RF-Emission Test Report

Application No.:	SEWM2311000466RG
Applicant:	COOSEA GROUP (HK) COMPANY LIMITED
Manufacturer:	COOSEA GROUP (HK) COMPANY LIMITED
Product Name:	Smart Phone
Model No.(EUT):	SN339D
FCC ID:	2A28USN339D
Standards:	ANSI C63.19-2019 CFR 47 FCC Part 20
Date of Receipt:	2023-11-17
Date of Test:	2024-01-24 to 2024-01-24
Date of Issue:	2024-01-31
Test conclusion:	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:

Well Wei

Wireless Laboratory Manager

SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Wireless Laboratory

REVISION HISTORY

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023-01-31		Original

TEST SUMMARY

Frequency Band	HAC RF Emission Test result*		Results
GSM 850	E-Field dB(V/m)	30.86	PASS
PCS 1900	E-Field dB(V/m)	14.29	PASS
WCDMA band 2	E-Field dB(V/m)	/	PASS
WCDMA band 5	E-Field dB(V/m)	/	PASS
LTE band 2	E-Field dB(V/m)	/	PASS
LTE band 4	E-Field dB(V/m)	/	PASS
LTE band 5	E-Field dB(V/m)	/	PASS
LTE band 12	E-Field dB(V/m)	/	PASS
LTE band 14	E-Field dB(V/m)	/	PASS
LTE band 17	E-Field dB(V/m)	/	PASS
LTE band 26	E-Field dB(V/m)	/	PASS
LTE band 30	E-Field dB(V/m)	/	PASS
LTE band 48	E-Field dB(V/m)	/	PASS
LTE band 66	E-Field dB(V/m)	/	PASS
LTE band 71	E-Field dB(V/m)	/	PASS
n2	E-Field dB(V/m)	/	PASS
n5	E-Field dB(V/m)	/	PASS
n25	E-Field dB(V/m)	/	PASS
n26	E-Field dB(V/m)	/	PASS
n30	E-Field dB(V/m)	/	PASS
n41	E-Field dB(V/m)	/	PASS
n48	E-Field dB(V/m)	/	PASS
n66	E-Field dB(V/m)	/	PASS
n70	E-Field dB(V/m)	/	PASS
n71	E-Field dB(V/m)	/	PASS
n77	E-Field dB(V/m)	/	PASS
WLAN2.4GHz	E-Field dB(V/m)	/	PASS
WLAN5GHz	E-Field dB(V/m)	/	PASS
HAC ResultS: PASS			

Note:
1) This portable wireless equipment has been shown to be hearing-aid compatible under the above rated category, specified in ANSI/IEEE Std.C63.19-2019 and had been tested in accordance with the specified measurement procedures, Hear-Aid Compatibility is based on the assumption that all production units will be designed electrically identical to the device tested in this report. Test results reported herein relate only to the item(s) tested and are for North American Bands only.
2) *- HAC RF Emission Test for low power exemption according to ANSI C63.19-2019 and HAC RF Emission rating is PASS.

Reviewed by

Nick Hu

Nick Hu

Prepared by

Leon Xu

Leon Xu

检验检测专用章
Inspection & Testing Services

CONTENTS

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1 General Information

1.1 Introduction

The purpose of the Hearing Aid Compatibility is to enable measurements of the near electric fields generated by wireless communication devices in the region controlled for use by a hearing aid in accordance with ANSI-C63.19-2019.

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 fields emitted by a WD to categorize these emissions for correlation with the RF immunity of a hearing aid.

Hence, the following are measurements made for the WD:
RF E-Field emissions

The measurement plane is parallel to, and 1.5cm in front of, the reference plane.

Applications for certification of equipment operation under part 20, that a manufacturer is seeking to certify as hearing aid compatible, as set forth in §20.19 of that part, shall include a statement indication compliance with the test requirements of §20.19 and indicating the appropriate U-rating for the equipment. The manufacturer of the equipment shall be responsible for maintaining the test results.

1.2 Details of Client

Applicant:	COOSEA GROUP (HK) COMPANY LIMITED
Address:	UNIT 5-6 16/F MULTIFIELD PLAZA 3-7A PRAT AVENUE TSIMSHATSUI KL
Manufacturer:	COOSEA GROUP (HK) COMPANY LIMITED
Address:	UNIT 5-6 16/F MULTIFIELD PLAZA 3-7A PRAT AVENUE TSIMSHATSUI KL

1.3 Test Location

Company:	SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Address:	South of No. 6 Plant, No. 1, Runsheng Road, Suzhou Industrial Park, Suzhou Area, China (Jiangsu) Pilot Free Trade Zone
Post code:	215000
Test Engineer:	Leon Liu

1.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **A2LA (Certificate No. 6336.01)**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01.

• **Innovation, Science and Economic Development Canada**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0120.

IC#: 27594.

• **FCC –Designation Number: CN1312**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory.

1.5 General Description of EUT

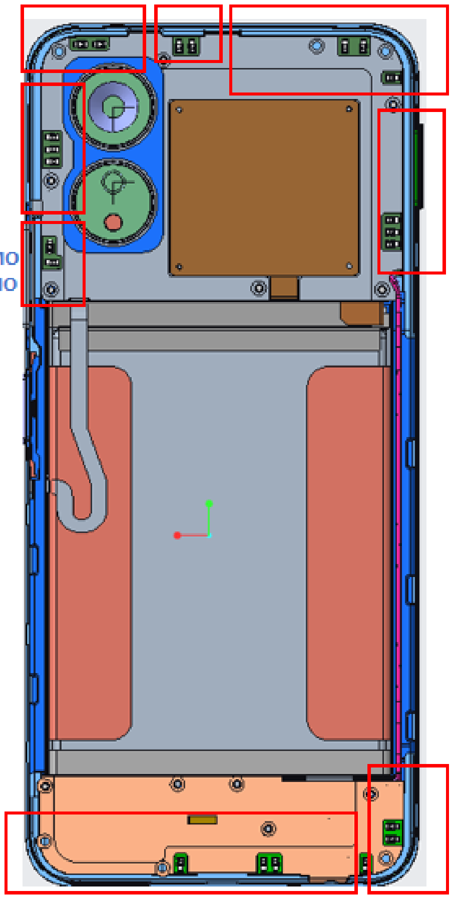
Device Type :	portable device		
Exposure Category:	uncontrolled environment / general population		
Product Name:	smart phone		
Model No.(EUT):	SN339D		
FCC ID:	2A28USN339D		
Product Phase:	Identical Prototype		
IMEI:	356704760005055		
Hardware Version:	1.0		
Software Version:	SN339DD10010		
Antenna Type:	Inner Antenna		
Device Operating Configurations :			
Modulation Mode:	**GSM:** GMSK, 8PSK; **WCDMA:** QPSK; **LTE:** QPSK,16QAM; NR:BPSK,QPSK,16QAM,64QAM,256QAM,CP-OFDM **WIFI:** DSSS, OFDM; **BT:** GFSK, π/4DQPSK,8DPSK		
Device Class:	B		
GPRS Multi-slots Class:	12	EGPRS Multi-slots Class:	12
HSDPA UE Category:	24	HSUPA UE Category	7
Power Class	4,tested with power level 5(GSM850)		
	1,tested with power level 0(GSM1900)		
	3, tested with power control "all 1"(WCDMA Band)		
	3, tested with power control Max Power(LTE Band)		
Frequency Bands:	Band	Tx (MHz)	Rx (MHz)
	GSM 850	824 - 849 MHz	869 - 894 MHz
	PCS 1900	1850 - 1910 MHz	1930 - 1990 MHz
	WCDMA band 2	1850 -1910 MHz	1930 - 1990 MHz
	WCDMA band 5	824 - 849MHz	869 - 894MHz
	LTE band 2	1850 - 1910 MHz	1930 - 1990 MHz
	LTE band 4	1710 - 1755 MHz	2110 - 2155 MHz
	LTE band 5	824 - 849 MHz	869 - 894 MHz
	LTE band 12	699 - 716 MHz	729 - 746 MHz
	LTE band 14	788 - 798 MHz	758 - 768 MHz
	LTE band 17	704 - 716 MHz	734 - 746 MHz
	LTE band 26	814 - 849 MHz	859 - 894 MHz
	LTE band 30	2305 - 2315 MHz	2350 - 2360 MHz
	LTE band 48	3550 - 3700 MHz	3550 - 3700 MHz
	LTE band 66	1710 - 1780 MHz	2110 - 2200 MHz
	LTE band 71	663 - 698 MHz	617 - 652 MHz
	n2	1850 - 1910 MHz	1930 - 1990 MHz
	n5	824 - 849 MHz	869 - 894 MHz
	n25	1850 - 1915 MHz	1930 - 1995 MHz
	n26	814 - 849 MHz	859 - 894 MHz
	n30	2305 - 2315 MHz	2350 - 2360 MHz

	n41	2496 - 2690 MHz	2496 - 2690 MHz
	n48	3550 - 3700 MHz	3550 - 3700 MHz
	n66	1710 - 1780 MHz	2110 - 2200 MHz
	n70	1695 - 1710 MHz	1995 - 2020 MHz
	n71	663 - 698 MHz	617 - 652 MHz
	WLAN2.4GHz	2400~2483.5	2400~2483.5
	WLAN5GHz	5150~5250MHz	5150~5250MHz
		5250~5350MHz	5250~5350MHz
		5470~5725MHz	5470~5725MHz
		5725~5850MHz	5725~5850MHz
	Bluetooth	2400~2483.5	2400~2483.5
Battery Information:	Model:	BL-A62CT	
	Normal Voltage:	+3.87V	
	Rated capacity:	4900mAh	
	Manufacturer:	Guangdong Fenghua New Energy Co.,Ltd.	

Note:
*Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information, SGS is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.

Remark:
As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

1.5.1 DUT Antenna Locations



Note:

1) The diversity Antenna does not support transmitter function.

1.5.2 List of air interfaces/frequency bands

Air Interface	Band (MHz)	Type	ANSI C63.19 Tested	Simultaneous Transmitter	Name of Voice Service	Power Reduction
GSM	850	VO	Yes	BT, Wi-Fi	CMRS Voice	NO
	1900					
	EDGE	VD	Yes		Google Duo*	
WCDMA	Band II	VO	No(1)	BT, Wi-Fi	CMRS Voice	NO
	Band V					
	HSPA	VD	No(1)		Google Duo*	
LTE (FDD)	LTE Band 2	VD	No(1)	BT, Wi-Fi	VoLTE Google Duo*	NO
	LTE Band 4					
	LTE Band 5					
	LTE Band 12					
	LTE Band 14					
	LTE Band 17					
	LTE Band 26					
	LTE Band 30					
	LTE Band 48					
	LTE Band 66					
	LTE Band 71					
LTE (TDD)	Band 48	VD	No(1)	BT, Wi-Fi	VoLTE Google Duo*	NO
5G NR (FDD)	NR Band n2	VD	No(1)	BT, Wi-Fi	VoNR Google Duo*	NO
	NR Band n5					
	NR Band n25					
	NR Band n26					
	NR Band n30					
	NR Band n66					
	NR Band n70					
	NR Band n71					
5G NR (FDD	NR Band n41	VD	No(1)	BT, Wi-Fi	VoNR Google Duo*	NO
	NR Band n48					
	NR Band n77					
Wi-Fi	2450	VD	No(1)	WWAN	Google Duo*	NO
BT	2450	DT	No(1)	WWAN	NA	NO

VO: Legacy Cellular Voice Service
DT: Digital Transport (no voice)
VD: IP Voice Service over Digital Transport
* For protocols not listed in Table 6.1 of ANSI C63.19-2019, the average speech level of −16 dBm0 should be used.
（1）The air interface is exempted from testing by low power exemption that its average antenna input power plus its MIF is Average antenna input Power +MIF <960MHz conducted power <= 29dBm; 960MHz-2000MHz conducted power<= 26dBm; >2000 MHz<= 25dBmThe SIP calling is android internal auxiliary functions under the dialing program.

1.6 Test Specification

Identity	Document Title
CFR 47 FCC Part 20	§20.19 Hearing aid-compatible mobile handsets.
ANSI C63.19-2019	American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices
KDB 285076 D01	HAC Guidance v06r04

1.7 ANSI C63.19-2011 limits

Emission Categories	E-field emissions dB(V/m)		
	< 960 MHz	960MHz-2000MHz	>2000 MHz
E field level	<= 39dB (V/m)	<= 36dB (V/m)	<= 35dB (V/m)

Table 1: Telephone near-field categories in linear units

2 Calibration certificate

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%

Table 2: The Ambient Conditions

3 HAC (T Coil) Measurement System

3.1 Measurement System Diagram for SPEAG Robotic

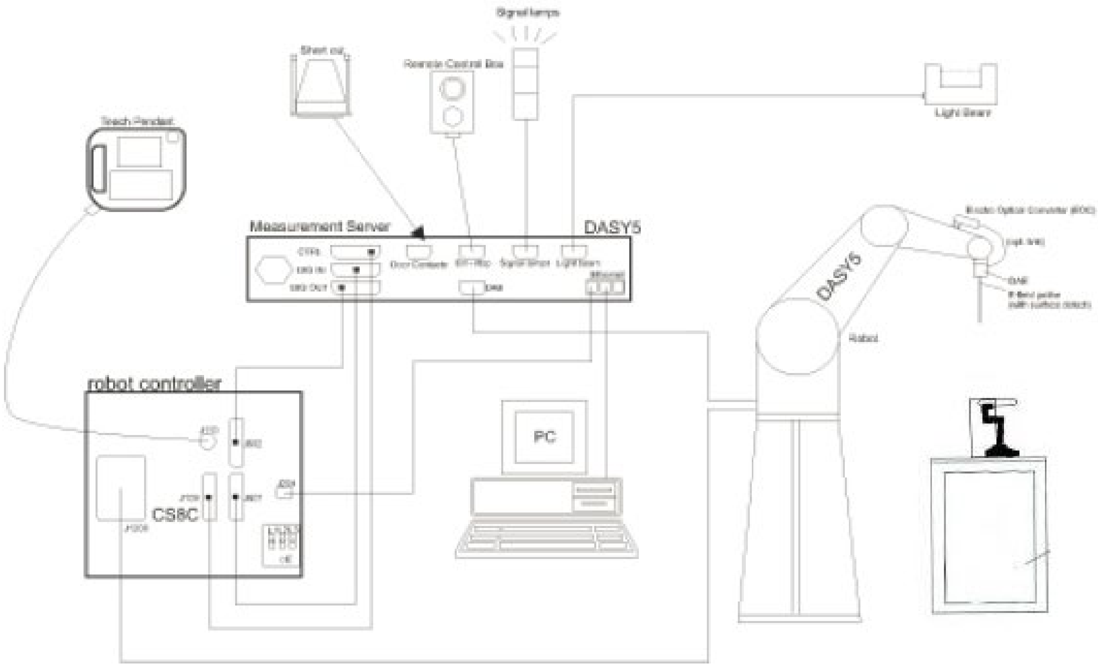


Fig. 1. The SPEAG Robotic Diagram

The DASY8 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stabile RX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
- An Audio Magnetic probe.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY8 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The Test Arch SAM phantom
- The device holder for handheld mobile phones.
- Validation dipole kits allowing to validate the proper functioning of the system.

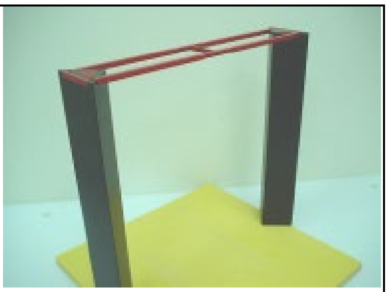
3.2 E-Field Probe

Construction	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges PEEK enclosure material
Calibration	In air from 100 MHz to 6.0 GHz (absolute accuracy ±6.0%, k=2)
Frequency	(extended to 20 MHz for MRI), Linearity: ± 0.2 dB (100 MHz to 6 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	Tip diameter: 8 mm Distance from probe tip to dipole centers: 2.5 mm

EF3DV3 E-Field Probe

3.3 Test Arch

Description	Enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot.
Dimensions	length: 370 mm width: 370 mm height: 370 mm



Test Arch

3.4 Phone Holder

Description	Supports accurate and reliable positioning of any phone Effect on near field <+/- 0.5 dB

Phone Holder

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4 Measurement uncertainty evaluation

Uncertainty Component	Uncertainty Value (%)	Probability Distribution	Divisor	ci €	Standard Uncertainty € (%)
Measurement system					
Probe calibration	±5.1	N	1	1	±5.1
Axial isotropy	±4.7	R	$\sqrt{3}$	1	±2.7
Sensor position	±16.5	R	$\sqrt{3}$	1	±9.5
Boundary effect	±2.4	R	$\sqrt{3}$	1	±1.4
Phantom Boundary Effect	±7.2	R	$\sqrt{3}$	1	±4.1
Linearity	±4.7	R	$\sqrt{3}$	1	±2.7
Scaling with PMR calibration	±10.0	R	$\sqrt{3}$	1	±5.8
System Detection limit	±1.0	R	$\sqrt{3}$	1	±0.6
Readout Electronics	±0.3	N	1	1	±0.3
Response time	±0.8	R	$\sqrt{3}$	1	±0.5
Integration time	±2.6	R	$\sqrt{3}$	1	±1.5
RF ambient conditions	±3.0	R	$\sqrt{3}$	1	±1.7
RF reflection	±12.0	R	$\sqrt{3}$	1	±6.9
Probe positioner	±1.2	R	$\sqrt{3}$	1	±0.7
Probe positioning	±4.7	R	$\sqrt{3}$	1	±2.7
Extrapolation and interpolation	±1.0	R	$\sqrt{3}$	1	±0.6
Related to test samples					
Device Positioning Vertical	±4.7	R	$\sqrt{3}$	1	±2.7
Device Positioning Lateral	±1.0	R	$\sqrt{3}$	1	±0.6
Device Holder and Phantom	±2.4	R	$\sqrt{3}$	1	±1.4
Power drift	±5.0	R	$\sqrt{3}$	1	±2.9
Phantom and Setup Related					
Phantom Thickness	±2.4	R	$\sqrt{3}$	1	±1.4
Combined Std. Uncertainty	$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$				**±16.3**
Expanded Std. Uncertainty on Power (K=2)					**±32.6**
Expanded Std. Uncertainty on Field (K=2)					**±16.3**

Table 3: Measurement uncertainties for RF

5 RF Emission Measurements Reference and Plane

Fig.3 illustrate the references and reference plane that shall be used in a typical EUT emissions measurement. The principle of this section is applied to EUT with similar geometry. Please refer to Appendix C for the setup photographs.

- The area is 5 cm by 5 cm.
- The area is centered on the audio frequency output transducer of the EUT.
- The area is in a reference plane, which is defined as 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 EUT handset, which, in normal handset use, rest against the ear.
- The measurement plane is parallel to, and 10 mm in front of, the reference plane.

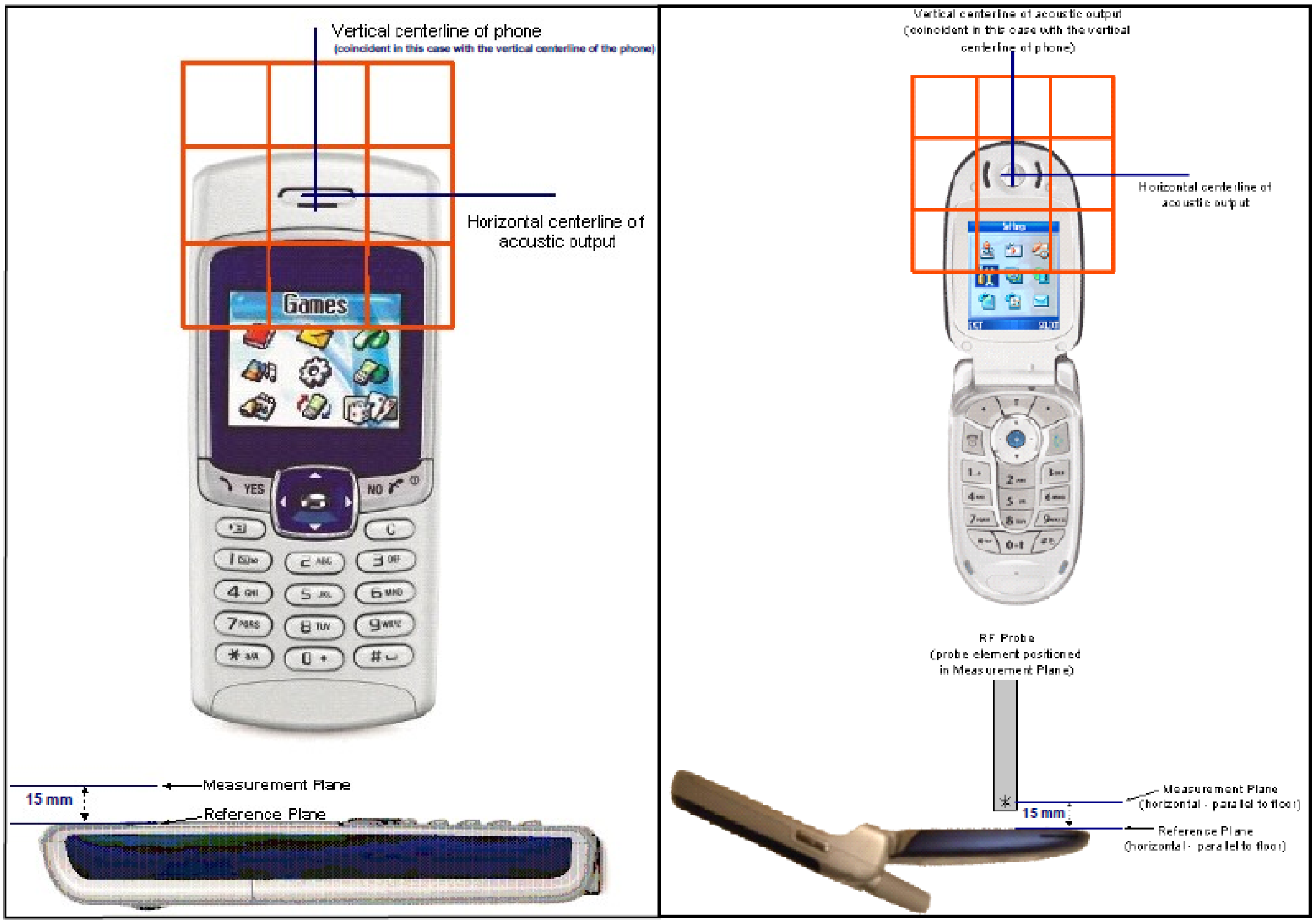

Fig.3 WD reference and plane for RF emission measurements

6 System Verification Procedure

6.1 System Check

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

• 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.

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

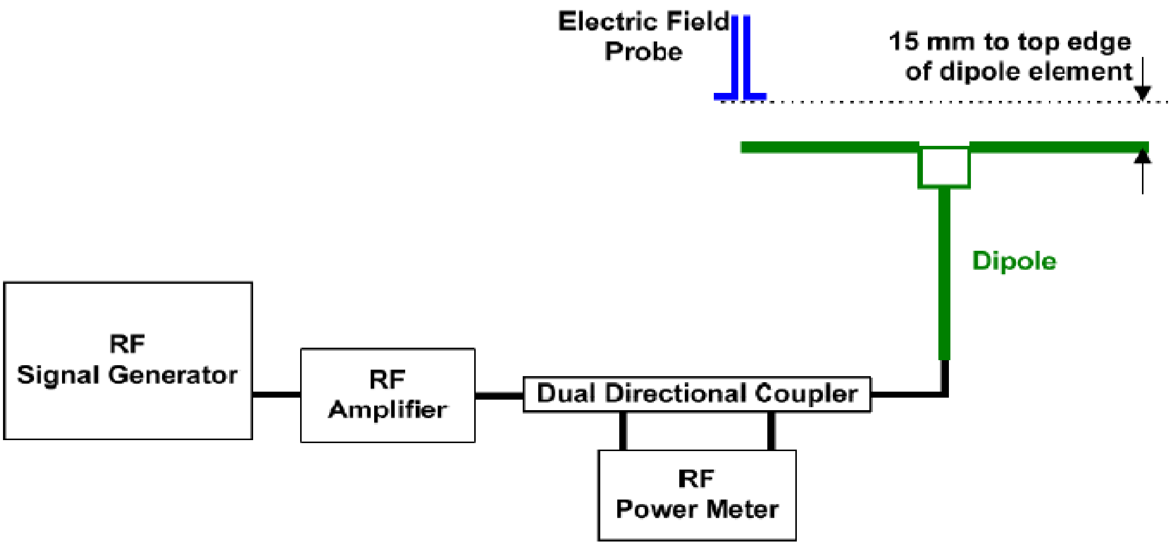

Fig.4 System verification

6.2 System Check Result

Mode	Frequency (MHz)	Input Power (mW)	E-Field (V/m)	Target Value (V/m)	Deviation (%)	Limit (%)	Test Date
CW	835	100	114.00	112.2	1.60	±18	2024/1/24
CW	1880	100	91.10	86.6	5.20	±18	2024/1/24

Note:

* Please refer to the appendix A for detailed measurement data and plot.

** Target value is provided by SPEAD in the calibration certificate of specific dipoles.

*** Deviation (%) = 100 * (Measured value minus Target value) divided by Target value.

**** ANSI C63.19 requires values within ± 18% are acceptable.

7 Modulation Interference Factor

For any specific fixed and repeatable modulated signal, a modulation interference factor (MIF, expressed in dB) may be developed that relates its interference potential to its steady-state rms signal level or average power level. This factor is a function only of the audio-frequency amplitude modulation characteristics of the signal and is the same for field-strength and conducted power measurements. It is important to emphasize that the MIF is valid only for a specific repeatable audio-frequency amplitude modulation characteristic. Any change in modulation characteristic requires determination and application of a new MIF
The Modulation Interference factor (MIF, in dB) is added to the measured average E-field (in dBV/m) and converts it to the RF Audio Interference level (in dBV/m). This level considers the audible amplitude modulation components in the RF E-field. CW fields without amplitude modulation are assumed to not interfere with the hearing aid electronics.
Modulations without time slots and low fluctuations at low frequencies have low MIF values, TDMA modulations with narrow transmission and repetition rates of few 100 Hz have high MIF values and give similar classifications as ANSI C63.19-2019.
DASY8 is therefore using the indirect measurement method according to ANSI C63.19-2019 which is the primary method. These near field probes read the averaged E-field measurement. Especially for the new high peak-to-average (PAR) signal types, the probes shall be linearized by PMR calibration in order to not overestimate the field reading. Probe Modulation Response (PMR) calibration linearizes the probe response over its dynamic range for specific modulations which are characterized by their UID and result in an uncertainty specified in the probe calibration certificate. The MIF is characteristic for a given waveform envelope and can be used as a constant conversion factor if the probe has been PMR calibrated.
The evaluation method for the MIF is defined in ANSI C63.19-2019 section D.7. An RMS demodulated RF signal is fed to a spectral filter (similar to an A weighting filter) and forwarded to a temporal filter acting as a quasi-peak detector. The averaged output of these filtering is scaled to a 1 kHz 80% AM signal as reference. MIF measurement requires additional instrumentation and is not well suited for evaluation by the end user with reasonable uncertainty.
It may alliteratively be determined through analysis and simulation, because it is constant and characteristic for a communication signal. DASY8 uses well-defined signals for PMR calibration. The MIF of these signals has been determined by simulation and it is automatically applied.

The MIF measurement uncertainty is estimated as follows, declared by HAC equipment provider SPEAG, for modulation frequencies from slotted waveforms with fundamental frequency and at least 2 harmonics within 10 kHz:
1. 0.2 dB for MIF: -7 to +5 dB
2. 0.5 dB for MIF: -13 to +11 dB
3. 1 dB for MIF: > -20 dB
MIF values applied in this test report were provided by the HAC equipment provider of SPEAG, and the worst values for all air interface are listed below to be determine the Low-power Exemption.

SPEAG UID	UID version	Communication system	MIF(dB)
10021	DAC	GSM-FDD (TDMA,GMSK)	3.63
10025	DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	3.75
10460	AAA	UMTS-FDD (WCDMA, AMR)	-25.43
10225	AAA	UMTS-FDD (HSPA+)	-20.39
10169	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	-15.63
10170	CAE	LTE-FDD (SC-FDMA,1RB, 20 MHz,16-QAM)	-9.76
10172	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	-1.62
10173	CAG	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	-12.08
10173	CAG	LTE-TDD (SC-FDMA,1RB, 20 MHz,16-QAM)	-1.44

10061	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	-2.02
10077	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps)	0.12
10427	AAB	IEEE 802.11n (HT Green eld, 150 Mbps, 64-QAM)	-13.44
10069	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	-3.15
10616	AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	-5.57
10671	AAB	IEEE 802.11ax WiFi (20MHz, MCS0, 90pc duty cycle)	-5.58

8 HAC Measurement Procedure

The evaluation was performed with the following procedure:

a) Confirm the proper operation of the field probe, probe measurement system, and other instrumentation and the positioning system.
b) Position the WD in its intended test position.
c) 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.
d) The center subgrid shall be centered on the T-Coil mode perpendicular measurement point or the acoustic output, as appropriate. Locate the field probe at the initial test position in the 50 mm by 50 mm grid, which is contained in the measurement plane, refer to illustrated in Figure 3. If the field alignment method is used, align the probe for maximum field reception.
e) Record the reading at the output of the measurement system.
f) Scan the entire 50 mm by 50 mm region in equally spaced increments and record the reading at each measurement point. The distance between measurement points shall be sufficient to assure the identification of the maximum reading.
g) Identify the five contiguous subgrids around the center subgrid whose maximum reading is the lowest of all available choices. This eliminates the three subgrids with the maximum readings. Thus, the six areas to be used to determine the WD's highest emissions are identified.
h) Identify the maximum reading within the nonexcluded subgrids identified in step g).
i) Convert the maximum reading identified in step h) to RF audio interference level, in, V/m, by taking the square root of the reading and then dividing it by the measurement system transfer function, established in 5.5.1.1. Convert the result to dB(V/m) by taking the base-10 logarithmand multiplying it by 20.
Indirect measurement method
Replacing step i) of 5.5.1.2, the RF audio interference level in dB(V/m) is obtained by adding the MIF (in dB) to the maximum steady-state rms field-strength reading, in dB(V/m), from step h). Use this result to determine the category rating.
j) Compare this RF audio interference level with the categories in Clause 8 and record the resulting WD category rating.
k) For the T-Coil mode M-rating assessment, determine whether the chosen perpendicular measurement point is contained in an included subgrid of the first scan. If so, then a second scan is not necessary. The first scan and resultant category rating may be used for the T-Coil mode M rating.
Otherwise, repeat step a) through step i), with the grid shifted so that it is centered on the perpendicular measurement point. Record the WD category rating.

9 HAC RF Measurement Results

9.1 Max Tune-up

Ant0				
Frequency Band		Channel	Frequency(MHz)	Average Power (dBm)
GSM	GSM850	251	848.8	34.00
	EDGE850	251	848.8	28.00
WCDMA	Band V	4233	846.6	24.50
	HSPA	4233	846.6	24.50
FDD LTE	Band 5	2060	844	24.50
	Band 12	23130	711	25.00
	Band 14	23330	793	25.00
	Band 17	23800	711	25.00
	Band 26	26965	841.5	24.50
	Band 71	133372	688	25.00
5G NR FDD	n5	169800	849	25.00
	n26	169800	849	25.00
	n71	139600	698	25.00
2.4GHz WLAN	802.11b	6	2437	11.50
	802.11g	6	2437	11.50
	802.11n-HT20	6	2437	11.50
	802.11n-HT40	6	2437	11.50
5GHz WLAN	802.11a	40	5200	15.00
	802.11n-HT20	40	5200	14.50
	802.11n-HT40	40	5200	14.50
	802.11ac-VHT20	40	5200	14.50
	802.11ac-VHT40	40	5200	13.50
	802.11ac-VHT80	40	5200	13.00

Ant2				
Frequency Band		Channel	Frequency(MHz)	Average Power (dBm)
FDD LTE	Band 2	19100	1900	23.00
	Band 4	20300	1745	24.50
	Band 30	27710	2310	20.00

	Band 66	132572	1770	24.50
5G NR FDD	n2	382000	1910	18.50
	n66	356000	1780	25.00
2.4GHz WLAN	802.11b	6	2437	11.50
	802.11g	6	2437	11.50
	802.11n-HT20	6	2437	11.50
	802.11n-HT40	6	2437	11.50
5GHz WLAN	802.11a	40	5200	15.00
	802.11n-HT20	40	5200	14.50
	802.11n-HT40	40	5200	14.50
	802.11ac-VHT20	40	5200	14.50
	802.11ac-VHT40	40	5200	13.50
	802.11ac-VHT80	40	5200	13.00

Ant3				
Frequency Band		Channel	Frequency(MHz)	Average Power (dBm)
GSM	GSM1900	810	1909.8	24.50
	EDGE1900	810	1909.8	20.50
WCDMA	Band II	9538	1907.6	16.00
	HSPA	9538	1907.6	16.00
FDD LTE	Band 2	19100	1900	17.00
	Band 4	20300	1745	18.00
	Band 30	27710	2310	21.00
	Band 66	132572	1770	18.00
5G NR FDD	n2	382000	1910	18.00
	n25	383000	1915	18.00
	n30	463000	2315	21.00
	n66	356000	1780	18.00
	n70	342000	1710	19.50
5G NR TDD	n41	528000	2640	19.00
2.4GHz WLAN	802.11b	6	2437	11.50
	802.11g	6	2437	11.50
	802.11n-HT20	6	2437	11.50
	802.11n-HT40	6	2437	11.50
5GHz WLAN	802.11a	40	5200	15.00
	802.11n-HT20	40	5200	14.50

	802.11n-HT40	40	5200	14.50
	802.11ac-VHT20	40	5200	14.50
	802.11ac-VHT40	40	5200	13.50
	802.11ac-VHT80	40	5200	13.00

Ant4				
Frequency Band		Channel	Frequency(MHz)	Average Power (dBm)
TDD LTE	Band 48	56640	3690	21.00
5G NR TDD	n48	646666	3699.99	18.00
	n77	662000	3930	18.00
2.4GHz WLAN	802.11b	6	2437	11.50
	802.11g	6	2437	11.50
	802.11n-HT20	6	2437	11.50
	802.11n-HT40	6	2437	11.50
5GHz WLAN	802.11a	40	5200	15.00
	802.11n-HT20	40	5200	14.50
	802.11n-HT40	40	5200	14.50
	802.11ac-VHT20	40	5200	14.50
	802.11ac-VHT40	40	5200	13.50
	802.11ac-VHT80	40	5200	13.00

9.2 Conducted RF Output Power

GSM 850 Ant 0					
Burst Output Power(dBm)					
Channel		128	190	251	Tune up
GSM(GMSK)	GSM	33.19	33.28	33.28	34.00

GSM 1900 Ant 3					
Burst Output Power(dBm)					
Channel		512	661	810	Tune up
GSM(GMSK)	GSM	23.58	23.65	23.62	24.50

9.3 Low-power Exemption

The primary method for establishing the RF interference potential of a WD is based on conducted power to the antenna. The waveform-specific modulation interference factor (MIF) is measured separately and added to the measured average conducted power, in dBm.

The WD's conducted power must be at or below either the stated RFAIPL (Table 4.1) or the stated peak power level (Table 4.2), or the average near-field emissions over the measurement area must be at or below the stated RFAIL (Table 4.3), or the stated peak field strength (Table 4.4).

The WD may demonstrate compliance by meeting any of these four requirements, but it must do so in each of its operating bands at its established worst-case normal speech-mode operating condition.

Table 4.1—Wireless device RF audio interference power level

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

Table 4.2—Wireless device RF peak power level

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

Table 4.3—Wireless device RF audio interference level

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

Table 4.4—Wireless device RF peak near-field level

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

An analysis shall be performed following the guidance of the RF air interface technology being evaluated. Factors that will affect the RF interference potential shall be evaluated, and the worst-case operating mode shall be identified and used in the evaluation. Any factor that can affect the RF interference potential shall be evaluated.

Examples of such factors are those that will change the RF signal envelope, such as discontinuous transmission due to data load, power management, or configuration options of the RF air interface technology.

RF audio interference power level is compared to the limits in Sec.5 Table 4.1.

Ant0				
Air Interface	**Max Average Antenna Input Power (dBm)**	**Worst Case MIF (dB)**	**Power + MIF(dB)**	**C63.19 test required**
GSM850	34.00	3.63	37.63	YES
EDGE850	28.00	3.75	31.75	YES
WCDMA	24.50	-25.43	-0.93	NO
WCDMA - HSPA	24.50	-20.39	4.11	NO
LTE - FDD	25.00	-9.76	15.24	NO
5G FR1 - FDD	25.00	-12.08	12.92	NO
802.11b	11.50	-2.02	9.48	NO
802.11g	11.50	0.12	11.62	NO
802.11n-HT20	11.50	-13.44	-1.94	NO
802.11n-HT40	11.50	-13.44	-1.94	NO
802.11a	15.00	-3.15	11.85	NO
802.11n-HT20	14.50	-13.44	1.06	NO
802.11n-HT40	14.50	-13.44	1.06	NO
802.11ac-VHT20	14.50	-5.57	8.93	NO
802.11ac-VHT40	13.50	-5.57	7.93	NO
802.11ac-VHT80	13.00	-5.57	7.43	NO

Note: Select tests with highest Power+MIF values for the same frequency band.

Ant2				
Air Interface	**Max Average Antenna Input Power (dBm)**	**Worst Case MIF (dB)**	**Power + MIF(dB)**	**C63.19 test required**
LTE - FDD	24.50	-9.76	14.74	NO
5G FR1 - FDD	25.00	-12.08	12.92	NO
802.11b	11.50	-2.02	9.48	NO
802.11g	11.50	0.12	11.62	NO
802.11n-HT20	11.50	-13.44	-1.94	NO

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802.11n-HT40	11.50	-13.44	-1.94	NO
802.11a	15.00	-3.15	11.85	NO
802.11n-HT20	14.50	-13.44	1.06	NO
802.11n-HT40	14.50	-13.44	1.06	NO
802.11ac-VHT20	14.50	-5.57	8.93	NO
802.11ac-VHT40	13.50	-5.57	7.93	NO
802.11ac-VHT80	13.00	-5.57	7.43	NO

Ant3				
Air Interface	**Max Average Antenna Input Power (dBm)**	**Worst Case MIF (dB)**	**Power + MIF(dB)**	**C63.19 test required**
GSM1900	24.50	3.63	28.13	YES
EDGE1900	20.50	3.75	24.25	NO
WCDMA	16.00	-25.43	-9.43	NO
WCDMA - HSPA	16.00	-20.39	-4.39	NO
LTE - FDD	21.00	-9.76	11.24	NO
5G FR1 - FDD	21.00	-12.08	8.92	NO
5G NR - TDD	19.00	-12.08	6.92	NO
802.11b	11.50	-2.02	9.48	NO
802.11g	11.50	0.12	11.62	NO
802.11n-HT20	11.50	-13.44	-1.94	NO
802.11n-HT40	11.50	-13.44	-1.94	NO
802.11a	15.00	-3.15	11.85	NO
802.11n-HT20	14.50	-13.44	1.06	NO
802.11n-HT40	14.50	-13.44	1.06	NO
802.11ac-VHT20	14.50	-5.57	8.93	NO
802.11ac-VHT40	13.50	-5.57	7.93	NO
802.11ac-VHT80	13.00	-5.57	7.43	NO

Ant4				
Air Interface	**Max Average Antenna Input Power (dBm)**	**Worst Case MIF (dB)**	**Power + MIF(dB)**	**C63.19 test required**
LTE – TDD	21.00	-1.44	19.56	NO
5G NR - TDD	18.00	-12.08	5.92	NO
802.11b	11.50	-2.02	9.48	NO
802.11g	11.50	0.12	11.62	NO
802.11n-HT20	11.50	-13.44	-1.94	NO

802.11n-HT40	11.50	-13.44	-1.94	NO
802.11a	15.00	-3.15	11.85	NO
802.11n-HT20	14.50	-13.44	1.06	NO
802.11n-HT40	14.50	-13.44	1.06	NO
802.11ac-VHT20	14.50	-5.57	8.93	NO
802.11ac-VHT40	13.50	-5.57	7.93	NO
802.11ac-VHT80	13.00	-5.57	7.43	NO

9.4 HAC RF Emission Test Results

Air Interface	Modulation / Mode	Channel	Frequency(MHz)	Ant	Average Antenna Input Power (dBm)	MIF	E-Field (dBV/m)	RF Limit (dB V/m)	RF Pass/Fail	Date
GSM850	GSM Voice	128	824.2	Ant 0	33.19	3.63	30.86	39.00	PASS	2024/1/24
GSM850	GSM Voice	190	836.6	Ant 0	33.28	3.63	30.86	39.00	PASS	2024/1/24
GSM850	GSM Voice	251	848.8	Ant 0	33.28	3.63	30.48	39.00	PASS	2024/1/24
GSM1900	GSM Voice	512	1850.2	Ant 3	23.58	3.63	14.29	36.00	PASS	2024/1/24
GSM1900	GSM Voice	661	1880	Ant 3	23.65	3.63	13.36	36.00	PASS	2024/1/24
GSM1900	GSM Voice	810	1909.8	Ant 3	23.62	3.63	12.68	36.00	PASS	2024/1/24

Remark:

1. The detail RF Emission results please refer to appendix B.

10 Equipment list

	Equipment	Manufacturer	Model	Serial Number	Calibration Date	Due date of calibration
☒	Software	SPEAG	DASY52 52.10.4	NA	NCR	NCR
☒	DAE	SPEAG	DAE4	1484	2023-06-05	2024-06-04
☒	E-Field Probe	SPEAG	EF3DV3	4051	2023-06-02	2024-06-01
☒	Validation Kits	SPEAG	CD835V3	1052	2022-05-25	2025-05-24
☒	Validation Kits	SPEAG	CD1880V3	1044	2022-05-25	2025-05-24
☒	Test Arch SD HAC	SPEAG	NA	NA	NCR	NCR
☒	Universal Radio Communication Tester	R&S	CMW500	111637	2023-09-13	2024-09-12
☒	Signal Generator	R&S	SMB100A	182393	2023-02-06	2024-02-05
☒	Preamplifier	Qiji	YX28980933	202104001	NCR	NCR
☒	Power Sensor	Keysight	U2002H	MY5639004	2023-09-13	2024-09-12
☒	Power Sensor	Agilent	U2002H	MY48200110	2023-11-21	2024-11-20
☒	Coaxial low pass filter	Mini-Circuits	VLF-2500(+)	NA	NCR	NCR
☒	Coaxial low pass filter	Microlab Fxr	LA-F13	NA	NCR	NCR
☒	DC POWER SUPPLY	SAKO	SK1730SL5A	NA	NCR	NCR
☒	Humidity and Temperature Indicator	MingGao	MingGao	NA	2023-06-15	2024-06-14

Note:
1. All the equipments are within the valid period when the tests are performed.

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