



No. 24T04Z102681-002



HAC RF TEST REPORT

No. 24T04Z102681-002

For

TCL Communication Ltd

GSM/UMTS/LTE/NR Mobile phone

Model Name: T513W

with

Hardware Version: 03

Software Version: vBCSH

FCC ID: 2ACCJH186

HAC-2019 Compliance: PASS

Issued Date: 2025-01-10

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

No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

Tel: +86(0)10-62304633-2512, Fax: +86(0)10-62304633-2504

Email: ctl_terminals@caict.ac.cn, website: www.caict.ac.cn

REPORT HISTORY

Report Number	Revision	Issue Date	Description
24T04Z102681-002	Rev.0	2025-01-06	Initial creation of test report
24T04Z102681-003	Rev.1	2025-01-10	Delete NFC information in section 3.1

TABLE OF CONTENT

1 TEST LABORATORY	5
1.1 INTRODUCTION & ACCREDITATION	5
1.2 TESTING LOCATION	5
1.3 TESTING ENVIRONMENT	6
1.4 PROJECT DATA	6
1.5 SIGNATURE	6
2 CLIENT INFORMATION	7
2.1 APPLICANT INFORMATION	7
2.2 MANUFACTURER INFORMATION	7
3 EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE)	8
3.1 ABOUT EUT	8
3.2 INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST	8
3.3 INTERNAL IDENTIFICATION OF AE USED DURING THE TEST	8
3.4 AIR INTERFACES / BANDS INDICATING OPERATING MODES	9
4 MAXIMUM OUTPUT POWER	10
5 REFERENCE DOCUMENTS	11
5.1 REFERENCE DOCUMENTS FOR TESTING	11
6 OPERATIONAL CONDITIONS DURING TEST	12
6.1 HAC MEASUREMENT SET-UP	12
6.2 PROBE SPECIFICATION	13
6.3 TEST ARCH PHANTOM & PHONE POSITIONER	14
6.4 ROBOTIC SYSTEM SPECIFICATIONS	14
7 EUT ARRANGEMENT	15
7.1 WD RF EMISSION MEASUREMENTS REFERENCE AND PLANE	15
8 SYSTEM VALIDATION	16
8.1 VALIDATION PROCEDURE	16
8.2 VALIDATION RESULT	16
9 EVALUATION OF MIF	17
9.1 INTRODUCTION	17
9.2 DUT MIF RESULTS	18
10 EVALUATION OF RF AUDIO INTERFERENCE POWER LEVEL	20
11 NEAR-FIELD EMISSION TEST PROCEDURES	21
12 NEAR-FIELD EMISSION TEST RESULTS	22
13 ANSIC 63.19-2019 LIMITS	23



No. 24T04Z102681-002

14 MEASUREMENT UNCERTAINTY	24
15 MAIN TEST INSTRUMENTS	25
16 CONCLUSION.....	25
ANNEX A TEST LAYOUT.....	26
ANNEX B TEST PLOTS.....	27
ANNEX C SYSTEM VALIDATION RESULT	30
ANNEX D PROBE CALIBRATION CERTIFICATE	33
ANNEX E DIPOLE CALIBRATION CERTIFICATE	54



No. 24T04Z102681-002

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.

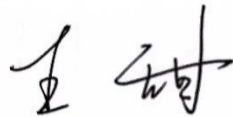
1.3 Testing Environment

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:	December 23, 2024
Testing End Date:	December 24, 2024

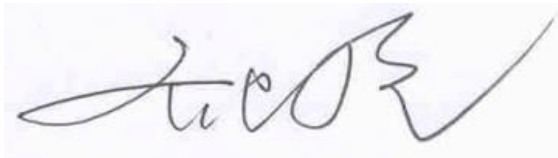
1.5 Signature



Wang Tian
(Prepared this test report)



Lin Jun
(Reviewed this test report)



Qi Dianyuan
Deputy Director of the laboratory
(Approved this test report)

2 Client Information

2.1 Applicant Information

Company Name:	TCL Communication Ltd.
Address/Post:	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong
Contact Person:	Ting Wang
Contact Email:	ting.wang.hz@tcl.com
Telephone:	+86 752 2639091
Fax	\

2.2 Manufacturer Information

Company Name:	TCL Communication Ltd.
Address/Post:	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong
Contact Person:	Ting Wang
Contact Email:	ting.wang.hz@tcl.com
Telephone:	+86 752 2639091
Fax	\

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

3.1 About EUT

Description:	GSM/UMTS/LTE/NR Mobile phone
Model name:	T513W
Operating mode(s):	GSM 850/900/1800/1900 WCDMA B2/4/5 LTE Band:2/4/5/12/25/26/41/66/71 5G NR N25/41/66/71 BT, Wi-Fi(2.4G), Wi-Fi(5G)

3.2 Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version
EUT1	016604000006891/016604000006917	03	vBCSH

*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	TLp049D7	\	VEKEN
AE2	Battery	TLp049C9	\	FENGHUA

*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/test ed	Simultaneous Transmissions Not Tested ⁽¹⁾	Name of Voice Service
GSM	850	VO	Yes	BT, WLAN	CMRS Voice
	1900				
GPRS/EDGE	850	DT	Yes		MEET
	1900				
WCDMA (UMTS)	850	VO	Yes	BT, WLAN	CMRS Voice
	1700				
	1900				
	HSPA	DT	Yes		MEET
LTE TDD	Band41	V/D	Yes	BT, WLAN	VoLTE, MEET
LTE FDD	Band2/4/5/12/25/26/66/71	V/D	Yes	BT, WLAN	VoLTE, MEET
NR	n25/n41/n66/n71	V/D	Yes	BT, WLAN	VoNR, 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)
GSM 850	33.3
GSM 1900	32
WCDMA 850	24.5
WCDMA 1700	24.5
WCDMA 1900	24.5
LTE Band2	25
LTE Band4	25
LTE Band5	25
LTE Band12	25
LTE Band25	25
LTE Band26	25
LTE Band41 PC2	27
LTE Band41 PC3	24.5
LTE Band66	25
LTE Band71	24
NR n25	24
NR n66	24.5
NR n71	24
NR n41	26.5
WLAN 2.4GHz	21
WLAN 5GHz	20

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 Core2 1.86 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.

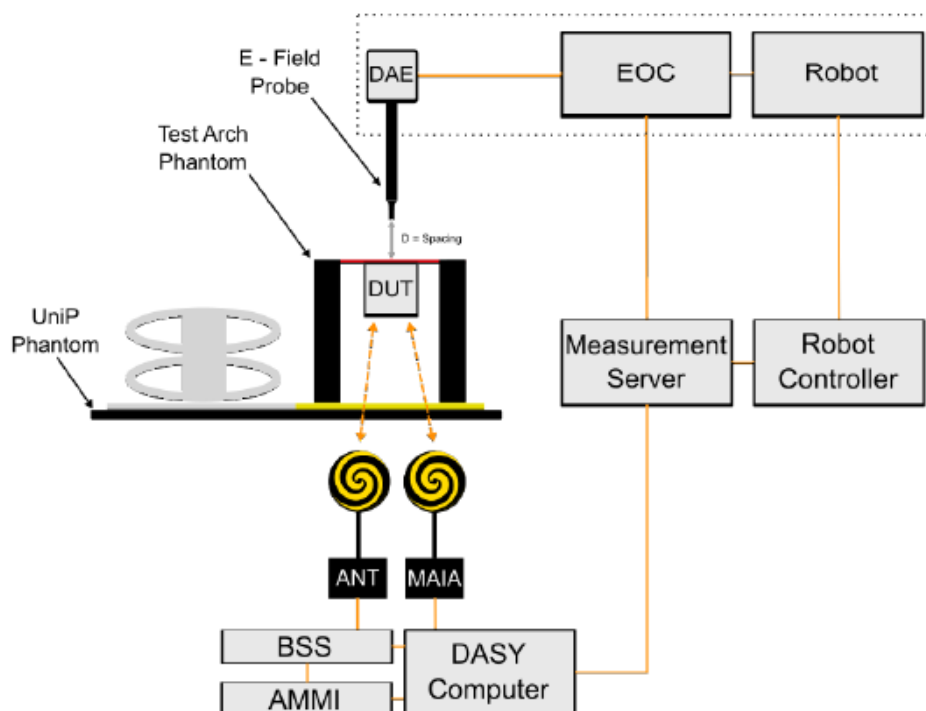


Fig. 1 HAC Test Measurement Set-up

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

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 $\pm 6.0\%$, $k=2$)
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



[EF3DV3]

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).

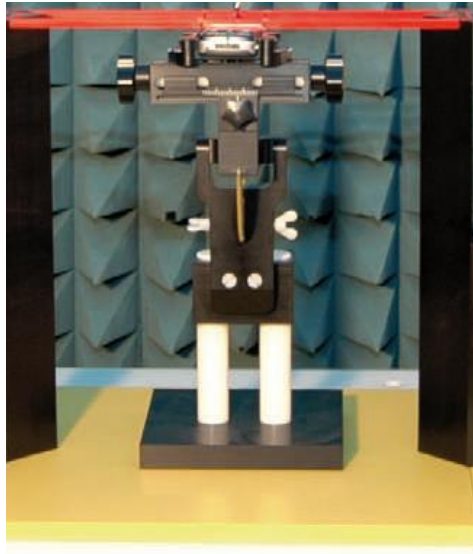


Fig. 2 HAC Phantom & Device Holder

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.

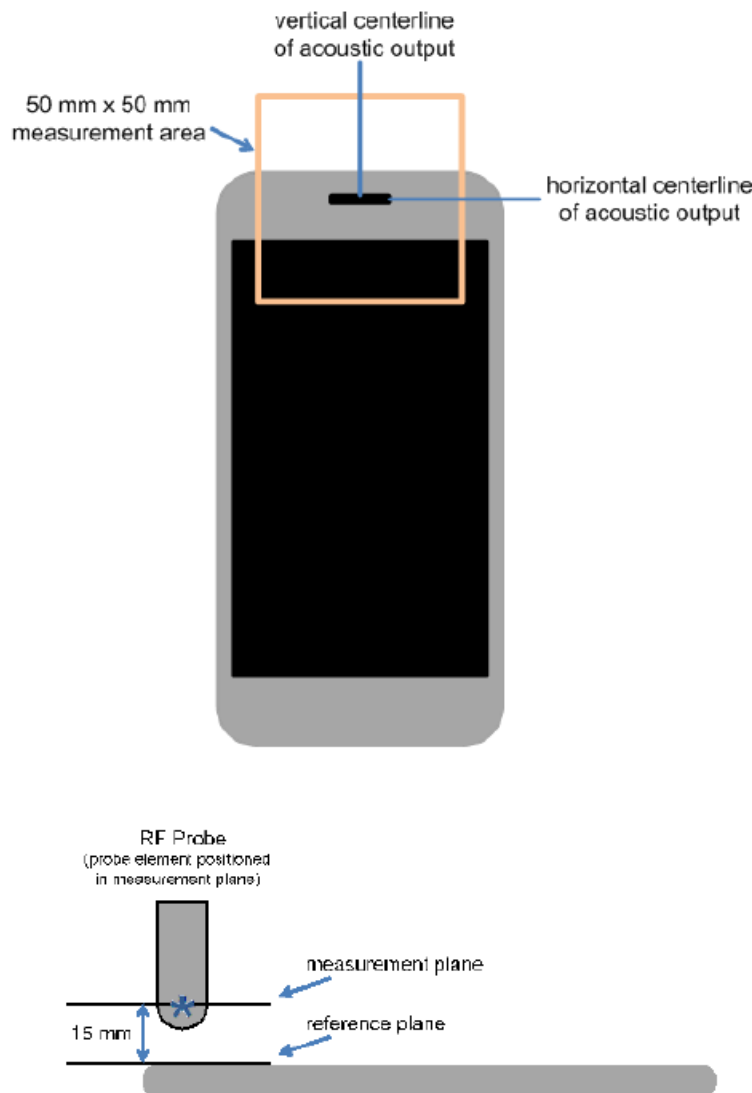


Fig. 3 WD measurement and reference planes for RF emission measurements

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.

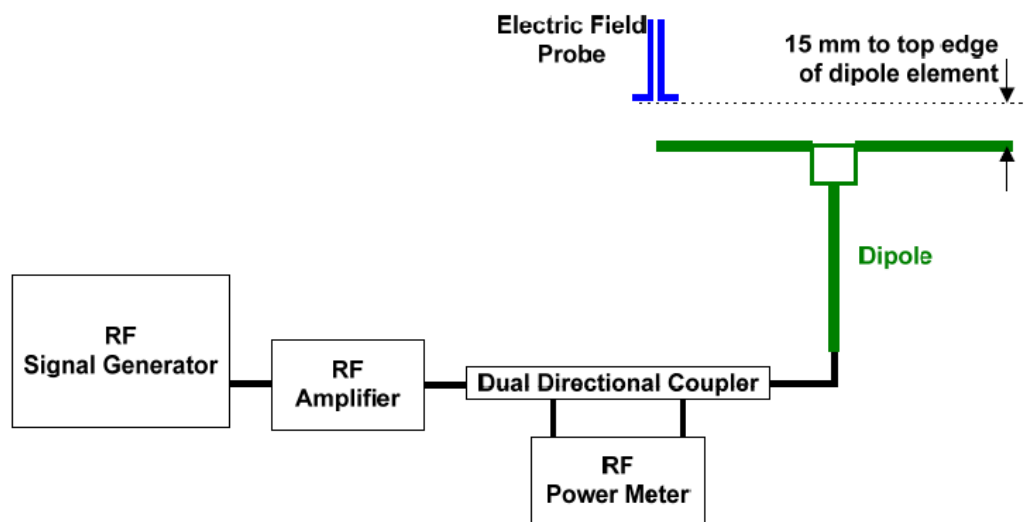


Fig. 4 Dipole Validation Setup

8.2 Validation Result

E-Field Scan						
Mode	Frequency (MHz)	Input Power (mW)	Measured ¹ Value(V/m)	Target ² Value(V/m)	Deviation ³ (%)	Limit ⁴ (%)
CW	835	100	118.00	112.60	4.80	± 18
CW	1880	100	88.40	88.20	0.23	± 18
CW	2600	100	83.10	85.30	-2.58	± 18

Notes:

1. Please refer to the attachment for detailed measurement data and plot.
2. Target value is provided by SPEAG in the calibration certificate of specific dipoles.
3. Deviation (%) = 100 * (Measured value minus Target value) divided by Target value.
4. ANSI C63.19 requires values within ± 18% are acceptable, of which 12% is deviation and 13% is measurement uncertainty. Values independently validated for the dipole actually used in the measurements should be used, when available.

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
$$\frac{10 \cdot \log_{10}(\text{filtered signal})}{1.154 \cdot \text{RMS of demodulated signal}}$$

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
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
GSM 850	33.3	3.63	36.93	29	To be tested
GSM 1900	32	3.63	35.63	26	To be tested
WCDMA 850	24.5	-20.39	4.11	29	PASS
WCDMA 1700	24.5	-20.39	4.11	26	PASS
WCDMA 1900	24.5	-20.39	4.11	26	PASS
LTE Band2	25	-9.76	15.24	26	PASS
LTE Band4	25	-9.76	15.24	26	PASS
LTE Band5	25	-9.76	15.24	29	PASS
LTE Band12	25	-9.76	15.24	29	PASS
LTE Band25	25	-9.76	15.24	26	PASS
LTE Band26	25	-9.76	15.24	29	PASS
LTE Band41 PC2	27	-1.62	25.38	25	To be tested
LTE Band41 PC3	24.5	-1.62	22.88	25	PASS
LTE Band66	25	-9.76	15.24	26	PASS
LTE Band71	24	-9.76	14.24	29	PASS
NR n25	24	-1.64	22.36	26	PASS
NR n66	24.5	-1.64	22.86	26	PASS
NR n71	24	-1.64	22.36	29	PASS
NR n41	26.5	-1.64	24.86	25	PASS
WLAN 2.4GHz	21	-0.36	20.64	25	PASS
WLAN 5GHz	20	-5.82	14.18	25	PASS

According to the above table, the RF_{AIPL} for WCDMA, LTE FDD, WIFI, NR TDD and NR FDD are less than the stated RF_{AIPL} (Table 13.1). Near field emission testing is required for the GSM, LTE TDD bands.

11 Near-field Emission Test Procedures

The evaluation was performed with the following procedure:

- 1) Confirm proper operation of the field probe, probe measurement system and other instrumentation and the positioning system.
- 2) Position the WD in its intended test position. The gauge block can simplify this positioning.
- 3) Set the WD to transmit a fixed and repeatable combination of signal power and modulation characteristic that is representative of the worst case (highest interference potential) encountered in normal use. Transiently occurring start-up, changeover, or termination conditions, or other operations likely to occur less than 1% of the time during normal operation, may be excluded from consideration.
- 4) The measurement area shall be centered on the acoustic output or the T-Coil mode measurement reference point, as appropriate. Locate the field probe at the initial test position in the 50 mm by 50 mm measurement area, which is contained in the measurement plane. If the field alignment method is used, align the probe for maximum field reception
- 5) Record the reading at the output of the measurement system.
- 6) Scan the entire 50 mm by 50 mm measurement area in equally spaced step sizes and record the reading at each measurement point.
- 7) Calculate the average of the measurements taken in Step 6)
- 8) 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)
- 9) Compare this RF audio interference level to the limits in ANSI C63.19-2019 clause 4.7 and record the result.

12 Near-field Emission Test Results

Bands	Frequency (MHz)	Channel	RFail (dBV/m)	Compliance
GSM 850	848.8	251	29.56	PASS
	836.6	190	29.79	PASS(see Fig B.1)
	824.2	128	28.47	PASS
GSM 1900	1909.8	810	24.49	PASS(see Fig B.2)
	1880	661	23.84	PASS
	1850.2	512	23.16	PASS
LTE Band41 PC2	2680	41490	23.63	PASS
	2636.5	41055	23.91	PASS
	2593	40620	24.89	PASS(see Fig B.3)
	2549.5	40185	22.56	PASS
	2506	39750	20.73	PASS

13 ANSIC 63.19-2019 Limits

13-1 Wireless device RF audio interference power level

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

13-2 Wireless device RF peak power level

Frequency range (MHz)	RF _{Peak Power} (dBm)
<960	35
960–2000	32
>2000	31

13-3 Wireless device RF audio interference level

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

13-4 Wireless device RF peak near-field level

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

14 Measurement Uncertainty

Error Description	Uncert. value	Prob. Dist.	Div.	(ci) Eav	Std. Unc. E
Measurement System					
Probe Calibration	±5.1 %	N	1	1	±5.1 %
Axial Isotropy	±4.7 %	R	√3	1	±2.7 %
Sensor Displacement	±7.2 %	R	√3	0.5	±2.1 %
Boundary Effects	±2.4 %	R	√3	1	±1.4 %
Phantom Boundary Effect	±7.2 %	R	√3	1	±4.2 %
Probe Linearity	±4.7 %	R	√3	1	±2.7 %
Scaling to Peak Power with MIF	±10.0 %	R	√3	1	±5.8 %
System Detection Limit	±1.0 %	R	√3	1	±0.6 %
Readout Electronics	±0.3 %	N	1	1	±0.3 %
Response Time	±0.8 %	R	√3	0	±0 %
Integration Time	±2.6 %	R	√3	0	±0 %
RF Ambient Conditions	±3.0 %	R	√3	1	±1.7 %
RF Reflections	±12.0 %	R	√3	1	±6.9 %
Probe Positioner	±1.2 %	R	√3	1	±0.7 %
Probe Positioning	±3.0 %	R	√3	1	±1.7 %
Extrapolation and Interpolation	±1.0 %	R	√3	1	±0.6 %
Test Sample Related					
Device Positioning Vertical	±4.7 %	R	√3	1	±2.7 %
Device Positioning Lateral	±1.0 %	R	√3	1	±0.6 %
Device Holder and Phantom	±2.4 %	R	√3	1	±1.4 %
Power Drift	±5.0 %	R	√3	1	±2.9 %
Phantom and Setup Related					
Phantom Thickness	±2.4 %	R	√3	1	±1.4 %
Combined Std. Uncertainty					±13.2 %
Expanded Std. Uncertainty on Power					±26.4 %
Expanded Std. Uncertainty on Field					±13.2 %

15 Main Test Instruments

Table 1: List of Main Instruments

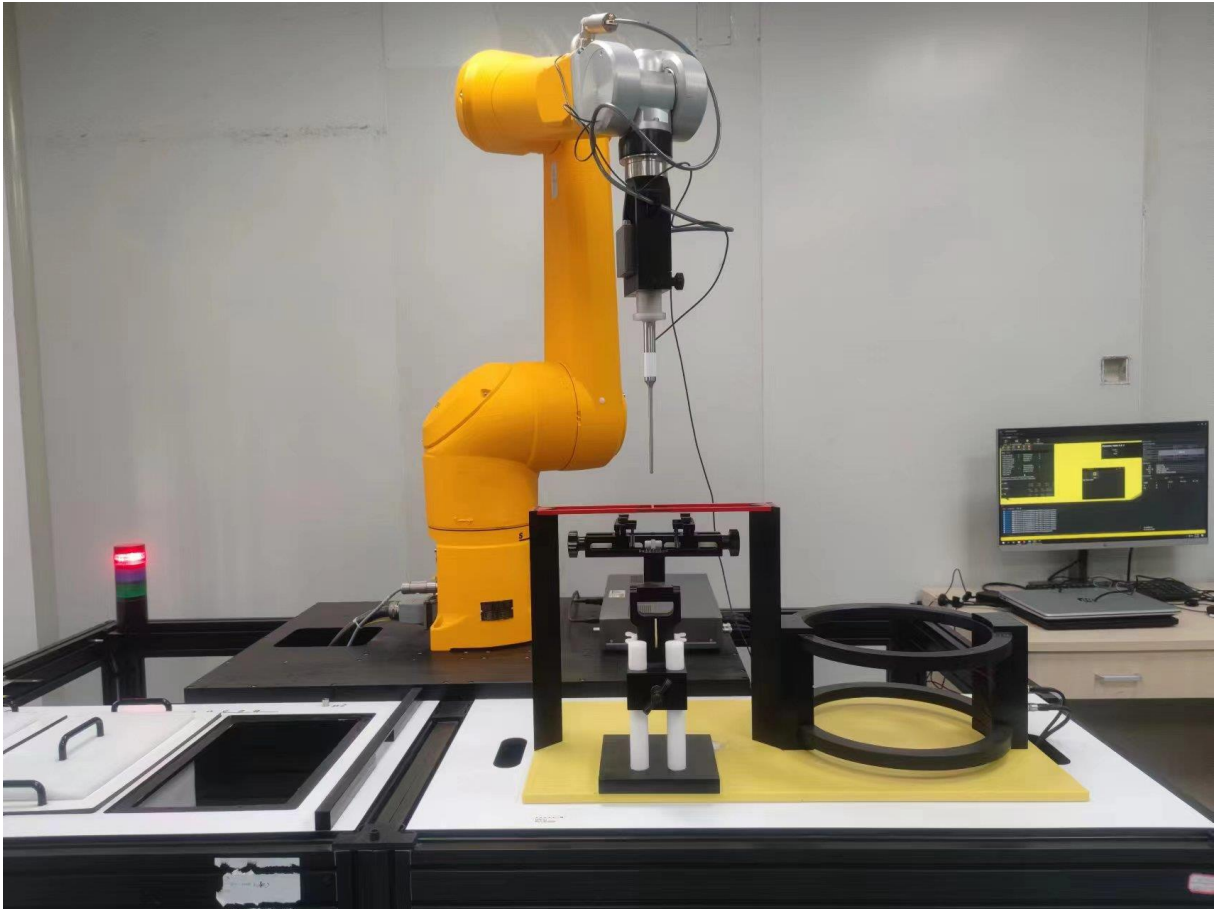
No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Signal Generator	E4483C	MY49071430	December 25, 2023	One Year
02	Power meter	NRP2	106276	May 17, 2024	One year
03	Power sensor	NRP6A	101369		
04	Amplifier	60S1G4	0331848	No Calibration Requested	
05	E-Field Probe	EF3DV3	4060	May 23, 2024	One year
06	DAE	SPEAG DAE4	1524	October 18, 2024	One year
07	HAC Dipole	CD835V3	1023	August 16, 2024	One year
08	HAC Dipole	CD1880V3	1018	August 16, 2024	One year
09	HAC Dipole	CD2600V3	1017	August 16, 2024	One year
10	BTS	CMW500	166370	July 4, 2024	One year
11	MAIA	SE UMS 171 DB	1554	No Calibration Requested	

16 Conclusion

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

END OF REPORT BODY

ANNEX A TEST LAYOUT



Picture A1:HAC RF System Layout

ANNEX B TEST PLOTS

Device Under Test

Manufacturer	Model	Dimensions[mm]	Speaker Position [mm]
1	1	146.2 x 71.8 x 7.5	144.3

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4060	May 23, 2024	DAE4 Sn1524	October 18, 2024

Communication Systems

Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	GSM-FDD (TDMA, GMSK)	190	836.6

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

Results

Emax [dB(V/m)]	Eavg50x50 max [dB(V/m)]	MIF [dB]	RFail [dB(V/m)]
27.78	26.16	3.63	29.79

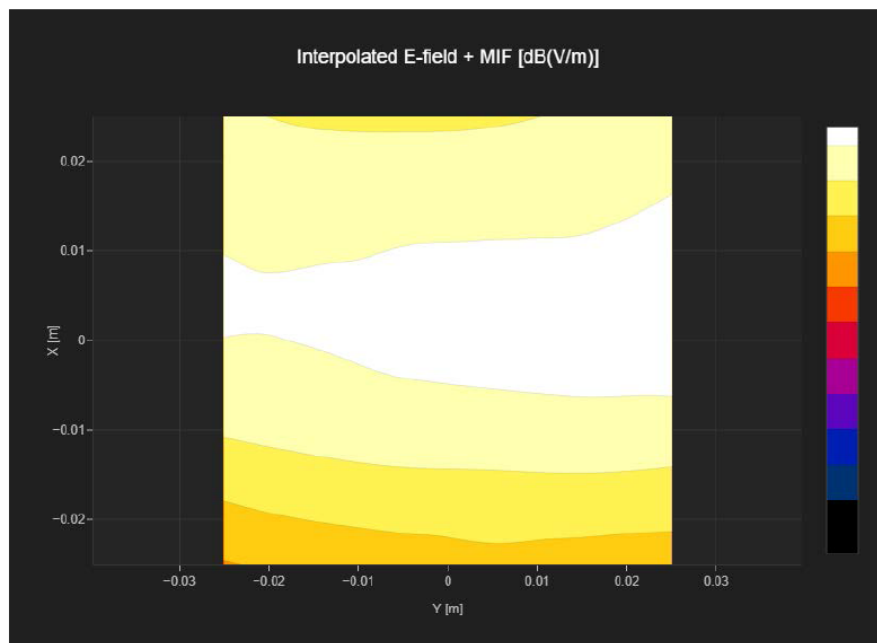


Fig B.1 GSM 850

Device Under Test

Manufacturer	Model	Dimensions[mm]	Speaker Position [mm]
1	1	146.2 x 71.8 x 7.5	144.3

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4060	May 23, 2024	DAE4 Sn1524	October 18, 2024

Communication Systems

Band Name	Communication Systems Name	Channel	Frequency [MHz]
PCS 1900	GSM-FDD (TDMA, GMSK)	810	1909.8

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

Results

E _{max} [dB(V/m)]	E _{avg50x50} max [dB(V/m)]	MIF [dB]	RFail [dB(V/m)]
26.73	20.86	3.63	24.49

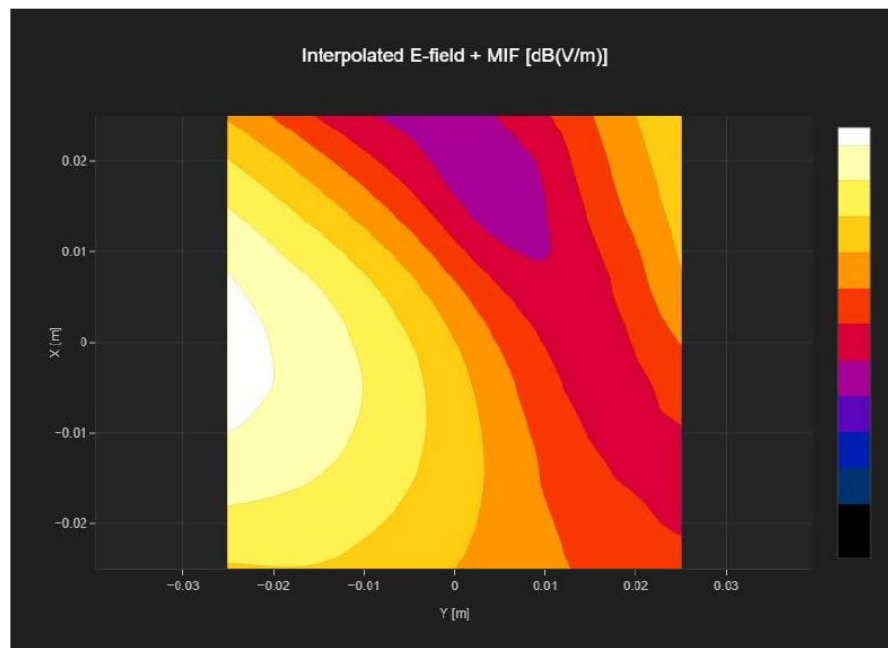


Fig B.2 GSM 1900

Device Under Test

Manufacturer	Model	Dimensions[mm]	Speaker Position [mm]
1	1	146.2 x 71.8 x 7.5	144.3

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4060	May 23, 2024	DAE4 Sn1524	October 18, 2024

Communication Systems

Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 41, E-UTRA/TDD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	40620	2593.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

Results

E _{max} [dB(V/m)]	E _{avg50x50 max} [dB(V/m)]	MIF [dB]	R _{Fail} [dB(V/m)]
30.06	26.51	-1.62	24.89

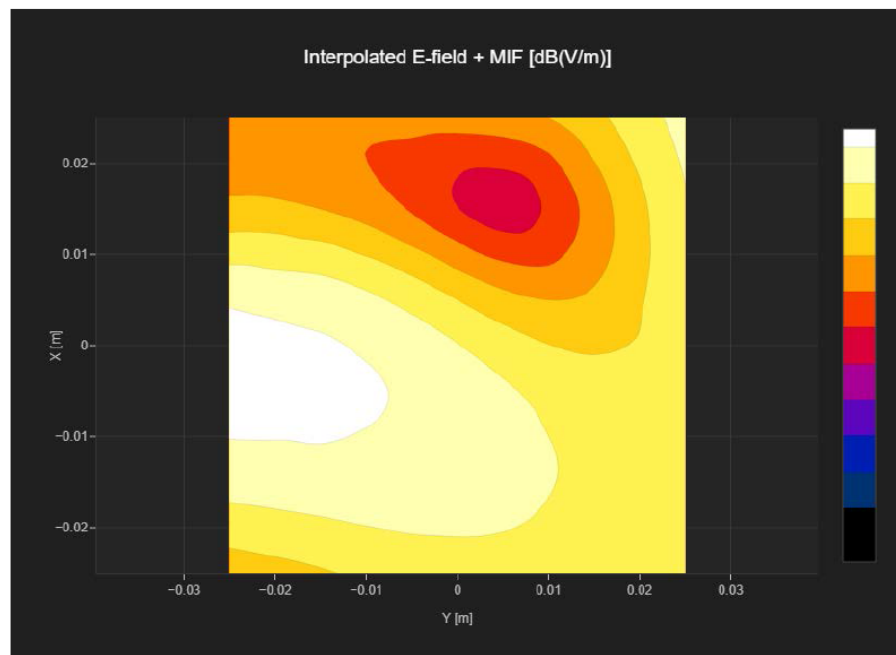


Fig B.3 LTE Band41 PC2

ANNEX C SYSTEM VALIDATION RESULT

E SCAN of Dipole 835 MHz

Device Under Test

Manufacturer	Model	Dimensions [mm]	Speaker Position [mm]
		146.2 x 71.8 x 7.5	144.3

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4060	May 23, 2024	DAE4 Sn1524	October 18, 2024

Communication Systems

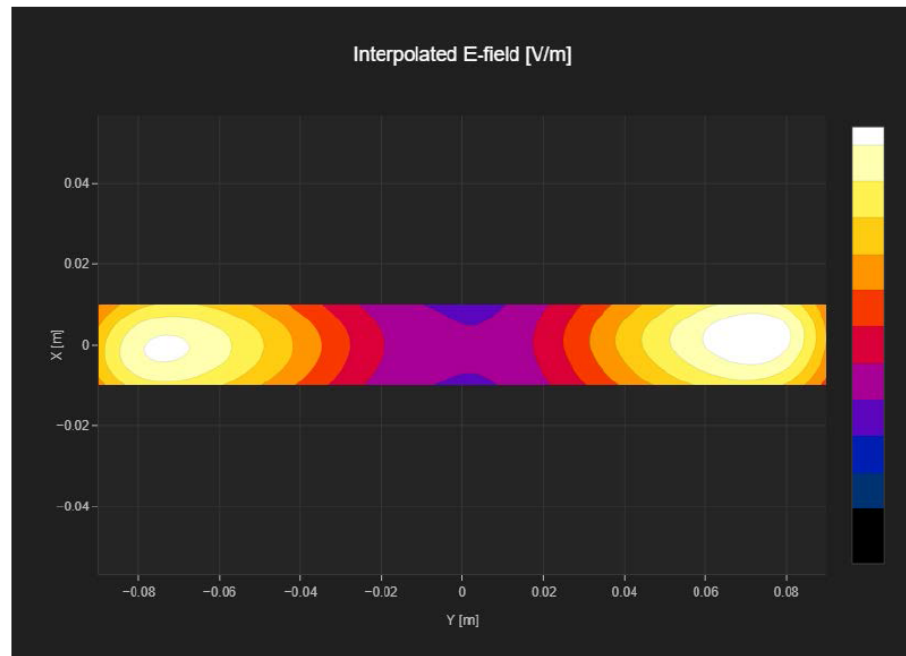
Band Name	Communication Systems Name	Channel	Frequency [MHz]
CD835	CW	50	835.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
20.0	180.0	5.0	5.0	15.0

Results

Dipole Type	Dipole Serial Number	E _{max} [V/m]	Drift [dB]
CD835	XXXX	118	-0.03



E SCAN of Dipole 1880 MHz

Device Under Test

Manufacturer	Model	Dimensions [mm]	Speaker Position [mm]
		146.2 x 71.8 x 7.5	144.3

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4060	May 23, 2024	DAE4 Sn1524	October 18, 2024

Communication Systems

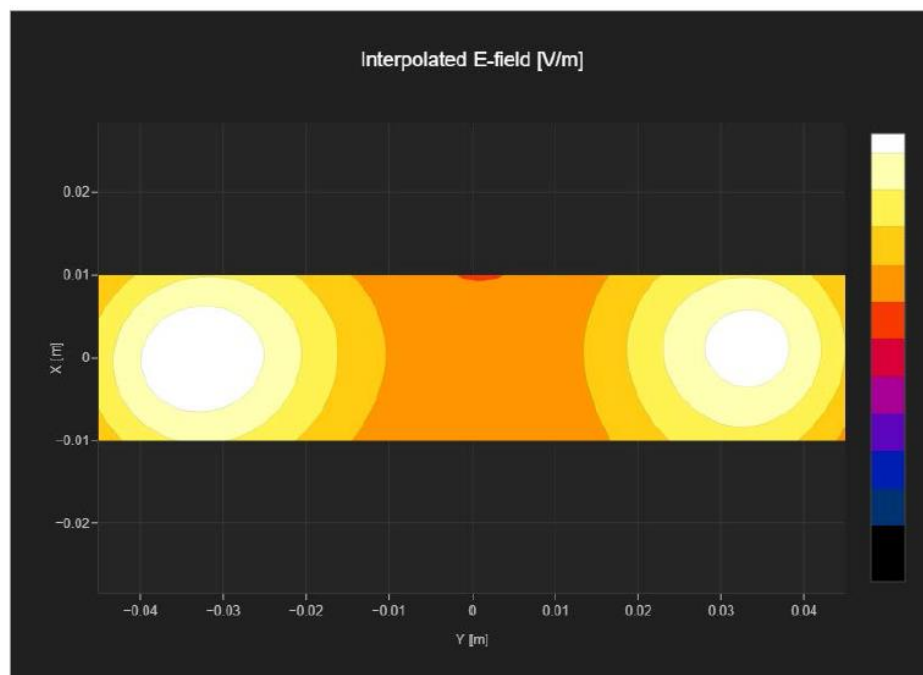
Band Name	Communication Systems Name	Channel	Frequency [MHz]
CD1880	CW	0	1880.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
20.0	90.0	5.0	5.0	15.0

Results

Dipole Type	Dipole Serial Number	E _{max} [V/m]	Drift [dB]
CD1880	XXXX	88.4	-0.01



E SCAN of Dipole 2600 MHz

Device Under Test

Manufacturer	Model	Dimensions [mm]	Speaker Position [mm]
		146.2 x 71.8 x 7.5	144.3

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4060	May 23, 2024	DAE4 Sn1524	October 18, 2024

Communication Systems

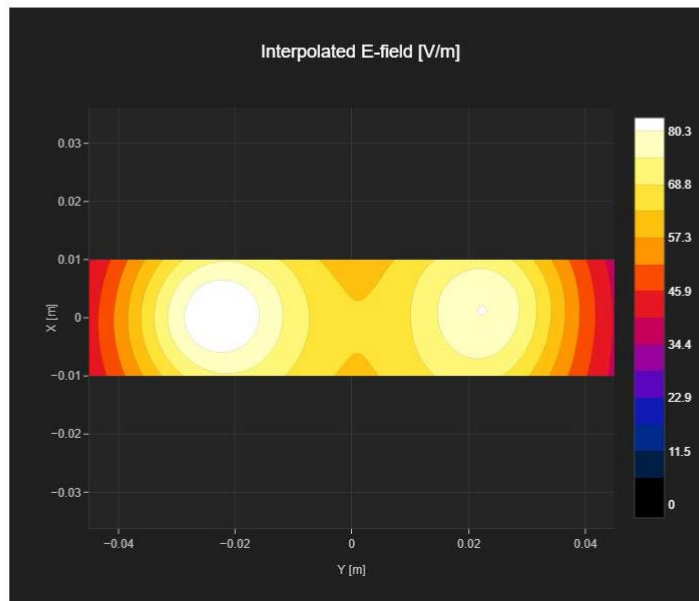
Band Name	Communication Systems Name	Channel	Frequency [MHz]
CD2600V3	CW	50	2600.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
20.0	90.0	5.0	5.0	15.0

Results

Dipole Type	Dipole Serial Number	E _{max} [V/m]	Drift [dB]
CD2600	XXXX	83.1	-0.01



ANNEX D PROBE CALIBRATION CERTIFICATE

Calibration Laboratory of

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client
CTTL
Beijing

Certificate No. **EF-4060_May24**

CALIBRATION CERTIFICATE

Object **EF3DV3 - SN:4060**

Calibration procedure(s) **QA CAL-02.v9, QA CAL-25.v8**
Calibration procedure for E-field probes optimized for close near field
evaluations in air

Calibration date **May 23, 2024**

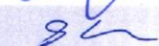
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3) °C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: CC2552 (20x)	26-Mar-24 (No. 217-04046)	Mar-25
DAE4	SN: 789	18-Oct-23 (No. DAE4-789_Oct23)	Oct-24
Reference Probe ER3DV6	SN: 2328	02-Oct-23 (No. ER3-2328_Oct23)	Oct-24

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-22)	In house check: Jun-24
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Calibrated by	Name Jeffrey Katzman	Function Laboratory Technician	Signature 
Approved by	Name Sven Kühn	Function Technical Manager	

Issued: May 23, 2024

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Glossary

NORM _{x,y,z}	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
En	incident E-field orientation normal to probe axis
Ep	incident E-field orientation parallel to probe axis
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1309-2005, "IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005
- CTIA Test Plan for Hearing Aid Compatibility, Rev 3.1.1, May 2017

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ for XY sensors and $\vartheta = 90$ for Z sensor ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz in R22 waveguide).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart).
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- Spherical isotropy (3D deviation from isotropy)**: in a locally homogeneous field realized using an open waveguide setup
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).