FCC Radio Test Report

FCC ID: 2BCGWS500

This report concerns: Class II Permissive Change

The worst cases of conducted and radiated emissions below 1GHz have been re-evaluated by sample of FCC ID: 2BCGWS500, model name: HS200-2. It is found that the new data are the worse, so the test data are reissue from the FCC ID: 2AXJ4S500, model name: Tapo S500. Model difference(s):
a. Changed the model name as HS200-2. (HS200-2 consists of original model Tapo S500*2 and an outer frame, functions and circuits are independent.)
b. Changed the information of applicant and manufacturer.
c. Changed the shell.
d. Changed the power rating.

Report No.	:	eLab-FCCP-2-2310G044A
Equipment	:	Kasa Smart Wi-Fi Light Switch, Single Pole
Model Name	:	HS200-2
Brand Name	:	tp-link
Applicant	:	TP-LINK CORPORATION PTE. LTD.
Address	:	7 Temasek Boulevard #29-03 Suntec Tower One, Singapore 038987
Manufacturer	:	TP-LINK CORPORATION PTE. LTD.
Address	:	7 Temasek Boulevard #29-03 Suntec Tower One, Singapore 038987
Radio Function	:	WLAN 2.4 GHz
FCC Rule Part(s)	:	FCC CFR Title 47, Part 15, Subpart C (15.247)
Measurement Procedure(s)	:	ANSI C63.10-2013
Date of Receipt	:	2023/11/13
Date of Test	:	2023/11/15 ~ 2023/11/16
Issued Date	:	2024/01/25

The above equipment has been tested and found in compliance with the requirement of the above standards by eLab Inc.

Prepared by : Hunter Chiang, Engineer

Approved by : Sam Chuang, Supervisor

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Declaration

eLab represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

eLab's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **eLab** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **eLab** issued reports.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

eLab's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

eLab is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

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REPORT ISSUED HISTORY

Report No.	Version	Description	Issued Date	Note
eLab-FCCP-2-2310G044A	R00	Original Report.	2023/12/27	Invalid
eLab-FCCP-2-2310G044A	R01	1. Updated the information of applicant and manufacturer. 2. Updated the test address. 3. Updated the P/N and type of antenna.	2024/01/09	Invalid
eLab-FCCP-2-2310G044A	R02	1. Updated the description of model difference on page 1. 2. Only retained the current test Items in the report, so the descriptions in section 1 and 4 have been updated. 3. Updated the uncertainty of radiated emissions.	2024/01/25	Valid

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

Standard(s) Section	Description	Result	Remark
15.207	AC Power Line Conducted Emissions	PASS	------
15.205(a)	Radiated Emissions	PASS	------

Note:

(1) “N/A” denotes test is not applicable in this test report.

(2) The other test records and results please refer to the test report number:
BTL-FCCP-2-2205C096A, issued date is Sep. 29, 2022, and issued by:
Test Laboratory: BTL Inc.
Address: No. 3 Jinshagang 1st Rd. Shixia, Dalang Town Dongguan City, Guangdong 523792 People’s Republic of China.

Which was accredited by A2LA, accreditation number is 5123.02, with the scopes of cited standards in this test report.
This report is only valid conjunction with the above referenced test report.

1.1 TEST FACILITY

The test facilities used to collect the test data in this report:

No.64, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City
The test sites and facilities are covered under FCC RN 681248 and DN: TW4045.
☒ C01 ☒ CB01 ☐ TR01

1.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))
The BTL measurement uncertainty as below table:

A. AC power line conducted emissions test:

Test Site	Method	Measurement Frequency Range	U (dB)
C01	CISPR	150 kHz ~ 30MHz	3.44

B. Radiated emissions test:

Test Site	Measurement Frequency Range	U,(dB)
CB01	0.03 GHz ~ 0.2 GHz	4.4417
	0.2 GHz ~ 1 GHz	4.5567

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By
AC Power Line Conducted Emissions	25°C	45%	AC 120V/60Hz	Hunter Chiang
Radiated Emissions-30MHz to 1000MHz	25°C	60%	AC 120V/60Hz	Hunter Chiang

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Kasa Smart Wi-Fi Light Switch, Single Pole
Brand Name	tp-link
Test Model	HS200-2
Series Model	N/A
Model Difference(s)	N/A
Power Source	AC Mains.
Power Rating	100-120V~ 50/60Hz 15A General Use 600 W Incandescent 1/6 HP Motor
Operation Frequency	2412 MHz ~ 2462 MHz
Modulation Type	IEEE 802.11b: DSSS IEEE 802.11g: OFDM IEEE 802.11n: OFDM
Bit Rate of Transmitter	IEEE 802.11b: 11/5.5/2/1 Mbps IEEE 802.11g: 54/48/36/24/18/12/9/6 Mbps IEEE 802.11n: up to 72.2 Mbps
Maximum Average Output Power	IEEE 802.11b: 22.97 dBm (0.1982 W)

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. Channel List:

CH01 - CH11 for IEEE 802.11b, IEEE 802.11g, IEEE 802.11n(HT20)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452		

3. Antenna Specification:

Ant.	Brand	P/N	Antenna Type	Connector	Gain (dBi)
1	tp-link	6035500141	PIFA	N/A	2.98

Note: The antenna gain is provided by the manufacturer.

2.2 DESCRIPTION OF TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Pretest Mode	Description
Mode 1	TX B Mode Channel 01/06/11
Mode 2	TX G Mode Channel 01/06/11
Mode 3	TX N(HT20) Mode Channel 01/06/11
Mode 4	TX B Mode Channel 01
Mode 5	TX B Mode Channel 01/02/06/10/11
Mode 6	TX G Mode Channel 01/02/06/10/11
Mode 7	TX N(HT20) Mode Channel 01/02/06/10/11

Following mode(s) was (were) found to be the worst case(s) and selected for the final test.

AC power line conducted emissions test	
Final Test Mode	Description
Mode 4	TX B Mode Channel 01

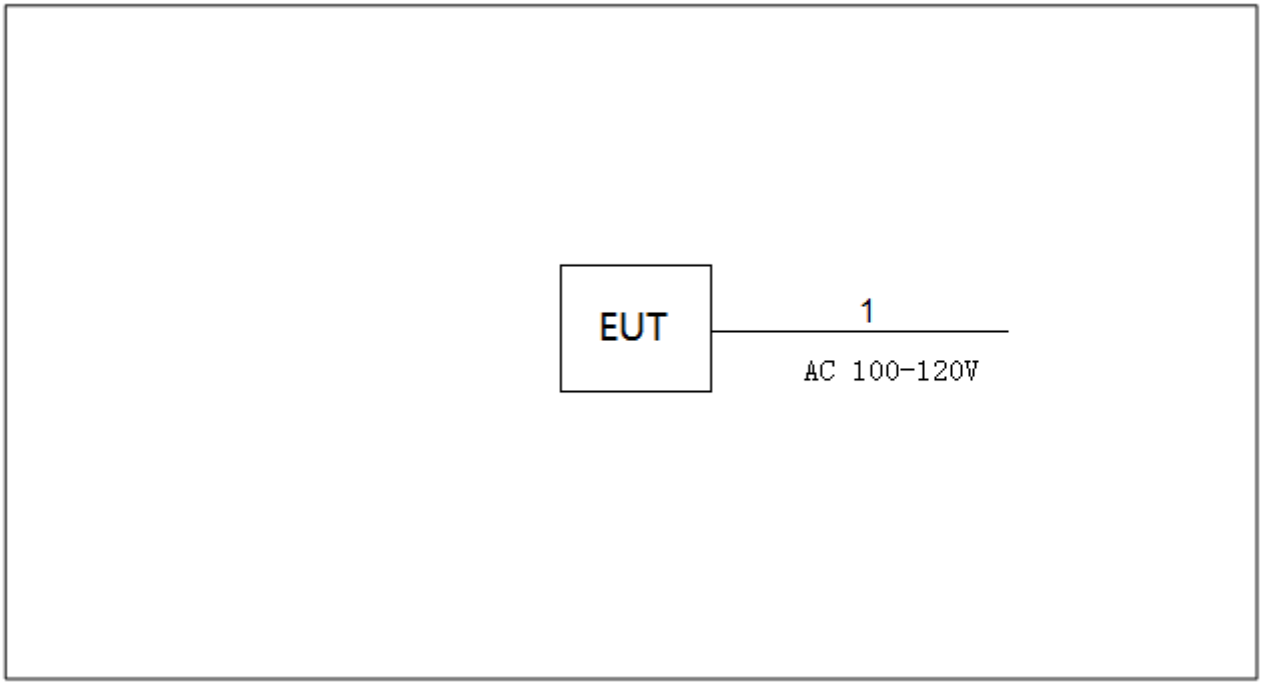
Radiated emissions test - Below 1GHz	
Final Test Mode	Description
Mode 4	TX B Mode Channel 01

NOTE:
(1) All the bit rate of transmitter have been tested and found the lowest rate is found to be the worst case and recorded.
(2) For AC power line conducted emissions and radiated emission below 1 GHz test, the TX B Mode Channel 01 is found to be the worst case and recorded.

2.3 PARAMETERS OF TEST SOFTWARE

Test Software Version	UI_mptool V1.0.0.1		
Frequency (MHz)	2412	2437	2462
IEEE 802.11b	118	118	117
IEEE 802.11g	111	127	109
IEEE 802.11n(HT20)	110	127	105

2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



2.5 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.
-	-	-	-	-

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	AC Cable	NO	NO	1.2m

3. AC POWER LINE CONDUCTED EMISSIONS

3.1 LIMIT

Frequency (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56 *	56 - 46 *
0.50 - 5.0	56	46
5.0 - 30.0	60	50

NOTE:
(1) The tighter limit applies at the band edges.
(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
(3) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor (if use)
Margin Level = Measurement Value – Limit Value
Calculation example:

Reading Level		Correct Factor		Measurement Value
38.22	+	3.45	=	41.67

Measurement Value		Limit Value		Margin Level
41.67	-	60	=	-18.33

The following table is the setting of the receiver.

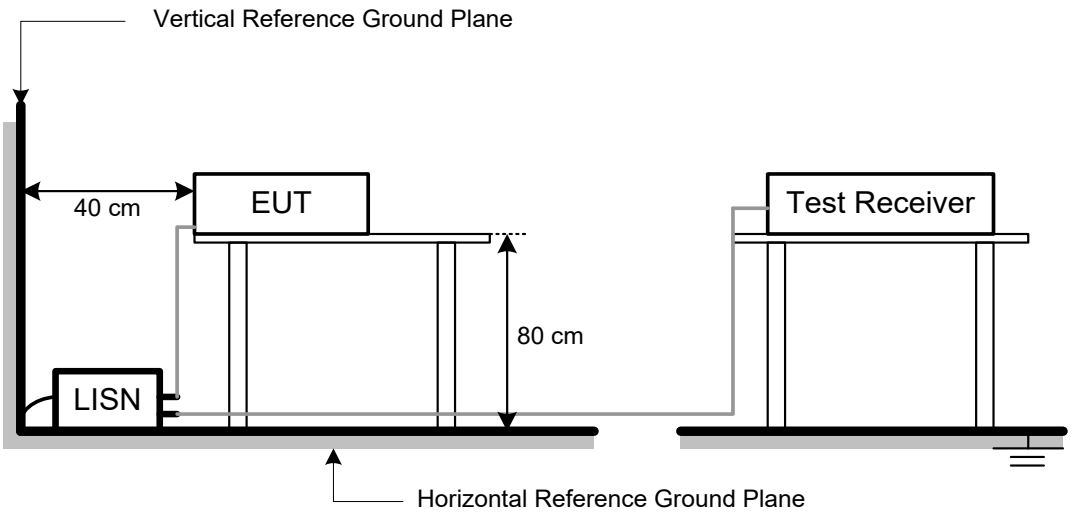
Receiver Parameter	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

3.2 TEST PROCEDURE

a. The EUT was placed 0.8 m above the horizontal ground plane with the EUT being connected to the power mains through a line impedance stabilization network (LISN).
All other support equipment were powered from an additional LISN(s).
The LISN provides 50 Ohm/50uH of impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle to keep the cable above 40 cm.
c. Excess I/O cables that are not connected to a peripheral shall be bundled in the center.
The end of the cable will be terminated, using the correct terminating impedance.
The overall length shall not exceed 1 m.
d. The LISN is spaced at least 80 cm from the nearest part of the EUT chassis.
e. For the actual test configuration, please refer to the related Item - EUT TEST PHOTO.

NOTE:
(1) In the results, each reading is marked as Peak, QP or AVG per the detector used.
BW=9 kHz (6 dB Bandwidth)
(2) All readings are Peak unless otherwise stated QP or AVG in column of Note. Both the QP and the AVG readings must be less than the limit for compliance.

3.3 TEST SETUP



3.4 TEST RESULTS

Please refer to the APPENDIX A.

4. RADIATED EMISSIONS

4.1 LIMIT

In case the emission fall within the restricted band specified on 15.205, then the 15.209 limit in the table below has to be followed.

LIMITS OF RADIATED EMISSIONS MEASUREMENT (30 MHz to 1000 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

NOTE:
(1) The limit for radiated test was performed according to FCC CFR Title 47, Part 15, Subpart C.
(2) The tighter limit applies at the band edges.
(3) Emission level (dBuV/m)=20log Emission level (uV/m).
(4) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)
Margin Level = Measurement Value - Limit Value
Calculation example:

Reading Level		Correct Factor		Measurement Value
19.11	+	2.11	=	21.22

Measurement Value		Limit Value		Margin Level
21.22	-	54	=	-32.78

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average

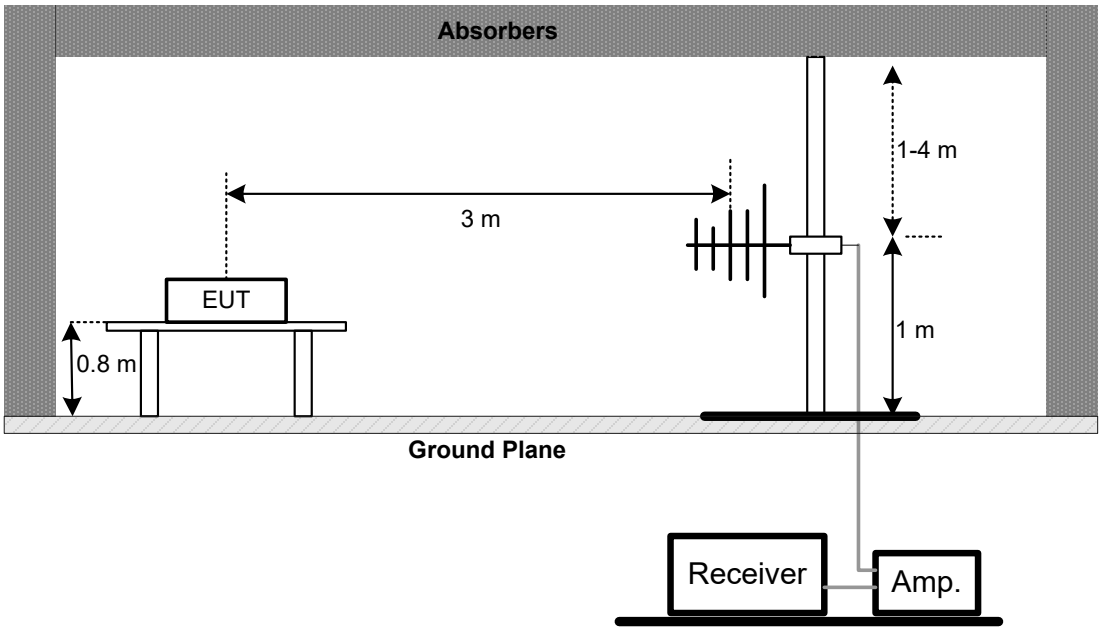
Spectrum Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9KHz~90KHz for PK/AVG detector
Start ~ Stop Frequency	90KHz~110KHz for QP detector
Start ~ Stop Frequency	110KHz~490KHz for PK/AVG detector
Start ~ Stop Frequency	490KHz~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

4.2 TEST PROCEDURE

a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz).
b. The height of the equipment or of the substitution antenna shall be 0.8 m or 1.5 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
c. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
d. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
f. For the actual test configuration, please refer to the related Item – EUT TEST PHOTO.

4.3 TEST SETUP

30 MHz to 1 GHz



4.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.5 TEST RESULTS - 30 MHZ TO 1000 MHZ

Please refer to the APPENDIX B.

5. MEASUREMENT INSTRUMENTS LIST

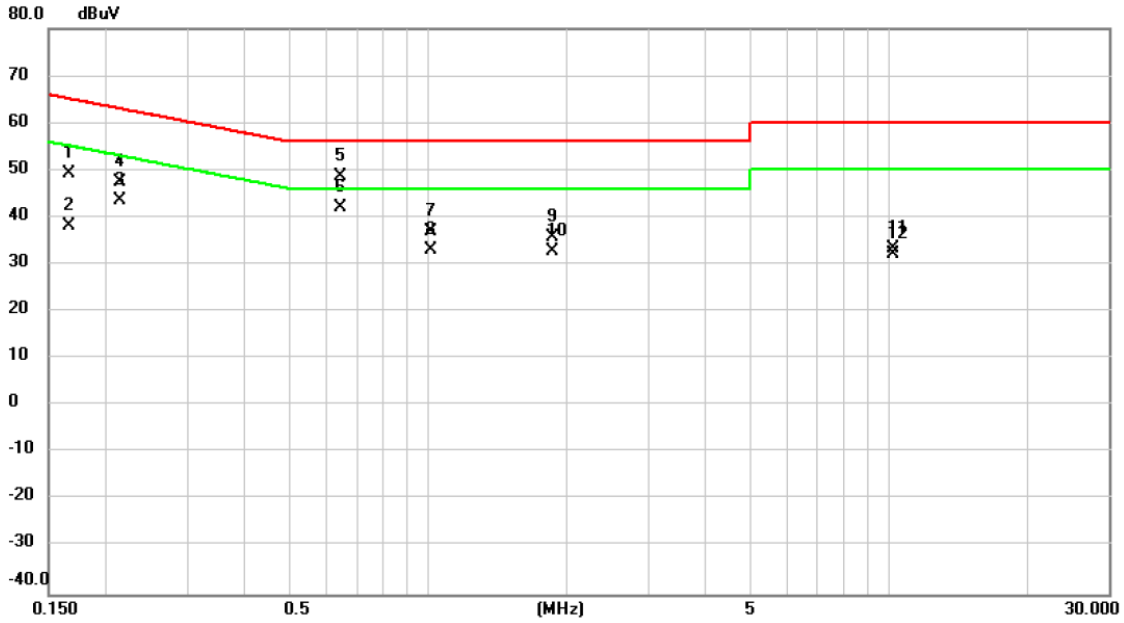
AC Power Line Conducted Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	TWO-LINE V-NETWORK	R&S	ENV216	101051	2023/7/15	2024/7/20
2	Test Cable	EMCI	EMCRG58-BM-BM-9000	210501	2022/12/15	2023/12/14
3	MXE EMI Receiver	Agilent	N9038A	MY54130009	2023/06/26	2024/06/25
4	Measurement Software	EZ	EZ_EMC (Version NB-03A1-01)	N/A	N/A	N/A

Radiated Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Preamplifier	EMCI	EMC051845SE	980779	2022/12/19	2023/12/18
2	Preamplifier	EMCI	EMC184045SE	980512	2022/12/02	2023/12/01
3	Preamplifier	EMCI	EMC001340	980555	2022/12/05	2023/12/04
4	Test Cable	EMCI	EMCCFD400-NM-NM-8000	200343	2023/11/14	2024/11/13
5	Test Cable	EMCI	EMC105-SM-SM-3000	210118	2022/12/08	2023/12/07
6	Test Cable	EMCI	EMC105-SM-SM-7000	210117	2023/11/14	2024/11/13
7	Test Cable	EMCI	EMCCFD400-NM-NM-3300	200348	2023/11/14	2024/11/13
8	EXA Signal Analyzer	keysight	N9010A	MY56480554	2023/9/12	2024/9/11
9	Loop Ant	Electro-Metrics	EMCI-LPA600	274	2023/06/28	2024/06/27
10	Log-bicon Antenna	Schwarzbeck	VULB9168	9168-1207	2023/01/13	2024/01/12
11	6dB Attenuator	EMCI	EMCI-N-6-06	AT-N0690	2023/01/13	2024/01/12
12	Measurement Software	EZ	EZ_EMC (Version NB-03A1-01)	N/A	N/A	N/A

Remark: ”N/A” denotes no model name, serial no. or calibration specified.
All calibration period of equipment list is one year.

APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS

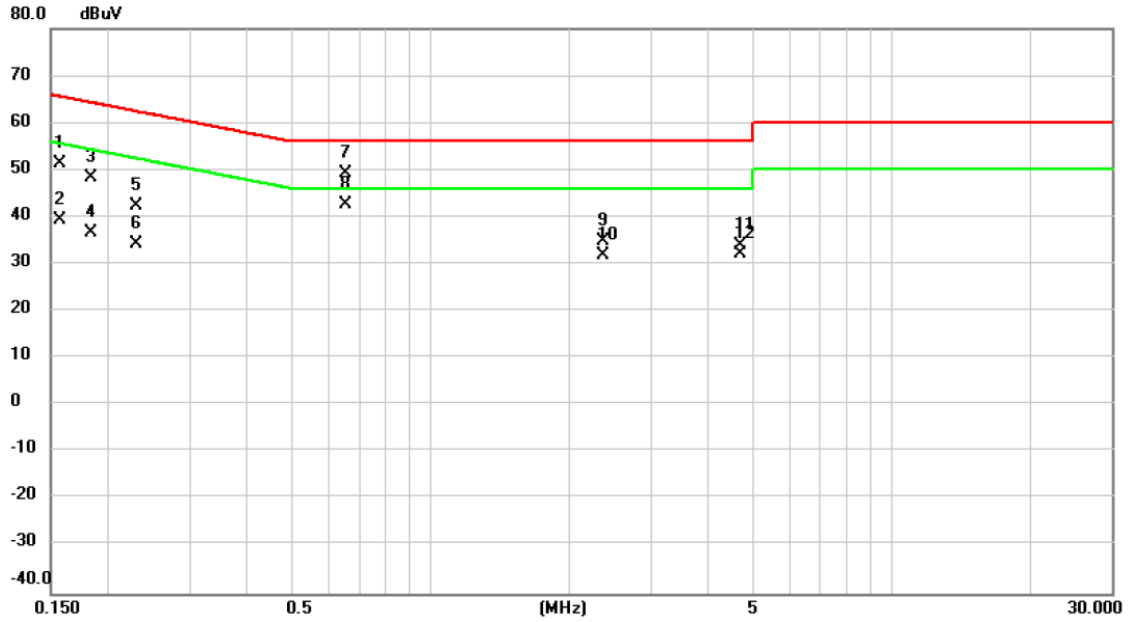
Test Mode	Normal	Tested Date	2023/11/16
Test Frequency	-	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1657	39.49	9.67	49.16	65.17	-16.01	QP	
2		0.1657	28.62	9.67	38.29	55.17	-16.88	AVG	
3		0.2140	33.87	9.67	43.54	63.05	-19.51	QP	
4		0.2140	37.68	9.67	47.35	53.05	-5.70	AVG	
5		0.6440	38.87	9.70	48.57	56.00	-7.43	QP	
6	*	0.6440	32.45	9.70	42.15	46.00	-3.85	AVG	
7		1.0130	27.10	9.73	36.83	56.00	-19.17	QP	
8		1.0130	23.31	9.73	33.04	46.00	-12.96	AVG	
9		1.8635	26.05	9.77	35.82	56.00	-20.18	QP	
10		1.8635	22.86	9.77	32.63	46.00	-13.37	AVG	
11		10.2000	23.28	10.06	33.34	60.00	-26.66	QP	
12		10.2000	21.96	10.06	32.02	50.00	-17.98	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

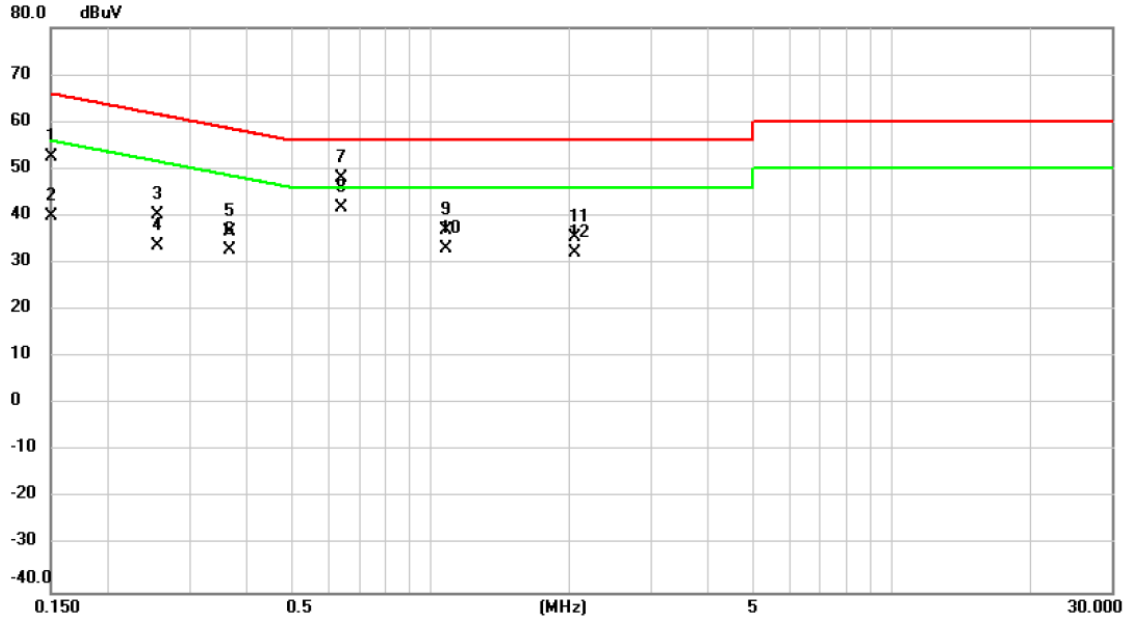
Test Mode	Normal	Tested Date	2023/11/16
Test Frequency	-	Phase	Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1570	41.78	9.67	51.45	65.62	-14.17	QP	
2		0.1570	29.59	9.67	39.26	55.62	-16.36	AVG	
3		0.1836	38.62	9.66	48.28	64.32	-16.04	QP	
4		0.1836	26.95	9.66	36.61	54.32	-17.71	AVG	
5		0.2301	32.68	9.66	42.34	62.45	-20.11	QP	
6		0.2301	24.64	9.66	34.30	52.45	-18.15	AVG	
7		0.6530	39.47	9.70	49.17	56.00	-6.83	QP	
8	*	0.6530	33.04	9.70	42.74	46.00	-3.26	AVG	
9		2.3675	24.88	9.82	34.70	56.00	-21.30	QP	
10		2.3675	21.93	9.82	31.75	46.00	-14.25	AVG	
11		4.6940	24.07	9.90	33.97	56.00	-22.03	QP	
12		4.6940	22.28	9.90	32.18	46.00	-13.82	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

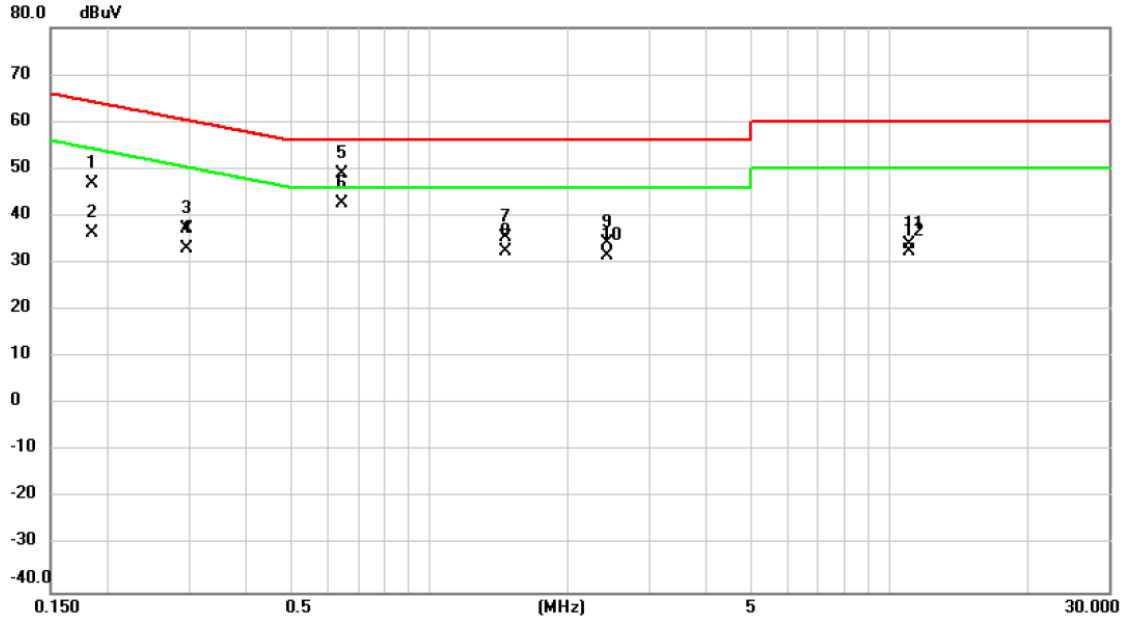
Test Mode	Idle	Tested Date	2023/11/16
Test Frequency	-	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1507	42.91	9.67	52.58	65.96	-13.38	QP	
2		0.1507	30.31	9.67	39.98	55.96	-15.98	AVG	
3		0.2550	30.69	9.66	40.35	61.59	-21.24	QP	
4		0.2550	24.02	9.66	33.68	51.59	-17.91	AVG	
5		0.3677	27.03	9.66	36.69	58.55	-21.86	QP	
6		0.3677	23.18	9.66	32.84	48.55	-15.71	AVG	
7		0.6394	38.31	9.70	48.01	56.00	-7.99	QP	
8	*	0.6394	32.00	9.70	41.70	46.00	-4.30	AVG	
9		1.0805	27.08	9.73	36.81	56.00	-19.19	QP	
10		1.0805	23.32	9.73	33.05	46.00	-12.95	AVG	
11		2.0615	25.56	9.78	35.34	56.00	-20.66	QP	
12		2.0615	22.37	9.78	32.15	46.00	-13.85	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	Idle	Tested Date	2023/11/16
Test Frequency	-	Phase	Neutral

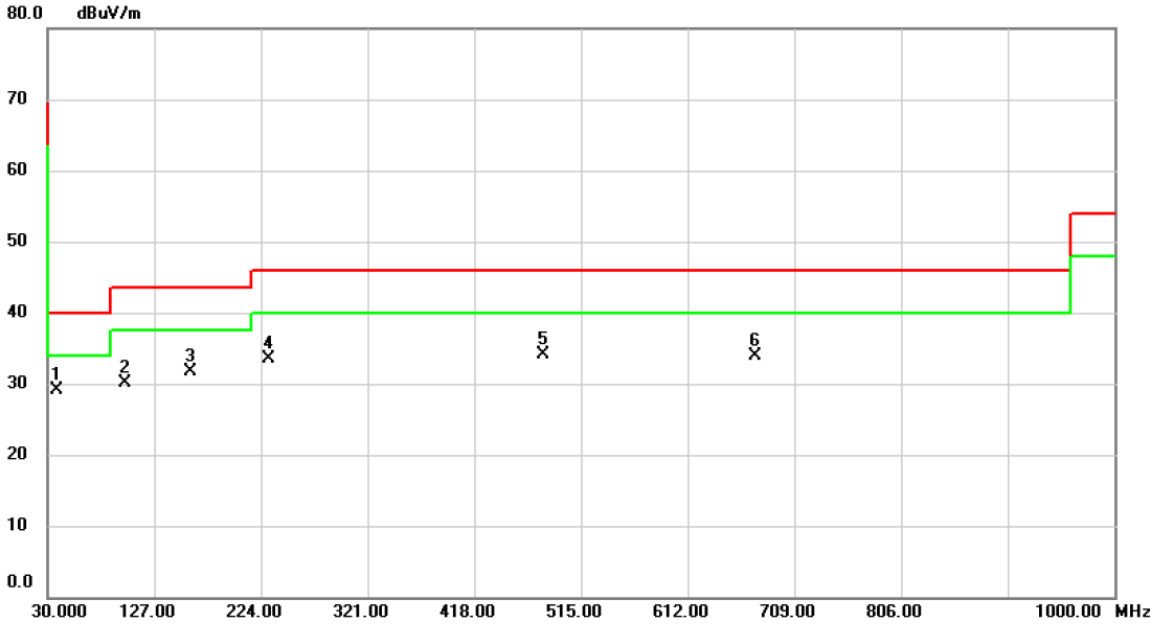


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1853	37.06	9.66	46.72	64.24	-17.52	QP	
2		0.1853	26.71	9.66	36.37	54.24	-17.87	AVG	
3		0.2963	27.53	9.65	37.18	60.35	-23.17	QP	
4		0.2963	23.26	9.65	32.91	50.35	-17.44	AVG	
5		0.6440	39.25	9.70	48.95	56.00	-7.05	QP	
6	*	0.6440	32.87	9.70	42.57	46.00	-3.43	AVG	
7		1.4675	25.82	9.76	35.58	56.00	-20.42	QP	
8		1.4675	22.77	9.76	32.53	46.00	-13.47	AVG	
9		2.4350	24.55	9.82	34.37	56.00	-21.63	QP	
10		2.4350	21.82	9.82	31.64	46.00	-14.36	AVG	
11		11.0250	23.80	10.11	33.91	60.00	-26.09	QP	
12		11.0250	22.21	10.11	32.32	50.00	-17.68	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX B - RADIATED EMISSION - 30 MHZ TO 1000 MHZ

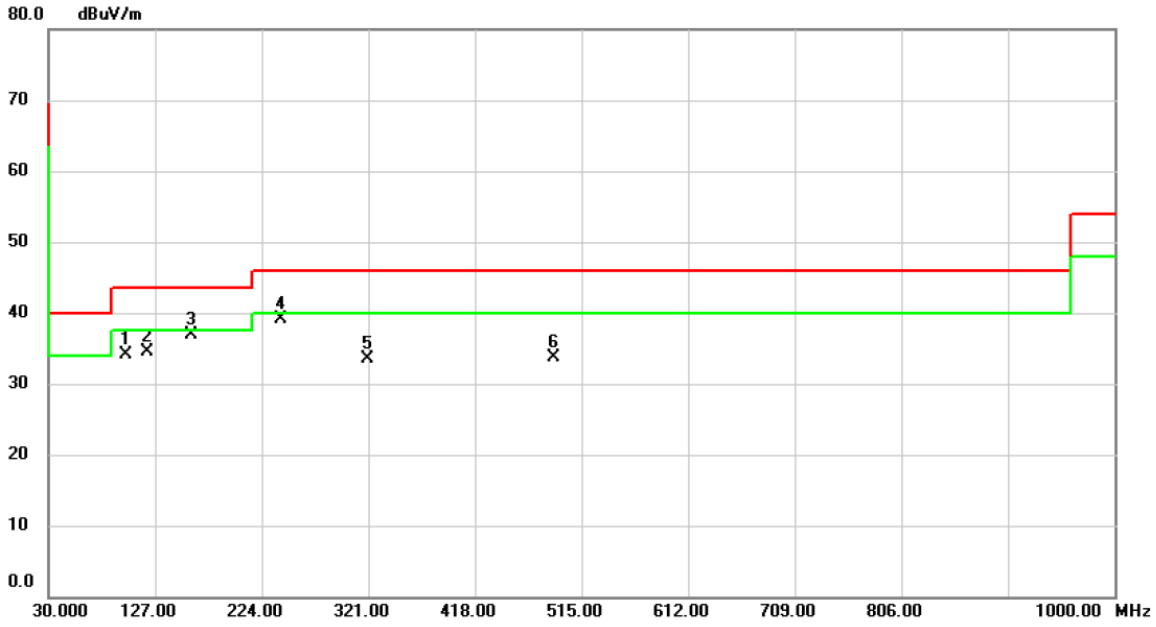
Test Mode	IEEE 802.11b	Test Date	2023/11/15
Test Frequency	2412MHz	Polarization	Vertical
Temp	25°C	Hum.	60%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	38.7300	41.95	-12.75	29.20	40.00	-10.80	peak	100	360	
2		99.8400	46.32	-16.19	30.13	43.50	-13.37	peak	100	51	
3		159.9800	43.04	-11.30	31.74	43.50	-11.76	peak	100	83	
4		230.7900	47.09	-13.67	33.42	46.00	-12.58	peak	100	102	
5		480.0800	39.72	-5.69	34.03	46.00	-11.97	peak	200	5	
6		673.1100	35.17	-1.36	33.81	46.00	-12.19	peak	100	106	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	IEEE 802.11b	Test Date	2023/11/15
Test Frequency	2412MHz	Polarization	Horizontal
Temp	25°C	Hum.	60%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		99.8400	50.31	-16.19	34.12	43.50	-9.38	peak	200	190	
2		120.2100	48.50	-14.02	34.48	43.50	-9.02	peak	200	351	
3	*	159.9800	48.22	-11.30	36.92	43.50	-6.58	peak	195	360	
4		241.4600	51.36	-12.25	39.11	46.00	-6.89	peak	100	253	
5		320.0300	43.44	-9.89	33.55	46.00	-12.45	peak	100	135	
6		489.7800	39.28	-5.51	33.77	46.00	-12.23	peak	200	200	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

End of Test Report