

# HEARING AID COMPATIBILITY Volume Control Evaluation Report

FCC ID : YHLBLU45GW  
Equipment : Smart phone  
Brand Name : BLU  
Model Name : G45  
Receive Volume Control Results : PASS  
Applicant : BLU Products, Inc.  
8600 NW 36th Street, Suite #300 Miami, FL  
33166,USA  
Manufacturer : BLU Products, Inc.  
8600 NW 36th Street, Suite #300 Miami, FL  
33166,USA  
FCC 47 CFR §20.19  
Standard : ANSI C63.19-2019  
ANSI/TIA-5050-2018  
Date Tested : Sep. 27, 2025 ~ Sep. 29, 2025

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample provide by manufacturer and the test data has been evaluated in accordance with the test procedures given in ANSI C63.19-2019 / 47 CFR Part 20.19 / ANSI/TIA-5050-2018 and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.



Approved by: Si Zhang

**Sporton International Inc. (Kunshan)**

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300  
People's Republic of China



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## History of this test report

| Report No. | Version | Description             | Issued Date   |
|------------|---------|-------------------------|---------------|
| HA590811C  | Rev. 01 | Initial issue of report | Oct. 24, 2025 |
|            |         |                         |               |
|            |         |                         |               |



## 1. Attestation of Test Results

| Mounting Force (N)             | Lowest Conversational Gain (dB) |
|--------------------------------|---------------------------------|
| 2N                             | 8.4                             |
| 8N                             | 12.6                            |
| Receive Volume Control Results | PASS                            |

## 2. General Information

| Product Feature & Specification |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicant Name                  | BLU Products, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Equipment Name                  | Smart phone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Brand Name                      | BLU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Model Name                      | G45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| IMEI Code                       | 350701670000362/350701670000370                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| FCC ID                          | YHLBLU45GW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| HW                              | A661-MB-V0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| SW                              | BLU_G1190_V15.0.G.01.00_GENERIC_02-09-20251652                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| EUT Stage                       | Production Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Frequency Band                  | GSM850: 824 MHz ~ 849 MHz<br>GSM1900: 1850 MHz ~ 1910 MHz<br>WCDMA Band II: 1850 MHz ~ 1910 MHz<br>WCDMA Band IV: 1710 MHz ~ 1755 MHz<br>WCDMA Band V: 824 MHz ~ 849 MHz<br>LTE Band 2: 1850 MHz ~ 1910 MHz<br>LTE Band 4: 1710 MHz ~ 1755 MHz<br>LTE Band 5: 824 MHz ~ 849 MHz<br>LTE Band 7: 2500 MHz ~ 2570 MHz<br>LTE Band 12: 699 MHz ~ 716 MHz<br>LTE Band 17: 704 MHz ~ 716 MHz<br>LTE Band 66: 1710 MHz ~ 1780 MHz<br>LTE Band 71: 663 MHz ~ 698 MHz<br>WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz<br>WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz<br>WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz<br>WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz<br>WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz<br>Bluetooth: 2402 MHz ~ 2480 MHz |
| Mode                            | GSM/GPRS/EGPRS<br>RMC/AMR 12.2Kbps<br>HSDPA/HSUPA<br>HSPA+(16QAM uplink is supported)<br>LTE: QPSK, 16QAM, 64QAM(Downlink only)<br>WLAN 2.4GHz 802.11b/g/n HT20/HT40<br>WLAN 5GHz 802.11a/n HT20/HT40<br>WLAN 5GHz 802.11ac VHT20/VHT40/VHT80<br>Bluetooth BR/EDR/LE                                                                                                                                                                                                                                                                                                                                                                                                                                        |



### **3. Testing Location**

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

| Testing Laboratory |                                                                                                                                                |                     |                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------|
| Test Firm          | Sporton International Inc. (Kunshan)                                                                                                           |                     |                                |
| Test Site Location | No. 1098, Pengxi North Road, Kunshan Economic Development Zone<br>Jiangsu Province 215300 People's Republic of China<br>TEL : +86-512-57900158 |                     |                                |
| Test Site No.      | Sporton Site No.                                                                                                                               | FCC Designation No. | FCC Test Firm Registration No. |
|                    | AC01-KS                                                                                                                                        | CN1257              | 314309                         |

### **4. Applied Standards**

- FCC CFR47 Part 20.19
- ANSI C63.19-2019
- ANSI/TIA-5050-2018
- FCC KDB 285076 D01 HAC Guidance v06r04
- FCC KDB 285076 D04 Volume Control v02
- FCC KDB 285076 D05 CG Interim Waiver DA 23-914 v01

## 5. Air Interface and Operating Mode

| Air Interface                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Band MHz | Type | C63.19<br>Volume<br>Control<br>Tested | Simultaneous<br>Transmitter          | Name of Voice<br>Service                  | Power State<br>Compliance |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|---------------------------------------|--------------------------------------|-------------------------------------------|---------------------------|
| GSM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GSM850   | VO   | Yes                                   | WLAN, BT                             | CMRS Voice                                | Full                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | GSM1900  |      |                                       | WLAN, BT                             |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | EDGE850  | VD   | No                                    | WLAN, BT                             | Google Meet <sup>(1)</sup>                |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | EDGE1900 |      |                                       | WLAN, BT                             |                                           |                           |
| UMTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Band 2   | VO   | Yes                                   | WLAN, BT                             | CMRS Voice                                | Full                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Band 4   |      |                                       | WLAN, BT                             |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Band 5   |      |                                       | WLAN, BT                             |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | HSPA     | VD   | No                                    | WLAN, BT                             | Google Meet <sup>(1)</sup>                |                           |
| LTE<br>(FDD)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Band 2   | VD   | Yes                                   | WLAN, BT                             | VoLTE<br>/<br>Google Meet <sup>(1)</sup>  | Full                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Band 4   |      |                                       | WLAN, BT                             |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Band 5   |      |                                       | WLAN, BT                             |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Band 7   |      |                                       | WLAN, BT                             |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Band 12  |      |                                       | WLAN, BT                             |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Band 17  |      |                                       | WLAN, BT                             |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Band 66  |      |                                       | WLAN, BT                             |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Band 71  |      |                                       | WLAN, BT                             |                                           |                           |
| Wi-Fi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2450     | VD   | Yes                                   | GSM, WCDMA, LTE, 5GHz WLAN, BT       | VoWiFi<br>/<br>Google Meet <sup>(1)</sup> | Full                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5200     |      |                                       | GSM, WCDMA, LTE, 2.4GHz WLAN, BT     |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5300     |      |                                       | GSM, WCDMA, LTE, 2.4GHz WLAN, BT     |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5500     |      |                                       | GSM, WCDMA, LTE, 2.4GHz WLAN, BT     |                                           |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5800     |      |                                       | GSM, WCDMA, LTE, 2.4GHz WLAN, BT     |                                           |                           |
| BT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2450     | DT   | No                                    | GSM, WCDMA, LTE,<br>2.4GHz/5GHz WLAN | NA                                        | NA                        |
| <b>Type Transport:</b><br>VO= Voice only<br>DT= Digital Transport only (no voice)<br>VD= CMRS and IP Voice Service over Digital Transport                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |      |                                       |                                      |                                           |                           |
| <b>Remark</b><br>1. Per KDB 285076 D05, Waiver DA 23-914 only requires conversational gain compliance for CMRS narrowband and CMRS wideband voice codecs as stated below. All other codecs either part of 3GPP set such as full-band and super-wideband codecs or OTT codecs are to be documented in the test report but not required to comply with the TIA 5050 Volume Control Standard.<br>2. The GSM /WCDMA/LTE and WIFI operation doesn't support Time average SAR feature, therefore, GSM /WCDMA/LTE and WIFI operation were assessment at the maximum power to meet HAC Volume Control compliance. |          |      |                                       |                                      |                                           |                           |

## 6. Volume Control Requirements

### <Conversational Gain>

- Per KDB 285076 D05, With a mounting force of 8N, the DUT shall have at least one volume control setting that will produce a conversational gain of  $\geq 6$  dB
- Per KDB 285076 D05, With a mounting force of 2N, the DUT shall have at least one volume control setting that will produce a conversational gain of  $\geq 6$  dB.
- Calculate the Conversational Gain by subtracting 70 dB from the measured dBSPL.  
[Conversational Gain = (Measured dBSPL Level – 70 dBSPL) dB]

### <Receive Distortion And Noise Performance>

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

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

### <Receive Acoustic Frequency Response Performance>

For the volume control settings determined in ANSI/TIA-5050-2018 section 5.1.1 with a mounting force of 8N and 2N, the receive frequency response shall be measured at the DRP in 1/12 octave bands. After translation to the FF, it shall fall between the applicable upper and lower limits. The exact limit values at any 1/12 octave band center frequency falling between two consecutive points specified in the table may be calculated using the formula given in Eq 2 below:

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

Where

$X_f$  = limit value at frequency  $f$

$X_1$  = limit value at frequency  $f_1$  as given in table

$X_2$  = limit value at frequency  $f_2$  as given in table

For Narrowband: The 1/12 octave band frequency response after translation to the FF shall fall between the upper and lower limits given in Table 1.

For Wideband: The 1/12 octave band frequency response after translation to the FF shall fall between the upper and lower limits given in Table 2.

Table 1 – Narrowband Receive Frequency Response Limits

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

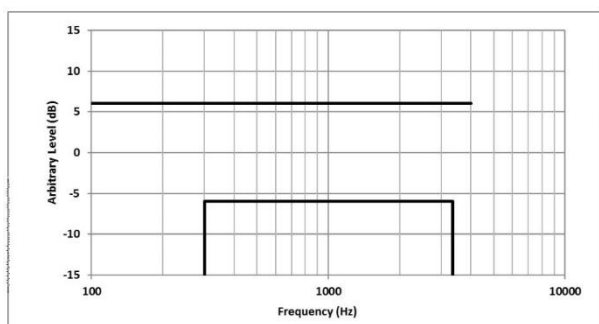
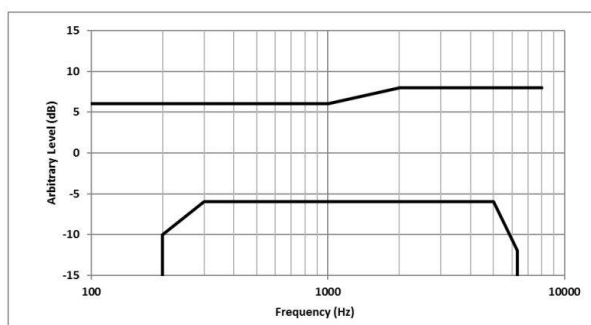
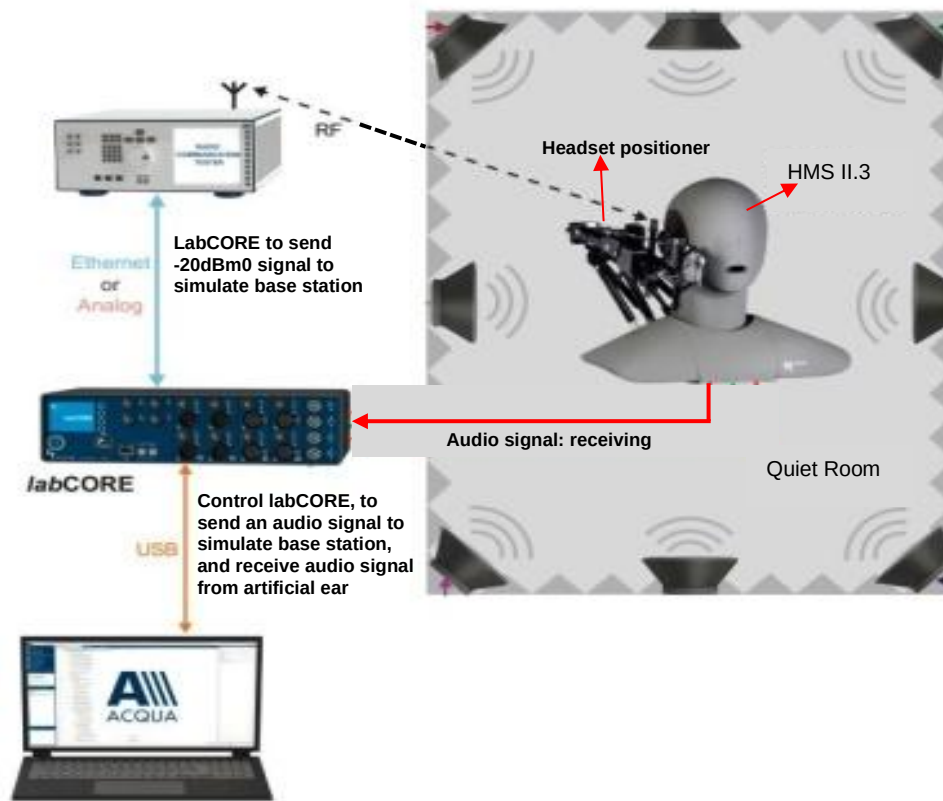


Table 2 – Wideband Receive Frequency Response Limits

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



## 7. System Description



### System Components:

| Name of Equipment             | Equipment Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| labCORE Audio Analyzer        | labCORE is a high-precision measurement hardware platform. It provides multiple channels, a wide variety of analog and digital inputs and outputs, high processing power and high-performance interfaces. labCORE is an all-in-one solution for measuring the voice and audio quality of a wide range of devices. labCORE is used in conjunction with the communication quality analysis system ACQUA. Connected to a computer via USB (Plug & Play), it is configured and controlled by ACQUA. Combinations with other HEAD acoustics hardware platforms and software applications are possible. labCORE settings are controlled via the intuitive ACQUA settings. They can be stored and assigned to selectable measurement sequences. |
| HMS II.3, artificial head     | HMS II.3 supports measurements in sending and receiving direction. For this purpose, the artificial head is equipped with an impedance simulator in the right ear and a two-way mouth loudspeaker – both meeting the requirements in the recommendations ITU-T P.57 and P.58                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Handset positioner            | Control the Newton's force(2N/8N) of the mobile phone on the artificial head                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| ACQUA, TIA-5050 Test Software | The SW version5.1.200 can be evaluated TIA-5050 section5.1, 5.2, 5.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| R&S base station simulator    | RF connect with the mobile phone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## **8. Volume Control Test Procedure**

### **<Conversational Gain>**

1. Configure the DUT with a mounting force of 8N and test equipment as shown in section 5 in an active call state with the applicable codec for the transmission mode under test.
2. Set the DUT volume control to the maximum setting.
3. If the DUT has an adjustable tone control feature, a tone control setting that meets the frequency response requirements in ANSI/TIA-5050 section 5.3.1 shall be used.
4. The ACQUA system is apply the real speech test signal at a level of -20 dBm0 at the RETP and measure the acoustic output at the Drum Reference Point (DRP) over one complete sequence of the test signal.
5. Translate the measurement made at the DRP to the Free Field (FF) using the translation data in ANSI/TIA-5050 Annex B.
6. Over the applicable frequency band, determine the ASL in dBSPL for the resulting sound pressure level in accordance with Method B of ITU-T Recommendation P.56:
  - a. Narrowband 100 Hz through 4000 Hz.
  - b. Wideband 100 Hz through 7720 Hz.Calculate the Conversational Gain by subtracting 70 dB from the measured dBSPL.  
[Conversational Gain = (Measured dBSPL Level – 70 dBSPL) dB]
7. Measure the output distortion per ANSI/TIA-5050 clause 5.2. If a distortion failure occurs at the maximum volume control setting, reduce the volume control setting and repeat the measurement to determine if a setting can be found for which the conversational gain requirement is met without a distortion failure.
8. Repeat steps 2-8 with a mounting force of 2N.

### **<Receive Distortion And Noise Performance>**

1. Configure the DUT with a mounting force of 8N and test equipment as shown in section in an active call state with the applicable codec for the transmission mode under test.
2. Receive distortion and noise is measured using the PN-SDNR procedure as described in ANSI/TIA-5050 Annex A.
3. To ensure DUT activation, the ACQUA system is apply the real speech test signal at a level of -20 dBm0 followed immediately by the initial 1/3 octave center frequency PN test signal in ANSI/TIA-5050 Table A.1 based on the narrowband or wideband operating mode. Measure the acoustic output at the DRP over the complete sequence of the PN test signal.
4. Translate the measurement made at the DRP to the FF using the translation data in ANSI/TIA-5050 Annex B.
5. Calculate the acoustic output unweighted total signal power of the stimulus measurement band as described in ANSI/TIA-5050 A.2.
6. Calculate the notched A-weighting distortion and noise components as described in ANSI/TIA-5050 A.3.
7. Calculate the ratio of the signal power to the total A-weighted distortion and noise power using ANSI/TIA-5050 Eq A-1.
8. Repeat for each of the remaining 1/3 octave center frequencies in Table A.1 based on the narrowband or wideband operating mode.
9. Repeat steps 2-8 with a mounting force of 2N.
10. The measured value that the system equipment will automatically calculates or converts to define whether it meets the requirements of ANSI/TIA-5050 annex A and annex B.

**<Receive Acoustic Frequency Response Performance>**

1. Configure the DUT with a mounting force of 8N and test equipment as shown in Figure 1 in an active call state with the applicable codec for the transmission mode under test.
2. If the DUT has an adjustable tone control feature the initial measurement is to be performed with the default tone control setting.
3. The ACQUA system is apply the real speech test signal with a level of -20 dBm0 at the RETP.
4. Capture the frequency spectrum at the DRP of the HATS using real-time analysis with 1/12 octave bands over the frequency range from 100 Hz to 4000 Hz for narrowband measurements, or over the frequency range from 100 Hz to 8000 Hz for wideband measurements, averaged over the entire duration of the test signal.
5. Transform the DRP frequency spectrum measurement to the FF (include ANSI/TIA-5050 Annex B).
6. Divide the 1/12 octave measurement data by the 1/12 octave frequency spectrum of the test signal at the RETP and present the measurement in terms of dB(Pa/V).
7. Apply the applicable frequency response limits to determine compliance.
8. If the default tone control setting does not meet the requirement, repeat the above steps for other tone control settings to determine a tone control setting that meets the requirements.
9. Repeat with a mounting force of 2N.
10. The receive acoustic frequency response performance was perform at max tone control setting.

**9. Test Equipment List**

| Manufacturer       | Name of Equipment        | Type/Model | Serial Number | Calibration |            |
|--------------------|--------------------------|------------|---------------|-------------|------------|
|                    |                          |            |               | Last Cal.   | Due Date   |
| HEAD acoustic GmbH | Audio Analyzer           | labCORE    | 77000544      | 2024/10/11  | 2025/10/10 |
| HEAD acoustic GmbH | Fullband artificial head | HMS II.3   | 12306242      | 2024/11/18  | 2025/11/17 |
| G.R.A.S            | Sound Calibrator         | 42AB       | 31744         | 2024/10/11  | 2025/10/10 |
| R&S                | Base Station             | CMW500     | 167143        | 2025/5/6    | 2026/5/5   |
| Testo              | Thermo-Hygrometer        | HTC-1      | 1949245       | 2025/1/11   | 2026/1/10  |

## 10. Device Support Codec

**General Note:**

1. Per KDB 285076 D04, it is expected to investigate and document only the worst-case test conditions and results. Each submitted test report shall document the codec type (i.e., NB, WB, EVS, etc.), every air interface (i.e., LTE, 5G NR, WI-FI) and band supported for the worst-case codec bit rate, band channel, bandwidth, air interface bit rate, subcarrier spacings, and resource blocks
2. Through Internal codec and air interface configuration investigation (e.g. (i.e., NB, WB, EVS codec, bandwidth, modulation data rate, subcarrier spacing, and resource blocks) that the worst investigate results of codec, air interface configuration etc. were include in section10
3. Per KDB 285076 D05, Waiver DA 23-914 only requires conversational gain compliance for CMRS narrowband and CMRS wideband voice codecs as stated below. All other codecs either part of 3GPP set such as full-band and super-wideband codecs or OTT codecs are to be documented in the test report but not required to comply with the TIA 5050 Volume Control Standard
4. If a handset does not have a wideband codec or the handset only has an AMR wideband codec, then the test report must document this fact and the passing requirement under these circumstances for the wideband codec test is waived. The passing results for the distortion/noise and frequency response tests must be reported in the handset's test report

| GSM Codec/bitrate |          |          |
|-------------------|----------|----------|
| Codec             | AMR NB   | EFR NB   |
| Bitrate           | 4.75kbps | 12.2kbps |
|                   | 5.15kbps |          |
|                   | 5.9kbps  |          |
|                   | 6.7kbps  |          |
|                   | 7.4kbps  |          |
|                   | 7.95kbps |          |
|                   | 10.2kbps |          |
|                   | 12.2kbps |          |

| WCDMA Codec/bitrate |          |           |
|---------------------|----------|-----------|
| Codec               | AMR NB   | AMR WB    |
| Bitrate             | 4.75kbps | 6.60kbps  |
|                     | 5.15kbps | 8.85kbps  |
|                     | 5.9kbps  | 12.65kbps |
|                     | 6.7kbps  | 14.25kbps |
|                     | 7.4kbps  | 15.85kbps |
|                     | 7.95kbps | 18.25kbps |
|                     | 10.2kbps | 19.85kbps |
|                     | 12.2kbps | 23.05kbps |
|                     |          | 23.85kbps |

| VoLTE/VoNR/VoWiFi Codec/bitrate |          |           |          |          |
|---------------------------------|----------|-----------|----------|----------|
| Codec                           | AMR NB   | AMR WB    | EVS NB   | EVS WB   |
| Bitrate                         | 4.75kbps | 6.60kbps  | 5.9kbps  | 5.9kbps  |
|                                 | 5.15kbps | 8.85kbps  | 7.2kbps  | 7.2kbps  |
|                                 | 5.9kbps  | 12.65kbps | 8kbps    | 8kbps    |
|                                 | 6.7kbps  | 14.25kbps | 9.6kbps  | 9.6kbps  |
|                                 | 7.4kbps  | 15.85kbps | 13.2kbps | 13.2kbps |
|                                 | 7.95kbps | 18.25kbps | 16.4kbps | 16.4kbps |
|                                 | 10.2kbps | 19.85kbps | 24.4kbps | 24.4kbps |
|                                 | 12.2kbps | 23.05kbps |          |          |
|                                 |          | 23.85kbps |          |          |
|                                 |          |           |          |          |

| Google meet Codec/bitrate investigation |                  |
|-----------------------------------------|------------------|
| Codec                                   | Opus (Full Band) |
| Bitrate                                 | 6Kbps~75Kbps     |

## **11. Volume Control Evaluation Results**

### **General Note:**

1. All the test result was done at quiet room and ambient noise is less than 40dBA.
2. Per KDB 285076 D05, in section2 addresses the technical testing requirements for the conversational gain, distortion, and frequency response tests that amends KDB 285076 D04 Volume Control under the conditions of the limited-term waiver DA 23-914, as follows:
  - a. Under the waiver, only CMRS narrowband and CMRS wideband voice codecs are required to comply with the volume control requirements of the TIA 5050-2018 Volume Control Standard as amended as follows:
    1. For the 2N mounting force test, one narrowband and one wideband voice codec embedded with the handset must pass with at least one volume control setting with a conversational gain of  $\geq 6$  dB for all voice services, bands of operation and air interfaces over which it operates using one codec bit rate of the applicant's choosing
    2. For the 8N mounting force test, one narrowband and one wideband voice codec embedded with the handset must pass with at least one volume control setting with a conversational gain of  $\geq 6$  dB 8 for all voice services, bands of operation and air interfaces over which they operate but is not required to meet or exceed the full 18 dB of conversational gain specified in section 5.1.1 of the TIA 5050 Volume Control Standard using one codec bit rate of the applicant's choosing
  - b. For all other narrowband and wideband codecs not evaluated in 2.a. above, TIA 5050-2018 Receive Distortion and Noise Performance and Receive Acoustic Frequency Response Performance evaluations are not required; however, these codecs shall be assessed for conversational gain and documented in the test report at the 2N and 8N levels with a gain of  $\geq 6$  dB for all voice services, bands of operation and air interfaces over which they operate. The handset volume setting used to comply with 2.a. shall be used for these other CMRS codec evaluations.
  - c. Any other codec for voice services embedded in the handset, not identified in 2.a. and 2.b. above, is not required to comply or demonstrate in the test reports for conversational gain.
3. All the test results were set the DUT volume control to the maximum setting.
4. Conversational Gain = (measured dBSPL Level – 70 dBSPL) dB
5. Through Internal radio configuration investigation (e.g. bandwidth, modulation data rate, subcarrier spacing, and resource blocks) that the worst radio configuration was document as below table.
6. Per KDB 285076 D05 and document of DA 23-914 item 30, the manufacturer only perform EVS codec to meet distortion/noise and frequency response tests at the 2N and 8N force levels.
7. The device have similar frequency in some LTE bands: LTE B12/17, 4/66 since the supported frequency spans for the smaller LTE bands are completely cover by the larger LTE bands, therefore, only larger LTE bands were required to be tested for hearing-aid compliance.
8. The worst case results of each air interface include in appendix A.



### <Evaluation results for KDB 285076 D05 2.a>

#### <LTE>

| HAC (Volume control) Test Record |               |                   |         |                 |                    | Receive Volume Control Performance |                                                              |            |                      |           | Receive Distortion and Noise Performance |            |                      |           | Receive Acoustic Frequency Response Performance |
|----------------------------------|---------------|-------------------|---------|-----------------|--------------------|------------------------------------|--------------------------------------------------------------|------------|----------------------|-----------|------------------------------------------|------------|----------------------|-----------|-------------------------------------------------|
| Plot No.                         | Air Interface | Modulation / Mode | Channel | Audio Codec     | Mounting Force (N) | Measured dB SPL Level              | Conversational Gain (Measured dB SPL Level - 70 dB SPL) (dB) | Limit (dB) | Margin to Limit (dB) | PASS/FAIL | Minimum PN-SDNR (dB) Doc. Section        | Limit (dB) | Margin to Limit (dB) | PASS/FAIL | Free Field (FF)                                 |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS NB 24.4kbps | 2N                 | 78.94                              | 8.94                                                         | ≥6         | 2.94                 | PASS      | 28.24                                    | ≥20        | 8.24                 | PASS      | 1.93                                            |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS NB 24.4kbps | 8N                 | 83.02                              | 13.02                                                        | ≥6         | 7.02                 | PASS      | 30.3                                     | ≥20        | 10.3                 | PASS      | 2.25                                            |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS WB 24.4kbps | 2N                 | 81.22                              | 11.22                                                        | ≥6         | 5.22                 | PASS      | 22.48                                    | ≥20        | 2.48                 | PASS      | 1.37                                            |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS WB 24.4kbps | 8N                 | 85.26                              | 15.26                                                        | ≥6         | 9.26                 | PASS      | 22.68                                    | ≥20        | 2.68                 | PASS      | 1.51                                            |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS NB 24.4kbps | 2N                 | 79.2                               | 9.2                                                          | ≥6         | 3.2                  | PASS      | 28.25                                    | ≥20        | 8.25                 | PASS      | 1.6                                             |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS NB 24.4kbps | 8N                 | 83.08                              | 13.08                                                        | ≥6         | 7.08                 | PASS      | 26.28                                    | ≥20        | 6.28                 | PASS      | 2.14                                            |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS WB 24.4kbps | 2N                 | 81.46                              | 11.46                                                        | ≥6         | 5.46                 | PASS      | 22.32                                    | ≥20        | 2.32                 | PASS      | 1.06                                            |
| 1                                | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS WB 24.4kbps | 8N                 | 85.49                              | 15.49                                                        | ≥6         | 9.49                 | PASS      | 21.89                                    | ≥20        | 1.89                 | PASS      | 1.86                                            |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS NB 24.4kbps | 2N                 | 79.21                              | 9.21                                                         | ≥6         | 3.21                 | PASS      | 26.35                                    | ≥20        | 6.35                 | PASS      | 1.78                                            |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS NB 24.4kbps | 8N                 | 83.3                               | 13.3                                                         | ≥6         | 7.3                  | PASS      | 31.29                                    | ≥20        | 11.29                | PASS      | 2.16                                            |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS WB 24.4kbps | 2N                 | 81.41                              | 11.41                                                        | ≥6         | 5.41                 | PASS      | 22.17                                    | ≥20        | 2.17                 | PASS      | 1.7                                             |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS WB 24.4kbps | 8N                 | 85.33                              | 15.33                                                        | ≥6         | 9.33                 | PASS      | 22.15                                    | ≥20        | 2.15                 | PASS      | 1.47                                            |
|                                  | LTE Band 12   | 10M_QPSK_1_0      | 23095   | EVS NB 24.4kbps | 2N                 | 79.26                              | 9.26                                                         | ≥6         | 3.26                 | PASS      | 29.02                                    | ≥20        | 9.02                 | PASS      | 1.56                                            |
|                                  | LTE Band 12   | 10M_QPSK_1_0      | 23095   | EVS NB 24.4kbps | 8N                 | 83.25                              | 13.25                                                        | ≥6         | 7.25                 | PASS      | 29.65                                    | ≥20        | 9.65                 | PASS      | 2.13                                            |
|                                  | LTE Band 12   | 10M_QPSK_1_0      | 23095   | EVS WB 24.4kbps | 2N                 | 81.74                              | 11.74                                                        | ≥6         | 5.74                 | PASS      | 22.2                                     | ≥20        | 2.2                  | PASS      | 1.88                                            |
|                                  | LTE Band 12   | 10M_QPSK_1_0      | 23095   | EVS WB 24.4kbps | 8N                 | 85.51                              | 15.51                                                        | ≥6         | 9.51                 | PASS      | 22.31                                    | ≥20        | 2.31                 | PASS      | 1.75                                            |
|                                  | LTE Band 66   | 20M_QPSK_1_0      | 132322  | EVS NB 24.4kbps | 2N                 | 79.15                              | 9.15                                                         | ≥6         | 3.15                 | PASS      | 26.46                                    | ≥20        | 6.46                 | PASS      | 1.85                                            |
|                                  | LTE Band 66   | 20M_QPSK_1_0      | 132322  | EVS NB 24.4kbps | 8N                 | 83.19                              | 13.19                                                        | ≥6         | 7.19                 | PASS      | 26.31                                    | ≥20        | 6.31                 | PASS      | 2.31                                            |
|                                  | LTE Band 66   | 20M_QPSK_1_0      | 132322  | EVS WB 24.4kbps | 2N                 | 81.41                              | 11.41                                                        | ≥6         | 5.41                 | PASS      | 22.38                                    | ≥20        | 2.38                 | PASS      | 1.91                                            |
|                                  | LTE Band 66   | 20M_QPSK_1_0      | 132322  | EVS WB 24.4kbps | 8N                 | 85.38                              | 15.38                                                        | ≥6         | 9.38                 | PASS      | 22.19                                    | ≥20        | 2.19                 | PASS      | 1.42                                            |
|                                  | LTE Band 71   | 20M_QPSK_1_0      | 133297  | EVS NB 24.4kbps | 2N                 | 79.32                              | 9.32                                                         | ≥6         | 3.32                 | PASS      | 28.53                                    | ≥20        | 8.53                 | PASS      | 1.67                                            |
|                                  | LTE Band 71   | 20M_QPSK_1_0      | 133297  | EVS NB 24.4kbps | 8N                 | 83.32                              | 13.32                                                        | ≥6         | 7.32                 | PASS      | 31.26                                    | ≥20        | 11.26                | PASS      | 2.2                                             |
|                                  | LTE Band 71   | 20M_QPSK_1_0      | 133297  | EVS WB 24.4kbps | 2N                 | 81.51                              | 11.51                                                        | ≥6         | 5.51                 | PASS      | 22.1                                     | ≥20        | 2.1                  | PASS      | 1.2                                             |
|                                  | LTE Band 71   | 20M_QPSK_1_0      | 133297  | EVS WB 24.4kbps | 8N                 | 85.63                              | 15.63                                                        | ≥6         | 9.63                 | PASS      | 22.05                                    | ≥20        | 2.05                 | PASS      | 1.56                                            |



## <WLAN>

| HAC (Volume control) Test Record |               |                   |         |                 |                    | Receive Volume Control Performance |                                                              |            |                      |           | Receive Distortion and Noise Performance |            |                      |           | Receive Acoustic Frequency Response Performance |
|----------------------------------|---------------|-------------------|---------|-----------------|--------------------|------------------------------------|--------------------------------------------------------------|------------|----------------------|-----------|------------------------------------------|------------|----------------------|-----------|-------------------------------------------------|
| Plot No.                         | Air Interface | Modulation / Mode | Channel | Audio Codec     | Mounting Force (N) | Measured dB SPL Level              | Conversational Gain (Measured dB SPL Level - 70 dB SPL) (dB) | Limit (dB) | Margin to Limit (dB) | PASS/FAIL | Minimum PN-SDNR (dB) Doc. Section        | Limit (dB) | Margin to Limit (dB) | PASS/FAIL | Free Field (FF)                                 |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS NB 24.4kbps | 2N                 | 79.49                              | 9.49                                                         | ≥6         | 3.49                 | PASS      | 28.54                                    | ≥20        | 8.54                 | PASS      | 0.51                                            |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS NB 24.4kbps | 8N                 | 83.61                              | 13.61                                                        | ≥6         | 7.61                 | PASS      | 30.52                                    | ≥20        | 10.52                | PASS      | 1.16                                            |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS WB 24.4kbps | 2N                 | 81.53                              | 11.53                                                        | ≥6         | 5.53                 | PASS      | 21.98                                    | ≥20        | 1.98                 | PASS      | 0.89                                            |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS WB 24.4kbps | 8N                 | 85.71                              | 15.71                                                        | ≥6         | 9.71                 | PASS      | 22.04                                    | ≥20        | 2.04                 | PASS      | 1.42                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS NB 24.4kbps | 2N                 | 79.11                              | 9.11                                                         | ≥6         | 3.11                 | PASS      | 29.85                                    | ≥20        | 9.85                 | PASS      | 0.79                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS NB 24.4kbps | 8N                 | 83.6                               | 13.6                                                         | ≥6         | 7.6                  | PASS      | 29.85                                    | ≥20        | 9.85                 | PASS      | 0.87                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS WB 24.4kbps | 2N                 | 81.62                              | 11.62                                                        | ≥6         | 5.62                 | PASS      | 22.08                                    | ≥20        | 2.08                 | PASS      | 0.35                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS WB 24.4kbps | 8N                 | 85.77                              | 15.77                                                        | ≥6         | 9.77                 | PASS      | 21.99                                    | ≥20        | 1.99                 | PASS      | 1.36                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS NB 24.4kbps | 2N                 | 79.65                              | 9.65                                                         | ≥6         | 3.65                 | PASS      | 30.23                                    | ≥20        | 10.23                | PASS      | 0.67                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS NB 24.4kbps | 8N                 | 83.52                              | 13.52                                                        | ≥6         | 7.52                 | PASS      | 30.64                                    | ≥20        | 10.64                | PASS      | 1.25                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS WB 24.4kbps | 2N                 | 81.67                              | 11.67                                                        | ≥6         | 5.67                 | PASS      | 21.98                                    | ≥20        | 1.98                 | PASS      | 1.16                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS WB 24.4kbps | 8N                 | 85.67                              | 15.67                                                        | ≥6         | 9.67                 | PASS      | 21.94                                    | ≥20        | 1.94                 | PASS      | 1.21                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 116     | EVS NB 24.4kbps | 2N                 | 79.35                              | 9.35                                                         | ≥6         | 3.35                 | PASS      | 27.83                                    | ≥20        | 7.83                 | PASS      | 0.9                                             |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 116     | EVS NB 24.4kbps | 8N                 | 83.51                              | 13.51                                                        | ≥6         | 7.51                 | PASS      | 26.97                                    | ≥20        | 6.97                 | PASS      | 1.3                                             |
| 2                                | WLAN5GHz      | 802.11a 6Mbps     | 116     | EVS WB 24.4kbps | 2N                 | 81.61                              | 11.61                                                        | ≥6         | 5.61                 | PASS      | 21.85                                    | ≥20        | 1.85                 | PASS      | 1.03                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 116     | EVS WB 24.4kbps | 8N                 | 85.58                              | 15.58                                                        | ≥6         | 9.58                 | PASS      | 22.42                                    | ≥20        | 2.42                 | PASS      | 0.81                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 157     | EVS NB 24.4kbps | 2N                 | 79.67                              | 9.67                                                         | ≥6         | 3.67                 | PASS      | 28.22                                    | ≥20        | 8.22                 | PASS      | 0.73                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 157     | EVS NB 24.4kbps | 8N                 | 83.54                              | 13.54                                                        | ≥6         | 7.54                 | PASS      | 29.9                                     | ≥20        | 9.9                  | PASS      | 1.16                                            |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 157     | EVS WB 24.4kbps | 2N                 | 81.63                              | 11.63                                                        | ≥6         | 5.63                 | PASS      | 22.35                                    | ≥20        | 2.35                 | PASS      | 0.64                                            |
| 3                                | WLAN5GHz      | 802.11a 6Mbps     | 157     | EVS WB 24.4kbps | 8N                 | 85.8                               | 15.8                                                         | ≥6         | 9.8                  | PASS      | 21.81                                    | ≥20        | 1.81                 | PASS      | 1.54                                            |



## &lt;Codec Investigation and Evaluation results for KDB 285076 D05 2.b&gt;

## &lt;GSM&gt;

| HAC (Volume control) Test Record |               |                   |         |                 |                    | Receive Volume Control Performance |                                                              |            |                      |           |
|----------------------------------|---------------|-------------------|---------|-----------------|--------------------|------------------------------------|--------------------------------------------------------------|------------|----------------------|-----------|
| Plot No.                         | Air Interface | Modulation / Mode | Channel | Audio Codec     | Mounting Force (N) | Measured dB SPL Level              | Conversational Gain (Measured dB SPL Level – 70 dB SPL) (dB) | Limit (dB) | Margin to Limit (dB) | PASS/FAIL |
|                                  | GSM850        | GSM Voice         | 189     | EFR NB 12.2kbps | 2N                 | 79.67                              | 9.67                                                         | ≥6         | 3.67                 | PASS      |
|                                  | GSM850        | GSM Voice         | 189     | EFR NB 12.2kbps | 8N                 | 83.65                              | 13.65                                                        | ≥6         | 7.65                 | PASS      |
| 4                                | GSM850        | GSM Voice         | 189     | AMR NB 4.75kbps | 2N                 | 78.66                              | 8.66                                                         | ≥6         | 2.66                 | PASS      |
|                                  | GSM850        | GSM Voice         | 189     | AMR NB 4.75kbps | 8N                 | 82.8                               | 12.8                                                         | ≥6         | 6.8                  | PASS      |
|                                  | GSM850        | GSM Voice         | 189     | AMR NB 12.2kbps | 2N                 | 79.68                              | 9.68                                                         | ≥6         | 3.68                 | PASS      |
|                                  | GSM850        | GSM Voice         | 189     | AMR NB 12.2kbps | 8N                 | 83.59                              | 13.59                                                        | ≥6         | 7.59                 | PASS      |
|                                  | GSM1900       | GSM Voice         | 661     | EFR NB 12.2kbps | 2N                 | 79.73                              | 9.73                                                         | ≥6         | 3.73                 | PASS      |
|                                  | GSM1900       | GSM Voice         | 661     | EFR NB 12.2kbps | 8N                 | 83.52                              | 13.52                                                        | ≥6         | 7.52                 | PASS      |
|                                  | GSM1900       | GSM Voice         | 661     | AMR NB 4.75kbps | 2N                 | 78.75                              | 8.75                                                         | ≥6         | 2.75                 | PASS      |
|                                  | GSM1900       | GSM Voice         | 661     | AMR NB 4.75kbps | 8N                 | 82.77                              | 12.77                                                        | ≥6         | 6.77                 | PASS      |
|                                  | GSM1900       | GSM Voice         | 661     | AMR NB 12.2kbps | 2N                 | 79.72                              | 9.72                                                         | ≥6         | 3.72                 | PASS      |
|                                  | GSM1900       | GSM Voice         | 661     | AMR NB 12.2kbps | 8N                 | 83.47                              | 13.47                                                        | ≥6         | 7.47                 | PASS      |

## &lt;UMTS&gt;

| HAC (Volume control) Test Record |               |                   |         |                  |                    | Receive Volume Control Performance |                                                              |            |                      |           |
|----------------------------------|---------------|-------------------|---------|------------------|--------------------|------------------------------------|--------------------------------------------------------------|------------|----------------------|-----------|
| Plot No.                         | Air Interface | Modulation / Mode | Channel | Audio Codec      | Mounting Force (N) | Measured dB SPL Level              | Conversational Gain (Measured dB SPL Level – 70 dB SPL) (dB) | Limit (dB) | Margin to Limit (dB) | PASS/FAIL |
| 5                                | WCDMA II      | Voice             | 9400    | AMR NB 4.75kbps  | 2N                 | 78.66                              | 8.66                                                         | ≥6         | 2.66                 | PASS      |
|                                  | WCDMA II      | Voice             | 9400    | AMR NB 4.75kbps  | 8N                 | 82.76                              | 12.76                                                        | ≥6         | 6.76                 | PASS      |
|                                  | WCDMA II      | Voice             | 9400    | AMR NB 12.2kbps  | 2N                 | 79.57                              | 9.57                                                         | ≥6         | 3.57                 | PASS      |
|                                  | WCDMA II      | Voice             | 9400    | AMR NB 12.2kbps  | 8N                 | 83.15                              | 13.15                                                        | ≥6         | 7.15                 | PASS      |
|                                  | WCDMA II      | Voice             | 9400    | AMR WB 6.60kbps  | 2N                 | 81.41                              | 11.41                                                        | ≥6         | 5.41                 | PASS      |
|                                  | WCDMA II      | Voice             | 9400    | AMR WB 6.60kbps  | 8N                 | 85.45                              | 15.45                                                        | ≥6         | 9.45                 | PASS      |
|                                  | WCDMA II      | Voice             | 9400    | AMR WB 23.85kbps | 2N                 | 81.82                              | 11.82                                                        | ≥6         | 5.82                 | PASS      |
|                                  | WCDMA II      | Voice             | 9400    | AMR WB 23.85kbps | 8N                 | 85.87                              | 15.87                                                        | ≥6         | 9.87                 | PASS      |
|                                  | WCDMA IV      | Voice             | 1413    | AMR NB 4.75kbps  | 2N                 | 78.7                               | 8.7                                                          | ≥6         | 2.7                  | PASS      |
|                                  | WCDMA IV      | Voice             | 1413    | AMR NB 4.75kbps  | 8N                 | 82.83                              | 12.83                                                        | ≥6         | 6.83                 | PASS      |
|                                  | WCDMA IV      | Voice             | 1413    | AMR NB 12.2kbps  | 2N                 | 79.62                              | 9.62                                                         | ≥6         | 3.62                 | PASS      |
|                                  | WCDMA IV      | Voice             | 1413    | AMR NB 12.2kbps  | 8N                 | 83.5                               | 13.5                                                         | ≥6         | 7.5                  | PASS      |
|                                  | WCDMA IV      | Voice             | 1413    | AMR WB 6.60kbps  | 2N                 | 81.31                              | 11.31                                                        | ≥6         | 5.31                 | PASS      |
|                                  | WCDMA IV      | Voice             | 1413    | AMR WB 6.60kbps  | 8N                 | 85.48                              | 15.48                                                        | ≥6         | 9.48                 | PASS      |
|                                  | WCDMA IV      | Voice             | 1413    | AMR WB 23.85kbps | 2N                 | 81.86                              | 11.86                                                        | ≥6         | 5.86                 | PASS      |
|                                  | WCDMA IV      | Voice             | 1413    | AMR WB 23.85kbps | 8N                 | 85.82                              | 15.82                                                        | ≥6         | 9.82                 | PASS      |
|                                  | WCDMA V       | Voice             | 4182    | AMR NB 4.75kbps  | 2N                 | 78.78                              | 8.78                                                         | ≥6         | 2.78                 | PASS      |
|                                  | WCDMA V       | Voice             | 4182    | AMR NB 4.75kbps  | 8N                 | 82.78                              | 12.78                                                        | ≥6         | 6.78                 | PASS      |
|                                  | WCDMA V       | Voice             | 4182    | AMR NB 12.2kbps  | 2N                 | 79.57                              | 9.57                                                         | ≥6         | 3.57                 | PASS      |
|                                  | WCDMA V       | Voice             | 4182    | AMR NB 12.2kbps  | 8N                 | 83.29                              | 13.29                                                        | ≥6         | 7.29                 | PASS      |
|                                  | WCDMA V       | Voice             | 4182    | AMR WB 6.60kbps  | 2N                 | 81.41                              | 11.41                                                        | ≥6         | 5.41                 | PASS      |
|                                  | WCDMA V       | Voice             | 4182    | AMR WB 6.60kbps  | 8N                 | 85.52                              | 15.52                                                        | ≥6         | 9.52                 | PASS      |
|                                  | WCDMA V       | Voice             | 4182    | AMR WB 23.85kbps | 2N                 | 81.84                              | 11.84                                                        | ≥6         | 5.84                 | PASS      |
|                                  | WCDMA V       | Voice             | 4182    | AMR WB 23.85kbps | 8N                 | 85.86                              | 15.86                                                        | ≥6         | 9.86                 | PASS      |



## &lt;LTE&gt;

| HAC (Volume control) Test Record |               |                   |         |                  |                    | Receive Volume Control Performance |                                                              |            |                      |           |
|----------------------------------|---------------|-------------------|---------|------------------|--------------------|------------------------------------|--------------------------------------------------------------|------------|----------------------|-----------|
| Plot No.                         | Air Interface | Modulation / Mode | Channel | Audio Codec      | Mounting Force (N) | Measured dB SPL Level              | Conversational Gain (Measured dB SPL Level – 70 dB SPL) (dB) | Limit (dB) | Margin to Limit (dB) | PASS/FAIL |
| 6                                | LTE Band 2    | 20M_QPSK_1_0      | 18900   | AMR NB 4.75kbps  | 2N                 | 78.41                              | 8.41                                                         | ≥6         | 2.41                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | AMR NB 4.75kbps  | 8N                 | 82.58                              | 12.58                                                        | ≥6         | 6.58                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | AMR NB 12.2kbps  | 2N                 | 79.5                               | 9.5                                                          | ≥6         | 3.5                  | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | AMR NB 12.2kbps  | 8N                 | 83.48                              | 13.48                                                        | ≥6         | 7.48                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | AMR WB 6.60kbps  | 2N                 | 81.34                              | 11.34                                                        | ≥6         | 5.34                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | AMR WB 6.60kbps  | 8N                 | 85.58                              | 15.58                                                        | ≥6         | 9.58                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | AMR WB 23.85kbps | 2N                 | 81.79                              | 11.79                                                        | ≥6         | 5.79                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | AMR WB 23.85kbps | 8N                 | 85.95                              | 15.95                                                        | ≥6         | 9.95                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS NB 5.9kbps   | 2N                 | 78.81                              | 8.81                                                         | ≥6         | 2.81                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS NB 5.9kbps   | 8N                 | 82.97                              | 12.97                                                        | ≥6         | 6.97                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS NB 24.4kbps  | 2N                 | 78.94                              | 8.94                                                         | ≥6         | 2.94                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS NB 24.4kbps  | 8N                 | 83.02                              | 13.02                                                        | ≥6         | 7.02                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS WB 5.9kbps   | 2N                 | 81.25                              | 11.25                                                        | ≥6         | 5.25                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS WB 5.9kbps   | 8N                 | 85.24                              | 15.24                                                        | ≥6         | 9.24                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS WB 24.4kbps  | 2N                 | 81.22                              | 11.22                                                        | ≥6         | 5.22                 | PASS      |
|                                  | LTE Band 2    | 20M_QPSK_1_0      | 18900   | EVS WB 24.4kbps  | 8N                 | 85.26                              | 15.26                                                        | ≥6         | 9.26                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | AMR NB 4.75kbps  | 2N                 | 78.63                              | 8.63                                                         | ≥6         | 2.63                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | AMR NB 4.75kbps  | 8N                 | 82.55                              | 12.55                                                        | ≥6         | 6.55                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | AMR NB 12.2kbps  | 2N                 | 79.41                              | 9.41                                                         | ≥6         | 3.41                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | AMR NB 12.2kbps  | 8N                 | 83.5                               | 13.5                                                         | ≥6         | 7.5                  | PASS      |
| 7                                | LTE Band 5    | 10M_QPSK_1_0      | 20525   | AMR WB 6.60kbps  | 2N                 | 81.3                               | 11.3                                                         | ≥6         | 5.3                  | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | AMR WB 6.60kbps  | 8N                 | 85.54                              | 15.54                                                        | ≥6         | 9.54                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | AMR WB 23.85kbps | 2N                 | 81.77                              | 11.77                                                        | ≥6         | 5.77                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | AMR WB 23.85kbps | 8N                 | 85.87                              | 15.87                                                        | ≥6         | 9.87                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS NB 5.9kbps   | 2N                 | 78.82                              | 8.82                                                         | ≥6         | 2.82                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS NB 5.9kbps   | 8N                 | 82.77                              | 12.77                                                        | ≥6         | 6.77                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS NB 24.4kbps  | 2N                 | 79.2                               | 9.2                                                          | ≥6         | 3.2                  | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS NB 24.4kbps  | 8N                 | 83.08                              | 13.08                                                        | ≥6         | 7.08                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS WB 5.9kbps   | 2N                 | 81.14                              | 11.14                                                        | ≥6         | 5.14                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS WB 5.9kbps   | 8N                 | 85.12                              | 15.12                                                        | ≥6         | 9.12                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS WB 24.4kbps  | 2N                 | 81.46                              | 11.46                                                        | ≥6         | 5.46                 | PASS      |
|                                  | LTE Band 5    | 10M_QPSK_1_0      | 20525   | EVS WB 24.4kbps  | 8N                 | 85.49                              | 15.49                                                        | ≥6         | 9.49                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | AMR NB 4.75kbps  | 2N                 | 78.53                              | 8.53                                                         | ≥6         | 2.53                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | AMR NB 4.75kbps  | 8N                 | 82.69                              | 12.69                                                        | ≥6         | 6.69                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | AMR NB 12.2kbps  | 2N                 | 79.38                              | 9.38                                                         | ≥6         | 3.38                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | AMR NB 12.2kbps  | 8N                 | 83.47                              | 13.47                                                        | ≥6         | 7.47                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | AMR WB 6.60kbps  | 2N                 | 81.26                              | 11.26                                                        | ≥6         | 5.26                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | AMR WB 6.60kbps  | 8N                 | 85.45                              | 15.45                                                        | ≥6         | 9.45                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | AMR WB 23.85kbps | 2N                 | 81.78                              | 11.78                                                        | ≥6         | 5.78                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | AMR WB 23.85kbps | 8N                 | 85.85                              | 15.85                                                        | ≥6         | 9.85                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS NB 5.9kbps   | 2N                 | 78.85                              | 8.85                                                         | ≥6         | 2.85                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS NB 5.9kbps   | 8N                 | 82.88                              | 12.88                                                        | ≥6         | 6.88                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS NB 24.4kbps  | 2N                 | 79.21                              | 9.21                                                         | ≥6         | 3.21                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS NB 24.4kbps  | 8N                 | 83.3                               | 13.3                                                         | ≥6         | 7.3                  | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS WB 5.9kbps   | 2N                 | 81.06                              | 11.06                                                        | ≥6         | 5.06                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS WB 5.9kbps   | 8N                 | 85.22                              | 15.22                                                        | ≥6         | 9.22                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS WB 24.4kbps  | 2N                 | 81.41                              | 11.41                                                        | ≥6         | 5.41                 | PASS      |
|                                  | LTE Band 7    | 20M_QPSK_1_0      | 21100   | EVS WB 24.4kbps  | 8N                 | 85.33                              | 15.33                                                        | ≥6         | 9.33                 | PASS      |
|                                  | LTE Band 12   | 10M_QPSK_1_0      | 23095   | AMR NB 4.75kbps  | 2N                 | 78.68                              | 8.68                                                         | ≥6         | 2.68                 | PASS      |
|                                  | LTE Band 12   | 10M_QPSK_1_0      | 23095   | AMR NB 4.75kbps  | 8N                 | 82.68                              | 12.68                                                        | ≥6         | 6.68                 | PASS      |
|                                  | LTE Band 12   | 10M_QPSK_1_0      | 23095   | AMR NB 12.2kbps  | 2N                 | 79.39                              | 9.39                                                         | ≥6         | 3.39                 | PASS      |



## Volume Control Evaluation Report

Report No. : HA590811C

|  |             |              |        |                  |    |       |       |    |      |      |
|--|-------------|--------------|--------|------------------|----|-------|-------|----|------|------|
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | AMR NB 12.2kbps  | 8N | 83.44 | 13.44 | ≥6 | 7.44 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | AMR WB 6.60kbps  | 2N | 81.2  | 11.2  | ≥6 | 5.2  | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | AMR WB 6.60kbps  | 8N | 85.52 | 15.52 | ≥6 | 9.52 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | AMR WB 23.85kbps | 2N | 81.81 | 11.81 | ≥6 | 5.81 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | AMR WB 23.85kbps | 8N | 85.92 | 15.92 | ≥6 | 9.92 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | EVS NB 5.9kbps   | 2N | 78.84 | 8.84  | ≥6 | 2.84 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | EVS NB 5.9kbps   | 8N | 82.76 | 12.76 | ≥6 | 6.76 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | EVS NB 24.4kbps  | 2N | 79.26 | 9.26  | ≥6 | 3.26 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | EVS NB 24.4kbps  | 8N | 83.25 | 13.25 | ≥6 | 7.25 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | EVS WB 5.9kbps   | 2N | 81.09 | 11.09 | ≥6 | 5.09 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | EVS WB 5.9kbps   | 8N | 85.19 | 15.19 | ≥6 | 9.19 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | EVS WB 24.4kbps  | 2N | 81.74 | 11.74 | ≥6 | 5.74 | PASS |
|  | LTE Band 12 | 10M_QPSK_1_0 | 23095  | EVS WB 24.4kbps  | 8N | 85.51 | 15.51 | ≥6 | 9.51 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | AMR NB 4.75kbps  | 2N | 78.45 | 8.45  | ≥6 | 2.45 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | AMR NB 4.75kbps  | 8N | 82.8  | 12.8  | ≥6 | 6.8  | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | AMR NB 12.2kbps  | 2N | 79.33 | 9.33  | ≥6 | 3.33 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | AMR NB 12.2kbps  | 8N | 83.48 | 13.48 | ≥6 | 7.48 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | AMR WB 6.60kbps  | 2N | 81.28 | 11.28 | ≥6 | 5.28 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | AMR WB 6.60kbps  | 8N | 85.6  | 15.6  | ≥6 | 9.6  | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | AMR WB 23.85kbps | 2N | 81.73 | 11.73 | ≥6 | 5.73 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | AMR WB 23.85kbps | 8N | 85.89 | 15.89 | ≥6 | 9.89 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | EVS NB 5.9kbps   | 2N | 78.92 | 8.92  | ≥6 | 2.92 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | EVS NB 5.9kbps   | 8N | 82.86 | 12.86 | ≥6 | 6.86 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | EVS NB 24.4kbps  | 2N | 79.15 | 9.15  | ≥6 | 3.15 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | EVS NB 24.4kbps  | 8N | 83.19 | 13.19 | ≥6 | 7.19 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | EVS WB 5.9kbps   | 2N | 81.08 | 11.08 | ≥6 | 5.08 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | EVS WB 5.9kbps   | 8N | 85.22 | 15.22 | ≥6 | 9.22 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | EVS WB 24.4kbps  | 2N | 81.41 | 11.41 | ≥6 | 5.41 | PASS |
|  | LTE Band 66 | 20M_QPSK_1_0 | 132322 | EVS WB 24.4kbps  | 8N | 85.38 | 15.38 | ≥6 | 9.38 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | AMR NB 4.75kbps  | 2N | 78.6  | 8.6   | ≥6 | 2.6  | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | AMR NB 4.75kbps  | 8N | 82.84 | 12.84 | ≥6 | 6.84 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | AMR NB 12.2kbps  | 2N | 79.39 | 9.39  | ≥6 | 3.39 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | AMR NB 12.2kbps  | 8N | 83.49 | 13.49 | ≥6 | 7.49 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | AMR WB 6.60kbps  | 2N | 81.33 | 11.33 | ≥6 | 5.33 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | AMR WB 6.60kbps  | 8N | 85.54 | 15.54 | ≥6 | 9.54 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | AMR WB 23.85kbps | 2N | 81.79 | 11.79 | ≥6 | 5.79 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | AMR WB 23.85kbps | 8N | 85.84 | 15.84 | ≥6 | 9.84 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | EVS NB 5.9kbps   | 2N | 78.82 | 8.82  | ≥6 | 2.82 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | EVS NB 5.9kbps   | 8N | 82.89 | 12.89 | ≥6 | 6.89 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | EVS NB 24.4kbps  | 2N | 79.32 | 9.32  | ≥6 | 3.32 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | EVS NB 24.4kbps  | 8N | 83.32 | 13.32 | ≥6 | 7.32 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | EVS WB 5.9kbps   | 2N | 81.16 | 11.16 | ≥6 | 5.16 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | EVS WB 5.9kbps   | 8N | 85.17 | 15.17 | ≥6 | 9.17 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | EVS WB 24.4kbps  | 2N | 81.51 | 11.51 | ≥6 | 5.51 | PASS |
|  | LTE Band 71 | 20M_QPSK_1_0 | 133297 | EVS WB 24.4kbps  | 8N | 85.63 | 15.63 | ≥6 | 9.63 | PASS |



## <WLAN>

| HAC (Volume control) Test Record |               |                   |         |                  |                    | Receive Volume Control Performance |                                                              |            |                      |           |
|----------------------------------|---------------|-------------------|---------|------------------|--------------------|------------------------------------|--------------------------------------------------------------|------------|----------------------|-----------|
| Plot No.                         | Air Interface | Modulation / Mode | Channel | Audio Codec      | Mounting Force (N) | Measured dB SPL Level              | Conversational Gain (Measured dB SPL Level – 70 dB SPL) (dB) | Limit (dB) | Margin to Limit (dB) | PASS/FAIL |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | AMR NB 4.75kbps  | 2N                 | 78.77                              | 8.77                                                         | ≥6         | 2.77                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | AMR NB 4.75kbps  | 8N                 | 82.8                               | 12.8                                                         | ≥6         | 6.8                  | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | AMR NB 12.2kbps  | 2N                 | 79.53                              | 9.53                                                         | ≥6         | 3.53                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | AMR NB 12.2kbps  | 8N                 | 83.68                              | 13.68                                                        | ≥6         | 7.68                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | AMR WB 6.60kbps  | 2N                 | 81.16                              | 11.16                                                        | ≥6         | 5.16                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | AMR WB 6.60kbps  | 8N                 | 85.42                              | 15.42                                                        | ≥6         | 9.42                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | AMR WB 23.85kbps | 2N                 | 81.75                              | 11.75                                                        | ≥6         | 5.75                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | AMR WB 23.85kbps | 8N                 | 85.87                              | 15.87                                                        | ≥6         | 9.87                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS NB 5.9kbps   | 2N                 | 78.9                               | 8.9                                                          | ≥6         | 2.9                  | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS NB 5.9kbps   | 8N                 | 82.93                              | 12.93                                                        | ≥6         | 6.93                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS NB 24.4kbps  | 2N                 | 79.49                              | 9.49                                                         | ≥6         | 3.49                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS NB 24.4kbps  | 8N                 | 83.61                              | 13.61                                                        | ≥6         | 7.61                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS WB 5.9kbps   | 2N                 | 81.11                              | 11.11                                                        | ≥6         | 5.11                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS WB 5.9kbps   | 8N                 | 85.11                              | 15.11                                                        | ≥6         | 9.11                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS WB 24.4kbps  | 2N                 | 81.53                              | 11.53                                                        | ≥6         | 5.53                 | PASS      |
|                                  | WLAN2.4GHz    | 802.11b 1Mbps     | 6       | EVS WB 24.4kbps  | 8N                 | 85.71                              | 15.71                                                        | ≥6         | 9.71                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | AMR NB 4.75kbps  | 2N                 | 78.68                              | 8.68                                                         | ≥6         | 2.68                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | AMR NB 4.75kbps  | 8N                 | 82.61                              | 12.61                                                        | ≥6         | 6.61                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | AMR NB 12.2kbps  | 2N                 | 79.58                              | 9.58                                                         | ≥6         | 3.58                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | AMR NB 12.2kbps  | 8N                 | 83.64                              | 13.64                                                        | ≥6         | 7.64                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | AMR WB 6.60kbps  | 2N                 | 81.21                              | 11.21                                                        | ≥6         | 5.21                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | AMR WB 6.60kbps  | 8N                 | 85.43                              | 15.43                                                        | ≥6         | 9.43                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | AMR WB 23.85kbps | 2N                 | 81.77                              | 11.77                                                        | ≥6         | 5.77                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | AMR WB 23.85kbps | 8N                 | 85.95                              | 15.95                                                        | ≥6         | 9.95                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS NB 5.9kbps   | 2N                 | 78.91                              | 8.91                                                         | ≥6         | 2.91                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS NB 5.9kbps   | 8N                 | 82.87                              | 12.87                                                        | ≥6         | 6.87                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS NB 24.4kbps  | 2N                 | 79.11                              | 9.11                                                         | ≥6         | 3.11                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS NB 24.4kbps  | 8N                 | 83.6                               | 13.6                                                         | ≥6         | 7.6                  | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS WB 5.9kbps   | 2N                 | 81.1                               | 11.1                                                         | ≥6         | 5.1                  | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS WB 5.9kbps   | 8N                 | 85.16                              | 15.16                                                        | ≥6         | 9.16                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS WB 24.4kbps  | 2N                 | 81.62                              | 11.62                                                        | ≥6         | 5.62                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 40      | EVS WB 24.4kbps  | 8N                 | 85.77                              | 15.77                                                        | ≥6         | 9.77                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | AMR NB 4.75kbps  | 2N                 | 78.82                              | 8.82                                                         | ≥6         | 2.82                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | AMR NB 4.75kbps  | 8N                 | 82.84                              | 12.84                                                        | ≥6         | 6.84                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | AMR NB 12.2kbps  | 2N                 | 79.47                              | 9.47                                                         | ≥6         | 3.47                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | AMR NB 12.2kbps  | 8N                 | 83.65                              | 13.65                                                        | ≥6         | 7.65                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | AMR WB 6.60kbps  | 2N                 | 81.06                              | 11.06                                                        | ≥6         | 5.06                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | AMR WB 6.60kbps  | 8N                 | 85.41                              | 15.41                                                        | ≥6         | 9.41                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | AMR WB 23.85kbps | 2N                 | 81.77                              | 11.77                                                        | ≥6         | 5.77                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | AMR WB 23.85kbps | 8N                 | 85.87                              | 15.87                                                        | ≥6         | 9.87                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS NB 5.9kbps   | 2N                 | 78.83                              | 8.83                                                         | ≥6         | 2.83                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS NB 5.9kbps   | 8N                 | 82.86                              | 12.86                                                        | ≥6         | 6.86                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS NB 24.4kbps  | 2N                 | 79.65                              | 9.65                                                         | ≥6         | 3.65                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS NB 24.4kbps  | 8N                 | 83.52                              | 13.52                                                        | ≥6         | 7.52                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS WB 5.9kbps   | 2N                 | 81.07                              | 11.07                                                        | ≥6         | 5.07                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS WB 5.9kbps   | 8N                 | 85.12                              | 15.12                                                        | ≥6         | 9.12                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS WB 24.4kbps  | 2N                 | 81.67                              | 11.67                                                        | ≥6         | 5.67                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 60      | EVS WB 24.4kbps  | 8N                 | 85.67                              | 15.67                                                        | ≥6         | 9.67                 | PASS      |
| 8                                | WLAN5GHz      | 802.11a 6Mbps     | 116     | AMR NB 4.75kbps  | 2N                 | 78.62                              | 8.62                                                         | ≥6         | 2.62                 | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 116     | AMR NB 4.75kbps  | 8N                 | 82.8                               | 12.8                                                         | ≥6         | 6.8                  | PASS      |
|                                  | WLAN5GHz      | 802.11a 6Mbps     | 116     | AMR NB 12.2kbps  | 2N                 | 79.62                              | 9.62                                                         | ≥6         | 3.62                 | PASS      |



## Volume Control Evaluation Report

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|  |          |               |     |                  |    |       |       |    |      |      |
|--|----------|---------------|-----|------------------|----|-------|-------|----|------|------|
|  | WLAN5GHz | 802.11a 6Mbps | 116 | AMR NB 12.2kbps  | 8N | 83.61 | 13.61 | ≥6 | 7.61 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | AMR WB 6.60kbps  | 2N | 81.23 | 11.23 | ≥6 | 5.23 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | AMR WB 6.60kbps  | 8N | 85.34 | 15.34 | ≥6 | 9.34 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | AMR WB 23.85kbps | 2N | 81.78 | 11.78 | ≥6 | 5.78 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | AMR WB 23.85kbps | 8N | 85.88 | 15.88 | ≥6 | 9.88 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | EVS NB 5.9kbps   | 2N | 78.93 | 8.93  | ≥6 | 2.93 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | EVS NB 5.9kbps   | 8N | 83.03 | 13.03 | ≥6 | 7.03 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | EVS NB 24.4kbps  | 2N | 79.35 | 9.35  | ≥6 | 3.35 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | EVS NB 24.4kbps  | 8N | 83.51 | 13.51 | ≥6 | 7.51 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | EVS WB 5.9kbps   | 2N | 81    | 11    | ≥6 | 5    | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | EVS WB 5.9kbps   | 8N | 85.07 | 15.07 | ≥6 | 9.07 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | EVS WB 24.4kbps  | 2N | 81.61 | 11.61 | ≥6 | 5.61 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 116 | EVS WB 24.4kbps  | 8N | 85.58 | 15.58 | ≥6 | 9.58 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | AMR NB 4.75kbps  | 2N | 78.78 | 8.78  | ≥6 | 2.78 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | AMR NB 4.75kbps  | 8N | 82.78 | 12.78 | ≥6 | 6.78 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | AMR NB 12.2kbps  | 2N | 79.64 | 9.64  | ≥6 | 3.64 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | AMR NB 12.2kbps  | 8N | 83.61 | 13.61 | ≥6 | 7.61 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | AMR WB 6.60kbps  | 2N | 81.22 | 11.22 | ≥6 | 5.22 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | AMR WB 6.60kbps  | 8N | 85.26 | 15.26 | ≥6 | 9.26 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | AMR WB 23.85kbps | 2N | 81.81 | 11.81 | ≥6 | 5.81 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | AMR WB 23.85kbps | 8N | 85.83 | 15.83 | ≥6 | 9.83 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | EVS NB 5.9kbps   | 2N | 78.82 | 8.82  | ≥6 | 2.82 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | EVS NB 5.9kbps   | 8N | 83.03 | 13.03 | ≥6 | 7.03 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | EVS NB 24.4kbps  | 2N | 79.67 | 9.67  | ≥6 | 3.67 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | EVS NB 24.4kbps  | 8N | 83.54 | 13.54 | ≥6 | 7.54 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | EVS WB 5.9kbps   | 2N | 81.04 | 11.04 | ≥6 | 5.04 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | EVS WB 5.9kbps   | 8N | 84.95 | 14.95 | ≥6 | 8.95 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | EVS WB 24.4kbps  | 2N | 81.63 | 11.63 | ≥6 | 5.63 | PASS |
|  | WLAN5GHz | 802.11a 6Mbps | 157 | EVS WB 24.4kbps  | 8N | 85.8  | 15.8  | ≥6 | 9.8  | PASS |

Test Engineer : Martin Li, Varus Wang, Light Wang, Ricky Gu

## 12. Uncertainty Assessment

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances. Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %.

The judgment of conformity in the report is based on the measurement results excluding the measurement uncertainty.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

| Component                                                                                                                                                                                                                                                                           | Standard uncertainty (dB) | $U^2$ (%) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------|
| Generator Accuracy<br>To enable harmonic distortion measurements to 0.1%, the generator distortion must be <0.05%. This is equivalent to a standard uncertainty of 0.043 dB.                                                                                                        | 0.043                     | 0.25      |
| Ear Simulator Pressure Sensitivity (incl. Measurement Mic.)<br>The uncertainty of the ear simulator as per the standards and quoted on its calibration certificate is 0.3 dB with a coverage factor of $k = 2$ . This is equivalent to a standard uncertainty of $0.3/2 = 0.15$ dB. | 0.15                      | 3.03      |
| Microphone Preamplifier<br>The manufacturer quotes the preamp to be within $\pm 0.02$ dB with a 95% probability or $2\sigma$ . This is equivalent to a standard uncertainty of $0.02/2 = 0.01$ dB.                                                                                  | 0.01                      | 0.01      |
| Analysis System / RMS Detector<br>Typical measurement system detector accuracy is 0.1 dB with a coverage factor of $k = 2$ . This is equivalent to a standard uncertainty of $0.1/2 = 0.05$ dB.                                                                                     | 0.05                      | 0.33      |
| Effect of Positioning on Mid-Band Sensitivity<br>For a handset, with the HATS positioning jig, the typical standard deviation estimated from a statistically significant number of measurements is $\pm 2$ dB. This is equivalent to a standard uncertainty of 2 dB.                | 2                         | 670.42    |
| Time Varying Effects of the Mouth Simulator for Send & Sidetone<br>For a receive measurement on a handset, the mouth simulator is not used (its uncertainty is zero), The standard uncertainty of 0 dB                                                                              | 0                         | 0.00      |
| Total Standard Uncertainty (%)                                                                                                                                                                                                                                                      | 25.96                     |           |
| UMAX ( $k = 2$ ) (%)                                                                                                                                                                                                                                                                | 51.9                      |           |
| UMAX ( $k = 2$ ) (dB)                                                                                                                                                                                                                                                               | 3.6                       |           |

**Uncertainty Budget of Volume Control assessment**

### **13. References**

- [1] ANSI C63.19:2019, "American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids", Aug. 2019.
- [2] ANSI/TIA-5050-2018, "Receive Volume Control Requirements for Wireless (Mobile) Devices", Jan. 2018
- [3] FCC KDB 285076 D01v06r04, "Equipment Authorization Guidance for Hearing Aid Compatibility", Sep. 2023.
- [4] FCC KDB 285076 D04 Volume Control v02, "GUIDANCE FOR PERFORMING VOLUME CONTROL MEASUREMENTS ON MOBILE HANDSETS", Sep. 2023
- [5] FCC KDB 285076 D05 HAC Waiver DA 23-914 v01, "HAC COMPLIANCE UNDER WAIVER DA 23-914", Sep. 2023
- [6] Head Acoustic System Handbook

## **Appendixes**

Please refer to separated files for the following appendixes

### **Appendix A. Volume Control Evaluation Results**

### **Appendix B. Calibration Certificate**

### **Appendix C. Test Setup Photos**

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