FCC RF Exposure Exemption report

for

CamerEye v2.0

Model No.: CamerEye 23001 & CamerEye 23004

FCC ID: 2BDEX-CAMEREYE

of

Applicant: Angarak Inc.
Address: 4640 Cass St #91275 San Diego CA 92109 USA

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.: W6M22311-23076-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

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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
January 23, 2024		Rick Chen	Rick Chen.

Technical responsibility for area of testing:

Date	WTS	Name	Signature
January 23, 2024		Kevin Wang	Kevin Wang

Registration number: W6M22311-23076-EE
FCC ID: 2BDEX-CAMEREYE

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:	Angarak Inc.
Street:	4640 Cass St #91275 San Diego
Town:	CA 92109
Country:	USA

Manufacturer: (if applicable)

Name:	VVDN Technologies Pvt Ltd
Street:	Plot No: CP-07, Sector-8, IMT Manesar,
Town:	Gurugram, Haryana - 122050
Country:	India

Date of receipt of test item: November 17, 2023

Date of test: from November 20, 2023 to January 11, 2024

1.4 General information of Test item

Type of test item:	CamerEye v2.0
Model no.:	CamerEye 23001 & CamerEye 23004
Multi-listing model no.:	./.
Brand name:	CamerEye
Power supply:	Adapter (I/P: 100-240V~, 50-60Hz, 1.0A O/P: 12.0V⎓3.0A, 36.0W)
Type of antenna:	PIFA antenna
Antenna gain:	WLAN 2.4G
	ANT 1, ANT2: 3.6 dBi
	WLAN 5G
	ANT 1, ANT2:
	Band 1: 3.6 dBi
	Band 4: 3.6 dBi
Directional gain:	WLAN 2.4G: 6.61 dBi
	WLAN 5G: 6.61 dBi

According to KDB 662911, Unequal antenna gains, with equal transmit powers. For antenna gains given by G_1, G_2, …, G_N dBi. If transmit signals are correlated, then Directional gain $=10\log[(10^{G_1/20}+10^{G_2/20}+\ldots+10^{G_N/20})^2/N]$ dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]
Each with the same directional gain G_{ANT} dBi, being driven by N_{ANT} transmitter outputs of equal power. Directional gain is to be computed as follows:

If any transmit signals are correlated with each other, Direction gain= G_{ANT} + 10 log(N_{ANT}) dBi

Registration number: W6M22311-23076-EE
FCC ID: 2BDEX-CAMEREYE
Technical data:

WLAN 2.4G		
Mode	Channel	Conducted Power (dBm)
802.11b	Ch 1 : 2412 MHz	12.93
	Ch 6 : 2437 MHz	16.22
	Ch 11 : 2462 MHz	14.06
802.11g	Ch 1 : 2412 MHz	11.47
	Ch 6 : 2437 MHz	14.11
	Ch 11 : 2462 MHz	11.34
802.11n 20MHz	Ch 1 : 2412 MHz	13.18
	Ch 6 : 2437 MHz	16.89
	Ch 11 : 2462 MHz	13.34

WLAN 5G			
Band	Mode	Channel	Conducted Power (dBm)
NII-1	802.11a	Ch 36 : 5180 MHz	6.74
		Ch 44 : 5220 MHz	9.92
		Ch 48 : 5240 MHz	9.68
	802.11n 20M	Ch 36 : 5180 MHz	7.44
		Ch 44 : 5220 MHz	12.22
		Ch 48 : 5240 MHz	12.14
	802.11n 40M	Ch 38 : 5190 MHz	8.45
		Ch 46 : 5230 MHz	11.37
	802.11ac 80M	Ch 42 : 5210 MHz	6.19
NII-3	802.11a	Ch 149 : 5745 MHz	13.70
		Ch 157 : 5785 MHz	13.90
		Ch 165 : 5825 MHz	13.60
	802.11n 20M	Ch 149 : 5745 MHz	16.28
		Ch 157 : 5785 MHz	16.55
		Ch 165 : 5825 MHz	16.21
	802.11n 40M	Ch 151 : 5755 MHz	14.49
		Ch 159 : 5795 MHz	14.62
	802.11ac 80M	Ch 155 : 5775 MHz	13.71

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Bluetooth			
Band	Mode	Channel	Conducted Power (dBm)
2.4GHz	BR	Ch 0 : 2402 MHz	9.13
		Ch 39 : 2441 MHz	7.84
		Ch 78 : 2480 MHz	8.14
	EDR	Ch 0 : 2402 MHz	8.06
		Ch 39 : 2441 MHz	6.45
		Ch 78 : 2480 MHz	7.08
	BLE 1M	Ch 0 : 2402 MHz	2.94
		Ch 19 : 2440 MHz	0.69
	BLE 2M	Ch 0 : 2402 MHz	2.05
		Ch 19 : 2440 MHz	2.75
		Ch 39 : 2480 MHz	2.07

Operation modes: Duplex

Modulation type: WLAN 2.4G: DSSS/OFDM

WLAN 5G: OFDM/DSSS

Bluetooth: GFSK、π/4DQPSK、8DPSK

Sample no.: #01

Special statement: ./.

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.

WLAN 2.4G

Mode	T_{on} (ms)	$T_{on}+T_{off}$ (ms)	Duty cycle (%)	Duty Factor (dB)	1/T - VBW (kHz)
802.11b	8.637	8.669	99.63%	0.02	0.01
802.11g	1.434	1.45	98.90%	0.05	0.01
802.11n 20MHz	1.338	1.358	98.53%	0.06	0.01

WLAN 5G

Mode	T_{on} (ms)	$T_{on}+T_{off}$ (ms)	Duty cycle (%)	Duty Factor (dB)	1/T - VBW (kHz)
802.11a	1.438	1.446	99.45%	0.02	0.01
802.11n 20M	1.358	1.366	99.41%	0.03	0.01
802.11n 40M	0.673	0.685	98.25%	0.08	0.01
802.11ac 80M	0.344	0.357	96.36%	0.16	2.91

BLE

Mode	T_{on} (ms)	$T_{on}+T_{off}$ (ms)	Duty cycle (%)	1/T - VBW (kHz)
BLE 1M	0.421	0.625	67.36%	2.38
BLE 2M	1.122	1.875	59.84%	0.89

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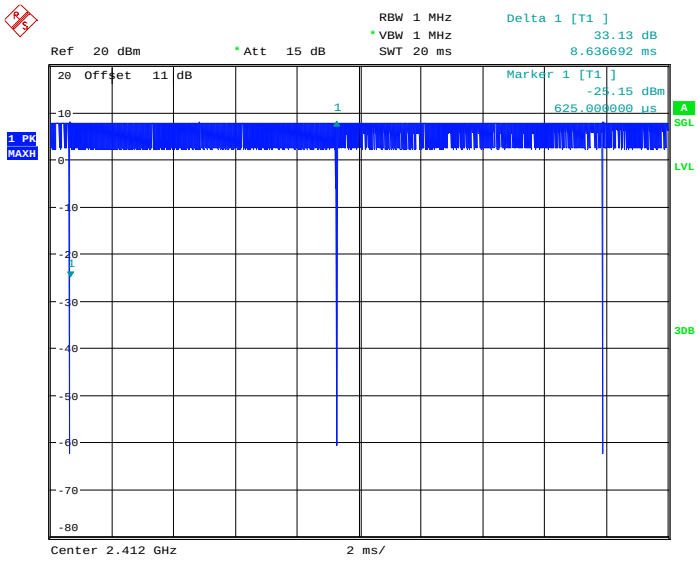
Duty cycle plot
WLAN 2.4G
802.11b



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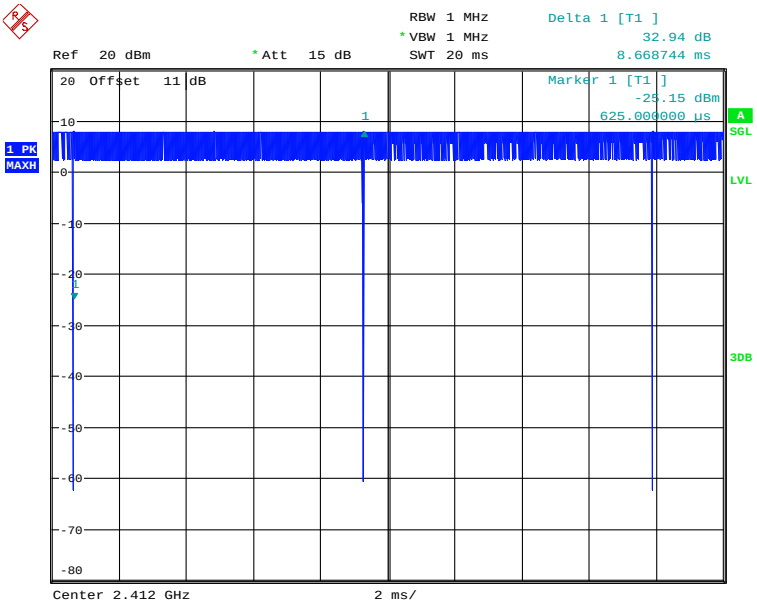

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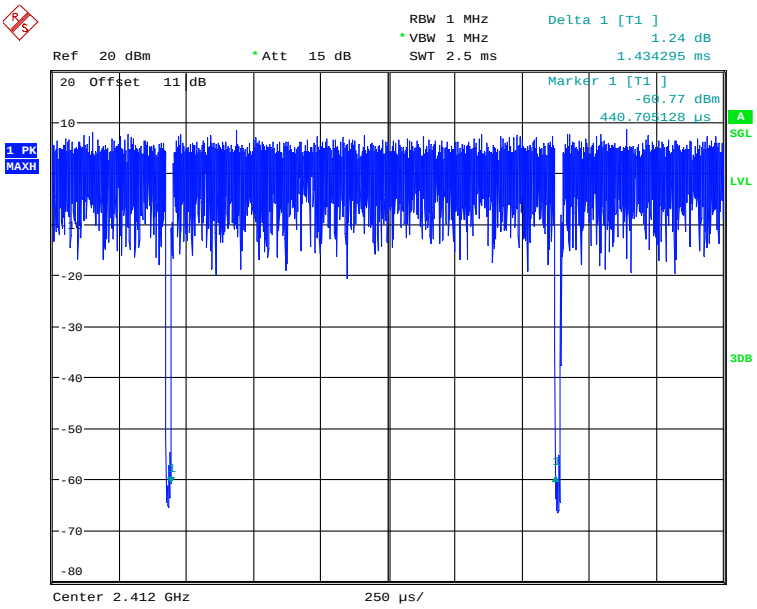
FCC ID: 2BDEX-CAMEREYE

802.11g



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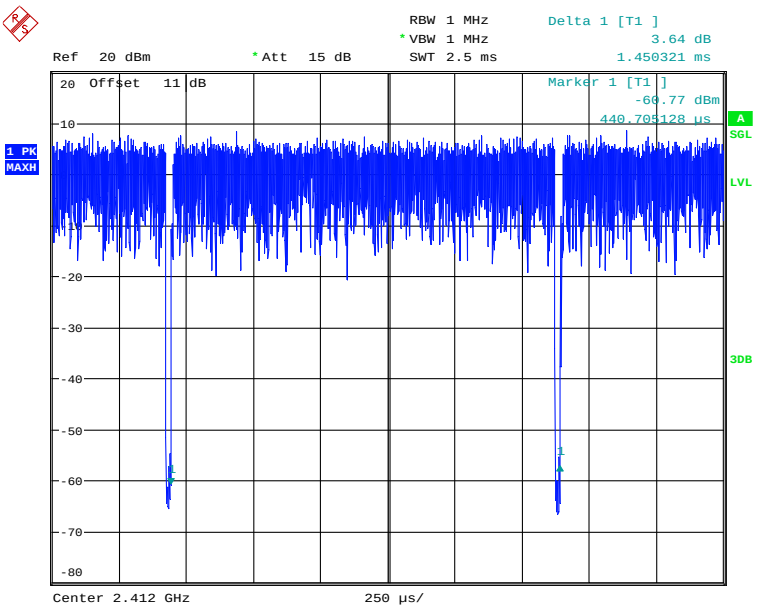

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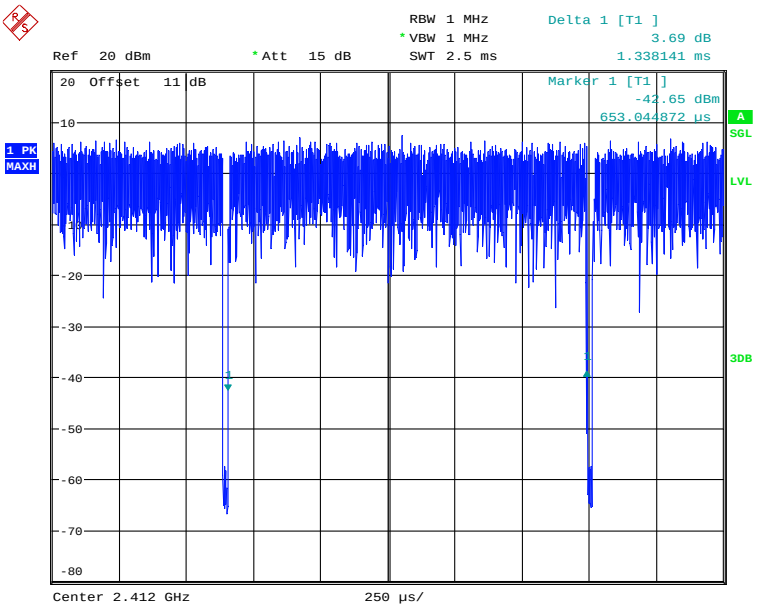
FCC ID: 2BDEX-CAMEREYE
802.11n 20MHz



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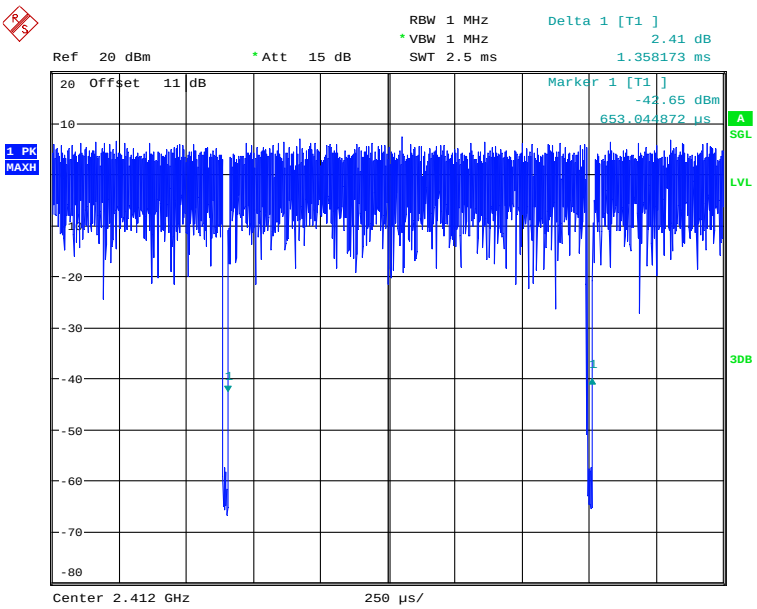

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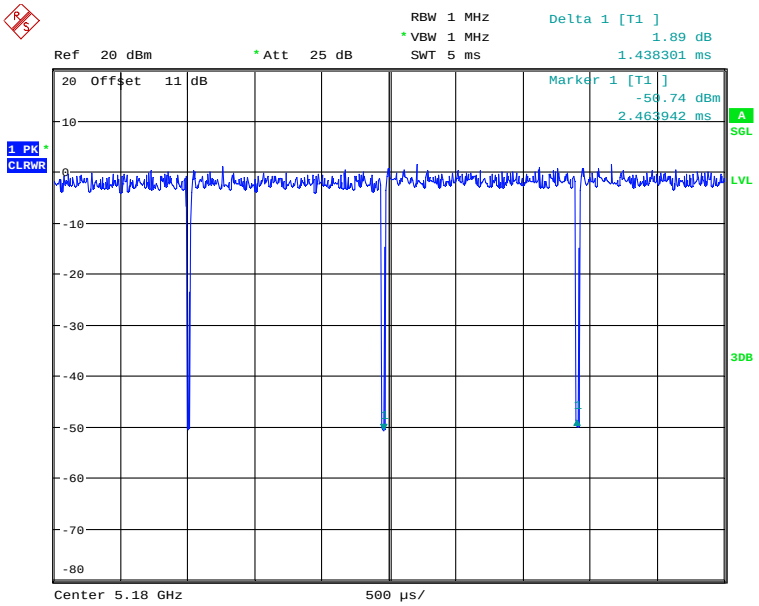
FCC ID: 2BDEX-CAMEREYE
WLAN 5G
802.11a



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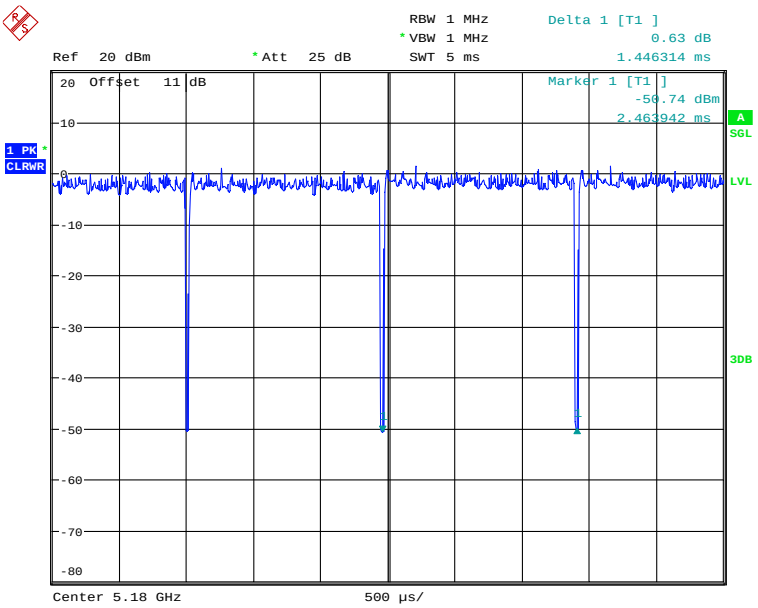

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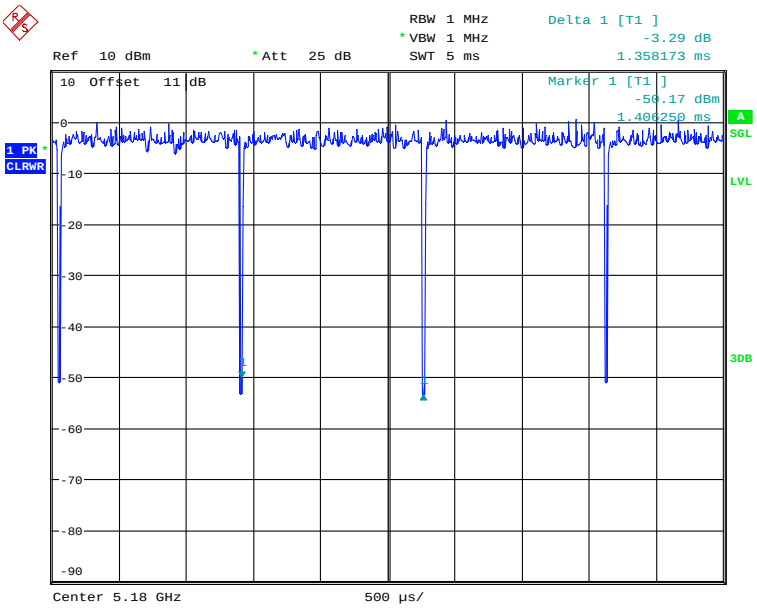
Registration number: W6M22311-23076-EE
FCC ID: 2BDEX-CAMEREYE

802.11n 20MHz



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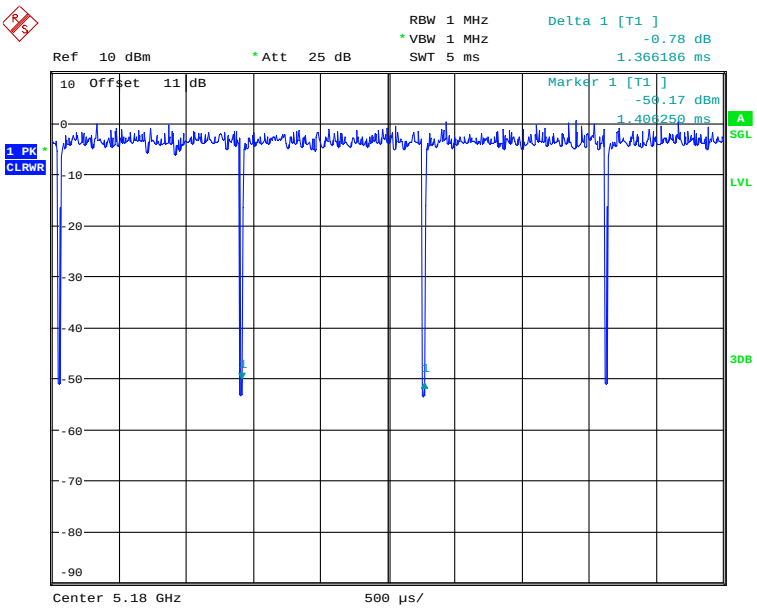

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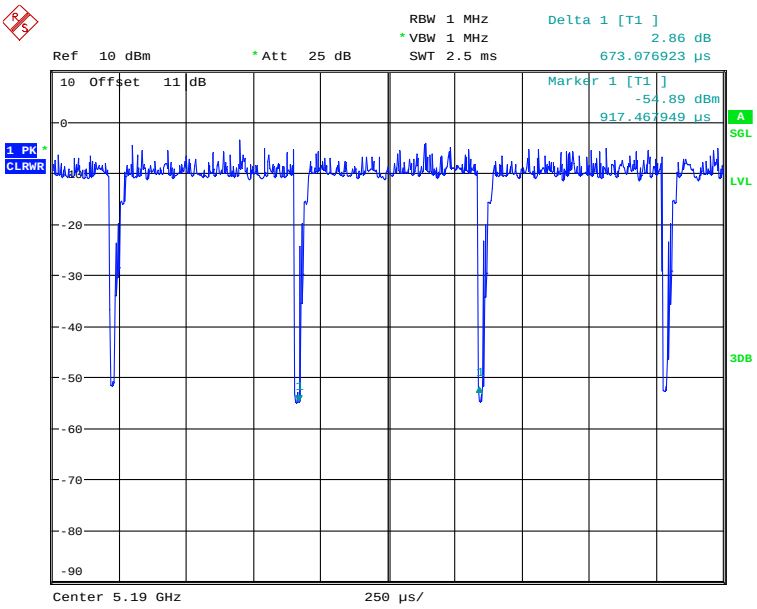
FCC ID: 2BDEX-CAMEREYE
802.11n 40MHz



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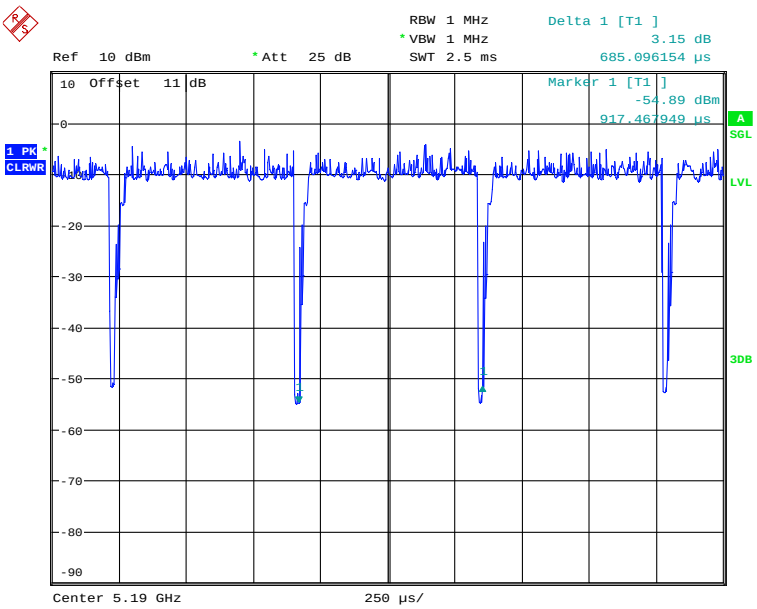

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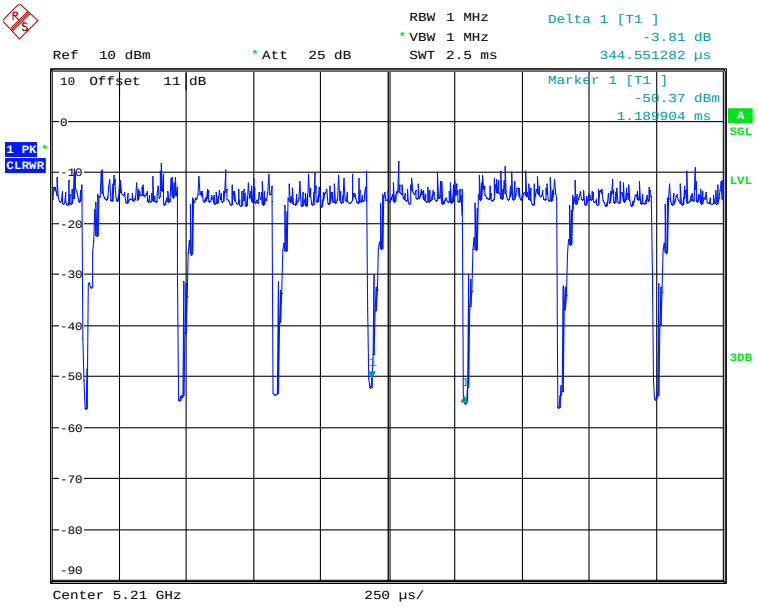
FCC ID: 2BDEX-CAMEREYE
802.11ac 80MHz



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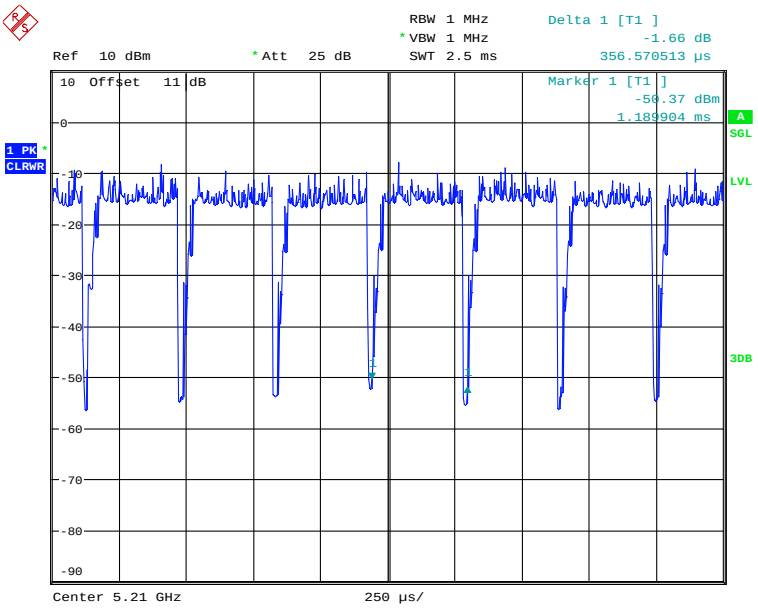

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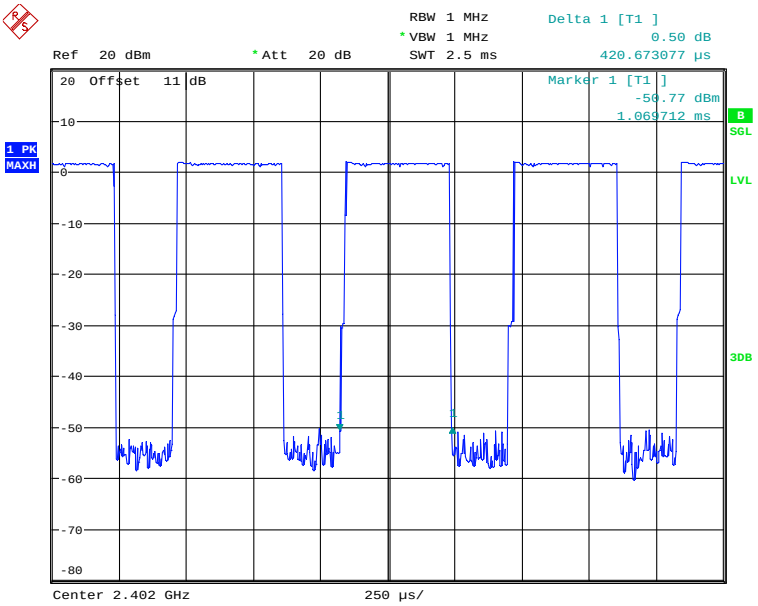
Registration number: W6M22311-23076-EE
FCC ID: 2BDEX-CAMEREYE
BLE
1M



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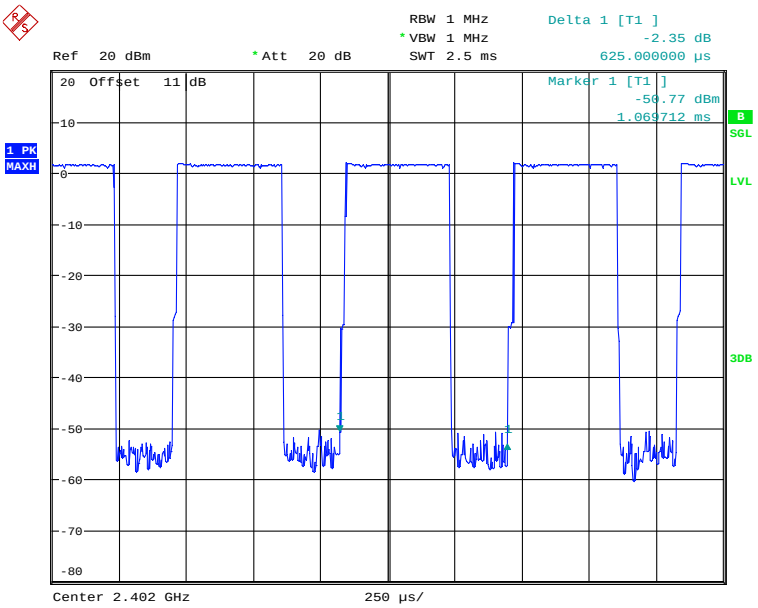

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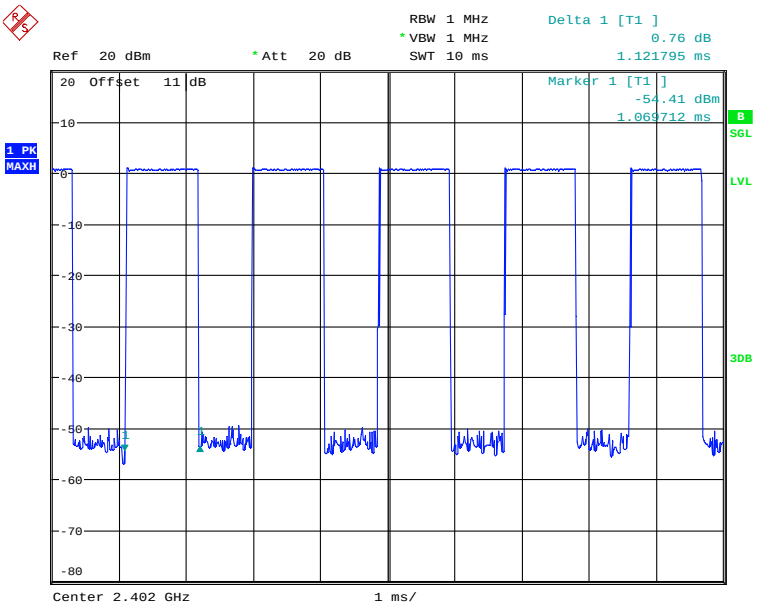
2M



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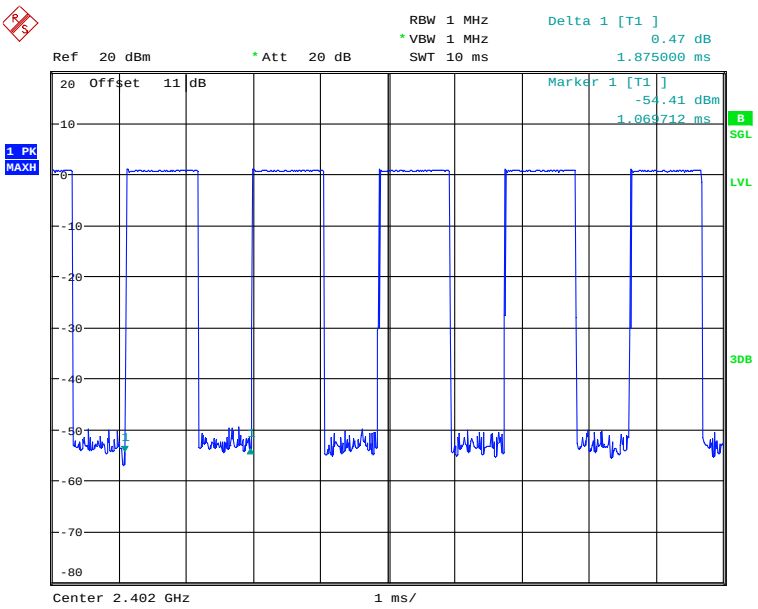

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1.7 Test standards

47 CFR FCC Part 2 Subpart J, section 2.1091

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	2023/7/24	2024/7/23
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	2023/9/20	2024/9/19
ETSTW-GSM 023	Power Divider	4901.19.A	None	SUHNER	2023/8/28	2024/8/27
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) (S_Cable 9)	279067	HUBER+SUHNER	2023/02/17	2024/2/16
ETSTW-Cable 058	Microwave Cable	SUCOFLEX 104	none	HUBER+SUHNER	2023/5/26	2024/5/25
ETSTW-Cable 093	Microwave Cable	SUCOFLEX 104	325536	HUBER+SUHNER	2024/1/10	2025/1/9
WTSTW-SW 008	Signal studio	Agilent	None	AUDIX	Version 2.0.0.1	

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

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

mW/cm^2.

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WLAN 2.4G

Mode	Channel/Frequency (MHz)	Conducted Power (dBm)	Antenna 1 Gain (dBi)	Antenna 2 Gain (dBi)	Directional gain (dBi)	Power density (mW/cm^2)	Limit (mW/cm^2)	Ratio
802.11b	Ch 1 : 2412 MHz	12.93	--	3.6	--	--	--	--
	Ch 6 : 2437 MHz	16.22	--	3.6	--	0.0191	1	0.0191
	Ch 11 : 2462 MHz	14.06	--	3.6	--	--	--	--
802.11g	Ch 1 : 2412 MHz	11.47	--	3.6	--	--	--	--
	Ch 6 : 2437 MHz	14.11	--	3.6	--	0.0118	1	0.0118
	Ch 11 : 2462 MHz	11.34	--	3.6	--	--	--	--
802.11 n20MHz	Ch 1 : 2412 MHz	13.18	--	--	--	--	--	--
	Ch 6 : 2437 MHz	16.89	--	--	6.61	0.0446	1	**0.0466**
	Ch 11 : 2462 MHz	13.34	--	--	--	--	--	--

WLAN 5G

Band 1

Mode	Channel/Frequency (MHz)	Conducted Power (dBm)	Antenna 1 Gain (dBi)	Antenna 2 Gain (dBi)	Directional gain (dBi)	Power density (mW/cm^2)	Limit (mW/cm^2)	Ratio
802.11a	Ch 36 : 5180 MHz	6.74	--	--	--	--	--	--
	Ch 44 : 5220 MHz	9.92	--	3.6	--	0.0045	1	0.0045
	Ch 48 : 5240 MHz	9.68	--	--	--	--	--	--
802.11 n 20MHz	Ch 36 : 5180 MHz	7.44	--	--	--	--	--	--
	Ch 44 : 5220 MHz	12.22	--	--	6.61	0.0152	1	**0.0152**
	Ch 48 : 5240 MHz	12.14	--	--	--	--	--	--
802.11 n 40MHz	Ch 38 : 5190 MHz	8.45	--	--	--	--	--	--
	Ch 46 : 5230 MHz	11.37	--	--	6.61	0.0125	1	0.0125
802.11 ac 80MHz	Ch 42 : 5210 MHz	6.19	--	--	6.61	0.0038	1	0.0038

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Band 4

Mode	Channel/Frequency (MHz)	Conducted Power (dBm)	Antenna 1 Gain (dBi)	Antenna 2 Gain (dBi)	Directional gain (dBi)	Power density (mW/cm^2)	Limit (mW/cm^2)	Ratio
802.11a	Ch 149 : 5745 MHz	13.70	--	--	--	--	--	--
	Ch 157 : 5785 MHz	13.90	--	3.6	--	0.0112	1	0.0112
	Ch 165 : 5825 MHz	13.60	--	--	--	--	--	--
802.11 n 20MHz	Ch 149 : 5745 MHz	16.28	--	--	--	--	--	--
	Ch 157 : 5785 MHz	16.55	--	--	6.61	0.0412	1	**0.0412**
	Ch 165 : 5825 MHz	16.21	--	--	--	--	--	--
802.11 n 40MHz	Ch 151 : 5755 MHz	14.49	--	--	--	--	--	--
	Ch 159 : 5795 MHz	14.62	--	--	6.61	0.0264	1	0.0264
802.11 ac 80MHz	Ch 155 : 5775 MHz	13.71	--	--	6.61	0.0214	1	0.0214

Bluetooth

Normal & EDR

Mode	Channel/Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Power density (mW/cm^2)	Limit (mW/cm^2)	Ratio
BR	Ch 0 : 2402 MHz	9.13	3.6	0.0037	1	**0.0037**
	Ch 39 : 2441 MHz	--	--	--	--	--
	Ch 78 : 2480 MHz	--	--	--	--	--
EDR	Ch 0 : 2402 MHz	8.06	3.6	0.0029	1	0.0029
	Ch 39 : 2441 MHz	--	--	--	--	--
	Ch 78 : 2480 MHz	--	--	--	--	--

Low energy

Mode	Channel/Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Power density (mW/cm^2)	Limit (mW/cm^2)	Ratio
1M	Ch 0 : 2402 MHz	2.94	3.6	0.0009	1	**0.0009**
	Ch 19 : 2440 MHz	--	--	--	--	--
	Ch 39 : 2480 MHz	--	--	--	--	--
2M	Ch 0 : 2402 MHz	--	--	--	--	--
	Ch 19 : 2440 MHz	2.75	3.6	0.0009	1	**0.0009**
	Ch 39 : 2480 MHz	--	--	--	--	--

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-
0.0466 (WLAN 2.4G)+0.0412 (WLAN 5G)+0.0037 (Bluetooth)= 0.0915<1