Hands-Free Profile (HFP)

Bluetooth® Test Suite

- Revision: HFP.TS.1.7.2.0
- Revision Date: 2018-11-21
- Group Prepared By: Audio, Telephony and Automotive Working Group
- Feedback Email: ata-main@bluetooth.org

Abstract:
This document defines test structures and procedures for the interoperability test of Bluetooth devices implementing the Hands-Free Profile.
## Revision History

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<td>0.9a / 0.9b</td>
<td>2001-10-22</td>
<td>Changes due to comments from BQRB:</td>
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<td></td>
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<td>Updated Disclaimer and Copyright notice, some typos corrected</td>
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<td>Changes due to comments from BTI:</td>
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<td></td>
<td></td>
<td>New TC's for “Call status” and “CLI” added with references to other TC's (which might be optional)</td>
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<td>Replaced AND with OR in TCMT</td>
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<td>TCMT call handling in non-regular situations split into two sections: incoming and outgoing call (and added a reference to the ICS)</td>
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<td>TCMT EC/NR split into two sections (feature supported and feature NOT supported)</td>
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<td>TCMT Remote audio volume control: split into two sections, microphone and speaker gain</td>
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<td>TCMT Park Mode: added reference to ICS</td>
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<td>Changes due to BARB comments on HFP:</td>
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<tr>
<td></td>
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<td>In-band ring tone test procedure modified.</td>
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<td>0.91</td>
<td>2002-01-21</td>
<td>The TC's &quot;Audio connection transfer with audio present&quot; is only applicable for devices being able to keep the SCO link up. Therefore, the TC's are optional. The Test Case Mapping table has been changed in order to reflect this (new group created)</td>
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<td>The alert of in incoming call at the HF can be done either with or without in-band ring tones. Not all AG may support both mechanisms; therefore the test cases have been split into two groups (also in the ICS).</td>
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<td>0.92</td>
<td>2002-03-20</td>
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<tr>
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<td>Transfer of reg. status modified.</td>
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<td>Changes after F2F meeting in Irving:</td>
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<td>Park mode related tests removed, considered part of the normal Service Level Connection handling.</td>
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<td>Registration failure related tests removed</td>
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<td>Microphone gain adjustment made separated from synchronization.</td>
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<td>Call Waiting test procedures only requiring Service Level Connection and using call status indications.</td>
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<td>Procedures for “Audio transfer towards the HF” with presence of audio removed.</td>
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<td>Errata 2351: Initial conditions in the “Audio transfer towards HF” procedures changed.</td>
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<td>2005-05-10</td>
<td>Changed item numbers in TCMT to match ICS for Subscriber Number Information, Enhanced Call Status, and Enhanced Call Control.</td>
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<td>1.1.4r3</td>
<td>2005-05-10</td>
<td>Changed document filename to correspond with current Bluetooth Test Document Numbering methodology.</td>
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<td>2005-05-31</td>
<td>Include TSE 738, 743, 771</td>
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<td>2005-10-31</td>
<td>Change name from HFP1.5.TS.1.1.x to HFP.TS.1.5.x. Correction of typos in TCMT: TP/ACS/BV-14-I changed to TP/ACS/BI-14-I AND TP/ACS/BV-13-I changed to TP/ACS/BI-13-I. Prepare for publication.</td>
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| 1.5.7            | 2007-08-30| TSE 1959: TP/VRD/BV-01-I fixed for parentheses  
TSE 1994 (See TSE 1891) Remove TP/ENO/BV-02-I from TCMT; and remove HF test purpose from test case  
TSE 2020: TP/ATA/BV-01 Remove the last pass and fail verdicts which requires the verification of SLC presence  
TSE 2036 TP/ATA/BV-02-I: Add note that HP is acceptable for power off.  
TSE 2042: change TCMT selection expression for TP/ECS/BV-03-I  
TSE 2041: TP/ECS/BV-01-I: remove requirement for TWC  
TSE 2140: TP/ICA/BV-03-I: fix typo  
TSE 2098 for TP/ACS/BV-01 – 08-I, TP/ACS/BV-09 –12-C, TP/ACS/BI-13-I, TP/ACS/BI-14-I TP/ACR/BV-01, 02; change TCMT (ACS 01,02,03,04 and ACR 01,02 only) and test procedure  
TSE 2100: TP/ATA/BV-02-I TCMT  
TSE 2142: TP/TP/ECC/BV-02-I: Clarify Pass and Fail verdicts  
TSE 2160: Add new test cases for link loss recovery  
TSE 2167: TP/TCA/BV-04-I: Modify TCMT expression  
TSE 2205: TP/NUM/BV-01-I: Require service field verification  
TSE 2230: TP/TCA/BV-04-I: Revise test procedure  
TSE 2234: TP/ECS/BV-02-I: Revise test procedure and pass verdict.  
TSE 2238: TP/RSV/BV-01-I AND TP/RMV/BV-01-I: TCMT changes  
TSE 1998: TCMT for TP/ATH/BV-05-I: overrides TSE 2027 in TCMT  
TSE 2027: Remove test cases ATH/BV-01 and ATH/BV-02 and add new test cases ATH/BV-03 – ATH/BV-06  
| 1.5.7a          | 2007-12-10| Correction to TCMT: add ATA/BV-01 and ATA/BV-02                                                                                                                                                                                                                               |
| 1.5.8r0         | 2008-02-17| Correction to TSE 2100; new row for ATA/BV-02-I  
TSE 2305: New test case TP/DIS/BV-01-I  
TSE 2307: Revised TP/TWC/BV-02-I  
TSE 2342: TP/VRA/BI-01-I: Fix pass verdict and TCMT  
TSE 2372: TP/RHH/BV-02-I, TP/RHH/BV-03-I: Remove sentence  
TSE 2373: TP/RHH/BV-04-I, TP/RHH/BV-05-I: Remove sentence  
TSE 2381: TP/ECS/BV-05-I: Remove test case  
TSE 2382: TP/ECC/BI-03-I, TP/ECC/BV-04-I: Remove test cases  
TSE 2393: TP/ACS/BV-10-I: Remove Note  
TSE 2399: TP/TCA/BV-04-I: Procedure change  
TSE 2433: TP/ESC/BV-03, TP/ESC/BV-04 TMCT change  
TSE 2434: TP/OR/BV-01-I, TP/OR/BV-02-I: TCMT  
TSE 2449: TP/TWC/BV-05-I: Change test case text  
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<td>TSE 2472: TP/TWC/BV-06-I: Pass verdict</td>
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<td>TSE 2488: TP/ECC/BV-01-I: Change test procedure</td>
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<td>1.5.9</td>
<td>2008 Nov 20</td>
<td>Prepare for publication TCMT: Change &quot;control&quot; to &quot;status&quot;</td>
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<td>2009 April 25</td>
<td>TSE 2683: New test case: TP/TCA/BV-05-I</td>
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<td>TSE 2684: TP/TWC/BV-02-I: update Notes</td>
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<td>TSE 2705: TP/ACS/BV-06-I, TP/ACS/BV-10-I</td>
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<td>TSE 2770: TP/TCA/BV-04-I TCMT update</td>
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<td>TSE 2807: TP/RHH/BV-02-I: Change &quot;on hold&quot; text.</td>
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<td>TSE 2808: TP/RHH/BV-03-I: Change &quot;on hold&quot; text.</td>
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<td>TSE 2809: TP/RHH/BV-04-I: Change &quot;on hold&quot; text.</td>
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<td>TSE 2810: TP/RHH/BV-05-I: Change &quot;on hold&quot; text.</td>
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<td>TSE 2811: TP/RHH/BV-06-I: Change &quot;on hold&quot; text.</td>
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<td>TSE 2812: TP/RHH/BV-07-I: Change &quot;on hold&quot; text.</td>
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<td>TSE 2813: TP/RHH/BV-08-I: Change &quot;on hold&quot; text.</td>
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<td>TSE 2883: TP/ATH/BV-03-I: Change test case mapping (TCMT)</td>
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<td>10 August 2009</td>
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| 1.5.11r0         | 17 August 2010 | TSE 2884: TP/ATH/BV-04-I, TP/ATH/BV-06-I  
TSE 2949: TP/TWC/BV-05-I; modify test procedure.  
TSE 3015: TP/ACS/BV-04-I: modify test procedure  
TSE 3282: TP/TWC/BV-02-I: modify test procedure  
TSE 3465: TP/ATH/BV-06-I; TCMT update  
TSE 3842: TP/ICA/BV-01-I test proc and pass verdict updates  
TSE 3850: TP/ECS/BV-02-I, TP/ECS/BV-03-I, TP/ECS/BV-01-I, TP/ECC/BI-03-I, TP/ECC/BI-04-I; |
| 1.5.11r1         | 08 February 2011 | Merged with change request FHP.TS.1.5.8_CR-270110+IIA-….doc. Input reviewer’s comments: Changed can to may in TP/ATH/BV-04-I, TP/ATH/BV-06-I Pass verdicts |
| 1.5.11r2         | 31 March 2011  | Completed test cases for wide band speech support  
Added and refined test cases for Wide band speech support in light of the R11 changes of the CR |
| 1.6.0r1-8        | 11 April 2011-4 May 2011 | Formatting updates. Removal of circular references to HFP TS. Review corrections  
New TOC. Corrected TCMT. Removed Annex section.  
Updates to TP/SLC/BV-05-C and TP/SLC/BV-08-C to indicate that 3 way calling is optional  
TP/IIC/BV-01-I corrected per the instructions from Josselin  
Removal of duplicate ACC test group and included tests  
Input reviewer’s edits to TCMT and updated according to ICS updated by EWR  
Minor edits  
Removed descriptors from TCMT. Fixed header. |
| 1.6.1r0          | 11-Nov-07     | TSE 2856: TP/ECS/BV-01-I, TP/ECS/BV-02-I, TP/ECS/BV-03-I TCMT per comment ID #8938  
TSE 3512: TP/ECC/BV-01-I: Init Conditions, Test Procedure, Test Condition, Expected Outcome.  
TSE 3906: TP/SDP/BV-01-I: Modify test purpose.  
TSE 4315: TP/TCA/BV-05-I: Change Fail condition.  
TSE 4399: TP/TWC/BV-05-I: Make Pass verdict match updated Test Procedure  
| 1.6.1r1          | 2012-01-31    | TSE 3512, TP/ECC/BV-01-I updated  
TSE 4315, TP/TCA/BV-05-I updated  
TSE 4438: TP/IIA/BV-03-I updated |
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<td>2012-02-13</td>
<td>TSE 4684: HFP Addendum 1.6.0 merged and TCMT updated</td>
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<td>2012-03-30</td>
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| 1.6.2r0          | 2012-09-06 | TSE 4901: Missing TP Name for 7.4.1.1 [Voice Recognition Activation].  
<pre><code>                  |             | Added “TP/VRA/BV-03-I” to the section header.                          |
</code></pre>
<p>|                  |            | TSE 4905: Add new section, 7.6 Terminate a Call, with test case TP/TCA/BV-06-I [Terminate a Call - AG Terminated NO CARRIER], and corresponding addition to the TCMT. |
|                  |            | TSE 4725: Changed “Call waiting and three way calling” to read only “Three way calling” in Tables 5.1 – 5.8. |
|                  |            | TSE 4743: Changes to TP/IID/BV-03-I initial conditions, test procedure, and pass and fail verdict to remove roaming. |
|                  |            | New test TP/PSI/BV-05-I, TCMT                                           |
|                  |            | New test TP/IIA/BV-05-I, TCMT                                           |
|                  |            | New test TP/IID/bv-04-I, TCMT                                           |
|                  |            | TCMT change for TP/IIA/BV-03-I and TP/IID/BV-02-I (See additional TSE 4743 changes in Revision 1.6.2r2) |
| 1.6.2r1          | 2012-10-22 | Editorial corrections. AT+BRSF Tables 5.1 – 5.8 made consistent with TSE 4725 and fixed the ICS item column for AG tables to show only 3/12 per TSE 4725. Corrected numbering errors to figures and their references. Added step numbers to the Test Procedure of TP/ICA/BV-02-I since the pass/fail criteria mentions specific step numbers. Added references to tests in section 5.5.1.X for audio connection establishment. Added the rest of TSE 4743 that was skipped in the previous revision and corrected change history. Corrected a spelling error in TCMT. |
| 1.6.2r2          | 2012-11-06 | Summaries added to section 5.30 Inquiry and Discoverability, 5.31 and Service Search, and 7.6 Terminate a Call. |
|                  |            | TCMT Changes:                                                           |
|                  |            | Combined the Phone status information: Transfer of call status cells because the requirements were the same, there was no need for the additional cell for TP/TCA/BV-04-I. |
|                  |            | Edits to TSE 4743 changes to reflect updated CRs, revised the test case mapping for TP/PSI/BV-02-I to accommodate the new ICS item for that test case mapping, “(HFP: 2/2 AND 2/25) OR HFP: 3/2d” |
| 1.6.2            | 2012-11-07 | Prepare for Publication                                                 |
| 1.6.3r1          | 2013-04-21 | TSE 5126: Updated TCMT mapping for TP/ACR/BV-01-I and TP/ACR/BV-02-I from “2/3a OR 3/3a” to “2/3 OR 3/3” |
|                  |            | TSE 5077: Updated TCMT mapping for TP/ENO/BV-02-I from “(NOT HFP: 2/14)” to “HFP: 1/1 AND (NOT HFP: 2/14)” |</p>
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<td>TSE 5076: Updated TCMT mapping for TP/OOR/BV-01-I from &quot;HFP: 2/1 AND HFP: 2/1a) OR (NOT HFP: 3/22)&quot; to &quot;HFP: 2/1 AND HFP: 2/1a) OR (HFP: 3/1 AND NOT HFP: 3/22)&quot;. Updated TCMT mapping for TP/OOR/BV-02-I from &quot;HFP: 3/1 OR (NOT HFP: 2/22)&quot; to &quot;HFP: 3/1 OR (HFP: 2/1 AND NOT HFP: 2/22)&quot;.</td>
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<td>TSE 5020: Reworded the test procedure in TP/TWC/BV-02-I in order for the test case to match the intent of the test case.</td>
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<td>TSE 5105: Edits to TP/ACC/BI-12-I.</td>
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<td>Updated MSC and Verdicts of TP/ACC/BI-12-I to align with CR in TSE 5105.</td>
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<td>TCRL 2013-2</td>
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<td>TSE 5209: Updated the TCMT mapping for TP/TCA/BV-05-I to &quot;(2/2 AND 2/6 AND 2/11 AND 2/12)&quot;</td>
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<td>TSE 5163: Updated Fail verdict to read &quot;Any of the Pass verdicts fail to occur&quot; and removed any Inconclusive Verdicts for TP/TWC/BV-02-I, TP/TWC/BV-03-I, TP/TWC/BV-05-I, and TP/TCA/BV-05-I. Removed note sections that were &quot;N/A&quot;.</td>
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<td>TSE 5321: Added “Ongoing call may be present in order to achieve the test purpose” to the initial condition of TP/ACC/BV-01-I, TP/ACC/BV-02-1 and TP/ACC/BV-03-I.</td>
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<td>1.6.4</td>
<td>2013-12-03</td>
<td>Adopted by BoD</td>
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<td>DDR CR r00</td>
<td>2013-12-18</td>
<td>Added HFP 1.7 and HF Indicators feature</td>
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<td>- Added Pass/Fail Verdict Conventions Section</td>
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<td>- Removed Fail Verdicts within Test Purposes</td>
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<td>- Removed “N/A” test condition sections</td>
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<td>- Re-drew any MS drawing objects to Visio for MSCs</td>
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<td>1.7.0r02</td>
<td>2014-04-06</td>
<td>Address various issues and comments generated as a result of Template Conversion process.</td>
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<td>1.7.0r03</td>
<td>2014-04-09</td>
<td>Further addressed editors’ comments. Prepared document for review.</td>
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<td>1.7.0r04</td>
<td>2014-07-16</td>
<td>Incorporated “HFP – 4.1 Updates TS CR r03”</td>
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<td>1.7.0r05</td>
<td>2014-07-21</td>
<td>Removed references to Synchronous Connection HCI commands.</td>
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<tr>
<td>1.7.0r06</td>
<td>2014-08-04</td>
<td>Address comments by Alicia</td>
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<td>1.7.0r07</td>
<td>2014-08-14</td>
<td>Addressed comments by the Technical Editor and Legal review. Revisited Test Suite Structure Format. TSE 5866: Reorganized the test procedure and pass verdict of TP/WBS/BV-03-I, since the previous text of the test procedure was written as “N/A” and everything was written in the pass verdict. TSE 5865: Removed “Test must be conducted using Profile Test System” from the Test Conditions of TP/ECC/BI-03-I and TP/ECC/BI-04-I. TSE 5572: Adds clarifying text to the subgroup objectives in the Call Status Query Section 3.24.1 for the case that the held call is not present for testing. Revises the test case mapping for TP/ECS/BV-01-I and TP/ECS/BV-02-I to include 2/21c.</td>
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<td>1.7.0r08</td>
<td>2014-08-18</td>
<td>Removed occurrences of “UUID” when discussing HF Indicators</td>
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<td>1.7.0r09</td>
<td>2014-08-18</td>
<td>Legal Review edits and addressed Meagan’s comments</td>
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<td>1.7.0r10</td>
<td>2014-08-25</td>
<td>Accepted MSC fixes by Alicia. Updated ACS/BV-15 to 18 with feedback from the IOP.</td>
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<td>1.7.0r11</td>
<td>2014-09-08</td>
<td>TSE 5924: Test impact for erratum 3243: Test case TP/ECS/BV-03-I mapping changed to 2/2 OR 3/2a TSE 5832: Changed pass criteria TP/TCA/BV-05-I.</td>
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<td>1.7.1r00</td>
<td>2015-04-24</td>
<td>TSE 6246: Updated tests from –I to –C: TP/TRS/BV-01-C, TP/PSI/BV-01-C, TP/PSI/BV-02-C, TP/PSI/BV-03-C TSE 6312: Revised TP/HFI/BI-03-I to verify invalid/unknown value handling</td>
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<td>1.7.1r01</td>
<td>2015-05-11</td>
<td>Reviewed by Miles Smith. Completed TSE 6246 by updating the tests (listed in cell above) in Table 2.1 and TOC</td>
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<td>1.7.1.0r00</td>
<td>2015-10-28</td>
<td>Updated version numbering to align with Specification version change from 1.7 to 1.7.1 for ESR09. With the specification taking a third identifying number, the TS version identifier moves to the fourth number and starts again at 0.</td>
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<td>TSE 6795: Updated Test Case Mapping for test cases TP/ATH/BV-03-I and TP/ATH/BV-04-I.</td>
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<td>2016-03-01</td>
<td>TSE 6678: Deleted last Initial Condition from test cases TP/ACS/BV-15-I – 18-I.</td>
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<td>2016-09-16</td>
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<td>2016-11-15</td>
<td>Fixed header styles and recreated table of contents.</td>
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<td>2017-03-15</td>
<td>TSE 8282: Updated HFP/HF/SLC/BV-10-I HFP/AG/SLC/BV-10-I by adding initial condition of remote device must not support HFI. Removed HF as IUT pass verdict “1. AT+BRSF Bluetooth Retrieve Supported Features of the HF does not have the HF Indicators feature bit set.” and added “3. A Service Level Connection is established.”. Removed AG as IUT pass verdict “1. AT+BRSF Bluetooth Retrieve Supported Features of the AG does not have the HF Indicators feature bit set.”, changed part of pass verdict 1 to “message responses”, and added “2. A Service Level Connection is established.”.</td>
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<td>2017-05-02</td>
<td>Template Conversion. Deleted the sentence “Both devices are in communication range” from every test condition section of each test case.</td>
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<td>2017-05-16</td>
<td>Moved general test case assumption text from section 4.6 to 4.2.2 and 4.2.3</td>
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<td>1.7.1.4r01</td>
<td>2017-08-21</td>
<td>TSE 9724: For HFP/HF/ICA/BV-02-I, HFP/AG/ICA/BV-02-I, HFP/HF/TWC/BV-05-I, and HFP/AG/TWC/BV-05-I, editorial revisions to Test Procedure numbering and text.</td>
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<td>1.7.1.4r03</td>
<td>2017-10-23</td>
<td>TSE 10006: Changed test case names from –I to –C that were changed in error during TC ID renaming: HFP/HF/SLC/BV-01-C – 04-C and HFP/AG/SLC/BV-01-C – 04-C.</td>
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<td>1.7.1.5r00-02</td>
<td>2018-02-26 – 2018-05-09</td>
<td>TSE 9904 (rating 3): Replaced Table 4.25 and accompanying text with a new table that defines the expected safe setting associated with the pass verdict for HFP/AG/ACC/BI-12-I.</td>
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<td>TSE 9938 (rating 4): Added HFP/AG/ATH/BV-04-I to Table 3.1. For HF Initiated Audio Transfer to the HF – SLC, added test case ID AG variant HFP/AG/ATH/BV-04-I. Added test purpose for AG variant and revised the HF test purpose HFP/HF/ATH/BV-04-I for clarity.</td>
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<td>TSE 10283 (rating 2): Added HFP/HF/ECS/BV-03-I to Table 3.1. Added test case ID HFP/HF/ECS/BV-03-I to “Transfer Current Call Status to Held” test grouping. Added an HF Test Purpose.</td>
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<td>TSE 9962 (rating 4): Moved test case HFP/HF/SDP/BV-01-I and HFP/AG/SDP/BV-01-I to a new section in the Annex in Section 6 for Supplementary Interoperability tests and removed from Test Suite Structure Table 3.1.</td>
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<td>TSE 10650 (rating 3): Removed ongoing call provision from test procedure for test cases HFP/HF/ACS/BV-05-I and HFP/HF/ACS/BV-09-I.</td>
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<td>1.7.2.0r00</td>
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<td>Updated version number to 1.7.2.0 to align with adoption of the specification 1.7.2</td>
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<td>Approved by BTI. Prepared for TCRL 2018-2 publication.</td>
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1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the Hands-free Profile Specification.

The objective of this test suite is to provide a basis for interoperability tests for Bluetooth devices giving a high probability of air interface interoperability between different manufacturers’ Bluetooth devices.
2 References, Definitions, and Abbreviations

2.1 References
This Bluetooth document incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter.

[1] Bluetooth Core Specification, Version 2.0 or later
[2] Hands-Free Profile (HFP) 1.5 or later
[3] Profile Implementation Conformance Statement (ICS)/ Implementation eXtra Information for Test (IXIT) for Hands-Free Profile 1.5 or later.
[4] 3GPP 27.007 v6.8.0, AT command set for User Equipment
[7] Hands-Free Profile (HFP) 1.7 or later
[8] Service Discovery Protocol, Vol. 3 Part B, Core Specifications 2.0 or later

2.2 Definitions
For the purpose of this Bluetooth document the definitions and abbreviations in [1], [2] and [5] apply.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>Standby Mode</td>
<td>For HF no active Service Level Connection with the AG.</td>
</tr>
<tr>
<td></td>
<td>For AG no current call and no active Service Level Connection with the HF.</td>
</tr>
<tr>
<td>Parked Mode</td>
<td>For HF Same as Standby, but with the HF and the AG in Park mode (see [1])</td>
</tr>
<tr>
<td></td>
<td>For AG Same as Standby, but with the HF and the AG in Park mode (see [1])</td>
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*Table 2.1: Definitions for HFP*
3 Test Suite Structure (TSS)

3.1 Overview

The Hands-Free Profile is dependent upon both the Serial Port Profile and the Generic Access Profile. This is illustrated in Figure 3.1.

Figure 3.1: Hands-free Profile Test Model

3.2 Test Strategy

Table 3.1 shows the Hands-Free Profile Test Suite Structure (TSS) including its subgroups defined for testing.

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<td>HFP/AG/ACS/BV-06-I</td>
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<td>HF is IUT, HF Initiated, AG has eSCO allows only SCO</td>
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<td>AG is IUT, AG Initiated, HF has eSCO allows only SCO</td>
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<td>AG is IUT, HF Initiated eSCO with 18ms latency</td>
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<td>HF is IUT, AG Initiates eSCO with 18ms latency</td>
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<td>HF is IUT, AG Initiates eSCO with invalid bandwidth</td>
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<td>HF is IUT, AG Initiates eSCO with S4 Settings</td>
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<td>HF is IUT, HF requests eSCO over Secure Connections</td>
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<td>Audio Release – HF Initiated</td>
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<td>Calling Line Identification (CLI)</td>
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<td>Accept an Incoming Call</td>
<td>Answer Incoming Call HF – In-band Ring</td>
<td>HFP/HF/ICA/BV-01-I</td>
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<td>Answer Incoming Call HF – In-band Setting</td>
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<td>Answer Incoming Call HF – Ring Muting</td>
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<td>Answer Incoming Call HF – No In-band Ring</td>
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<td>Answer Incoming Call HF – No In-band Ring + Audio Connection</td>
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<td>Answer Incoming Call AG</td>
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<td>Reject an Incoming Call</td>
<td>Reject Incoming Call from HF</td>
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<td>Reject Incoming Call from AG</td>
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<td>Terminate a Call</td>
<td>Terminate a Call – HF Terminated</td>
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<td>Terminate a Call – AG Terminated</td>
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<td>Terminate a Call – Remote Party Terminated</td>
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<td>Outgoing Call Abandon from HF</td>
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<td>Terminate Ongoing Call – While Call Waiting</td>
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<td>Audio Connection Transfer during an Ongoing Call</td>
<td>HF Initiated Audio Transfer to the HF – No SLC</td>
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<td>HF Initiated Audio Transfer to the HF – SLC</td>
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<td>AG Initiated Audio Transfer to the HF – No SLC</td>
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<td>AG Initiated Audio Transfer to the HF – SLC</td>
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<td>AG Initiated Audio Transfer to the AG</td>
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<td>Place a Call with the Phone Number</td>
<td>Place Call – Phone Number</td>
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<td>Place a Call Using Memory Dialing</td>
<td>Place Call - Memory</td>
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<td>Place Call – No Number at Memory Location</td>
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<td>Place a Call to the Last Number Dialed</td>
<td>Place Call – Last Number</td>
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<td>Place Call – No Last Number in the AG</td>
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<td>Three Way Calling</td>
<td>Call Waiting – User Busy</td>
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<td>Call Waiting – Drop Active/Retrieve Waiting Call</td>
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<td>Call Waiting – Hold Active/Retrieve Waiting Call or Held</td>
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<td>3 Way – Explicit Call Transfer</td>
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<td>Call handling in Non-Regular Situations</td>
<td>Incoming Call Interrupted – Call Terminated</td>
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<td>Echo Canceling (EC) and Noise Reduction (NR)</td>
<td>EC/NR OFF – AG Supports EC/NR</td>
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<td>EC/NR OFF – AG Doesn’t Support EC/NR</td>
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<td>Voice Recognition Activation</td>
<td>Voice Recognition Activation HF</td>
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<td>Voice Recognition Activation AG</td>
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<td>Voice Recognition Activation from AG to HF Not Supported</td>
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<td>Voice Recognition Deactivation</td>
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<td>Attach a Number to a Voice Tag</td>
<td>Phone Number/Voice Tag- AG Accepts</td>
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<td>Ability to Transmit DTMF Codes</td>
<td>Transmit DTMF</td>
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<td>Remote Audio Volume Control - Speaker</td>
<td>Speaker Vol Ctrl – Remote/Local</td>
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<td>Speaker Vol Ctrl – Remote</td>
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<td>Speaker Vol Ctrl – Store Settings</td>
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<td>Remote Audio Volume Control - Microphone</td>
<td>Micro Gain Ctrl – Remote/Local</td>
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<td>Micro Gain Ctrl – Remote</td>
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<td>Enhanced Call Status Functions</td>
<td>Query List of Current Calls</td>
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<td>Sending of Correct Call Status on SLC Initialization</td>
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<td>Transfer of Current Call Status to Held</td>
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<td>Enhanced Call Control Not Supported – Release Call</td>
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<td>Query Response and Hold Status</td>
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<td>Put an Incoming Call in a Response and Held State from HF</td>
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<td>Put an Incoming Call in a Response and Held State from AG</td>
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<td>Accept a Response and Held Call from HF</td>
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<td>Accept a Response and Held Call from AG</td>
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<td>Response and Held Call Terminated by Caller</td>
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<td>Subscriber Number Information</td>
<td>Query AG with Subscriber Number Information</td>
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<td>HF Supports Subscriber Number Information, AG Does Not Support Subscriber</td>
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<td>AG Initiates SLC with 3-way</td>
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<td>HF Initiates SLC, No 3-way</td>
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<td>AG Initiates SLC, No 3-way</td>
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<td>HF Initiates SLC with codec negotiation</td>
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<td>HF Initiates SLC without codec negotiation</td>
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<td>AG Initiates SLC without codec negotiation</td>
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<td>SLC, Lower Tester and IUT both support HF Indicator, with some in common</td>
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<td>SLC, IUT supports HF Indicator, Lower Tester does not</td>
<td>HFP/HF/SLC/BV-10-I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HFP/AG/SLC/BV-10-I</td>
</tr>
<tr>
<td>Codec Connection Setup</td>
<td>Codec Connection Setup – HF Initiated</td>
<td>HFP/HF/ACC/BV-01-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup following an initial successful Codec Connection</td>
<td>HFP/HF/ACC/BV-02-I</td>
</tr>
<tr>
<td></td>
<td>Setup – HF Initiated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup Failure – HF Initiated</td>
<td>HFP/HF/ACC/BV-03-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup – AG Initiated</td>
<td>HFP/HF/ACC/BV-04-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup Failure – AG Initiated</td>
<td>HFP/HF/ACC/BV-05-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection – AG Initiated – Verify Support for T1 Settings</td>
<td>HFP/HF/ACC/BV-06-I</td>
</tr>
<tr>
<td>Layer</td>
<td>Test purpose</td>
<td>Test case identifier</td>
</tr>
<tr>
<td>-------</td>
<td>--------------</td>
<td>----------------------</td>
</tr>
<tr>
<td></td>
<td>Codec Connection – AG Initiated – Verify Support for T2 Settings</td>
<td>HFP/HF/ACC/BV-07-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup – HF Initiated</td>
<td>HFP/AG/ACC/BV-08-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup Failure – HF Initiated</td>
<td>HFP/AG/ACC/BV-09-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup – AG Initiated</td>
<td>HFP/AG/ACC/BV-10-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup following an initial successful Codec Connection Setup – AG Initiated</td>
<td>HFP/AG/ACC/BV-11-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup Failure due to invalid eSCO parameters</td>
<td>HFP/AG/ACC/BI-12-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup Failure, codec currently unavailable on the HF device</td>
<td>HFP/AG/ACC/BI-13-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup Failure, WBS codecs currently unavailable on the HF device</td>
<td>HFP/AG/ACC/BI-14-I</td>
</tr>
<tr>
<td></td>
<td>Codec Connection Setup Failure – AG Initiated</td>
<td>HFP/AG/ACC/BV-15-I</td>
</tr>
<tr>
<td>Wide Band Speech Support</td>
<td>Verify AG SDP record correctly reflects support for the wide band speech service</td>
<td>HFP/AG/WBS/BV-01-I</td>
</tr>
<tr>
<td></td>
<td>Verify HF SDP record correctly reflects support for the wide band speech service</td>
<td>HFP/HF/WBS/BV-02-I</td>
</tr>
<tr>
<td></td>
<td>Verify the HF device correctly supports codec re-negotiation during SLC</td>
<td>HFP/HF/WBS/BV-03-I</td>
</tr>
<tr>
<td>Individual Indicators Activation</td>
<td>Activate all indicators using a fixed string</td>
<td>HFP/AG/IIA/BV-01-I</td>
</tr>
<tr>
<td></td>
<td>Activate only service indicator</td>
<td>HFP/AG/IIA/BV-02-I</td>
</tr>
<tr>
<td></td>
<td>Activate only roaming status indicator</td>
<td>HFP/AG/IIA/BV-03-I</td>
</tr>
<tr>
<td></td>
<td>Activate or deactivate specific indicators</td>
<td>HFP/HF/IIA/BV-04-I</td>
</tr>
<tr>
<td></td>
<td>Activate only battery level indicator</td>
<td>HFP/AG/IIA/BV-05-I</td>
</tr>
<tr>
<td></td>
<td>Deactivate all non-mandatory indicators using a fixed string</td>
<td>HFP/AG/IID/BV-01-I</td>
</tr>
<tr>
<td></td>
<td>Deactivate only signal strength indicator</td>
<td>HFP/AG/IID/BV-02-I</td>
</tr>
<tr>
<td></td>
<td>Deactivate only battery level status indicator and the signal strength indicator</td>
<td>HFP/AG/IID/BV-03-I</td>
</tr>
<tr>
<td></td>
<td>Deactivate only signal strength indicator – Battery status reported</td>
<td>HFP/AG/IID/BV-04-I</td>
</tr>
<tr>
<td>Layer</td>
<td>Test purpose</td>
<td>Test case identifier</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td>Standard event reporting off and all indicators activated</td>
<td>HFP/AG/IIC/BV-01-I</td>
</tr>
<tr>
<td></td>
<td>Register individual indicators configuration when standard event reporting is OFF</td>
<td>HFP/AG/IIC/BV-02-I</td>
</tr>
<tr>
<td></td>
<td>Standard indicator read command still works when indicators are deactivated</td>
<td>HFP/AG/IIC/BV-03-I</td>
</tr>
<tr>
<td>Inquiry and Discoverability</td>
<td>Verify inquiry and discoverability</td>
<td>HFP/HF/DIS/BV-01-I, HFP/AG/DIS/BV-01-I</td>
</tr>
<tr>
<td>HF Indicators</td>
<td>HF sends an updated HF indicator value</td>
<td>HFP/HF/HFI/BV-01-I</td>
</tr>
<tr>
<td></td>
<td>AG receives an updated HF indicator value</td>
<td>HFP/AG/HFI/BV-02-I</td>
</tr>
<tr>
<td></td>
<td>AG receives invalid updated HF indicator values</td>
<td>HFP/AG/HFI/BI-03-I</td>
</tr>
</tbody>
</table>

Table 3.1: Test Suite Structure for the Hands-Free Profile

3.3 Test Groups

The test groups are organized in 3 levels. The first level defines the profile procedure groups representing the profile procedures. An optional second level separates the profile procedures in functional modules. The last level in each branch contains the standard ISO subgroups BV and BI.

3.4 Initialization

Before performing any test cases, an initialization procedure between HF and AG has to be performed to ensure that the devices have stored the information with which device they have to interoperate while performing the Hands-Free profile. For most test cases, it is assumed as a general precondition that this initialization has been performed for this pair of devices.

In addition, some of the Individual Indicator Activation feature tests require the AG to register and de-register with a cellular network in order to test the proper operation of relevant indicators. This may be accomplished by using a network simulator, or any other means available to the Lower Tester.
# 4 Test Cases

## 4.1 Introduction

### 4.1.1 Test Case Identification Conventions

Test cases shall be assigned unique identifiers per the conventions in [5]. The convention used here is `<spec abbreviation>/<<IUT role>>/<class>/<<feat>>/<<func>>/<<subfunc>>/<<cap>>/<<xx>>-<<nn>>-<y>.

Bolded ID parts shall appear in the order prescribed. Non-bolded ID parts (if applicable) shall appear between the bolded parts. The order of the non-bolded parts may vary from test suite to test suite, but shall be consistent within each individual test suite.

<table>
<thead>
<tr>
<th>Identifier Abbreviation</th>
<th>Spec Abbreviation &lt;spec abbreviation&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFP</td>
<td>Hands-Free Profile</td>
</tr>
<tr>
<td><strong>Identifier Abbreviation</strong></td>
<td><strong>Role Identifier &lt;IUT role&gt;</strong></td>
</tr>
<tr>
<td>HF</td>
<td>Hands-Free role</td>
</tr>
<tr>
<td>AG</td>
<td>Audio Gateway role</td>
</tr>
<tr>
<td><strong>Identifier Abbreviation</strong></td>
<td><strong>Feature Identifier &lt;feat&gt;</strong></td>
</tr>
<tr>
<td>ACC</td>
<td>Codec connection set up</td>
</tr>
<tr>
<td>ACR</td>
<td>Audio connection release</td>
</tr>
<tr>
<td>ACS</td>
<td>Audio connection set up</td>
</tr>
<tr>
<td>ATA</td>
<td>Audio connection transfer towards the AG:</td>
</tr>
<tr>
<td>ATH</td>
<td>Audio connection transfer towards the HF:</td>
</tr>
<tr>
<td>CIT</td>
<td>Normal call process interrupted</td>
</tr>
<tr>
<td>DIS</td>
<td>Discoverable</td>
</tr>
<tr>
<td>ENO</td>
<td>Echo Canceling (EC) and Noise Reduction (NR)</td>
</tr>
<tr>
<td>HFI</td>
<td>Hands-Free Indicators</td>
</tr>
<tr>
<td>ICA</td>
<td>Accept an incoming call</td>
</tr>
<tr>
<td>ICR</td>
<td>Reject an incoming call</td>
</tr>
<tr>
<td>IIA</td>
<td>Individual Indicators Activation</td>
</tr>
<tr>
<td>IIC</td>
<td>Individual Indicators Conflicts</td>
</tr>
<tr>
<td>IID</td>
<td>Individual Indicators Deactivation</td>
</tr>
<tr>
<td>OCL</td>
<td>Last number re-dial from the HF:</td>
</tr>
</tbody>
</table>
### Table 4.1: Hands-Free Profile Test Case Feature Identification Conventions

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCM</td>
<td>Memory dialing from the HF:</td>
</tr>
<tr>
<td>OCN</td>
<td>Place a call with the phone number supplied by the HF:</td>
</tr>
<tr>
<td>OOR</td>
<td>Out of Range</td>
</tr>
<tr>
<td>RMV</td>
<td>Remote microphone volume</td>
</tr>
<tr>
<td>RSV</td>
<td>Remote speaker volume</td>
</tr>
<tr>
<td>SLC</td>
<td>Service Level Connections</td>
</tr>
<tr>
<td>TCA</td>
<td>Terminate a call</td>
</tr>
<tr>
<td>TDC</td>
<td>Ability to transmit DTMF codes</td>
</tr>
<tr>
<td>TRS</td>
<td>Transfer registration status</td>
</tr>
<tr>
<td>TWC</td>
<td>Three Way Calling</td>
</tr>
<tr>
<td>VRA</td>
<td>Voice recognition activation</td>
</tr>
<tr>
<td>VRD</td>
<td>Voice recognition deactivation</td>
</tr>
<tr>
<td>VTG</td>
<td>Attach a voice tag to a phone number</td>
</tr>
<tr>
<td>WBS</td>
<td>Wide band speech</td>
</tr>
</tbody>
</table>

#### 4.1.2 Conformance

When conformance is claimed, all capabilities indicated as mandatory for this Specification shall be supported in the specified manner (process-mandatory), this also applies for all optional and conditional capabilities for which support is indicated. All mandatory capabilities and optional and conditional capabilities for which support is indicated are subject to verification as part of the Bluetooth Qualification Program.

The Bluetooth Qualification Program may employ tests to verify implementation robustness. The level of implementation robustness that is verified varies from one Specification to another and may be revised for cause based on interoperability issues found in the market.

Such tests may verify:

- That claimed capabilities may be used in any order and any number of repetitions that is not excluded by the Specification, OR
- These capabilities enabled by the implementations are sustained over durations expected by the use case, OR
- That the implementation gracefully handles any quantity of data expected by the use case, OR
- That in cases where more than one valid interpretation of the Specification exists, the implementation complies with at least one interpretation and gracefully handles other interpretations OR
- That the implementation is immune to attempted security exploits.
A single execution of each of the required tests is required in order to constitute a pass verdict. However, it is noted that in order to provide a foundation for interoperability, it is necessary that a qualified implementation consistently and repeatedly passes any of the applicable tests.

In any case, where a member finds an issue with the Test Plan Generator, the Test Case as described in the Test Suite, or with the Test System utilized, the Member is required to notify the responsible party via an errata request such that the issue may be addressed.

4.1.3 Pass/Fail Verdict Conventions
Each test case has an Expected Outcome section, which outlines all the detailed pass criteria conditions that shall be met by the IUT to merit a Pass Verdict.

The convention in this test suite is that unless there is a specific set of fail conditions outlined in the test case, the IUT fails the test case as soon one of the pass criteria conditions cannot be met. If this occurs, the outcome of the test shall be the Fail Verdict.

4.2 General Test Case Assumptions

4.2.1 Service Level Connections Management
In this test suite, it is always assumed that both the HF and the AG are capable of initiating a “Service Level Connection set up” procedure, as stated in Section 4.2 and 4.3 in [2], whenever requested in any of the test procedures listed within this test suite and according to the implementation in both devices.

4.2.2 Audio Connection Setup
In this test suite, it is always assumed that both the HF and the AG are capable of initiating an “Audio Connection set up” procedure, as stated in Section 4.11 in [2] whenever requested in any of the test procedures listed within this test suite and according to the implementation in both devices.

4.2.3 Audio Connection Release
In this test suite, it is always assumed that both the HF and the AG are capable of initiating an “Audio Connection release” procedure, as stated in Section 4.12 in [2], whenever requested in any of the test procedures listed within this test suite and according to the implementation in both devices.

4.3 Out of Range Tests
Test group with the objective to verify the proper behavior on link loss.

4.3.1 Out of Range Tests
Test subgroup with the objectives:

- To verify that AG is capable of handling link loss during the active call process.
- To verify that the HF is capable of reconnecting with the AG and transferring audio to itself.

4.3.1.1 AG reconnects to HF
- Test Case ID(s)
HFP/AG/OOR/BV-01-I

HFP/HF/OOR/BV-01-I

• Test Purpose

AG: To verify that AG can re-connect to HF after a link loss recovery and transfer the audio pathway to HF.

HF: To verify that HF returns to stand-by state upon link loss. Ensure the HF device is in connectible mode after link loss.

• Reference:

[2] 4.2.2

• Initial Condition

Devices are paired and connected with ongoing call audio routed to HF.

The HF device does not support automatic link-loss recovery feature.

• Test Procedure

1. Take the devices out of range from each other and wait for 30 seconds.
2. Bring the devices back into Bluetooth operating range.
3. Initiate user action on the AG to connect with the HF and transfer audio pathway. Depending upon implementation this may be done autonomously or by one or more user actions on the AG.

• Expected Outcome

Pass verdict

- As a result of step 1 the AG acknowledges the link loss and routes the call audio back to itself. This may require user action or confirmation on the AG. Ensure the HF device is in connectible mode.

- As a result of step 2 the AG may autonomously initiate a re-connection to the HF.

- As a result of step 3 a service level connection is established between the AG and HF. The AG routes the audio pathway to the HF by setting up an audio connection.

4.3.1.2 HF reconnects to AG

• Test Case ID(s)

HFP/HF/OOR/BV-02-I

HFP/AG/OOR/BV-02-I

• Test Purpose

HF: To verify that HF can re-connect to AG after a link loss recovery and transfer the audio pathway to itself. This can be done by user-action or autonomously by the HF after sensing the link-loss (Section 4.2.2 in [2]).

AG: To verify that AG returns to stand-by state upon link loss. Ensure the AG device is in connectible mode after link loss.
• Reference:
  [2] 4.2.2

• Initial Condition
Devices are paired and connected with ongoing call audio routed to HF.
The AG device does not support automatic link-loss recovery feature.

• Test Procedure
  1. Take the devices out of range from each other and wait for 30 seconds.
  2. Bring the devices back into Bluetooth operating range.
  3. Initiate user action on the HF to connect with the AG and transfer audio pathway. Depending upon implementation this may be done autonomously or by one or more user actions on the HF.

• Expected Outcome
  Pass verdict
  - As a result of step 1, the HF acknowledges the link loss and returns to stand-by state. Ensure the AG device is in connectible mode
  - As a result of step 2 the HF may autonomously initiate a re-connection to the AG.
  - As a result of step 3 a service level connection is established between the AG and HF. The HF establishes an audio connection with the AG and routes audio pathway to itself.

4.4  Transfer of Phone Status
Test group with the objective to verify that the HF is capable of reporting the current status of the AG.

4.4.1  Transfer of Registration Status
Test subgroup with the objectives:

• To verify that the HF is capable of tracking the current registration status of the AG.
• To verify that AG is capable of indicating its current registration status to the HF.

4.4.1.1  Transfer Registration Status
• Test Case ID(s)
  HFP/HF/TRS/BV-01-C
  HFP/AG/TRS/BV-01-C
• Test Purpose
  HF: To verify that the HF accepts the registration status indication.
  AG: To verify that the AG issues the proper registration status indication to the HF.

• Reference
  [2] 4.4
• **Initial Condition**
  HF: Service Level Connection between the HF and the AG established.
  AG: Service Level Connection between the HF and the AG established.
  If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level connection set up” procedure, as stated in 4.2 in [2].

• **Test Procedure**
  Use a test device to simulate the presence of a control channel of a cellular network, such that the AG gets registered into it. The AG notifies this event.
  Disable the control channel. The AG gets de-registered and notifies this event.
  Enable again the control channel. The AG gets registered again and notifies this event.

• **Test Condition**
  Both devices are initialized (see Section 3.4).

• **Expected Outcome**
  **Pass verdict**
  The AG sends a +CIEV unsolicited result code indicating a change in the registration status to the HF. HF accepts the status update with no effect on function.

### 4.5 Transfer of Call Status

Testing for the “Transfer of call status” feature, as stated in Section 4.10 in [2], is performed as part of the following call handling test cases within this test suite:

**Incoming call answering related test procedures**

- **Answer Incoming Call HF – In-band Ring**
  HFP/HF/ICA/BV-01-I  HFP/AG/ICA/BV-01-I

- **Answer Incoming Call HF – In-band Ring**
  HFP/HF/ICA/BV-02-I  HFP/AG/ICA/BV-02-I

- **Answer Incoming Call HF – Ring Muting**
  HFP/HF/ICA/BV-03-I

- **Answer Incoming Call HF – No In-band Ring**
  HFP/HF/ICA/BV-04-I  HFP/AG/ICA/BV-04-I

- **Answer Incoming Call AG**
  HFP/HF/ICA/BV-06-I  HFP/AG/ICA/BV-06-I

**Incoming call rejection related test procedures**

- **Reject incoming Call from HF**
  HFP/HF/ICR/BV-01-I  HFP/AG/ICR/BV-01-I

- **Reject incoming Call from AG**
  HFP/HF/ICR/BV-02-I  HFP/AG/ICR/BV-02-I

**Call termination related test procedures**

- **Terminate a Call - HF Terminated**
  HFP/HF/TCA/BV-01-I  HFP/AG/TCA/BV-01-I

- **Terminate a Call - AG Terminated**
  HFP/HF/TCA/BV-02-I  HFP/AG/TCA/BV-02-I

- **Terminate a Call – Remote Party Terminated**
  HFP/HF/TCA/BV-03-I  HFP/AG/TCA/BV-03-I
Outgoing call set up related test procedures

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>HFP/HC/OCN/BV-01-I</th>
<th>HFP/HC/OCN/BV-01-I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place Call – Phone Number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place Call – Memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place Call – Last Number</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For more details, refer to the “Transfer of call status” related statements in each of these test cases.

### 4.5.1 Transfer of Phone Status Indicators

Test subgroup with the objectives:

- To verify that the HF receives the status indications of the AG.
- To verify that the AG sends the status indications to the HF in the proper format.

#### 4.5.1.1 Transfer Signal Strength Indication

- **Test Case ID(s)**
  - HFP/HF/PSI/BV-01-C
  - HFP/AG/PSI/BV-01-C

- **Test Purpose**
  - **HF:** To verify that the HF receives the signal strength status of the AG.
  - **AG:** To verify that the AG sends the signal strength status of the HF in the proper format.

- **Reference**
  - [2] 4.5

- **Initial Condition**
  - **HF:** Service Level Connection between the AG and the HF established.
  - **AG:** Service Level Connection between the AG and the HF established.

- **Test Procedure**
  - **AG:** Impair the signal to the AG so that a reduction in signal strength can be observed.
  - **HF:** Verify that the signal strength indication is received at the HF.

  Verify that the value of the indicator relatively follows the signal strength at the AG (i.e., if the signal strength goes up, the value of result code goes higher accordingly and vice versa).

- **Expected Outcome**
  - **Pass verdict**
    The indicator is received at the HF as the signal strength changes and the value received changes in the same relative manner that the signal strength is changing. HF accepts the status update with no effect on function.
4.5.1.2 Transfer Roaming Status Indication

- Test Case ID(s)
  
  **HFP/HF/PSI/BV-02-C**
  **HFP/AG/PSI/BV-02-C**

- Test Purpose
  
  HF: To verify that the HF receives the roaming status of the AG.
  
  AG: To verify that the AG sends the roaming status of the AG in the proper format.

- Reference
  
  [2] 4.6

- Initial Condition
  
  HF: Service Level Connection between the AG and the HF established.
  
  AG: Service Level Connection between the AG and the HF established.

- Test Procedure
  
  AG: 1. Cause the AG to register on a network other than the home network.
  
         2. Cause the AG to register on the home network.
  
  HF: 1. Verify that roam indication is received at the HF, indicating that the AG is roaming.
  
         2. Verify that the roam indication is received at the HF, indicating that the AG is not roaming.

- Expected Outcome
  
  Pass verdict
  The indicator is received at the HF as the roaming status changes.

4.5.1.3 Transfer Battery Level Indication

- Test Case ID(s)
  
  **HFP/HF/PSI/BV-03-C**
  **HFP/AG/PSI/BV-03-C**

- Test Purpose
  
  HF: To verify that the HF receives the battery level status of the AG.
  
  AG: To verify that the AG sends the battery level status to the HF in the proper format.

- Reference
  
  [2] 4.7
• Initial Condition
  HF: Service Level Connection between the AG and the HF established.
  AG: Service Level Connection between the AG and the HF established.

• Test Procedure
  AG: Adjust the battery level on the AG to a level that will cause a battery level indication to be sent to the HF.
  HF: Verify that the battery level indication is received at the HF.

  Verify that the value of the indicator relatively follows the battery level (i.e., if the battery level goes up, the value of battery level indication received at the HF goes higher accordingly).

• Expected Outcome
  Pass verdict
  The indicator is received at the HF as the battery level indicator changes.

4.5.1.4 Query Operator Selection

• Test Case ID(s)
  HFP/HF/PSI/BV-04-I
  HFP/AG/PSI/BV-04-I

• Test Purpose
  HF: To verify that the HF can query the currently selected operator name
  AG: To verify that the AG accepts and responds to the request of the HF to query the currently selected operator name.

• Reference
  [2] 4.8

• Initial Condition
  HF: Service Level Connection between the AG and the HF established.
  AG: Service Level Connection between the AG and the HF established.

• Test Procedure
  HF: 1. HF sets the format of the operator selection to long alphanumeric.
  
  2. HF queries the currently selected operator name from the AG.

• Expected Outcome
  Pass verdict
  The AG responds with the operator name in long alphanumeric.
4.5.1.5  HFP/AG/PSI/BV-05-I [Transfer Roaming Status Indication – Roaming function not supported]

• Test Purpose
  AG: To verify that, when the AG (IUT) does not support the roaming function, its roaming status indicates the AG is not roaming.

• Reference
  [2] 4.2.1, 4.6, 4.33.2

• Initial Condition
  Service Level Connection between the AG and the HF is not yet established.
  AG is registered on the home network.

• Test Procedure
  1. Service Level Connection is established
  2. AG responds to AT+CIND? Read command sent from the Lower Tester (HF)

• Expected Outcome
  Pass verdict
  The roaming status indicator is either not present in the indicator list received at the HF, or if it is received by the HF it indicates the AG is not roaming.

4.6  Audio Connections Handling

Test group with the objective to verify the capability of establishing and removing an audio connection between the HF and the AG, whenever necessary and even not directly related to any ongoing call process.

The tests procedures described below in this section are only applicable for AGs and HFs that in its normal behavior, with no special test means according to their implementations, may establish or release Audio Connections out of the rest of the procedures described in this test suite.

4.6.1  Audio Connection Set Up

Test subgroup with the objective to verify the capability of both the HF and the AG for initiating the establishment of an audio connection between them.

Reference conditions: All tests in the section Audio Connection Setup shall verify the capability of the IUT to follow the Synchronous Connection Interoperability Requirements defined in [2].

4.6.1.1  HFP/HF/ACS/BV-01-I [HF is IUT, HF Initiated, AG is SCO only]

• Test Purpose
  IUT is an HF. Audio Setup HF Initiated (AG with SCO only)
  HF: To verify the capability of the IUT for initiating an audio connection with an AG. The AG supports and accepts only SCO connections.
• Reference
  [2] 4.11, 5.7.1

• Initial Condition
An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall not include EV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure
  HF: IUT shall initiate a full duplex audio connection with the AG.
  AG: Accepts connection request from IUT with only HV packet types allowed.

• Expected Outcome
  Pass verdict
  Full duplex audio is available between the HF and AG.

4.6.1.2  HFP/AG/ACS/BV-02-I [AG is IUT, AG Initiated, HF is SCO only]

• Test Purpose
  IUT is an AG. Audio Setup AG initiated (HF with SCO only)
  AG: To verify the capability of the IUT for initiating an audio connection with an HF. The HF supports and accepts only SCO connections.

• Reference
  [2] 4.11, 5.7.1

• Initial Condition
An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall not include EV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure
  AG: IUT shall initiate a full duplex audio connection with the HF.
  HF: Accepts connection request from IUT with only HV packet types allowed.

• Expected Outcome
  Pass verdict
  Full duplex audio is available between the HF and the AG.

4.6.1.3  HFP/HF/ACS/BV-03-I [HF is IUT, AG Initiated, AG is SCO only]

• Test Purpose
  IUT is an HF. Audio Setup is AG initiated (AG with SCO only).
HF: To verify the capability of the IUT for accepting an audio connection with an AG. The AG requests only SCO connections.

- Reference
  [2] 4.11, 5.7.1

- Initial Condition
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall not include EV packet types in LMP_features req or LMP_features_res messages.

- Test Procedure
  AG: The AG requests a full duplex audio connection with HF. The connection request by the AG shall allow only HV packet types in the connection setup request.
  HF: The HF accepts a full duplex audio connection request by the AG.

- Expected Outcome
  Pass verdict
  Full duplex audio is available between the HF and the AG.

4.6.1.4 HFP/AG/ACS/BV-04-I [AG is IUT, HF Initiated, HF is SCO only]

- Test Purposes
  IUT is AG. Audio Setup is HF initiated (HF with SCO only).
  AG: To verify the capability of the IUT for accepting an audio connection with an HF. The HF requests only SCO connections.

- Reference
  [2] 4.11, 5.7.1

- Initial Condition
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall not include EV packet types in LMP_features_req or LMP_features_res messages.

- Test Procedure
  AG: The AG accepts a full duplex audio connection request by the HF. On-going call may be present in order to achieve the test purpose.
  HF: The HF requests a full duplex audio connection with AG. The connection request by the HF shall allow only HV packet types in the connection setup request.
• Expected Outcome

Pass verdict

Full duplex audio is available between the HF and AG.

4.6.1.5 HFP/HF/ACS/BV-05-I [HF is IUT, HF Initiated, AG has eSCO]

• Test Purpose

IUT is an HF. Audio Setup HF Initiated (AG with eSCO).

HF: To verify the capability of the IUT for initiating an audio connection with an AG. The AG supports and accepts SCO or S1 eSCO connections.

• Reference

[2] 4.11, 5.7.1

• Initial Condition

The Lower Tester (AG) is configured not to support BR/EDR Secure Connections, hence ensuring that the Secure Connections feature is not used on the connection during the test.

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure

AG: Accepts audio connection request from the IUT and allows HV and EV packet types. The AG shall accept all HV packets and only the S1 eSCO parameters in the accept response.

HF: HF requests a full duplex audio connection with the AG.

• Expected Outcome

Pass verdict

Full duplex audio is available between the HF and AG.

• Notes

If the IUT supports only SCO, a SCO connection shall be established.

4.6.1.6 HFP/AG/ACS/BV-06-I [AG is IUT, AG Initiated, HF has eSCO]

• Test Purpose

IUT is an AG. Audio Setup AG initiated (HF with eSCO).

AG: To verify the capability of the IUT for initiating an audio connection with an HF. The HF supports and accepts SCO or S1 eSCO connections.

• Reference

[2] 4.11, 5.7.1
• Initial Condition

The Lower Tester (HF) is configured not to support BR/EDR Secure Connections, hence ensuring that the Secure Connections feature is not used on the connection during the test.

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure

AG: AG requests a full duplex audio connection with the HF.

HF: Accepts audio connection request from the IUT and allows HV and EV packet types. The HF shall accept all HV packets and only the S1 eSCO parameters in the accept response.

• Expected Outcome

Pass verdict
Full duplex audio is available between the HF and AG.

• Notes

If the IUT supports only SCO, a SCO connection shall be established.

4.6.1.7 HFP/HF/ACS/BV-07-I [HF is IUT, AG Initiated, AG has eSCO]

• Test Purpose

IUT is an HF. Audio Setup is AG initiated (AG supports eSCO)

HF: To verify the capability of the IUT for accepting an audio connection request from an AG. The AG supports and accepts SCO or S1 eSCO connections.

• Reference

[2] 4.11, 5.7.1

• Initial Condition

The Lower Tester (AG) is configured not to support BR/EDR Secure Connections, hence ensuring that the Secure Connections feature is not used on the connection during the test.

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure

AG: The AG shall initiate a full duplex audio connection with the IUT. The AG makes a connection setup request that will allow S1 eSCO and HV packet types. On-going call may be present in order to achieve the test purpose.

HF: The IUT accepts the audio connection request from the AG.
• Expected Outcome
  Pass verdict
  Full duplex audio is available between the IUT and AG.

4.6.1.8  HFP/AG/ACS/BV-08-I [AG is IUT, HF Initiated, HF has eSCO]

• Test Purpose
  IUT is AG. Audio Setup is HF initiated (HF supports eSCO).

  AG: To verify the capability of the IUT for accepting an audio connection request from an HF. The HF supports and accepts SCO or S1 eSCO connections.

• Reference
  [2] 4.11, 5.7.1

• Initial Condition
  The Lower Tester (HF) is configured not to support BR/EDR Secure Connections, hence ensuring that the Secure Connections feature is not used on the connection during the test.

  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure
  AG: Negotiates audio connection with HF. On-going call may be present in order to achieve the test purpose.

  HF: The HF shall initiate a full duplex audio connection with the IUT. The HF makes a connection setup request that will allow S1 eSCO and HV packet types.

• Expected Outcome
  Pass verdict
  Full duplex audio is available between the HF and AG.

4.6.1.9  HFP/HF/ACS/BV-09-I [HF is IUT, HF Initiated, AG has eSCO allows only SCO]

• Test Purpose
  IUT is an HF. Audio Setup HF Initiated (AG with eSCO accepts only SCO).

  HF: To verify the capability of the IUT for initiating an audio connection with an AG. The AG accepts only SCO connections.

• Reference
  [2] 4.11, 5.7.1
• Initial Condition
   An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure
   AG: Negotiates audio connection with HF accepting only HV packet types in the accept response.
   HF: HF requests a full duplex audio connection with the AG.

• Expected Outcome
   Pass verdict
   Full duplex audio is available between the HF and AG.

• Notes
   If the IUT does not have support for eSCO, and does not request eSCO in any other tests, it is OK for the IUT to initiate SCO in this test.

4.6.1.10 HFP/AG/ACS/BV-10-I [AG is IUT, AG Initiated, HF has eSCO allows only SCO]

• Test Purpose
   IUT is an AG. Audio Setup AG Initiated (HF with eSCO accepts only SCO).
   AG: To verify the capability of the IUT for requesting an audio connection with an HF. The HF accepts only SCO connections.

• Reference
   [2] 4.11, 5.7.1

• Initial Condition
   An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure
   AG: IUT requests a full duplex audio connection with the HF.
   HF: Negotiates audio connection with AG accepting only HV1 packet types in the accept response.

• Expected Outcome
   Pass verdict
   Full duplex audio is available between the HF and AG.
4.6.1.11 HFP/AG/ACS/BV-11-I [AG is IUT, HF Initiated eSCO with 18ms latency]

- **Test Purpose**
  IUT is an AG. Audio Setup is HF Initiated (HF latency 18ms).

  AG: To verify the capability of the IUT for accepting an audio connection request from an HF. The HF supports and accepts SCO, S1 eSCO and long latency eSCO connections.

- **Reference**
  [2] 4.11, 5.7.1

- **Initial Condition**
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

- **Test Procedure**
  AG: IUT handles the Synchronous Connection request from the HF. On-going call may be present in order to achieve the test purpose.

  HF: HF requests a full duplex audio connection with the IUT. The HF starts the negotiation with the connection setup request with arguments of 18ms max_latency and allows all EV and HV packet types.

- **Expected Outcome**
  Pass verdict
  Full duplex audio is available between the HF and AG.

4.6.1.12 HFP/HF/ACS/BV-12-I [HF is IUT, AG Initiates eSCO with 18ms latency]

- **Test Purpose**
  IUT is an HF. Audio Setup initiated by AG (AG latency 18ms).

  HF: To verify the capability of the IUT for accepting an audio connection request from an AG. The AG supports and accepts SCO, S1 eSCO and long latency eSCO connections.

- **Reference**
  [2] 4.11, 5.7.1

- **Initial Condition**
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include EV and HV packet types in LMP_features_req or LMP_features_res messages.
• Test Procedure

AG: AG requests a full duplex audio connection with the IUT. The AG starts the negotiation with the connection setup request with arguments of 18ms max_latency and allows all EV and HV packet types. On-going call may be present in order to achieve the test purpose.

HF: Negotiates audio connection with HF.

• Expected Outcome

Pass verdict

Full duplex audio is available between the HF and AG.

4.6.1.13 HFP/HF/ACS/BI-13-I [HF is IUT, AG Initiates eSCO with invalid bandwidth]

• Test Purpose

IUT is an HF. Audio Setup initiated by AG. The AG eSCO setting for txbandwidth and rxbandwidth is not 8000 bytes/s.

HF: To verify that the HF whether it supports SCO or eSCO as the device under test, will not accept a connection request for invalid eSCO settings from the Lower Tester.

AG: On-going call may be present in order to achieve the test purpose. The Lower Tester requests only an eSCO connection, HV packets shall not be requested by the Lower Tester.

• Reference

[2] 4.11, 5.7.1

• Initial Condition

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure

1. Lower Tester requests eSCO with the S1 eSCO parameters in the connection setup request changed to include txbandwidth and rxbandwidth values of 12000 bytes/s.

2. The IUT responds to this connection request.

3. Lower Tester requests eSCO with the S1 eSCO parameters in the connection setup request changed to include txbandwidth and rxbandwidth values of 6000 bytes/s.

4. The IUT responds to this connection request.

• Expected Outcome

Pass verdict

HF rejects eSCO connection requests from the Lower Tester and does not attempt to renegotiate eSCO parameters or start a new SCO or eSCO connection after rejecting the requests from the Lower Tester.
4.6.1.14 HFP/AG/ACS/BI-14-I [AG is IUT, HF Initiates eSCO with invalid bandwidth]

- **Test Purpose**
  
  IUT is an AG. Audio Setup initiated by HF. The HF eSCO setting for txbandwidth and rxbandwidth is not 8000 bytes/s.

  HF: On-going call may be present in order to achieve the test purpose. The Lower Tester requests only an eSCO connection, HV packets shall not be requested by the Lower Tester.

  AG: To verify that the AG whether it supports SCO or eSCO, as the device under test, will not accept a connection request for invalid eSCO settings from the Lower Tester.

- **Reference**
  
  [2] 4.11, 5.7.1

- **Initial Condition**
  
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or Imp_features_res messages.

- **Test Procedure**
  
  1. Lower Tester requests eSCO with the S1 eSCO parameters in the connection setup request changed to include txbandwidth and rxbandwidth values of 12000 bytes/s.

  2. The IUT responds to this connection request.

  3. Lower Tester requests eSCO with the S1 eSCO parameters in the connection setup request changed to include txbandwidth and rxbandwidth values of 6000 bytes/s.

  4. The IUT responds to this connection request.

  On-going call may be present in order to achieve the test purpose.

- **Expected Outcome**

  **Pass verdict**

  AG rejects eSCO connection requests from the Lower Tester and does not attempt to renegotiate eSCO parameters or start a new SCO or eSCO connection after rejecting the requests from the Lower Tester.

- **Notes**

  In the case of a non-eSCO IUT (one which does not have EV3/4/5 packets defined in LMP_supported_features_req/res), the Lower Tester will not send a synchronous connection request over the air to the IUT. No response is expected from the IUT.
4.6.1.15  HFP/HF/ACS/BV-15-I [HF is IUT, AG Initiates eSCO with S4 Settings]

- Test Purpose
  To verify the capability of the HF (IUT) for accepting an audio connection request with S4 settings from an AG (Lower Tester).

- Reference
  [2] 4.11, 5.7.3

- Initial Condition
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

- Test Procedure
  AG: Requests a full duplex audio connection with the IUT. The AG starts the Synchronous Connection negotiation with arguments of S4 settings (only allowing 2-EV3 packet types). On-going call may be present in order to achieve the test purpose.

  HF: Negotiates audio connection with AG.

- Expected Outcome
  Pass verdict
  Full duplex audio is available between the HF and AG using the S4 settings.

- Note
  To verify the connection uses S4, the Lower Tester can use the Synchronous Connection Complete event which contains the interval and retransmission window values and calculate if they match the S4 latency: “This is a value in milliseconds representing the upper limit of the sum of the synchronous interval and the size of the eSCO window, where the eSCO window is the reserved slots plus the retransmission window”. [1] (Vol 2. Part E. 7.1.26 and 7.1.27)

4.6.1.16  HFP/AG/ACS/BV-16-I [AG is IUT, HF requests eSCO with S4 Settings]

- Test Purpose
  To verify the capability of the AG (IUT) for accepting an audio connection response with S4 settings from an HF (Lower Tester).

- Reference
  [2] 4.11, 5.7.3

- Initial Condition
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.
• Test Procedure

HF: Requests a full duplex audio connection with S4 settings with the IUT (only allowing 2-EV3 packet types).

AG: IUT handles the Synchronous Connection request from the HF. On-going call may be present in order to achieve the test purpose.

• Expected Outcome

Pass verdict
Full duplex audio is available between the HF and AG using the S4 settings.

• Note

To verify that the connection uses S4, the Lower Tester can use the Synchronous Connection Complete event which contains the interval and retransmission window values and calculate if they match the S4 latency: “This is a value in milliseconds representing the upper limit of the sum of the synchronous interval and the size of the eSCO window, where the eSCO window is the reserved slots plus the retransmission window”. [1] (Vol 2. Part E. 7.1.26 and 7.1.27)

4.6.1.17 HFP/HF/ACS/BV-17-I [HF is IUT, HF requests eSCO over Secure Connections]

• Test Purpose

To verify the capability of the HF (IUT) for creating an eSCO audio connection request with the Lower Tester when Secure Connections is used.

• Reference

[2] 4.11, 5.7.3

• Initial Condition

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established.

The ACL link between the AG and the HF uses BR/EDR Secure Connections.

The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure

HF: Requests an eSCO full duplex audio connection with the Lower Tester. On-going call may be present in order to achieve the test purpose.

AG: Negotiates and establishes an audio connection with the IUT over eSCO.

• Expected Outcome

Pass verdict
Full duplex audio is available between the HF and AG using eSCO.
4.6.1.18 HFP/AG/ACS/BV-18-I [AG is IUT, AG Initiates eSCO over Secure Connections]

• Test Purpose
  To verify the capability of the AG (IUT) for creating an eSCO audio connection request with the Lower Tester when Secure Connections is used.

• Reference
  [2] 4.11, 5.7.3

• Initial Condition
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established.

  The ACL link between the AG and the HF uses BR/EDR Secure Connections.

  The Lower Tester shall include all EV and HV packet types in LMP_features_req or LMP_features_res messages.

• Test Procedure
  AG: Requests an eSCO full duplex audio connection with the Lower Tester. On-going call may be present in order to achieve the test purpose.

  HF: Negotiates and establishes an audio connection with the IUT over eSCO.

• Expected Outcome
  Pass verdict
  Full duplex audio is available between the HF and AG using eSCO.

4.6.2 Audio Connection Release

Test subgroup with objective to verify the capability of both the HF and the AG for removing an existing audio connection between them.

4.6.2.1 Audio Release – HF Initiated

• Test Case ID(s)
  HFP/HF/ACR/BV-01-I
  HFP/AG/ACR/BV01-I

• Test Purpose
  HF: To verify the capability of the HF for removing an existing audio connection with the AG, whenever necessary and even out of a call process.

  AG: To verify that the AG responds accordingly to the removal of the existing audio connection by the HF. On-going call may be present in order to achieve the test purpose.

• Reference
• Initial Condition
  HF: An Audio Connection with the AG currently established.
  AG: An Audio Connection with the HF currently established.

• Test Procedure
  HF: Initiate the action (manufacturer specific) on the HF to remove the Audio Connection with the AG.

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict
  Current audio connection between the HF and the AG is removed.
  The audio paths are routed to the AG.
  HF side is muted.

4.6.2.2 Audio Release – AG Initiated

• Test Case ID(s)
  HFP/HF/ACR/BV-02-I
  HFP/AG/ACR/BV-02-I

• Test Purpose
  HF: To verify that the HF responds accordingly to the removal of the existing audio connection from the AG.
  AG: To verify that the AG can initiate the removal of an existing audio connection with the HF, whenever necessary and even out of a call process. On-going call may be present inorder to achieve the test purpose.

• Reference

• Initial Condition
  HF: An audio connection with the AG currently established.
  AG: An audio connection with the HF currently established.

• Test Procedure
  AG: Initiate the action (manufacturer specific) on the AG to remove the Audio Connection with the HF.
• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict
  Current Audio Connection between the HF and the AG is removed.

4.7 Calling Line Identification (CLI)
Test group with the objective to verify the capability of sending an incoming caller ID to the HF.

4.7.1 Calling Line ID
Test subgroup objectives:
To verify the AG is capable of sending an incoming caller ID to the HF when provided by the network services.

4.7.1.1 Caller ID
• Test Case ID(s)
  HFP/HF/CLI/BV-01-I
  HFP/AG/CLI/BV-01-I

• Test Purpose
  HF: To verify that the HF accepts the incoming caller ID.
  AG: To verify that the AG, following the proper procedure, and when provided by the network services, sends the incoming caller ID towards the HF.

• Reference
  [2] 4.13.1

• Initial Condition
  Calling Line Identification (CLI) notification feature, according to section 4.23 in [2], shall be set up as active such that the Calling Line Identification is transferred from the AG.
  HF: A Service Level Connection between the HF and the AG established.
  AG: A Service Level Connection between the HF and the AG established.
  The AG shall be configured to alert the HF of an incoming call connection.

• Test Procedure
  AG: Initiate a call establishment to the AG from a network simulator or any other suitable means.
• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  
  **Pass verdict**
  Upon the call establishment initiation in the AG, the AG provides the caller ID information to the HF. HF accepts the information with no effect on function.

### 4.8 Accept an Incoming Call
Test group with the objective to verify the capability of accepting incoming calls from the HF.

#### 4.8.1 Answer an Incoming Call
Test subgroup with the objective to verify the procedures for accepting incoming calls from the HF and the AG.

##### 4.8.1.1 Answer Incoming Call HF – In-band Ring

• Test Case ID(s)
  
  **HFP/HF/ICA/BV-01-I**
  **HFP/AG/ICA/BV-01-I**

• Test Purpose
  
  **HF:** To verify that the HF, following the proper procedure, alerts of an incoming call using the in-band ring tone injected from the AG.

  To verify that the HF, following the proper procedure, can answer an incoming call in the AG.

  **AG:** To verify that the AG, following the proper procedure, sends proper alert indications to the HF and inject the corresponding in-band ring tone towards the HF.

  To verify that the AG starts the process for answering an incoming call on request from the HF.

• Reference
  
  [2] 4.13.1

• Initial Condition
  
  **HF:** A Service Level Connection between the HF and the AG established.

  If necessary, proper set up (manufacturer specific) shall be made in the HF, to assure that the in-band ring tone, if present, is used as alert signal.

  **AG:** A Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

  The AG shall be configured to alert the HF of an incoming call connection.
• Test Procedure
  AG: Initiate a call establishment to the AG from a network simulator or any other suitable means.

  HF: Upon alerting, the call shall be answered from either the HF or the AG by performing the corresponding action.

  Drop the call.

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict
  Upon the call establishment initiation in the AG, the AG shall alert the HF of the incoming call.

  Upon the call establishment initiation in the AG, the AG shall provide an indication of the incoming call to the HF by injecting some audible signal on the audio link.

  As a result of the acceptance of the call in the HF or the answering of the call in the AG, alerting in the AG and HF is stopped, the call is answered in the AG and proper bi-directional conversation with the remote party is possible via the HF audio means.

  The AG sends a +CIEV unsolicited result code updating the change in call status as stated in Section 4.10 in [2].

  The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

4.8.1.2 Answer Incoming Call HF – In-band Setting

• Test Case ID(s)
  HFP/HF/ICA/BV-02-I
  HFP/AG/ICA/BV-02-I

• Test Purpose
  HF: To verify that the HF, following the proper procedure, alerts of an incoming call using the proper ring signal and reacting accordingly to changes in the in-band ring tone setting in the AG.

  To verify that the HF, following the proper procedure, can answer an incoming call in the AG.

  AG: To verify that the AG, following the proper procedure, is capable of changing its in-band ring tone setting as expected, sending proper indications to the HF.

  To verify that the AG, following the proper procedure, sends proper alert indications to the HF.

  To verify that the AG starts the process for answering an incoming call on request from the HF.
• Reference

[2] 4.13.4

• Initial Condition

HF: A Service Level Connection between the HF and the AG established.

If necessary, proper set up (manufacturer specific) shall be made in the HF, to assure that the in-band ring tone, if present, is used as alert signal.

AG: A Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

The AG shall be configured to alert the HF of an incoming call connection.

Proper actions shall be taken, to assure that the in-band ring tone setting in the AG is in its default state, that is, AG feeds in-band ring tone to the HF as alert signal.

• Test Procedure

1. Make proper set-up such that the AG disables the in-band ring tone.

2. Initiate a call establishment to the AG from a network simulator or any other suitable means.

3. Upon alerting, the call shall be answered from the HF by performing the corresponding action.

4. End the call at the remote.

5. Make proper set-up such that the AG enables the in-band ring tone again.

6. Initiate a call establishment to the AG from a network simulator or any other suitable means.

7. Upon alerting, the call shall be answered from the HF by performing the corresponding action.

8. End the call at the remote.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

Upon the call establishment initiation in the AG, the AG shall alert.

Upon the call establishment initiation in the AG, once step 1 is performed and meaning that the in-band ring tone is disabled, the HF shall alert the user using the local ring tone in step 3.
Upon the call establishment initiation in the AG, once step 5 is performed, meaning that the in-band ring tone is enabled again, the HF shall alert the user using the in-band ring tone in step 7.

As a result of the acceptance of the call in the HF in all cases, alerting in the AG and HF is stopped, the call is answered in the AG and proper bi-directional conversation with the remote party is possible via the HF audio means.

### 4.8.1.3 HFP/HF/ICA/BV-03-I [Answer Incoming Call HF – Ring Muting]

#### Test Purpose

**HF:** To verify that the HF, following the proper procedure, alerts of an incoming call using the local ring signal regardless of the presence of the in-band ring tone.

To verify that the HF, following the proper procedure, can answer an incoming call in the AG.

#### Reference

[2] 4.13.1

#### Initial Condition

**HF:** A Service Level Connection between the HF and the AG established.

If necessary, proper set up shall be made in the HF, to assure that the in-band ring tone is not used.

**AG:** A Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

The AG shall be configured to alert the HF of an incoming call connection.

If necessary, proper set up shall be made in the AG, to assure that the in-band ring tone is fed to the HF as alert signal.

#### Test Procedure

**HF:** Make proper set-up such that the HF mutes the in-band ring tone and uses the local alert signal.

**AG:** Initiate a call establishment to the AG from a network simulator or any other suitable means.

**HF:** Upon alerting, the call shall be answered from the HF by performing the corresponding action.

Drop the call.

#### Test Condition

Both devices are initialized (see Section 3.4).
• Expected Outcome

**Pass verdict**

Upon the call establishment initiation in the AG, the HF shall alert the user.

As a result of the acceptance of the call in the HF, alerting in the AG and HF is stopped, the call is answered in the AG and proper bi-directional conversation with the remote party is possible via the HF audio means.

The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

### 4.8.1.4 Answer Incoming Call HF – No In-band Ring

**• Test Case ID(s)**

HFP/HF/ICA/BV-04-I

HFP/AG/ICA/BV-04-I

**• Test Purpose**

This test assumes that the AG does not use an in-band ring tone as alert mechanism for the HF.

HF: To verify that the HF, following the proper procedure, alerts of an incoming call using a locally generated alert signal.

To verify that the HF, following the proper procedure, can answer an incoming call in the AG.

AG: To verify that the AG, following the proper procedure, sends proper alert indications to the HF.

To verify that the AG starts the process for answering an incoming call on request from the HF.

**• Reference**

[2] 4.13.2

**• Initial Condition**

HF: A Service Level Connection between the HF and the AG established.

AG: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

The AG shall be configured to alert the HF of an incoming call connection.

**• Test Procedure**

AG: Initiate a call establishment to the AG from a network simulator or any other suitable means.

HF: Upon alerting, the call shall be answered from HF by performing the corresponding action.
• Test Condition
Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

Upon the call establishment initiation in the AG, the AG shall alert.

Upon the call establishment initiation in the AG, the HF shall alert via a locally generated alert signal(s).

As a result of the action in the HF, alerting in the AG and HF is stopped, the call is answered in the AG and proper bi-directional conversation with the remote party is possible via the HF audio means.

The AG sends a +CIEV unsolicited result code updating the change in call status as stated in Section 4.10 in [2].

The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

4.8.1.5 Answer Incoming Call HF – No In-Band Ring + Audio Connection

• Test Case ID(s)

HFP/HF/ICA/BV-05-I
HFP/AG/ICA/BV-05-I

• Test Purpose

This test is only applicable for HF and AG implementations which in their normal behavior, with no special test means, allow an Audio Connection to be present when “Answer an Incoming call – no in-band ring tone” procedure, as described in Section 4.13.2 in [2], is being performed.

This test assumes that the AG does not use an in-band ring tone as alert mechanism for the HF.

HF: To verify that the HF, following the proper procedure, does the following:
Alerts of an incoming call using a locally generated alert signal.
Can answer an incoming call in the AG.

AG: To verify that the AG does as follows:
Following the proper procedure, sends proper alert indications to the HF.
Starts the process for answering an incoming call on request from the HF.

• Reference

[2] 4.13.2

• Initial Condition

HF: Audio Connection between the HF and the AG established before the incoming call procedure starts.

AG: Audio Connection between the HF and the AG established before the incoming call procedure starts.

The AG shall be configured to alert the HF of an incoming call connection.
• Test Procedure
AG: Initiate a call establishment to the AG from a network simulator or any other suitable means.
HF: Upon alerting, the call shall be answered from HF by performing the corresponding action.

• Test Condition
Both devices are initialized (see Section 3.4).

• Expected Outcome
Pass verdict
Upon the call establishment initiation in the AG, the AG shall alert.

Upon the call establishment initiation in the AG, the HF shall alert via a locally generated alert signal(s).

As a result of the action in the HF, alerting in the AG and HF is stopped, the call is answered in the AG and proper bi-directional conversation with the remote party is possible via the HF audio means.

4.8.1.6 Answer Incoming Call AG

• Test Case ID(s)
HFP/HF/ICA/BV-06-I
HFP/AG/ICA/BV-06-I

• Test Purpose
HF: To verify that the HF, following the proper procedure, alerts of an incoming call.
To verify that the HF reacts as expected when the incoming call is answered in the AG.

AG: To verify that the AG, following the proper procedure, sends proper alert indications to the HF.
To verify that, once the incoming call is answered in the AG, the AG stops alerting and properly indicates the call status change to the HF.

• Reference

• Initial Condition
HF: A Service Level Connection between the HF and the AG established.

AG: A Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

The AG shall be configured to alert the HF of an incoming call connection.
• Test Procedure
  AG: Initiate a call establishment to the AG from a network simulator or any other suitable means.

  Upon alerting in the HF, the call shall be answered in the AG by performing the corresponding action.

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict
  Upon the call establishment initiation in the AG, the AG shall alert.

  Upon the call establishment initiation in the AG, the HF shall properly alert.

  As a result of the action in the AG, alerting in the HF is stopped and the call is answered in the AG.

  The AG sends a +CIEV unsolicited result code updating the change in call status, as stated in Section 4.10 in [2].

  The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

4.9  Reject an Incoming Call
Test group with the objective to verify the capability of rejecting incoming calls.

4.9.1  Reject an Incoming Call
Test subgroup with the objective to verify the procedures for rejecting an incoming call from both the HF and the AG.

4.9.1.1  Reject incoming Call from HF
• Test Case ID(s)
  HFP/HF/ICR/BV-01-I
  HFP/AG/ICR/BV-01-I

• Test Purpose
  HF: To verify that the HF, following the proper procedure, can reject an incoming call in which the HF is alerted.

  AG: To verify that the AG, following the proper procedure, rejects an incoming call on request from the HF, which is currently alerted.

• Reference
• Initial Condition
  
  HF: A Service Level Connection between the HF and the AG established.

  AG: Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

  The AG shall be configured to alert the HF of an incoming call connection.

• Test Procedure

  AG: Initiate a call establishment to the AG from a network simulator or any other suitable means.

  HF: Upon alerting, the call shall be rejected from HF by performing the corresponding action.

• Test Condition

  Both devices are initialized (see Section 3.4).

• Expected Outcome

  Pass verdict

  Upon the call establishment initiation to the AG, the AG shall properly alert.

  Upon the call establishment initiation in the AG, the HF shall alert.

  As a result of the action in the HF, both the HF and the AG shall stop alerting and the AG shall reject the call.

  The AG sends a +CIEV unsolicited result code updating the change in call status, as stated in Section 4.10 in [2].

  The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

4.9.1.2 Reject incoming Call from AG

• Test Case ID(s)

  HFP/HF/ICR/BV-02-I
  HFP/AG/ICR/BV-02-I

• Test Purpose

  HF: To verify that the HF receives the proper indication when a call is rejected by the AG.

  AG: To verify that the AG, upon the corresponding action (manufacturer specific), rejects an incoming call. The AG shall then indicate this event to the HF.

• Reference

• **Initial Condition**

**HF:** A Service Level Connection between the HF and the AG established.

**AG:** Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

The AG shall be configured to alert the HF of an incoming call connection.

• **Test Procedure**

**AG:** Initiate a call establishment to the AG from a network simulator or any other suitable means.

Upon alerting, the call shall be rejected in the AG by performing the corresponding action.

• **Test Condition**

Both devices are initialized (see Section 3.4).

• **Expected Outcome**

**Pass verdict**

Upon the call establishment initiation to the AG, the AG shall alert.

Upon the call establishment initiation in the AG, the HF shall alert.

Upon call rejection, the HF shall stop alerting.

Upon the action in the AG, the AG shall reject the incoming call and stop alerting.

The AG sends a +CIEV unsolicited result code updating the change in call status, as stated in Section 4.10 in [2].

The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

### 4.10 Terminate a Call

Test group with objective to verify the capability of terminating calls.

#### 4.10.1 Terminate an Ongoing Call Process

Test subgroup with the objective to verify the procedures for terminating an ongoing call process from both the HF and the AG.

#### 4.10.1.1 Terminate a Call - HF Terminated

• **Test Case ID(s)**

  HFP/HF/TCA/BV-01-I
  
  HFP/AG/TCA/BV-01-I
• **Test Purpose**
  
  **HF:** To verify that the HF, following the proper procedure, can terminate an ongoing call in the AG.
  
  **AG:** To verify that the AG, following the proper procedure, terminates an ongoing call on request from the HF.

• **Reference**
  
  [2] 4.15.1

• **Initial Condition**
  
  **HF:** Service Level Connection between the HF and the AG established.
  
  If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].
  
  **AG:** Service Level Connection between the HF and the AG established.
  
  A call is ongoing in the AG.

• **Test Procedure**
  
  **HF:** Perform the corresponding action (manufacturer specific) in the HF such that the ongoing call is terminated.

• **Test Condition**
  
  Both devices are initialized (see Section 3.4).

• **Expected Outcome**
  
  **Pass verdict**
  
  Upon the action in the HF, the AG shall terminate the current call.
  
  The AG sends the +CIEV unsolicited result code updating the call status, as stated in Section 4.10 in [2].
  
  The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

4.10.1.2  **Terminate a Call - AG Terminated**

• **Test Case ID(s)**
  
  **HFP/HF/TCA/BV-02-I**
  
  **HFP/AG/TCA/BV-02-I**

• **Test Purpose**
  
  **HF:** To verify that the HF receives the proper indication when a call is terminated from the AG.
  
  **AG:** To verify that the AG, upon the corresponding action (manufacturer specific), terminates an ongoing call. The AG shall then indicate this event to the HF.
Hands-Free Profile (HFP) / Test Suite

- **Reference**
  
  [2] 4.15.2

- **Initial Condition**
  
  HF: Service Level Connection between the HF and the AG established.
  
  AG: Service Level Connection between the HF and the AG established.
  
  If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

  A call is ongoing in the AG.

- **Test Procedure**

  AG: Perform the corresponding action (manufacturer specific) in the AG such that the ongoing call is terminated.

  HF: No action required.

- **Test Condition**

  Both devices are initialized (see Section 3.4).

- **Expected Outcome**

  **Pass verdict**

  Upon the action in the AG, the AG shall terminate the current call and indicate this event to the HF.

  The AG sends the +CIEV unsolicited result code updating the call status, as stated in Section 4.10 in [2].

  The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

4.10.1.3 **Terminate a Call – Remote Party Terminated**

- **Test Case ID(s)**

  **HFP/HF/TCA/BV-03-I**

  **HFP/AG/TCA/BV-03-I**

- **Test Purpose**

  HF: To verify that the HF receives the proper indication from the AG when a call is terminated from the remote party.

  AG: To verify that the AG, upon release, from the remote party, of an ongoing call in which the HF is currently used as audio port, indicates this event to the HF.

- **Reference**

  [2] 4.15.2
• **Initial Condition**

  **HF:** Service Level Connection between the HF and the AG established.

  **AG:** Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

  A call is ongoing in the AG.

• **Test Procedure**
  Terminate the call from the remote party.

• **Test Condition**
  Both devices are initialized (see Section 3.4).

• **Expected Outcome**
  **Pass verdict**
  Upon call release from the remote party, the AG shall indicate this event to the HF.
  The AG sends the +CIEV unsolicited result code updating the call status, as stated in Section 4.10 in [2].
  The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

### 4.10.1.4 Outgoing Call Abandon from HF

• **Test Case ID(s)**

  **HFP/HF/TCA/BV-04-I**

  **HFP/AG/TCA/BV-04-I**

• **Test Purpose**

  **HF:** To verify that the HF, following the proper procedure, can release a call after dialing and prior to call completion.

  **AG:** To verify that the AG, following the proper procedure, can release a call after instructed to dial from the HF but prior to call completion.

• **Reference**

  [2] 4.15.1

• **Initial Condition**

  **HF:** Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].
AG: Service Level Connection between the HF and the AG established.

Configure the AG to accept outgoing call set-up requests from the HF.

The AG shall be ready to place an outgoing call either towards a test device or to a real network.

• Test Procedure
  HF: If HF supports call origination, perform the corresponding action (manufacturer specific) to request the establishment of an outgoing call from the AG to the phone number supplied by the HF.

  Prior to the called party being alerted, abandon the call by performing the corresponding action to hang-up the call.

  AG: If HF does not support call origination, perform the corresponding action to request the establishment of an outgoing call from the AG.

  Prior to the called party being alerted, abandon the call by performing the corresponding action to hang-up the call using the HF.

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict

  The HF sends the proper hang-up command to the AG.

  The AG shall release the outgoing call.

  The AG sends the +CIEV unsolicited result code updating the call status, as stated in Section 4.10 in [2].

4.10.1.5 HFP/AG/TCA/BV-05-I [Terminate Ongoing Call – While Call Waiting]

• Test Purpose
  AG: To verify, following the proper procedure that the AG in the presence of an incoming waiting call, terminates the active call upon receiving AT+CHUP command from the HF device.

• Reference
  [2] 4.2, 4.33.2

• Initial Condition
  HF: Service Level Connection between the HF and the AG established.

  A call is ongoing in the AG with audio pathway routed to the HF.

  AG: Service Level Connection between the HF and the AG established.

  A call is ongoing in the AG.
• Test Procedure
  The following actions shall be performed:

  AG: Place a second call to the AG from a test device or any other means.

  HF: On reception of the call waiting notification, initiate an action in the HF to hang-up the active call (AT+CHUP).

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict
  - Upon the action in the HF, the AG shall terminate the active call and send a +CIEV unsolicited result code indicating (call=0).
  - The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

• Notes
  The handling of the waiting call is left up to the manufacturer specific implementation on the AG, or the network thereof.

  In some wireless networks, the waiting call may be retrieved as a presentation of a new call (RING indication). It does not affect the verdict for this test.

4.11 Audio Connection Transfer during an Ongoing Call
Test group with the objective to verify the capability of transferring the audio paths between the AG and the HF during an ongoing call.

4.11.1 Audio Connection Transfer towards the HF
Test subgroup with the objective to verify the capability of transferring the audio paths from the AG to the HF during an ongoing call.

The procedures corresponding to these test cases are only applicable if there is no current Audio Connection established between the HF and the AG. In fact, if the Audio Connection already exists, these procedures are not necessary because the audio paths of the AG are assumed to be already routed towards the HF.

4.11.1.1 HF Initiated Audio Transfer to the HF – No SLC
• Test Case ID(s)
  HFP/HF/ATH/BV-03-I
  HFP/AG/ATH/BV-03-I
• Test Purpose
  HF: To verify that HF can transfer the audio paths from the AG to the HF after establishing a service level connection, during an ongoing call.
AG: To verify that the AG can transfer the audio paths to the HF, when requested by HF during an ongoing call process.

• Reference
  [2] 4.16

• Initial Condition
  HF: A Service Level Connection does not exist between the HF and the AG.
  AG: A call process is ongoing in the AG, with the audio paths routed to the AG means.

• Test Procedure
  HF: Initiate the action in the HF to transfer the audio connection from AG to HF. This requires the HF to establish a service level connection before requesting audio transfer. This step may require more than one user action on the HF.
  AG: Accept the connection request from HF if prompted. AG shall not be configured to set up an audio autonomously without request from HF.

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict
  The HF initiates the “Service Level Connection set up” procedure, as stated in 4.2 in [2].
  The user action in the HF transfers the audio paths from AG to HF.
  The full duplex audio paths corresponding to the current call in the AG are available in the HF.
  The call is ongoing on the AG, but with its audio means deactivated and the audio paths routed to the HF.

4.11.1.2 HF Initiated Audio Transfer to the HF - SLC

• Test Case ID(s)
  HFP/HF/ATH/BV-04-I
  HFP/AG/ATH/BV-04-I

• Test Purpose
  HF: To verify that HF can initiate an action to transfer the audio paths from AG to HF during an ongoing call with established Service level connection.
  AG: To verify the transfer of the audio paths from AG to HF, when initiated by an action in the HF, during an ongoing call with established Service Level Connection.

• Reference
  [2] 4.16
• Initial Condition

HF: Service Level Connection between the HF and the AG is established.

AG: Service Level Connection between the HF and the AG is established.

A call process is ongoing in the AG, with the audio paths routed to the AG means.

• Test Procedure

HF: Initiate the action in the HF to transfer the audio connection from AG to HF.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

The user action in the HF transfers the audio paths from AG to HF.

The full duplex audio paths corresponding to the current call in the AG are available in the HF.

The call is ongoing on the AG, but with its audio means deactivated and the audio paths routed to the HF.

A Service Level Connection may be re-established after it is released by the AG after an audio connection.

4.11.1.3 AG Initiated Audio Transfer to the HF – No SLC

• Test Case ID(s)

HFP/HF/ATH/BV-05-I

HFP/AG/ATH/BV-05-I

• Test Purpose

HF: To verify that the AG can transfer of the audio paths from the AG to the HF after establishing a service level connection during an ongoing call.

AG: To verify that the AG can transfer the audio paths to the HF, when initiated from AG during an ongoing call process.

• Reference

[2] 4.16

• Initial Condition

HF: A Service Level Connection does not exist between the HF and the AG.

AG: A call process is ongoing in the AG, with the audio paths routed to the AG means.

• Test Procedure

HF: Accept connection request from AG if necessary.
AG: Initiate the corresponding action (manufacturer specific) in the AG to transfer the audio connection from AG to HF. This may require more than on user action.

- Test Condition
  Both devices are initialized (see Section 3.4).

- Expected Outcome
  Pass verdict
  The AG initiates the “Service Level Connection setup” procedure, as stated in 4.2 in [2].
  The action in the AG transfers the audio paths from AG to HF.
  The full duplex audio paths corresponding to the current call in the AG are available in the HF.
  The call is ongoing on the AG, but with its audio means deactivated and the audio paths routed to the HF.

4.11.1.4 AG Initiated Audio Transfer to the HF - SLC

- Test Case ID(s)
  HFP/HF/ATH/BV-06-I
  HFP/AG/ATH/BV-06-I

- Test Purpose
  HF: To verify the transfer of the audio paths from the AG to the HF, initiated by an action in the AG during an ongoing call.
  AG: To verify that the AG can transfer the audio paths to the HF, when requested during an ongoing call process.

- Reference
  [2] 4.16

- Initial Condition
  HF: Service Level Connection between the HF and the AG established.
  AG: Service Level Connection between the HF and the AG established.
  A call process is ongoing in the AG, with the audio paths routed to the AG means. This condition may be achieved by manually releasing the audio link from AG or HF means, without removing the service level connection.

- Test Procedure
  AG: Initiate the corresponding action (manufacturer specific) in the AG to transfer the audio connection from AG to HF.

- Test Condition
  Both devices are initialized (see Section 3.4).
• Expected Outcome

**Pass verdict**

The action in the AG transfers the audio paths from AG to HF.

The full duplex audio paths corresponding to the current call in the AG are available in the HF.

The call is ongoing on the AG, but with its audio means deactivated and the audio paths routed to the HF.

A Service Level Connection may be re-established after it is released by the AG after an audio connection.

### 4.11.2 Audio Connection Transfer towards the AG

Test subgroup with the objective to verify the capability of transferring the audio paths from the HF to the AG during an ongoing call.

#### 4.11.2.1 AG initiated Audio Transfer to the AG

• Test Case ID(s)

  **HFP/HF/ATA/BV-01-I**

  **HFP/AG/ATA/BV-01-I**

• Test Purpose

  **HF:** To verify that the HF transfers the audio paths of the ongoing call to the AG, when requested from the AG.

  **AG:** To verify the transfer of the audio paths from the HF to the AG, initiated by an action in the AG during an ongoing call.

• Reference

  [2] 4.17

• Initial Condition

  **HF:** Audio Connection between the HF and the AG established.

  A call is ongoing in the AG. The audio paths of the ongoing call are available in the HF via a Bluetooth Audio Connection.

  **AG:** Audio Connection between the HF and the AG established.

  A call is ongoing in the AG. The audio paths of the ongoing call are routed towards the HF via a Bluetooth Audio Connection.

• Test Procedure

  **AG:**

  1. Initiate the corresponding action (manufacturer specific) in the AG to transfer the Audio Connection from the HF to the AG.

  2. Drop the current call.
3. Use whatever means available to check the presence of a Service Level Connection between the HF and the AG.

- **Test Condition**
  Both devices are initialized (see Section 3.4).

- **Expected Outcome**
  **Pass verdict**
  The user action in the AG, in step 1, transfers the audio paths from the HF to the AG.

  After step 1, the Audio Connection between the HF and the AG is removed.

  After step 1, the audio paths corresponding to the current call in the AG are no longer available in the HF.

  After step 1 and before step 2, the call process remains ongoing in the AG, with the audio paths routed to the AG means.

### 4.11.2.2 HF Initiated Audio Transfer to the AG

- **Test Case ID(s)**
  
  **HFP/HF/ATA/BV-02-I**

  **HFP/AG/ATA/BV-02-I**

- **Test Purpose**
  **HF:** To verify that the HF transfers the audio paths of the ongoing call to the AG, when requested from the HF.

  **AG:** To verify the transfer of the audio paths from the HF to the AG, initiated by an action in the HF during an ongoing call.

- **Reference**
  [2] 4.17

- **Initial Condition**
  **HF:** Audio Connection between the HF and the AG established.

  A call is ongoing in the AG. The audio paths of the ongoing call are available in the HF via a Bluetooth Audio Connection.

  **AG:** Audio Connection between the HF and the AG established.

  A call is ongoing in the AG. The audio paths of the ongoing call are routed towards the HF via a Bluetooth Audio Connection.

- **Test Procedure**
  **HF:** Initiate the corresponding action (manufacturer specific) in the HF to transfer the audio connection from the HF to the AG.
AG: After audio transfer is complete, terminate current call.

- Test Condition
  Both devices are initialized (see Section 3.4).

- Expected Outcome
  **Pass verdict**
  The action in the HF, in step 1, transfers the audio paths from the HF to the AG.
  
  After step 1, the Audio Connection between the HF and the AG is removed.
  
  After step 1, the audio paths corresponding to the current call in the AG are no longer available in the HF.
  
  After step 1 and before step 2, the call process remains ongoing in the AG, with the audio paths routed to the AG means.
  
  Once step 2 is performed, (if the Service Level Connection was removed by the AG as a result of the audio transfer) the AG re-establishes the SLC between the HF and the AG.

- Notes
  Power-off is an acceptable way to transfer audio. It is acceptable for the test execution to conclude with the HF powered off.

### 4.12 Place a Call with the Phone Number

Test group with the objective to verify the capability of placing outgoing calls from the HF, using the complete phone number.

#### 4.12.1 Place a Call with the Phone Number Supplied by the HF

Test subgroup with the objective to verify the procedure for placing outgoing calls with the phone number supplied by the HF.

#### 4.12.1.1 Place Call – Phone Number

- Test Case ID(s)
  
  **HFP/HF/OCN/BV-01-I**
  **HFP/AG/OCN/BV-01-I**

- Test Purpose
  
  **HF:** To verify that the HF, following the proper procedure, can make the AG place an outgoing call to the phone number provided from the HF.

  **AG:** To verify that the AG, following the proper procedure, places an outgoing call on request from the HF, using the phone number supplied by the HF.

- Reference
  
  [2] 4.18
• **Initial Condition**

HF: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

AG: Service Level Connection between the HF and the AG established.

Configure the AG to accept outgoing call set-up requests from the HF.

The AG shall be ready to place an outgoing call either towards a test device or to a real network.

• **Test Procedure**

HF: Enter the called phone number in the HF and perform the corresponding action (manufacturer specific) to request the establishment of an outgoing call from the AG to that number.

The call shall be answered in the remote party.

• **Test Condition**

Both devices are initialized (see Section 3.4).

• **Expected Outcome**

**Pass verdict**

The AG places the call to the number supplied by the HF.

Upon successful call establishment initiation, the AG shall set-up an audio connection with the HF such that any incoming audio tone from the network is audible in the HF.

Once the call is answered in the called device, the audio paths shall be available in the HF such that a full duplex bi-directional conversation is possible.

Upon successful call establishment initiation in the AG, any incoming audio from the network is audible in the HF.

The AG sends the +CIEV unsolicited result code updating the call status, as stated in Section 4.10 in [2].

The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

### 4.13 Place a Call Using Memory Dialing

Test group with the objective to verify the capability of placing outgoing calls from the HF using the memory dialing capability of the AG.

#### 4.13.1 Memory Dialing from the HF

Test subgroup with the objective to verify the procedure for placing outgoing calls, from the HF, to a phone number stored in one of the memory locations of the AG.
4.13.1.1 Place Call – Memory

• Test Case ID(s)

HFP/HF/OCM/BV-01-I
HFP/AG/OCM/BV-01-I

• Test Purpose

HF: To verify that the HF, following the proper procedure, can make the AG place an outgoing call with a phone number stored in one of its memory locations.

AG: To verify that the AG, following the proper procedure, places an outgoing call on request from the HF, using a phone number stored in one of its memory locations.

• Reference

[2] 4.19

• Initial Condition

HF: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

AG: Service Level Connection between the HF and the AG established.

Configure the AG to accept outgoing call set-up requests from the HF.

The AG shall be ready to place an outgoing call either towards a test device or to a real network.

The AG shall have proper phone numbers stored in the corresponding memory locations addressed in this test procedure.

• Test Procedure

HF: Perform the corresponding (manufacturer specific) action to request the establishment of an outgoing call from the AG to the phone number corresponding to the desired memory location. The range of the memory positions is fully product dependent and is totally out of the scope of this specification.

The call shall be answered in the remote party.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

The AG places the call to the phone number corresponding to the memory location provided by the HF.
Upon successful call establishment initiation, the AG shall set-up an audio connection with the HF such that any incoming audio from the network is audible in the HF.

Once the call is answered in the called device, the audio paths shall be available in the HF such that a full duplex bi-directional conversation is possible.

Upon successful call establishment initiation in the AG any incoming audio from the network is audible in the HF.

The AG sends the +CIEV unsolicited result code updating the call status, as stated in Section 4.10 in [2].

The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

4.13.1.2 Place Call – No Number at Memory Location

• Test Case ID(s)

HFP/HF/OCM/BV-02-I

HFP/AG/OCM/BV-02-I

• Test Purpose

HF: To verify HF capability to accept ERROR response.

AG: To verify that the AG can respond with an error message when HF attempts to access invalid or empty memory location.

• Reference

[2] 4.19

• Initial Condition

HF: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

AG: Service Level Connection between the HF and the AG established.

Configure the AG to accept outgoing call set-up requests from the HF.

The AG shall be ready to place an outgoing call either towards a test device or to a real network.

The AG shall have at least one empty memory location for stored numbers in this test procedure.

• Test Procedure

HF: Perform the corresponding (manufacturer specific) action to request the establishment of an outgoing call from the AG to the phone number corresponding to the empty memory location. The range of the memory positions is fully product dependent and is totally out of the scope of this specification.
Perform the corresponding action (manufacturer specific) to request the establishment of an outgoing call from the AG to the phone number corresponding to an out of range memory location. The range of the memory positions is fully product dependent and is totally out of the scope of this specification.

- **Test Condition**
  Both devices are initialized (see Section 3.4).

- **Expected Outcome**
  **Pass verdict**
  The AG returns an ERROR to the HF.

  The HF abandons a call when AG returns ERROR.

### 4.14 Place a Call to the Last Number Dialed

Test group with the objective to verify the capability of placing outgoing calls from the HF, using the last phone number dialed in the AG.

#### 4.14.1 Last Number Re-Dial from the HF

Test subgroup with the objective to verify the procedure for placing outgoing calls, from the HF, to a phone number corresponding to the last number dialed in the AG.

#### 4.14.1.1 Place Call – Last Number

- **Test Case ID(s)**
  - HFP/HF/OCL/BV-01-I
  - HFP/AG/OCL/BV-01-I

- **Test Purpose**
  HF: To verify that the HF, following the proper procedure, can make the AG place an outgoing call with a phone number corresponding to the last number dialed in the AG.

  AG: To verify that the AG, following the proper procedure, places an outgoing call on request from the HF, using a phone number corresponding to the last number dialed in the AG.

- **Reference**
  [2] 4.20

- **Initial Condition**
  HF: Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

  AG: Service Level Connection between the HF and the AG established.
Configure the AG to accept outgoing call set-up requests from the HF.

The AG shall be ready to place an outgoing call either towards a test device or to a real network.

- **Test Procedure**
  
  **HF:** Perform the corresponding action (manufacturer specific) to request the establishment of an outgoing call from the AG to the phone number corresponding to last number dialed in the AG.

  The call shall be answered in the remote party.

- **Test Condition**
  Both devices are initialized (see Section 3.4).

- **Expected Outcome**
  
  **Pass verdict**
  The AG places the call to the phone number corresponding to the last number dialed.

  Upon successful call establishment initiation, the AG shall set-up an audio connection with the HF such that any incoming audio from the network is audible in the HF.

  Once the call is answered in the called device, the audio paths shall be available in the HF such that a full duplex bi-directional conversation is possible.

  Upon successful call establishment initiation in the AG any incoming audio from the network is audible in the HF.

  The AG sends the +CIEV unsolicited result code updating the call status, as stated in Section 4.10 in [2].

  The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

### 4.14.1.2 Place Call – No Last Number in the AG

- **Test Case ID(s)**
  
  **HFP/HF/OCL/BV-02-I**

  **HFP/AG/OCL/BV-02-I**

- **Test Purpose**
  
  **HF:** To verify HF capability to accept ERROR response.

  **AG:** To verify that the AG can respond with an error message when the HF requests that the AG place an outgoing call corresponding to the last number dialed on the AG.

- **Reference**
  
  [2] 4.20
• Initial Condition
  HF: Service Level Connection between the HF and the AG established.
  
  If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].
  
  AG: Service Level Connection between the HF and the AG established.
  
  Configure the AG to accept outgoing call set-up requests from the HF.
  
  The AG shall be ready to place an outgoing call either towards a test device or to a real network.
  
  The AG shall be configured so that no last number dialed is stored.

• Test Procedure
  HF: Perform the corresponding action (manufacturer specific) to request the establishment of an outgoing call from the AG to the phone number corresponding to last number dialed in the AG.

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict
  The AG returns ERROR to the HF.
  
  The HF abandons call when AG returns ERROR.

4.15 Three Way Calling
Test group with the objective to verify the capability of handling the presence of multiple calls from the HF.

4.15.1 Three Way Calls Handling
Test subgroup with the objectives:

• To verify the procedures for call waiting notification from the AG to the HF.
• To verify the procedures for placing calls to a third party from the HF.
• To verify the procedures for holding calls and handling of three way calls from the HF.

4.15.1.1 Call Waiting - User Busy

• Test Case ID(s)
  HFP/HF/TWC/BV-01-I
  HFP/AG/TWC/BV-01-I
• Test Purpose

HF: To verify, following the proper procedure, that the HF, on reception of the indication from the AG, notifies the presence of an incoming call waiting.

To verify that a user, performing the corresponding actions (manufacturer specific) in the HF, to send the User Busy indication to the AG (AT+CHLD=0).

AG: To verify, following the proper procedure, that the AG indicates to the HF the presence of an incoming call waiting.

To verify that the AG performs the actions requested from the HF with respect call hold and multiparty handling procedures.

• Reference

[2] 4.21, 4.22.1

• Initial Condition

HF: Service Level Connection between the HF and the AG established.

A call is ongoing in the AG.

The proper request to activate the Call Waiting indication in the AG has previously been issued following the procedure and rules stated in Section 4.21 in [2].

AG: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

A call is ongoing in the AG.

The Call Waiting notification indication in the AG has been activated following the procedure and rules stated in Section 4.21 in [2].

• Test Procedure

The following actions shall be performed:

AG: 1. Place a second call to the AG from a test device or any other means.

HF: 2. On reception of the call waiting notification, sends the User Determined User Busy (UDUB) for a waiting call.

• Test Condition

Both devices are initialized (see Section 3.4).
• Expected Outcome

Pass verdict

The expected results of the steps listed in the “Test procedure” above are as follows:

As result of step 1, the user shall be notified, via the HF means, of the presence of a second call waiting.

The AG shall update the Call Setup Status to the HF.

As result of step 2, the waiting call is rejected. The active call remains active.

The AG shall again update the Call Setup Status to the HF.

4.15.1.2 Call Waiting- Drop Active/Retrieve Waiting Call

• Test Case ID(s)

HFP/HF/TWC/BV-02-I

HFP/AG/TWC/BV-02-I

• Test Purpose

HF: To verify, following the proper procedure, that the HF, on reception of the indication from the AG, notifies the presence of an incoming call waiting.

To verify that a user, performing the corresponding actions (manufacturer specific) in the HF, to end an active call and accept the other (held or waiting) call (AT+CHLD=1).

AG: To verify, following the proper procedure, that the AG indicates to the HF the presence of an incoming call waiting.

To verify that the AG performs the actions requested from the HF with respect call hold and multiparty handling procedures.

• Reference

[2] 4.21, 4.22.1

• Initial Condition

HF: Service Level Connection between the HF and the AG established.

A call is ongoing in the AG.

The proper request to activate the Call Waiting indication in the AG has previously been issued following the procedure and rules stated in Section 4.21 in [2].

AG: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

A call is ongoing in the AG.
The Call Waiting notification indication in the AG has been activated following the procedure and rules stated in Section 4.21 in [2].

- **Test Procedure**
  The following actions shall be performed:

  AG: 1. Place a second call to the AG from a test device or any other means.

  HF: 2. On reception of the call waiting notification, the user accepts the call at the HF releasing all active calls.

- **Test Condition**
  Both devices are initialized (see Section 3.4).

- **Expected Outcome**
  **Pass verdict**
  The expected results of the steps listed in the “Test procedure” above are as follows:

  As result of step 1, the user shall be notified, via the HF means, of the presence of a second call waiting.

  The AG shall update the Call Setup Status to the HF.

  As result of step 2, the active call is ended and the other (held or waiting) call is accepted.

  The audio path corresponding to the NEWLY active call is established to the HF such that full duplex conversation with the newly active call can take place.

  The AG shall again update the Call Setup Status to the HF.

- **Notes**
  In some wireless networks, the active call may first be ended and a few seconds later, the waiting call may be presented as a new call (RING indication).

4.15.1.3 **Call Waiting- Hold Active/Retrieve Waiting Call or Held**

- **Test Case ID(s)**
  - **HFP/HF/TWC/BV-03-I**
  - **HFP/AG/TWC/BV-03-I**

- **Test Purpose**
  HF: To verify that the HF, following the proper procedure, and on reception of the indication from the AG, notifies the presence of an incoming call waiting.

  To verify that a user, performing the corresponding actions (manufacturer specific) in the HF, to place an active call on hold and accept a call waiting (AT+CHLD=2).

  AG: To verify that the AG, following the proper procedure, indicates to the HF the presence of an incoming call waiting.
To verify that the AG performs the actions requested from the HF with respect call hold and multiparty handling procedures.

• Reference
[2] 4.21, 4.22.1

• Initial Condition
HF: Service Level Connection between the HF and the AG established.
A call is ongoing in the AG.
The proper request to activate the Call Waiting indication in the AG has previously been issued following the procedure and rules stated in Section 4.21 in [2].

AG: Service Level Connection between the HF and the AG established.
If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].
A call is ongoing in the AG (A).
The Call Waiting notification indication in the AG has been activated following the procedure and rules stated in Section 4.21 in [2].

• Test Procedure
The following actions shall be performed:
AG: 1. Place a second call (B) to the AG from a test device or any other means.

HF: 2. On reception of the call waiting notification, initiate an action in the HF to hold the active call (A) and accept the waiting call (B).

HF: 3. Initiate an action on the HF to swap call positions (placing call B on hold and retrieving call A).

4. Initiate an action on the HF to release the active call (A) and retrieve held call (B).

• Test Condition
Both devices are initialized (see Section 3.4).

• Expected Outcome
Pass verdict
The expected results of the steps listed in the “Test procedure” above are as follows:

As result of step 1, the user shall be notified, via the HF means, of the presence of a second call waiting.
The AG shall update the Call Setup Status to the HF.
As result of step 2, the active call is placed in HOLD status and the call waiting is accepted.

The AG updates the Call Hold Status indicator to the HF.

The audio path corresponding to the NEWLY active call is established to the HF such that full duplex conversation with the newly active call can take place.

The AG shall again update the Call Setup Status to the HF.

As a result of step 3 the ACTIVE/HOLD call positions are swapped and the audio path corresponding to the NEWLY active call is established to the HF such that full duplex conversation with the newly active call can take place.

The AG updates the Call Hold Status indicator to the HF.

As a result of step 4 the active call is released and the held call is retrieved and the audio path corresponding to the NEWLY active call is established to the HF such that full duplex conversation with the newly active call can take place.

The AG updates the Call Hold Status indicator to the HF.

4.15.1.4 3 Way-call- Joins Calls

• Test Case ID(s)
  
  HFP/HF/TWC/BV-04-I
  
  HFP/AG/TWC/BV-04-I

• Test Purpose
  
  HF: To verify that a user, performing the corresponding actions (manufacturer specific) in the HF, to join an active call and a held call in a three party call (AT+CHLD=3).

  AG: To verify that the AG performs the actions requested from the HF with respect call hold and multiparty handling procedures.

• Reference
  
  [2] 4.21, 4.22.1

• Initial Condition
  
  HF: Service Level Connection between the HF and the AG established.

  A call is ongoing in the AG.

  AG: Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

  A call is ongoing in the AG (A).
A second call (B) is on hold at the AG.

- **Test Procedure**
  
  The following actions shall be performed:

  HF:
  1. Initiate an action on the HF to join the active and held call positions into a 3-way conversation.
  2. Initiate an action on the HF to release the 3-way call.

- **Test Condition**
  
  Both devices are initialized (see Section 3.4).

- **Expected Outcome**
  
  **Pass verdict**
  
  The expected results of the steps listed in the “Test procedure” above are as follows:

  As result of step 1, both the active and held calls (A & B) are joined with into a three party conference.
  
  The AG updates the Call Hold Status indicator to the HF.
  
  The audio path corresponding to the conference is established to the HF such that full duplex conversation with the all three parties can take place.
  
  As a result of step 2 all calls are released.
  
  The AG updates the Call Status indicator to the HF.

### 4.15.1.5 3 Way – HF Initiated

- **Test Case ID(s)**

  **HFP/HF/TWC/BV-05-I**
  
  **HFP/AG/TWC/BV-05-I**

- **Test Purpose**

  HF: To verify that a user, performing the corresponding actions (manufacturer specific) in the HF, can request that the AG place a call to a third party while engaged in an active call.

  AG: To verify that the AG, upon receiving an origination request from the HF, puts the current call on hold and originates a call to a third party.

  To verify that the AG performs the actions requested from the HF with respect to call hold and three-way-call handling procedures.

- **Reference**

  [2] 4.22.2
• Initial Condition

**HF:** Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the AG shall initiate the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

An incoming call is initiated to the AG and is answered by HF.

A call is ongoing in the AG.

**AG:** Service Level Connection is established between the HF and the AG.

A call is ongoing in the AG.

• Test Procedure

1. Place a second call from the HF using any available command (dial, redial, memory dial) by performing the corresponding action (manufacturer specific) to request the establishment of an outgoing call from the AG.

2. The call should be answered by the remote party.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

**Pass verdict**

As a result of step 1 the first call shall be placed on hold in the AG and the AG places the call as directed by the HF.

As a result of steps 2 the audio paths corresponding to the second call shall be available in the HF, such that a full duplex conversation with the remote party can be held.

4.15.1.6 3 Way – Explicit Call Transfer

• Test Case ID(s)

**HFP/HF/TWC/BV-06-I**

**HFP/AG/TWC/BV-06-I**

• Test Purpose

**HF:** To verify that a user, performing the corresponding actions (manufacturer specific) in the HF, can make the AG perform an Explicit Call Transfer.

**AG:** To verify that the AG performs the actions requested from the HF with respect to call hold and three way calls handling procedures (AT+CHLD=4).

• Reference

[2] 4.17, 4.24.2
• Initial Condition

HF: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

A call is ongoing in the AG.

A second call is on hold at the AG; See HFP/HF/TWC/BV-03-I and HFP/AG/TWC/BV-03-I Call Waiting- Hold Active/Retrieve Waiting Call or Held Test Procedure.

AG: Service Level Connection between the HF and the AG established.

A call is ongoing in the AG with audio routed through HF means.

A second call is on hold at the AG.

• Test Procedure

Perform the action on the HF to disconnect the AG from the calls and connect the other two parties (Explicit Call Transfer, AT+CHLD=4).

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

The expected results of the steps listed in the “Test procedure” above are as follows:

- As a result of the Explicit Call Transfer the two remote parties are connected and the AG is disconnected from the call process.

- AG updates the call and call status indicators.

4.16 Call handling in Non-Regular Situations

Test group with the objective to verify that both the AG and HF respond as expected when a normal call process is interrupted.

4.16.1 Normal Incoming Call Process Interrupted

Test subgroup with the objective to verify that both the AG and HF respond as expected when an incoming call process is interrupted.

4.16.1.1 Incoming Call Interrupted – Call Terminated

• Test Case ID(s)

HFP/HF/CIT/BV-01-I

HFP/AG/CIT/BV-01-I
• Test Purpose
  HF: To verify that the HF responds as expected when a normal incoming call process is interrupted from the remote party.
  AG: To verify that the AG informs as expected of the interruption in an incoming call process.

• Reference

• Initial Condition
  HF: Service Level Connection between the HF and the AG established.
  AG: Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

  The AG shall be configured to alert the HF of an incoming call connection.

• Test Procedure
  1. Initiate a call establishment to the AG from a network simulator or any other suitable means.
  2. During alerting, interrupt the call from the remote party or network simulator.

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict

  Upon the call establishment initiation in the AG, both the HF and the AG shall alert.

  When the incoming call process is interrupted, the HF stops alerting.

  When the incoming call process is interrupted, the AG stops alerting.

4.17 Echo Canceling (EC) and Noise Reduction (NR)
Test group with the objective to verify the capability of the HF for dealing with the presence of Echo Canceling (EC) and Noise Reduction (NR) functions in the AG.

4.17.1 The HF Requests Turning OFF the AG’s EC and NR
Test subgroup with the objective to verify the capability of the HF for turning OFF the Echo Canceling (EC) and Noise Reduction (NR) functions of the AG.

4.17.1.1 EC/NR OFF – AG Supports EC/NR

• Test Case ID(s)
  HFP/HF/ENO/BV-01-I
  HFP/AG/ENO/BV-01-I
• Test Purpose
HF: To verify that the HF is capable of disabling the EC/NR function of the AG.
AG: To verify that the AG acknowledges with the proper response indicating that its embedded EC/NR function has been disabled on request from the HF.

• Reference

• Initial Condition
HF: Embedded EC/NR function of the HF enabled.
AG: Embedded EC/NR function of the AG enabled.

The AG shall be configured to alert the HF of an incoming call connection.

• Test Procedure
HF: Initiate establishment of Service Level Connection procedure, as stated in 4.2 in [2].
AG: Initiate a call establishment to the AG from a network simulator or any other suitable means.
HF: Upon alerting, the call shall be answered from HF by performing the corresponding action.

• Test Condition
Both devices are initialized (see Section 3.4).

• Expected Outcome
Pass verdict
Upon connection to AG, the HF, it shall request the EC/NR function of the AG to be turned OFF.

On request from HF, the AG shall disable its embedded EC/NR function.

The HF shall use its embedded EC/NR functionality during the call and the AG shall keep its EC/NR function disabled.

The request from the HF to disable AG based EC/NR shall be made prior to any audio connection.

4.17.1.2 HFP/AG/ENO/BV-02-I [EC/NR OFF – AG Doesn’t Support EC/NR]

• Test Purpose
AG: To verify that an AG not supporting embedded EC/NR function, replies accordingly to the HF request.

• Reference
• Initial Condition

HF: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

AG: Service Level Connection between the HF and the AG established.

The AG shall be configured to alert the HF of an incoming call connection.

• Test Procedure

HF: Perform the corresponding action (manufacturer specific) in the HF such that it requests the EC/NR function of the AG to be turned OFF.

AG: Initiate a call establishment to the AG from a network simulator or any other suitable means.

HF: Upon alerting, the call shall be answered from HF by performing the corresponding action.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

Upon the action/event in the HF, it shall request the EC/NR function of the AG to be turned OFF.

AG responds to the EC/NR request with ERROR.

AG accepts the call.

• Notes

If the HF received NO EC/NR function in the AG by Bluetooth Retrieve Support Features event, the HF might not request the EC/NR function of the AG to be turned OFF.

4.18 Voice Recognition Activation

Test group with the objective to verify that the HF is capable of handling the Voice Recognition function resident in the AG.

4.18.1 Voice Recognition Activation

Test subgroup with the objective to verify that, Voice Recognition function of the AG can be activated from both the HF and the AG.

4.18.1.1 Voice Recognition Activation HF

• Test Case ID(s)

  HFP/HF/VRA/BV-01-I
  HFP/AG/VRA/BV-01-I
• Test Purpose

HF: To verify that the HF issues to the AG a request for activating the Voice Recognition function and as a result the AG starts the voice input sequence.

AG: To verify that the AG, on request from the HF, activates the Voice Recognition function and starts the voice input sequence.

• Reference

[2] 4.25.1

• Initial Condition

HF: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

AG: Service Level Connection between the HF and the AG established.

The Voice Recognition feature shall be available in the AG.

• Test Procedure

HF: Perform the corresponding action (manufacturer specific) in the HF such that the request for activating the Voice Recognition function is issued to the AG.

AG: Check the expected behavior of the Voice Recognition functionality according to the implementation in the AG.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

Upon the action in the HF, the AG shall activate the Voice Recognition function and start the voice input sequence. How the AG handles the result of this voice input process is implementation dependent.

In some AG implementations the Voice Recognition function is automatically deactivated once the voice input process is completed, in this case the AG shall issue the proper indication to the HF.

In AG implementations that do not disable the Voice Recognition autonomously, the HF is in charge of its deactivation and test HFP/HF/VRD/BV-01-I and HFP/AG/VRD/BV-01-I Voice Recognition Deactivation shall be performed accordingly.

The user can use the HF audio means to access the Voice Recognition function in the AG.

The AG performs the expected actions corresponding to its implementation.
4.18.1.2 Voice Recognition Activation AG

• Test Case ID(s)

HFP/HF/VRA/BV-02-I
HFP/AG/VRA/BV-02-I

• Test Purpose

HF: To verify that the HF responds properly when the AG activates autonomously the Voice Recognition function.

AG: To verify that the AG, when initiating the activation of its Voice Recognition function, provides the proper indication to the HF and starts the voice input sequence.

• Reference

[2] 4.25.2

• Initial Condition

HF: Service Level Connection between the HF and the AG established.

AG: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

The Voice Recognition feature shall be available in the AG.

• Test Procedure

AG: If necessary, proper set up shall be made in the AG such that the Voice Recognition function uses the HF as voice input port.

Perform the corresponding action (manufacturer specific) in the AG such that its Voice Recognition function is activated.

Check the expected behavior of the Voice Recognition functionality according to the implementation in the AG.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

Upon the action, the AG shall activate the Voice Recognition function and start the voice input sequence. How the AG handles the result of this voice input process is implementation dependent.

In some AG implementations the Voice Recognition function is automatically deactivated once the voice input process is completed, in this case the AG shall issue the proper indication to the HF.
In AG implementations that do not disable the Voice Recognition autonomously, the HF is in charge of its deactivation and test \texttt{HFP/HF/VRD/BV-01-I} and \texttt{HFP/AG/VRD/BV-01-I} Voice Recognition Deactivation shall be performed accordingly.

The user can use the HF audio means to access the Voice Recognition function in the AG.

The AG performs the expected actions corresponding to its implementation.

4.18.1.3 \texttt{HFP/AG/VRA/BI-01-I \textbf{[Voice Recognition Activation from AG to HF Not Supported]}}

- **Test Purpose**
  AG: To verify that the AG does not attempt to use Voice Recognition using HF that does not support the feature.

- **Reference**
  \cite{2} 4.25.2

- **Initial Condition**
  HF: Service Level Connection between the HF and the AG established.

  The Voice Recognition feature shall not available in the HF. This is indicated by BRSF information and the SDP supported features attribute.

  AG: Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the AG shall take care of its establishment initiating the "Service Level Connection set up" procedure, as stated in 4.2 in \cite{2}.

  The Voice Recognition feature shall be available in the AG.

- **Test Procedure**
  AG: Perform the corresponding action (manufacturer specific) in the AG such that its Voice Recognition function is activated.

  Check the expected behavior of the Voice Recognition functionality according to the implementation in the AG.

- **Test Condition**
  Both devices are initialized (see Section 3.4).

- **Expected Outcome**
  **Pass verdict**

  Upon the action, the AG shall not attempt to use HF as its audio port. This means that the AG does not send the \texttt{+BVRA:1} unsolicited result code, and it does not attempt to set-up audio connection with HF.

  The user cannot use the HF audio means to access the Voice Recognition function in the AG.
4.18.2 Voice Recognition Deactivation

Test subgroup with the objective to verify that, Voice Recognition function of the AG can be deactivated from the HF when necessary.

4.18.2.1 Voice Recognition Deactivation

- Test Case ID(s)
  
  **HFP/HF/VRD/BV-01-I**
  
  **HFP/AG/VRD/BV-01-I**

- Test Purpose
  
  HF: To verify that the HF issues to the AG a request for deactivating the Voice Recognition function.
  
  AG: To verify that the AG, on request from the HF, deactivates the Voice Recognition function. This test shall only be performed with AG implementations that do not deactivate the Voice Recognition function autonomously.

- Reference
  
  [2] 4.25.3

- Initial Condition
  
  HF: Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

  The HF has already performed the “Voice recognition activation” procedure as stated in Section 4.25.1 in [2].

  AG: Service Level Connection between the HF and the AG established.

  The AG has already performed the “Voice recognition activation” procedure as stated in Section 4.25.1 in [2] and the Voice Recognition function in the AG remains enabled.

- Test Procedure
  
  HF: Perform the corresponding action (manufacturer specific) in the HF such that the request for deactivating the Voice Recognition function is issued to the AG.

  AG: Check that the Voice Recognition function is deactivated in the AG.

- Test Condition
  
  Both devices are initialized (see Section 3.4).
• Expected Outcome

Pass verdict
Upon proper event/action in the HF, the AG shall deactivate the Voice Recognition function.

The user can no longer use the HF audio means to access the Voice Recognition function in the AG.

The AG disables the Voice Recognition function.

4.19 Attach a Phone Number to a Voice Tag
Test group with the objective to verify that, for HF's supporting embedded voice recognition functionality, the AG is capable of acting as input device to attach a phone number to a voice tag in the HF.

4.19.1 Attach a Phone Number to a Voice Tag
Test subgroup with the objective to verify that, on request from the HF, the AG returns a phone number intended to be attached to a voice tag in the HF.

4.19.1.1 Phone Number/Voice Tag- AG Accepts
• Test Case ID(s)

HFP/HF/VTG/BV-01-I

HFP/AG/VTG/BV-01-I

• Test Purpose
HF: To verify that, during the voice training sequence in the HF, the HF is capable of requesting to the AG for a phone number to be attached to the current voice tag.

AG: To verify that the AG, on request from the HF, responds, when expected, with the proper phone number to be attached to the current voice tag in the HF.

• Reference
[2] 4.26

• Initial Condition
HF: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

The Voice Recognition feature shall be available in the HF.

AG: Service Level Connection between the HF and the AG established.

• Test Procedure
AG: Set up the AG in the proper state such that the forthcoming request from the HF is accepted.
**HF:** Perform the corresponding action (manufacturer specific) in the HF such that, during the voice training sequence, a phone number to be attached to the current voice tag is requested from the AG.

**AG:** Perform the corresponding actions (manufacturer specific) in the AG such that the requested phone number is returned to the HF.

**HF:** Perform the corresponding actions (manufacturer specific) in the HF such that the new voice tag just created is entered.

- **Test Condition**
  Both devices are initialized (see Section 3.4).

- **Expected Outcome**
  **Pass verdict**
  Upon the action in the HF, the AG shall perform the proper procedure such a phone number can be entered/selected.

  On reception of the phone number from the AG, the HF functionality shall attach the phone number to the current voice tag.

  Upon the action in the HF, the new voice tag can be entered.

### 4.20 Ability to Transmit DTMF Codes

Test group with the objective to verify that, on request from the HF during an ongoing call, the AG triggers the generation of the proper DTMF codes towards the network.

#### 4.20.1 Transmit DTMF Code

Test subgroup with the objective to verify that, on request from the HF during an ongoing call, the AG triggers the generation of the correct DTMF code towards the network.

#### 4.20.1.1 Transmit DTMF

- **Test Case ID(s)**
  
  HFP/HF/TDC/BV-01-I
  
  HFP/AG/TDC/BV-01-I

- **Test Purpose**
  
  **HF:** To verify that the HF issues to the AG a request for transmitting a DTMF code when necessary.

  **AG:** To verify that the AG, on request from the HF, triggers the generation of the correct DTMF code towards the network.

- **Reference**
  
  [2] 4.27
• Initial Condition

HF: Service Level Connection between the HF and the AG established.

If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in 4.2 in [2].

AG: Service Level Connection between the HF and the AG established.

A call is ongoing in the AG.

• Test Procedure

HF: Perform the corresponding action (manufacturer specific) in the HF such that the request for transmitting the following DTMF codes is issued to the AG:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, *, #

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

The correct outgoing DTMF code generation request from the AG (or the tone itself) shall be detected in the network simulator or in the remote party.

The HF shall issue the request for transmitting the correct DTMF code.

The AG shall trigger the generation of the DTMF codes towards the network.

4.21 Remote Audio Volume Control—Speaker

Test group with the objective to verify the speaker gain control of the HF.

In general, within this test group, “General Audio requirements” section 12.4 in [1] shall be taken as reference for proper volume settings. By default, it is always assumed that whenever a volume setting shall be checked, an audio signal following the recommendations stated in Section 12.4 in [1] is injected at the proper port using suitable means.

4.21.1 Remote speaker volume control

Test subgroup objectives:

To verify the speaker gain control of the HF.

4.21.1.1 Speaker Vol Ctrl – Remote/Local

• Test Case ID(s)

  HFP/HF/RSV/BV-01-I
  HFP/AG/RSV/BV-01-I
• Test Purpose

HF: To verify the speaker volume control of the HF if remote and local speaker volume control is supported.

AG: To verify the speaker volume control of the HF if remote and local speaker volume control is supported.

• Reference

[2] 4.28

• Initial Condition

HF: Audio Connection between the HF and the AG established.

A call is ongoing in the AG. The audio paths of the ongoing call are available in the HF via a Bluetooth Audio Connection.

AG: Audio Connection between the HF and the AG established.

A call is ongoing in the AG. The audio paths of the ongoing call are routed towards the HF via a Bluetooth Audio Connection.

• Test Procedure

1. Perform the corresponding action (manufacturer specific) on the AG to set the speaker volume in the HF to a level significantly higher than the nominal level.

2. Check the volume level in the HF.

3. Perform the corresponding action (manufacturer specific) in the HF to decrease its speaker volume to a level significantly lower than the nominal level.

4. Check the volume level in the HF.

5. Perform the corresponding action (manufacturer specific) on the AG to increase the speaker volume in the HF to the nominal level.

6. Check the volume level in the HF.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

The actions on the HF and AG result in the respective speaker volume settings.

4.21.1.2 Speaker Vol Ctrl – Remote

• Test Case ID(s)

HFP/HF/RSV/BV-02-I
HFP/AG/RSV/BV-02-I
• Test Purpose
  HF: To verify the speaker volume control of the HF if only remote speaker volume control is supported.
  AG: To verify the speaker volume control of the HF if only remote speaker volume control is supported.

• Reference
  [2] 4.28

• Initial Condition
  HF: Audio Connection between the HF and the AG established.
      A call is ongoing in the AG. The audio paths of the ongoing call are available in the HF via a Bluetooth Audio Connection.
  AG: Audio Connection between the HF and the AG established.
      A call is ongoing in the AG. The audio paths of the ongoing call are routed towards the HF via a Bluetooth Audio Connection.

• Test Procedure
  1. Perform the corresponding action (manufacturer specific) on the AG to set the speaker volume in the HF to the maximum level.
  2. Check the volume level in the HF.
  3. Perform the corresponding action (manufacturer specific) on the AG to set the speaker volume in the HF to the minimum level.
  4. Check the volume level in the HF.

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict
  The actions on the AG result in the respective speaker volume settings.

4.21.1.3 Speaker Vol Ctrl – Store Settings

• Test Case ID(s)
  HFP/HF/RSV/BV-03-I
  HFP/AG/RSV/BV-03-I

• Test Purpose
  HF: To verify that, if storing the speaker volume settings in the HF is supported, the correct settings are used when establishing a new Service Level Connection.
AG: To verify that if storing the speaker volume settings in the HF is supported, the correct settings are used when establishing a new Service Level Connection.

- Reference
  [2] 4.28

- Initial Condition
  HF: Audio Connection between the HF and the AG established. A call is ongoing in the AG. The audio paths of the ongoing call are available in the HF via a Bluetooth Audio Connection.

  AG: Audio Connection between the HF and the AG established. A call is ongoing in the AG. The audio paths of the ongoing call are routed towards the HF via a Bluetooth Audio Connection.

- Test Procedure
  1. Set the speaker volume to a value significantly different from the nominal volume either from the HF or the AG.
  2. Check the volume level in the HF.
  3. Perform the corresponding actions (manufacturer specific) from the HF such that an "Audio Connection transfer towards the AG" procedure is performed, as stated in Section 4.17 in [2].
  4. Drop the current call from the AG.
  5. Place a new call to the AG. Answer the call from the AG.
  6. Perform the corresponding actions (manufacturer specific) either from the HF or the AG such that an "Audio Connection transfer towards the HF" procedure is performed, as stated in Section 4.16 in [2].
  7. Check the volume level in the HF.
  8. Set the speaker volume back to the nominal volume from the AG.
  9. Check the volume level in the HF.

- Test Condition
  Both devices are initialized (see Section 3.4).

- Expected Outcome
  Pass verdict
  After the audio connection is transferred back towards the HF, in step 7, the speaker volume is restored to the value that was set before the audio was transferred towards the AG.

  After the audio connection is transferred back towards the HF, in steps 8 and 9, the user can properly modify, as expected, the speaker volume from the AG.
4.22 Remote Audio Volume Control - Microphone

Test group with the objective to verify the microphone gain control of the HF.

In general, within this test group, "General Audio requirements" section 12.4 in [1] shall be taken as reference for proper volume settings. By default, it is always assumed that whenever a volume setting shall be checked, an audio signal following the recommendations stated in Section 12.4 in [1] is injected at the proper port using suitable means.

4.22.1 Remote Microphone Gain Control

Test subgroup objectives:

To verify the microphone gain control of the HF.

4.22.1.1 Gain Ctrl – Remote/Local

• Test Case ID(s)

HFP/HF/RMV/BV-01-I

HFP/AG/RMV/BV-01-I

• Test Purpose

HF: To verify the microphone gain control of the HF if remote and local microphone gain control is supported.

AG: To verify the microphone gain control of the HF if remote and local microphone gain control is supported.

• Reference

[2] 4.28

• Initial Condition

HF: Audio Connection between the HF and the AG established.

A call is ongoing in the AG. The audio paths of the ongoing call are available in the HF via a Bluetooth Audio Connection.

No automatic microphone gain control function shall be active in the HF.

AG: Audio Connection between the HF and the AG established.

A call is ongoing in the AG. The audio paths of the ongoing call are routed towards the HF via a Bluetooth Audio Connection.

• Test Procedure

1. Perform the corresponding action (manufacturer specific) on the AG to set the microphone gain in the HF to a level significantly higher than the nominal level.

2. Check the microphone gain of the HF.
3. Perform the corresponding action (manufacturer specific) in the HF to decrease its microphone gain to a level significantly lower than the nominal level.

4. Check the microphone gain of the HF.

5. Perform the corresponding action (manufacturer specific) on the AG to increase the microphone gain in the HF to the nominal level.

6. Check the microphone gain of the HF.

- **Test Condition**
  Both devices are initialized (see Section 3.4).

- **Expected Outcome**
  **Pass verdict**
  The actions on the HF and AG result in the respective microphone gain settings.

### 4.22.1.2 Micro Gain Ctrl – Remote

- **Test Case ID(s)**
  
  - HFP/HF/RMV/BV-02-I
  - HFP/AG/RMV/BV-02-I

- **Test Purpose**
  **HF:** To verify the microphone gain control of the HF if remote microphone gain control is supported.
  **AG:** To verify the microphone gain control of the HF if remote microphone gain control is supported.

- **Reference**
  [2] 4.28

- **Initial Condition**
  **HF:** Audio Connection between the HF and the AG established.
  
  A call is ongoing in the AG. The audio paths of the ongoing call are available in the HF via a Bluetooth Audio Connection.
  
  No automatic microphone gain control function shall be active in the HF.
  
  **AG:** Audio Connection between the HF and the AG established.
  
  A call is ongoing in the AG. The audio paths of the ongoing call are routed towards the HF via a Bluetooth Audio Connection.

- **Test Procedure**
  
  1. Perform the corresponding action (manufacturer specific) on the AG to set the microphone gain in the HF to the maximum level.
  2. Check the microphone gain of the HF.
3. Perform the corresponding action (manufacturer specific) on the AG to set the microphone gain in the HF to the minimum level.

4. Check the microphone gain of the HF.

- Test Condition
  Both devices are initialized (see Section 3.4).

- Expected Outcome
  Pass verdict
  The actions on the AG result in the respective microphone gain settings.

### 4.22.1.3 Gain Ctrl – Store Settings

- Test Case ID(s)
  **HFP/HF/RMV/BV-03-I**
  **HFP/AG/RMV/BV-03-I**

- Test Purpose
  HF: To verify that if storing the microphone gain settings in the HF is supported the correct settings are used when establishing a new Service Level Connection.
  AG: To verify that if storing the microphone gain settings in the HF is supported the correct settings are used when establishing a new Service Level Connection.

- Reference
  [2] 4.28

- Initial Condition
  HF: Audio Connection between the HF and the AG established.
  A call is ongoing in the AG. The audio paths of the ongoing call are available in the HF via a Bluetooth Audio Connection.
  No automatic microphone gain control function shall be active in the HF.
  
  AG: Audio Connection between the HF and the AG established.
  A call is ongoing in the AG. The audio paths of the ongoing call are routed towards the HF via a Bluetooth Audio Connection.

- Test Procedure
  1. Set the microphone gain to a value significantly different from the nominal volume either from the HF or the AG.
  2. Check the microphone gain of the HF.
  3. Perform the corresponding actions (manufacturer specific) from the HF such that an "Audio Connection transfer towards the AG" procedure is performed, as stated in Section 4.17 in [2]. The call shall be kept active in the AG means.
4. Drop the current call from the AG.
5. Place a new call to the AG. Answer the call from the AG.
6. Perform the corresponding actions (manufacturer specific) either from the HF or the AG such that an “Audio Connection transfer towards the HF” procedure is performed, as stated in Section 4.16 in [2].
7. Check the microphone gain of the HF.
8. Set the microphone gain to the nominal level either from the HF or the AG.
9. Check the microphone gain of the HF.

- Test Condition
  Both devices are initialized (see Section 3.4).

- Expected Outcome
  Pass verdict
  After the audio connection is transferred back towards the HF, in step 7, the microphone gain is restored to the value that was set before the audio was transferred towards the AG.
  After the audio connection is transferred back towards the HF, in steps 8 and 9, the user can properly modify, as expected, the microphone gain from the AG.

### 4.23 Enhanced Call Status Functions

#### 4.23.1 Call Status Query
Test subgroup with the objective to verify current status of all calls can be queried and updated.

- **Held Call Prerequisites for Testing on AG**
  In these test cases held call shall be present for testing if one or more of the following features are supported:
  - The AG supports HFP Three-way calling or Respond and Hold features.
  - The AG locally supports multi-party calling functions capable of putting a waiting call on hold.
  Held call might not be present for testing if none of the above features are supported by AG. In this case, the tests shall be executed using an active call only.

#### 4.23.1.1 Query List of Current Calls

- **Test Case ID(s)**
  - HFP/HF/ECS/BV-01-I
  - HFP/AG/ECS/BV-01-I

- **Test Purpose**
  - AG: Verify AG can respond to request for a list of the current call status.
  - HF: Verify HF can request the status of current calls in the AG.

- **Reference**
  - [2] 4.31.1
• Initial Condition
  HF: HF is powered on and paired with the AG, but there is no Service Level Connection.
  AG: One voice call is in progress.
      One voice call is on hold if the held call prerequisites are fulfilled.

• Test Procedure
  HF: HF initiates Service Level Connection to the AG.
      HF verifies call status using the AT+CLCC (List Current Calls) command.

• Expected Outcome
  Pass verdict
  HF: The HF sends AT+CLCC command to query call status.
  AG: The AG responds by sending a response reflecting the status for each current call.

4.23.1.2 Sending of Correct Call Status on SLC Initialization
• Test Case ID(s)

  HFP/HF/ECS/BV-02-I
  HFP/AG/ECS/BV-02-I

• Test Purpose
  AG: AG can send the correct call status when SLC is initialized.
  HF: HF can accept call status upon SLC initialization.

• Reference
  [2] 4.10

• Initial Condition
  HF: Service Level Connection between the HF and the AG is NOT in place.
  AG: One voice call is in progress.
      One voice call is on hold if the held call prerequisites are fulfilled.

• Test Procedure
  1. HF initiates SLC with the AG.
  2. AG accepts the SLC request.
  3. AG passes the correct call status to the HF.
• Expected Outcome

Pass verdict

HF: The HF initiates a SLC.

The HF detects the call in progress.

The HF detects the call on hold.

AG: The AG accepts the SLC.

The AG sends the correct call status in the SLC start-up.

4.23.1.3 Transfer of Current Call Status to Held

• Test Case ID(s)

HFP/HF/ECS/BV-03-I

HFP/AG/ECS/BV-03-I

• Test Purpose

HF: Verify that the HF accepts the change in call hold status.

AG: Verify that the AG correctly informs of change in call hold status.

• Reference

[2] 4.10

• Initial Condition

HF: Service Level Connection between the HF and the AG established.

An ongoing audio connection between HF and AG exists.

AG: At least one voice call is already in progress.

• Test Procedure

1. Initiate an incoming call to the AG from an outside source.

2. From the AG, place current call on hold and accept the incoming call.

3. AG shall inform HF of change in call status

• Test Condition

Test must be performed using Network Services that support call hold and/or multiparty calls.

• Expected Outcome

Pass verdict

HF: HF accepts the status update with no effect on function.

AG: The AG shall send the correct call hold status to the HF.
4.24 Enhanced Call Control Functions

4.24.1 Call Controls
Test subgroup with the objective to verify the ability to control specific call status.

- Held Call prerequisites for Testing on AG:

  In these test cases, held call shall be present for testing if one or more of the following features are supported:
  - The AG supports HFP Three-way calling or Respond and Hold features.
  - The AG locally supports multi-party calling functions capable of putting a waiting call on hold.
  Held call might not be present for testing if none of the above features are supported by AG.

4.24.1.1 Release Specified Call Index

- Test Case ID(s)
  HFP/AG/ECC/BV-01-I
  HFP/HF/ECC/BV-01-I

- Test Purpose
  AG: Verify AG can release the specified call without affecting other calls.
  HF: Verify that the HF can request the AG to release a specific call.

- Reference
  [2] 4.32.1

- Initial Condition
  HF: Service Level Connection between the HF and the AG established.
  An ongoing audio connection between HF and AG exists.
  AG: Two voice calls are in progress (multiparty).

- Test Procedure
  HF: 1. Request the AG to release one of the active calls only.
       2. AG informs the HF of change in call status.

- Test Condition
  Test must be performed using Network Services that support multiparty calls.

- Expected Outcome
  Pass verdict
  HF: The HF can request the correct active call to be released.
  AG: AG releases correct active call.
4.24.1.2 Private Consultation Mode

- Test Case ID(s)
  
  HFP/AG/ECC/BV-02-I
  HFP/HF/ECC/BV-02-I

- Test Purpose
  
  AG: Verify that the AG can place parties in a multi-party call on hold.
  
  HF: Verify that the HF can request the AG to place parties of a multi-party call on hold.

- Reference
  
  [2] 4.32.2

- Initial Condition
  
  HF: Service Level Connection between the HF and the AG established.
      An ongoing audio connection between HF and AG exists.
  
  AG: An ongoing multi-party call is active on the AG. (Call 1 and call 2).

- Test Procedure
  
  HF requests placement of call 1 on hold and remain with call 2.

- Test Condition
  
  Test must be performed using Network Services that support call hold and/or multiparty calls.

- Expected Outcome
  
  Pass verdict
  
  HF: HF requests placement of call 1 on hold.
  
  AG: AG places call 1 on hold.
      Call 2 remains active.
      The AG shall send the correct call hold status to the HF.

4.24.1.3 HFP/AG/ECC/BI-03-I [Enhanced Call Control Not Supported-Release Call]

- Test Purpose
  
  AG: Verify the AG responds to unknown command.

- Reference
  
  [2] 4.32.1
• Initial Condition
  HF:  1. HF supports Enhanced Call Control features.
       2. Service Level Connection between the HF and the AG established.
       3. An ongoing audio connection between HF and AG exists.
  AG:  1. AG does not support Enhanced Call Control features.
       2. One voice call is in progress.
       3. One voice call is on hold if held call prerequisites are fulfilled.

• Test Procedure
  HF to request the AG to release the held call only. (AT+CHLD=1x).

• Expected Outcome
  Pass verdict
  AG:  1. The AG responds with ERROR.
       2. The active call is not affected.
       3. The call on hold, if it exists during initial condition, is not affected.

4.24.1.4 HFP/AG/ECC/BI-04-I [Enhanced Call Control Not Supported-Private Consult Mode]

• Test Purpose
  AG:  Verify the AG responds to unknown command.

• Reference
  [2] 4.32.2

• Initial Condition
  HF:  1. HF supports Enhanced Call Control features.
       2. Service Level Connection between the HF and the AG established.
       3. An ongoing audio connection between HF and AG exists.
  AG:  1. AG does not support Enhanced Call Control features.
       2. One voice call is in progress if held call prerequisites are NOT fulfilled.
       3. One multi-party call is in progress if held call prerequisites are fulfilled.

• Test Procedure
  HF requests the AG for private consult mode with one party of multiparty call (AT+CHLD=2x).
• Expected Outcome
  
  Pass verdict

  AG: The AG responds with ERROR.

  The call is not affected.

4.25 Response and Hold

4.25.1 Response and Hold Call Scenarios

Test subgroup with the objective to verify the HF and AG are capable of supporting all the Response and Hold call scenarios.

4.25.1.1 Query Response and Hold Status

• Test Case ID(s)

  HFP/HF/RHH/BV-01-I
  HFP/AG/RHH/BV-01-I

• Test Purpose

  HF: To verify the HF can query the current response and hold status from the AG.

  AG: To verify the AG can return the current response and hold status from the HF.

• Reference

  [2] 4.29.1

• Initial Condition

  HF: A Service Level Connection between the HF and AG is not established.

  AG: The AG has put a received incoming call in the Response and Hold state (i.e., on hold).

• Test Procedure

  HF: Perform any necessary steps to ensure a Service Level Connection is established between the HF and AG.

• Test Condition

  Both devices are initialized (see Section 3.4).

• Expected Outcome
  
  Pass verdict

  After the Service Level Connection has been established, the HF call status tracks the call status of the AG. The HF is in the Response and Hold state (i.e., on hold).
4.25.1.2 Put an Incoming Call in a Response and Held State from HF

• Test Case ID(s)
  - HFP/HF/RHH/BV-02-I
  - HFP/AG/RHH/BV-02-I

• Test Purpose
  HF: To verify that the HF, following the proper procedure, can place an incoming call in a response and held state in the AG.

  AG: To verify that the AG places an incoming call in a response and held state, upon request from the HF.

• Reference
  [2] 4.29.2

• Initial Condition
  HF: A Service Level Connection between the HF and AG established.

  AG: A Service Level Connection between the HF and AG established.

  The AG shall be configured to alert the HF of an incoming call connection.

• Test Procedure
  AG: Initiate a call establishment to the AG from a network simulator or any other suitable means. Insert voice signals at the originating source.

  HF: Upon alerting, place the call in a response and held state at the HF by performing the corresponding action.

• Test Condition
  Both devices are initialized (see Section 3.4).

• Expected Outcome
  Pass verdict
  Upon the call establishment initiation to the AG, the AG shall inform the HF about the incoming call.

  As a result of placing the call in a response and held state in the HF, the AG shall stop informing the HF about the incoming call.

  The AG sends the call status as active to the HF, as stated in Section 4.29.2 in [2].

4.25.1.3 Put an Incoming Call in a response and held state from AG

• Test Case ID(s)
  - HFP/HF/RHH/BV-03-I
  - HFP/AG/RHH/BV-03-I
• Test Purpose

HF: To verify that the HF receives the current response and hold call status from the AG, after the incoming call is placed in a response and held state.

AG: To verify that the AG places an incoming call in a response and held state and notifies the HF of the response and hold call status.

• Reference

[2] 4.29.3

• Initial Condition

HF: A Service Level Connection between the HF and AG established.

AG: A Service Level Connection between the HF and AG established.

The AG shall be configured to alert the HF of an incoming call connection.

• Test Procedure

AG: 1. Initiate a call establishment to the AG from a network simulator or any other suitable means. Insert voice signals at the originating source.

2. Upon alerting, place the call in a response and held state by performing the corresponding action on the AG.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

Upon the call establishment initiation to the AG, the AG shall inform the HF about the incoming call.

As a result of placing the call in a response and held state in the AG, the AG shall stop informing the HF about the incoming call.

The HF call status is hold and tracks the call status of the AG, as stated in Section 4.29.3 in [2].

4.25.1.4 Accept a Response and Held Call From HF

• Test Case ID(s)

HFP/HF/RHH/BV-04-I

HFP/AG/RHH/BV-04-I

• Test Purpose

HF: To verify that the HF, following the proper procedure, can accept an incoming call previously placed in a response and hold state.
AG: To verify that the AG allows a response and held call to be accepted, upon request from the HF.

• Reference
[2] 4.29.4

• Initial Condition
HF: A Service Level Connection between the HF and AG established.
    The HF recognizes an incoming call is in the response and hold state.
AG: A Service Level Connection between the HF and AG established.
    The AG has an incoming call in the response and hold state.

Remote Party:
    Voice signals are inserted at the remote phone or network simulator on hold with the AG.

• Test Procedure
HF: Accept the response and held call at the HF by performing the corresponding action.

• Test Condition
Both devices are initialized (see Section 3.4).

• Expected Outcome
Pass verdict
As a result of the action in the HF, the incoming call is changed from response and held to active in the AG and proper bi-directional conversation with the remote party is possible via the HF audio means.

    The call status of the HF and AG are both active and not in a response and held state.

4.25.1.5 Accept a Response and Held Call from AG

• Test Case ID(s)
  HFP/HF/RHH/BV-05-I
  HFP/AG/RHH/BV-05-I

• Test Purpose
HF: To verify that the HF receives the updated response and held call status from the AG, after a response and held call is accepted.
AG: To verify that the AG accepts a response and held call and notifies the HF of the updated response and held call status.

• Reference
[2] 4.29.5
• Initial Condition

**HF:** A Service Level Connection between the HF and AG established.

The HF recognizes a call is in the response and hold state.

**AG:** A Service Level Connection between the HF and AG established.

The AG has a call in the response and hold state.

**Remote Party:**

Voice signals are inserted at the remote phone or network simulator in a response and hold state with the AG.

• Test Procedure

**AG:** Accept the response and held call at the AG by performing the corresponding action.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

**Pass verdict**

As a result of the action in the AG, the response and held call is changed from response and held to active in the AG and proper bi-directional conversation with the remote party is possible via the AG audio means.

The call status of the HF and AG are both active and not on response and held.

4.25.1.6 *Reject a Response and Held Call from HF*

• Test Case ID(s)

**HFP/HF/RHH/BV-06-I**

**HFP/AG/RHH/BV-06-I**

• Test Purpose

**HF:** To verify that the HF, following the proper procedure, can reject a response and held call.

**AG:** To verify that the AG allows a response and held call to be rejected, upon request from the HF.

• Reference

[2] 4.29.6

• Initial Condition

**HF:** A Service Level Connection between the HF and AG established.

The HF recognizes a call is in the response and hold state.
AG: A Service Level Connection between the HF and AG established.

The AG has an incoming call in the response and held state.

- Test Procedure
  HF: Reject the response and held call at the HF by performing the corresponding action.

- Test Condition
  Both devices are initialized (see Section 3.4).

- Expected Outcome
  Pass verdict
  As a result of the action in the HF, the response and held call is ended at the AG.

  The call status of the HF and AG are both idle.

4.25.1.7 Reject a Response and Held Call from AG

- Test Case ID(s)
  HFP/HF/RHH/BV-07-I
  HFP/AG/RHH/BV-07-I

- Test Purpose
  HF: To verify that the HF receives the updated response and hold call status from the AG, after call is rejected.

  AG: To verify that the AG rejects a response and held call and notifies the HF of the updated response and hold call status.

- Reference
  [2] 4.29.7

- Initial Condition
  HF: A Service Level Connection between the HF and AG established.

  The HF recognizes an incoming call is in the response and hold state.

  AG: A Service Level Connection between the HF and AG established.

  The AG has a call in the response and hold state.

- Test Procedure
  AG: Reject the held incoming call at the AG by performing the corresponding action.

- Test Condition
  Both devices are initialized (see Section 3.4).
• Expected Outcome

Pass verdict

As a result of the action in the AG, the response and held call is ended at the AG.

The call status of the HF and AG are both idle.

4.25.1.8 Response and Held Call Terminated by Caller

• Test Case ID(s)

HFP/HF/RHH/BV-08-I

HFP/AG/RHH/BV-08-I

• Test Purpose

HF: To verify that the HF receives the updated response and hold call status from the AG, after response and held call is terminated by the caller.

AG: To verify that the AG notifies the HF of the updated response and hold call status, after the held call is terminated by the caller.

• Reference

[2] 4.29.8

• Initial Condition

HF: A Service Level Connection between the HF and AG established.

The HF recognizes an incoming call is in the response and hold state.

AG: A Service Level Connection between the HF and AG established.

The AG has a call in the response and hold state.

• Test Procedure

Remote Party:

Via the remote phone or network simulator used to initiate the call, terminate the call at the far-away device.

• Test Condition

Both devices are initialized (see Section 3.4).

• Expected Outcome

Pass verdict

As a result of the action at the far-away device, the response and held call is ended at the AG.

The call status of the HF and AG are both idle.
4.26 Subscriber Number Information

Test group with the objective to verify the HF and AG are capable of supporting the Subscriber Number Information functionality.

4.26.1 Subscriber Number Information Query Scenarios

Test subgroup with the objective to verify the HF and AG are capable of supporting all the Subscriber Number Information call scenarios.

4.26.1.1 Query AG with Subscriber Number Information

- **Test Case ID(s)**
  - HFP/AG/NUM/BV-01-I
  - HFP/HF/NUM/BV-01-I

- **Test Purpose**
  
  **HF:** To verify the HF can query the AG for Subscriber Number Information.
  
  **AG:** To verify the AG can respond with Subscriber Number Information when such information is available to the AG OR that the AG can respond correctly when the subscriber number is not available to the AG.

- **Reference**
  - [2] 4.30

- **Initial Condition**
  
  **HF:** A Service Level Connection between the HF and AG established.
  
  **AG:** Ensure the AG has access to one or more subscriber numbers.
  
  A Service Level Connection between the HF and AG established.

- **Test Procedure**
  
  **HF:** Upon Service Level Connection, HF issues the AT+CNUM command to gather Subscriber Number Information.
  
  **AG:** Upon receiving the AT+CNUM command, AG responds back with Subscriber Number Information.

- **Test Condition**
  Both devices are initialized (see Section 3.4).

- **Expected Outcome**
  
  **Pass verdict**
  
  Subscriber number available at the AG:
  
  - HF sends AT+CNUM command to AG.
AG sends the required fields: number, type, and service.

Subscriber number NOT available to the AG:

- HF sends AT+CNUM command to AG.
- Upon requesting the subscriber number from the AG the AG responds with “OK”.

### 4.26.2 Subscriber Number Information Interoperability

Test subgroup with the objective to verify that the HF and AG are interoperable with devices that do not support Subscriber Number Information.

#### 4.26.2.1 HFP/HF/NUM/BI-01-I [HF Supports Subscriber Number Information, AG Does Not Support Subscriber Number Information]

- **Test Purpose**
  
  HF:  To verify an HF that supports Subscriber Number Information is interoperable with an AG that does not support it.

- **Reference**
  
  [2] 4.33.1

- **Initial Condition**
  
  HF: The HF supports Subscriber Number Information.
  
  A Service Level Connection between the HF and AG established.

  AG: The AG does not support Subscriber Number Information.
  
  A Service Level Connection between the HF and AG established.

- **Test Procedure**
  
  HF: Issue AT+CNUM=? Test action command to gather Subscriber Number Information from the AG.

- **Test Condition**
  
  Both devices are initialized (see Section 4.3)

- **Expected Outcome**
  
  **Pass verdict**
  
  The AG will signal the completion of the AT+CNUM=? Action command with an error code.

  The HF continues to operate in a manner that is consistent with having an unsupported Subscriber Number Information.

### 4.27 Service Level Connections

Tests for SLC handling verify the operations performed as part of the SLC establishment and release as specified in 4.2 and 4.3 of [2].
Tests in this section are defined as Conformance tests so that the details of the message exchanges may be verified. Typically, the IUT will be connected to a Lower Tester device that emulates the opposite end of the Bluetooth link.

4.27.1 SLC Establishment
This test subgroup exercises the establishment of a service level connection between AG and HF.

4.27.1.1 HF Initiates SLC with 3-way

• Test Case ID(s)
  
  HFP/HF/SLC/BV-01-C
  HFP/AG/SLC/BV-01-C

• Test Purpose
  An SLC is established between the HF and AG, initiated by the HF. Both devices support three-way calling.

• Reference
  [2] 4.2, 4.33

• Initial Condition
  Devices are turned on and in range.
  Devices may need to be paired together. No Bluetooth connections exist between the devices.
  AG device is in connectable mode.

• Test Procedure
  1. An RFCOMM connection is established between the HF and AG via any means necessary, with HF in the RFCOMM Device A role.
  2. Optionally, the IUT may initiate one or more AT commands. The Lower Tester will respond with ERROR.
  3. The HF initiates the SLC connection establishment. The Lower Tester device indicates support for three-way calling in its BRSF message.
  4. The HF and AG successfully complete the SLC establishment as shown in Figure 4.1.
Hands-Free Profile (HFP) / Test Suite

Figure 4.1: T SLC with 3-way

- Expected Outcome

Pass verdict

The test passes if all of the pass criteria below are observed.

HF as IUT:

1. Beginning with the AT+BRSF command, the HF generates the messages, and only the messages, indicated in Figure 4.1 Each is correctly formatted.

2. AT+BRSF. Bluetooth Retrieve Supported Features coded per [2] Supported features bitmap corresponds to the items claimed by the HF IUT in the completed ICS document as mapped in Table 4.2.

<table>
<thead>
<tr>
<th>HF BRSF bit</th>
<th>Feature</th>
<th>ICS Item</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>EC and/or NR function</td>
<td>3/14</td>
<td>Echo cancelling (EC) and Noise reduction (NR)</td>
</tr>
<tr>
<td>1</td>
<td>Three way calling</td>
<td>3/12</td>
<td>Three Way Calling</td>
</tr>
<tr>
<td>2</td>
<td>CLI presentation capability</td>
<td>3/13</td>
<td>Calling Line Identification (CLI)</td>
</tr>
<tr>
<td>3</td>
<td>Voice recognition activation</td>
<td>3/15</td>
<td>Voice recognition activation</td>
</tr>
</tbody>
</table>
Table 4.2

3. AT+CMER. Mobile Terminated Event Reporting coded per [4]. Contains the <ind> value 3 (indicator event reporting using result code +CIEV: <ind>,<value>).

AG as IUT:

1. The AG generates the messages, and only the messages, indicated in Figure 4.1. Each is correctly formatted.

2. +BRSF. Bluetooth Retrieve Supported Features coded per [2]. Supported features bitmap corresponds to the features claimed by the AG IUT in the completed ICS document as mapped in Table 4.3.

<table>
<thead>
<tr>
<th>AG BRSF bit</th>
<th>Feature</th>
<th>ICS Item</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Three way calling</td>
<td>2/12</td>
<td>Three Way Calling</td>
</tr>
<tr>
<td>1</td>
<td>EC and/or NR function</td>
<td>2/14</td>
<td>Echo canceling (EC) and Noise reduction (NR)</td>
</tr>
<tr>
<td>2</td>
<td>Voice recognition function</td>
<td>2/15</td>
<td>Voice recognition activation</td>
</tr>
<tr>
<td>3</td>
<td>In-band ring tone capability</td>
<td>2/4a</td>
<td>Accept an incoming voice call (in-band ring)</td>
</tr>
<tr>
<td>4</td>
<td>Attach a number to a voice tag</td>
<td>2/16</td>
<td>Attach a phone number to a voice tag</td>
</tr>
<tr>
<td>5</td>
<td>Ability to reject a call</td>
<td>2/5</td>
<td>Reject an incoming voice call</td>
</tr>
<tr>
<td>6</td>
<td>Enhanced call status</td>
<td>2/21a OR 2/21c</td>
<td>(Enhanced Call Status) OR (Enhanced Call Status with limited network notification)</td>
</tr>
<tr>
<td>7</td>
<td>Enhanced call control</td>
<td>2/21b</td>
<td>Enhanced Call Control</td>
</tr>
<tr>
<td>8</td>
<td>Extended Error Result Codes</td>
<td>N/A</td>
<td>Note: This feature does not correspond to an ICS item.</td>
</tr>
<tr>
<td>9</td>
<td>Codec Negotiation</td>
<td>2/3c</td>
<td>Codec Negotiation support</td>
</tr>
</tbody>
</table>

Table 4.3

3. First +CIND. Indicator Control coded per [4] contains the list of indicators supported by the AG with their corresponding ranges.
4. Second +CIND. Indicator Control coded per [4] contains the values of the indicators. Indicator values are within the ranges indicated in the first +CIND.

5. +CHLD. Call Related Supplementary Services coded per [4]. Supported features match the features claimed by the AG IUT in the completed ICS document (2/12a through 2/12d).

• Notes
   It is permissible for the IUT to send other commands, including commands not specified by [2], before and after SLC establishment, e.g., for improved interoperability with some devices.

4.27.1.2 AG Initiates SLC with 3-way

• Test Case ID(s)
  HFP/HF/SLC/BV-02-C
  HFP/AG/SLC/BV-02-C

• Test Purpose
  An SLC is established between the AG and HF, initiated by the AG. Both devices support three-way calling.

• Reference
  [2] 4.2, 4.33

• Initial Condition
  Devices are turned on and in range.
  Devices may need to be paired together. No Bluetooth connection exists between the devices.
  HF device is in connectable mode.

• Test Procedure
  The test procedure is identical to that in Section 4.27.1.1 - HF Initiates SLC with 3-way, except that the AG is in the RFCOMM Device A role as follows:
  - An RFCOMM connection is established between the HF and AG via any means necessary, with AG in the RFCOMM Device A role.

• Expected Outcome
  The Pass verdicts are identical to those in Section 4.27.1.1 - HF Initiates SLC with 3-way.

• Notes
  See Section 4.27.1.1 - HF Initiates SLC with 3-way.

4.27.1.3 HF Initiates SLC, No 3-way

• Test Case ID(s)
  HFP/HF/SLC/BV-03-C
  HFP/AG/SLC/BV-03-C
• Test Purpose
An SLC is established between the HF and AG, initiated by the HF. At least one device does not support three-way calling.

• Reference
[2] 4.2, 4.33

• Initial Condition
Devices are turned on and in range.
Devices may need to be paired together. No Bluetooth connection exists between the devices.
AG device is in connectable mode.

• Test Procedure
1. An RFCOMM connection is established between the HF and AG via any means necessary, with HF in the RFCOMM Device A role.
2. Optionally, the IUT may initiate one or more AT commands. The Lower Tester will respond with ERROR.
3. The HF initiates the SLC connection establishment.
4. The HF and AG successfully complete the SLC establishment as shown in Figure 4.2. The Lower Tester device does not indicate support for three-way calling in its BRSF message.

• Expected Outcome
Pass verdict
The test passes if all of the pass criteria below are observed.
HF as IUT:

1. The HF generates the messages, and only the messages, indicated in Figure 4.2. Each is correctly formatted.

2. AT+BRSF. Bluetooth Retrieve Supported Features coded per [2]. Supported features bitmap corresponds to the items claimed by the HF IUT in the completed ICS document as mapped in Table 4.4.

<table>
<thead>
<tr>
<th>HF BRSF bit</th>
<th>Feature</th>
<th>ICS Item</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>EC and/or NR function</td>
<td>3/14</td>
<td>Echo cancelling (EC) and Noise reduction (NR)</td>
</tr>
<tr>
<td>1</td>
<td>Three way calling</td>
<td>3/12</td>
<td>(Three Way Calling</td>
</tr>
<tr>
<td>2</td>
<td>CLI presentation capability</td>
<td>3/13</td>
<td>Calling Line Identification (CLI)</td>
</tr>
<tr>
<td>3</td>
<td>Voice recognition activation</td>
<td>3/15</td>
<td>Voice recognition activation</td>
</tr>
<tr>
<td>4</td>
<td>Remote volume control</td>
<td>3/18a, 3/18b</td>
<td>(Remote audio volume control – speaker) OR (Remote audio volume control – microphone)</td>
</tr>
<tr>
<td>5</td>
<td>Enhanced call status</td>
<td>3/21a</td>
<td>Enhanced Call Status</td>
</tr>
<tr>
<td>6</td>
<td>Enhanced call control</td>
<td>3/21b</td>
<td>Enhanced Call Control</td>
</tr>
<tr>
<td>7</td>
<td>Codec Negotiation</td>
<td>3/3c</td>
<td>Codec Negotiation support</td>
</tr>
</tbody>
</table>

Table 4.4

3. AT+CMER. Mobile Terminated Event Reporting coded per [4]. Contains the <ind> value 3 (indicator event reporting using result code +CIEV: <ind>,<value>).

AG as IUT:

1. The AG generates the messages, and only the messages, indicated in Figure 4.2. Each is correctly formatted.

2. +BRSF. Bluetooth Retrieve Supported Features coded per [2]. Supported features bitmap corresponds to the features claimed by the AG IUT in the completed ICS document as mapped in Table 4.5.

<table>
<thead>
<tr>
<th>AG BRSF bit</th>
<th>Feature</th>
<th>ICS Item</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Three way calling</td>
<td>2/12</td>
<td>Three Way Calling</td>
</tr>
<tr>
<td>1</td>
<td>EC and/or NR function</td>
<td>2/14</td>
<td>Echo canceling (EC) and Noise reduction (NR)</td>
</tr>
<tr>
<td>2</td>
<td>Voice recognition function</td>
<td>2/15</td>
<td>Voice recognition activation</td>
</tr>
</tbody>
</table>
### Table 4.5

<table>
<thead>
<tr>
<th>AG BRSF bit</th>
<th>Feature</th>
<th>ICS Item</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>In-band ring tone capability</td>
<td>2/4a</td>
<td>Accept an incoming voice call (in-band ring)</td>
</tr>
<tr>
<td>4</td>
<td>Attach a number to a voice tag</td>
<td>2/16</td>
<td>Attach a phone number to a voice tag</td>
</tr>
<tr>
<td>5</td>
<td>Ability to reject a call</td>
<td>2/5</td>
<td>Reject an incoming voice call</td>
</tr>
<tr>
<td>6</td>
<td>Enhanced call status</td>
<td>2/21a OR 2/21c</td>
<td>(Enhanced Call Status) OR (Enhanced Call Status with limited network notification)</td>
</tr>
<tr>
<td>7</td>
<td>Enhanced call control</td>
<td>2/21b</td>
<td>Enhanced Call Control</td>
</tr>
<tr>
<td>8</td>
<td>Extended Error Result Codes</td>
<td>N/A</td>
<td>Note: This feature does not correspond to an ICS item.</td>
</tr>
<tr>
<td>9</td>
<td>Codec Negotiation</td>
<td>2/3c</td>
<td>Codec Negotiation support</td>
</tr>
</tbody>
</table>

3. First +CIND. Indicator Control coded per [4], contains the list of indicators supported by the AG with their corresponding ranges.

4. Second +CIND. Indicator Control coded per [4], contains the values of the indicators. Indicator values are within the ranges indicated in the first +CIND.

- **Notes**
  It is permissible for the IUT to send other commands, including commands not specified by [2], before and after SLC establishment, e.g., for improved interoperability with some devices.

#### 4.27.1.4 AG Initiates SLC, No 3-way

- **Test Case ID(s)**
  
  **HFP/HF/SLC/BV-04-C**

  **HFP/AG/SLC/BV-04-C**

- **Test Purpose**
  An SLC is established between the AG and HF, initiated by the AG. At least one device does not support three-way calling.

- **Reference**
  [2] 4.2, 4.33

- **Initial Condition**
  Devices are turned on and in range.

  Devices may need to be paired together. No Bluetooth connection exists between the devices.

  HF device is in connectable mode.
• **Test Procedure**

The test procedure is identical to that in Section 4.27.1.3 - HF Initiates SLC, No 3-way, except that the AG is in the RFCOMM Device A role as follows:

An RFCOMM connection is established between the HF and AG via any means necessary, with AG in the RFCOMM Device A role.

• **Expected Outcome**

The Pass verdicts are identical to those in Section 4.27.1.3 - HF Initiates SLC, No 3-way.

• **Notes**

The notes are identical to those in Section 4.27.1.3 - HF Initiates SLC, No 3-way.

### 4.27.1.5 HF Initiates SLC with codec negotiation

• **Test Case ID(s)**

*HFP/HF/SLC/BV-05-I*

*HFP/AG/SLC/BV-05-I*

• **Test Purpose**

To verify the SLC establishment procedure initiated by the HF when codec negotiation is supported.

• **Reference**

[2] 4.2

• **Initial Condition**

Devices are turned on and in range.

Devices may need to be paired together. No Bluetooth connections exist between the devices.

AG device is in connectable mode.

• **Test Procedure**

An RFCOMM connection is established between the HF and AG via any means necessary, with HF in the RFCOMM Device A role.

- Optionally, if the IUT is a HF device it may initiate one or more AT commands. The Lower Tester will respond with ERROR.

- Optionally, if the IUT is an AG device it may initiate one or more unsolicited responses. The Lower Tester will ignore these.

The HF initiates the SLC connection establishment. The Lower Tester device indicates support for codec negotiation in its BRoS message.

The HF sends the codec negotiation AT+BAC to indicate the list of supported codecs to the AG device.

The HF and AG successfully complete the SLC establishment as shown in Figure 4.3.
Figure 4.3: T SLC with codec negotiation

• Expected Outcome

Pass verdict
The test passes if all of the pass criteria below are observed.

HF as IUT

Beginning with the AT+BRSF command, the HF generates the messages, and only the messages, indicated in Figure 4.3. Each is correctly formatted.

AT+BRSF. Bluetooth Retrieve Supported Features coded per [2]. Supported features bitmap corresponds to the items claimed by the HF IUT in the completed ICS document as mapped in Table 4.6.

<table>
<thead>
<tr>
<th>HF BRSF bit</th>
<th>Feature</th>
<th>ICS Item</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>EC and/or NR function</td>
<td>3/14</td>
<td>Echo cancelling (EC) and Noise reduction (NR)</td>
</tr>
<tr>
<td>1</td>
<td>Three way calling</td>
<td>3/12</td>
<td>Three Way Calling</td>
</tr>
<tr>
<td>2</td>
<td>CLI presentation capability</td>
<td>3/13</td>
<td>Calling Line Identification (CLI)</td>
</tr>
<tr>
<td>3</td>
<td>Voice recognition activation</td>
<td>3/15</td>
<td>Voice recognition activation</td>
</tr>
<tr>
<td>4</td>
<td>Remote volume control</td>
<td>3/18a OR 3/18b</td>
<td>(Remote audio volume control – speaker) OR (Remote audio volume control – microphone)</td>
</tr>
</tbody>
</table>
Hands-Free Profile (HFP) / Test Suite

<table>
<thead>
<tr>
<th>5</th>
<th>Enhanced call status</th>
<th>3/21a</th>
<th>Enhanced Call Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Enhanced call control</td>
<td>3/21b</td>
<td>Enhanced Call Control</td>
</tr>
<tr>
<td>7</td>
<td>Codec Negotiation</td>
<td>3/3c</td>
<td>Codec Negotiation support</td>
</tr>
</tbody>
</table>

Table 4.6

AT+BAC, the AT to indicate the HF list of supported codec commands, is sent to the AG Device.

Bit7 of the AT+BRSF is set to one to indicate support for codec negotiation.

AG as IUT

The AG generates the messages, and only the messages, indicated in Figure 4.3. Each is correctly formatted.

AT+BRSF. Bluetooth Retrieve Supported Features coded per [2]. Supported features bitmap corresponds to the features claimed by the AG IUT in the completed ICS document as mapped in Table 4.7.

<table>
<thead>
<tr>
<th>AG BRSF bit</th>
<th>Feature</th>
<th>ICS Item</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Three way calling</td>
<td>2/12</td>
<td>Three Way Calling</td>
</tr>
<tr>
<td>1</td>
<td>EC and/or NR function</td>
<td>2/14</td>
<td>Echo canceling (EC) and Noise reduction (NR)</td>
</tr>
<tr>
<td>2</td>
<td>Voice recognition function</td>
<td>2/15</td>
<td>Voice recognition activation</td>
</tr>
<tr>
<td>3</td>
<td>In-band ring tone capability</td>
<td>2/4a</td>
<td>Accept an incoming voice call (in-band ring)</td>
</tr>
<tr>
<td>4</td>
<td>Attach a number to a voice tag</td>
<td>2/16</td>
<td>Attach a phone number to a voice tag</td>
</tr>
<tr>
<td>5</td>
<td>Ability to reject a call</td>
<td>2/5</td>
<td>Reject an incoming voice call</td>
</tr>
<tr>
<td>6</td>
<td>Enhanced call status</td>
<td>2/21a OR 2/21c</td>
<td>(Enhanced Call Status) OR (Enhanced Call Status with limited network notification)</td>
</tr>
<tr>
<td>7</td>
<td>Enhanced call control</td>
<td>2/21b</td>
<td>Enhanced Call Control</td>
</tr>
<tr>
<td>8</td>
<td>Extended Error Result Codes</td>
<td>N/A</td>
<td>Note: This feature does not correspond to an ICS item.</td>
</tr>
<tr>
<td>9</td>
<td>Codec Negotiation</td>
<td>2/3c</td>
<td>Codec Negotiation support</td>
</tr>
</tbody>
</table>

Table 4.7

AT+BAC is acknowledged correctly by the AG Device.

Bit9 of the AT+BRSF is set to one to indicate support for codec negotiation.
• Notes
   It is permissible for the IUT to send other commands, including commands not specified by [2], before and after SLC establishment, e.g., for improved interoperability with some devices.

4.27.1.6 AG Initiates SLC with codec negotiation
   • Test Case ID(s)
     HFP/HF/SLC/BV-06-I
     HFP/AG/SLC/BV-06-I
   • Test Purpose
     To verify the SLC establishment procedure initiated by the AG when codec negotiation is supported.
   • Reference
     [2] 4.2
   • Initial Condition
     Devices are turned on and in range.
     Devices may need to be paired together. No Bluetooth connection exists between the devices.
     HF device is in connectable mode.
   • Test Procedure
     The test procedure is identical to that in HF Initiates SLC with codec negotiation, except that the AG is in the RFCOMM Device A role as follows:
     An RFCOMM connection is established between the HF and AG via any means necessary, with AG in the RFCOMM Device A role.
   • Expected Outcome
     The Pass verdicts are identical to those in HF Initiates SLC with codec negotiation.
   • Notes
     The notes are identical to those in HF Initiates SLC with codec negotiation.

4.27.1.7 HFP/AG/SLC/BV-07-I [HF Initiates SLC without codec negotiation]
   • Test Purpose
     To verify the SLC establishment procedure initiated by the HF when codec negotiation is not supported.
   • Reference
     [2] 4.2
   • Initial Condition
     Devices are turned on and in range.
Devices may need to be paired together. No Bluetooth connection exists between the devices.

AG device is in connectable mode.

- **Test Procedure**

  An RFCOMM connection is established between the HF and AG via any means necessary, with HF in the RFCOMM Device A role

  Optionally, if the IUT is a HF device it may initiate one or more AT commands. The Lower Tester will respond with ERROR.

  Optionally, if the IUT is an AG device it may initiate one or more unsolicited responses. The Lower Tester will ignore these.

  The HF initiates the SLC connection establishment.

  The HF and AG successfully complete the SLC establishment as shown in Figure 4.4. The HF device does not indicate support for codec negotiation in its BRSF message.

  The HF does not send the AT+BAC list of supported codecs command to the AG Device.

  ![Diagram](image)

  **Figure 4.4:** T SLC without Codec Negotiation

  - **Expected Outcome**

    **Pass verdict**

    The test passes if all of the pass criteria below are observed.

    The HF generates the messages, and only the messages, indicated in Figure 4.4. Each is correctly formatted.

    AT+BRSF. Bluetooth Retrieve Supported Features coded per [2]. Supported features bitmap corresponds to the items claimed by the HF IUT in the completed ICS document as mapped in Table 4.8.
<table>
<thead>
<tr>
<th>HF BRSF bit</th>
<th>Feature</th>
<th>ICS Item</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>EC and/or NR function</td>
<td>3/14</td>
<td>Echo cancelling (EC) and Noise reduction (NR)</td>
</tr>
<tr>
<td>1</td>
<td>Three way calling</td>
<td>3/12</td>
<td>Three Way Calling</td>
</tr>
<tr>
<td>2</td>
<td>CLI presentation capability</td>
<td>3/13</td>
<td>Calling Line Identification (CLI)</td>
</tr>
<tr>
<td>3</td>
<td>Voice recognition activation</td>
<td>3/15</td>
<td>Voice recognition activation</td>
</tr>
<tr>
<td>4</td>
<td>Remote volume control</td>
<td>3/18a OR 3/18b</td>
<td>(Remote audio volume control – speaker) OR (Remote audio volume control – microphone)</td>
</tr>
<tr>
<td>5</td>
<td>Enhanced call status</td>
<td>3/21a</td>
<td>Enhanced Call Status</td>
</tr>
<tr>
<td>6</td>
<td>Enhanced call control</td>
<td>3/21b</td>
<td>Enhanced Call Control</td>
</tr>
<tr>
<td>7</td>
<td>Codec Negotiation</td>
<td>3/3c</td>
<td>Codec Negotiation</td>
</tr>
</tbody>
</table>

Table 4.8

Bit 7 of the AT+BRSF is set to zero to indicate no support for codec negotiation.

- **Notes**
  It is permissible for the IUT to send other commands, including commands not specified by [2], before and after SLC establishment, e.g., for improved interoperability with some devices.

4.27.1.8  **HFP/HF/SLC/BV-08-I [AG Initiates SLC without codec negotiation]**

- **Test Purpose**
  To verify the SLC establishment procedure initiated by the AG when codec negotiation is supported.

- **Reference**
  [2] 4.2

- **Initial Condition**
  Devices are turned on and in range.
  Devices may need to be paired together. No Bluetooth connection exists between the devices.
  AG device is in connectable mode.

- **Test Procedure**
  An RFCOMM connection is established between the HF and AG via any means necessary, with AG in the RFCOMM Device A role.
Optionally, if the IUT is a HF device it may initiate one or more AT commands. The Lower Tester will respond with ERROR.

Optionally, if the IUT is an AG device it may initiate one or more unsolicited responses. The Lower Tester will ignore these.

The AG initiates the SLC connection establishment.

The HF and AG successfully complete the SLC establishment as shown in Figure 4.5. The AG device does not indicate support for codec negotiation in its BRSF message.

The HF may or may not send the AT+BAC list of supported codecs command to the AG Device depending on the HF device support for codec negotiation.

The AG will respond to the AT+BAC command from the HF device with ERROR.

Figure 4.5: SLC without Codec Negotiation, HF supports codec negotiation

- **Expected Outcome**

  **Pass verdict**
  
  The test passes if all of the pass criteria below are observed.

  The AG generates the messages, and only the messages, indicated in Figure 4.5. Each is correctly formatted.

  +BRSF. Bluetooth Retrieve Supported Features coded per [2]. Supported features bitmap corresponds to the features claimed by the AG IUT in the completed ICS document as mapped in Table 4.9.
<table>
<thead>
<tr>
<th>AG BRSF bit</th>
<th>Feature</th>
<th>ICS Item</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Three way calling</td>
<td>2/12</td>
<td>Three Way Calling</td>
</tr>
<tr>
<td>1</td>
<td>EC and/or NR function</td>
<td>2/14</td>
<td>Echo canceling (EC) and Noise reduction (NR)</td>
</tr>
<tr>
<td>2</td>
<td>Voice recognition function</td>
<td>2/15</td>
<td>Voice recognition activation</td>
</tr>
<tr>
<td>3</td>
<td>In-band ring tone capability</td>
<td>2/4a</td>
<td>Accept an incoming voice call (in-band ring)</td>
</tr>
<tr>
<td>4</td>
<td>Attach a number to a voice tag</td>
<td>2/16</td>
<td>Attach a phone number to a voice tag</td>
</tr>
<tr>
<td>5</td>
<td>Ability to reject a call</td>
<td>2/5</td>
<td>Reject an incoming voice call</td>
</tr>
<tr>
<td>6</td>
<td>Enhanced call status</td>
<td>2/21a OR 2/21c</td>
<td>(Enhanced Call Status) OR (Enhanced Call Status with limited network notification)</td>
</tr>
<tr>
<td>7</td>
<td>Enhanced call control</td>
<td>2/21b</td>
<td>Enhanced Call Control</td>
</tr>
<tr>
<td>8</td>
<td>Extended Error Result Codes</td>
<td>N/A</td>
<td>Note: This feature does not correspond to an ICS item.</td>
</tr>
<tr>
<td>9</td>
<td>Codec Negotiation</td>
<td>2/3c</td>
<td>Codec Negotiation</td>
</tr>
</tbody>
</table>

Table 4.9

Bit9 of the AT+BRSF is set to zero to indicate no support for codec negotiation.

• Notes

It is permissible for the IUT to send other commands, including commands not specified by [2], before and after SLC establishment, e.g., for improved interoperability with some devices.

4.27.1.9 SLC, Lower Tester and IUT both support HF Indicator, with some in common

• Test Case ID(s)

**HFP/HF/SLC/BV-09-I**

**HFP/AG/SLC/BV-09-I**

• Test Purpose

This test verifies that an IUT (AG or HF) can correctly initiate a SLC when both devices support HF Indicators and have at least one HF Indicator in common.

• Reference

[7] 4.2, 4.35
• Initial Condition

Devices are turned on, paired and in range.

No Bluetooth connection exists between the devices.

The AG device is in connectable mode.

• Test Procedure

1. An RFCOMM connection is established between the HF and AG via any means necessary, with AG in the RFCOMM Device A role.

2. Optionally, the HF may initiate one or more AT commands. The AG may respond with ERROR.

3. The HF and AG successfully complete the SLC establishment as shown in Figure 4.6. Both devices indicate support for HF indicators in the BRSF exchange and have at least one indicator in common.

4. The Lower Tester shall use <Unsupported HF Indicator 1> and <Supported HF Indicator 1> from the HFP IXIT [3] as the list of supported HF Indicators.
HF AG
RFCOMM Connection Establishment
BRSF Exchange
(BAC Exchanges)
(CIDN Exchanges)
(CMER Exchanges)
(CHLD Exchanges)
AT+BIND=<HF Supported HF Indicators>
OK
AT+BIND=?
+BIND:<Indicator>,0 or 1
OK
For each HF Indicator supported by the AG.

Figure 4.6: Both devices support HF Indicators

- Expected Outcome
  
  **Pass verdict**
  
  The test passes if all of the pass criteria below are observed.

  **HF as IUT:**

  1. The BRSF of the HF has the HF Indicators feature bit set.
  2. The HF generates the messages in the order indicated in Figure 4.6. Each is correctly formatted.
AG as IUT:

1. AT+BRSF Bluetooth Retrieve Supported Features of the AG has the HF Indicators feature bit set.
2. The AG generates the messages in the order indicated in Figure 4.6. Each is correctly formatted.

• Notes

It is permissible for the IUT to send other commands, including commands not specified by [2], before and after SLC establishment, e.g., for improved interoperability with some devices.

4.27.1.10 SLC, IUT support HF Indicator, Lower Tester does not

• Test Case ID(s)

  HFP/HF/SLC/BV-10-I
  HFP/AG/SLC/BV-10-I

• Test Purpose

This test verifies that an IUT (AG or HF) can correctly initiate a SLC when the remote device does not support HF Indicators.

• Reference

[7] 4.2, 4.35

• Initial Condition

  Devices are turned on, paired and in range.

  No Bluetooth connection exists between the devices.

  The AG device is in connectable mode.

  Remote (HF or AG) device does not support HF Indicators.

• Test Procedure

  An RFCOMM connection is established between the HF and AG via any means necessary, with AG in the RFCOMM Device A role

  Optionally, the HF may initiate one or more AT commands. The AG may respond with ERROR.

  The HF and AG successfully complete the SLC establishment as shown in Figure 4.7.
**Figure 4.7: Lower Tester does not support HF Indicators**

- **Expected Outcome**
  - **Pass verdict**
  
The test passes if all of the pass criteria below are observed.

**HF as IUT:**

1. The HF generates the messages in the order and number as indicated in **Figure 4.7.** Each is correctly formatted.
2. The HF does not send any AT+BIND commands during SLC.
3. A Service Level Connection is established

**AG as IUT:**

1. The AG generates the message responses in the order and number as indicated in **Figure 4.7.**
   Each is correctly formatted.
2. A Service Level Connection is established.

- **Notes**
  
  It is permissible for the IUT to send other commands, including commands not specified by [2], before and after SLC establishment, e.g., for improved interoperability with some devices.
4.28 Codec Connection Setup

Test subgroup objectives:

To verify the capability of both the HF and the AG for creating a working codec connection between both devices according to the Codec Connection Setup in section 4.11 of [2]. In this test sub group there is reference made to a legacy audio connection, this refers to the audio connection setup procedure employed by devices based on Hands-Free profile v1.5 and earlier Hands-Free specification versions.

4.28.1 HFP/HF/ACC/BV-01-I [Codec Connection Setup – HF Initiated]

- Test Purpose

To verify the capability of the HF of initiating a working Codec Connection Setup successfully with an AG.

HF: IUT is the HF. HF initiates Codec Connection Setup.

AG: The AG supports the Codec Connection Setup procedure initiated by the HF.

- Reference

[2] 4.11

- Initial Condition

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT shall determine whether the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records before attempting any audio connection. AG and HF support Codec Connection Setup.

Ongoing call may be present in order to achieve test purpose.

- Test Procedure

This test need only be run once. It does not matter which codec is negotiated so long as one is selected via the Codec Connection Setup procedure. Table 4.10 outlines the codecs which shall be supported by both devices if the wide band speech service is supported.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>mSBC</td>
<td>Mandatory if wide band speech is supported</td>
</tr>
</tbody>
</table>

*Table 4.10*

Optional wide band speech codecs may also be used if supported by the IUT.

HF: The IUT shall initiate a full duplex audio connection with the AG using the Codec Connection Setup in [2]. The HF initiates the Codec Connection request successfully in Figure 4.8 below.
AG: Accepts connection request from IUT using the Codec Connection Setup in [2]. The AG successfully initiates the Codec Connection request in Figure 4.9.
Figure 4.9: AG initiates the Codec Connection setup procedure successfully

Supported Connections

Table 4.11 outlines those features of the synchronous connection which shall be supported by both devices if the Codec Connection setup procedure and wide band speech service using a mandatory wide band speech codec are selected.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD using HV1 packets (D0)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>CVSD using HV3 packets (D1)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>3</td>
<td>CVSD using eSCO EV3 packets (S1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>4</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
</tbody>
</table>
Table 4.11

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S3)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters.</td>
</tr>
<tr>
<td>6</td>
<td>Transparent data using eSCO EV3 packets (T1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec.</td>
</tr>
<tr>
<td>7</td>
<td>Transparent data using eSCO EDR 2-EV3 packets (T2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec.</td>
</tr>
<tr>
<td>8</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S4)</td>
<td>Support for these settings is applicable when using HPF v1.7 or later. See [2] for details on the eSCO parameters.</td>
</tr>
</tbody>
</table>

* Expected Outcome

**Pass verdict**

Full duplex audio is available between the HF and AG using the Codec Connection Setup. The codec which shall be supported between the HF and AG when using the Codec Connection setup procedure is CVSD. If the WBS service is supported mSBC shall be supported. A single codec negotiated during the codec connection setup procedure is used throughout the synchronous connection.

### 4.28.2 HFP/HF/ACC/BV-02-I [Codec Connection Setup following an initial successful Codec Connection Setup – HF Initiated]

* Test Purpose

To verify the capability of the HF of initiating a working Codec Connection Setup successfully with an AG following an already successful Codec Connection Setup procedure, selecting the same codec.

**HF:**

IUT is the HF. HF initiates the Codec Connection Setup. This connection attempt follows an already successful Codec Connection Setup procedure and the same codec shall be used for this connection attempt.

**AG:**

AG has already successfully established a working Codec Connection Setup and is no longer required to alert the HF device as to the codec to be used for subsequent codec connection setup procedures if the same codec is used.

* Reference

[2] 4.11

* Initial Condition

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT has already determined the remote device can support the Codec Connection setup procedure using the AT+BRSF and/or SDP records. The AG and HF devices have already successfully initiated a working codec connection setup procedure.
Ongoing call may be present in order to achieve test purpose.

- **Test Procedure**

This test need only be run once. *Table 4.12* outlines the codecs which shall be supported by both devices if the wide band speech service is supported.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>mSBC</td>
<td>Mandatory if wide band speech is supported</td>
</tr>
</tbody>
</table>

*Table 4.12*

Optional wide band speech codecs may also be used if supported by the IUT.

**HF:** The IUT shall initiate a full duplex audio connection with the AG using the Codec Connection Setup in [2]. The HF initiates the Codec Connection request successfully in *Figure 4.10*.

**AG:** Accepts connection request from IUT using the Codec Connection Setup in [2]. The AG successfully initiates the Codec Connection request in *Figure 4.10*. As the codec has already been successfully negotiated in the initial Codec Connection Setup procedure the AG does not alert the HF device as to the codec to be used for this Codec Connection Setup.

**Supported Connections**

*Table 4.13* outlines those features of the synchronous connection which shall be supported by both devices if the Codec Connection setup procedure and wide band speech service using a mandatory wide band speech codec are selected.
### Hands-Free Profile (HFP) / Test Suite

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD using HV1 packets (D0)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>CVSD using HV3 packets (D1)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>3</td>
<td>CVSD using eSCO EV3 packets (S1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>4</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>5</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S3)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>6</td>
<td>Transparent data using eSCO EV3 packets (T1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec</td>
</tr>
<tr>
<td>7</td>
<td>Transparent data using eSCO EDR 2-EV3 packets (T2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec</td>
</tr>
<tr>
<td>8</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S4)</td>
<td>Support for these settings is applicable when using HPF v1.7 or later. See [2] for details on the eSCO parameters.</td>
</tr>
</tbody>
</table>

**Table 4.13**

- **Expected Outcome**
  
  **Pass verdict**
  
  Full duplex audio is available between the HF and AG using the Codec Connection Setup. The codec use is the same as that used in the previous connection.

### 4.28.3 HFP/ACC/BV-03-I [Codec Connection Setup Failure – HF Initiated]

- **Test Purpose**
  
  To verify the capability of the HF initiating a legacy audio connection with an AG that does not support the Codec Connection setup procedure. The HF should be able to correctly negotiate a working legacy audio connection to the AG.

- **Reference**
  
  [2] 4.11
• Initial Condition

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT shall determine whether the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records before attempting any audio connection.

Ongoing call may be present in order to achieve test purpose.

HF: IUT is the HF. The HF shall determine that the AG only supports the legacy connection method and in turn employ the legacy method to establish the connection.

• Test Procedure

HF: IUT shall initiate a full duplex audio connection with the AG without using the Codec Connection Setup in [2]. The HF successfully initiates the legacy audio connection to the AG in Figure 4.11.

![Diagram](image)

**Figure 4.11:** HF initiates a legacy audio connection successfully

AG: AG accepts legacy audio connection setup attempt from the HF:

• Expected Outcome

Pass verdict

Full duplex audio is available between the HF and AG. The audio connection can be SCO or eSCO depending on the supported features of the AG device.

4.28.4 HFP/HF/ACC/BV-04-I [Codec Connection Setup – AG Initiated]

• Test Purpose

To verify the capability of the HF accepting a full duplex audio connection from an AG using the Codec Connection Setup procedure.

HF: IUT is the HF.

AG: AG initiates a connection using the Codec Connection Setup procedure.
• Reference

[2] 4.11

• Initial Condition

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT shall determine whether the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records before attempting any audio connection.

• Test Procedure

This test only needs to be run once. It does not matter which of the codecs below are selected. Table 4.14 outlines the codecs which shall be supported by both devices if the wide band speech service is supported.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>mSBC</td>
<td>Mandatory if wide band speech is supported</td>
</tr>
</tbody>
</table>

Table 4.14

Optional wide band speech codecs may also be used if supported by the IUT.

AG: AG shall initiate a full duplex audio connection with the HF using the Codec Connection Setup in [2]. The AG successfully initiates the Codec Connection request in Figure 4.12.

![Diagram](image-url)

**Figure 4.12:** AG initiates the Codec Connection setup procedure successfully
HF: IUT shall accept a full duplex audio connection from an AG using the Codec Connection Setup in [2].

Supported Connections

Table 4.15 outlines those features of the synchronous connection which shall be supported by both devices if the Codec Connection setup procedure and wide band speech service using a mandatory wide band speech codec are selected.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD using HV1 packets (D0)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>CVSD using HV3 packets (D1)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>3</td>
<td>CVSD using eSCO EV3 packets (S1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>4</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>5</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S3)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters.</td>
</tr>
<tr>
<td>6</td>
<td>Transparent data using eSCO EV3 packets (T1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec</td>
</tr>
<tr>
<td>7</td>
<td>Transparent data using eSCO EDR 2-EV3 packets (T2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec</td>
</tr>
<tr>
<td>8</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S4)</td>
<td>Support for these settings is applicable when using HPF v1.7 or later. See [2] for details on the eSCO parameters.</td>
</tr>
</tbody>
</table>

Table 4.15

- Expected Outcome

Pass verdict

Full duplex audio is available between the HF and AG using the Codec Connection Setup. The codec which shall be supported between the HF and AG when using the Codec Connection setup procedure is CVSD. If the WBS service is supported mSBC shall be supported. A single codec negotiated during the codec connection setup procedure is used throughout the synchronous connection.
4.28.5 HFP/HF/ACC/BV-05-I [Codec Connection Setup Failure – AG Initiated]

- **Test Purpose**
  To verify the capability of the HF supporting the Codec Connection Setup procedure, accepting a legacy audio connection setup from an AG not supporting the Codec Connection Setup procedure.

  HF: IUT is the HF. HF supports Codec Connection Setup.

  AG: AG initiates a legacy audio connection setup procedure.

- **Reference**
  [2] 4.11

- **Initial Condition**
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT shall determine whether the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records before attempting any audio connection.

- **Test Procedure**
  AG: AG shall initiate a legacy audio connection setup to the HF. The AG successfully initiates the legacy audio connection to the AG in Figure 4.13.

  ![Diagram](image)

  **Figure 4.13:** AG initiates a legacy audio connection successfully

  HF: IUT shall accept a full duplex audio connection with the AG using the legacy audio connection setup procedure.

- **Expected Outcome**
  **Pass verdict**

  Full duplex audio is available between the HF and AG using the legacy method. The audio connection can be SCO or eSCO depending on the supported features of the AG device.
4.28.6 HFP/HF/ACC/BV-06-I [Codec Connection – AG Initiated – Verify Support for T1 Settings]

- **Test Purpose**
  
  To verify the capability of the HF accepting a full duplex audio connection from an AG using the Codec Connection Setup procedure with T1 link parameters.

  HF: IUT is the HF.

  AG: AG initiates the Codec Connection Setup procedure.

- **Reference**

  [2] 4.11

- **Initial Condition**

  The Lower Tester (HF) is configured not to support BR/EDR Secure Connections, hence ensuring that the Secure Connections feature is not used on the connection during the test.

  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT has already determined that the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records.

- **Test Procedure**

  This test only needs to be run once. The codec selected in this test must be mSBC

  AG: AG shall initiate a full duplex audio connection with the HF using the Codec Connection Setup in [2]. The AG successfully initiates the Codec Connection request with the T1 link parameters.

  HF: IUT shall accept a full duplex audio connection from an AG using the Codec Connection Setup in [2].

**Supported Connections**

Table 4.16 outlines those features of the synchronous connection which shall be supported by both devices for this test.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Transparent data using eSCO EV3 packets (T1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec</td>
</tr>
</tbody>
</table>

*Table 4.16*

- **Expected Outcome**

  **Pass verdict**

  AG successfully initiated the T1 synchronous connection via the codec connection setup procedure to the HF device. Full duplex audio is available between the HF and AG. The codec selected is mSBC.
4.28.7 HFP/HF/ACC/BV-07-I [Codec Connection – AG Initiated – Verify Support for T2 Settings]

- **Test Purpose**
  
  To verify the capability of the HF accepting a full duplex audio connection from an AG using the Codec Connection Setup procedure with T2 link parameters. Codec Connection Setup, AG initiated (AG and HF supports Codec Connection Setup).

  **HF:** IUT is a HF.

  **AG:** AG initiates a T2 connection using the Codec Connection Setup process.

- **Reference**
  
  [2] 4.11

- **Initial Condition**

  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT has already determined that the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records.

- **Test Procedure**

  This test needs only to be run once. The codec selected shall be mSBC.

  **AG:** AG shall initiate a full duplex audio connection with the HF using the Codec Connection Setup in [2]. The AG successfully initiates the Codec Connection request with the T2 link parameters.

  **HF:** IUT shall accept a full duplex audio connection from an AG using the Codec Connection Setup in [2].

**Supported Connections**

Table 4.17 outlines those features of the synchronous connection which shall be supported by both devices for this test.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Transparent data using eSCO EDR 2-EV3 packets (T2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec</td>
</tr>
</tbody>
</table>

*Table 4.17*

- **Expected Outcome**

  **Pass verdict**

  AG successfully initiated the T2 synchronous connection via the codec connection setup procedure to the HF device. Full duplex audio is available between the HF and AG. The codec selected is mSBC.
4.28.8 HFP/AG/ACC/BV-08-I [Codec Connection Setup – HF Initiated]

- **Test Purpose**
  
  To verify the capability of the AG accepting a full duplex audio connection with a HF using the Codec Connection Setup procedure in [2].

  **HF:** HF initiates the Codec Connection Setup procedure.

  **AG:** IUT is the AG. The AG shall accept the connection attempt from the HF.

- **Reference**
  [2] 4.11

- **Initial Condition**

  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT shall determine whether the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records before attempting any audio connection.

- **Test Procedure**

  This test only needs to be run once. Table 4.18 outlines the codecs which shall be supported by both devices if the wide band speech service is supported. For the purposes of this test either codec may be selected.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>mSBC</td>
<td>Mandatory if wide band speech is supported</td>
</tr>
</tbody>
</table>

*Table 4.18*

Optional wide band speech codecs may also be used if supported by the IUT.

**HF:** The HF shall initiate a full duplex audio connection with the IUT using the Codec Connection Setup procedure in [2] The HF initiates the Codec Connection request successfully in Figure 4.14.
AG: AG shall accept a full duplex audio connection with the HF using the Codec Connection Setup procedure. The AG successfully initiates the Codec Connection request in Figure 4.15 below.
The presence of a new connection is notified

\[ \text{AT+BCS=<CODEC_ID>} \]

\[ \text{OK} \]

**Figure 4.15**: AG initiates the Codec Connection setup procedure successfully

**Supported Connections**

Table 4.19 outlines those features of the synchronous connection which shall be supported by both devices if the Codec Connection setup procedure and wide band speech service using a mandatory wide band speech codec are selected.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD using HV1 packets (D0)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>CVSD using HV3 packets (D1)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>3</td>
<td>CVSD using eSCO EV3 packets (S1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>4</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>No</td>
<td>Feature</td>
<td>Description</td>
</tr>
<tr>
<td>----</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>5</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S3)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters.</td>
</tr>
<tr>
<td>6</td>
<td>Transparent data using eSCO EV3 packets (T1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec.</td>
</tr>
<tr>
<td>7</td>
<td>Transparent data using eSCO EDR 2-EV3 packets (T2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec.</td>
</tr>
<tr>
<td>8</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S4)</td>
<td>Support for these settings is applicable when using HPF v1.7 or later. See [2] for details on the eSCO parameters.</td>
</tr>
</tbody>
</table>

**Table 4.19**

- **Expected Outcome**

  **Pass verdict**

  AG successfully establishes a full duplex audio connection between the HF and AG using the Codec Connection Setup procedure. CVSD shall be supported between the HF and AG when using the Codec Connection setup procedure. mSBC shall be supported if the wide band speech service is supported by both the HF and AG:

  - A single codec negotiated during the codec connection setup procedure is used throughout the synchronous connection.

**4.28.9 HFP/AG/ACC/BV-09-I [Codec Connection Setup Failure – HF Initiated]**

- **Test Purpose**

  To verify the capability of the AG accepting a full duplex audio connection with a HF using the legacy audio connection setup procedure.

  HF: HF initiates a legacy audio connection to the AG.

  AG: IUT is the AG. AG shall accept the legacy audio connection attempt from the HF.

- **Reference**

  [2] 4.11

- **Initial Condition**

  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT shall determine whether the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records before attempting any audio connection.
• **Test Procedure**

**HF:** IUT shall initiate a full duplex audio connection with the AG using the legacy audio connection setup procedure in [2]. The HF successfully initiates the legacy audio connection to the AG in Figure 4.16.

![Diagram of audio connection process]

*Figure 4.16: HF initiates a legacy audio connection successfully*

**AG:** AG shall accept a full duplex audio connection with the HF using the legacy audio connection setup procedure.

• **Expected Outcome**

**Pass verdict**

Full duplex audio is available between the HF and AG. The audio connection can be SCO or eSCO depending on the supported features of the AG device.

4.28.10 **HFP/AG/ACC/BV-10-I [Codec Connection Setup– AG Initiated]**

• **Test Purpose**

To verify the capability of the AG of initiating a working Codec Connection Setup successfully with a HF, the HF supports the Codec Connection Setup procedure before attempting any audio connection

**HF:** The HF shall accept the Codec Connection Setup attempt.

**AG:** AG is the IUT. AG shall initiate the Codec Connection Setup attempt.

• **Reference**

[2] 4.11

• **Initial Condition**

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT shall determine whether the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records.
• **Test Procedure**

The test only needs to be run once. **Table 4.20** outlines the codecs which shall be supported by both devices if the wide band speech service is supported. For the purposes of this test either may be selected.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>mSBC</td>
<td>Mandatory if wide band speech is supported</td>
</tr>
</tbody>
</table>

**Table 4.20**

Optional wide band speech codecs may also be used if supported by the IUT.

**AG:** AG shall initiate a full duplex audio connection with the HF using the Codec Connection Setup procedure. The AG successfully initiates the Codec Connection request in **Figure 4.17** below.

![Codec Connection Setup Diagram](attachment:image.png)

**Figure 4.17:** AG initiates the Codec Connection setup procedure successfully

**HF:** IUT shall accept a full duplex audio connection with the AG using the Codec Connection Setup procedure in [2].
Supported Connections

Table 4.21 outlines those features of the synchronous connection which shall be supported by both devices if the Codec Connection setup procedure and wide band speech service using a mandatory wide band speech codec are selected.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD using HV1 packets (D0)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>CVSD using HV3 packets (D1)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>3</td>
<td>CVSD using eSCO EV3 packets (S1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>4</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>5</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S3)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters.</td>
</tr>
<tr>
<td>6</td>
<td>Transparent data using eSCO EV3 packets (T1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec</td>
</tr>
<tr>
<td>7</td>
<td>Transparent data using eSCO EDR 2-EV3 packets (T2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec</td>
</tr>
<tr>
<td>8</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S4)</td>
<td>Support for these settings is applicable when using HPF v1.7 or later. See [2] for details on the eSCO parameters.</td>
</tr>
</tbody>
</table>

Table 4.21

- Expected Outcome

  Pass verdict

  AG successfully initiated the synchronous connection for the codec connection setup procedure to the HF device. Full duplex audio is available between the HF and AG using the Codec Connection Setup procedure. CVSD shall be supported between the HF and AG when using the Codec Connection setup procedure. mSBC shall be supported if the wide band speech service is supported by both the HF and AG. A single codec negotiated during the codec connection setup procedure is used throughout the synchronous connection.

4.28.11  HFP/AG/ACC/BV-11-I [Codec Connection Setup following an initial successful Codec Connection Setup – AG Initiated]

- Test Purpose

  To verify the capability of the AG initiating a full duplex audio connection using the Codec Connection Setup procedure. The AG has already successfully initiated a codec connection setup procedure with the HF device and is not required to alert the HF device if the codec to use if this remains unchanged.
AG: IUT is the AG. AG initiates the Codec Connection Setup. This connection attempt follows an already successful Codec Connection Setup procedure and the same codec shall be used for this connection attempt.

HF: HF has already successfully established a working Codec Connection Setup and is no longer required to alert the AG device as to the codec to be used for subsequent codec connection setup procedures if the same codec is used.

- Reference
  [2] 4.11

- Initial Condition
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT has already determined the remote device can support the Codec Connection setup procedure using the AT+BRSF and/or SDP records. The AG and HF devices have already successfully initiated a working codec connection setup procedure.

- Test Procedure
  The table below outlines the codecs which shall be supported by both devices if the wide band speech service is supported.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>mSBC</td>
<td>Mandatory if wide band speech is supported</td>
</tr>
</tbody>
</table>

*Table 4.22*

Optional wide band speech codecs may also be used if supported by the IUT.

HF: HF shall accept a full duplex audio connection from an AG using the Codec Connection Setup in [2].

AG: AG shall initiate a full duplex audio connection with the HF using the Codec Connection Setup in [2]. The AG successfully initiates the Codec Connection request in Figure 4.18. As the codec has already been successfully negotiated in the initial Codec Connection Setup procedure the AG does not alert the HF device as to the codec to be used for this Codec Connection Setup.
Synchronous Connection Setup
Established Codec Connection
The presence of a new connection is notified

SLC Established, Codec Selected,
Audio Connection Established and Released

Figure 4.18: AG initiates the Codec Connection setup procedure successfully

Supported Connections

Table 4.23 outlines those features of the synchronous connection which shall be supported by both devices if the Codec Connection setup procedure and wide band speech service using a mandatory wide band speech codec are selected.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD using HV1 packets (D0)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>CVSD using HV3 packets (D1)</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>3</td>
<td>CVSD using eSCO EV3 packets (S1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>4</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>5</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S3)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters</td>
</tr>
<tr>
<td>No</td>
<td>Feature</td>
<td>Description</td>
</tr>
<tr>
<td>----</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>6</td>
<td>Transparent data using eSCO EV3 packets (T1)</td>
<td>Only if eSCO is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec.</td>
</tr>
<tr>
<td>7</td>
<td>Transparent data using eSCO EDR 2-EV3 packets (T2)</td>
<td>Only if eSCO and EDR is supported by the devices, see [2] for details on the eSCO parameters. These settings are only applicable when using the mSBC codec.</td>
</tr>
<tr>
<td>8</td>
<td>CVSD using eSCO EDR 2-EV3 packets (S4)</td>
<td>Support for these settings is applicable when using HPF v1.7 or later. See [2] for details on the eSCO parameters.</td>
</tr>
</tbody>
</table>

Table 4.23:

- **Expected Outcome**
  
  **Pass verdict**
  
  Full duplex audio is available between the HF and AG using the Codec Connection Setup. The codec use is the same as that used in the previous connection.

**4.28.12 HFP/AG/ACC/BI-12-I [Codec Connection Setup failure due to invalid eSCO parameters]**

- **Test Purpose**
  
  To verify the AG successfully initiates Codec Connection Setup and does not abandon the establishment of eSCO transport without attempting the use of “safe settings” parameters.

  **HF (Lower Tester):** HF shall be configured so that the first eSCO request shall be accepted with invalid parameters which shall make the parameter negotiation fail. The 2nd and further eSCO requests shall be accepted with valid parameters.

  **AG (IUT):** AG initiates the Codec Connection Setup procedure. The Codec Connection Setup procedure fails due to invalid eSCO parameters between the HF and AG device. The AG shall repeat the eSCO connection setup process, before giving up the AG shall have attempted to request at LMP the use of “safe settings” for the given codec, as specified in Table 5.9 and Table 5.11 in [2] and Section 5.7.1 in [7].

- **Reference**
  
  [2] 4.11

  [7] 5.7.1

- **Initial Condition**
  
  The Lower Tester (HF) is configured not to support BR/EDR Secure Connections, hence ensuring that the Secure Connections feature is not used on the connection during the test.

  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT has already determined the remote device can support the Codec Connection setup procedure using the AT+BRSF and/or SDP records.
• Test Procedure

This test only needs to be run once. Table 4.24 outlines the codecs which shall be supported by both devices if the wide band speech service is supported. For the purposes of this test either codec may be selected.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD</td>
<td>Mandatory to support in [2]</td>
</tr>
<tr>
<td>2</td>
<td>mSBC</td>
<td>Mandatory if wide band speech is supported</td>
</tr>
</tbody>
</table>

*Table 4.24*

Optional wide band speech codecs may also be used if supported by the IUT.

AG: IUT shall initiate a full duplex audio connection with the HF using the Codec Connection Setup in [2]. The AG successfully initiates the Codec Connection request in Figure 4.19 after an initial failure due to invalid synchronous connection parameters from the HF device.

HF: HF shall accept a full duplex audio connection from an AG using the Codec Connection Setup in [2]. However during this first attempt the HF device shall use invalid eSCO parameters during the synchronous connection phase.

After the unsuccessful attempt to establish a full duplex audio connection the HF device shall accept a full duplex audio connection from an AG using the “safe settings” parameters.
Figure 4.19: AG initiates the Codec Connection setup procedure successfully on second attempt

Supported Connections

Table 4.25 defines the expected safe settings that the IUT is expected to choose as part of the pass verdict.

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CVSD using eSCO EV3 packets (S1)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Transparent data using eSCO EV3 packets (T1)</td>
<td>These settings are only applicable when using the mSBC codec</td>
</tr>
</tbody>
</table>

Table 4.25: Supported Connections
• Expected Outcome

Pass verdict

AG successfully initiated the synchronous connection for the codec connection setup procedure to the HF device. AG successfully requests the use of “safe settings” to complete the codec connection procedure to the HF device after the initial synchronous connection failure.

Full duplex audio is available between the HF and AG using the Codec Connection Setup procedure.

4.28.13 HFP/AG/ACC/BI-13-I [Codec Connection Setup failure, codec currently unavailable on the HF device]

• Test Purpose

To verify the capability of the AG to accept an updated list of supported codecs in the event the currently negotiated codec becomes unavailable on the HF device during a codec connection setup procedure.

HF: HF device does not support the currently selected codec causing the Codec Connection Setup procedure to fail.

AG: IUT is an AG. The AG initiates the Codec Connection Setup process. The codec connection setup procedure fails because the HF device cannot support the currently selected codec. If no optional codecs are supported the CVSD codec shall be selected.

• Reference

[2] 4.11

• Initial Condition

An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT has already determined the remote device can support the Codec Connection setup procedure using the AT+BRSF and/or SDP records.

• Test Procedure

HF: HF shall refuse the currently selected codec as unavailable from the AG device during the codec connection setup procedure.

AG: AG shall initiate a full duplex audio connection with the HF using the Codec Connection Setup in [2]. The currently selected codec from the AG shall be refused by the HF device as unavailable.
The presence of a new connection is notified

**Figure 4.20:** AG initiates the Codec Connection setup procedure; the HF device refuses the currently selected codec as unavailable

- **Expected Outcome**

  **Pass verdict**

  AG accepts the updated supported codec list from the HF device during the codec connection setup procedure. AG successfully creates a full duplex audio connection using the codec connection procedure to the HF device following this failure.

  A single codec negotiated during the codec connection setup procedure is used throughout the synchronous connection

### 4.28.14  HFP/AG/ACC/BI-14-I [Codec Connection Setup failure, WBS codecs currently unavailable on the HF device]

- **Test Purpose**

  To verify the capability of the AG to accept an updated list of supported codecs indicating the availability of CVSD only in the event the currently negotiated codec becomes unavailable on the HF device during a codec connection setup procedure.
AG: IUT is an AG. AG initiates the Codec Connection Setup procedure. The codec connection setup procedure fails because the HF device cannot in this instance support the currently selected WBS codec.

- Reference
  
  [2] 4.11

- Initial Condition
  
  An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT has already determined the remote device can support the Codec Connection setup procedure using the AT+BRSF and/or SDP records.

- Test Procedure
  
  HF: HF shall refuse the currently selected codec as unavailable from the AG device during the codec connection setup procedure. Upon re-negotiation the HF shall only indicate support for CVSD.

  AG: AG shall initiate a full duplex audio connection with the HF using the Codec Connection Setup in [2]. The currently selected codec from the AG shall be refused by the HF device as unavailable.

---

**Figure 4.21:** AG initiates the Codec Connection setup procedure; the HF device refuses the currently selected codec as unavailable.
• Expected Outcome

Pass verdict
AG accepts the updated supported codec list indicating support for CVSD only from the HF device during the codec connection setup procedure. AG successfully creates a full duplex audio connection using the CVSD codec to the HF device following this failure. CVSD is used throughout the synchronous connection.

4.28.15 HFP/AG/ACC/BV-15-I [Codec Connection Setup Failure – AG Initiated]

• Test Purpose
To verify the capability of the AG successfully initiating a legacy audio connection setup with a HF, the HF does not support the Codec Connection Setup procedure

HF: The HF does not support the Codec Connection Setup procedure and shall only accept a connection from the AG using the legacy connection method.

AG: IUT is the AG. AG initiates a connection with the HF device using the legacy connection method.

• Reference
[2] 4.11

• Initial Condition
An SLC is established between the IUT and Lower Tester, there are no Synchronous Connections established. The IUT shall determine whether the remote device can support the Codec Connection setup procedure using the AT+BRSF and SDP records before attempting any audio connection.

• Test Procedure
HF: The HF shall accept a full duplex audio connection with the AG using the legacy audio connection setup procedure

AG: AG shall initiate a full duplex audio connection with the HF using the legacy audio connection setup procedure to the HF. The audio connection setup may result in a SCO or eSCO connection between the AG and HF depending on the supported features of the HF and the AG. The
AG successfully initiates the legacy audio connection to the AG in Figure 4.22.

**Figure 4.22:** AG successfully negotiates a legacy audio connection

- **Expected Outcome**
  
  **Pass verdict**
  
  AG establishes a connection with the HF using the legacy connection method. Full duplex audio is available between the HF and AG. The audio connection can be SCO or eSCO depending on the supported features of the AG device.

### 4.29 Wide Band Speech Support

Tests for confirming the device is supporting the wide band speech service correctly.

Tests in this section are defined as Interoperability tests so that the details of the message exchanges may be verified. Typically, the IUT will be connected to a Lower Tester device that emulates the opposite end of the Bluetooth link.

#### 4.29.1 HFP/AG/WBS/BV-01-I [Verify AG SDP record correctly reflects support for the wide band speech service]

- **Test Purpose**
  
  To verify that a HFP device can determine support for the wide band speech service on an AG via the AG’s SDP record.

- **Reference**
  
  [2] 5.3

- **Initial Condition**
  
  Devices are turned on and in range.

  Devices may need to be paired together.

  An HFP connection may or may not be established between the HF and AG device.
If no connection exists the AG device is in connectable mode.

- **Test Procedure**
  
  An SDP connection is initiated from the HF device to the AG, the HFP AG SDP record which includes the support features attribute is sent to the HF device.

- **Expected Outcome**
  
  **Pass verdict**
  
  The test passes if all of the pass criteria below are observed.

If the AG device supports the wide band speech service, its HFP AG SDP record shall include support for the wide band speech bit in the supported features attribute of the service record. This bit shall be set to 1 to indicate support for the wide band speech service.

<table>
<thead>
<tr>
<th>Bit position (0=LSB)</th>
<th>Feature</th>
<th>Default in AG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Three way calling (yes/no, 1 = yes, 0 = no)</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>EC and/or NR function (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Voice recognition function (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>In-band ring tone capability (yes/no, 1 = yes, 0 = no)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Attach a phone number to a voice tag (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Wide band speech (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
</tbody>
</table>

*Table 4.26*

- **Notes**
  
  Some devices will de-register their SDP records once the HFP is connected. The reason for this being the service is now not available to other available HFP devices, in which case this test may only pass when the HFP service is not connected.

**4.29.2 HFP/HF/WBS/BV-02-I [Verify the HF SDP record correctly reflects support for the wide band speech service]**

- **Test Purpose**
  
  To verify that an AG device can determine support for the wide band speech service on an HF via the AG’s SDP record.

- **Reference**
  
  [2] 5.3

- **Initial Condition**
  
  Devices are turned on and in range.
Devices may need to be paired together.

A HFP connection may or may not be established between the HF and AG device.

If no connection exists the HF device is in connectable mode.

• Test Procedure

An SDP connection is initiated from the AG device to the HF, the HFP HF SDP record which includes the support features attribute is sent to the AG device.

• Expected Outcome

Pass verdict

The test passes if all of the pass criteria below are observed.

If the HF device supports the wide band speech service, its HFP HF SDP record shall include support for the wide band speech bit in the supported features attribute of the service record. This bit shall be set to 1 to indicate support for the wide band speech service.

<table>
<thead>
<tr>
<th>Bit position (0=LSB)</th>
<th>Feature</th>
<th>Default in HF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>EC and/or NR function (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>Three way calling (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>CLI presentation capability (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Voice recognition activation (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Remote volume control (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Wide band speech (yes/no, 1 = yes, 0 = no)</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4.27

• Notes

Some devices will de-register their SDP records once the HFP is connected. The reason for this being the service is now not available to other available HFP devices, in which case this test may only pass when the HFP is not connected.

4.29.3 HFP/HF/WBS/BV-03-I [Verify HF device correctly supports codec renegotiation during SLC]

• Test Purpose

At any time during an SLC the HF device may update the list of supported codecs on the HF device; the AG device shall then use one of the updated lists in subsequent codec connection setup procedures.

• Reference

[2] 4.2
• **Initial Condition**
  A HFP connection is established between the HF and AG device
  A synchronous connection may or may not be established between both devices.

• **Test Procedure**
  The HF device at any time during the SLC shall send the AT+BAC AT command to update the list of supported codecs on the HF device.

![Diagram showing the flow of communication between HF and AG](image)

**Figure 4.23:** HF re-negotiates the list of supported codecs

The AG shall use the updated list of supported codecs of the HF device in the next codec connection setup procedure.

• **Expected Outcome**
  **Pass verdict**
  The HF was able to send AT+BAC with an updated codec list.

### 4.30 Individual Indicators Activation

The purpose of these tests is to verify that the AG correctly implements the AT+BIA command by notifying, or not-notifying, the HF of a specific indicator as directed by the HF.

#### 4.30.1 Individual Indicators Activation

Verify that the individual indicator activation feature works on the AG and HF devices as defined.

**4.30.1.1 HFP/AG/IIA/BV-01-I [Activate all indicators using a fixed string]**

• **Test Purpose**
  AG: Verify that the HF device can activate all indicators using a fixed string.

• **Reference**
  [2] 4.33, 4.34

• **Initial Condition**
  A Service Level Connection between the HF and the AG is established.
  An AT+BIA command has previously been sent by HF to deactivate all non-mandatory indicators.
• Test Procedure

The HF (Lower Tester) shall send an ‘activate all indicators’ AT+BIA command to the AG (IUT). This command shall be a fixed string containing all indicators set to 1. The number of indicators in the command is the maximum allowed by the HFP specification, defined in 4.33.2, AT+CIND command. The command used shall be:

AT+BIA=1,1,1,1,1,...,1

Using a test device, simulate the presence of a control channel of a cellular network, such that the AG is registered.

Disable the control channel. The AG is de-registered.

Adjust the battery level on the AG to a level that should cause a battery level indication to be sent to the HF.

• Expected Outcome

Pass verdict

An OK is sent by AG upon AT+BIA command reception.

When service is modified, the AG sends the corresponding indicator.

When battery level is modified, the AG sends the corresponding indicator.

4.30.1.2 HFP/AG/IIA/BV-02-I [Activate only service indicator]

• Test Purpose

AG: Verify that the HF device can activate the service indicator on the AG and leave the other indicators’ status unchanged.

• Reference

[2] 4.33, 4.34

• Initial Condition

A Service Level Connection between the HF and the AG is established.

An AT+BIA command has previously been sent by HF to deactivate all non-mandatory indicators

• Test Procedure

The HF (Lower Tester) shall send an AT+BIA command to the AG (IUT) to activate only the service indicator. The command used shall be:

AT+BIA=,,,1,,, with the ‘1’ at the place of the service indicator, according to the mapping of the AG implementation.

Adjust the battery level on the AG to a level that should cause a battery level indication to be sent to the HF.
Use a test device to simulate the presence of a control channel of a cellular network, such that the AG is registered.

Disable the control channel. The AG is de-registered.

- **Expected Outcome**
  
  **Pass verdict**

  An OK is sent by AG upon AT+BIA command reception.

  When service is toggled, the AG sends the corresponding indicator.

  The AG does not send a battery level indication.

  No non-mandatory indicators are sent by the AG.

4.30.1.3 HFP/AG/IIA/BV-03-I [Activate only roaming status indicator]

- **Test Purpose**

  AG: Verify that the HF (Lower Tester) device can activate the roaming indicator on the AG (IUT) and leave the other indicators’ status unchanged.

- **Reference**

  [2] 4.33, 4.34

- **Initial Condition**

  A Service Level Connection between the HF and the AG is established.

  An AT+BIA command has previously been sent by HF to deactivate all non-mandatory indicators EXCEPT the signal strength indicator.

- **Test Procedure**

  The HF shall send a BIA command to the IUT to activate only the roaming indicator. The command used shall be:

  \( \text{AT+BIA=}, \ldots, 1, \ldots \) with the ‘1’ at the place of the roaming indicator, according to the mapping of the AG implementation.

  Adjust the battery level on the AG to a level that should cause a battery level indication to be sent to the HF.

  Impair the signal to the AG so that a reduction in signal strength can be observed.

  Cause the AG to register on a network other than the home network.

  Cause the AG to register on the home network.

- **Expected Outcome**

  **Pass verdict**

  An OK is sent by AG upon BIA command reception.
When roaming is toggled, the AG sends the corresponding indicator.

When signal strength is modified, the AG sends the corresponding indicator.

When battery level is modified, the AG does not send a battery level indication.

No other non-mandatory indicators are sent by the AG.

4.30.1.4 HFP/HF/IIA/BV-04-I [Activate or deactivate specific indicators]

- **Test Purpose**
  
  HF: Verify that the HF device can send a correctly formatted command to activate or deactivate some indicators.

- **Reference**
  
  [2] 4.33, 4.34

- **Initial Condition**
  
  A Service Level Connection between the HF and the AG is established.

- **Test Procedure**
  
  The HF (IUT) sends an AT+BIA command to the AG (Lower Tester).

- **Expected Outcome**
  
  Pass verdict
  
  An OK is sent by the AG to the HF upon AT+BIA command reception.

4.30.1.5 HFP/AG/IIA/BV-05-I [Activate only battery level indicator]

- **Test Purpose**
  
  AG: Verify that the HF (Lower Tester) device can activate the battery level indicator on the AG (IUT) and leave the other indicators’ status unchanged.

- **Reference**
  
  [2] 4.33, 4.34

- **Initial Condition**
  
  A Service Level Connection between the HF and the AG is established.

  An AT+BIA command has previously been sent by HF to deactivate all non-mandatory indicators.

- **Test Procedure**
  
  1. The HF shall send a BIA command to the IUT to activate only the battery level indicator.
     
     The command used shall be:

     \[
     \text{AT+BIA} =,,,\ldots,1,,
     \]

     with the ‘1’ at the place of the battery level indicator, according to the mapping of the AG implementation.
2. Adjust the battery level on the AG to a level that should cause a battery level indication to be sent to the HF.

3. Take action to make a change that normally would trigger a change in a non-mandatory indicator, e.g., impair the signal to the AG so that a reduction in signal strength can be observed.

   • Expected Outcome
     
     Pass verdict

     An OK is sent by AG upon BIA command reception.

     When battery level is changed, the AG sends the corresponding indicator.

     No other non-mandatory indicators are sent by the AG.

4.30.2 Individual Indicators Deactivation

Verify that the individual indicator de-activation feature works on the AG and HF devices as defined.

4.30.2.1 HFP/AG/IID/BV-01-I [Deactivate all non-mandatory indicators using a fixed string]

   • Test Purpose
     
     AG: Verify that the HF device can deactivate all the indicators using a fixed string.

   • Reference

     [2] 4.33, 4.34

   • Initial Condition

     A Service Level Connection between the HF and the AG is established.

     An AT+BIA command has previously been sent by HF to activate all the indicators, or no AT+BIA command has been sent after Service Level Connection establishment.

   • Test Procedure

     The HF (Lower Tester) shall send an AT+BIA command to the AG (IUT) to deactivate all indicators. This command shall be a fixed string containing all indicators set to 0. The number of indicators in the command is the maximum allowed by the HFP specification, defined in 4.33.2 in [2], AT+CIND command. The command used shall be:

     \[
     \text{AT+BIA=0,0,0,0, ...,0}
     \]

     Impair the signal to the AG so that a reduction in signal strength can be observed.

     Then, an incoming call is received and answered on AG.

   • Expected Outcome

     Pass verdict

     An OK is sent by AG upon AT+BIA command reception.

     During the call set up and call, the correct call set up and call indicators are sent by AG.

     No non-mandatory indicators are sent by the AG.
4.30.2.2  HFP/AG/IID/BV-02-I [Deactivate only signal strength indicator]

- Test Purpose
  AG: Verify that the HF (Lower Tester) device can deactivate the signal strength indicator on the AG (IUT) and leave the other indicators’ status unchanged.

- Reference
  [2] 4.33, 4.34

- Initial Condition
  A Service Level Connection between the HF and the AG is established.

  An AT+BIA command has previously been sent by HF to activate all indicators, or no AT+BIA command has been sent after Service Level Connection establishment.

- Test Procedure
  The HF sends a BIA command to the AG to deactivate only the signal strength indicator. The command used shall be:

  AT+BIA=,,,....,0,,, with the ‘0’ at the place of the signal strength indicator, according to the mapping of the AG implementation.

  Impair the signal to the AG so that a reduction in signal strength can be observed.

  Cause the AG to register on a network other than the home network.

  Cause the AG to register on the home network.

- Expected Outcome
  Pass verdict
  An OK is sent by AG upon AT+BIA command reception.

  When roaming is toggled, the AG sends the corresponding indicator.

  The signal strength indicator is not sent by AG.

4.30.2.3  HFP/AG/IID/BV-03-I [Deactivate only battery level status indicator and the signal strength indicator]

- Test Purpose
  AG: Verify that the HF (Lower Tester) device can deactivate the battery level status indicator and the signal strength status indicator on the AG (IUT) and leave the other indicators status unchanged.

- Reference
  [2] 4.33, 4.34

- Initial Condition
  A Service Level Connection between the HF and the AG is established.
An AT+BIA command has previously been sent by HF to activate all indicators.

- **Test Procedure**

The HF sends an AT+BIA command to the AG to deactivate only the signal strength indicator and the battery level indicator. The command used shall be:

AT+BIA=,,...,0,0,, with the two '0's at the place of the signal strength and battery indicators, according to the mapping of the AG implementation.

Impair the signal to the AG so that a reduction in signal strength can be observed.

Adjust the battery level on the AG to a level that should cause a battery level indication to be sent to the HF.

Take action to make a change that normally would trigger a change in a non-mandatory indicator, e.g., force the AG to disable the presence of a cellular network.

- **Expected Outcome**

**Pass verdict**

An OK is sent by AG upon AT+BIA command reception.

The signal strength indicator is not sent by AG.

The battery level indicator is not sent by AG.

When the change in status of the activated non-mandatory indicator occurs, the corresponding indicator is sent by the AG.

### 4.30.2.4 HFP/AG/IID/BV-04-I [Deactivate only signal strength indicator – Battery status reported]

- **Test Purpose**

AG: Verify that the HF (Lower Tester) device can deactivate the signal strength indicator on the AG (IUT) while battery status remains an active indicator and all other indicators status is left unchanged.

- **Reference**

[2] 4.33, 4.34

- **Initial Condition**

A Service Level Connection between the HF and the AG is established.

An AT+BIA command has previously been sent by HF to activate all indicators, or no AT+BIA command has been sent after Service Level Connection establishment.

- **Test Procedure**

1. The HF sends a BIA command to the AG to deactivate only the signal strength indicator.

   The command used shall be:
AT+BIA=,,...,0,, with the ‘0’ at the place of the signal strength indicator, according to the mapping of the AG implementation.

2. Impair the signal to the AG so that a reduction in signal strength would be observed if the indicator were active.

3. Cause the AG to change its reported battery level.

• Expected Outcome

   Pass verdict
   An OK is sent by AG upon AT+BIA command reception.

   When the battery level is changed, the AG sends the correct battery level to the AG.

   The signal strength indicator is not sent by AG when the Lower Tester forces a change in the received signal strength on the AG.

4.30.3 Individual Indicators Conflicts

Verify that the AT+BIA command operates correctly with other commands.

4.30.3.1 HFP/AG/IIC/BV-01-I [Standard event reporting off and all indicators activated]

• Test Purpose

   Verify that standard event reporting remains off even if indicators are activated individually

• Reference

   [2] 4.33, 4.34

• Initial Condition

   A Service Level Connection between the HF (Lower Tester) and the AG (IUT) is established.

   An AT+BIA command has previously been sent by HF to activate all the indicators, or no AT+BIA command has been sent after Service Level Connection establishment.

• Test Procedure

   The HF sends the command:

   AT+CMER=3,0,0,0

   to the AG to deactivate events reporting.

   The HF sends an AT+BIA command to the AG to activate every indicator.

   Initiate an incoming call to the AG.

• Expected Outcome

   Pass verdict
   No indicator is sent.
4.30.3.2 HFP/AG/IIC/BV-02-I [Register individual indicators configuration when standard event reporting is OFF]

• Test Purpose
  Verify that individual indicator configuration is registered when standard event reporting is off, and that the AG properly sets this configuration when standard event reporting is turned on. A complex configuration shall be used to make sure the AG does not set a default configuration.

• Reference
  [2] 4.33 and 4.34

• Initial Condition
  A Service Level Connection between the HF (Lower Tester) and the AG (IUT) is established.

  An AT+BIA command has previously been sent by HF to activate all the indicators, or no AT+BIA command has been sent after Service Level Connection.

• Test Procedure
  1. The HF sends an AT+BIA command to the AG to deactivate all the indicators.
  2. The HF sends an AT+CMER=3,0,0,0 to the AG to deactivate the events reporting.
  3. The HF sends an AT+BIA to the AG command to activate all indicators except battery level.
  4. The HF sends an AT+CMER=3,0,0,1 to the AG to activate the events reporting.
  5. Adjust the battery level on the AG to a level that should cause a battery level indication to be sent to the HF.
  6. Use a test device to simulate the presence of a control channel of a cellular network, such that the AG is registered.
  7. Disable the control channel. The AG is de-registered.

• Expected Outcome
  Pass verdict
  For every AT+BIA and AT+CMER command, an OK is sent back.

  When service is toggled, the AG sends the corresponding indicator.

  The battery level indicator is not sent by AG.

4.30.3.3 HFP/AG/IIC/BV-03-I [Standard indicator read command still works when indicators are deactivated]

• Test Purpose
  Verify that the standard indicator read command returns correct values even if indicators are deactivated individually.

• Reference
  [2] 4.33, 4.34
• Initial Condition

A Service Level Connection between the HF (Lower Tester) and the AG (IUT) is established.

An AT+BIA command has previously been sent by HF to activate all the indicators, or no AT+BIA command has been sent after Service Level Connection.

• Test Procedure

The HF sends an AT+BIA command to the AG to deactivate every indicator.

Use a test device to simulate the presence of a control channel of a cellular network, such that the AG is registered.

Disable the control channel. The AG is de-registered.

Impair the signal to the AG so that a reduction in signal strength can be observed.

The Lower Tester sends an AT+CIND query to the AG.

• Expected Outcome

Pass verdict

The correct signal strength value is sent in the CIND response.

The correct service value is sent in the CIND response.

### 4.31 Inquiry and Discoverability

To verify that the HF can be placed in discoverable and connectable mode and the AG can search for the HF device and connect with it.

#### 4.31.1 Verify inquiry and discoverability

• Test Case ID(s)

**HFP/HF/DIS/BV-01-I**

**HFP/AG/DIS/BV-01-I**

• Test Purpose

**HF:** To verify that the HF, following the manufacturer specific procedure, can be placed in discoverable and connectable mode.

**AG:** To verify that the AG can search for the HF device and connect with it.

• Reference

[6] 6.1, 6.3

• Initial Condition

AG and HF devices are not paired with each other.

• Test Procedure

**HF:** Using manufacturer specific operation, bring the HF device into discoverable mode.
Accept the incoming pairing and connection requests if prompted, or configure it to auto-accept.

AG: Using manufacturer specific operation search for the HF device and connect with it.

Perform the necessary operations needed for pairing with HF if requested.

- Test Condition
  Both devices are not initialized as defined in Section 3.4.

- Expected Outcome
  **Pass verdict**
  The HF device can be placed in discoverable mode
  The AG device can find the HF device
  The AG device is successfully connected with the HF device
  Pairing is successful if initiated by AG or HF.

### 4.32 HF Indicators

The exchange of supported HF indicators is tested in the Service Level Connection (SLC) establishment section. In this section we test the exchange of value updates and the unsolicited enabling/disabling of HF indicators.

#### 4.32.1 HFP/HF/HFI/BV-01-I [HF sends an updated HF indicator value]

- **Test Purpose**
  This test verifies that an IUT (HF) can correctly send an updated value for a HF indicator.

- **Reference**
  [7] 4.2, 4.35

- **Initial Condition**
  Devices are turned on, paired and in range.

  A SLC has been established between both devices with HF Indicators are supported.

  The devices have at least one HF Indicator in common (<HF Indicator>).

  The initial state of the Indicator is enabled

- **Test Procedure**
  The HF and AG successfully complete sequence shown in Figure 4.24.
**Expected Outcome**

**Pass verdict**
The test verdict is Pass if all of the pass criteria below are observed.

1. The HF was able to update the value of an HF Indicator using AT+BIEV.
2. The HF did not send updates for deactivated HF Indicators.
3. The HF generates the messages in the order and number as indicated in Figure 4.24. Each is correctly formatted.

**Notes**
The internal events that trigger the AT+BIEV updates are implementation specific.

**4.32.2 HFP/AG/HFI/BV-02-I [AG receives an updated HF indicator value]**

**Test Purpose**
This test verifies that an IUT (AG) can correctly receive an updated value for a HF indicator.

**Reference**
[7] 4.2, 4.35

**Initial Condition**
Devices are turned on, paired and in range.
A SLC has been established between both devices with HF Indicators are supported.

The devices have at least one HF Indicator in common.

- **Test Procedure**
  1. If the Initial state of the HF Indicator is disabled, the AG shall enable the HF indicator.
  2. When the HF Indicator is enabled, the Lower Tester (HF) shall send updates for the Indicator as described in Figure 4.25.

![Diagram](image)

**Figure 4.25:** HFP/AG/HFI/BV-02-I: AG receives updated HF Indicator values

- **Expected Outcome**
  - **Pass verdict**
    The test passes if all of the pass criteria below are observed.
    - The AG was able to receive updated values of an HF Indicator using AT+BIEV.

4.32.3 HFP/AG/HFI/BI-03-I [AG receives invalid updated HF indicator values]

- **Test Purpose**
  This test verifies that an IUT (AG) can correctly handle illegal HF indicators sent by the Lower Tester (HF).

- **Reference**
  [7] 4.2, 4.35

- **Initial Condition**
  Devices are turned on, paired and in range.
A SLC has been established between both devices with HF Indicators are supported.

The devices have at least one HF Indicator in common.

• Test Procedure
  1. The AG may temporarily disable the HF indicator status for <Supported HF Indicator 1>.
  2. When the HF Indicator is enabled, the Lower Tester (HF) shall send updates for the Indicator as described in Figure 4.26.
  3. The Lower Tester shall use <Unsupported HF Indicator 1>, <Supported HF Indicator 1>, <value1>, and <illegal value1> values from the HFP IXIT [3].

Figure 4.26: HFP/AG/HFI/BI-03-I: AG receives invalid HF Indicator values

• Expected Outcome
  Pass verdict
  The test passes if all of the pass criteria below are observed.

  The AG was able to receive invalid updated values.

  The AG did not terminate the connection and is still functional.
The AG responded with OK to AT+BIEV=< Supported HF Indicator 1>,<value1> if the indicator was enabled, or ERROR if it was disabled.

The AG responded with ERROR to AT+BIEV=<Unsupported HF Indicator >,<value1>

The AG responded with ERROR or OK to AT+BIEV=<Supported HF Indicator 1>,<illegal value1> where <illegal value1> was outside the range of valid values.
5 Test Case Mapping

The Test Case Mapping Table (TCMT) maps test cases to specific capabilities in the ICS. Profiles, protocols, and services may define multiple roles, and it is possible that a product may implement more than one role. The product shall be tested in all roles for which support is declared in the ICS document.

The columns for the TCMT are defined as follows:

- **Item** contains an y/x reference, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS Proforma for Hands-Free Profile (HFP) [3]. If the item is defined with Protocol, Profile or Service abbreviation before y/x, the table and feature number referenced are defined in the abbreviated ICS proforma document.

- **Feature**: recommended to be the primary feature defined in the ICS being tested or may be the test case name.

- **Test Case(s)**: the applicable test case identifiers required for Bluetooth Qualification if the corresponding y/x references defined in the Item column are supported.

For purpose and structure of the ICS/IXIT proforma and instructions for completing the ICS/IXIT proforma refer to the Bluetooth ICS and IXIT proforma document.

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<td>Phone status information: Transfer of registration status</td>
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<td>Phone status information: Transfer of call status</td>
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<td>Phone status information: signal strength</td>
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<td>Phone status information: Operator selection</td>
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<tr>
<td>HFP 2/3a</td>
<td>AG is IUT, AG Initiated, HF is SCO only</td>
<td>HFP/AG/ACS/BV-02-I</td>
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<td>HFP 2/3</td>
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<td>HFP 2/3a</td>
<td>AG is IUT, AG Initiated, HF has eSCO, allows only SCO</td>
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<tr>
<td>HFP 3/3a</td>
<td>HF is IUT, HF Initiated, AG has eSCO</td>
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<td>HFP 3/3a</td>
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<td>Accept an incoming voice call (AG)</td>
<td>HFP/AG/ICA/BV-06-I</td>
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<td>HFP 3/4a OR HFP 3/4b</td>
<td>Accept an incoming voice call (AG)</td>
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<tr>
<td>HFP 3/4a</td>
<td>Accept an incoming voice call (in-band ring)</td>
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<td>HFP/AG/ICA/BV-02-I</td>
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<tr>
<td>HFP 3/4a</td>
<td>Accept an incoming voice call (in-band ring) and Capability to change the “in-band ring” settings</td>
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<td>HFP 3/4c</td>
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<td>Accept an incoming voice call (no in-band ring)</td>
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<tr>
<td>HFP 3/4b</td>
<td>Accept an incoming voice call (no in-band ring)</td>
<td>HFP/HF/ICA/BV-04-I</td>
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<td>Audio connection establishment independent of call processing</td>
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<tr>
<td>HFP 3/5</td>
<td>Reject an incoming call</td>
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<td>HFP/HF/ATH/BV-06-I</td>
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<td>HFP 2/7</td>
<td>Audio connection transfer</td>
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<td>HFP 3/7 AND HFP 3/7a</td>
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<tr>
<td>HFP 3/8</td>
<td>Place call with the phone number supplied by the HF</td>
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<td>HFP 3/9</td>
<td>Place call using memory dialing</td>
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<td>HFP/AG/RSV/BV-03-I</td>
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HFP/HF/RSV/BV-03-I |
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HFP/AG/RMV/BV-02-I  
HFP/AG/RMV/BV-03-I |
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HFP/HF/RMV/BV-03-I |
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|         |         | HFP/HF/ECC/BV-02-I |
| HFP 1/1 AND (NOT HFP 2/21b) | Enhanced Call Control | HFP/AG/ECC/BI-03-I  
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|         |         | HFP/AG/SLC/BV-02-C |
| HFP 3/12 | SLC Establishment with Three Way Calling | HFP/HF/SLC/BV-01-C  
|         |         | HFP/HF/SLC/BV-02-C |
| HFP 1/1 | SLC Establishment without Three Way Calling | HFP/AG/SLC/BV-03-C  
|         |         | HFP/AG/SLC/BV-04-C  
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| HFP 1/2 | SLC Establishment without Three Way Calling | HFP/AG/SLC/BV-03-C  
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| | | HFP/AG/ACC/BV-09-I  
| | | HFP/AG/ACC/BV-10-I  
| | | HFP/AG/ACC/BV-11-I  
| | | HFP/AG/ACC/BI-12-I  
| | | HFP/AG/ACC/BI-13-I  
| | | HFP/AG/ACC/BI-14-I  
| | | HFP/AG/ACC/BV-15-I  
| HFP 1/2 AND HFP 3/3c AND HFP 3/24 AND HFP 4/2 | Wide band Speech | HFP/HF/ACC/BV-01-I  
| | | HFP/HF/ACC/BV-02-I  
| | | HFP/HF/ACC/BV-03-I  
| | | HFP/HF/ACC/BV-04-I  
| | | HFP/HF/ACC/BV-05-I  
| | | HFP/HF/ACC/BV-06-I  
| | | HFP/HF/ACC/BV-07-I  
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| HFP 1/2 AND HFP 3/3c | Codec Negotiation | HFP/HF/SLC/BV-05-I  
| | | HFP/HF/SLC/BV-06-I  
| HFP 1/1 AND HFP 2/3c | Codec Negotiation | HFP/AG/SLC/BV-07-I  
| HFP 1/2 AND HFP 3/3c | Codec Negotiation | HFP/HF/SLC/BV-08-I  
| HFP 1/1 AND HFP 2/24 | Wide band Speech | HFP/AG/WBS/BV-01-I  
| HFP 1/2 AND HFP 3/24 | Wide band Speech | HFP/HF/WBS/BV-02-I  
| | | HFP/HF/WBS/BV-03-I  
| HFP 2/23 | Individual Indicators Activation | HFP/AG/IIA/BV-01-I  
| | | HFP/AG/IIA/BV-02-I  
| | | HFP/AG/IID/BV-01-I  
| | | HFP/AG/IID/BV-03-I  
| | | HFP/AG/IIC/BV-01-I  
| | | HFP/AG/IIC/BV-02-I  
| | | HFP/AG/IIC/BV-03-I  
| HFP 2/23 AND NOT HFP 2/25 | Individual Indicators Activation | HFP/AG/IIA/BV-05-I  
| | | HFP/AG/IID/BV-04-I  

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| HFP 1/1 AND HFP 8/4 | Respond to SDP request during SLC | HFP/AG/SDP/BV-02-C |
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| HFP 1/1 AND HFP 8/5 | Handle dynamic server channel number for HFP service | HFP/AG/SDP/BV-03-C |
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*Table 5.1: Test Case Mapping*
6 Annex - Supplementary Interoperability Tests

This section provides a supplementary set of interoperability tests. These tests are aimed at scenarios that do not have a direct specification reference. The tests are recommended by the Bluetooth SIG to be run for improved interoperability but they are not required to be executed as part of the Bluetooth Qualification program.

6.1 Audio Connection Transfer during an Ongoing Call

To verify the capability of transferring call audio between HF and AG.

6.1.1 Audio Connection Transfers towards AG and HF

To verify the capabilities of transferring audio from AG to HF and HF to AG during an ongoing call.

6.1.1.1 Multiple audio transfers during call – AG and HF initiated

- Test Case ID(s)
  
  HFP/AG/ATAH/BV-01-I
  
  HFP/HF/ATAH/BV-01-I

- Test Purpose

  AG: To verify that the AG can initiate and respond to audio transfers between AG and HF multiple times during an ongoing call.

  HF: To verify that the HF can initiate and respond to multiple audio transfers during an ongoing call

  This test case is to verify multiple audio transfers during one SLC. This common scenario differs from the test cases in Section 4.11 where only one audio transfer is tested in one SLC connection.

- Reference

  [2] 4.16

- Initial Condition

  HF and AG are paired and connected.

  There is an active call with call audio routed to the HF.

- Test Procedure

  1. Initiate an action on the AG to transfer the call audio to AG.
  2. Initiate an action on the HF to transfer the call audio back to HF.
  3. Initiate an action on the AG to transfer the call audio back to AG.
  4. Initiate an action on the AG to transfer the call audio back to HF.
  5. Initiate an action on the HF to transfer the call audio to AG. (HF may be powered off)
6.2 Audio Connection Transfers
To verify the capability of transferring the audio path during an ongoing call.

6.2.1 Audio transfer by SLC release during an active call

- Test Case ID(s)
  - HFP/AG/ATA/BV-03-I
  - HFP/HF/ATA/BV-03-I

- Test Purpose
  To verify audio can be transferred from HF to AG during an active call by releasing the SLC.
  Releasing the service level connection is defined in Section 4.3 in [2] and a common scenario not tested in is tested here. This test case is to ensure that the status of an active call is not affected by SLC release. An example is user deciding to turn OFF the HF to continue the call on the AG.

- Reference
  [2] 4.16

- Initial Condition
  The AG and the HF are paired and connected.

- Test Procedure
  Make a call from an external line to the AG. Answer the call from the AG.
  Initiate user action on the AG to release SLC. The HF may be powered off.

- Test Condition
  Both devices have to be in communication range.
- Expected Outcome
  Pass verdict
  The call remains active.
  The call audio is routed to the AG.

6.2.2 Audio transfer by powering ON HF

- Test Case ID(s)
  
  HFP/AG/ATH/BV-09-I
  
  HFP/HF/ATH/BV-09-I

- Test Purpose
  To verify audio can be transferred from AG to HF during an active call when HF is powered ON. This case does not apply to HF devices that cannot be powered off in all situations, e.g., car kits.

  A user may choose to power ON a HF device to continue a call which is on an AG using the HF device. Audio transfer during call scenarios is addressed in Section 4.11; this test case is merely an additional scenario (connection and audio transfer during a call), which is a very common user scenario affecting interoperability.

- Reference
  [2] 4.16

- Initial Condition
  The AG and the HF were paired and connected previously.

  AG is idle state and is configured to receive connection requests from HF.

  The HF is powered OFF.

- Test Procedure
  Make a call to the AG. Verify audio in the AG device.

  Power ON HF.

  Initiate necessary user action on HF to connect AG to HF and transfer audio to the HF if audio is not routed automatically.

- Test Condition
  The test should be performed under normal conditions. Both devices have to be in communication range.

- Expected Outcome
  Pass verdict
  AG connects to HF automatically or by user initiated action

  The call remains active and the call audio is routed to the HF
The AG sends the +CIEV unsolicited result code updating the call status.

The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

### 6.3 Service Search

To verify that the IUT can respond to Service Search requests in various conditions.

#### 6.3.1 Service Search Requests

- **Test Case ID(s)**
  - HFP/HF/SDP/BV-01-I
  - HFP/AG/SDP/BV-01-I

- **Test Purpose**
  - To verify that the IUT can respond to Service Search requests after pairing, after SLC creation and after a call is made active with audio routed to the HF.

- **Reference**
  - [2] 4.2, 4.11, 5.3
  - [6] 6.5
  - [8] 2.5

- **Initial Condition**
  - The AG and HF are not paired.

- **Test Procedure**
  - From the Lower Tester, perform a service discovery for HFP in the following conditions:
    - Before pairing.
    - After pairing and before RFCOMM channel establishment.
    - 30 seconds after the Service Level Connection has been established.
    - During an ongoing call with audio routed to the HF.

- **Expected Outcome**
  - Pass verdict
  - The service discovery is successful in all cases.

### 6.4 Service Level Connections

Verify the operations performed as part of the SLC establishment.

#### 6.4.1 Service Level Connections

To verify IUT can handle service level connection establishment scenarios.
### 6.4.1.1 SLC during SDP response

- **Test Case ID(s)**
  
  - HFP/AG/SDP/BV-02-C
  - HFP/HF/SDP/BV-02-C

- **Test Purpose**
  
  Check if the IUT can respond to Service Search requests during SLC connection process.

  SLC establishment is detailed in 4.2 in [2], this test case is to ensure that an SDP query response does not affect SLC establishment.

- **Reference**
  
  [2] 4.2

- **Initial Condition**
  
  IUT and Lower Tester are paired but not connected with each other.

- **Test Procedure**
  
  From the Lower Tester, perform service discovery (for HFP) in the following two conditions.

  After Pairing before SLC channel establishment.

  After Pairing and in-between SLC connection (After AT+BRSF and before +CIND).

- **Test Condition**
  
  Both devices have to be in communication range.

- **Expected Outcome**
  
  **Pass verdict**

  SLC establishment is successful.

  SDP search is successful in both cases.

### 6.4.1.2 Handle dynamic server channel number for HFP service

- **Test Case ID(s)**
  
  - HFP/AG/SDP/BV-03-C
  - HFP/HF/SDP/BV-03-C

- **Test Purpose**
  
  Check if the IUT can handle a change in Server Channel number for HFP service.

  This test is to prevent interoperability issues encountered with devices which cache the server channel number. This is to verify that devices can interoperate when the server channel number changes.
• Reference

[2] 5.3

• Initial Condition
AG and HF devices are not paired with each other.

• Test Procedure
1. Pair and connect IUT and Lower Tester.
2. Initiate SLC release from the IUT.
3. Change the Server Channel number of the HFP service on the Lower Tester. (Change the content of the SDP record - Protocol Descriptor List which has the RFCOMM Server Channel number).
4. From the IUT, initiate a connection to the Lower Tester once again without performing pairing.

• Test Condition
Both devices have to be in communication range.

• Expected Outcome
Pass verdict
As a result of step 4, IUT establishes an HFP SLC with the Lower Tester.

6.4.1.3 HFP/HF/DIS/BV-02-I [HF disallows connections in non-discoverable mode]

• Test Purpose
HF: To verify that devices that implement pairing, go through pairing before connection. The HF device disallows connections with an unpaired device in non-discoverable mode. This test case applies only to devices that require a secure connection. This test case does not apply to devices that do not support non-discoverable mode.

This case is aimed at ensuring security. This test case is to ensure that a connection process is preceded by pairing for those devices that necessitate pairing.

• Reference

[2] 6.1, 6.2

• Initial Condition
The HF and AG are not paired with each other.

Devices are in non-discoverable mode without any prior pairing.

HF is powered ON.

• Test Procedure
Set HF in discoverable mode.

Search for the HF from the AG. Do NOT pair AG to HF.
Set the HF in non-discoverable mode.

Attempt to connect to the HF from the AG.

- **Test Condition**
  Both devices have to be in communication range.

- **Expected Outcome**
  Pass verdict
  The HF device fails to accept the connection request from the AG.

## 6.5 Incoming Call

To verify the capabilities of handling scenarios during an incoming call.

### 6.5.1 Audio Connection Establishment during Incoming call

To verify the capabilities of connection establishment during an incoming call.

#### 6.5.1.1 HF connects to AG during in-coming call

- **Test Case ID(s)**
  
  HFP/HF/ICA/BV-07-I
  
  HFP/AG/ICA/BV-07-I

- **Test Purpose**
  
  AG: To verify an AG can accept a connection from HF during an incoming call.
  
  HF: To verify that HF can connect to an AG that is receiving an in-coming call.
  
  SLC establishment is detailed in 4.2 in [2]. This test case is to verify this feature in the presence of an incoming call. The SLC establishment should not affect the incoming call status and the incoming call should not affect the SLC establishment.

- **Reference**
  

- **Initial Condition**
  
  AG is paired with the HF but not connected.
  
  AG is configured not to initiate automated connection during incoming call.
  
  The only device paired to the AG is the HF under test.
  
  When testing AG, use HF device does not page AG autonomously.

- **Test Procedure**
  
  1. Make an incoming call from an external line to the AG.
  
  2. Initiate user action on the HF to connect to the AG and if necessary, initiate user action on the AG to accept the connection request.
3. Answer incoming call from the HF if the call is not answered automatically
4. When the AG and HF are connected initiate user action on the HF to transfer call audio to the HF if the call audio is not routed automatically.

- Test Condition
  Both devices have to be in communication range.

- Expected Outcome
  Pass verdict
  As a result of step 2 HF connects to the AG.
  The call alert is heard on the HF if the call is not answered automatically.
  As a result of step 3 HF answers the incoming call.
  Bi-directional conversation with the remote party is available through the HF audio means.
  The AG sends the +CIEV unsolicited result code updating the call status.
  The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

6.5.2 Link Loss during Incoming call
To verify the capabilities of handling a link loss during an incoming call.

6.5.2.1 HFP/AG/ICA/BV-08-I [Link loss during in-coming call]

- Test Purpose
  To verify AG can handle link loss during an incoming call.
  This is a common scenario to ensure that link loss does not affect the status of the incoming call.

- Reference

- Initial Condition
  AG and HF are paired and connected.

- Test Procedure
  Place an incoming call to the AG from an external line.
  Place the HF device out of Bluetooth range.

- Test Condition
  Both devices have to be in communication range.
• Expected Outcome
  Pass verdict
  The loss of Bluetooth link does not affect the incoming call.

6.5.2.2  HFP/AG/ICA/BV-09-I [SLC release during in-coming call]

• Test Purpose
  To verify AG can handle SLC release during an incoming call.

  This test is to ensure that SLC release detailed in 4.3 in [2] does not affect the status of an incoming call. One possible scenario is turning HF OFF during incoming call.

• Reference

• Initial Condition
  AG and HF are paired and connected.

• Test Procedure
  Place an incoming call to the AG from an external line.

  Initiate user action on the HF to release SLC.

• Test Condition
  Both devices have to be in communication range.

• Expected Outcome
  Pass verdict
  The SLC release does not affect the incoming call.

6.6  Voice Recognition Activation
To verify the capabilities of handling scenarios in voice recognition activation function resident in the AG.

6.6.1  Voice Recognition Activation

• Test Case ID(s)
  HFP/HF/VRA/BV-03-I
  HFP/AG/VRA/BV-03-I

• Test Purpose
  To verify that if an AG provides audio notification alerting activation of voice recognition, then this notification is heard on the HF.

  This test case is to test for a scenario in voice recognition that does not have a direct specification reference but affect the interoperability among devices. The process involved in notifying the user of the voice recognition activation is not defined and this test addresses this particular scenario.
• Reference
  [2] 4.25

• Initial Condition
  Service Level Connection between the HF and the AG established.

  If the Service Level Connection is not already set up, the HF shall take care of its establishment initiating the “Service Level Connection set up” procedure, as stated in Section 4.2 in [2].

  The Voice Recognition feature is available in the AG.

  The AG alerts the HF of voice recognition activation. This is implementation specific.

• Test Procedure
  HF: Perform the corresponding action (manufacturer specific) in the HF such that the request for activating the Voice Recognition function is issued to the AG.

  AG: Check the expected behavior of the Voice Recognition functionality according to the implementation in the AG.

• Test Condition
  Both devices have to be in communication range.

• Expected Outcome
  Pass verdict
  Upon the action in the HF, the AG shall activate the Voice Recognition function and start the voice input sequence.

  The AG initiates an audio connection to the HF (If the audio connection does not exist already).

  If the AG provides an audio notification, alerting the user that Voice Recognition is activated and waiting for voice input, then this notification is heard on the HF OR the HF may choose to provide its own audio notification.

  How the AG handles the result of this voice input process is implementation dependent.

6.7 Call Origination from AG
To verify the capabilities of handling a call audio when the call is placed by dialing a number from the AG.

6.7.1 Place outgoing call by dialing number on the AG
• Test Case ID(s)
  HFP/AG/OCA/BV-01-I
  HFP/HF/OCA/BV-01-I
• Test Purpose
AG: To verify that call audio is routed to the HF automatically or by user initiated action on the HF when the call is placed by dialing a number from the AG.
HF: To verify that HF can handle an outgoing call that was placed by dialing a number on the AG.

This is a very common user scenario and this test tests for the call status and audio transfer when a call is placed by dialing a number on the AG. The procedure to follow is left up to the implementation.

• Reference
[2] 4.16

• Initial Condition
AG and HF are paired and connected.

• Test Procedure
Place an outgoing call to an external line by dialing a number on the AG.

If the audio is not routed automatically to the HF, initiate user action on the HF to route the call audio to the HF.

• Test Condition
Both devices have to be in communication range.

• Expected Outcome
Pass verdict
Call is active and the audio is routed to the HF.

Bi-directional conversation with the remote party is available through the HF audio means.

The AG sends the +CIEV unsolicited result code updating the call status.

The AG does not send +CIEV unsolicited results codes for call status indicators which are not changed.

6.8 Terminate a Call
To verify the extended response indication codes for AT commands are sent by the IUT when the network becomes unavailable during an active call.

6.8.1 HFP/AG/TCA/BV-06-I [Terminate a Call – AG Terminated NO CARRIER]

• Test Purpose
AG: To verify that the NO CARRIER signal is sent by the IUT when the network becomes unavailable during an active call.

• Reference
[2] 4.33.2
**Initial Condition**

**HF:** Service level connection between the HF and the AG established.

**AG:** Service level connection between the HF and the AG established.

A call is active.

**Test Procedure**

**HF:** No action required.

**AG:** The network becomes unavailable during the active call.

**Test Condition**

Both devices are initialized, according to Section 2.2.

The network becomes unavailable during the active call.

**Expected Outcome**

**Pass verdict**

Upon unavailability of the network, the AG issues a call=0 CIEV indication followed by a NO CARRIER signal.