



RADIO EXPOSURE TEST REPORT

FCC ID : O6ZHR54R1-500
Equipment : Digital Satellite Receiver
Brand Name : DIRECTV
Model Name : HR54-500
Applicant : Humax Co., Ltd.
HUMAX BLDG., 2, Yeongmun-ro, Cheoin-gu
Yongin-si, Gyeonggi-do
South Korea
17040
Manufacturer : Humax Co., Ltd.
HUMAX BLDG., 2, Yeongmun-ro, Cheoin-gu
Yongin-si, Gyeonggi-do
South Korea
17040
Standard : 47 CFR Part 2.1091

The product was received on Oct. 25, 2017, and testing was started from Oct. 31, 2017 and completed on Nov. 30, 2023. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)



Table of Contents

History of this test report.....3

Summary of Test Result.....4

1 General Description5

1.1 EUT General Information5

1.2 Table for Mode5

1.3 Antenna Information5

1.4 Accessories7

1.5 Applicable Standards7

1.6 Testing Location7

2 Maximum Permissible Exposure8

2.1 Limit of Maximum Permissible Exposure8

2.2 MPE Calculation Method9

2.3 MPE Exemption9

2.4 Calculated Result and Limit11

Photographs of EUT v01



History of this test report

Report No.	Version	Description	Issued Date
FA7O2406-03	01	Initial issue of report	Jan. 03, 2024



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacture who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen

Report Producer: Vicky Huang



1 General Description

1.1 EUT General Information

RF General Information			
Evaluation Mode	Frequency Range (MHz)	Operating Frequency (MHz)	Modulation Type
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850	5180-5240 5260-5320 5500-5700 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)
RF4CE	2400-2483.5	2425-2475	O-QPSK

1.2 Table for Mode

Operating Mode	
1	WLAN 2.4GHz + RF4CE
2	WLAN 5GHz + RF4CE

1.3 Antenna Information

Ant.	WLAN 2.4/5GHz Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	
						2.4GHz	5GHz
1	2	Airgain	N2425HMHRA-290	PCB Antenna	I-PEX	2.8	4.1
2	1	Airgain	N2425HMHRD-190	PCB Antenna	I-PEX	3.8	4.2
Ant.	RF4CE Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	
3	1	HUMAX	HR54RF4CE_Ant1	Printed Antenna	N/A	5.2	
4	2	HUMAX	HR54RF4CE_Ant2	Printed Antenna	N/A	4.8	

Note 1: The above information was declared by manufacturer.

Note 2: The antenna is the cross-polarized antenna; it doesn't need to evaluate array gain.



<For 2.4GHz function>

For IEEE 802.11b mode <1TX/1RX>:

Only Port 1 can be used as transmitting/receiving antenna.

For IEEE 802.11g mode <1TX/1RX>:

The EUT supports the antenna with TX and RX diversity functions.

Both Port 1 and Port 2 support transmit and receive functions, but only one of them will be used at one time.

The Port 1 generated the worst case, so it was selected to test and record in the report.

For IEEE 802.11n mode <2TX/2RX>:

Port 1 and Port 2 will transmit/receive the same signal simultaneously.

Port 1 and Port 2 can be used as transmitting/receiving antennas.

<For 5GHz function>

For IEEE 802.11a mode <1TX/1RX>:

The EUT supports the antenna with TX and RX diversity functions.

Both Port 1 and Port 2 support transmit and receive functions, but only one of them will be used at one time.

The Port 1 generated the worst case, so it was selected to test and record in the report.

For IEEE 802.11n mode <2TX/2RX>:

Port 1 and Port 2 will transmit/receive the same signal simultaneously.

Port 1 and Port 2 can be used as transmitting/receiving antennas.

<For RF4CE function>

For RF4CE mode <1TX/1RX>:

The EUT supports the antenna with TX and RX diversity functions.

Both Port 1 and Port 2 support transmit and receive functions, but only one of them will be used at one time.

The Port 1 generated the worst case, so it was selected to test and record in the report.



1.4 Accessories

Accessories			
Equipment Name	Brand Name	Model Name	Rating
Adapter	DIRECTV	EPS44R3-15	INPUT: 120V~1.3A, 60Hz OUTPUT: 12V, 4A, 48W
Equipment Name	Brand Name	Part Number	Rating
Hard Disk	SEAGATE	1SD102-500	-

1.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 2.1091
- ♦ KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ 47 CFR Part 1.1307
- ♦ 47 CFR Part 1.1310

1.6 Testing Location

Testing Location Information	
Test Lab. : Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
Test site Designation No. TW3787 with FCC.	
Conformity Assessment Body Identifier (CABID) TW3787 with ISED.	

Note: The tested sample of the WLAN 2.4GHz, RF4CE output power was received on Sep. 11, 2023.



2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	*(100)	<6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1500	-	-	f/300	<6
1500-100,000	-	-	5	<6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f ²)	<30
30-300	27.5	0.073	0.2	<30
300-1500	-	-	f/1500	<30
1500-100,000	-	-	1.0	<30

Note: f = frequency in MHz ; *Plane-wave equivalent power density



2.2 MPE Calculation Method

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

2.3 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth.

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Option (C): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance

R between the person and the antenna / radiating structure, where $R > \lambda / 2 \pi$.



Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R ² .
1.34-30	3,450 R ² /f ² .
30-300	3.83 R ² .
300-1,500	0.0128 R ² f.
1,500-100,000	19.2R ² .

Note: R is in meters, f is in MHz.



2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Distance (cm)	S (mW/cm ²)	S Limit (mW/cm ²)	Option	TL EIRP (dBm)	TL Ratio
2.4G;D1D	3.80	27.87	31.67	0.50	32.17	20	0.32789	1.00000	B	37.006	0.3284
5.2G;D1D	4.20	23.94	28.14	0.50	28.64	20	0.14546	1.00000	B	37.006	0.1457
5.3G;D1D	4.20	23.38	27.58	0.50	28.08	20	0.12786	1.00000	B	37.006	0.1281
5.6G;D1D	4.20	23.51	27.71	0.50	28.21	20	0.13174	1.00000	B	37.006	0.1320
5.8G;D1D	4.20	26.82	31.02	0.50	31.52	20	0.28231	1.00000	B	37.006	0.2828
RF4CE	5.20	3.83	9.03	0.50	9.53	20	0.00179	1.00000	B	37.006	0.0018

Simultaneous Transmission Analysis Mode:

Test Mode 1: WLAN 2.4GHz + RF4CE

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Distance (cm)	S (mW/cm ²)	Limit (mW/cm ²)	Option	TL EIRP (dBm)	TL Ratio
2.4G;D1D	3.80	27.87	31.67	0.50	32.17	20	0.32789	1.00000	B	37.006	0.3284
RF4CE	5.20	3.83	9.03	0.50	9.53	20	0.00179	1.00000	B	37.006	0.0018
Sum TL Ratio_B	0.3302										
Ratio Limit	1										

Test Mode 2: WLAN 5GHz + RF4CE

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Distance (cm)	S (mW/cm ²)	Limit (mW/cm ²)	Option	TL EIRP (dBm)	TL Ratio
5.8G;D1D	4.20	26.82	31.02	0.50	31.52	20	0.28231	1.00000	B	37.006	0.2828
RF4CE	5.20	3.83	9.03	0.50	9.53	20	0.00179	1.00000	B	37.006	0.0018
Sum TL Ratio_B	0.2846										
Ratio Limit	1										

Note: The above antenna gain was declared by manufacturer.

————THE END————