Maximum Permissible Exposure Report

1. Product Information

FCC ID:	2AFIVRT-RT-G1
Product name	Android TV^{TM} Box (GMS)
Test Model	RT-G1
Power supply	DC 12V from adapter
Operation frequency	2402MHz-2480MHz for Bluetooth 2.412-2.462GHz for 2.4G WIFI
Antenna Type	Internal Antenna
Antenna Gain	BT/BLE/2.4G WIFI Internal Antenna, 3.0dBi
Hardware version	S905X2_S5_DDR3_V1.0
Software version	RT-G1 RTBox:9 PI 20190925:user release-keys
Channel Number	79 Channels for Bluetooth V4.0 (DSS) 40 channels for Bluetooth V4.0(DTS) 11 channels for 20MHz bandwidth (2412~2462MHz) 7 channels for 40MHz bandwidth (2422~2452MHz)
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Device

2. Evaluation Method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.
In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

3. Limit

3. 1 Refer Evaluation Method

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
FCC_KDB_publication_447498_D01_General_1_RF_Exposure_Guidance_v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.
FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.
FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: mobile devices

3. 2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
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

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 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

F=frequency in MHz
*=Plane-wave equivalent power density

4. MPE Calculation Method

Predication of MPE limit at a given distance
Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$

Where: S=power density
      P=power input to antenna
      G=power gain of the antenna in the direction of interest relative to an isotropic radiator
      R=distance to the center of radiation of the antenna

5. Antenna Information

ES-D4 can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
Antenna 0	Internal Antenna	2000 MHz – 2500 MHz	3.0 dBi	BT/WiFi Antenna
Antenna 1	Internal Antenna	2000 MHz – 2500 MHz	3.0 dBi	WiFi Antenna

6. Conducted Power

[BT Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	3.443
	39	2441	1.998
	78	2480	0.344
π/4DQPSK	0	2402	2.978
	39	2441	1.437
	78	2480	-0.242
8DPSK	0	2402	3.375
	19	2440	1.861
	39	2480	0.173

[BLE Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
BT LE	0	2402	-0.612
	19	2440	-1.187
	39	2480	-2.814

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm) ANT 0	Max Conducted Power(dBm) ANT 1
IEEE 802.11b	1	2412	11.53	10.04
	6	2437	11.37	10.09
	11	2462	10.74	10.42
IEEE 802.11g	1	2412	10.85	10.51
	6	2437	11.13	10.68
	11	2462	10.85	10.78
IEEE 802.11n HT20	1	2412	11.36	11.10
	6	2437	11.32	11.08
	11	2462	10.91	11.14
IEEE 802.11n HT40	3	2422	12.96	10.67
	6	2437	12.85	10.43
	9	2452	11.49	10.14

[2.4GWIFI MIMO Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm) ANT0 + ANT1
IEEE 802.11n HT20	1	2412	14.24
	6	2437	14.21
	11	2462	14.04
IEEE 802.11n HT40	3	2422	14.97
	6	2437	14.82
	9	2452	13.88

7. Measurement Results

BT

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	3.0	2.0	0
Tolerance ±(dB)	1.0	1.0	1.0
π/4DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	3.0	1.0	0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	3.0	1.0	0
Tolerance ±(dB)	1.0	1.0	1.0

BLE

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	0	-1	-2
Tolerance ±(dB)	1.0	1.0	1.0

2.4GWIFI

IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	11.0	11.0	10.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	10.0	11.0	10.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n20 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.0	14.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n40 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.0	14.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0

8. Evaluation Results

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, r =20cm, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

BT

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Duty Cycle	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
GFSK	2.402	4	2.512	3.0	100%	0.0010	1.0000
π/4DQPSK	2.402	4	2.512	3.0	100%	0.0010	1.0000
8DPSK	2.402	4	2.512	3.0	100%	0.0010	1.0000

BLE

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Duty Cycle	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
BT LE	2.402	1	1.259	3.0	100%	0.0005	1.0000

2.4GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Duty Cycle	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
IEEE 802.11b	2.412	12	15.849	3.0	100%	0.0063	1.0000
IEEE 802.11g	2.437	12	15.849	3.0	100%	0.0063	1.0000
IEEE 802.11n HT20	2.412	15	31.623	3.0	100%	0.0126	1.0000
IEEE 802.11n HT40	2.422	15	31.623	3.0	100%	0.0126	1.0000

Simultaneous transmit mode

Band/Mode	Max. MPE1 (mW/cm^2)	Max. MPE2 (mW/cm^2)	Total MPE (mW/cm^2)	MPE Limits (mW/cm^2)
BT&2.4GWIFI	0.0010	0.0126	0.0136	1.0000
BLE&2.4GWIFI	0.0005	0.0126	0.0131	1.0000

Remark:
1. Output power including turn-up tolerance;
2. Output power is burst average power;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer;
4. MPE values = PG/4πR²;
5. Bluetooth and 2.4G WIFI can simultaneous transmit.

9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

-----------------THE END OF REPORT----------------