# **TEST REPORT**

**Reference No.** : WTF18S09122915-2W

**FCC ID** ..... : 2AAGEAV5AV72

Applicant.....: Chengdu Vantron Technology, Ltd.

610045

Manufacturer .....: The same as above

Address : The same as above

Product..... : M2M Gateway

Model(s). ..... : AV5, AV7

Brand.....: NA

Standards...... FCC CFR47 Part 15 Section 15.225: 2016

Date of Receipt sample .... : 2018-09-04

**Date of Test** ...... : 2018-09-05 to 2018-09-28

**Date of Issue**.....: 2018-09-29

Test Result..... : Pass

#### Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

#### Prepared By:

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Ford Wang / Project Engineer

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### 2 Laboratories Introduction

Waltek Services Test Group Ltd. is one of the largest and the most comprehensive third party testing organizations in China, our headquarter located in Shenzhen (CNAS Registration No. L3110, A2LA Certificate Number: 4243.01) and have branches in Foshan (CNAS Registration No. L6478), Dongguan (CNAS Registration No. L9950), Zhongshan, Suzhou (CNAS Registration No. L7754), Ningbo and Hong Kong, Our test capability covered four large fields: safety test. Electronic Magnetic Compatibility(EMC), reliability and energy performance, Chemical test. Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CPSC(Consumer Product Safety Commission), CEC(California energy efficiency), IC(Industry Canada) and ELI(Efficient Lighting Initiative). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as UL, Intertek(ETL-SEMKO), CSA, TÜV Rheinland, TÜV SÜD, etc. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

#### Waltek Services (Shenzhen) Co., Ltd.

#### A. Accreditations for Conformity Assessment (International)

Country/Region	Accreditation Body	Scope	Note
USA		FCC ID \ DOC \ VOC	1
Canada		IC ID \ VOC	2
Japan	CNAS	MIC-T \ MIC-R	-
Europe	,	(Registration No.: L3110)	
Taiwan	A2LA	NCC	-
Hong Kong	(Certificate No.: 4243.01)	OFCA	-
Australia		RCM	-
India		WPC	-
Thailand	International Services	NTC	_
Singapore		IDA	-

#### Note:

- 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476.
- 2. IC Canada Registration No.: 7760A

#### B. TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of	Notify body number

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TUV Rheinland	
Intertek	
TUV SUD	Optional.
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTF18S09122915 -2W	2018-09-04	2018-09-04 to 2019-09- 28	2018-09-29	original	-	Vaild

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## 4 General Information

## 4.1 General Description of E.U.T.

Product: M2M Gateway

Model(s): AV5, AV7

Model Description:

The models are different in size and appearance. Two models were

tested. The worst data of AV 5 is recorded in the report.

WCDMA Band(s) Band2/5

LTE Band(s): FDD Band 2/4/5/12/13/17

2.4G-802.11b/g/n HT20

Wi-Fi Specification: 802.11n HT40

NFC: Support

Highest frequency

(Exclude Radio):

Note: NA.

#### 4.2 Details of E.U.T.

Operation Frequency: NFC:13.56MHz

Type of Modulation: NFC: ASK, 2ASK

Antenna installation: NFC: Loop antenna

Ratings: DC 12-34V by DC Power

DC 5V 1A by PC

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### 4.3 Channel List

NFC Test Mode				
Channel No.	Frequency (MHz)			
0	0	13.56MHz		

#### 4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests; the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	N/A	13.56MHz	N/A

## 5 Test Summary

Test Requirement	Result
15.207	PASS
15.205(a) 15.209 15.225	PASS
15.225	PASS
15.215(c)	PASS
15.203	PASS
	15.207 15.205(a) 15.209 15.225 15.225

Note: C=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.

# 6 Equipment Used during Test

## 6.1 Equipments List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	2017-09-12	2018-09-11
2.	LISN	R&S	ENV216	101215	2017-09-12	2018-09-11
3.	Cable	Тор	TYPE16(3.5M)	-	2017-09-12	2018-09-11
Condu	cted Emissions Test S	Site 2#				
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	2017-09-12	2018-09-11
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2017-09-12	2018-09-11
3.	Limiter	York	MTS-IMP-136	261115-001- 0024	2017-09-12	2018-09-11
4.	Cable	LARGE	RF300	-	2017-09-12	2018-09-11
3m Ser	mi-anechoic Chamber	for Radiation Emis	sions Test site	1#		
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	2018-04-29	2019-04-28
2	Amplifier	Agilent	8447D	2944A10178	2018-01-13	2019-01-12
3	Active Loop Antenna	Beijing Dazhi	ZN30900A	0703	2017-10-17	2018-10-16
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	33 6	2018-04-09	2019-04-08
5	Coaxial Cable (below 1GHz)	Тор	TYPE16(13M)	-	2017-09-12	2018-09-11
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2018-04-09	2019-04-08
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2018-04-13	2019-04-12
8	Coaxial Cable (above 1GHz)	Тор	1GHz-18GHz	EW02014-7	2018-04-13	2019-04-12
3m Ser	3m Semi-anechoic Chamber for Radiation Emissions Test site 2#					
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2018-04-13	2019-04-12
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2018-04-09	2019-04-08
3	Amplifier	ANRITSU	MH648A	M43381	2018-04-13	2019-04-12
4	Cable	HUBER+SUHNER	CBL2	525178	2018-04-13	2019-04-12

RF Coi	RF Conducted Testing					
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	2017-09-12	2018-09-11
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2017-09-12	2018-09-11
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2017-09-12	2018-09-11

## **6.2 Measurement Uncertainty**

Parameter	Uncertainty	
Radio Frequency	± 1 x 10 <sup>-6</sup>	
RF Power	± 1.0 dB	
RF Power Density	± 2.2 dB	
·	± 5.03 dB	
Radiated Spurious	(Bilog antenna 30M~1000MHz)	
Emissions test	± 5.47 dB	
	(Horn antenna 1000M~25000MHz)	
Confidence interval: 95%. Confidence factor:k=2		

## 6.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

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### 7 Conducted Emission

Test Requirement: FCC CFR 47 Part 15 Section 15.207

Test Method: ANSI C63.10:2013

Test Result: PASS

Frequency Range: 150kHz to 30MHz

Class/Severity: Class B

Limit:

Fraguency (MHz)	Limit (dBµV)		
Frequency (MHz)	Qua i-peak	Average	
0.15 to 0.5	66 to 5 *	56 to 46*	
0.5 to	56	60	
5 to 30	60	50	

#### 7.1 E.U.T. Operation

Operating Environment:

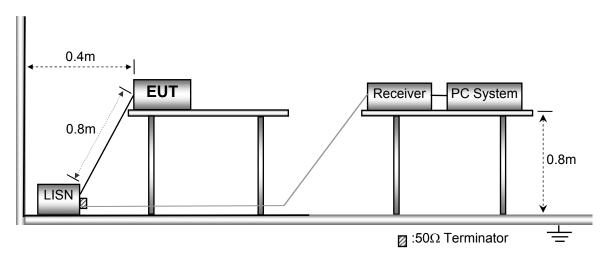
Temperature: 25.5 °C
Humidity: 51 % RH
Atmospheric Pressure: 101.2kPa

**EUT Operation:** 

The test was performed in transmitting mode, the test data were shown in the report.

### 7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013

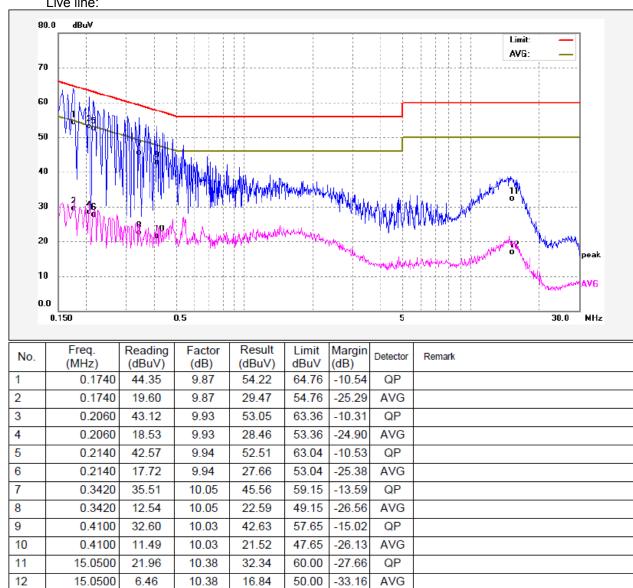


#### 7.3 Measurement Description

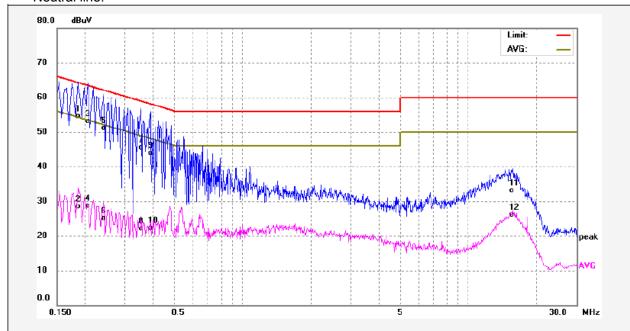
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

#### 7.4 Test Result





### Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1860	44.62	9.89	54.51	64.21	-9.70	QP	
2	0.1860	18.63	9.89	28.52	54.21	-25.69	AVG	
3	0.2060	43.20	9.93	53.13	63.36	-10.23	QP	
4	0.2060	18.76	9.93	28.69	53.36	-24.67	AVG	
5	0.2420	41.07	9.99	51.06	62.02	-10.96	QP	
6	0.2420	15.09	9.99	25.08	52.02	-26.94	AVG	
7	0.3540	35.52	10.06	45.58	58.87	-13.29	QP	
8	0.3540	12.00	10.06	22.06	48.87	-26.81	AVG	
9	0.3899	33.89	10.04	43.93	58.06	-14.13	QP	
10	0.3899	12.20	10.04	22.24	48.06	-25.82	AVG	
11	15.7620	22.77	10.39	33.16	60.00	-26.84	QP	
12	15.7620	15.64	10.39	26.03	50.00	-23.97	AVG	

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## 8 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209

Test Method: ANSI C63.10

Test Result: PASS
Measurement Distance: 3m

Limit:

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

## 8.1 EUT Operation

Operating Environment:

Temperature: 23.5 °C
Humidity: 51.1 % RH
Atmospheric Pressure: 101.2kPa

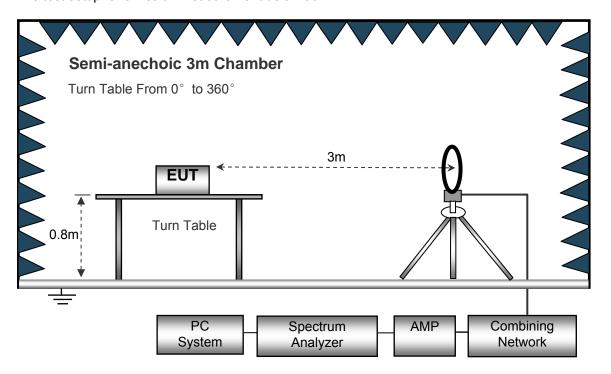
**EUT Operation:** 

The test was performed in transmitting mode, the test data were shown in the report.

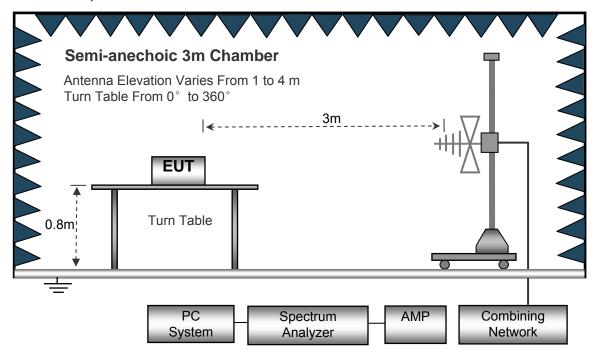
#### 8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013

The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



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#### 8.3 Spectrum Analyzer Setup

Below 30MHz

Delow Solvii IZ		
	Sweep Speed	. Auto
	IF Bandwidth	.10kHz
	Video Bandwidth	.10kHz
	Resolution Bandwidth	.10kHz
30MHz ~ 1GHz	Z	
	Sweep Speed	. Auto
	Detector	.PK

8.4 Test Procedure

- 1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Repeat above procedures until the measurements for all frequencies are complete.
- 7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.

### 8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

## 8.6 Summary of Test Results

Test Frequency: 9 kHz ~ 30MHz Note: Correct factor = Cable loss + Antenna factor

Fraguency	Receiver	Turn	RX Antenna		Corrected	Corrected	FCC Part 15.225	
Frequency	Reading (QP)	table Angle	Height	Polar	Factor	Amplitude (QP)	Limit	Margin
(MHz)	(dBµV) @3m	Degree	(m)	(H/V)	(dB/m)	(dBµV/m) @3m	(dBµV/ m)@3m	(dB)
13.56	56.21	120	1.9	Н	19.68	75.89	124	-48.11
13.56	49.36	312	1.5	V	19.68	69.04	124	-54.96

Frequency	Receiver Reading	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
(MHz)	dBμV @3m	QP	dB/m	dB	dBµV/m @30m	dBµV/m @30m	dB
5.268	32.59	QP	20.20	40.00	12.79	29.54	-16.75
12.547	35.64	QP	19.90	40.00	15.54	29.54	-14.00

Frequency Range	Frequency	Maximum Detector		Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
(MHz)	(MHz)	dBµV @3m	QP	dB/m	dB	dBμV/m @30m	dBµV/m @30m	dB
13.110~ 13.41	13.395	30.15	QP	21.55	40	11.70	40.51	-28.81
13.410~ 13.553	13.532	35.26	QP	21.55	40	16.81	50.47	-33.36
13.567~ 13.71	13.569	36.21	QP	21.55	40	17.76	50.47	-32.71
13.710~ 14.01	13.704	29.36	QP	21.55	40	10.91	40.51	-29.6

## Test Frequency: 30MHz ~ 1GHz

Frequency	Receiver	Detec	Turn table	RX Antenna		Correcte	Corrected		Part 209/205
rrequericy	Reading	tor	Angle	Height	Polar	d Factor	Amplitude	Limit	Margin
(MHz)	(dBµV) @3m	(QP)	Degree	(m)	(H/V)	(dB)	(dBµV/m) @3m	(dBµV/m) @3m	(dB)
33.25	31.25	QP	142	1.2	Н	-14.30	16.95	40.00	-23.05
33.25	32.65	QP	208	2.0	V	-14.30	18.35	40.00	-24.65
221.36	35.29	QP	48	1.8	Н	-13.58	21.71	46.00	-24.29
221.36	39.65	QP	109	1.6	V	-13.58	26.07	46.00	-19.93
516.69	38.45	QP	201	1.7	Н	-5.63	32.82	46.00	-13.18
516.69	38.69	QP	198	1.6	V	-5.63	33.06	46.00	-12.94

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## 9 Frequency Tolerance

Test Requirement: FCC Part15.225
Test Method: ANSI C63.10: 2013

Limit The frequency tolerance of the carrier signal shall be maintained

within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests

shall be performed using a new battery.

#### 9.1 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.

- 2. Set EUT as normal operation
- 3. Set SPA Centre Frequency = fundamental frequency, RBW=30 Hz, VBW= 100 Hz, Span =3 kHz.
- 4. Set SPA Max hold. Mark peak.

#### 9.2 Test Result

Power Supply	Temperature (°C)	Measured Frequency (MHz)	Frequency Error	Part 15.225 Limit	
	-20	13.5636	0.0265%	±0.01%	
	-10	13.5629	0.0214%	±0.01%	
	0	13.5626	0.0194%	±0.01%	
	+10	13.5629	0.0211%	±0.01%	
DC 5V	+20	13.5633	0.0241%	±0.01%	
	+30	13.5635	0.0260%	±0.01%	
	+40	13.5620	0.0147%	±0.01%	
	+50	13.5634	0.0254%	±0.01%	
	-20	13.5604	0.0033%	±0.01%	
DC 3.75 V	-10	13.5612	0.0088%	±0.01%	
	0	13.5617	0.0123%	±0.01%	

	+10	13.5607	0.0055%	±0.01%
	+20	13.5614	0.0100%	±0.01%
	+30	13.5618	0.0131%	±0.01%
	+40	13.5604	0.0029%	±0.01%
	+50	13.5604	0.0027%	±0.01%
	-20	13.5608	0.0056%	±0.01%
	-10	13.5612	0.0088%	±0.01%
	0	13.5622	0.0162%	±0.01%
	+10	13.5608	0.0062%	±0.01%
DC5.75V	+20	13.5610	0.0071%	±0.01%
	+30	13.5606	0.0047%	±0.01%
	+40	13.5617	0.0122%	±0.01%
	+50	13.5615	0.0108%	±0.01%

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## 10 20dB Bandwidth

Test Requirement: FCC Part15.215(C)
Test Method: ANSI C63.10: 2013

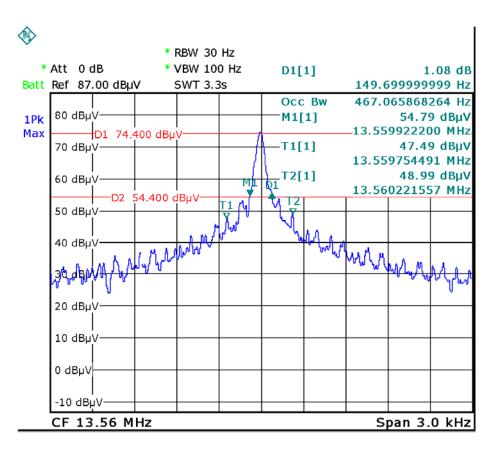
#### 10.1 Test Procedure

- 1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
- 2. 20dB Bandwidth the resolution bandwidth of 30 Hz and the video bandwidth of 100 Hz were used.
- 3. Measured the spectrum width with power higher than 20dB below carrier.

#### 10.2 Test Result

Frequency(MHz)	Bandwidth Emission(Hz)
13.56	149.70

**Test Plot** 



## 11 Antenna Requirement

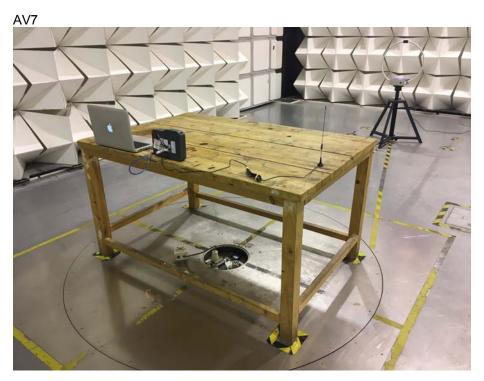
According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has an Loop antenna, fulfil the requirement of this section.

## 12 Photographs- Test Setup Photos

## 12.1 Photograph – Radiation Emission Test Setup

Test frequency from 9 KHz to 30MHz Below 30MHz Test Site 2#





Test frequency from 30MHz to 1GHz





## 12.2 Photograph – Conducted Emission Test Setup

AV5: Test Site 1#







Reference No.: WTF18S09122915-2W Page 26 of 26

# 13 Photographs of EUT.

Note: Please refer to appendix: WTS17S0888240E\_Photo.

=====End of Report=====