

FCC RF Exposure report
for
Wi-Fi HaLow MESH Outdoor Gateway
Model No.: ARFHL-OD-MS01
FCC ID: TKZARFHLOD

of

Applicant: AsiaRF Co., Ltd.

Address: 1F, 7, Houde Street, Yonghe Dist. New Taipei City 23455
Taiwan R.O.C.

Tested and Prepared

by

Worldwide Testing Services (Taiwan) Co., Ltd.

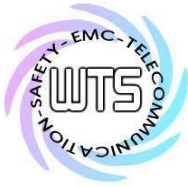
FCC Registration No.: TW1072, TW1140, TW1146, TW1477, TW0037

Industry Canada filed test laboratory Reg. No.: 20037, 31634



Report No.: W6M22410-23861-EE

6F, NO. 58, LANE 188, RUEY-KUANG RD., NEIHU TAIPEI 114, TAIWAN, R.O.C.
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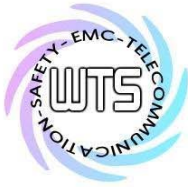


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Worldwide Testing Services(Taiwan) Co., Ltd.

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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 its 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:

February 08, 2025

Rick Chen

Rick Chen.

Date

WTS-Lab.

Name

Signature

Technical responsibility for area of testing:

February 08, 2025

Kevin Wang

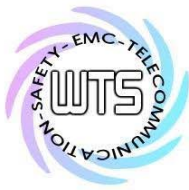
Kevin Wang

Date

WTS

Name

Signature



Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M22410-23861-EE

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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. 99, Sec. 1, Balian Rd., Xizhi Dist.,
New Taipei City 221032, Taiwan (R.O.C.)

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.: TW1072, TW1140, TW1146, TW1477, TW0037

Industry Canada filed test laboratory Reg. No.: 20037, 31634

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

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

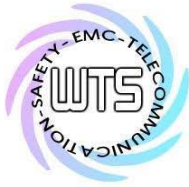
1.3 Application details

Approval holder

Name: AsiaRF Co., Ltd.
Street: 1F, 7, Houde Street, Yonghe Dist.
Town: New Taipei City 23455
Country: Taiwan R.O.C.

Manufacturer: (if applicable)

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



Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M22410-23861-EE

FCC ID: TKZARFHLOD

Test date

Date of receipt of test item: November 14, 2024

Date of test: from November 15, 2024 to January 22, 2025

1.4 General information of Test item

Type of test item: Wi-Fi HaLow MESH Outdoor Gateway

Model no.: ARFHL-OD-MS01

Multi-listing model no.: ARFHL-OD-MS02

Brand name: AsiaRF

Power supply: POE 48Vd.c (for ARFHL-OD-MS01) 、
USB 5Vd.c. (for ARFHL-OD-MS02)

Antenna type: Dipole antenna

Antenna gain: ANT1: 3.24 dBi 、 ANT2: 3.24 dBi

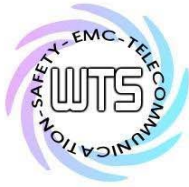
Directional gain: 6.25 dBi

According to KDB 662911, Unequal antenna gains, with equal transmit powers. For antenna gains given by $G_1, G_2, \dots, G_N$ dBi. If transmit signals are correlated, then Directional gain
 $= 10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N]$ 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.]

Technical data

Model No.: ARFHL-OD-MS01

Band	Mode	Channel	Conducted power with DF		Combine (dBm)
			Antenna 1 (dBm)	Antenna 2 (dBm)	
2.4GHz	802.11b	Ch 1 : 2412 MHz	16.43	16.52	-
		Ch 6 : 2437 MHz	16.01	16.57	-
		Ch 11 : 2462 MHz	15.58	16.52	-
	802.11g	Ch 1 : 2412 MHz	15.60	15.70	-
		Ch 6 : 2437 MHz	15.12	15.73	-
		Ch 11 : 2462 MHz	14.58	15.66	-
	802.11n 20MHz	Ch 1 : 2412 MHz	15.84	15.84	18.85
		Ch 6 : 2437 MHz	15.39	15.94	18.69
		Ch 11 : 2462 MHz	14.87	15.98	18.47
	802.11n 40MHz	Ch 1 : 2422 MHz	12.78	12.76	15.78
		Ch 4 : 2437 MHz	12.27	12.68	15.49
		Ch 7 : 2452 MHz	12.38	12.67	15.54



Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M22410-23861-EE

FCC ID: TKZARFHLOD

Multi-listing Model No.: ARFHL-OD-MS02

Band	Mode	Channel	Conducted power with DF		Combine (dBm)
			Antenna 1 (dBm)	Antenna 2 (dBm)	
2.4GHz	802.11b	Ch 1 : 2412 MHz	16.05	16.27	-
		Ch 6 : 2437 MHz	15.61	16.21	-
		Ch 11 : 2462 MHz	15.16	16.33	-
	802.11g	Ch 1 : 2412 MHz	15.41	15.46	-
		Ch 6 : 2437 MHz	14.97	15.44	-
		Ch 11 : 2462 MHz	14.37	15.54	-
	802.11n 20MHz	Ch 1 : 2412 MHz	15.81	15.53	18.68
		Ch 6 : 2437 MHz	15.37	15.62	18.51
		Ch 11 : 2462 MHz	14.95	15.71	18.36
	802.11n 40MHz	Ch 1 : 2422 MHz	12.72	12.50	15.63
		Ch 4 : 2437 MHz	12.22	12.50	15.38
		Ch 7 : 2452 MHz	12.15	12.52	15.35

Operation modes: Duplex

Modulation type: OFDM/DSSS

Sample no.: #03

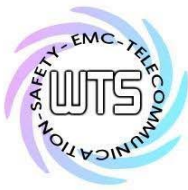
Classification:

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

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	8.506	8.57	99.25%	0.03	0.01
802.11g	1.422	1.518	93.68%	0.28	0.70
802.11n 20M	0.689	0.821	83.92%	0.76	1.45
802.11n 40M	0.357	0.417	85.61%	0.67	2.80

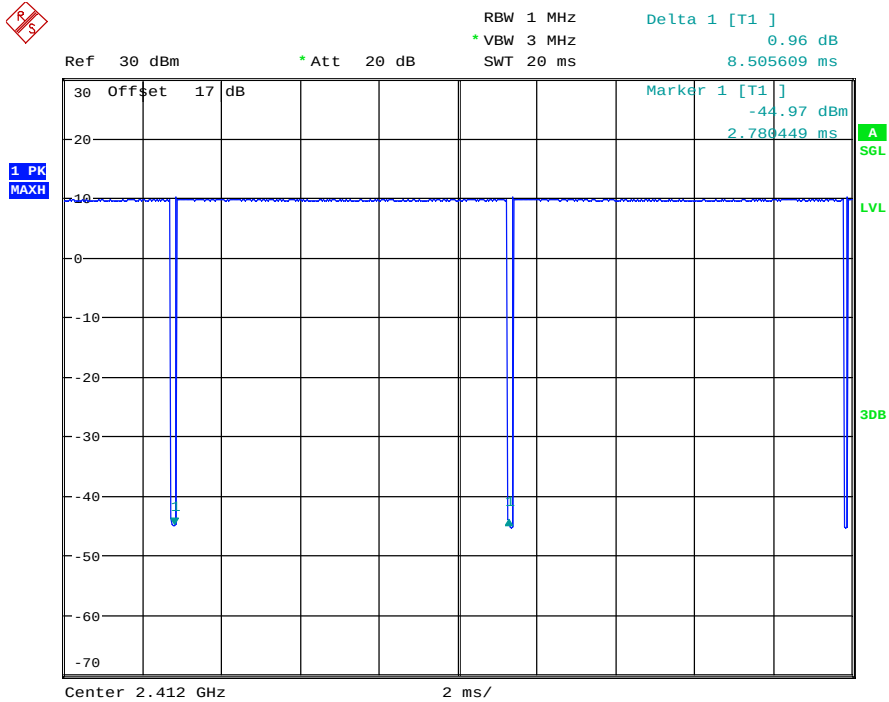


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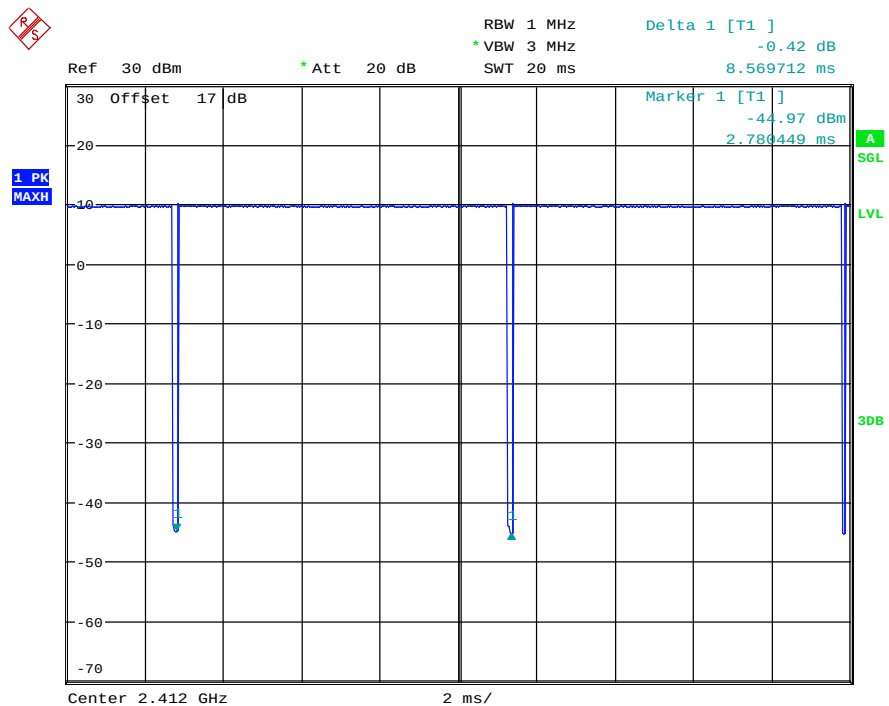
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Duty cycle plot

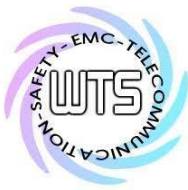
802.11b



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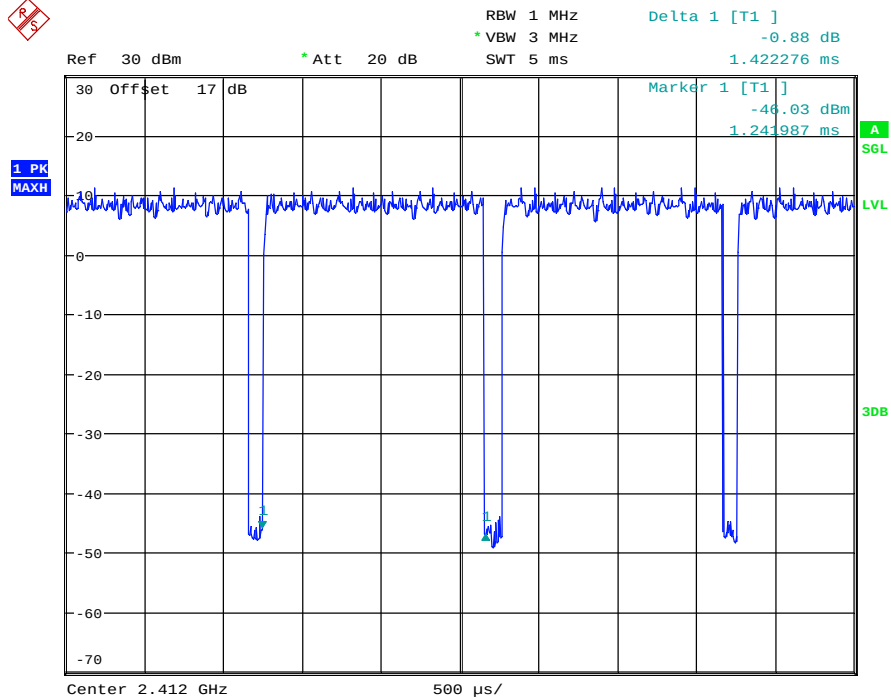
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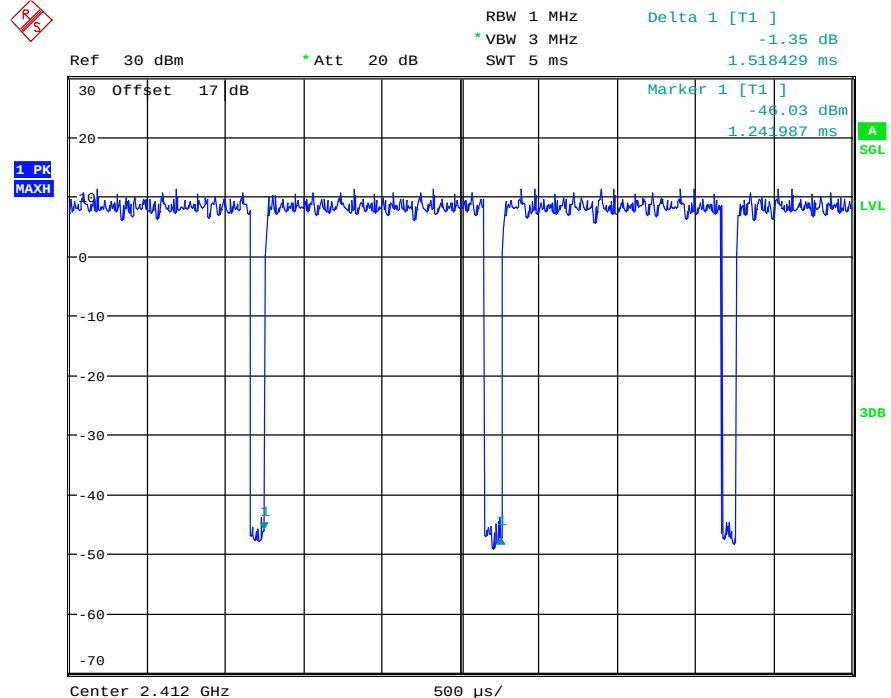
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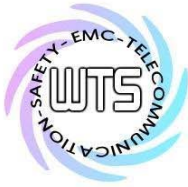
802.11g



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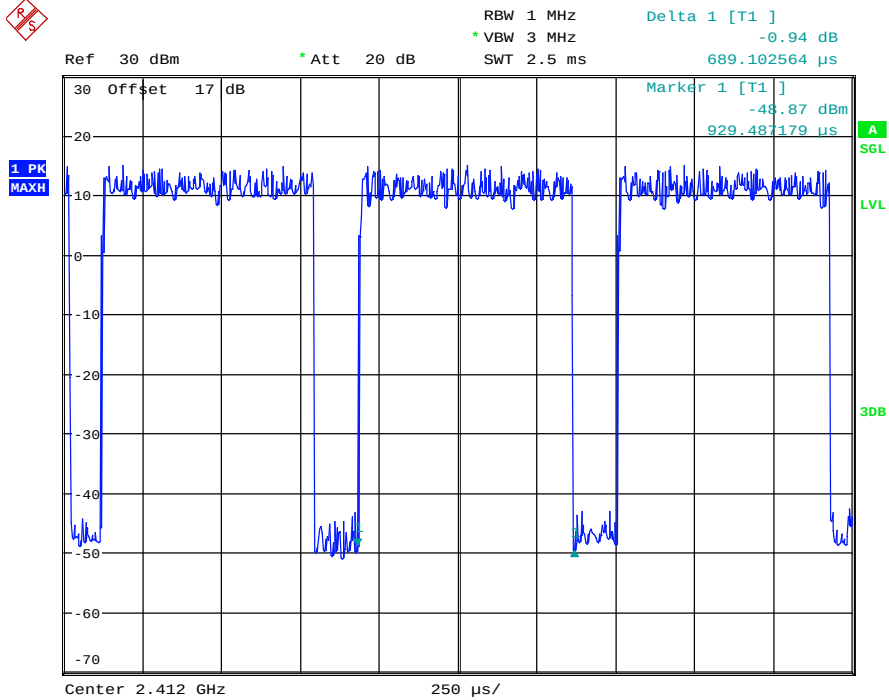
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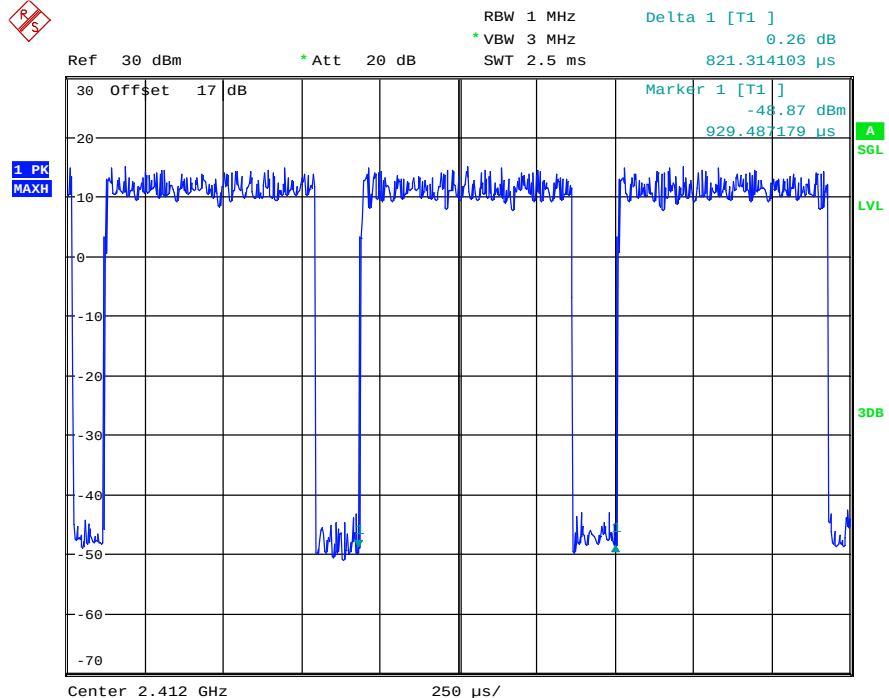
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FCC ID: TKZARFHLOD

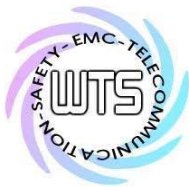
802.11n20MHz



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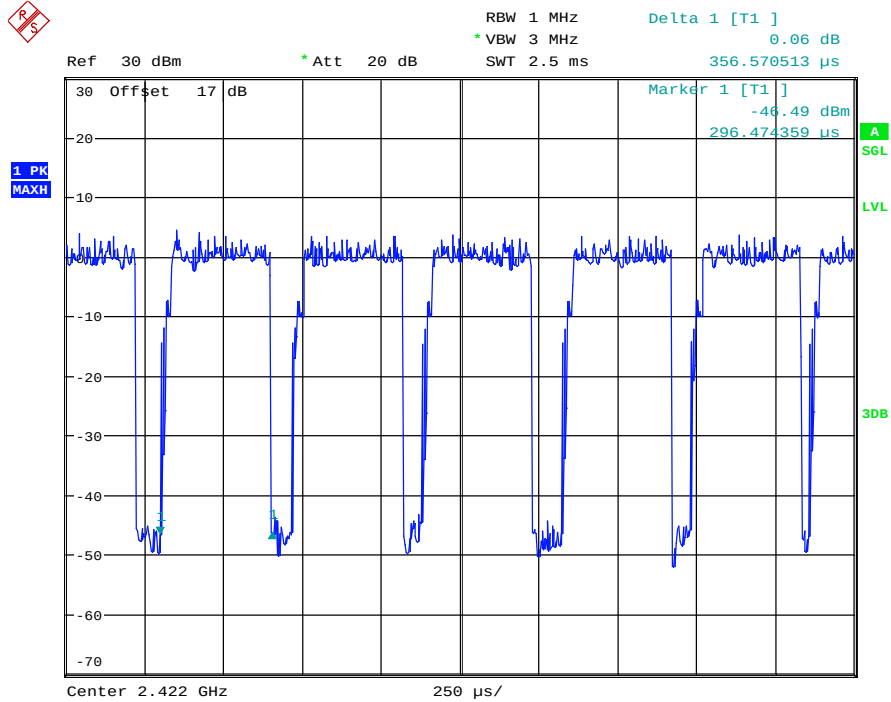
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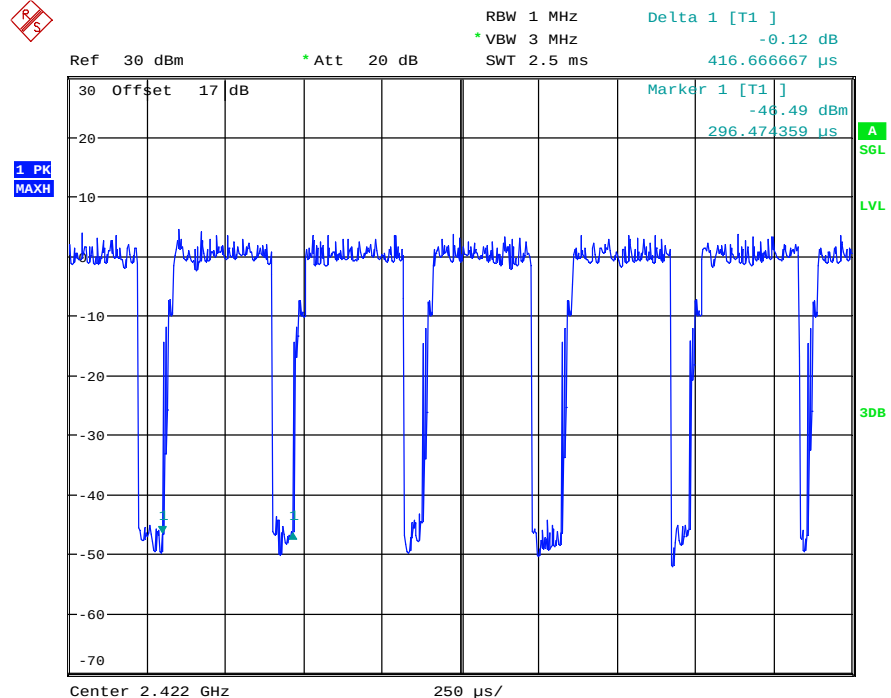
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FCC ID: TKZARFHLOD

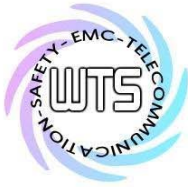
802.11n40MHz



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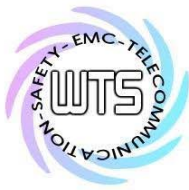
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1.6 Test standards

FCC KDB Publication

447498 D01 General RF Exposure Guidance v06



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2 Test configuration

2.1 Test environment

Relative humidity content: 20 ... 75 %

Air pressure: 86 ... 103 kPa

Extreme conditions parameters: ./.

2.2 Measurement uncertainty

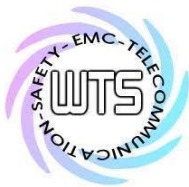
Test item Name	Uncertainty
Estimation Result of Uncertainty of Conducted Output Power Measurement (Peak Output Power (transmitter))	Expanded Uncertainty : 1.63 dB

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

2.3 Test Equipment List

Max Output Power

Code No.	Test equipment	Mode No.	Serial No.	Brand	Cal. Date	Next Cal. Date
ETSTW-RE 050	Attenuator 10dB	50HF-010-1	None	JFW	2024/2/16	2025/2/15
ETSTW-RE 055	SPECTRUM ANALYZER	FSU 26	200074	R&S	2024/3/7	2025/3/6
ETSTW-RE 099	DC Block	50DB-007-1	None	JFW	2024/2/16	2025/2/15
ETSTW-Cable 030	Microwave Cable	SUCOFLEX 104 (S_Cable 9)	279067	HUBER+SUHNER	2024/2/16	2025/2/15



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3 Equivalent Isotropic Radiated Power (EIRP)

FCC Rule: 15.247

EIRP = max. conducted output power + antenna gain

EIRP = 18.85 dBm + 6.25 dBi [antenna gain claimed by manufacturer] = 25.1 dBm = 323.59 mW

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

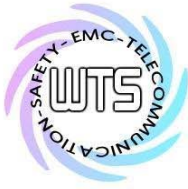
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

(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



Registration number: W6M22410-23861-EE

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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/cm².

Established separation distance is 20 cm.

Operating frequency band: 2412-2462 MHz

The product meets RF exposure requirement.

Because the power density of 0.0644 mW/cm² at 2412 MHz is below the power density limit of 1 mW/cm².