

TEST REPORT


Applicant	Benq Corporation
Address	16 Jihu Road, Neihu, Taipei 114, Taiwan

Manufacturer or Supplier	Benq Corporation
Address	16 Jihu Road, Neihu, Taipei 114, Taiwan
Product	InstaShow S Host
Brand Name	BenQ
Model	WDC20R
Additional Model & Model Difference	N/A
Date of tests	Jun. 07, 2021 ~ Jun. 19, 2021

The tests have been carried out according to the requirements of the following standard:

☒ **FCC Part 15, Subpart C, Section 15.247**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Tested by Andy Zhu Supervisor / EMC Department	Approved by Glyn He Assistant Manager / EMC Department
	 Date: Dec. 13, 2021

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TABLE OF CONTENTS

RELEASE CONTROL RECORD	3
1 SUMMARY OF TEST RESULTS.....	4
2 MEASUREMENT UNCERTAINTY	4
3 GENERAL INFORMATION	5
3.1 GENERAL DESCRIPTION OF EUT	5
3.2 DESCRIPTION OF TEST MODES	7
3.2.1 CONFIGURATION OF SYSTEM UNDER TEST	8
3.2.2 Test Mode Applicability and tested channel detail	8
3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS	9
3.4 DESCRIPTION OF SUPPORT UNITS	9
4 TEST TYPES AND RESULTS.....	10
4.1. RADIATED EMISSION MEASUREMENT	10
4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT	10
4.2.2 TEST INSTRUMENTS.....	11
4.2.3 TEST PROCEDURES	12
4.2.4 DEVIATION FROM TEST STANDARD	13
4.2.5 TEST SETUP.....	14
4.2.6 EUT OPERATING CONDITIONS	15
4.2.7 TEST RESULTS	16
4 PHOTOGRAPHS OF THE TEST CONFIGURATION.....	18
5 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB	19



Test Report No.: RF2102WDG0185-1

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF190730N005-1	Original release	Nov. 04, 2019
RF2102WDG0185-1	Based on the report RF190730N005-1, added heat sink, shielded case and ANT GND to the motherboard, it needs to be retested Radiated Emission (below 1GHz) test item after engineer evaluated.	Dec. 13, 2021

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit.

Note: This report is prepared for supplementary report.

2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Radiated emissions	9KHz ~ 30MHz	2.16dB
	30MHz ~ 1GMHz	3.82dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	InstaShow S Host
MODEL NO.	WDC20R
ADDITIONAL NO.	N/A
FCC ID	JVPWDC20R
NOMINAL VOLTAGE	DC 12V From Adapter Input 100-240V~ 50/60Hz 0.6A max
MODULATION TECHNOLOGY	DSSS, OFDM
MODULATION TYPE	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
OPERATING FREQUENCY	2412MHz ~ 2462MHz for 11b/g/n(HT20) 2422MHz ~ 2452MHz for 11n(HT40)
PEAK OUTPUT POWER	22.47dBm(Maximum)
ANTENNA TYPE	Dipole Antenna, with 3.01dBi gain
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	DC Line: Unshielded, Detachable 30cm

NOTES:

1. This is a supplementary report of Report No: RF190730N005-1. The differences between them are as follows:

- added heat sink, shielded case and ANT GND to the motherboard.

According to the above conditions, only Radiated Emission (below 1GHz) test item needs to be performed. And all data was verified to meet the requirements.

2. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitter and 2 receiver.

MODULATION MODE	FUNCTION
802.11b	2TX
802.11g	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX

3. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
4. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
5. Please refer to the EUT photo document (Reference No.: 2102WDG0185) for detailed product photo.
6. The EUT was powered by the following adapter:

Adapter
BRAND: N/A



Test Report No.: RF2102WDG0185-1

MODEL:	FJ-SW1202000N
INPUT:	100-240V~ 50/60Hz 0.6A max
OUTPUT:	DC 12V, 2000mA
DC LINE:	Unshielded, Non-detachable 120cm

3.2 DESCRIPTION OF TEST MODES

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2412 MHz	7	2442 MHz
2	2417 MHz	8	2447 MHz
3	2422 MHz	9	2452 MHz
4	2427 MHz	10	2457 MHz
5	2432 MHz	11	2462 MHz
6	2437 MHz		

7 channels are provided for 802.11n (HT40):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz		

3.2.1 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photographs of the test configuration for reference.

3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports.

The worst case was found when positioned on X axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report:

EUT CONFIGURE MODE	APPLICABLE TO				MODE
	RE<1G	RE≥1G	PLC	APCM	
-	√	-	-	-	Powered by Adapter with WIFI function

Where **RE<1G**: Radiated Emission below 1GHz

RE≥1G: Radiated Emission above 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

RADIATED EMISSION TEST (BELOW 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports (if EUT with antenna diversity architecture).

- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1	DSSS	DBPSK	1.0

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE	TESTED BY
RE<1G	25deg. C, 53%RH	DC 12V from Adapter	yoyo
RE≥1G	-	-	-
PLC	-	-	-
APCM	-	-	-

3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C, Section 15.247

KDB 558074 D01 15.247 Meas Guidance v05r02

KDB 662911 D01 v02r01

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together without other necessary accessories or support units.

4 TEST TYPES AND RESULTS

4.1. RADIATED EMISSION MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTES:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESU40	100449	Mar. 07,22
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV7	102331	May 09, 22
Active Loop Antenna (9KHz -30MHz)	SCHWARZBECK	FMZB 1519B	1519B-045	May 29,22
Amplifier (9KHz -1GHz)	Burgeon	BPA-530	100210	Mar. 13,22
Bilog Antenna (20MHz -2GHz)	Teseq	CBL 6111D	30643	May 29,22
Horn Antenna (1GHz -18GHz)	ETS -Lindgren	3117	00062558	May 29,22
Horn Antenna (18GHz -40GHz)	SCHWARZBECK	BBHA 9170	BBHA9170147	May 09, 22
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	NSEMC003	May 22,22
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A
Broadband Preamplifier (1GHz~18GHz)	SCHWARZBECK	BBV9718	305	May 08,22
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Mar. 13,22
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A

NOTES:

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 749762.

4.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. For below 1GHz was used bilog antenna, and above 1GHz was used horn antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
- g. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

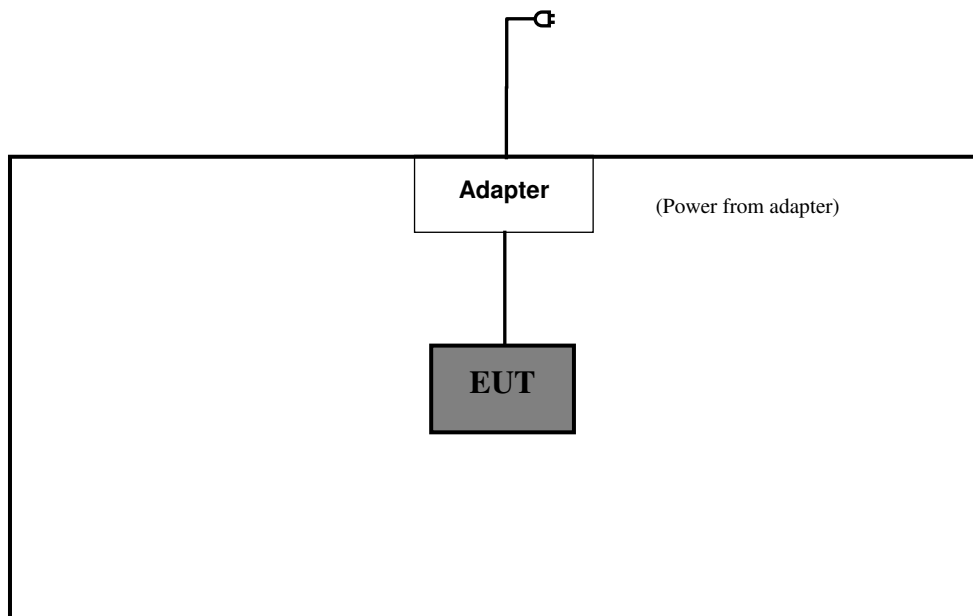
NOTES:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes, the worst-case test configuration was reported on the file test setup photo.

4.2.4 DEVIATION FROM TEST STANDARD

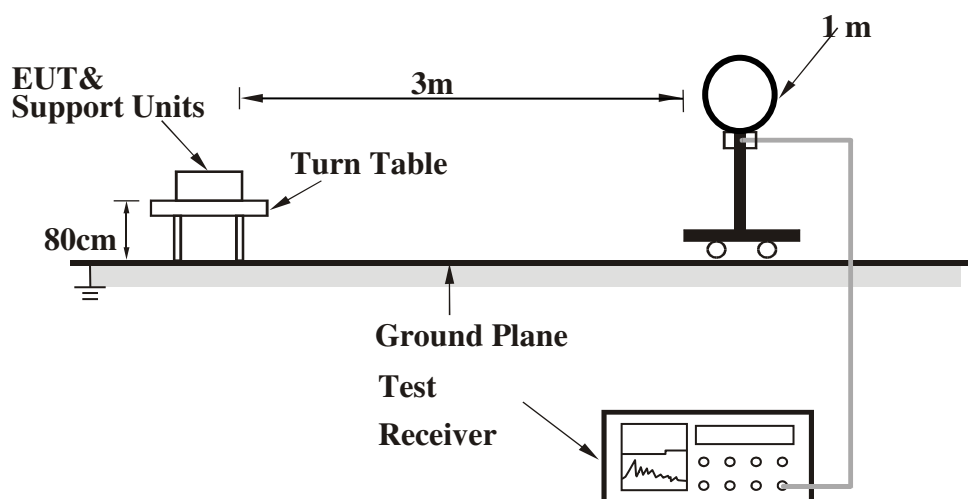
No deviation.

4.2.1 TEST SETUP DIAGRAM

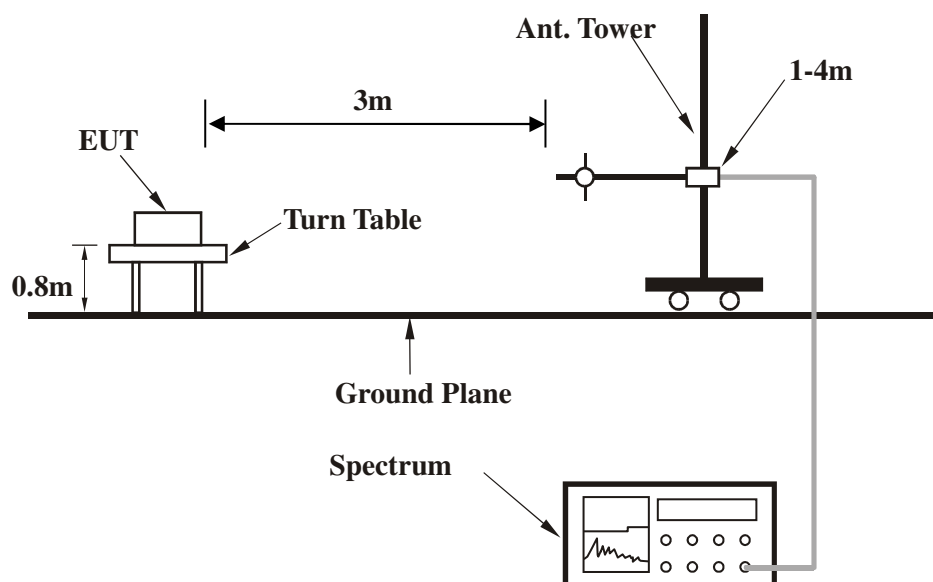


4.2.5 TEST SETUP

Below 30MHz test setup



Below 1GHz test setup



Note: For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT OPERATING CONDITIONS

- a. Placed the EUT on a testing table.
- b. Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- c. The necessary accessories enable the EUT in full functions.

4.2.7 TEST RESULTS

BELOW 1GHz WORST-CASE DATA:

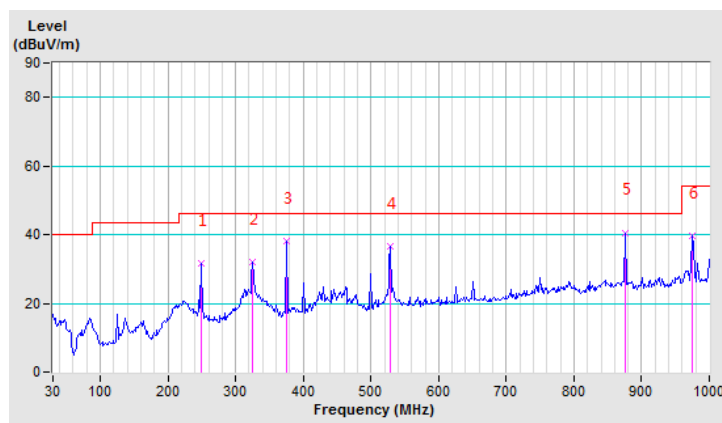
802.11b

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	249.18	31.58 QP	46.00	-14.42	1.00 H	360	48.20	-16.62
2	325.35	31.98 QP	46.00	-14.02	1.00 H	0	45.41	-13.43
3	375.10	38.01 QP	46.00	-7.99	1.00 H	359	49.96	-11.95
4	528.99	36.65 QP	46.00	-9.35	1.00 H	310	45.15	-8.50
5	875.64	40.58 QP	46.00	-5.42	1.00 H	296	42.83	-2.25
6	975.13	39.63 QP	54.00	-14.37	1.00 H	156	40.24	-0.61

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

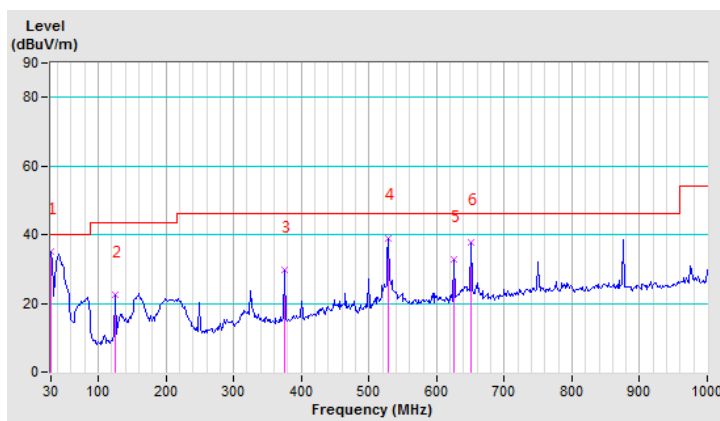


CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	30.00	35.05 QP	40.00	-4.95	1.00 V	125	47.11	-12.06
2	124.82	22.37 QP	43.50	-21.13	1.00 V	230	41.75	-19.38
3	375.10	29.60 QP	46.00	-16.40	1.00 V	201	41.55	-11.95
4	528.99	39.05 QP	46.00	-6.95	1.00 V	85	47.55	-8.50
5	625.37	32.85 QP	46.00	-13.15	1.00 V	144	39.20	-6.35
6	650.24	37.74 QP	46.00	-8.26	1.00 V	167	43.49	-5.75

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.





Test Report No.: RF2102WDG0185-1

4 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).

5 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---