HAC (Volume Control) Test Report

Application No.:	SUES251100231671
FCC ID:	2BSUT-54237
Applicant:	CROSSCALL
Applicant Address:	245, Rue Paul Langevin 13290，Aix-en-Provence，France
Manufacturer:	CROSSCALL
Manufacturer Address:	245, Rue Paul Langevin 13290，Aix-en-Provence，France
Product Name:	Mobile phone
Model No.(EUT):	54237-1
Standards:	ANSI C63.19-2019 ANSI/TIA-5050-2018 47CFR Part 20.19 KDB 285076 D01 v06r04 KDB 285076 D04 v02 KDB 285076 D05 v01
Date of Receipt:	2025/11/05
Date of Test:	2025/11/19 to 2025/11/27
Date of Issue:	2025/11/27
Test conclusion:	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Revision Record			
Version	**Description**	**Date**	**Remark**
01	Original	2025-11-27	/

Authorized for issue by:				
Tested By		Trevor Wang **Trevor Wang/Project Engineer**		
Approved By		Nada Cao **Nada Cao/Reviewer**		

2 Test Summary of Minimum Conversational Gain

Mode	Band	Conv. Gain (dB)		Limit (dB)	Result
		2N	8N		
WCDMA	B2	7.91	12.02	≥6	Pass
	B4	7.99	11.93		Pass
	B5	7.72	12.03		Pass
LTE	B2	8.16	12.08		Pass
	B5	8.09	12.01		Pass
	B7	8.15	12.23		Pass
	B12	8.17	12.05		Pass
	B14	8.34	12.18		Pass
	B17	8.09	12.05		Pass
	B30	8.14	12.14		Pass
	B42	8.04	12.03		Pass
	B43	8.04	12.01		Pass
	B48	8.09	12.09		Pass
	B41(38)	8.01	12.00		Pass
	B66(4)	8.05	12.00		Pass
FR1	n2	7.91	11.78		Pass
	n5	7.87	11.54		Pass
	n7	7.71	11.86		Pass
	n14	8.03	11.91		Pass
	n30	8.04	11.81		Pass
	n66	7.87	11.93		Pass
	n77	7.80	11.89		Pass
Minimum Conversational Gain		7.71	11.54		Pass

3 Contents

4 General Information

4.1 General Description of EUT

IMEI:	352047350007410/352047350007428		
Hardware Version:	15		
Software Version:	N2161V.4.02.10.US01		
Antenna Type:	Embedded Antenna		
Frequency Bands:	Band	Tx (MHz)	Rx (MHz)
	WCDMA band 2	1850 -1910 MHz	1930 - 1990 MHz
	WCDMA band 4	1710 -1755MHz	2110 - 2155MHz
	WCDMA band 5	824 - 849MHz	869 - 894MHz
	LTE band 2	1850 - 1910 MHz	1930 - 1990 MHz
	LTE band 4	1710 - 1755 MHz	2110 - 2155 MHz
	LTE band 5	824 - 849 MHz	869 - 894 MHz
	LTE band 7	2500 - 2570 MHz	2620 - 2690 MHz
	LTE band 12	699 - 716 MHz	729 - 746 MHz
	LTE band 14	788 - 798 MHz	758 - 768 MHz
	LTE band 17	704 - 716 MHz	734 - 746 MHz
	LTE band 30	2305 - 2315 MHz	2350 - 2360 MHz
	LTE band 42	3450 - 3600 MHz	3450 - 3600 MHz
	LTE band 43	3600 - 3800 MHz	3600 - 3800 MHz
	LTE band 48	3550 - 3700 MHz	3550 - 3700 MHz
	LTE band 38	2570 - 2620 MHz	2570 - 2620 MHz
	LTE band 41	2496 - 2690 MHz	2496 - 2690 MHz
	LTE band 66	1710 - 1780 MHz	2110 - 2200 MHz
	FR1 n2	1850 - 1910 MHz	1930 - 1990 MHz
	FR1 n5	824 - 849 MHz	869 - 894 MHz
	FR1 n7	2500 - 2570 MHz	2620 - 2690 MHz
	FR1 n14	788 - 798 MHz	758- 768 MHz
	FR1 n30	2305 - 2315 MHz	2350 - 2360 MHz
	FR1 n66	1710 - 1780 MHz	2110 - 2200 MHz
	FR1 n77	3450 - 3980 MHz	3450 - 3980 MHz
	WLAN2.4GHz	2412-2462 MHz	2412-2462 MHz
	WLAN5GHz	5180~5240MHz	5180~5240MHz
		5260~5320MHz	5260~5320MHz
		5500~5720MHz	5500~5720MHz
		5745~5825MHz	5745~5825MHz
	WLAN6GHz	5925-6425MHz	5925-6425MHz
		6425-6525MHz	6425-6525MHz
		6525-6875MHz	6525-6875MHz
		6875-7125MHz	6875-7125MHz
	Bluetooth	2402~2480	2402~2480

4.2 Air interfaces and Operation Mode.

Air Interface	Band (MHz)	Type	ANSI C63.19 Tested	Simultaneous Transmitter	Name of Voice Service	Power Reduction
WCDMA	Band II	VO	Yes	BT, Wi-Fi	CMRS Voice	NO
	Band IV					
	Band V					
LTE FDD	LTE band 2	VO	Yes	BT, Wi-Fi	VoLTE	NO
	LTE band 4					
	LTE band 5					
	LTE band 7					
	LTE band 12					
	LTE band 14					
	LTE band 17					
	LTE band 30					
	LTE band 66					
LTE TDD	LTE band 38	VO	Yes	BT, Wi-Fi	VoLTE	NO
	LTE band 42					
	LTE band 48					
	LTE band 41					
FR1 FDD	FR1 n2	VO	Yes	BT, Wi-Fi	VoNR	NO
	FR1 n5					
	FR1 n7					
	FR1 n14					
	FR1 n30					
	FR1 n66					
FR1 TDD	FR1 n77	VO	Yes	BT, Wi-Fi	VoNR	NO
Wi-Fi	2437	DT	NO(1)	WWAN, BT	NA	NO
	5190					
	5200					
	5210					
	5280					
	5580					
	5785					
	5975					
BT	2437	DT	No	WWAN, WiFi	NA	NO

VO: Legacy Cellular Voice Service
DT: Digital Transport (no voice)
VD: IP Voice Service over Digital Transport
*ANSI C63.19-2019 use table 6.1 to establish the Normal speech input level and NOTE 2 of table 6.1 identifies the group of VoIP voice services that use −16 dBm0 as the normal speech input level.
Remark:
1.The WLAN6GHz U-NII 6/7/8 were above 6GHz and were not evaluated due to outside of the current scope of ANSI C63.19 and FCC HAC regulations.
2. The WLAN6GHz UNI-5 was evaluated for operations which are entirely below 6GHz, above 6 GHz were not evaluated due outside of the current scope of ANSI C63.19 and FCC HAC regulations.

EUT support Codec for Volume control test

Air interface	Audio Codec Evaluated
WCDMA	AMR-NB,AMR-WB
LTE	AMR-NB,AMR-WB
FR1	AMR-NB,AMR-WB

Codec /Birate	
NB AMR	WB AMR
4.75 Kbps	6.60Kbps
5.15Kbps	8.85Kbps
5.90Kbps	12.65Kbps
6.60Kbps	14.25Kbps
7.40 Kbps	15.85Kbps
7.95Kbps	18.25Kbps
10.20Kbps	19.85Kbps
12.20Kbps	23.05Kbps
	23.85Kbps

Note：
Per KDB 285076 D04, it is expected to investigate and document only the worst-case test conditions and results. Each submitted test report shall document the codec type (i.e., NB, WB, EVS, etc.), every air interface (i.e., LTE, 5G NR, WI-FI), and band supported for the worst-case codec bit rate, band channel, bandwidth, air interface bit rate, subcarrier spacings, and resource blocks.

4.3 Test Environment

Temperature	Relative humidity
Relative humidity	54%
Atmospheric pressure	101.7kPa
Background Noise	15dB

4.4 Measurement Uncertainty

For ANSI/TIA-5050 testing, the EUT was linked and controlled by base station emulator. Communication between the EUT and the emulator was established by coaxial connection. The EUT was set from the emulator to radiate maximum output power during testing. Also EUT was set to backlight off during testing.

Test Item	Uncertainty
Receiving volume control	1.7dB
Recriving distortion and noise	1.7dB
Receiving frequency response	1.7dB

Note:

a) All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2.

b) Depends on the microphone calibration. The value is valid if calibration is carried out with recommended pistonphone/calibrator in the HMS II.3 manual.

c) Time and frequency accuracies of labCORE determined by the internal clock accuracy. The time and frequency resolution and accuracy may change due to analysis of the digital signals in ACQUA or if an external clock is applied.

4.5 Test Location

All tests were performed at:
SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch
No. 10, Weiye Road, Kunshan Development Zone, Suzhou, Jiangsu, China
No tests were sub-contracted.
Note:

a) SGS is not responsible for wrong test results due to incorrect information (e.g., max. internal working frequency, antenna gain, cable loss, etc) is provided by the applicant. (If applicable).

b) SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (If applicable).

c) Sample(s) provided by customer.

4.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• A2LA

SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 6706.01.

• FCC

SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch has been recognized by FCC as an accredited testing laboratory. Designation Number: CN1387.

• ISED

SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch has been recognized by ISED as an accredited testing laboratory. Company Number: 32368

5 Equipment list

Equipment	Model	Equipment No.	Cal Data	Cal Due Data
Microphone	46AE	KSES307108	2025-05-27	2026-05-26
Sound calibrator	GRAS 42AG	KSES304302a	2025-05-27	2026-05-26
HEAD Measurement System	HMS II.3-LN	KSES330101	/	/
Multi-channel audio Analyzer	Labcore	KSES304303	2025-05-27	2026-05-26
Radio communication tester	CMW 500	SUEM100806	2025-01-20	2026-01-19
Radio communication tester	CMX 500	SUWI-01-56-02	2025-01-16	2026-01-15
Acoustic Chamber	/	KSES330801	2025-02-05	2027-02-04

6 Volume Control Requirement

Conversational Gain

a) Per KDB 285076 D05, with a mounting force of 8N, the DUT shall have at least one volume control setting that will produce a conversational gain of ≥ 6dB.

b) Per KDB 285076 D05, with a mounting force of 2N, the DUT shall have at least one volume control setting that will produce a conversational gain of ≥ 6dB.

c) Calculate the Conversational Gain by subtracting 70 from the measures SPL.
[Conversational Gain = (Measured SPL Level-70dsSPL)]

Receive Distortion and Noise Performance:

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

a) Narrowband transmission mode: Each 1/3 octave band center frequency from 400Hz to 3150Hz.

b) Wideband transmission mode: Each 1/3 octave band center frequency from 250Hz to 5000Hz.

c) Per K 285076 D05, choose one narrowband and one wideband for all voice services, bands of operation and air interfaces over which it operates using one codec bit rate of the applicant's choosing to meet Receive Distortion and Noise Performance requirement.

Receive Acoustic Frequency Response Performance:

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

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

Where

X_f = limit value at frequency f

X_1 = limit value at frequency f_1 as given in table

X_2 = limit value at frequency f_2 as given in table

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

c) For wideband: The 1/12 octave band frequency response after translation to the FF shall fall between the upper and lower limits (Arbitrary level) given the Table 2.

Table 1 – Narrowband Receive Frequency Response Limits

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

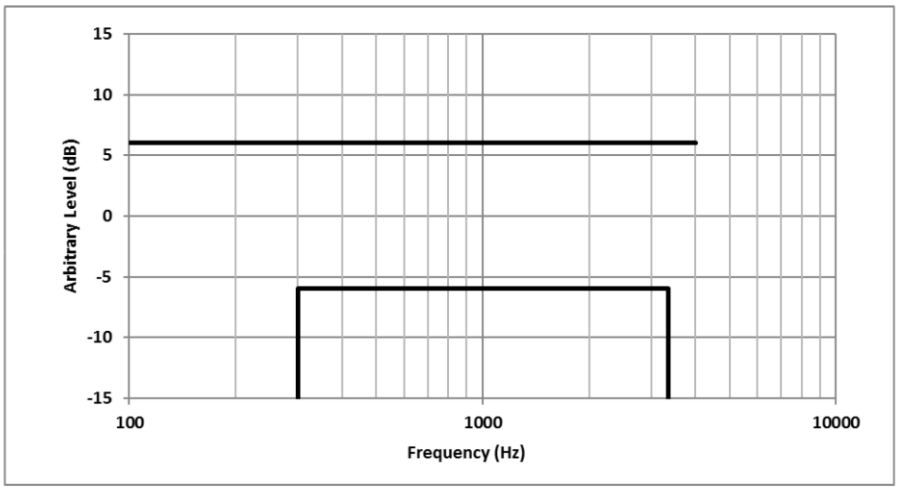


Figure 2 – Narrowband Receive Frequency Response Limits

Table 2 – Wideband Receive Frequency Response Limits

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

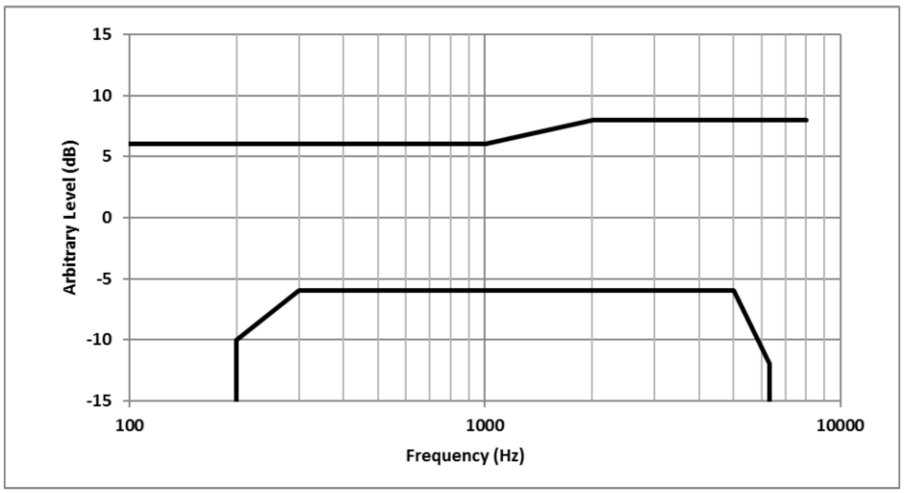


Figure 3 – Wideband Receive Frequency Response Limits

7 Measurement Procedure

According to ANSI /TIA-5050, the test procedure for wireless communications device is as below.

Conversational Gain

a) Configure the DUT with a mounting force of 8N and test equipment as shown in section 4 in an active call state with the applicable codec for the transmission mode under test.

b) Set the DUT volume control to the maximum setting.

c) If the DUT has an adjustable tone control feature, a tone control setting that meets the frequency response requirements in ANSI/TIA-5050 section 5.3.1shall be used.

d) The ACQUA system is apply the real speech test signal at a level of -20dBm0 at the RETP and measure the acoustic output at the Drum Reference Point (DRP) over one complete sequence of the test signal.

e) Translate the measurement made at DRP to Free Filed (FF) using the translation data in ANSI/TIA-5050 AnnexB.

f) Over the applicable frequency band, determine the ASL in SPL for the resulting sound pressure level in accordance with Method B of ITU-T Recommendation P.56,
Narrowband 100Hz through 4000 Hz
Wideband 100Hz through 7720 Hz
Calculate the Conversational Gain by subtracting 70 from the measured dBSPL.
[Conversational Gain = (Measured dBSPL Level – 70dBSPL) dB]

g) Measure output distortion per ANSI/TIA-5050 clause 5.2. If a distortion failure occurs at the maximum volume control setting. reduce the volume control setting and repeat the measurement to determine if a setting can be found for which the conversational gain requirement is met without a distorton failure.

h) Repeat steps 2-8 with a mounting force of 2N.

Receive Distortion and Noise Performance:

a) Configure the DUT with a mounting force of 8N and test equipment as shown in section in an active call state with the applicable codec for the transmission mode under test.

b) Receive distortion and noise is measured using the PN-SDNR procedure.

c) To ensure DUT activation, apply the real speech test signal at a level of -20 dBm0 followed immediately by the initial 1/3 octave center frequency PN test signal based on the narrowband or wideband operating mode. Measure the acoustic output at the DRP over the complete sequence of the PN test signal.

d) Translate the measurement made at DRP to the FF.

e) Calculate the acoustic out unweighted test signal power of the stimulus measurement band.

f) Calculate the notched A-weighting distortion and noise components.

g) Calculate the ratio of signal power to the total A-weighted distortion and noise power ad follow:

$$\text{PN-SDNR (dB)} = 20 * Log\left[\frac{measured\ stimulus\ amplitude}{measured\ distortion\ amplitude}\right]$$

h) Repeat for each of the remaining 1/3 octave center frequencies based on the narrowband or wideband operating mode.

i) Repeat steps 2-8 with a mounting force of 2N.

j) The measured value that the system equipment will automatically calculate or converts to define whether it meets the requirements of ANSI/TIA-5050.

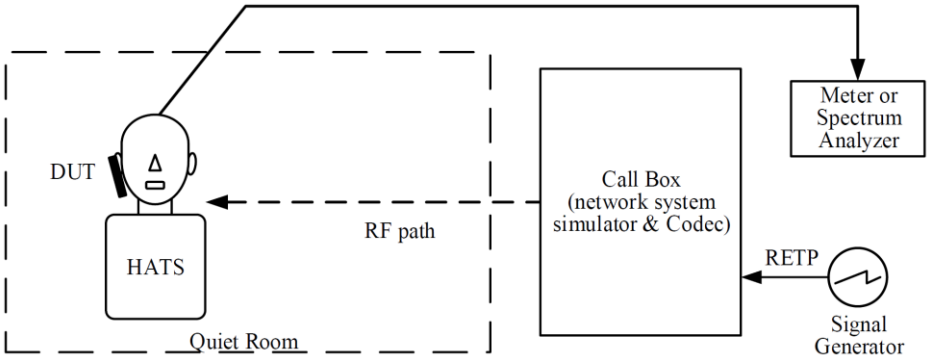
Receive Acoustic Frequency Response Performance:

a) Configure the DUT with a mounting force of 8N and test equipment as shown in Figure 1 in an active call state with the applicable codec for the transmission mode under test.

b) If the DUT has an adjustable tone control feature the initial measurement is to be performed with the default tone control setting.

c) Apply the real speech test signal with a level of-20 dBm0 at the RETP.
d) Capture the frequency spectrum at the DRP of the HATS using real-time analysis with 1/12 octave bands over the frequency range from 100 Hz to 4000 Hz for narrowband measurements, or over the frequency range from 100 Hz to 8000 Hz for wideband measurements, averaged over the entire duration of the test signal.
e) Transform the DRP frequency spectrum measurement to the FF.
f) Divide the 1/12 octave measurement data by the 1/12 octave frequency spectrum of the test signal at the RETP and present the measurement in terms of (Pa/V).
g) Apply the applicable frequency response limits to determine compliance.
h) If the default tone control setting does not meet the requirement, repeat the above steps for other tone control settings to determine a tone control setting that meets the requirements.
i) Repeat with a mounting force of 2N.
j) The receive acoustic frequency response performance was perform at max tone control setting.

8 System Description



Above is the measurement set-up diagram, and the sequence of the measurement is Volume Control testing procedure over a wireless communication device:

a) In order to satisfy the quiet room condition below 40 dBA background noise according to TIA-5050 standard, HATS and DUT were placed in Acoustic Chamber and the noise level was checked using Sound Level Meter 46AE.

b) labCORE equipment is used for signal generator and meter. This equipment directly provided operating voltage for HATS's microphone and-20 dBm0 sound source to Call Box RETP Point.

c) CMW500 Call box was used for GSM, WCDMA, LTE and WIFI call tests, where the audio input level was set to 1.572 V so that the signal source level supplied from labCORE to RETP matched -20 dBm0. When testing NR calls using CMX500 Call box.

d) Handset Position, in all tests, handset was placed at the standard test position of IEEE std 269.

9 Test Result

1. Per KDB 285076 D05. in section2 addresses the technical testing requirements for the conversational gain, distortion, and frequency response tests that amends KDB 285076 D04 Volume Control under the conditions of the limited-term waiver DA 23-914, as follows:

   a. Under the waiver, only CMRS narrowband and CMRS wideband voice codecs are reguired to comply with the volume control reguirements of the TIA 5050-2018 Volume Control Standard as amended as follows:

      1. For the 2N mounting force test, one narrowband and one wideband voice codec embedded with the handset must pass with at least one volume control setting with a conversational gain of ≥ 6 dB for all voice services, bands of operation and air interfaces over which it operates using one codec bit rate of the applicant's choosing.

      2. For the 8N mounting force test, one narrowband and one wideband voice codec embedded with the handset must pass with at least one volume control setting with a conversational gain of ≥ 6 dB for all voice services, bands of operation and air interfaces over which they operate but is not reguired to meet or exceed the full 18 dB of conversational gain specified in section 5.1.1 of the TIA 5050 Volume Control Standard using one codec bit rate of the applicant's choosing.

   b. For all other narrowband and wideband codecs not evaluated in 2.a. above, TIA 5050-2018 Receive Distortion and Noise Performance and Receive Acoustic Freguency Response Performance evaluations are not required; however, these codecs shall be assessed for conversational gain and documented in the test report at the 2N and 8N levels with a gain of ≥ 6 dB for all voice services, bands of operation and air interfaces over which they operate. The handset volume setting used to comply with 2.a. shall be used for these other CMRS codec evaluations.

   c. Any other codec for voice services embedded in the handset, not identified in 2.a. and 2.b. above, is not required to comply or demonstrate in the test reports for conversational gain.

2. The ambient noise of the quite room not exceed 40 dBA.

3. The device have similar freguency in some LTE and NR bands: LTE 4/66, 38/4, since the supported frequency spans for the smaller LTE bands are completely cover by the larger LTE bands, therefore, only larger LTE bands were required to be tested for hearing-aid compliance.

4. In this report only assessment 2G/3G/4G/5G/WiFi operation.

The test steps are as follows:

1. Worst configuration investigation
   Per each air interface, select one band and one codec and based on “worst conversational gain value” to determine worst configuration.
   a. dentify RB sizes
   b. Identify modulations
   c. Identify bandwidths
2. Worst bitrate investigation
   Identify worst bitrate
   As stated in Appendix A, Section 1.1
3. Test all supported bands at the worst birate.
   As stated in Appendix A, Section 1.2
4. Per KDB 285076 D05 and document of DA 23-914 item 30, the manufacturer only perform EVS codec to meetdistortion/noise and freguency response tests at the 2N and 8N force levels.

Air interface	Conversational Gain	Receive Distortion and Noise Performance:	Receive Acoustic Frequency Response Performance:
WCDMA	AMR-NB, AMR-WB	AMR-NB, AMR-WB	AMR-NB, AMR-WB
LTE	AMR-NB, AMR-WB	AMR-NB, AMR-WB	AMR-NB, AMR-WB
FR1	AMR-NB, AMR-WB	AMR-NB, AMR-WB	AMR-NB, AMR-WB

5. As stated in Appendix A, Section 2.1

Refer to Appendix A - Volume Control Test Data and Plots.

10 Test Setup Photo

Refer to Appendix B - Volume Control Test Setup Photo.

--- End of the Report ---