

## **HAC Receive Volume Control Test Report**

### For

Applicant Name:	Xwireless LLC
Address:	11565 Old Georgetown Road, Rockville, MD, USA
EUT Name:	Mobile Phone
Brand Name:	Vortex
Model Number:	C24

### **Issued By**

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.		
	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park,		
Address:	Tantou Community, Songgang Street, Bao'an District, Shenzhen, China		

Report Number: Test Standards: FCC ID: BTF240419R00403 ANSI C63.19:2019 FCC 47 CFR §20.19 TIA-5050:2018 2ADLJ-C24

Test Conclusion: Test Date: Date of Issue: Pass 2024-06-05 to 2024-06-20 2024-06-21

Prepared By:

Zoey Zhang

Zoey Zhang / Project Engineer 2024-06-21 Ryan.CJ / EMC Manager 2024-06-21

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Date:

Approved By:

Date:



Revision History			
Version	Issue Date	Revisions Content	
Rev_V0	2024-06-21	Original	
Note:		Once the revision has been made, then previous versions reports are replaced by the latest version.	



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# 1. Introduction

## 1.1 Identification of Testing Laboratory

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.		
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China		
Phone Number:	+86-0755-23146130		
Fax Number:	+86-0755-23146130		

## **1.2 Identification of the Responsible Testing Location**

Test Location:	BTF Testing Lab (Shenzhen) Co., Ltd.		
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China		
Description:	All measurement facilities used to collect the measurement data are located at F101,201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China		

### **1.3 Laboratory Condition**

Ambient Temperature:	18℃ to 25℃
Ambient Relative Humidity:	32% to 49%
Ambient Pressure:	100 kPa to 102 kPa

### 1.4 Announcement

- (1) The test report reference to the report template version v0.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) This document may not be altered or revised in any way unless done so by BTF and all revisions are duly noted in the revisions section.
- (5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- (6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.



# 2. Product Information

## 2.1 Application Information

Company Name:	Xwireless LLC
Address:	11565 Old Georgetown Road, Rockville, MD, USA

## 2.2 Manufacturer Information

Company Name:	Xwireless LLC
Address:	11565 Old Georgetown Road, Rockville, MD, USA

### 2.3 Factory Information

Company Name:	ZTECH COMMNICATION(SZ) CO LTD
Address:	FL 7 BLOCK D BAO' AN ZHIGU INNOVATION PARK YIN' TIAN ROAD NO.4 XI' XIANG STR' BAO' AN DISTRICT SZ CHINA

## 2.4 General Description of Equipment under Test (EUT)

EUT Name	Mobile Phone
Under Test Model Name	C24
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	N/A
Software and Firmware Version	N/A
Dimensions (Approx.)	150*71*10mm
Weight (Approx.)	163g



# 2.5 Equipment under Test Ancillary Equipment

	Battery	
	Brand Name	Vortex
Ancillary Equipment 1	Model No.	C24
	Serial No.	N/A
	Capacity	Typical capacity: 2300mAh
	Rated Voltage	3.8 V

# 2.6 Technical Information

	2G Network GSM/GPRS/EGPRS 850/1900
	3G Network WCDMA/HSDPA/HSUPA Band 2/4/5
Network and Wireless	4G Network FDD LTE Band 2/4/5/12/13/25/26/66/71 TDD LTE Band 41
connectivity	2.4G WIFI 802.11b, 802.11g, 802.11n(HT20)
	BT (EDR+BLE)



# 3. Summary of Test Results

## 3.1 Test Standards

No.	Identity	Document Title
1	ANSI 062 10 2010	American National Standard for Methods of Measurement of Compatibility
	ANSI C63.19-2019	between Wireless Communication Devices and Hearing Aids
2	FCC 47 CFR §20.19	Hearing Aid Compatible Mobile Headsets
3	TIA-5050:2018	Telecommunications Communications Products Receive Volume Control Requirements for Wireless (Mobile) Devices
4	KDB285076 D05v01	HACWaiverDA23-914
5	KDB285076 D04v02	Volume Control
6	KDB285076 D01v06r04	HAC Guidance

## 3.2 Air Interfaces / Bands Indicating Operating Modes

Air Interface	Band	Туре	Simultaneous Transmitter	Name of Service
	850	VO	WLAN & BT	CMRS Voice
GSM	1900	VO	WLAN & BT	CMRS Voice
	GPRS/EGPRS	DT	N/A	N/A
	Band II	VO	WLAN & BT	CMRS Voice
	Band IV	VO	WLAN & BT	CMRS Voice
WCDMA	Band V	VO	WLAN & BT	CMRS Voice
	HSPA	DT	N/A	N/A
	Band 2	VD	WLAN & BT	VoLTE
	Band 4	VD	WLAN & BT	VoLTE
	Band 5	VD	WLAN & BT	VoLTE
	Band 12	VD	WLAN & BT	VoLTE
	Band 13	VD	WLAN & BT	VoLTE
LTE	Band 25	VD	WLAN & BT	VoLTE
	Band 26	VD	WLAN & BT	VoLTE
	Band 41	VD	WLAN & BT	VoLTE
	Band 66	VD	WLAN & BT	VoLTE
	Band 71	VD	WLAN & BT	VoLTE
WLAN	2.4g	DT	WWAN	N/A
BT	2450	DT	WWAN	N/A

VO: Voice Only VD: CMRS and IP Voice Service over Digital Transport

DT: Digital Transport Only

Note:The hearing aid compatibility mode of the prototype was turned on during testing, and all tests were performed in HAC mode

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# 4. Test Uncertainty

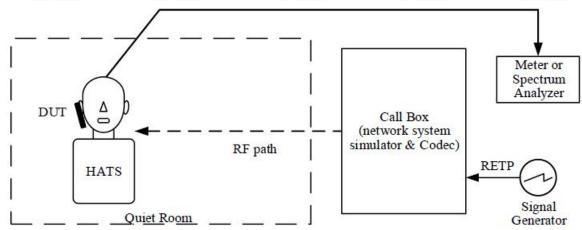
UNCERTAINTY EVA	ALUATION FOR AU	DIO HAC	MEASURE	MENT	
Uncertainty Component	Tol (+- %)	Prob. Dist.	Div.	Uncertainty (dB)	Uncertainty (%)
	Measurement Sy	stem			
RF reflections	0.1	R	√3	0.06	
Acoustic noise	0.1	R	√3	0.06	
Probe coil sensitivity	0.49	R	√3	0.28	
Reference signal level	0.25	R	√3	0.14	
Positioning accuracy	0.4	R	√3	0.23	
Cable loss	0.1	N	2	0.05	
Frequency analyzer	0.15	R	√3	0.09	
System repeatability	0.2	N	1	0.20	
Repeatability of the WD	0.4	N	1	0.40	
Combined Standard Uncertainty		N	1	0.61	
Expanded uncertainty (confidence level of 95%,k = 2)		N	K=2	1.22	15.05
REPORTED Expanded uncertainty (confidence level of 95%, k = 2)		N	K=2	1.20	15.00



## 5. Measurement System

## 5.1 MEASUREMENT SET-UP

The general test arrangement is shown in Figure 1. The Call Box passes the voice channel stream to the DUT without modification. There is no gain or loss in the voice channel stream due to the Call Box interface.



#### NOTES:

1. Additional information related to the air interface for the various RF technologies is specified in several 3GPP documents. A list of these can be found in 3GPP TS 26.132 V14.0.0 clause 4 2. Additional information related to the test setup can be found in 3GPP TS 26.132, V14.0.0 clause 5.1.

3. The RETP (receive electrical test point) is the point in the device test arrangement where signals are applied to the DUT in the receive direction.



## 6. Evaluation of Test

## 6.1 RECEIVE VOLUME CONTROL PERFORMANCE

### 6.1.1 Requirement

- 1. With a mounting force of 8N, the DUT shall have at least one volume control setting that will produce a conversational gain of ≥ 6 dB with the output distortion and the frequency response meeting the requirements in clause 5.2.1 & 5.3.1 respectively.
- 2. With a mounting force of 2N, the DUT shall have at least one volume control setting that will produce a conversational gain of ≥ 6 dB with the output distortion and the frequency response meeting the requirements in clause 5.2.1 & 5.3.1 respectively.

NOTE: Other acoustic receive features may be available such as additional amplification, tone control, automatic gain control, etc. ANSI/TIA-4953-B contains performance requirements for output levels and tone control operation for amplified devices.

### 6.1.2 Method of Measurement

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

#### 6.1.3 Test Result

Refer to test Annex A.

Remark: The report only reflects the test data plots of worst mode (for GSM 1900, WCDMA Band 2, LTE Band 5, 2.4G WIFI)

#### 6.1.4 Test Conclusion

PASS.



## 6.2 RECEIVE DISTORTION AND NOISE PERFORMANCE

#### 6.2.1 Requirement

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

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

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

#### 6.2.2 Method of Measurement

- 1. Configure the DUT with a mounting force of 8N and test equipment as shown in Figure 1 in an active call state with the applicable codec for the transmission mode under test with the volume control at the setting determined in 5.1.1.
- 2. Receive distortion and noise is measured using the PN-SDNR procedure as described in Annex A.
- 3. 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 in Table A.1 based on the narrowband or wideband operating mode. Measure the acoustic output at the DRP over the complete sequence of the PN test signal.
- 4. Translate the measurement made at the DRP to the FF using the translation data in Annex B.
- 5. Calculate the acoustic output unweighted total signal power of the stimulus measurement band as described in A.2.
- 6. Calculate the notched A-weighting distortion and noise components as described in A.3.
- 7. Calculate the ratio of the signal power to the total A-weighted distortion and noise power using Eq A-1.
- 8. Repeat for each of the remaining 1/3 octave center frequencies in Table A.1 based on the narrowband or wideband operating mode.
- 9. Repeat steps 2-8 with a mounting force of 2N.

#### 6.2.3 Test Result

Refer to test Annex A.

Remark: The report only reflects the test data plots of worst mode (for GSM 1900, WCDMA Band 2, LTE Band 5, 2.4G WIFI)

#### 6.2.4 Test Conclusion

PASS.



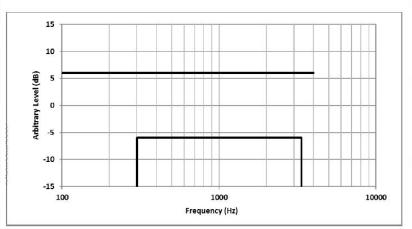
## 6.3 RECEIVE ACOUSTIC FREQUENCY RESPONSE PERFORMANCE

#### 6.3.1 Requirement

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

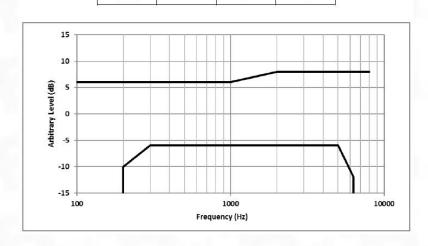
Lower Limit Frequency (Hz)	Lower Limit (dB)	Upper Limit Frequency (Hz)	Upper Limit (dB)		
300	-6	100	+6		
3400	-6	4000	+6		





2. Wideband: The 1/12 octave band frequency response after translation to the FF or DF shall fall between the upper and lower limits given in Table 2 and shown in Figure below.
Table 2 – Wideband Receive Frequency Response Limits

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



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#### 6.3.2 Method of Measurement

- 1. Configure the DUT with a mounting force of 8N and test equipment as shown in Figure 1 in an active call state with the applicable codec for the transmission mode under test with the volume control at the setting determined in 5.1.1.
- 2. If the DUT has an adjustable tone control feature the initial measurement is to be performed with the default tone control setting.
- 3. Apply the real speech test signal with a level of -20 dBm0 at the RETP.
- 4. Capture the frequency spectrum at the DRP of the HATS using real-time analysis with 1/12 octave bands over the frequency range from 100 Hz to 4000 Hz for narrowband measurements, or over the frequency range from 100 Hz to 8000 Hz for wideband measurements, averaged over the entire duration of the test signal.
- 5. Transform the DRP frequency spectrum measurement to the FF or DF (see Annex B).
- 6. Divide the 1/12 octave measurement data by the 1/12 octave frequency spectrum of the test signal at the RETP and present the measurement in terms of dB(Pa/V).
- 7. Apply the applicable frequency response limits to determine compliance.

8. If the default tone control setting does not meet the requirement, repeat the above steps for other tone control settings to determine a tone control setting that meets the requirements.

9. Repeat with a mounting force of 2N.

#### 6.3.3 Test Result

Refer to test Annex A.

Remark: The report only reflects the test data plots of worst mode (for GSM 1900, WCDMA Band 2, LTE Band 5, 2.4G WIFI)

#### 6.3.4 Test Conclusion

PASS.



# 7. Test Equipment List

Description	Manufacturer	Model	Internal number	Cal. Date	Cal. Due
WIDEBAND RADIO COMMU NICATION TESTER	ROHDE&SCHWARZ	CMW500	BTF-EM-023	2023/11/16	2024/11/15
Conditioning Amplifier	Brule&Kjaer	Туре -2690030	BTF-EM-146	2024/1/30	2025/1/29
Head and Torso Simulator	Brule&Kjaer	Type 4128C	BTF-EM-148	2024/1/30	2025/1/29
Sound Calibration	Brule&Kjaer	Туре 4231	BTF-EM-149	2024/1/30	2025/1/29
Anechoic Test Chamber	MEC	Type 115	BTF-EM-150	N/A	N/A

# 8. Air Interfaces / Bands used for testing

Air-interface	Band	Tested Codec	Tested Rate(kbps)		
GSM	850/1900	EFR	/		
		AMR-NB	4.75/12.2		
VCDMA(UMTS)	Band 2/4/5	AMR-WB	6.6/23.85		
	Band 2/4/5/12/13/25/26/ A		4.75/12.2		
VoLTE	41/66/71	AMR-WB	6.6/23.85		
	240	AMR-NB	4.75/12.2		
VoWIFI	2.4G	AMR-WB	6.6/23.85		



# 9. Test Result

#### 9.1 Receive volume control, distortion and noise performance

1         363.00         12842.4014         1         1         Max         FR         No         98         9300         9300         900         920	Plot No.	Mode	Channel/Freq.	BW	Codec B itrate	Volume Level	Codec T ype	Codec B andwidt h	Mountin g Force (N)	Freque ncy(H Z)	Min PN- SDNR(d B)	PN-SDN R Limb (dB)	Signal Q uality (d B)	Convers ational Gain	FCC CG Limit (d B)	CG Mar gin (dB)	Verdi ct
i         i         Max         Err         No         20         300	1	CSM850	129/92/ 2011-	/	/	Max	EFR	NB	8N	3150	21.68	20.00	90.58	20.58	6.00	14.58	Page
2         PC5100         512/163.2481z         /    <		6310050	120/024.210112	/	/	Max	EFR	NB	2N	3150	20.99	20.00	90.23	20.23	6.00	14.23	r ass
Image: border index	2	BCS1000	512/1950 2MHz	/	/	Max	EFR	NB	8N	3150	21.26	20.00	90.45	20.45	6.00	14.45	Bass
3         WCDMA Bandili         932:152.4hF         (         12.00         Max         Max         Max         Wait         Solution         <	2	PC31900	512/1050.20012	/	1	Max	EFR	NB	2N	3150	20.67	20.00	90.11	20.11	6.00	14.11	r ass
3         WCDMA Bard II         9521352 AbrL (         (         23.55 (AbrL (         Max         AMR         WB         AMR         980         21.50         21.50         21.50         40.00         15.21           4         //         23.65         Max         AMR         WB         2M         3150         21.61         20.00         91.52         21.50         60.00         15.21           4         WCDMA Bard IV         1312/172.4brL         (         12.00         Max         AMR         WB         2M         3150         21.61         20.00         91.52         21.52         60.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.00         15.20         15.20         16.00         15.20         15.20         16.00         15.20         16.00         15.20         16.00         15.20         16.20 <td< td=""><td></td><td></td><td></td><td>/</td><td>12.20</td><td>Max</td><td>AMR</td><td>NB</td><td>8N</td><td>3150</td><td>21.31</td><td>20.00</td><td>91.27</td><td>21.27</td><td>6.00</td><td>15.27</td><td></td></td<>				/	12.20	Max	AMR	NB	8N	3150	21.31	20.00	91.27	21.27	6.00	15.27	
Image: border in the state intermant of the state intermatting state i	2		0262/1952 4MH-	/	12.20	Max	AMR	NB	2N	3150	21.40	20.00	90.96	20.96	6.00	14.96	Bass
4	3	WCDIMA Balld II	9202/1052.410102	/	23.85	Max	AMR	WB	8N	3150	21.87	20.00	91.56	21.56	6.00	15.56	Pass
4         WCDMA Band IV         131217172.4ME         /         120         Max         AMR         NB         2M         3150         21.61         20.00         91.82         21.82         6.00         15.22           /         335         Max         AMR         WB         6M         3150         21.42         20.00         91.22         21.22         6.00         15.22         6.00         15.22         6.00         15.22         6.00         15.22         6.00         15.22         6.00         15.22         6.00         15.22         6.00         15.22         6.00         15.22         6.00         15.22         6.00         15.22         6.00         15.21         6.00         15.21         6.00         15.21         6.00         15.21         6.00         15.21         6.00         15.21         6.00         15.21         7.00         9.01         7.00         16.00         15.21         7.00         16.00         16.00         16.00         16.00         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16.01         16				/	23.85	Max	AMR	WB	2N	3150	21.95	20.00	91.12	21.12	6.00	15.12	
4         WCDMA Band W         131211712.4Mi2         /         23.85         Max         AMR         WB         6M         3150         21.50         20.00         91.62         21.82         6.00         15.20           5         WCDMA Band W         423.984.6MHz         /         12.20         Max         AMR         WB         6M         3150         21.40         20.00         91.62         21.22         6.00         15.52           5         WCDMA Band W         423.984.6MHz         /         12.20         Max         AMR         NB         2M         3150         21.40         20.00         91.47         21.47         6.00         15.51           6         /         12.20         Max         AMR         NB         2M         3150         21.60         91.00         91.00         16.00         16.11         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00         16.31         6.00				/	12.20	Max	AMR	NB	8N	3150	21.45	20.00	91.35	21.35	6.00	15.35	
index         index <th< td=""><td>1</td><td></td><td>1312/1712 /MHz</td><td>1</td><td>12.20</td><td>Max</td><td>AMR</td><td>NB</td><td>2N</td><td>3150</td><td>21.61</td><td>20.00</td><td>91.08</td><td>21.08</td><td>6.00</td><td>15.08</td><td>Pass</td></th<>	1		1312/1712 /MHz	1	12.20	Max	AMR	NB	2N	3150	21.61	20.00	91.08	21.08	6.00	15.08	Pass
5         WCDMA Band V         423946.0MHz         /         12.0         Max         AMR         NB         8N         3150         21.40         20.00         91.36         21.36         6.00         15.36           6         VCDMA Band V         423946.0MHz         /         12.00         Max         AMR         NB         2N         3150         21.62         20.00         91.47         20.00         15.37           6         LTE FDD Band 2         18700/1800.0MHz         2MHz_OPSK_10         12.00         Max         AMR         NB         8N         3150         21.07         20.00         91.47         20.00         14.20           6         LTE FDD Band 2         18700/1800.0MHz         2MHz_OPSK_10         12.00         Max         AMR         NB         8N         3150         21.91         20.00         90.01         20.01         80.0         14.33           7         LTE FDD Band 4         20601720.0MHz         2MHz_OPSK_10         12.20         Max         AMR         NB         2N         3150         22.01         20.00         90.11         20.11         6.00         14.33           7         LTE FDD Band 5         20525636.5MHz         20MHz_OPSK_10         12.20<	4	WCDWA Band IV	1312/1712:40012	/	23.85	Max	AMR	WB	8N	3150	21.50	20.00	91.62	21.62	6.00	15.62	Fass
Nuccha Band V         4233846.68.ht         /         120         Max         AMR         NB         2N         S150         21.00         01.15         21.15         6.00         15.15           6         L         4233846.68.ht         /         2285         Max         AMR         WB         8N         3150         21.02         20.00         91.47         21.00         91.47         6.00         15.29           6         LTE FDD Band 2         18700/1800.0M12         21.20         Max         AMR         NB         2N         3150         21.00         90.01         20.01         6.00         14.30           7         ATE FDD Band 2         18700/1800.0M12         20MH2_OPSK_10         21.20         Max         AMR         NB         2N         3150         22.01         20.00         90.11         20.11         6.00         14.30           7         ATE FDD Band 4         200501720.0M12         20.25         Max         AMR         NB         2N         3150         22.01         20.00         90.11         20.11         6.00         13.01           7         ATE FDD Band 4         20501720.0M12         20.0M12_OPSK_10         22.0         Max         AMR         NB </td <td></td> <td></td> <td></td> <td>/</td> <td>23.85</td> <td>Max</td> <td>AMR</td> <td>WB</td> <td>2N</td> <td>3150</td> <td>21.74</td> <td>20.00</td> <td>91.22</td> <td>21.22</td> <td>6.00</td> <td>15.22</td> <td></td>				/	23.85	Max	AMR	WB	2N	3150	21.74	20.00	91.22	21.22	6.00	15.22	
Number         Wath A Band V         AddR         V         B         A 150         21.62         20.00         91.47         21.47         6.00         15.47           I         23.85         Max         AMR         VB         2N         350         21.77         20.00         91.29         21.29         6.00         15.29           I         I         23.85         Max         AMR         NB         3150         21.91         20.00         90.25         20.25         6.00         14.29           I         I         200         Max         AMR         NB         20.01         20.01         20.01         6.00         14.10         14.20         Max         AMR         NB         3150         22.01         20.00         90.11         20.11         6.00         14.10         14.10         14.10         14.10         15.00         14.1				/	12.20	Max	AMR	NB	8N	3150	21.49	20.00	91.36	21.36	6.00	15.36	
Image: border index	_	WCDMA Band V	4000/046 6MH-	/	12.20	Max	AMR	NB	2N	3150	21.60	20.00	91.15	21.15	6.00	15.15	Daga
A         FEDD Band 2         FEDE Band 2         FEEE FEDE Band 2         FEEE FEEE FEEE FEEE FEEE FEEE FEEE FEE	5	WCDIMA Balld V	4233/640.0WIHZ	/	23.85	Max	AMR	WB	8N	3150	21.62	20.00	91.47	21.47	6.00	15.47	Pass
h         h				/	23.85	Max	AMR	WB	2N	3150	21.77	20.00	91.29	21.29	6.00	15.29	
6         LTE FDD Band 2         18700/1880.0MHz         20MHz_OPSK_1         23.85         Max         AMR         WB         SN         3150         22.03         20.00         90.31         20.38         6.00         14.38           7         LTE FDD Band 4         20050/1720.0MHz         23.85         Max         AMR         WB         SN         3150         22.07         20.00         90.11         20.11         6.00         14.11           7         LTE FDD Band 4         20050/1720.0MHz         2004Hz_OPSK_1.99         12.20         Max         AMR         NB         2N         3150         22.00         90.11         20.17         6.00         13.41           7         LTE FDD Band 4         20050/1720.0MHz         2004Hz_OPSK_1.99         12.20         Max         AMR         NB         2N         3150         22.10         20.00         89.95         19.95         6.00         13.89           23.85         Max         AMR         WB         2N         3150         22.18         20.00         90.41         20.41         6.00         14.90           200529385.5MHz         10MHz_OPSK_1.9         12.20         Max         AMR         NB         2N         3150         22.18<					12.20	Max	AMR	NB	8N	3150	21.98	20.00	90.25	20.25	6.00	14.25	
Image: border in the state in thest and the state in the state in the state in the sta			40700/4000 0041-		12.20	Max	AMR	NB	2N	3150	22.91	20.00	90.01	20.01	6.00	14.01	Dese
1         LTE FDD Band 4         20050/1720.0MHz         20MHz_QPSK_19         12.20         Max         AMR         NB         8N         3150         22.10         20.00         90.17         20.17         6.00         14.17           7         LTE FDD Band 4         20050/1720.0MHz         20MHz_QPSK_19         12.20         Max         AMR         NB         2N         3150         23.02         20.00         89.95         19.95         6.00         14.30           23.85         Max         AMR         WB         8N         3150         23.08         20.00         90.20         20.20         6.00         14.20           8         LTE FDD Band 5         2055/836.5MHz         10MHz_QPSK_10         12.20         Max         AMR         NB         2N         3150         21.89         20.00         90.40         20.00         6.00         14.30           9         LTE FDD Band 52         2055/836.5MHz         10MHz_QPSK_10         12.20         Max         AMR         NB         2N         3150         21.89         20.00         90.40         20.00         10.40         10.40         10.40         12.20         Max         AMR         NB         2N         3150         21.89	0	LIE FOD Band 2		20MHZ_QPSK_1_0	23.85	Max	AMR	WB	8N	3150	22.03	20.00	90.38	20.38	6.00	14.38	Pass
1         1         2         Max         AMR         NB         2N         3150         23.02         20.00         89.95         19.95         6.00         13.95         23.85         Max         AMR         NB         2N         3150         23.02         20.00         89.95         19.95         6.00         13.95           23.85         Max         AMR         WB         2N         3150         22.16         20.00         89.96         19.95         6.00         14.00           23.85         Max         AMR         WB         2N         3150         22.16         20.00         89.96         19.96         6.00         14.00           4         HE         MB         MB         SN         3150         21.96         20.00         89.96         19.97         6.00         14.00           20525836.5MH2         10MHz_OPSK_10         12.20         Max         AMR         NB         8N         3150         21.96         20.00         90.02         20.00         60.00         14.10           2335         Max         AMR         NB         8N         3150         21.96         20.00         90.02         20.00         90.02         20.02					23.85	Max	AMR	WB	2N	3150	22.97	20.00	90.11	20.11	6.00	14.11	Í
7         LTE FDD Band 4         20050/1720.0MHz         20MHz_QPSK_10         23.85         Max         AMR         WB         8N         3150         22.16         20.00         90.20         20.20         6.00         14.20           8         LTE FDD Band 5         2055/365.5MHz         10MHz_QPSK_10         12.20         Max         AMR         NB         8N         3150         21.80         20.00         90.04         20.00         6.00         14.04           8         LTE FDD Band 5         2055/363.5MHz         10MHz_QPSK_10         12.20         Max         AMR         NB         2N         3150         21.96         20.00         90.04         20.04         6.00         14.04           23.85         Max         AMR         NB         2N         3150         21.96         20.00         90.04         20.00         14.04         10.01         10.01         23.85         Max         AMR         NB         2N         3150         21.96         20.00         90.01         20.00         6.00         14.04         10.00         14.02         10.01         10.01         10.01         10.01         10.01         10.01         10.01         10.01         10.01         10.01         10.01					12.20	Max	AMR	NB	8N	3150	22.10	20.00	90.17	20.17	6.00	14.17	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	7		00050/4700 0041		12.20	Max	AMR	NB	2N	3150	23.02	20.00	89.95	19.95	6.00	13.95	Dese
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		LTE FDD Band 4	20050/1720.0MHz	20MHZ_QPSK_1_99	23.85	Max	AMR	WB	8N	3150	22.16	20.00	90.20	20.20	6.00	14.20	Pass
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$					23.85	Max	AMR	WB	2N	3150	23.08	20.00	89.96	19.96	6.00	13.96	Í
$ \left[ $					12.20	Max	AMR	NB	8N	3150	21.89	20.00	90.04	20.04	6.00	14.04	
$ \left[ 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 $			00505/000 51411		12.20	Max	AMR	NB	2N	3150	22.78	20.00	89.87	19.87	6.00	13.87	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	ð	LTE FDD Band 5	20525/836.5IVIHZ	TUMHZ_QPSK_T_U	23.85	Max	AMR	WB	8N	3150	21.96	20.00	90.19	20.19	6.00	14.19	Pass
$ \left[ \begin{array}{c c c c c c c c c c c c c c c c c c c $				1.1	23.85	Max	AMR	WB	2N	3150	22.83	20.00	90.02	20.02	6.00	14.02	Í
9         LTE FDD Band 12         23130/711.0MHz         10MHz_QPSK_149         23.85         Max         AMR         WB         8N         3150         21.99         20.00         90.40         20.40         6.00         14.40           23.85         Max         AMR         WB         8N         3150         21.99         20.00         90.40         20.40         6.00         14.40           10         23.85         Max         AMR         WB         2N         3150         22.90         20.00         90.25         20.25         6.00         14.20           10         LTE FDD Band 13         23230/782.0MHz         10MHz_QPSK_10         12.20         Max         AMR         NB         8N         2500         22.04         20.00         90.22         20.22         6.00         14.22           10         10HHz_QPSK_10         102.00         Max         AMR         NB         2N         2500         22.04         20.00         90.28         20.22         6.00         13.98         12.98         23.85         Max         AMR         NB         2N         2500         22.12         20.00         90.07         20.07         6.00         14.07         14.28         23.85					12.20	Max	AMR	NB	8N	3150	21.95	20.00	90.34	20.34	6.00	14.34	
Image: Relation in the section in the secting section in the section in t			00400/744 01411		12.20	Max	AMR	NB	2N	3150	22.86	20.00	90.16	20.16	6.00	14.16	
Image: height base in the image: height base index in the image: height base index in the image: he	9	LIE FDD Band 12	23130/711.0MHz	10MHZ_QPSK_1_49	23.85	Max	AMR	WB	8N	3150	21.99	20.00	90.40	20.40	6.00	14.40	Pass
10         LTE FDD Band 13         23230/782.0MHz         10MHz_QPSK_10         12.20         Max         AMR         NB         2N         2500         22.96         20.00         89.98         19.98         6.00         13.98         23.98           10         LTE FDD Band 13         23230/782.0MHz         10MHz_QPSK_10         12.20         Max         AMR         WB         8N         2500         22.96         20.00         89.98         19.98         6.00         13.98         23.98         23.85         Max         AMR         WB         8N         2500         22.12         20.00         90.28         20.00         14.28         14.28           11         LTE FDD Band 25         26140/1860.0MHz         20MHz_QPSK_10         12.20         Max         AMR         NB         8N         2500         22.15         20.00         90.07         20.07         6.00         14.07           11         LTE FDD Band 25         26140/1860.0MHz         20MHz_QPSK_10         12.20         Max         AMR         NB         2N         23.00         20.00         90.08         20.08         6.00         14.08         20.98         20.00         20.00         90.08         20.08         6.00         14.08					23.85	Max	AMR	WB	2N	3150	22.90	20.00	90.25	20.25	6.00	14.25	( – L
10       LTE FDD Band 13       23230/782.0MHz       10MHz_QPSK_1_0       23.85       Max       AMR       WB       8N       2500       22.12       20.00       90.28       20.28       6.00       14.28         23.85       Max       AMR       WB       8N       2500       23.03       20.00       90.28       20.28       6.00       14.28         23.85       Max       AMR       WB       2N       2500       23.03       20.00       90.07       20.07       6.00       14.07         11       LTE FDD Band 25       26140/1860.0MHz       20MHz_QPSK_1.0       12.20       Max       AMR       NB       8N       2500       22.15       20.00       90.37       20.37       6.00       14.37         11       LTE FDD Band 25       26140/1860.0MHz       20MHz_QPSK_1.0       12.20       Max       AMR       NB       2N       3150       23.20       20.00       90.08       20.08       6.00       14.38         2014       26140/1860.0MHz       20MHz_QPSK_1.0       12.20       Max       AMR       NB       8N       2500       22.18       20.00       90.08       20.08       6.00       14.41         2014       6.00       14.41					12.20	Max	AMR	NB	8N	2500	22.04	20.00	90.22	20.22	6.00	14.22	
Image: height of the state of the					12.20	Max	AMR	NB	2N	2500	22.96	20.00	89.98	19.98	6.00	13.98	
Image: height in the problem	10	LIE FDD Band 13	23230/782.0MHz	10MHz_QPSK_1_0	23.85	Max	AMR	WB	8N	2500	22.12	20.00	90.28	20.28	6.00	14.28	Pass
11     LTE FDD Band 25     20140/1860.0MHz     20MHz_QPSK_1_0     12.20     Max     AMR     NB     2N     3150     23.20     20.00     90.08     20.08     6.00     14.08       23.85     Max     AMR     WB     8N     2500     22.18     20.00     90.41     20.41     6.00     14.41					23.85	Max	AMR	WB	2N	2500	23.03	20.00	90.07	20.07	6.00	14.07	
11     LTE FDD Band 25     26140/1860.0MHz     20MHz_QPSK_1_0     23.85     Max     AMR     WB     8N     2500     22.18     20.00     90.41     20.41     6.00     14.41					12.20	Max	AMR	NB	8N	2500	22.15	20.00	90.37	20.37	6.00	14.37	
23.85 Max AMR WB 8N 2500 22.18 20.00 90.41 20.41 6.00 14.41					12.20	Max	AMR	NB	2N	3150	23.20	20.00	90.08	20.08	6.00	14.08	
	11	LTE FDD Band 25	26140/1860.0MHz	20MHz_QPSK_1_0	23.85	Max	AMR	WB	8N	2500	22.18	20.00	90.41	20.41	6.00	14.41	Pass
23.85 Max AMR WB 2N 3150 23.14 20.00 90.14 20.14 6.00 14.14					23.85	Max	AMR	WB	2N	3150	23.14	20.00	90.14	20.14	6.00	14.14	



Plot No.	Mode	Channel/Freq.	BW	Codec B itrate	Volume Level	Codec T ype	Codec B andwidt h	Mountin g Force (N)	Freque ncy(H Z)	Min PN- SDNR(d B)	PN-SDN R Limb (dB)	Signal Q uality (d B)	Convers ational Gain	FCC CG Limit (d B)	CG Mar gin (dB)	Verdi ct
				12.20	Max	AMR	NB	8N	3150	22.07	20.00	90.45	20.45	6.00	14.45	
40		00040/000 00411-		12.20	Max	AMR	NB	2N	1600	22.91	20.00	90.22	20.22	6.00	14.22	Dava
12	LTE FDD Band 26 26840/829.0MHz	MHz 10MHz_QPSK_1_49	23.85	Max	AMR	WB	8N	3150	22.04	20.00	90.51	20.51	6.00	14.51	Pass	
				23.85	Max	AMR	WB	2N	1600	22.96	20.00	90.30	20.30	6.00	14.30	
			12.20	Max	AMR	NB	8N	1600	22.11	20.00	90.32	20.32	6.00	14.32		
13	LTE TDD Band 41	41090/2640.0MHz		12.20	Max	AMR	NB	2N	3150	23.00	20.00	90.11	20.11	6.00	14.11	Pass
13	LIE IDD Band 41	41090/2640.0MHz	20MHz_QPSK_1_99	23.85	Max	AMR	WB	8N	1600	22.19	20.00	90.35	20.35	6.00	14.35	Pass
				23.85	Max	AMR	WB	2N	3150	23.15	20.00	90.17	20.17	6.00	14.17	Í l
			20MHz 20MHz_QPSK_1_0	12.20	Max	AMR	NB	8N	3150	21.97	20.00	90.61	20.61	6.00	14.61	– Pass
		400070/4700144		12.20	Max	AMR	NB	2N	3150	22.89	20.00	90.39	20.39	6.00	14.39	
14	LTE FDD Band 66	132072/1720MHz		23.85	Max	AMR	WB	8N	3150	22.05	20.00	90.65	20.65	6.00	14.65	
				23.85	Max	AMR	WB	2N	3150	22.94	20.00	90.32	20.32	6.00	14.32	
				12.20	Max	AMR	NB	8N	3150	22.25	20.00	90.53	20.53	6.00	14.53	
45		400070/000 00411-		12.20	Max	AMR	NB	2N	2500	23.08	20.00	90.35	20.35	6.00	14.35	
15	LTE FDD Band 71	133372/688.0MHz	20MHz_QPSK_1_99	23.85	Max	AMR	WB	8N	3150	22.18	20.00	90.58	20.58	6.00	14.58	Pass
				23.85	Max	AMR	WB	2N	2500	23.02	20.00	90.41	20.41	6.00	14.41	
	16 2.4G WIFI 6/2437.0MHz			12.20	Max	AMR	NB	8N	3150	21.01	20.00	90.16	20.16	6.00	14.16	
16			12.20	Max	AMR	NB	2N	3150	21.14	20.00	90.28	20.28	6.00	14.28		
01		0/2437.UWHZ	Hz /	23.85	Max	AMR	WB	8N	3150	21.52	20.00	90.29	20.29	6.00	14.29	- Pass
				23.85	Max	AMR	WB	2N	3150	21.69	20.00	90.37	20.37	6.00	14.37	



#### 9.2 Receive acoustic frequency response performance

Plot	Mode	Channel/Freq.	BW	Volume Level	Codec Type	Codec Bandwidth	Mounting Force (N)	RFR	
No.		- chainfoir rogi	2	Tordino Lovor				Test Result	
1	GSM850	128/824.2MHz	/	Max	EFR	NB	2N	Pass	
				Max	EFR	NB	8N		
2	PCS1900	512/1850.2MHz	1	Max	EFR	NB	2N	Pass	
-	1 00 1000	0.12,1000.2.00.12		Max	EFR	NB	8N		
				Max	AMR	NB	2N		
3	WCDMA Band II	9262/1852.4MHz	1	Max	AMR	NB	8N	Pass	
Ŭ		0202/1002.11112		Max	AMR	WB	2N	1 400	
				Max	AMR	WB	8N		
				Max	AMR	NB	2N		
4	WCDMA Band IV	1312/1712.4MHz	/	Max	AMR	NB	8N	Pass	
4		1312/17 12.410112	/	Max	AMR	WB	2N	r ass	
				Max	AMR	WB	8N		
				Max	AMR	NB	2N		
_				Max	AMR	NB	8N		
5	WCDMA Band V	4233/846.6MHz	/	Max	AMR	WB	2N	Pass	
				Max	AMR	WB	8N		
				Max	AMR	NB	2N		
		18700/1860.0MHz		Max	AMR	NB	8N		
6	LTE FDD Band 2		20MHz_QPSK_1_0	Max	AMR	WB	2N	Pass	
				Max	AMR	WB	8N		
				Max	AMR	NB	2N		
					Max	AMR	NB	8N	
7	LTE FDD Band 4	20050/1720.0MHz	20MHz_QPSK_1_99	Max	AMR	WB	2N	Pass	
				Max	AMR	WB	8N		
				Max	AMR	NB	2N		
				Max	AMR	NB	8N		
8	LTE FDD Band 5	20525/836.5MHz	10MHz_QPSK_1_0	Max	AMR	WB	2N	Pass	
				Max	AMR	WB	8N	1 400	
				Max	AMR	NB	2N		
				Max	AMR	NB	8N		
9	LTE FDD Band 12	23130/711.0MHz	10MHz_QPSK_1_49	Max	AMR	WB	2N		
				Мах	AMR	WB	8N	Pass	
							2N		
				Max	AMR	NB			
10	LTE FDD Band 13	23230/782.0MHz	10MHz_QPSK_1_0	Max	AMR	NB WB	8N	Pass	
				Max	AMR		2N		
				Max	AMR	WB	8N		
				Max	AMR	NB	2N		
11	LTE FDD Band 25	26140/1860.0MHz	20MHz_QPSK_1_0	Max	AMR	NB	8N	Pass	
	LTE FUD Band 25 26140/1860.0MHz		Max	AMR	WB	2N			
				Max	AMR	WB	8N		

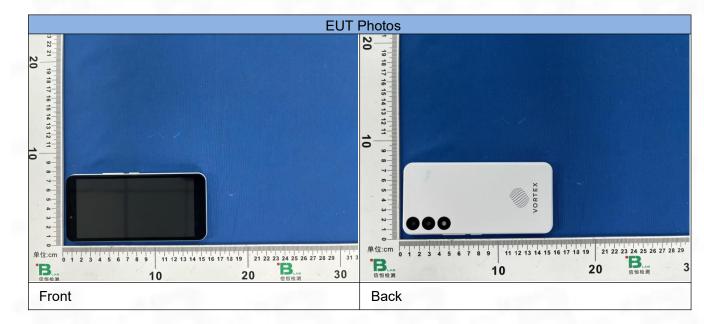
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Plot	Mada	Channel/Eren	DW		Cadaa Tura			RFR
No.	Mode	Channel/Freq.	BW	Volume Level	Codec Type	Codec Bandwidth	Mounting Force (N)	Test Result
				Max	AMR	NB	2N	
10		20040/020 00411-		Max	AMR	NB	8N	Dees
12	LTE FDD Band 26	26840/829.0MHz	10MHz_QPSK_1_49	Max	AMR	WB	2N	Pass
				Max	AMR	WB	8N	
				Max	AMR	NB	2N	
10	3 LTE TDD Band 41	11000/0010 0010		Max	AMR	NB	8N	D
13	LIE IDD Band 41	1 41090/2640.0MHz	20MHz_QPSK_1_99	Max	AMR	WB	2N	Pass
				Max	AMR	WB	8N	
		6 132072/1720MHz	20MHz_QPSK_1_0	Max	AMR	NB	2N	Pass
				Max	AMR	NB	8N	
14	LTE FDD Band 66			Max	AMR	WB	2N	
				Max	AMR	WB	8N	
				Max	AMR	NB	2N	Pass
15		100070/000 0141		Max	AMR	NB	8N	
15	LTE FDD Band 71	133372/688.0MHz	20MHz_QPSK_1_99	Max	AMR	WB	2N	
				Max	AMR	WB	8N	
				Max	AMR	NB	2N	
	2.4G WIFI			Max	AMR	NB	8N	
16	6 2.4G WIFI 802.11b		/	Max	AMR	WB	2N	Pass
				Max	AMR	WB	8N	



# 10. EUT photograph



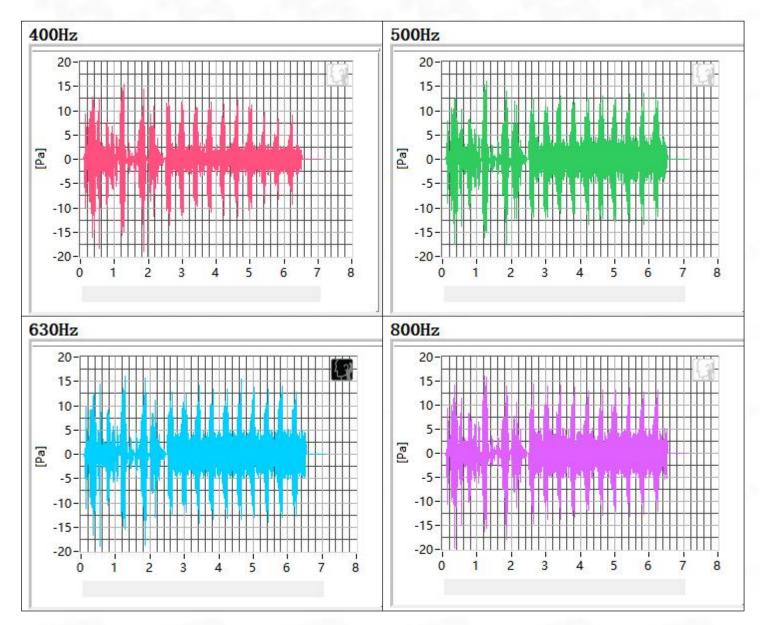
# **Volume Control Verification Test Results**

Date of Testing	Test Location	Air Interface Equipment	Acoustical Calibrator	HATS Sens.(dB)	Ambient Noise(dBA)
31/5/2024	Whisper 1	CMW 500	Type 4182C	97.30	32.29
31/5/2024	Whisper 1	CMW 500	Type 4182C	97.25	31.26
31/5/2024	Whisper 1	CMW 500	Type 4182C	97.19	32.19



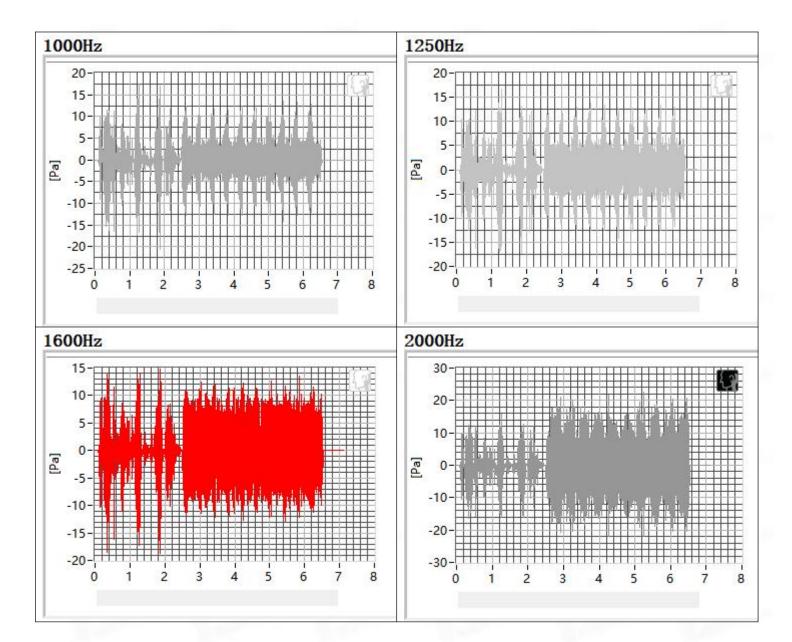
## ANNEX A Test Data 1. GSM 1900 in channel 512

### 1.1 Receive Distortion and Noise 8N NB

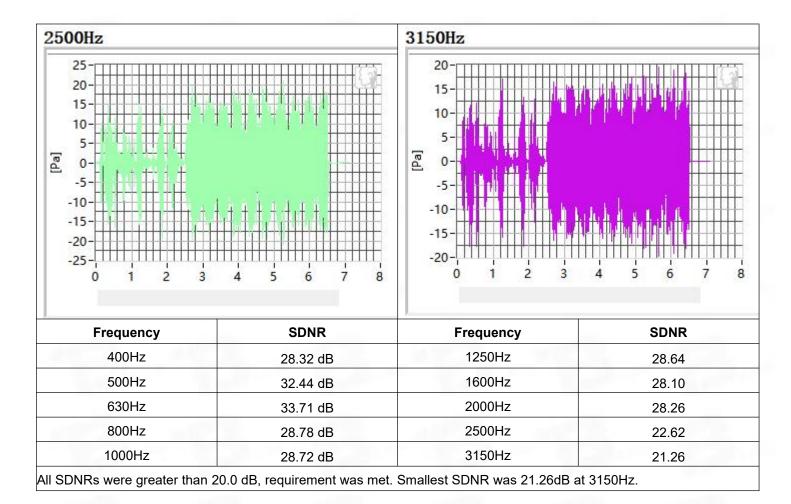


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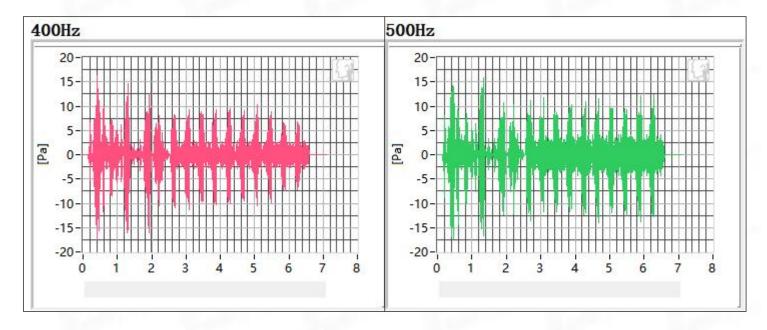








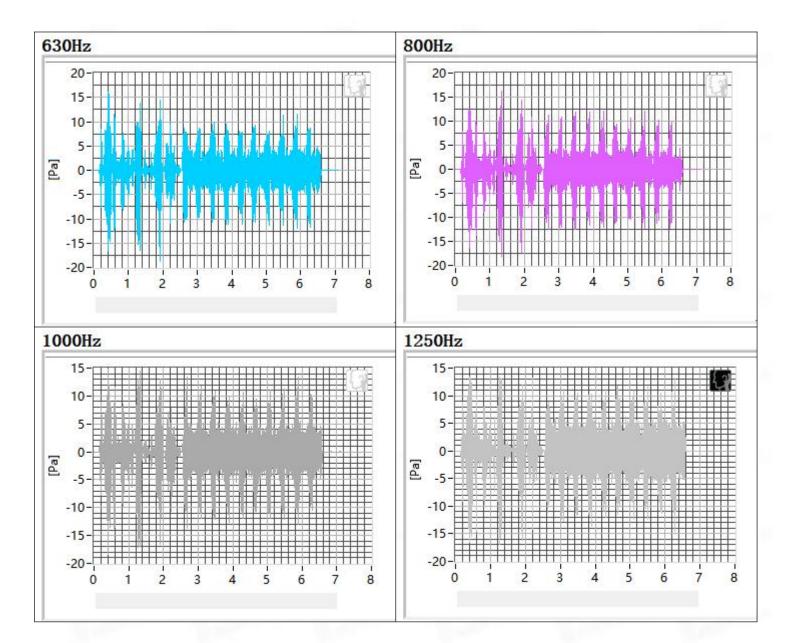
### 1.2 Receive Distortion and Noise 2N NB



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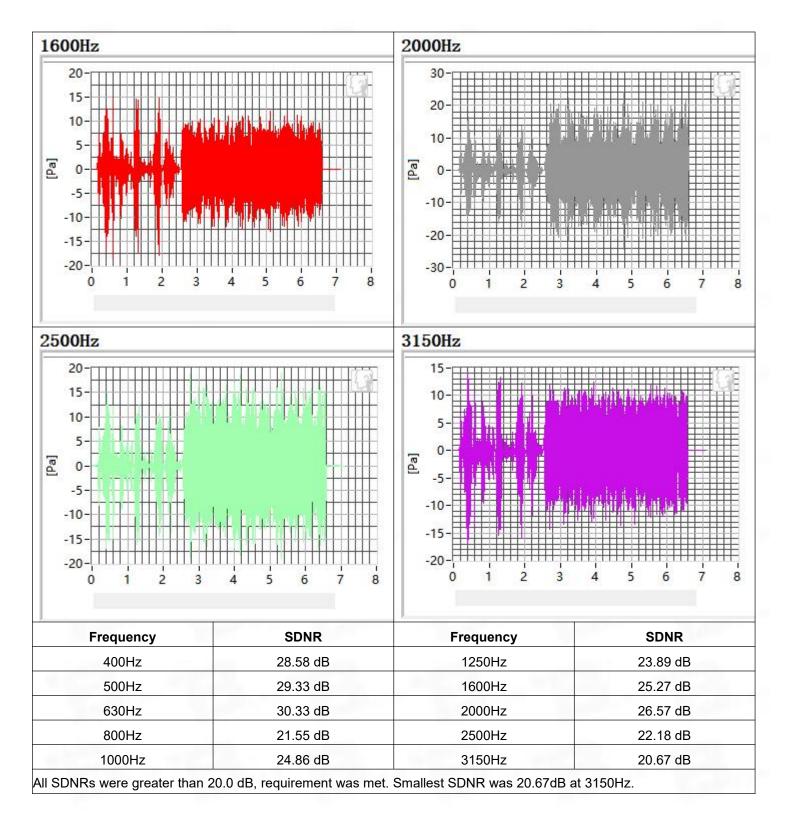




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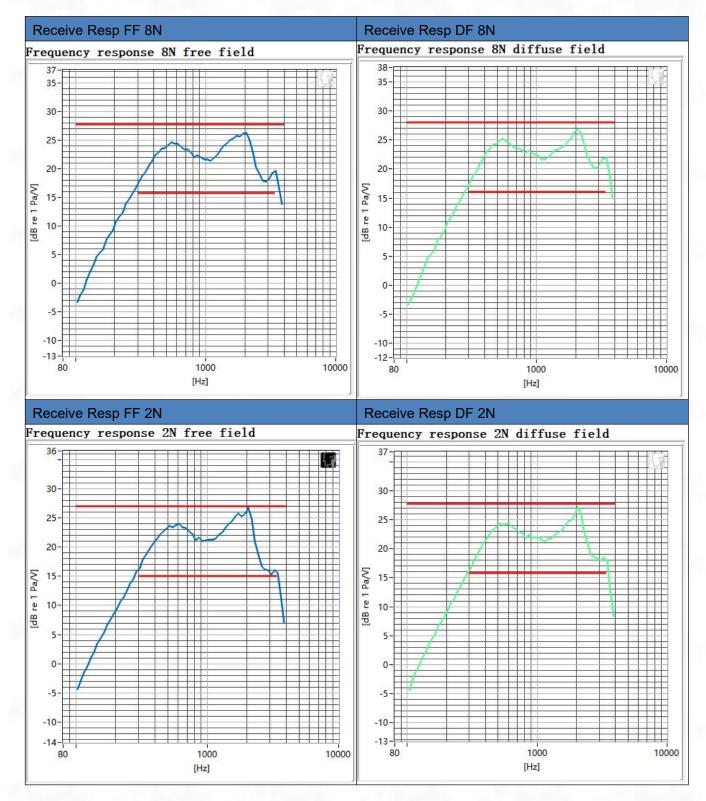


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## **1.3 Receive Frequency Response**

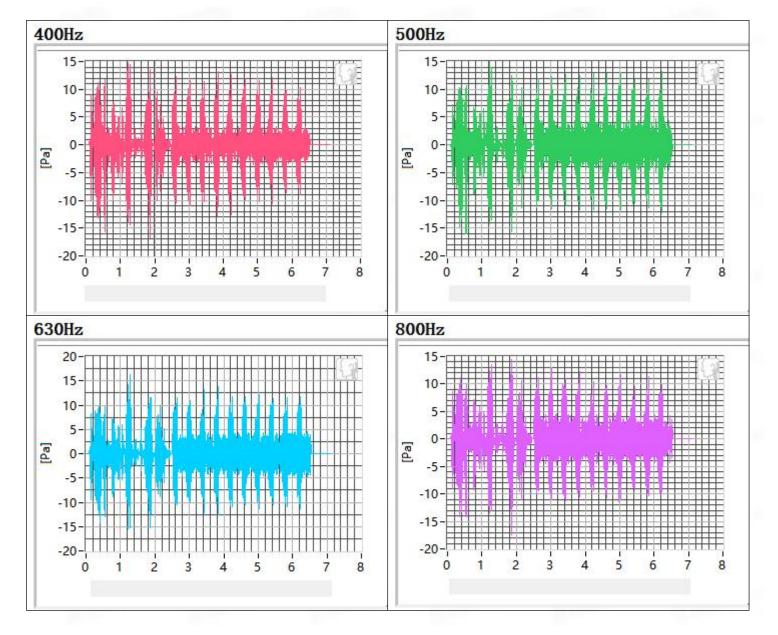


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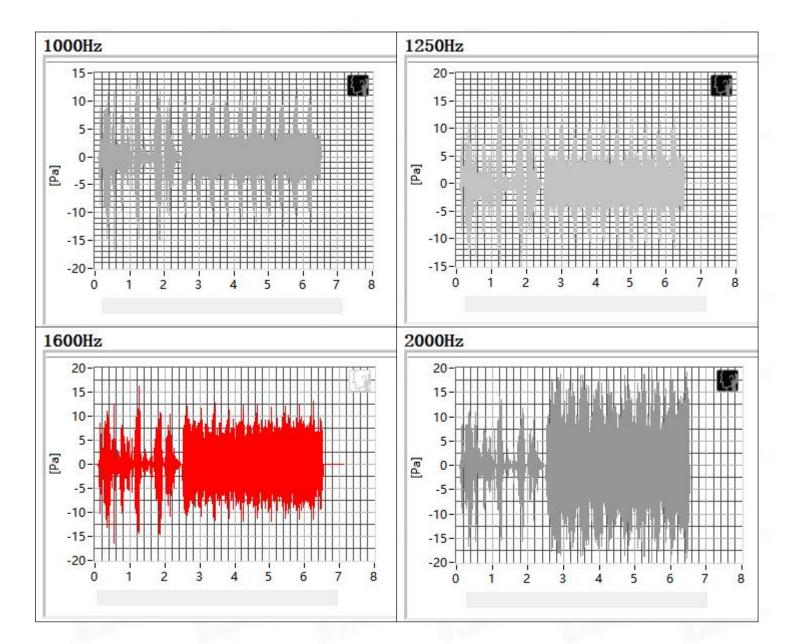
## 2. WCDMA band 2 in channel 9262

### 2.1 Receive Distortion and Noise 8N NB



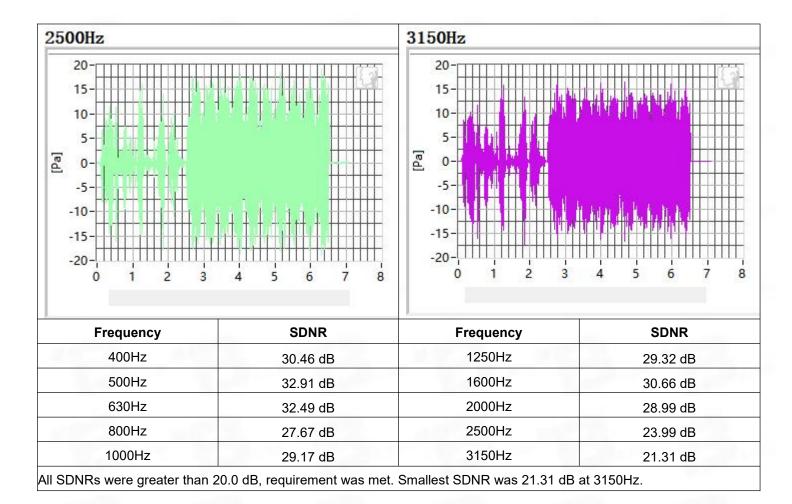
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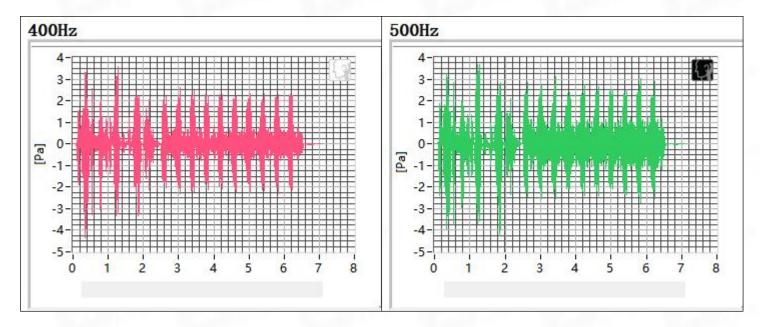


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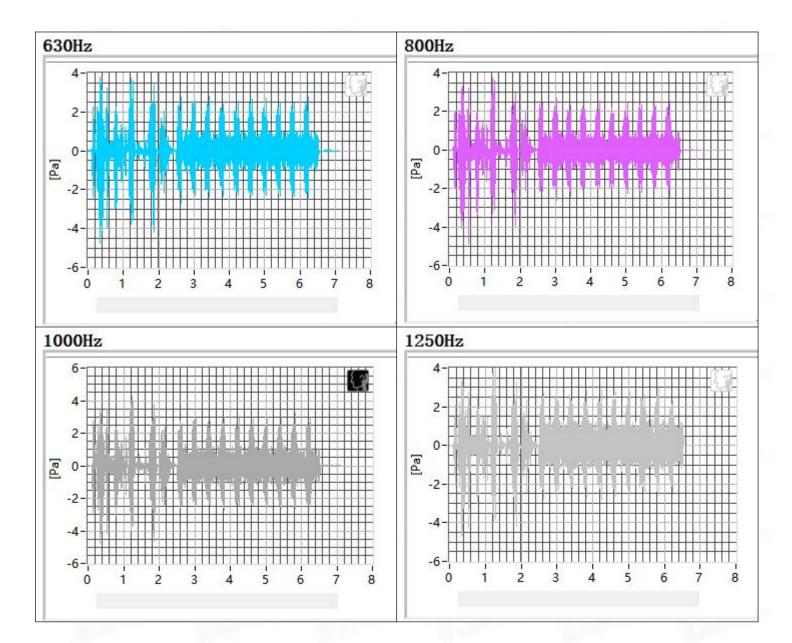
### 2.2 Receive Distortion and Noise 2N NB



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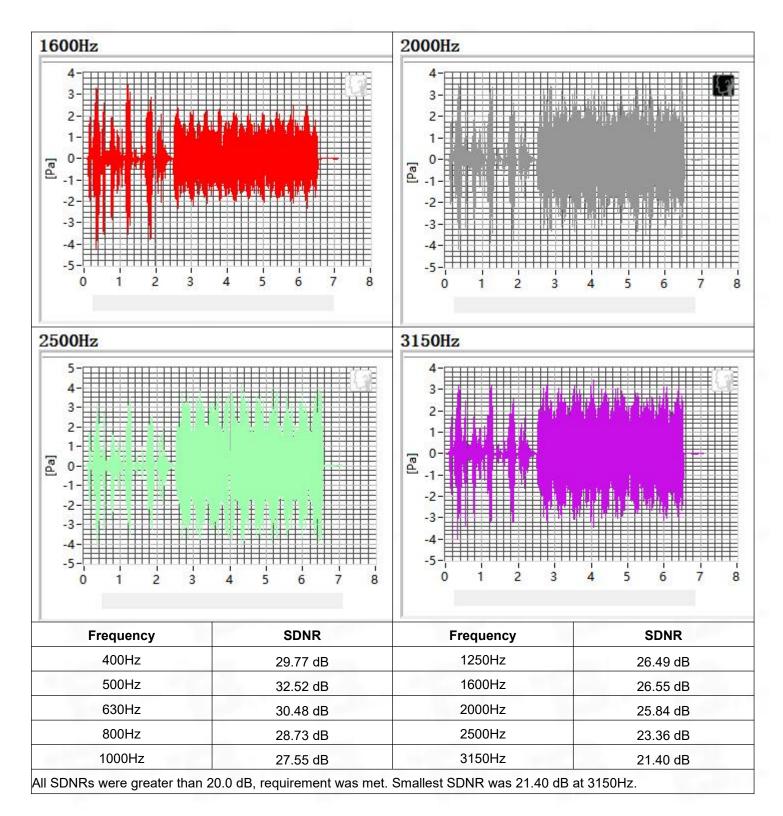
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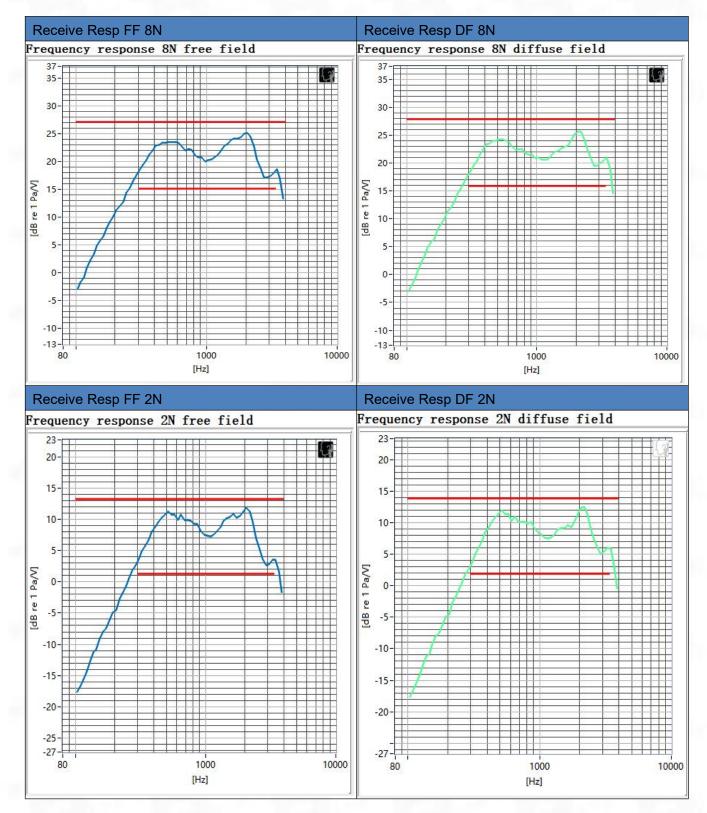






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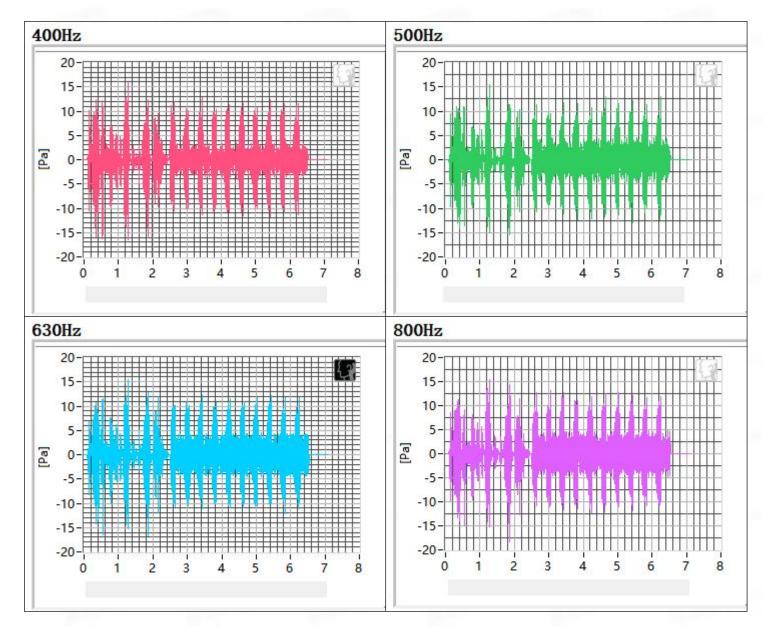
### 2.3 Receive Frequency Response



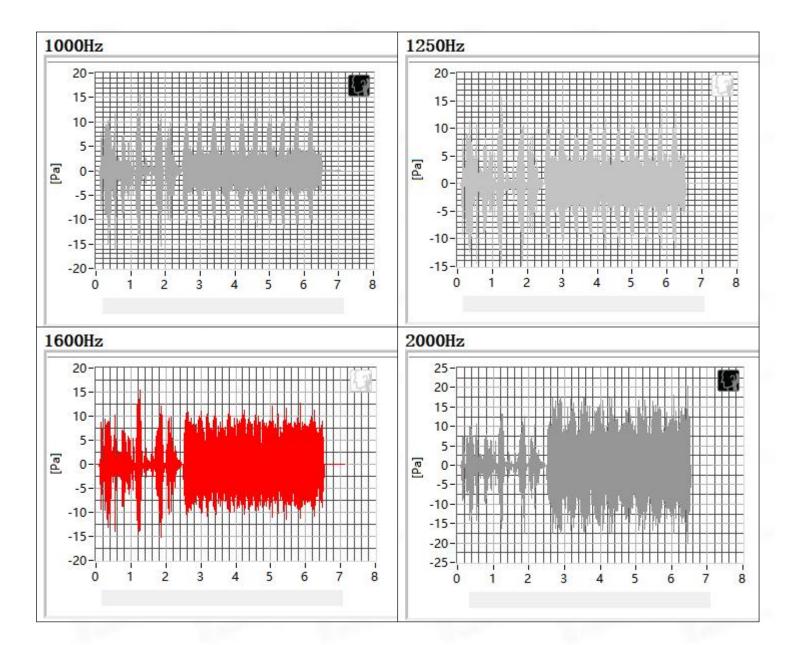
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# 3. LTE band 5 in channel 20525

### 3.1 Receive Distortion and Noise 8N NB

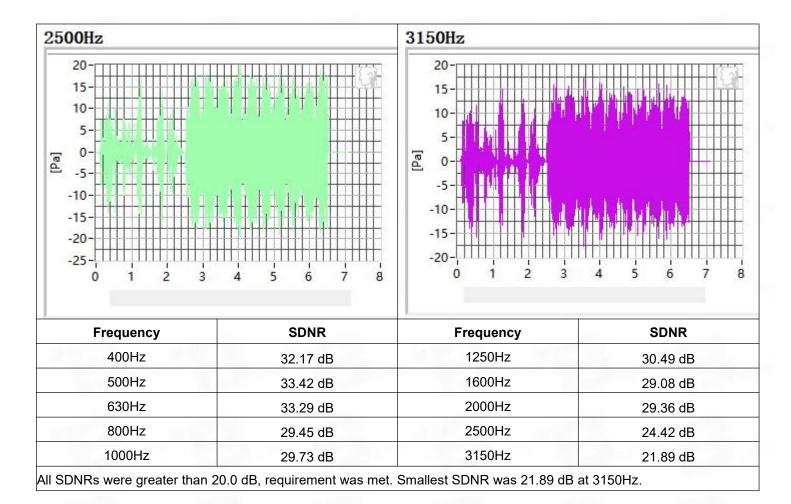




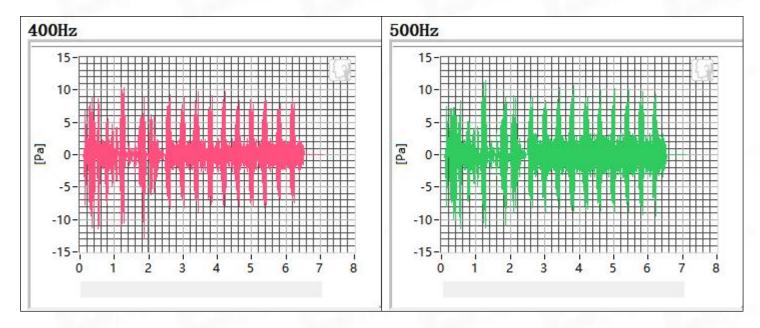


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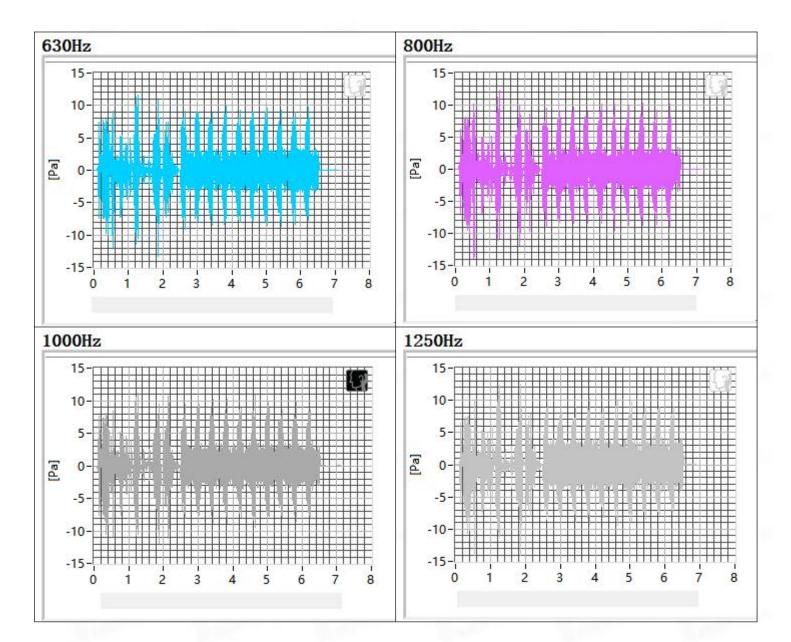
### 3.2 Receive Distortion and Noise 2N NB



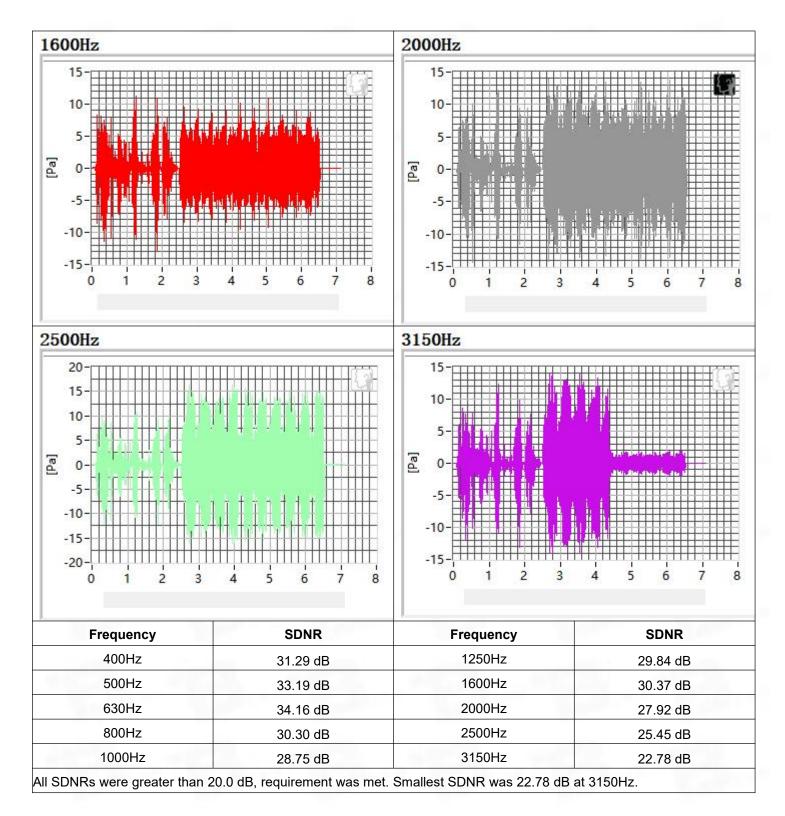
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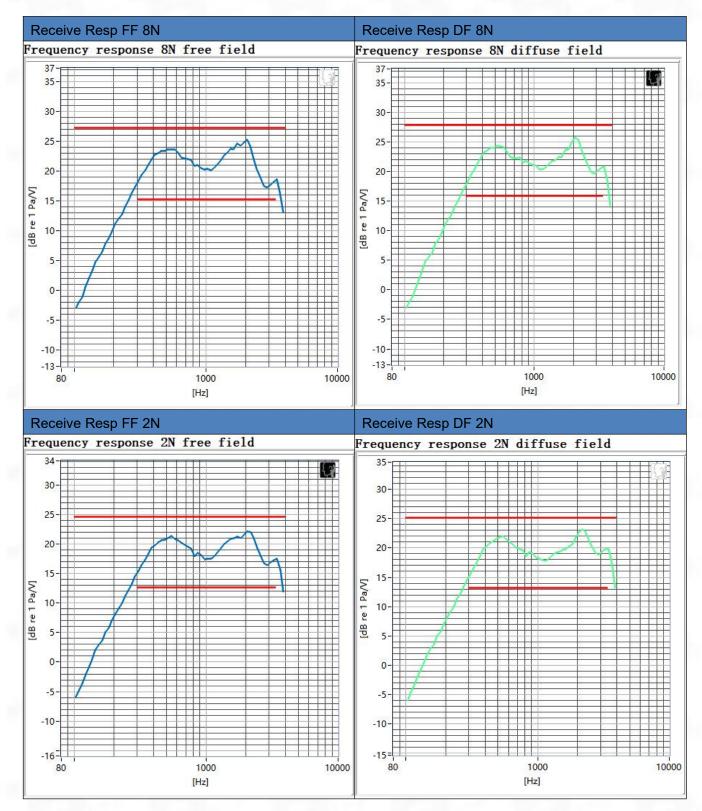




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### 3.3 Receive Frequency Response



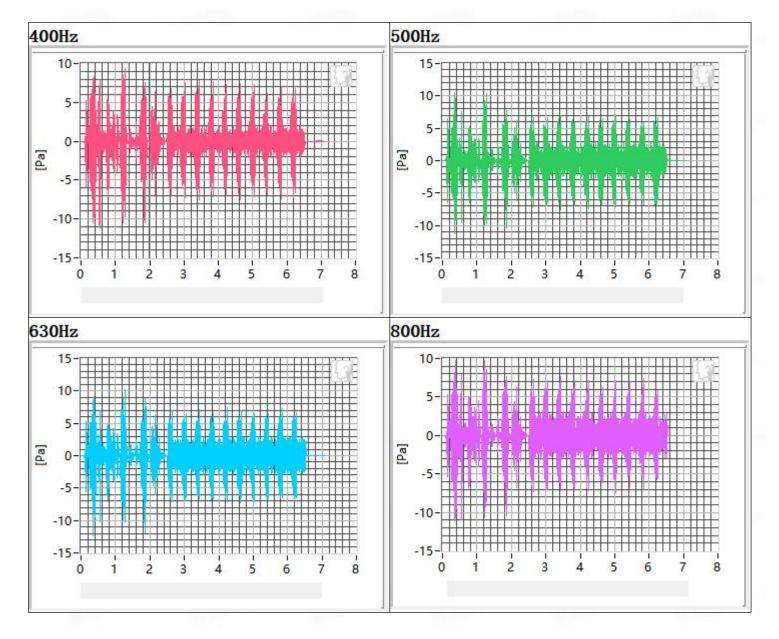
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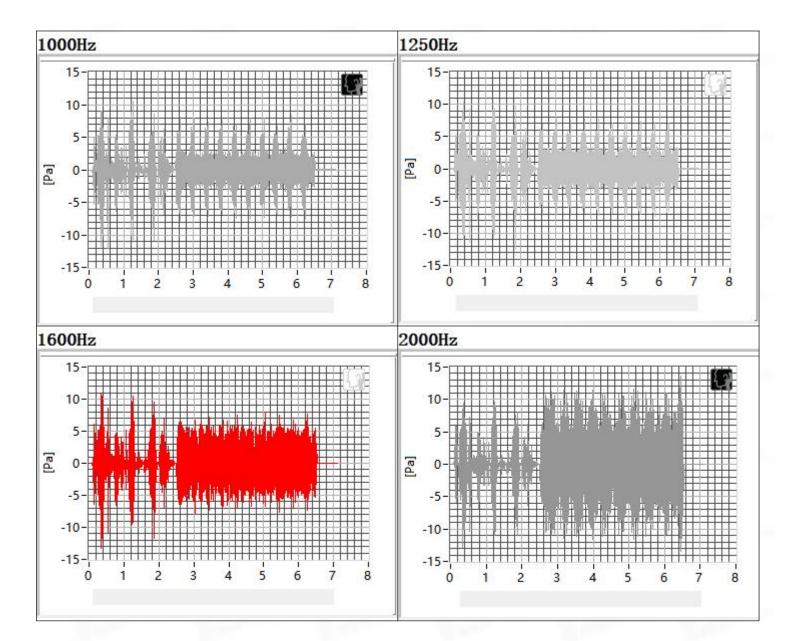
## 4. 2.4G WIFI in channel 6

### 4.1 Receive Distortion and Noise 8N NB



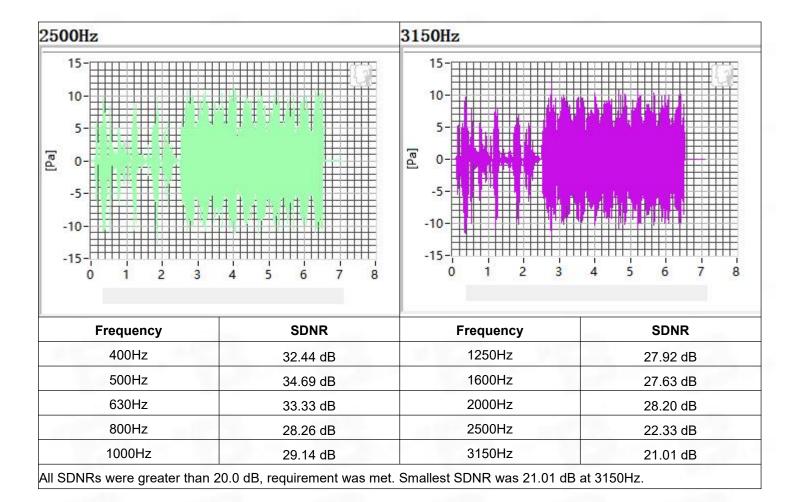
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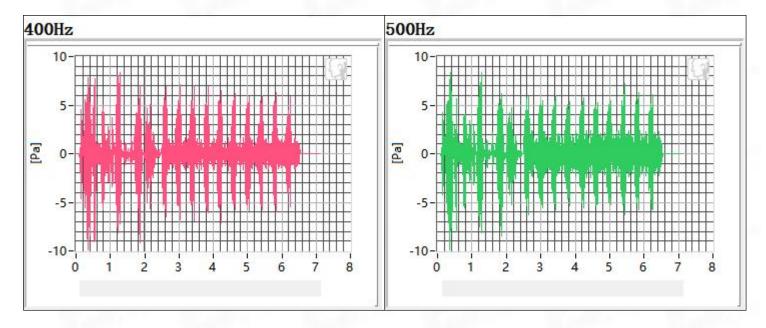


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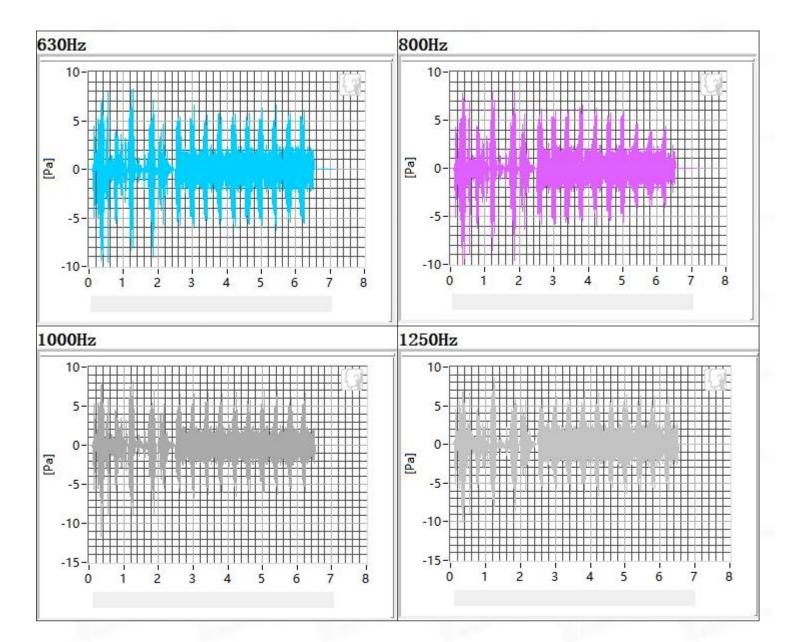
### 3.2 Receive Distortion and Noise 2N NB



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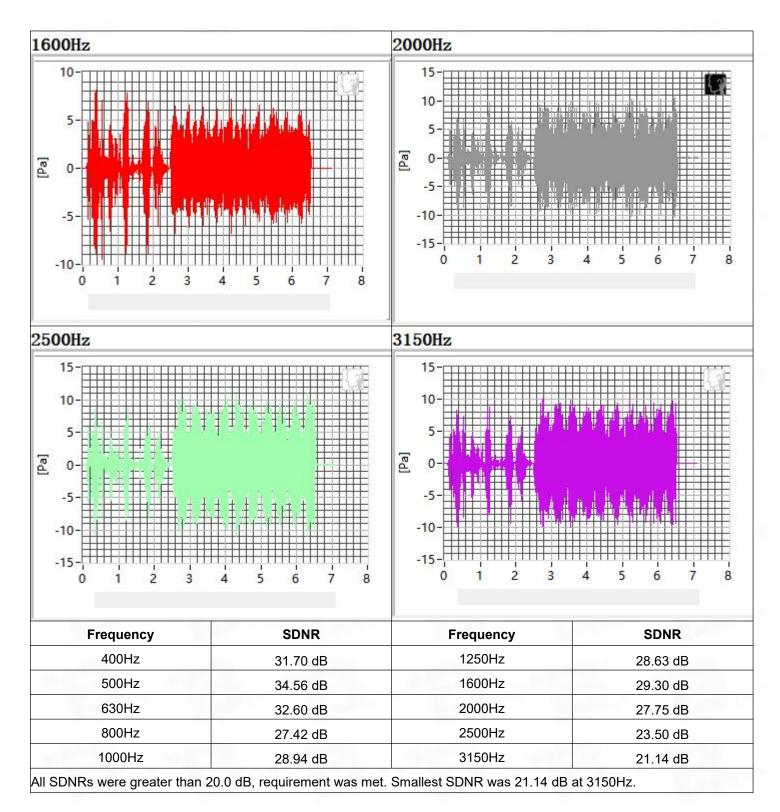
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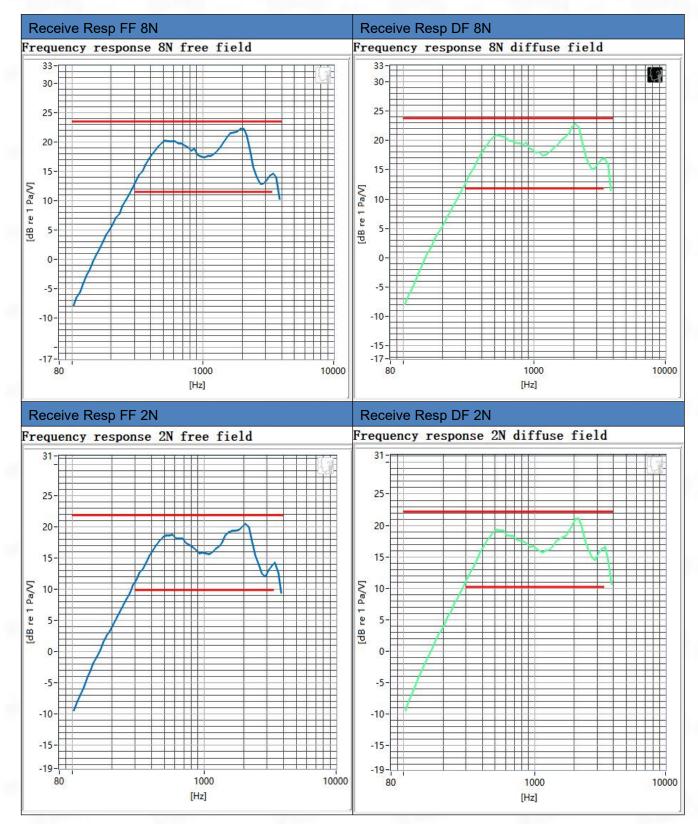
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### 3.3 Receive Frequency Response

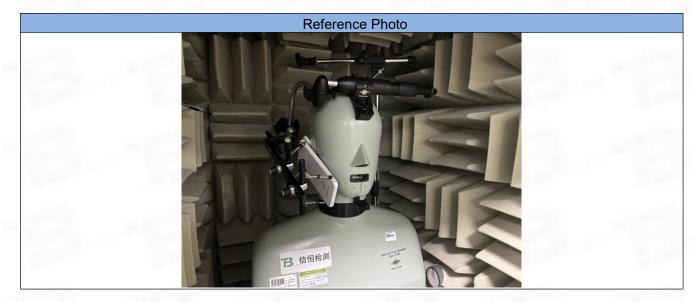


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# **ANNEX B Test Setup Photo**



# ANNEX C CALIBRATION REPORT

Please refer the document "CALIBRATION REPORT.pdf".



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