



RF Exposure Evaluation Report

Application No.: SZEM2009008718CR
Applicant: SAGEMCOM BROADBAND SAS
Address of Applicant: 250 Route de l'Empereur - 92848 RUEIL MALMAISON CEDEX- FRANCE
Manufacturer: SAGEMCOM BROADBAND SAS
Address of Manufacturer: 250 Route de l'Empereur - 92848 RUEIL MALMAISON CEDEX- FRANCE
Factory: AGEMCOM BROADBAND SAS
Address of Factory: 250 Route de l'Empereur - 92848 RUEIL MALMAISON CEDEX- FRANCE
Equipment Under Test (EUT):
Product Name: Home Hub 4000(FAST 5689)
Model No.: FAST 5689
FCC ID: VW3FAST5689
Trade mark: SAGEMCOM
Standards: 47 CFR Part 1.1307
47 CFR Part 1.1310
47 CFR Part 2.1091
KDB447498D01 General RF Exposure Guidance v06
Date of Receipt: 2020-09-02
Date of Test: 2020-09-03 to 2020-09-30
Date of Issue: 2020-11-19

Test Result :	PASS*
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* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu

Keny Xu
EMC Laboratory Manager



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2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020-11-19		Original

Authorized for issue by:			
			
		Leo Lai/Project Engineer	
			
		Eric Fu/Reviewer	



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4 General Information

4.1 General Description of EUT

Test voltage:	120V~60Hz
Power adapter:	Model: MSA-Z5000IS12.0-60A-P Input: 100-120V~50/60Hz 1.5A Max, Output: DC 12V 5A

Z-Wave

Antenna Gain:	0dBi
Channels:	908.4MHz, 908.42MHz, 916MHz
Modulation:	FSK
Antenna Type:	Internal Antenna

WiFi 2.4G

Operation Frequency:	802.11b/g/n/ax(HT20/HE20): 2412MHz to 2462MHz 802.11n/ax(HT40/HE40): 2422MHz to 2452MHz
Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11ax: OFDM&OFDMA (1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK)
Number of Channels:	802.11802.11b/g/n(HT20)/ax(HE20): 11 802.11n(HT40)/ax(HE40):7
Channel Spacing:	5MHz
Antenna Type:	Internal Antenna

Antenna Gain:

2.4G-1	2.4G-2	2.4G-3	DB-2 (2.4G)	5G-1	5G-2
Vertical (dipole)	Vertical (dipole)	Horizontal (dipole)	Horizontal (dipole)	Mix (PIFA)	Mix (PIFA)
5G-3	DB-2 (5G)	5G-4	5G-5	5G-6	DB-1 (5G)
Horizontal (dipole)	Horizontal (dipole)	Mix (PIFA)	Mix (PIFA)	Horizontal (dipole)	Horizontal (dipole)



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Frequency (MHz)	E-total(dBi) ANT1	E-total(dBi) ANT2	E-total(dBi) ANT3	E-total(dBi) ANT4 (DB-2)	Peak Gain of 3D Directional pattern
2400	3.57	3.49	3.94	3.12	6.45
2450	3.85	3.35	3.85	2.52	6.78
2500	3.22	2.88	3.34	2.72	6.79

WiFi 5G

Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	UNII Band I	802.11a/n(HT20)/ac(VHT20)/ax(HE20)	5180-5240	4
		802.11n(HT40)/ac(VHT40)/ax(HE40)	5190-5230	2
		802.11ac(VHT80)/ax(HE80)	5210	1
	UNII Band II-A	802.11a/n(HT20)/ac(VHT20)/ax(HE20)	5260-5320	4
		802.11n(HT40)/ac(VHT40)/ax(HE40)	5270-5310	2
		802.11ac(VHT80)/ax(HE80)	5290	1
		802.11ac(VHT160)/ax(HE160)	5250	1
	UNII Band II-C	802.11a/n(HT20)/ac(VHT20)/ax(HE20)	5500-5700	11
		802.11n(HT40)/ac(VHT40)/ax(HE40)	5510-5670	5
		802.11ac(VHT80)/ax(HE80)	5530-5630	2
		802.11ac(VHT160)/ax(HE160)	5570	1
	UNII Band III	802.11a/n(HT20)/ac(VHT20)/ax(HE20)	5745-5825	5
		802.11n(HT40)/ac(VHT40)/ax(HE40)	5755-5895	2
		802.11ac(VHT80)/ax(HE80)	5775	1
Modulation Type:	802.11a: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)			



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	802.11ax: OFDM&OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Channel Spacing:	802.11a/n(HT20)/ac(VHT20)/ax(HE20) : 20MHz 802.11n(HT40)/ac(VHT40)/ax(HE40) : 40MHz 802.11ac(VHT80)/ax(HE80) : 80MHz 802.11ac(VHT80)/ax(HE80) : 160MHz
DFS Function:	Master
TPC Function:	Support
Antenna Type:	Internal Antenna

Antenna Gain:

2.4G-1	2.4G-2	2.4G-3	DB-2 (2.4G)	5G-1	5G-2
Vertical (dipole)	Vertical (dipole)	Horizontal (dipole)	Horizontal (dipole)	Mix (PIFA)	Mix (PIFA)
5G-3	DB-2 (5G)	5G-4	5G-5	5G-6	DB-1 (5G)
Horizontal (dipole)	Horizontal (dipole)	Mix (PIFA)	Mix (PIFA)	Horizontal (dipole)	Horizontal (dipole)

	Band 1	Band 2A	Band 2C	Band 3
5G-1	4.49	4.26	-	-
5G-2	3.57	3.71	-	-
5G-3	4.89	4.81	-	-
DB-2(5G)	4.02	4.4	-	-
5G-4	-	-	3.88	3.4
5G-5	-	-	3.78	4.29
5G-6	-	-	4.96	4.84
DB-1(5G)	-	-	4.91	4.5
Total(dBi) 4ANTs	6.98	6.96	6.85	6.85

Zigbee

Antenna Gain:	3.85dBi
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Channel Spacing:	5MHz
Number of Channels:	16
Modulation Type:	O-QPSK
Operation Frequency:	2405MHz to 2480MHz
Antenna Type:	Internal Antenna

4.2 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

4.3 Test Facility

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

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.4 Deviation from Standards

None.

4.5 Abnormalities from Standard Conditions



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None.

4.6 Other Information Requested by the Customer

None.



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5 RF Exposure Evaluation

5.1 RF Exposure Compliance Requirement

5.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
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				
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

F= Frequency in MHz

Friis Formula

Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

5.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.



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5.1.3 EUT RF Exposure Evaluation

WiFi 2.4G

Antenna Gain: 6.79dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 4.775 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 30 cm (mW/cm ²)	Limit (mW/cm ²)	Result
2462	29.97	993.12	0.4193	1.0	PASS

WiFi 5G

Antenna Gain: 6.85dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 4.842 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 30 cm (mW/cm ²)	Limit (mW/cm ²)	Result
5775	29.02	797.99	0.3416	1.0	PASS

Zigbee

Antenna Gain: 3.85dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.427 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 30 cm (mW/cm ²)	Limit (mW/cm ²)	Result
2475	18.93	78.16	0.0168	1.0	PASS

Z-Wave

The Max. power (including tune-up tolerance) is: (*)

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency (MHz)	Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 30 cm (mW/cm ²)	Limit (mW/cm ²)	Result
908.40	-1.308	0.74	0.000065	0.60560	PASS

(*) Refer to test report SZEM200900871804 for EUT test Max Conducted Peak Output Power(including tune-up tolerance) value.

E=EIRP-20logD+104.7





E=93.85dBuV/m(Refer to test report SZEM200900871801)

D=3m

EIRP=93.85-(-20log(3)+104.7)

EIRP=-1.308dBm(0.74mW)

Exposure conditions for simultaneous transmission operations

Simultaneous transmission MPE test is not required, because the Max. sum of the MPE ratios for WiFi 2.4G, WiFi 5G, Zigbee and Z-Wave is $0.4193/1.0+0.3416/1.0+0.0168/1.0+0.000065/0.60560 \approx 0.77781 < 1$

Note: Refer to report No. SZEM200900871801, SZEM200900871802, SZEM200900871803 and SZEM200900871804 for EUT test Max Conducted Peak Output Power value, due to Z-Wave, WiFi 2.4G, WiFi 5G and Zigbee can simultaneous transmit the signal so all of the maximum power are selected for this evaluation. The distance r (4th column) calculated from the Fries transmission formula is far greater than 30 cm separation requirement.

- End of the Report -



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