HEARING AID COMPATIBILITY RF EMISSIONS TEST REPORT

FCC ID	**:**	**A4RGU0NP**
Equipment	**:**	**Phone**
Model Name	**:**	**GU0NP, GM66V**
Applicant	**:**	**Google LLC 1600 Amphitheatre Parkway, Mountain View, CA, 94043 USA**
Standard	**:**	**FCC 47 CFR §20.19 ANSI C63.19-2019**

The product was received on Jan. 03, 2025 and testing was started from May 08, 2025 and completed on May 08, 2025. 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 C63.19-2019 / 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

Testing Laboratory
3786

Sporton International Inc. Wensan Laboratory

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan

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History of this test report

Report No.	Version	Description	Issued Date
HA4N0920A	Rev. 01	Initial issue of report	May 23, 2025

1. General Information

Product Feature & Specification	
Applicant Name	Google LLC
Equipment Name	Phone
Model Name	GU0NP, GM66V
FCC ID	A4RGU0NP
S/N	52171FDCG0000C
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 NB IoT B23: 2000 MHz ~2020 MHz NTN NB IoT B255: 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 NTN: BPSK, QPSK 5G NR: DFT-s-OFDM/CP-OFDM, Pi/2 BPSK/QPSK/16QAM/64QAM/256QAM 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: Carlie Tsai

2. Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3786) and the FCC designation No. TW3786 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC test.

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan TEL:+886-3-327-0838 FAX: +886-3-327-0855
Test Site No.	Sporton Site No.: **SAR015-HY**

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 v01r07

4. 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	Yes[1,2]	GSM, WCDMA, LTE, 5G NR, 5G/6GHz WLAN	VoWiFi / Google Meet	Pmax
	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	Pmax
	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
UWB	6500/8000	DT	No	WWAN, WLAN, BT, Thread, NFC	NA	NA
NFC	13.56	DT	No	WWAN, WLAN, BT, Thread, UWB	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 product was evaluated for HAC RF compliance in accordance with ANSI C63.19-2019, using both the RF_{AIPL} and RF_{AIL} assessment approaches. The results confirm that the product meets the applicable HAC RF requirements defined in the standard.
2. The FR2 and WiFi 6E are currently outside the scope of ANSI C63.19 and FCC HAC regulations therefore they were not evaluated.
3. The UNII-5 was evaluated for operations which are entirely below 6 GHz, above 6 GHz were not evaluated due outside of the current scope of ANSI C63.19 and FCC HAC regulations.
4. 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.
5. The product supports the TAS feature for UMTS, LTE, NR, and Wi-Fi; therefore, HAC testing for these technologies was conducted at the Pmax power level. For GSM, the device was configured to operate at its maximum transmit power in the held-to-ear mode.
6. Pmax is the maximum output power for the handset for the indicated air interface.
7. Head refers to the handset's maximum RF power possible for all user conditions during held-to-ear scenarios.

5. 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

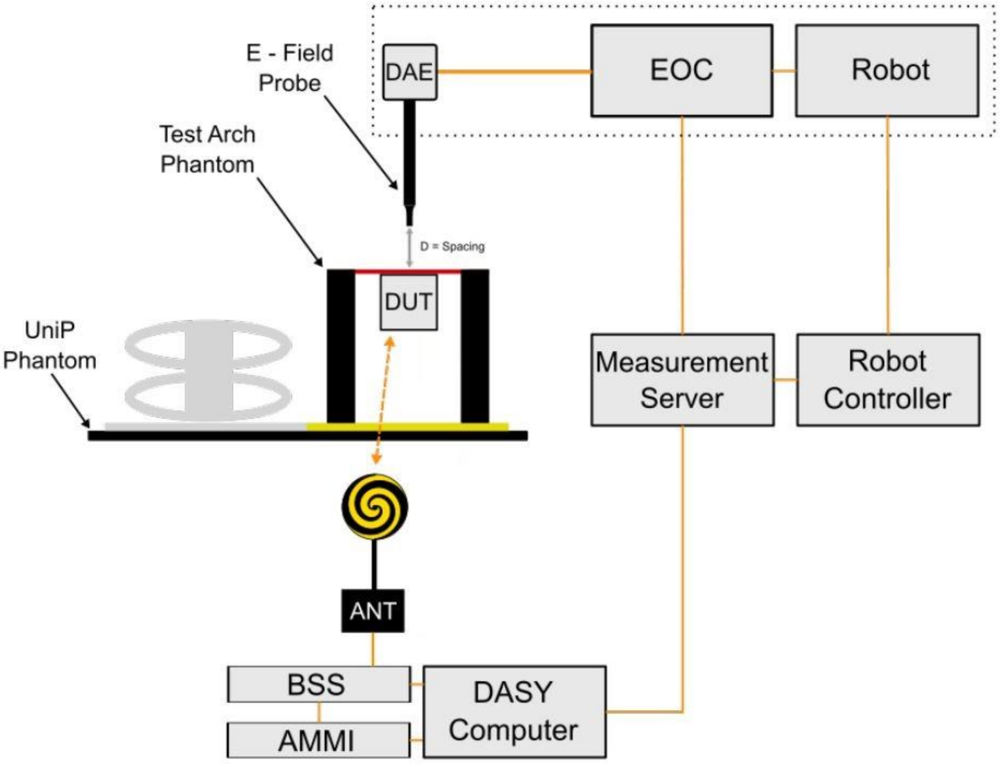
Table 4.2 - Wireless device RF peak power level	
Frequency range (MHz)	$RF_{Peak\ Power}$ (dBm)
< 960	35
960 - 2000	32
> 2000	31

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

6. System Description and Operation

<System Components>



Remark:

A typical al DASY system for HAC measurements consists of

- 6-axis robotic arm (Staubli TX2-60L/ TX2-90XL) for positioning the probe
- Mounting Platform for keeping the phantoms at a field location relative to the robot
- Measurement Server for handling all time-critical tasks, such as measurement data acquisition and supervision of safety features
- EOC (Electrical to Optical Converter) for converting the optical signal from the Data Acquisition Electronics (DAE) to electrical before being transmitted to the measurement server
- LB (Light Beam unit) for probe alignment (measurement of the exact probe length and eccentricity)
- Test Arch for Device Under Test (DUT) testing
- DAE that reads the probe voltages and transmits them to the DASY PC. It is also used to detect probe touch and collision signals
- Device Holder for positioning the DUT beneath the phantom
- ANT (wideband Antenna) for broadcasting the downlink signals emitted by base station simulators (BSS) to the WD
- Operator PC for running the DASY software to define/execute the measurements.

The following components are needed for RFail measurements only:

- Modulation Interference Factor (MIF)
- Isotropic E-field, free-space probe (e.g., EF3DVx)
- Radiofrequency (RF) emission calibration dipoles for system check / validation purposes.

<EF3DV3 E-Field Probe Specification>

Construction	One dipole parallel, two dipoles normal to probe axis Interleaved sensors Built-in shielding against static charges PEEK enclosure material
Calibration	In air from 30 MHz to 6.0 GHz (absolute accuracy ±5.1%, k=2)
Frequency	30 MHz – 6 GHz Linearity: ±0.2 dB (100 MHz – 3 GHz)
Directivity	± 0.2 dB in air (rotation around probe axis) ± 0.4 dB in air (rotation normal to probe axis)
Dynamic Range	2 – >1000 V/m
Linearity	± 0.2 dB
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 3.9 mm (body: 12 mm) Distance from probe tip to dipole centers: 1.5 mm Sensor displacement to probe's calibration point: <0.7 mm

Voltage to E-field Conversion

The measured voltage is first linearized to a quantity proportional to the square of the E-field using the (a, b, c, d) set of parameters specific to the communication system and sensor：

$$\mathbf{V_{compi}} = \mathbf{U_i} + \mathbf{U_i^2} \cdot \frac{\mathbf{10^{\frac{d}{10}}}}{\mathbf{dcp_i}}$$

where V_{compi} = compensated signal of channel i (μV) (i = x, y, z)
U_i = input signal of channel i (μV) (i = x, y, z)
d = PMR factor d (dB) (Probe parameter)
dcp_i = diode compression point of channel i (μV) (Probe parameter, i = x, y, z)

$$\mathbf{V_{compi}}_{\mathbf{dB}\sqrt{\mu V}} = \mathbf{10} + \mathbf{log_{10}}\left(\mathbf{V_{compi}}\right)$$

$$\mathbf{corr_i} = \mathbf{a_i} \cdot \mathbf{e} - \left(\frac{{\mathbf{V_{compi}}_{\mathbf{dB}\sqrt{\mu V}}}^{-\mathbf{b_i}}}{\mathbf{C_i}}\right)^{\mathbf{2}}$$

where $coor_i$ = correction factor of channel i (dB) (i = x, y, z)
$V_{compi\ dB\sqrt{\mu V}}$ = compensated voltage of channel i (dB$\sqrt{}$μV) (i = x, y, z)
a_i = PMR factor a of channel i (dB) (Probe parameter, i = x,y,z)
b_i = PMR factor b of channel i (dB$\sqrt{}$μV) (Probe parameter, i = x,y,z)
c_i = PMR factor c of channel i (Probe parameter, i = x,y,z)

The voltage $V_{idB\sqrt{\mu V}}$ is the linearized voltage in dB$\sqrt{}$μV：

$$\mathbf{V_{i\,dB\sqrt{\mu V}}} = \mathbf{V_{compi\,dB\sqrt{\mu V}}} - \mathbf{corr_i}$$

where $V_{i\ dB\sqrt{\mu V}}$ = linearized voltage of channel i (dB$\sqrt{}$μV) (i = x,y,z)
$V_{compi\ dB\sqrt{\mu V}}$ = compensated voltage of channel i (dB$\sqrt{}$μV) (i = x,y,z)
$Corr_i$ = correction factor of channel i (dB) (i = x,y,z)

Finally, the linearized voltage is converted in µV：

$$\mathbf{V_i = 10^{\frac{V_{i\,dB\sqrt{\mu V}}}{10}}}$$

where V_i = linearized voltage of channel i (µV) (i = x,y,z)
$V_{i\ dB\sqrt{\ }\mu V}$ = linearized voltage of channel i (dB√µV (i = x,y,z)

The E-field data for each channel are calculated using the linearized voltage：

E-field Probes：$\mathbf{E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}}$

where V_i = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = sensor sensitivity (µV/(V/m)^2 of channel i (i = x, y, z)
ConvF = sensitivity enhancement in solution
E_i = electric field strength of channel i in V/m

The RMS value of the field components gives the total field strength (Hermitian magnitude)：

$$\mathbf{E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}}$$

Averaged E-field Calculation

The averaged E-field is defined by

$$\mathbf{E_{avg} = \frac{1}{n} \cdot \sum_{i=1}^{n} E_i}$$

where n = = the number of measurement grid point
E_i = the E-field measured at point i

RFail Calculation

The RFail is finally computed with

$$\boldsymbol{RFail[dB(V/m)] = 20 \cdot \log_{10}(E_{avg}) + MIF}$$

where RFail = the Radio Frequency Audio Interference Level in dB(V/m)
E_{avg} = the averaged E-field in (V/m) calculated
MIF = the Modulation Interference Factor in dB.

7. RF Emissions Test Procedure

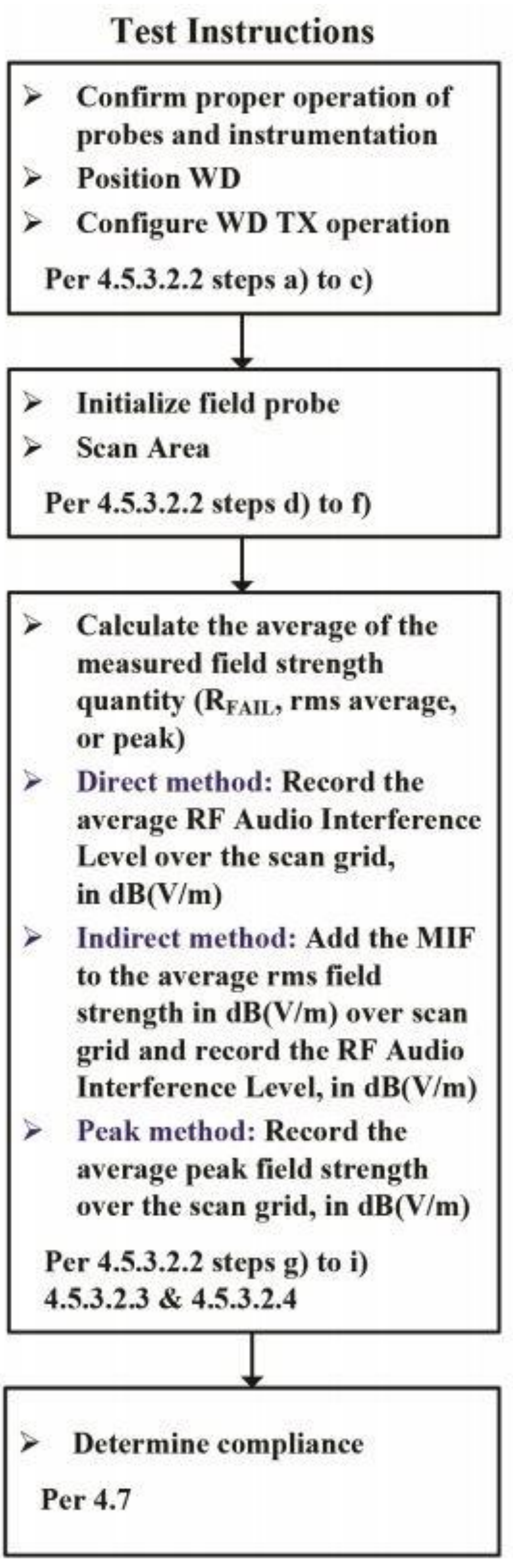
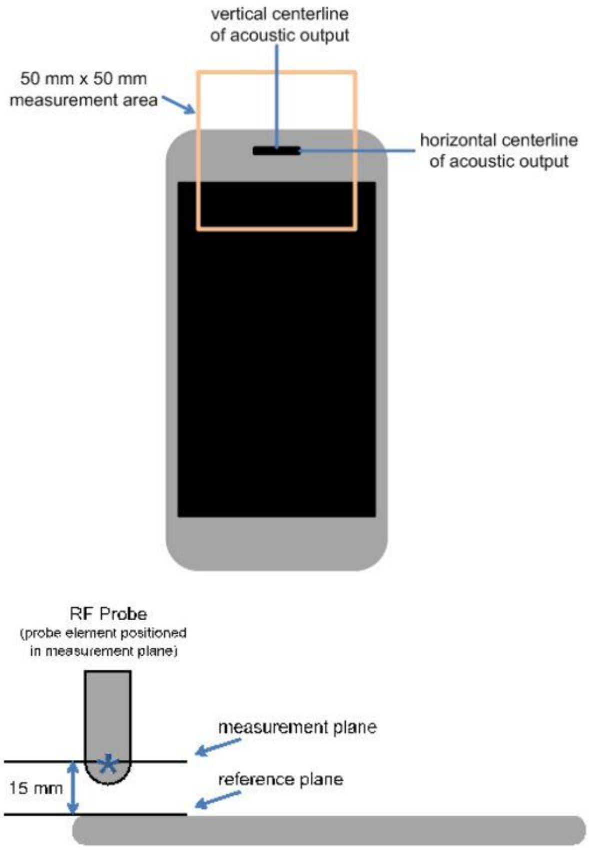
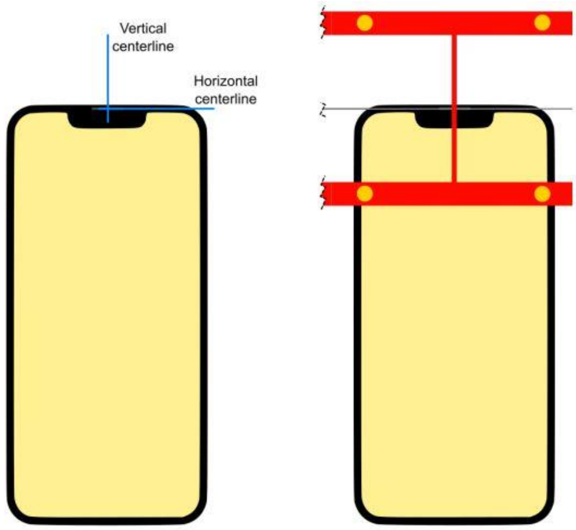


Figure of WD near-field emission scan flowchart according to ANSI C63.19:2019



The references and reference plane that shall be used in the WD emissions measurement



Device Under Test Positioning under the Test Arch

Test procedure: Indirect measurement—preferred

a. The measurement procedure using a probe and instrumentation chain with a response of <10 kHz (see ANSI C63.19-2019 section4.5.1) is identical to the direct measurement method of ANSI C63.19-2019 section4.5.3.2.2: however, because of the bandwidth limitations, it cannot include the direct use of the spectral and temporal weighting functions. The output of such measurement systems must be readings of steady state rms field strength in dB(V/m).
b. The RF audio interference level in dB(V/m) is obtained by adding the Modulation Interference Factor (in decibels) to the average steady state rms field strength reading over the measurement area, in dB(V/m), from Step c). Use this result to determine the WD's compliance per ANSI C63.19-2019 section4.7.
c. Scan the entire 50 mm by 50 mm measurement area in equally spaced step sizes and record the reading at each measurement point. The step size shall meet the specification for step size in ANSI C63.19:2019 section 4.5.3.
d. Calculate the average of the measurements taken in Step c
e. Convert the average value found in Step d) to RF audio interference level, in volts per meter, by taking the square root of the reading and then dividing it by the measurement system transfer function, as established in ANSI C63.19:2019 section4.5.3.2.1 pre-test procedure. Convert the result to dB(V/m) by taking the base-10 logarithm and multiplying it by 20. Expressed as a formula

RF audio interference level in db(V/M) $20 * \log(R_{ave}^{1/2} / TF)$
where
R_{ave} is the average reading

f. Compare this RF audio interference level to the limits in ANSI C63.19:2019 section4.7 and record the result
g. Per ANSI C63.19-2019 section4.6, WDs capable of operating multiple transmitters shall be subject to emissions requirements for all such transmitters expected to be operated when the WD is in voice mode operation positioned at a user's ear. Each qualified transmitter is tested individually using the method of Clause 4. Other WD transmitters shall be temporarily disabled or reduced in power level such that their average antenna input power is at least 6 dB lower than the average antenna input power of the transmitter under test. The transmitter under test is set to the fixed and repeatable combination of power and modulation characteristic that is representative of the worst case (highest interference potential) likely to be encountered while the WD is experiencing normal voice mode operation. The limiting measurement for device qualification is the highest RF audio interference potential measured for any of the WD transmitters. If the highest interference measurement is from a transmitter that is not required for normal voice mode operation, a secondary rating may be given that applies when that transmitter is disabled

8. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	2450MHz Calibration Dipole	CD2450V3	1186	Jan. 21, 2025	Jan. 20, 2026
SPEAG	Data Acquisition Electronics	DAE4	854	Aug. 14, 2024	Aug. 13, 2025
SPEAG	Isotropic E-Field Probe	EF3DV3	4088	Aug. 14, 2024	Aug. 13, 2025
Testo	Hygro meter	608-H1	45196600	Oct. 28, 2024	Oct. 27, 2025
R&S	Wideband Radio Communication Tester	CMW500	115793	Dec. 12, 2024	Dec. 11, 2025
SPEAG	Test Arch Phantom	N/A	N/A	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Signal Generator	MG3710A	6201502524	Sep. 24, 2024	Sep. 23, 2025
Anritsu	Power Meter	ML2495A	1419002	Aug. 13, 2024	Aug. 12, 2025
Anritsu	Power Sensor	MA2411B	1911176	Aug. 13, 2024	Aug. 12, 2025
ATM	Dual Directional Coupler	C122H-10	P610410z-02	NCR	NCR
Woken	Attenuator	WK0602-XX	N/A	NCR	NCR
Anritsu	Spectrum Analyzer	N9010A	MY53470118	Aug. 09, 2024	Aug. 08, 2025
Mini-Circuits	Power Amplifier	ZVE-8G+	D120604	Oct. 16, 2024	Oct. 15, 2025
Mini-Circuits	Power Amplifier	ZHL-42W+	715701915	May. 17, 2024	May. 16, 2025

Note:

1. NCR: “No-Calibration Required”

9. System Validation

Obtaining accurate measurements and relevant quantities in Module HAC depends on the proper functioning of many components and the correct parameter settings. Faulty results due to drift, failures, or incorrect parameters might not be recognized, as the differences might not be obvious in the measurements.
SPEAG DASY incorporates a system check, also called system verification procedure, to test for the proper functioning of the system based on the tests described in ANSI C63.19-2019: the RF interference potential test setup is verified with RF Emission Calibration Dipoles.

<Test Setup>

1. Set the RF signal generator for either CW. Set its output power so the peak power applied to the antenna is equal to that recorded for the real or emulated signal using the WD modulation format
2. Average input power P = 100 mW (20 dBm) after adjustment for return loss. An input power that generates field levels similar to those from the WD or other suitable level may also be used
3. The test fixture should meet the two-wavelength separation criterion
4. The probe-to-dipole separation, which is measured from closest surface of the dipole to the center point of the probe sensor element, should be 15 mm

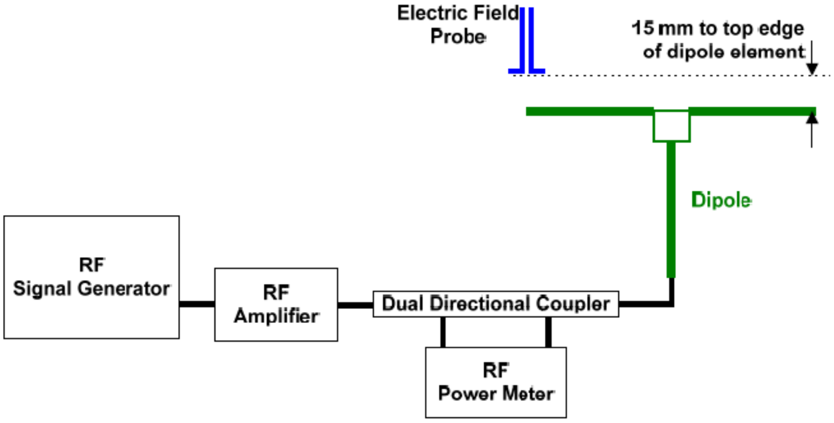


Figure of Setup Diagram

<Validation Procedure>

Place a dipole antenna meeting the requirements given in ANSI C63.19: 2019 D.11 in the position normally occupied by the WD. The dipole antenna serves as a known source for an electrical and magnetic output. Position the E-field probe so that:

a. The probe and its cable are parallel to the coaxial feed of the dipole antenna
b. The probe cable and the coaxial feed of the dipole antenna approach the measurement area from opposite directions; and
c. The center point of the probe element(s) is 15 mm from the closest surface of the dipole elements

Scan the length of the dipole with the E-field probe and record the two maximum values found near the dipole ends. Average the two readings and compare the reading to expected value in the calibration certificate or expected value in this standard.

Frequency (MHz)	Input Power (dBm)	Target Value (V/m)	Measured E-Field (V/m)	Deviation (%)	Date
2450	20	87.1	84.5	-2.99	May 08, 2025

10. 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 C63.19: 2019 D.3, and weighting system as specified in ANSI C63.19: 2019 D.4 and ANSI C63.19: 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
*NA	5G NR 25% PC1.5(DFT-s-OFDM, 1 RB, 100MHz,BPSK, 30kHz)	-0.78
*NA	5G NR 25% PC1.5(DFT-s-OFDM, 50% RB, 100MHz,BPSK, 30kHz)	-0.82
*NA	5G NR 25% PC1.5(DFT-s-OFDM, 1 RB, 100MHz,QPSK, 30kHz)	-0.96
*NA	5G NR 25% PC1.5(CP-OFDM, 1 RB, 100MHz,QPSK, 30kHz)	-1.56
*NA	5G NR 25% PC1.5(CP-OFDM, 50% RB, 100MHz,QPSK, 30kHz)	-1.72
*NA	5G NR 25% PC1.5(DFT-s-OFDM, 1 RB, 10MHz,BPSK, 30kHz)	-0.83
*NA	5G NR 25% PC1.5(DFT-s-OFDM, 50% RB, 10MHz,BPSK, 30kHz)	-0.85
*NA	5G NR 25% PC1.5(DFT-s-OFDM, 1 RB, 10MHz,QPSK, 30kHz)	-0.99
*NA	5G NR 25% PC1.5(CP-OFDM, 1 RB, 10MHz,QPSK, 30kHz)	-1.61
*NA	5G NR 25% PC1.5(CP-OFDM, 50% RB, 10MHz,QPSK, 30kHz)	-1.76

Remark:
Refer to appendix E for RFE UID specifications summary provided by SPEAG
*Refer to appendix G for MIF measurements conducted by test lab for 5G NR TDD power class 1.5.

11. Evaluation of WD RF interference potential

General Note:

1. The following table is according to ANSI C63.19:2019 section 4.4 indirect measurement procedure to evaluation max average conducted power from each air interface plus MIF to evaluate whether it complies with ANSI C63.19-2019 Table 4.1 RF_{AIPL}, compliance with table 4.1 means compliance with WD emission requirements.

2. To demonstrate compliance with ANSI C63.19-2019 requirment, HAC RF evaluations were performed using the Pmax average power level for technologies that support the TAS feature, including UMTS, LTE, FR1, and Wi-Fi. For GSM, the evaluation was based on the head average power level, as TAS is not supported for this technology.

3. If certain air interfaces did not meet the requirements specified in ANSI C63.19-2019 Table 4.1, they were further evaluated according to the RF_{AIL} criteria in Table 4.3 of the same standard. The results of the RF_{AIL} evaluation can be found in Section 11.1.

<WWAN operation>

Ant 0							
Air Interface	Max Burst Antenna Input Power (dBm)	Duty Cycle (%)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
GSM850	33.50	12.5	24.50	3.63	28.13	29	Pass
GPRS850 - 1TX	33.50	12.5	24.50	3.8	28.3	29	Pass
GPRS850 - 2TX	32.50	25	26.50	1.15	27.65	29	Pass
GPRS850 - 3TX	31.50	37.5	27.24	-0.67	26.57	29	Pass
GPRS850 - 4TX	30.50	50	27.50	-2.05	25.45	29	Pass
EDGE850 - 1TX	27.50	12.5	18.50	3.75	22.25	29	Pass
EDGE850 - 2TX	26.50	25	20.50	1.23	21.73	29	Pass
EDGE850 - 3TX	25.50	37.5	21.24	-0.52	20.72	29	Pass
EDGE850 - 4TX	24.50	50	21.50	-1.82	19.68	29	Pass
WCDMA	25.00	100	25.00	-25.43	-0.43	26	Pass
WCDMA - HSPA	25.00	100	25.00	-20.39	4.61	26	Pass
LTE - FDD	25.30	100	25.30	-9.76	15.54	25	Pass
LTE – TDD_PC2/PC3	27.00	63.3	25.00	-1.44	23.56	25	Pass
5G FR1 - FDD	25.30	100	25.30	-12.08	13.22	25	Pass
5G NR - TDD_PC3	25.10	100	25.10	-12.08	13.02	25	Pass
5G NR - TDD_PC2	27.00	50	24.00	-1.64	22.36	25	Pass
5G NR - TDD_PC1.5	27.00	25	21.00	-0.15	20.85	25	Pass

Ant 1							
Air Interface	Max Burst Antenna Input Power (dBm)	Duty Cycle (%)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
GSM850	33.50	12.5	24.50	3.63	28.13	29	Pass
GPRS850 - 1TX	33.50	12.5	24.50	3.8	28.3	29	Pass
GPRS850 - 2TX	32.50	25	26.50	1.15	27.65	29	Pass
GPRS850 - 3TX	31.50	37.5	27.24	-0.67	26.57	29	Pass
GPRS850 - 4TX	30.50	50	27.50	-2.05	25.45	29	Pass
EDGE850 - 1TX	27.50	12.5	18.50	3.75	22.25	29	Pass
EDGE850 - 2TX	26.50	25	20.50	1.23	21.73	29	Pass
EDGE850 - 3TX	25.50	37.5	21.24	-0.52	20.72	29	Pass
EDGE850 - 4TX	24.50	50	21.50	-1.82	19.68	29	Pass
GSM1900	30.50	12.5	21.50	3.63	25.13	26	Pass
GPRS1900 - 1TX	30.50	12.5	21.50	3.8	25.3	26	Pass
GPRS1900 - 2TX	29.00	25	23.00	1.15	24.15	26	Pass
GPRS1900 - 3TX	28.50	37.5	24.24	-0.67	23.57	26	Pass
GPRS1900 - 4TX	27.50	50	24.50	-2.05	22.45	26	Pass
EDGE1900 - 1TX	26.50	12.5	17.50	3.75	21.25	26	Pass
EDGE1900 - 2TX	25.50	25	19.50	1.23	20.73	26	Pass
EDGE1900 - 3TX	24.50	37.5	20.24	-0.52	19.72	26	Pass
EDGE1900 - 4TX	23.50	50	20.50	-1.82	18.68	26	Pass
WCDMA	25.00	100	25.00	-25.43	-0.43	26	Pass
WCDMA - HSPA	25.00	100	25.00	-20.39	4.61	26	Pass
LTE - FDD	25.30	100	25.30	-9.76	15.54	25	Pass
LTE – TDD_PC2/PC3	27.00	63.3	25.00	-1.44	23.56	25	Pass
5G FR1 - FDD	25.30	100	25.30	-12.08	13.22	25	Pass
5G NR - TDD_PC3	25.10	100	25.10	-12.08	13.02	25	Pass
5G NR - TDD_PC2	27.00	50	24.00	-1.64	22.36	25	Pass
5G NR - TDD_PC1.5	27.00	25	21.00	-0.15	20.85	25	Pass

Ant 2							
Air Interface	Max Burst Antenna Input Power (dBm)	Duty Cycle (%)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
GSM1900	30.50	12.5	21.50	3.63	25.13	26	Pass
GPRS1900 - 1TX	30.50	12.5	21.50	3.8	25.3	26	Pass
GPRS1900 - 2TX	29.00	25	23.00	1.15	24.15	26	Pass
GPRS1900 - 3TX	28.50	37.5	24.24	-0.67	23.57	26	Pass
GPRS1900 - 4TX	27.50	50	24.50	-2.05	22.45	26	Pass
EDGE1900 - 1TX	26.50	12.5	17.50	3.75	21.25	26	Pass
EDGE1900 - 2TX	25.50	25	19.50	1.23	20.73	26	Pass
EDGE1900 - 3TX	24.50	37.5	20.24	-0.52	19.72	26	Pass
EDGE1900 - 4TX	23.50	50	20.50	-1.82	18.68	26	Pass
WCDMA	25.00	100	25.00	-25.43	-0.43	26	Pass
WCDMA - HSPA	25.00	100	25.00	-20.39	4.61	26	Pass
LTE - FDD	25.00	100	25.00	-9.76	15.24	25	Pass
LTE – TDD_PC2/PC3	27.00	63.3	25.00	-1.44	23.56	25	Pass
5G FR1 - FDD	25.10	100	25.10	-12.08	13.02	25	Pass
5G NR - TDD_PC3	25.10	100	25.10	-12.08	13.02	25	Pass
5G NR - TDD_PC2	27.00	50	24.00	-1.64	22.36	25	Pass
5G NR - TDD_PC1.5	27.00	25	21.00	-0.15	20.85	25	Pass

Ant 5							
Air Interface	Max Burst Antenna Input Power (dBm)	Duty Cycle (%)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
LTE - FDD	25.00	100	25.00	-9.76	15.24	25	Pass
LTE – TDD_PC2/PC3	27.00	63.3	25.00	-1.44	23.56	25	Pass
5G FR1 - FDD	25.00	100	25.00	-12.08	12.92	25	Pass
5G NR - TDD_PC3	25.10	100	25.10	-12.08	13.02	25	Pass
5G NR - TDD_PC2	27.00	50	24.00	-1.64	22.36	25	Pass
5G NR - TDD_PC1.5	27.00	25	21.00	-0.15	20.85	25	Pass

Ant 6							
Air Interface	Max Burst Antenna Input Power (dBm)	Duty Cycle (%)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
LTE – TDD	24.50	63.3	20.90	-1.44	19.46	25	Pass
5G FR1 - FDD	25.00	100	25.00	-12.08	12.92	25	Pass
5G FR1 - TDD_PC3	25.00	100	25.00	-12.08	12.92	25	Pass
5G NR - TDD_PC2	27.00	50	24.00	-1.64	22.36	25	Pass
5G NR - TDD_PC1.5	27.00	25	21.00	-0.15	20.85	25	Pass

Ant 1+5							
Air Interface	Max Burst Antenna Input Power (dBm)	Duty Cycle (%)	Max Average Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
5G FR1 - TDD_PC1.5 UL MIMO	30.01	25	24.01	-0.78	23.23	25	Pass

Note: The above UL MIMO power is a conservative, linear sum of the worst-case max allowed powers among PC1.5 MIMO antennas.

<WLAN operation>
<SISO 2.4GHz>

Ant 3					
Air Interface	Max Burst Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
802.11b	24.00	-2.02	21.98	25	Pass

Ant 4					
Air Interface	Max Burst Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
802.11b	24.00	-2.02	21.98	25	Pass

<MIMO 2.4GHz>

Ant 3+4					
Air Interface	Max Burst Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
802.11b	26.00	-2.02	23.98	25	Pass
802.11g	25.00	0.12	25.12	25	Testing
802.11n-HT20	24.00	-13.44	10.56	25	Pass
802.11ac-VHT20	24.00	-5.57	18.43	25	Pass
802.11ax-HE20	24.00	-5.58	18.42	25	Pass
802.11be-EHT20	24.00	-28.73	-4.73	25	Pass

<MIMO 5/6GHz>

Ant 3+4					
Air Interface	Max Burst Antenna Input Power (dBm)	Worst Case MIF (dB)	RF_{AIPL}(dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
802.11a	24.00	-3.15	20.85	25	Pass
802.11n-HT20	24.00	-13.44	10.56	25	Pass
802.11n-HT40	23.00	-13.44	9.56	25	Pass
802.11ac-VHT20	24.00	-5.57	18.43	25	Pass
802.11ac-VHT40	23.00	-5.57	17.43	25	Pass
802.11ac-VHT80	23.00	-5.57	17.43	25	Pass
802.11ac-VHT160	21.00	-5.57	15.43	25	Pass
802.11ax-HE20	24.00	-5.58	18.42	25	Pass
802.11ax-HE40	23.00	-5.58	17.42	25	Pass
802.11ax-HE80	23.00	-5.58	17.42	25	Pass
802.11ax-HE160	23.00	-5.58	17.42	25	Pass
802.11be-EHT20	24.00	-28.73	-4.73	25	Pass
802.11be-EHT40	23.00	-28.73	-5.73	25	Pass
802.11be-EHT80	23.00	-28.73	-5.73	25	Pass
802.11be-EHT160	23.00	-28.73	-5.73	25	Pass

11.1 Evaluation RF_{AIL}

General Note:

1. The HAC measurement system applies MIF value onto the measured RMS E-field, which is indirect method in ANSI C63.19-2019 version, and reports the RF audio interference level.
2. Phone Condition: Mute on; Backlight off; Max Volume

Plot No.	Air Interface	Radio Configuration	Channel	DUT Status	Transmit Ant.	Average Antenna Input Power (dBm)	MIF	RF_{AIL} (dBV/m)	RF_{AIL} Limit (dBV/m)	Result
1	WLAN2.4GHz	802.11g 6Mbps	6	Close Mode	Ant 4+3	24.78	0.12	26.16	35	PASS
2	WLAN2.4GHz	802.11g 6Mbps	6	Open Mode	Ant 4+3	21.93	0.12	20.87	35	PASS

Test Engineer：Dennis Hsieh

12. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.
The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances. Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is showed below Table..
The judgment of conformity in the report is based on the measurement results excluding the measurement uncertainty.

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (E)	Standard Uncertainty (E)
Measurement System					
Probe Calibration	5.1	Normal	1	1	± 5.1 %
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	1	± 2.7 %
Sensor Displacement	16.5	Rectangular	$\sqrt{3}$	1	± 9.5 %
Boundary Effects	2.4	Rectangular	$\sqrt{3}$	1	± 1.4 %
Phantom Boundary Effects	7.2	Rectangular	$\sqrt{3}$	1	± 4.1 %
Linearity	4.7	Rectangular	$\sqrt{3}$	1	± 2.7 %
Scaling with PMR Calibration	10.0	Rectangular	$\sqrt{3}$	1	± 5.77 %
System Detection Limit	1.0	Rectangular	$\sqrt{3}$	1	± 0.6 %
Readout Electronics	0.3	Normal	1	1	± 0.3 %
Response Time	0.8	Rectangular	$\sqrt{3}$	1	± 0.5 %
Integration Time	2.6	Rectangular	$\sqrt{3}$	1	± 1.5 %
RF Ambient Conditions	3.0	Rectangular	$\sqrt{3}$	1	± 1.7 %
RF Reflections	12.0	Rectangular	$\sqrt{3}$	1	± 6.9 %
Probe Positioner	1.2	Rectangular	$\sqrt{3}$	1	± 0.7 %
Probe Positioning	4.7	Rectangular	$\sqrt{3}$	1	± 2.7 %
Extrap. and Interpolation	1.0	Rectangular	$\sqrt{3}$	1	± 0.6 %
Test Sample Related					
Device Positioning Vertical	4.7	Rectangular	$\sqrt{3}$	1	± 2.7 %
Device Positioning Lateral	1.0	Rectangular	$\sqrt{3}$	1	± 0.6 %
Device Holder and Phantom	2.4	Rectangular	$\sqrt{3}$	1	± 1.4 %
Power Drift	5.0	Rectangular	$\sqrt{3}$	1	± 2.9 %
Phantom and Setup Related					
Phantom Thickness	2.4	Rectangular	$\sqrt{3}$	1	± 1.4 %
Combined Standard Uncertainty					± 16.30 %
Coverage Factor for 95 %					K = 2
Combined Std. Uncertainty					**± 16.30 %**
Coverage Factor for 95 %					**K = 2**
Expanded STD Uncertainty					**± 32.6 %**
Declaration of Conformity: The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.					
Comments and Explanations: The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.					

Uncertainty Budget of HAC free field assessment

13. References

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

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

[3] FCC KDB 285076 D03v01r07, “Hearing aid compatibility frequently asked questions”, Dec. 2024

[4] SPEAG DASY System Handbook