

FCC Radio Test Report

FCC ID: M82-EKI1360CE

Report No. : BTL-FCCP-5-2112T115
Equipment : Ethernet Device
Model Name : EKI-1362-CE, EKI-1361-CE, EKI-6233BN, EKI-136X-CE,
EKI-136X-MB-CE, EKI136XXXXXX, EKI-136X-CXXXXXXX,
EKI-6233XXXXXXX (where "X" may be any alphanumeric character ,
blank or "-".)
Brand Name : ADVANTECH
Applicant : Advantech Co., Ltd.
Address : No.1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 11491,
Taiwan, R.O.C.
Radio Function : Transmit Simultaneously
FCC Rule Part(s) : FCC CFR Title 47, Part 15, Subpart C
FCC CFR Title 47, Part 15, Subpart E
Measurement Procedure(s) : ANSI C63.10-2013
Date of Receipt : 2021/12/24
Date of Test : 2021/12/24 ~ 2022/6/9
Issued Date : 2022/6/17

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

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Declaration

BTL 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).

BTL'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. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

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BTL'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.

BTL 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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REVISION HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-5-2112T115	R00	Original Report.	2022/6/17	Valid

1 SUMMARY OF TEST RESULTS

Test procedures according to the technical standards.

Standard(s) Section	Description	Test Result	Judgement	Remark
15.205 15.209 15.247(d) 15.407(b)	Radiated Emissions	APPENDIX A	Pass	-----

NOTE:

- (1) "N/A" denotes test is not applicable in this Test Report.
- (2) The report format version is TP.1.1.1.

1.1 TEST FACILITY

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

No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

The test sites and facilities are covered under FCC RN: 674415 and DN: TW0659.

☐ C05 ☐ CB08 ☐ CB11 ☒ CB15 ☐ CB16
☐ SR05

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k = 2$, providing a level of confidence of approximately **95 %**. The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{CISPR} requirement.

A. Radiated emissions test :

Test Site	Measurement Frequency Range	U_1 (dB)
CB15	0.03 GHz ~ 0.2 GHz	4.17
	0.2 GHz ~ 1 GHz	4.72
	1 GHz ~ 6 GHz	5.21
	6 GHz ~ 18 GHz	5.51
	18 GHz ~ 26 GHz	3.69
	26 GHz ~ 40 GHz	4.23

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	Environment Condition	Test Voltage	Tested by
Radiated emissions	22 °C, 65 %	DC 48V	Vincent Lee

2 GENERAL INFORMATION

2.1 DESCRIPTION OF EUT

Equipment	Ethernet Device
Model Name	EKI-1362-CE, EKI-1361-CE, EKI-6233BN, EKI-136X-CE, EKI-136X-MB-CE, EKI136XXXXXX, EKI-136X-CXXXXXXX, EKI-6233XXXXXXX (where "X" may be any alphanumeric character , blank or "-".)
Brand Name	ADVANTECH
Model Difference	Different model are due to marketing purpose and COM port quantity difference.
Power Source	DC Voltage supplied from DC power supply.
Power Rating	DC 12-48V
Products Covered	1 * CPU: Microchip Technology / SAM9X60T-V/DWB, 600MHZ 1 * Mother Board: ADVANTECH / EKI-1362-CE 1 * Memory: DDR2-800M 1Gb 1 * WLAN Module: Azure Wave / AW-CM276NF 2 * Antenna: Cortec / AN2450-92K01BRS
Operation Band	2400 MHz ~ 2483.5 MHz UNII-1: 5150 MHz to 5250 MHz UNII-2A: 5250 MHz to 5350 MHz UNII-2C: 5470 MHz to 5725 MHz UNII-3: 5725 MHz to 5850 MHz
Operation Frequency	2412 MHz ~ 2462 MHz UNII-1: 5180 MHz to 5240 MHz UNII-2A: 5260 MHz to 5320 MHz UNII-2C: 5500 MHz to 5700 MHz UNII-3: 5745 MHz to 5825 MHz
Test Model	EKI-1362-CE
Sample Status	Engineering Sample
EUT Modification(s)	N/A

NOTE:

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

(2) Channel List:

WLAN 2.4 GHz:

CH01 - CH11 for IEEE 802.11b, IEEE 802.11g, IEEE 802.11n (HT20)					
CH03 - CH09 for IEEE 802.11n (HT40)					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	05	2432	09	2452
02	2417	06	2437	10	2457
03	2422	07	2442	11	2462
04	2427	08	2447		

WLAN 5 GHz:

IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11ac (VHT20)		IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)	
UNII-1		UNII-1		UNII-1	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230		
44	5220				
48	5240				

IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11ac (VHT20)		IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)	
UNII-2A		UNII-2A		UNII-2A	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	54	5270	58	5290
56	5280	62	5310		
60	5300				
64	5320				

IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11ac (VHT20)		IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)	
UNII-2C		UNII-2C		UNII-2C	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	102	5510	106	5530
104	5520	110	5550	122	5610
108	5540	118	5590		
112	5560	126	5630		
116	5580	134	5670		
120	5600				
124	5620				
128	5640				
132	5660				
136	5680				
140	5700				

IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11ac (VHT20)		IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)	
UNII-3		UNII-3		UNII-3	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	151	5755	155	5775
153	5765	159	5795		
157	5785				
161	5805				
165	5825				

(3) Table for Filed Antenna:

Antenna	Manufacture	Product Number	Type	Connector	Frequency (MHz)	Gain (dBi)
1		AN2450-92K01BRS	Dipole	SMA Male Reverse	2400-2500	5.03
					5150-5850	5.01
2		AN2450-92K01BRS	Dipole	SMA Male Reverse	2400-2500	5.03
					5150-5850	5.01

Note:

(1) The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and receivers (2T2R).

(2) For Power Spectral Density (CDD mode)

$$\text{Directional Gain} = 10 \cdot \log\{[10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_n/20}]^2 / N_{\text{ANT}}\} = 8.04 \text{ dBi} > 6 \text{ dBi}$$

The reduced power spectral density limits (dBm/3 kHz) = 8 - (8.04 - 6) = 5.96

(3) For Conducted Output Power (CDD mode)

For $N_{\text{ANT}} = 2 < 5$,

$$\text{Direction gain} = G_{\text{ANT}} + 0 = 5.03 + 0 = 5.03 \text{ dBi}.$$

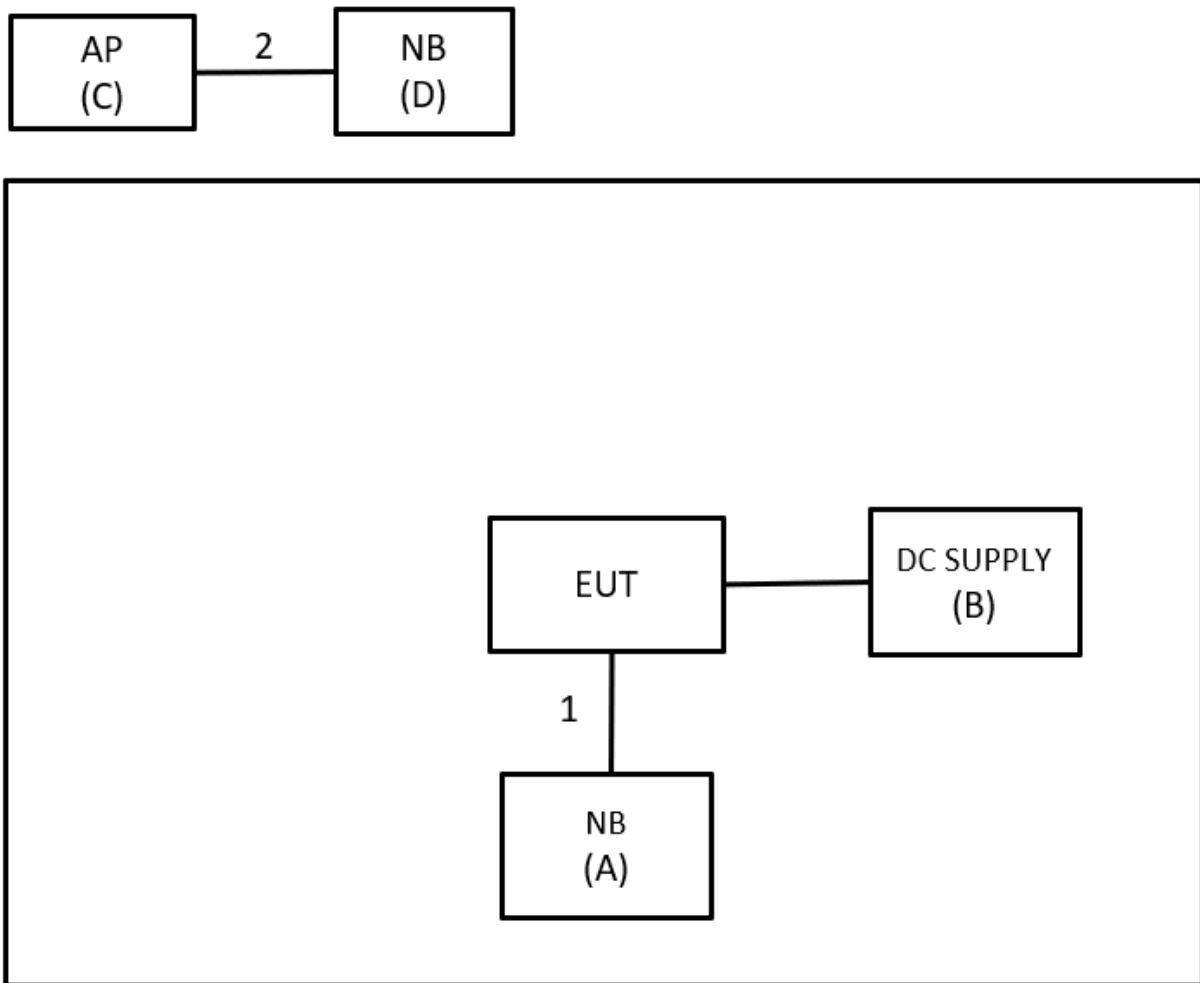
The Direction gain is less than 6 dBi, so conducted power limits will not be reduced.

(4) Operating Mode and Antenna Configuration

Operating Mode	TX Mode	2TX
IEEE 802.11b		V (ANT 1+ ANT 2)
IEEE 802.11g		V (ANT 1+ ANT 2)
IEEE 802.11n (HT20)		V (ANT 1+ ANT 2)
IEEE 802.11n (HT40)		V (ANT 1+ ANT 2)

2.2 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Equipment letters and Cable numbers refer to item numbers described in the tables of clause 2.3.



2.3 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	NB	ACER	TMP446-M50L4	N/A	Furnished by test lab.
B	DC Power Supply	TWINTX	TPS-6015	N/A	Furnished by test lab.
C	AP	ASUS	RT-AX88U AX6000	N/A	Furnished by test lab.
D	NB	HP	TPN-I119	N/A	Furnished by test lab.

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
1	N/A	N/A	1m	RJ45 Cable	Furnished by test lab.
2	N/A	N/A	3m	RJ-45 Cable	Furnished by test lab.

3 RADIATED EMISSIONS TEST

3.1 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 (9 kHz to 1000 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

LIMITS OF RADIATED EMISSIONS MEASUREMENT (Above 1000 MHz)

Frequency (MHz)	Radiated Emissions (dBuV/m)		Measurement Distance (meters)
	Peak	Average	
Above 1000	74	54	3

LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

Frequency (MHz)	EIRP Limit (dBm)	Equivalent Field Strength at 3m (dBuV/m)
5150-5250	-27	68.3
5250-5350	-27	68.3
5470-5725	-27	68.3
5725-5850	-27 (NOTE 2)	68.3
	10 (NOTE 2)	105.3
	15.6 (NOTE 2)	110.9
	27 (NOTE 2)	122.3

NOTE:

- (1) The limit for radiated test was performed according to FCC 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

3.2 TEST PROCEDURE

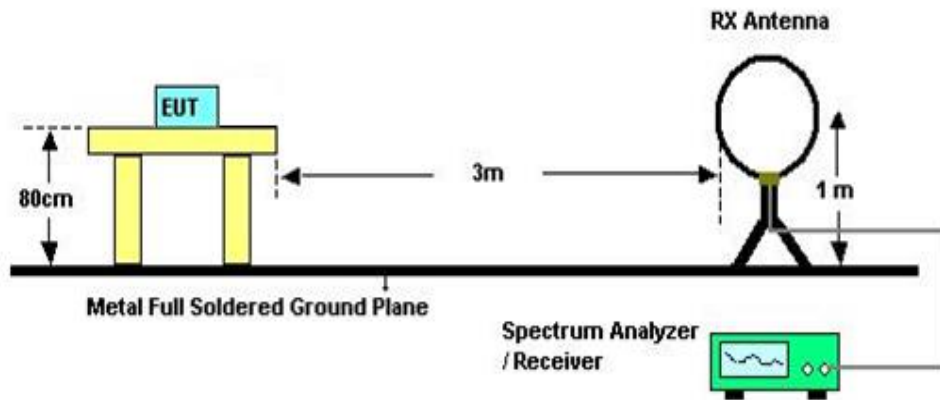
- The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 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.(above 1GHz)
- 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.
- 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).
- The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
- 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.
- 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)
- All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)
- For the actual test configuration, please refer to the related Item – EUT TEST PHOTO.

3.3 DEVIATION FROM TEST STANDARD

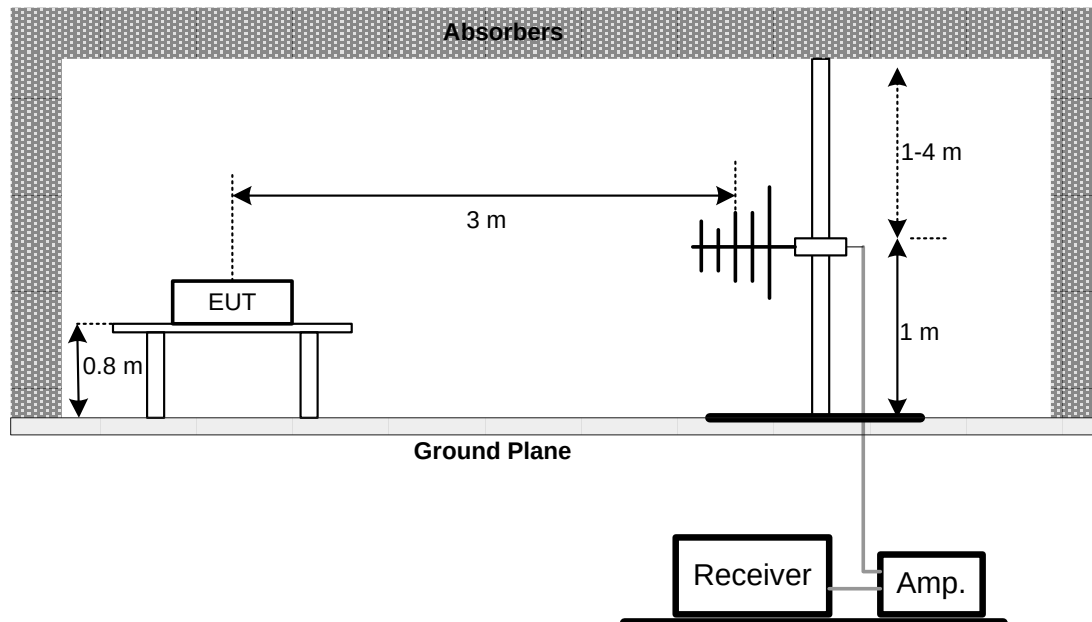
No deviation.

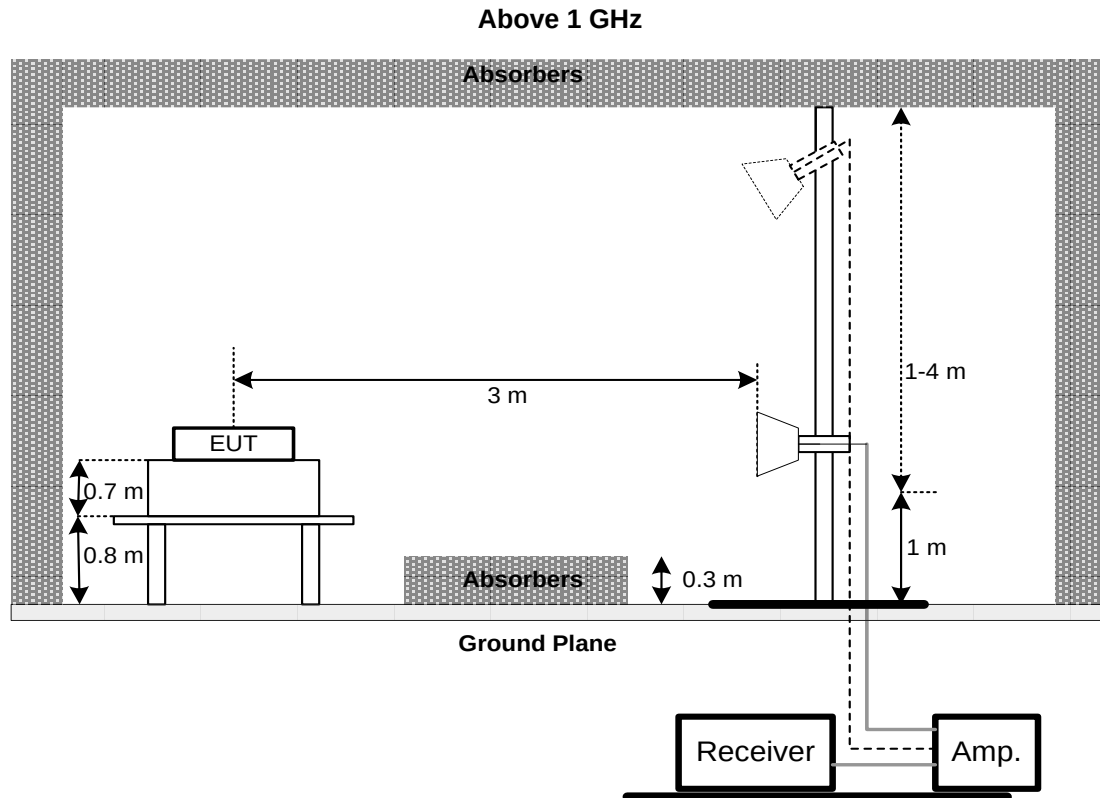
3.4 TEST SETUP

9 kHz to 30 MHz



30 MHz to 1 GHz





3.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

3.6 TEST RESULT

Please refer to the APPENDIX A.

NOTE:

- (1) No limit: This is fundamental signal, the judgment is not applicable.
For fundamental signal judgment was referred to Peak output test.

4 LIST OF MEASURING EQUIPMENTS

Radiated Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Preamplifier	EMCI	EMC012645B	980222	2022/4/6	2023/4/5
2	Preamplifier	EMCI	EMC184045SE	980512	2022/4/6	2023/4/5
3	Test Cable	EMCI	EMC104-SM-100 0	180809	2022/4/6	2023/4/5
4	Test Cable	EMCI	EMC-SM-SM-700 0	180408	2022/4/6	2023/4/5
5	Signal Analyzer	Agilent	N9010A	MY56480554	2021/8/25	2022/8/24
6	Horn Ant	SCHWARZBECK	BBHA 9120D	9120D-1342	2022/5/26	2023/5/25
7	Horn Ant	Schwarzbeck	BBHA 9170	340	2021/7/9	2022/7/8
8	Measurement Software	EZ	EZ EMC (Version NB-03A1-01)	N/A	N/A	N/A

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

5 EUT TEST PHOTO

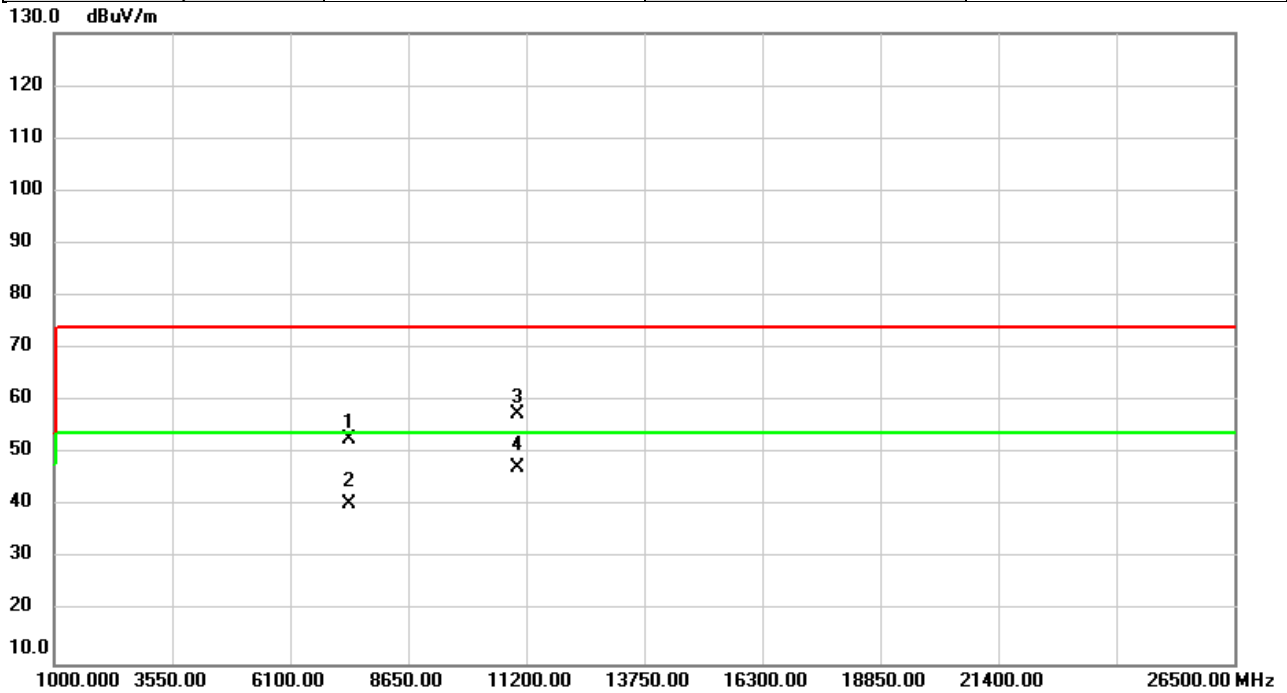
Please refer to document Appendix No.: TP-2112T115-FCCP-1 (APPENDIX-TEST PHOTOS).

6 EUT PHOTOS

Please refer to document Appendix No.: EP-2112T115-2 (APPENDIX-EUT PHOTOS).

APPENDIX A RADIATED EMISSIONS

Test Mode	IEEE 802.11b & IEEE 802.11n (HT20)	Test Date	2022/6/9
Test Frequency	2462MHz & 5500 MHz	Polarization	Vertical
Temp	22°C	Hum.	65%



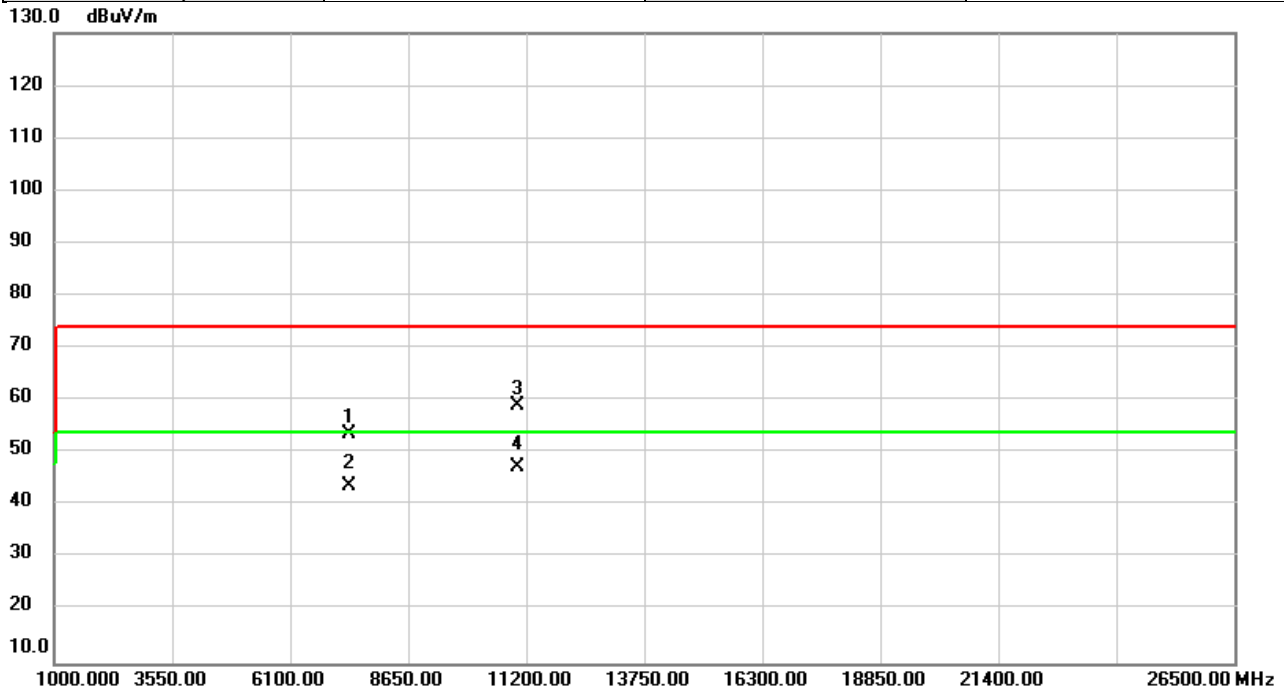
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7386.000	55.17	-2.44	52.73	74.00	-21.27	peak	
2		7386.000	42.97	-2.44	40.53	54.00	-13.47	AVG	
3		11000.00	51.32	6.27	57.59	74.00	-16.41	peak	
4	*	11000.00	40.98	6.27	47.25	54.00	-6.75	AVG	

REMARKS:

(1) Measurement Value = Reading Level + Correct Factor.

(2) Margin Level = Measurement Value - Limit Value.

Test Mode	IEEE 802.11b & IEEE 802.11n (HT20)	Test Date	2022/6/9
Test Frequency	2462MHz & 5500 MHz	Polarization	Horizontal
Temp	22°C	Hum.	65%

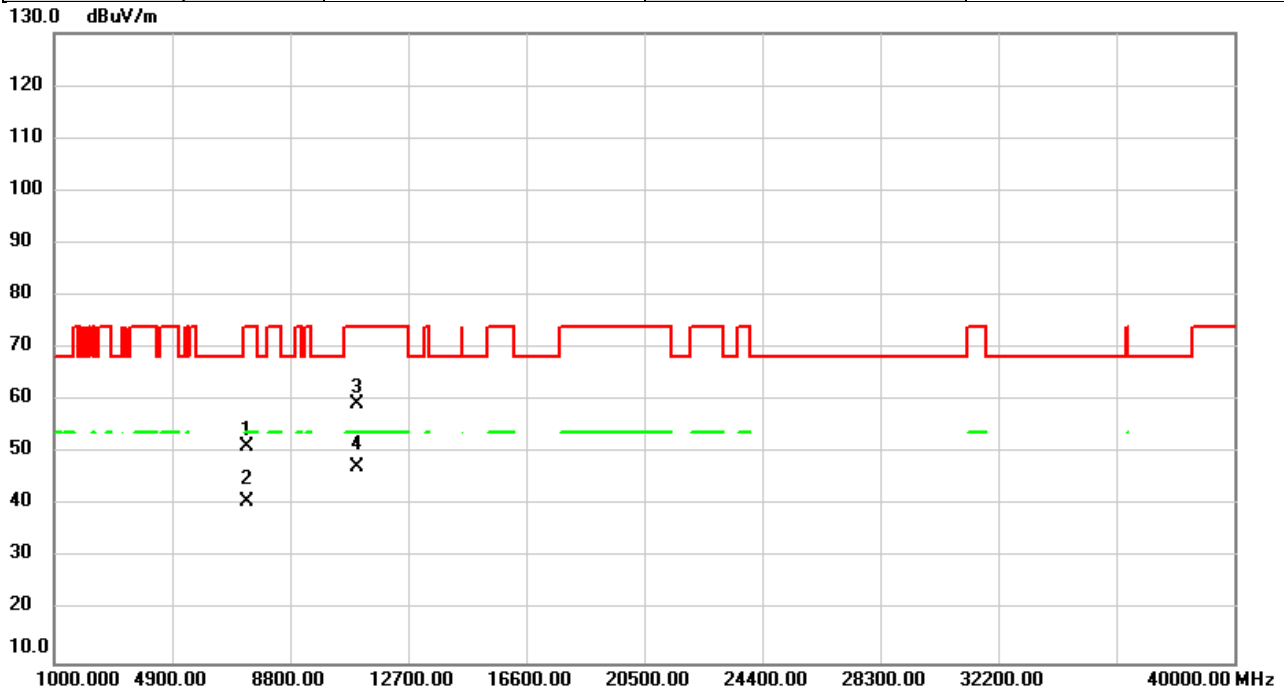


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7386.000	56.22	-2.44	53.78	74.00	-20.22	peak	
2		7386.000	46.19	-2.44	43.75	54.00	-10.25	AVG	
3		11000.00	52.67	6.27	58.94	74.00	-15.06	peak	
4	*	11000.00	41.13	6.27	47.40	54.00	-6.60	AVG	

REMARKS:

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

Test Mode	IEEE 802.11n (HT20) & IEEE 802.11b	Test Date	2022/6/9
Test Frequency	5500 MHz & 2462MHz	Polarization	Vertical
Temp	22°C	Hum.	65%

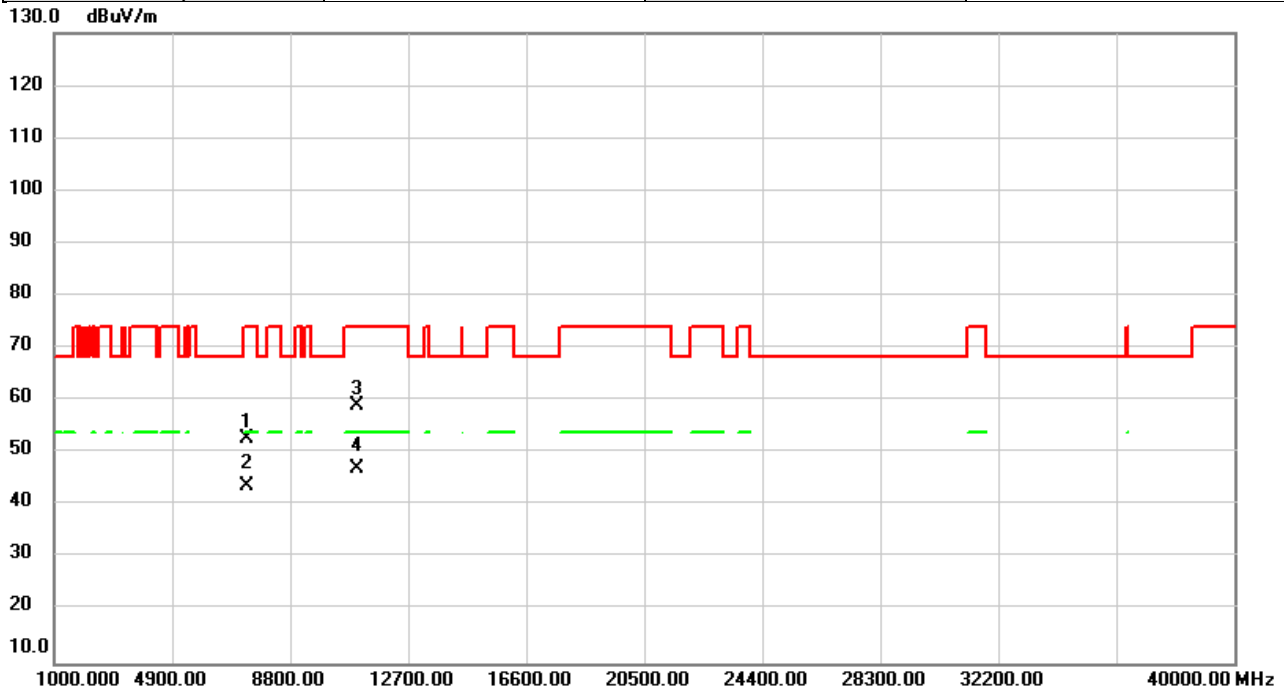


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7386.000	53.69	-2.44	51.25	74.00	-22.75	peak	
2		7386.000	43.11	-2.44	40.67	54.00	-13.33	AVG	
3		11000.00	52.98	6.27	59.25	74.00	-14.75	peak	
4	*	11000.00	41.00	6.27	47.27	54.00	-6.73	AVG	

REMARKS:

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

Test Mode	IEEE 802.11n (HT20) & IEEE 802.11b	Test Date	2022/6/9
Test Frequency	5500 MHz & 2462MHz	Polarization	Horizontal
Temp	22°C	Hum.	65%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7386.000	55.19	-2.44	52.75	74.00	-21.25	peak	
2		7386.000	46.24	-2.44	43.80	54.00	-10.20	AVG	
3		11000.00	52.83	6.27	59.10	74.00	-14.90	peak	
4	*	11000.00	40.85	6.27	47.12	54.00	-6.88	AVG	

REMARKS:

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

End of Test Report