

April 24, 2022

Federal Communications Commission
Office of Engineering and Technology
Laboratory Division

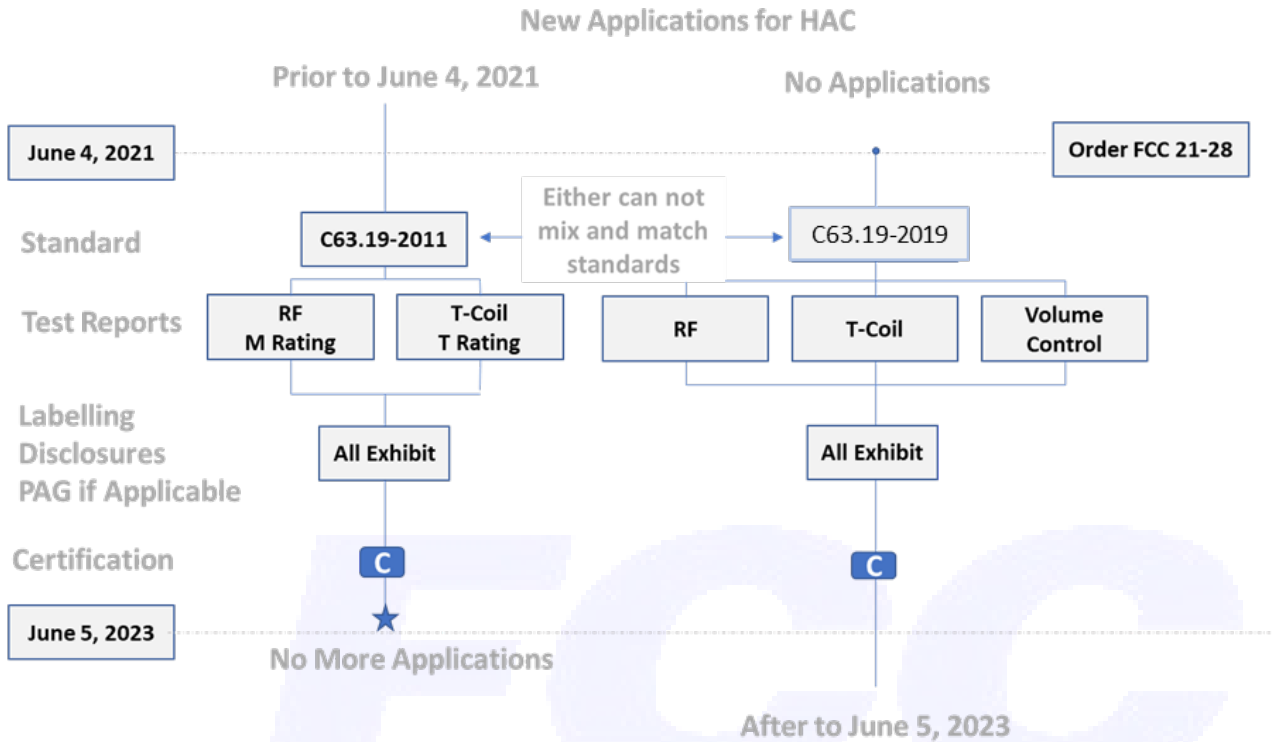
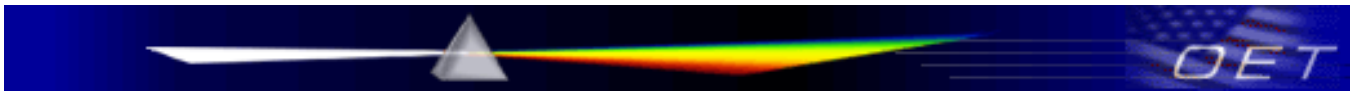
**EQUIPMENT AUTHORIZATION GUIDANCE
FOR HEARING AID COMPATIBILITY**

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 December 4, 2023. All Hearing Aid Compatibility (HAC) applicable grants of certification, including permissive changes, issued on or after December 5, 2023² must be compliant with ANSI C63.19-2019 and their supporting HAC test report(s) shall 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.
- h) Testing laboratories that have been accredited to ANSI C63.19-2011 and recognized by the FCC for the HAC Scope, may test applicable devices for compliance to the ANSI C63.19-2019 standard until the completion of their next accreditation assessment or the expiration of their FCC recognition for the HAC Scope.

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

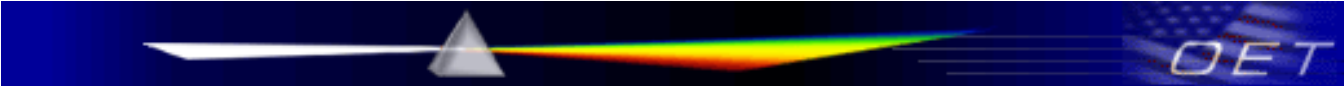
² DA 23-327 extended requiring C63.19-2019 from June 5, 2023, to December 5, 2023.



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 for ANSI C63.19-2011.
- 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 report³.
- 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* 285076 D04 Volume Control) for each model marketed and reported.
- d) Handsets capable of operating with multiple transmitters are subject to requirements for each transmitter that operate in the voice mode when positioned at a user’s ear. The following C63.19 standards and clauses apply:
 - A. C63.19-2011 does not address simultaneous transmission test procedures; therefore, handsets that can support connections simultaneous shall be independently tested for each air interface/band during a voice connection supporting transporting voice under clause 4 or 5 as applicable for M rating and clause 7 for T rating.
 - B. C63.19 -2019 shall be tested using the method of Clause 4 for RF interference potential and clause 6 for T-Coil testing during a voice connection. For RF interference, Clause 4.6 addresses simultaneous transmission. Each qualified transmitter is tested individually using the method of Clause 4 for RF interference potential and under clause 4.6 the other transmitters (operating simultaneously) are temporarily disabled or reduced in power level such that their average antenna input power is at least 6

³M rating only for reporting HAC rating is no longer permitted.

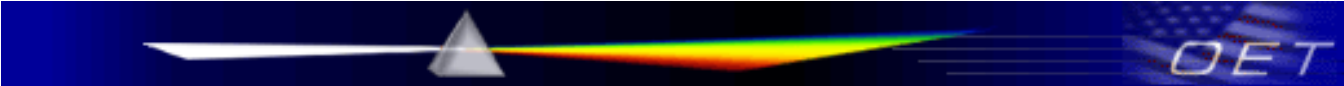


dB lower than the average antenna input power of the transmitter under test. If the voice connection under test is not dependent on the other simultaneous transmitter (i.e., the transmitter disabled or reduced by 6db), then the measurement of the transmitter under test is used for determining HAC compliance. When the voice connection under test is dependent on the other simultaneous transmitter, the measurement that establishes HAC qualification is the highest audio interference measurement of the simultaneous transmitters for that dependent connection mode. See C63.19 -2019 clause 4.6.

- C. Example: : The following modes must be tested as applicable for the different C63.19 standard used:
- 1) Voice and signaling connection are transported over an individual air interface channels one at a time without any other simultaneous transmissions.
 - i. C63.19-2011: tested for each air interface/band supporting transporting voice
 - ii. C63.19 -2019: Clause 4.6 is not applicable and tested for each air interface/band supporting transporting voice.
 - 2) Voice and signaling connection are transported over a single air interface channel with other simultaneous transmissions not associated with that voice connection.
 - i. C63.19-2011 : tested for each air interface/band supporting transporting voice
 - ii. C63.19 -2019: Clause 4.6 applies. The transmission evaluated is the channel transporting the voice. The other simultaneous transmissions not associated with that voice are temporarily disabled or reduced at least by 6 dB in accordance with clause 4.6.
 - 3) Voice connection with dependent simultaneous transmissions such that the dependent simultaneous transmissions is not transporting voice.
 - i. C63.19-2011: tested for each air interface/band supporting transporting voice.
 - ii. C63.19 -2019: Clause 4.6 applies. The transmission evaluated must use the highest audio interference potential of any of the transmitters depend voice contention under test for HAC compliance. If the dependent simultaneous connection transmission not associated with that voice has a higher interference measurement, then that primary interference from that measurement applies for HAC compliance for this connection mode.
 - 4) Voice connection with dependent simultaneous transmissions transporting voice (i.e., carrier bonded or carrier aggregation).
 - i. C63.19-2011: tested for each air interface/band supporting transporting voice.
 - ii. C63.19 -2019. The measurement that establishes HAC qualification is the highest audio interference potential of any of the transmitters for this connection mode.

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).
- 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 as an 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 (Manufacturer's test mode method) of ANSI C63.19-2011. For ANSI C63.19-2019 see sections 6.3.3 and 6.3.4 . *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.⁴

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 note 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 models⁵ 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.
- d) For C63.19- 2019 Handset's conversational gain.

6. Labeling, Insert or Handset Manual, and Disclosures

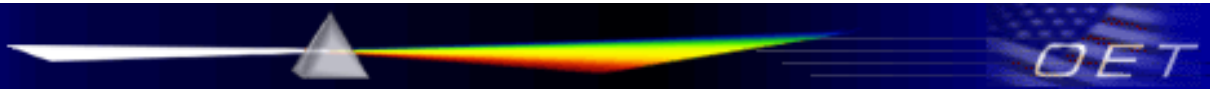
The user manual exhibit shall demonstrate the required disclosure statements as specified in section 20.19(f). This includes, as appropriate:

Labeling and disclosure requirements

- (1) **Package label.** For all handset models certified as 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 actual conversational gain tested shall be displayed with and without a hearing aid when certified using a technical standard ANSI C63.19-2019. 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;

⁴ Use of the HX code is no longer required.

⁵ Manufactures 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.



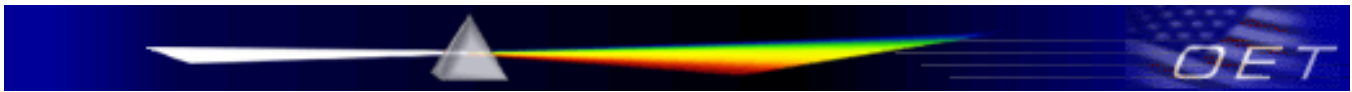
- ii. The ANSI standard used to determine the hearing aid compatibility of the handset model's air interfaces and frequency bands;
- iii. If using the ANSI C63.19-2011 standard or an earlier version of the standard, the lowest hearing aid compatibility rating assigned to any of the covered air interfaces 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, Model Variations, Device Configuration Capability

- a) Multiple compliance reports under a single FCC ID that represent distinct models⁶ 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 model designation is required to distinguish between the models. 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. For ANSI C63.19-2011 if the HAC rating changes, then a new model designation must be assigned to ensure distinction from the prior version.

⁶ 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).



- e) For ANSI C63.19 -2011 any changes⁷ 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 report⁸.
- 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.⁹

8. Testing Guidance

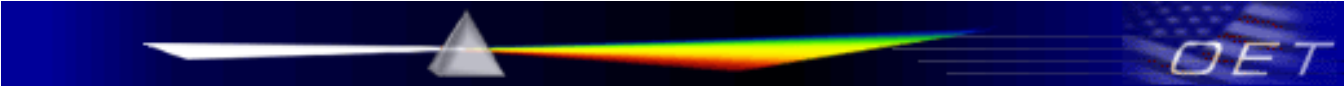
- a) HAC test environments (probes, equipment, test fixtures, etc.) must be properly calibrated according to manufacturer's and ANSI C63.19 requirements.
- b) Testing must be done in accordance with ANSI C63.19 under the worst-case operating mode (highest interference potential that results in a lower rating or compliance in accordance with C63.19-2011 or C63.19-2019 as applicable).
- 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.
- 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 efficiency¹⁰ 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

⁷ 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.

⁸ Note 2

⁹ *See*: Permissive Change Policies, KDB Publication 178919.

¹⁰ Antenna efficiency is the position providing the maximum ratio of the power delivered to the antenna relative to the power radiated from the antenna as defined by the manufacture.



retracted or extended, keyboard extended, etc.), only the position of maximum antenna efficiency¹¹ 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:¹²
- 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 accessory that attaches to a handset such that the handset and accessory can be held to the ear are not permitted to be used for demonstrating hearing aid compliance.
- l) Foldable¹³, flip, two-sided, or any handset that support held-to-the-ear mode in two positions (for example, both the closed-side and open-side positions of a foldable handset) both positions shall be tested. For C63.19-2011, the lower rating shall apply to the entire handset. For C63.19-2019 both positions must pass to be HAC compliant
- m) A foldable handset or any other type as defined in I above) that supports speaker mode (such as the open-side position of a foldable handset) and HAC tested in the held to ear 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. A Class II permissive change would be required to change the previously speaker only position. This to a held-to-the-ear mode for the For C63.19-2011, any change in rating shall require a new model designation as required by CFR Title 47 20.19.
- n) A handset may come with capability to select a mode for HAC compliance. The instruction manual shall clearly explain to a user how to simply make the selection, Only one selection is permitted and when selected the handset must meet all the HAC requirements of C63.19-2011 (M&T rating) if certified under C63.19-2011 or C63.19-2019 (HAC and Volume Control) if certified under C63.19-2019. The handset instructions, quick guide and handset settings search functions (i.e. typing “Hearing”) shall reveal how to select the HAC capability mode.

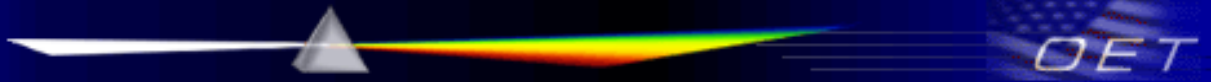
References

- 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.*
- KDB Publication 178919 D01, *Permissive Change Policy.*
- KDB Publication 178919 D02, *Permissive Change Frequently Asked Questions.*

¹¹ As defined by the manufacture for best for ink performance (assume maximum radiated field stretch).

¹² 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.

¹³ Foldable handsets are any handset that supports two held-to-ear positions-closed-side and open side positions.



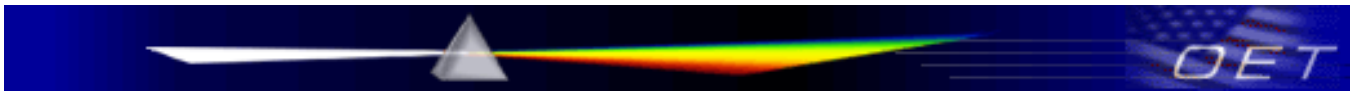
- ANSI C63.19-2007, *American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids*.
- ANSI C63.19-2011, *American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids*.
- ANSI 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.



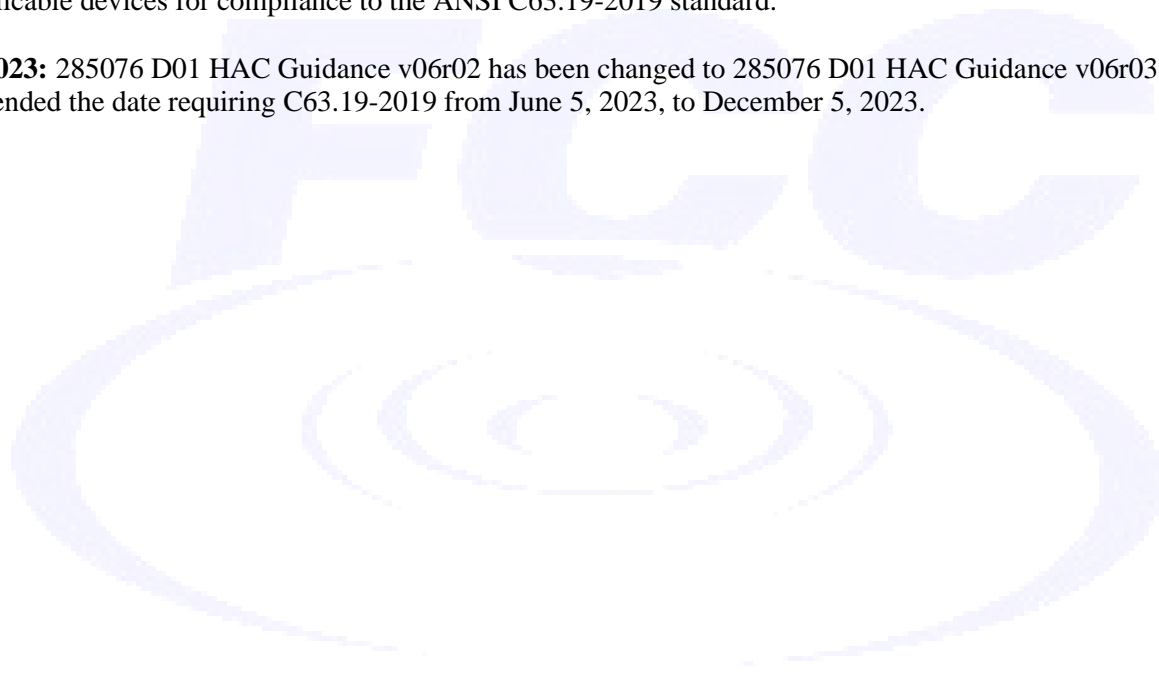
04/06/2020: 285076 D01 HAC Guidance v05 has been changed to 285076 D01 HAC Guidance v05r01. minor updates to Appendix B.

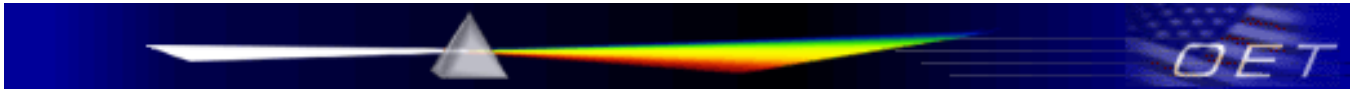
02/23/2022: 285076 D01 HAC Guidance v05r01 has been changed to 285076 D01 HAC Guidance v06 to address C63.19-2019.

07/20/2022: 285076 D01 HAC Guidance v06 has been changed to 285076 D01 HAC Guidance v06r01. v06r01 Added item n in section 8.n; under Testing Guidance for clarification. A handset may come with capability to select a mode for HAC compliance.

09/19/2022: 285076 D01 HAC Guidance v06r01 has been changed to 285076 D01 HAC Guidance v06r02. Section 1.Introduction (b), has been changed to clarify that all applicable grants of certification issued on or after June 5, 2023 must be compliant with ANSI C63.19-2019. And Section 1.Introduction 1 h) was added to confirm that testing laboratories that have been accredited to ANSI C63.19-2011 and recognized by the FCC for the HAC Scope, may test applicable devices for compliance to the ANSI C63.19-2019 standard.

04/24/2023: 285076 D01 HAC Guidance v06r02 has been changed to 285076 D01 HAC Guidance v06r03. DA 23-327 extended the date requiring C63.19-2019 from June 5, 2023, to December 5, 2023.



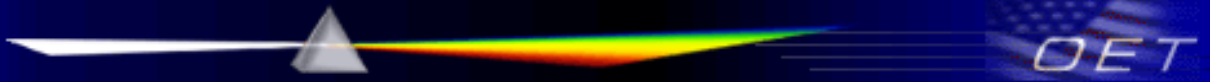


Appendix A

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:

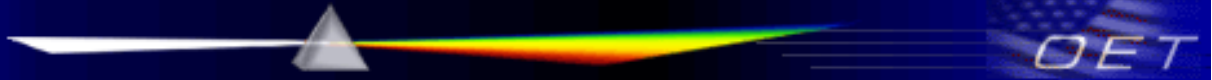
1. Summary
2. Air Interfaces and Bands
3. Test Site Description
4. Description of Test System
5. Equipment List
6. Description of EUT
7. Modes, Features, and Capabilities for each model tested
8. Justification of Held to Ear Modes Tested
9. Test Procedure
10. Test System Validation, Calibration, and 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			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

