T-COIL TEST REPORT

Report No.:	20241217G26473X-W2
Product:	Smart Phone
Model No.:	A55
FCC ID:	2AQRMA55
Brand Name:	FOXX
Applicant:	FOXX Development Inc.
Address:	3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA
Test date:	12/16/2024~12/28/2024
Issued Date:	12/30/2024
Issued by:	CCIC Southern Testing Co., Ltd.
Lab Location:	Electronic Testing Building, No.43, Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China
	Tel: 86-755-26627338 **E-Mail:** manager@ccic-set.com

Test Report

Product. :	Smart Phone
Model No. …….:	A55
Brand Name……..:	FOXX
Applicant……...:	FOXX Development Inc.
Applicant Address……..:	3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA
Test Standards…….:	ANSI C63.19-2019 American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids FCC 47CFR §20.19 American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids
Test Result……:	Pass
Tested by ……..:	Carl Wei Carl Wei , Test Engineer
Reviewed by…….:	Sun Jiaohui Sun Jiaohui, Senior Engineer
Approved by…….:	Chris You Chris You , RF Manager

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1. Administrative Data

1.1 Testing Laboratory

Test Site:	CCIC Southern Testing Co., Ltd.
Address:	Electronic Testing Building, No.43, Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China
A2LA Lab Code:	CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.
FCC Registration:	CCIC-SET Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN1283, valid time is until June 30, 2025.
ISED Registration:	CCIC-SET Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A, CAB Identifier: CN0064, valid time is until June 30, 2025.
Test Environment Condition:	Temperature (℃): 18℃ ~25℃ Relative Humidity (%): 35%~75% RH Atmospheric Pressure (kPa): 86KPa-106KPa

2. Equipment Under Test (EUT)

Identification of the Equipment under Test

Sample Name:	Smart Phone	
Model Name:	A55	
Brand Name:	FOXX	
General description:	Support Band	GSM850/1900, WCDMA B2/4/5 LTE B2/4/5/12/17/25/26/41/66/71 2.4G WIFI, Bluetooth,
	Test Band	GSM 850/1900 WCDMA Band 2/4/5 LTE B2/4/5/12/17/25/26/41/66/71
	Development Stage	Identical Prototype
	Accessories	Power Supply
	Antenna type	PIFA Antenna
	Operation mode	GSM Voice WCDMA Voice LTE Voice
	Modulation mode	GSM: GMSK, 8PSK WCDMA: QPSK LTE: QPSK, 16QAM 2.4GHz WIFI: DSSS, OFDM BT: GFSK/π/4-DQPSK/8-DPSK

Note: these models only the model name is difference for market purpose

3. SUMMARY OF TEST RESUSLTS

3.1 Test Standards

No.	Identity	Document Title
1	FCC 47 CFR Part 20.19	Hearing aid-compatible mobile handsets.
2	ANCI C63.19:2019	American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids
3	KDB 285076 D01 HAC Guidance v06r02	EQUIPMENT AUTHORIZATION GUIDANCE FOR HEARING AID COMPATIBILITY
4	KDB 285076 D02 v04	Guidance for performing T-Coil tests for air interfaces supporting voice over IP (e.g., LTE and WiFi) to support CMRS based telephone services", Feb. 23, 2022
5	KDB 285076 D03 v01r06	Hearing aid compatibility frequently asked questions

3.2. Attestation of Testing Summary

Band	Frequency response	result
GSM850	PASS	PASS
GSM1900	PASS	PASS
WCDMA850	PASS	PASS
WCDMA1700	PASS	PASS
WCDMA1900	PASS	PASS
VoLTE Band 2	PASS	PASS
VoLTE Band 4	PASS	PASS
VoLTE Band 5	PASS	PASS
VoLTE Band 12	PASS	PASS
VoLTE Band 17	PASS	PASS
VoLTE Band 25	PASS	PASS
VoLTE Band 26 part 90	PASS	PASS
VoLTE Band 26 part 22	PASS	PASS
VoLTE Band 41	PASS	PASS
VoLTE Band 66	PASS	PASS
VoLTE Band 71	PASS	PASS

4. Hearing Aid Compatibility (HAC)

4.1 Introduction

The purpose of this standard is to establish categories for hearing aids and for WD (wireless communications devices) that can indicate to health care practitioners and hearing aid users which hearing aids are compatible with which WD, and to provide tests that can be used to assess the electromagnetic characteristics of hearing aids and WD and assign them to these categories. The various parameters required, in order to demonstrate compatibility and accessibility are measured. The design of the standard is such that when a hearing aid and WD achieve one of the categories specified, as measured by the methodology of this standard, the indicated performance is realized.

In order to provide for the usability of a hearing aid with a WD, several factors must be coordinated:

a) Radio frequency (RF) measurements of the near-field electric and magnetic fields emitted by a WD to categorize these emissions for correlation with the RF immunity of a hearing aid.

b) Magnetic field measurements of a WD emitted via the audio transducer associated with the T-coil mode of the hearing aid, for assessment of hearing aid performance.

c) Measurements with the hearing aid and a simulation of the categorized WD T-coil emissions to assess the hearing aid RF immunity in the T-coil mode.

The WD radio frequency (RF) and audio band emissions are measured. Hence, the following are measurements made for the WD:

a) RF E-Field emissions

b) T-coil mode, magnetic signal strength in the audio band

c) T-coil mode, magnetic signal and noise articulation index

d) T-coil mode, magnetic signal frequency response through the audio band Corresponding to the WD measurements, the hearing aid is measured for:

a) RF immunity in microphone mode

b) RF immunity in T-coil mode

4.2 Description of Test System

4.2.1 COMOHAC T-COIL PROBE

Serial Number:	SN 24/13 TCP28
Frequency range:	200 Hz -5000 Hz
Dimensions:	6.55mm length*2.29mm diameter
DC resistance:	860.6Ω
Wire size:	51 AWG
Inductance:	132.1 mH at 1kHz
Sensitivity:	-60.20 dB (V/A/m) at 1kHz

4.2.4 System Hardware

The HAC positioning ruler is used to position the phone properly with the regard to the position of the probe during a measurement. The positioning system is made of a dedicated frame that can be fixed on the table. The tip of the probe is positioned on a reference point located on the top of the positioning ruler. The distance between this reference point and the cross located on the ruler being known, the speaker of the phone is positioned on this cross in order to make sure both probe and phone are positioned properly.

During the measurement, the HAC ruler has to be removed so that it does not interfere with the measurement.

Position device

5. OPERATIONAL CONDITIONS DURING TEST

5.1 Schematic Test Configuration

The EUT should use its internal transmitter. The antenna(s), battery and accessories shall be those specified by the manufacturer. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. If a wireless link was used, the antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the handset.

Air Interface	Band	C63.19 Tested	Type	Simultaneous Transmitter	Name of Service	Power Reduction
GSM	850	Yes	VO	WLAN & BT	CMRS Voice	No
	1900	Yes	VO	WLAN & BT	CMRS Voice	No
	GPRS/EGPRS	Yes	DT	N/A	N/A	No
WCDMA	Band II	Yes	VO	WLAN & BT	CMRS Voice	No
	Band IV	Yes	VO	WLAN & BT	CMRS Voice	No
	Band V	Yes	VO	WLAN & BT	CMRS Voice	No
	HSPA	Yes	DT	N/A	N/A	No
LTE	Band 2	Yes	VD	WLAN & BT	VoLTE	No
	Band 4	Yes	VD	WLAN & BT	VoLTE	No
	Band 5	Yes	VD	WLAN & BT	VoLTE	No
	Band 12	Yes	VD	WLAN & BT	VoLTE	No
	Band 17	Yes	VD	WLAN & BT	VoLTE	No
	Band 25	Yes	VD	WLAN & BT	VoLTE	No
	Band 26 part 90	Yes	VD	WLAN & BT	VoLTE	No
	Band 26 part 22	Yes	VD	WLAN & BT	VoLTE	No
	Band 41	Yes	VD	WLAN & BT	VoLTE	No
	Band 66	Yes	VD	WLAN & BT	VoLTE	No
	Band 71	Yes	VD	WLAN & BT	VoLTE	No
WLAN	2.4G	No	DT	WWAN	N/A	No
BT	2450	No	DT	WWAN	N/A	No

NA: Not Applicable

VO: Voice Only

VD: CMRS and IP Voice Service over Digital Transport

DT: Digital Transport Only

Notes:

1. For protocols not listed in Table 6.1 of ANSI C63.19:2019,the average speech level of -20 dBm0 should be used.

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

5.2 Equipments and results of validation testing

System Audio Validation

Put the phone on call and select the CMU decoder cal. When the decoder cal is selected, a full sacle(3.14 dBm) signal is provided to the speech port. Measure the voltage form the speech connector using the provided CMU speech cable. For this connect the GSM/WCMDA out connector (or CDMA2K OUT connector) to the front panel of the keithley and read the AC voltage. With the speech cable provided by satiom, the GSM/WCDMA OUT connector 2 and the CDMA2K OUT connector is the connector 4.

Put the phone on call and select the CMU encoder cal. And send a signal to the CMU and check to avoid influencing the calibration. An RMS voltmeter would indicate 100 mV RMS during the first phase and 10 mV RMS during the second phase. After the first two phases, the two input channels are both calibrated for absolute measurements of voltages. The resulting factors are displayed above the multi-meter window.

After phases 1 and 2, the input channels are calibrated to measure exact voltages. This is required to use the inputs for measuring voltages with their peak and RMS value.

In phase 3, a multi-sine signal covering each third-octave band from 50 Hz to 10 kHz is generated and applied to both audio outputs. The probe should be positioned in the center of the AMCC and aligned in the z-direction, the field orientation of the AMCC. The “Coil In” channel is measuring the voltage over the AMCC internal shunt, which is proportional to the magnetic field in the AMCC. At the same time, the “Probe In" channel samples the amplified signal picked up by the probe coil and provides it to a numerical integrator. The ratio of the two voltages in each third-octave filter leads to the spectral representation over the frequency band of interest. The Coil signal is scaled in dBV, and the Probe signal is first integrated and normalized to show dB A/m. The ratio probe-to-coil at the frequency of 1 kHz is the sensitivity which will be used in the consecutive T-Coil jobs.

Audio Level and Gain Measurements

W-CDMA/GSM

No correction gain factors were measured for W-CDMA/GSM due to the Rohde & Schwarz CMW500, hosting a calibrated audio board. The gains used to measure W-CDMA/GSM are set to 100.

Protocol	Input(dBm0)
CDMA	-18
GSM	-16
WCDMA	-16
VOLTE	-16

5.3 T-Coil Performance Requirements

In order to be rated for T-Coil use, a WD shall meet the requirements for signal level and signal quality contained in this part.

1) T-Coil coupling field intensity

When measured as specified in this standard, there arc two groups of qualifying measurement points:

Primary group: A qualifying measurement point shall have its T-Coil signal, desired ABM signal, >-18 dB(A/m) at I kHz, in a 1/3 octave band filter. These measurements shall be made with the WD operating at a reference input level as specified in Table 6.1. Simultaneously, the qualifying measurement point shall have its weighted magnetic noise, undesired ABM field <-38 dB(A/m).

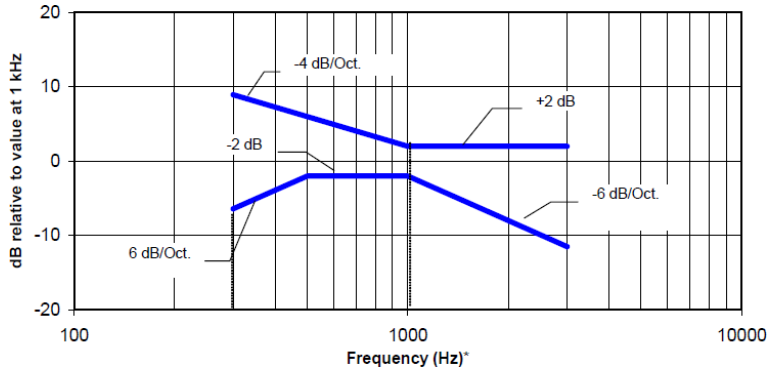
Secondary group: A qualifying measurement point shall have its weighted magnetic noise, undesired ABM field <-38 dB(A/m). This group inherently includes all the members of the primary group.

These levels arc designed to be compatible with hearing aids that produce the same acoustic output level for either an acoustic input level of 65 dB SPL or a magnetic input level of-25 dB(A/m) (56.2 mA/m)39 at either 1.0 kHz or 1.6 kHz. The hearing aid operational measurements are performed per ANSI S3.22-2014.

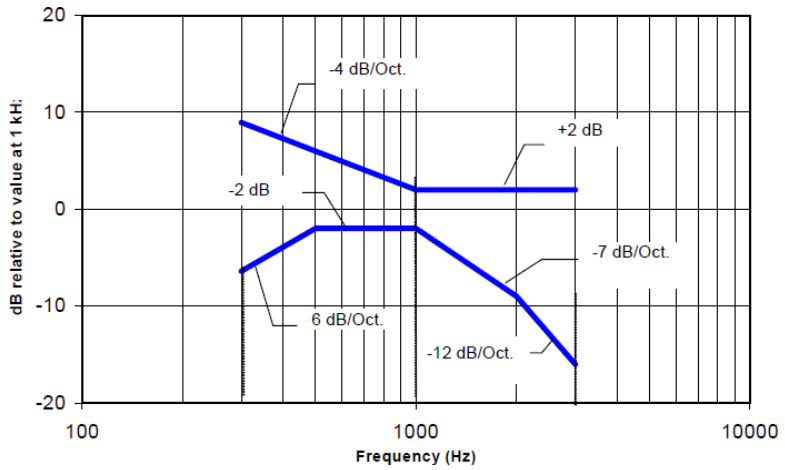
2) Frequency response

The frequency response of the axial component of the magnetic field, measured in 1/3 octave bands, shall follow the response curve specified in this sub-clause, over the frequency range 300 Hz to 3000 Hz. Figure 1 and Figure 2 provide the boundaries for the specified frequency.

These response curves are for true field strength measurements of the T-Coil signal. Thus the 6 dB/octave probe response has been corrected from the raw readings.



Magnetic field frequency response for WDs with a field ≤ –15 dB (A/m) at 1 kHz



Magnetic field frequency response for WDs with a field that exceeds –15dB(A/m) at 1 kHz

3) Desired ABM signal, undesired ABM field qualification requirements

<Non-2G GSM operating modes>

The goal of this requirement is to ensure an adequate area where desired ABM signal is sufficiently strong to be heard clearly and a larger area where undesired ABM field is sufficiently low as to avoid undue annoyance. Qualifying measurement points shall fulfill the requirements of ANSI 63.19-2019 section 6.6.2; both the primary and secondary group requirements shall be met:

__ The primary group shall include at least 75 measurement points.
__ The secondary group shall include at least 300 contiguous measurement points.

Additionally, to avoid an oddly shaped area of low noise,the secondary group shall include at least one longitudinal column of at least 10 contiguous qualifying points and at least one transverse row containing at least 15 contiguous qualifying points.

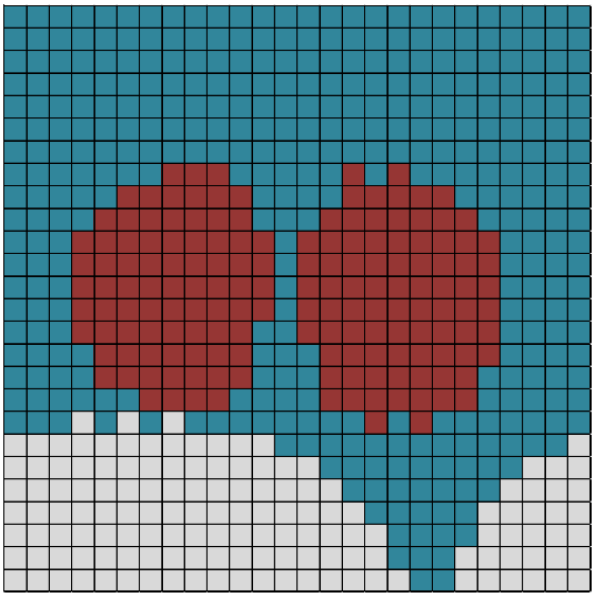
Figure 6.6 is an example of a qualifying scan. The total number of primary group qualifying measurement points is 161, which is ≥75.The total number of secondary group qualifying points is 536,which is ≥300.

The secondary group has a longitudinal column of 26,which is ≥10,and a transverse row also of 26 contiguous points, which is≥15.

<2G GSM operating modes>

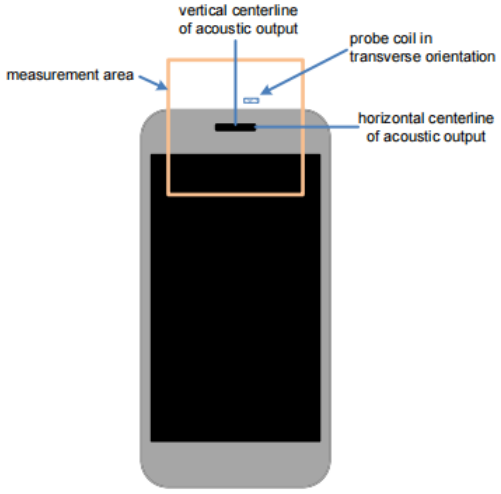
If the 2G GSM operating mode(s) are selected for qualification, the qualifying measurement points shall
fulfil the requirements of 6.6.2; both the primary and secondary group requirements shall be met:

__ The primary group shall include at least 25 measurement points.
__ The secondary group shall include at least 125 contiguous measurement points.



Red (primary group): AB desired ABM signal M1 ≥−18 dB(A/m) and undesired ABM field ≤−38 dB(A/m)
Blue and red (secondary group): undesired ABM field ≤−38 dB(A/m)

5.4 T-Coil measurement points and reference plane



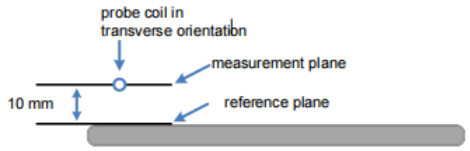
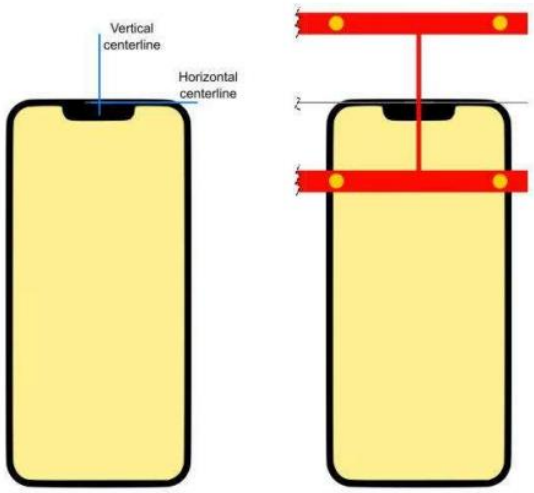


Figure A.4—Measurement and reference planes probe orientation for WD audio frequency magnetic field measurements



Device Under Test Positioning under the Test Arch

The T-Coil measurement plane, reference plane and other measurement parameters shall be:

a) The reference plane is the planar area that contains 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.

b) The measurement plane is parallel to, and 10 mm in front of, the reference plane.

c) The reference axis is normal to the reference plane and passes through the center of the acoustic output (or the center of the hole array); or may be centered on or near a secondary inductive source. The actual location of the reference axis and resultant measurement area shall be noted in the test report.

d) The measurement area shall be 50 mm by 50 mm. The measurement area for both desired ABM signal and undesired ABM field may be located where the transverse magnetic measurements are optimum with regard to the requirements. However, the measurement area should be in the vicinity of the acoustic output of the WD and shall be located in the same half of the phone as the WD receiver. In a WD handset with a centered receiver and a circularly symmetrical magnetic field, the measurement axis and the reference axis would coincide.

e) Measurements of desired ABM signal strength and undesired ABM field are made at 2.0 mm ± 0.5 mm or 4 mm intervals in an X-Y measurement area pattern over the entire measurement area (676 measurement points total); either all measured, or measured plus interpolated, per 6.4.

f) Desired ABM signal frequency response is measured at a single location at or near the maximum desired ABM signal strength location.

g) The actual locations of the measurement points shall be noted in the test report.

5.5 Test procedure for T-Coil signal—preferred

This subclause describes the procedures used to measure the ABM (T-Coil) performance of the WD. Measurements shall be performed over a measurement area 50 mm square, in the measurement plane, as specified in A.3. The measurement area shall be scanned with a uniform measurement point spacing of 2.0 mm ± 0.5 mm in each X-Y axis of the plane, yielding 676 measurement points with approximately even spacing throughout the area.

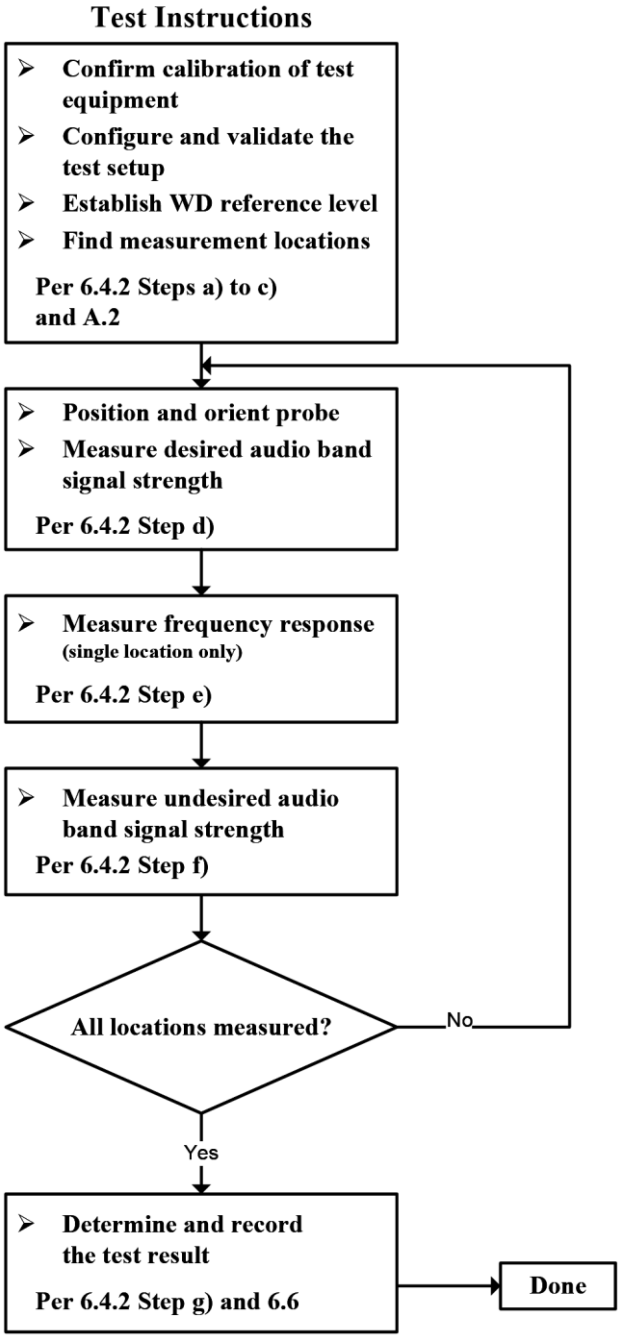
Optionally, measurement point spacing may be increased to 4 mm, with interpolation employed to yield the required 676 equivalent measurement points distributed uniformly over the 50 mm square measurement area. Interpolated points shall be derived from the average of the linear representations of the field strengths of the nearest two or four equidistant measured points. The area of measurement is increased to a 52 mm square so that edge rows and columns of the required 50 mm square can be either measured or interpolated, with none extrapolated.

In addition to measuring the desired ABM signal levels, the weighted magnitude of the unintended signal shall also be determined. Weighting of the unintended and undesired ABM field shall be by the spectral and temporal weighting described in D.4 through D.6.

In order to assure that the required signal quality is measured, the measurement of the intended signal and the measurement of the unintended signal shall be made at the same locations. Measurements shall not include undesired influence from the WD’s RF field; therefore, use of a coaxial connection to a base station simulator or non-radiating load might be necessary. However, even then with a coaxial connection to a base station simulator or non-radiating load there could still be RF leakage from the WD, which could interfere with the desired measurement. Pre-measurement checks should be made to avoid this possibility. All measurements shall be done with the WD operating on battery power with an appropriate normal speech audio signal input level given in Table 6.1. If the device display can be turned off during a phone call, then that may be done during the measurement as well. If tested with the display in the off state this shall be documented in the test report.

Measurements shall be performed with the probe coil oriented in the transverse direction, as illustrated in A.3, that is, aligned in the plane of the measurement area and perpendicular to the long dimension of the WD. A multi-stage sequence consists of first measuring the field strength of the desired T-Coil signal (desired ABM signal) that is useful to a hearing aid T-Coil at each specified measurement point. The undesired magnetic component (undesired ABM field) is then measured in the same transverse orientation at each of the same measurement points. At a single location only, taken at or near the highest desired ABM signal reading, the desired ABM signal frequency response shall be determined in a third measurement stage. The flowchart in Figure 6.3 illustrates this three-stage process.

Test flow for T-Coil signal test



The following steps summarize the basic test flow for determining desired ABM signal and undesired ABM field. These steps assume that a sine wave or narrowband 1/3 octave signal can be used for the measurement of desired ABM signal level. An alternative procedure, yielding equivalent results, using a broadband excitation is described in 6.5.

a) A validation of the test setup and instrumentation shall be performed. This may be done using a TMFS or Helmholtz Coil. Measure the emissions and confirm that they are within tolerance of the expected values.

b) Confirm that equipment that requires calibration has been calibrated, and that the noise level meets the requirements given in 6.3.2.

c) Position the WD in the test setup and connect the WD RF connector to a base station simulator or a non-radiating load (if necessary to control RF interference in the measurement equipment) as shown in Figure 6.1 or Figure 6.2.

d) The drive level to the WD is set such that the reference input level specified in Table 6.1 is input to the base station simulator (or manufacturer’s test mode equivalent) in the 1 kHz, 1/3 octave band. This drive level shall be used for the T-Coil signal test (desired ABM signal) at f = 1 kHz. Either a sine wave at 1025 Hz, or a voice-like signal, band-limited to the 1 kHz 1/3 octave, as specified in 6.4.3, shall be used for the reference audio signal. If interference is found at 1025 Hz an alternative nearby reference audio signal frequency may be used.35 The same drive level will be used for the desired ABM signal frequency response measurements at each 1/3 octave band center frequency. The WD volume control may be set at any level up to maximum, provided that a signal at any frequency at maximum modulation would not result in clipping or signal overload.

e) At each measurement location over the measurement area and in the transverse orientation, measure and record the desired 1 kHz T-Coil magnetic signal (desired ABM signal) as described in Step c).

f) At or near a location representing a maximum in the just-measured desired ABM signal, measure and record the desired T-Coil magnetic signals (desired ABM signal at fi) as described in 6.4.5.2 in each individual ISO 266:1975 R10 standard 1/3 octave band. The desired audio band input frequency (fi) shall be centered in each 1/3 octave band maintaining the same drive level as determined in Step c), and the reading taken for that band.

Equivalent methods of determining the frequency response may also be employed, such as fast Fourier transform (FFT) analysis using noise excitation or input－output comparison using simulated speech. The full-band integrated or half-band integrated probe output, as described in D.9, may be used, as long as the appropriate calibration curve is applied to the measured result, so as to yield an accurate measurement of the field magnitude. (The resulting measurement shall be an accurate measurement in dB(A/m).) Compare the frequency response found to the requirements of 6.6.3.

g) At the same locations measured in Step d), measure and record the undesired broadband audio magnetic signal (undesired ABM field) with no audio signal applied (or digital zero applied, if appropriate) using the specified spectral weighting, the half-band integrator followed by the temporal weighting.

h) Calculate and record the location and number of the measurement points that satisfy both the minimum desired ABM signal level and the maximum undesired ABM field level specified in 6.6.2. Compare this to the requirements in 6.6.4 and record the result.

i) Calculate and record the location and number of the measurement points that satisfy the maximum undesired ABM field level and distribution requirements specified in 6.6.4.

6. Max Conducted RF Output Power

2G

Mode: GSM850	Maximum Tune-up(dBm)	Burst Average Power (dBm)		
		CH128	CH190	CH251
		824.2MHz	836.6MHz	848.8MHz
GSM	33.00	32.65	32.67	32.86
Mode: GSM1900	Maximum Tune-up(dBm)	Burst Average Power (dBm)		
		CH512	CH661	CH810
		1850.2MHz	1880.0MHz	1909.8MHz
GSM	30.00	29.71	29.66	29.26

3G

Mode	Maximum Tune-up(dBm)	WCDMA Band II		
		Conducted Power (dBm)		
		CH9262	CH9400	CH9538
		1852.4	1880.0	1907.6
RMC 12.2K	23.00	22.69	22.60	22.44
Mode	Maximum Tune-up(dBm)	WCDMA Band IV		
		Conducted Power (dBm)		
		CH1312	CH1413	CH1513
		1712.4	1732.6	1752.6
RMC 12.2K	22.50	22.20	22.48	22.41
Mode	Maximum Tune-up(dBm)	WCDMA Band V		
		Conducted Power (dBm)		
		CH4132	CH4183	CH4233
		826.4	836.6	846.6
RMC 12.2K	23.00	22.50	22.50	22.56

4G

Band 2

Bandwidth	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	18700	18900	19100
					1860.0MHz	1880.0MHz	1900.0MHz
20MHz	QPSK	1	0	24.00	23.81	23.78	23.74
			49	24.00	23.72	23.77	23.77
			99	24.00	23.73	23.79	23.80
		50	0	23.00	22.71	22.56	22.51
			24	23.00	22.83	22.71	22.54
			49	23.00	22.77	22.51	22.67
		100	0	23.00	22.72	22.62	22.65
	16QAM	1	0	23.00	22.53	22.31	22.60
			49	23.00	22.49	22.43	22.63
			99	23.00	22.44	22.34	22.60
		50	0	22.00	21.93	21.78	21.70
			24	22.00	21.97	21.67	21.71
			49	22.00	21.94	21.74	21.71
		100	0	22.00	21.94	21.75	21.70

Band 4

Bandwidth	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	20050	20175	20300
					1720.0MHz	1732.5MHz	1745.0MHz
20MHz	QPSK	1	0	24.00	23.39	23.64	23.66
			49	24.00	23.37	23.84	23.63
			99	24.00	23.61	23.81	23.85
		50	0	23.00	22.29	22.60	22.49
			24	23.00	22.33	22.55	22.47
			49	23.00	22.46	22.65	22.59
		100	0	23.00	22.44	22.61	22.60
	16QAM	1	0	23.00	22.04	22.71	22.78
			49	23.00	22.13	22.80	22.79
			99	23.00	22.36	22.73	22.95
		50	0	22.00	21.58	21.58	21.56
			24	22.00	21.67	21.77	21.56
			49	22.00	21.70	21.63	21.77
		100	0	22.00	21.58	21.66	21.61

Band 5

Bandwidth	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	20450	20525	20600
					829.0MHz	836.5MHz	844.0MHz
10MHz	QPSK	1	0	24.00	23.37	23.45	23.50
			24	24.00	23.35	23.57	23.62
			49	24.00	23.37	23.69	23.70
		25	0	22.50	22.43	22.48	22.45
			12	23.00	22.37	22.43	22.68
			24	23.00	22.48	22.46	22.57
		50	0	23.00	22.41	22.47	22.56
	16QAM	1	0	24.00	23.56	22.41	22.38
			24	23.50	23.45	22.41	22.50
			49	24.00	23.56	22.53	22.68
		25	0	22.00	21.56	21.43	21.90
			12	22.00	21.81	21.53	21.54
			24	22.00	21.53	21.55	21.72
		50	0	22.00	21.96	21.59	21.52

Band 12

Bandwidth	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	23060	23095	23130
					704.0MHz	707.5MHz	711.0MHz
10MHz	QPSK	1	0	23.00	22.55	22.68	22.62
			24	23.00	22.54	22.62	22.72
			49	23.00	22.63	22.76	22.98
		25	0	22.00	21.66	21.59	21.65
			12	22.00	21.73	21.67	21.58
			24	22.00	21.54	21.62	21.87
		50	0	22.00	21.69	21.74	21.62
	16QAM	1	0	23.00	22.71	21.68	21.62
			24	23.00	22.77	21.61	21.63
			49	23.00	22.76	21.73	21.72
		25	0	21.50	21.02	21.02	20.61
			12	21.50	20.98	20.52	21.09
			24	21.50	20.96	21.14	21.27
		50	0	21.50	21.07	20.61	21.02

Band 17

Band width	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	23780 709MHz	23790 710MHz	23800 711MHz
10MHz	QPSK	1	0	23.00	22.55	22.63	22.70
			24	23.00	22.55	22.71	22.73
			49	23.00	22.69	22.76	22.93
		25	0	22.00	21.57	21.63	21.63
			12	22.00	21.60	21.61	21.68
			24	22.00	21.70	21.59	21.87
		50	0	22.00	21.55	21.60	21.60
	16QAM	1	0	23.00	22.67	21.57	21.6
			24	23.00	22.63	21.66	21.69
			49	23.00	22.92	21.83	21.75
		25	0	21.00	20.83	20.52	20.6
			12	21.50	20.39	21.09	21.12
			24	21.50	20.99	21.15	21.26
		50	0	21.50	20.52	21.10	21.04

Band 25

Band width	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	26140 1860.0MHz	26365 1882.5MHz	26590 1905.0MHz
20MHz	QPSK	1	0	24.00	23.65	23.69	23.64
			49	24.00	23.70	23.69	23.69
			99	24.00	23.64	23.70	23.71
		50	0	23.00	22.73	22.74	22.60
			24	23.00	22.70	22.64	22.52
			49	23.00	22.74	22.65	22.64
		100	0	23.00	22.84	22.63	22.52
	16QAM	1	0	23.00	22.50	22.37	22.63
			49	23.00	22.50	22.34	22.53
			99	23.00	22.48	22.34	22.64
		50	0	22.00	21.95	21.73	21.62
			24	22.00	21.94	21.70	21.70
			49	22.00	21.91	21.77	21.61
		100	0	22.00	21.93	21.73	21.72

Band 26 Part90

Band width	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	26740
					819.0MHz
10MHz	QPSK	1	0	24.00	23.58
			24	24.00	23.50
			49	24.00	23.56
		25	0	23.00	22.53
			12	22.50	22.49
			24	23.00	22.50
		50	0	23.00	22.59
	16QAM	1	0	24.00	23.69
			24	24.00	23.66
			49	24.00	23.64
		25	0	22.00	21.50
			12	22.00	21.50
			24	22.00	21.52
		50	0	22.00	21.57

Band 26 Part 22

Band width	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	26865	26915	26965
					831.5MHz	836.5MHz	841.5MHz
15MHz	QPSK	1	0	24.00	23.39	23.53	23.44
			37	24.00	23.42	23.67	23.58
			74	24.00	23.51	23.82	23.69
		36	0	23.00	22.56	22.45	22.41
			18	23.00	22.50	22.50	22.66
			39	23.00	22.48	22.64	22.81
		75	0	23.00	22.60	22.55	22.69
	16QAM	1	0	24.00	23.60	22.50	23.00
			38	24.00	23.52	22.54	23.22
			75	24.00	23.65	22.76	23.35
		36	0	22.50	21.58	22.07	21.64
			18	22.00	21.56	21.71	21.54
			39	22.50	21.64	21.72	22.12
		75	0	22.00	21.45	21.55	21.73

Band 41

Band width	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	39750	40620	41490
					2506.0 MHz	2593.0 MHz	2680.0 MHz
20MHz	QPSK	1	0	23.50	23.03	22.82	23.02
			49	23.50	22.89	22.77	23.19
			99	23.50	22.85	22.83	23.39
		50	0	22.00	21.91	21.64	21.84
			24	22.00	21.96	21.68	21.97
			49	22.50	21.99	21.76	22.19
		100	0	22.00	21.91	21.69	21.97
	16QAM	1	0	22.00	21.70	21.56	21.82
			49	22.00	21.57	21.66	21.14
			99	22.50	21.58	21.60	22.09
		50	0	21.50	21.24	20.87	21.14
			24	21.50	21.16	20.82	21.37
			49	21.50	21.10	20.84	21.39
		100	0	21.50	21.06	20.93	21.14

Band 66

Band width	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	132072	132322	132572
					1720.0 MHz	1745.0 MHz	1770.0 MHz
20MHz	QPSK	1	0	23.50	22.77	23.15	23.06
			49	23.50	22.85	23.06	23.08
			99	23.50	22.97	23.23	22.92
		50	0	22.50	21.86	22.00	21.97
			24	22.50	21.82	22.01	21.84
			49	22.50	21.86	22.02	21.91
		100	0	22.00	21.90	21.89	21.98
	16QAM	1	0	22.50	21.49	22.13	21.92
			49	22.50	21.59	22.13	21.99
			99	22.50	21.76	22.17	21.78
		50	0	21.50	20.97	21.07	21.04
			24	21.50	21.03	20.95	20.97
			49	21.50	21.10	21.06	20.92
		100	0	21.00	20.92	20.94	20.99

Band 71

Band width	Modulation	RB allocation	RB offset	Maximum Tune-up(dBm)	133222	133322	133372
					673.0 MHz	683.0 MHz	688.0 MHz
20MHz	QPSK	1	0	24.00	23.33	23.51	23.46
			49	24.00	23.38	23.52	23.39
			99	24.00	23.43	23.61	23.33
		50	0	23.00	22.28	22.53	22.35
			24	22.50	22.38	22.45	22.30
			49	23.00	22.60	22.44	22.29
		100	0	22.50	22.37	22.39	22.34
	16QAM	1	0	22.50	22.08	22.35	22.40
			49	22.50	22.10	22.48	22.31
			99	22.50	22.24	22.46	22.22
		50	0	22.00	21.96	21.42	21.73
			24	22.00	21.56	21.90	21.71
			49	22.50	22.01	21.86	21.25
		100	0	22.00	21.47	21.74	21.76

2.4G

Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)
2.4G WIFI (2.4~2.4835)	802.11b	1	2412	15.59	16.00
		6	2437	9.76	10.00
		11	2462	11.92	12.00
	802.11g	1	2412	15.09	15.50
		6	2437	9.98	10.00
		11	2462	11.60	12.00
	802.11n(HT20)	1	2412	12.94	13.00
		6	2437	6.65	7.00
		11	2462	9.46	9.50

Bluetooth

EDR	Mode	Maximum Tune-up(dBm)	Average Conducted Output Power (dBm)		
			0	39	78
			2402MHz	2441MHz	2480MHz
	GFSK	5.50	5.30	2.72	1.12
	π/4QPSK	5.50	5.28	3.41	1.88
	8DPSK	6.00	5.59	3.79	2.26
BLE	Mode	Maximum Tune-up(dBm)	Average Conducted Output Power (dBm)		
			0	20	39
			2402MHz	2440MHz	2480MHz
	1Mbps	-1.50	-1.68	-3.86	-4.32

7. TEST RESULTS

General Note:
1.Phone Condition:Mute on; Backlight off; Max Volume
2. Codec Investigation: For a voice service/air interface,investigate the variations of codec configurations (WB, NB bit rate) and document the parameters (ABM1, ABM2, S+N/N, frequency response) for that voice service. It is only necessary to document this for one channel/band, the following worst investigation codec would be remarked to be used for the testing for the handset.
3. Air Interface Investigation:
a. Through Internal radio configuration investigation (e.g. band width, modulation data rate, subcarrier spacings, and resource blocks) that the worst radio configuration was document as below table.
b. Use the worst-case codec test and document a limited set of bands/channel/bandwidths.
c. According to the ANSI C63.19-2019 section 6.3.3, using a frequency near the center of the frequency band perform T-coil evaluation.

<GSM Evaluation Results>

Codec Investigation					
Codec	**AMR NB Full Rate**	**AMR NB Full Rate**	**EFR NB (FR V2)**	**Orientation**	**Band/Channel**
Bit rate	**4.75 Kbps**	**12.2 Kbps**	**12.2Kbps**		
Primary Group Contiguous Point Count	**77**	82	85	Transversal(Y)	GSM 850 /1900
Secondary Group Contiguous Point Count	**208**	226	219		
Secondary Group Max Longitudinal	26	26	26		
Secondary Group Max Transverse	15	15	15		
Frequency response	Pass	Pass	Pass		
Note: The bold data represents the worst case.					

<WCDMA Evaluation Results>

Codec Investigation						
Codec	**NB AMR**	**WB AMR**	**NB AMR**	**WB AMR**	**Orientation**	**Band/Channel**
Bit rate	**4.75 Kbps**	**6.60 Kbps**	**12.2 Kbps**	**23.85Kbps**		
Primary Group Contiguous Point Count	**221**	251	236	262	Transversal(Y)	WCDMA Band II /9400
Secondary Group Contiguous Point Count	**513**	542	539	550		
Secondary Group Max Longitudinal	26	26	26	26		
Secondary Group Max Transverse	26	26	26	26		
Frequency response	Pass	Pass	Pass	Pass		
Note: The bold data represents the worst case.						

<VoLTE Evaluation Results>

Codec Investigation						
Codec	**NB AMR**	**WB AMR**	**NB AMR**	**WB AMR**	**Orientation**	**Band/Channel**
Bit rate	**4.75 Kbps**	**6.60 Kbps**	**12.2 Kbps**	**23.85Kbps**		
Primary Group Contiguous Point Count	**241**	263	255	269	Transversal(Y)	LTE Band 41 /40620
Secondary Group Contiguous Point Count	**564**	593	578	588		
Secondary Group Max Longitudinal	26	26	26	26		
Secondary Group Max Transverse	26	26	26	26		
Frequency response	Pass	Pass	Pass	Pass		
Note: The bold data represents the worst case.						

Air Interface Investigation												
Plot No.	**Mode**	**Channel /Freq.**	**BW**	**Probe Position**	**Modulation/Mode**	**Primary Group Contiguous Point Count**	**Secondary Grour Contiguous Point Count**	**Secondary Group Max Longitudinal**	**Secondary Group Max Transverse**	**Freq. Response Variation (dB)**	**Ambient Noise (dBA/m)**	**Freq. Response**
1	GSM850	190 /836.6MHz	/	Transversal(Y)	Voice	**77**	**208**	26	15	1.50	-50.47	Pass
2	PCS1900	661 /1880.0MHz	/	Transversal(Y)	Voice	88	216	26	16	1.53	-50.92	Pass
3	WCDMA Band II	9400 /1880.0MHz	/	Transversal(Y)	Voice	**221**	**513**	26	26	1.58	-50.65	Pass
4	WCDMA Band IV	1413 /1732.6MHz	/	Transversal(Y)	Voice	226	532	26	26	1.67	-50.87	Pass
5	WCDMA Band V	4183 /836.6MHz	/	Transversal(Y)	Voice	233	529	26	26	1.62	-50.41	Pass
6	LTE FDD Band 2	18900 /1880MHz	20MHz_ QPSK_1_50	Transversal(Y)	Voice	258	582	26	26	1.61	-50.82	Pass
7	LTE FDD Band 4	20175 /1732.5MHz	20MHz_ QPSK_1_50	Transversal(Y)	Voice	262	589	26	26	1.53	-50.14	Pass
8	LTE FDD Band 5	20525 /836.5MHz	10MHz_ QPSK_1_25	Transversal(Y)	Voice	249	574	26	26	1.60	-50.22	Pass
9	LTE FDD Band 12	23095 /707.5MHz	10MHz_ QPSK_1_25	Transversal(Y)	Voice	257	582	26	26	1.59	-50.36	Pass
10	LTE FDD Band 17	23790 /710.0MHz	10MHz_ QPSK_1_25	Transversal(Y)	Voice	254	569	26	26	1.52	-50.41	Pass
11	LTE FDD Band 25	26365 /1882.5MHz	20MHz_ QPSK_1_50	Transversal(Y)	Voice	266	581	26	26	1.47	-50.72	Pass

12	LTE FDD Band 26 part 90	26740 /819.0MHz	10MHz_ QPSK_1_25	Transversal(Y)	Voice	261	573	26	26	1.54	-50.36	Pass
13	LTE FDD Band 26 part 22	26915 /836.5MHz	15MHz_ QPSK_1_38	Transversal(Y)	Voice	263	576	26	26	1.57	-50.39	Pass
14	LTE TDD Band 41	40620 /2593MHz	20MHz_ QPSK_1_50	Transversal(Y)	Voice	**241**	**564**	26	26	1.49	-50.17	Pass
15	LTE FDD Band 66	132322 /1745MHz	20MHz_ QPSK_1_50	Transversal(Y)	Voice	274	586	26	26	1.51	-50.28	Pass
16	LTE FDD Band 71	133322 /683MHz	20MHz_ QPSK_1_50	Transversal(Y)	Voice	277	593	26	26	1.55	-50.49	Pass

Remark:

1. There is special HAC mode software on this EUT.
2. The volume was adjusted to maximum level and the backlight turned off during T-Coil testing

8. Measurement Uncertainty

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

9. MAIN TEST INSTRUMENTS

No.	EQUIPMENT	TYPE	Series No.	Due Date
1	T-Coil Probe	SATIMO/STCOIL	SN 24/13 TCP28	2025/05/14
2	TMFS	SATIMO/STMFS	SN 13/22 TMFS30	2025/05/05
3	Amplifier	Nucletudes	143060	2025/01/17
4	Multi-meter	Keithley - 2000	4014020	2025/01/17
5	Wireless Communication Tester	CMU200	113189	2025/04/10
6	Wireless Communication Tester	CMW500	148888	2025/03/26

10. ANNEX A SYSTEM SETUP

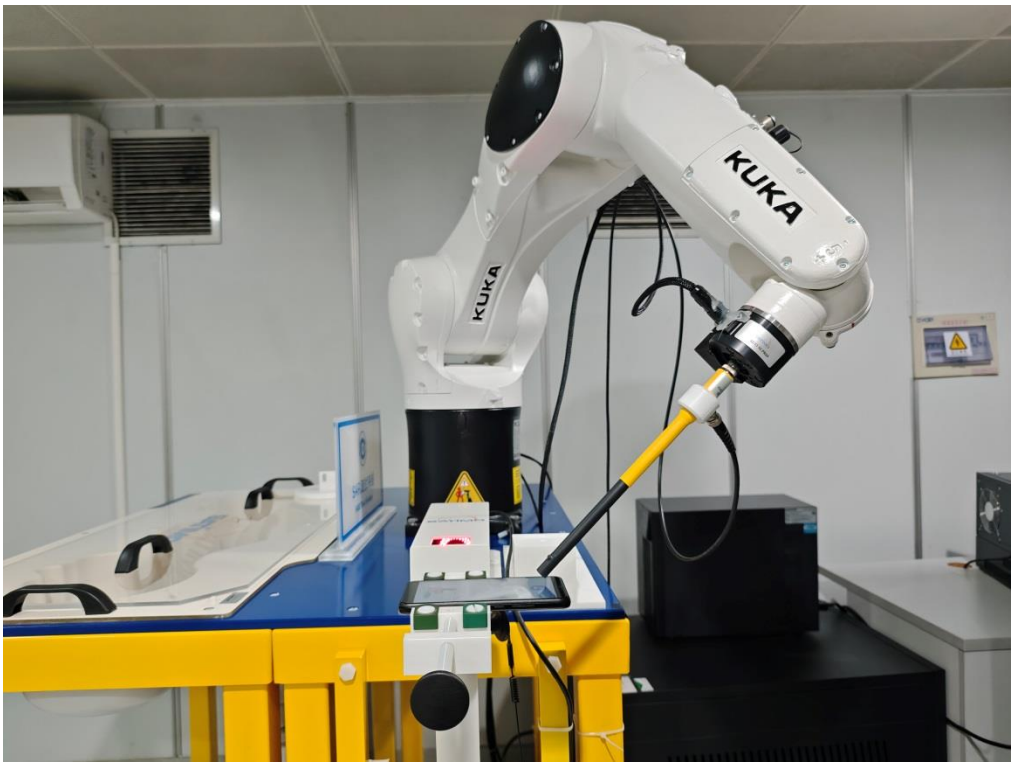
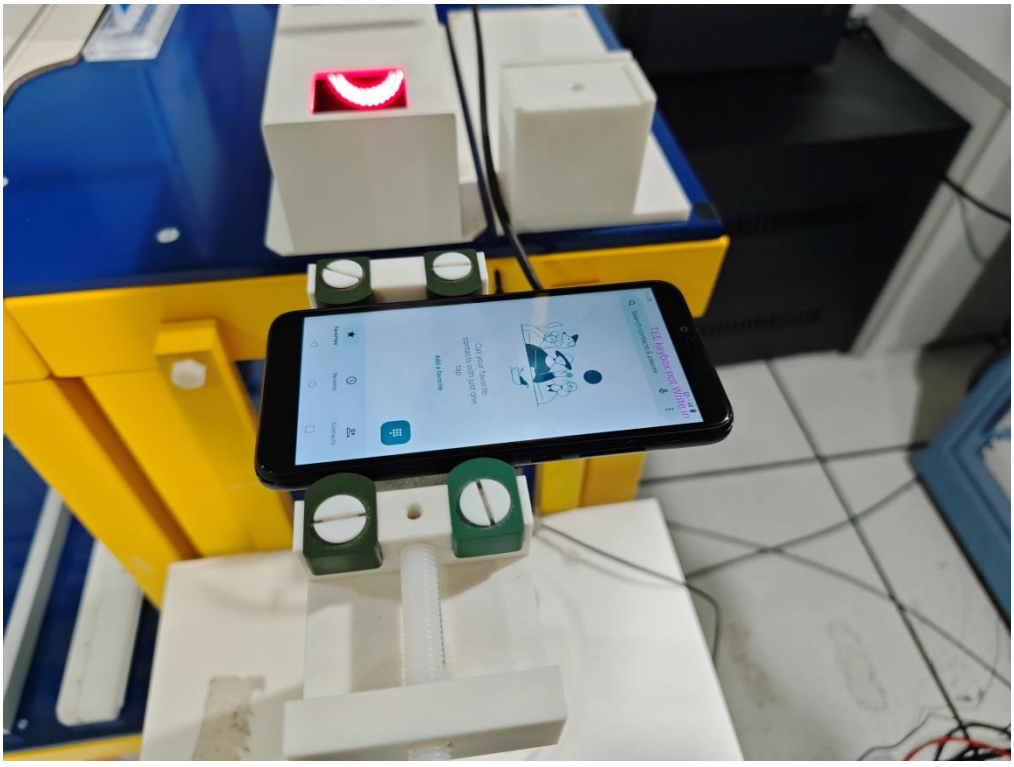
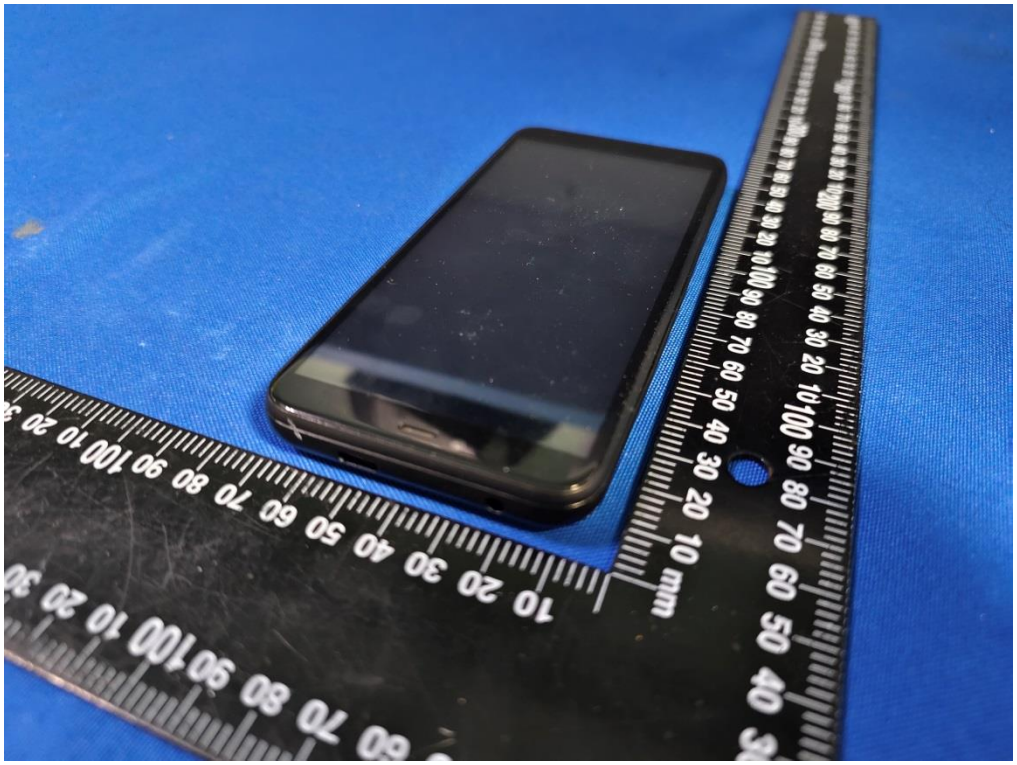
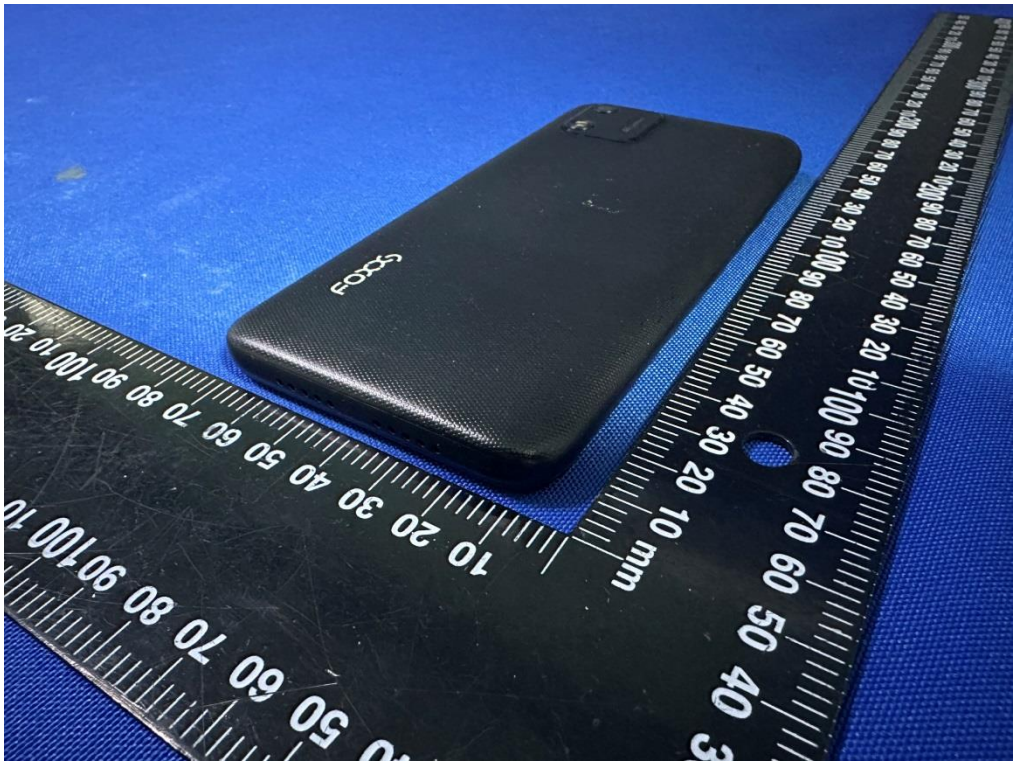


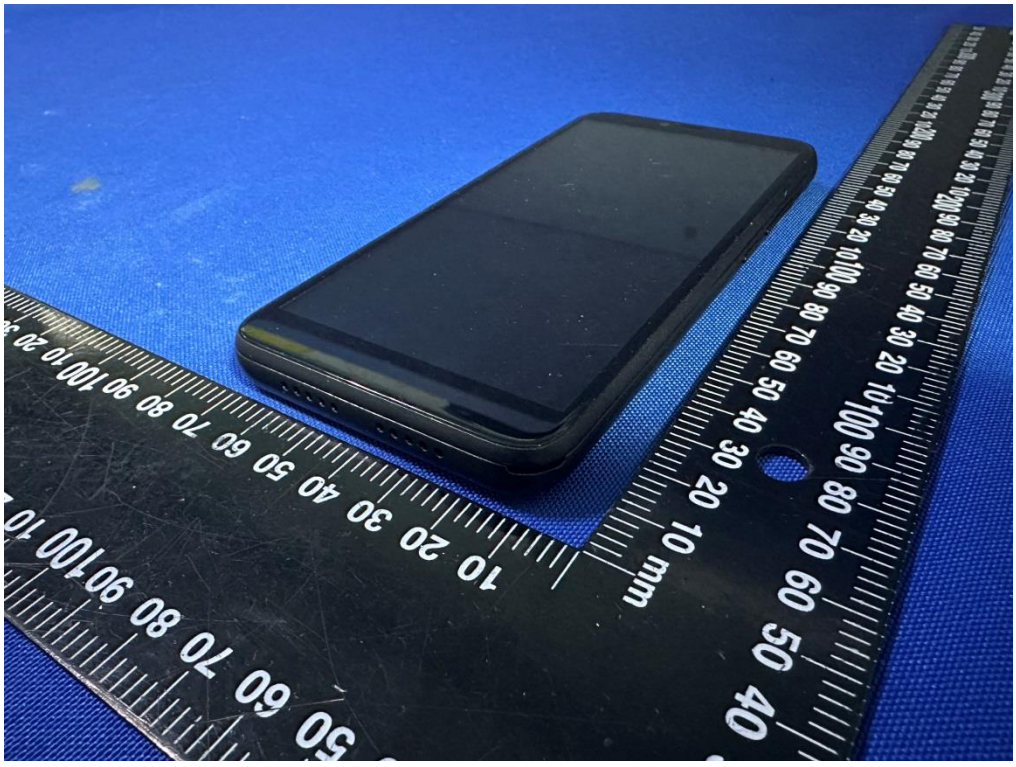
Fig.1 Testing Photo



11. ANNEX B EUT PHOTO




FOXXS



12. ANNEX C TEST PLOTS

Measurement at GSM850

Date of measurement: 16/12/2024

Experimental Conditions

Probe	SN 24/13 TCP28
Signal	GSM
Band	GSM850
Channels	Middle
Channels Number	190
Frequency (MHz)	836.6

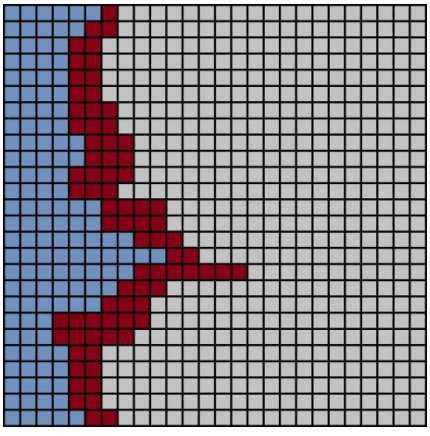
Results

Device compliant	Yes
Measurement status	Complete

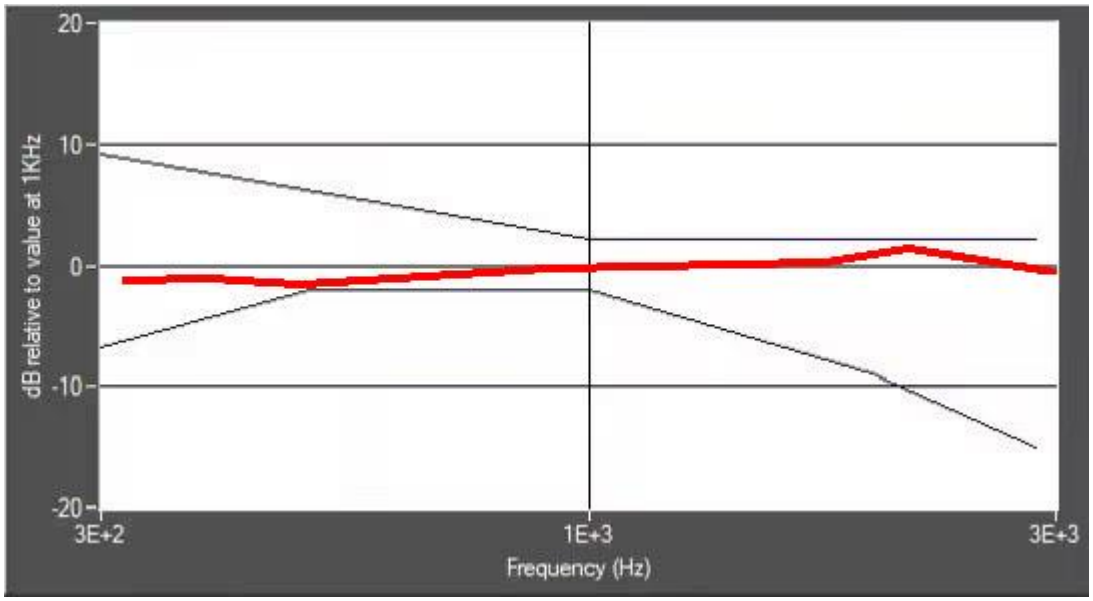
Requirement verification

C63.19	Mode	Band	Test Description	Minimum limit	Measured	Verdict
7.3.1.1	GSM	GSM 850	Primary group size	25	77	PASS
7.3.1.2			Secondary group size	125	208	PASS
7.3.1.3			Secondary Group Max Longitudinal	-	26	PASS
7.3.1.4			Secondary Group Max Transverse	-	15	PASS
7.3.2			Frequency response inside boundaries	-	1.50	PASS

Qualifying points



Frequency response（field that exceeds -15 dB）



Measurement at WCDMA Band 2 (1900)

Date of measurement: 17/12/2024

Experimental Conditions

Probe	SN 24/13 TCP28
Signal	W-CDMA
Band	Band 2 (1900)
Channels	Middle
Channels Number	9400
Frequency (MHz)	1880.0

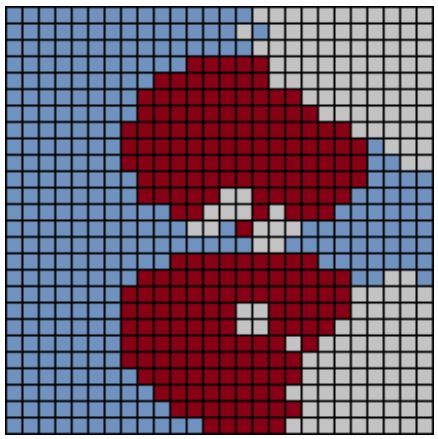
Results

Device compliant	Yes
Measurement status	Complete

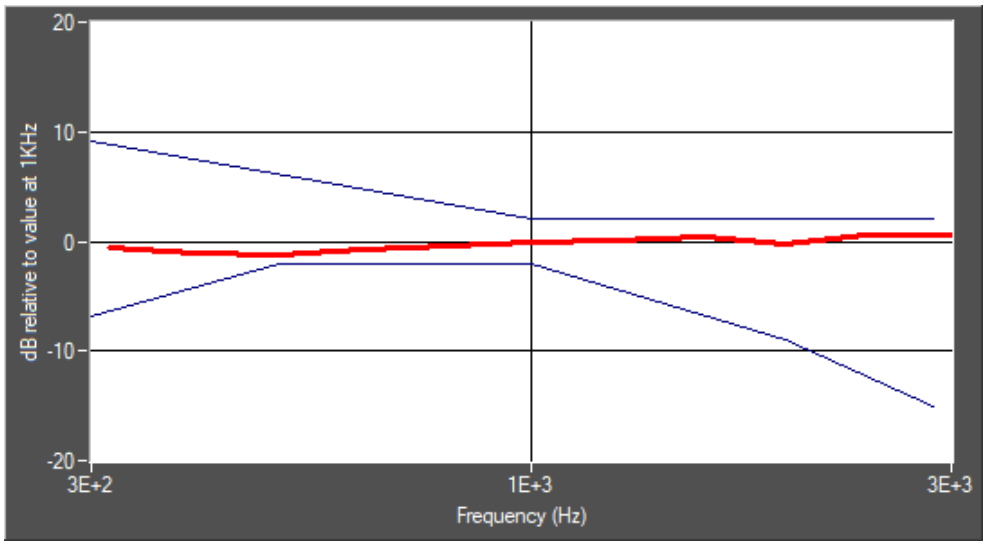
Requirement verification

C63.19	Mode	Band	Test Description	Minimum limit	Measured	Verdict
7.3.1.1	WCDMA	Band2_WCDMA1900	Primary group size	75	221	PASS
7.3.1.2			Secondary group size	300	513	PASS
7.3.1.3			Secondary Group Max Longitudinal	10	26	PASS
7.3.1.4			Secondary Group Max Transverse	15	26	PASS
7.3.2			Frequency response inside boundaries	-	1.58	PASS

Qualifying points



Frequency response（field that exceeds -15 dB）



Measurement at LTE Band 41

Date of measurement: 18/12/2024

Experimental Conditions

Probe	SN 24/13 TCP28
Signal	LTE TDD
Band	LTE band 41
Channels	Middle
Channels Number	40620
Frequency (MHz)	2593.0

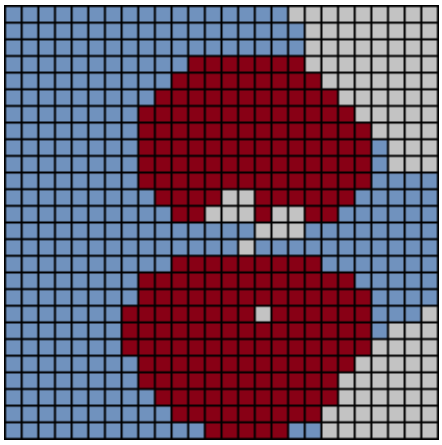
Results

Device compliant	Yes
Measurement status	Complete

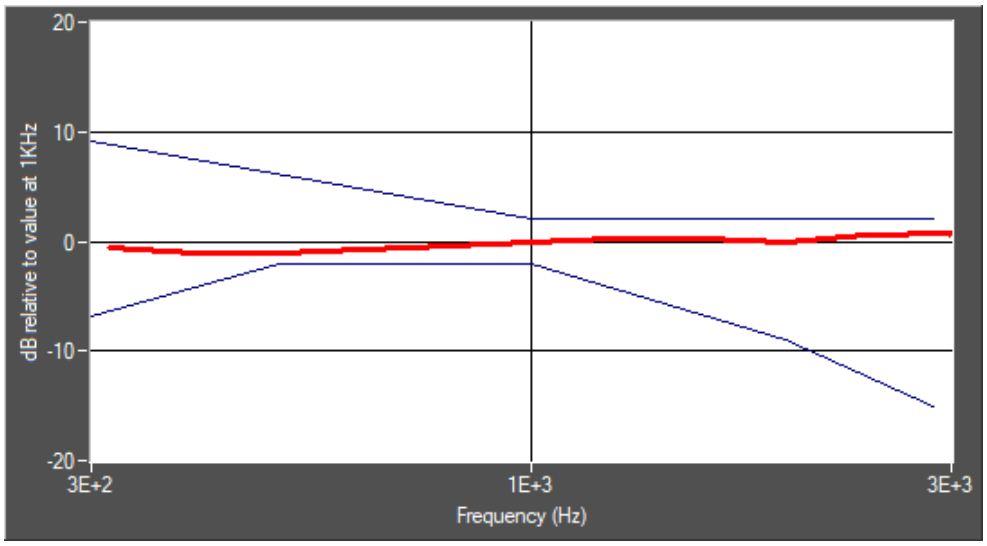
Requirement verification

C63.19	Mode	Band	Test Description	Minimum limit	Measured	Verdict
7.3.1.1	LTE	LTE TDD band 41	Primary group size	75	241	PASS
7.3.1.2			Secondary group size	300	564	PASS
7.3.1.3			Secondary Group Max Longitudinal	10	26	PASS
7.3.1.4			Secondary Group Max Transverse	15	26	PASS
7.3.2			Frequency response inside boundaries	-	1.49	PASS

Qualifying points



Frequency response（field that exceeds -15 dB）



13. ANNEX D CALIBRATION REPORT

COMOHAC T-coil Probe Calibration Report

Ref : ACR.145.29.24.BES.A

SERIAL NO.: SN 24/13 TCP28

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 05/15/2024

Accreditations #2-6789
Scope available on www.cofrac.fr

Summary:

This document presents the method and results from an accredited COMOHAC T-coil Probe calibration performed at MVG, using the COMOHAC test bench, for use with a MVG COMOHAC system only. The test results covered by accreditation are traceable to the International System of Units (SI).

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	Name	Function	Date	Signature
Prepared by :	Cyrille ONNEE	Measurement Responsible	5/15/2024	
Checked & approved by:	Jérôme Luc	Technical Manager	5/15/2024	
Authorized by:	Yann Toutain	Laboratory Director	5/16/2024	

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2024.05.16 10:21:49 +02'00'

	Customer Name
Distribution :	

Issue	Name	Date	Modifications
A	Cyrille ONNEE	5/15/2024	Initial release
B	Cyrille ONNEE	5/16/2024	

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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOHAC T-COIL PROBE
Manufacturer	MVG
Model	STCOIL
Serial Number	SN 24/13 TCP28
Product Condition (new / used)	Used
Frequency Range of Probe	200-5000 Hz

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOHAC T-coil Probes are built in accordance to the ANSI C63.19 and IEEE 1027 standards.

Figure 1 – *MVG COMOHAC T-coil Probe*

Coil Dimension	6.55 mm length * 2.29 mm diameter
DC resistance	860.6 Ω
Wire size	51AWG
Inductance at 1 kHz	132.1 mH at 1 kHz

3 MEASUREMENT METHOD

All methods used to perform the measurements and calibrations comply with the ANSI C63.19 and IEEE 1027 standards. All measurements were performed using a Helmholtz coil built according to the specifications outlined in ANSI C63.19 and IEEE 1027.

3.1 SENSITIVITY

The T-coil was positioned within the Helmholtz coil in axial orientation. Using an audio generator connected to the input of the Helmholtz coil, a known field (1 A/m) was generated within the coil and the T-coil probe reading recorded over the frequency range of 100 Hz to 1000 Hz.

3.2 LINEARITY

The T-coil probe was positioned within the Helmholtz coil in axial orientation. The audio generator connected to the input of the Helmholtz coil was adjusted to obtain a field within the coil from 0 dB A/m to -50 dB A/m and the T-coil reading recorded at each power level (10 dB steps).

3.3 SIGNAL TO NOISE MEASUREMENT OF THE CALIBRATION SYSTEM

The T-coil probe was positioned within the Helmholtz coil in axial orientation. The audio generator connected to the input of the Helmholtz coil was adjusted to obtain a field of -50 dB A/m. The T-coil reading was recorded. The audio generator is then turned off and the T-coil reading recorded.

4 MEASUREMENT UNCERTAINTY

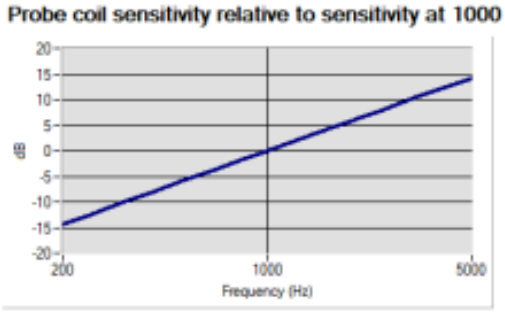
The guidelines outlined in the ANSI C63.19 and IEEE 1309 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique.

The estimated expanded uncertainty (k=2) in calibration for the sensitivity dB (V/(A/m)) is +/-0.42 dB with respect to measurement conditions.

5 CALIBRATION RESULTS

Calibration Parameters	
Lab Temperature	20 +/- 1°C
Lab Humidity	30-70 %

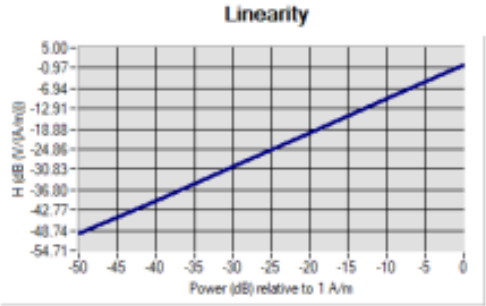
5.1 SENSITIVITY



	Measured	Required
Sensitivity at 1 kHz	-60.44 dB (V/(A/m))	–60.5 +/- 0.5 dB (V/(A/m))
Max. deviation from Sensitivity	0.34 dB	+/- 0.5 dB

6 VERIFICATION RESULTS

6.1 LINEARITY



	Measured	Required
Linearity Slope	0.28 dB	+/ 0.5 dB

6.2 SIGNAL TO NOISE MEASUREMENT OF THE CALIBRATION SYSTEM

	Measured	Required
Signal to Noise	14.15 dB	'Reading with -50 dB A/m in coil' – 'no signal applied' > 10 dB

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
COMOHAC Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Audio Generator	National Instruments	15222AE	11/2021	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Helmholtz Coil	MVG	HC07 SN47/10	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

————End of the Report————