T-COIL TEST REPORT

Report No. : SET2019-06539

Product : LTE Mobile Phone

Model No. : NX629J

FCC ID : 2AHJO-NX629J

Brand Name : nubia

Applicant : Nubia Technology Co., Ltd.

Address : 10/F, Tower A, Hans Innovation Mansion, North Ring Rd.,No.9018, High-Tech Park, Nanshan District, Shenzhen, China.

Test date : 03/19/2019

Issued Date : 06/05/ 2019

Issued by : CCIC-SET

Lab Location : Building 28/29, East of Shigu Xili Industrial Zone, Nanshan District Shenzhen, Guangdong 518055, China.

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Test Report

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Applicant……………………...: Nubia Technology Co., Ltd.
Applicant Address…………...: 10/F, Tower A, Hans Innovation Mansion, North Ring Rd.,No.9018, High-Tech Park, Nanshan District, Shenzhen, China.

Test Standards………………..: ANSI C63.19-2011 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

T Rating………………………: T3

Test Result……………………: Pass

Tested by ……………………..:

Mei chun , Test Engineer

Reviewed by…………………..:

Chris You, Senior Engineer

Approved by…………………..:

Shuangwen Zhang , Manager

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1. Administrative Data

1.1 Testing Laboratory

Test Site: CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd

Address: Building 28/29, East of Shigu Xili Industrial Zone, Nanshan District Shenzhen, Guangdong 518055, China.

NVLAP Lab Code: CCIC-SET is a third party testing organization accredited by NVLAP according to ISO/IEC 17025. The accreditation certificate number is 201008-0.

FCC Registration: CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC 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: CN5031, valid time is until December 31, 2019.

ISED Registration: CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC 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.

Test Environment Condition:

Temperature (°C): 21°C

Relative Humidity (%): 60%

Atmospheric Pressure (kPa): 86KPa-106KPa

2. Equipment Under Test (EUT)

Identification of the Equipment under Test

Sample Name:	LTE Mobile Phone	
Model Name:	NX629J	
Brand Name:	nubia	
General description:	Support Band	GSM850MHz/1900MHz, WCDMA 850MHz /1900MHz /1700;CDMA BC0/BC1, LTE Band 2/4/5/7/12/17/25/26/30/41/66, WIFI2.4G&5G
	Test Band	GSM850MHz/1900MHz WCDMA Band 2/4/5
	Development Stage	Identical Prototype
	Accessories	Power Supply
	Antenna type	PIFA Antenna
	Operation mode	GSM GPRS /EGPRS: Multi-slot Class12,Class B WCDMA/HSDPA/HSUPA/HSPA+ LTE
	Modulation mode	GSM: GMSK, 8PSK WCDMA: QPSK LTE: QPSK, 16QAM 2.4GHz WIFI: DSSS, OFDM 5GHz WIFI: OFDM BT: GFSK/ π /4-DQPSK/8-DPSK

Note: the CDMA, LTE HAC Test data please refer to Report: B19N00750-HACT-coil

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 C63.19:2011	American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids
3	KDB 285076 D01 HAC Guidance v05	Provides equipment authorization guidance for mobile handsets subject to the requirements of Section 20.19 for hearing aid compatibility

3.2.Summary Of HAC Rating

Summary of T-Rating

Band	T-Rating	Frequency response
GSM850	T3	PASS
GSM1900	T3	PASS
WCDMA850	T4	PASS
WCDMA1700	T4	PASS
WCDMA1900	T4	PASS

4. Hearing Aid Compatibility (HAC)

4.1 Introduction

The purpose of the Hearing Aid Compatibility extension is to enable measurements of the near electric and magnetic fields generated by wireless communication devices in the region controlled for use by a hearing aid in accordance with ANSI-C63.19-2011 FCC has granted a request for waiver of the HAC rules in section 20.19 for dual band GSM handsets. The waiver has specific conditions, as stated in the order (FCC 05-166) and expires 1 August 2007.

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

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

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

e) T-coil mode, magnetic signal frequency response through the audio band

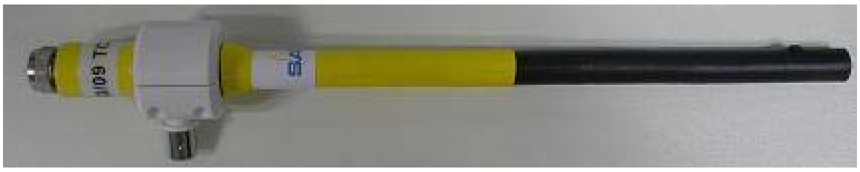
Corresponding to the WD measurements, the hearing aid is measured for:

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:	860.6 Ω
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

During SAR test, EUT was operating in Traffic Mode (Channel Allocated) at Normal Voltage Condition. A communication link is set up with a System Simulator (SS) by air link, and a call is established.

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 (MHz)	Type	C63.19-2011 Tested	Simultaneous Transmissions Scenarios invoice (Not to be tested)	Reduced power	VOIP
GSM	850	Voice	Yes	Yes: WIFI or BT	N/A	N/A
	1900	Voice	Yes	Yes: WIFI or BT	N/A	N/A
	GPRS	Data	N/A	N/A	N/A	N/A
WCDMA	850	Voice	Yes	Yes: WIFI or BT	N/A	N/A
	1700	Voice	Yes	Yes: WIFI or BT	N/A	N/A
	1900	Voice	Yes	Yes: WIFI or BT	N/A	N/A
	HSPA	Data	N/A	N/A	N/A	N/A
CDMA	BC0	Voice	Yes	Yes: WIFI or BT	N/A	N/A
	BC1	Voice	Yes	Yes: WIFI or BT	N/A	N/A
	1XRTT, EVDO	Data	N/A	N/A	N/A	N/A
LTE	Band 2/4/5/7/12/17/25 /26/30/66	Data	Yes	Yes: WIFI or BT	N/A	N/A
WIFI	2.4/5GHz	Data	N/A	Yes GSM or WCDMA	N/A	N/A
BT	2.4GHz	Data	N/A	Yes GSM or WCDMA	N/A	N/A
Note: N/A=Not support LTE support Vo-LTE						

The volume is at the maximum value, and the backlight of the phone is turned off. The Manufacturer doesn't design HAC mode software on the EUT

5.2 HAC Measurement System

The HAC measurement system being used is the COMO HAC system, the system is controlled remotely from a PC, which contains the software to control the robot and data acquisition equipment. The software also displays the data obtained from test scans.

In operation, the system first does an 2D scan at a fixed depth within a 50mm*50mm area. When the maximum HAC point has been found, the system will then carry out a 3D scan centred at that point to determine volume averaged HAC level.

WD reference and plane for RF emission measurements

5.3 Magnetic measurement locations for the WD

T-Coil measurement points and reference planeThe following figure illustrates the three standard probeorientations. Position 1 is the axial orientation of the probe coil;orientation 2 and orientation 3 are radial orientations. The space between themeasurement positions is not fixed. It is recommended that a scan of the EUT bedone for each probe coil orientation and that the maximum level recorded beused as the reading for that orientation of the pro be coil.

1) The reference plane is the planar area that contains thehighest point in the area of th e phone that normally rests against the user'sear. It is parallel to the centerline of the recei ver area of the phone and isdefined by the points of the receiver-end of the EUT handset,

which, in normal handsetuse, rest against the ear.

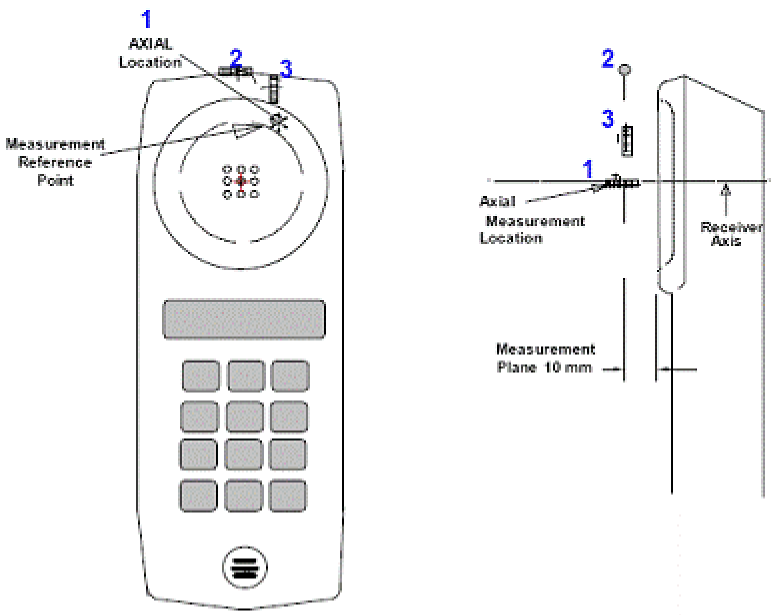
2) The measurement plane is parallel to, and10 mmin front of, the reference plane.

3) The reference axis is normal to the reference plane andpasses through the center of the receiver speaker section (or the center of thehole array); or may be centered on a secondary inductive source. The actuallocation of the measurement point shall be noted in the test report as the measurement reference point.

4) The measurement points may be located where the axialand radial field intensity measurements are optimum with regard to therequirements. However, the measurement points should be near the acousticoutput of the EUT and shall be located in the same half of the phone as the EUTreceiver. In a EUT handset with a centered receiver and a circularly symmetricalmagnetic field, the measurement axis and the reference axis would coincide.

5) The relative spacing of each measurement orientation isnot fixed. The axial and two radial orientations should be chosen to select the optimal position.

6) The measurement point for the axial position is located10 mmfrom the reference plane on themeasurement axis. The actual location of the measurementpoint shall be noted in test reports and designated as the measurement reference point.



Axis and planes for EUT audio frequency magnetic field measurements

5.4 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

T-Coil Measurement Procedure

The following illustrate a typical T-Coil signal test scan over a wireless communications device:

a. Position the EUT in the test setup and connect the EUT RF connector to a base station simulator.

b. The drive level to the EUT is set such that the reference input level defined in 6.3.2.1, Table 6.1 is input to the base station simulator in the 1 kHz, 1/3 octave band. This drive level shall be used for the T-Coil signal test (ABM1) 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 defined in 6.3.2, shall be used for the reference audio signal. If interference is found at 1025 Hz an alternate nearby reference audio signal frequency may be used. The same drive level will be used for the ABM1 frequency response measurements at each 1/3 octave band center frequency. The EUT 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.

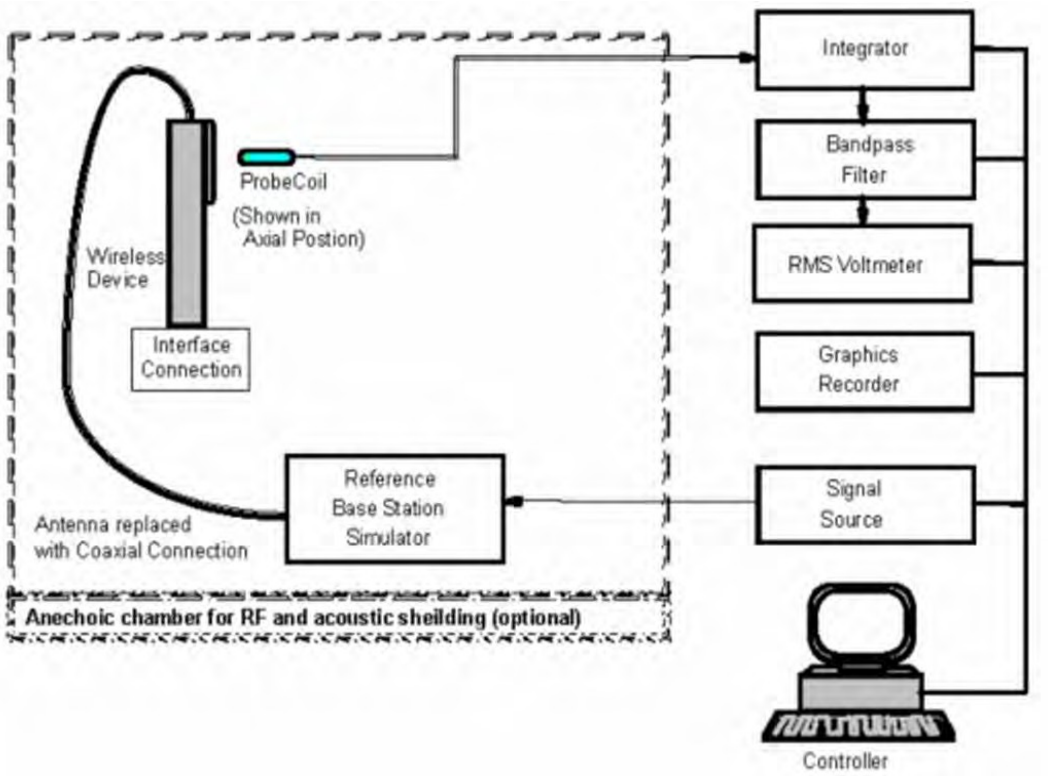
c. Determine the magnetic measurement locations for the EUT, if not already specified by the manufacturer, as described in 6.3.4.1.1 and 6.3.4.4.

d. At each measurement location, measure and record the desired T-Coil magnetic signals (ABM1 at f i) as described in 6.3.4.2 in each individual ISO 266-1975 R10 standard 1/3 octave band. The desired audio band input frequency (f i) shall be centered in each 1/3 octave band maintaining the same drive level as determined in Step 2) 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.18, 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.) All measurements of the desired signal shall be shown to be of the desired signal and not of an undesired signal. This may be shown by turning the desired signal on and off with the probe measuring the same location. If the scanning method is used the scans shall show that all measurement points selected for the ABM1 measurement meet the ambient and test system noise criterion in 6.2.1.

e. At each measurement location measure and record the undesired broadband audio magnetic signal (ABM2) as described in 6.3.4.3 with no audio signal applied (or digital zero applied, if appropriate) using A-weighting, and the half-band integrator. Calculate the ratio of the desired to undesired signal strength (i.e., signal quality).

f. Change the probe orientation to one of the two remaining orientations. At both measurement orientations, measure and record ABM1 using either a sine wave at 1025 Hz or a voice-like signal for the reference audio input signal.

g. Determine the category that properly classifies the signal quality.



T-Coil measurement test setup

6. CHARACTERISTICS OF THE TEST

Axial and Radial Field Intensity

All orientations of the magnetic field, in the axial and radial position along the measurement plane shall be ≥ -18 dB(A/m) at 1 kHz in a 1/3 octave band filter per §8.3.1.

Frequency Response

The frequency response of the axial component of the magnetic field shall follow the response curve specified in EIA RS-504-1983, over the frequency range 300 Hz – 3000 Hz per §8.3.2.

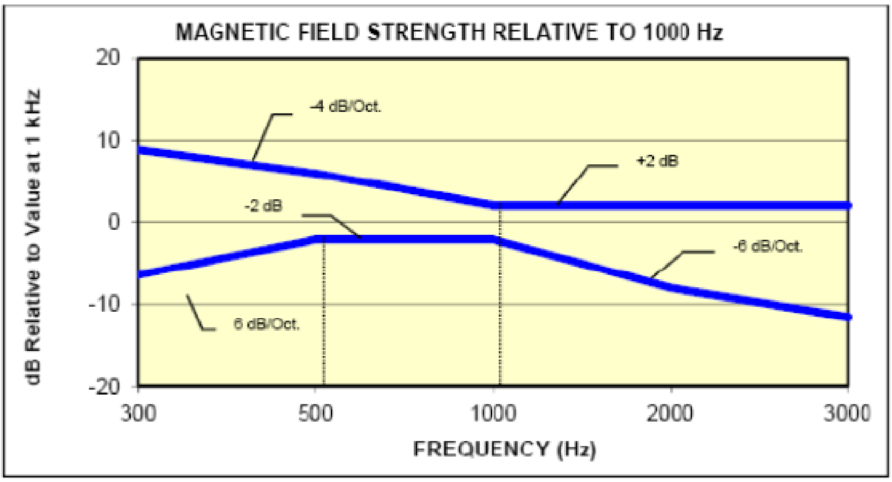


Figure 4-1
Magnetic field frequency response for Wireless Devices with an axial field ≤-15 dB (A/m) at 1 kHz

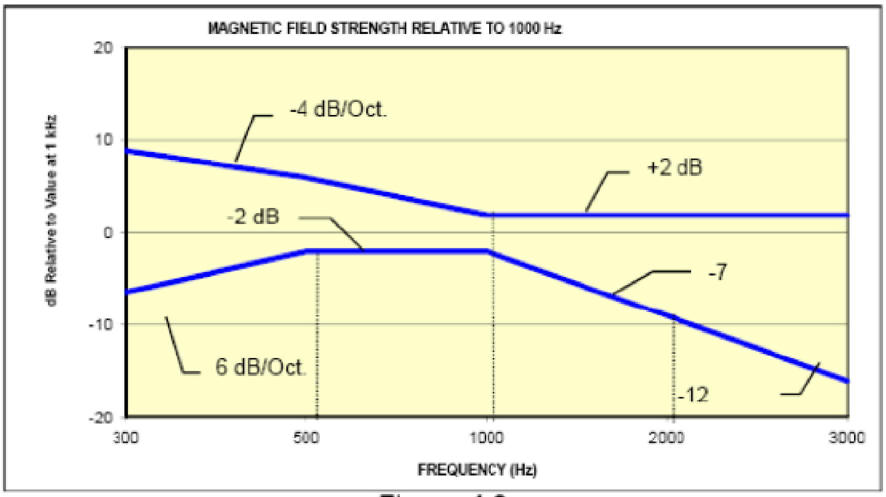


Figure 4-2
Magnetic Field frequency response for wireless devices with an axial field that exce
-15 dB(A/m) at 1 kHz

Signal Quality

The table below provides the signal quality requirement for the intended audio magnetic signal from a wireless device. Only the RF immunity of the hearing aid is measured in T-coil mode. It is assumed that a hearing aid can have no immunity to an interference signal in the audio band, which is the intended reception band for this mode. The only criterion that can be measured is the RF immunity in T-coil mode. This is measured using the same procedure as the audio coupling mode at the same levels.

The signal quality of the axial and radial components of the magnetic field was used to determine the T-coil mode category.

Table 3 T-Coil Mode Categories

Category	Telephone RF Parameter
	Wireless Device Signal Quality (Signal + Noise-to-noise ratio in dB)
T1	0 to 10 dB
T2	10 to 20 dB
T3	20 to 30 dB
T4	＞30 dB

7. TEST RESULTS

7.1 Summary of Power Measurement Results

The power level results were listed in the following tables:

Primary antenna:

Conducted RF Power of GSM850

Band	GSM 850			GSM 1900		
Channel	128	190	251	512	661	810
Frequency	824.2	836.4	848.8	1850.2	1880.0	1909.8
GSM	31.2	31.1	31.2	28.8	28.7	28.5

Conducted RF Power of WCDMA

Band	WCDMA 850			WCDMA1900		
TX Channel	4132	4182	4233	9262	9400	9538
Frequency	826.4	835	846.6	1852.4	1880.0	1907.6
ARM	21.61	21.23	21.52	21.63	21.01	21.73

Conducted RF Power of WCDMA

Band	WCDMA 1700		
TX Channel	1312	1412	1513
Frequency	1712.4	1732.4	1752.6
ARM	21.73	21.18	21.56

7.2 Summary of Measurement Results

T-Coil Values of the EUT

Temperature: 23.0~23.5°C, humidity: 62~64%.			
Band	Channel	Frequency (MHz)	Test Results Category
GSM850	190	836.6	T3
GSM1900	661	1880.0	T3
WCDMA850	4182	835	T4
WCDMA1700	1413	1732.6	T4
WCDMA1900	9538	1907.6	T4

8. Measurement Uncertainty

Measurement Uncertainty of RF Emission Test

Uncertainty Component	Uncertainty value	Probe Dist.	Div	(Ci) E	(Ci) H	Std. Unc.(+-%)	
						E	H
Measurement System							
Probe calibration	6.00	N	1.000	1	1	6.00	6.00
Axial Isotropy	2.02	R	1.732	1	1	1.17	1.17
Sensor Displacemant	14.30	R	1.732	1	0.217	8.26	1.79
Boundary effect	2.50	R	1.732	1	1	0.87	0.87
Phantom Boundary effect	6.89	R	1.732	1	0	3.52	0.00
Linearity	2.58	R	1.732	1	1	1.49	1.49
Scaling to PMR Calibration	9.02	N	1.000	1	1	9.02	9.02
System Detection Limit	1.30	R	1.732	1	1	0.75	0.75
Readout Electronics	0.25	R	1.732	1	1	0.14	0.14
Reponse Time	1.23	R	1.732	1	1	0.71	0.71
Integration Time	2.15	R	1.732	1	1	1.24	1.24
RF Ambient Conditions	2.03	R	1.732	1	1	1.17	1.17
RF Reflections	9.09	R	1.732	1	1	5.25	5.25
Probe positioner	0.63	N	1.000	1	0.71	0.63	0.45
Probe positioning	3.12	N	1.000	1	0.71	3.12	2.22
Extrapolation and Interpolation	1.18	R	1.732	1	1	0.68	0.68
Uncertainties of the EUT							
Test sample positioning Vertical	2.73	R	1.732	1	0.71	1.58	1.12
Test sample positioning Lateral	1.19	R	1.732	1	1	0.69	0.69
Device Holder and Phantom	2.20	N	1.000	1	1	2.20	2.20
Power Drift	4.08	R	1.732	1	1	2.36	2.36
Phantom and Setup Related							
Phantom Thickness	2.00	N	1.000	1	0.6	2.00	1.20
Conbined Std. Uncertainty(k=1)						16.18	13.25
Expanded Uncertainty on Power						32.35	26.50
Expanded Uncertainty on Field						16.18	13.25

Note:

N-Nomal

R-Rectangular

Div.- Divisor used to obataion standard uncertanty

Measurement Uncertainty of T-Coil Test

No.	Uncertainty Component	Type	Uncertainty Value (%)	Probability Distribution	k	ci	Standard Uncertainty (%) ui(%)	Degree of freedom Veff or vi
	Measurement System							
1	—Probe Calibration	B	6	N	3	1	3.5	∞
2	—Axial isotropy	B	4.7	R	1.732	0.5	4.3	∞
3	—Hemispherical Isotropy	B	9.4	R	1.732	0.5	4.3	∞
4	—Boundary Effect	B	11.0	R	1.732	1	6.4	∞
5	—Linearity	B	4.7	R	1.732	1	2.7	∞
6	—System Detection Limits	B	1.0	R	1.732	1	0.6	∞
7	—Probe Coil Sensitivity	B	0.49	R	1.732	1	0.28	∞
8	—Response Time	B	0.00	R	1.732	1	0.00	∞
9	—Integration Time	B	0.00	R	1.732	1	0.00	∞
10	—RF Ambient Conditions	B	3.0	R	1.732	1	1.73	∞
11	—Probe Position Mechanical tolerance	B	0.4	R	1.732	1	0.2	∞
12	—Probe Position with respect to Phantom Shell	B	2.9	R	1.732	1	1.7	∞

	Uncertainties of the DUT							
13	—Position of the DUT	A	4.8	N	3	1	4.8	5
14	—Holder of the DUT	A	7.1	N	3	1	7.1	5
15	—Repeatability of the WD	B	5.0	R	1.732	1	2.9	∞
	Acoustic noise							
16	—Acoustic noise	B	1.0	R	1.732	1	0.6	∞
21	—Cable loss	B	0.46	N	1.732	1	0.46	∞
Combined Standard Uncertainty				RSS			17.26	42.33
Expanded uncertainty (Confidence interval of 95 %)				K=2			34.52	

9. MAIN TEST INSTRUMENTS

No.	EQUIPMENT	TYPE	Series No.	Cal. Date	Due Date
1	T-Coil Probe	SATIMO/STCOIL	SN 24/13 TCP28	2019/03/04	2020/03/04
2	TMFS	SATIMO/STMFS	SN 07/14 TMFS24	2019/09/01	2020/09/01
3	Amplifier	Nucletudes	143060	2019/04/04	2020/04/04
4	Multimeter	Keithley - 2000	4014020	2019/04/04	2020/04/04
5	Wireless Communication Tester	CMU200	A0304212	2019/06/10	2019/06/10

10. ANNEX A SYSTEM SETUP

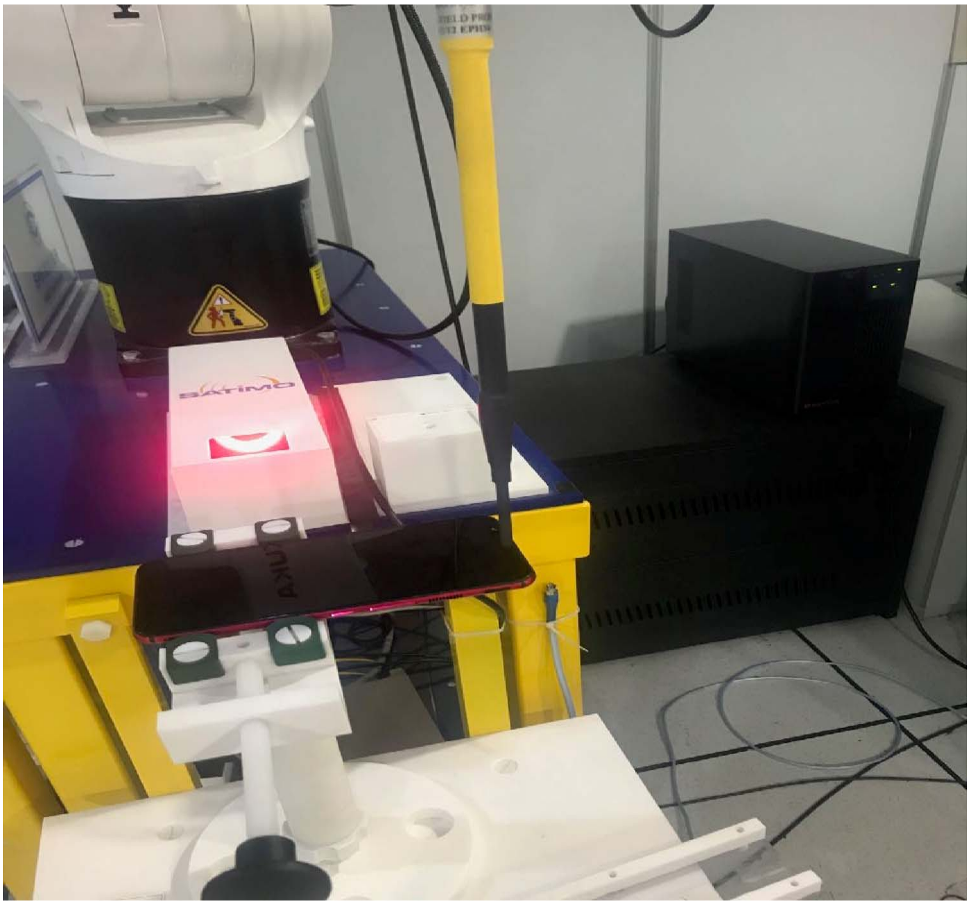
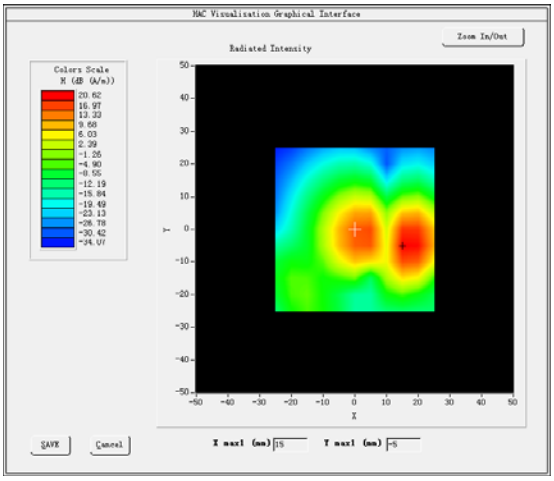
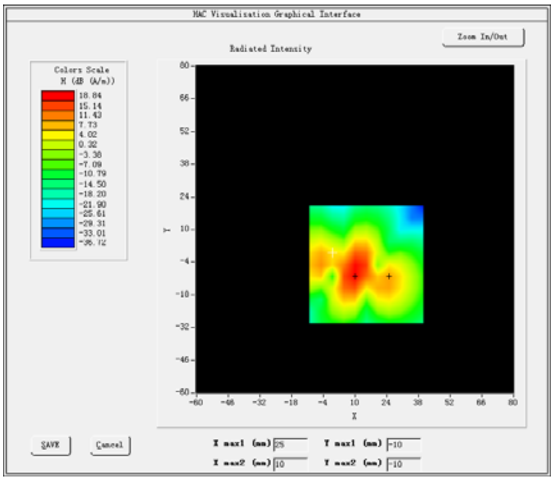
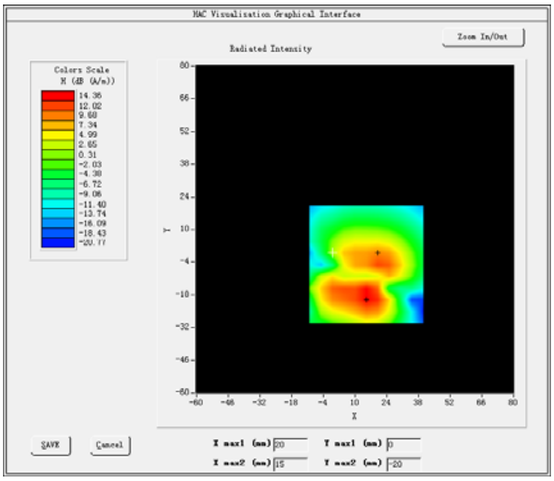


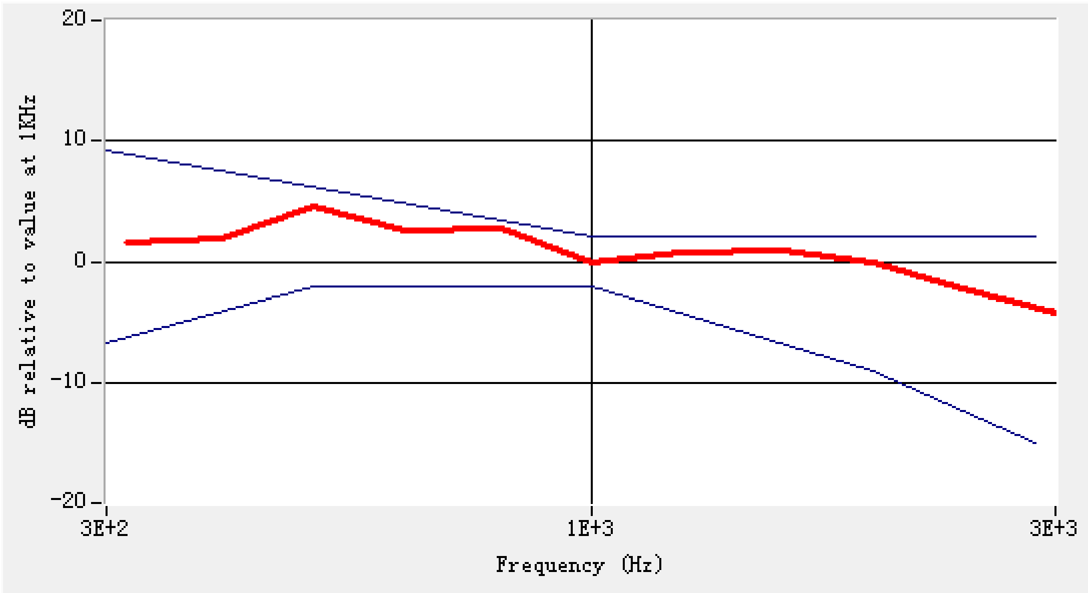
Fig.1 Testing Photo

11. ANNEX D TEST PLOTS

<u>Worst-Case Test Plot GSM1900</u> Frequency (MHz): 1880.00000

AXIAL ABM1	RADIAL H ABM1
	
RADIAL V ABM1	
	

Magnetic field frequency response (field that exeeds -15 dB)



Test Summary

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	GSM	GSM1900	Intensity, Axial	-18	Max	20.62	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.37	-	PASS
				-18	Left side	18.84	-	PASS
7.3.1.2			Intensity, RadialV	-18	Upper side	7.92	-	PASS
				-18	Lower side	15.35	-	PASS
7.3.3			Signal to noise/noise, Axial	20	Max	35.49	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	27.26	T3	PASS
				20	Left side	37.28	T4	PASS
7.3.3			Signal to noise/noise, RadialV	20	Upper side	24.93	T3	PASS
				20	Lower side	20.62	T3	PASS
7.3.2			Frequency reponse, Axial	0	-	0.56	-	PASS

12. ANNEX E CALIBRATION REPORT

COMOHAC T-coil Probe Calibration Report

Ref : ACR.66.3.19.SATU.A

CCIC SOUTHERN ELECTRONIC PRODUCT TESTING (SHENZHEN) CO., LTD
ELECTRONIC TESTING BUILDING, NO. 43 SHAHE ROAD, XILI JIEDAO, NANSHAN DISTRICT
SHENZHEN, GUANGDONG, CHINA
MVG COMOHAC T-COIL PROBE
SERIAL NO.: SN 24/13 TCP28

Calibrated at MVG US
2105 Barrett Park Dr. - Kennesaw, GA 30144

Calibration Date: 03/04/19

Summary:

This document presents the method and results from an accredited COMOHAC T-coil Probe calibration performed in MVG USA using the COMOHAC test bench, for use with a MVG COMOHAC system only. All calibration results are traceable to national metrology institutions.

COMOHAC T-COIL PROBE CALIBRATION REPORT

Ref: ACR.66.3.19.SATU.A

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	3/7/2019	
Checked by :	Jérôme LUC	Product Manager	3/7/2019	
Approved by :	Kim RUTKOWSKI	Quality Manager	3/7/2019	

	Customer Name
Distribution :	CCIC SOUTHERN ELECTRONIC PRODUCT TESTING (SHENZHEN) CO., LTD

Issue	*Date*	*Modifications*
A	3/7/2019	Initial release

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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

A yearly calibration interval is recommended.

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 guideline outlined in the IEEE ANSI C63.19 standard was followed to generate the measurement uncertainty for validation measurements. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

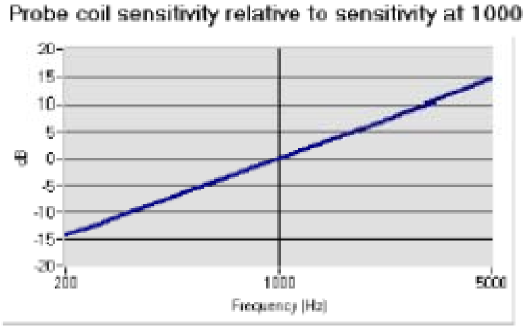
Uncertainty analysis of the T-coil probe calibration

Uncertainty Component	Tol. (± dB)	Prob. Dist.	Div.	Uncertainty (dB)	Uncertainty (%)
Current/Volage Accuracy	0.224	R	√3	0.13	
Acoustic/ Signal Source drift	0.008	R	√3	0.00	
Probe coil sensitivity	0.2	R	√3	0.12	
Positioning accuracy	0.4	R	√3	0.23	
Acoustic Signal Receive Accuracy	0.03	R	√3	0.02	
Acoustic Signal Receive Linearity	0.006	R	√3	0.00	
System repeatability	0.4	N	1	0.40	
Combined Standard Uncertainty		N	1	0.49	
Expanded uncertainty (confidence level of 95%, k = 2)		N	k=2	1.00	12.0

5 CALIBRATION MEASUREMENT RESULTS

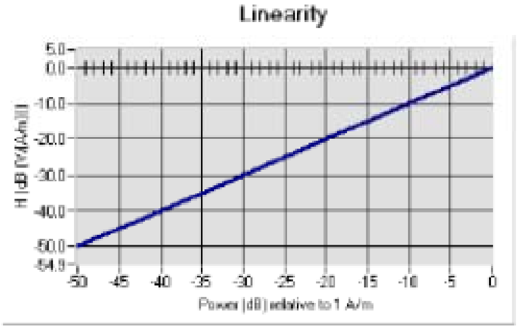
Calibration Parameters	
Lab Temperature	21°C
Lab Humidity	45%

5.1 SENSITIVITY



	Measured	Required
Sensitivity at 1 kHz	-60.24 dB (V/A/m)	–60.5 +/- 0.5 dB (V/A/m)
Max. deviation from Sensitivity	0.40 dB	+/- 0.5 dB

5.2 LINEARITY



	Measured	Required
Linearity Slope	0.05 dB	+/ 0.5 dB

5.3 SIGNAL TO NOISE MEASUREMENT OF THE CALIBRATION SYSTEM

	Measured	Required
Signal to Noise	-77.96 dB A/m	'Reading with -50 dB A/m in coil' – 'no signal applied' > 10 dB

6 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	02/2017	02/2020
Reference Probe	MVG	TCP 18 SN 47/10	10/2018	10/2019
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Helmholtz Coil	MVG	HC07 SN47/10	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	150798832	11/2017	11/2020

———End of the Report———