

TEST REPORT

Applicant:	Zhejiang Hanshow Technology Co., Ltd.
Address of Applicant:	Bld. 33, No. 966 xiuyuan Rd., BeiKeJian Innovation Park, XiuZhou District, Jiaxing, Zhejiang, China
Manufacturer:	Zhejiang Hanshow Technology Co., Ltd.
Address of Manufacturer:	Bld. 33, No. 966 xiuyuan Rd., BeiKeJian Innovation Park, XiuZhou District, Jiaxing, Zhejiang, China
Equipment Under Test (E	EUT)
Product Name:	electronic shelf label
Model No.:	Nebular-266R-N, Nebular-266F-N, Nebular-266-N, Nebular- 266Y-N
FCC ID:	2AHB5-NEBULAR-266
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.249
Date of sample receipt:	December 10, 2020
Date of Test:	December 11-18, 2020
Date of report issued:	December 21, 2020
Test Result :	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Robinson Luo Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver. Page 1 of 22



2 Version

Version No.	Date	Description
00	December 21, 2020	Original

Prepared By:

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Date:

December 21, 2020

Project Engineer

Check By:

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Reviewer

Date:

December 21, 2020



3 Contents

	Pa	ge
1	COVER PAGE	. 1
2	VERSION	. 2
3	CONTENTS	. 3
4	TEST SUMMARY	. 4
	.1 MEASUREMENT UNCERTAINTY	. 4
5	GENERAL INFORMATION	. 5
	.1 GENERAL DESCRIPTION OF EUT	
	DESCRIPTION OF SUPPORT UNITS	. 7
	5.4 DEVIATION FROM STANDARDS	
	5.5 ABNORMALITIES FROM STANDARD CONDITIONS	
	5.7 TEST LOCATION	-
	Additional Instructions	
6	TEST INSTRUMENTS LIST	. 9
7	TEST RESULTS AND MEASUREMENT DATA	11
	'.1 ANTENNA REQUIREMENT	
	7.2.1 Spurious emissions	
8	TEST SETUP PHOTO	22
9	EUT CONSTRUCTIONAL DETAILS	22

4 Test Summary

Test Item	Section in CFR 47	Result	
Antenna requirement	15.203	Pass	
AC Power Line Conducted Emission	15.207	N/A	
Field strength of the fundamental signal	15.249 (a)	N/A	
Spurious emissions	15.249 (a) (d)/15.209	Pass	
Band edge	15.249 (d)/15.205	N/A	
20dB Occupied Bandwidth	15.215 (c)	N/A	

Remarks:

- 1. Test according to ANSI C63.10: 2013.
- 2. Pass: The EUT complies with the essential requirements in the standard.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	30MHz-200MHz	3.8039dB	(1)
Radiated Emission	200MHz-1GHz	3.9679dB	(1)
Radiated Emission	1GHz-18GHz	4.29dB	(1)
Radiated Emission	18GHz-40GHz	3.30dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	3.44dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			



5 General Information

5.1 General Description of EUT

Product Name:	electronic shelf label			
Model No.:	Nebular-266R-N, Nebular-266F-N, Nebular-266-N, Nebular-266Y-N			
Test Model No:	Nebular-266R-N			
Remark: All above mod	dels are identical in the same PCB layout, interior structure and electrical circuits.			
The differences are wh commercial purpose.	en product at word of EPD screen color, appearance color and model name for			
Serial No.:	131020061384738410			
Hardware Version:	HS_EL5102_1M_62_04			
Software Version: V1.0				
Test sample(s) ID: GTS202012000155-1				
Sample(s) Status Engineered sample				
Operation Frequency: 2402MHz~2480MHz				
Channel numbers:	157			
Channel separation:	0.5MHz			
Modulation type: GFSK				
Antenna Type: Integral Antenna				
Antenna gain:	0dBi(declare by applicant)			
Power supply:	DC 3V			
Operation Frequency: Channel numbers: Channel separation: Modulation type: Antenna Type: Antenna gain:	2402MHz~2480MHz 157 0.5MHz GFSK Integral Antenna 0dBi(declare by applicant)			

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402.0	41	2422.0	81	2442.0	121	2462.0
2	2402.5	42	2422.5	82	2442.5	121	2462.5
3	2402.0	43	2423.0	83	2442.0	122	2463.0
4	2403.5	44	2423.5	84	2443.5	123	2463.5
5	2403.5	45	2424.0	85	2444.0	125	2464.0
6	2404.5	46	2424.5	86	2444.5	126	2464.5
7	2405.0	47	2425.0	87	2445.0	120	2465.0
8	2405.5	48	2425.5	88	2445.5	128	2465.5
9	2406.0	49	2426.0	89	2446.0	120	2466.0
10	2406.5	50	2426.5	90	2446.5	130	2466.5
10	2400.3	51	2420.3	90	2440.3	130	2400.3
12	2407.0	52	2427.0	91	2447.0	132	2407.0
12	2407.5	53	2427.5	92	2447.5	132	2467.5
13	2408.5	54	2428.5	94	2448.5	133	2468.5
14	2400.0	55	2429.0	95	2449.0	135	2469.0
16	2409.5	56	2429.5	96	2449.5	136	2469.5
10	2409.5	57	2430.0	97	2450.0	137	2409.0
17	2410.0	58	2430.0	98	2450.5	137	2470.5
10	2410.3	59	2430.5	99	2450.5	139	2470.3
20	2411.5	60	2431.5	100	2451.5	140	2471.5
20	2411.3	61	2431.3	100	2451.5	140	2471.3
21	2412.0	62	2432.0	101	2452.0	141	2472.0
22	2412.3	63	2432.5	102	2452.5	142	2472.3
23	2413.5	64	2433.5	103	2453.5	143	2473.5
25	2413.0	65	2434.0	104	24554.0	145	2473.0
26	2414.5	66	2434.5	105	2454.5	146	2474.5
20	2415.0	67	2435.0	100	2455.0	147	2475.0
28	2415.5	68	2435.5	107	2455.5	148	2475.5
20	2415.5	69	2435.5	109	2456.0	140	2475.0
30	2416.5	70	2436.5	110	2456.5	149	2476.5
31	2410.3	70	2430.5	111	2457.0	150	2470.3
32	2417.0	72	2437.5	112	2457.5	152	2477.5
33	2417.5	73	2437.5	112	2458.0	152	2478.0
34	2418.0	74	2438.5	113	2458.5	153	2478.5
35	2418.5	74	2438.5	114	2458.5	154	2478.5
36	2419.0	75	2439.0	115	2459.0	155	2479.0
30	2419.5	76	2439.5	117	2459.5	156	2479.5
38	2420.0	78	2440.0	118	2460.0	137	2400.0
39	2420.5	78	2440.5	119	2460.5		
40	2421.0	80	2441.0	120	2461.0		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:



Channel	Frequency
The lowest channel	2402MHz
The middle channel	2441MHz
The Highest channel	2480MHz

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
Remark: During the test, the dutycycle >98%, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.	

Per-test mode.			
We have verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:			
Axis	Х	Y	Z
Field Strength(dBuV/m)	94.26	95.00	93.14

5.3 Description of Support Units

None.

5.4 Deviation from Standards

None.

5.5 Abnormalities from Standard Conditions

None.



5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• FCC — Registration No.: 381383

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 381383.

• IC — Registration No.: 9079A

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A

• NVLAP (LAB CODE:600179-0)

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

5.7 Test Location

-	o #	
5.8	Additional Instru	uctions
	Fax: 0755-27798960	
	Tel: 0755-27798480	
	Address: No. 123- 128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102	
	Global United Technol	ology Services Co., Ltd.
	All tests were perform	ned at:

Test Software	Special test command provided by manufacturer
Power level setup	Default



6 Test Instruments list

Radiated Emission:							
ltem	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)	
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 02 2020	July. 01 2025	
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A	
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 25 2020	June. 24 2021	
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 25 2020	June. 24 2021	
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 25 2020	June. 24 2021	
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 25 2020	June. 24 2021	
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A	
8	Coaxial Cable	GTS	N/A	GTS213	June. 25 2020	June. 24 2021	
9	Coaxial Cable	GTS	N/A	GTS211	June. 25 2020	June. 24 2021	
10	Coaxial cable	GTS	N/A	GTS210	June. 25 2020	June. 24 2021	
11	Coaxial Cable	GTS	N/A	GTS212	June. 25 2020	June. 24 2021	
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 25 2020	June. 24 2021	
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 25 2020	June. 24 2021	
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 25 2020	June. 24 2021	
15	Band filter	Amindeon	82346	GTS219	June. 25 2020	June. 24 2021	
16	Power Meter	Anritsu	ML2495A	GTS540	June. 25 2020	June. 24 2021	
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 25 2020	June. 24 2021	
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 25 2020	June. 24 2021	
19	Splitter	Agilent	11636B	GTS237	June. 25 2020	June. 24 2021	
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 25 2020	June. 24 2021	
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 18 2020	Oct. 17 2021	
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 18 2020	Oct. 17 2021	
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 18 2020	Oct. 17 2021	
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 25 2020	June. 24 2021	

RF C	RF Conducted Test:						
ltem	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)	
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	June. 25 2020	June. 24 2021	
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 25 2020	June. 24 2021	
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June. 25 2020	June. 24 2021	
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	June. 25 2020	June. 24 2021	
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	June. 25 2020	June. 24 2021	
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	June. 25 2020	June. 24 2021	
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	June. 25 2020	June. 24 2021	
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	June. 25 2020	June. 24 2021	

Gene	General used equipment:						
ltem	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)	
1	Humidity/ Temperature Indicator	КТЈ	TA328	GTS243	June. 25 2020	June. 24 2021	
2	Barometer	ChangChun	DYM3	GTS255	June. 25 2020	June. 24 2021	



Test results and Measurement Data 7

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203
15 203 requirement:	

15.203 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, 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.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

EUT Antenna:

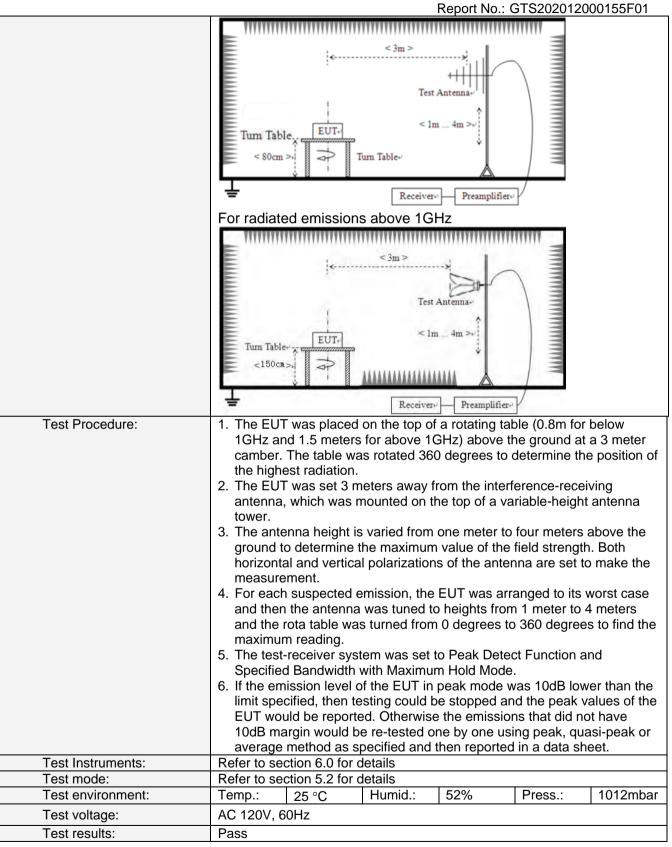
The antenna is integral antenna, the best case gain of the antenna is 0dBi, reference to the appendix II for details.



7.2 Radiated Emission Method

 Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency Detector		RBW	VBW	Remark
	9kHz- Quasi-peak 150kHz		k 200Hz	300Hz	Quasi-peak Value
	150kHz- Quasi-peak 30MHz		k 9kHz	10kHz	Quasi-peak Value
	30MHz- 1GHz	Quasi-pea	k 120KH	z 300KHz	Quasi-peak Value
	Above 1GHz	Peak Peak	1MHz 1MHz	3MHz 10Hz	Peak Value Average Value
Limit:	Freque				Remark
(Field strength of the			Limit (dBuV/m @3m) 94.00		Average Value
fundamental signal)	2400MHz-24	483.5MHz		4.00	Peak Value
Limit:	Eroque			4.00 (uV/m)	Remark
(Spurious Emissions)	Freque 0.009MHz-0				Quasi-peak Value
	0.490MHz-1		2400/F(kHz) @300m 24000/F(kHz) @30m		Quasi-peak Value
	1.705MHz-3		,	/	Quasi-peak Value
	30MHz-8		30 @30m 100 @3m		Quasi-peak Value
	88MHz-2		150 @3m		Quasi-peak Value
	216MHz-9		200 @3m		Quasi-peak Value
	960MHz-1GHz		500 @3m		Quasi-peak Value
			500 @3m		Average Value
	Above 1GHz			@3m	Peak Value
Limit: (band edge)	Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.				
Test setup:	For radiated e	missions fro		20111-	
	i oi raulateu e				
	<pre></pre>				
	For radiated emissions from 30MHz to1GHz				





Measurement data:

7.2.1 Spurious emissions

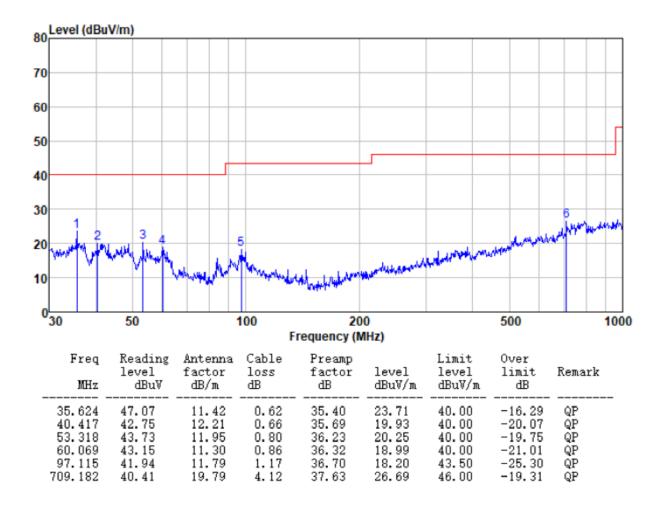
Below 30MHz

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o), the test result no need to reported.

Below 1GHz

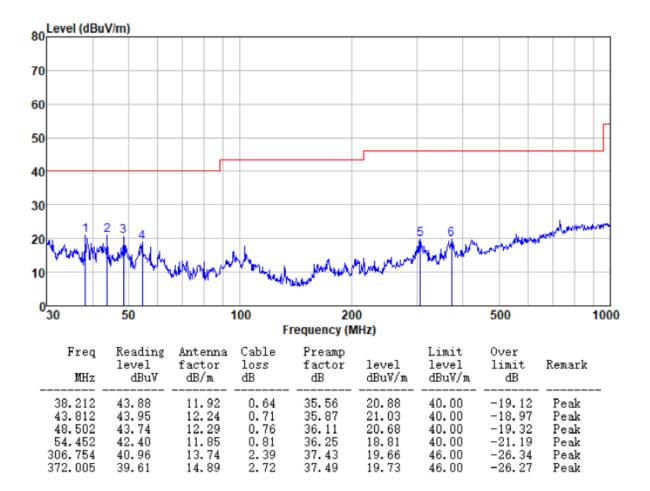
Pre-scan all test modes, found worst case at 2480MHz, and so only show the test result of 2480MHz

Horizontal:





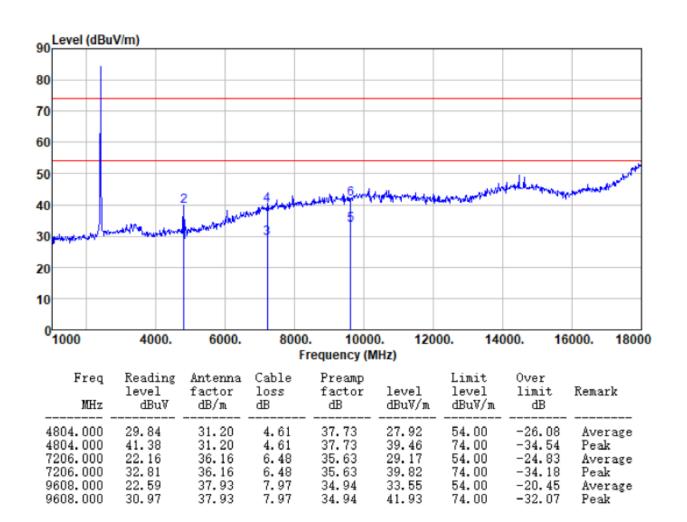
Vertical:





Above 1GHz

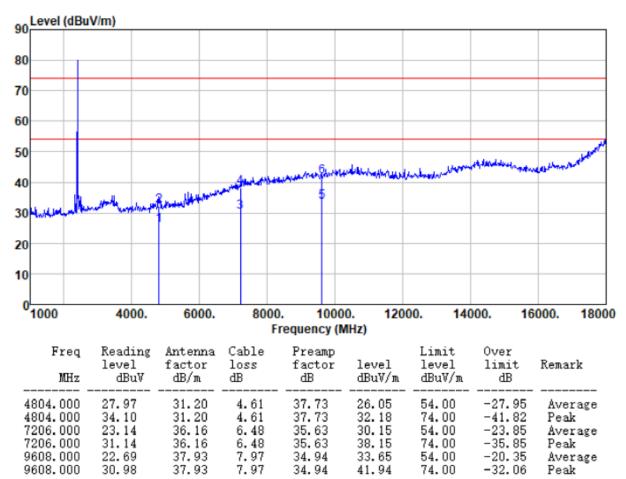
Test channel:	Lowest		
Horizontal:			



GTS

Report No.: GTS202012000155F01

Vertical:





90 Level (dBuV/m)

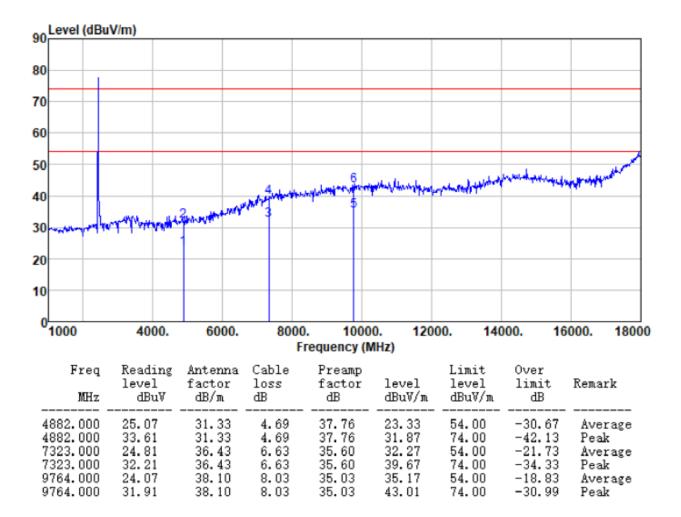
Report No.: GTS202012000155F01



80 70 60 50 40 Worker William 30 20 10 0^L 1000 4000. 6000. 8000. 10000. 12000. 14000. 16000. 18000 Frequency (MHz) Freq Reading Antenna Cable Preamp Limit Over level factor loss factor level level limit Remark MHz dBu∛ dB/m dB dB dBu∛/m dBu∛/m dB 4882.000 4882.000 31.33 31.33 37.76 31.30 4.69 29.5654.00 -24.44 Average 39.40 4.69 37.76 37.66 -36.34 74.00Peak 7323.000 24.32 -22.22 36.43 6.63 35.60 31.78 54.00 Average 7323.000 32.39 36.43 6.63 35.60 39.85 74.00 -34.15Peak 54.00 -19.55 9764.000 8.03 35.03 34.45 23.35 38.10 Average 9764.000 30.42 38.10 8.03 35.03 41.52 74.00 -32.48 Peak



Vertical:

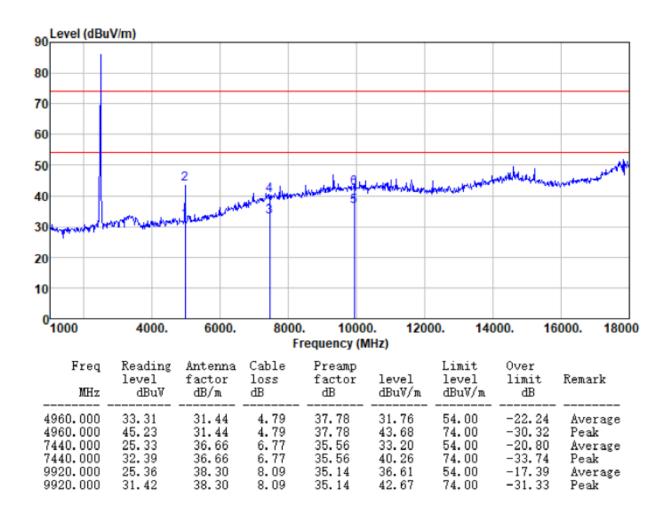




Report No.: GTS202012000155F01

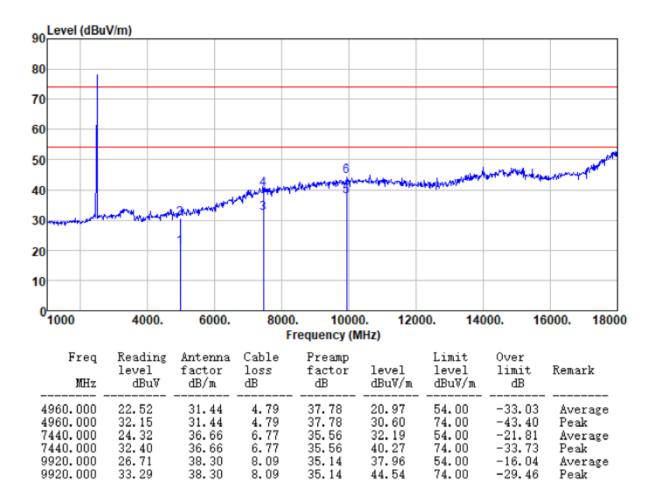


Horizontal:





Vertical:



Remarks:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss - Preamplifier Factor

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

3. "*", means this data is the too weak instrument of signal is unable to test.



8 Test Setup Photo

Reference to the **appendix I** for details.

9 EUT Constructional Details

Reference to the **appendix II** for details.

-----End-----