RF Emission HAC TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

TD LTE digital mobile phone

ISSUED TO
Lemobile Information Technology (Beijing) Co., Ltd.

WENHUAYING NORTH (NO.1, LINKONG 2ND ST), GAOLIYING, SHUNYI DISTRICT, BEIJING, CHINA

Report No.:	BL-SZ1590187-701
EUT Type:	TD LTE digital mobile phone
Model Name:	Le Max
Brand Name:	Letv
FCC ID:	2AFWMLEMAX
Test Standard:	FCC 47 CFR Part 20.19
	ANSI C63.19: 2011
	KDB 285076 D01 HAC Guidance v04
M-Rating:	E-Field: M3
Test conclusion:	Pass
Test Date:	Nov. 9, 2015
Date of Issue:	Nov. 19, 2015

Tested by: Tu Lang
Tu Lang
(Engineer)
Date: Nov. 19, 2015

Approved by: Wei Yanquan
Wei Yanquan
(Chief Engineer)
Date: Nov. 19, 2015

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Revision History

Version	Issue Date	Revisions
Rev. 01	Nov. 16, 2015	Initial Issue
Rev. 02	Nov. 19, 2015	Second Issue

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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 has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625. The laboratory has met the requirements of the IAS Accreditation Criteria for Testing Laboratories (AC89), has demonstrated compliance with ISO/IEC Standard 17025:2005. The accreditation certificate number is TL-588. 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	40 to 50%
Ambient Pressure	100 to 102 KPa

1.4 Announce

(1) The test report reference to the report template version v1.0.

(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

Applicant	Lemobile Information Technology (Beijing) Co., Ltd.
Address	WENHUAYING NORTH (NO.1, LINKONG 2ND ST), GAOLIYING, SHUNYI DISTRICT, BEIJING, CHINA

2.2 Manufacturer

Manufacturer	Lemobile Information Technology (Beijing) Co., Ltd.
Address	WENHUAYING NORTH (NO.1, LINKONG 2ND ST), GAOLIYING, SHUNYI DISTRICT, BEIJING.

2.3 Factory Information

Factory	Lemobile Information Technology (Beijing) Co., Ltd.
Address	WENHUAYING NORTH (NO.1, LINKONG 2ND ST), GAOLIYING, SHUNYI DISTRICT, BEIJING.

2.4 General Description for Equipment under Test (EUT)

EUT Type	TD LTE digital mobile phone
Model Name Under Test	Le Max
Series Model Name	N/A
Description of Model Name Differentiation	N/A
Hardware Version	N/A
Software Version	N/A
Dimensions	83×165×6 mm
Weight	202.8 g(with battery)
Network and Wireless connectivity	2G Network GSM 850/ 900/ 1800/ 1900, GPRS, EGPRS; 3G Network WCDMA Band 2/ 5, HSDPA, HSUPA; 4G Network LTE FDD Band 1/ 3/ 7; LTE TDD Band 38/ 39/ 40/ 41; WLAN; Bluetooth; GPS

2.5 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 MHz ~849 MHz	RX: 869 MHz ~ 894 MHz
	GSM 1900	TX: 1850 MHz ~ 1910 MHz	RX: 1930 MHz ~ 1990 MHz
	WCDMA Band 2	TX: 1850 MHz ~ 1910 MHz	RX: 1930 MHz ~ 1990 MHz
	WCDMA Band 5	TX: 824 MHz ~ 849 MHz	RX: 869 MHz ~ 894 MHz
	LTE Band 7	TX: 2500 MHz ~ 2570 MHz	RX: 2620 MHz ~ 2690 MHz
	LTE Band 41	TX: 2469 MHz ~ 2690 MHz	RX: 2469 MHz ~ 2690 MHz
	802.11b/g	2400 MHz ~2483.5 MHz	
	802.11 n(HT20/HT40)	2400 MHz ~2483.5 MHz	
	802.11a	5150 MHz ~ 5250 MHz	
		5725 MHz ~ 5850 MHz	
	802.11 n(HT20/HT40)	5150 MHz ~ 5250 MHz	
		5725 MHz ~ 5850 MHz	
	802.11ac(HT20 /HT40/HT80)	5150 MHz ~ 5250 MHz	
		5725 MHz ~ 5850 MHz	
	Bluetooth	2400 MHz ~ 2483.5 MHz	
Antenna Type	WWAN: PIFA Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna		
DTM	Not Support		
Hotspot Function	Support		
Exposure Category	General Population/Uncontrolled exposure		
EUT Stage	Portable Device		

2.6 EUT Air Interface Description

Air Interface	Band	Type	C63.19 Tested	Simultaneous Transmitter	OTT	Power Reduction
GSM	GSM850	Voice	Yes	Bluetooth/WLAN	N/A	Not Support
	GSM1900	Voice	Yes	Bluetooth/WLAN	N/A	Not Support
WCDMA	Band 2	RMC	Yes	Bluetooth/WLAN	N/A	Not Support
	Band 5	RMC	Yes	Bluetooth/WLAN	N/A	Not Support
LTE	FDD B7	VOIP	Yes[Note]	Bluetooth/WLAN	N/A	Not Support
	TDD B41	VOIP	Yes[Note]	Bluetooth/WLAN	N/A	Not Support
Note: Testing the T-coil for LTE VOIP is not required according with KDB 285076 D02 T Coil testing for CMRS IP v01r01.						

2.7 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	LeTV
	Model No.	LT633
	Serial No.	N/A
	Capacitance	3400 mAh
	Rated Voltage	3.8 V
	Extreme Voltage	4.35 V
Ancillary Equipment 2	AC Adapter (Charger for Battery)	
	Brand Name	CHENYANG
	Model Number	LSUUL050200-A00
	Rated Input	100-240 V~, 50/60 Hz, 0.5 A
	Rated Output	5 V⎓, 2000 mA

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 63.19:2011	American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids
3	KDB 285076 D01 HAC Guidance v04	Provides equipment authorization guidance for mobile handsets subject to the requirements of Section 20.19 for hearing aid compatibility

3.2 HAC Test Configuration and Setting

For HAC RF emission 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 air link. The distance between the EUT and the communicating antenna of the test set is larger than 50 cm and the output power radiated from the wireless communication test set antenna is at least 30 dB smaller than the output power of EUT. The EUT was set from the wireless communication test set to radiate maximum output power during HAC testing.

3.3 Summary Of HAC M-Rating

Band	Measurement Result		M-Rating
GSM 850	E-Field dB (V/m)	36.19	M4
GSM 1900	E-Field dB (V/m)	34.59	M3
WCDAMA Band 2	E-Field dB (V/m)	6.17	M4
WCDAMA Band 5	E-Field dB (V/m)	6.13	M4
LTE Band 7	E-Field dB (V/m)	19.53	M4
LTE Band 41	E-Field dB (V/m)	18.08	M4

3.4 ANSI C63.19 HAC RF Categories

3.4.1 RF Emissions

The ANSI Standard presents performance requirements for acceptable interoperability of hearing with wireless communications devices. When these parameters are met, a hearing aid operates acceptably in close proximity to a wireless communications device.

WD RF audio interference level categories:

Category	Limits for E-Field Emission (V/m)	
	<960MHz	>960MHz
M1	50 to 55	40 to 45
M2	45 to 50	35 to 40
M3	40 to 45	30 to 35
M4	<40	<30

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	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.

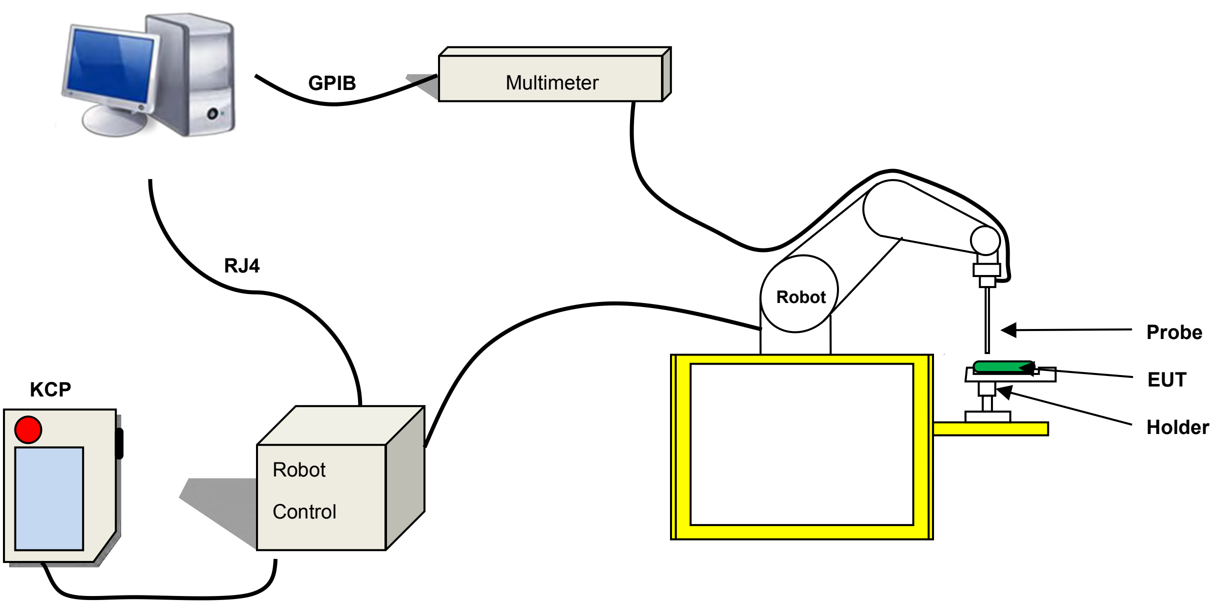
Compatibility Tests involved:

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 E-Field Probe

Serial Number:	SN 24/13 EPH41
Frequency:	0.7GHz – 2.5GHz
Probe length:	330mm
Length of one dipole:	3.3mm
Maximum external diameter:	8mm
Probe extremity diameter:	5mm
Distance between dipoles/probe extremity:	3mm
Resistance of the three dipole (at the connector):	Dipole 1:R1=2.1807 M Dipole 2:R1=2.0612 M Dipole 3:R3=2.1892 M
Connector (HIROSE series SR30)	6 wire male (Hirose SR30series)

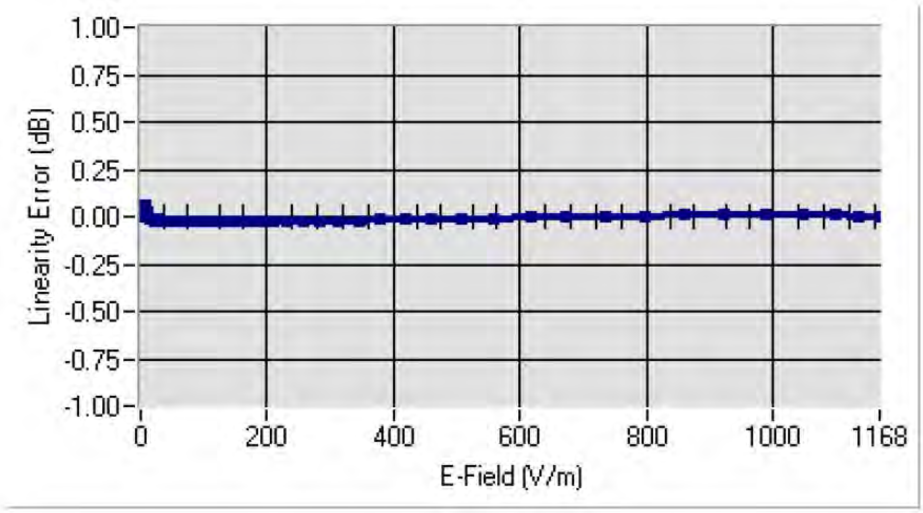
E-Field Probe Calibration Process

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

LINEARITY

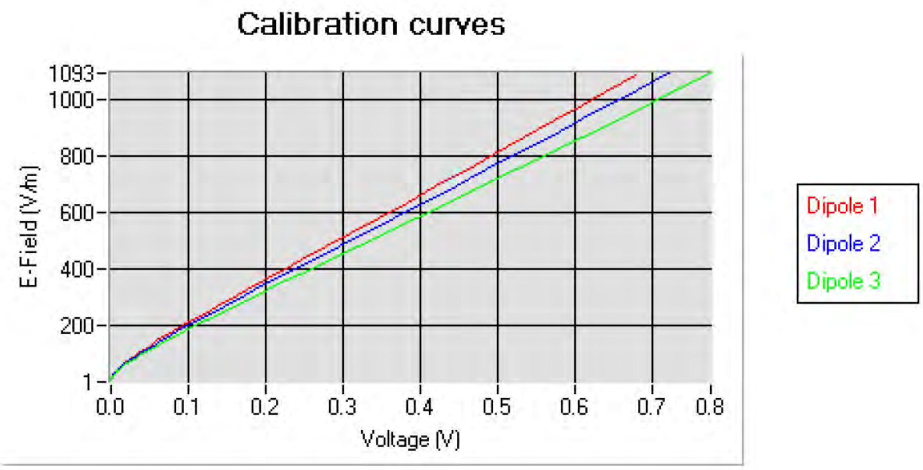
The linearity was determined using a standard dipole with the probe positioned 10 mm above the dipole. The input power of the dipole was adjusted from -15 to 36 dBm using a 1dB step (to cover the range 2V/m to 1000V/m).

Linearity: +/- 1.49% (+/- 0.07 dB)



SENSITIVITY

The sensitivity factors of the three dipoles were determined using the waveguide method outlined in the fore mentioned standards.

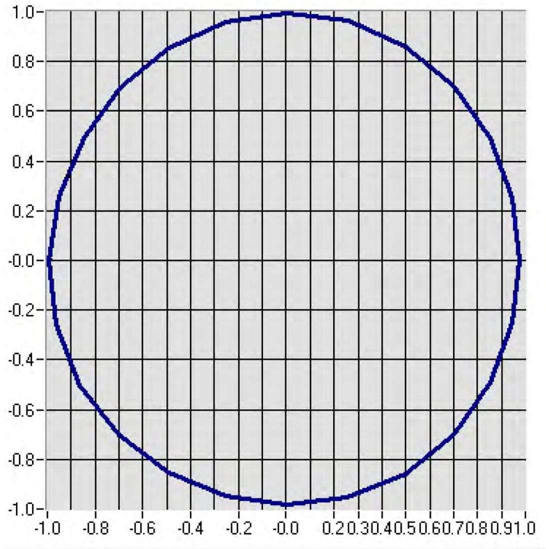


Frequency (GHz)	Normz dipole 1 (μV/(V/m) ²)	Normz dipole 2 (μV/(V/m) ²)	Normz dipole 3 (μV/(V/m) ²)
0.7GHz-2.5GHz	6.54	4.86	5.80
Frequency (GHz)	**DCP dipole 1 (mV)**	**DCP dipole 2 (mV)**	**DCP dipole 3 (mV)**
0.7GHz-2.5GHz	96	96	92

ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps.

Isotropy: +/- 1.22% (+/- 0.05 dB)



5 SYSTEM VERIFICATION

5.1 System Check Procedure

The input signal was an unmodulated continuous wave. The following points were taken into consideration in performing this check:

• Average Input Power P = 100mW RMS (20dBm RMS) after adjustment for return loss

• The test fixture must meet the 2 wavelength separation criterion

• The proper measurement of the 1 cm probe to dipole separation, which is measured from top surfaceof the dipole to the calibration reference point of the sensor, defined by the probe manufacturer is shown in the following diagram:

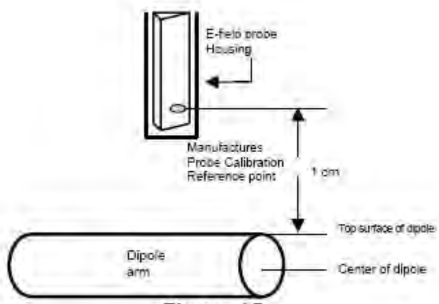


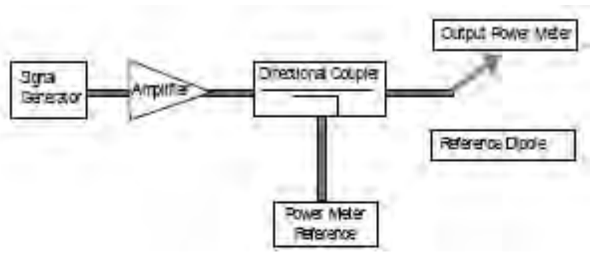
Figure 15
Separation Distance from Dipole to Field Probe

RF power was recorded using both an average reading meter and a peak reading meter. Readings of the probe are provided by the measurement system. To assure proper operation of the near-field measurement probe the input power to the dipole shall be commensurate with the full rated output power of the wireless device (e.g. - for a cellular phone wireless device the average peak antenna input power will be on the order of 100mW (i.e. - 20dBm) RMS after adjustment for any mismatch.

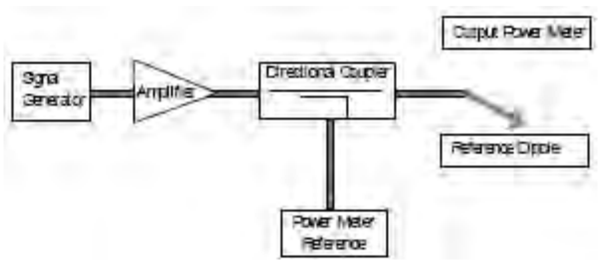
5.2 Validation Procedure

A dipole antenna meeting the requirements given in PC63.19 was placed in the position normally occupied by the WD. The length of the dipole was scanned with both E-field and H-field probes and the maximum values for each were recorde. Using the near-field measurement system, scan the antenna over the radiating dipole and record the greatest field reading observed. Due to the nature of E-fields about free-space dipoles, the two E-field peaks measured over the dipole are averaged to compensate for non-paralellity of the setup see manufacturer method on dipole calibration certificates, Field strength measurements shall be made only when the probe is stationary. RF power was recorded using both an average and a peak power reading meter.

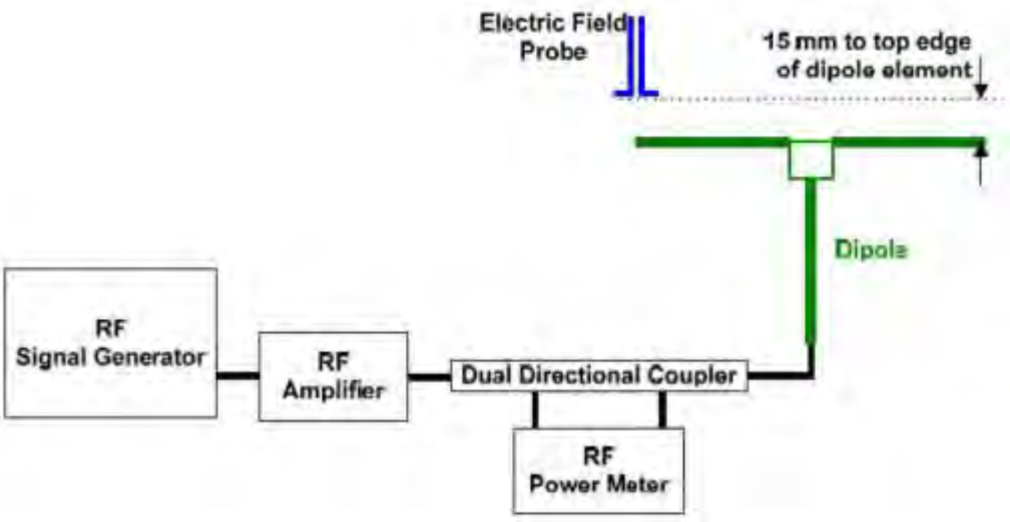
Setup for Desired Output Power to Dipole



Setup to Dipole



5.3 System Validation Setup



Using this setup configuration, the signal generator was adjusted for the desired output power 20dBm (100mW) at a specified frequency. The reference power from the coupled port of the directional coupler is recorded. Next, the output cable is connected to the reference dipole

5.4 System Validation Results

Comparing to the original HAC value provided by SATIMO, the validation data should be within its specification of 10 %.

Date	Frequency	Input Power (dBm)	E-field Result (V/m)	Target Field (V/m)	Tolerance (%)
2015/11/09	835 MHz	20.0	214.10	220.4	-2.86
2015/11/09	1880MHz	20.0	155.88	153.4	1.62
2015/11/09	2450MHz	20.0	141.91	134.7	5.35

6 Modulation Interference Factor (MIF)

The HAC Standard ANSI C63.19-2011 defines a new scaling using the Modulation Interference Factor (MIF). 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 MIF may be determined using a radiated RF field, a conducted RF signal, or in a preliminary stage, a mathematical analysis of a modeled RF signal:

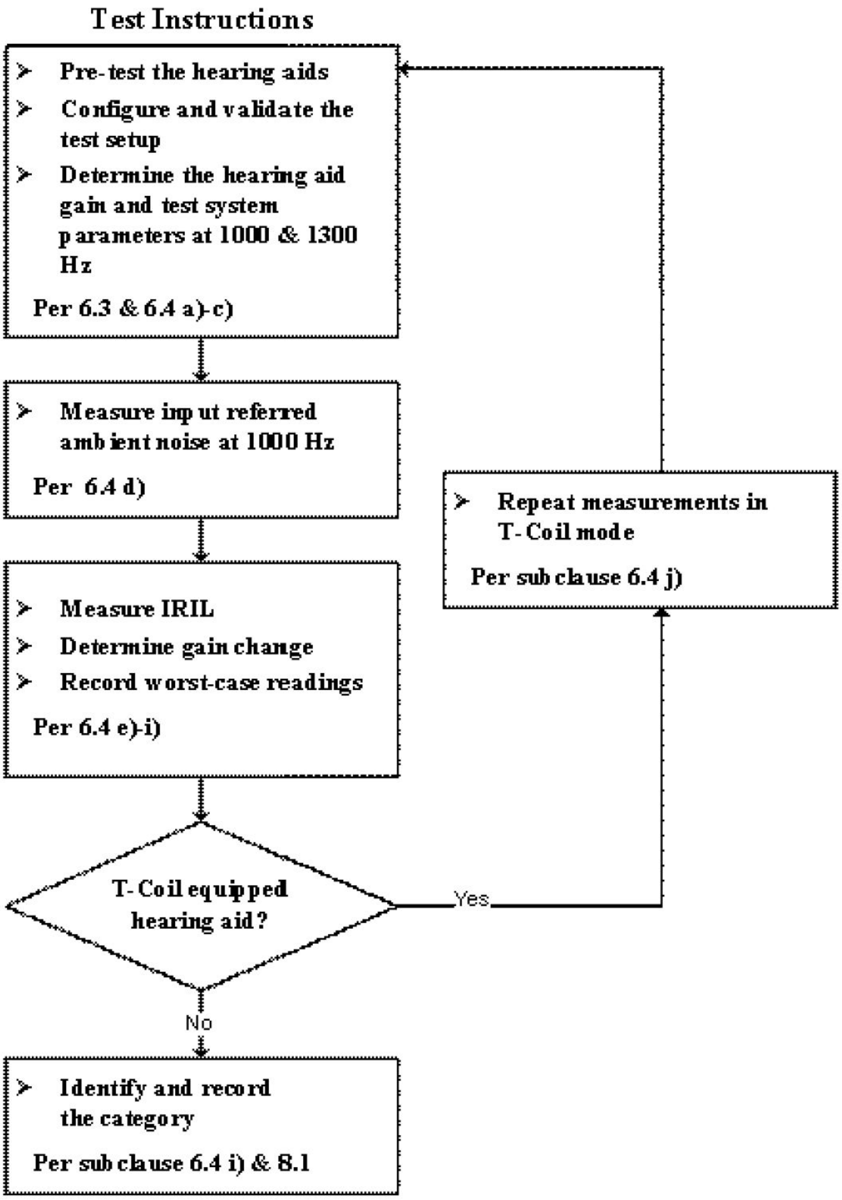
a) Verify the slope accuracy and dynamic range capability over the desired operating frequency band of a fast probe or sensor, square-law detector, as specified in D.3, and weighting system as specified in D.4 and D.5. For the probe and instrumentation included in the measurement of MIF, additional calibration and application of calibration factors are not required.
b) Using RF illumination or conducted coupling, apply the specific modulated signal in question to the measurement system at a level within its confirmed operating dynamic range.
c) Measure the steady-state rms level at the output of the fast probe or sensor.
d) Measure the steady-state average level at the weighting output.
e) Without changing the square-law detector or weighting system, and using RF illumination or conducted coupling, substitute for the specific modulated signal a 1kHz, 80% amplitude-modulated carrier at the same frequency and adjust its strength until the level at the weighting output equals the step d) measurement.
f) Without changing the carrier level from step e), remove the 1 kHz modulation and again measure the steady-state rms level indicated at the output of the fast probe or sensor.
g) The MIF for the specific modulation characteristic is provided by the ratio of the step f) measurement to the step c) measurement, expressed in dB (20 × log(step f))/step c)).

In practice, step e) and step f) need not be repeated for each MIF determination if the relationship between the two measurements has been preestablished for the measurement system over the operating frequency and dynamic ranges.

Probe	Signal Type	MIF
E-Field Probe	CW	-100.00
	GSM	3.63
	WCDMA	-27.23
	CDMA2000	-19.75
	TD-SCDMA	3.10
	FDD-LTE	-15.6
	TDD-LTE	-1.6

7 HAC RF IMMUNITY MEASUREMENT PROCEDURES

7.1 HAC Measurement Process Diagram



7.2 HAC RF Test Setup

Reference and plane for RF emission measurements

7.3 RF Emission Measurement Procedure

The following illustrate a typical RF emissions test scan over a wireless communications device:

a. Proper operation of the field probe, probe measurement system, other instrumentation, and the positioning system was confirmed.
b. WD is positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.
c. The WD operation for maximum rated RF output power was configured and confirmed with the base station simulator, at the test channel and other normal operating parameters as intended for the test. The battery was ensured to be fully charged before each test.
d. The center sub-grid was centered over the center of the acoustic output (also audio band magnetic output, if applicable). The WD audio output was positioned tangent (as physically possible) to the measurement plane.
e. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the HAC Phantom.
f. The measurement system measured the field strength at the reference location.

8 CONDUCTED RF OUPUT POWER

8.1 GSM

Test Band	Test Mode	Test Channel	Measured (dBm)
850	GSM	LCH	33.69
		MCH	33.47
		HCH	33.37
	GSM/GPRS	LCH_Slot1	33.61
		LCH_Slot2	31.98
		LCH_Slot3	31.10
		LCH_Slot4	29.36
		MCH_Slot1	33.44
		MCH_Slot2	32.27
		MCH_Slot3	30.98
		MCH_Slot4	29.82
		HCH_Slot1	33.33
		HCH_Slot2	31.96
		HCH_Slot3	30.57
		HCH_Slot4	29.47
	GSM/EDGE	LCH_Slot1	27.91
		LCH_Slot2	25.72
		LCH_Slot3	24.01
		LCH_Slot4	23.34
		MCH_Slot1	27.69
		MCH_Slot2	25.57
		MCH_Slot3	23.91
		MCH_Slot4	23.25
		HCH_Slot1	27.37
		HCH_Slot2	25.21
		HCH_Slot3	23.59
		HCH_Slot4	22.95

Test Band	Test Mode	Test Channel	Measured (dBm)
1900	GSM/TM1	LCH	30.13
		MCH	30.54
		HCH	30.61
	GSM/TM2	LCH_Slot1	30.63
		LCH_Slot2	29.48
		LCH_Slot3	27.15
		LCH_Slot4	25.90
		MCH_Slot1	30.93
		MCH_Slot2	29.53
		MCH_Slot3	27.38
		MCH_Slot4	26.12
		HCH_Slot1	30.85
		HCH_Slot2	29.44
		HCH_Slot3	27.78
		HCH_Slot4	25.96
	GSM/TM3	LCH_Slot1	25.67
		LCH_Slot2	24.25
		LCH_Slot3	22.86
		LCH_Slot4	20.83
		MCH_Slot1	26.07
		MCH_Slot2	24.73
		MCH_Slot3	23.37
		MCH_Slot4	21.43
		HCH_Slot1	26.22
		HCH_Slot2	24.94
		HCH_Slot3	23.58
		HCH_Slot4	21.57

8.2 WCDMA

Test Band	Test Mode	Test Channel	Measured (dBm)
WCDMA850	UMTS/TM1	LCH_RMC12	24.15
		MCH_ RMC12	24.95
		HCH_ RMC12	24.69
WCDMA850	UMTS/HSDPA	LCH_Case1	23.12
		LCH_Case2	22.36
		LCH_Case3	22.31
		LCH_Case4	22.22
		MCH_Case1	23.92
		MCH_Case2	23.06
		MCH_Case3	23.03
		MCH_Case4	23.01
		HCH_Case1	23.62
		HCH_Case2	22.84
		HCH_Case3	22.80
		HCH_Case4	22.79
WCDMA850	UMTS/HSUPA	LCH_Case1	22.70
		LCH_Case2	21.69
		LCH_Case3	21.68
		LCH_Case4	22.23
		LCH_Case5	22.36
		MCH_Case1	23.70
		MCH_Case2	22.15
		MCH_Case3	21.82
		MCH_Case4	23.16
		MCH_Case5	22.45
		HCH_Case1	23.27
		HCH_Case2	21.87
		HCH_Case3	21.60
		HCH_Case4	22.95

		HCH_Case5	22.26

Test Band	Test Mode	Test Channel	Measured (dBm)
WCDMA1900	UMTS/TM1	LCH_RMC12	23.44
		MCH_ RMC12	23.60
		HCH_ RMC12	23.23
WCDMA1900	UMTS/TM2	LCH_Case1	22.62
		LCH_Case2	21.89
		LCH_Case3	22.18
		LCH_Case4	22.17
		MCH_Case1	23.19
		MCH_Case2	22.45
		MCH_Case3	22.39
		MCH_Case4	22.36
		HCH_Case1	22.67
		HCH_Case2	21.89
		HCH_Case3	21.84
		HCH_Case4	21.82
WCDMA1900	UMTS/TM3	LCH_Case1	22.63
		LCH_Case2	21.70
		LCH_Case3	21.68
		LCH_Case4	21.86
		LCH_Case5	21.84
		MCH_Case1	22.83
		MCH_Case2	21.95
		MCH_Case3	21.93
		MCH_Case4	22.12
		MCH_Case5	21.86
		HCH_Case1	22.35
		HCH_Case2	20.91
		HCH_Case3	20.97
		HCH_Case4	21.63
		HCH_Case5	21.62

8.3 LTE

Channel Bandwidth: 5 MHz

Modulation	Channel	RB Configuration		Average Power [dBm]	Verdict
		Size	Offset		
QPSK	LCH	1	0	21.57	PASS
		1	12	21.64	PASS
		1	24	21.65	PASS
		12	0	20.52	PASS
		12	6	20.57	PASS
		12	13	20.57	PASS
		25	0	20.54	PASS
	MCH	1	0	23.95	PASS
		1	12	23.73	PASS
		1	24	24.04	PASS
		12	0	22.97	PASS
		12	6	23.06	PASS
		12	13	23.01	PASS
		25	0	23.00	PASS
	HCH	1	0	23.04	PASS
		1	12	22.83	PASS
		1	24	22.59	PASS
		12	0	22.15	PASS
		12	6	22.09	PASS
		12	13	21.93	PASS
		25	0	22.04	PASS
16QAM	LCH	1	0	20.81	PASS
		1	12	20.90	PASS
		1	24	20.92	PASS
		12	0	19.61	PASS
		12	6	19.67	PASS
		12	13	19.65	PASS
		25	0	19.52	PASS
	MCH	1	0	23.20	PASS
		1	12	23.51	PASS
		1	24	23.47	PASS
		12	0	22.04	PASS
		12	6	22.13	PASS
		12	13	22.09	PASS
		25	0	22.05	PASS
	HCH	1	0	22.05	PASS
		1	12	21.84	PASS
		1	24	21.59	PASS
		12	0	21.18	PASS
		12	6	21.13	PASS
		12	13	20.96	PASS

		25	0	21.09	PASS

Channel Bandwidth: 10 MHz

Modulation	Channel	RB Configuration		Average Power [dBm]	Verdict
		Size	Offset		
QPSK	LCH	1	0	21.67	PASS
		1	24	21.95	PASS
		1	49	21.91	PASS
		25	0	20.88	PASS
		25	12	21.02	PASS
		25	25	20.91	PASS
		50	0	20.94	PASS
	MCH	1	0	24.03	PASS
		1	24	24.21	PASS
		1	49	24.00	PASS
		25	0	22.95	PASS
		25	12	22.94	PASS
		25	25	22.89	PASS
		50	0	23.00	PASS
	HCH	1	0	23.05	PASS
		1	24	22.99	PASS
		1	49	22.43	PASS
		25	0	22.45	PASS
		25	12	22.38	PASS
		25	25	22.03	PASS
		50	0	22.20	PASS
16QAM	LCH	1	0	20.85	PASS
		1	24	21.15	PASS
		1	49	21.10	PASS
		25	0	19.84	PASS
		25	12	20.00	PASS
		25	25	19.88	PASS
		50	0	19.89	PASS
	MCH	1	0	23.40	PASS
		1	24	23.54	PASS
		1	49	23.40	PASS
		25	0	21.94	PASS
		25	12	22.03	PASS
		25	25	21.88	PASS
		50	0	21.92	PASS
	HCH	1	0	22.36	PASS
		1	24	22.33	PASS
		1	49	21.74	PASS
		25	0	21.46	PASS
		25	12	21.41	PASS

		25	25	21.06	PASS
		50	0	21.21	PASS

Channel Bandwidth: 15 MHz

Modulation	Channel	RB Configuration		Average Power [dBm]	Verdict
		Size	Offset		
QPSK	LCH	1	0	22.02	PASS
		1	37	21.99	PASS
		1	74	22.36	PASS
		37	0	21.13	PASS
		37	18	21.06	PASS
		37	38	21.26	PASS
		75	0	21.22	PASS
	MCH	1	0	23.84	PASS
		1	37	23.88	PASS
		1	74	24.09	PASS
		37	0	23.02	PASS
		37	18	23.01	PASS
		37	38	22.88	PASS
		75	0	23.02	PASS
	HCH	1	0	23.50	PASS
		1	37	23.06	PASS
		1	74	22.69	PASS
		37	0	22.53	PASS
		37	18	22.50	PASS
		37	38	22.27	PASS
		75	0	22.48	PASS
16QAM	LCH	1	0	21.26	PASS
		1	37	21.18	PASS
		1	74	21.58	PASS
		37	0	20.12	PASS
		37	18	20.02	PASS
		37	38	20.23	PASS
		75	0	20.20	PASS
	MCH	1	0	23.23	PASS
		1	37	23.39	PASS
		1	74	23.37	PASS
		37	0	21.99	PASS
		37	18	22.03	PASS
		37	38	21.88	PASS
		75	0	22.00	PASS
	HCH	1	0	22.91	PASS
		1	37	22.46	PASS
		1	74	22.05	PASS
		37	0	21.46	PASS
		37	18	21.49	PASS

		37	38	21.32	PASS
		75	0	21.55	PASS

Channel Bandwidth: 20 MHz

Modulation	Channel	RB Configuration		Average Power [dBm]	Verdict
		Size	Offset		
QPSK	LCH	1	0	22.12	PASS
		1	49	22.35	PASS
		1	99	22.57	PASS
		50	0	21.28	PASS
		50	25	21.36	PASS
		50	50	21.37	PASS
		100	0	21.29	PASS
	MCH	1	0	23.85	PASS
		1	49	24.11	PASS
		1	99	23.79	PASS
		50	0	22.98	PASS
		50	25	23.23	PASS
		50	50	23.01	PASS
		100	0	22.99	PASS
	HCH	1	0	23.38	PASS
		1	49	23.31	PASS
		1	99	22.87	PASS
		50	0	22.68	PASS
		50	25	22.64	PASS
		50	50	22.34	PASS
		100	0	22.51	PASS
16QAM	LCH	1	0	21.34	PASS
		1	49	21.58	PASS
		1	99	21.80	PASS
		50	0	20.42	PASS
		50	25	20.31	PASS
		50	50	20.33	PASS
		100	0	20.39	PASS
	MCH	1	0	23.57	PASS
		1	49	23.64	PASS
		1	99	23.71	PASS
		50	0	22.02	PASS
		50	25	22.18	PASS
		50	50	21.97	PASS
		100	0	22.01	PASS
	HCH	1	0	22.91	PASS
		1	49	22.78	PASS
		1	99	22.29	PASS
		50	0	21.73	PASS

		50	25	21.64	PASS
		50	50	21.33	PASS
		100	0	21.54	PASS

9 HAC RF Emission Test Results

9.1 E-Filled Emission Test Results

Band	Mode	Ch.	Freq. (MHz)	Peak E-Field dB (V/m)	M-Rating	Meas.No.
GSM 850	Voice	128	824.2	35.84	M4	1#
		189	836.4	36.19	M4	2#
		251	848.8	35.84	M4	3#
GSM 1900	Voice	512	1850.2	26.52	M4	4#
		661	1880.0	26.43	M4	5#
		810	1909.8	34.59	M3	6#
WCDMA Band 2	RMC	9262	1852.5	5.84	M4	7#
		9400	1880.0	6.17	M4	8#
		9538	1907.4	5.32	M4	9#
WCDMA Band 5	RMC	4132	826.4	4.43	M4	10#
		4182	836.4	6.13	M4	11#
		4232	846.6	5.79	M4	12#
LTE Band 7	QPSK	20850	2510.0	19.47	M4	13#
		21100	2535.0	19.51	M4	14#
		21350	2560.0	19.53	M4	15#
LTE Band 41	QPSK	39750	2506.0	17.87	M4	16#
		40620	2593.0	18.08	M4	17#
		41490	2680.0	17.93	M4	18#

10 TEST EQUIPMENTS LIST

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
PC	Dell	N/A	N/A	N/A	N/A
800-950MHz Dipole	SATIMO	SIDB835	SN 18/12 DHA41	2015/03/16	2016/03/15
1700-2000MHz Dipole	SATIMO	SIDB1900	SN 18/12 DHB46	2015/03/16	2016/03/15
2100-2600MHz Dipole	SATIMO	SIDB2450	SN 18/12 DHC48	2015/03/16	2016/03/15
E-Field Probe	SATIMO	SCE	SN 24/13 EPH41	2015/03/16	2016/03/15
Antenna	SATIMO	ANTA3	SN 17/13 ZNTA45	N/A	N/A
MultiMeter	Keithley	MultiMeter 2000	4024022	2015/02/13	2016/02/12
Signal Generator	R&S	SMF100A	1167.0000k02/104260	2015/02/17	2016/02/16
Power Meter	Agilent	E4419B	GB40201833	2015/10/14	2016/10/13
Power Sensor	R&S	NRP-Z21	103971	2015/07/16	2016/07/15
Power Amplifier	SATIMO	6552B	22374	N/A	N/A
Wireless Communication Test Set	R&S	CMU 200	123666	2015/10/15	2016/10/14
Wireless Communications Test Set	R&S	CMW 500	138884	2015/07/16	2016/07/15

11 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 v04, “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 v01r01 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

E-Field System Check Data(835MHz Head)

Experimental conditions.

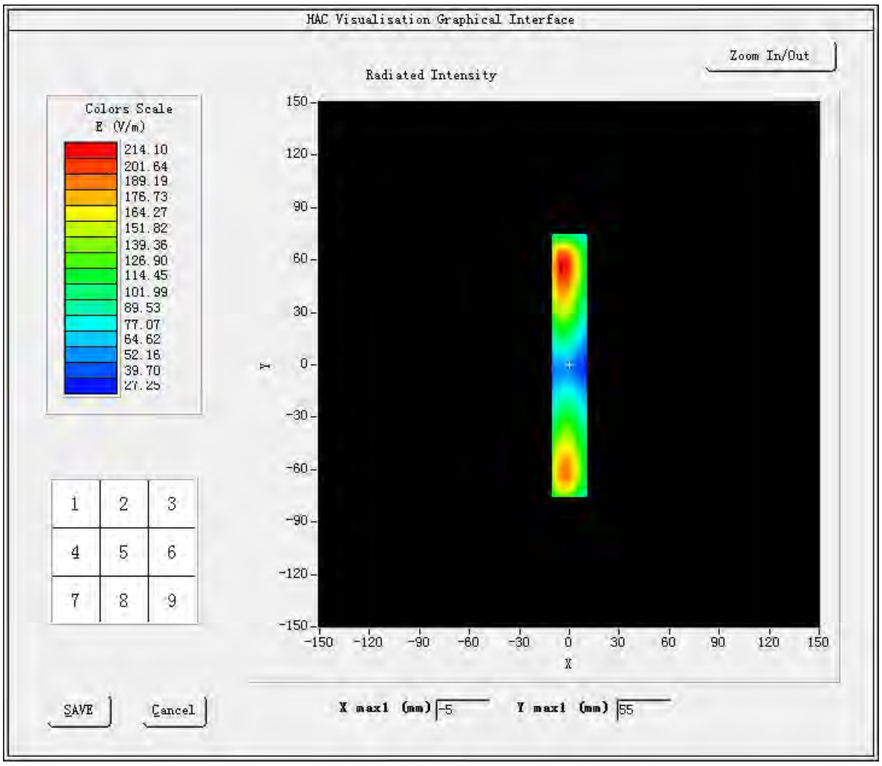
Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	835MHz
Channel	
Signal	CW
Date of measurement	09/11/2015

HAC Measurement Results

Frequency (MHz): 880.200000

Maximum value of total field = 214.10 V/m

SURFACE E-Field



E-Filed System Check Data (1880MHz)

Experimental conditions

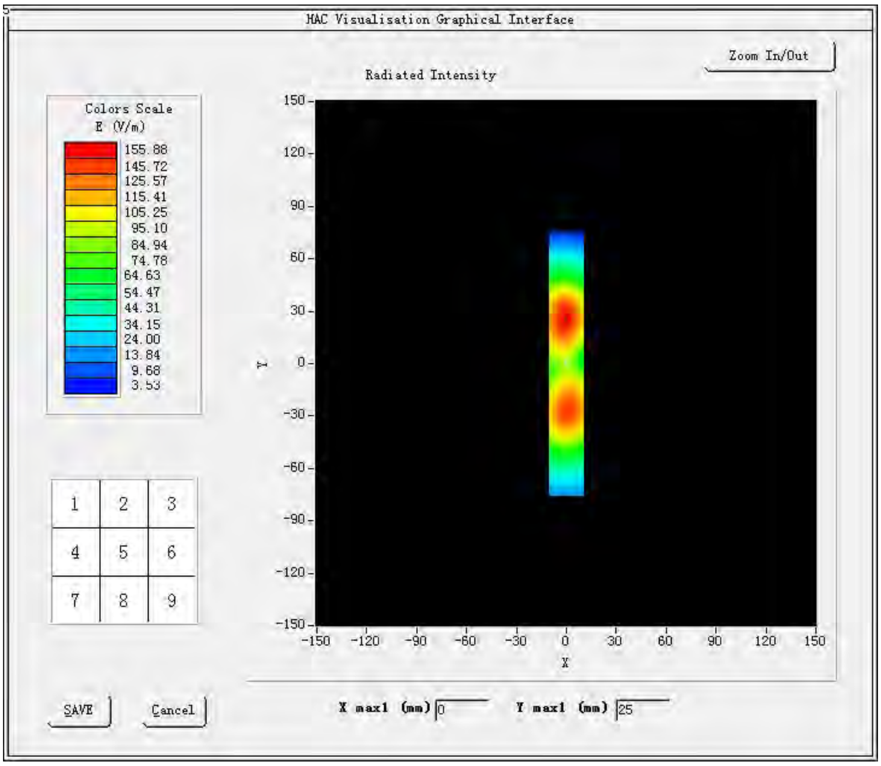
Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	1880 MHz
Channel	
Signal	CW
Date of measurement	09/11/2015

HAC Measurement Results

Frequency (MHz): 1880.000000

Maximum value of total field = 155.88V/m

SURFACE HAC



E-Filed System Check Data (2450MHz)

Experimental conditions

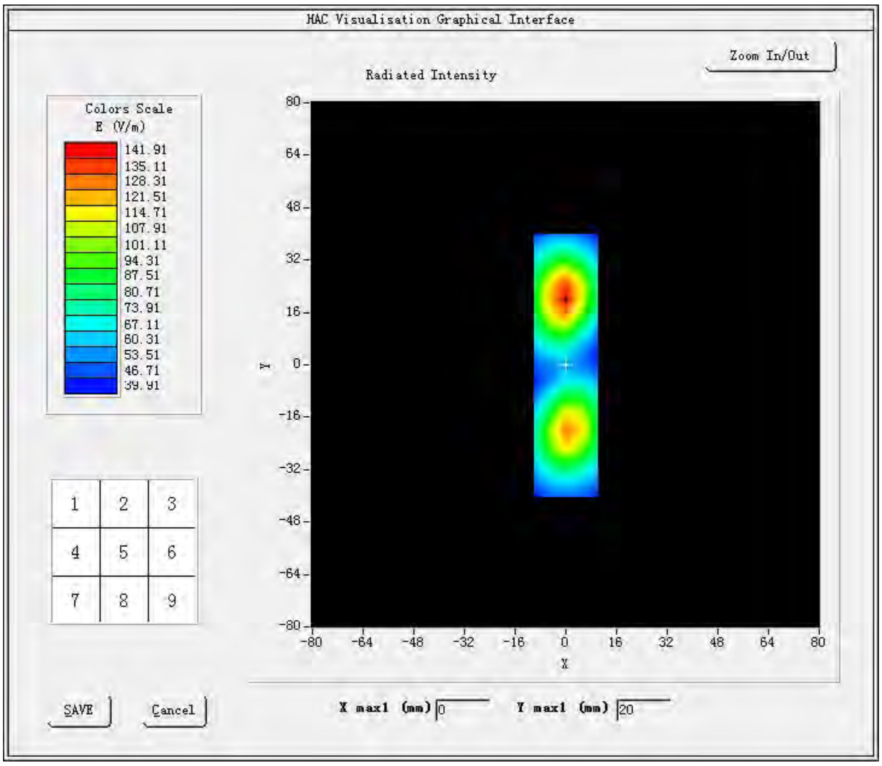
Grid size (mm x mm)	20.0, 80.0
Step (mm)	5
Band	2450 MHz
Channel	
Signal	CW
Date of measurement	09/11/2015

HAC Measurement Results

Frequency (MHz): 2450.000000

Maximum value of total field = 141.91V/m

SURFACE HAC



ANNEX B HAC RF MEASUREMENT RESULT

TABLE OF MEASUREMENT RESULT LIST

Band	Mode	PARAMETERS
GSM 850	**Voice**	Measurement 1: E-field on Low Channel
		Measurement 2: E-field on Middle Channel
		Measurement 3: E-field on High Channel
GSM 1900	**Voice**	Measurement 4: E-field on Low Channel
		Measurement 5: E-field on Middle Channel
		Measurement 6: E-field on High Channel
WCDMA Band 2	**RMC**	Measurement 7: E-field on Low Channel
		Measurement 8: E-field on Middle Channel
		Measurement 9: E-field on High Channel
WCDMA Band 5	**RMC**	Measurement 10: E-field on Low Channel
		Measurement 11: E-field on Middle Channel
		Measurement 12: E-field on High Channel
LTE Band 7	**QPSK**	Measurement 13: E-field on Low Channel
		Measurement 14: E-field on Middle Channel
		Measurement 15: E-field on High Channel
LTE Band 41	**QPSK**	Measurement 16: E-field on Low Channel
		Measurement 17: E-field on Middle Channel
		Measurement 18: E-field on High Channel

MEASUREMENT 1

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM 850
Channel	Low
Signal	GSM
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 128):

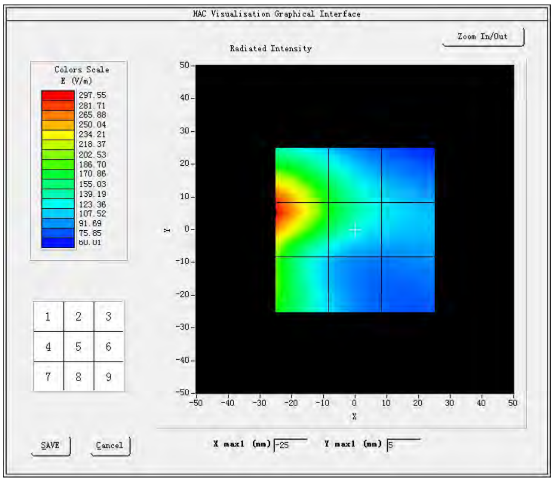
Frequency (MHz): 824.200000

Modulation Interference Factor (MIF) = 3.630000

Maximum value of total field = 35.84 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 39.95	Grid 2: 35.61	Grid 3: 31.84
Grid 4: 40.43	**Grid 5: 35.84**	Grid 6: 32.18
Grid 7: 36.93	Grid 8: 31.53	Grid 9: 30.27

MEASUREMENT 2

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM 850
Channel	Middle
Signal	GSM
Date of measurement	09/11/2015

HAC Measurement Results

Middle Band (Channel 189):

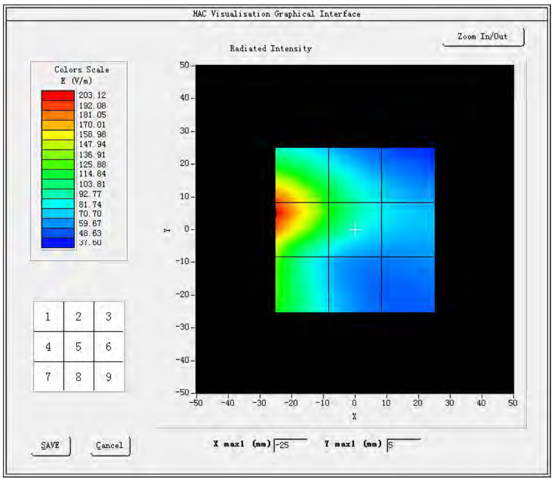
Frequency (MHz): 836.400000

Modulation Interference Factor (MIF) = 3.630000

Maximum value of total field =36.19 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 39.97	Grid 2: 35.78	Grid 3: 31.70
Grid 4: 40.72	**Grid 5: 36.19**	Grid 6: 32.21
Grid 7: 37.24	Grid 8: 31.72	Grid 9: 30.15

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	09/11/2015

HAC Measurement Results

Higher Band (Channel 251):

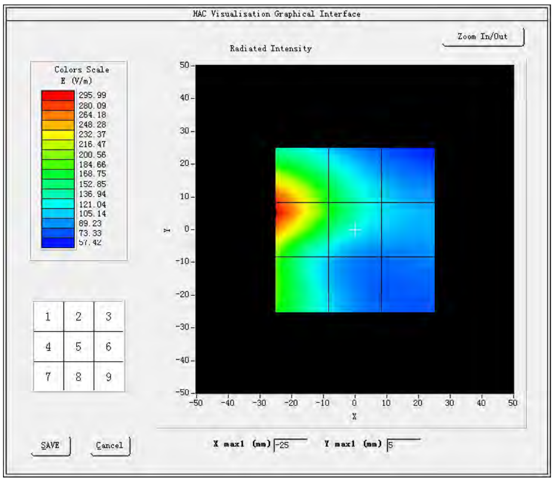
Frequency (MHz): 848.800000

Modulation Interference Factor (MIF) = 3.630000

Maximum value of total field = 35.84 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 39.86	Grid 2: 35.52	Grid 3: 31.42
Grid 4: 40.37	**Grid 5: 35.84**	Grid 6: 31.69
Grid 7: 36.87	Grid 8: 31.53	Grid 9: 29.69

MEASUREMENT 4

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM 1900
Channel	Low
Signal	GSM
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 512):

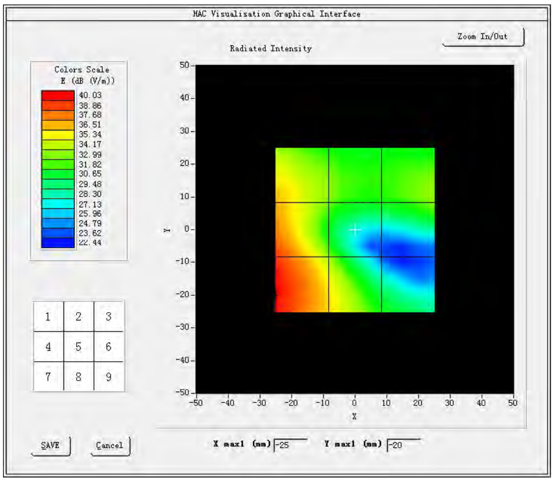
Frequency (MHz): 1850.200000

Modulation Interference Factor (MIF) = 3.630000

Maximum value of total field = 26.52 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 27.53	Grid 2: 23.93	Grid 3: 24.35
Grid 4: 29.86	Grid 5: 23.64	Grid 6: 24.21
Grid 7: 31.07	**Grid 8: 26.52**	Grid 9: 22.28

MEASUREMENT 5

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM 1900
Channel	Middle
Signal	GSM
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 661):

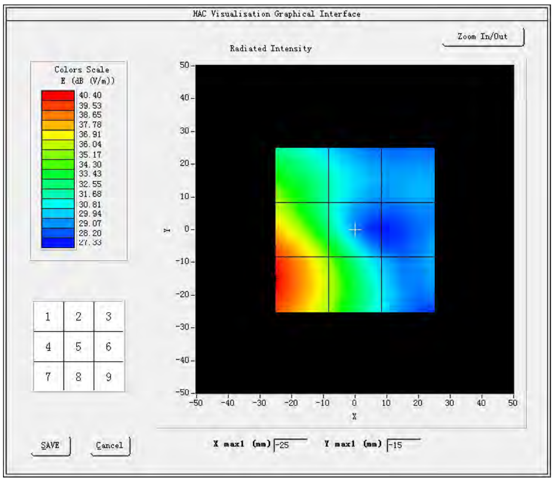
Frequency (MHz): 1880.000000

Modulation Interference Factor (MIF) =3.63000

Maximum value of total field = 26.43 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 26.43	Grid 2: 22.29	Grid 3: 20.60
Grid 4: 30.52	Grid 5: 25.23	Grid 6: 20.48
Grid 7: 31.39	**Grid 8: 26.53**	Grid 9: 21.15

MEASUREMENT 6

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	GSM 1900
Channel	High
Signal	GSM
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 810):

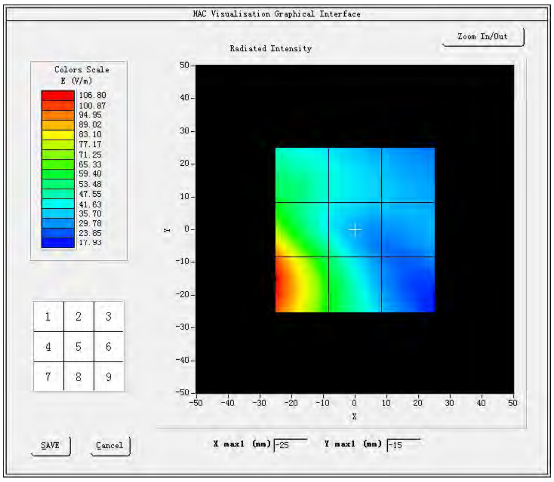
Frequency (MHz): 1909.800000

Modulation Interference Factor (MIF) =3.630000

Maximum value of total field =34.59 dB (V/m)

Hearing Aid Near-Field Category: M3

SURFACE HAC



E in dB (V/m)

Grid 1: 25.53	Grid 2: 23.37	Grid 3: 20.66
Grid 4: 34.96	**Grid 5: 34.59**	Grid 6: 21.42
Grid 7: 34.49	**Grid 8: 28.74**	Grid 9: 21.67

MEASUREMENT 7

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	WCDMA Band 2
Channel	Low
Signal	WCDMA
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 9262):

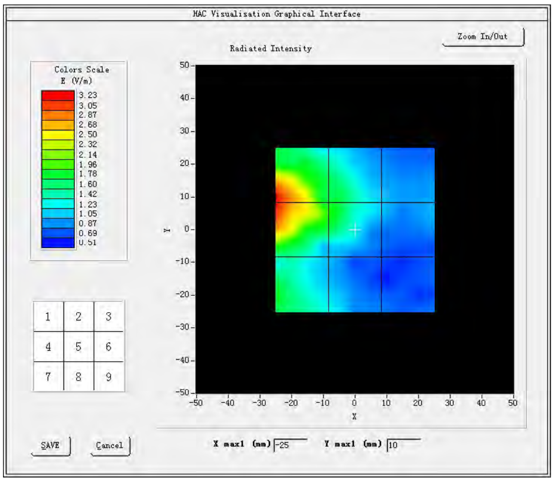
Frequency (MHz): 1852.500000

Modulation Interference Factor (MIF) = 27.230000

Maximum value of total field = 5.84 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 10.44	Grid 2: 5.08	Grid 3: 0.08
Grid 4: 10.47	**Grid 5: 5.84**	Grid 6: 0.27
Grid 7: 5.60	Grid 8: 1.96	Grid 9: -1.93

MEASUREMENT 8

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	WCDMA Band 2
Channel	Middle
Signal	WCDMA
Date of measurement	09/11/2015

HAC Measurement Results

Middle Band (Channel 9400):

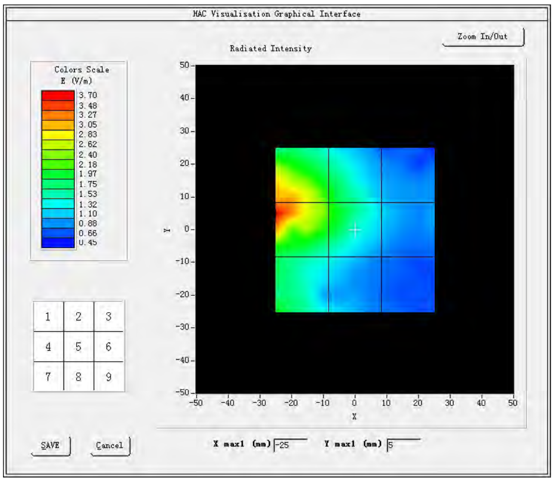
Frequency (MHz): 1880.000000

Modulation Interference Factor (MIF) = 27.230000

Maximum value of total field =6.17 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 9.83	**Grid 2: 6.17**	Grid 3: -0.15
Grid 4: 11.23	Grid 5: 6.00	Grid 6: 0.75
Grid 7: 6.42	Grid 8: 1.88	Grid 9: -1.72

MEASUREMENT 9

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	WCDMA Band 2
Channel	High
Signal	WCDMA
Date of measurement	09/11/2015

HAC Measurement Results

Higher Band (Channel 9538):

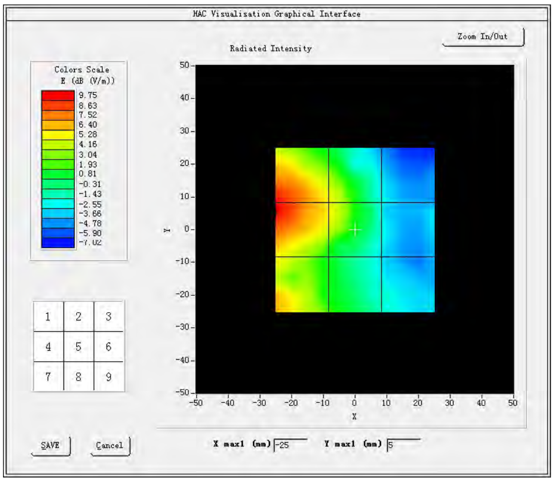
Frequency (MHz): 1907.400000

Modulation Interference Factor (MIF) = 27.230000

Maximum value of total field = 5.32 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 9.66	Grid 2: 4.92	Grid 3: -2.68
Grid 4: 10.11	**Grid 5: 5.32**	Grid 6: -2.59
Grid 7: 6.90	Grid 8: 2.36	Grid 9: -2.01

MEASUREMENT 10

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	WCDMA Band 5
Channel	Low
Signal	WCDMA
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 4132):

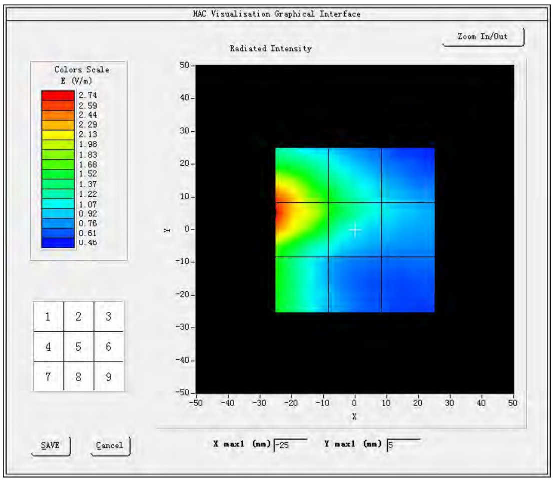
Frequency (MHz): 826.400000

Modulation Interference Factor (MIF) = 27.230000

Maximum value of total field = 4.43 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 8.36	Grid 2: 4.05	Grid 3: -0.29
Grid 4: 8.94	**Grid 5: 4.43**	Grid 6: 0.13
Grid 7: 4.72	Grid 8: -0.94	Grid 9: -2.78

MEASUREMENT 11

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	WCDMA Band 5
Channel	Middle
Signal	WCDMA
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 4182):

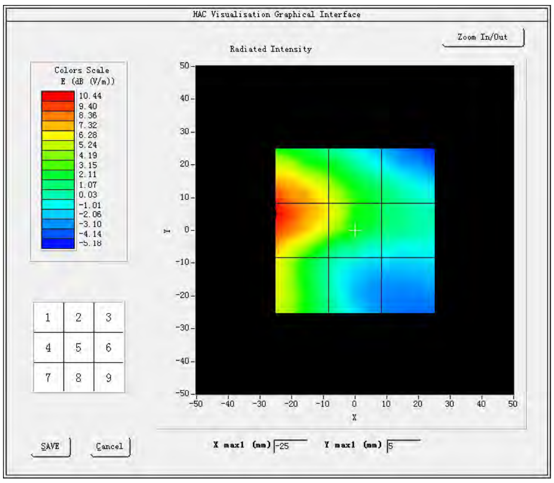
Frequency (MHz): 836.400000

Modulation Interference Factor (MIF) = 27.230000

Maximum value of total field = 6.13 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 9.90	Grid 2: 5.67	Grid 3: 1.34
Grid 4: 10.62	**Grid 5: 6.13**	Grid 6: 1.39
Grid 7: 6.70	Grid 8: 0.56	Grid 9: -1.32

MEASUREMENT 12

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	WCMA Band 5
Channel	High
Signal	WCDMA
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 4233):

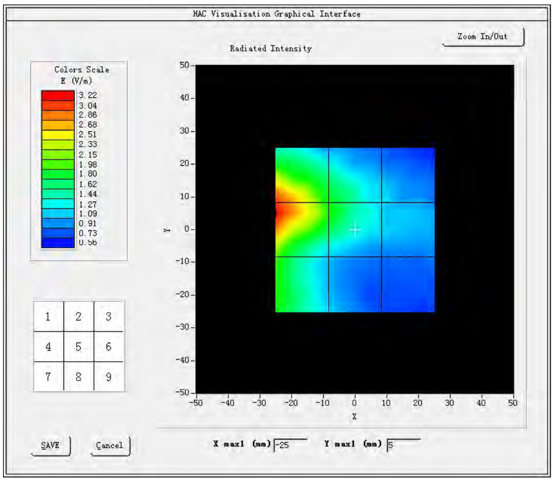
Frequency (MHz): 846.600000

Modulation Interference Factor (MIF) = 27.230000

Maximum value of total field = 5.79 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 9.74	Grid 2: 5.27	Grid 3: 1.33
Grid 4: 10.34	**Grid 5: 5.79**	Grid 6: 1.20
Grid 7: 6.56	Grid 8: 0.76	Grid 9: -1.11

MEASUREMENT 13

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	LTE Band 7
Channel	Low
Signal	LTE
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 20850):

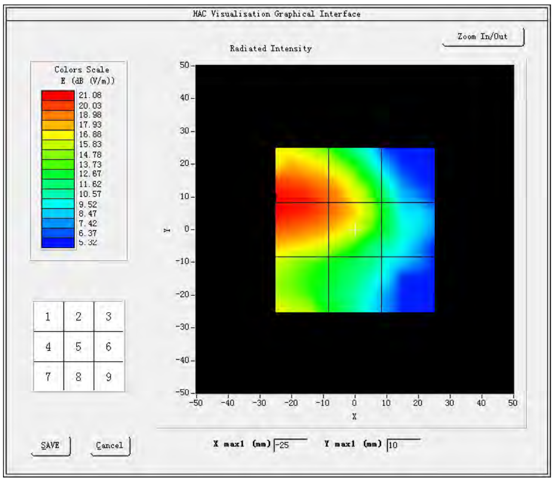
Frequency (MHz): 2510.000000

Modulation Interference Factor (MIF) = -1.6000

Maximum value of total field = 19.47 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 21.15	**Grid 2: 19.27**	Grid 3: 11.56
Grid 4: 21.26	**Grid 5: 19.47**	Grid 6: 12.84
Grid 7: 17.07	Grid 8: 14.08	Grid 9: 9.94

MEASUREMENT 14

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	LTE Band 7
Channel	Middle
Signal	LTE
Date of measurement	09/11/2015

HAC Measurement Results

Middle Band (Channel 21100):

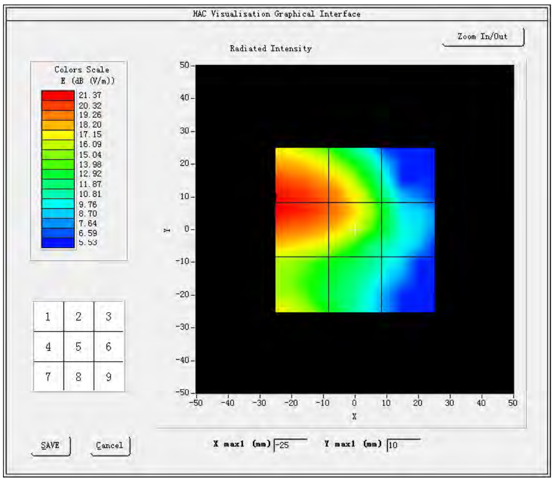
Frequency (MHz): 2535.000000

Modulation Interference Factor (MIF) = -1.6000

Maximum value of total field =19.51 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 21.22	**Grid 2: 19.30**	Grid 3: 11.50
Grid 4: 21.35	**Grid 5: 19.51**	Grid 6: 12.81
Grid 7: 17.16	Grid 8: 14.12	Grid 9: 10.04

MEASUREMENT 15

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	LTE Band 7
Channel	High
Signal	LTE
Date of measurement	09/11/2015

HAC Measurement Results

Higher Band (Channel 21350):

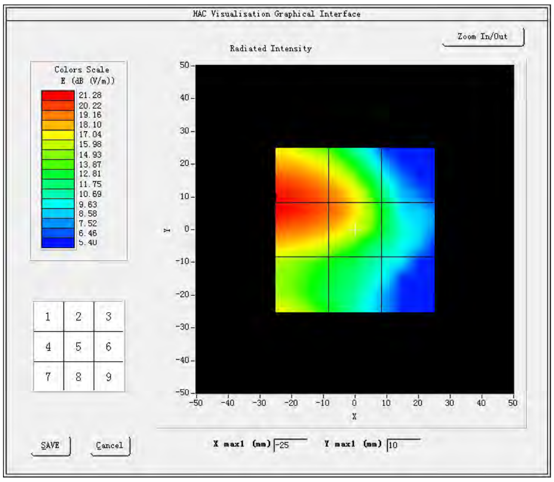
Frequency (MHz): 2560.000000

Modulation Interference Factor (MIF) =-1.6000

Maximum value of total field = 19.53 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 21.26	**Grid 2: 19.29**	Grid 3: 11.35
Grid 4: 21.39	**Grid 5: 19.53**	Grid 6: 12.61
Grid 7: 17.14	Grid 8: 14.09	Grid 9: 10.11

MEASUREMENT 16

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	LTE Band 41
Channel	Low
Signal	LTE
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 39750):

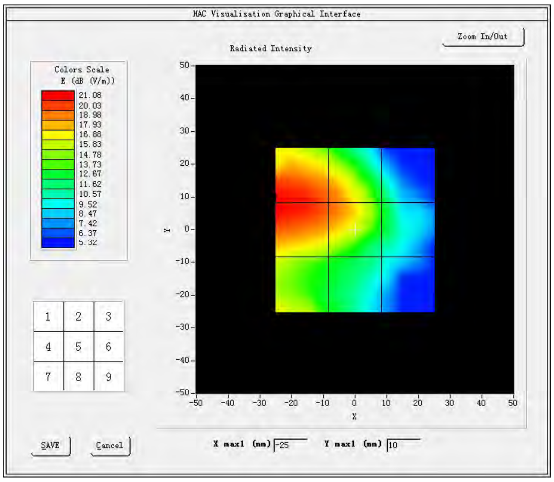
Frequency (MHz): 2506.000000

Modulation Interference Factor (MIF) = -1.6000

Maximum value of total field = 17.87 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 19.55	**Grid 2: 17.67**	Grid 3: 9.96
Grid 4: 19.66	**Grid 5: 17.87**	Grid 6: 11.24
Grid 7: 15.47	Grid 8: 12.48	Grid 9: 8.34

MEASUREMENT 17

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	LTE Band 41
Channel	Middle
Signal	LTE
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 40620):

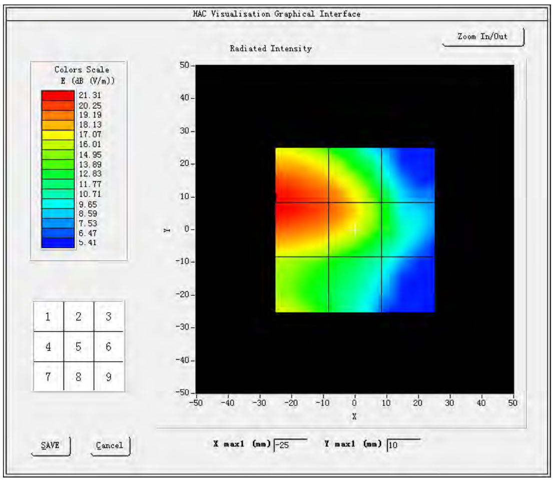
Frequency (MHz): 2593.000000

Modulation Interference Factor (MIF) = -1.6000

Maximum value of total field =18.08 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 19.68	**Grid 2: 17.84**	Grid 3: 11.00
Grid 4: 19.80	**Grid 5: 18.08**	Grid 6: 11.85
Grid 7: 15.23	Grid 8: 12.77	Grid 9: 8.73

MEASUREMENT 18

Experimental conditions

Grid size (mm x mm)	50.0, 50.0
Step (mm)	5
Band	LTE Band 41
Channel	High
Signal	LTE
Date of measurement	09/11/2015

HAC Measurement Results

Lower Band (Channel 41490):

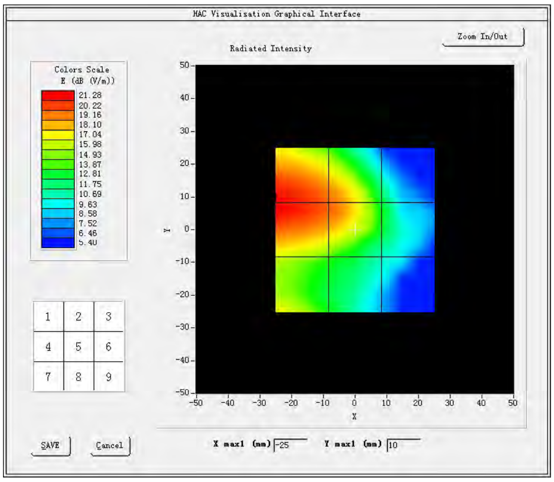
Frequency (MHz): 2680.000000

Modulation Interference Factor (MIF) = -1.6000

Maximum value of total field = 17.93 dB (V/m)

Hearing Aid Near-Field Category: M4

SURFACE HAC



E in dB (V/m)

Grid 1: 19.66	**Grid 2: 17.69**	Grid 3: 9.75
Grid 4: 19.79	**Grid 5: 17.93**	Grid 6: 11.01
Grid 7: 15.54	Grid 8: 12.49	Grid 9: 8.51

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document " BL-SZ1590187-AW. PDF".

ANNEX D HAC E-Field TEST SETUP PHOTOS

Please refer the document " BL-SZ1590187-E-Field. PDF".

ANNEX E CALIBRATION FOR PROBE AND DIPOLEF

F.1 E-Field Probe

COMOHAC E-Field Probe Calibration Report

Ref : ACR.75.16.15.SATU.A

SHENZHEN BALUN TECHNOLOGY CO.,LTD.
BLOCK B, FL 1, BAISHA SCIENCE AND TECHNOLOGY PARK, SHAHE XI ROAD,
NANSHAN DISTRICT, SHENZHEN, GUANGDONG PROVINCE, P.R. CHINA 518055
MVG COMOHAC E-FIELD PROBE
SERIAL NO.: SN 24/13 EPH41

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

03/16/2015

Summary:

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

COMOHAC E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.75.18.15.SATU.A

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	3/16/2015	JS
Checked by :	Jérôme LUC	Product Manager	3/16/2015	JS
Approved by :	Kim RUTKOWSKI	Quality Manager	3/16/2015	Kim Rutkowski

	Customer Name
Distribution :	SHENZHEN BALUN TECHNOLOGY Co.,Ltd.

Issue	*Date*	*Modifications*
A	3/16/2015	Initial release

TABLE OF CONTENTS

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOHAC E FIELD PROBE
Manufacturer	MVG
Model	SCE
Serial Number	SN 24/13 EPH41
Product Condition (new / used)	Used
Frequency Range of Probe	0.7GHz-2.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=1.139 MΩ Dipole 2: R2=1.139 MΩ Dipole 3: R3=1.104 MΩ

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOHAC E field Probes are built in accordance to the ANSI C63.19 and IEEE 1309 standards.

Figure 1 – *MVG COMOHAC E field Probe*

Probe Length	330 mm
Length of Individual Dipoles	3.3 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	5 mm
Distance between dipoles / probe extremity	3 mm

3 MEASUREMENT METHOD

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

3.1 LINEARITY

The linearity was determined using a standard dipole with the probe positioned 10 mm above the dipole. The input power of the dipole was adjusted from -15 to 36 dBm using a 1dB step (to cover the range 2V/m to 1000A/m).

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using the waveguide method outlined in the fore mentioned standards.

3.3 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps.

3.4 PROBE MODULATION RESPONSE

The modulation factor was determined by illuminating the probe with a reference wave from a standard dipole 10 mm away, applying first a CW signal and then a modulated signal (both at same power level). The modulation factor is the ratio, in linear units, of the CW to modulated signal reading.

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528 and IEC/CEI 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. 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 probe calibration in waveguide					
ERROR SOURCES	**Uncertainty value (%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (%)**
Incident or forward power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Reflected power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Field homogeneity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Field probe positioning	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Combined standard uncertainty					4.509%
Expanded uncertainty 95 % confidence level k = 2					9.0%

5 CALIBRATION MEASUREMENT RESULTS

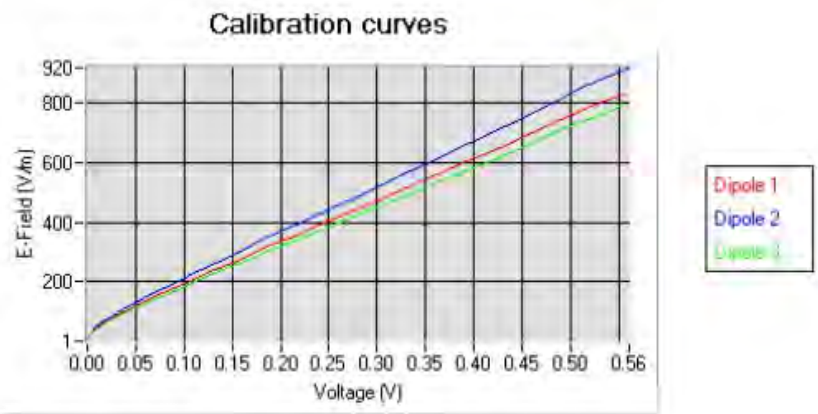
Calibration Parameters	
Lab Temperature	21 °C

Lab Humidity	45 %

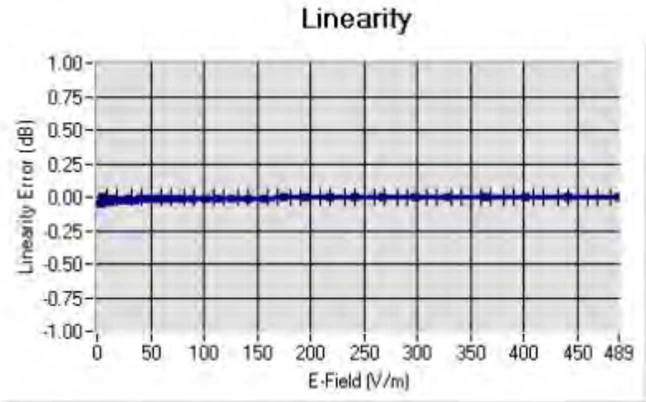
5.1 SENSITIVITY IN AIR

Normx dipole 1 (µV/(V/m)²)	Normy dipole 2 (µV/(V/m)²)	Normz dipole 3 (µV/(V/m)²)
5.19	5.27	5.14

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
95	97	91

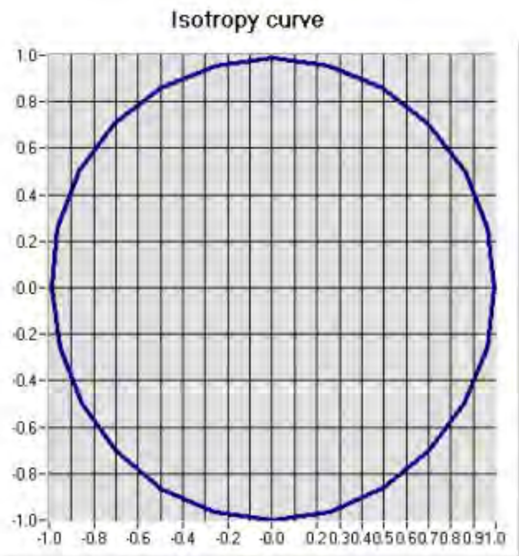


5.2 LINEARITY



Linearity:+/-1.10% (+/-0.05dB)

5.3 ISOTROPY



Isotropy:+/-0.71% (+/-0.03dB)

6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
HAC positioning ruler	MVG	TABH12 SN 42/09	Validated. No cal required.	Validated. No cal required.
COMOHAC Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	MVG	EPH28 SN 08/11	10/2014	10/2015
Reference Probe	MVG	HPH38 SN31/10	10/2014	10/2015
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

F.2 800-950 MHz Dipole

HAC Reference Dipole Calibration Report

Ref : ACR.75.19.15.SATU.A

SHENZHEN BALUN TECHNOLOGY CO.,LTD.
BLOCK B, FL 1, BAISHA SCIENCE AND TECHNOLOGY PARK, SHAHE XI ROAD,
NANSHAN DISTRICT, SHENZHEN, GUANGDONG PROVINCE, P.R. CHINA 518055
MVG COMOHAC REFERENCE DIPOLE
FREQUENCY: 800-950MHZ
SERIAL NO.: SN 18/12 DHA41

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

03/16/2015

Summary:

This document presents the method and results from an accredited HAC reference dipole calibration performed in MVG USA using the COMOHAC test bench. All calibration results are traceable to national metrology institutions.

HAC REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.75.19.15.SATU.A

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	3/16/2015	JS
Checked by :	Jérôme LUC	Product Manager	3/16/2015	JS
Approved by :	Kim RUTKOWSKI	Quality Manager	3/16/2015	Kim Rutkowski

	Customer Name
Distribution :	SHENZHEN BALUN TECHNOLOGY Co.,Ltd.

Issue	*Date*	*Modifications*
A	3/16/2015	Initial release

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TABLE OF CONTENTS

1 INTRODUCTION

This document contains a summary of the requirements set forth by the ANSI C63.19 standard for reference dipoles used for HAC measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOHAC 800-950 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SIDB835
Serial Number	SN 18/12 DHA41
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOHAC Validation Dipoles are built in accordance to the ANSI C63.19 standard. The product is designed for use with the COMOHAC system only.

Figure 1 – *MVG COMOHAC Validation Dipole*

4 MEASUREMENT METHOD

The ANSI C63.19 standard outlines the requirements for reference dipoles to be used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standard.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for HAC system validation measurements and checks must have a return loss of -10 dB or better. The return loss measurement shall be performed in free space.

4.2 REFERENCE DIPOLE CALIBRATION

The IEEE ANSI C63-19 standard states that the dipole used for validation measurements and checks must be scanned with the E and H field probe, with the dipole 10 mm below the probe. The E and H field strength plots are compared to the simulation results obtained by MVG.

5 MEASUREMENT UNCERTAINTY

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.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Gain
400-6000MHz	0.1 dB

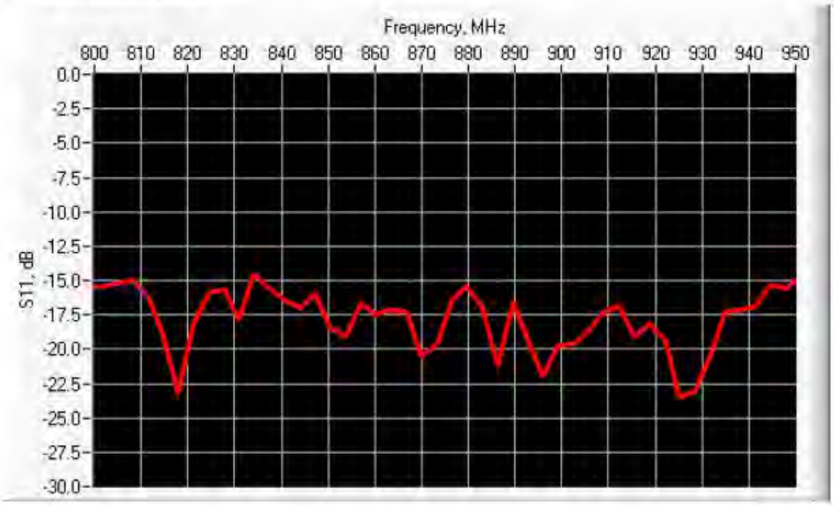
5.2 VALIDATION MEASUREMENT

The guideline outlined in the IEEE ANSI C63.19 standard was followed to generate the measurement uncertainty for validation measurements.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	**Uncertainty value (%)**	**Probability Distribution**	**Divisor**	**Uncertainty (dB)**	**Standard Uncertainty (%)**
RF reflections	0.1	R	$\sqrt{3}$	0.06	
Field probe conv. Factor	0.4	R	$\sqrt{3}$	0.23	
Field probe anisotropy	0.25	R	$\sqrt{3}$	0.14	
Positioning accuracy	0.2	R	$\sqrt{3}$	0.12	
Probe cable placement	0.1	R	$\sqrt{3}$	0.06	
System repeatability	0.2	R	$\sqrt{3}$	0.12	
EUT repeatability	0.4	N	1	0.40	
Combined standard uncertainty				0.52	
Expanded uncertainty 95 % confidence level k = 2				1.00	13.0

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Worst Case Return Loss (dB)	Requirement (dB)
800-950 MHz	-14.53	-10

6.2 VALIDATION MEASUREMENT

The IEEE ANSI C63.19 standard states that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss requirements. The system validations measurement results are then compared to MVG's simulated results.

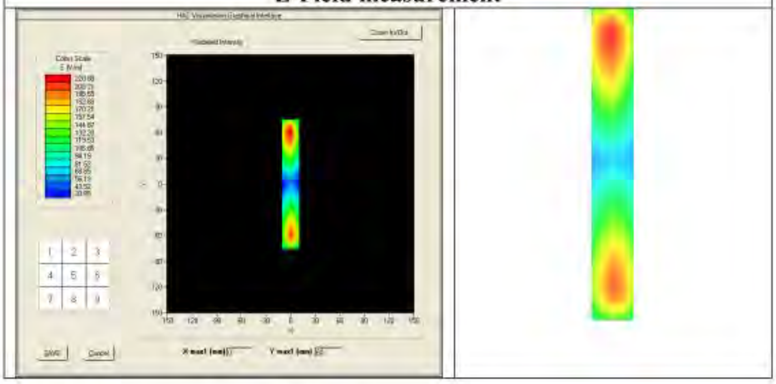
Measurement Condition

Software Version	OpenHAC V2
HAC positioning ruler	SN 42/09 TABH12
E-Field probe	SN 08/11 EPH28
H-Field probe	SN 31/10 HPH38
Distance between dipole and sensor center	10 mm
E-field scan size	X=150mm/Y=20mm
H-field scan size	X=40mm/Y=20mm
Scan resolution	dx=5mm/dy=5mm
Frequency	835 MHz
Input power	20 dBm
Lab Temperature	21°C
Lab Humidity	45%

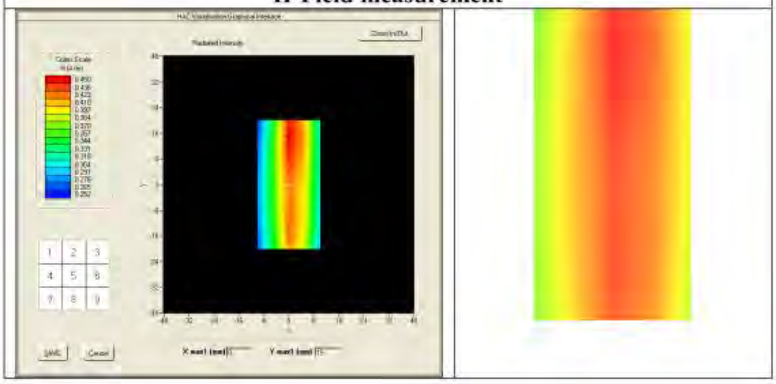
Measurement Result

	Measured	Internal Requirement
E field (V/m)	220.88	220.4
H field (A/m)	0.45	0.445

E-Field measurement



H-Field measurement



7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
HAC positioning ruler	MVG	TABH12 SN 42/09	Validated. No cal required.	Validated. No cal required.
COMOHAC Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	MVG	EPH28 SN 08/11	10/2014	10/2015
Reference Probe	MVG	HPH38 SN31/10	10/2014	10/2015
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

F.3 1700-2000 MHz Dipole

HAC Reference Dipole Calibration Report

Ref : ACR.75.20.15.SATU.A

SHENZHEN BALUN TECHNOLOGY CO.,LTD.
BLOCK B, FL 1, BAISHA SCIENCE AND TECHNOLOGY PARK, SHAHE XI ROAD,
NANSHAN DISTRICT, SHENZHEN, GUANGDONG PROVINCE, P.R. CHINA 518055
MVG COMOHAC REFERENCE DIPOLE
FREQUENCY: 1700-2000MHZ
SERIAL NO.: SN 18/12 DHB46

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

03/16/2015

Summary:

This document presents the method and results from an accredited HAC reference dipole calibration performed in MVG USA using the COMOHAC test bench. All calibration results are traceable to national metrology institutions.

TABLE OF CONTENTS

1 INTRODUCTION

This document contains a summary of the requirements set forth by the ANSI C63.19 standard for reference dipoles used for HAC measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOHAC 1700-2000 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SIDB1900
Serial Number	SN 18/12 DHB46
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOHAC Validation Dipoles are built in accordance to the ANSI C63.19 standard. The product is designed for use with the COMOHAC system only.

Figure 1 – *MVG COMOHAC Validation Dipole*

4 MEASUREMENT METHOD

The ANSI C63.19 standard outlines the requirements for reference dipoles to be used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standard.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for HAC system validation measurements and checks must have a return loss of -10 dB or better. The return loss measurement shall be performed in free space.

4.2 REFERENCE DIPOLE CALIBRATION

The IEEE ANSI C63-19 standard states that the dipole used for validation measurements and checks must be scanned with the E and H field probe, with the dipole 10 mm below the probe. The E and H field strength plots are compared to the simulation results obtained by MVG.

5 MEASUREMENT UNCERTAINTY

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.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Gain
400-6000MHz	0.1 dB

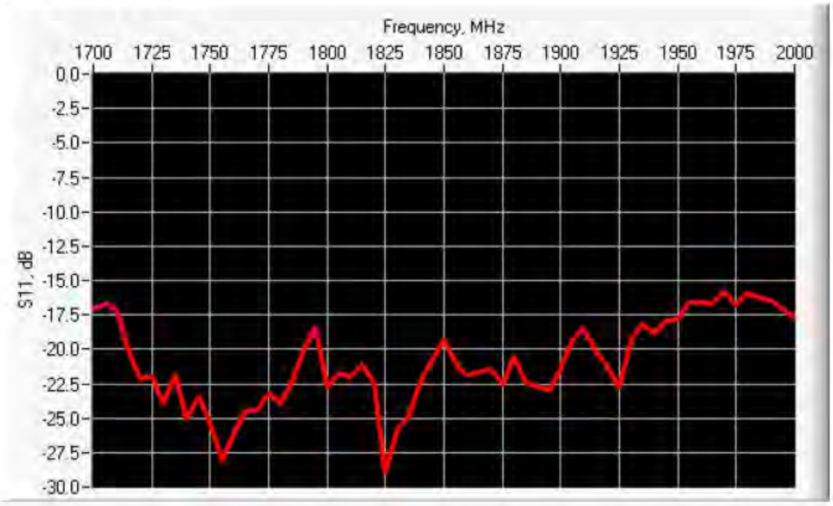
5.2 VALIDATION MEASUREMENT

The guideline outlined in the IEEE ANSI C63.19 standard was followed to generate the measurement uncertainty for validation measurements.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	Uncertainty value (%)	Probability Distribution	Divisor	Uncertainty (dB)	Standard Uncertainty (%)
RF reflections	0.1	R	$\sqrt{3}$	0.06	
Field probe conv. Factor	0.4	R	$\sqrt{3}$	0.23	
Field probe anisotropy	0.25	R	$\sqrt{3}$	0.14	
Positioning accuracy	0.2	R	$\sqrt{3}$	0.12	
Probe cable placement	0.1	R	$\sqrt{3}$	0.06	
System repeatability	0.2	R	$\sqrt{3}$	0.12	
EUT repeatability	0.4	N	1	0.40	
Combined standard uncertainty				0.52	
Expanded uncertainty 95 % confidence level k = 2				1.00	13.0

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Worst Case Return Loss (dB)	Requirement (dB)
1700-2000 MHz	-15.78	-10

6.2 VALIDATION MEASUREMENT

The IEEE ANSI C63.19 standard states that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss requirements. The system validations measurement results are then compared to MVG's simulated results.

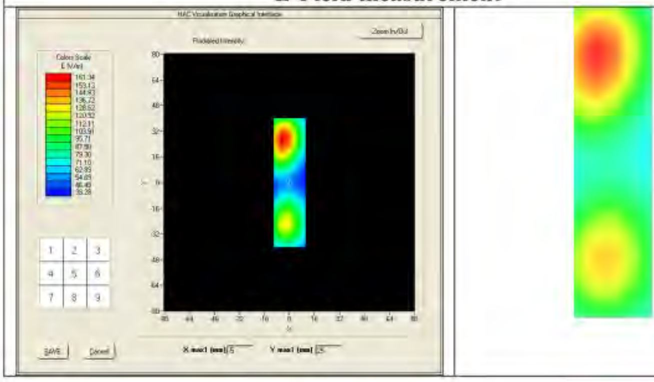
Measurement Condition

Software Version	OpenHAC V2
HAC positioning ruler	SN 42/09 TABH12
E-Field probe	SN 08/11 EPH28
H-Field probe	SN 31/10 HPH38
Distance between dipole and sensor center	10 mm
E-field scan size	X=150mm/Y=20mm
H-field scan size	X=40mm/Y=20mm
Scan resolution	dx=5mm/dy=5mm
Frequency	1900 MHz
Input power	20 dBm
Lab Temperature	21°C
Lab Humidity	45%

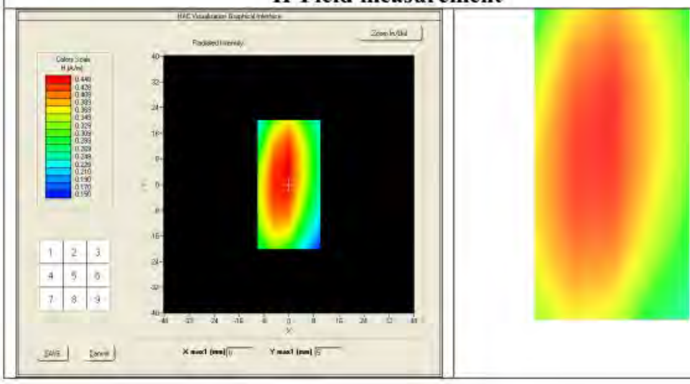
Measurement Result

	Measured	Internal Requirement
E field (V/m)	161.34	153.4
H field (A/m)	0.45	0.445

E-Field measurement



H-Field measurement



7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
HAC positioning ruler	MVG	TABH12 SN 42/09	Validated. No cal required.	Validated. No cal required.
COMOHAC Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	MVG	EPH28 SN 08/11	10/2014	10/2015
Reference Probe	MVG	HPH38 SN31/10	10/2015	10/2015
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

F.3 2100-2600 MHz Dipole

HAC Reference Dipole Calibration Report

Ref : ACR.75.21.15.SATU.A

SHENZHEN BALUN TECHNOLOGY CO.,LTD.
BLOCK B, FL 1, BAISHA SCIENCE AND TECHNOLOGY PARK, SHAHE XI ROAD,
NANSHAN DISTRICT, SHENZHEN, GUANGDONG PROVINCE, P.R. CHINA 518055
MVG COMOHAC REFERENCE DIPOLE
FREQUENCY: 2100-2600MHZ
SERIAL NO.: SN 18/12 DHC48

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

03/16/2015

Summary:

This document presents the method and results from an accredited HAC reference dipole calibration performed in MVG USA using the COMOHAC test bench. All calibration results are traceable to national metrology institutions.

HAC REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.75.21.15.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	3/16/2015	JS
Checked by :	Jérôme LUC	Product Manager	3/16/2015	JS
Approved by :	Kim RUTKOWSKI	Quality Manager	3/16/2015	[illegible]

	Customer Name
Distribution :	SHENZHEN BALUN TECHNOLOGY Co.,Ltd.

Issue	Date	Modifications
A	3/16/2015	Initial release

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TABLE OF CONTENTS

1 INTRODUCTION

This document contains a summary of the requirements set forth by the ANSI C63.19 standard for reference dipoles used for HAC measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOHAC 2100-2600 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SIDB2450
Serial Number	SN 18/12 DHC48
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOHAC Validation Dipoles are built in accordance to the ANSI C63.19 standard. The product is designed for use with the COMOHAC system only.

Figure 1 – *MVG COMOHAC Validation Dipole*

4 MEASUREMENT METHOD

The ANSI C63.19 standard outlines the requirements for reference dipoles to be used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standard.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for HAC system validation measurements and checks must have a return loss of -10 dB or better. The return loss measurement shall be performed in free space.

4.2 REFERENCE DIPOLE CALIBRATION

The IEEE ANSI C63-19 standard states that the dipole used for validation measurements and checks must be scanned with the E and H field probe, with the dipole 10 mm below the probe. The E and H field strength plots are compared to the simulation results obtained by MVG.

5 MEASUREMENT UNCERTAINTY

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.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Gain
400-6000MHz	0.1 dB

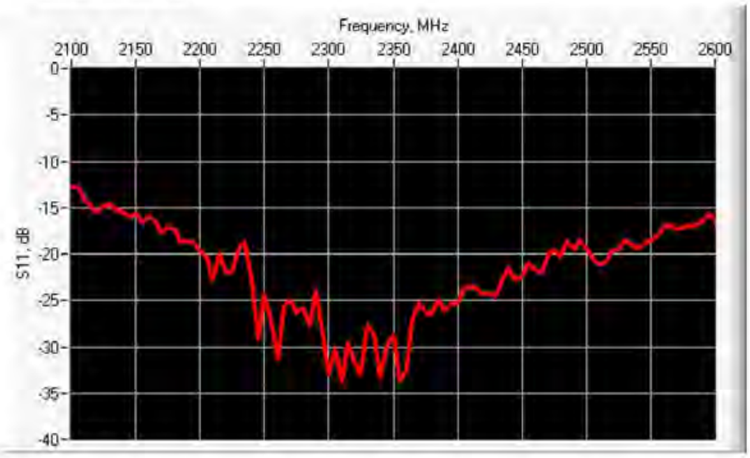
5.2 VALIDATION MEASUREMENT

The guideline outlined in the IEEE ANSI C63.19 standard was followed to generate the measurement uncertainty for validation measurements.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	**Uncertainty value (%)**	**Probability Distribution**	**Divisor**	**Uncertainty (dB)**	**Standard Uncertainty (%)**
RF reflections	0.1	R	$\sqrt{3}$	0.06	
Field probe conv. Factor	0.4	R	$\sqrt{3}$	0.23	
Field probe anisotropy	0.25	R	$\sqrt{3}$	0.14	
Positioning accuracy	0.2	R	$\sqrt{3}$	0.12	
Probe cable placement	0.1	R	$\sqrt{3}$	0.06	
System repeatability	0.2	R	$\sqrt{3}$	0.12	
EUT repeatability	0.4	N	1	0.40	
Combined standard uncertainty				0.52	
Expanded uncertainty 95 % confidence level k = 2				1.00	13.0

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Worst Case Return Loss (dB)	Requirement (dB)
2100-2600 MHz	-12.80	-10

6.2 VALIDATION MEASUREMENT

The IEEE ANSI C63.19 standard states that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss requirements. The system validations measurement results are then compared to MVG's simulated results.

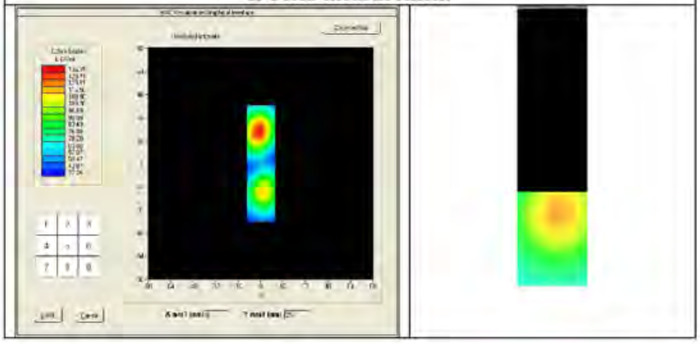
Measurement Condition

Software Version	OpenHAC V2
HAC positioning ruler	SN 42/09 TABH12
E-Field probe	SN 08/11 EPH28
H-Field probe	SN 31/10 HPH38
Distance between dipole and sensor center	10 mm
E-field scan size	X=150mm/Y=20mm
H-field scan size	X=40mm/Y=20mm
Scan resolution	dx=5mm/dy=5mm
Frequency	2450 MHz
Input power	20 dBm
Lab Temperature	21°C
Lab Humidity	45%

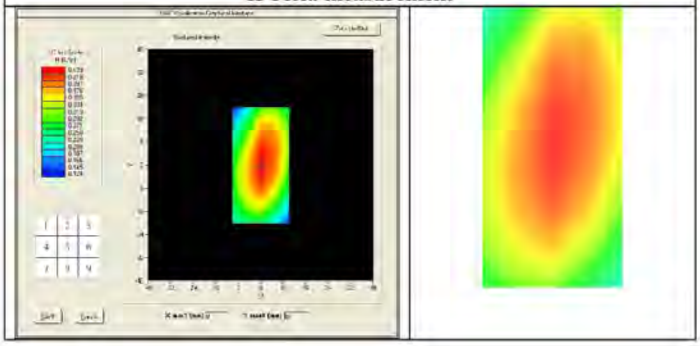
Measurement Result

	Measured	Internal Requirement
E field (V/m)	136.31	134.7
H field (A/m)	0.44	0.439

E-Field measurement



H-Field measurement



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Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

--END OF REPORT--