

**Federal Communications Commission
Office of Engineering and Technology
Laboratory Division**

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Draft Laboratory Division Publications Report

Title: HAC Guidance

Short Title: 285076 D01 HAC and D02 T-Coil Guidance

Reason: Update Both D01 HAC Guidance and D02 T-Coil Guidance per the FOURTH REPORT AND ORDER FCC 15-155.

Keyword/Subject: 20.19, Hearing Aid Compatibility, HAC

First Category: Licensed Service Rules and Procedures

Second Category: HAC Hearing Aid Compatibility (lic)

Question:

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

Answer:

See the attached documents below:

- [285076 D01 HAC Guidance v05](#) provides equipment authorization guidance for mobile handsets subject to the requirements of Section 20.19 for hearing aid compatibility.
- [285076 D02 T-Coil testing v03](#) provides additional guidance for T-Coil tests including voice-over-IP based telephone services.

Attachment List:

[285076 D01 HAC Guidance v05](#)
[285076 D02 T-Coil testing v03](#)

EQUIPMENT AUTHORIZATION GUIDANCE FOR HEARING AID COMPATIBILITY

1. Introduction

- a) This publication provides guidance to clarify the Hearing Aid Compatibility (HAC) equipment authorization requirements for wireless handsets subject to Section 20.19 of the FCC rules.
- b) The guidance includes¹ wireless handsets² designed to be held to the ear that are manufactured with or the manufacturer includes, under the direction of service provider, two-way voice communications;³ including Voice over Internet Protocol applications (VoIP).⁴
- c) Manufacturers of wireless handsets that are seeking certification of a handset as hearing aid compatible⁵ under Section 20.19 must submit, as part of the equipment certification application process, test report(s) demonstrating HAC compliance in accordance with ANSI C63.19-2007 or ANSI C63.19-2011.⁶

¹ Section 20.19 currently excludes testing for air interfaces operating over licensed Public Safety, private enterprise, and non-terrestrial Mobile Satellite Service (MSS) networks. The term “private enterprise networks” refers to private networks that are designed and deployed to meet a business’s specific communications needs. Such systems may include, for example, internal networks to support the operations of “power and petroleum companies, airlines, railroad, trucking and other transportation concerns, [and] manufacturing facilities” (FCC 15-155, ¶ 40, n111).

² This includes any handset, even if the manufacturer claims that usually, or most often, users will operate it in a speakerphone mode or other mode. A device that cannot be practically held to the ear for voice communication would only then not be subject to the HAC requirements of Section 20.19.

³ Fourth Report and Order (FCC 15-155, released November 20, 2015) expanded the types of voice services (effective January 1, 2018) that apply to hearing aid-compatibility. The expanded rules include all voice communications services that enables real-time, two-way voice communications to and from the interconnected public switched telephone network (i.e., GSM, WCDMA, CDMA, VoLTE, Wi-Fi Calling and OTT services); services not interconnected with the public switched telephone network and available to the public that permit calls to and from others on the same service.

⁴ See companion KDB Publication 285076 D02 for further guidance on T-coil requirements.

⁵ Service providers and manufacturers are required to make available (providers to customers and manufacturers to providers) a number or percentage of Hearing Aid-Compatible (HAC) handset models out of the total number of wireless handsets it offers in the United States or imported for use in the United States, that are used for the delivery of two-way voice communications. The number for manufacturers is defined by a schedule in Section 20.19(c)(1) for radio frequency interference (M-Rating) and Section 20.19(d)(1) for inductive coupling (T-rating). Manufacturers and providers must also submit to the FCC Wireless Telecommunications Bureau (WTB) regular reports demonstrating compliance pursuant to a reporting schedule set out in Section 20.19(i) (Reporting Requirements). The handset (model/FCCID/HAC Rating/ANSI-C63.19-standard-version/availability) reported to the WTB must be validated by the supporting test report exhibits (FCC ID/HAC Rating/ANSI C63.19 standard-version) in the Equipment Authorization System (EAS). There is no requirement that the grant of certification and HAC report exhibits include an up-to-date model designation in the EAS for each model reported to the WTB.

⁶ The ANSI C63.19-2007 standard is limited in frequency bands and air interfaces and would only be applicable to handsets that have only those frequency bands and air interfaces specified in ANSI C63.19-2007. Because ANSI C63.19-2007 is a subset of ANSI C63.19-2011, this KDB publication references only ANSI C63.19-2011.

- d) Handsets that operate only in frequency bands that are not addressed in ANSI C63.19-2011 are not subject to Section 20.19 HAC requirements.

2. Equipment Certification Application Filing Requirements

- a) The HAC test report exhibits must be submitted with an application for equipment certification, either as an original application, or as a Class II Permissive Change application to add or change the HAC rating of a handset subject to Section 20.19.
- b) A certification application associated with a HAC-tested handset must include test report exhibit(s) containing one complete M-rating test report for each model marketed and reported as M# rated, or one complete M-rating report and one complete T-rating report (see example in Appendix A) for a model marketed and reported as M#T#.
- c) Concurrent connections or 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 defined into two categories: (i) concurrent connections using simultaneous transmissions; and (ii) concurrent connections not using simultaneous transmissions.
 - 1) Handsets that have the ability to support concurrent connections using simultaneous transmissions⁷ shall be independently tested for each air interface/band given in ANSI C63.19-2011.
 - 2) 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) given in ANSI C63.19-2011, shall be tested in both modes (non-concurrent and concurrent) to determine the worst-case mode for applying the HAC rating. The worst-case mode⁸ shall be documented in the test report.
 - 3) All air interfaces/bands that can be operated in concurrent connections 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.
- d) Manufacturers that qualify for the Global System for Mobile communications (GSM) 1900 MHz band power reduction option⁹ and provide test results where the HAC rating is based on reduced power in the 1900 MHz band, must provide in the certification application filing a statement

⁷ Concurrent 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. ANSI C63.19-2011 does not provide measurement procedures for simultaneous transmissions. Until measurement procedures are provided for simultaneous transmissions, results for 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 evaluated.

⁸ Worst-case mode may not be under the condition where multiple connections are multiplexed over a single air interface transmission. The worst case mode is likely to be when the carrier envelope is bursting or varying significantly at a rate within the audio band. Do not assume the SAR worst case is the same for HAC.

⁹ The option to meet the M3 HAC standard through a user-selectable power reduction for GSM operations in the 1900 MHz band (Section 20.19(e)(1)(iii)) is available only to entities that otherwise would have qualified for the *de minimis* exception (Section 20.19(e)(1)(i)) but must offer one hearing aid-compatible handset because of their employee size (see Section 20.19(e)(1)(ii)).

documenting that they are qualified, and must document the required information in the test report and user's manual exhibits.

- e) A certification application for certification that shows test results in the M4 or M4T4 category cannot declare a lower rating (M3, M3T4). In all cases, the test report must have test results demonstrating the same rating declared by the manufacturer and reported to the FCC WTB.

3. Test Report Exhibits

- a) An example of items to be included in a test report is provided in Appendix A.
- b) In addition, test reports should include a matrix list of Air Interfaces and Bands (M- and T-report, see Appendix B for an example of the list to be provided):
 - 1) List all air interfaces and bands supported by the handset.
 - 2) For each air interface, indicate the type of voice transport mode:
 - a. VO = legacy Cellular Voice Service, from Table 7.1 in 7.4.2.1 of ANSI C63.19-2011;
 - b. DT = Digital Transport only (no voice); and
 - c. VD = IP Voice Service over Digital Transport.
 - 3) For each air interface, indicate the Voice Service:
 - a. For air interfaces marked VO it is to be noted in accordance with 7.4.2.1 of ANSI C63.19-2011 (see Appendix B for example).
 - b. For all others and VD, list the service, and if a reference level other than -20 dBm0 or the VoLTE July 2012 interpretation of ANSI C63.19-2011¹⁰ then the reference level must be established through a KDB Inquiry providing a technical description of the network audio signal level plan.
 - c. The test report shall just note "KDB ref and value". Then in an exhibit marked confidential upload to the operational description folder, a simple letter stating the reference level and the KDB Inquiry tracking number.
 - d. Reference levels unless otherwise noted are assumed to be in accordance with 7.4.2.1 of ANSI C63.19-2011, KDB Publication 285076 D02, i.e., or -20 dBm0.
 - 4) Indicate any air interface/bands that operate in simultaneous or concurrent service transmission mode.
 - 5) If the GSM air interfaces in the 1900 MHz band were tested using the option to reduce power, state in the test report the maximum power in the 1900 MHz band, and the reduced power used for testing to demonstrate compliance to the requirement that power be reduced by no more than 2.5 dB.
- c) MIF evaluation section (M-report) ANSI C63.19-2011.
 - 1) If the MIF values are tested, a description of the method and test equipment (manufacturer and model number) used to establish the Modulation Index Factor (MIF) as defined in 5.5.1.3 of ANSI C63.19-2011. Provide any justification for MIF values if the value is less than the sample values listed in D.7 Table D.5 of ANSI C63.19-2011, and values approaching the margin.

¹⁰ ANSI C63.19-2011 interpretation_T_coil_audio_levels_for_LTE_July_2012. Defining levels for VoLTE service see http://c63.org/documents/misc/posting/new_interpretations.htm_for_-16_dBm0. VoLTE is a voice service over an LTE air interface. For HAC compliance, VoLTE and Wi-Fi calling are considered separate services.

- 2) If the handset uses the MIF values predetermined by the test equipment manufacturer: a) Provide a separate exhibit or attestation, signed from the applicant (device manufacturer) that the values used represent worst-case air interfaces and operation of the device; and b) 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. Also see KDB Publication 285076 D02 for additional guidance.

4. Grant Note Codes

Use a Form-731 grant note code of "HC" for the frequency bands and air interfaces for which the tests have been performed and HAC rating obtained.¹¹

5. Grant Comments

- a) Add the text indicating the HAC rating in the comment field: "*HAC Rating M# or M#T#-20YY (-2007 or -2011).*"
- b) For air interfaces/bands included in ANSI C63.19-2011 that have voice capability and are certified for HAC (for which the grant note "HC" is used) the following grant comments will be automatically added: "*This equipment complies with the hearing aid compatibility technical requirements of Section 20.19 of the rules.*"
- c) When multiple models¹² have been offered with different HAC ratings under the same FCC ID, the HAC ratings must list the ratings for each model: "*M#T#-20YY, M#T#-20YY.*" It is not required to list the actual model associated with the multiple ratings.
- d) If the HAC rating requires a user-selectable mode reducing the power for the GSM air interface in the 1900 MHz band, then add the following grant comment: "*HAC rating requires user activation of a special mode for GSM operation in the 1900 MHz band.*"

6. Manual and Disclosures

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

- a) Section 20.19(f)(1): an explanation of the ANSI C63.19 rating system.
- b) Section 20.91(f)(3): disclosure statement for HAC-rated handsets operating over the GSM air interface in the 1900 MHz band with a user-selectable mode or a special mode necessary to meet the hearing aid compatibility standard for reducing the power under the provisions of Section 20.19(c)(1).

¹¹ Use of the HX note code is no longer required.

¹² The grant comment must list all HAC ratings for handsets under each FCC ID that have been offered and reported to FCC as HAC-compliant. The format is "*HAC Ratings: M#T#-200N, M#T#-20YY*" after the colon with each distinctive rating/model separated by a comma. When a permissive change has been granted for a new distinctive model, the new grant comment shall list all the HAC ratings offered under the single FCC ID, even if the previous model is no longer available from the manufacturer.

7. Permissive Changes, Product Changes, and Model Variations

- a) Multiple compliance reports under a single FCC ID that represent distinct models¹³ 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) 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 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. If the HAC rating changes, then a new model designation must be assigned to ensure distinction from the prior version.
- d) Any changes¹⁴ 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.
- e) A Class II permissive change application that only includes an M-rating report for a handset previously granted with a rating of M#T# is acceptable as a distinctive new model Section 20.19(g). The grant comment associated with the Class II permissive change would then be “*HAC Ratings: M#T#, M#.*”
- f) When adding a T-Coil rating for a device according to the Class II permissive change procedures for handsets, 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 then 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 report.
- g) 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.¹⁵

8. Testing Guidance

- a) HAC test environments (probes, equipment, test fixtures, etc.) must be properly calibrated according to the manufacturer 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).

¹³ Distinct models are defined in Section 20.19(a) (3) (iii). If a manufacturer assigns different model designations solely to distinguish units sold to different carriers (for either the same or different FCC ID), 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) and 20.19(d).

¹⁴ 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.

¹⁵ See: Permissive Change Policies, KDB Publication 178919.

- c) No external special parts or ancillary devices are permitted for testing to demonstrate HAC compliance.
- d) Handset models with user instructions that disable any of its features, degrade performance, reduce RF output power, and degrade battery performance, etc., for the purposes of meeting HAC compliance are not permitted. However, a 2.5 dB transmitter power reduction is permitted for the GSM air interface in the 1900 MHz band for certain manufacturers of handsets using a user-selectable mode of reducing the power by no more than 2.5 dB under the provisions of Section 20.19(c)(1). Handsets using this provision must be so noted in the test report and provide the appropriate text in the grant comment field and disclosure statements.
- e) Certain user controls and settings may be acceptable for processing audio signals in accordance with ANSI C63.19-2007 or ANSI C63.19-2011 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 the application.
- f) 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.
- g) In addition to the air interfaces/bands documentation, the application shall document all other key features of the device tested, including:¹⁶
 - 1) Special HAC audio configurations permitted in accordance with ANSI C63.19-2011.
 - 2) Statements regarding special antenna positions for HAC compliance (see 8f)).
 - 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 Wi-Fi or Bluetooth profile).
 - 4) Use of any feature not discussed above that is disabled during testing must be clearly documented in the test report.
- h) For interpretations and explanations issued by ASC C63®, see:
http://www.c63.org/documents/misc/posting/new_interpretations.htm

9. 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 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*.

¹⁶ An applicant has the option to submit the description of the EUT in the operational description exhibit, and request long-term or short-term confidentiality.

- DA 12-550; *Amendment of the Commission's Rules Governing Hearing Aid-Compatible Mobile Handsets*, 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*, Docket No. 15-285, NOTICE OF PROPOSED RULEMAKING; *Amendment of the Commission's Rules Governing Hearing Aid-Compatible Mobile Handsets*, Docket No. 07-250, FOURTH REPORT AND ORDER; Adopted: November 19, 2015; Released: November 20, 2015.
- Section [20.19 Hearing aid-compatible mobile handsets:](#)

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

Air Interface	Band MHz	Type	ANSI C63.19 Tested	Simultaneous Transmitter	Name of Voice Service	Power Reduction
GSM	850	VO	Yes	BT and Wi-Fi	*	NA
	1900					Yes
	GPRS/EDGE	DT	NA			NA
WCDMA (UMTS)	850	VO	Yes	BT and Wi-Fi	*	NA
	1900					
	HSPA	DT		BT and Wi-Fi		
CDMA	800	VO	Yes	BT and Wi-Fi	*	NA
	1900					
LTE	700	VD	Yes	BT and Wi-Fi	VoLTE* Skype** XYNet***	NA
	850					
	1700					
	1900					
Wi-Fi	2450	VD	NA	BT and GSM, LTE, CDMA, WCDMA or GSM	Wi-Fi-Calling Skype** XYNet***	NA
	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	NA

where:

VO: legacy Cellular Voice Service from Table 7.1 in 7.4.2.1 of ANSI C63.19-2011

DT: Digital Transport only (no voice)

VD: IP Voice Service over Digital Transport

BT: Bluetooth

* Ref Lev In accordance with 7.4.2.1 of ANSI C63.19-2011 and the July 2012 VoLTE interpretation

** Ref Lev -20 dBm0

*** Ref Lev XYNet established by KDB Inquiry NNNNNN @ -16 dBm0

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.

05/TBD/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.

**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**

1.0 Introduction

In 2015 the Federal Communications Commission expanded the rules to include new features and scopes for devices.¹⁷ The revised rules for hearing aid-compatibility 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.^{18, 19} In addition, effective January 1, 2018 the expanded rules eliminate the previous exclusions permitted for testing VoLTE and Wi-Fi calling air interfaces due to unavailable test equipment and unknown network engineering information.²⁰

The requirements for T-Coil signal tests are defined in Clause 7 of ANSI C63.19-2011.²¹ This document only provides some additional clarification and guidance for air interfaces that support VoIP not explicitly identified in Table 7.1 of ANSI C63.19-2011.²² This includes support for VoLTE, Wi-Fi Calling (VoIP) and the expanded scope for testing pre-installed over-the-top (OTT) applications services and coding algorithms such as: Google Hangouts, Yahoo Messenger (Internet Low Bitrate Codec), WebRTC [Opus, Skype (SILK)], IETF RFC 6716, H.263 and H.264, etc.²³

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.

¹⁷ Fourth Report and Order (FCC 15-155, Released November 20, 2015).

¹⁸ Voice over IP is defined in Section 9.3 of the FCC rules as Interconnected VoIP service. VoIP service is a service that: (1) Enables real-time, two-way voice communications; (2) requires a broadband connection from the user's location; (3) requires Internet protocol-compatible customer premises equipment (CPE); and (4) permits users generally to receive calls that originate on the public switched telephone network and to terminate calls to the public switched telephone network (i.e., VoLTE, Wi-Fi Calling and OTT). Non-interconnected VoIP, works the same except that it permits calls to others using the same service.

¹⁹ The expanded rules currently exclude testing for air interfaces operating over licensed Public Safety, private enterprise, and non-terrestrial Mobile Satellite Service (MSS) networks.

²⁰ Third Report and Order (DA 12-550, April 9, 2012)

²¹ Section 20.19 rules permit ANSI C63.19-2007 or ANSI C63.19-2011. However, as per the expanded requirements of the FOURTH REPORT AND ORDER all handsets with air interfaces including Voice over IP (VoIP) supporting two-way voice communication are covered by the measurement procedures in ANSI C63.19-2011. The ANSI C63.19-2007 standard is limited in frequency bands and air interfaces and would only be applicable to handsets that have only those frequency bands and air interfaces.

²² See: ANSI C63.19-2011_interpretation_T_coil_audio_levels_for_LTE_July_2012
http://c63.org/documents/misc/posting/new_interpretations.htm - T coil audio levels for LTE.

²³ OTT: Testing T-Coil requires that an engineered service have established standards for voice quality, network average talker reference levels, codec(s) and codec frequency response.

If a service provider requires specific applications which support voice calling and which have not been tested by the manufacturer, such applications must be tested to demonstrate compliance in order for the handset to be counted for meeting their obligation.

2.0 T-Coil compliance tests for VoIP

ANSI C63.19 HAC T-Coil testing is a measurement of the intended magnetic field 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 intensity; (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,²⁴ using a defined network reference test signals over the handset's supported air interfaces using the appropriate codecs.²⁵ The applied 1000 Hz test signal of 7.4.2.1 that correlates to normal speech is critical in establishing the 8.3.1 signal intensity, the 8.2.2 required reference to normalize the frequency response, and the 8.3.4 reference as the signal (ABM1) for the signal to noise (ABM2) ratio (all sub-clause references are in ANSI C63.19-2011). This level established the baseline for T-Coil measurements.

3.0 Instrumentation for T-Coil testing for VoIP

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

1. Establishing or simulating an audio connection to/from the hand set under test between matching compatible codecs over a digital data stream (without transcoding), and
2. 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 or the ANSI C63.19-2011 VoLTE interpretation of July 2012 with -16 dBm0.

For protocols not listed in Table 7.1 of ANSI C63.19-2011 or the ANSI C63.19-2011 VoLTE interpretation, the average speech level applied is -20 dBm0. Applicants using a reference level higher than -20 dBm0 must submit a KDB inquiry and a technical description of the network audio signal level plan.²⁶

²⁴ See: 7.1 through 7.3.2 of ANSI C63.19-2011.

²⁵ 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 associated with an air interface, voice coder, and band and bit rate.

²⁶ The -20 dBm0 establishes a generic reference acceptable at the present time; if a manufacturer is designing for a service provider who has established an alternative engineered audio signal level for a specific service, this must be approved by FCC through a KDB inquiry or the PAG approval process; the KDB inquiry or PAG KDB must include a detailed justification and information about the basis for an alternative.

For T-coil testing only the performance over all air interfaces (supporting a voice service under test) using the worst-case codec needs to be tested and documented. This will require first investigating the various codec configurations (WB, NB bit rate) over a limited set of bands/channels/bandwidth to determine the worst case codec. This investigation is to be documented in the test report. The variations found for the codec configurations and only one orientation and band/channel/bandwidth chosen by the investigation must be documented.²⁷

After the worst-case codec has been determined, then for each air interface band test and document over a limited set of channels/bandwidths. The tester should use reasonable judgement to note the results that have the largest degrading effect on the signal-to-noise ratio, and that these results are as expected. Consult with the manufacturer for any abnormal results.²⁸

Example of tests documented:

Codec Investigation					
Codec State	Rate 1		Rate N	Orientation	Band/channel
ABM1 (dBA/m)				*	*
ABM2 (dBA/m)					
S/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 C63.19-2011
Voice service /air interface/ band	Axial								
	Radial								

²⁷ Many test reports show very little or no significant variation and also demonstrate a wide margin 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.

²⁸ Many test reports show variation that may affect the rating for axial orientation and 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.

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.

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.

05/TBD/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.