

FCC PART 15 SUBPART C TEST REPORT

for

Water Leak Sensor

Model No.: WLS-23

FCC ID: GX9WLS23

of

Applicant: **CLIMAX TECHNOLOGY CO., LTD.**

Address: **No. 258, Sinhu 2nd Rd., Neihu District 114 Taipei City
Taiwan (R.O.C.)**

Tested and Prepared

by

Worldwide Testing Services (Taiwan) Co., Ltd.

FCC Registration No.: TW1477, TW0020, TW1072

Industry Canada filed test laboratory Reg. No. 20037

A2LA Accredited No.: 2732.01



Report No.: W6M21909-19377-C-1

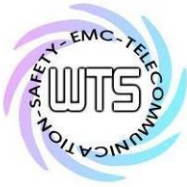
6F, NO. 58, LANE 188, RUEY-KUANG RD., NEIHU TAIPEI 114, TAIWAN, R.O.C.
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Worldwide Testing Services(Taiwan) Co., Ltd.

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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.

The test results of this test report relate exclusively to the item tested as specified in 1.5.

The test report may only be reproduced or published in full.

Reproduction or publication of extracts from the report requires the prior written approval of the Worldwide Testing Services(Taiwan) Co., Ltd.

Tester:

October 04, 2019

Leon Chueh

Date

WTS-Lab.

Name

Signature

Technical responsibility for area of testing:

October 04, 2019

Kevin Wang

Date

WTS

Name

Signature



Worldwide Testing Services(Taiwan) Co., Ltd.

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1.2 Testing laboratory

1.2.1 Location

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

FAX:886-2-2791-5046

Company

Worldwide Testing Services(Taiwan) Co., Ltd.

6F, NO. 58, LANE 188, RUEY-KUANG RD.

NEIHU, TAIPEI 114, TAIWAN R.O.C.

Tel : 886-2-66068877

Fax : 886-2-66068879

1.2.2 Details of accreditation status

Accredited testing laboratory

A2LA accredited number: 2732.01

FCC filed test laboratory Reg. No. TW1477, TW0020, TW1072

Industry Canada filed test laboratory Reg. No. 20037

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

Name: ./.

Accredited number: ./.

Street: ./.

Town: ./.

Country: ./.

Telephone: ./.

Fax: ./.

1.3 Details of approval holder

Name: CLIMAX TECHNOLOGY CO., LTD.

Street: No. 258, Sinhu 2nd Rd., Neihu District

Town: 114 Taipei City

Country: Taiwan (R.O.C.)

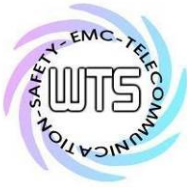
Telephone: +886-2-2794-0001

Fax: +886-2-2792-6618

1.4 Application details

Date of receipt of test item: September 20, 2019

Date of test: from September 23, 2019 to October 04, 2019



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1.5 Test item

Description of test item:	Water Leak Sensor
Type identification:	WLS-23
Brand name:	./.
Multi-listing model number:	./.
Transmitting frequency:	433.82 MHz
Operation mode:	Simplex
Voltage supply:	Battery 3Vd.c.(CR123AP)
Highest clock frequency:	433.82 MHz
Antenna type:	Monopole Antenna

Photos: see Annex

Manufacturer (if applicable)

Name	./.
Street	./.
Town	./.
Country	./.
Additional information:	./.

1.6 Test standards

Technical standard : FCC RULES PART 15 SUBPART C § 15.231 (a) (2018-10)



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2 Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed.



or

The deviations were ascertained in the course of the tests performed.



2.2 Test environment

Relative humidity content: 20 ... 75 %

Air pressure: 86 ... 103 kPa

Details of power supply: Battery 3Vd.c.(CR123AP)

Test item Name	Uncertainty
Estimation Result of Uncertainty of Conducted Emission	Expanded Uncertainty : AMN : 1.30 dB Voltage probe : 1.36 dB
Estimation Result of Uncertainty of Radiated Emission(3M)	Expanded Uncertainty : 0.009-30 MHz : 2.02 dB 30-1000 MHz : 3.49 dB 1-18 GHz : 3.01 dB 18-40 GHz : 2.43 dB
Estimation Result of Uncertainty of Bandwidth Measurement 20 dB Bandwidth, Occupied bandwidth, Channel bandwidth, Necessary Bandwidth	Expanded Uncertainty : 0.45 kHz
Estimation Result of Uncertainty of Frequency Drift Measurement Frequency stability	Expanded Uncertainty : 6.11 Hz
Estimation Result of Uncertainty of Band Edge Measurement	Expanded Uncertainty : 0.98 dBc

The decision rule is: Measurement uncertainty is not taken into account.



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2.3 Test equipment utilized

No.	Test equipment	Type	Serial No.	Manufacturer	Cal. Date	Next Cal. Date
ETSTW-CE 001	EMI TEST RECEIVER	ESHS10	842121/013	R&S	2019/6/4	2020/6/3
ETSTW-CE 003	AC POWER SOURCE	APS-9102	D161137	GW	Function Test	
ETSTW-CE 004	ZWEILEITER-V-NETZNACHBILDUNG TWO-LINE V-NETWORK	ESH3-Z5	840731/011	R&S	2018/11/1	2019/10/31
ETSTW-CE 006	IMPULSBEGRENZER PULSE LIMITER	ESH3-Z2	100226	R&S	2019/8/16	2020/8/15
ETSTW-CE 008	HF-EICHLITUNG RF STEP ATTENUATOR 139dB DPSP	334.6010.02	844581/024	R&S	Function Test	
ETSTW-CE 009	TEMP.&HUMIDITY CHAMBER	GTH-225-40-1P-U	MAA0305-009	GIANT FORCE	2019/7/23	2020/7/22
ETSTW-CE 016	TWO-LINE V-NETWORK	ENV216	100050	R&S	2019/9/16	2020/9/15
ETSTW-CE 028	MXE EMI Receiver	N9038A	MY53220110	Agilent	2019/7/18	2020/7/17
ETSTW-RE 003	EMI TEST RECEIVER	ESI 26	831438/001	R&S	2019/6/4	2020/6/3
ETSTW-RE 004	EMI TEST RECEIVER	ESI 40	832427/004	R&S	2019/5/29	2020/5/28
ETSTW-RE 012	TUNABLE BANDREJECT FILTER	D.C 0309	146	K&L	Function Test	
ETSTW-RE 013	TUNABLE BANDREJECT FILTER	D.C 0336	397	K&L	Function Test	
ETSTW-RE 018	MICROWAVE HORN ANTENNA	AT4560	27212	AR	2019/7/25	2020/7/24
ETSTW-RE 027	Passive Loop Antenna	6512	00034563	ETS-Lindgren	2019/7/22	2020/7/21
ETSTW-RE 030	Double-Ridged Guide Horn Antenna	3117	00035224	ETS-Lindgren	2019/4/2	2020/4/1
ETSTW-RE 042	Biconical Antenna	HK116	100172	R&S	2019/1/29	2020/1/28
ETSTW-RE 043	Log-Periodic Dipole Antenna	HL223	100166	R&S	2019/4/23	2020/4/22
ETSTW-RE 044	Log-Periodic Antenna	HL050	100094	R&S	2019/5/13	2020/5/12
ETSTW-RE 045	ESA-E SERIES SPECTRUM ANALYZER	E4404B	MY45111242	Agilent	Pre-test Use	
ETSTW-RE 050	Attenuator 10dB	50HF-010-1	None	JFW	2019/2/27	2020/2/26
ETSTW-RE 051	Attenuator 6dB	50HF-006-1	None	JFW	2019/2/27	2020/2/26
ETSTW-RE 053	Attenuator 3dB	50HF-003-1	None	JFW	2019/2/27	2020/2/26
ETSTW-RE 055	SPECTRUM ANALYZER	FSU 26	200074	R&S	2019/3/5	2020/3/4
ETSTW-RE 060	Attenuator 30dB	5015-30	F651012z-01	ATM	2019/2/27	2020/2/26
ETSTW-RE 062	Amplifier Module	CHC 2	None	KMIC	2019/5/16	2020/5/15
ETSTW-RE 064	Bluetooth Test Set	MT8852B-042	6K00005709	Anritsu	Function Test	
ETSTW-RE 069	Double-Ridged Guide Horn Antenna	3117	00069377	ETS-Lindgren	Function Test	
ETSTW-RE 072	CELL SITE TEST SET	8921A	3339A00375	HP	2019/9/16	2020/9/15
ETSTW-RE 088	SOLID STATE AMPLIFIER	KMA180265A01	99057	KMIC	2019/9/16	2020/9/15
ETSTW-RE 091	Match Pad	MDCS1500	None	WOKEN	2019/5/9	2020/5/8
ETSTW-RE 099	DC Block	50DB-007-1	None	JFW	2019/2/22	2020/2/21
ETSTW-RE 112	AC POWER SOURCE	TFC-1005	T-0A023536	T-Power	Function test	
ETSTW-RE 115	2.4GHz Notch Filter	N0124411	473874	MICROWAVE CIRCUITS	2019/1/14	2020/1/13
ETSTW-RE 120	RF Player	MP9200	MP9210-111022	ADIVIC	Function test	



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ETSTW-RE 122	SIGNAL GENERATOR	SMF100A	102149	R&S	2019/6/3	2020/6/2
ETSTW-RE 125	5GHz Notch filter	5NSL11-5200/E221.3-O/O	1	K&L Microwave	2019/8/7	2020/8/6
ETSTW-RE 126	5GHz Notch filter	5NSL12-5800/E221.3-O/O	1	K&L Microwave	2019/8/7	2020/8/6
ETSTW-RE 127	RF Switch Box	RFS-01	None	WTS	2019/2/26	2020/2/25
ETSTW-RE 128	5.3GHz Notch filter	N0153001	SN487233	Microwave Circuits	2019/8/7	2020/8/6
ETSTW-RE 129	5.5GHz Notch filter	N0555984	SN487234	Microwave Circuits	2019/8/7	2020/8/6
ETSTW-RE 130	Handheld RF Spectrum Analyzer	N9340A	CN0147000204	Agilent	Pre-test Use	
ETSTW-RE 142	Amplifier	8447D	2805A03378	Agilent	2019/5/16	2020/5/15
ETSTW-RE 147	Bi-log Hybrid Antenna	MCTD 2786B	BLB16M04005	ETC	2019/4/2	2020/4/1
ETSTW-RF 002	Electromagnetic field probe	LF-30	K-0007	STT	2019/5/27	2020/5/26
ETSTW-EMI 011	USB Compact Modulator	SFC-U	101689	R&S	2019/5/16	2020/5/15
ETSTW-GSM 002	Universal Radio Communication Tester	CMU 200	109439	R&S	2019/3/5	2020/3/4
ETSTW-GSM 003	Radio Communication Analyzer	MT8820C	6201342073	Anritsu	2019/3/26	2020/3/25
ETSTW-GSM 004	Wideband Radio Communication Tester	CMW500	128092	R&S	2018/10/19	2019/10/18
ETSTW-GSM 019	Band Reject Filter	WRCTF824/849-822/851-40 /12+9SS	3	WI	2019/1/14	2020/1/13
ETSTW-GSM 020	Band Reject Filter	WRCD1747/1748-1743/1752-32/5SS	1	WI	2019/1/14	2020/1/13
ETSTW-GSM 021	Band Reject Filter	WRCD1879.5/1880.5-1875.5/1884.5-32/5SS	3	WI	2019/1/14	2020/1/13
ETSTW-GSM 022	Band Reject Filter	WRCT901.9/903.1-904.25-50/8SS	1	WI	2019/1/14	2020/1/13
ETSTW-GSM 023	Power Divider	4901.19.A	None	SUHNER	2019/9/2	2020/9/1
ETSTW-GSM 024	Radio Communication Analyzer	MT8821C	None	Anritsu	2019/3/5	2020/3/4
ETSTW-GSM 025	Band Reject Filter	BRM19835	001	Micro-Tronics	2019/8/7	2020/8/6
ETSTW-Cable 011	SMA to N type Cable	RGU-400	None	THERMAX	Pre-test Use NCR	
ETSTW-Cable 016	BNC Cable	Switch Box	B Cable 1	Schwarz beck	2019/2/21	2020/2/20
ETSTW-Cable 017	BNC Cable	X Cable	B Cable 2	Schwarz beck	2019/2/21	2020/2/20
ETSTW-Cable 018	BNC Cable	Y Cable	B Cable 3	Schwarz beck	2019/2/21	2020/2/20
ETSTW-Cable 019	BNC Cable	Z Cable	B Cable 4	Schwarz beck	2019/2/21	2020/2/20
ETSTW-Cable 020	N TYPE Cable	OATS Cable 1	N30N30-L335-15M	JYE BAO CO.,LTD.	2019/7/1	2020/6/30
ETSTW-Cable 026	Microwave Cable	SUCOFLEX 104	279075	HUBER+SUHNER	2019/2/25	2020/2/24
ETSTW-Cable 027	Microwave Cable	SUCOFLEX 104	279083	HUBER+SUHNER	2019/5/10	2020/5/9
ETSTW-Cable 028	Microwave Cable	FA147A0015M2020	30064-2	UTIFLEX	2019/9/16	2020/9/15
ETSTW-Cable 029	Microwave Cable	FA147A0015M2020	30064-3	UTIFLEX	2019/9/16	2020/9/15
ETSTW-Cable 030	Microwave Cable	SUCOFLEX 104 (S Cable 9)	279067	HUBER+SUHNER	2019/2/25	2020/2/24
ETSTW-Cable 043	Microwave Cable	SUCOFLEX 104	317576	HUBER+SUHNER	2019/5/16	2020/5/15
ETSTW-Cable 058	Microwave Cable	SUCOFLEX 104	none	HUBER+SUHNER	2019/6/6	2020/6/5
ETSTW-Cable 064	Microwave Cable	SUCOFLEX 104	MY28891	HUBER+SUHNER	2019/5/16	2020/5/15
ETSTW-Cable 066	SMA type cable	32022	None	ASTROLAB	2019/3/15	2020/3/14
ETSTW-Cable 071	N TYPE CABLE	EMCCFD400-NM-NM-25000	170239	EMCI	2019/6/6	2020/6/5

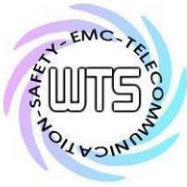


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ETSTW-Cable 072	SMA type cable (8m)	SUCOFLEX 104	805800/4	HUBER+SUHNER	2019/5/16	2020/5/15
ETSTW-Cable 074	SMA type cable (2m)	SUCOFLEX 104	802563/4	HUBER+SUHNER	2019/5/16	2020/5/15
WTSTW-SW 002	EMI TEST SOFTWARE	EZ EMC	None	Farad	Version ETS-03A1	
WTSTW-SW 006	EMI TEST SOFTWARE	e3	None	AUDIX	Version 9.161014	
WTSTW-SW 008	Signal studio	Agilent	None	AUDIX	Version 2.0.0.1	
ETSTW-TH 001	Thermohygrometer	608-H1	45204316	Testo	2019/9/9	2020/9/8
ETSTW-TH 002	Thermohygrometer	608-H1	45204317	Testo	2019/9/9	2020/9/8



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2.4 General Test Procedure

POWER LINE CONDUCTED INTERFERENCE: The procedure used was ANSI STANDARD C63.10-2013 6.2 using a LISN (if necessary). Both lines were observed. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

RADIATION INTERFERENCE: The test procedure used was ANSI STANDARD C63.10-2013 6.3 using a spectrum analyzer. The bandwidth of the spectrum analyzer was 100 kHz with an appropriate sweep speed. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was the 100 kHz and the video bandwidth was 300 kHz.

FORMULA OF CONVERSION FACTORS: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dB μ V) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB.

Example:

Freq (MHz)	METER READING + ACF + CABLE LOSS (to the receiver) = FS
33	20 dB μ V + 10.36 dB/m + 6 dB = 36.36 dB μ V/m @3m

ANSI STANDARD C63.10-2013 6.2.2 MEASUREMENT PROCEDURES: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m (non metallic table). The EUT was placed in the center of the table. The table used for radiated measurements is capable of continuous rotation. The spectrum was scanned from 30 MHz to 10th harmonic of the fundamental.

Peak readings were taken in three (3) orthogonal planes and the highest readings.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

ANSI STANDARD C63.10-2009 B.2.7: Any measurements that utilize special test software shall be indicated and referenced in the test report. During testing, test software 'EZ EMC' was used for setting up different operation modes.



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3 Test results (enclosure)

☒ 1st test

☐ test after modification

☐ production test

TEST CASE	Para. Number	Required	Test passed	Test failed
Transmission Requirements	FCC 15.231(a)	☒	☒	☐
Radiated Emission	FCC 15.231(b)	☒	☒	☐
Bandwidth of Emission	FCC 15.231(c)	☒	☒	☐
Frequency Tolerance	FCC 15.231(d)	☐	☐	☐
Period Alternate Field Strength Requirements	FCC 15.231(e)	☒	☒	☐
Antenna Requirement	FCC 15.203	☒	☒	☐
Conducted Measurement at (AC) Power Line	FCC 15.207	☐	☐	☐

The following is intentionally left blank.



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3.1 Transmission Requirements

FCC 15.231(a)

3.1.1 Limit of Transmission Time

- ☒ According to 15.231(a)(1), a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- ☐ According to 15.231(a)(2), a transmitter activated automatically shall cease transmission within 5 seconds after activation.
- ☐ According to 15.231(a)(3), periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
- ☐ According to 15.231(a)(4), intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.
- ☐ According to 15.231(a)(5), transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

3.1.2 Active Time

- ☒ This manually operated transmitter employs a switch that automatically deactivate the transmitter within 801.6032064 ms of being released.
- ☐ This transmitter is operated by automatic activation and active will cease transmission in _____ ms after activation.
- ☐ Others: This product is employed for radio control purpose during emergencies. When emergency switch is pulled down, the EUT will transmit a signal around _____ ms and continue to retransmit the signal every 5 minutes during the pendency of the alarm condition.

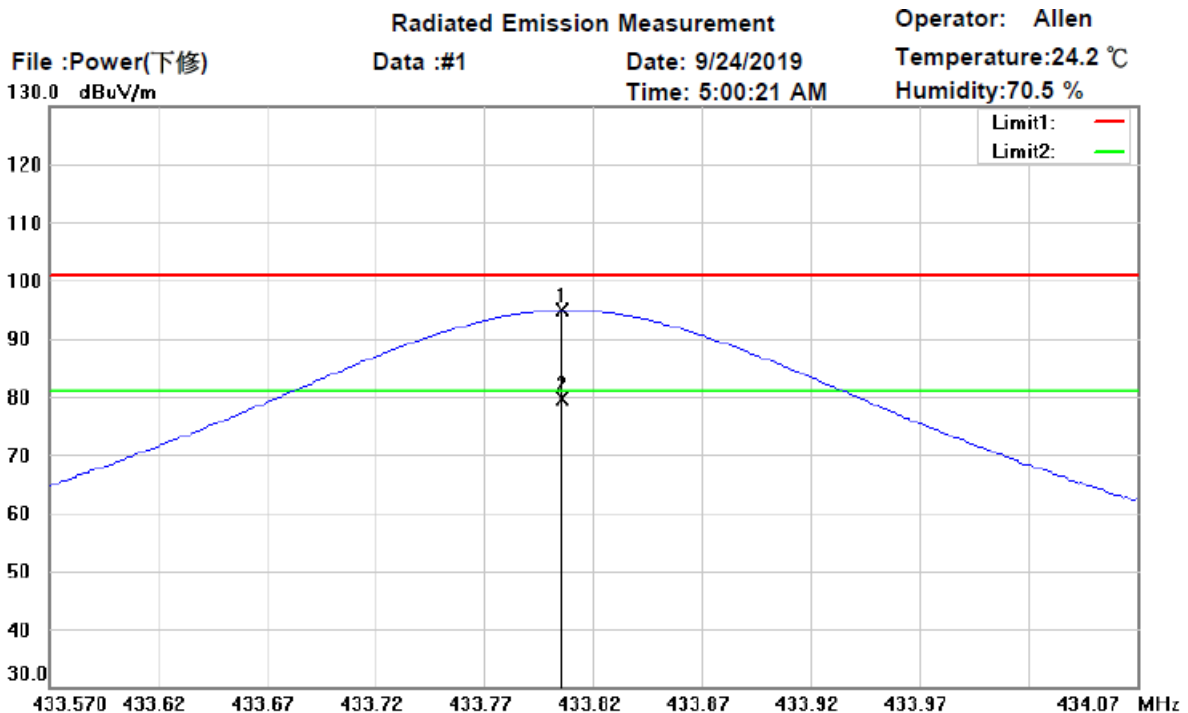
Explanation: See attached diagrams in appendix.

Test equipment used: ETSTW-RE 055, ETSTW-RE 004



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3.2 Output Power (Field Strength)



Site : Chamber

Condition : FCC 15.231(433MHz)Power(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: **Horizontal**

Power : 3 Vd.c.

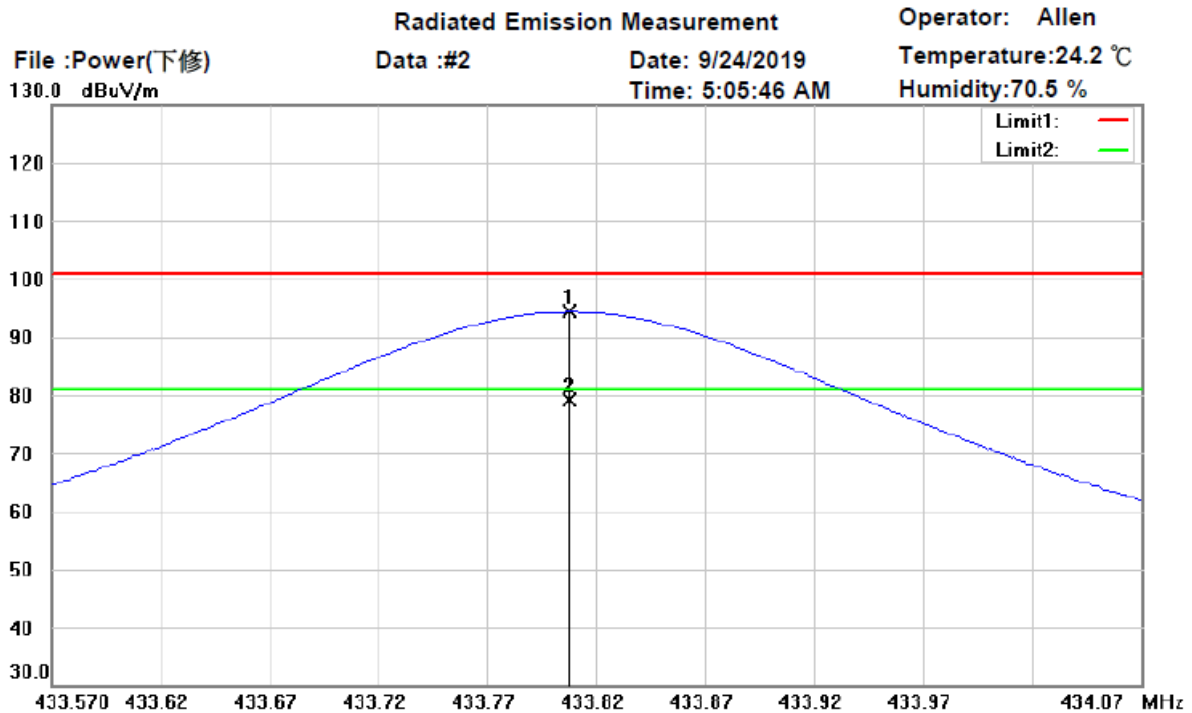
Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	433.8054	70.13	peak	24.65	94.78	100.80	210	200	-6.02	
*	433.8054	54.96	AVG	24.65	79.61	80.80	210	200	-1.19	



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Site : Chamber

Condition : FCC 15.231(433MHz)Power(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: Vertical

Power : 3 Vd.c.

Distance: 3m

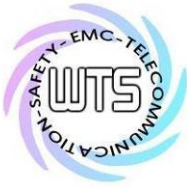
Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	433.8075	69.61	peak	24.65	94.26	100.80	130	40	-6.54	
*	433.8075	54.44	AVG	24.65	79.09	80.80	130	40	-1.71	

Limit 15.231(b)

Fundamental Frequency (MHz)	Field strength of fundamental, limit $\mu\text{V/m}$
40.66 – 40.70	2,250
70 – 130	1,250
130 – 174	1,250 to 3,750
174 – 260	3,750
260 – 470	3,750 to 12,500** (433.82 MHz: 80.82 dB $\mu\text{V/m}$ = 10992.51 $\mu\text{V/m}$)
Above 470	12,500

** linear interpolation

Test equipment used: ETSTW-RE 004, ETSTW-RE 111



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3.3 Out of Band Radiated Emissions

FCC Rule: 15.231(b) , 15.35

For out of band emissions that are close to or that exceed the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

Guidance on Measurement of pulsed emission: 15.35(c)

“the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.”

Duty Cycle correction = $20 \log (\text{dwell time}/100\text{ms or one period})$

Limits:

For frequencies (Average measurements)

Correction factor conform 15.35 (c) (Average measurements)

Duty cycle correction :

Max. Peak reading – duty cycle correction

Max permitted average Limits = Max permitted Fundamental limit – 20 dB

For example for 433.82 fundamental carrier:

Max permitted average Limit: $80.82 \text{ dB}\mu\text{V/m} - 20 \text{ dB} = 60.82 \text{ dB}\mu\text{V/m}$

For frequencies above 1GHz (Peak measurements).

Modified Limits for peak conform 15.35 (b) = Max Permitted average Limits + 20dB (because Peak detector is used)

Explanation: See attached diagrams in appendix.

Test equipment used: ETSTW-RE 004, ETSTW-RE 030, ETSTW-RE 111



Registration number: W6M21909-19377-C-1
FCC ID: GX9WLS23

3.4 Transmitter Radiated Emissions in restricted Bands

FCC Rules: 15.231 (b), 15.205, 15.209, 15.35

Radiated emission measurements were performed from 30 MHz to 8000 MHz.

For radiated emission tests, the analyzer setting was as followings:

RES BW VID BW

Frequency <1 GHz 100 kHz 100 kHz (Peak measurements)

Frequency >1 GHz 1 MHz 1 MHz (Peak measurements)

1 MHz 1 MHz (Average measurements)

Limits:

For frequencies below 1GHz :

Frequency of Emission (MHz)	Field strength (microvolts/meter)	Field Strength (dB microvolts/meter)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

For frequencies above 1GHz (Average measurements).

Guidance on Measurement of pulsed emission:

“If the emission is pulsed, modify the unit for continues operation , use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.

For frequencies above 1GHz (Average measurements).

The correction factor, based on the channel dwell time in a 100 ms period, may be mathematically applied to a measurement made with an average detector, to further reduce the value.

Duty cycle correction = $20 \log (\text{dwell time}/100\text{ms})$

No duty cycle correction was added to the reading

Modified Limits for peak conform 15.35 (b) = Max Permitted average Limits + 20dB (because Peak detector is used)

Above 960 MHz

For mode DSSS CW: $54 \text{ dB}\mu\text{V/m} + 20 \text{ dB} = 74 \text{ dB}\mu\text{V/m}$

Explanation: See attached diagrams in appendix.



Registration number: W6M21909-19377-C-1

FCC ID: GX9WLS23

3.5 Spurious Emission radiated, Transmitter

Spurious emission was measured with modulation (declared by manufacturer).

The limits on the field strength of the spurious emission in the table § 15.231(b) are based on the fundamental frequency of the intentional radiator. Spurious emission shall be attenuated to the average (or alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength.

In addition, radiated emission which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (See § 15.205(c)).

SAMPLE CALCULATION OF LIMIT. All results will be updated by an automatic measuring system in accordance to point 2.3.

Calculation of test results:

Such factors like antenna correction, cable loss, external attenuation etc. are already included in the provided measurement results. This is done by using validated test software and calibrated test system according the accreditation requirements.

The peak and average spurious emission plots was measured with the average limits.

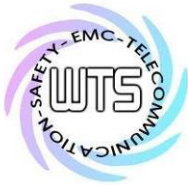
In the Table being listed the critical peak and average value an exhibit the compliance with the above calculated Limits.

Summary table with radiated data of the test plots

Model: WLS-23 Date: --
 Mode: -- Temperature: -- °C Engineer: --
 Polarization: Horizontal Humidity: -- %

Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--

Frequency (MHz)	Reading (dBuV) Peak	Factor (dB)		Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
		Corr.	Duty	Peak	Ave.	Peak	Ave.			
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--



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Registration number: W6M21909-19377-C-1

FCC ID: GX9WLS23

Polarization: Vertical

Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--

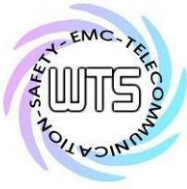
Frequency (MHz)	Reading (dBuV) Peak	Factor (dB) Corr. Duty	Result @3m (dBuV/m) Peak Ave.	Limit @3m (dBuV/m) Peak Ave.	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
--	--	-- --	-- --	-- --	--	--	--
--	--	-- --	-- --	-- --	--	--	--
--	--	-- --	-- --	-- --	--	--	--
--	--	-- --	-- --	-- --	--	--	--

Note

1. Correction Factor = Antenna factor + Cable loss - Preamplifier
2. The formula of measured value as: Test Result = Reading + Correction Factor
3. Detector function in the form : PK = Peak, QP = Quasi Peak, AV = Average
4. All not in the table noted test results are more than 20 dB below the relevant limits.
5. See attached diagrams in appendix.

All other not noted test plots do not contain significant test results in relation to the limits
Test results: The unit meet the FCC requirements.

Test equipment used: ETSTW-RE 004, ETSTW-RE 030, ETSTW-RE 062, ETSTW-RE 142,
ETSTW-RE 147



Registration number: W6M21909-19377-C-1

FCC ID: GX9WLS23

3.6 Channel Bandwidth

Measurement of Necessary Bandwidth (BN)

Used frequency	Bandwidth	Limit
433.82 MHz	50.10020040 kHz	1.08455 MHz

Explanation: The bandwidth fulfills the requirements of FCC § 15.231, see attached diagrams in appendix.

Limits:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test equipment used: ETSTW-RE 055, ETSTW-RE 004



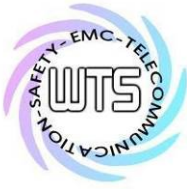
Registration number: W6M21909-19377-C-1
FCC ID: GX9WLS23

3.7 Antenna requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

Explanation: This Monopole Antenna is integral antenna which passes antenna requirement.

The equipment meets the requirements	yes ☒	no ☐
--------------------------------------	--	--------------------------------



Registration number: W6M21909-19377-C-1

FCC ID: GX9WLS23

3.8 Duty Cycle

The correction factor, based on the channel dwell time in a 100ms period, may be mathematically applied to a measurement made with an average detector, to further reduce the measured value.

Average Reading = Peak Reading (dBuV/m) + Duty Cycle Correction

Duty Cycle Correction = $20 \log (\text{Cycle})$

In order to determine the Duty Cycle, the EUT is measured as:

Testing Mode	T period (ms)	T on (ms)	Duty Cycle	Duty Cycle Correction $20*\log(\text{Duty Cycle})$
Transmitting Mode	100	17.43487	0.1743487	-15.17

Explanation: See attached diagrams in appendix.

Test equipment used: ETSTW-RE 055, ETSTW-RE 004



Registration number: W6M21909-19377-C-1

FCC ID: GX9WLS23

3.9 Conducted Measurement at (AC) Power Line

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the table bellows with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

This measurement was transact first with instrumentation using an average and peak detector and a 10 kHz bandwidth. If the peak detector achieves a calculated level, the measurement is repeated by an instrumentation using a quasi-peak detector.

Frequency	Level	
	quasi-peak (dB μ V/m)	average (dB μ V/m)
-- kHz	--	--

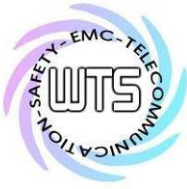
Note

- 1. The formula of measured value as: Test Result = Reading + Correction Factor**
- 2. The Correction Factor = Cable Loss + LISN Insertion Loss + Pulse Limit Loss**
- 3. Detector function in the form : PK = Peak, QP = Quasi Peak, AV = Average**
- 4. All not in the table noted test results are more than 20 dB below the relevant limits.**
- 5. This test is not required because the EUT is battery-used.**

Limits:

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi Peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Test equipment used: ETSTW-CE 001, ETSTW-CE 016, ETSTW-RE 045



Appendix

A Photos

1. External Photos
2. Internal Photos
3. Set Up Photo of Radiated Emission

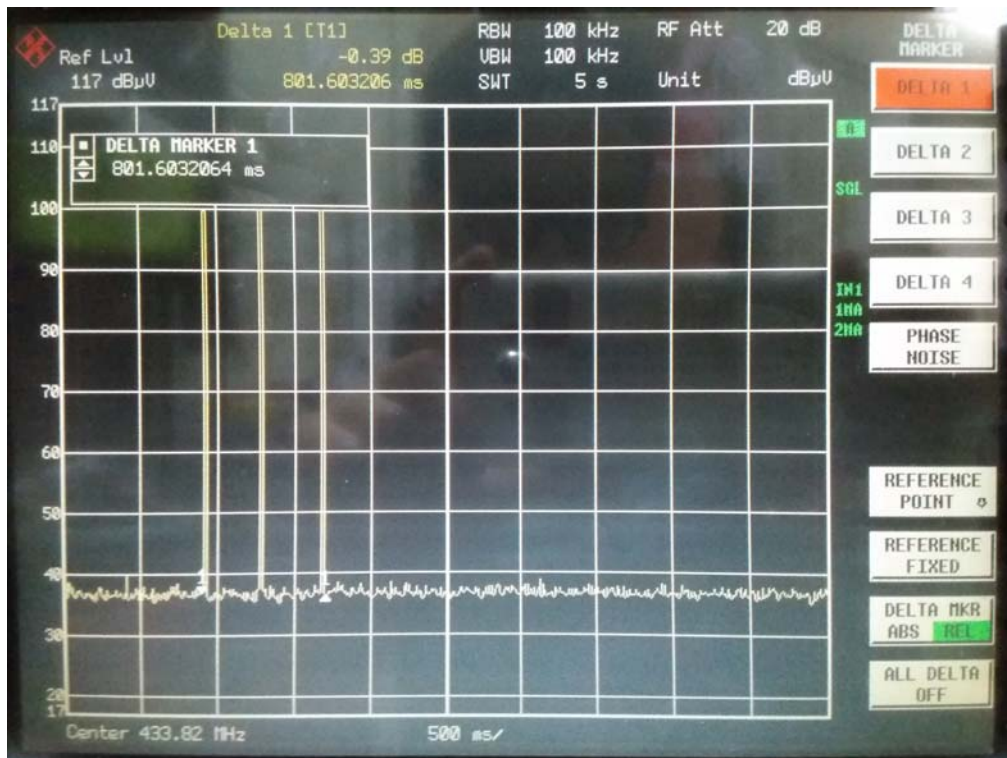
B Measurement diagrams

1. Active Time
2. Bandwidth
3. Duty Cycle
4. Spurious Emissions radiated

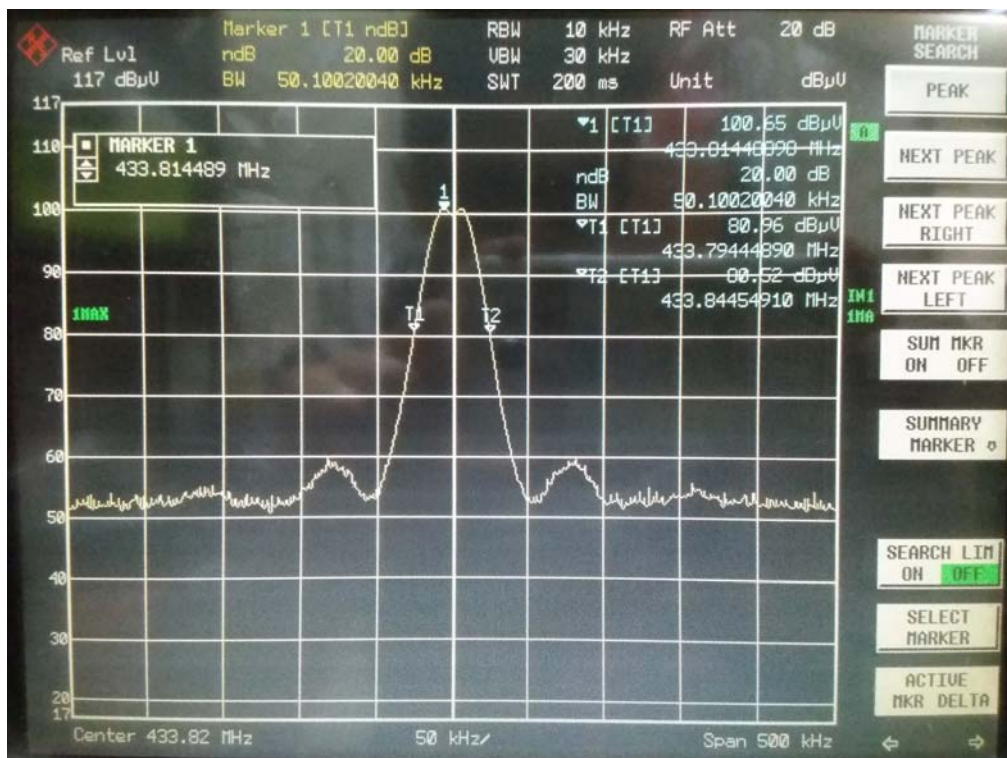
Registration number: W6M21909-19377-C-1

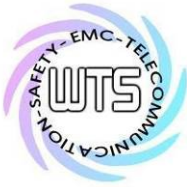
FCC ID: GX9WLS23

Active Time



Bandwidth



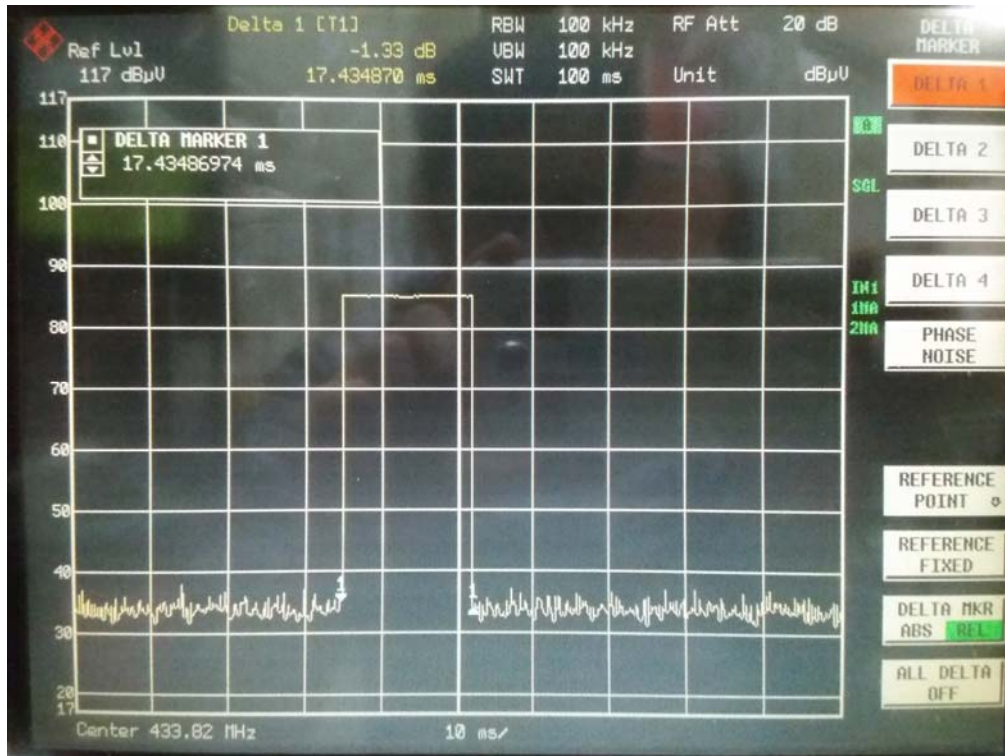


Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M21909-19377-C-1

FCC ID: GX9WLS23

Duty Cycle





Address:6F.,No.58,Ln 188,Ruey Kuang Rd,Neihu,Taipei
Tel:+886-2-6606-8877
Fax:+886-2-6606-8879

Radiated Emission Measurement

Operator: Allen

File :1

Data :#1

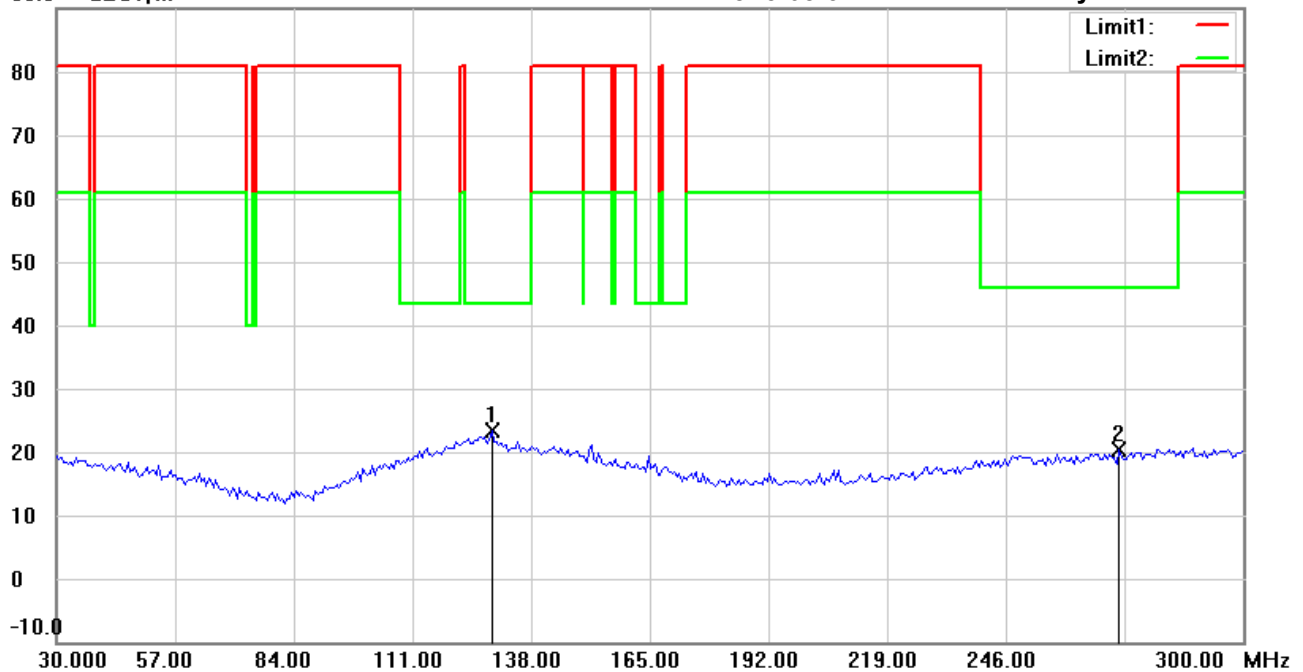
Date: 9/24/2019

Temperature:24.2 °C

90.0 dBuV/m

Time: 5:08:34 AM

Humidity:70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 30-300(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: *Horizontal*

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	129.0180	29.62	peak	-6.32	23.30	43.50	100	140	-20.20	
	271.8637	27.00	peak	-6.69	20.31	46.00	100	35	-25.69	

*:Maximum data x:Over limit !:over margin



Address: 6F., No. 58, Ln 188, Ruey Kuang Rd, Neihu, Taipei
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Fax: +886-2-6606-8879

Radiated Emission Measurement

Operator: Allen

File :1

Data :#2

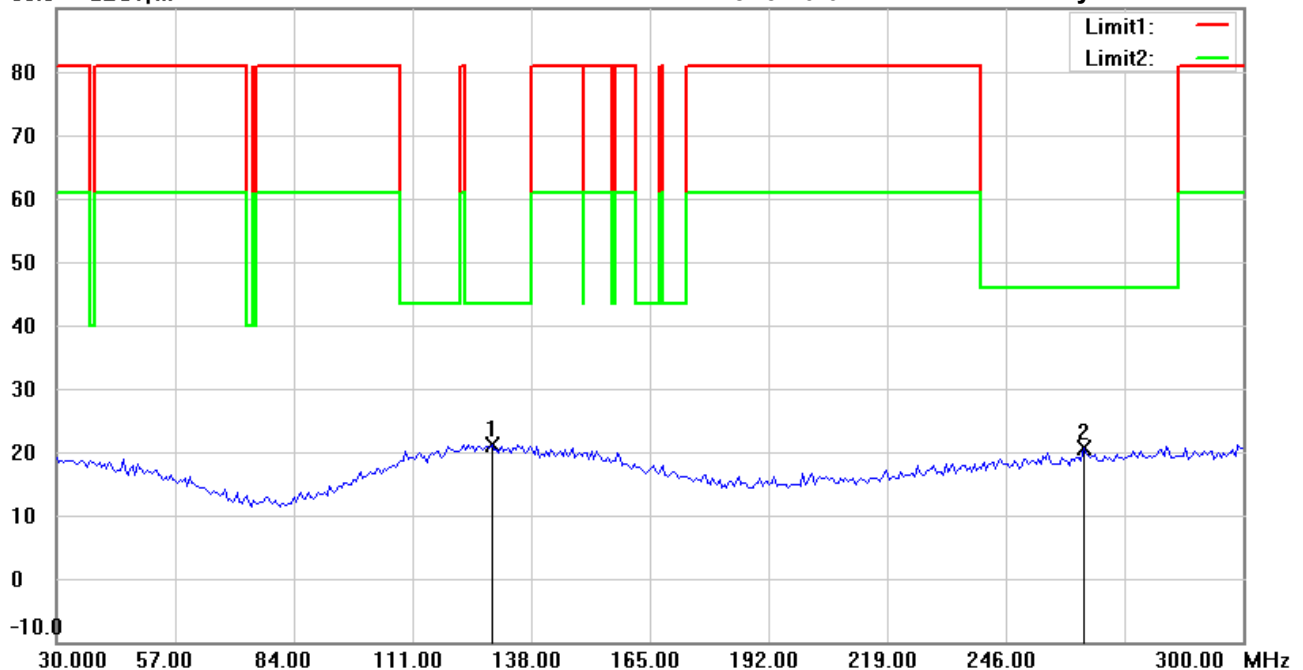
Date: 9/24/2019

Temperature: 24.2 °C

90.0 dBuV/m

Time: 5:10:01 AM

Humidity: 70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 30-300(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: **Vertical**

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	129.0180	27.45	peak	-6.32	21.13	43.50	100	85	-22.37	
	263.7475	27.76	peak	-7.18	20.58	46.00	100	200	-25.42	

*:Maximum data x:Over limit !:over margin



Address: 6F., No. 58, Ln 188, Ruey Kuang Rd, Neihu, Taipei
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Radiated Emission Measurement

Operator: Allen

File : 2

Data : #1

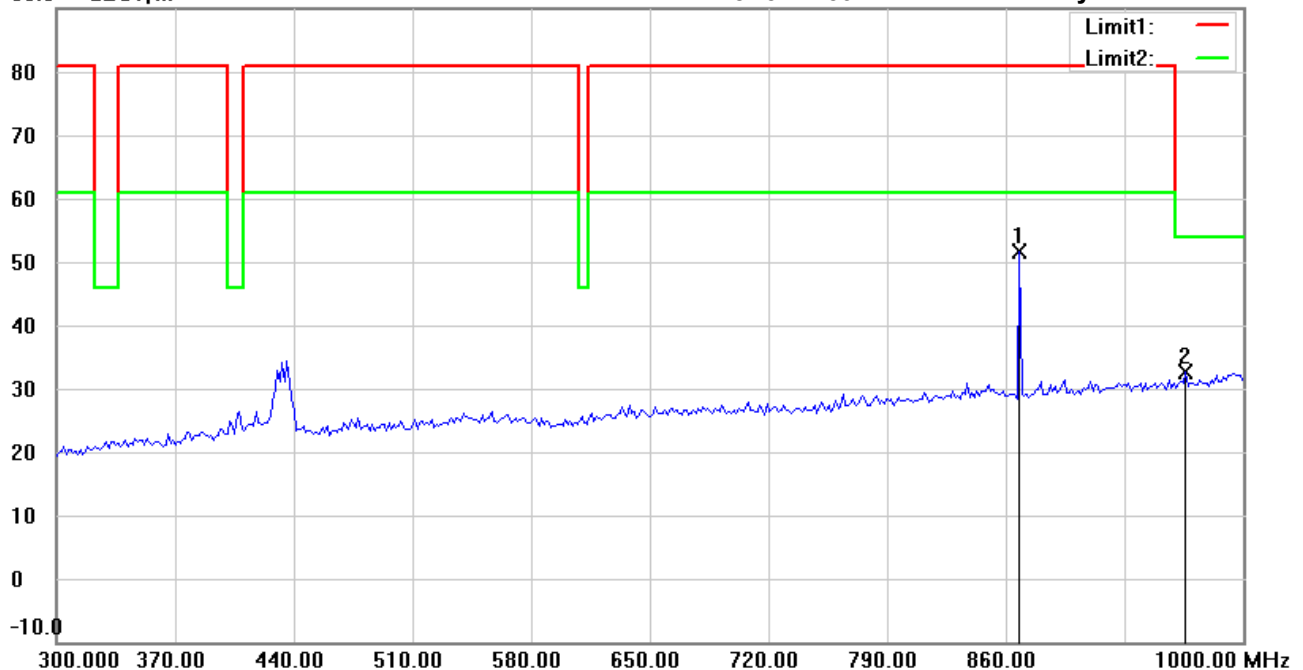
Date: 9/24/2019

Temperature: 24.2 °C

90.0 dBuV/m

Time: 5:11:59 AM

Humidity: 70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 300-1000(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: *Horizontal*

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	868.1363	48.89	peak	2.85	51.74	80.80	100	235	-29.06	
*	966.3327	28.19	peak	4.48	32.67	54.00	100	160	-21.33	

*:Maximum data x:Over limit !:over margin



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Radiated Emission Measurement

Operator: Allen

File : 2

Data : #2

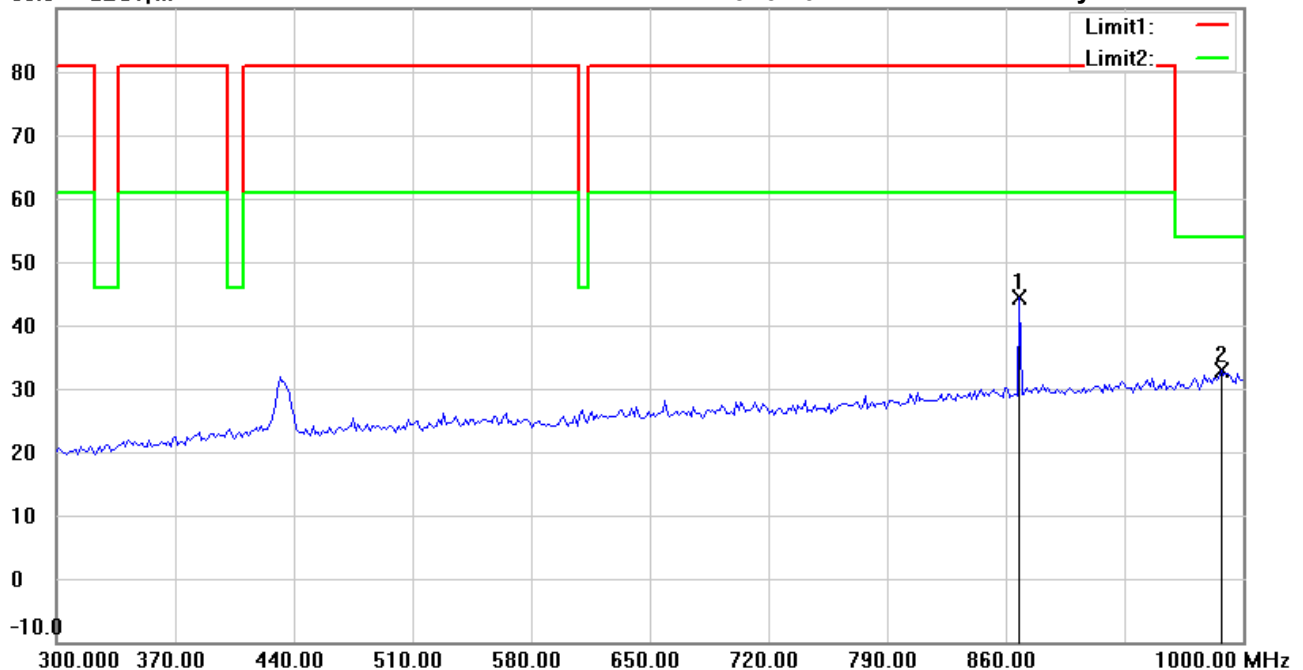
Date: 9/24/2019

Temperature: 24.2 °C

90.0 dBuV/m

Time: 5:13:21 AM

Humidity: 70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 300-1000(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: **Vertical**

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	868.1363	41.48	peak	2.85	44.33	80.80	100	100	-36.47	
*	987.3747	27.94	peak	4.83	32.77	54.00	100	25	-21.23	

*:Maximum data x:Over limit !:over margin



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Radiated Emission Measurement

Operator: Allen

File : 3

Data : #1

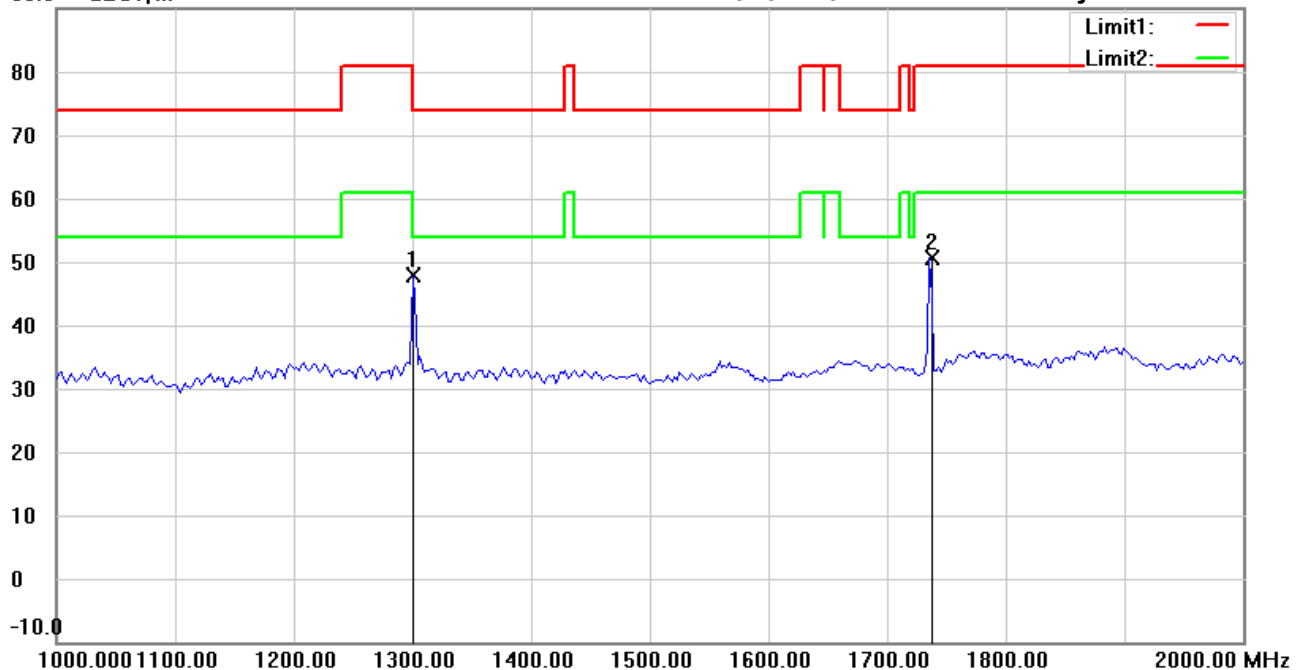
Date: 9/24/2019

Temperature: 24.2 °C

90.0 dBuV/m

Time: 5:22:34 AM

Humidity: 70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 1000-2000(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: *Horizontal*

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1300.601	56.91	peak	-8.96	47.95	74.00	150	36	-26.05	
	1735.471	58.90	peak	-8.27	50.63	80.80	150	114	-30.17	

*:Maximum data x:Over limit !:over margin



Address: 6F., No. 58, Ln 188, Ruey Kuang Rd, NeiHu, Taipei
Tel: +886-2-6606-8877
Fax: +886-2-6606-8879

Radiated Emission Measurement

Operator: Allen

File : 3

Data : #4

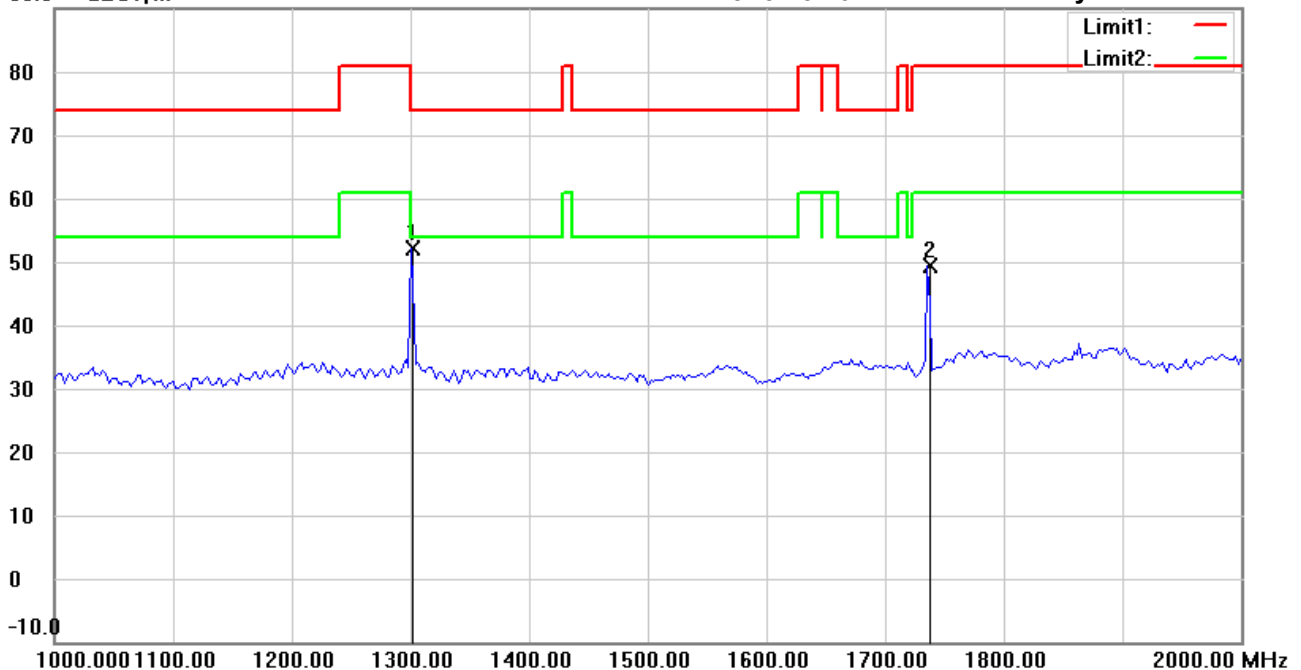
Date: 9/24/2019

Temperature: 24.2 °C

90.0 dBuV/m

Time: 5:28:29 AM

Humidity: 70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 1000-2000(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: **Vertical**

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1301.578	61.19	peak	-8.97	52.22	74.00	150	240	-21.78	
	1735.471	57.71	peak	-8.27	49.44	80.80	150	310	-31.36	

*:Maximum data x:Over limit !:over margin



Address: 6F., No. 58, Ln 188, Ruey Kuang Rd, Neihu, Taipei
Tel: +886-2-6606-8877
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Radiated Emission Measurement

Operator: Allen

File :3

Data :#2

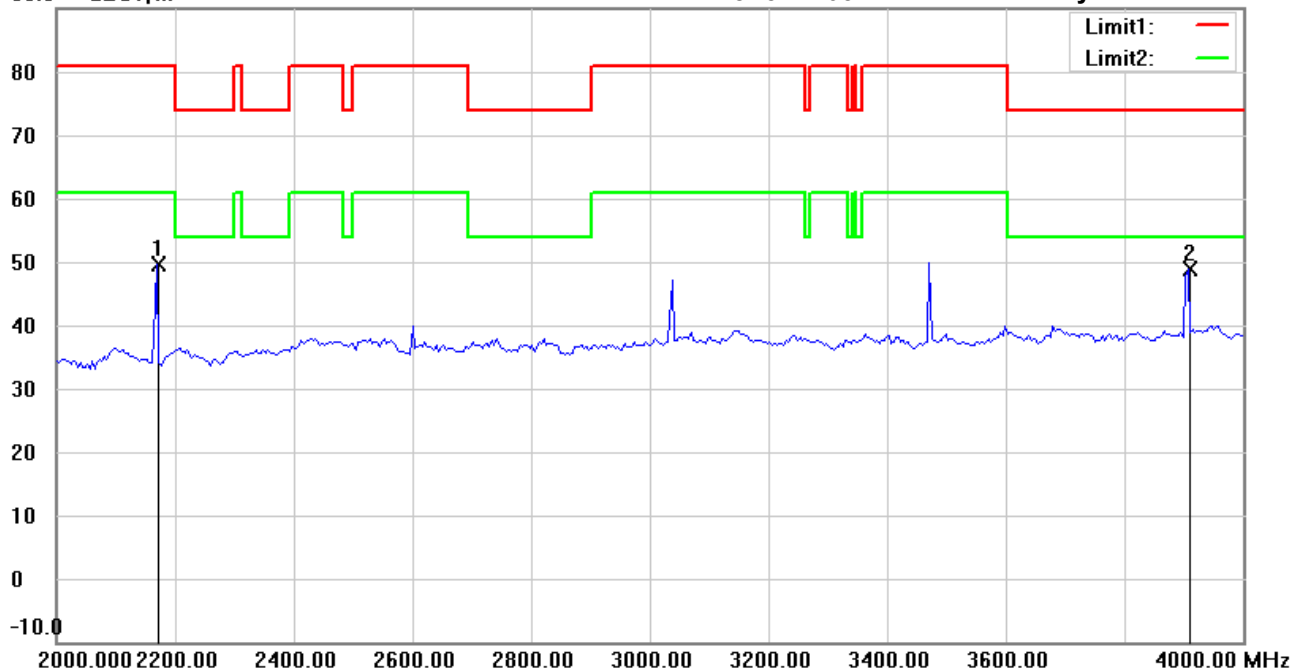
Date: 9/24/2019

Temperature: 24.2 °C

90.0 dBuV/m

Time: 5:24:05 AM

Humidity: 70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 2000-4000(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: *Horizontal*

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	2168.337	56.78	peak	-7.24	49.54	80.80	150	250	-31.26	
*	3907.816	50.92	peak	-1.96	48.96	74.00	150	175	-25.04	

*:Maximum data x:Over limit !:over margin



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Radiated Emission Measurement

Operator: Allen

File :3

Data :#5

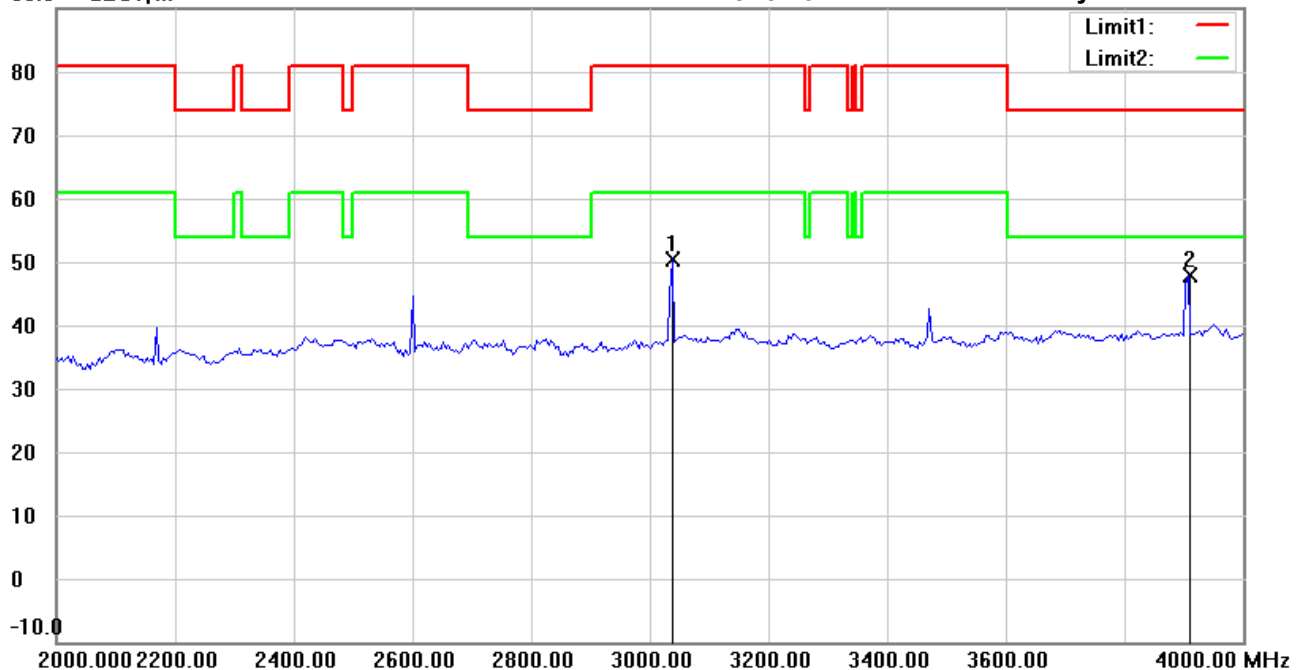
Date: 9/24/2019

Temperature: 24.2 °C

90.0 dBuV/m

Time: 5:29:47 AM

Humidity: 70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 2000-4000(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: **Vertical**

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	3038.076	54.74	peak	-4.24	50.50	80.80	150	210	-30.30	
*	3907.816	49.93	peak	-1.96	47.97	74.00	150	45	-26.03	

*:Maximum data x:Over limit !:over margin



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Tel: +886-2-6606-8877
Fax: +886-2-6606-8879

Radiated Emission Measurement

Operator: Allen

File :3

Data :#3

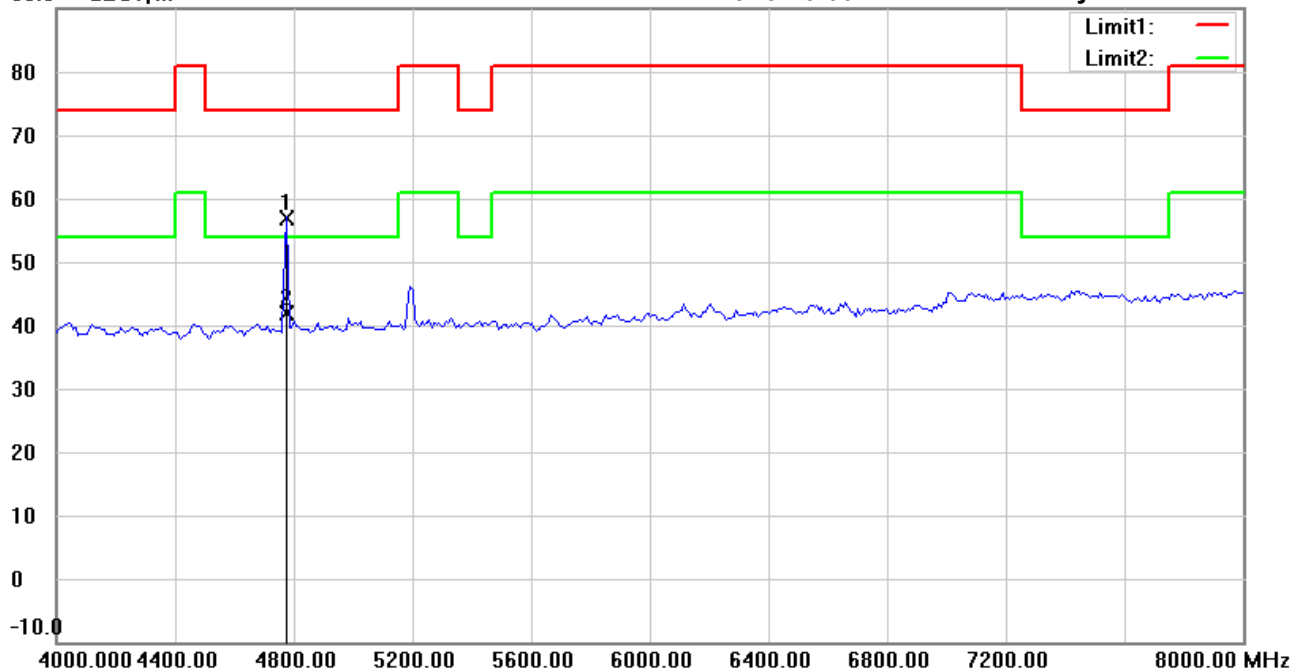
Date: 9/24/2019

Temperature: 24.2 °C

90.0 dBuV/m

Time: 5:26:00 AM

Humidity: 70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 4000-8000(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: **Horizontal**

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	4772.049	59.11	peak	-2.15	56.96	74.00	150	110	-17.04	
*	4772.049	43.94	AVG	-2.15	41.79	54.00	150	110	-12.21	

*:Maximum data x:Over limit !:over margin



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Tel: +886-2-6606-8877
Fax: +886-2-6606-8879

Radiated Emission Measurement

Operator: Allen

File :3

Data :#6

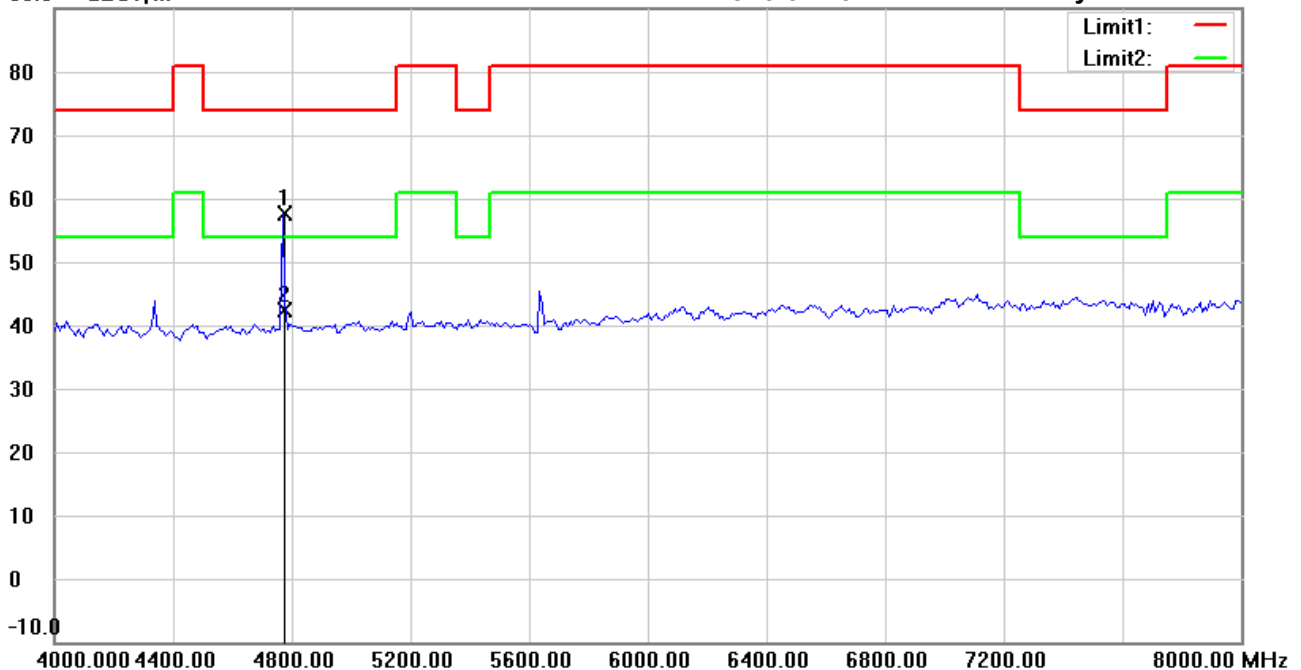
Date: 9/24/2019

Temperature: 24.2 °C

90.0 dBuV/m

Time: 5:31:15 AM

Humidity: 70.5 %



Site : Chamber

Condition : FCC 15.231(433MHz) 4000-8000(PK)

EUT : W6M21909-19377

M/N:

Test Mode : TX 433.82MHz

Note :

Polarization: **Vertical**

Power : 3 Vd.c.

Distance: 3m

Mk.	Frequency (MHz)	Reading (dBuV)	Detector	Corr. factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	4772.169	59.67	peak	-2.15	57.52	74.00	150	359	-16.48	
*	4772.169	44.50	AVG	-2.15	42.35	54.00	150	359	-11.65	

*:Maximum data x:Over limit !:over margin