HEARING AID COMPATIBILITY RF EMISSIONS TEST REPORT

FCC ID	:	**A4RGGH2X**
Equipment	:	**Phone**
Model Name	:	**GGH2X, GC15S**
WD Emission Result	:	**PASS**
Applicant	:	**Google LLC 1600 Amphitheatre Parkway, Mountain View, CA 94043 USA**
Standard	:	**FCC 47 CFR §20.19 ANSI C63.19-2019**

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample provide by manufacturer and the test data has been evaluated in accordance with the test procedures given in ANSI 63.19-2019 / 47 CFR Part 20.19 and has been pass the FCC requirement.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Laboratory, the test report shall not be reproduced except in full.

Approved by: Cona Huang / Deputy Manager

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History of this test report

Report No.	Version	Description	Issued Date
HA3D2001A	Rev. 01	Initial issue of report	May. 13, 2024
HA3D2001A	Rev. 02	Update section 1, 2	May. 24, 2024

1. General Information

Product Feature & Specification	
Applicant Name	Google LLC
Equipment Name	Phone
Model Name	GGH2X, GC15S
FCC ID	A4RGGH2X
Frequency Band	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 30: 2305 MHz ~ 2315 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 48: 3550 MHz ~ 3700 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz 5G NR n2 : 1850 MHz ~ 1910 MHz 5G NR n5 : 824 MHz ~ 849 MHz 5G NR n7 : 2500 MHz ~ 2570 MHz 5G NR n12 : 699 MHz ~ 716 MHz 5G NR n14 : 788 MHz ~ 798 MHz 5G NR n25 : 1850 MHz ~ 1915 MHz 5G NR n26 : 814 MHz ~ 849 MHz 5G NR n30 : 2305 MHz ~ 2315 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n48 : 3550 MHz ~ 3700 MHz 5G NR n66 : 1710 MHz ~ 1780 MHz 5G NR n70 : 1695 MHz ~ 1710 MHz 5G NR n71 : 663 MHz ~ 698 MHz 5G NR n77: 3700 MHz ~ 3980 MHz, 3450MHz ~ 3550MHz 5G NR n78: 3700 MHz ~ 3800 MHz, 3450MHz ~ 3550MHz 5G NR n258 : 24.25 GHz~24.45 GHz, 24.75GHz ~25.25GHz 5G NR n260 : 37 GHz~40 GHz 5G NR n261 : 27.5 GHz~28.35 GHz NTN Band 23: 2000 MHz ~2020 MHz NTN Band 255: 1626.5 MHz ~ 1660.5 MHz WLAN 2.4 GHz Band: 2400 MHz ~ 2483.5 MHz WLAN 5.2 GHz Band: 5150 MHz ~ 5250 MHz WLAN 5.3 GHz Band: 5250 MHz ~ 5350 MHz WLAN 5.6 GHz Band: 5470 MHz ~ 5725 MHz WLAN 5.8 GHz Band: 5725 MHz ~ 5850 MHz WLAN 5.9 GHz Band: 5850 MHz ~ 5895 MHz WLAN 6E: 5925 MHz ~ 6425 MHz, 6425 MHz ~ 6525 MHz, 6525 MHz ~ 6875 MHz, 6875 MHz ~ 7125 MHz Bluetooth: 2400 MHz ~ 2483.5 MHz NFC: 13.56 MHz WPC: 110 kHz ~ 148.5 kHz(Rx) UWB: 6489.6 MHz, 7987.2 MHz Thread: 2405 MHz ~ 2480 MHz
Mode	GSM/GPRS/EGPRS UMTS: RMC/AMR 12.2Kbps, HSDPA, HSUPA LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR: DFT-s-OFDM/CP-OFDM, Pi/2 BPSK/QPSK/16QAM/64QAM/256QAM NTN: BPSK,QPSK WLAN:802.11a/b/g/n/ac/ax/be HT20/HT40/VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160/EHT20/EHT40/EHT80/EHT160 Bluetooth BR/EDR/LE/CS NFC: ASK WPC: ASK UWB: BPM-BPSK/HPSK Thread: QPSK

Reviewed by: Jason Wang

Report Producer: Daisy Peng

2. Air Interfaces

Air Interface	Band MHz	Type	C63.19 Tested	Simultaneous Transmitter	Name of Voice Service	Power State for HAC Compliance
GSM	GSM850	VO	No(1)	WLAN, BT, Thread	CMRS Voice	Head
	GSM1900					
	EDGE850	VD			Google Meet	
	EDGE1900					
UMTS	Band 2	VO	No(1)	WLAN, BT, Thread	CMRS Voice	Pmax
	Band 4					
	Band 5					
	HSPA	VD			Google Meet	
LTE	Band 2	VD	No(1)	5G NR, WLAN, BT, Thread	VoLTE / Google Meet	Pmax
	Band 4					
	Band 5					
	Band 7					
	Band 12					
	Band 13					
	Band 14					
	Band 17					
	Band 25					
	Band 26					
	Band 30					
	Band 38					
	Band 41					
	Band 48					
	Band 66					
	Band 71					
5G NR	n2	VD	No(1,2)	LTE, WLAN, BT, Thread	VoNR / Google Meet	Pmax
	n5					
	n7					
	n12					
	n14					
	n25					
	n26					
	n30					
	n38					
	n41					
	n48					
	n66					
	n70					
	n71					
	n77					
	n78					
	n258	VD			Google Meet	NA
	n260					
	n261					
Wi-Fi	2450	VD	No(1,2)	GSM, WCDMA, LTE, 5G NR, 5G/6GHz WLAN	VoWiFi / Google Meet	Head
	5200			GSM, WCDMA, LTE, 5G NR, 2.4G WLAN, BT, Thread		
	5300					
	5500					
	5800 / 5900					
	U-NII 5	VD		GSM, WCDMA, LTE, 5G NR, 2.4G WLAN, BT, Thread	VoWiFi / Google Meet	Head
	U-NII 6					
	U-NII 7					
	U-NII 8					
NTN	B23	DT	No	NA	NA	NA
	B255					
BT / Thread	2450	DT	No	GSM, WCDMA, LTE, 5G NR, 5G/6GHz WLAN	NA	NA

Type Transport:
VO= Voice only
DT= Digital Transport only (no voice)
VD= CMRS and IP Voice Service over Digital Transport

Remark:
1. The air interface max power plus MIF is complies with ANSI63.19-2019 Table 4.1 RF_{AIPL}
2. NR FR2 and WiFi 6E are currently outside the scope of ANSI C63.19 and FCC HAC regulations therefore they were not evaluated.
3. Because features of Google Meet allow the option of voice-only communications, Meet has been tested for HAC/T-Coil compatibility to ensure the best user experience.
4. The product only 3G/4G/5G support TAS feature, therefore UMTS/LTE/5GFR1 HAC were tested at Pmax level. The GSM and WIFI set to highest device transmit power in a held to the ear mode.
5. Pmax is the maximum output power for the handset for the indicated air interface.
6. Head refers to the handset's maximum RF power possible for all user conditions during held-to-ear scenarios.

3. Applied Standards

- FCC CFR47 Part 20.19
- ANSI C63.19-2019
- FCC KDB 285076 D01 HAC Guidance v06r04
- FCC KDB 285076 D03 HAC FAQ v01r06

4. WD Emission Requirements

The WD's conducted power must be at or below either the stated RFAIPL (Table 4.1) or the stated peak power level (Table 4.2), or the average near-field emissions over the measurement area must be at or below the stated RFAIL (Table 4.3), or the stated peak field strength (Table 4.4). The WD may demonstrate compliance by meeting any of these four requirements, but it must do so in each of its operating bands at its established worst-case normal speech-mode operating condition.

Table 4.1 - Wireless device RF audio interference power level	
Frequency range (MHz)	RF_{AIPL} (dBm)
< 960	29
960 - 2000	26
> 2000	25

Table 4.2 - Wireless device RF peak power level	
Frequency range (MHz)	$RF_{Peak\ Power}$ (dBm)
< 960	35
960 - 2000	32
> 2000	31

Table 4.3 - Wireless device RF audio interference level	
Frequency range (MHz)	RF_{AIL} [dB(V/m)]
< 960	39
960 - 2000	36
> 2000	35

Table 4.4 - Wireless device RF peak near-field level	
Frequency range (MHz)	RF_{Peak} [dB(V/m)]
< 960	45
960 - 2000	42
> 2000	41

5. Modulation Interference Factor

For any specific fixed and repeatable modulated signal, a Modulation Interference Factor (MIF, expressed in decibels) may be developed that relates its interference potential to its steady state rms signal level or average power level. This factor is a function only of the audio frequency amplitude modulation characteristics of the signal and is the same for field strength or conducted power measurements. It is important to emphasize that the MIF is valid only for a specific repeatable audio frequency amplitude modulation characteristic. Any change in modulation characteristic requires determination and application of a new MIF.
MIF may be determined using a radiated RF field, a conducted RF signal, or, in a preliminary stage, a mathematical analysis of a modeled RF signal.

a. Verify the slope accuracy and dynamic range capability over the desired operating frequency band of a fast probe or sensor, square-law detector, as specified in ANSI 63.19: 2019 D.3, and weighting system as specified in ANSI 63.19: 2019 D.4 and ANSI 63.19: 2019 D.5. For the probe and instrumentation included in the measurement of MIF, additional calibration and application of calibration factors are not required.
b. Using RF illumination, or conducted coupling, apply the specific modulated signal in question to the measurement system at a level within its confirmed operating dynamic range
c. Measure the steady-state rms level at the output of the fast probe or sensor
d. Measure the steady-state average level at the weighting output
e. Without changing the square-law detector or weighting system, and using RF illumination, or conducted coupling, substitute for the specific modulated signal a 1 kHz, 80% amplitude modulated carrier at the same frequency and adjust its strength until the level at the weighting output equals the Step d) measurement
f. Without changing the carrier level from Step e), remove the 1 kHz modulation and again measure the steady-state rms level indicated at the output of the fast probe or sensor.
g. The MIF for the specific modulation characteristic is given by the ratio of the Step f) measurement to the Step c) measurement, expressed in decibels (20*log(step6/step3)

In practice, Step e) and Step f) need not be repeated for each MIF determination if the relationship between the two measurements has been pre-established for the measurement system over the operating frequency and dynamic ranges. In such cases, only the modulation characteristic being tested needs to be available during WD testing
Since indirect measurement procedure was using for RF audio interference power level evaluation, the MIF values applied in this test report were provided by the HAC equipment provider of SPEAG, and the worst values for all air interface are listed below to be determine the Wireless device RF audio interference power level.

UID	Communication System Name	MIF(dB)
10021	GSM-FDD(TDMA,GMSK)	3.63
10023	GPRS-FDD (TDMA, GMSK, TN 0)	3.8
10024	GPRS-FDD (TDMA, GMSK, TN 0-1)	1.15
10027	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	-0.67
10028	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	-2.05
10025	EDGE-FDD (TDMA, 8PSK, TN 0)	3.75
10026	EDGE-FDD (TDMA, 8PSK, TN 0-1)	1.23
10029	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	-0.52
10058	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	-1.82
10460	UMTS-FDD(WCDMA, AMR)	-25.43
10225	UMTS-FDD (HSPA+)	-20.39
10170	LTE-FDD(SC-FDMA,1RB,20MHz,16-QAM)	-9.76
10173	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	-1.44
10769	5G NR 100% duty (CP-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	-12.08
10973	5G NR 40% duty ((DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	-1.64
10061	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	-2.02
10077	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	0.12
10427	IEEE 802.11n (HT Greeneld, 150 Mbps, 64-QAM)	-13.44
10069	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	-3.15
10616	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	-5.57
10671	IEEE 802.11ax (20MHz, MCS0, 90pc duty cycle)	-5.58
11026	IEEE 802.11be (320MHz, MCS0, 99pc duty cycle)	-28.73

6. Evaluation of WD RF audio interference power level

General Note:

1. The following table is according to ANSI 63.19:2019 section 4.4 indirect measurement procedure to evaluation max average conducted power from each air interface plus MIF to evaluate whether it complies with ANSI63.19-2019 Table 4.1 RF_{AIPL}, compliance with table 4.1 means compliance with WD emission requirements.
2. Since the device support TAS feature for UMTS, LTE and FR1, thus HAC RF was evaluated at Pmax Average Power level to complies with ANSI63.19-2019 Table 4.1 $RF_{AIPL.}$
3. The Head Average Power level for GSM/WLAN operation was used to complies with ANSI63.19-2019 Table 4.1 $RF_{AIPL.}$

Ant 0					
Air Interface	Max Burst Antenna Input Power (dBm)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	Power + MIF(dB)	C63.19 test required(2019)
GSM850	33.50	24.50	3.63	28.13	No
GPRS850 - 1TX	33.50	24.50	3.8	28.3	No
GPRS850 - 2TX	32.50	26.50	1.15	27.65	No
GPRS850 - 3TX	31.50	27.24	-0.67	26.57	No
GPRS850 - 4TX	30.50	27.50	-2.05	25.45	No
EDGE850 - 1TX	27.50	18.50	3.75	22.25	No
EDGE850 - 2TX	26.50	20.50	1.23	21.73	No
EDGE850 - 3TX	25.50	21.24	-0.52	20.72	No
EDGE850 - 4TX	24.50	21.50	-1.82	19.68	No
WCDMA	25.00	25.00	-25.43	-0.43	No
WCDMA - HSPA	25.00	25.00	-20.39	4.61	No
LTE - FDD	25.70	25.70	-9.76	15.94	No
LTE – TDD	25.10	23.40	-1.44	21.96	No
5G NR - FDD	25.70	25.70	-12.08	13.62	No
5G NR - TDD	27.00	24.00	-1.64	22.36	No

Ant 1					
Air Interface	Max Burst Antenna Input Power (dBm)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	Power + MIF(dB)	C63.19 test required(2019)
GSM850	33.50	24.50	3.63	28.13	No
GPRS850 - 1TX	33.50	24.50	3.8	28.3	No
GPRS850 - 2TX	30.70	26.50	1.15	27.65	No
GPRS850 - 3TX	28.90	27.24	-0.67	26.57	No
GPRS850 - 4TX	27.70	27.70	-2.05	25.65	No
EDGE850 - 1TX	27.50	18.50	3.75	22.25	No
EDGE850 - 2TX	26.50	20.50	1.23	21.73	No
EDGE850 - 3TX	25.50	21.24	-0.52	20.72	No
EDGE850 - 4TX	24.50	21.50	-1.82	19.68	No
GSM1900	24.70	21.50	3.63	25.13	No
GPRS1900 - 1TX	24.70	21.50	3.8	25.3	No
GPRS1900 - 2TX	21.70	23.00	1.15	24.15	No
GPRS1900 - 3TX	19.90	24.24	-0.67	23.57	No
GPRS1900 - 4TX	18.70	18.70	-2.05	16.65	No
EDGE1900 - 1TX	24.70	17.50	3.75	21.25	No
EDGE1900 - 2TX	21.70	19.50	1.23	20.73	No
EDGE1900 - 3TX	19.90	20.24	-0.52	19.72	No
EDGE1900 - 4TX	18.70	20.50	-1.82	18.68	No
WCDMA	25.60	24.30	-25.43	-1.13	No
WCDMA - HSPA	25.60	24.30	-20.39	3.91	No
LTE - FDD	25.70	25.70	-9.76	15.94	No
LTE – TDD	21.50	21.50	-1.44	20.06	No
5G NR - FDD	25.70	24.90	-12.08	12.82	No
5G NR - TDD	24.00	24.00	-1.64	22.36	No

Ant 2					
Air Interface	Max Burst Antenna Input Power (dBm)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	Power + MIF(dB)	C63.19 test required(2019)
GSM1900	30.50	21.50	3.63	25.13	No
GPRS1900 - 1TX	30.50	21.50	3.8	25.3	No
GPRS1900 - 2TX	29.00	23.00	1.15	24.15	No
GPRS1900 - 3TX	28.50	24.24	-0.67	23.57	No
GPRS1900 - 4TX	27.50	24.50	-2.05	22.45	No
EDGE1900 - 1TX	26.50	17.50	3.75	21.25	No
EDGE1900 - 2TX	25.50	19.50	1.23	20.73	No
EDGE1900 - 3TX	24.50	20.24	-0.52	19.72	No
EDGE1900 - 4TX	23.50	20.50	-1.82	18.68	No
WCDMA	25.60	25.60	-25.43	0.17	No
WCDMA - HSPA	25.60	25.60	-20.39	5.21	No
LTE - FDD	25.60	25.60	-9.76	15.84	No
LTE – TDD	25.10	21.50	-1.44	20.06	No
5G NR - FDD	25.60	25.60	-12.08	13.52	No
5G NR - TDD	27.00	24.00	-1.64	22.36	No

Ant 5					
Air Interface	Max Burst Antenna Input Power (dBm)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	Power + MIF(dB)	C63.19 test required(2019)
LTE - FDD	25.60	25.60	-9.76	15.84	No
LTE - TDD	25.10	20.50	-1.44	19.06	No
5G NR - FDD	25.60	25.60	-12.08	13.52	No
5G NR - TDD	27.00	24.00	-1.64	22.36	No

Ant 6					
Air Interface	Max Burst Antenna Input Power (dBm)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	Power + MIF(dB)	C63.19 test required(2019)
LTE – TDD	25.30	21.70	-1.44	20.26	No
5G NR - FDD	25.30	25.30	-12.08	13.22	No
5G NR - TDD	27.50	24.50	-1.64	22.86	No

Ant 3 / Ant 4					
Air Interface		Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	Power + MIF(dB)	C63.19 test required(2019)
2.4GHz WLAN	802.11b	17.00	-2.02	14.98	No

Ant 3+4				
Air Interface	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	Power + MIF(dB)	C63.19 test required(2019)
802.11g	20.00	0.12	20.12	No
802.11n-HT20	20.00	-13.44	6.56	No
802.11ac-VHT20	20.00	-5.57	14.43	No
802.11ax-HE20	20.00	-5.58	14.42	No
802.11be-EHT20	20.00	-28.73	-8.73	No
802.11a	24.00	-3.15	20.85	No
802.11n-HT20	24.00	-13.44	10.56	No
802.11n-HT40	23.00	-13.44	9.56	No
802.11ac-VHT20	24.00	-5.57	18.43	No
802.11ac-VHT40	23.00	-5.57	17.43	No
802.11ac-VHT80	23.00	-5.57	17.43	No
802.11ac-VHT160	23.00	-5.57	17.43	No
802.11ax-HE20	24.00	-5.58	18.42	No
802.11ax-HE40	23.00	-5.58	17.42	No
802.11ax-HE80	23.00	-5.58	17.42	No
802.11ax-HE160	23.00	-5.58	17.42	No
802.11be-EHT20	24.00	-28.73	-4.73	No
802.11be-EHT40	23.00	-28.73	-5.73	No
802.11be-EHT80	23.00	-28.73	-5.73	No
802.11be-EHT160	23.00	-28.73	-5.73	No
802.11a	24.00	-3.15	20.85	No
802.11ax-HE20	24.00	-5.58	18.42	No
802.11ax-HE40	23.00	-5.58	17.42	No
802.11ax-HE80	23.00	-5.58	17.42	No
802.11ax-HE160	23.00	-5.58	17.42	No
802.11be-EHT20	24.00	-28.73	-4.73	No
802.11be-EHT40	23.00	-28.73	-5.73	No
802.11be-EHT80	23.00	-28.73	-5.73	No
802.11be-EHT160	23.00	-28.73	-5.73	No

Conclusion

The device max average conducted power plus MIF are meet table 4.1 of ANSI 63.19:2019 section 4.7 requirement

7. References

[1] ANSI C63.19:2019, “American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids”, Aug. 2019.

[2] FCC KDB 285076 D01v06r04, “Equipment Authorization Guidance for Hearing Aid Compatibility”, Sep. 2023.

[3] FCC KDB 285076 D03v01r06, “Hearing aid compatibility frequently asked questions”, Jul. 2022

[4] SPEAG DASY System Handbook