

**Test Report No. 7191174250-EEC17/01**  
dated 24 Nov 2017



PSB Singapore

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH  
47 CFR FCC Parts 15B & C & E  
OF A  
**Wireless Speaker System**  
**[ Model : SC-GA10 ]**  
**[ Contains FCC ID : 2AJYB-S810 ]**

**TEST FACILITY** TÜV SÜD PSB Pte Ltd  
Electrical & Electronics Centre (EEC), Product Services,  
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**FCC REG. NO.** 994109 (Test Firm Registration Number)  
SG0002 (Designation Number)

**IND. CANADA REG. NO.** 2932I-1 (3m and 10m Semi-Anechoic Chamber, Science Park)

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**QUOTATION NUMBER** 2191073452

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LA-2007-0380-A  
LA-2007-0381-F  
LA-2007-0382-B  
LA-2007-0383-G

LA-2007-0384-G  
LA-2007-0385-E  
LA-2007-0386-C  
LA-2010-0464-D

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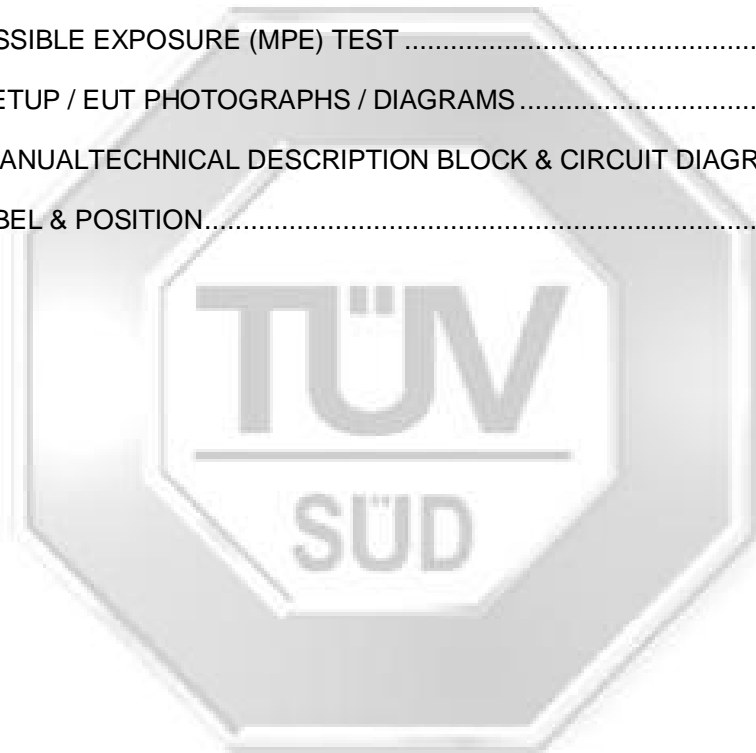
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**TEST SUMMARY**

The product was tested in accordance with the customer's specifications.

**Test Results Summary**

Test Standard	Description	Pass / Fail
47 CFR FCC Part 15 (Bluetooth)		
15.107(a), 15.207	Conducted Emissions	Pass
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.247(a)(1)	Carrier Frequency Separation	Not Tested *See Note 6
	Spectrum Bandwidth (20dB Bandwidth Measurement)	Not Tested *See Note 6
15.247(a)(1)(iii)	Number of Hopping Frequencies	Not Tested *See Note 6
	Average Frequency Dwell Time	Not Tested *See Note 6
15.247(b)(1)	Maximum Peak Power	Not Tested *See Note 6
15.247(d)	RF Conducted Spurious Emissions	Not Tested *See Note 6
15.247(d)	Band Edge Compliance (Conducted)	Not Tested *See Note 6
15.247(d)	Band Edge Compliance (Radiated)	Not Tested *See Note 6
15.247(e)	Peak Power Spectral Density	Not Tested *See Note 6
1.1310	Maximum Permissible Exposure	Pass



**TEST SUMMARY**

The product was tested in accordance with the customer's specifications.

**Test Results Summary**

Test Standard	Description	Pass / Fail
47 CFR FCC Part 15 (2.4GHz Wi-Fi)		
15.107(a), 15.207	Conducted Emissions	Pass
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.247(a)(2)	Spectrum Bandwidth (6dB Bandwidth Measurement)	Not Tested *See Note 7
15.247(b)(3)	Maximum Peak Power	Not Tested *See Note 7
15.247(d)	RF Conducted Spurious Emissions (Non-Restricted Bands)	Not Tested *See Note 7
15.247(d)	RF Conducted Spurious Emissions (Restricted Bands)	Not Tested *See Note 7
15.247(d)	Band Edge Compliance (Conducted)	Not Tested *See Note 7
15.247(d)	Band Edge Compliance (Radiated)	Not Tested *See Note 7
15.247(e)	Peak Power Spectral Density	Not Tested *See Note 7
1.1310	Maximum Permissible Exposure	Pass



**TEST SUMMARY**

The product was tested in accordance with the customer's specifications.

**Test Results Summary**

Test Standard	Description	Pass / Fail
47 CFR FCC Part 15 (5GHz Wi-Fi)		
15.107(a), 15.207	Conducted Emissions	Pass
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.407(e)	Spectrum Bandwidth (6dB Bandwidth Measurement)	Not Tested *See Note 8
15.407(a)(1)(2)(3)	Maximum Peak Power	Not Tested *See Note 8
15.407(b)	RF Conducted Spurious Emissions (Non-Restricted Bands)	Not Tested *See Note 8
15.209	RF Conducted Spurious Emissions (Restricted Bands)	Not Tested *See Note 8
15.407(a)(1)(2)(3)	Peak Power Spectral Density	Not Tested *See Note 8
1.1310	Maximum Permissible Exposure	Pass



**TEST SUMMARY**

**Notes**

1. Three channels as listed below, which respectively represent the lower, middle and upper channels of the Equipment Under Test (EUT) during Bluetooth mode were chosen and tested. For each channel, the EUT was configured to operate in the test mode.

<u>Transmit Channel</u>	<u>Frequency (GHz)</u>
Channel 0 (Lower Channel)	2.402
Channel 39 (Middle Channel)	2.441
Channel 78 (Upper Channel)	2.480

2. Three channels as listed below, which respectively represent the lower, middle and upper channels of the Equipment Under Test (EUT) during Wi-Fi 2.4GHz mode were chosen and tested. For each channel, the EUT was configured to operate in the test mode.

<u>Transmit Channel</u>	<u>Frequency (GHz)</u>
Channel 1 (Lower Channel)	2.412
Channel 7 (Middle Channel)	2.437
Channel 13 (Upper Channel)	2.462

3. Three channels as listed below, which respectively represent the lower, middle and upper channels of the Equipment Under Test (EUT) during Wi-Fi 5GHz mode were chosen and tested. For each channel, the EUT was configured to operate in the test mode.

<u>Transmit Channel</u>	<u>Frequency (GHz)</u>
Channel 36 (Lower Channel)	5.180
Channel 100 (Middle Channel)	5.500
Channel 149 (Upper Channel)	5.745

4. The EUT is a Class B device when in non-transmitting state and meets the 47 CFR FCC Part15B Class B requirements.
5. All test measurement procedures are according to ANSI C63.4: 2014, ANSI C63.10: 2013 and KDB 558074 D01 DTS Measurement Guidance V04.
6. The EUT contains FCC (FCC ID: 2AJYB-S810) certified Bluetooth module model Stream 810 from StreamUnlimited Engineering GmbH. The module was integrated into the EUT without any modification as per information from Panasonic AVC Networks Singapore. This RF module was tested by TÜV AUSTRIA SERVICES GMBH, and reported in M/FG-16/134, dated 19 Dec 2016.
7. The EUT contains FCC (FCC ID: 2AJYB-S810) certified 2.4GHz Wi-Fi module model Stream 810 from StreamUnlimited Engineering GmbH. The module was integrated into the EUT without any modification as per information from Panasonic AVC Networks Singapore. This RF module was tested by TÜV AUSTRIA SERVICES GMBH, and reported in M/FG-16/135, dated 19 Dec 2016.
8. The EUT contains FCC (FCC ID: 2AJYB-S810) certified 5GHz Wi-Fi module model Stream 810 from StreamUnlimited Engineering GmbH. The module was integrated into the EUT without any modification as per information from Panasonic AVC Networks Singapore. This RF module was tested by TÜV AUSTRIA SERVICES GMBH, and reported in M/FG-16/136, dated 19 Dec 2016.

**Modifications**

No modifications were made.

**PRODUCT DESCRIPTION**

Description	: The Equipment Under Test (EUT) is a <b>Wireless Speaker System</b> .
Applicant	: StreamUnlimited Engineering GmbH
Manufacturer	: Panasonic Corporation 1006 Oaza Kadoma, Kadoma-City, Osaka 571 8501, Japan
Factory	: Panasonic AVC Networks Johor Malaysia Sdn. Bhd. IE. PLO 460, Jalan Bandar, 81700 Pasir Gudang, Johor, Malaysia
Model Number(s)	: (Host) SC-GA10
FCC ID	: (Modular) 2AJYB-S810; manufacturer: StreamUnlimited Engineering GmbH, Gutheil Schoder Gasse 10, 1100 Vienna, Austria
Serial Number(s)	: Nil
Microprocessor(s)	: Marvell 88W8897P
Operating Frequency	: i. 2402MHz – 2480MHz (Bluetooth) ii. 2412MHz – 2472MHz (Wi-Fi) iii. 5180MHz – 5320MHz (Wi-Fi) iv. 5500MHz – 5825MHz (Wi-Fi)
Clock / Oscillator Frequency	: 40MHz, 16MHz
Modulation	: Bluetooth i. Gaussian Frequency Shift Keying (GFSK) ii. $\pi/4$ Differential-Quadrature Phase Shift Keying (DQPSK) iii. 8 Differential Phase-Shift Keying (DPSK)  Wi-Fi i. Complementary Code Keying (CCK) ii. Binary Phase Shift Keying (BPSK) iii. Quadrature Phase Shift Keying (QPSK) iv. 16Quadrature Amplitude Modulation (16QAM) v. 64Quadrature Amplitude Modulation (64QAM)
Occupied Channel Bandwidth	: 1339.9MHz (as declared by the manufacturer)
Antenna Gain	: 1.0 dBi
Port / Connectors	: AUX, AC Power, UFL.
Rated Input Power	: 100V – 240V, 50/60Hz, 19.5V 3.34A
Accessories	: Refer to manufacturer's user manual / operating manual



**SUPPORTING EQUIPMENT DESCRIPTION**

<b>Equipment Description (Including Brand Name)</b>	<b>Model, Serial &amp; FCC ID Number</b>	<b>Cable Description (List Length, Type &amp; Purpose)</b>
Fujitsu LifeBook S Series Laptop	M/N: S6410 S/N: C071200719 FCC ID: DoC	1.80m unshielded RJ45 Cable
Fujitsu Limited AC Adapter	M/N: SEC100P3-19.0 S/N: 08903690B FCC ID: DoC	1.80m unshielded power cable
D-Link Router	M/N: DIR-850L S/N: R3XU2D4000130 FCC ID: KA2IR850LA1	Nil
Channel Well Technology AC Adapter	M/N: SAG024F 4 EU S/N: Nil FCC ID: DoC	1.80m unshielded power cable
Logitech M100 Optical Mouse	M/N: M-U0004 S/N: Nil FCC ID: DoC	1.80m unshielded cable
Apple iPod Nano	M/N: MC062ZP S/N: YM9517XB72R FCC ID: DoC	1.00m unshielded auxiliary cable
Samsung Galaxy S4 Mobile Phone	M/N: GT-I9505 S/N: R21D53LTSHJ FCC ID: A3LGTI9505	Nil





**EUT OPERATING CONDITIONS**

**47 CFR FCC Part 15**

- 1. Conducted Emissions**
- 2. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)**
- 3. Maximum Permissible Exposure**

The EUT was exercised by operating in maximum continuous transmission in test mode, i.e transmitting at lower, middle and upper channels respectively at one time.





**CONDUCTED EMISSION TEST**

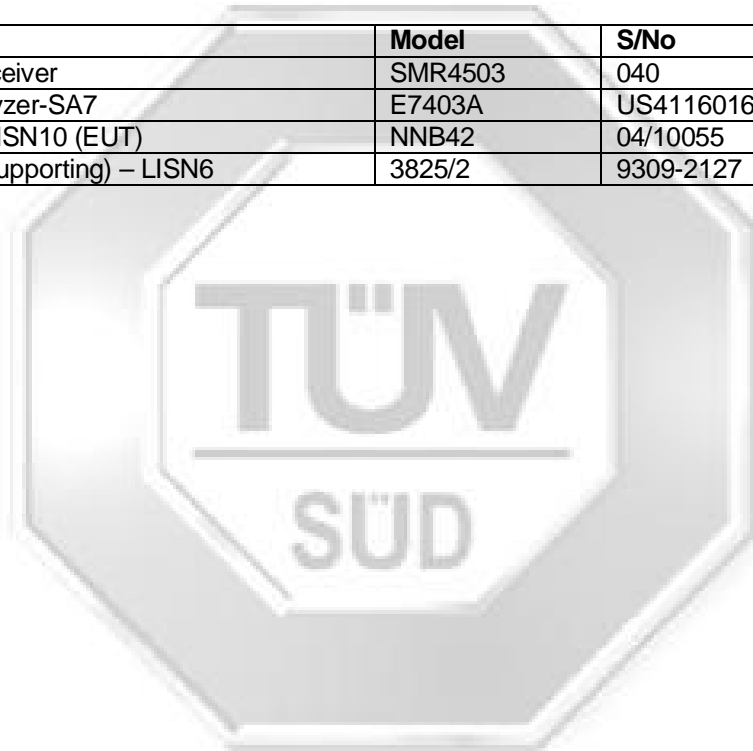
**47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Limits**

Frequency Range (MHz)	Limit Values (dBµV)	
	Quasi-peak (Q-P)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50

\* Decreasing linearly with the logarithm of the frequency

**47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Test Instrumentation**

Instrument	Model	S/No	Cal Due Date
Schaffner EMI Receiver	SMR4503	040	22 Mar 2018
Agilent EMC Analyzer-SA7	E7403A	US41160167	03 Aug 2018
Schaffner LISN –LISN10 (EUT)	NNB42	04/10055	04 Oct 2018
EMCO LISN (for supporting) – LISN6	3825/2	9309-2127	06 Oct 2018





**CONDUCTED EMISSION TEST**

**47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Test Setup**

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another LISN.

**47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 9kHz. Both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line.

**Sample Calculation Example**

At 20 MHz

Q-P limit = 60.0 dBμV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBμV  
(Calibrated for system losses)

Therefore, Q-P margin = 60.0 - 40.0 = 20.0

i.e. 20.0 dB below Q-P limit



**CONDUCTED EMISSION TEST**

**47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Results**

Test Input Power	120V 60Hz	Temperature	22°C
Line Under Test	AC Mains	Relative Humidity	55%
Mode	Bluetooth Audio Playback	Atmospheric Pressure	1030mbar
		Tested By	Lim Kay Tak

Frequency (MHz)	Q-P Value (dBµV)	Q-P Limit (dBµV)	Q-P Margin (dB)	AV Value (dBµV)	AV Limit (dBµV)	AV Margin (dB)	Line
0.1527	42.9	65.9	23.0	30.2	55.9	25.7	Live
0.5207	43.7	56.0	12.3	36.5	46.0	9.5	Live
0.9380	29.8	56.0	26.2	23.6	46.0	22.4	Live
2.1250	30.3	56.0	25.7	23.9	46.0	22.1	Live
2.5601	30.4	56.0	25.6	22.8	46.0	23.2	Live
2.8111	29.8	56.0	26.2	21.2	46.0	24.8	Live

Test Input Power	120V 60Hz	Temperature	22°C
Line Under Test	AC Mains	Relative Humidity	55%
Mode	Wi-Fi 2.4GHz Audio Playback	Atmospheric Pressure	1030mbar
		Tested By	Lim Kay Tak

Frequency (MHz)	Q-P Value (dBµV)	Q-P Limit (dBµV)	Q-P Margin (dB)	AV Value (dBµV)	AV Limit (dBµV)	AV Margin (dB)	Line
0.1502	42.5	66.0	23.5	27.2	56.0	28.8	Live
0.1806	38.2	64.5	26.3	21.3	54.5	33.2	Live
0.2585	34.4	61.5	27.1	16.7	51.5	34.8	Live
0.5236	44.0	56.0	12.0	34.0	46.0	12.0	Live
2.6978	30.0	56.0	26.0	18.7	46.0	27.3	Live
2.7757	28.7	56.0	27.3	16.6	46.0	29.4	Neutral



**CONDUCTED EMISSION TEST**

**47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Results**

Test Input Power	120V 60Hz	Temperature	22oC
Line Under Test	AC Mains	Relative Humidity	55%
Mode	Wi-Fi 5GHz Audio Playback	Atmospheric Pressure	1030mbar
		Tested By	Lim Kay Tak

Frequency (MHz)	Q-P Value (dBµV)	Q-P Limit (dBµV)	Q-P Margin (dB)	AV Value (dBµV)	AV Limit (dBµV)	AV Margin (dB)	Line
0.1522	43.0	65.9	22.9	27.0	55.9	28.9	Live
0.1701	39.9	65.0	25.1	21.8	55.0	33.2	Neutral
0.2007	36.2	63.6	27.4	21.5	53.6	32.1	Live
0.5384	43.6	56.0	12.4	33.8	46.0	12.2	Live
1.8710	28.7	56.0	27.3	19.5	46.0	26.5	Live
2.7246	30.1	56.0	25.9	19.4	46.0	26.6	Live

Notes

- All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
- A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
- EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:  
9kHz - 30MHz  
RBW: 9kHz                      VBW: 30kHz
- Conducted Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 9kHz – 30MHz is ±2.2dB.



**RADIATED EMISSION TEST**

**47 CFR FCC Part 15.205 Restricted Bands**

MHz		MHz		MHz		GHz	
0.090	- 0.110	16.42	- 16.423	399.9	- 410	4.5	- 5.15
0.495	- 0.505	16.69475	- 16.69525	608	- 614	5.35	- 5.46
2.1735	- 2.1905	16.80425	- 16.80475	960	- 1240	7.25	- 7.75
4.125	- 4.128	25.5	- 25.67	1300	- 1427	8.025	- 8.5
4.17725	- 4.17775	37.5	- 38.25	1435	- 1626.5	9.0	- 9.2
4.20725	- 4.20775	73	- 74.6	1645.5	- 1646.5	9.3	- 9.5
6.215	- 6.218	74.8	- 75.2	1660	- 1710	10.6	- 12.7
6.26775	- 6.26825	108	- 121.94	1718.8	- 1722.2	13.25	- 13.4
6.31175	- 6.31225	123	- 138	2200	- 2300	14.47	- 14.5
8.291	- 8.294	149.9	- 150.05	2310	- 2390	15.35	- 16.2
8.362	- 8.366	156.52475	- 156.52525	2483.5	- 2500	17.7	- 21.4
8.37625	- 8.38675	156.7	- 156.9	2690	- 2900	22.01	- 23.12
8.41425	- 8.41475	162.0125	- 167.17	3260	- 3267	23.6	- 24.0
12.29	- 12.293	167.72	- 173.2	3332	- 3339	31.2	- 31.8
12.51975	- 12.52025	240	- 285	3345.8	- 3358	36.43	- 36.5
12.57675	- 12.57725	322	- 335.4	3600	- 4400	Above 38.6	
13.36	- 13.41						

**47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Limits**

Frequency Range (MHz)	Quasi-Peak Limit Values (dBµV/m)
0.009 - 0.490	20 log [2400 / F (kHz)] @ 300m
0.490 - 1.705	20 log [24000 / F (kHz)] @ 30m
1.705 - 30.0	30.0 @ 30m
30 - 88	40.0 @ 3m
88 - 216	43.5 @ 3m
216 - 960	46.0 @ 3m
Above 960	54.0* @ 3m

\* For frequency bands 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.

**47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Test Instrumentation**

Instrument	Model	S/No	Cal Due Date
ESU 40 EMI Test Receiver	ESU 40	1302.6005k40-100355-wq	29 Sep 2018
Schaffner Bilog Antenna –(30MHz-2GHz) BL4	CBL6112B	2593	18 Jan 2018
EMCO Horn Antenna(1GHz-18GHz)	3115	0003-6088	24 Mar 2018
ETS Horn Antenna(18GHz-40GHz) (Ref)	3116	0004-2474	18 Oct 2018
EMCO Loop Ant (ext)_red_00134413	6502	134413	28 Oct 2018
Com-Power Preamplifier (1MHz-1GHz)	PAM-103	441096	25 Sep 2018
R&S Preamplifier (1GHz -18GHz)	SCU18	102191	10 Mar 2018
Agilent Preamplifier(1GHz-26.5GHz) (PA18)	8449D	3008A02305	02 Oct 2018
Toyo Preamplifier (26.5GHz-40GHz)	HAP26-40W	00000005	18 Oct 2018
Micro-tronics Bandstop Filter (2.4GHz)	BRM50701-02	007	13 Aug 2018
Micro-Tronics Bandstop Filter (5.15-5.25GHz)	BRC14719	001	13 Dec 2017
Micro-Tronics Bandstop Filter (5.25-5.35GHz)	BRC14720	001	13 Dec 2017
Micro-Tronics Bandstop Filter (5.47-5.725GHz)	BRC50704	006	13 Dec 2017



**RADIATED EMISSION TEST**

**47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Test Setup**

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table for measurement up to 1GHz. For measurement above 1GHz, 1.5m height table was used.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

**47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
  - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
  - b. The EUT was then rotated to the direction that gave the maximum emission.
  - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point in the range of 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from the lowest radio frequency signal generated from the EUT, without going below 9kHz to 10<sup>th</sup> harmonics of the EUT fundamental frequency, using the loop antenna for frequency below 30MHz, Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

**Sample Calculation Example**

At 300 MHz	Q-P limit = 46.0 dB $\mu$ V/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB	
Q-P reading obtained directly from EMI Receiver = 40.0 dB $\mu$ V/m (Calibrated level including antenna factors & cable losses)	
Therefore, Q-P margin = 46.0 - 40.0 = 6.0	i.e. 6.0 dB below Q-P limit



**RADIATED EMISSION TEST**

**47 CFR FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results**

Test Input Power	120V 60Hz	Temperature	24°C
Test Distance	3m ( $\geq$ 30MHz – 25GHz)	Relative Humidity	60%
Mode	Bluetooth Audio Playback	Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin Li Chelmin Lim Kay Tak

Spurious Emissions ranging from 9kHz – 30MHz (for 9kHz – 90kHz, 110kHz – 490kHz) \*See Note 5

Freq (GHz)	Peak Value (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	AV Value (dB $\mu$ V/m)	AV Limit (dB $\mu$ V/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
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Spurious Emissions ranging from 9kHz – 30MHz \*See Note 5

Frequency (MHz)	Q-P Value (dB $\mu$ V/m)	Q-P Limit (dB $\mu$ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
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Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dB $\mu$ V/m)	Q-P Limit (dB $\mu$ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
36.7030	27.1	40.0	12.9	100	315	V
48.2700	25.4	40.0	14.6	124	126	V
51.2820	28.1	40.0	11.9	131	62	V
97.5110	32.3	43.5	11.2	100	124	V
124.2020	32.4	43.5	11.1	100	100	V
712.9640	34.7	46.0	11.3	100	86	H





**RADIATED EMISSION TEST**

**47 CFR FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results**

Spurious Emissions above 1GHz – 25GHz

Freq (GHz)	Peak Value (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	AV Value (dBμV/m)	AV Limit (dBμV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
1.5989	41.0	74.0	33.0	-- *See Note 2	54.0	14.9 *See Note 3	101	359	V
2.1330	43.5	74.0	30.5	-- *See Note 2	54.0	10.5 *See Note 3	399	353	V
3.1942	42.3	74.0	31.7	-- *See Note 2	54.0	11.7 *See Note 3	101	111	H
4.2625	47.3	74.0	26.7	-- *See Note 2	54.0	6.7 *See Note 3	101	306	H
4.8306	58.8	74.0	15.2	53.9	54.0	0.1	101	328	V
7.2722	54.3	74.0	19.7	48.0	54.0	6.0	399	332	V





**RADIATED EMISSION TEST**

**47 CFR FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results**

Test Input Power	120V 60Hz	Temperature	24°C
Test Distance	3m ( $\geq 30$ MHz – 25GHz)	Relative Humidity	60%
Mode	2.4GHz Wi-Fi Audio Playback	Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin Li Chelmin Lim Kay Tak

Spurious Emissions ranging from 9kHz – 30MHz (for 9kHz – 90kHz, 110kHz – 490kHz) \*See Note 5

Freq (GHz)	Peak Value (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	AV Value (dB $\mu$ V/m)	AV Limit (dB $\mu$ V/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
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Spurious Emissions ranging from 9kHz – 30MHz \*See Note 5

Frequency (MHz)	Q-P Value (dB $\mu$ V/m)	Q-P Limit (dB $\mu$ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
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Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dB $\mu$ V/m)	Q-P Limit (dB $\mu$ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
34.7100	30.3	40.0	9.7	100	90	V
51.1640	30.0	40.0	10.0	100	90	V
91.6190	34.2	43.5	9.3	134	129	V
124.7880	35.8	43.5	7.7	100	81	V
138.3320	32.5	43.5	11.0	100	199	V
179.1530	34.5	43.5	9.0	100	269	H



**RADIATED EMISSION TEST**

**47 CFR FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results**

Spurious Emissions above 1GHz – 25GHz

Freq (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBµV/m) *See Note 2	AV Limit (dBµV/m)	AV Margin (dB) *See Note 3	Height (cm)	Azimuth (Degrees)	Pol (H/V)
2.9342	42.9	74.0	31.1	--	54.0	11.1	100	188	H
3.2013	43.9	74.0	30.1	--	54.0	10.1	100	63	H
3.4683	45.9	74.0	28.1	--	54.0	8.1	100	68	H
3.7354	49.1	74.0	24.9	--	54.0	4.9	100	275	H
4.2696	48.3	74.0	25.7	--	54.0	5.7	100	317	H
7.3985	50.0	74.0	24.0	--	54.0	4.0	300	180	V





**RADIATED EMISSION TEST**

**47 CFR FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results**

Test Input Power	120V 60Hz	Temperature	24°C
Test Distance	3m ( $\geq 30$ MHz – 40GHz)	Relative Humidity	60%
Mode	5GHz Wi-Fi Audio Playback	Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin Li Chelmin Lim Kay Tak

Spurious Emissions ranging from 9kHz – 30MHz (for 9kHz – 90kHz, 110kHz – 490kHz) \*See Note 5

Freq (GHz)	Peak Value (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	AV Value (dB $\mu$ V/m)	AV Limit (dB $\mu$ V/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
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Spurious Emissions ranging from 9kHz – 30MHz \*See Note 5

Frequency (MHz)	Q-P Value (dB $\mu$ V/m)	Q-P Limit (dB $\mu$ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
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Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dB $\mu$ V/m)	Q-P Limit (dB $\mu$ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
34.7100	29.6	40.0	10.4	100	283	V
36.2800	29.2	40.0	10.8	100	274	V
47.2700	30.4	40.0	9.6	199	26	V
91.6190	34.5	43.5	9.0	109	109	V
124.7370	35.8	43.5	7.7	100	101	V
126.3770	35.8	43.5	7.7	100	103	V



**RADIATED EMISSION TEST**

**47 CFR FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results**

Spurious Emissions above 1GHz – 40GHz

Freq (GHz)	Peak Value (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	AV Value (dBμV/m)	AV Limit (dBμV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
2.6671	49.0	74.0	25.0	-- *See Note 2	54.0	5.0 *See Note 3	200	171	H
3.7354	49.3	74.0	24.7	-- *See Note 2	54.0	4.7 *See Note 3	101	275	H
4.2615	48.3	74.0	25.7	-- *See Note 2	54.0	5.7 *See Note 3	101	311	H
4.2696	48.3	74.0	25.7	-- *See Note 2	54.0	5.7 *See Note 3	101	316	H
6.0486	56.8	74.0	17.2	37.1	54.0	16.9	200	306	H
10.4382	48.5	74.0	25.5	-- *See Note 2	54.0	5.5 *See Note 3	300	76	V





**RADIATED EMISSION TEST**

Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. As the measured peak shows compliance to the average limit, as such no average measurement was required.
3. The average margin indicates the margin of the measured peak value below the average limit.
4. "--" indicates no emissions were found and shows compliance to the limits.
5. The measurement was done at 3m. The measured results were extrapolated to the specified test limits as specified in § 15.209 (a) based on 40dB/decade.
6. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
7. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
8. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:  
30MHz - 1GHz  
RBW: 120kHz                      VBW: 1MHz  
>1GHz  
RBW: 1MHz                        VBW: 3MHz
9. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
10. The channel in the table refers to the transmit channel of the EUT.
11. Radiated Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 1GHz is  $\pm 3.8\text{dB}$  and >1GHz – 40GHz is  $\pm 4.5\text{dB}$ .



**MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST**

**47 CFR FCC Part 1.1310 Maximum Permissible Exposure (MPE) Limits**

The EUT shows compliance to the requirements of this section, which states the MPE limits for general population / uncontrolled exposure are as shown below:

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (min)
0.3 - 1.34	614	1.63	100 <sup>Note 2</sup>	30
1.34 - 30	824 / f	2.19 / f	180 / f <sup>2</sup> <sup>Note 2</sup>	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	-	-	f / 1500	30
1500 - 100000	-	-	1.0	30

Notes

- f = frequency in MHz
- Plane wave equivalent power density

**47 CFR FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Instrumentation**

Instrument	Model	S/No	Cal Due Date
PMM 8053 Portable Field Meter	8053	0220J10308	20 Jan 2019
PMM Electric Field Probe	EP330	1010J10301	20 Jan 2019

**47 CFR FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Setup**

- The EUT and supporting equipment were set up as shown on the setup photo.
- The relevant field probe was positioned at least 20cm away from the EUT and supporting equipment boundary.

**47 CFR FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Method**

- The EUT was switched on and allowed to warm up to its normal operating condition.
- The test was first carried out at one of the positions / sides of the EUT.
- Power density measurement (mW/cm<sup>2</sup>) was made using the field meter set to the required averaging time.
- Steps 2 and 3 were repeated for the next position and its associate EUT operating mode, until all possible positions and modes were measured.

**Sample Calculation Example**

At 2400 MHz, limit = 1.0 mW/cm <sup>2</sup>
Power density reading obtained directly from field meter = 0.3 mW/cm <sup>2</sup> averaged over the required 30 minutes.
Therefore, margin = 0.3 – 1.0 = -0.7 mW/cm <sup>2</sup> i.e. 0.7 mW/cm <sup>2</sup> below limit



**MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST**

**47 CFR FCC Part 1.1310 Maximum Permissible Exposure (MPE) Results**

Test Input Power	120V 60Hz	Temperature	24°C
Test Distance	20cm	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Li Chelmin

Bluetooth

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm <sup>2</sup> )	Averaging Time (min)	Limit (mW/cm <sup>2</sup> )
0 (lower ch)	2.402	0.002	30	1.0
39 (mid ch)	2.441	0.001	30	1.0
78 (upper ch)	2.480	0.001	30	1.0

2.4GHz Wi-Fi

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm <sup>2</sup> )	Averaging Time (min)	Limit (mW/cm <sup>2</sup> )
1 (lower ch)	2.412	0.003	30	1.0
6 (mid ch)	2.437	0.002	30	1.0
11 (upper ch)	2.462	0.001	30	1.0

5GHz Wi-Fi

Channel	Channel Frequency (GHz)	Power Density Value (W/m <sup>2</sup> )	Averaging Time (min)	Limit (W/m <sup>2</sup> )
36 (lower ch)	5.180	0.002	30	1.0
100 (mid ch)	5.500	0.001	30	1.0
149 (upper ch)	5.745	0.001	30	1.0

Notes

1. All possible modes of operation were investigated. Only the worst case highest radiation levels were measured. Measurements were taken at the required averaging time. All other radiation levels were relatively insignificant.
2. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
3. Maximum Permissible Exposure Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 0.1MHz – 3GHz is ±15.0%.



**Test Report No. 7191174250-EEC17/01**  
**dated 24 Nov 2017**

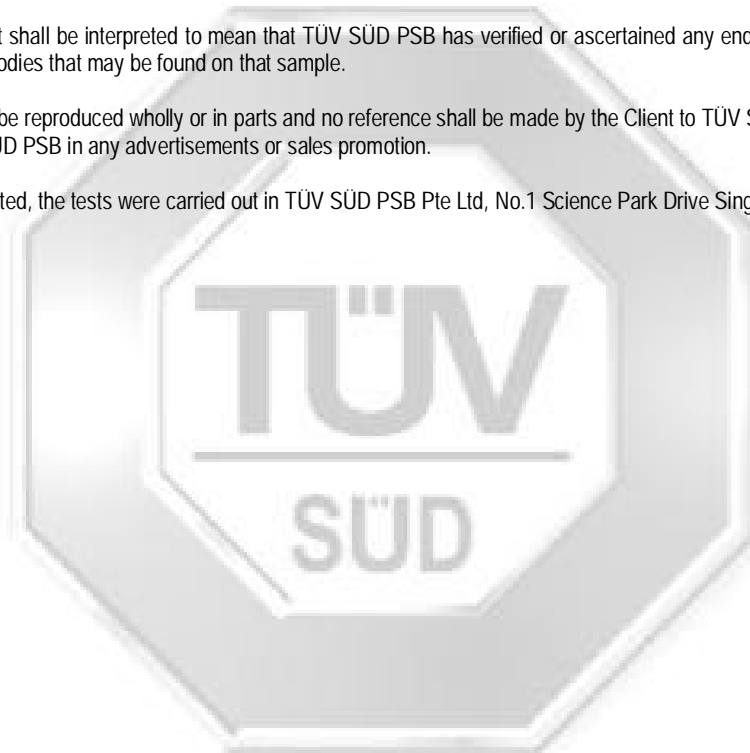


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July 2011



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**ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS**

