TEST REPORT

FCC ID: 2AI4T-VVDI

For

Shenzhen Xhorse Electronics Co., Ltd.

VVDI Key Tool

Model No.	:	VVDI Key Tool
Trade Name	:	Xhorse®
Prepared for	:	Shenzhen Xhorse Electronics Co., Ltd.
Address	:	2009, Changhong Science and Technology Building, Science Park South 12th Road, Nanshan District Shenzhen
Prepared by	:	Shenzhen Alpha Product Testing Co., Ltd.
Address	:	Building B, East Area of Nanchang Second, Industrial Zone, Gushu 2nd Road, Bao'an, Shenzhen, China
Report No.	:	T1870724 07
Date of Receipt	:	June 06, 2017
Date of Test	:	June 06-July 05, 2017
Date of Report	:	July 05, 2017
Version Number	:	REV0

TABLE OF CONTENT

DECLARATION

Applicant : Shenzhen Xhorse Electronics Co., Ltd.
Manufacturer : Shenzhen Xhorse Electronics Co., Ltd.
Product : VVDI Key Tool

(A) Model No. : VVDI Key Tool
(B) Trade Name : Xhorse®
(C) Power supply : DC 3.7V from battery or DC 5V form USB port

Measurement Standard Used:
FCC Rules and Regulations Part 15 Subpart C : 2016,
ANSI C63.4:2014, ANSI C63.10:2013

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....…..:	Reak Yang Project Engineer	Reak Yang
Approved by (name + signature)…....:	Simple Guan Project Manager	
Date of issue…… ……..:		July 05, 2017

1. General Information

1.1. Description of Device (EUT)

EUT	:	VVDI Key Tool
Model No.	:	VVDI Key Tool
DIFF.	:	N/A
Trade mark	:	Xhorse®
Power supply	:	DC 3.7V from battery or DC 5V form USB port
Radio Technology	:	RFID
Operation frequency	:	125KHz
Antenna Type	:	Integrated antenna, TX antenna max gain 0dBi
Software version	:	/
Hardware version	:	/
Applicant	:	Shenzhen Xhorse Electronics Co., Ltd.
Address	:	2009, Changhong Science and Technology Building, Science Park South 12th Road, Nanshan District Shenzhen
Manufacturer	:	Shenzhen Xhorse Electronics Co., Ltd.
Address	:	2009, Changhong Science and Technology Building, Science Park South 12th Road, Nanshan District Shenzhen
Adapter	:	N/A

1.2. Description of Test Facility

Shenzhen Alpha Product Testing Co., Ltd

Building B, East Area of Nanchang Second, Industrial Zone, Gushu 2nd Road,

Bao'an, Shenzhen, China

March 25, 2015 File on Federal Communication Commission

Registration Number: 203110

July 18, 2014 Certificated by IC

Registration Number: 12135A

1.3. Test Procedure

POWER LINE CONDUCTED INTERFERENCE:

The test procedure used was ANSI Standard ANSI C63.4:2014 using a 50 u H LISN. Both Lines were observed. The bandwidth of the receiver was 10kHz with an appropriate sweep speed. The ambient temperature of the EUT was 25℃ with a humidity of 58%.

RADIATION INTERFERENCE:

The test procedure used was ANSI Standard ANSI C63.4:2014 using a ANRITSU spectrum analyzer with a pre-selector. The analyzer was calibrated in dB above a micro volt at the output of the antenna. The resolution bandwidth was 100kHz and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3MHz above 1 GHz. The ambient temperature of the EUT was 25℃ with a humidity of 58%.

FORMULA OF CONVERSION FACTORS:

The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer and cable loss. The antenna correction factors and cable loss are stated in terms of dB. The gain of the Pre-selector was accounted for in the Spectrum Analyzer Meter Reading.
Example:
Freq (MHz) METER READING + ACF + CABLE = FS
33.20 dBuV + 10.36 dB + 0.9 dB= 44.46 dBuV/m @ 3m
ANSI STANDARD ANSI C63.4:2014 10.1.7 MEASUREMENT PROCEDURES: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation. When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes. The situation was similar for the conducted measurement except that the table did not rotate. The EUT was setup as described in ANSI Standard ANSI C63.4:2014 10.1.7 with the EUT 40 cm from the vertical ground wall.

2. Summary of test

2.1. Summary of test result

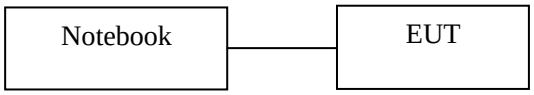
Description of Test Item	Standard	Results
Radiated Emission (9KHz-1.25MHz)	Section 15: 209& RSS-310 Issue 4	PASS
20dB Bandwidth	Section 15.215& RSS-310 Issue 4	PASS
Power Line Conducted Emissions (150KHz-30MHz)	Section 15: 15.207& RSS-310 Issue 4	PASS
Antenna Requirement	Section 15: 15.203& RSS-310 Issue 4	PASS
Note: 1：“N/A” denotes test is not applicable in this Test Report 2：Test with the test procedure RFID tool. 3：All tests are according to ANSI C63.10-2013.		

2.2. Assistant equipment used for test

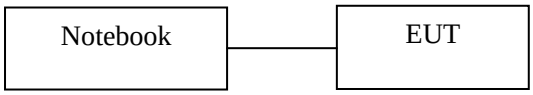
Description	:	Notebook
Manufacturer	:	ACER
Model No.	:	ZQT

2.3. Block Diagram of Test setup

1, For radiated emissions test: EUT was placed on a turn table, which is 0.8 meter high above ground for blew 1GHz, 1.5 meter high above ground for above 1GHz. EUT was be set into BT test mode by software before test.



2, For Power Line Conducted Emissions Test.



2.4. Test mode

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (KHz)
1	CH1	125
Note: According exploratory test, EUT will have maximum output power in those data rate. so those data rate were used for all test.		

NOTE: NEW BATTERY IS USED DURING ALL TEST

2.5. Test Conditions

Temperature range	21-25℃
Humidity range	40-75%
Pressure range	86-106kPa

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

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.71dB	
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB	Polarize: V
	2.57dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.90dB	Polarize: V
	3.92dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.28dB	Polarize: H
	4.26dB	Polarize: V
Uncertainty for radio frequency	1×10-9	
Uncertainty for conducted RF Power	0.16dB	
Uncertainty for temperature	0.2℃	
Uncertainty for humidity	1%	
Uncertainty for DC and low frequency voltages	0.06%	

2.7. Test Equipment

Equipment	Manufacture	Model No.	Serial No.	cal. Date	Cal. Interval
3m Semi-Anechoic	CHENYU	N/A	N/A	2017.07.21	2Year
Spectrum analyzer	Agilent	E4407B	MY46185649	2017.09.29	1Year
Receiver	R&S	ESPI	101873	2017.09.29	1Year
Receiver	R&S	ESCI	101165	2017.09.29	1Year
Bilog Antenna	SCHWARZBECK	VULB 9168	VULB9168-438	2017.09.30	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D(1201)	2017.09.30	2Year
Active Loop Antenna	Beijing Daze	ZN30900A	SEL0097	2017.09.30	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2017.09.29	1 Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2017.09.29	1 Year
Cable	Resenberger	N/A	No.1	2017.09.29	1Year
Cable	SCHWARZBECK	N/A	No.2	2017.09.29	1Year
Cable	SCHWARZBECK	N/A	No.3	2017.09.29	1Year
Pre-amplifier	HP	HP8347A	2834A00455	2017.09.29	1Year
Pre-amplifier	Agilent	8449B	3008A02664	2017.09.29	1Year
vector Signal Generator	Agilent	N5182A	MY49060042	2017.09.29	1 Year
vector Signal Generator	Agilent	E4438C	US44271917	2017.09.29	1 Year
X-series USB Peak and Average Power Sensor	Agilent	U2021XA	MY54080020	2017.09.29	1 Year
X-series USB Peak and Average Power Sensor	Agilent	U2021XA	MY54110001	2017.09.29	1 Year
Signal Analyzer	Agilent	N9020A	MY48030494	2017.09.29	1 Year

3. 20dB bandwidth

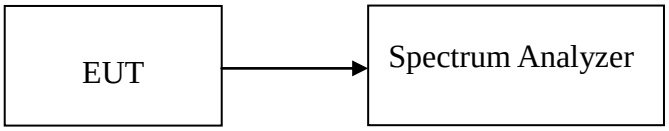
3.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

3.2. Test Procedure

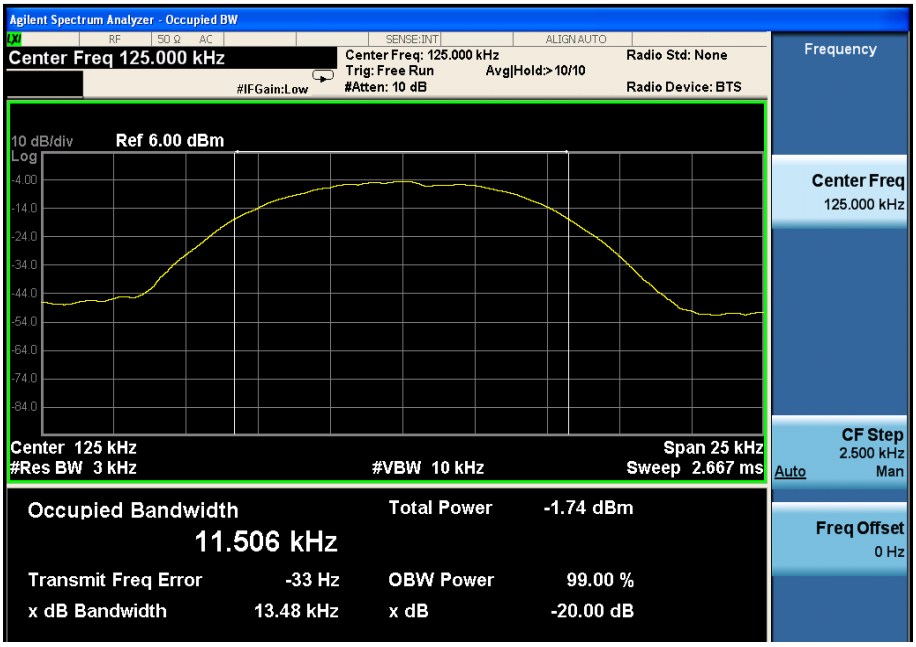
The transmitter output was coupled to a spectrum analyzer via a antenna. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3KHz RBW and 10kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

3.3. Test Setup



3.4. Test Result

Mode	Freq (KHz)	20dB Bandwidth (KHz)	Limit (kHz)	Conclusion
Tx Mode	125	13.48	/	PASS



4. Radiated emissions

4.1. Limit(FCC 15.209)

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Note:

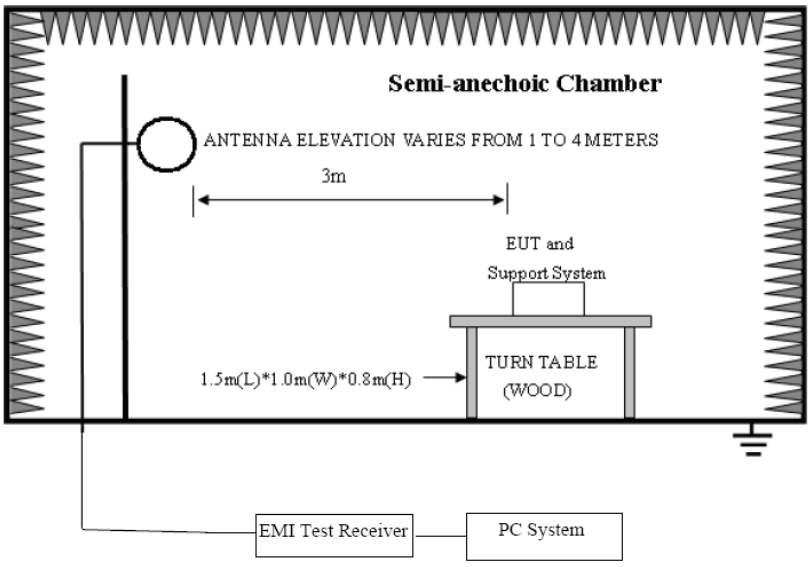
a) The tighter limit applies at the band edges.
For example: F.S limit at 88MHz is 100uV/m

b) If measurement is made at 3m distance, then F.S Limit at 3m distance is adjusted by using the formula of $L_{d1} = L_{d2} * (d2/d1)^2$.
For example:
F.S Limit at 30m(d2) distance is 30uV/m(L_{d2}), then F.S Limit at 3m(d1) distance is
L_{d1} = 30uV/m * $(30/3)^2$ = 100 * 30uV/m = 69.54 dBuV/m

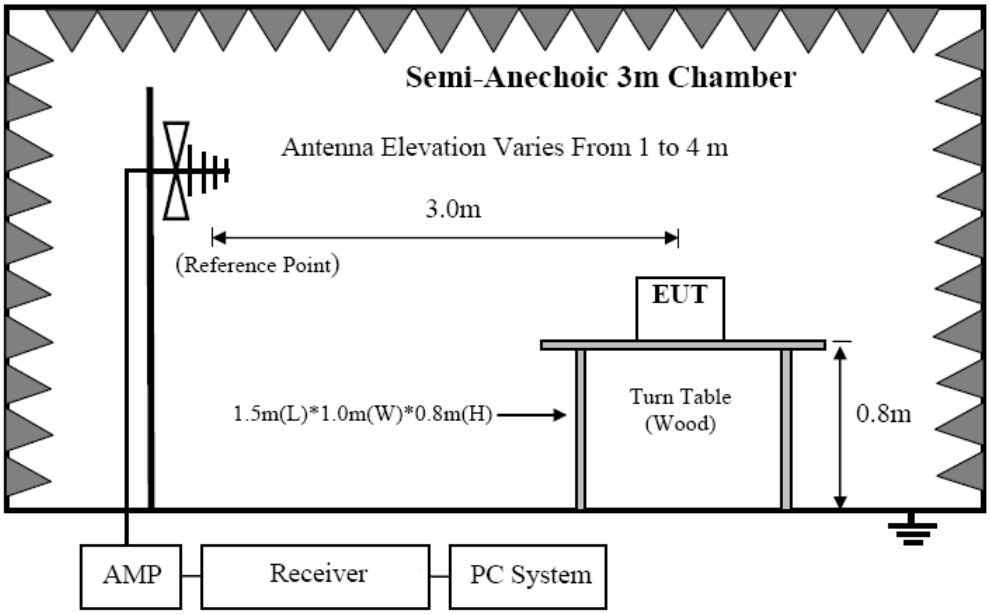
4.2. Block Diagram of Test setup

In 3m Anechoic Chamber Test Setup Diagram for below 30MHz

4.2. Block diagram of test setup



In 3m Anechoic Chamber Test Setup Diagram for frequency 30MHz-1GHz



4.3. Test Procedure

Procedure of Preliminary Test

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 4.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4:2003.

Mains cables, telephone lines or other connections to auxiliary equipment located outside the test are shall drape to the floor, be fitted with ferrite clamps or ferrite tubes placed on the floor at the point where the cable reaches the floor and then routed to the place where they leave the turntable. No extension cords shall be used to mains receptacle.

The antenna was placed at 3 meter away from the EUT as stated in ANSI C63.10:2013. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.

The Receiver quickly scanned from 9KHz to 30MHz and 30MHz to 1GHz The EUT

test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

The test mode(s) described in clause 2.4 were scanned during the preliminary test:

After the preliminary scan, we found the test mode producing the highest emission level. The EUT and cable configuration, antenna position, polarization and turntable position of the above highest emission level were recorded for the final test.

Procedure of Final Test

EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.

The Receiver scanned from9KHz to 30MHz and 30MHz to 1GHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

Recorded at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.

The test data of the worst-case condition(s) was recorded.

The bandwidth of test receiver is set at 200Hz for 9 KHz to 150 KHz measure, 10 KHz for 150 KHz to 30MHz measure and 120 KHz for 30 MHz to 1GHz measure .

4.4. Test Result

PASS. (See below detailed test result)

Radiated Emissions Result (125KHz)

EUT	VVDI Key Tool	**Model Name**	VVDI Key Tool
Temperature	26°C	**Relative Humidity**	56%
Pressure	960hPa	**Test voltage**	DC 5V
Test Mode	TX	**Distance**	3m

Freq. (MHz)	Position H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	Margin (dBuV/m)
0.110	H	Peak	25.73	24.8	50.53	126.77	76.24
0.125	H	Peak	46.47	24.8	71.27	125.67	54.4
0.484	H	Peak	23.91	25.03	48.94	113.71	64.77
0.500	H	Peak	27.04	25.03	52.07	113.62	61.55
N/A							
Freq. (MHz)	**Position H/V**	**Detector Mode (PK/QP)**	**Reading (dBuV)**	**Factor (dB)**	**Actual FS (dBuV/m)**	**Limits 3m (dBuV/m)**	**Margin (dBuV/m)**
0.110	V	Peak	24.51	24.8	49.31	126.77	77.46
0.125	V	Peak	43.91	24.8	68.71	125.67	56.96
0.495	V	Peak	22.53	25.03	47.56	113.71	66.15
0.500	V	Peak	25.49	25.03	50.52	113.62	63.1
N/A							

Note:

1: 30m to 3m correction factor calculation:

40*Log(30m/3m)=40

2: --Means other frequency and mode comply with standard requirements and at least have 20dB margin.

3: Correct Factor=Cable Loss+ Antenna Factor- Amplifier Gain

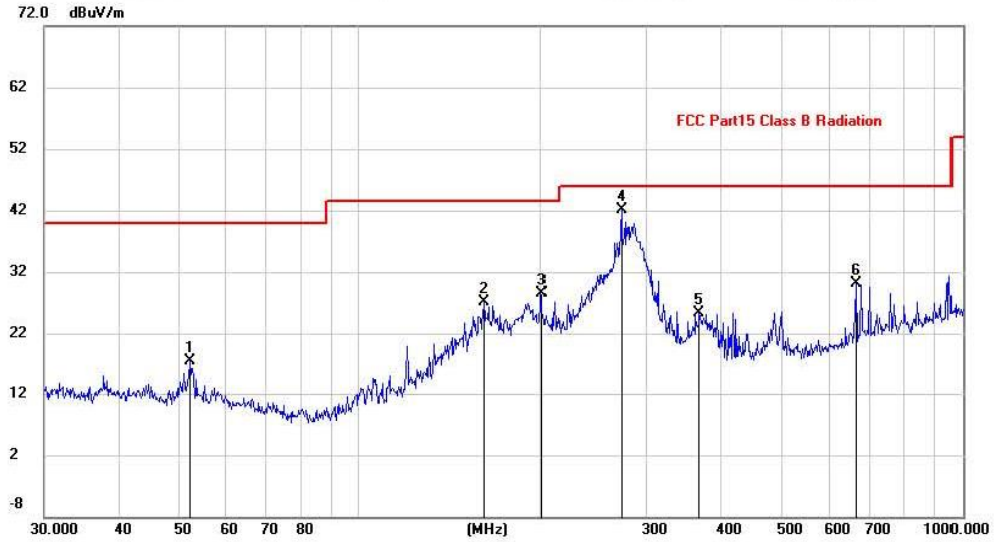
Measurement Result=Reading + Correct Factor

Margin=Measurement Result-Limit

Site LAB	Polarization: *Horizontal*	Temperature: 23.5
Limit: FCC Part15 Class B Radiation	Power:	Humidity: 51 %
EUT:	Distance: 3m	
M/N: VVDI Key TOOL		
Mode: 125KHz		
Note:		

Radiated Emission Measurement

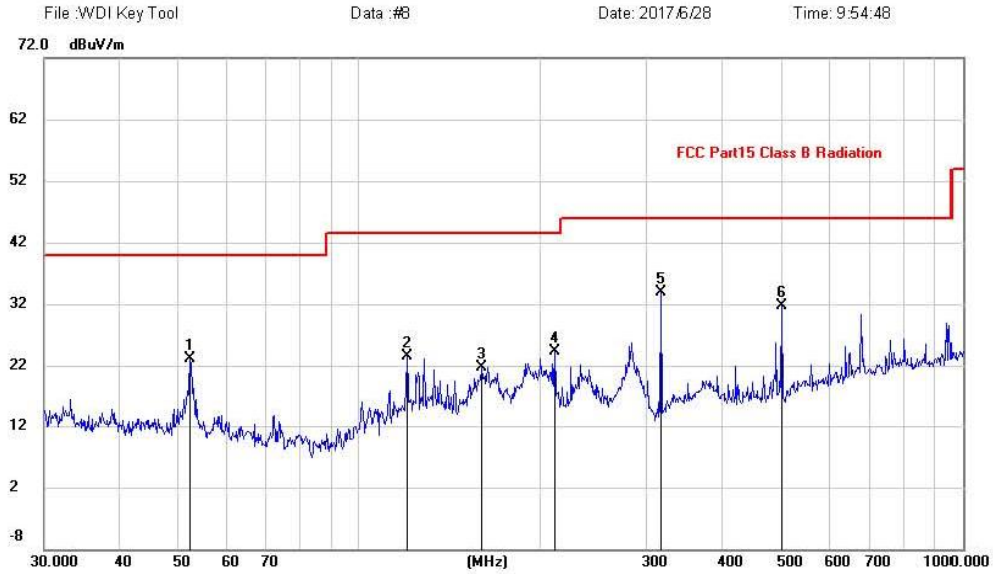
File :WDI Key Tool Data :#7 Date: 2017/6/28 Time: 9:54:17



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		52.3912	3.86	13.55	17.41	40.00	-22.59	peak			
2		160.9089	12.61	14.50	27.11	43.50	-16.39	peak			
3		200.6881	18.07	10.35	28.42	43.50	-15.08	peak			
4	*	271.3246	29.34	12.81	42.15	46.00	-3.85	peak			
5		365.5391	10.35	14.89	25.24	46.00	-20.76	peak			
6		670.4893	9.58	20.51	30.09	46.00	-15.91	peak			

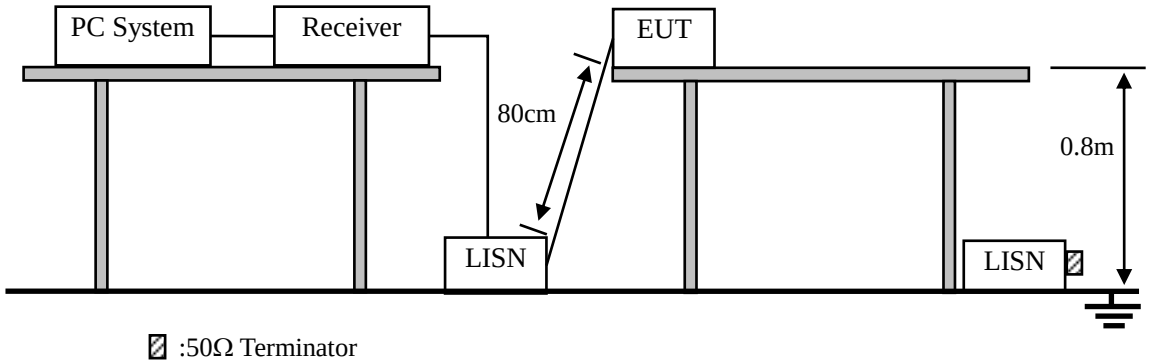
Site LAB	Polarization: *Vertical*	Temperature: 23.5
Limit: FCC Part15 Class B Radiation	Power:	Humidity: 51 %
EUT:	Distance: 3m	
M/N: VVDI Key TOOL		
Mode: 125KHz		
Note:		

Radiated Emission Measurement



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		52.3912	9.50	13.55	23.05	40.00	-16.95	peak			
2		119.8556	10.93	12.58	23.51	43.50	-19.99	peak			
3		159.7844	7.12	14.58	21.70	43.50	-21.80	peak			
4		210.0482	13.56	10.69	24.25	43.50	-19.25	peak			
5	*	316.5890	20.13	13.79	33.92	46.00	-12.08	peak			
6		501.1790	14.39	17.22	31.61	46.00	-14.39	peak			

5. Power Line Conducted Emissions



:50Ω Terminator

5.1. Block Diagram of Test Setup

5.2. Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

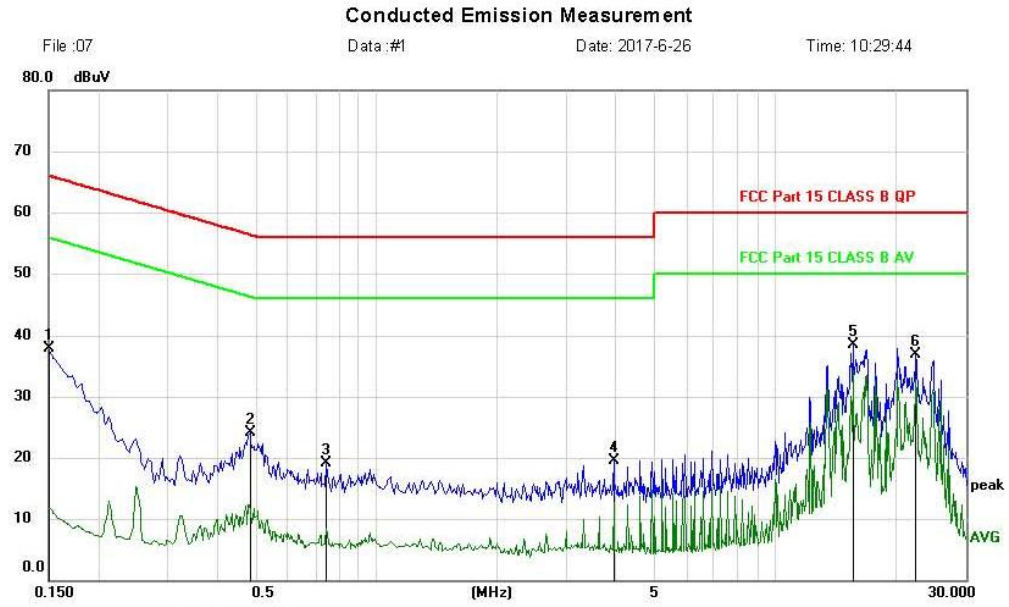
5.3. Test Procedure

(1) The EUT was placed on a non-metallic table, 80cm above the ground plane.
(2) Setup the EUT and simulator as shown in 10.1
(3) The EUT Power connected to the power mains through a power adapter and a line impedance stabilization network (L.I.S.N1). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N1), this provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.4 2014 on conducted Emission test.
(4) The bandwidth of test receiver is set at 10KHz.
(5) The frequency range from 150 KHz to 30MHz is checked.

5.4. Test Result

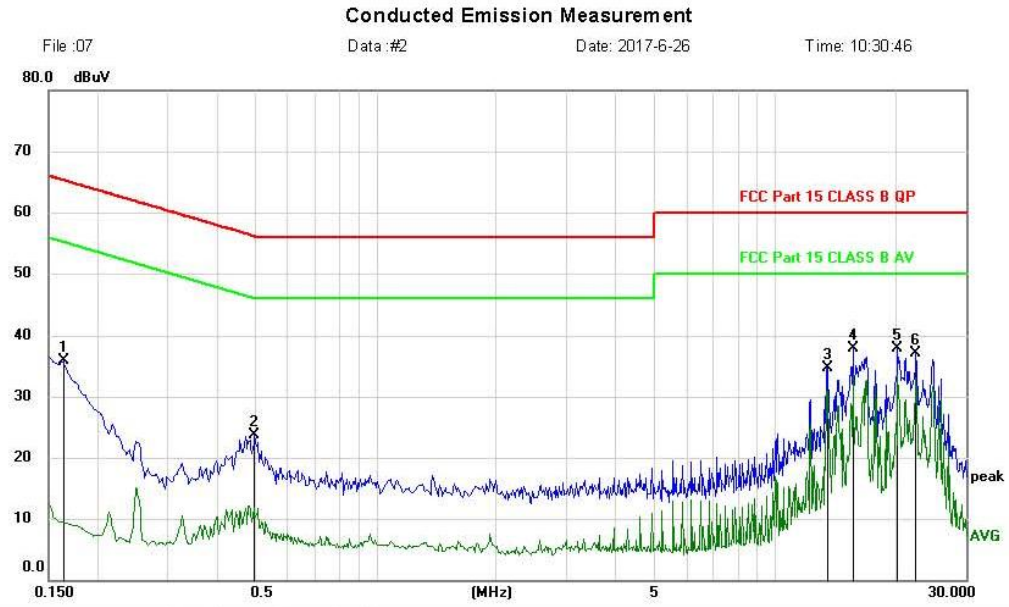
PASS. (See below detailed test data)

Site: LAB	Phase: N	Temperature: 24.2
Limit: FCC Part 15 CLASS B QP	Power:	Humidity: 53 %
EUT:		
M/N: VVDI Key TOOL		
Mode: TX		
Note:		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1500	28.20	9.66	37.86	66.00	-28.14	peak	
2		0.4830	14.35	9.71	24.06	56.29	-32.23	peak	
3		0.7440	9.41	9.74	19.15	56.00	-36.85	peak	
4		3.9405	9.52	10.08	19.60	56.00	-36.40	peak	
5	*	15.6205	28.09	10.43	38.52	60.00	-21.48	peak	
6		22.4605	26.37	10.61	36.98	60.00	-23.02	peak	

Site: LAB	Phase:	L1	Temperature: 24.2
Limit: FCC Part 15 CLASS B QP	Power:		Humidity: 53 %
EUT:			
M/N: VVDI Key TOOL			
Mode: TX			
Note:			



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1635	26.27	9.66	35.93	65.28	-29.35	peak	
2		0.4965	13.92	9.71	23.63	56.06	-32.43	peak	
3		13.4205	24.42	10.35	34.77	60.00	-25.23	peak	
4	*	15.6205	27.41	10.43	37.84	60.00	-22.16	peak	
5		20.2605	27.34	10.48	37.82	60.00	-22.18	peak	
6		22.4605	26.40	10.61	37.01	60.00	-22.99	peak	

6. Antenna Requirements

6.1. Standard Requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

6.2. Antenna Connected Construction

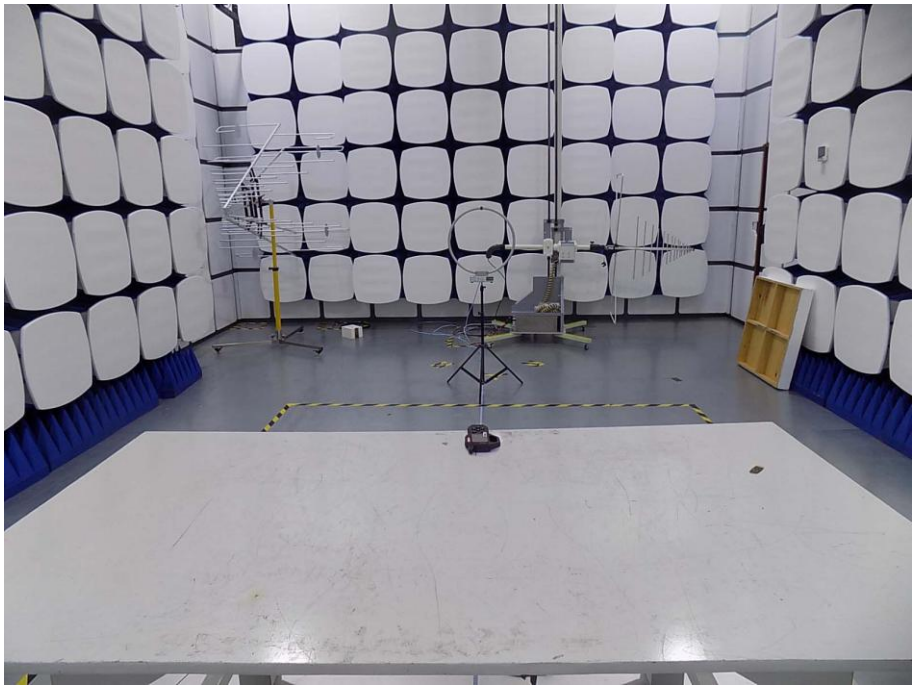
The antenna is Coil antenna and no consideration of replacement. Please see EUT photo for details.

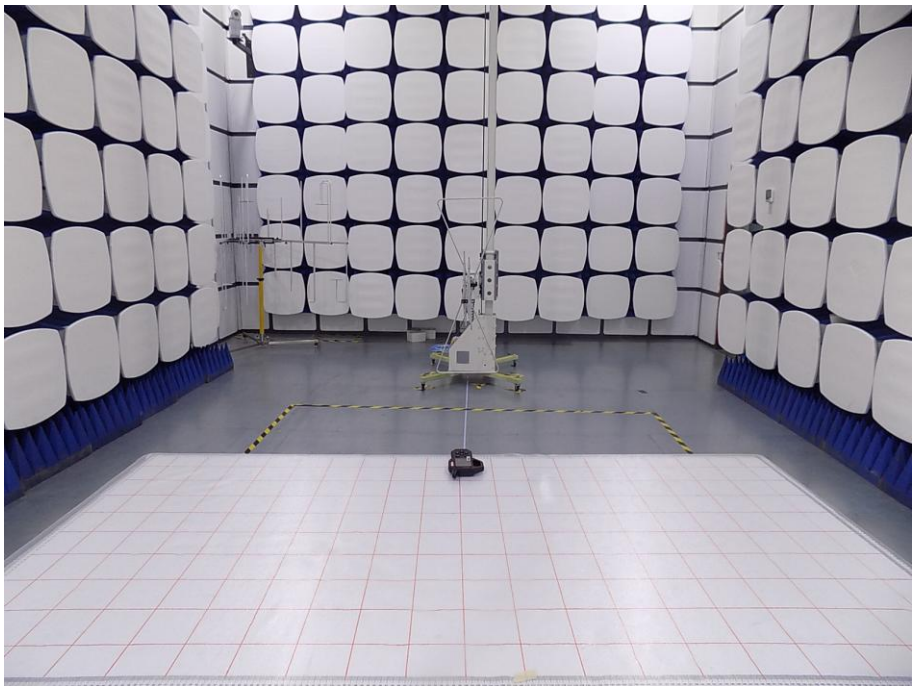
6.3. Results

The EUT antenna is Coil Antenna. It comply with the standard requirement.

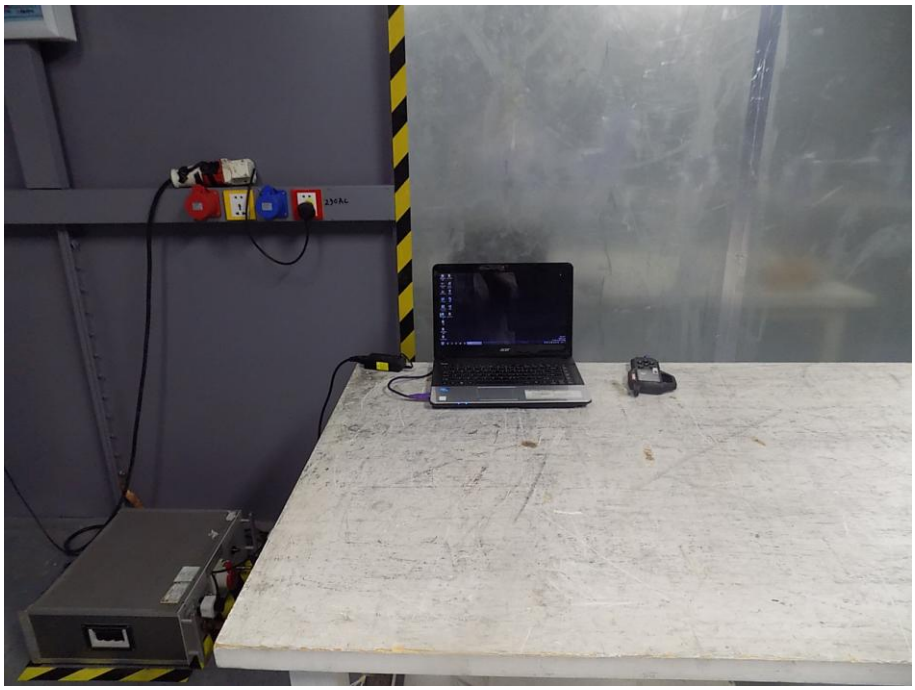
7. Test setup photo

Photographs of Radiated Emission test setup





Photographs of Conducted Emission Test Setup



8. Photos of EUT

--------END OF THE REPORT-------