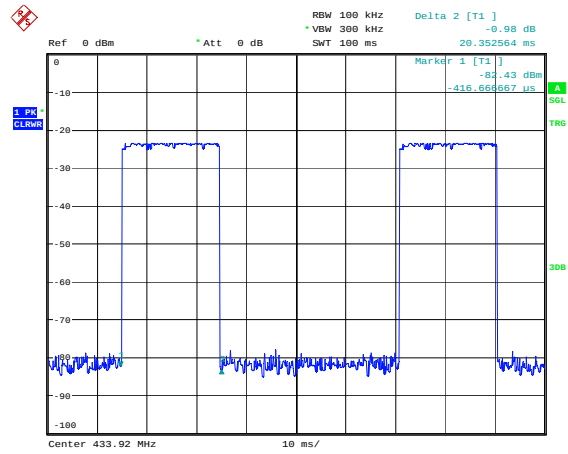
Note: Effective time one cycle=20.35*2=40.70ms

Duty Cycle= Effective time one cycle/ 100 or period time (which is less) =0.407

AV Factor = 20 log(Duty Cycle)=-7.8



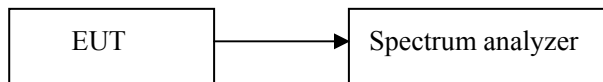
Period time



Pulse time 1

8.0 Limit of Transmission Time

8.1 Block diagram of Test setup



8.2 Test Specification

Environmental conditions: Temperature 22° C Humidity: 50% Atmospheric pressure: 103kPa

8.3 Test Equipment

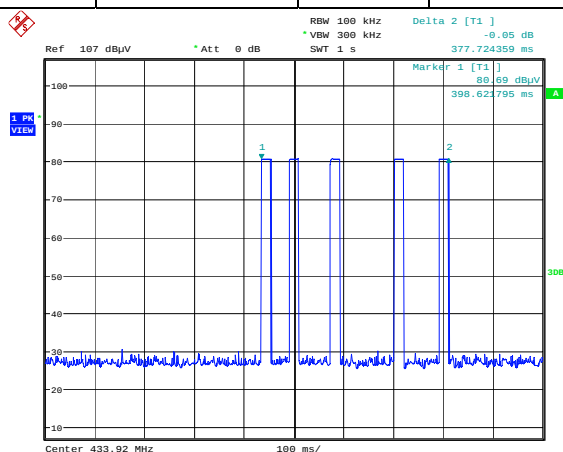
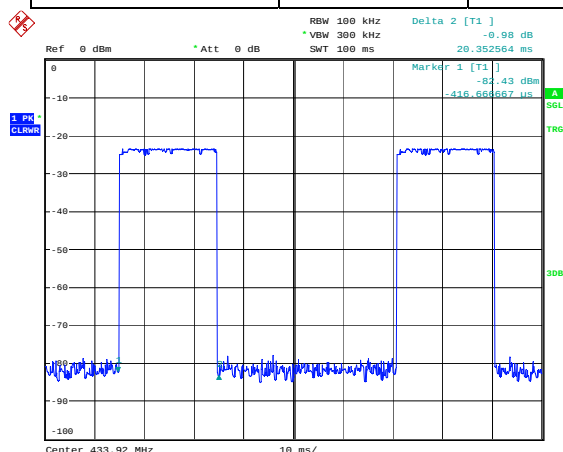
Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
Spectrum Analyzer	ROHDE&SCHWARZ	FSU	1166.1660.03	July 3, 2014	July 2, 2015

8.4 Limit

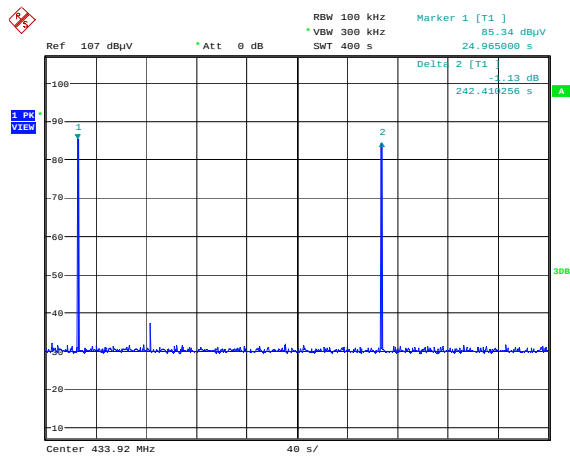
15.231(e) In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

TEST RESULTS

Channel Frequency (MHz)	Pulse Width (ms)	Number of Pulse	Transmission Time (ms)	Limit (Second)	Test conclusion
433.92	20.35	5	101.75	1s	PASS

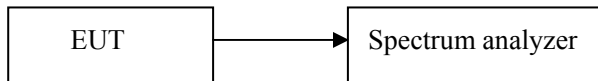


Channel Frequency (MHz)	Silent Period (Second)	Limit 30 Times Of The Transmission Time	Limit (Second)	Test conclusion
433.92	242.4	3052.5	>10s	PASS



9.0 Occupied Bandwidth

9.1 Block diagram of Test setup



9.2 Test Specification

Environmental conditions: Temperature 22° C Humidity: 50% Atmospheric pressure: 103kPa

9.3 Test Equipment

Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
Spectrum Analyzer	ROHDE&SCHWARZ	FSU	1166.1660.03	July 3, 2014	July 2, 2015

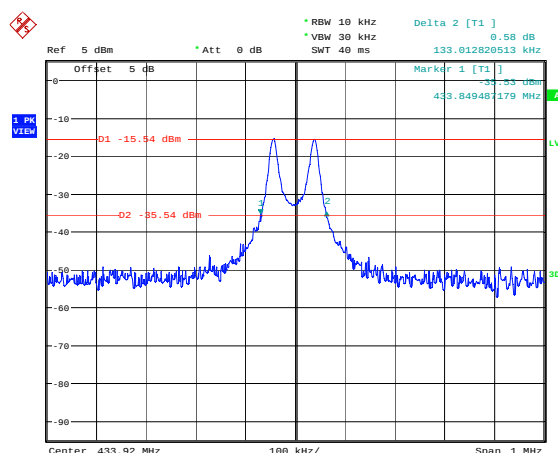
9.4 Limit

According to 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the centre frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

9.5 Test Result

Channel	20dB Bandwidth (kHz)	Limit (kHz)	Conclusion
(Low)	133.0	1084.8	PASS

Note: Limit = 433.92MHz * 0.25% = 1084.8 kHz



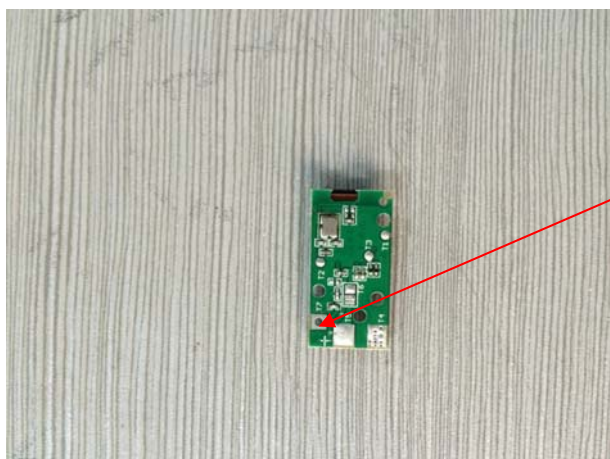
10.0 Antenna Requirement

10.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

10.2 Antenna Specification

According to the manufacturer declared, the EUT has an internal antenna; the directional gain of antenna is -3 dBi, and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.



Antenna

*****END OF REPORT*****