

Prüfbericht-Nr.: <i>Test Report No.:</i>	50059271 001	Auftrags-Nr.: <i>Order No.:</i>	164074269	Seite 1 von 22 Page 1 of 22
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	19.09.2016	
Auftraggeber: <i>Client:</i>	Qingdao Intelligent&Precise Electronics Co.,Ltd, No218,Qianwangang Road Qingdao Economic&Technological Development Zone, Qingdao, Shangdong, China			
Prüfgegenstand: <i>Test item:</i>	IEEE 802.11 b/g/n 2.4GHz 1T1R USB Module			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	ZDWM2401			
Auftrags-Inhalt: <i>Order content:</i>	FCC approval			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.209 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 2: Section 2.1091 CFR47 FCC Part 1: Section 1.1310 FCC KDB publication 447498 D01 v06			
Wareneingangsdatum: <i>Date of receipt:</i>	19.09.2016	Refer to photo document		
Prüfmuster-Nr.: <i>Test sample No.:</i>	A0000443928-001			
Prüfzeitraum: <i>Testing period:</i>	19.09.2016 - 31.10.2016			
Ort der Prüfung: <i>Place of testing:</i>	Accurate Technology Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
02.11.2016 Lin Lin / Project Manager		02.11.2016 Owen Tian / Technical Certifier		
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>
				Unterschrift <i>Signature</i>
Sonstiges / Other: This report is for DTS equipment class. FCC ID: 2AJVQ-ZDWM2401				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 PEAK OUTPUT POWER

RESULT: Pass

5.1.3 6dB BANDWIDTH

RESULT: Pass

5.1.4 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH

RESULT: Pass

5.1.5 POWER SPECTRAL DENSITY

RESULT: Pass

5.1.6 SPURIOUS EMISSIONS

RESULT: Pass

5.1.7 CONDUCTED EMISSIONS

RESULT: Pass

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1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:
Appendix A: Test Results of WiFi Module
Appendix B: Test Results of RF Exposure

2. Test Sites

2.1 Test Facilities

Accurate Technology Co., Ltd.
(FCC Registration No.: 752051 & IC Registration Number: 5077A-2)

F1, Bldg A, Changyuan New Material Port, Keyuan Rd., Science & Industry Park, Nanshan District, Shenzhen, 518057, P.R. China

The tests at the test site have been conducted under the supervision of a TÜV engineer.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Type	S/N	Calibrated until
Radio Spectrum Test				
Spectrum Analyzer	Rohde&Schwarz	FSV40	101495	Jan.10, 2017
Spectrum Analyzer	Agilent	N9030A	MY51380221	Oct.14, 2017
Open Switch and Control Unit	Rohde&Schwarz	OSP120 + OSP-B157	101244 + 100866	Jan.10, 2017
Conducted emissions				
Test Receiver	Rohde&Schwarz	ESCS30	100307	Jan.10, 2017
L.I.S.N.	Schwarzbeck	NLSK8126	8126431	Jan.10, 2017
Pulse Limiter	Rohde&Schwarz	ESH3-Z2	100305	Jan.10, 2017
Radiated emissions				
Spectrum Analyzer	Rohde&Schwarz	FSV40	101495	Jan.10, 2017
Test Receiver	Rohde&Schwarz	ESR	101817	Jul. 29, 2017
Loop Antenna	Schwarzbeck	FMZB1516	1516131	Jan.14, 2017
Bilog Antenna	Schwarzbeck	VULB9163	9163-194	Jan.14, 2017
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-655	Jan.14, 2017
Horn Antenna	Schwarzbeck	BBHA9170	9170-359	Jan.10, 2017
RF Switching Unit+PreAMP	Compliance Direction	RSU-M2	38322	Jan.10, 2017
Pre-Amplifier	Agilent	8447D	294A10619	Jan.10, 2017
Pre-Amplifier	Rohde&Schwarz	CBLU1183540-01	3791	Jan.10, 2017

2.3 Traceability

All measurement equipment calibrations are traceable to NIST or where calibration is performed outside the United States, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Items	Extended Uncertainty
-------	----------------------

CE	Disturbance Voltage (dBuV)	U=1.94dB, k=2, σ =95%
RE (9kHz-30MHz)	Field strength (dBuV/m)	U=3.08dB, k=2, σ =95%
RE (30-1000MHz)	Field strength (dBuV/m)	U=4.42dB, k=2, σ =95%
RE (above 1000MHz)	Field strength (dBuV/m)	U=4.06dB, k=2, σ =95%

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The Accurate Technology Co., Ltd. facility located at F1, Bldg A, Changyuan New Material Port, Keyuan Rd., Science & Industry Park, Nanshan District, Shenzhen, 518057, P.R. China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3. General Product Information

3.1 Product Function and Intended Use

The EUT is IEEE 802.11 b/g/n 2.4GHz 1T1R USB WiFi Module.
 For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

Technical Specification	Value
Kind of Equipment:	IEEE 802.11 b/g/n WiFi Module
Type Designation:	ZDWM2401
FCC ID:	2AJVQ-ZDWM2401
Equipment Class:	DTS
Wireless Technology:	IEEE 802.11 b/g/n
Operating Frequency Range:	2412-2462MHz for 802.11b/g/n-HT20 2422-2452MHz for 802.11n-HT40
Channel Number:	11 Channels for 802.11b/g/n-HT20 7 Channels for 802.11n-HT40
Channel Separation:	5MHz
Type of Modulation:	DSSS, OFDM
Operating Voltage:	DC 5V
Operating Temperature Range:	-10°C to 70°C
Antenna Type:	Integral Antenna
Smart Antenna Systems:	Not Applicable
Number of Antenna:	1
Antenna Gain:	2dBi

Table 3: List of Radio Frequency Channel

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
1	2412	2	2417	3	2422	4	2427
5	2432	6	2437	7	2442	8	2447
9	2452	10	2457	11	2462		

3.3 Independent Operation Modes

The basic operation modes are:

- A. WiFi operating
 - 1. Transmitting (802.11b/g/n)
 - i. Low channel
 - ii. Middle channel
 - iii. High channel
- B. DC power supply via PC
- C. Standby
- D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

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*Page 8 of 22***3.5 Submitted Documents**

- Bill of Material	- Circuit Diagram
- PCB Layout	- Instruction Manual
- Photo Document	- Rating Label

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Table 4: List of Frequencies under Test, 802.11b/g/n

802.11b/g/n-HT20				
Test Channel	Channel Number	Frequency (MHz)	Power Setting	Remark
Low	1	2412	Default	802.11b: 1Mbps
Middle	6	2437	Default	802.11g: 6Mbps
High	11	2462	Default	802.11n-HT20: MCS0
802.11n-HT40				
Test Channel	Channel number	Frequency (MHz)	Power Setting	Remark
Low	3	2422	Default	802.11n-HT40: MCS0
Middle	6	2437	Default	
High	9	2452	Default	

Note: All test modes have been pre-scanning test and the above mode is the worst case of test mode.

4.3 Special Accessories and Auxiliary Equipment

Table 5: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N	Rating
Notebook PC	Lenovo	X240	PD-01UAM3	Input: DC 20V, 3.25A
Printer	HP	HP laserjet 1015	CNFG030424	---

Table 6: List of Accessories and Cables

Interface(s) / Port (s)	Max. cable length, Shielding	Cable classification
USB	50cm, shielded with ferrite ring	USB cable

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test below 1 GHz

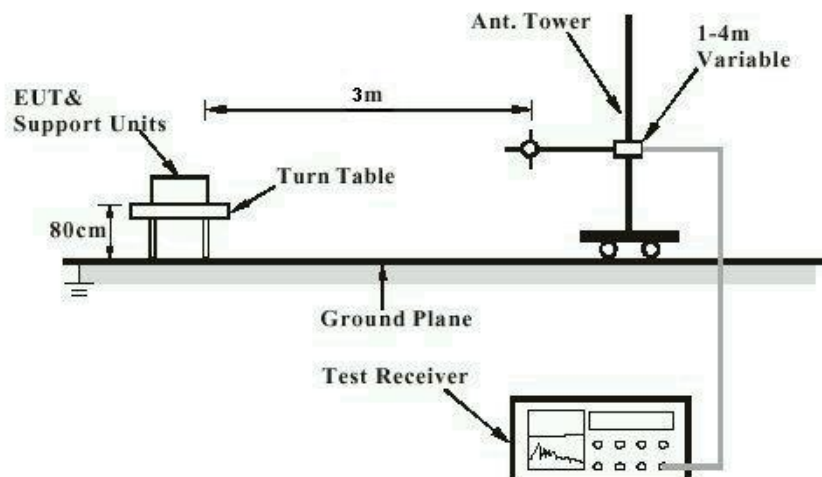


Diagram of Measurement Configuration for Radiation Test above 1 GHz

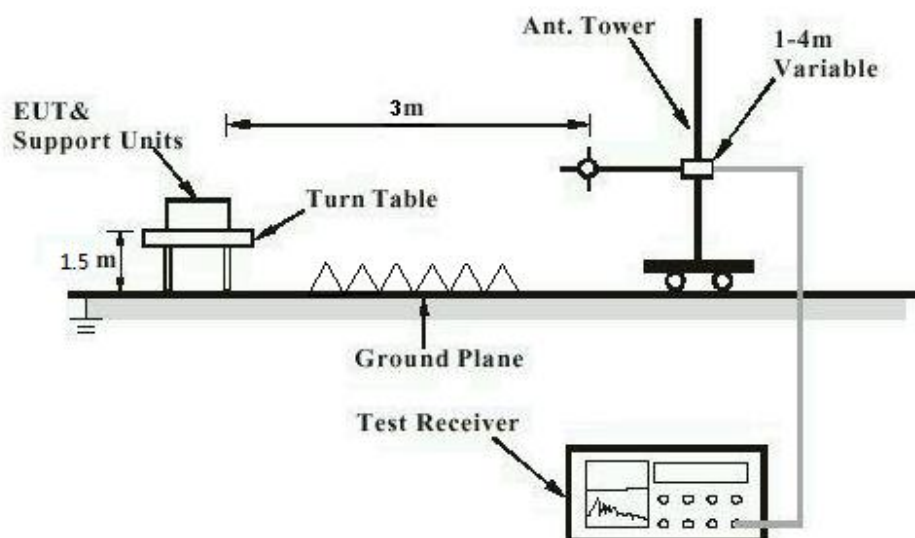


Diagram of Measurement Equipment Configuration for Conduction Measurement

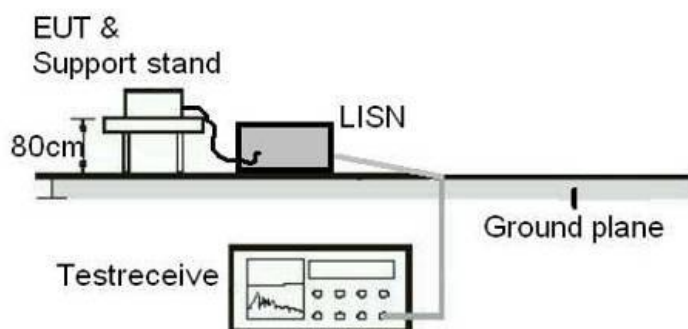
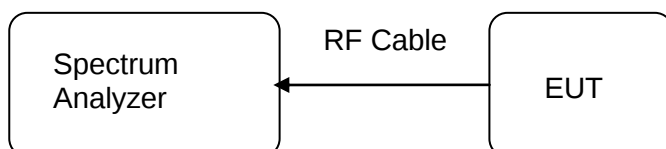


Diagram of Measurement Equipment Configuration for Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Pass**

Test standard	:	FCC Part 15.247(b)(4) and Part 15.203
Limit	:	the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declared, the EUT has an integral antenna, the directional gain of antenna is 2 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to compliance the provision.

Refer to EUT photo for details.

5.1.2 Peak Output Power
RESULT:
Pass

Date of testing : 2016-09-26
 Test standard : FCC Part 15.247(b)(3)
 Basic standard : ANSI C63.10:2013
 KDB 558074 D01 DTS Meas Guidance v03r05
 Limit : 1Watt
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A.1
 Ambient temperature : 25°C
 Relative humidity : 50%
 Atmospheric pressure : 101.0 kPa

Table 7: Test result of Peak Output Power

Channel (mode)	Channel Frequency (MHz)	Peak Output Power		Limit (W)	Verdict
		dBm	W		
1 (802.11b)	2412	18.1	0.065	1	Pass
6 (802.11b)	2437	18.5	0.071	1	Pass
11 (802.11b)	2462	18.4	0.069	1	Pass
1 (802.11g)	2412	18.1	0.065	1	Pass
6 (802.11g)	2437	18.3	0.068	1	Pass
11 (802.11g)	2462	18.3	0.068	1	Pass
1 (802.11n-HT20)	2412	17.0	0.050	1	Pass
6 (802.11n-HT20)	2437	17.3	0.054	1	Pass
11 (802.11n-HT20)	2462	17.2	0.052	1	Pass
3 (802.11n-HT40)	2422	16.3	0.043	1	Pass
6 (802.11n-HT40)	2437	16.5	0.045	1	Pass
9 (802.11n-HT40)	2452	16.5	0.045	1	Pass

5.1.3 6dB Bandwidth
RESULT:
Pass

Date of testing : 2016-09-26
 Test standard : FCC Part 15.247(a)(2)
 Basic standard : ANSI C63.10:2013
 KDB 558074 D01 DTS Meas Guidance v03r05
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A.1
 Ambient temperature : 26°C
 Relative humidity : 50%
 Atmospheric pressure : 101.0 kPa

Table 8: Test result of 6dB Bandwidth

Channel (mode)	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Verdict
1 (802.11b)	2412	10116	at least 500	Pass
6 (802.11b)	2437	10116	at least 500	Pass
11 (802.11b)	2462	10116	at least 500	Pass
1 (802.11g)	2412	16455	at least 500	Pass
6 (802.11g)	2437	16455	at least 500	Pass
11 (802.11g)	2462	16455	at least 500	Pass
1 (802.11n-HT20)	2412	17670	at least 500	Pass
6 (802.11n-HT20)	2437	17670	at least 500	Pass
11 (802.11n-HT20)	2462	17453	at least 500	Pass
3 (802.11n-HT40)	2422	36468	at least 500	Pass
6 (802.11n-HT40)	2437	36469	at least 500	Pass
9 (802.11n-HT40)	2452	36469	at least 500	Pass

*refer to 50059271 001 Appendix A for detail test graph.

5.1.4 Conducted Spurious Emissions measured in 100 kHz Bandwidth**RESULT:****Pass**

Date of testing	:	2016-09-26
Test standard	:	FCC part 15.247(d)
Basic standard	:	ANSI C63.10:2013 KDB 558074 D01 DTS Meas Guidance v03r05 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power);
Limit	:	In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	:	Shield room

Test setup

Test Channel	:	Low/ Middle/ High
Operation mode	:	A.1
Ambient temperature	:	23°C
Relative humidity	:	51%
Atmospheric pressure	:	101.0 kPa

*refer to 50059271 001 Appendix A for detail test graph.

5.1.5 Power spectral density
RESULT:
Pass

Date of testing : 2016-09-26
 Test standard : FCC part 15.247(e)
 Basic standard : ANSI C63.10:2013
 KDB 558074 D01 DTS Meas Guidance v03r05
 Limit : 8dBm/3kHz
 Kind of test site : Shield room

Test setup

Test Channel : Low/ Middle/ High
 Operation mode : A.1
 Ambient temperature : 23°C
 Relative humidity : 53%
 Atmospheric pressure : 101kPa

Table 9: Test result of Power spectral density

Operation Mode	Test Channel (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
802.11b	2412	-6.55	8	Pass
	2437	-7.45	8	Pass
	2462	-6.22	8	Pass
802.11g	2412	-9.83	8	Pass
	2437	-9.44	8	Pass
	2462	-10.13	8	Pass
802.11n-HT20	2412	-12.30	8	Pass
	2437	-12.45	8	Pass
	2462	-11.74	8	Pass
802.11n-HT40	2422	-15.02	8	Pass
	2437	-15.18	8	Pass
	2452	-14.19	8	Pass

*refer to 50059271 001 Appendix A for detail test graph.

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5.1.6 Spurious Emissions**RESULT:****Pass**

Date of testing	:	2016-09-26 to 2016-10-27
Test standard	:	FCC part 15.247(d)
Basic standard	:	ANSI C63.10:2013
Limits	:	Refer to 15.209
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/ Middle/ High
Operation mode	:	A.1
Ambient temperature	:	23°C
Relative humidity	:	48%
Atmospheric pressure	:	101.0 kPa

*All emissions were greater than 20 dB below the limit for below 30MHz and above 18GHz, since the spurious emissions only record the 30MHz to 18GHz test data.

**refer to 50059271 001 Appendix A for detail test graph.

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5.1.7 Conducted emissions**RESULT:****Pass**

Date of testing	:	2016-10-27
Test standard	:	FCC Part 15.207
Basic standard	:	ANSI C63.10:2013
Frequency range	:	0.15MHz – 30MHz
Limits	:	FCC Part 15.207
Kind of test site	:	Shield Room

Test Setup

Input Voltage	:	DC 5V via USB port
Operation Mode	:	B
Ambient temperature	:	23°C
Relative humidity	:	48%
Atmospheric pressure	:	101.0 kPa

*refer to 50059271 001 Appendix A for detail test graph.