



Maximum Permissible Exposure Report

1. Product Information

EUT	: Roku Monitoring Hub
Test Model	: SS100BX
Power Supply	: Input: 5V $\overline{=}$ 1000mA For Adapter Input: 100-240V~, 50/60Hz, 0.25A Max For Adapter Output: 5V $\overline{=}$ 1000mA
Hardware Version	: GW3U-P1.0-V1.8
Software Version	: 6.0.0.39
Bluetooth	:
Frequency Range	: 2402MHz ~ 2480MHz
Channel Number	: 40 channels for Bluetooth V5.0 (DTS)
Channel Spacing	: 2MHz for Bluetooth V5.0 (DTS)
Modulation Type	: GFSK for Bluetooth V5.0 (DTS)
Bluetooth Version	: V5.0
Antenna Description	: Internal Antenna0, 3.8dBi (max.)
WIFI(2.4G Band)	:
Frequency Range	: 2412MHz ~ 2462MHz
Channel Spacing	: 5MHz
Channel Number	: 11 Channels for 20MHz bandwidth (2412~2462MHz) 7 Channels for 40MHz bandwidth (2422~2452MHz)
Modulation Type	: IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	: External Antenna1, 2.2dBi (max.)
SRD	:
Frequency Range	: 906.8MHz, 910MHz, 913.2MHz
Channel Number	: 3
Modulation Type	: GFSK
Antenna Description	: External Antenna2, 2.0dBi (Max.)





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 C95.1–2019](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz 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/cm ²)	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/cm ²)	Averaging Time (minute)
Limits for Occupational/Uncontrolled 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

EUT can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
Internal Antenna0	2400-2500 MHz	3.8dBi	BT Antenna
External Antenna1	2400-2500 MHz	2.2dBi	WIFI Antenna
External Antenna2	906.8-913.2MHz	2.0dBi	SRD Antenna

6. Conducted Power

[BT LE]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	18.64
	19	2440	18.82
	39	2480	18.87

[2.4G WLAN]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
IEEE 802.11b	1	2412	17.25
	6	2437	17.33
	11	2462	18.27
IEEE 802.11g	1	2412	19.10
	6	2437	19.75
	11	2462	19.14
IEEE 802.11n HT20	1	2412	18.53
	6	2437	18.79
	11	2462	18.54
IEEE 802.11n HT40	3	2422	18.91
	6	2437	19.04
	9	2452	18.98





TX frequency range: 906.8MHz, 910MHz, 913.2MHz

Mode	Channel	Frequency (MHz)	Field Strength (dBuV/m @3m)	Maximum Conducted Output Power (dBm)
GFSK	1	906.8	90.96	-4.20
	2	910	89.97	-5.19
	3	913.2	90.85	-4.31

Field Strength: dBuV/m @3m

Maximum Conducted Output Power: $EIRP = E - 104.7 + 20 \log D = E - 104.7 + 20 \log 3$

7. Manufacturing Tolerance

BT LE(Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	18.0	18.0	18.0
Tolerance ± (dB)	1.0	1.0	1.0

IEEE 802.11b(Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	17.0	17.0	18.0
Tolerance ± (dB)	1.0	1.0	1.0

IEEE 802.11g(Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	19.0	19.0	19.0
Tolerance ± (dB)	1.0	1.0	1.0

IEEE 802.11n20(Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	18.0	18.0	18.0
Tolerance ± (dB)	1.0	1.0	1.0

IEEE 802.11n40(Peak)			
Channel	Channel 03	Channel 06	Channel 09
Target (dBm)	18.0	19.0	18.0
Tolerance ± (dB)	1.0	1.0	1.0

SRD			
Channel	Channel 1	Channel 2	Channel 3
Target (dBm)	-4.0	-5.0	-4.0
Tolerance ± (dB)	1.0	1.0	1.0





8. Measurement Results

8.1 Standalone MPE Evaluation

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, $r = 20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

[BT LE]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
BT LE	19.0	79.4328	3.8	2.3988	0.0379	1.0000

[2.4GWLAN]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11b	19.0	79.4328	2.2	1.6596	0.0262	1.0000
IEEE 802.11g	20.0	100.0000	2.2	1.6596	0.0330	1.0000
IEEE 802.11n HT20	19.0	79.4328	2.2	1.6596	0.0262	1.0000
IEEE 802.11n HT40	20.0	100.0000	2.2	1.6596	0.0330	1.0000

[SRD]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
GFSK	-3.0	0.5012	2.0	1.5849	0.0003	0.6045
	-4.0	0.3981	2.0	1.5849	0.0002	0.6045
	-3.0	0.5012	2.0	1.5849	0.0003	0.6045

Remark:

1. Output power including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.





8.2 Simultaneous Transmission MPE Evaluation

The sample support one BT, another and one 2.4G WLAN, another and one SRD transmit antenna, so need consider simultaneous transmission;

Simultaneous transmission MPE

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

\sum of MPE ratios ≤ 1.0

Mode	MPE1 (mW/cm2)	MPE2 (mW/cm2)	MPE3 (mW/cm2)	\sum MPE ratios	Limit	Results
BT LE +2.4G WIFI+SRD	0.0379	0.0330	0.0003	0.0712	1.0	PASS

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-----

