

HAC (Volume Control) Test Report

Application No.:	SUCR2505000494WM
FCC ID:	WYPS6002
Applicant:	Sonim Technologies, Inc.
Applicant Address:	4445 Eastgate Mall, Suite 200, San Diego, CA 92121, USA
Manufacturer:	Sonim Technologies, Inc.
Manufacturer Address:	4445 Eastgate Mall, Suite 200, San Diego, CA 92121, USA
Product Name:	Smartphone
Model No.(EUT):	X800
Type No.:	S6002
Trademark:	Sonim
Standards:	ANSI C63.19-2019 ANSI/TIA-5050-2018 47CFR Part 20.19 KDB 285076 D01 v06r04 KDB 285076 D04 v02 KDB 285076 D05 v01
Date of Receipt:	2025/05/28
Date of Test:	2025/05/28 to 2025/06/10
Date of Issue:	2025/06/13
Test conclusion:	PASS *

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

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

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Revision Record			
Version	Description	Date	Remark
00	Original	2025/06/13	/

Authorized for issue by:				
Tested By		Hainan Sun		
		Hainan Sun/Project Engineer		
Approved By		Nada Cao		
		Nada Cao/Reviewer		

2 Test Summary of Minimum Conversational Gain

Mode	Band	Conv. Gain (dB)		Limit (dB)	Result
		2N	8N		
GSM	850	7.47	12.71	≥6	Pass
	1900	7.52	12.69		Pass
WCDMA	II	7.02	12.06	≥6	Pass
	II	7.78	N/A		Pass
	IV	7.13	12.1		Pass
	V	7.19	12.27		Pass
LTE	2	7.06	12.09	≥6	Pass
	4	7.25	12.19		Pass
	5	7.14	11.81		Pass
	7	7.16	12		Pass
	12	6.93	11.89		Pass
	13	6.71	11.99		Pass
	14	6.61	11.93		Pass
	14	6.77	N/A		Pass
	25	6.87	11.96		Pass
	26	6.97	11.85		Pass
	30	7.03	12.1		Pass
	38	6.93	11.89		Pass
	41	7.02	11.94		Pass
	42	6.93	11.86		Pass
	48	6.92	11.95		Pass
	66	6.93	11.84		Pass
	71	7.04	12.17		Pass
WLAN-2.4G	802.11b	6.95	11.87	≥6	Pass
	802.11g	6.91	11.72		Pass
	802.11n	7.08	11.7		Pass
	802.11ax	7.01	11.79		Pass
WLAN-5G	802.11a	6.9	11.26	≥6	Pass
	802.11a	N/A	11.85		Pass
	802.11n	6.6	11.28		Pass
	802.11n	6.56	N/A		Pass
	802.11ac	6.63	11.47		Pass
	802.11ax	6.8	11.38		Pass
WLAN-6E	802.11ax	6.81	11.51	≥6	Pass
Minimum Conversational Gain		6.56	11.26		Pass

Note:

According to the manufacturer's statement, perform verification testing in the original report (original report number SUCR240600020104) and select the worst position for verification.

The worst case is presented by selecting the maximum value from the original report (report number SUCR240600020104) and this report (report number SUCR250500049401).

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4 General Information

4.1 General Description of EUT

IMEI:	351348280187947		
Hardware Version:	V1.0		
Software Version:	X80.0-06-14.0-19.50.00		
Antenna Type:	PIFA Antenna		
Frequency Bands:	Band	Tx (MHz)	Rx (MHz)
	GSM850	824 - 849	869 - 894
	GSM1900	1850 - 1910	1930 - 1990
	WCDMA Band II	1850 - 1910	1930 - 1990
	WCDMA Band IV	1710 - 1755	2110 - 2155
	WCDMA Band V	824 - 849	869 - 894
	LTE Band 2	1850 - 1910	1930 - 1990
	LTE Band 4	1710 - 1755	2110 - 2155
	LTE Band 5	824 - 849	869 - 894
	LTE Band 7	2500 - 2570	2620 - 2690
	LTE Band 12	699 - 716	729 - 746
	LTE Band 13	777 - 787	746 - 756
	LTE Band 14	704 - 716	734 - 746
	LTE Band 25	1850 - 1915	1930 - 1995
	LTE Band 26	814 - 849	859 - 894
	LTE Band 30	2305 - 2315	2350 - 2360
	LTE Band 38	2570 - 2620	2570 - 2620
	LTE Band 41	2496 - 2690	2496 - 2690
	LTE Band 42	3400 - 3600	3400 - 3600
	LTE Band 48	3550 - 3700	3550 - 3700
	LTE Band 66	1710 - 1780	2110 - 2200
	LTE Band 71	663 - 698	617 - 652
	Wi-Fi 2.4G	2402~2462	2402~2462
		5150~5250	5150~5250
	Wi-Fi 5G	5250~5350	5250~5350
		5470~5725	5470~5725
		5725~5850	5725~5850
	Wi-Fi 6E	5925 - 6425	5925 - 6425

4.2 Air interfaces and Operation Mode.

Air Interface	Type	ANSI C63.19 Tested	Simultaneous Transmitter	Name of Voice Service	Power Reduction
GSM	VO	Yes	BT, WLAN	CMRS Voice	NO
EDGE	VD	Yes		Google Duo*	NO
WCDMA	VO	Yes		CMRS Voice	NO
LTE	VD	Yes		VoLTE Google Duo*	NO
WLAN	VD	Yes	WWAN		NO

Transport Type:
VO: Legacy Cellular Voice Service
DT: Digital Transport (no voice)
VD: IP Voice Service over Digital Transport

Note:

- a) *For protocols not listed in Table 6.1 of ANSI C63.19, the average speech level of -20 dBm0 should be used.
- b) Per KDB 285076 D05, Wavier DA 23-914 only requires conversational gain compliance for CMRS narrowband and CMRS wideband voice codecs as stated below. All other codecs either part of 3GPP set such as full-band and super-wideband codecs or OTT codecs are to be documented in the test report but not required to comply with the ANSI/TIA 5050 Volume Control Standard
- c) The device has similar frequency in some LTE bands: LTE B2/25, LTE B4/66, LTE B5/26, LTE B12/17 since the supported frequency spans for the narrower LTE bands are completely cover by the wider LTE bands, therefore, only wider LTE bands were required to be tested for hearing-aid compliance.
- d) The test channel is middle channel of each operation band.

EUT support Codec for Volume control test

Air interface	Audio Codec Evaluated
GSM	HR V1, FR V1, FR V2
WCDMA	AMR-NB,AMR-WB
LTE	AMR-NB,AMR-WB,EVS-NB,EVS-WB
WLAN	AMR-NB,AMR-WB,EVS-NB,EVS-WB

Codec /Birate					
NB AMR	WB AMR		EVS NB	EVS WB	
4.75 Kbps	6.60Kbps	18.25Kbps	5.9Kbps	5.9 Kbps	24.4Kbps
5.15Kbps	8.85Kbps	19.85Kbps	7.2Kbps	7.2Kbps	32Kbps
5.90Kbps	12.65Kbps	23.05Kbps	8.0Kbps	8.0Kbps	48Kbps
6.60Kbps	14.25Kbps	23.85Kbps	9.6Kbps	9.6Kbps	64Kbps
7.40 Kbps	15.85Kbps		13.2Kbps	13.2Kbps	96Kbps
7.95Kbps			16.4Kbps	16.4Kbps	128Kbps
10.20Kbps			24.4Kbps		
12.20Kbps					

4.3 Test Environment

Temperature	Relative humidity
Relative humidity	54%
Atmospheric pressure	101.7kPa
Background Noise	15dB

4.4 Measurement Uncertainty

For ANSI/TIA-5050 testing, the EUT was linked and controlled by base station emulator. Communication between the EUT and the emulator was established by coaxial connection. The EUT was set from the emulator to radiate maximum output power during testing. Also EUT was set to backlight off during testing.

Test Item	Uncertainty
Receiving volume control	1.7dB
Receiving distortion and noise	1.7dB
Receiving frequency response	1.7dB

Note:

- a) All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2.
- b) Depends on the microphone calibration. The value is valid if calibration is carried out with recommended pistonphone/calibrator in the HMS II.3 manual.
- c) Time and frequency accuracies of labCORE determined by the internal clock accuracy. The time and frequency resolution and accuracy may change due to analysis of the digital signals in ACQUA or if an external clock is applied.

4.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch
No. 10, Weiye Road, Kunshan Development Zone, Suzhou, Jiangsu, China

No tests were sub-contracted.

Note:

- a) SGS is not responsible for wrong test results due to incorrect information (e.g., max. internal working frequency, antenna gain, cable loss, etc) is provided by the applicant. (If applicable).
- b) SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (If applicable).
- c) Sample(s) provided by customer.

4.6 Test Facility

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

• **A2LA**

SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 6706.01.

• **FCC**

SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch has been recognized by FCC as an accredited testing laboratory. Designation Number: CN1387.

• **ISED**

SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch has been recognized by ISED as an accredited testing laboratory. Company Number: 32368

5 Equipment list

Equipment	Model	Equipment No.	Cal Data	Cal Due Data
Microphone	46AE	KSES307108	2024-06-13	2025-06-14
Sound calibrator	GRAS 42AG	KSES304302a	2024-06-13	2025-06-14
HEAD Measurement System	HMS II.3-LN	KSES330101	/	/
Multi-channel audio Analyzer	Labcore	KSES304303	2024-06-13	2025-06-14
Radio communication tester	CMW 500	SUWI-01-16-05	2025-01-20	2026-01-19
Radio communication tester	CMX 500	SUWI-01-56-02	2025-01-16	2026-01-15
Acoustic Chamber	/	KSES330801	2025-02-06	2027-02-05

6 Volume Control Requirement

Conversational Gain

- a) Per KDB 285076 D05, with a mounting force of 8N, the DUT shall have at least one volume control setting that will produce a conversational gain of $\geq 6\text{dB}$.
- b) Per KDB 285076 D05, with a mounting force of 2N, the DUT shall have at least one volume control setting that will produce a conversational gain of $\geq 6\text{dB}$.
- c) Calculate the Conversational Gain by subtracting 70 from the measures SPL.

[Conversational Gain = (Measured SPL Level-70dsSPL)]

Receive Distortion and Noise Performance:

With a mounting force of 8N and 2N, the ratio of the stimulus signal power to the 100Hz to 8000Hz total A-weighted distortion and noise power shall $\geq 20\text{dB}$ when tested over the range of 1/3 octave band center frequencies:

- a) Narrowband transmission mode: Each 1/3 octave band center frequency from 400Hz to 3150Hz.
- b) Wideband transmission mode: Each 1/3 octave band center frequency from 250Hz to 5000Hz.
- c) Per K 285076 D05, choose one narrowband and one wideband for all voice services, bands of operation and air interfaces over which it operates using one codec bit rate of the applicant's choosing to meet Receive Distortion and Noise Performance requirement.

Receive Acoustic Frequency Response Performance:

- a) For the volume control settings determined in ANSI/TIA-5050 section 5.1.1 with a mounting force of 8N and 2N, the receive frequency response shall be measured at the DRP in 1/12 octave bands. After translation to the FF, it shall fall between the applicable upper and lower limits. The exact limit values at any 1/12 octave band center frequency falling between two consecutive points specified in the table may be calculated using the formula given in Eq 2 below:

$$X_f = X_1 + (X_2 - X_1) * \left(\frac{\log_{10} f - \log_{10} f_1}{\log_{10} f_2 - \log_{10} f_1} \right) \quad \text{Eq 2}$$

Where

X_f = limit value at frequency f

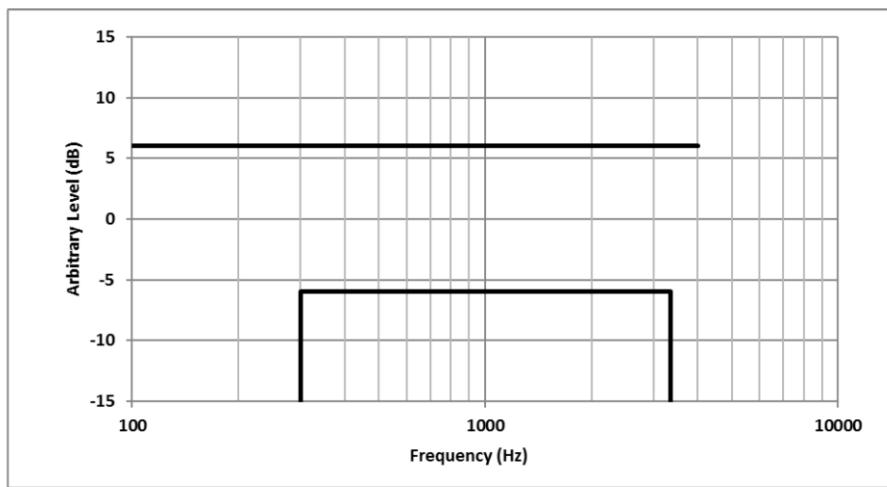
X_1 = limit value at frequency f_1 as given in table

X_2 = limit value at frequency f_2 as given in table

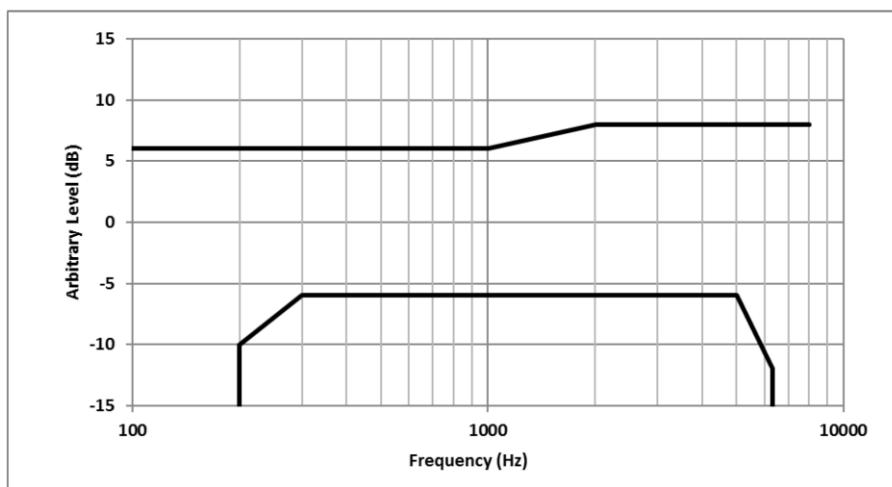
- b) For Narrowband: The 1/12 octave band frequency response after translation to the FF shall fall between the upper and lower limits (Arbitrary level) given the Table 1.
- c) For wideband: The 1/12 octave band frequency response after translation to the FF shall fall between the upper and lower limits (Arbitrary level) given the Table 2.

Table 1 – Narrowband Receive Frequency Response Limits

Lower Limit Frequency (Hz)	Lower Limit (dB)	Upper Limit Frequency (Hz)	Upper Limit (dB)
300	-6	100	+6
3400	-6	4000	+6

**Figure 2 – Narrowband Receive Frequency Response Limits****Table 2 – Wideband Receive Frequency Response Limits**

Lower Limit Frequency (Hz)	Lower Limit (dB)	Upper Limit Frequency (Hz)	Upper Limit (dB)
200	-10	100	+6
300	-6	1000	+6
5000	-6	2000	+8
6300	-12	8000	+8

**Figure 3 – Wideband Receive Frequency Response Limits**

7 Measurement Procedure

According to ANSI /TIA-5050, the test procedure for wireless communications device is as below.

Conversational Gain

- a) Configure the DUT with a mounting force of 8N and test equipment as shown in section 4 in an active call state with the applicable codec for the transmission mode under test.
- b) Set the DUT volume control to the maximum setting.
- c) If the DUT has an adjustable tone control feature, a tone control setting that meets the frequency response requirements in ANSI/TIA-5050 section 5.3.1 shall be used.
- d) The ACQUA system is apply the real speech test signal at a level of -20dBm0 at the RETP and measure the acoustic output at the Drum Reference Point (DRP) over one complete sequence of the test signal.
- e) Translate the measurement made at DRP to Free Filed (FF) using the translation data in ANSI/TIA-5050 AnnexB.
- f) Over the applicable frequency band, determine the ASL in SPL for the resulting sound pressure level in accordance with Method B of ITU-T Recommendation P.56,
Narrowband 100Hz through 4000 Hz
Wideband 100Hz through 7720 Hz

Calculate the Conversational Gain by subtracting 70 from the measured dB SPL.

[Conversational Gain = (Measured dB SPL Level – 7dB SPL) dB]

- g) Measure output distortion per ANSI/TIA-5050 clause 5.2. If a distortion failure occurs at the maximum volume control setting, reduce the volume control setting and repeat the measurement to determine if a setting can be found for which the conversational gain requirement is met without a distortion failure.
- h) Repeat steps 2-8 with a mounting force of 2N.

Receive Distortion and Noise Performance:

- a) Configure the DUT with a mounting force of 8N and test equipment as shown in section in an active call state with the applicable codec for the transmission mode under test.
- b) Receive distortion and noise is measured using the PN-SDNR procedure.
- c) To ensure DUT activation, apply the real speech test signal at a level of -20 dBm0 followed immediately by the initial 1/3 octave center frequency PN test signal based on the narrowband or wideband operating mode.
Measure the acoustic output at the DRP over the complete sequence of the PN test signal.
- d) Translate the measurement made at DRP to the FF.
- e) Calculate the acoustic out unweighted test signal power of the stimulus measurement band.
- f) Calculate the notched A-weighting distortion and noise components.
- g) Calculate the ratio of signal power to the total A-weighted distortion and noise power ad follow:
$$\text{PN-SDNR (dB)} = 20 * \log \left[\frac{\text{measured stimulus amplitude}}{\text{measured distortion amplitude}} \right]$$

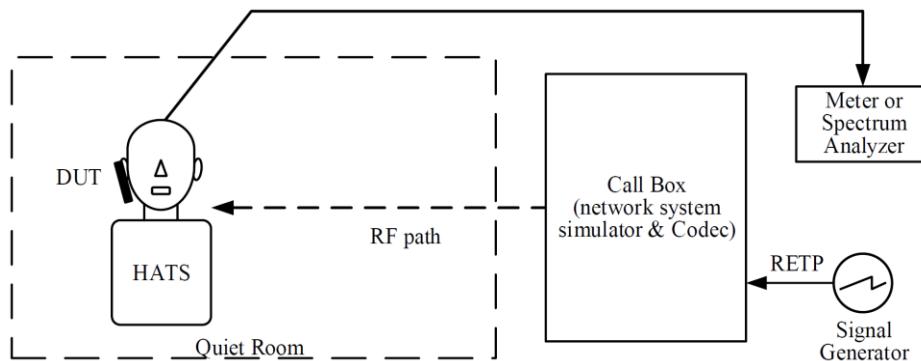
- h) Repeat for each of the remaining 1/3 octave center frequencies based on the narrowband or wideband operating mode.
- i) Repeat steps 2-8 with a mounting force of 2N.

- j) The measured value that the system equipment will automatically calculate or converts to define whether it meets the requirements of ANSI/TIA-5050.

Receive Acoustic Frequency Response Performance:

- a) Configure the DUT with a mounting force of 8N and test equipment as shown in Figure 1 in an active call state with the applicable codec for the transmission mode under test.
- b) If the DUT has an adjustable tone control feature the initial measurement is to be performed with the default tone control setting.
- c) Apply the real speech test signal with a level of -20 dBm0 at the RETP.
- d) Capture the frequency spectrum at the DRP of the HATS using real-time analysis with 1/12 octave bands over the frequency range from 100 Hz to 4000 Hz for narrowband measurements, or over the frequency range from 100 Hz to 8000 Hz for wideband measurements, averaged over the entire duration of the test signal.
- e) Transform the DRP frequency spectrum measurement to the FF.
- f) Divide the 1/12 octave measurement data by the 1/12 octave frequency spectrum of the test signal at the RETP and present the measurement in terms of (Pa/V).
- g) Apply the applicable frequency response limits to determine compliance.
- h) If the default tone control setting does not meet the requirement, repeat the above steps for other tone control settings to determine a tone control setting that meets the requirements.
- i) Repeat with a mounting force of 2N.
- j) The receive acoustic frequency response performance was perform at max tone control setting.

8 System Description



Above is the measurement set-up diagram, and the sequence of the measurement is Volume Control testing procedure over a wireless communication device:

- In order to satisfy the quiet room condition below 40 dBA background noise according to TIA-5050 standard, HATS and DUT were placed in Acoustic Chamber and the noise level was checked using Sound Level Meter 46AE.
- labCORE equipment is used for signal generator and meter. This equipment directly provided operating voltage for HATS's microphone and -20 dBm0 sound source to Call Box RETP Point.
- CMW500 Call box was used for GSM, WCDMA, LTE and WIFI call tests, where the audio input level was set to 1.572 V so that the signal source level supplied from labCORE to RETP matched -20 dBm0. When testing NR calls using CMX500 Call box.
- Handset Position, in all tests, handset was placed at the standard test position of IEEE std 269.

9 Test Result

Refer to Appendix A - Volume Control Test Data and Plots.

10 Test Setup Photo



11 EUT Constructional Details (EUT Photos)

Refer to Appendix - Photographs of EUT Constructional Details for SUCR2505000494WM.

--- End of the Report ---