FCC RF Exposure Exemption report

for

Embedded Display System with CAN Bus

Model No.: E070W1D1-4 V.3U

FCC ID: 2AT5JE070W1D14V3U

of

Applicant: Powerview Display Corp.
Address: Rm. 5, 6F., No. 32, Taiyuan St., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)

Tested and Prepared

by

Worldwide Testing Services (Taiwan) Co., Ltd.

FCC Registration No.: TW1477, TW1072

Industry Canada filed test laboratory Reg. No.: 20037, 5107A

Report No.: W6M22305-22685-EE

6F, NO. 58, LANE 188, RUEY-KUANG RD., NEIHU TAIPEI 114, TAIWAN, R.O.C.
TEL: 886-2-66068877 FAX: 886-2-66068879 E-mail: wts@wts-lab.com

Registration number: W6M22305-22685-EE
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1 General Information

1.1 Notes

The purpose of conformity testing is to increase the probability of adherence to the essential requirements or conformity specifications, as appropriate.
The complexity of the technical specifications, however, means that full and thorough testing is impractical for both technical and economic reasons.
Furthermore, there is no guarantee that a test sample which has passed all the relevant tests conforms to a specification.
Neither is there any guarantee that such a test sample will interwork with other genuinely open systems.
The existence of the tests nevertheless provides the confidence that the test sample possesses the qualities as maintained and that is performance generally conforms to representative cases of communications equipment.

Laboratory disclaimer-
1. The test results of this test report relate exclusively to the item tested as specified in 1.5.
2. The test report may only be reproduced or published in full.
3. Reproduction or publication of extracts from the report requires the prior written approval of the Worldwide Testing Services(Taiwan) Co., Ltd.
4. Antenna gain is provided by applicant and laboratory issue relevant data and results.

Tester:

Date	WTS-Lab.	Name	Signature
July 21, 2023		Sora Kuo	Sora

Technical responsibility for area of testing:

Date	WTS	Name	Signature
July 21, 2023		Kevin Wang	Kevin Wang

1.2 Testing laboratory

1.2.1 Location

10m OATS
No.5-1, Lishui, Shuang Sing Village, Wanli Dist.,
New Taipei City 207, Taiwan (R.O.C.)

3 meter semi-anechoic chamber
No.35, Aly. 21, Ln. 228, Ankang Rd., Neihu Dist.,
Taipei City 114, Taiwan (R.O.C.)
Tel: 886-2-6613-0228

Worldwide Testing Services (Taiwan) Co., Ltd.
6F., No. 58, Ln. 188, Ruiguang Rd., Neihu Dist.,
Taipei City 114 , Taiwan (R.O.C.)
Tel: 886-2-6606-8877

1.2.2 Details of accreditation status

Accredited testing laboratory
FCC filed test laboratory Reg. No.: TW1477, TW1072
Industry Canada filed test laboratory Reg. No.: 20037, 5107A

Test location, where different from Worldwide Testing Services (Taiwan) Co., Ltd. :

Name:	./.
Accredited no.:	./.
Street:	./.
Town:	./.
Country:	./.

1.3 Application details

Approval holder

Name:	Powerview Display Corp.
Street:	Rm. 5, 6F., No. 32, Taiyuan St., Zhubei City,
Town:	Hsinchu County 302,
Country:	Taiwan (R.O.C.)

Manufacturer: (if applicable)

Name:	./.
Street:	./.
Town:	./.
Country:	./.

Date of receipt of test item: June 08, 2023

Date of test: from June 09, 2023 to July 13, 2023

1.4 General information of Test item

Type of test item: Embedded Display System with CAN Bus

Model no.: E070W1D1-4 V.3U

Multi-listing model no.: E070W1D1-4 v.nx

Brand name: ./.

Power supply: 12Vd.c., 2A

Battery 3.7Vd.c. (working battery)

Battery 3Vd.c. (BR1225 RTC battery)

Type of antenna: WLAN 2.4G/BT: Chip antenna

WCDMA/LTE: PCB antenna

Antenna gain: WLAN 2.4G/BT: 1.53 dBi

WCDMA

Band 2: 1.72 dBi、Band 4: 2.05 dBi、Band 5: -1.81 dBi

LTE

Band 2: 1.69 dBi、Band 4: 2.06 dBi、Band 12: -6.94 dBi

Technical data

WLAN		
Mode	Channel	Conducted Power (dBm)
802.11b	Ch 1 : 2412 MHz	14.96
	Ch 6 : 2437 MHz	15.21
	Ch 11 : 2462 MHz	15.15
802.11g	Ch 1 : 2412 MHz	10.73
	Ch 6 : 2437 MHz	14.11
	Ch 11 : 2462 MHz	11.17
802.11n20MHz	Ch 1 : 2412 MHz	11.26
	Ch 6 : 2437 MHz	13.35
	Ch 11 : 2462 MHz	11.29
802.11n40MHz	Ch 1 : 2422 MHz	6.69
	Ch 4 : 2437 MHz	11.30
	Ch 7 : 2452 MHz	6.78

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Bluetooth		
Mode	Channel	Conducted Power (dBm)
Normal mode	Ch 0 : 2402 MHz	7.81
	Ch 39 : 2441 MHz	7.82
	Ch 78 : 2480 MHz	7.65
EDR mode	Ch 0 : 2402 MHz	4.70
	Ch 39 : 2441 MHz	5.32
	Ch 78 : 2480 MHz	4.89
Low energy mode	Ch 0 : 2402 MHz	6.38
	Ch 19 : 2440 MHz	7.03
	Ch 39 : 2480 MHz	6.52

WCDMA			
Band	Channel/Frequency(MHz)	Conducted Power (dBm)	EIRP/ERP (dBm)
Band 2	CH 9400/1880 MHz	21.58	23.3
Band 4	CH 1312/1712.4 MHz	22.02	24.07
Band 5	CH 4183/836.6 MHz	22.96	19

LTE			
Band	Channel/Frequency(MHz)	Conducted Power (dBm)	EIRP/ERP (dBm)
Band 2	CH 18625/1852.5 MHz	22.47	24.16
Band 4	CH 20175/1732.5 MHz	22.07	24.13
Band 12	CH 23095/707.5 MHz	21.73	19.58

Operation modes: Duplex

Modulation type: WLAN: DSSS, OFDM

Bluetooth Normal & EDR mode: GFSK、π/4DQPSK、8DPSK

Bluetooth Low energy mode: GFSK

WCDMA: BPSK

LTE: QPSK, 16QAM

Sample no.: #03

Classification:

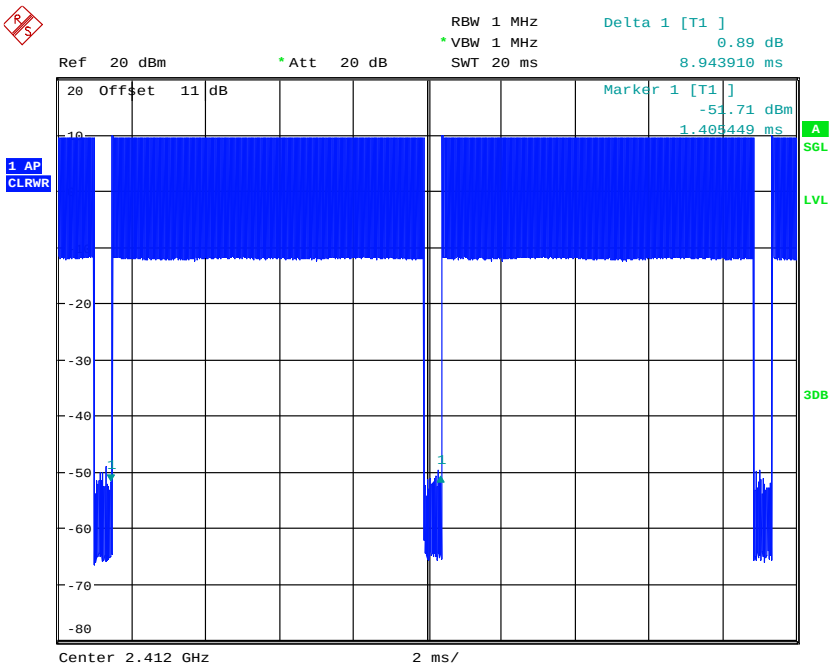
Fixed Device	☒
Mobile Device (Human Body distance ＞ 20cm)	☐
Portable Device (Human Body distance ＜ 20cm)	☐

1.5 Duty cycle and factor

The duty factor is computed as [10 log (1 / D)], where D is the duty cycle.

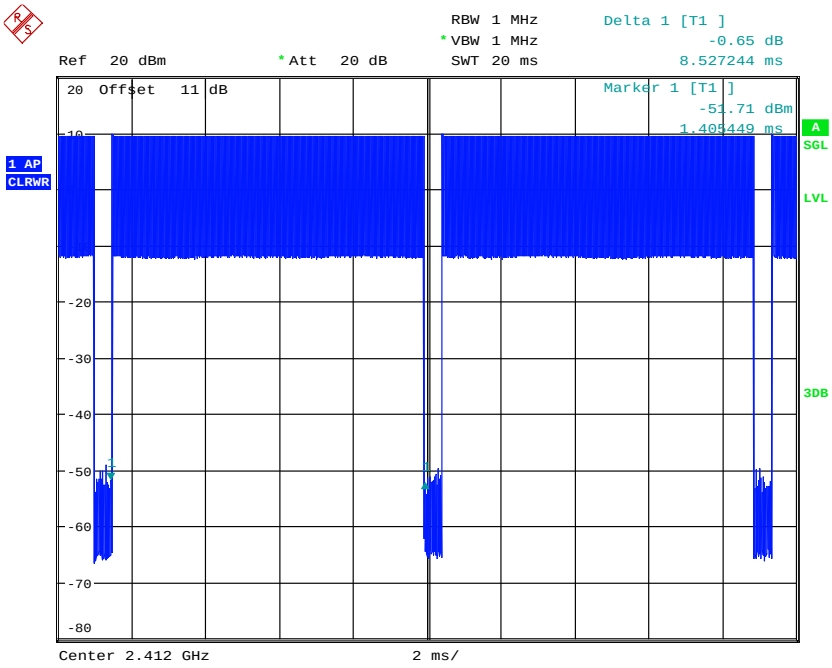
Mode	Ton (ms)	Ton+Toff (ms)	Duty cycle (%)	Duty Factor (dB)	1/T - VBW (KHz)
802.11b	8.527	8.943	95.35%	0.21	0.12
802.11g	1.423	1.903	74.78%	1.26	0.70
802.11n 20M	1.326	1.815	73.06%	1.36	0.75
802.11n 40M	0.661	1.134	58.29%	2.34	1.51

Duty cycle plot
802.11b



DUTY 802.11B
Date: 6.JUL.2023 13:10:23

Registration number: W6M22305-22685-EE
FCC ID: 2AT5JE070W1D14V3U



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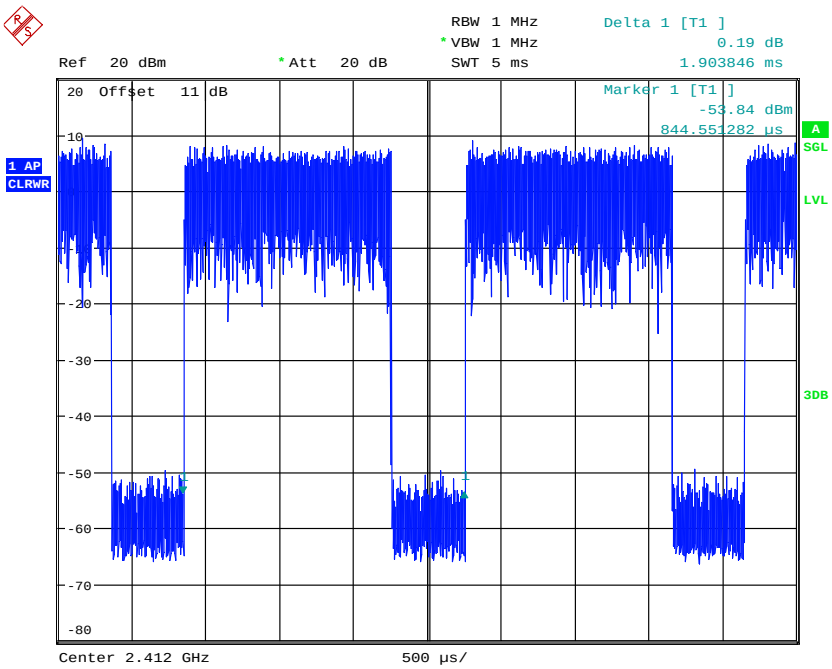
802.11g



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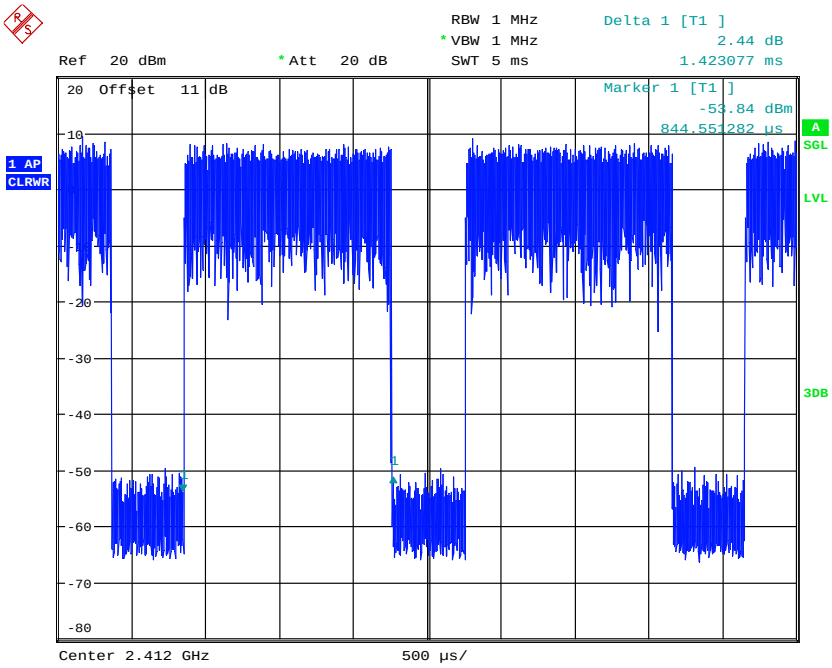
Registration number: W6M22305-22685-EE
FCC ID: 2AT5JE070W1D14V3U



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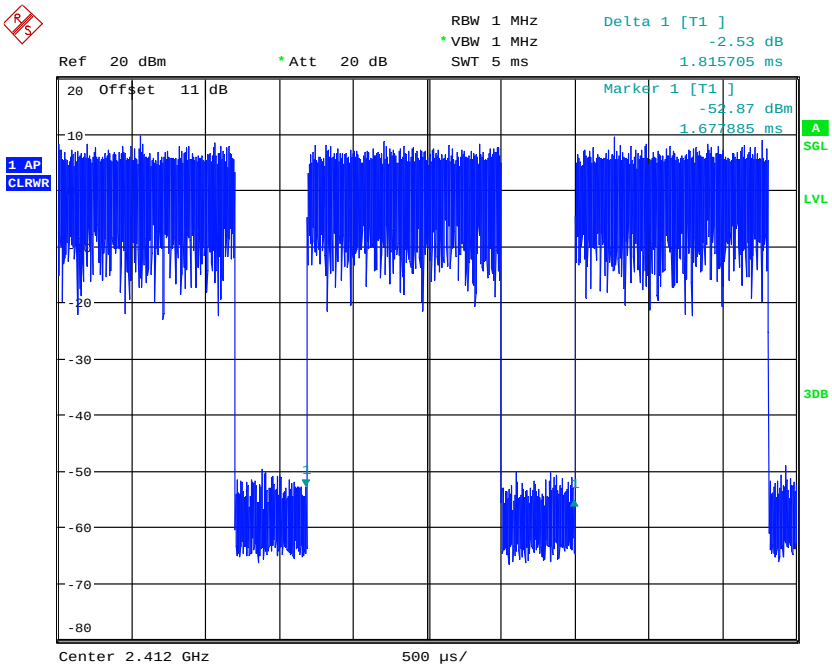
802.11n 20MHz



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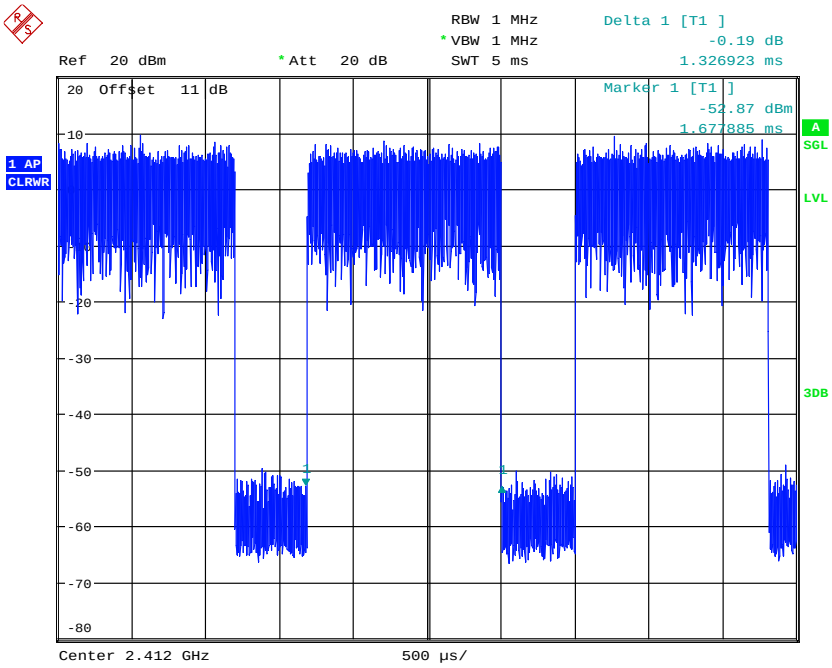
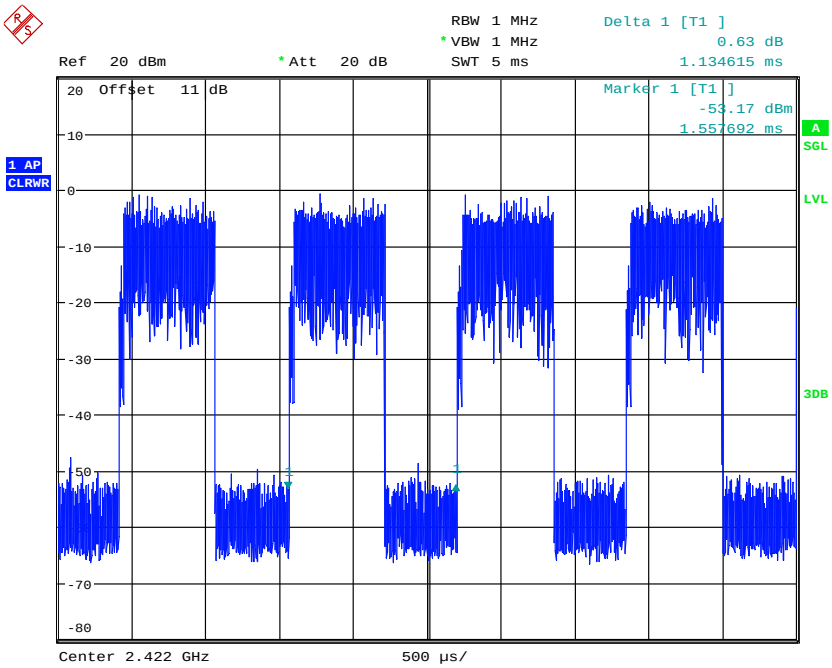
Date: 6.JUL.2023 13:12:41

Registration number: W6M22305-22685-EE
FCC ID: 2AT5JE070W1D14V3U



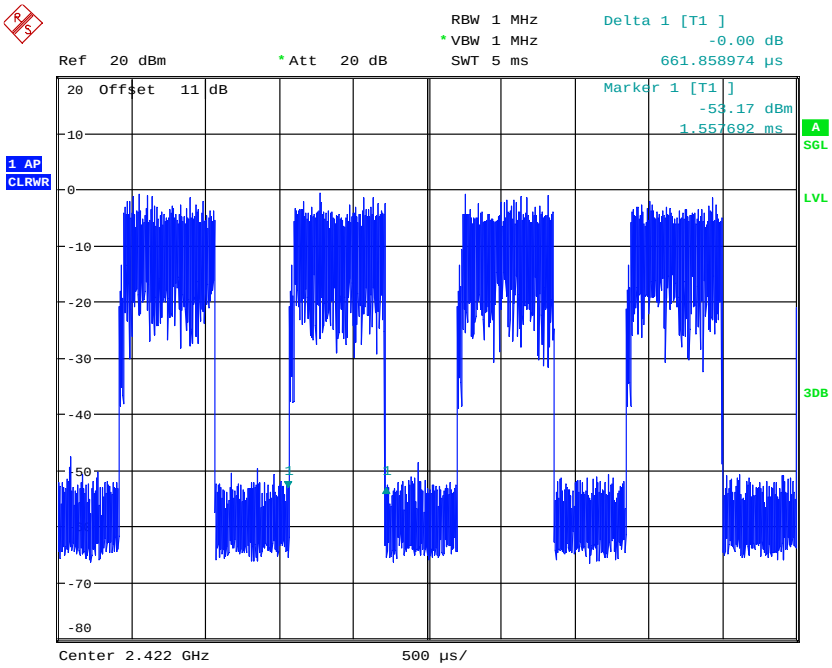
DUTY 802.11N20
Date: 6.JUL.2023 13:12:49

802.11n 40MHz



DUTY 802.11N40
Date: 6.JUL.2023 13:13:48

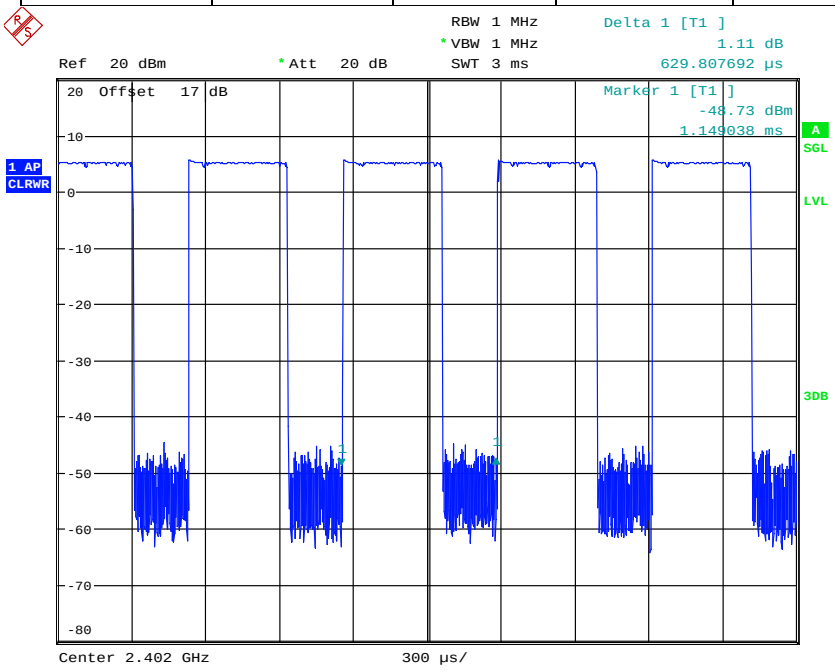
Registration number: W6M22305-22685-EE
FCC ID: 2AT5JE070W1D14V3U



DUTY 802.11N40
Date: 6.JUL.2023 13:13:56

Registration number: W6M22305-22685-EE
FCC ID: 2AT5JE070W1D14V3U

Mode	T_{on} (ms)	$T_{on}+T_{off}$ (ms)	Duty cycle (%)	1/T - VBW (kHz)
BLE	0.418	0.629	66.45%	2.39



DUTY BLE 1M
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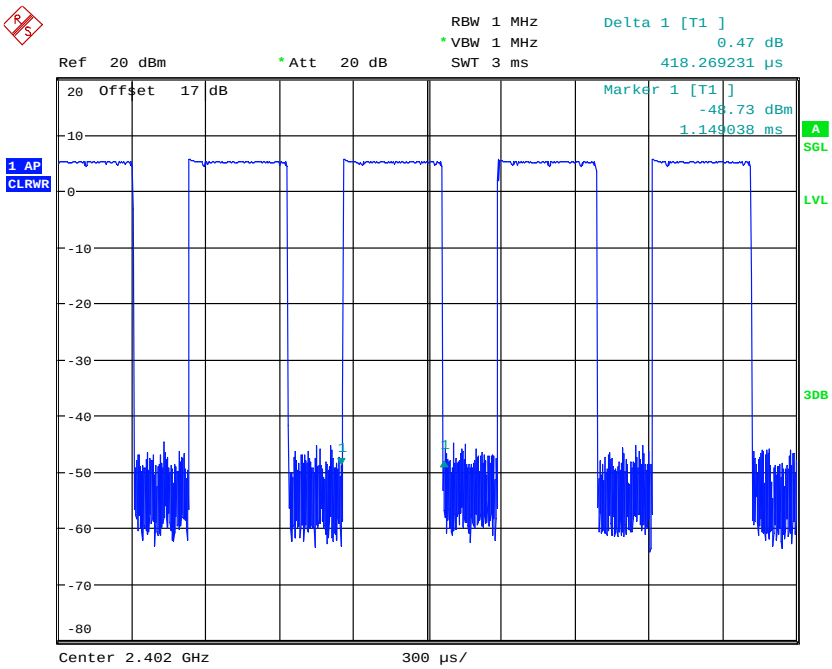

DUTY BLE 1M
Date: 6.JUL.2023 11:59:56

1.6 Test standards

15 SUBPART C § 15.247 (2021-10)
47CFR Part 22 (2021-10), Part 24 (2021-10), Part 27 (2021-10)

.

2 Test configuration

2.1 Test environment

Relative humidity content: 20 ... 75 %

Air pressure: 86 ... 103 kPa

Extreme conditions parameters: ./.

2.2 Measurement uncertainty

Test item Name	Uncertainty
Estimation Result of Uncertainty of Conducted Output Power Measurement (Peak Output Power (transmitter))	Expanded Uncertainty：1.48 dB

The decision rule is: Measurement uncertainty is not included in the calculation of test results.

2.3 Test Equipment List

RF Conducted

No.	Test equipment	Type	Serial No.	Manufacturer	Cal. Date	Next Cal. Date
ETSTW-CE 009	TEMP.&HUMIDITY CHAMBER	GTH-225-40-1P-U	MAA0305-009	GIANT FORCE	2022/8/3	2023/8/2
ETSTW-RE 050	Attenuator 10dB	50HF-010-1	None	JFW	2023/2/17	2024/2/16
ETSTW-RE 051	Attenuator 6dB	50HF-006-1	None	JFW	2023/2/17	2024/2/16
ETSTW-RE 053	Attenuator 3dB	50HF-003-1	None	JFW	2023/2/17	2024/2/16
ETSTW-RE 055	SPECTRUM ANALYZER	FSU 26	200074	R&S	2023/3/22	2024/3/21
ETSTW-RE 060	Attenuator 30dB	5015-30	F651012z-01	ATM	2023/2/17	2024/2/16
ETSTW-RE 099	DC Block	50DB-007-1	None	JFW	2023/2/17	2024/2/16
ETSTW-RE 112	AC POWER SOURCE	TFC-1005	T-0A023536	T-Power	Function test	
ETSTW-RE 127	RF Switch Box	RFS-01	None	WTS	2023/2/17	2024/2/16
ETSTW-RE 153	Signal Analyzer	FSV40	101929	R&S	2022/10/3	2023/10/2
ETSTW-GSM 023	Power Divider	4901.19.A	None	SUHNER	2022/9/2	2023/9/1
ETSTW-Cable 027	Microwave Cable	SUCOFLEX 104	279083	HUBER+SUHNER	2023/4/27	2024/4/26
ETSTW-Cable 030	Microwave Cable	SUCOFLEX 104 （S_Cable 9）	279067	HUBER+SUHNER	2023/02/17	2024/2/16
ETSTW-Cable 045	Microwave Cable	SUCOFLEX 104	325536	HUBER+SUHNER	2022/10/21	2023/10/20
ETSTW-Cable 058	Microwave Cable	SUCOFLEX 104	none	HUBER+SUHNER	2023/5/26	2024/5/25
WTSTW-SW 008	Signal studio	Agilent	None	AUDIX	Version 2.0.0.1	

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No.	Test equipment	Type	Serial No.	Manufacturer	Cal. Date	Next Cal. Date
ETSTW-GSM 002	Universal Radio Communication Tester	CMU 200	109439	R&S	2023/3/22	2024/3/21
ETSTW-GSM 003	Radio Communication Analyzer	MT8820C	6201342073	Anritsu	2023/5/10	2024/5/9
ETSTW-GSM 004	Wideband Radio Communication Tester	CMW500	128092	R&S	2022/10/24	2023/10/23
ETSTW-GSM 019	Band Reject Filter	WRCTF824/849-822/851-40 /12+9SS	3	WI	2023/1/4	2024/1/3
ETSTW-GSM 020	Band Reject Filter	WRCD1747/1748-1743/1752-32/5SS	1	WI	2023/1/4	2024/1/3
ETSTW-GSM 021	Band Reject Filter	WRCD1879.5/1880.5-1875.5/1884.5-32/5SS	3	WI	2023/1/4	2024/1/3
ETSTW-GSM 022	Band Reject Filter	WRCT901.9/903.1-904.25-50/8SS	1	WI	2023/1/4	2024/1/3
ETSTW-GSM 024	Radio Communication Analyzer	MT8821C	None	Anritsu	2022/5/3	2023/5/2
ETSTW-GSM 025	Band Reject Filter	BRM19835	1	Micro-Tronics	2022/8/5	2023/8/4

3 Equivalent Isotropic Radiated Power (EIRP)

3.1 Exemption Limits for Routine Evaluation according to 47 CFR FCC Part 2 Subpart J, section 2.1091

FCC OET Bulletin 65 Edition 97.01 determines the equations for predicting RF fields and applicable limits.
The prediction for power density in the far-field but will over-predict power density in the near field, where it could be used for walking a "worst case" or conservative prediction.
Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 20 cm normally can be maintained between the user and the device.

MPE Calculation Method

(A) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz *Plane-wave equivalent power density

E = Electric field (V/m) P = output power (W) G = EUT Antenna numeric gain (numeric)
d = Separation distance between radiator and human body (m)
The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2} \quad mW/cm^2.$$

WLAN 2.4G

Mode	Channel/ Frequency (MHz)	Max output power (dBm)	Antenna Gain (dBi)	Power density (mW/cm^2)	Limit (mW/cm^2)	Ratio
802.11b	Ch 1 : 2412 MHz	14.96	1.8	0.0094	1	0.0094
	Ch 6 : 2437 MHz	15.21	1.8	0.01	1	**0.01**
	Ch 11 : 2462 MHz	15.15	1.8	0.0098	1	0.0098
802.11g	Ch 1 : 2412 MHz	10.73	1.8	0.0036	1	0.0036
	Ch 6 : 2437 MHz	14.11	1.8	0.0078	1	0.0078
	Ch 11 : 2462 MHz	11.17	1.8	0.0039	1	0.0039
802.11n 20MHz	Ch 1 : 2412 MHz	11.26	1.8	0.0040	1	0.0040
	Ch 6 : 2437 MHz	13.35	1.8	0.0065	1	0.0065
	Ch 11 : 2462 MHz	11.29	1.8	0.0041	1	0.0041
802.11n 40MHz	Ch 1 : 2422 MHz	6.69	1.8	0.0014	1	0.0014
	Ch 4 : 2437 MHz	11.30	1.8	0.0041	1	0.0041
	Ch 7 : 2452 MHz	6.78	1.8	0.0014	1	0.0014

Band	Channel/Frequency (MHz)	Max output power (dBm)	Antenna Gain (dBi)	Power density (mW/cm^2)	Limit (mW/cm^2)	Ratio
WCDMA Band 2	CH 9400/ 1880 MHz	21.58	1.72	0.0425	1	0.0425
WCDMA Band 4	CH 1312/ 1712.4 MHz	22.02	2.05	0.0508	1	0.0508
WCDMA Band 5	CH 4183/ 836.6 MHz	22.96	-1.81	0.0259	0.5577	0.0464
LTE Band 2	CH 18625/ 1852.5 MHz	22.47	1.69	0.0518	1	**0.0518**
LTE Band 4	CH 20175/ 1732.5 MHz	22.07	2.06	0.0515	1	0.0515
LTE Band 12	CH 23095/ 707.5 MHz	21.73	-6.94	0.006	0.4717	0.0127

From the peak EUT RF output power, the minimum mobile separation distance, d = 20 cm, as well as the gain of the used antenna, the RF power density can be obtained.

Simultaneous evaluation-
0.01 (WLAN 2.4G) + 0.0518 (WCDMA) = 0.0618<1