Federal Communications Commission
Office of Engineering and Technology
Laboratory Division

2/23/2022

GUIDANCE FOR PERFORMING VOLUME CONTROL MEASUREMENTS ON MOBILE HANDSETS

I. INTRODUCTION

In 2021, the Federal Communications Commission (FCC) amended its hearing aid compatibility (HAC) rules to incorporate by reference the ANSI C63.19-2019 technical standard for determine hearing aid compatibility. This standard become effective June 4, 2021 and for the first time includes a volume control requirement. The standard uses the TIA-5050 volume control standard. The volume control part of the ANSI C63.19-2019 standard addresses the needs of those who use hearing aids and cochlear implants along with those with hearing loss who do not wear cochlear implants or other such hearing aid devices.[1] The ANSI C63.19-2019 standard requires that for a handset model to be certified as HAC, the handset model meet the TIA-5050 volume control standard, along with the rest of the ANSI C63.19-2019 standard.[2]

The purpose of this document is to provide specific guidance and clarification with respect to the volume control requirements defined in TIA-5050.

II. TEST CONSIDERATIONS

A mobile handset must meet the volume control requirements on all air interfaces as required by §20.19(b)(3) which states, "a handset is hearing aid-compatible if it meets the 2019 ANSI standard for all frequency bands and all air interfaces over which it operates." This guidance does not require every combination of codec, codec data rate, air interface, band, band channel, bandwidth, modulation data rate, subcarrier spacings, and resource blocks to be documented in a test report. However, it is expected to investigate and document only the worst-case test conditions and results. Each submitted test report shall document the codec type (i.e., NB, WB, EVS, etc.), every air interface (i.e., LTE, 5G NR, WI-FI), and band supported for the worst-case codec bit rate, band channel, bandwidth, air interface bit rate, subcarrier spacings, and resource blocks, for the handset to be considered compliant to §20.19(b)(3).

To be compliant, at least one volume control setting must meet the test requirements with a mounting force at both 8N and 2N[3].

The ambient noise of the quite room shall not exceed 40 dBA.

Handsets that support alternative audio functions such as automatic gain control and amplification are not covered by TIA-5050. Those alternative audio functions are therefore not required to meet the volume control requirements. If a handset supports audio functions such as automatic

---

[1] Report and Order (FCC 21-28, released February 22, 2021, WT Docket No. 20-3).

[2] Compliance to TIA-5050 is required as defined in section 7 of ANSI C63.19-2019.

[3] 8N force is used for testing requirements related to use by persons without hearing devices. 2N force is used for testing requirements related to use by persons with hearing devices.
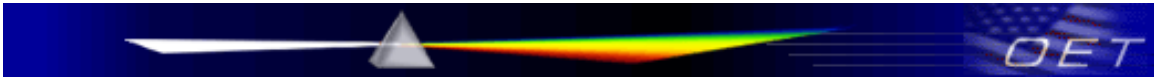
gain control and no other volume control mechanisms, then those audio functions shall meet the volume control requirements.

III.   TECHNICAL REQUIREMENTS

A.   Receive Volume Control Performance

The procedures for the receive volume control performance can be found in section 5.1 of TIA-5050. An ITU-T P.58 compliant Head and Torso Simulator (HATS) is required for all testing. Irrespective of codec or air interface tested, the test signal must be used in accordance with IEEE standard 269 based on the uncompressed real male speech with an active speech level (ASL) of -20 dBm0. [4]

B.   Receive Distortion and Noise Performance

Special attention should be given to Narrowband and Wideband transmissions ensuring that appropriate limits are chosen based on codec performance. For codecs with performance that exceeds wideband codecs (i.e. exceeding 50 to 7,000 Hz), the wideband limits are applicable. [5] For example, for super wideband or full band codecs, as defined by 3GPP TS26, measure the ASL frequency response for the sound pressure level from 100 to 7,720 Hz.

C.   Receive Acoustic Frequency Response Performance

The device shall meet the frequency response requirements at both 2N and 8N mounting force as specified in section 5.3 of TIA-5050. Measurements shall be taken at the DRP and transformed to either the Free Field (FF) or Diffuse Field (DF)[6]. The 1/12 octave band frequency listed in TIA-5050 Tables B.1 and B.3 shall be used for all frequency response measurements. [7]

IV.   SPECIAL CONSIDERATIONS

Pre-installed over-the-top (OTT) services, such as Google Duo and Apple Face Time, shall be compliant with TIA-5050. [8]

V.   TEST DATA PRESENTATION

TIA-5050 contains no specific requirements for test data presentation; however, there are several recommendations which will enhance the review process. Follow the general test report format and reporting best practices similar to those outlined in ANSI C63.19-2019 section 9.

---

[4] The alternative ASLs provided by ANSI standard C63.19-2019 for T-coil testing are not applicable for volume control measurements.

[5] The 3GPP specification include provisions for Super-wideband (SWB) and Full band (FB) codecs which have enhanced bitrates and audio bandwidths which exceed the definition of wideband as defined in section 4.5.2 of TIA-5050.

[6] The DF transform is only to be used when measuring the frequency response of a device as specified in the 3GPP TS 26.131 and measured in accordance with TS 26.132. Use the FF transform for all other measurements.

[7] The R40 frequency spacing, as shown in Tables B.2 and B.4 of TIA-5050, are presented for reference only.

[8] OTT services are defined in KDB publication 285076 D03 Question 1.
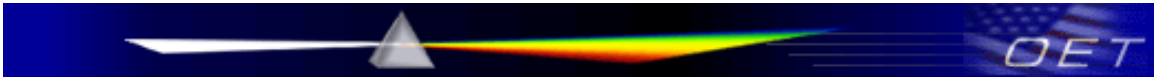
The Volume Control Report shall be submitted as a separate test report exhibit. Include a summary data table in the forward or executive summary including at least one result that is compliant with the test standard for each codec. Also include in the summary test data table any codecs which fail and their passing volume control settings to indicate appropriate mitigation steps were taken. It is recommended that the summary test data table include cross references to section or page numbers facilitate in the review process. An example is provided in Table V-1.

In addition to a summary test data table, include the following in the test report:

1. A list of applicable codecs

2. Evidence of compliance to ambient noise allowance

3. Detailed measured gain

4. Detailed measured distortion in dB

5. Frequency response plots for each codec used showing correct reference to either FF or DF

6. Frequency response data showing 1/12 octave bands; this may be presented as graphical or tabulated data. Table V-1. Example Test Data Summary Table

Codec	Volume Control Setting	Tone Control Setting	Mounting Force (N)	Wideband or Narrowband	Conversational Gain (dB) *Doc. Section*	Volume Control Limit (dB)	Minimum PN-SDNR (dB) *Doc. Section*	Frequency Response (P/F) *Doc. Section*

1. Volume Control Setting listed in terms of percent of maximum or in decibels relative to maximum, however this is displayed on the device. If the device does not support a numerical representation of the volume control setting, some description of the volume setting needs to be included by the host manufacturer if the handset does not meet the volume control requirements at the maximum volume setting.

2. Tone Control Setting (if applicable) is listed for tone control settings that meet the TIA-5050 section 5.3.1 requirements.

3. Conversational Gain listed as calculated conversational gain [Conversational Gain = (measured dBSPL Level – 70 dB) dB].

4. The Document Section number is used as a quick reference to determine where in the document the detailed results can be found.

5. Measured PN-SDNR shall be $\geq$ 20dB as stated in TIA-5050.

6. Frequency response can be given in a pass/fail format. Plot the measured frequency response against the limits in the appropriate test report section or appendix.
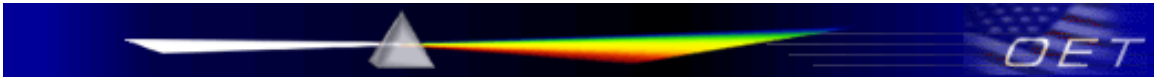
Change Notice;

10/24/2022: 285076 D04 Volume Control v01 was replaced by 285076 D04 Volume Control v01r01: Section II. TEST CONSIDERATIONS was clarified to be consistent with the requirements in the rules §20.19(b)(3).