T-Coil HAC TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

4G Smart Phone

ISSUED TO
Guizhou Fortuneship Technology Co., Ltd.

(No. 4 Plant, High-tech Industrial Park, Xinpu Economic Development Zone) Jingkai Road, Xinpu Jingkai District, Xinpu New District, Zunyi City, Guizhou Province, P. R. China

Tested by: Zong Liyao
Zong Liyao
(Engineert)
Date Dec. 21, 2017

Approved by:
Liao Jianming
(Technical Director)
Date Dec. 21, 2017

Report No.:	BL-SZ17B0271-702
EUT Name:	4G Smart Phone
Model Name:	C145
Brand Name:	NC1
FCC ID:	2ALQJB125C
Test Standard:	FCC 47 CFR Part 20.19 ANSI C63.19: 2011 KDB 285076 D01 HAC Guidance v05
T-Rating:	T-Coil: T4
Test conclusion:	Pass
Test Date:	Nov. 29, 2017
Date of Issue:	Dec. 21, 2017

Block B, 1st FL,Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong, P. R. China 518055
TEL: +86-755-66850100
FAX: +86-755-61824271
www.baluntek.com

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Dec. 13, 2017	Initial Issue
Rev. 02	Dec. 18, 2017	Updated the Test Standard version on cover page; Updated the section 2.7 on page 8; Updated the section 3.1 Test Standard on page 9; Updated the ANNEX B on page 25-48. Updated the Test Photo in the document “BL-SZ17B0271-T-coil. PDF”.
Rev. 03	Dec. 21, 2017	Added note for OTT capabilities on page 8. Updated the Test Standard version in section 10.

TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100
Fax Number	+86 755 6182 4271

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory is a testing organizatin accredited by FCC as a accredited testing laboratory. The designation number is CN1196. The laboratory is a testing organization accredited by American Association for Laboratory Accreditation (A2LA) according to ISO/IEC 17025.The accreditation certificate is 4344.01. The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Test Environment Condition

Ambient Temperature	21 to 23 ℃
Ambient Relative Humidity	42 to 53 %
Ambient Pressure	100 to 102 kPa

1.4 Announce

(1) The test report reference to the report template version v1.1.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.

(5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.

(6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Guizhou Fortuneship Technology Co., Ltd.
Address	(No. 4 Plant, High-tech Industrial Park, Xinpu Economic Development Zone) Jingkai Road, Xinpu Jingkai District, Xinpu New District, Zunyi City, Guizhou Province, P. R. China

2.2 Manufacturer Information

Manufacturer	Guizhou Fortuneship Technology Co., Ltd.
Address	(No. 4 Plant, High-tech Industrial Park, Xinpu Economic Development Zone) Jingkai Road, Xinpu Jingkai District, Xinpu New District, Zunyi City, Guizhou Province, P. R. China

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	4G Smart Phone
EUT Model Under the test	C145
Series Model Name	N/A
Difference description	N/A
Hardware Version	S525_MAIN_PCB_V1.0
Software Version	S525_D1_LS020E_V1.0_20171104
Dimensions	N/A
Weight	N/A
Network and Wireless connectivity	2G Network GSM 850/900/1900; 3G Network WCDMA Band 2/5; 4G Network LTE Band 2/4/7/12/17; WIFI 802.11b, 802.11g and 802.11n (HT20/40) Bluetooth, GPS, GLONASS

2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	N/A
	Model No.	BTGLIBAT-B125C
	Serial No.	N/A
	Capacitance	1950 mAh
	Rated Voltage	3.8 V
	Limit Charge Voltage	4.2 V

2.6 Technical Information

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	GSM, WCDMA, LTE, WLAN, Bluetooth		
Frequency Range	GSM 850	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	GSM 1900	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	WCDMA Band 2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	WCDMA Band 5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE Band 2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE Band 4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	LTE Band 7	TX: 2500 ~ 2570 MHz	RX: 2620 ~ 2690 MHz
	LTE Band 12	TX: 699 ~ 716 MHz	RX: 729 ~746 MHz
	LTE Band 17	TX: 704 ~ 716 MHz	RX: 734 ~ 746 MHz
	802.11b/g	2400 ~2483.5 MHz	
	802.11n (HT20/HT40)	2400 ~2483.5 MHz	
	Bluetooth	2400 ~2483.5 MHz	
Antenna Type	PIFA Antenna		
Hotspot Function	Support		
Exposure Category	General Population/Uncontrolled exposure		
EUT Stage	Portable Device		

2.7 EUT Air Interface description

Air Interface	Band	Type	C63.19 Tested	Simultaneous Transmitter	OTT	Power Reduction
GSM	850	VO	Yes	Bluetooth/WLAN	NA	Not Support
	1900	VO	Yes	Bluetooth/WLAN	NA	Not Support
	GPRS/EDGE	DT	No	Bluetooth/WLAN	Yes	Not Support
WCDMA	Band 2	VO	Yes	Bluetooth/WLAN	NA	Not Support
	Band 5	VO	Yes	Bluetooth/WLAN	NA	Not Support
	HSUPA/HSDPA	DT	No	Bluetooth/WLAN	Yes	Not Support
LTE	Band 2	DT	No	Bluetooth/WLAN	Yes	Not Support
	Band 4	DT	No	Bluetooth/WLAN	Yes	Not Support
	Band 7	DT	No	Bluetooth/WLAN	Yes	Not Support
	Band 12	DT	No	Bluetooth/WLAN	Yes	Not Support
	Band 17	DT	No	Bluetooth/WLAN	Yes	Not Support
2.4G WLAN	2450	DT	No	WWAN	Yes	Not Support
Bluetooth	2450	DT	No	WWAN	NA	Not Support

VO=CMRS Voice Service
DT=Digital Transport
VD=CMRS IP Voice Service and Digital Transport
Note: The manufacturer not install applications to support VoIP function for this product.

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	FCC 47 CFR Part 20.19	Hearing aid-compatible mobile handsets.
2	ANSI C 63.19:2010	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
4	KDB 285076 D02 T-Coil testing for CMRS IP v03	Guidance for Performing T-COIL Tests for Air interfaces Supporting Voice Over IP (E.G., LTE AND WI-FI) to Support CMRS Based Telephone Services.

3.2 HAC Test Configuration and Setting

For HAC T-Coil testing, the EUT was linked and controlled by wireless communication test set. Communication between the EUT and the wireless communication test set was established by coaxial connection. The EUT was set from the wireless communication test set to radiate maximum output power during HAC testing.

3.3 Summary Of HAC T-Rating

Band	T-Rating	Frequency response
GSM 850 (Voice)	T4	PASS
GSM 1900 (Voice)	T4	PASS
WCDMA Band 2 (Voice)	T4	PASS
WCDMA Band 5 (Voice)	T4	PASS

3.4 ANSI C63.19 HAC T-Coil Categories

3.4.1 T-Coil Field Intensity

When measured as specified in this standard, the T-Coil signal shall be ≥ –18 dB (A/m) at 1 kHz, in a 1/3 octave band filter for all orientations.

3.4.2 T-Coil Signal Quality

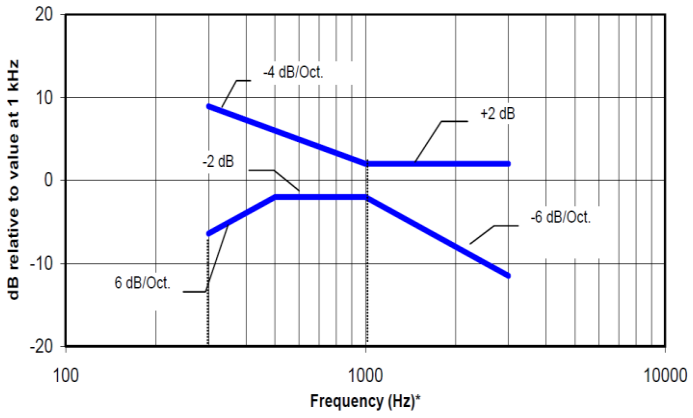
The table below provides the signal quality requirement for the intended audio magnetic signal from a wireless device. Only the RF immunity of the hearing aid is measured in T-coil mode. It is assumed that a hearing aid can have no immunity to an interference signal in the audio band, which is the intended 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.

Category	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
Magnetic Coupling Parameters	

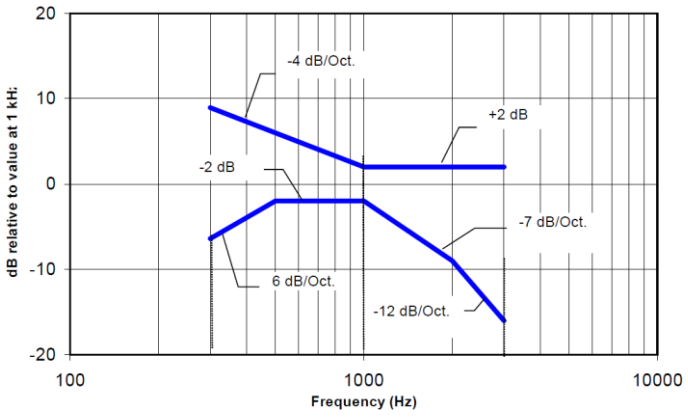
3.4.3 Frequency Response

The frequency response of the axial component of the magnetic field, measured in 1/3 octave bands, shall follow the below response curve, over the frequency range 300 Hz to 3000 Hz. Following Figures 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.

≤ –15 dB (A/m) at 1 kHz



> –15 dB(A/m) at 1 kHz



Note: Frequency response is between 300 Hz and 3000 Hz.

3.5 HAC Test Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in ANSI C 63.19:2011.This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Uncertainty Component	Uncertainty Value	Prob. 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	1.17	1.17
Sensor Displacement	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 tp PMR Calibration	9.02	N	1.000	1	1	9.02	9.02
System detection limits	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
Test sample Related							
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
Combined Std. Uncertainty(k=1)						16.18	13.25
Expanded Uncertainty on Power						32.35	26.50
Expanded Uncertainty on Field						16.18	13.25

4 SATIMO HSC MEASUREMENT SYSTEM

4.1 Definition of Hearing Aid Compatibility (HAC)

On July 10.2003.the Federal Communications Commission (FCC) adopted new rules requiring wireless manufacturers and service providers to provide digital wireless phones that are compatible with hearing aids. The FCC has modified the exemption for wireless phones under the Hearing Aid Compatibility Act of 1998 (HAC Act) in WT Docket 01-309 RM-8658 to extend the benefits of wireless telecommunications to individuals with hearing disabilities. These benefits encompass business, social and emergency communications, which increase the value of the wireless network for everyone. An estimated more than 10% of the population in the United States show signs of hearing impairment and of that fraction, almost 80% use hearing aids. Approximately 500 million people worldwide suffer from hearing loss.

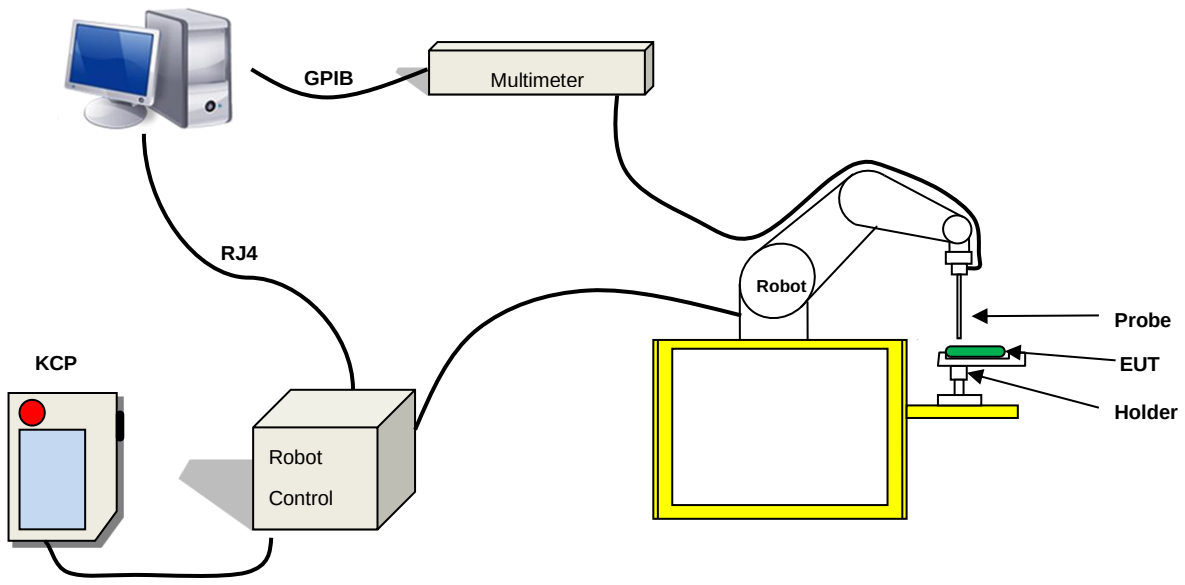
Compatibility Tests involved:

The standard calls for wireless communications devices to be measured for:
- RF Electric-field emissions.
- RF Magnetic- field emissions.
- T-coil mode, magnetic-signal strength in the audio band.
- T-coil mode, magnetic-signal frequency response through the audio band.
- T-coil mode, magnetic-signal and noise articulation index.

The hearing aid must be measured for:
- RF immunity in microphone mode
- RF immunity in T-coil mode

4.2 SATIMO HAC System

SATIMO HAC System Diagram:



4.2.1 Robot

The SATIMO HAC system uses the high precision robots from KUKA. For the 6-axis controller system, the robot controller version (KUKA) from KUKA is used. The KUKA robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

4.2.2 HAC T-Coil Probe

Serial Number:	SN 46/15 TCP34
Frequency:	200Hz – 5000Hz
Probe length:	220mm
Length of Coil:	6.55mm
Diameter of Coil:	2.29mm
Resistance:	860.6
Wire size:	51 AWG
Inductance at 1 KHz:	132.1 mH at 1 KHz

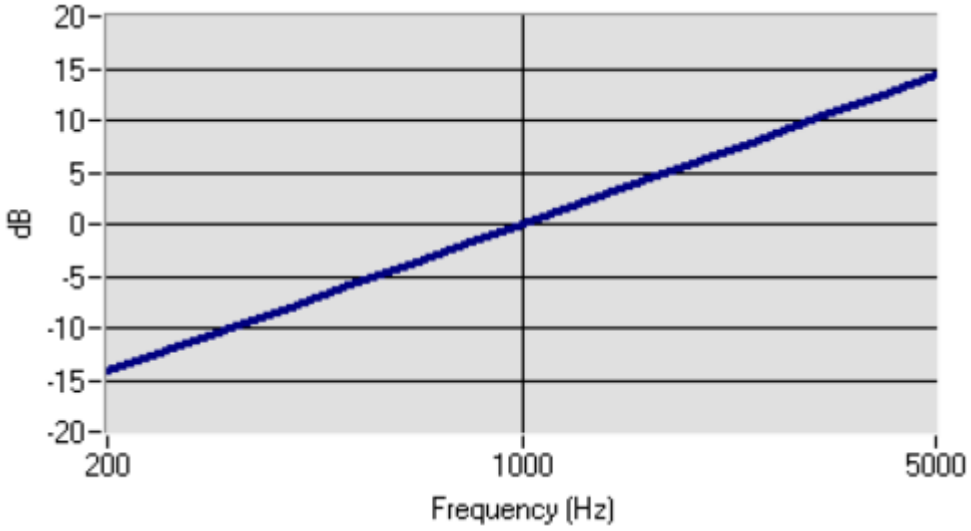
T-Coil Probe Calibration Process

All methods used to perform the measurements and calibrations comply with the ANSI C63.19 and IEEE 1309 standards.

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.

Probe Coil sensitivity relative to sensitivity at 1000 Hz

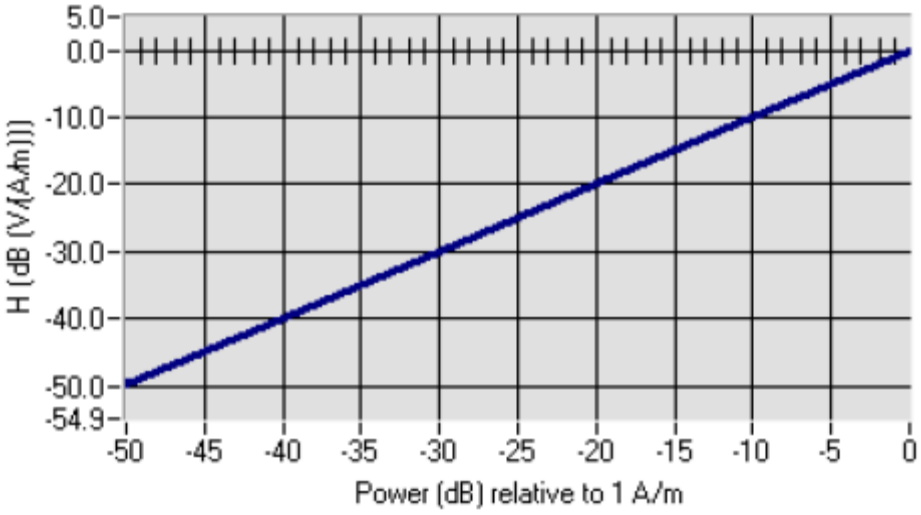


	Measured	Required
Sensitivity at 1 KHz	-60.19 dB (V/A/m)	- 60.5 +/- 0.5 dB (V/A/m)
Max. deviation from Sensitivity	0.40 dB	+/- 0.5 dB

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).

Linearity



	Measured	Required
Linearity Slope	0.09 dB	+/ 0.5 dB

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.

	Measured	Required
Signal to Noise	-63.14 dB A/m	‘Reading with -50 dB A/m in coil’ – ‘no signal applied’ > 10 dB

5 T-Coil AUDIO VALIDATION

5.1 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.

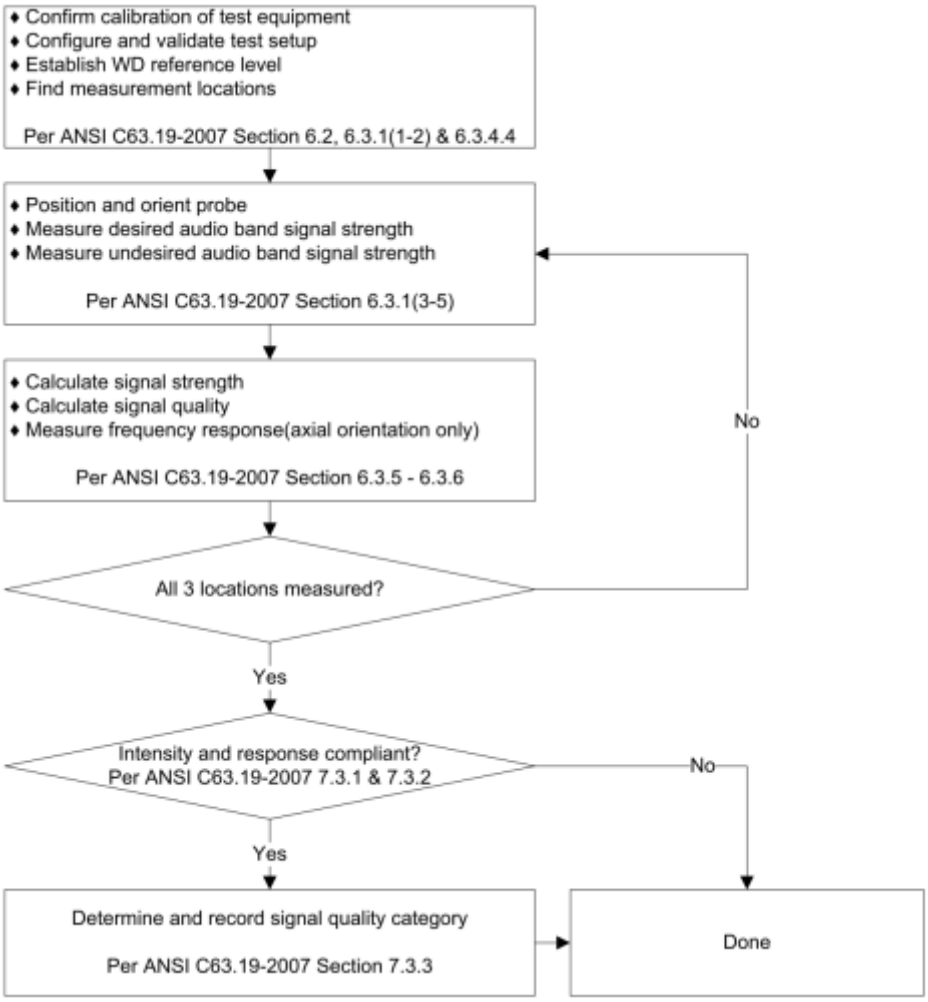
In phase 3, a multi-sine signal covering each third-octave band from 50 Hz to 10 kHz is generated and applied to both audio outputs. The probe should be positioned in the center of the AMCC and aligned in the z-direction, the field orientation of the AMCC. The “Coil In” channel is measuring the voltage 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..

5.2 System Validation Results

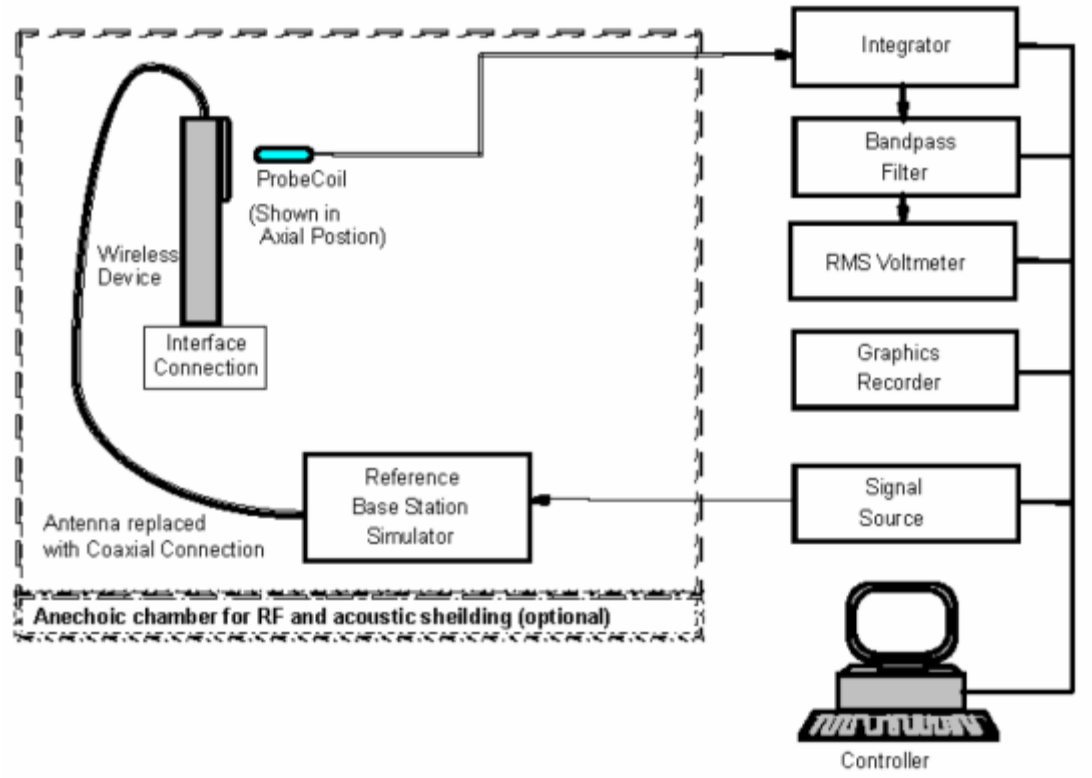
Date	Frequency	Input Level (mV)	Axial Description	Location	Magnetic Field (dB A/m)	Target Field (dB A/m)	Tolerance (%)
2017/11/29	1025 Hz	500.0	Axial	Max	-13.82	-13.34	3.60
			Radial H	Right side	-21.06	-19.93	5.67
				Left side	-20.69	-19.25	7.48
			Radial V	Right side	-20.96	-19.56	7.16
				Left side	-20.01	-18.55	7.87
Note: The tolerance limit of System validation ±10%.							

6 HAC MEASUREMENT PROCEDURES

6.1 HAC Measurement Process Diagram



6.2 HAC T-Coil Test Setup



T-Coil measurement test setup.

6.3 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 based on Table 7.7.

8 HAC T-Coil Test Results

Band	Ch.	Mode	Location	ABM1 (dB A/m)	Signal to noise (dB)	T-Rating	Frequency Response	Meas. No.
GSM 850 (Voice)	128	Axial	Max	21.67	48.27	T4	Pass	1#
		Radial H	Right side	9.53	34.43	T4		
			Left side	18.14	51.30	T4		
	190	Axial	Max	22.31	50.06	T4	Pass	2#
		Radial H	Right side	10.06	33.30	T4		
			Left side	19.54	53.34	T4		
	251	Axial	Max	21.72	48.78	T4	Pass	3#
		Radial H	Right side	9.87	31.48	T4		
			Left side	18.52	51.44	T4		
GSM 1900 (Voice)	512	Axial	Max	21.31	50.77	T4	Pass	4#
		Radial H	Right side	9.18	37.58	T4		
			Left side	17.32	51.36	T4		
	661	Axial	Max	21.77	51.31	T4	Pass	5#
		Radial H	Right side	9.6	35.91	T4		
			Left side	19.18	51.52	T4		
	810	Axial	Max	21.36	50.15	T4	Pass	6#
		Radial H	Right side	9.45	34.67	T4		
			Left side	17.81	52.21	T4		
WCDMA Band 2 (Voice)	9262	Axial	Max	21.47	52.59	T4	Pass	7#
		Radial H	Right side	9.51	45.43	T4		
			Left side	18	55.34	T4		
	9400	Axial	Max	21.88	53.45	T4	Pass	8#
		Radial H	Right side	9.69	45.97	T4		
			Left side	19.21	55.14	T4		
	9538	Axial	Max	21.33	52.13	T4	Pass	9#
		Radial H	Right side	9.45	46.97	T4		
			Left side	17.92	56.11	T4		
WCDMA Band 5 (Voice)	4132	Axial	Max	21.34	52.08	T4	Pass	10#
		Radial H	Right side	9.47	47.25	T4		
			Left side	17.99	56.03	T4		
	4182	Axial	Max	21.01	53.52	T4	Pass	11#
		Radial H	Right side	8.91	46.73	T4		
			Left side	17.87	54.59	T4		
	4233	Axial	Max	21.39	53.29	T4	Pass	12#
		Radial H	Right side	9.46	46.60	T4		
			Left side	17.96	55.20	T4		

9 TEST EQUIPMENTS LIST

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
PC	Dell	N/A	N/A	N/A	N/A
TMFS	MVG	STMFS	SN 24/16 TMFS27	2017/03/22	2018/03/21
T-coil Probe	MVG	STCOIL	SN 46/15 TCP34	2017/03/22	2018/03/21
RF coaxial Cable	MVG	N/A	N/A	N/A	N/A
MultiMeter	Keithley	MultiMeter 2000	4024022	2017/06/12	2018/06/11
Signal Generator	R&S	SMF100A	1167.0000k02/104260	2017/06/12	2018/06/11
Power Sensor	Agilent	E9300A	MY41498012	2017/11/02	2018/11/01
Power Sensor	Agilent	E9300A	MY41499891	2017/11/02	2018/11/01
Power Amplifier	SATIMO	6552B	22374	2017/06/12	2018/06/11
Wireless Communication Test Set	R&S	CMU 200	123666	2017/11/02	2018/11/01

10 REFERENCES

1 FCC 47 CFR Part 20.19 “Hearing aid-compatible mobile handsets.”

2 ANSI C 63.19:2011 “American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids”, 27 May 2011

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

4 KDB 285076 D02, T-Coil testing for CMRS IP v03 provides guidance for T-Coil tests for voice-over-IP (e.g. LTE and Wi-Fi) CMRS based Telephone Services.

4 SATIMO COMOHAC_V4

5 SATIMO OPENHAC_V4

ANNEX A HAC TEST RESULT OF SYSTEM VERIFICAION

T-coil System Check Data

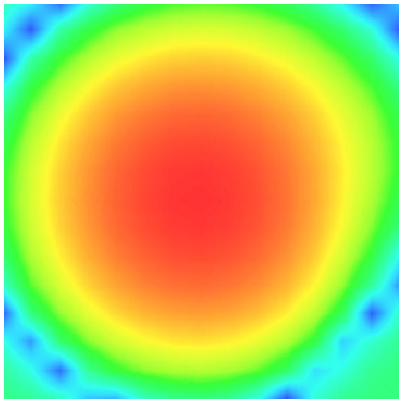
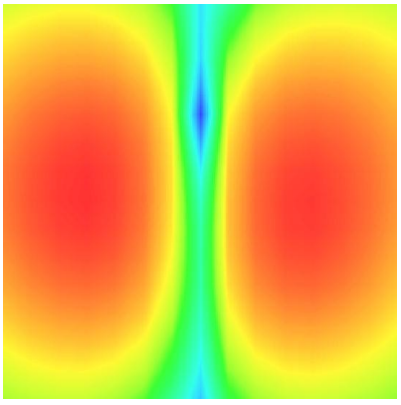
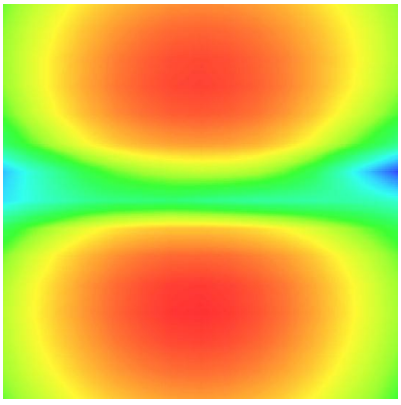
Experimental conditions

Grid size (mm x mm)	70.0, 70.0
Step (mm)	5
Band	-
Channel	-
Signal	Audio
Date of measurement	2017-11-29

HAC Measurement Results

Test Description	Minimum Limit	Location	Measured
	dBA/m	-	dBA/m
Intensity, Axial	-18	Max	-13.82
Intensity, RadialH	-18	Right side	-21.06
	-18	Left side	-20.69
Intensity, RadialV	-18	Upper side	-20.96
	-18	Lower side	-20.01

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H	RADIAL V
		

ANNEX B HAC RF MEASUREMENT RESULT

TABLE OF MEASUREMENT RESULT LIST

Band	Mode	PARAMETERS
GSM 850	T-Coil	Measurement 1: Low Channel Measurement 2: Middle Channel Measurement 3: High Channel
GSM 1900	T-Coil	Measurement 4: Low Channel Measurement 5: Middle Channel Measurement 6: High Channel
WCDMA Band2	T-Coil	Measurement 7: Low Channel Measurement 8: Middle Channel Measurement 9: High Channel
WCDMA Band5	T-Coil	Measurement 10: Low Channel Measurement 11: Middle Channel Measurement 12: High Channel

MEASUREMENT 1

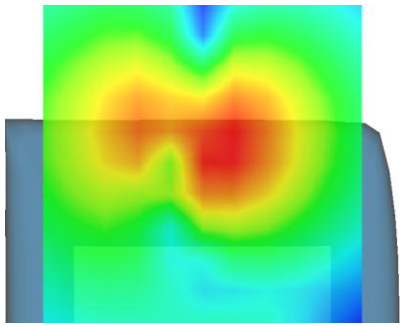
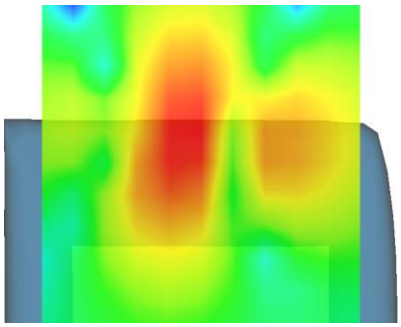
Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM850
Channel	Low
Signal	GSM
Date of measurement	2017-11-29

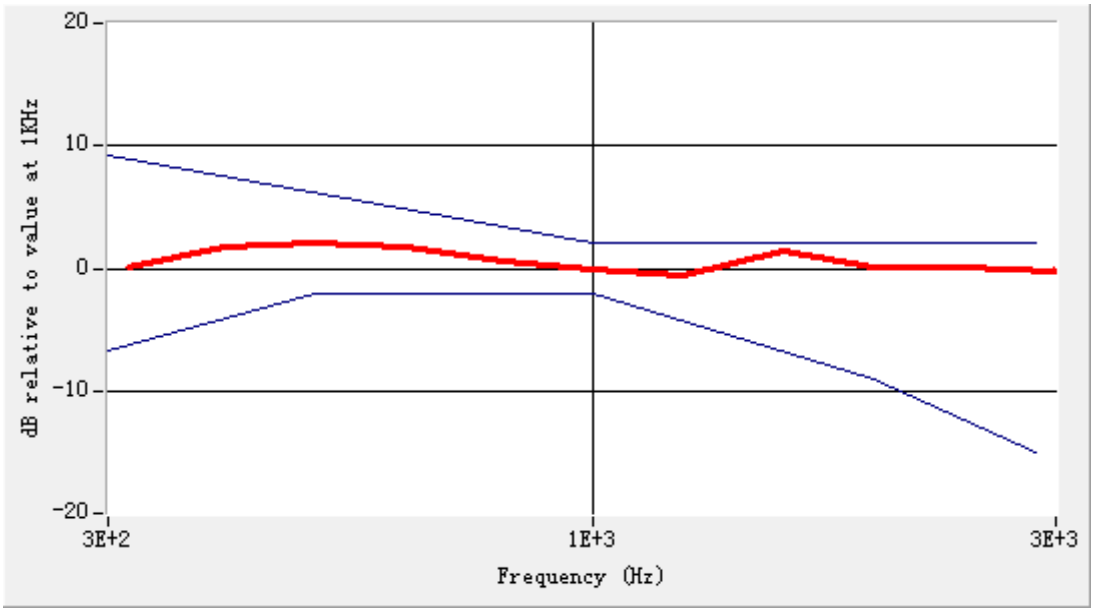
HAC Measurement Results

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	GSM	GSM850	Intensity, Axial	-18	Max	21.67	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.53	-	PASS
				-18	Left side	18.14	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	48.27	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	34.43	T4	PASS
				20	Left side	51.30	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	0.62	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response



MEASUREMENT 2

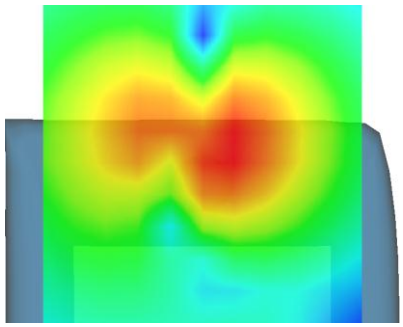
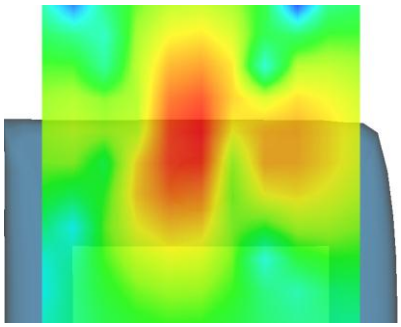
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM850
Channel	Middle
Signal	GSM
Date of measurement	2017-11-29

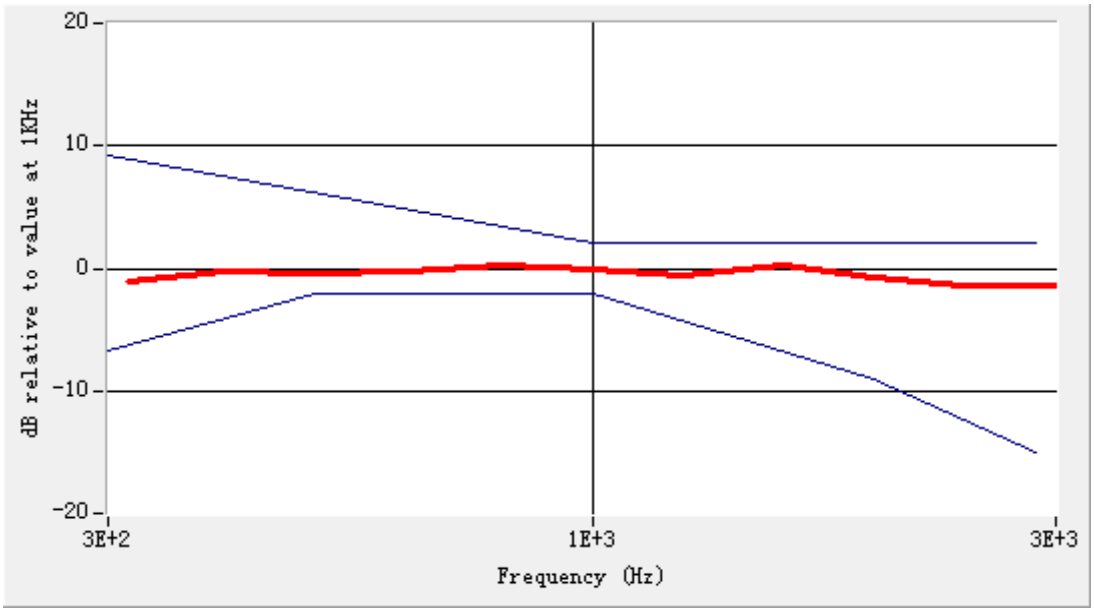
HAC Measurement Results

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	GSM	GSM850	Intensity, Axial	-18	Max	22.31	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	10.06	-	PASS
				-18	Left side	19.54	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	50.06	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	33.30	T4	PASS
				20	Left side	53.34	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	1.52	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response



MEASUREMENT 3

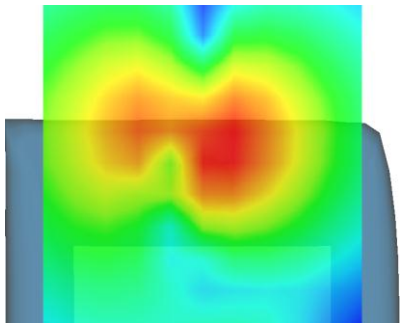
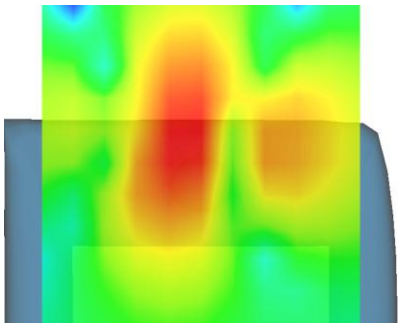
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM850
Channel	High
Signal	GSM
Date of measurement	2017-11-29

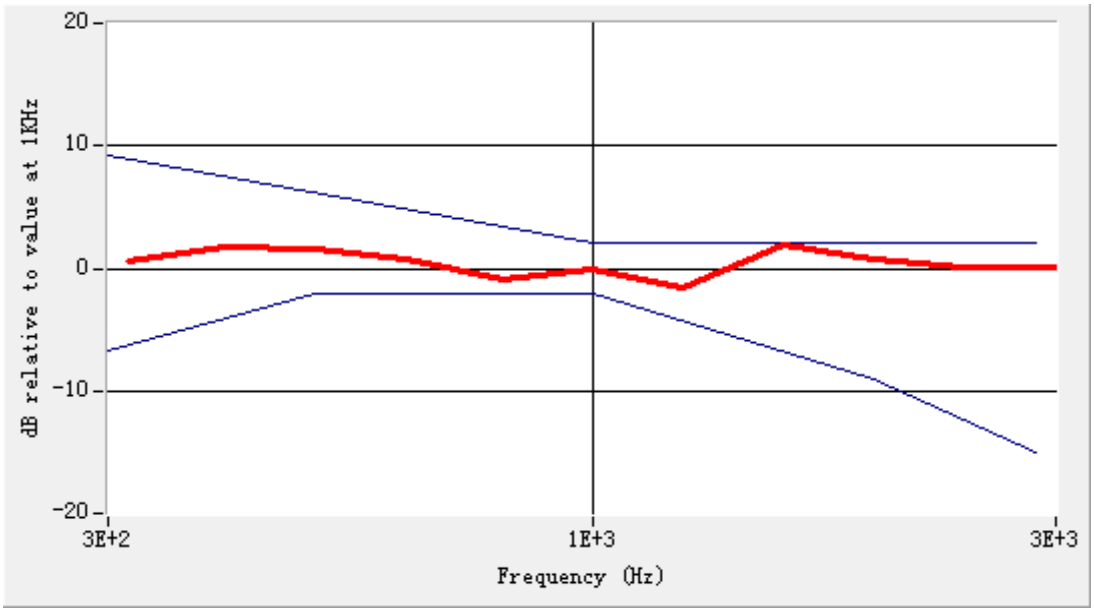
HAC Measurement Results

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	GSM	GSM850	Intensity, Axial	-18	Max	21.72	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.87	-	PASS
				-18	Left side	18.52	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	48.78	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	31.48	T4	PASS
				20	Left side	51.44	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	0.10	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response



MEASUREMENT 4

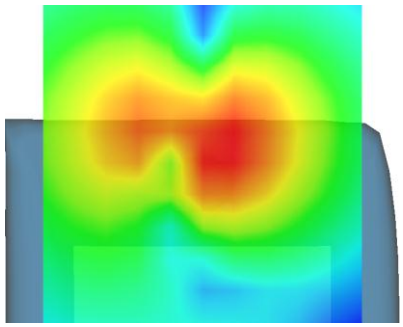
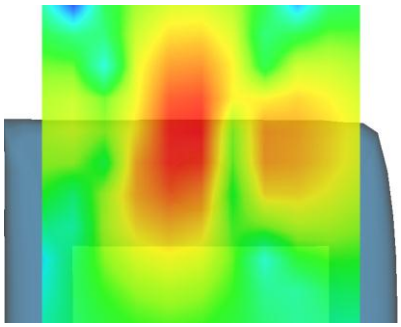
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM1900
Channel	Low
Signal	GSM
Date of measurement	2017-11-29

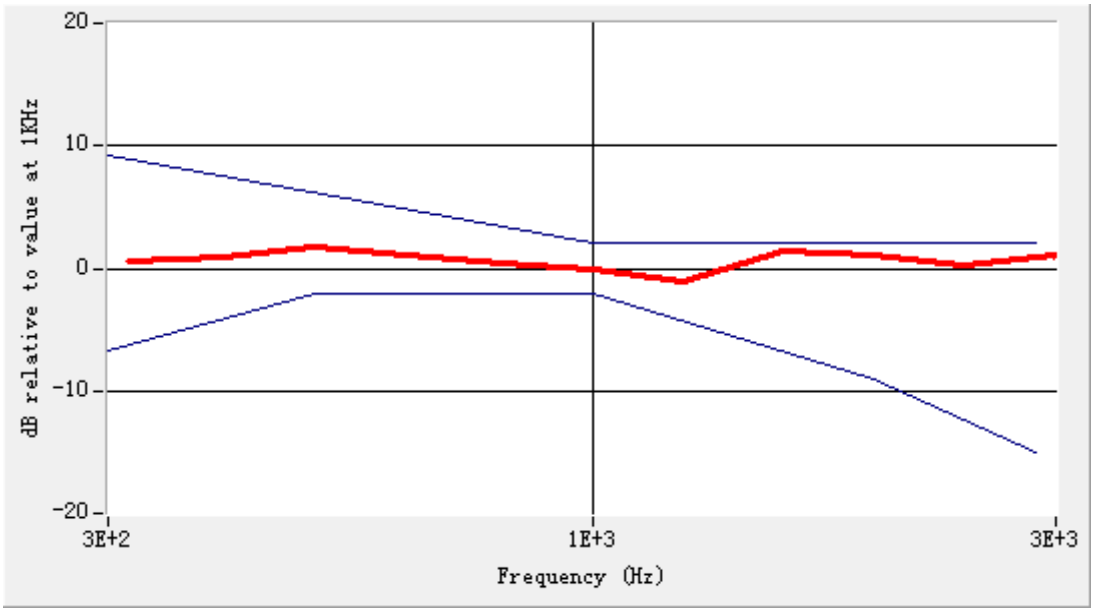
HAC Measurement Results

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	21.31	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.18	-	PASS
				-18	Left side	17.32	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	50.77	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	37.58	T4	PASS
				20	Left side	51.36	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	0.56	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response



MEASUREMENT 5

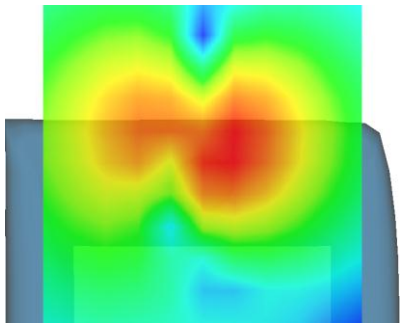
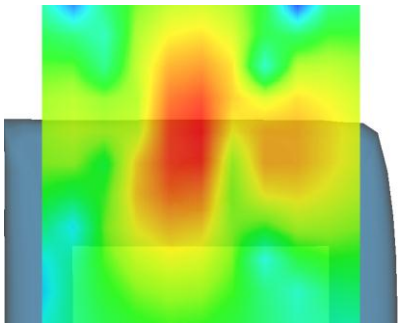
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM1900
Channel	Middle
Signal	GSM
Date of measurement	2017-11-29

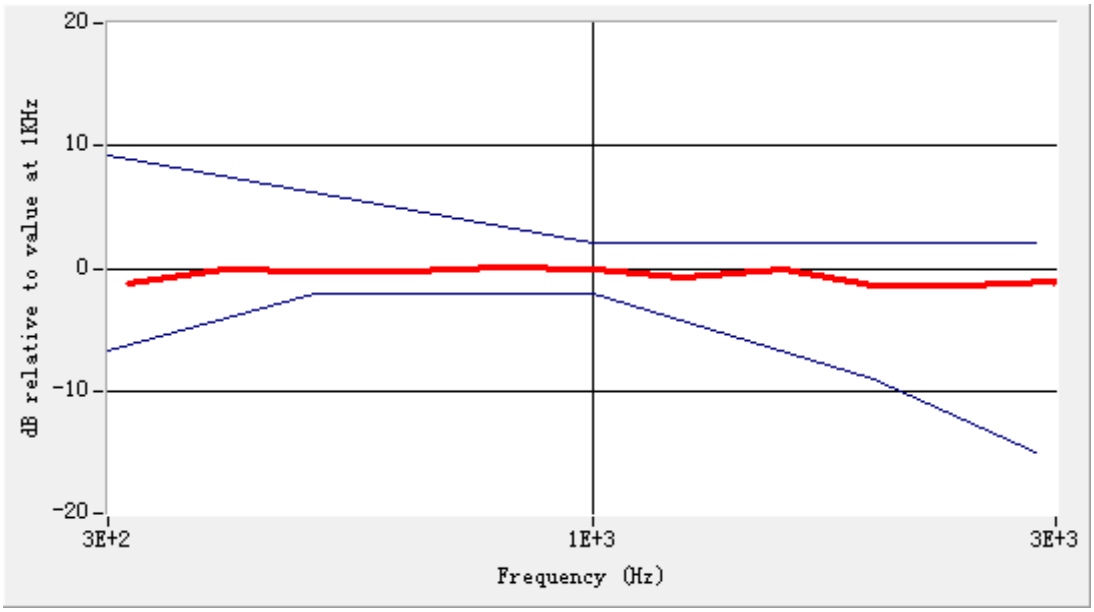
HAC Measurement Results

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	21.77	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.60	-	PASS
				-18	Left side	19.18	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	51.31	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	35.91	T4	PASS
				20	Left side	51.52	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	1.69	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response



MEASUREMENT 6

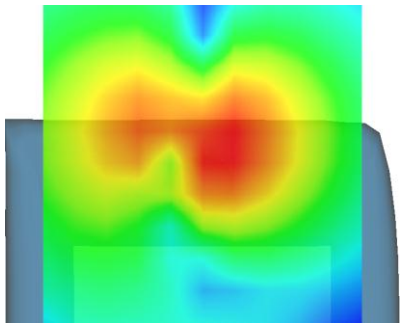
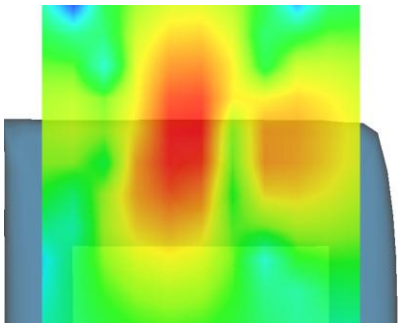
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM1900
Channel	High
Signal	GSM
Date of measurement	2017-11-29

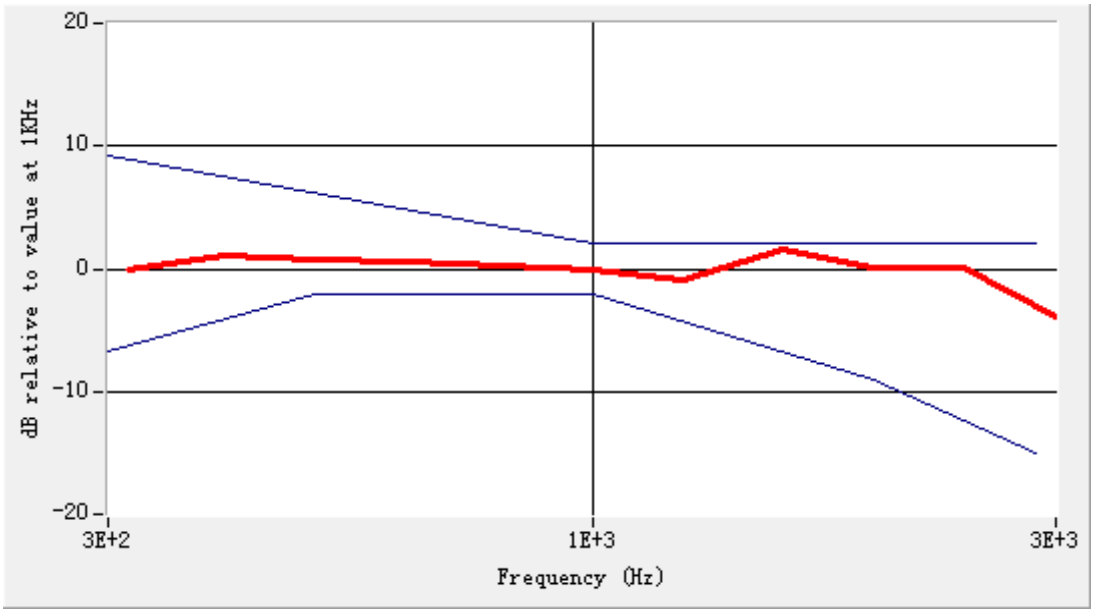
HAC Measurement Results

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	21.36	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.45	-	PASS
				-18	Left side	17.81	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	50.15	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	34.67	T4	PASS
				20	Left side	52.21	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	0.48	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response



MEASUREMENT 7

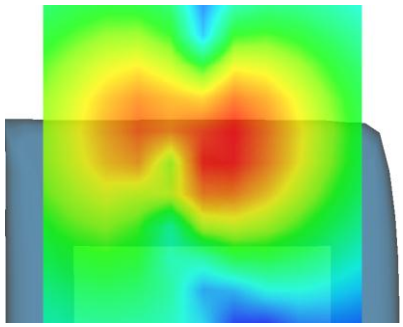
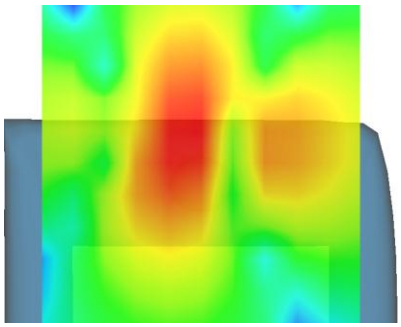
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	Band2_WCDMA1900
Channel	Low
Signal	WCDMA
Date of measurement	2017-11-29

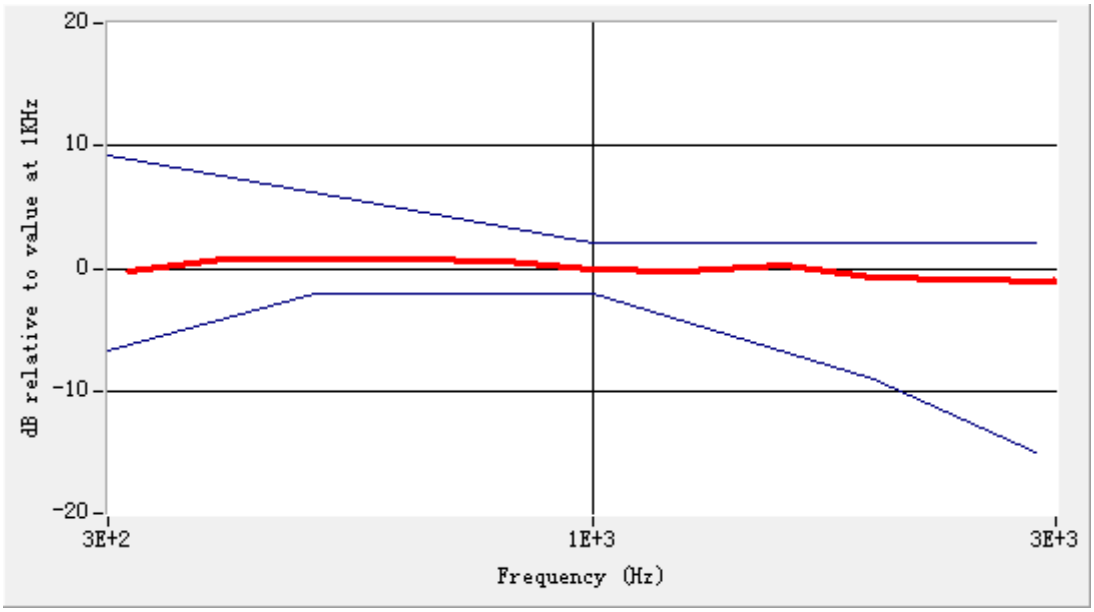
HAC Measurement Results

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	WCDMA	Band2_WCDMA1900	Intensity, Axial	-18	Max	21.47	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.51	-	PASS
				-18	Left side	18.00	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	52.59	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	45.43	T4	PASS
				20	Left side	55.34	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	1.77	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response



MEASUREMENT 8

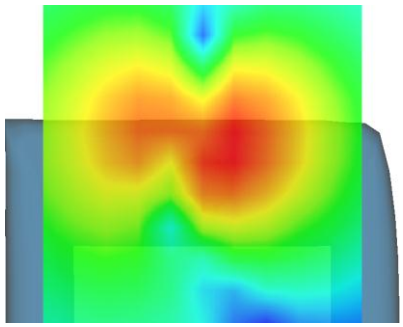
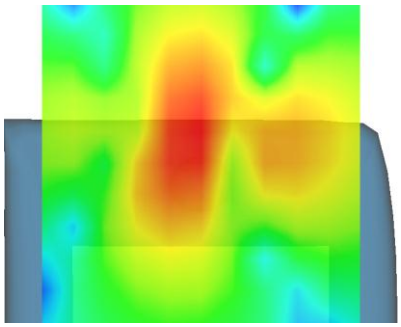
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	Band2_WCDMA1900
Channel	Middle
Signal	WCDMA
Date of measurement	2017-11-29

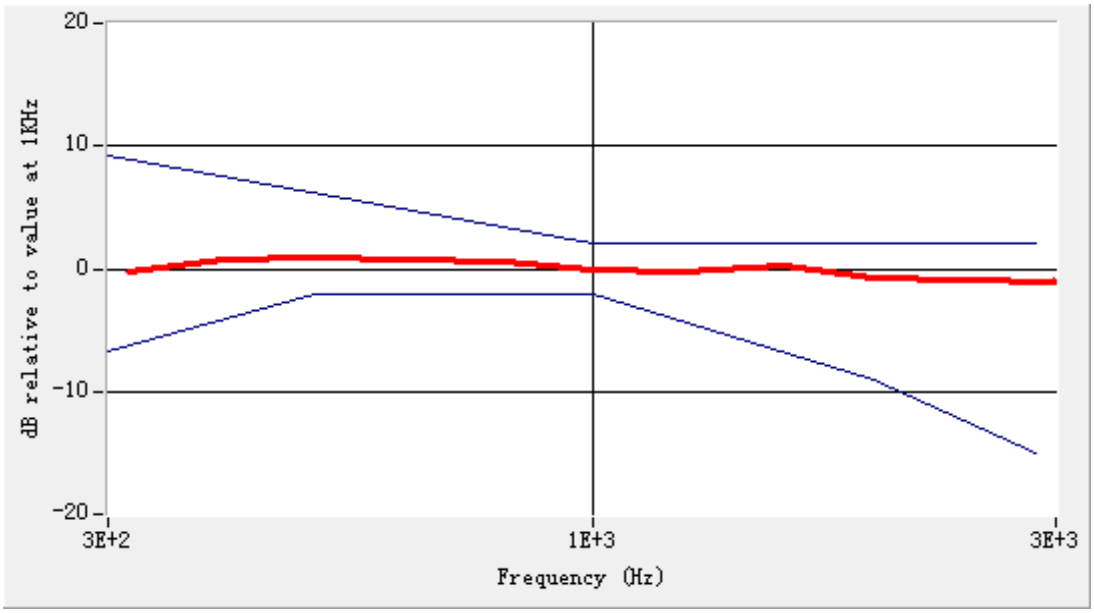
Test Summary

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	WCDMA	Band2_WCDMA1900	Intensity, Axial	-18	Max	21.88	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.69	-	PASS
				-18	Left side	19.21	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	53.45	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	45.97	T4	PASS
				20	Left side	55.14	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	1.77	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response



MEASUREMENT 9

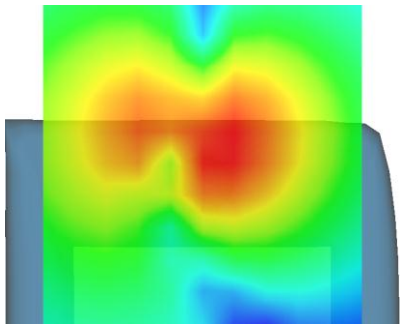
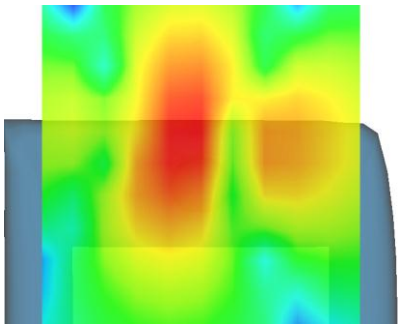
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	Band2_WCDMA1900
Channel	High
Signal	WCDMA
Date of measurement	2017-11-29

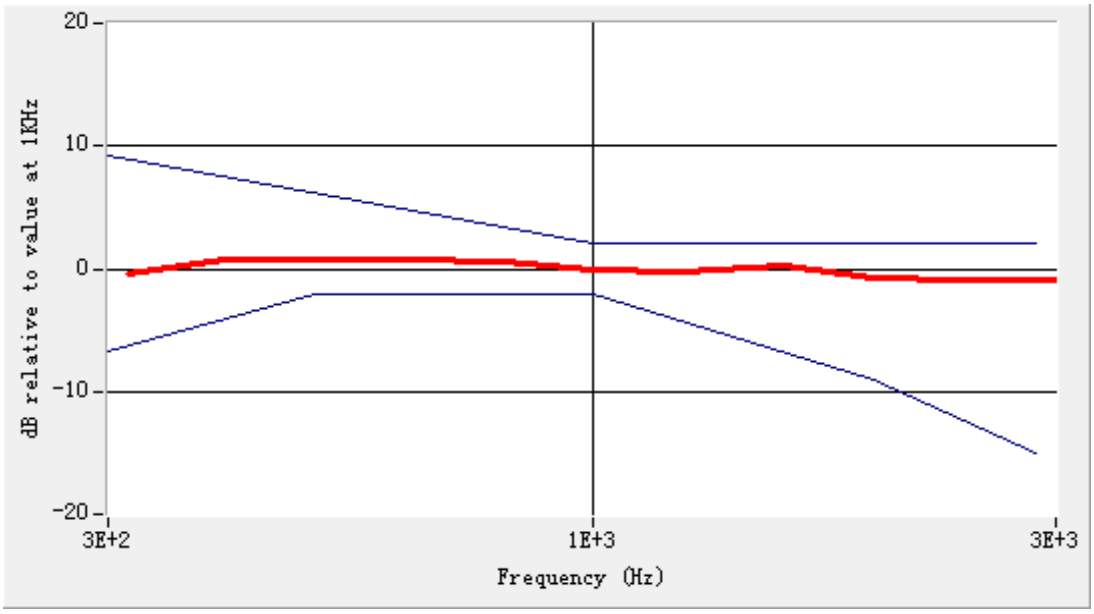
HAC Measurement Results

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	WCDMA	Band2_ WCDMA1900	Intensity, Axial	-18	Max	21.33	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.45	-	PASS
				-18	Left side	17.92	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	52.13	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	46.97	T4	PASS
				20	Left side	56.11	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	1.71	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response



MEASUREMENT 10

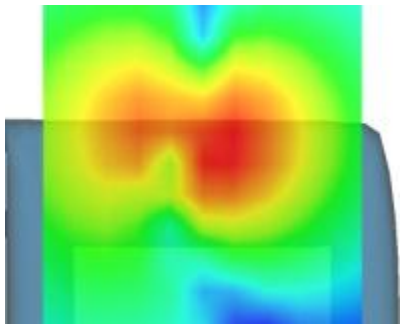
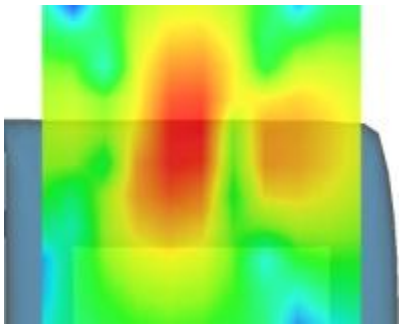
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Scanning Height (mm)	10.0
Band	Band5_WCDMA850
Channel	Low
Signal	WCDMA
Date of measurement	2017-11-29

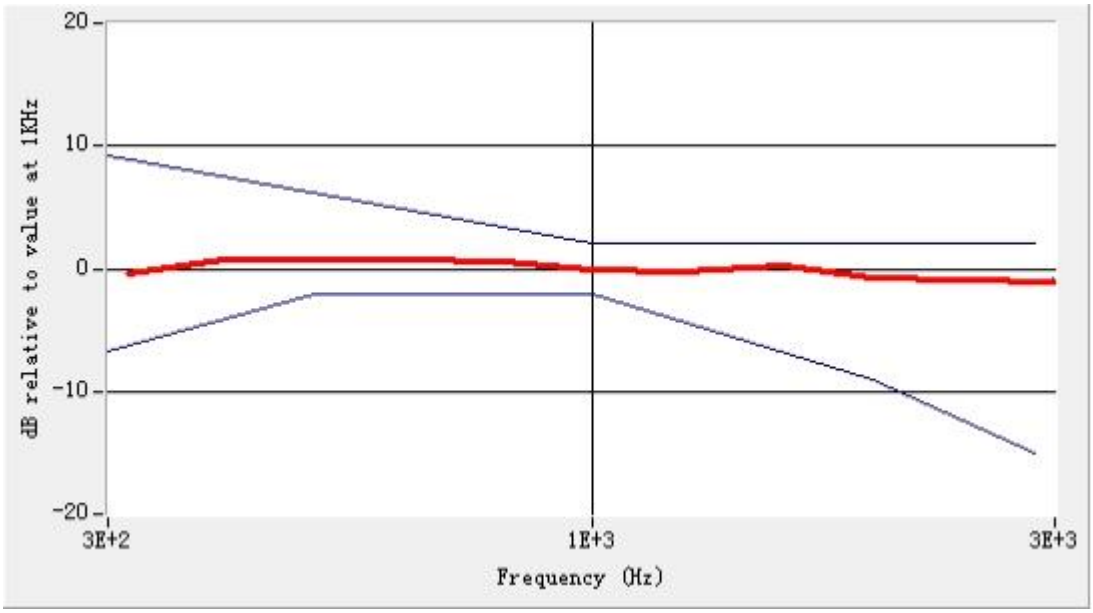
HAC Measurement Results

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	WCDMA	Band5_ WCDMA850	Intensity, Axial	-18	Max	21.34	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.47	-	PASS
				-18	Left side	17.99	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	52.08	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	47.25	T4	PASS
				20	Left side	56.03	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	1.74	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response (field that exeeds -15 dB)



MEASUREMENT 11

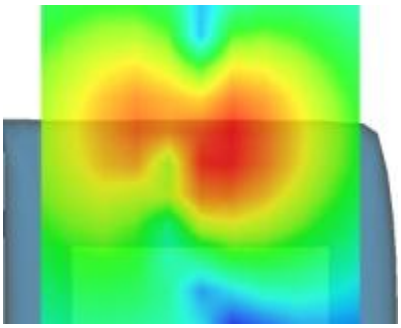
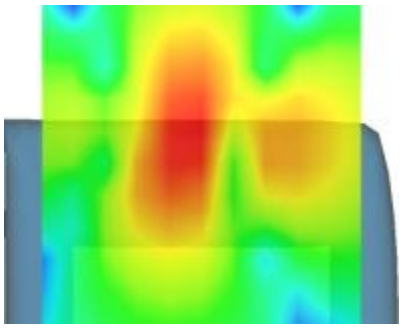
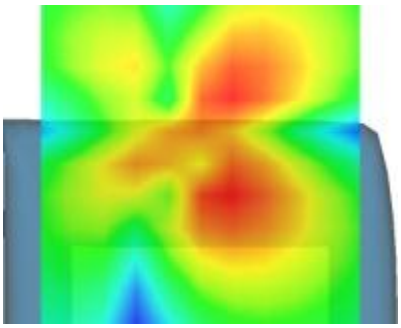
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Scanning Height (mm)	10.0
Band	Band5_WCDMA850
Channel	Middle
Signal	WCDMA
Date of measurement	2017-11-29

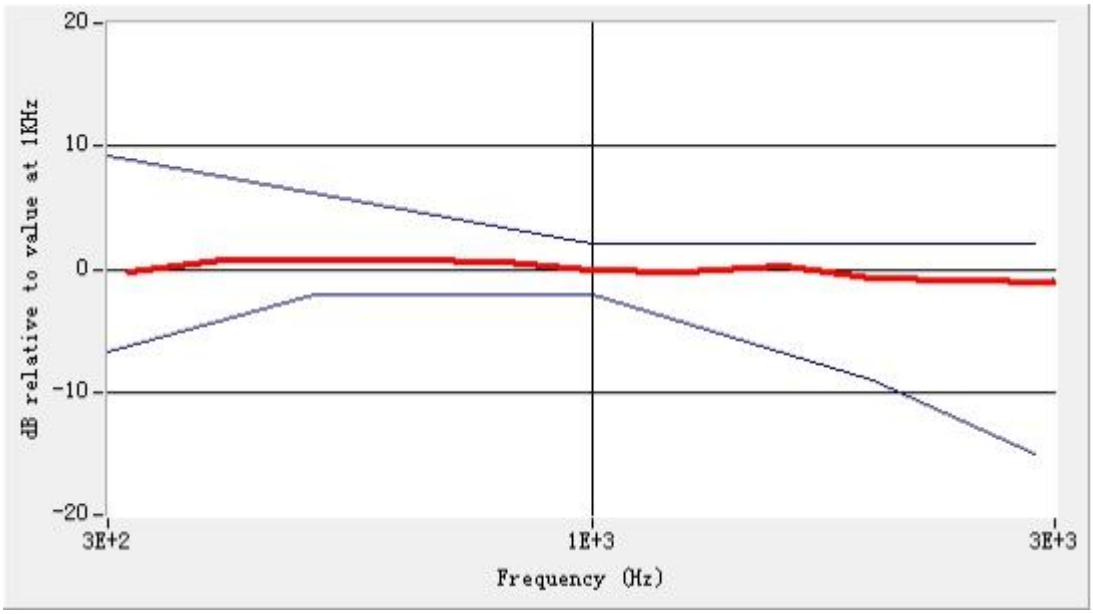
HAC Measurement Results

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	WCDMA	Band5_WCDMA850	Intensity, Axial	-18	Max	21.01	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	8.91	-	PASS
				-18	Left side	17.87	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	53.52	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	46.73	T4	PASS
				20	Left side	54.59	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	1.77	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H	RADIAL V
		

Frequency response (field that exeeds -15 dB)



MEASUREMENT 12

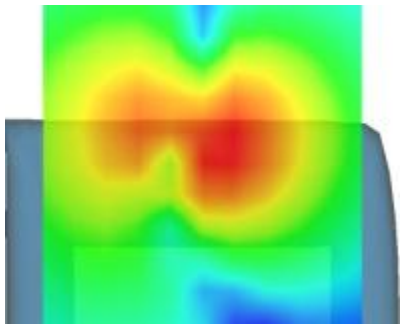
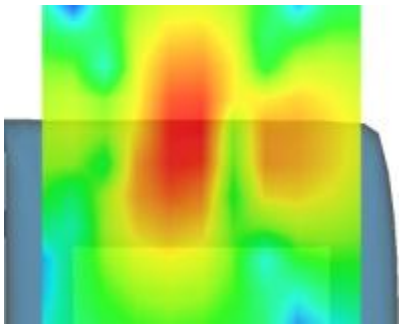
Experimental conditions.

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Scanning Height (mm)	10.0
Band	Band5_WCDMA850
Channel	High
Signal	WCDMA
Date of measurement	2017-11-29

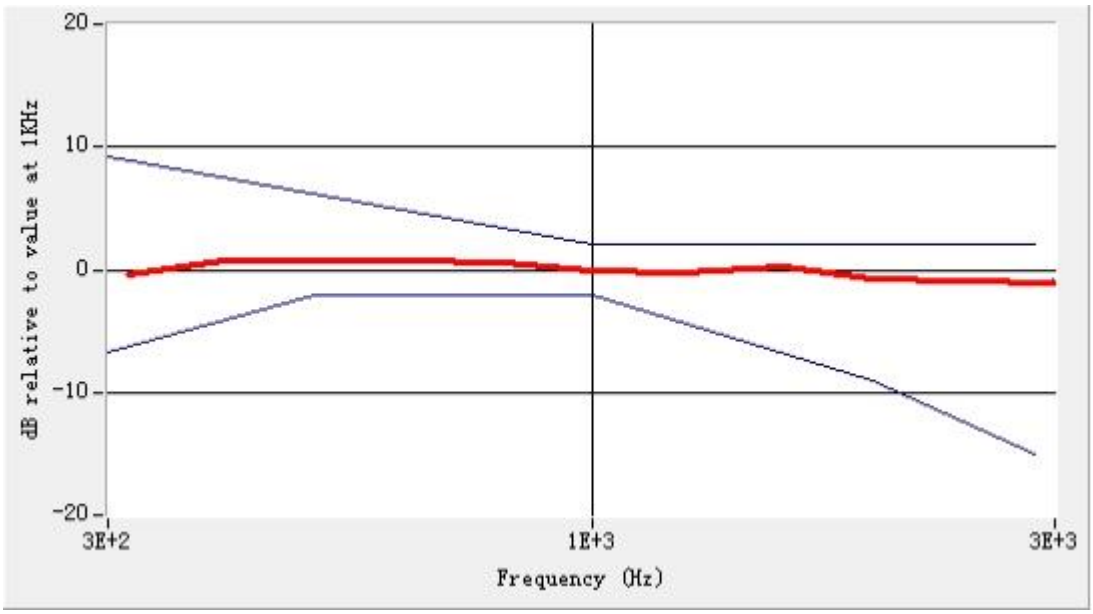
HAC Measurement Results

C63.19	Mode	Band	Test Description	Minimum Limit	Location	Measured	Category	Verdict
				dBA/m	-	dBA/m	-	Pass/Fail
7.3.1.1	WCDMA	Band5_ WCDMA850	Intensity, Axial	-18	Max	21.39	-	PASS
7.3.1.2			Intensity, RadialH	-18	Right side	9.46	-	PASS
				-18	Left side	17.96	-	PASS
				dB		dB		
7.3.3			Signal to noise/noise, Axial	20	Max	53.29	T4	PASS
7.3.3			Signal to noise/noise, RadialH	20	Right side	46.60	T4	PASS
				20	Left side	55.20	T4	PASS
7.3.2			Frequency reponse, Axial	0	-	1.77	-	PASS

T.Coil Scan Overlay Magnetic Field Distributions

AXIAL	RADIAL H
	

Frequency response (field that exeeds -15 dB)



ANNEX C EUT EXTERNAL PHOTO

Please refer the document “BL-SZ17B0271-AW. PDF”.

ANNEX D TEST SETUP PHOTO

Please refer the document “BL-SZ17B0271-T-coil. PDF”.

ANNEX E CALIBRATION FOR PROBE AND DIPOLE

Please refer the “CALIBRATION FOR PROBE AND DIPOLE. PDF”.

--END OF REPORT--