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3 Test Summary

Test items for EN 301 893

Test Items	Test Requirement	Test Method	Limit / Severity	Result
Centre frequencies	Clause 4.2	Clause 5.3.2	±20 ppm	PASS
Nominal Channel Bandwidth and Occupied Channel Bandwidth	Clause 4.3	Clause 5.3.3	>5MHz and 80%~100% Nominal Bandwidth	PASS
RF Output Power,EIRP	clause 4.4	Clause 5.3.4	20 dBm	PASS
Power Spectrum Density	clause 4.4	Clause 5.3.4	7dBm/MHz	PASS
Transmitter unwanted emissions outside the 5 GHz RLAN bands	clause 4.5.1	clause 5.3.5	Table 3	PASS
Transmitter unwanted emissions within the 5 GHz RLAN bands	clause 4.5.2	clause 5.3.6	Figure 1	PASS
Receiver spurious emissions	clause 4.6	clause 5.3.7	Table 4	PASS
Dynamic Frequency Selection (DFS)	clause 4.7	clause 5.3.8	Table 5	N/A
Adaptivity (Channel Access Mechanism)	clause 4.9	clause 5.3.8	Clause 4.9.2	PASS
User Access Restrictions	clause 4.10	clause 4.10	clause 4.10.2	PASS
N/A : Not Application				

EN 301 893: **Broadband Radio Access Networks (BRAN);
5 GHz high performance RLAN;
Harmonized EN covering the essential requirements
of article 3.2 of the R&TTE Directive**

4 General Information

4.1 Client Information

Applicant:	LigoWave LLC
Address of Applicant:	138 Mountain Brook Dr Canton, GA 30115 United States
Manufacturer:	LigoWave LLC
Address of Manufacturer:	138 Mountain Brook Dr Canton, GA 30115 United States

4.2 General Description of E.U.T.

Product Name:	Broadband Digital Transmission System
Model No.:	LigoDLB 5-90
EUT Power Supply:	Model: 1# Model No: AY012E-ZF243; 2#:GRT-240050 Input: AC 100V-240V, 50Hz/60Hz, 0.5A Output: DC24V, 0.5A
Operating Temperature:	-40°C to +60°C
Operating Humidity:	up to 95%
Technical Parameter:	
Operating Frequency:	5470MHz~5725MHz
Nominal Bandwidth	802.11a: 20MHz, 802.11n20:20MHz,802.11n40:40MHz
Channel Spacing:	5MHz
Modulation:	OFDM
Antenna Type:	Sector antenna
Antenna Gain	19 dBi
Transmit Power Control(TPC)	Not support

4.3 Description of test

The available channel of EUT:

Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
96	5480	113	5565	130	5650
97	5485	114	5570	131	5655
98	5490	115	5575	132	5660
.....
.....
110	5550	127	5635	141	5705
111	5555	128	5640	142	5710
112	5560	129	5645	143	5715

According to EN 301893 clause 5.1.3, for 802.11a and 802.11n-HT20 mode, we selected channel No.96, 120 and 143 to perform the test, for 802.11n-HT40 mode, we selected channel No.98,120 and 141 to perform the test. For 802.11n mode, the EUT support 2×2 MIMO, for 802.11a mode, the EUT just support SISO.For conducted method test, the detail test plan as below:

Test Items	Test conditions	Ant.port	Test channel
Center Frequencies	Normal and extreme	Ant. Port 1	Middle
Occupied Bandwidth	Normal	Ant. Port 1	Middle
RF Output Power,EIRP	Normal and extreme	Ant. Port 1 & 2	Low & High
Power Spectrum Density	Normal	Ant. Port 1 & 2	Low & High
Transmitter Unwanted emission Outside 5GHz R-LAN Bands	Normal	Ant. Port 1 & 2	Middle
Transmitter Unwanted emission within 5GHz R-LAN Bands	Normal	Ant. Port 1	Low & High
Receiver Spurious Emissions	Normal	Enclosure	Middle

Note: For 802.11a mode, all tests were performed in Ant.port 1.

For Receiver Spurious Emissions test item, the test was performed under 802.11n-HT40 mode.

4.4 Test Modes

Test mode	Keep the EUT in continuous transmitting mode (100% duty cycle)
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Remark:Pre-scan all data mode, MCS0 mode was the worst case mode, so all tests were performed in this mode.

4.5 Description of Support Units

The EUT has been tested independently.

4.6 Laboratory Facility

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

CNAS - Registration No.: L3923

Shenzhen Bontek Compliance Testing Laboratory Co., Ltd. to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.The acceptance letter from the CNAS is maintained in our files: Registration:L3923, April 22, 2015.

4.7 Laboratory Location

Shenzhen Bontek Compliance Testing Laboratory Co., Ltd.

1st-3rd Floor, Building C, Shuanghuan Xin Yi Dai Hi-Tech Industrial Park, No.8 Baoqing Road, Baolong Industrial Zone, Longgang District, Shenzhen, Guangdong, China

Tel: +86-755-86337020

Fax: +86-755-86337028

4.8 Test Instruments list

No.	Equipment	Manufacturer	Model No.	S/N	Calculator date	Calculator due date
1	EMI Test Receiver	R&S	ESCI	100687	2015-4-6	2016-4-5
2	EMI Test Receiver	R&S	ESPI	100097	2014-7-25	2015-7-24
3	Amplifier	HP	8447D	1937A02492	2015-4-6	2016-4-5
4	Single Power Conductor Module	FCC	FCC-LISN-5-50-1-01-CISPR25	07101	2015-4-6	2016-4-5
5	Single Power Conductor Module	FCC	FCC-LISN-5-50-1-01-CISPR25	07102	2015-4-6	2016-4-5
6	Power Clamp	SCHWARZBECK	MDS-21	3812	2015-4-6	2016-4-5
7	Positioning Controller	C&C	CC-C-1F	MF7802113	N/A	N/A
8	Electrostatic Discharge Simulator	TESEQ	NSG437	125	2015-4-6	2016-4-5
9	Signal generator	Rhode & Schwarz	SMIQ 03HD + option SM-B1, SMIQB11, SMIQB12, SMIQB14, SMIQB17, SMIQB20	1125.5555.46	2015-4-6	2016-4-5
10	GSM system simulator	Rhode & Schwarz	CMU200 + option K20, K21, K22, K23, K24, K27, K28, K29, K42, K65, B12, B41, B52, B66, B56	1100.0008.34	2015-4-6	2016-4-5
11	GSM system simulator	Agilent	8960 Series 10 E1985A + GSM_AMPS	B.01.76 GB42450443	2015-4-6	2016-4-5
12	Spectrum Analyzer	Agilent	E4404B	US41192833	2015-4-6	2016-4-5
14	6dB Attenuator	Atten	Attenuator	DC-4GHz	2015-4-6	2016-4-5
15	Digital Multimeter	Fluke	15B	91280239	2015-4-6	2016-4-5
16	Fast Transient Burst Generator	SCHAFFNER	MODULA6150	34572	2015-4-6	2016-4-5
17	Fast Transient Noise Simulator	Noiseken	FNS-105AX	10501	2015-4-6	2016-4-5
20	Capacitive Coupling Clamp	TESEQ	CDN8014	25096	2015-4-6	2016-4-5
24	TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB9163	9163-324	2015-4-6	2016-4-5
25	Horn Antenna	SCHWARZBECK	BBHA9120A	0499	2014-11-28	2015-11-27
27	Triple-Loop Antenna	EVERFINE	LLA-2	711002	2015-4-6	2016-4-5
29	RF POWER AMPLIFIER	FRANKONIA	FLL-75	1020A1109	2015-4-6	2016-4-5
30	CDN	FRANKONIA	CDN M2+M3	A3027019	2015-4-6	2016-4-5

31	6DB Attenuator	FRANKONIA	N/A	1001698	2015-4-6	2016-4-5
32	EM Injection clamp	FCC	F-203I-23mm	091536	2015-4-6	2016-4-5
33	9kHz-2.4GHz signal generator 2024	MARCONI	10S/6625-99-457-8730	112260/042	2015-4-6	2016-4-5
34	10dB attenuator	ELECTRO-METRICS	EM-7600	836	2015-4-6	2016-4-5
35	10KV surge generator	SANKI	SKS-0510M	048110003E321	2015-11-14	2016-11-13
36	HRMONICS&FLICKRE ANALYSER	VOLTECH	PM6000	200006700433	2014-6-27	2015-6-26
37	Spectrum Analyzer	R&S	FSP	100397	2014-11-2	2015-11-1
38	Broadband preamplifier	SCH WARZBECK	BBV9718	9718-182	2015-4-6	2016-4-5
39	Temperature & Humidity Chamber	TOPSTAT	TOS-831A	3438A05208	2015-4-6	2016-4-5



5 Essential Radio Test Suites Specification in EN 301893.

5.1 Test Conditions

Please refer to **EN 301893 Clause 5.1.1**

Normal Test Condition:

Temperature: +15 °C to +30 °C;

The normal test voltage is 230Vac

Extreme Test Conditions:

(1). Temperatures: -40°C to +60°C.

(2). Voltages: 217 Vac to 253 Vac;

5.2 Centre frequencies

Test Method: EN 301 893: clause 5.3.2.

EUT Operations: Refer to section 5.4 of this report

Ambient: Temp.: 25 °C, Humid.: 52% Press.: 1010 mBar

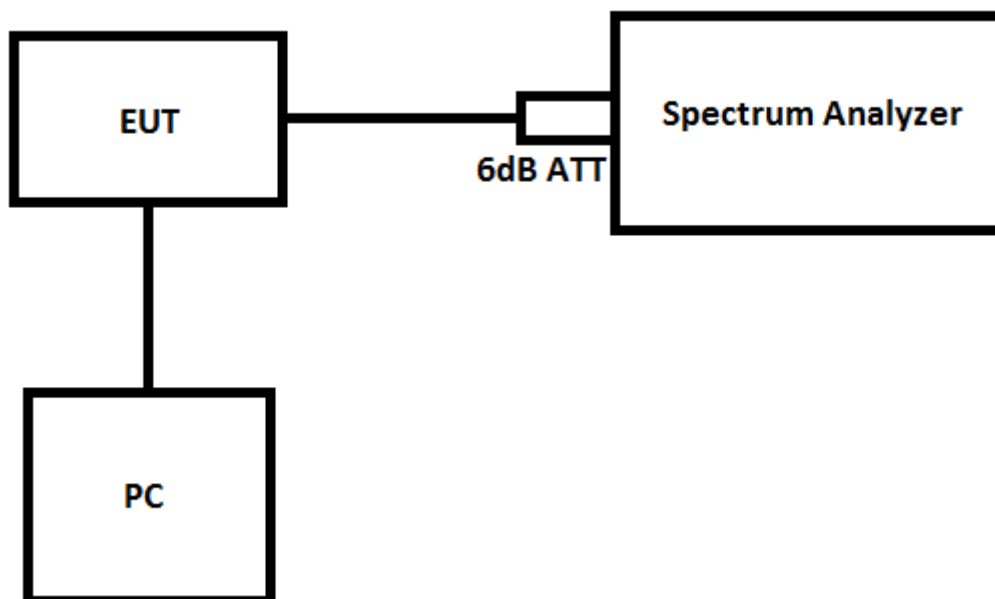
Equipment Used: Refer section 5.8 of this report.

5.2.1 Test Limit

EN 301 893: clause 4.2.2

The actual centre frequency for any given channel declared by the manufacturer shall be maintained within the range $f_c \pm 20$ ppm.

5.2.2 Test Setup



5.2.3 Measurement Record:

Test Data

Frequency (MHz)	Measured Frequency For Operating Conditions					Maximum Frequency Error (kHz)	Maximum Frequency Error (ppm)
	Normal	Extreme					
	25 °C 230 Vac	-40 °C 217 Vac	-40 °C 253 Vac	60 °C 217 Vac	60 °C 253 Vac		
TX0-802.11a mode							
5600	5599.96	5599.93	5599.93	5599.92	5599.91	-90	-16.07
TX1-802.11a mode							
5600	5599.96	5599.92	5599.95	5599.92	5599.94	-80	-14.28
TX0-802.11n-HT20							
5600	5599.96	5599.93	5599.92	5599.90	5599.93	-100	-17.85
TX1-802.11n-HT20							
5600	5599.96	5599.94	5599.92	5599.92	5599.96	-80	-14.28
TX0-802.11n-HT40							
5590	5590.00	5589.91	5589.91	5589.92	5589.90	-100	-17.89
TX1-802.11n-HT40							
5590	5590.00	5589.90	5589.94	5599.93	5589.92	-100	-17.89

Test Result:Pass



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