

RF TEST REPORT

FCC ID: 2BCFYHT-178AX

Test Report No.....: RF240329016-01-002
Product(s) Name.....: Wireless Home Gateway
Model(s).....: HT-178AX
Trade Mark.....: HEIGHTS
Applicant.....: Heights Telecom T LTD
Address.....: Ha-Sakhlav 6, Irus, 7680900, Israel
Receipt Date.....: 2024.04.01
Test Date.....: 2024.04.02~2024.04.03
Issued Date.....: 2024.04.07
Standards.....: 47 CFR FCC Part 15, Subpart E(Section 15.407);
ANSI C63.10:2013
Testing Laboratory.....: Shenzhen Haiyun Standard Technical Co., Ltd.

Prepared By:	Checked By:	Approved By:	
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Table of Contents

History of this test report.....	3
1. General Information	4
1.1 Applicant.....	4
1.2 Manufacturer	4
1.3 Basic Description of Equipment Under Test.....	4
1.4 Transmit Operating Mode.....	5
2. Summary of Test Results	6
2.1 Summary of Test Items	6
2.2 Application of Standard	6
2.3 Test Instruments.....	7
2.4 Operation Mode.....	8
2.5 Test Condition	8
2.6 Measurement Uncertainty	8
2.7 Test Location	9
2.8 SUPPORT UNITS	9
2.9 Deviation from Standards	9
2.10 Abnormalities from Standard Conditions	9
3. Test Procedure And Results	10
3.1 AC Power Line Conducted Emission.....	10
3.1.1 Limit	10
3.1.2 Test Procedure	10
3.1.3 Test Setup.....	10
3.1.4 Test Result.....	11
3.2 Radiated Emission.....	13
3.2.1 Limit	13
3.2.2 Test Procedure	14
3.2.3 Test Setup.....	15
3.2.4 Test Result.....	16

History of this test report

Amendment Report Issue Date: 2024.04.07

☐ No additional attachment

☒ Additional attachments were issued following record

Attachment No.	Issue Date	Description
RF230808001-01-002	2023.09.04	Original report
RF240329016-01-002	2024.04.07	Add DSL functions and related circuits, So tested Radiated Emission-Below 1GHz and Conducted Emission.

1. General Information

1.1 Applicant

Heights Telecom T LTD

Ha-Sakhlav 6, Irus, 7680900, Israel

1.2 Manufacturer

Heights Telecom T LTD

Ha-Sakhlav 6, Irus, 7680900, Israel

1.3 Basic Description of Equipment Under Test

Product No.	POC240329016-S001	
Equipment Name	Wireless Home Gateway	
Model Name	HT-178AX	
Trademark	HEIGHTS	
Power Supply	DC 12V from adapter	
Adapter Information	Model: SOY-1200200US-063 Input: 100-240V~ 50/60Hz 0.75A Max Output: DC 12V2.0A, 24W Manufacturer: Shenzhen SOY Technology Co., Ltd.	
Operating Temperature	0°C-45°C	
EUT Stage	○ Product Unit	● Final-Sample
Operating Band & Max conducted power	5150MHz ~5350MHz	● IEEE 802.11a/n/ac/ax (20MHz)
	5470MHz ~5725MHz	● IEEE 802.11n/ac/ax (40MHz)
	5725MHz ~5850MHz	● IEEE 802.11ac/ax (80MHz)
		● IEEE 802.11ac/ax (160MHz)
Product Type	IEEE 802.11a: WLAN (SISO) IEEE 802.11n/ac/ax: WLAN (MIMO)	
Nominal Bandwidth	20MHz / 40MHz / 80MHz / 160MHz	
Modulation	OFDM, OFDMA	
Antenna gain	Ant1: 3.16dBi, Ant2: 3.15dBi, Ant3: 3.24dBi, Ant4: 3.15dBi	
Antenna type	PCB Antenna	
Data Rate (Mbps)	IEEE 11a mode : 6/9/12/18/24/36/48/54 IEEE 11n mode : up to 600 IEEE 11ac mode : up to 3464 IEEE 11ax mode : up to 4803.9	
Type of Device	Master device	
DFS Function (Master devices)	●	5250MHz ~5350MHz
	●	5470MHz ~5725MHz

Channel Information			
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
5150-5250	802.11a /n /ac /ax (20MHz)	5180-5240	36-48
5250-5350		5260-5320	52-64
5470-5725		5500-5700	100-140
5725-5850		5745-5825	149-165
5150-5250	802.11n /ac /ax (40MHz)	5190-5230	38-46
5250-5350		5270-5310	54-62
5470-5725		5510-5670	102-134
5725-5850		5755-5795	151-159
5150-5250	802.11ac /ax (80MHz)	5210	42
5250-5350		5290	58
5470-5725		5530-5610	106-122
5725-5850		5775	155
5150-5350	802.11 ac /ax (160MHz)	5250	50
5470-5725		5570	114

Note: For 802.11ax mode only support full RU mode.

1.4 Transmit Operating Mode

Transmit Operating Mode					Transmit Multiple Antennas				
☒ Operating mode 1 (single antenna)					☒ 1TX				
☐ Operating mode 2 (multiple antenna, no beam forming)					☐ 2TX	☐ 3TX	☐	4TX	
☒ Operating mode 3 (multiple antenna, with beam forming)					☐ 2TX	☐ 3TX	☒	4TX	
☒ 802.11b	Operating mode	☒ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11n(20MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11n(40MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11ac(20MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11ac(40MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11ac(80MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11ac(160MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11ax(20MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11ax(40MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11ax(80MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			
☒ 802.11ax(160MHz)	Operating mode	☐ 1TX	☐ 2TX		☐ 3TX	☒ 4TX			

2. Summary of Test Results

2.1 Summary of Test Items

47 CFR FCC Part 15, Subpart E (Section 15.407)			
Test item	Standard	Results	Remarks
AC Power Conducted Emission	15.207 15.407(b)	Pass	Meet the requirement of the limit
Radiated Emission	15.205(a) 15.209(a) 15.407(b)	Pass Note3	Meet the requirement of the limit
Antenna Requirements	15.203	Compliance	Note1
Spectrum Bandwidth	15.407(a) 15.407(e)	Pass Note2	Meet the requirement of the limit
Maximum EIRP	15.407(a)	Pass Note2	Meet the requirement of the limit
Power Spectral Density	15.407(a)	Pass Note2	Meet the requirement of the limit
Dynamic Frequency Selection (DFS)	15.407(h)	Pass Note4	Meet the requirement of the limit
Note: 1.The EUT has 4 PCB antennas arrangement which was permanently attached. 2. For test data, please refer to the report RF230808001-01-002; FCC ID: 2BCFYHT-178AX. 3. For Above 1GHz test data, please refer to the report RF230808001-01-002; FCC ID: 2BCFYHT-178AX. 4. For test data, please refer to the report RF230808001-01-003; FCC ID: 2BCFYHT-178AX.			

2.2 Application of Standard

47 CFR FCC Part 15, Subpart E

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

ANSI C63.10:2013

2.3 Test Instruments

Radiated Emissions						
No.	Equipment	Manufacturer	Type No.	Serial No.	Cal. date (yyyy/mm/dd)	Cal. Due date (yyyy/mm/dd)
1	Test receiver	Rohde&Schwarz	ESU	100184	2023/5/3	2024/5/2
2	Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-127 3	2023/5/4	2024/5/3
3	Low frequency amplifier	Unknown	LNA 0920N	2014	2023/5/3	2024/5/2
4	High frequency amplifier	Schwarzbeck	BBV 9718	284	2023/5/3	2024/5/2
5	Loop Antenna	Schwarzbeck	FMZB1519 B	00029	2023/7/16	2024/7/15
6	Log periodic antenna	Schwarzbeck	VULB 9168	1151	2023/5/4	2024/5/3
7	Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-127 3	2022/5/5	2025/5/4
8	Horn Antenna	Schwarzbeck	BBHA 9170	9170#685	2023/7/16	2024/7/15
9	Temp&Humidity Recorder	Meideshi	JR900	/	2023/5/3	2024/5/2
10	RF cable(966 chamber)9kHz-1 GHz	Unknown	Unknown	Unknown	2023/5/3	2024/5/2
11	RF cable(966 chamber)1GHz- 18GHz	Unknown	Unknown	Unknown	2023/5/3	2024/5/2
12	RF cable(966 chamber)18GHz -40GHz	Unknown	Unknown	Unknown	2023/5/3	2024/5/2
13	Test software	Farad Technology Co., Ltd	EZ-EMC Ver.TW-03A2			
Conducted Emission						
1	Test receiver	Rohde&Schwarz	ESCI	100718	2023/5/3	2024/5/2
2	LISN	Rohde&Schwarz	ENV216	100075	2023/5/3	2024/5/2
3	Pulse limiter	Rohde&Schwarz	ESH3-Z2	102299	2023/5/3	2024/5/2
4	RF cable (9kHz-30MHz)	Unknown	Unknown	Unknown	2023/5/3	2024/5/2
5	Test software	Farad Technology Co., Ltd	EZ-EMC Ver.TW-03A2			
RF Conducted Emission						
1	MXA Signal Analyzer	Keysight	N9021B	MY600801 69	2023/4/23	2024/4/22
2	RF Control Unit	dsusoft	JS0806-2	21G806044 9	2023/4/23	2024/4/22
3	power supply unit	dsusoft	JS0806-4A DC	N/A	2023/4/23	2024/4/22
4	VXG Signal Generator	Keysight	M9384B	MY612707 87	2023/4/23	2024/4/22
5	EXG Analog Signal Generator	Keysight	N5173B	MY591012 82	2023/4/23	2024/4/22
6	Test software	dsusoft	JS1120-3 Ver.3.2.22.0			

2.4 Operation Mode

Please refer to report RF230808001-01-002 details of Operation Mode.

2.5 Test Condition

Test Item	Environmental conditions	Input Power	Tested by
AC Power Conducted Emission	25°C, 53% RH	AC 120V/60Hz	Freedom Zhuo
Radiated Emission below 1GHz	24°C, 51% RH	AC 120V/60Hz	Freedom Zhuo

Note: Adapter supply voltage AC 120V/60Hz.

The applicant declare the operating environment of EUT as below:

Normal conditions: 12V DC, 0~45°C

2.6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Uncertainty	
Parameter	Uncertainty
Occupied Channel Bandwidth	±143.88kHz
Power Spectral Density	±0.743dB
Conducted Spurious Emission	±1.328dB
RF power conducted	±0.384dB
Conducted emission(9kHz~30MHz) AC main	±2.72dB
Radiated emission(9kHz~30MHz)	±2.66dB
Radiated emission (30MHz~1GHz)	±4.62dB
Radiated emission (1GHz~18GHz)	±4.86dB
Radiated emission (18GHz~40GHz)	±3.80dB

2.7 Test Location

Company:	Shenzhen Haiyun Standard Technical CO., Ltd.
Address:	No. 110-113, 115, 116, Block B, Jinyuan Business Building, Bao'an District, Shenzhen, China
CNAS Registration Number:	CNAS L18252
CAB identifier:	CN0145
A2LA Certificate Number:	6823.01
Telephone:	0755-26024411

2.8 SUPPORT UNITS

None

2.9 Deviation from Standards

None

2.10 Abnormalities from Standard Conditions

None

3. Test Procedure And Results

3.1 AC Power Line Conducted Emission

3.1.1 Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μ V)	Average Level dB(μ V)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

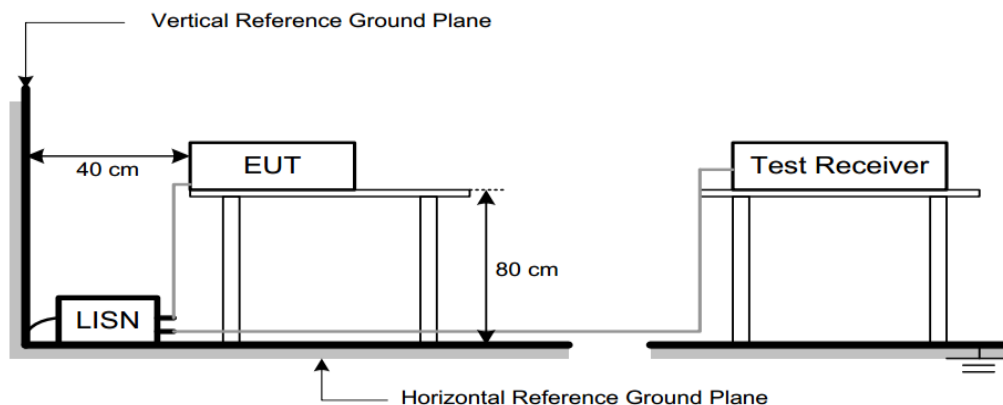
3.1.2 Test Procedure

Test Method	
●Conducted Measurement	○Radiated Measurement
Test Channels	
○ Lowest, Middle and Highest Channel	○ Lowest and Highest Channel
Environmental conditions	
●Normal	○Normal and Extreme

Note: ●:Test ○:No Test

- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

3.1.3 Test Setup



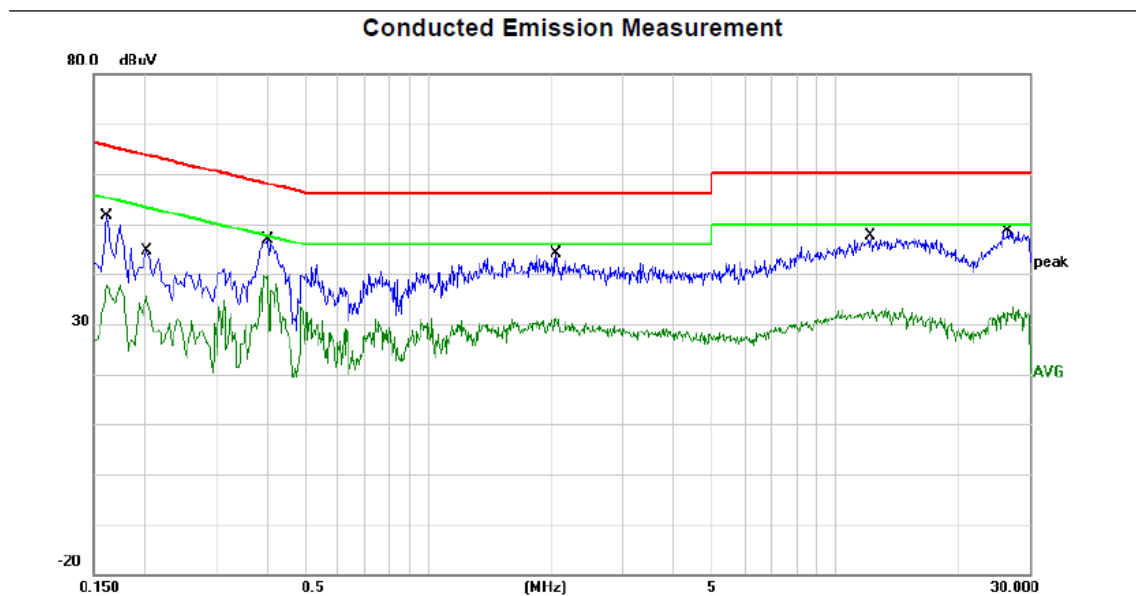
3.1.4 Test Result

Note:

1. Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Factor, the value was added to Original Receiver Reading by the software automatically.
2. Measurement = Reading + Correct Factor.
3. Over = Measurement – Limit
4. The TX AX20MIMO Mode Channel 149 is found to be the worst case and recorded.

150kHz~30MHz	TX AX20MIMO Channel 149
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Line



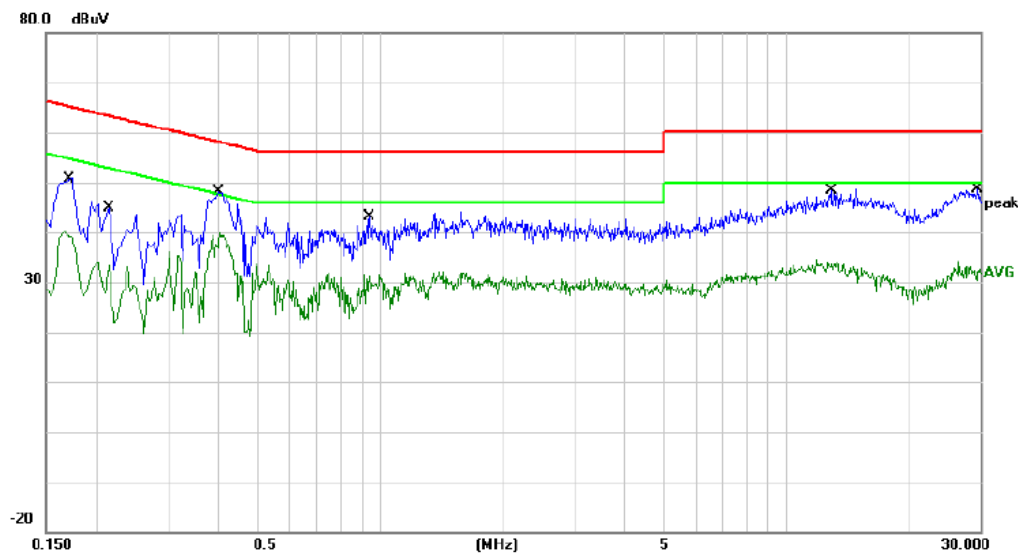
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1620	27.28	20.09	47.37	65.36	-17.99	QP	
2		0.1620	13.51	20.09	33.60	55.36	-21.76	AVG	
3		0.2020	21.23	19.99	41.22	63.53	-22.31	QP	
4		0.2020	12.10	19.99	32.09	53.53	-21.44	AVG	
5		0.4020	24.28	20.37	44.65	57.81	-13.16	QP	
6 *		0.4020	14.64	20.37	35.01	47.81	-12.80	AVG	
7		2.0580	15.79	20.18	35.97	56.00	-20.03	QP	
8		2.0580	8.14	20.18	28.32	46.00	-17.68	AVG	
9		12.2500	19.44	20.14	39.58	60.00	-20.42	QP	
10		12.2500	9.35	20.14	29.49	50.00	-20.51	AVG	
11		26.6260	20.98	20.04	41.02	60.00	-18.98	QP	
12		26.6260	8.16	20.04	28.20	50.00	-21.80	AVG	

150kHz~30MHz

TX AX20MIMO Channel 149

Neutral

Conducted Emission Measurement



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1700	28.11	20.25	48.36	64.96	-16.60	QP	
2		0.1700	17.52	20.25	37.77	54.96	-17.19	AVG	
3		0.2140	19.15	20.26	39.41	63.05	-23.64	QP	
4		0.2140	7.68	20.26	27.94	53.05	-25.11	AVG	
5		0.3980	25.76	20.23	45.99	57.90	-11.91	QP	
6	*	0.3980	16.45	20.23	36.68	47.90	-11.22	AVG	
7		0.9420	16.29	20.08	36.37	56.00	-19.63	QP	
8		0.9420	8.77	20.08	28.85	46.00	-17.15	AVG	
9		12.9100	20.22	20.19	40.41	60.00	-19.59	QP	
10		12.9100	11.11	20.19	31.30	50.00	-18.70	AVG	
11		29.6500	21.06	20.08	41.14	60.00	-18.86	QP	
12		29.6500	8.52	20.08	28.60	50.00	-21.40	AVG	

3.2 Radiated Emission

3.2.1 Limit

1) Limit of radiated emission measurement:

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequency (MHz)	Distance Meters(m)	Field Strength Limit	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
0.009 – 0.49	300	$2400/F(\text{kHz})$	-
0.490 – 1.705	30	$24000/F(\text{kHz})$	-
1.705 – 30	30	30	-
30~88	3	100	40.0
88~216	3	150	43.5
216~960	3	200	46.0
960~1000	3	500	54.0
Above 1000	3	74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak) 54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)	

Note: (1) Emission level $\text{dB}\mu\text{V} = 20 \log$ Emission level $\mu\text{V}/\text{m}$

(2) The smaller limit shall apply at the cross point between two frequency bands.

(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

2) Limit of unwanted emission out of the restricted bands:

Frequency(MHz)	EIRP Limit(dBm/MHz)	Equivalent Field Strength at 3m($\text{dB}\mu\text{V}/\text{m}$)
5150-5250	-27	68.2
5250-5350	-27	68.2
5470-5725	-27	68.2
5725-5850	-27 NOTE (2)	68.2
	10 NOTE (2)	105.2
	15.6 NOTE (2)	110.8
	27 NOTE (2)	122.2

Note: (1) The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength: $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d=3\text{m}$

(2) According to 15.407(b)(4)(i), all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

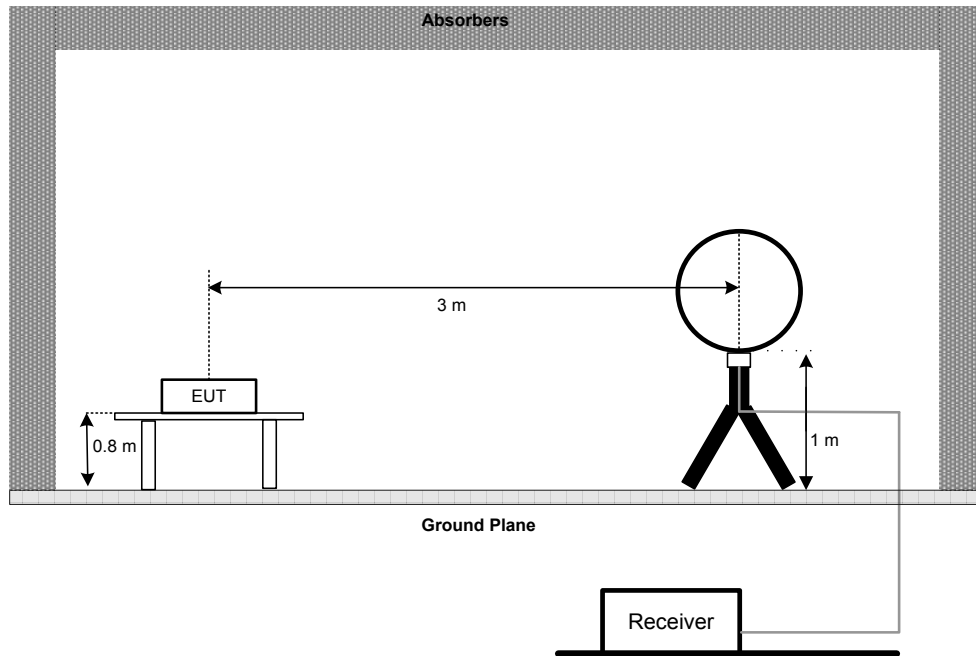
3.2.2 Test Procedure

Test Method	
○Conducted Measurement	●Radiated Measurement
Test Channels	
●Lowest, Middle and Highest Channel	○ Lowest and Highest Channel
Environmental conditions	
●Normal	○Normal and Extreme
Note:●:Test ○:No Test	

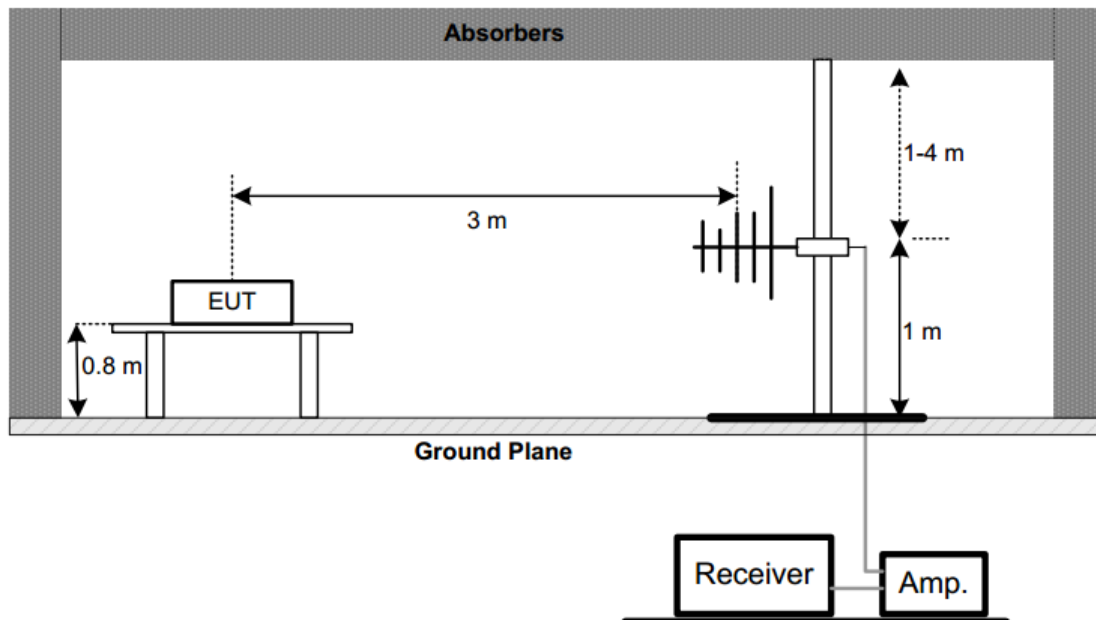
- a) The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1 GHz)
- b) The measuring distance of 3 m or 1.5m 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)
- c) The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; 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.
- d) 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).
- e) The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
- f) 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.
- g) 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 1 GHz)
- h) 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 1 GHz)
- i) For the actual test configuration, please refer to the related Item -EUT Test Photos.

3.2.3 Test Setup

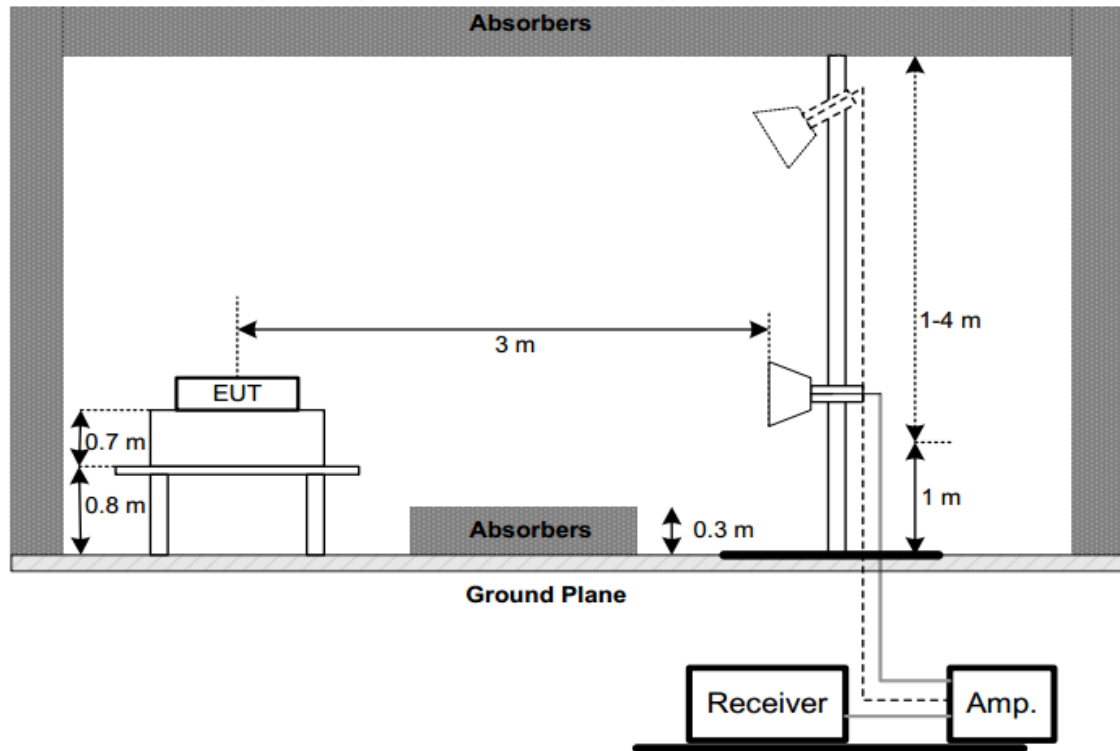
(A) Radiated Emission Test Set-Up Frequency Below 30 MHz



(B) Radiated Emission Test Set-Up Frequency 30 MHz-1000 MHz



(C) Radiated Emission Test Set-Up Frequency Above 1 GHz



3.2.4 Test Result

1) Radiated emission: 9kHz-30MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not recorded in this report.

2) Radiated emission: 30MHz-1G

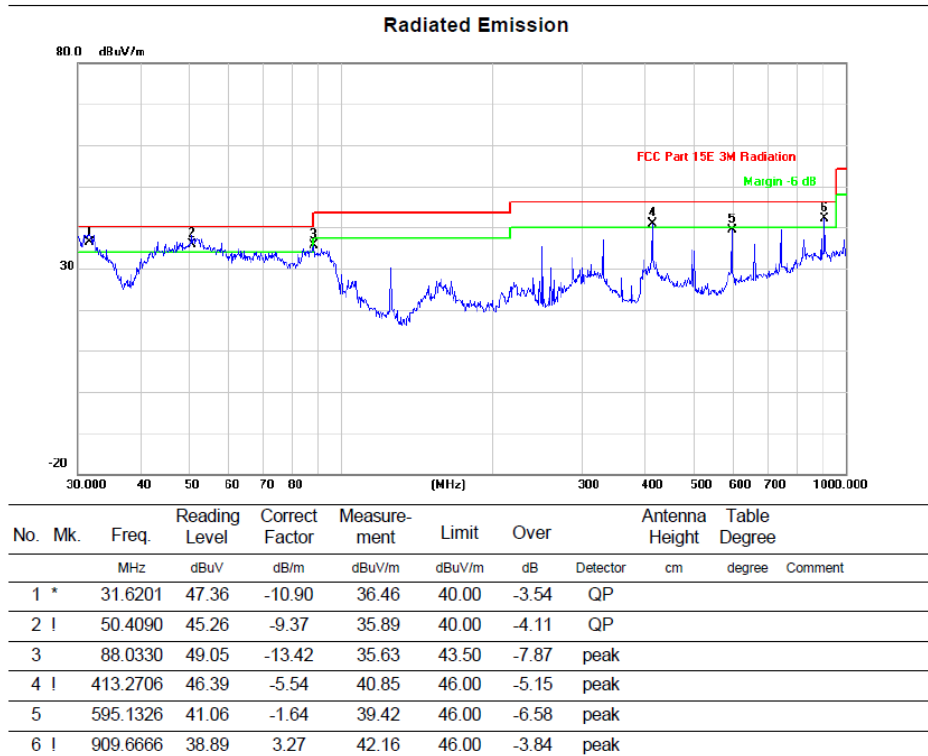
Note:

1. Measurement = Reading + Correct Factor.
2. Over = Measurement – Limit
3. The TX AX20MIMO Mode Channel 149 is found to be the worst case and recorded.

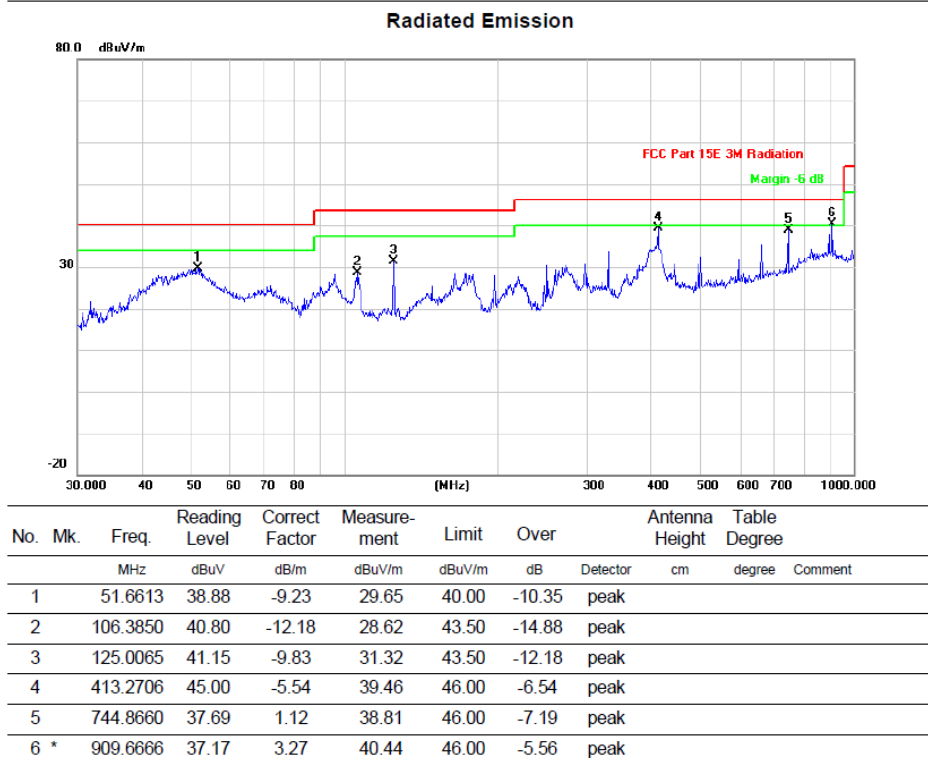
Below 1G (30MHz~1GHz)

TX AX20MIMO Channel 149

VERTICAL



HORIZONTAL



Statement

1. The report is invalid without the official seal or special seal of Shenzhen Haiyun Standard Technology Co., Ltd. (hereinafter referred to as the unit).
2. The report is invalid without the signature of the approver.
3. The report is invalid if altered arbitrarily.
4. The report shall not be partially copied without the written approval of the unit.
5. The reported test results are only valid for the tested samples.
6. If there is any objection to the test report, it shall be submitted to the test unit within 15 days from the date of receiving the report, and the overdue shall not be accepted.

Shenzhen Haiyun Standard Technology Co., Ltd.

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(END OF REPORT)