HAC RF TEST REPORT

No. 24T04Z100644-003

For

Shenzhen Tinno Mobile Technology Corp.

Smart Phone

Model Name: U572AA ,U572AC

with

Hardware Version: V1.0

Software Version: U572AAV01.04.10

FCC ID: XD6U572AA

HAC-2019 Compliance: PASS

Issued Date: 2024-5-12

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

Test Laboratory:

CTTL, Telecommunication Technology Labs, CAICT

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REPORT HISTORY

Report Number	Revision	Issue Date	Description
24T04Z100644-003	Rev.0	2024-5-12	Initial creation of test report

TABLE OF CONTENT

1 Test Laboratory

1.1 Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2017 accredited test laboratory under American Association for Laboratory Accreditation (A2LA) with lab code 7049.01, and is also an FCC accredited test laboratory (CN1349), and ISED accredited test laboratory (CAB identifier:CN0066). The detail accreditation scope can be found on A2LA website.

1.2 Testing Location

CompanyName:	CTTL
Address:	No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

1.3 Testing Environment

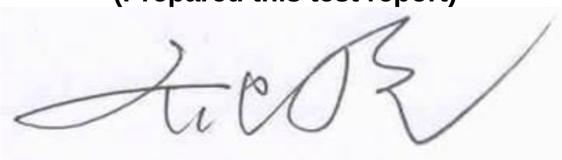
Temperature:	18°C~25°C,
Relative humidity:	30%~ 70%
Ground system resistance:	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

1.4 Project Data

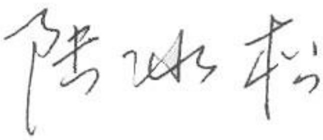
Project Leader:	Qi Dianyuan
Test Engineer:	Wang Tian
Testing Start Date:	\
Testing End Date:	\

1.5 Signature

Wang Tian
(Prepared this test report)



Qi Dianyuan
(Reviewed this test report)



Lu Bingsong
Deputy Director of the laboratory
(Approved this test report)

2 Client Information

2.1 Applicant Information

Company Name:	Shenzhen Tinno Mobile Technology Corp.
Address/Post:	27-001, South Side of Tianlong Mobile Headquarters Building, Tongfa South Road, Xili Community, Xili Street, Nanshan District, She nzhen ,PRC
Contact Person:	xiaoping.li
Contact Email:	xiaoping.li@tinno.com
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2.2 Manufacturer Information

Company Name:	Shenzhen Tinno Mobile Technology Corp.
Address/Post:	27-001, South Side of Tianlong Mobile Headquarters Building, Tongfa South Road, Xili Community, Xili Street, Nanshan District, Shen zhen ,PRC
Contact Person:	xiaoping.li
Contact Email:	xiaoping.li@tinno.com
Telephone:	0755-86095550
Fax	0755-86095551

3 Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1 About EUT

Description:	Smart Phone
Model name:	U572AA ,U572AC
Operating mode(s):	WCDMA B1/2/4/5/8 LTE Band:2/3/4/5/7/12/14/20/29/30/66 BT, Wi-Fi(2.4G), Wi-Fi(5G), NFC

3.2 Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version
EUT1	\	\	\

*EUT ID: is used to identify the test sample in the lab internally.

3.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	TNO496386AG-N1	/	GUANGDONG FENGHUA NEW ENERGY CO.,LTD

*AE ID: is used to identify the test sample in the lab internally.

3.4 Air Interfaces / Bands Indicating Operating Modes

Air-interface	**Band(MHz)**	**Type**	**C63.19/tested**	**Simultaneous Transmissions Not Tested(1)**	**Name of Voice Service**
WCDMA (UMTS)	850	VO	Yes	BT, WLAN	CMRS Voice
	1700				
	1900				
	HSPA	DT	Yes		MEET
LTE FDD	Band2/4/5/7/12/14/30/66	V/D	Yes	BT, WLAN	VoLTE, MEET
BT	2450	DT	NA	WWAN	NA
WLAN	2450	V/D	Yes	WWAN	VoWiFi, MEET
WLAN	5G	V/D	Yes	WWAN	VoWiFi, MEET

NA: Not Applicable VO: Voice Only V/D: CMRS and IP Voice Service over Digital Transport
DT: Digital Transport
Note1: According to KDB285076 D01, clause 2 d), for the Interference Level, the single transmission scenario of each frequency band is higher than or equal to the simultaneous transmission scenario, so the frequency band that has evaluated the single will not evaluate the simultaneous.

4 Maximum Output Power

Bands	Conducted Power (dBm)
WCDMA 850	24
WCDMA 1700	24
WCDMA 1900	24
LTE Band2	24.5
LTE Band4	24.5
LTE Band5	25
LTE Band7	24
LTE Band12	25
LTE Band14	25
LTE Band30	24
LTE Band66	24.5
WLAN 2.4G	19
WLAN 5G	18.5

5 Reference Documents

5.1 Reference Documents for testing

The following document listed in this section is referred for testing.

Reference	Title	Version
ANSI C63.19-2019	American National Standard for Methods of Measurement of Compatibility Between Wireless Communication Devices and Hearing Aids	2019 Edition
FCC 47 CFR §20.19	Hearing Aid Compatible Mobile Headsets	2024 Edition
KDB285076 D01 v06r04.	Equipment Authorization Guidance for Hearing Aid Compatibility	2023 Edition

6 Operational Conditions During Test

6.1 HAC MEASUREMENT SET-UP

These measurements are performed using the DASY6/8 automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Stäubli), robot controller, Intel Core2 computer, near-field probe, probe alignment sensor. The robot is a six-axis industrial robot performing precise movements. A cell controller system contains the power supply, robot controller, teach pendant (Joystick),and remote control, is used to drive the robot motors. The PC consists of the HP Intel Core21.86 GHz computer with Windows 10 system and HAC Measurement Software DASY6/8, A/D interface card, monitor, mouse, and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE)circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

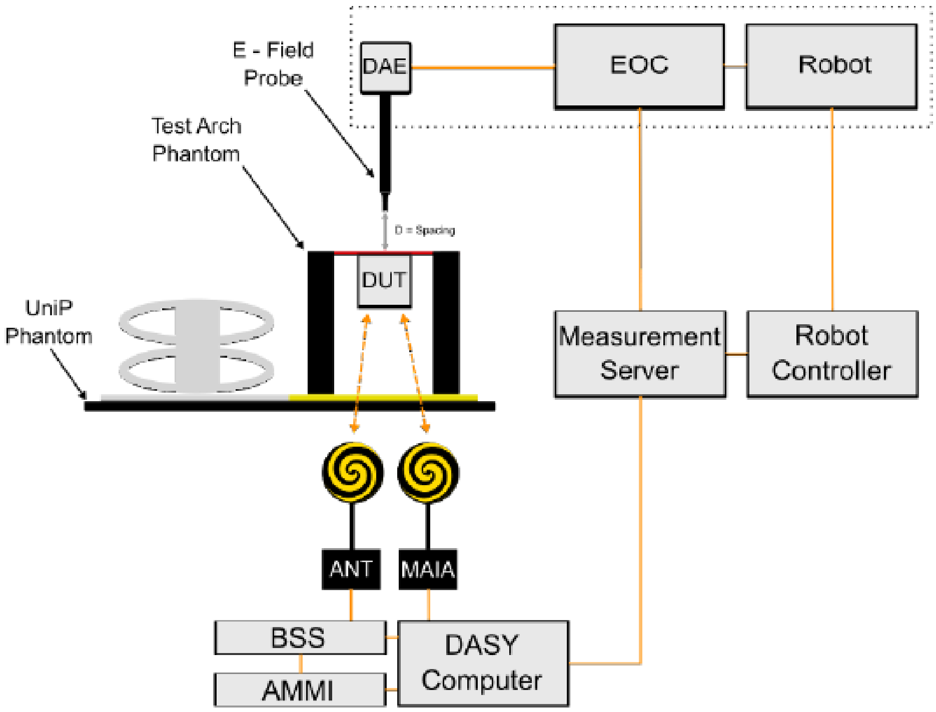
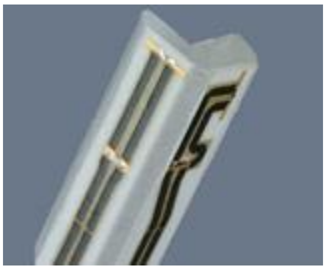


Fig. 1 HAC Test Measurement Set-up

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

6.2 Probe Specification

E-Field Probe Description



[EF3DV3]

Construction	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges
Calibration	In air from 30 MHz to 6.0 GHz (absolute accuracy ±6.0%, k=2)
Frequency	30 MHz to 6 GHz Linearity: ± 0.2 dB (100 MHz to 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 V/m to 1000 V/m; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 4 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.5 mm
Application	General near-field measurements up to 6 GHz Field component measurements Fast automatic scanning in phantoms

6.3 Test Arch Phantom &Phone Positioner

The Test Arch phantom should be positioned horizontally on a stable surface. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. It enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot (Dimensions: 370 x 370 x 370 mm).

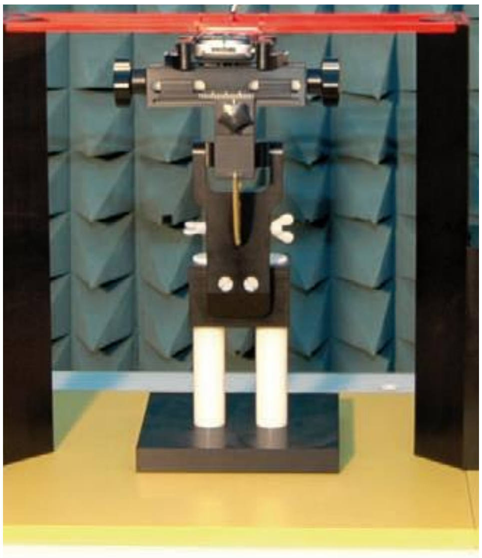


Fig. 2 HAC Phantom & Device Holder

6.4 Robotic System Specifications

Specifications

Positioner: Stäubli Unimation Corp. Robot Model: RX160L
Repeatability: ±0.02 mm
No. of Axis: 6

Data Acquisition Electronic (DAE) System

Cell Controller
Processor: Intel Core2
Clock Speed: 1.86GHz
Operating System: Windows 10
Data Converter
Features: Signal Amplifier, multiplexer, A/D converter, and control logic
Software: DASY6/8 cD6 HAC
Connecting Lines: Optical downlink for data and status info.
Optical uplink for commands and clock

7 EUT Arrangement

7.1 WD RF Emission Measurements Reference and Plane

Figure 3 illustrates the references and reference plane that shall be used in the WD emissions measurement.

• The measurement area is 50.0 mm by 50.0 mm.

• The measurement area is centered on the audio frequency output transducer of the WD (speaker or T-Coil signal).

• The measurement area is in a reference plane, which is defined as the planar area tangent to the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver area of the phone and is defined by the points of the receiver-end of the WD handset, which, in normal handset use, rest against the ear.

•The measurement plane is parallel to, and 15.0 mm in front of, the reference plane.

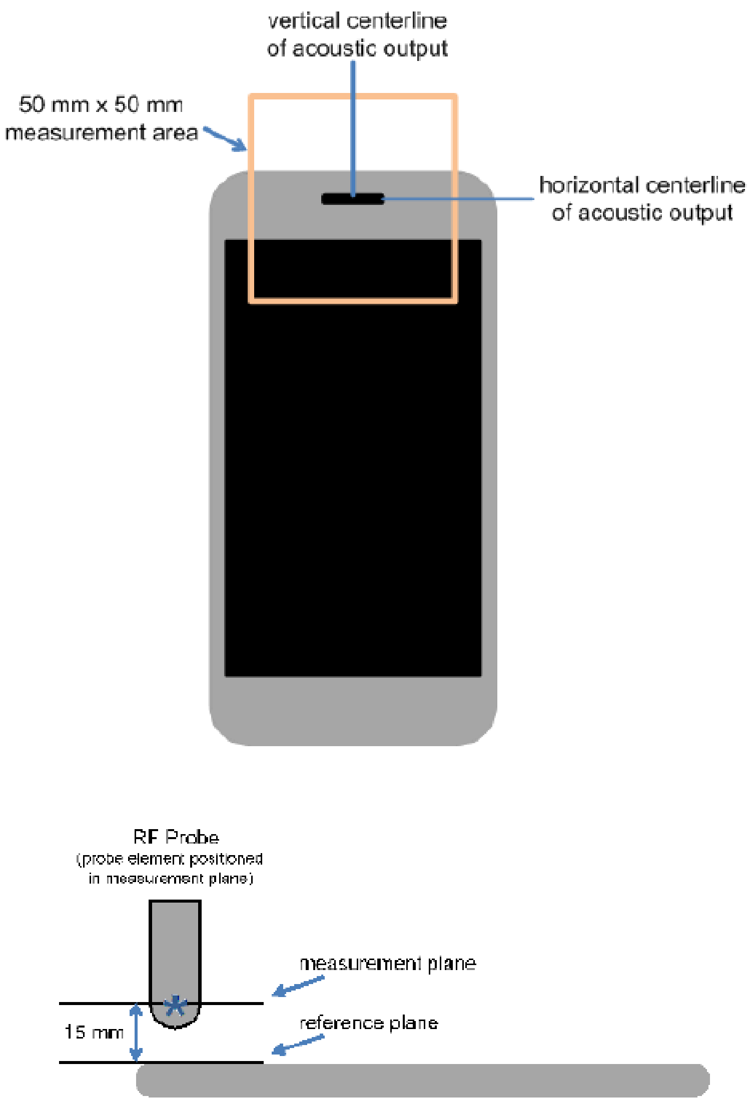


Fig. 3 WD measurement and reference planes for RF emission measurements

8 System Validation

8.1 Validation Procedure

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

•The probes and their cables are parallel to the coaxial feed of the dipole antenna

•The probe cables and the coaxial feed of the dipole antenna approach the measurement area from opposite directions

• The center point of the probe element(s) are 15 mm from the closest surface of the dipole elements.

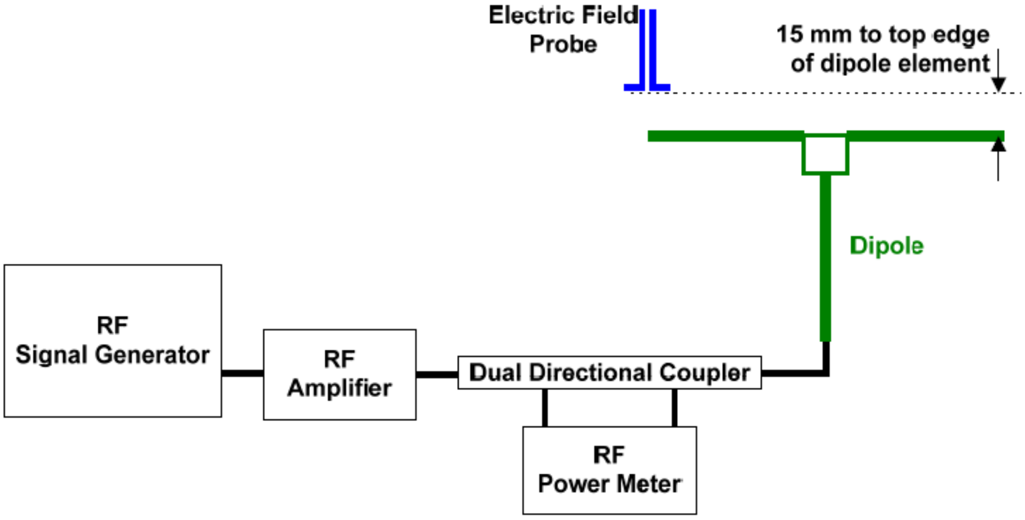


Fig. 4 Dipole Validation Setup

9 Evaluation of MIF

9.1 Introduction

The HAC Standard ANSI C63.19-2019 defines the MIF as a scaling factor to evaluate the Radio Frequency Audio Interference Level (RFail). It is applicable to any modulation scheme. The MIF (in dB) is added to the measured averaged E-field (in dBV /m) to obtain the RFail (also in dBV/m) which defines the audible amplitude of the measured RF signal strength. The RFail is then compared to the associated qualification level.

The MIF is defined in section D.7 of the ANSI C63.19-2019 as the interference potential of a signal 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. The modulated signal is processed as described below:

• The full signal bandwidth is presented to a wideband square law detector which demodulates the signal.

• The baseband signal (after demodulation) is presented to a spectral weighting filter which is

normalized to 1 kHz. The filter frequency response is shown in Section D.4 of the ANSI C63.19-

2019 standard.

• The spectral weighted signal is presented to a temporal weighting filter consisting of rapid Root

Mean Square (RMS) level detection followed by peak detection with a 550 ms decay time.

• The MIF is calculated as $\frac{10 \cdot log10_{10}(filtered\ signal)}{1.154 \cdot RMS\ of\ \ demodulated\ signal}$

Measurements of the MIF value are conducted using the MAIA designed by SPEAG. The resulting deviations from the simulated values are within the requirements of the HAC standard.

MAIA is a hardware interface for evaluating the modulation and audio interference characteristics of RF signals in the frequency range 698–6000 MHz. It uses USB-powered active electronics to identify the modulation of the DUT. It can be operated with the over-the-air interface using the built-in ultra-broadband planar log spiral antenna (698–6000 MHz) or in the conducted mode using the coaxial SMA 50W connector (300–6000 MHz).

Fig. 5 MAIA View

9.2 DUT MIF results

Based on the KDB285076D01v06r02, the handset can also use the MIF values predetermined by the test equipment manufacturer. 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.

Typical MIF levels in ANSI C63.19-2019	
Transmission protocol	Modulation interference factor
GSM-FDD (TDMA, GMSK)	+3.63 dB
EDGE-FDD (TDMA, 8PSK, TN 0-1)	+1.23dB
EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	-0.52dB
EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	-1.82dB
UMTS-FDD(WCDMA, AMR)	-25.43dB
UMTS-FDD (HSPA+)	-20.39dB
LTE-FDD (SC-FDMA, 1RB, 20MHz, QPSK)	-15.63 dB
LTE-FDD (SC-FDMA, 1RB, 20MHz, 16QAM)	-9.76 dB
LTE-FDD (SC-FDMA, 1RB, 20MHz, 64QAM)	-9.93 dB
LTE-TDD (SC-FDMA, 1RB, 20MHz, QPSK)	-1.62 dB
LTE-TDD (SC-FDMA, 1RB, 20MHz, 16QAM)	-1.44 dB
LTE-TDD (SC-FDMA, 1RB, 20MHz, 64QAM)	-1.54 dB
LTE-TDD(SC-FDMA,1RB,20MHz,QPSK,UL Subframe=2,3,4,7,8,9)	-3.41 dB
LTE-TDD(SC-FDMA,1RB,20MHz,16QAM,UL Subframe=2,3,4,7,8,9)	-3.17 dB
LTE-TDD(SC-FDMA,1RB,20MHz,64QAM,UL Subframe=2,3,4,7,8,9)	-3.31 dB

IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	-5.90 dB
IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	-5.17 dB
IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	-3.37 dB
IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	-2.02 dB
IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	-0.36dB
IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	-15.80 dB
IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	-5.82 dB
IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	-12.23dB
IEEE 802.11ax (20MHz, MCS0, 90pc duty cycle)	-5.58dB
IEEE 802.11ax (20MHz, MCS0, 99pc duty cycle)	-20.98dB
5G NR (DFT-s-OFDM, 1RB, 100 MHz, QPSK, 30 kHz)	-1.64dB
5G NR (CP-OFDM, 1RB, 20 MHz, QPSK, 15 kHz)	-1.65dB
5G NR (DFT-s-OFDM, 1RB, 20 MHz, QPSK, 15 kHz)	−15.06dB
5G NR (CP-OFDM, 1RB, 5 MHz, QPSK, 15 kHz)	−12.18dB
5G NR (CP-OFDM, 1RB, 10 MHz, QPSK, 15 kHz)	−12.26dB
5G NR (CP-OFDM, 1RB, 15 MHz, QPSK, 15 kHz)	−12.08dB
5G NR (CP-OFDM, 1RB, 20 MHz, QPSK, 15 kHz)	−12.20dB
5G NR (CP-OFDM, 1RB, 5 MHz, QPSK, 30 kHz)	−14.39dB
5G NR (CP-OFDM, 1RB, 10 MHz, QPSK, 30 kHz)	−14.47dB
5G NR (CP-OFDM, 1RB, 15 MHz, QPSK, 30 kHz)	−14.33dB
5G NR (CP-OFDM, 1RB, 20 MHz, QPSK, 30 kHz)	−14.46dB
5G NR (CP-OFDM, 1RB, 25 MHz, QPSK, 30 kHz)	−14.35dB
5G NR (CP-OFDM, 1RB, 30 MHz, QPSK, 30 kHz)	−14.32dB
5G NR (CP-OFDM, 1RB, 40 MHz, QPSK, 30 kHz)	−14.32dB
5G NR (CP-OFDM, 1RB, 50 MHz, QPSK, 30 kHz)	−14.55dB
5G NR (CP-OFDM, 1RB, 60 MHz, QPSK, 30 kHz)	−14.45dB
5G NR (CP-OFDM, 1RB, 80 MHz, QPSK, 30 kHz)	−14.47dB
5G NR (CP-OFDM, 1RB, 90 MHz, QPSK, 30 kHz)	−14.43dB
5G NR (CP-OFDM, 1RB, 100 MHz, QPSK, 30 kHz)	−14.38dB
5G NR (DFT-s-OFDM, 1RB, 5 MHz, QPSK, 15 kHz)	−15.06dB
5G NR (DFT-s-OFDM, 1RB, 10 MHz, QPSK, 15 kHz)	−15.06dB
5G NR (DFT-s-OFDM, 1RB, 15 MHz, QPSK, 15 kHz)	−15.06dB
5G NR (DFT-s-OFDM, 1RB, 20 MHz, QPSK, 15 kHz)	−15.06dB

10 Evaluation of RF Audio Interference Power Level

According to ANSIC 63.19-2019, the WD's conducted power must be at or below either the stated RF_{AIPL} (Table 13-1) or the stated peak power level (Table 13-2), or the average near-field emissions over the measurement area must be at or below the stated RF_{AIL} (Table 13-3), or the stated peak field strength (Table 13-4). 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. This chapter will evaluate the RF audio interference power level of WD.

Bands	Average $Power_{max}$ (dBm)	MIF_{worst} (dB)	Power + MIF	C63.19 Lowest RF_{AIPL}(dBm)	Compliance
WCDMA 850	24	-20.39	4	29	PASS
WCDMA 1700	24	-20.39	4	26	PASS
WCDMA 1900	24	-20.39	4	26	PASS
LTE Band2	24.5	-9.76	15	26	PASS
LTE Band4	24.5	-9.76	15	26	PASS
LTE Band5	25	-9.76	15	29	PASS
LTE Band7	24	-9.76	14	25	PASS
LTE Band12	25	-9.76	15	29	PASS
LTE Band14	25	-9.76	15	29	PASS
LTE Band30	24	-9.76	14	29	PASS
LTE Band66	24.5	-9.76	15	26	PASS
WLAN 2.4G	19	-0.36	19	25	PASS
WLAN 5G	18.5	-5.82	13	25	PASS

According to the above table, the RF_{AIPL} for WCDMA, LTE and WIFI are less than the stated RF_{AIPL} (Table 11.1).

11 ANSIC 63.19-2019 Limits

11-1 Wireless device RF audio interference power level

Frequency range (MHz)	RF_{AIPL} (dBm)
<960	29
960–2000	26
>2000	25

11-2 Wireless device RF peak power level

Frequency range (MHz)	$RF_{Peak\ Power}$ (dBm)
<960	35
960–2000	32
>2000	31

11-3 Wireless device RF audio interference level

Frequency range (MHz)	RF_{AIL} [dB(V/m)]
<960	39
960–2000	36
>2000	35

11-4 Wireless device RF peak near-field level

Frequency range (MHz)	RF_{Peak} [dB(V/m)]
<960	45
960–2000	42
>2000	41

12 Conclusion

The HAC measurement indicates that the EUT complies with the HAC limits of the ANSIC63.19-2019. It is comprehensively determined as **PASS**

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