

**Federal Communications Commission
Office of Engineering and Technology
Laboratory Division Public Draft Review**

Draft Laboratory Division Publications Report

Title: 285076 C63.19-2019 Update DR04-44373

Short Title: C63.19-2019 Update

Reason: Report and Order FCC 21-28 adopted February 16, 2021; effective June 4, 2021
adopted C63.19-2019

Publication: 285076

Keyword/Subject: Section 20.19, Hearing Aid Compatibility, HAC

First Category: Administrative Requirements

Second Category: Hearing Aid Compatibility

Question: What are the equipment authorization requirements for hearing aid compatibility of mobile handsets?

Answer:

The following documents provide guidance on the equipment authorization of RF devices subject to the Hearing Aid Compatibility (HAC) rules:

285076 D01 HAC Guidance v06 provides equipment authorization guidance for mobile handsets subject to the requirements of section 20.19 for hearing aid compatibility.

285076 D02 T-Coil testing for CMRS IP v04 1 provides guidance for T-Coil tests for voice-over-IP (e.g., LTE and Wi-Fi) CMRS based Telephone Services.

285076 D03 HAC FAQ v05 provides answers to several Frequently Asked Questions.

285076 D04 Volume Control v01 provides guidance for testing to ANSI TIA 5050.

Attachment List:

[285076 D01 HAC Guidance v06 *](#)

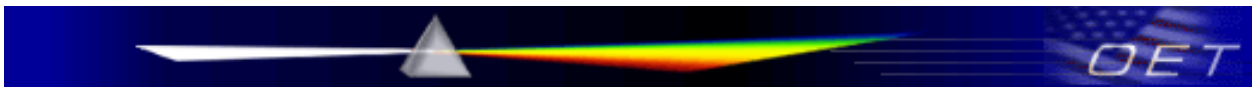
[285076 D02 T-Coil testing for CMRS IP v04 *](#)

[285076 D03 HAC FAQ v05*](#)

[285076 D04 Volume Control v01**](#)

* Update

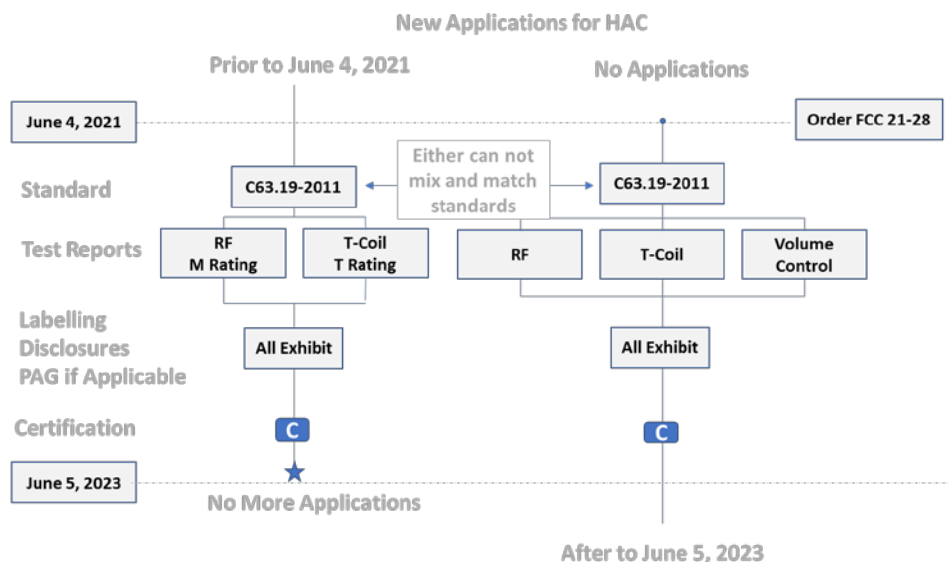
** New Publication



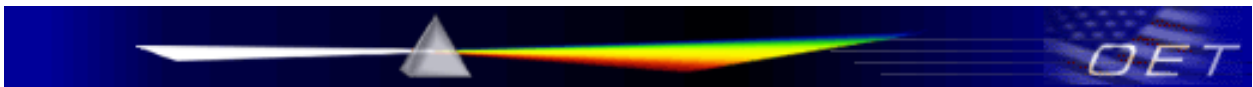
EQUIPMENT AUTHORIZATION GUIDANCE FOR HEARING AID COMPATIBILITY

1. Introduction

- a) This publication provides guidance on the Hearing Aid Compatibility (HAC) equipment authorization requirements for wireless handsets, subject to section 20.19¹, and submitted for certification.
- b) Manufacturers of wireless handsets that are seeking certification of a handset as hearing aid compatible under section 20.19 must submit, as part of the equipment certification process, a test report that demonstrates HAC compliance in accordance with ANSI C63.19-2011 or ANSI C63.19-2019 for a two year transition period until June 4, 2023. Starting on June 5, 2023, test reports must demonstrate compliance with ANSI C63.19- 2019.
- c) During the transition period, submitted test reports must use either ANSI C63.19-2011 or C63.19-2019 in their entirety and cannot mix and match requirements from both versions.
- d) A handset that provides digital mobile service for two-way voice communications as defined in section 20.19(a) must demonstrate compliance with the bands covered by either ANSI C63.19-2011 or ANSI C63.19-2019, depending on which standard is being used for certification purposes, but is not required to demonstrate HAC compliance for bands not covered by the relevant standard.
- e) However, handsets that do operate (as defined in d above) in bands not covered by the relevant standard require disclosure statements as defined in section 20.19(f)(2)(iv).
- f) For test reports submitted under ANSI C63.19-2019 it is required to meet section 7 of the standard for volume control requirements. Section 7 of the standard requires compliance to ANSI/TIA-5050-2018 Receive Volume Control Requirements for Wireless (Mobile) Devices. *See 285076 D04 Volume Control included as an attachment to this Publication 285076.*
- g) A handset that demonstrates compliance to ANSI C63.19-2011 shall be rated in accordance with section 20.19(b)(2) (i) M and T ratings. Handsets that demonstrate compliance to C63.19-2019 shall be rated as hearing aid compatible in accordance with section 20.19 (b)(2), (ii) as hearing aid compatible.



¹ Section 20.19 as amended by Order FCC 21-28 adopted February 16, 2021, effective June 4, 2021.



2. Equipment Certification Application Filing Requirements

- a) The HAC test report must be submitted as an exhibit with an application for equipment certification, either in an original application, or in a Class II Permissive Change application to add or change the HAC rating of a handset subject to section 20.19.
- b) For ANSI C63.19-2011, a certification application associated with a HAC-tested handset must include an exhibit containing one complete RF interference (M) test report for each model marketed and reported and one complete T-Coil magnetic coupling report².
- c) For ANSI C63.19-2019, a certification application associated with a HAC-tested handset must include an exhibit containing: one complete RF interference test report, one complete T Coil magnetic coupling report, and one complete volume control test report (*see* D04) for each model marketed and reported.
- d) Concurrent connections or concurrent services are modes that permit active voice calls at the same time with other active connections for data or other voice calls. For the purposes of this document, “concurrent connections” are considered in two categories: (i) concurrent connections using simultaneous transmissions³; and (ii) concurrent connections not using simultaneous transmissions.
 - 1) At present ANSI C63.19-2011 does not provide simultaneous transmission test procedures; therefore, handsets that have the ability to support concurrent connections using simultaneous transmissions shall be independently tested for each air interface/band given in ANSI C63.19-2011.
 - 2) Handsets tested to ANSI C63.19-2019 must demonstrate compliance to clause 4.6 Multiple simultaneous transmitters of ANSI C63.19-2019.
 - 3) Handsets that provide concurrent connections not using simultaneous transmissions, such as time division multiplexing over the same air interface or packet IP multiplexing with an air interface/band(s) covered in ANSI C63.19-2011 or ANSI C63.19-2019, shall be tested in both modes (non-concurrent and concurrent) to determine the worst-case mode for determining the HAC rating. The worst-case mode⁴ shall be documented in the test report.
 - 4) All air interfaces/bands that can be operated in a concurrent connection mode with another air interface/band (simultaneous transmission or other concurrent connection mode) shall be indicated in the test report. The test report shall identify the mode (simultaneous transmission or other) and the operation with which the indicated mode is concurrent.

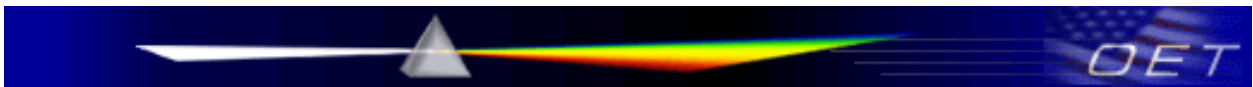
3. Test Report Exhibits

- a) An example of the items to be included in the test report is provided in Appendix A.
- b) In addition, test reports should include a list of air interfaces and bands (*see* Appendix B for an example of the list to be provided).

²M rating only for reporting HAC rating is no longer permitted.

³ Concurrent connections using simultaneous transmissions (as defined for this document) means transmitters that are radiating simultaneously, establishing independent concurrent connections, operating over separate or the same air interfaces/bands, such that each air interface/band transmission is contributing to the radiated field. Until measurement procedures are provided for simultaneous transmissions, devices offering this capability are not required to be tested in the simultaneous transmission mode. NOTE: Transmitters radiating simultaneously, establishing a single bonded connection, are not considered concurrent simultaneous transmissions, and must be tested for that mode.

⁴ The worst-case mode might not be under the condition where multiple connections are multiplexed over a single air interface transmission.



- c) MIF evaluation section.
 - 1) If the MIF values are tested, include a description of the method and test equipment (manufacturer and model number) used to establish the Modulation Index Factor (MIF) (as described in 5.5.1.3 of ANSI C63.19-2011 and ANSI C63.19-2019).
 - 2) If the handset uses the MIF values predetermined by the test equipment manufacturer: (i) provide a separate exhibit or attestation, signed by the applicant (device manufacturer) that states the values used represent worst-case air interfaces and operation of the device; and (ii) list the same MIF value specified by the test equipment manufacturer in the test report. For the MIF values used, document the version number/version date of the MIF values provided (manufacturer files, etc.) and the supporting documentation for the related (version number/version and date) values.
- d) Telecoil (T-Coil) testing is to be performed in accordance with 7.3.2 (Base station simulator method) or 7.3.3 (Manufacturers test mode method) of ANSI C63.19-2011 or ANSI C63.19-2019. *See also* KDB Publication 285076 D02 for additional guidance.
- e) When handsets are demonstrating HAC compliance to ANSI C63.19-2019 for GSM air interfaces clearly indicate in the test report if 6.6.4.2 Non-2G GSM operating modes or 6.6.4.3 2G GSM operating modes was used.

4. Grant Note Codes

Use a Form-731 grant note code of “HC” in the grant note field for the frequency bands and air interfaces for which the tests have been performed and the HAC rating obtained.⁵

5. Grant Comments

- a) Add the text indicating the HAC rating in the grant comments field: *M#T#-2011* or *HAC-2019*.
- b) The grant not HC adds the following text to the grant: “This equipment complies with the hearing aid compatibility technical requirements of Section 20.19 of the rules”.
- c) When multiple models⁶ have been offered with different HAC ratings under the same FCC ID, the HAC ratings must list the ratings for each model: “HAC Rating: *M3T3-2011*, *M4T4-2011*, *HAC-2019*.” Different Ratings for different models are separated by a Comma. It is not required to list the actual models associated with the multiple ratings in the Grant Comment of the equipment authorization.

6. Labeling, Insert or Handset Manual, and Disclosures

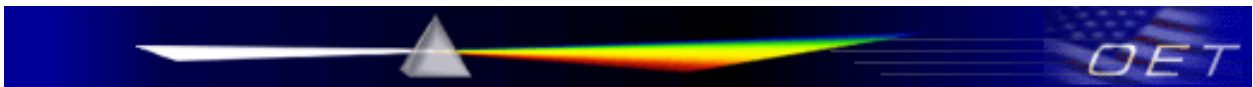
The user manual exhibit shall demonstrate the required disclosure statements as specified in section 20.19(f). This includes, as appropriate:

(f) Labeling and disclosure requirements

- (1) **Package label.** For all handset models certified to be hearing aid-compatible, manufacturers and service providers shall ensure that the handset’s package label states that the handset is hearing aid-compatible and the handset’s actual conversational gain with and without a

⁵ Use of the HX code is no longer required.

⁶ Manufacturers must file a yearly report to the Wireless Telecommunication Bureau (WTB) for Hearing Aid Compatibility Status under 20.19(i)- Reporting requirements-for the models tested. However, for the Equipment Authorization System (EAS) the test reports and Grant Comments do not need to identify which HAC test report or grant comment rating is associated with the specific models that were reported to WTB. Only the test reports results need to match the ratings reported for the set of models under that FCC ID.



hearing aid if certified using a technical standard ANSI C63.19-2019 with volume control requirements. The actual conversational gain displayed with a hearing aid shall be the lowest rating assigned to the handset for any covered air interface or frequency band.

(2) Package insert or handset manual. For all handset models certified to be hearing aid-compatible, manufacturers and service providers shall disclose to consumers using a package insert or in the handset's user manual:

- i. That the handset is hearing aid-compatible;
- ii. The ANSI standard used to determine the hearing aid compatibility of the handset model's air interfaces and frequency bands;
- iii. If using the ANSI C63.19-2011 standard or an earlier version of the standard, the lowest hearing aid compatibility rating assigned to any of the covered air interfaces or frequency bands;
- iv. The air interfaces or frequency bands on the handset that are not certified to be hearing aid-compatible, if applicable, or have been determined to be hearing aid-compatible under special testing circumstances;
- v. Any handset model certified to be hearing aid-compatible for some but not all of the air interfaces or frequency bands covered by the model must include the following disclosure language:

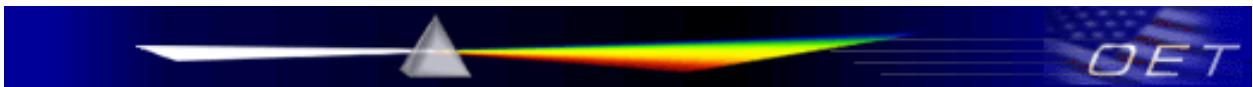
This phone has been tested and certified for use with hearing aids for some of the wireless technologies that it uses. However, there may be some newer wireless technologies used in this phone that have not been tested yet for use with hearing aids. It is important to try the different features of this phone thoroughly and in different locations, using your hearing aid or cochlear implant, to determine if you hear any interfering noise. Consult your service provider or the manufacturer of this phone for information on hearing aid compatibility. If you have questions about return or exchange policies, consult your service provider or phone retailer.

- vi. An explanation of the ANSI rating system, which includes an explanation that the ANSI C63.19-2019 standard does not use the rating system that older versions of the standard used;
- vii. An explanation of a handset model's volume control capabilities, including its conversational gain both with and without hearing aids, if the handset is certified using a technical standard that includes volume control requirements; and
- viii. An explanation of special testing circumstances, if a handset model has air interfaces that have been certified as hearing aid-compatible under such circumstances, and how these circumstances affect the use and operation of the handset.

7. Permissive Changes, Product Changes, and Model Variations

- a) Multiple compliance reports under a single FCC ID that represent distinct models⁷ with different HAC ratings are permissible.
- b) A Class II permissive change application must contain a complete HAC compliance report for all applicable air interfaces/bands.
- c) It is permissible to apply for a Class II Permissive Change under the same FCC ID to evaluate a new model for a new rating under ANSI C63.19-2011 or under ANSI C63.19-2019. In both cases, a new

⁷ Distinct models are defined in section 20.19(a). If a manufacturer assigns different model designations solely to distinguish units sold to different carriers (for either the same or different FCC IDs), or to signify other distinctions that do not relate to either form, features, or capabilities, such designations shall not count as distinct models for purposes of compliance to the required schedules set out in sections 20.19(c).



model designation is required to distinguish between the model and the rating. However, the model designation is not required to be listed in the Grant comments. The responsibility to report by FCC ID and model number is not an equipment authorization requirement but a reporting requirement under section 20.19(i). Section 20.19(i) sets out Wireless Telecommunication Bureau HAC reporting requirements.

- d) A permissive change is permitted for multi-band and multi-mode handsets that were previously tested under ANSI C63.19-2007 and can now be tested under ANSI C63.19-2011 or ANSI C63.19-2019 to include all the additional bands and modes. The new standard must be used to test all the modes and air interfaces covered in ANSI C63.19-2011 or ANSI C63.19-2019. If the HAC rating changes, then a new model designation must be assigned to ensure distinction from the prior version.
- e) Any changes⁸ that affect the HAC rating must be reported as a Class II permissive change. The handset must be given a new model designation distinct from that of the prior version of the handset.
- f) When seeking a Class II permissive change by adding a T-Coil rating using the ANSI C63.19-2011 standard, a complete M-rating report and a complete T-rating report must be submitted with the certification application. Only if there has been no product change to add the T-Coil, or the T-Coil is at the same location as the acoustical output location (*see* 5.5 of ANSI C63.19-2011), can the previous M-rating report be resubmitted as an exhibit in the permissive change application. This is because it is possible that under a single FCC ID there could be model variations with different M-ratings. A T-rating report must be associated with its specific M-rating report⁹.
- g) Volume control cannot be added to a ANSI C63.19-2011 test report. It is permissible to add a C2PC as a distinctive model variant to FCC ID for compliance to ANSI C63.19-2019. In this case all three test reports must be added to the model variant.
- h) If the manufacturer builds the product with alternative components, it must be tested to show compliance using the components representing the worst-case situation, according to the guidance for the permissive change procedure.¹⁰

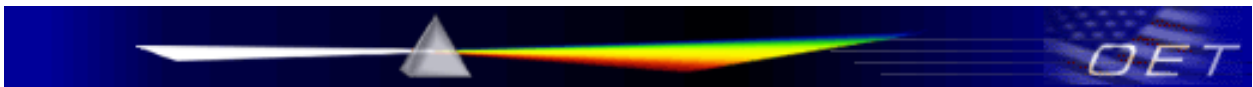
8. Testing Guidance

- a) HAC test environments (probes, equipment, test fixtures, etc.) must be properly calibrated according to manufacturer's and ANSI C63.19 requirements.
- b) Testing must be done in accordance with ANSI C63.19 under the worst-case operating mode (highest interference potential that results in a lower rating).
- c) No external special parts or ancillary devices are permitted in order to demonstrate HAC compliance.
- d) In many cases, HAC guidance permits investigations to determine worst case conditions to minimize what is reported in the test reports. It is the responsibility of the manufacture (grantee) to approve these conditions based on evaluation and engineering judgment. The choice must be made on the testing evaluation based on the performance criteria as defined in ANSI C63.19 and its procedures.
- e) It should be noted that worst case HAC is not related to SAR worst case. In fact, in many cases it is the opposite.

⁸ Any type of equipment modification (antenna position, design, metallic surface, adding system processes, changing battery capacity or type, etc.) has the potential to change the rating. The manufacturer must evaluate the equipment modification to determine if there is a change in the rating and if a Class II permissive change is required. Equipment changes that do not result in a change of the HAC rating being marketed and reported to the WTB do not require a Class II permissive change.

⁹ Note 2

¹⁰ *See*: Permissive Change Policies, KDB Publication 178919.

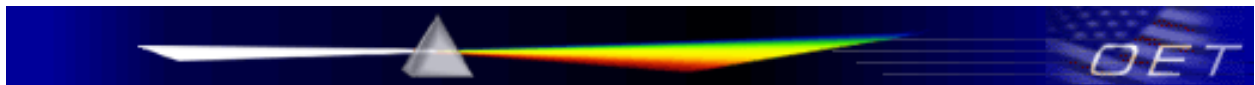


- f) Handset models with user instructions that disable any of its features, degrade performance, reduce RF output power, degrade battery performance, etc. for the purpose of meeting HAC compliance are not permitted.
- g) Certain user controls and settings may be acceptable for processing audio signals in accordance with ANSI C63.19 requirements, to improve the performance for people with hearing loss. A clear description of these controls must be provided in the test report submitted with each application.
- h) The antenna must be tested in a position of maximum antenna efficiency for voice operation, for the handset held to the ear position. When the handset can be used in more than one position (for example, with antenna retracted or extended, keyboard extended, etc.), only the position of maximum antenna efficiency for held to the ear voice calls, as defined by the manufacturer, must be tested. All typical handset positions for held to the ear operation, which can result in an increase of the antenna efficiency, must be tested.
- i) In addition to the air interfaces/bands documentation, the application shall document all other key features of the device tested, including: ¹¹
 - 1) Special HAC audio configurations permitted in accordance with ANSI C63.19.
 - 2) Statements regarding special antenna positions for HAC compliance (*see* 8(f)).
 - 3) The applicant shall provide a general declaration in cases where specific transmission modes do not operate in the held-to-ear mode for providing voice service (i.e., held-to-ear modes do not include Bluetooth profile).
 - 4) Use of any feature, not discussed above, which is disabled during testing must be clearly documented in the test report.
- j) For interpretations and explanations issued by ANSI-ASC C63, *see*:
http://www.c63.org/documents/misc/posting/new_interpretations.htm.
- k) A handset that has the capability to allow an optional modular accessory that attaches to a handset such that the handset and accessory can be held to the ear needs to be tested as a unit only if the accessory is included with the handset as a packaged sale item, or any accessory that enables or is used as part of a voice service(s) as defined in section 20.19(a).
- l) Foldable phones that support held-to-the-ear mode in both the closed-side and open-side positions shall be tested and comply on each side position. When tested under C63.19-2011, the lower rating shall apply to the entire foldable phone.
- m) A foldable phone that only supports held-to-the-ear mode in the closed-side position and speaker mode in the open-side position such that HAC testing is only performed in the closed side position, then an attestation is required by the applicant. The attestation shall state that this feature will remain persistent under the model designation(s) under this FCC ID as Hearing Aid compliant under CFR Title 47 20.19 unless a Class II permissive change is filed demonstrating held-to-the-ear mode in the open-side position. Any change in rating shall require a new model designation as required by CFR Title 47 20.19.

References

- KDB Publication 285076 D02, *Guidance for Performing T-Coil tests for Air Interfaces Supporting Voice over IP (e.g., LTE and Wi-Fi) to support CMRS based Telephone Services.*
- KDB Publication 285076 D03, *Hearing Aid Compatibility Frequently Asked Questions.*
- KDB Publication 285076 D04, *Volume Control Reference.*

¹¹ An applicant has the option to submit the description of the EUT in the operational description application folder and request long-term or short-term confidentiality.

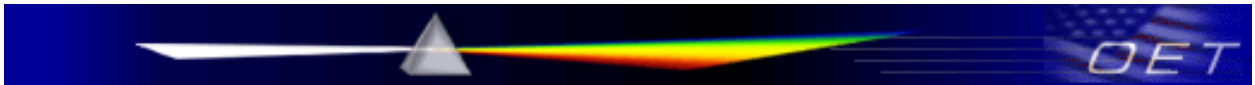


- KDB Publication 178919 D01, *Permissive Change Policy*.
- KDB Publication 178919 D02, *Permissive Change Frequently Asked Questions*.
- ANSI C63.19-2007, *American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids*.
- ANSI C63.19-2011, *American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids*.
- ANSI C63.19-2019, *American National Standard Methods of Measurement of Compatibility Between Wireless Communication Devices and Hearing Aids*.
- ANSI/TIA-5050-2018, *Telecommunications—Communications Products—Receive Volume Control Requirements for Wireless (Mobile) Devices*.
- DA 12-550; *Amendment of the Commission's Rules Governing Hearing Aid-Compatible Mobile Handsets*, WT Docket No. 07-250, Third Report and Order; adopted: April 9, 2012; released: April 9, 2012.
- FCC 15-155; *Improvements to Benchmarks and Related Requirements Governing Hearing Aid-Compatible Mobile Handsets*, WT Docket No. 15-285, Fourth Report and Order and Notice of Proposed Rulemaking; adopted: November 19, 2015; released: November 20, 2015.
- FCC 17-135; *Amendment of the Commission's Rules Governing Hearing Aid-Compatible Mobile Handsets*, WT Docket No. 07-250, Report and Order and Order on Reconsideration; adopted October 24, 2017; released October 26, 2017.
- FCC 21-28; *Amendment of the Commission's Rules Governing Standards for Hearing Aid-Compatible Handsets*, WT Docket No. 20-3, Report and Order; adopted February 16, 2021; released February 22, 2021.
- Section 20.19 References in this document:
- [Section 20.19 Hearing aid-compatible mobile handsets](#).
 - 20.19(a) Definitions
 - 20.19(b) Hearing aid compatibility; technical standards
 - 20.19(c) Phase-in of hearing aid-compatibility requirements
 - 20.19(e) *De minimis* exception for certain manufacturers and service providers
 - 20.19(f) Labeling and disclosure requirements
 - 20.19(f)(1) Package labeling
 - 20.19(f)(2) Package insert or handset manual
 - 20.19(g) Model designation requirements
 - 20.19(h) Website and record retention requirements
 - 20.19(i) Reporting requirements

Change Notice

10/31/2013: 285076 D01 HAC Guidance v0302 has been changed to 285076 D01 HAC Guidance v04. Revisions reflect further guidance provided for attachment 285076 D02 T-Coil testing for CMRS IP of this KDB.

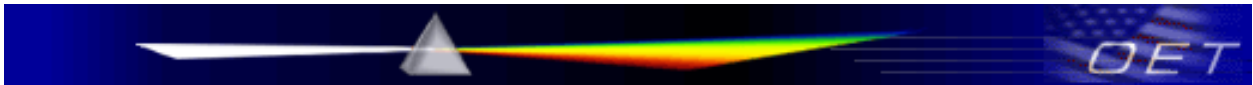
04/26/2016: 285076 D01 HAC Guidance v04 has been changed to 285076 D01 HAC Guidance v04r01. Revisions reflect update of KDB Publication 285076 D02 T-Coil testing for CMRS IP v02 removing the exemption for T-Coil testing for VoLTE and clarifying the exemption for WI-FI Calling. Editorial corrections including updating the document format.



09/12/2017: 285076 D01 HAC Guidance v04r01 has been changed to 285076 D01 HAC Guidance v05. This change represents a major revision to address the Fourth Report and Order (FCC 15-155) rule for expansion of voice service and eliminate the exclusion permitted by the Third Report and Order (DA 12-550, April 9, 2012) for testing VoLTE and Wi-Fi calling.

04/06/2020: 285076 D01 HAC Guidance v05 has been changed to 285076 D01 HAC Guidance v05r01. minor updates to Appendix B.

06/XX/2021: 285076 D01 HAC Guidance v05r01 has been changed to 285076 D01 HAC Guidance v06 to address C63.19-2019.

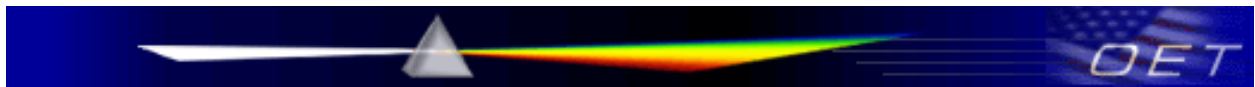


Appendix A

Example of Test Report Contents

The following items should be included in a HAC test report for a handset applying for certification under section 20.19:

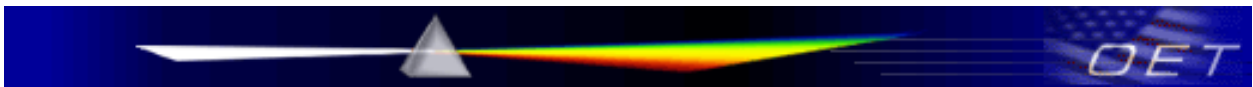
1. Summary
2. Air Interfaces and Bands
3. Test Site Description
4. Description of Test System
5. Equipment List
6. Description of EUT
7. Modes, Features, and Capabilities for each model tested
8. Justification of Held to Ear Modes Tested
9. Test Procedure
10. Test System Validation, Calibration, and Alignment Procedures
11. MIF evaluation (M-rating report)
12. T-Coil (T-rating report)
13. Detailed Measurements (M-rating and T-rating Reports)
14. References and Supporting Test Data
15. Detailed Test Measurement Plots



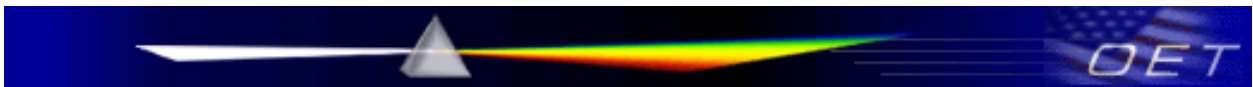
Appendix B
Example of Test Report List of Air Interfaces and Frequency Bands
This an Example only and does not indicate specific configurations.

Air Interface	Band MHz	Type	ANSI C63.19 Tested	Simultaneous Transmitter	Name of Voice Service
GSM	850	VO	Yes	BT and Wi-Fi	
	1900				
	GPRS/EDGE	VD	Yes		DUO**
WCDMA (UMTS)	850	VO	Yes	BT and Wi-Fi	*
	1900				
	HSPA	VD		BT and Wi-Fi	DUO**
CDMA	800	VO	Yes	BT and Wi-Fi	*
	1900				
LTE	700	VD	Yes	BT and Wi-Fi	VoLTE* DUO** XYNet***
	850				
	1700				
	1900				
Wi-Fi	2450	VD	NA	BT and GSM, LTE, CDMA, WCDMA or GSM	Wi-Fi-Calling** DUO**
	5200 (U-NII-1)				
	5300 (U-NII-2A)				
	5500 (U-NII-2C)				
	5800 (U-NII-3)				
BT	2450	DT	NA	Wi-Fi and BT and GSM, LTE, CDMA, WCDMA or GSM	NA

1) **Air Interface/ Band MHz:** List of all air interfaces and bands supported by the handset.



- 2) **Type:** For each air interface, indicate the type of voice transport mode:
 - i) VO = legacy Cellular Voice Service, from Table 7.1 in 7.4.2.1 of ANSI C63.19-2011;
 - ii) DT = Digital Transport only (no voice); and
 - iii) VD = IP Voice Service over Digital Transport.
- 2) **ANSI C63.19 Tested:** Yes or No
- 3) **Simultaneous Transmitter:** Indicate any air interface/bands that operate in simultaneous or concurrent service transmission mode.
- 4) **Name of Voice Service:** See Q4 in 285076 D03 HAC FAQ for further clarification.
 - a. * Ref Lev in accordance with 7.4.2.1 of ANSI C63.19-2011 and the July 2012 VoLTE interpretation
 - b. ** Ref Lev -20 dBm0
 - c. *** Ref Lev XYNet established by KDB Inquiry NNNNNN @ -16 dBm0



285076 D02 T-Coil testing for CMRS IP v04

GUIDANCE FOR PERFORMING T-COIL TESTS FOR AIR INTERFACES SUPPORTING VOICE OVER IP (e.g., LTE AND Wi-Fi) TO SUPPORT CMRS BASED TELEPHONE SERVICES

1. Introduction

In 2015 the Federal Communications Commission expanded the scope of the hearing aid-compatibility (HAC) rules to include new features.¹² The revised rules become effective January 1, 2018. The expanded rules include two-way voice services over air interfaces utilizing Voice over Internet Protocol (VoIP), or any other protocol that provides real time two-way voice communication either through interconnected or non-interconnected public networks.¹³ In addition, effective January 1, 2018 the expanded rules eliminated the previous exclusions permitted for testing VoLTE and Wi-Fi calling air interfaces due to unavailable test equipment and unknown network engineering information.¹⁴

The requirements for T-Coil signal tests are defined in Clause 7 of ANSI C63.19-2011 and C63.19-2019. This KDB publication provides clarification and guidance for air interfaces that support VoIP¹⁵ not explicitly identified in Table 7.1 of ANSI C63.19-2011 and Table 6.1—Normal speech input level for ANSI C63.19-2019¹⁶.

Manufacturers must test all voice applications and services installed within the handset to be counted as HAC rated. This includes applications installed by a manufacturer at the direction of a service provider.

2. T-Coil compliance tests for VoIP

ANSI C63.19 HAC T-Coil testing is a measurement of the intended magnetic field strength of the audio signal generated by a telephone handset and detected by hearing aids that are equipped with T-Coil magnetic pick-up coils. The handset generates a magnetic field of the received audio from the far-end telephone conversation and magnetically couples directly into the hearing aid, bypassing the hearing aid's acoustic microphone. T-Coil compliance testing includes three measurement parameters: (1) the magnetic field strength; (2) the frequency response; and (3) the signal quality as a signal to noise ratio between the wanted magnetic fields of the received audio and stray unwanted magnetic fields. These measurements are typically made using a base station simulator,¹⁷ using defined network reference test

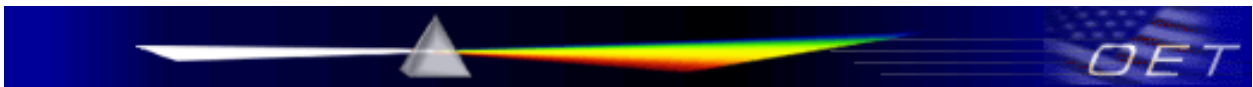
¹² Fourth Report and Order (FCC 15-155, released November 20, 2015, WT Docket No. 15-285).

¹³ Voice services are as defined in section 20.19(a). The expanded rules currently exclude testing for air interfaces operating over licensed Public Safety, private enterprise, and non-terrestrial Mobile Satellite Service (MSS) networks.

¹⁴ Third Report and Order (DA 12-550, April 9, 2012, WT Docket No. 07-250).

¹⁵ See filename C63.19-2011_interpretation_T_coil_audio_levels_for_LTE_July_2012.pdf, http://c63.org/documents/misc/posting/new_interpretations.htm.

¹⁷ See: 7.1 through 7.3.2 of ANSI C63.19-2011.



signals over the handset's supported air interfaces with the appropriate codecs.¹⁸ The applied 1000 Hz test signal defined in ANSI C63.19 that correlates to normal speech is critical in establishing the signal intensity, required reference to normalize the frequency response, and the reference as the signal (ABM1) for the signal to noise (ABM2) ratio (all sub-clause references are in ANSI C63.19). This level establishes the baseline for T-Coil measurements.

3. Instrumentation for T-Coil testing for VoIP

Base station simulators or adjunct network simulators must support all the applicable air interfaces. The manufacturer is responsible to identify and/or provide the necessary means for:

- a) Establishing or simulating an audio connection to/from the handset under test between matching compatible codecs over a digital data stream (without transcoding), and
- b) Injecting the necessary ANSI C63.19 test tones at the calibrated nominal speech level applied at a digital or analog calibrated reference point.

The applied reference input level applied at the calibrated reference point for legacy protocols fixed to specific air-interfaces are defined in 7.4.2.1 Table 7.1 of ANSI C63.19-2011, ANSI C63.19-2011 VoLTE interpretation of July 2012 with -16 dBm0 or table 6.1—Normal speech input level of ANSI C63.19-2019.

For protocols not listed in Table 7.1 of ANSI C63.19-2011, the ANSI C63.19-2011 VoLTE interpretation, or table 6.1—Normal speech input level of ANSI C63.19-2019 note 2, the average speech level of -20 dBm0.¹⁹ should be used.

ANSI C63.19-2019 use table 6.1 to establish the Normal speech input level and NOTE 2 of table 6.1 identifies the group of VoIP voice services that use -16 dBm0 as the normal speech input level. The group includes a variety of voice services, including Voice-over-LTE (VoLTE), Voice-over-IP-multimedia-subsystem (VoIMS), Voice-over-Wi-Fi (VoWiFi) and similar services. The interpretation of by this publication is that Note 2 defines the VOIP service that use -16 dBm0. Other services not defined by note 2 shall use -20dBm0 or the level defined in an attestation by the manufacture.

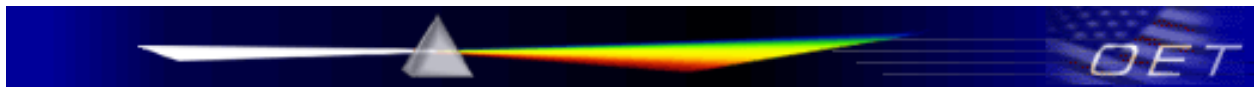
Reporting results involves a two-step process: (1) **Codec Investigation** to determine the worst-case codec for each voice service, and (2) **Air Interface Investigation**. Using the worst-case codec for a voice service, a range of channels and bands shall be tested.²⁰

- a) **Codec Investigation:** For a voice service/air interface, investigate the variations of codec configurations (WB, NB bit rate) and document the parameters (ABM1, ABM2, S+N/N, frequency response) for that voice service. It is only necessary to document this for one channel/band.

¹⁸ Testing T-Coil requires establishing the connection and testing the variations of voice coder, air interface, band, and bit rate, as defined for that service. The rating is based on the worst-case measurement results associated with an air interface, voice coder, and band and bit rate.

¹⁹ The -20 dBm0 establishes an average reference level as established in IEEE Std 269- 2010 referring a maximum at -10 dBm0, average at -20 dBm0, and minimum at -35 dBm0.

²⁰ The objective of the two-step process is to ensure that the results reported for each voice service represent a rating for the worst-case combination of code, channel, and band.



However, the tester should spot check other combinations to ensure that the channel/band used represents the worst-case codec.²¹

- b) **Air Interface Investigation:** Use the worst-case codec test and document a limited set of bands/channels/bandwidth. Observe the effect of changing the band and bandwidth to ensure that there are no unexpected variations. Using the knowledge of the observed variations, it is necessary to report only a set band/channel/bandwidth for each orientation for a voice service/air interface. Consult with the manufacturer for any abnormal results.²²

Example of test documentation:

Codec Investigation-air interface					
Codec State	Rate 1		Rate N	Orientation	Band/channel
ABM1 (dBA/m)				*	*
ABM2 (dBA/m)					
S+N/N (dB)					
Frequency response	Pass	Pass	Pass		

* It is only necessary to document each orientation, band, or channel investigated—use your judgment.

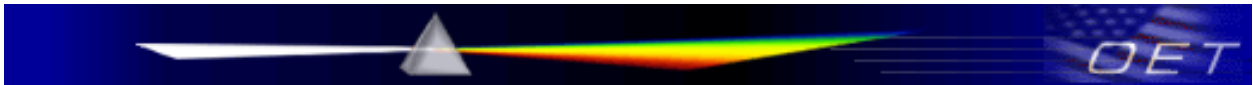
Air Interface Investigation									
Mode:	Orientation	Channel as noted	Bandwidth if applicable	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response Variation dB	Signal Quality dB	T-Rating ANSI C63.1 9-2011
Voice service/air interface/ band	Axial								
	Radial								

Change Notice

10/31/2013: 285076 D02 T-Coil testing for CMRS IP v01 has been changed to 285076 D02 T-Coil testing for CMRS IP v01r01. Revisions reflect changes to the Permit Bur Ask requirements for 4.2 applicants testing T-Coil for CMRS Voice over IP transport.

²¹ Many test reports have shown very little or no significant variations, and also demonstrate wide margins from the rating threshold, indicating that the variations in band/channel/bandwidth have little effect on the signal quality and even less effect on the rating.

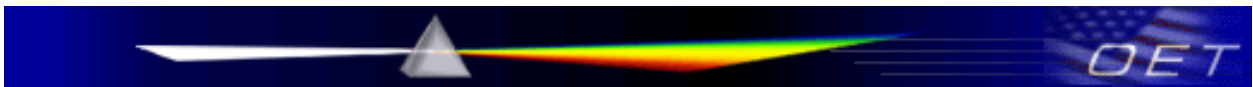
²² Many test reports show variations that may affect the rating for axial orientation, and for some air interfaces especially GSM. However, within an air interface, and between air-interfaces transporting IP, small variations may not significantly affect the signal quality and T-rating.



04/26/2016: 285076 D02 T-Coil testing for CMRS IP v02 replaces 285076 D02 T-Coil testing for CMRS IP v01r01. Revision to remove the exemption for T-Coil testing for VoLTE and clarification of the exemption for Wi-Fi calling.

09/12/2017: 285076 D02 T-Coil testing for CMRS IP v03 replaces 285076 D02 T-Coil testing for CMRS IP v02. This change represents a major revision to address the Fourth Report and Order (FCC 15-155) rule for expansion of voice service and eliminate the exclusion permitted by the Third Report and Order (DA 12-550, April 9, 2012) for testing VoLTE and Wi-Fi calling.

06/XX/2021: **285076 D02 T-Coil testing for CMRS IP v03** has been changed to 285076 D02 T-Coil testing for CMRS IP v04 to address ANSI C63.19-2019.



HEARING AID COMPATIBILITY

Frequently Asked Questions

Q1. What is a manufacturer's responsibility for testing HAC compliance of over-the-top (OTT) – voice services operating over IP, installed on a wireless handset by the manufacturer, service provider, or end-user?

A1.

OTT is an IP based application for voice calls supported by an application included by the manufacturer with the sale of the handset. Common examples are Google Duo, Microsoft Teams and Apple Face Time. In these cases, the typical call box cannot be used to test calling capability for the handset being tested.

Considering the following five conditions for voice services (including OTT or any other voice service):

- a. Pre-installed (installed and delivered) by the manufacturer.
- b. Pre-installed (installed and delivered) by the manufacturer for the operating system manufacturer's software partner.
- c. Installed and delivered by the manufacturer at the direction of the service provider.
- d. Service provider installed (post-installed by the service provider after delivery from the manufacturer).
- e. Installed by the end-user after purchase.

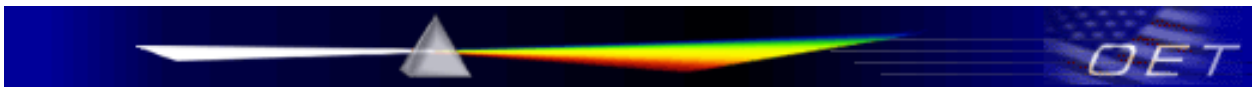
For items (a) through (c), it is the responsibility of the manufacturer to test the handset that is reported to the FCC Wireless Telecommunications Bureau (WTB) as HAC compliant.

For item (d), the service provider cannot market or report this as HAC compliant (section 20.19). Optionally, the service provider can arrange for the manufacturer (grantee) to apply for a Class II Permissive Change to add the service provider's model number.

For item (e), testing is not required.

Q2. For the OTT voice applications installed by the service provider (post-installed by the service provider after delivery from the manufacturer), is the service provider required to arrange for the manufacturer to file a Class II Permissive Change, including a HAC test report, if the service provider added OTT voice service to a handset model, even if subscribers are not required to use it?

A2. Section 20.19 requires that if a handset is marketed, sold, and reported as HAC compliant by a service provider, and that handset contains alternative voice services that meet the definition of section 20.19(a), then all delivered voice services need to have been tested to demonstrate compliance. There is no provision in the rules that permits a service provider to continue to claim that the handset is HAC compliant only for certain voice services and not for others that qualify under section 20.19(a). The service provider and the manufacturer must cooperate to update the application filing under a Class II Permissive Change application.



Q3. What is the meaning of “voice services or voice applications,” and the “specific applications which support voice calling,” video, and other communications applications, in terms of those that are not ordinarily used with a device placed next to the ear verses devices that are designed to be held to the ear?

A3. The meaning of “all voice services or voice applications” applies to both: (a) voice applications that are used in delivery of a digital mobile service as defined in section 20.19(a); and (b) handsets as defined in FCC 10-145 (WT Docket No. 07-250, released August 5, 2010) at paragraph 20, “Handsets Covered by the Rule.” *See also* Fourth Report and Order (FCC 15-155, released: November 20, 2015) at paras. 40-41).

In most cases the features of a product’s design are intuitively obvious when providing an audio output not customarily intended to be held next to the ear versus a design for audio output to be held next to the ear. HAC testing is applicable for any device that has a feature designed to be held to the ear.

Q4. KDB Publication 285076 D01 Appendix B shows an example of a table with a column entitled “Name of Voice Service” that includes examples of air interfaces. Is it necessary to identify the non-VoIP modes that need to be listed as well?

A4. No, only voice services that are not defined in ANSI C63.19-2011 or C63.19-2019 need to be identified in this column. For all other services identified in ANSI C63.19-2011, use a single * symbol. Specific listing is not needed because legacy circuit-switched voice services are bound to the air interface in ANSI C63.19-2011 and ANSI C63.19-2019 which are identified in the Air Interface column. IP transporter voice services are independent of the air interface, only bound to the IP layer, and therefore the service needs to be identified by name.

Q5. Are OTT IP voice services (e.g., Skype, Google Hangouts, etc.) a VD for Voice and Data type air interface for 3G data services (e.g., EDGE, HSPA, EVDO)?

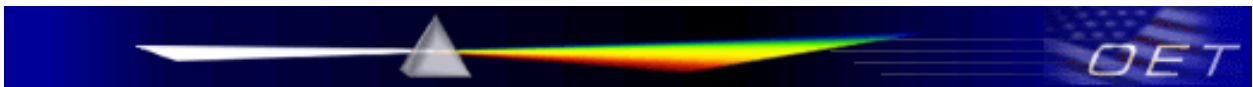
A5. Yes, these are voice services, because EDGE, HSPA, and EVDO are IP packet transporters and as such they can transport IP voice services.

Q6. Does HSPA circuit-switched (CS) voice services over HSPA (CSoHS) need to be tested?

A6. Yes, if the handset has the capability to support VoHSPA or CSoHS, it needs to be tested to demonstrate compliance.

Q7. What is Wi-Fi calling, is it considered an OTT IP service, and what is the reference level that should be used for compliance testing referenced in Appendix B of KDB Publication 285076 D01 and in KDB Publication 285076 D02?

A7. Wi-Fi calling (or cellular-provider Wi-Fi calling) for the purpose of these publications are not considered an OTT service. It is an advanced calling or roaming feature provided by the licensed mobile-service provider (carrier) originating and terminating calls over their network infrastructure using Wi-Fi as the service drop connection instead of using the licensed service bands. *Wi-Fi calling is not just any voice service operating over Wi-Fi; it is a feature of the mobile service provider’s network, for providing the carrier’s voice service in areas where there is Wi-Fi coverage (such as in a home).*



Wi-Fi calling is not defined by ANSI C63.19 and therefore testing shall use a reference level of -20 dBm0 as noted by “***” in reporting per Appendix B of KDB Publication 285076 D01. If ASC C63®-EMC provides an update of the ANSI C63.19 standard and this is adopted by the FCC or another entity provides a new value accepted by OET through a PAG procedure, then testing can be performed using that reference level and appropriately noted in the table. Reference levels approved by the FCC on a case-by-case basis should be noted with “****” in the table.

Note that for Wi-Fi calling, the M-rating is primarily influenced by the air interface, while T-Coil (T-rating) is primarily influenced by the codec and basic phone magnetic-background noise.

Q8. What are the steps to get approval to use the Pre-Approval Guidance (PAG) Reuse procedures for VOIP OTT T-coil testing?

A8. When 388624 D02 Pre-Approval Guidance List requires a PAG for specific HAC air interfaces, reuse is permitted in accordance with the following guidance.

Requesting reuse must follow the procedures in accordance with 388624 D01 Pre-Approval Guidance section II D

An initial PAG is required to certify handsets that support voice protocols which currently do not have a specified reference input level in ANSI C63.19-2011 (section 7.4.2.1) and/or for which the handset cannot be tested for compliance using the customary laboratory Call Boxes (examples are provided below for reference). Furthermore, the initial PAG that requests reuse must:

1. Describe or illustrate the setup of call setup. Include all special software, auxiliary devices, and phones.
2. Define the method that permitted establishing the call, selecting the various codecs, data rates and calibrating the reference levels in with respect to -20 dBm0 (i.e. -23.14 below full scale).
3. State that there has been an investigation for the worst-case codecs and bit rate tested and how the codecs were selected.
4. Clearly specify the text and diagrams that will be re-used.

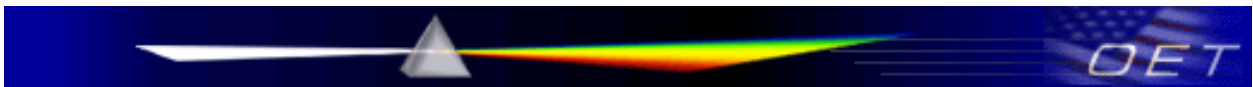
Examples:

OTT (PAG)

OTT is an IP-based application that supports voice calling supported by the data connection as provided by the handset manufacturer. Currently the most common examples are Google Duo and Apple Face time. In these cases, the typical call box cannot be used to test calling capability for the handset being tested.

To apply the PAG reuse procedures, it is necessary to insert an additional section that:

- Describes or provide diagrams for how to setup a call. In this case, one must include the ancillary equipment (in block diagram form) that indicates how to establish a call to the handset’s EUT, and the equipment for injecting the reference and test tones.
- Defines the method that permits establishing the call, including selecting the various codecs, data rates and determining the reference levels in terms of -20 dBm0 (i.e. -23.14 below saturation). For example, Duo uses an ancillary handset using special software from Google to make a connection, select codecs and bit rates, and the reference level.



- States that there has been an investigation for the worst-case codecs and bit rate tested and how the codecs were selected. Details about which codecs were investigated and the results obtained do not need to be included, as is typically required for wireless interfaces.

Q9. Are there any interim procedures for testing VoLTE/OTT calls over 5G Sub 6 bands since current call boxes do not support simulated 5G calls or internet connections?

A9. Currently, laboratories are having difficulty in establishing a voice connection for testing T-Coil over 5G Sub 6 air interfaces. The problem is the inability to establish 5G sub 6 VoLTE or OTT voice calls over 5G NR F1 air interfaces using the current call boxes. Below is an interim PAG procedure to address this issue:

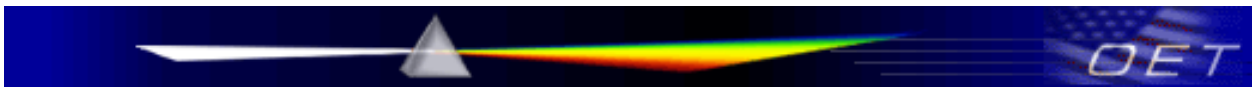
1. This procedure is only applicable for 5G Sub 6 calls that use the same protocol, Codec(s) and reference level as VoLTE over LTE (i.e. -16 dBm0) or OTT calls (such as Duo or AppleTalk).
2. For LTE, establish the ABM1S65G value by using the ABM1LTE magnetic intensity for an LTE call in the same band as the 5G sub6 band under test.
3. For OTT, establish the ABM1S65G value by using an IP connection for magnetic intensity for a call in the same band as the 5G sub6 band under test.
4. Also note the actual ABM2LTE/OTT value.
5. Establish an ABM2S65G value, using a 5G manufacture test mode over 5G Sub 6 channels for the same band under test.
6. Document in the test report matrix:
 - i. Include columns for both ABM2LTE and ABM2S65G for comparison.
 - ii. Establish the S+N1/N2 for the rating.
 - 1.S+N1 = ABM1LTE (step 2) and
 - 2.N2 = ABM2S65G (step 4)
 - 3.Subtract 3 dB from S+N1/N2.
 - iii. Rating based on (ABM1LTE/ ABM2S65G) -3dB.
7. Manufacture must provide an attestation (cover letter) confirming that the results using ABM1 values obtained from VoLTE connections over LTE bands and ABM2 values for 5G sub 6 connections over the same bands provide a reasonable representation of the HAC rating over the 5G sub 6 connections.
8. A grant note comment “T-coil 5G sub 6 bands appraised as equivalent LTE connections.”
9. Manufacture must also comply with section 20.19 (f)(2)(v) Disclosure requirements relating to handsets treated as hearing aid-compatible over fewer than all their operations.
10. This procedure qualifies for Reuse procedures as defined in Q8 above.

Change Notice:

04/06/2020 285076 D03 HAC FAQ v01r01 replaces 285076 D03 HAC FAQ v01. V01r01 added Question 8 to provide guidance for PAG reuse policy of Publication 388624.

07/29/2020 285076 D03 HAC FAQ v01r02 replaces 285076 D03 HAC FAQ V01r01. Added Question 9 to provide guidance for PAG testing a 5G Sub6 interim procedure.

10/13/2020 85076 D03 HAC FAQ v01r03 replaces 285076 D03 HAC FAQ v01r02. V01r03 added to Question 9 to provide interim guidance for PAG testing a 5G Sub6 interim procedure to include OTT voice service.



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.²³ 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.²⁴

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 as specified in section 5 of TIA-5050 for each audio codec on at least one air interface and one tone control setting. If multiple air interfaces (e.g. LTE, Wi-Fi, etc.) support the same codec, then only one such air interface need be tested for each supported codec. For example, if a codec is used over LTE and 5G NR, then that codec need only be tested either over LTE or 5G NR.²⁵ Likewise, if a handset has the ability to adjust the frequency response via a tone control feature, the handset is considered compliant if it meets the requirements on at least one tone control setting.

To be compliant, at least one volume control setting for each codec must meet the test requirements of TIA-5050. Additionally, a mobile handset is compliant if all supported codecs meet the test requirements with a mounting force at both 8N and 2N for at least one volume control setting.²⁶

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 and as such are not required to meet the volume control requirements.

III. TECHNICAL REQUIREMENTS

A. Receive Volume Control Performance

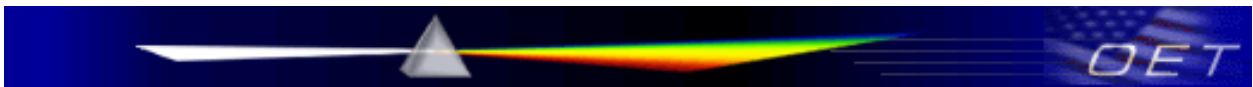
The procedures for the receive volume control performance can be found in section 5.1 of TIA-5050. An ITU-T P.58 compliant Head and Torso Simulator (HATS) is required for all testing. Irrespective of codec

²³ Report and Order (FCC 21-28, released February 22, 2021, WT Docket No. 20-3).

²⁴ Compliance to TIA-5050 is required as defined in section 7 of ANSI C63.19-2019.

²⁵ As stated in section 4.6 of TIA-5050.

²⁶ 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.



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 dBm0.²⁷

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.²⁸ 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)²⁹. The 1/12 octave band frequency listed in TIA-5050 Tables B.1 and B.3 shall be used for all frequency response measurements.³⁰

IV. SPECIAL CONSIDERATIONS

Pre-installed over-the-top (OTT) services, such as Google Duo and Apple Face Time, shall be compliant with TIA-5050.³¹

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. The general test report format should follow reporting best practices and should follow a format similar to those outlined in ANSI C63.19-2019 section 9.

The Volume Control Report should be submitted as a separate test report exhibit. A summary data table in the forward or executive summary should be included which contains 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 also 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 in dB SPL

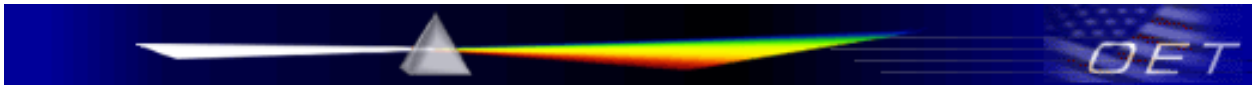
²⁷ The alternative ASLs provided by ANSI standard C63.19-2019 for T-coil testing are not applicable for volume control measurements.

²⁸ 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.

²⁹ 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.

³⁰ The R40 frequency spacing, as shown in Tables B.2 and B.4 of TIA-5050, are presented for reference only.

³¹ OTT services are defined in KDB publication 285076 D03 Question 1.



4. Detailed measured distortion in dB
5. Frequency response plots for each codec used showing correct reference to either FF or DF
6. Tabulated frequency response data showing 1/12 octave bands

Table V-1. Example Test Data Summary Table

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

1. Volume Control Setting listed in terms of percent of maximum or in decibels relative to maximum, however this is displayed on the device.
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 dBSPL) 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 $\geq 20\text{dB}$ as stated in TIA-5050.
6. Frequency response can be given in a pass/fail format. The measured frequency response should be plotted against the limits in the appropriate test report section or appendix.