



## FCC HAC (RF) Compliance Test Report

Product Name: Smart Phone

Model: H1511

Report No.: SYBH(Z-SAR)012072015-H1

FCC ID: QISH1511

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DATE	2015-09-07	2015-09-07

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### Reliability Laboratory of Huawei Technologies Co., Ltd.

## Table of Contents

1	General Information.....	4
1.1	Statement of Compliance .....	4
1.2	ANSI C63.19-2011 limits .....	4
1.3	EUT Description .....	5
1.3.1	General Description .....	7
1.3.2	List of air interfaces/frequency bands .....	8
1.4	Test specification(s).....	9
1.5	Testing laboratory.....	9
1.6	Applicant and Manufacturer .....	9
1.7	Application details.....	9
1.8	Ambient Condition .....	9
2	HAC RF Measurement System.....	10
2.1	HAC RF Measurement Set-up .....	10
2.2	Probe description.....	11
2.3	Test Arch Phantom & Phone Positioner .....	11
2.4	WD RF Emission Measurements Reference and Plane .....	12
2.5	Test Equipment List.....	13
2.6	Measurement Uncertainty Evaluation .....	14
3	System Verification Procedure .....	15
3.1	System Check .....	15
3.2	Validation Result.....	15
3.3	Modulation Interference Factor .....	16
4	HAC Measurement Procedure .....	17
5	HAC Test Configuration .....	18
5.1	General Description.....	18
5.2	GSM Test Configuration .....	18
5.3	CDMA Test Configuration.....	18
5.4	UMTS Test Configuration .....	18
6	HAC RF Measurement Results .....	19
6.1	Conducted power measurements .....	19
6.2	Low-power Exemption Conclusions .....	21
6.3	E-Field Emission Results.....	22
	Appendix A. System Check Plots .....	23
	Appendix B. HAC Measurement Plots.....	23
	Appendix C. Calibration Certificate.....	23
	Appendix D. Photo documentation .....	23
	Appendix E. MIF Specification documentation .....	23

**※ ※ Modified History ※ ※**

<b>REV.</b>	<b>DESCRIPTION</b>	<b>ISSUED DATE</b>	<b>REMARK</b>
Rev.1.0	Initial Test Report Release	2015-09-07	Li Wei

## 1 General Information

### 1.1 Statement of Compliance

The M-rating of Hearing-Aid Compatibility (HAC) found during testing for H1511 are as below Table 1. So the M-rating of H1511 is **M3**.

Band	HAC RF Emission Test result*		M-rating
<b>GSM850</b>	E-Field dB(V/m)	43.18	<b>M3</b>
<b>GSM1900</b>	E-Field dB(V/m)	26.99	M4
<b>UMTS Band II</b>	E-Field dB(V/m)	/	M4
<b>UMTS Band IV</b>	E-Field dB(V/m)	/	M4
<b>UMTS Band V</b>	E-Field dB(V/m)	/	M4
<b>CDMA BC0</b>	E-Field dB(V/m)	/	M4
<b>CDMA BC1</b>	E-Field dB(V/m)	/	M4
<b>CDMA BC10</b>	E-Field dB(V/m)	/	M4

Table 1: Summary of test result

Note:

1) This portable wireless equipment has been shown to be hearing-aid compatible under the above rated category, specified in ANSI/IEEE Std.C63.19-2011 and had been tested in accordance with the specified measurement procedures, Hear-Aid Compatibility is based on the assumption that all production units will be designed electrically identical to the device tested in this report. Test results reported herein relate only to the item(s) tested and are for North American Bands only.

2) \*- HAC RF Emission Test for CDMA &UMTS bands are exempted according to ANSI C63.19-2011 and HAC RF Emission rating is M4 (Refer to Section 6.2 for details).

### 1.2 ANSI C63.19-2011 limits

Emission Categories	E-field emissions	
	< 960 MHz	> 960 MHz
Category M1	50 to 55 dB(V/m)	40 to 45 dB(V/m)
Category M2	45 to 50 dB(V/m)	35 to 40 dB(V/m)
Category M3	40 to 45 dB(V/m)	30 to 35 dB(V/m)
Category M4	<40 dB(V/m)	<30 dB(V/m)

Table 2: Telephone near-field categories in linear units

### 1.3 EUT Description

Device Information:			
DUT Name:	Smart Phone		
Type Identification:	H1511		
FCC ID :	QISH1511		
MEID DEC:	867686020041123		
Device Type :	Portable device		
Exposure Category:	Uncontrolled environment / general population		
Device Phase:	Identical Prototype		
Hardware Version :	HL1NINAMH		
Software Version :	User release M MDA		
Antenna Type :	Internal		
Others Accessories	Headset		
Device Operating Configurations:			
Supporting Mode(s)	GSM850/1900;CDMA BC0/BC1/BC10;UMTS Band II/IV/V, LTE Band II/IV/V/VII/XII/XIII/XVII/XXV/XXVI/ XXIX / XXX /XLI, WiFi 2.4G/5G,BT		
Test Modulation	GSM(GMSK/8PSK), CDMA(QPSK), UMTS(QPSK), LTE(QPSK/16QAM), WiFi(DSSS/OFDM),BT(GFSK)		
Operating Frequency Range(s)	Band(MHz)	Tx (MHz)	Rx (MHz)
	GSM850	824-849	869-894
	GSM1900	1850-1910	1930-1990
	CDMA BC0	824-849	869-894
	CDMA BC1	1850-1910	1930-1990
	CDMA BC10	806-824	851-869
	UMTS Band II	1850-1910	1930-1990
	UMTS Band IV	1710-1755	2110-2155
	UMTS Band V	824-849	869-894
	LTE Band II	1850 -1910	1930 -1990
	LTE Band IV	1710 -1755	2110 -2155
	LTE Band V	824-849	869-894
	LTE Band VII	2500 -2570	2620 -2690
	LTE Band XII	699-716	729-746
	LTE Band XIII	777-787	746-756
	LTE Band XVII	704-716	734-746
	LTE Band XXV	1850-1915	1925-1990
	LTE Band XXVI	814-849	859-894
	LTE Band XXIX	N/A	717-728
	LTE Band XXX	2305-2315	2350-2360
	LTE Band XLI	2496-2690	2496-2690
	WiFi 2.4G	2412-2462	
	WiFi 5G	5150-5250	
5250-5350			
5470-5725			
5725-5850			
BT	2402-2480		
Power Class :	4, tested with power level 5(GSM850)		
	1, tested with power level 0(GSM1900)		
	Tested with power control "All up" (CDMA BC0)		
	Tested with power control "All up" (CDMA BC1)		
	Tested with power control "All up" (CDMA BC10)		
	3, tested with power control "all 1"(UMTS Band II)		
	3, tested with power control "all 1"(UMTS Band IV)		

	3, tested with power control "all 1"(UMTS Band V)
Test Channels (low-mid-high) :	128-190-251(GSM850)
	512-661-810(GSM1900)
	1013-384-777(CDMA BC0)
	25-600-1175(CDMA BC1)
	450-565-670(CDMA BC10)
	9262-9400-9538(UMTS Band II)
	1312-1413-1513(UMTS Band IV)
	4132-4182-4233(UMTS Band V)

Table 3: Device information and operating configuration

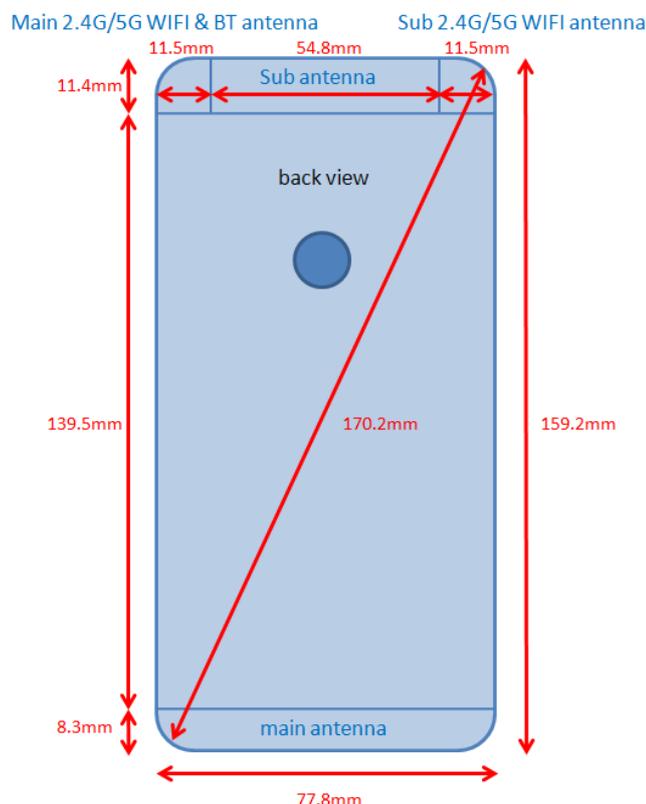
### 1.3.1 General Description

H1511 is subscriber equipment in the LTE/WCDMA/CDMA/GSM system. The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. The HSPA+/UMTS frequency band is Band I and Band II and Band IV and Band V. The CDMA/1XEV-DO band is BC1 and BC0 and BC10. The LTE frequency band is B2 and B3 and B4 and B5 and B7 and B12 and B13 and B17 and B25 and B26 and B29 and B30 and B41. But only GSM850 and GSM1900MHz and WCDMA Band II and Band IV and Band V and CDMA BC1 and BC0 and BC10 and LTE B2 and LTE B4 and LTE B5 and LTE B7 and LTE B12 and LTE B13 and LTE B17 and LTE B25 and LTE B26 and B29 and B30 and LTE B41 bands test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, LTE/HSPA+/UMTS and GSM/GPRS/EDGE and CDMA2000 1x and 1XEV-DO protocol processing, voice, video MMS service, GPS, AGPS NFC and WIFI etc. Externally it provides micro SD card interface (it can also used as micro SD card interface), earphone port (to provide voice service) and USIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

#### Battery Information:

Name	Manufacture	Serials number	Description
Rechargeable Li-ion	Huawei Technologies Co., Ltd.	N/A	Battery Model: HB416683ECW Rated capacity: 3450mAh Nominal Voltage: $\text{---}$ 3.8V Charging Voltage: $\text{---}$ 4.35V

The location of the antennas inside device is shown as below picture:



**Note:**

1) The device supports the dynamic antenna switching function to optimize transmission efficiency for wide range frequency operations. It has two 2G/3G/4G Tx antennas (Main Antenna and Sub Antenna). Main Antenna can support 2G/3G/4G. Sub Antenna only supports GSM850, UMTS Band V, CDMA BC0/10 and LTE Band V/XII/XIII/XVII/XXVI.

### 1.3.2 List of air interfaces/frequency bands

Air-Interface	Bands (MHz)	Type	C63.19 HAC tested	Simultaneous but not tested	OTT	Additional GSM power reduction
GSM	850	VO	Yes	Yes:WiFi/BT	N/A	N/A
	1900	VO	Yes	Yes:WiFi/BT	N/A	N/A
	GPRS/EDGE	DT	N/A	Yes:WiFi/BT	Yes	N/A
CDMA	BC0(850)	VO	Yes*	Yes-WiFi/BT	N/A	N/A
	BC1(1900)	VO	Yes*	Yes-WiFi/BT	N/A	N/A
	BC10(800)	VO	Yes*	Yes-WiFi/BT	N/A	N/A
	1x/EVDO	DT	N/A	Yes-WiFi/BT	Yes	N/A
UMTS	Band II(1900)	VO	Yes*	Yes:WiFi/BT	N/A	N/A
	Band IV(1700)	VO	Yes*	Yes:WiFi/BT	N/A	N/A
	Band V(850)	VO	Yes*	Yes:WiFi/BT	N/A	N/A
	HSPA/DC-HSDPA	DT	N/A	Yes:WiFi/BT	Yes	N/A
LTE	LTE Band II	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band IV	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band V	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band VII	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band XII	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band XIII	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band XVII	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band XXV	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band XXVI	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band XXIX	VD	No**	Yes:WiFi/BT	Yes	N/A
	LTE Band XXX	VD	No**	Yes:WiFi/BT	Yes	N/A
LTE Band XLI	VD	No**	Yes:WiFi/BT	Yes	N/A	
WiFi	2.4G	VD	No**	Yes:GSM/UMTS/CDMA/LTE	Yes	N/A
WiFi	5G	VD	No**	Yes:GSM/UMTS/CDMA/LTE	Yes	N/A
BT	2.4G	DT	N/A	Yes:GSM/UMTS/CDMA/LTE	N/A	N/A

Note:

1) Type Transport

VO =Voice Only

DT = Digital Data – Not intended for CMRS service

VD = CMRS and Data Transport

2) \*- Evaluated for MIF and low-power exemption according to ANSI C63.19-2011.

3) \*\*- T-coil measurement has not been made in accordance with the guidance issued by OET in KDB publication 285076 D02 T-Coil testing for CMRS IP for that air interface. The M value for the associated acoustical location has not been tested.

4) The 3GPP VoLTE CMRS service is defined by GSMA in PRD IR.92 for IP Voice Service and Digital Transport.

#### 1.4 Test specification(s)

ANSI C63.19-2011	American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids
KDB 285076 D01	HAC Guidance v04

#### 1.5 Testing laboratory

Test Site	Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Zone G1, Huawei Industrial Base, Bantian Industry Area, Longgang District, Shenzhen, Guangdong, China
Telephone	+86-755-28785513
Fax	+86-755-36834474
State of accreditation	The Test laboratory (area of testing) is accredited according to ISO/IEC 17025. CNAS Registration number: L0310 A2LA TESTING CERT #2174.01

#### 1.6 Applicant and Manufacturer

Company Name	HUAWEI TECHNOLOGIES CO., LTD
Address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

#### 1.7 Application details

Start Date of test	2015-08-06
End Date of test	2015-08-06

#### 1.8 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

## 2 HAC RF Measurement System

### 2.1 HAC RF Measurement Set-up

These measurements are performed using the DASY5 NEO automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Stäubli), robot controller, Lenovo Intel Core i5 3.1 GHz computer, near-field probe, probe alignment sensor. The robot is a six-axis industrial robot performing precise movements. A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The PC consists of the Lenovo Intel Core i5 3.1 GHz computer with Windows 7 system and HAC Measurement Software DASY5 NEO, A/D interface card, monitor, mouse, and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

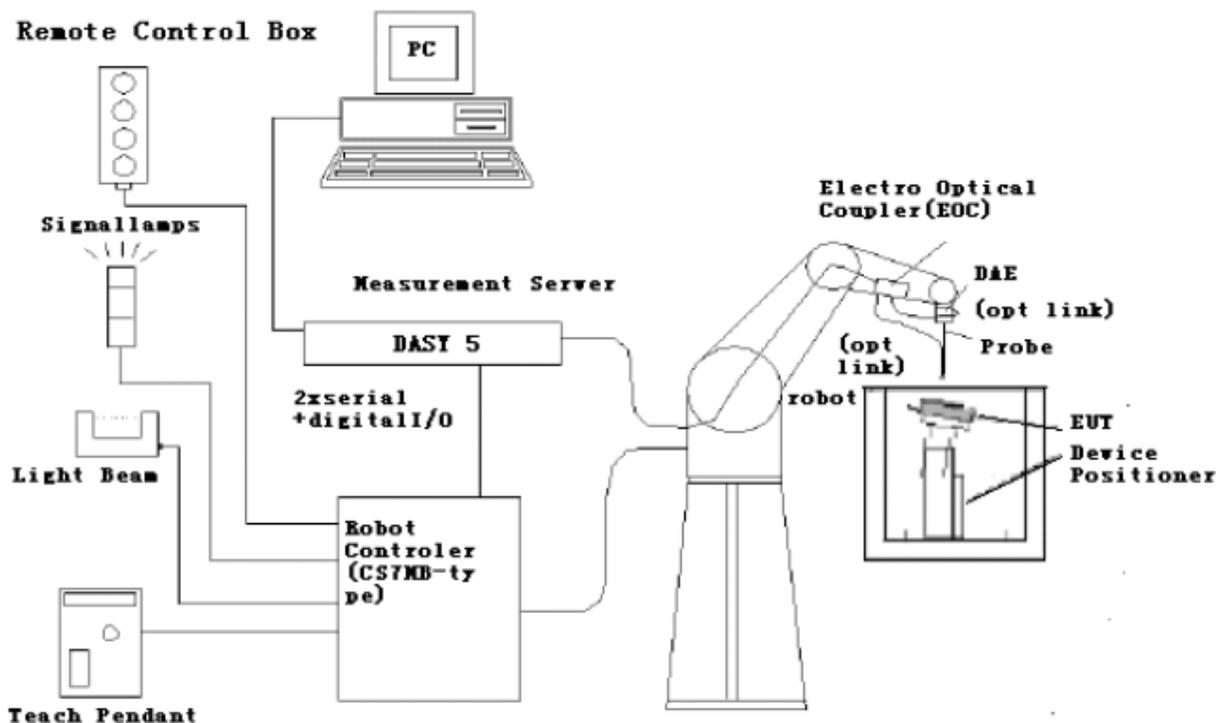
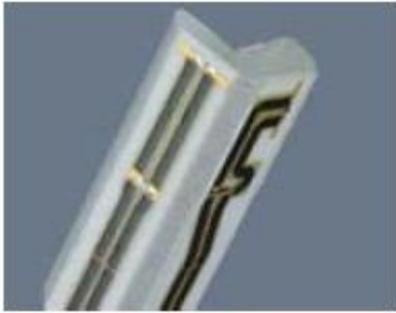


Fig. 1 HAC Test Measurement Set-up

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

## 2.2 Probe description

### E-Field Probe Description

Construction	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges PEEK enclosure material	 <p>[ER3DV6]</p>
Calibration	In air from 100 MHz to 3.0 GHz (absolute accuracy $\pm 6.0\%$ , $k=2$ )	
Frequency	40 MHz to > 6 GHz (can be extended to < 20 MHz) Linearity: $\pm 0.2$ dB (100 MHz to 3 GHz)	
Directivity	$\pm 0.2$ dB in air (rotation around probe axis) $\pm 0.4$ dB in air (rotation normal to probe axis)	
Dynamic range	2 V/m to > 1000 V/m; Linearity: $\pm 0.2$ dB	
Dimensions	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.5 mm The closest part of the sensor element is 1.1mm closer to the tip	
Application	General near-field measurements up to 6 GHz Field component measurements Fast automatic scanning in phantoms	

## 2.3 Test Arch Phantom & Phone Positioner

The Test Arch phantom should be positioned horizontally on a stable surface. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. It enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot (Dimensions: 370 x 370 x 370 mm).

The Phone Positioner supports accurate and reliable positioning of any phone with effect on near field  $< \pm 0.5$  dB.

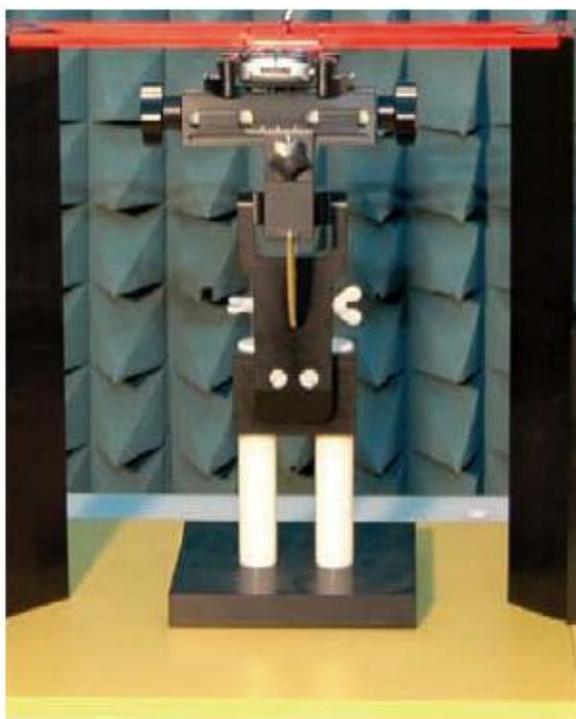


Fig. 2 HAC Phantom & Device Holder

## 2.4 WD RF Emission Measurements Reference and Plane

Figure 3 illustrates the references and reference plane that shall be used in the WD emissions measurement.

- The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.
- The grid is centered on the audio frequency output transducer of the WD (speaker or T-coil).
- The grid is located by reference to a reference plane. This reference plane is the planar area that contains the highest point in the area of the WD that normally rests against the user's ear
- The measurement plane is located parallel to the reference plane and 15 mm from it, out from the phone. The grid is located in the measurement plane.



Fig. 3 WD reference and plane for RF emission measurements

## 2.5 Test Equipment List

This table gives a complete overview of the HAC measurement equipment

Devices used during the test described are marked

	Manufacturer	Device	Type	Serial number	Date of last calibration	Valid period
<input checked="" type="checkbox"/>	SPEAG	Dosimetric E-Field Probe	ER3DV6	2441	2014-11-21	One year
<input checked="" type="checkbox"/>	SPEAG	835 MHz Dipole	CD835V3	1114	2014-11-17	One year
<input checked="" type="checkbox"/>	SPEAG	1880 MHz Dipole	CD1880V3	1100	2014-11-17	One year
<input checked="" type="checkbox"/>	SPEAG	Data acquisition electronics	DAE4	852	2015-04-27	One year
<input checked="" type="checkbox"/>	SPEAG	HAC Test Arch	SD HAC P01 BA	1053	NCR	NCR
<input checked="" type="checkbox"/>	SPEAG	Software	DASY 5	N/A	NCR	NCR
<input checked="" type="checkbox"/>	Agilent	Signal Generator	N5181A	MY47420989	2015-01-07	One year
<input checked="" type="checkbox"/>	MINI-CIRCUITS	Amplifier	ZHL-42W	QA0746001	NCR	NCR
<input checked="" type="checkbox"/>	Agilent	Power Meter	E4417A	MY45101339	2015-01-07	One year
<input checked="" type="checkbox"/>	Agilent	Power Meter Sensor	E9321A	MY44420359	2015-01-07	One year
<input checked="" type="checkbox"/>	AR	Directional Coupler	DC7144M1	0423264	2015-05-04	One year
<input checked="" type="checkbox"/>	R & S	Power Meter	NRP	100740	2015-07-02	One year
<input checked="" type="checkbox"/>	R & S	Power Meter Sensor	NRP-Z11	106288	2015-07-02	One year
<input checked="" type="checkbox"/>	R & S	Universal Radio Communication Tester	CMU200	113989	2015-05-18	One year

## 2.6 Measurement Uncertainty Evaluation

Uncertainty Component	Uncertainty Value	Probability Distribution	Divisor	ci (E)	Standard Uncertainty (E)
<b>Measurement System</b>					
Probe calibration	± 5.1%	Normal	1	1	± 5.1%
Axial isotropy	± 4.7%	Rectangular	√3	1	± 2.7%
Sensor Displacement	± 16.5%	Rectangular	√3	1	± 9.5%
Test Arch	± 7.2%	Rectangular	√3	1	± 4.1%
Linearity	± 4.7%	Rectangular	√3	1	± 2.7%
Scaling to Peak Envelope Power	± 0.0%	Rectangular	√3	1	± 0.0%
System Detection Limit	± 1.0%	Rectangular	√3	1	± 0.6%
Readout Electronics	± 0.3%	Normal	1	1	± 0.3%
Response Time	± 0.8%	Rectangular	√3	1	± 0.5%
Integration Time	± 2.6%	Rectangular	√3	1	± 1.5%
RF Ambient Conditions	±3.0%	Rectangular	√3	1	± 1.7%
RF Reflections	±12.0%	Rectangular	√3	1	± 6.9%
Probe positioner	± 1.2%	Rectangular	√3	1	± 0.7%
Probe positioning	± 4.7%	Rectangular	√3	1	± 2.7%
Extrap. and Interpolation	± 1.0%	Rectangular	√3	1	± 0.6%
<b>Test Sample Related</b>					
Device Positioning Vertical	± 4.7%	Rectangular	√3	1	± 2.7%
Device Positioning Lateral	± 1.0%	Rectangular	1	1	± 0.6%
Device Holder and Phantom	± 2.4%	Rectangular	√3	1	± 1.4%
Power Drift	± 5.0%	Rectangular	√3	1	± 2.9%
<b>Phantom and Set-up</b>					
Phantom Thickness	± 2.4%	Rectangular	√3	1	± 1.4%
<b>Combined Std. Uncertainty</b>					<b>± 15.2%</b>
<b>Expanded Std. Uncertainty on Power</b>					<b>± 30.4%</b>
<b>Expanded Std. Uncertainty on Field</b>					<b>± 15.2%</b>

Table 4: Measurement uncertainties

Note: Worst-Case uncertainty budget for HAC free field assessment according to ANSI C63.19. The budget represents a worst case analysis. For specific tests and configurations, the uncertainty could be considerably smaller.

### 3 System Verification Procedure

#### 3.1 System Check

Place a dipole antenna meeting the requirements given in ANSI C63.19-2011 in the position normally occupied by the WD. The dipole antenna serves as a known source for an electrical and magnetic output. Position the E-field probe so that the following occurs:

- The probes and their cables are parallel to the coaxial feed of the dipole antenna
- The probe cables and the coaxial feed of the dipole antenna approach the measurement area from opposite directions
- The center point of the probe element(s) are 15 mm from the closest surface of the dipole elements.

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

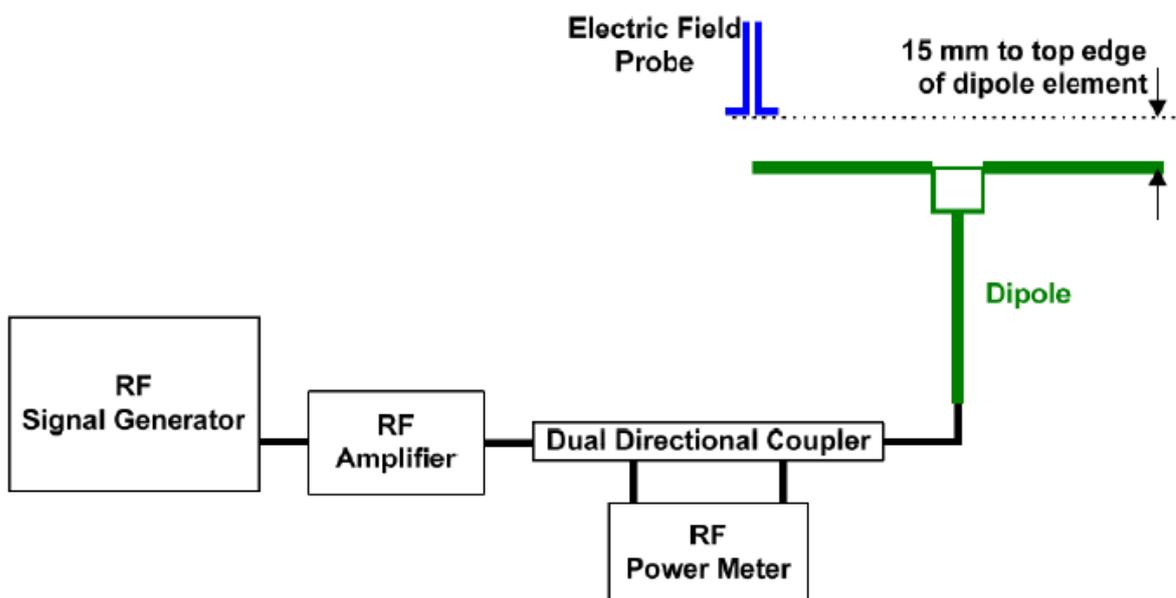


Fig. 4 Dipole Validation Setup

#### 3.2 Validation Result

Frequency (MHz)	Input Power (mW)	E-Field Value 1 (V/m)	E-Field Value 2 (V/m)	Averaged Measured Value <sup>1</sup> (V/m)	Target Value <sup>2</sup> (V/m)	Deviation <sup>3</sup> (%)	Limit <sup>4</sup> (%)	Test Date
835	100	119.1	113.2	116.2	106.3	9.27%	±25%	2015-08-06
1880	100	89.57	92.77	91.2	88.0	3.60%	±25%	2015-08-06

<sup>1</sup> Please refer to the attachment for detailed measurement data and plot.

<sup>2</sup> Target value is provided by SPEAD in the calibration certificate of specific dipoles.

<sup>3</sup> Deviation (%) = 100 \* (Measured value minus Target value) divided by Target value.

<sup>4</sup> ANSI C63.19 requires values within ± 25% are acceptable, of which 12% is deviation and 13% is measurement uncertainty. Values independently validated for the dipole actually used in the measurements should be used, when available.

### 3.3 Modulation Interference Factor

The HAC Standard ANSI C63.19-2011 defines a new scaling using the Modulation Interference Factor(MIF) which replaces the need for the Articulation Weighting Factor(AWF) during the evaluation and is applicable to any modulation scheme.

The Modulation Interference Factor(MIF, in dB) is added to the measured average E-field (in dB V/m) and converts it to the RF Audio Interference level(in dB V/m). This level considers the audible amplitude modulation components in the RF E-field. CW fields without amplitude modulation are assumed to not interfere with the hearing aid electronics. Modulations without time slots and low fluctuations at low frequencies have low MIF values. TDMA modulations with narrow transmission and repetition rates of few 100 Hz have high MIF values and give similar classifications as ANSI C63.19-2007.

ER3D E-Field probes have a bandwidth <10 kHz and can therefore not evaluate the RF envelope in the full audio band. DASY52 is therefore using the “indirect” measurement method according to ANSI C63.19-2011 which is the primary method. These near field probes read the averaged E-field measurement. Especially for the new high peak-to-average(PAR) signal types, the probes shall be linearized by probe modulation response(PMR) calibration in order to not overestimate the field reading. The evaluation method or the MIF is defined in ANSI C63.19-2011 section D.7. An RMS demodulated RF signal is fed to a spectral filter(similar to an A weighting filter) and forwarded to a temporal filter acting as a quasi-peak detector. The averaged output of these filtering is called to a 1 kHz 80% AM signal as reference. MIF measurement requires additional instrumentation and is not well suited for evaluation by the end user with reasonable uncertainty. It may alternatively be determined through analysis and simulation, because it is constraint and characteristic for a communication signal. DASY52 uses well defined signals for PMR calibration. The MIF of these signals has been determined by simulation and is automatically applied.

MIF values applied in this test report were provided by the HAC equipment provider, SPEAG, and the values are listed below:

UID	Communication System Name	MIF(dB)
10011-CAB	UMTS-FDD (WCDMA)	-27.23
10021-DAB	GSM-FDD (TDMA, GMSK)	3.63
10290-AAB	CDMA2000, RC1, SO55, Full Rate	-19.47
10291-AAB	CDMA2000, RC3, SO55, Full Rate	-19.70

The MIF measurement uncertainty is estimated as follows, declared by the HAC equipment provider, SPEAG, for modulation frequencies from slotted waveforms with fundamental frequency and at least 2 harmonics within 10 kHz:

- i) 0.2 dB for MIF: -7 to +5 dB
- ii) 0.5 dB for MIF: -13 to +11 dB
- iii) 1 dB for MIF: > -20 dB

## 4 HAC Measurement Procedure

### The evaluation was performed with the following procedure:

- a) Confirm the proper operation of the field probe, probe measurement system, and other instrumentation and the positioning system.
- b) Position the WD in its intended test position.
- c) Set the WD to transmit a fixed and repeatable combination of signal power and modulation characteristic that is representative of the worst case (highest interference potential) encountered in normal use. Transiently occurring start-up, changeover, or termination conditions, or other operations likely to occur less than 1% of the time during normal operation, may be excluded from consideration.
- d) The center subgrid shall be centered on the T-Coil mode perpendicular measurement point or the acoustic output, as appropriate. Locate the field probe at the initial test position in the 50 mm by 50 mm grid, which is contained in the measurement plane, refer to illustrated in Figure 3. If the field alignment method is used, align the probe for maximum field reception.
- e) Record the reading at the output of the measurement system.
- f) Scan the entire 50 mm by 50 mm region in equally spaced increments and record the reading at each measurement point. The distance between measurement points shall be sufficient to assure the identification of the maximum reading.
- g) Identify the five contiguous subgrids around the center subgrid whose maximum reading is the lowest of all available choices. This eliminates the three subgrids with the maximum readings. Thus, the six areas to be used to determine the WD's highest emissions are identified.
- h) Identify the maximum reading within the nonexcluded subgrids identified in step g).
- i) Convert the maximum reading identified in step h) to RF audio interference level, in, V/m, by taking the square root of the reading and then dividing it by the measurement system transfer function, established in 5.5.1.1. Convert the result to dB(V/m) by taking the base-10 logarithm and multiplying it by 20.

#### Indirect measurement method

Replacing step i) of 5.5.1.2, the RF audio interference level in dB(V/m) is obtained by adding the MIF (in dB) to the maximum steady-state rms field-strength reading, in dB(V/m), from step h). Use this result to determine the category rating.

- j) Compare this RF audio interference level with the categories in Clause 8 and record the resulting WD category rating.
- k) For the T-Coil mode M-rating assessment, determine whether the chosen perpendicular measurement point is contained in an included subgrid of the first scan. If so, then a second scan is not necessary. The first scan and resultant category rating may be used for the T-Coil mode M rating. Otherwise, repeat step a) through step i), with the grid shifted so that it is centered on the perpendicular measurement point. Record the WD category rating.

## **5 HAC Test Configuration**

### **5.1 General Description**

The phone was tested in all normal configurations for the ear use. The EUT is mounted in the device holder equivalent as for classic dosimeter measurements. The acoustic output of the EUT shall coincide with the center point of the area formed by the dielectric wire and the middle bar of the arch's top frame. The EUT shall be moved vertically upwards until it touches the frame. The fine adjustment is possible by sliding the complete. The EUT holder is on the yellow base plate of the Test Arch phantom. These test configurations are tested at the high, middle and low frequency channels of each applicable operating mode; for example, GSM, WCDMA(UMTS), CDMA and TDMA.

### **5.2 GSM Test Configuration**

A communication link is set up with a System Simulator (SS) by air link, and a call is established. The Absolute Radiofrequency Channel Number (ARFCN) is allocated to 128, 190 and 251 in the case of GSM850, to 512, 661 and 810 in the case of GSM1900. The EUT is commanded to operate at maximum transmitting power. Using CMU200 the power level is set to "5" in HAC of GSM850, set to "0" in HAC of GSM1900.

### **5.3 CDMA Test Configuration**

HAC tests for CDMA BC0, BC1 and BC10, a communication link is set up with a base station by air link. We established the radio link through call processing. The Absolute Radio Frequency Channel Number (ARFCN) are allocated to 1013, 384, 777CH respectively in the case of CDMA BC0, allocated to 25, 600, 1175CH respectively in the case of CDMA BC1, allocated to 450, 565, 670CH respectively in the case of CDMA BC10. RF configurations is measured in RC3 and RC1 with the EUT configured to transmit at full rate using Loopback Service Option SO55, at the same time the EUT shall be operated at its maximum RF output power setting.

### **5.4 UMTS Test Configuration**

A communication link is set up with a System Simulator (SS) by air link, and a call is established. The Absolute Radiofrequency Channel Number (ARFCN) is allocated to 9262, 9400 and 9538 in the case of UMTS Band II, to 1312, 1413 and 1513 in the case of UMTS Band IV, to 4132, 4182 and 4233 in the case of UMTS Band V. The EUT is commanded to operate at maximum transmitting power. Using CMU200 the power level is set to to all up bits for UMTS bands.

## 6 HAC RF Measurement Results

### 6.1 Conducted power measurements

GSM850	Test Mode	Burst Average Power (dBm)			Tune-up limit(dBm)
		128CH	190CH	251CH	
	GSM(CS)	30.74	30.70	30.52	31.5
CDMA BC0	Test Mode	Conducted Power (dBm)			Tune-up limit(dBm)
		1013CH	384CH	777CH	
	RC1 SO55	23.44	23.47	23.65	24.2
RC3 SO55	23.40	23.42	23.59		
CDMA BC10	Test Mode	Conducted Power (dBm)			Tune-up limit(dBm)
		450CH	565CH	670CH	
	RC1 SO55	23.42	23.50	23.47	24.2
RC3 SO55	23.40	23.45	23.41		
UMTS Band V	Test Mode	Average Power (dBm)			Tune-up limit(dBm)
		4132CH	4182CH	4233CH	
	12.2kbps RMC	22.93	22.96	23.01	
	64kbps RMC	22.90	22.88	22.97	
	144kbps RMC	22.97	22.99	23.00	
384kbps RMC	22.81	22.90	22.98	23.8	

Table 5: Conducted power measurement results of Sub Antenna

GSM850	Test Mode	Burst Average Power (dBm)			Tune-up limit(dBm)
		128CH	190CH	251CH	
	GSM(CS)	32.76	32.73	32.69	33.5
GSM1900	Test Mode	Burst Average Power (dBm)			Tune-up limit(dBm)
		512CH	661CH	810CH	
	GSM(CS)	30.93	30.98	30.84	31.0
CDMA BC0	Test Mode	Conducted Power (dBm)			Tune-up limit(dBm)
		1013CH	384CH	777CH	
	RC1 SO55	23.93	24.16	24.00	25.0
RC3 SO55	24.01	24.11	24.01		
CDMA BC1	Test Mode	Conducted Power (dBm)			Tune-up limit(dBm)
		25CH	600CH	1175CH	
	RC1 SO55	23.32	23.33	23.20	23.7
RC3 SO55	23.29	23.20	23.17		
CDMA BC10	Test Mode	Conducted Power (dBm)			Tune-up limit(dBm)
		450CH	565CH	670CH	
	RC1 SO55	24.11	24.25	24.18	25.0
RC3 SO55	24.05	24.14	24.10		
UMTS Band II	Test Mode	Average Power (dBm)			Tune-up limit(dBm)
		9262CH	9400CH	9538CH	
	12.2kbps RMC	22.79	22.82	22.70	23.0
	64kbps RMC	22.70	22.67	22.66	
	144kbps RMC	22.75	22.67	22.73	
384kbps RMC	22.71	22.70	22.63		
UMTS Band IV	Test Mode	Average Power (dBm)			Tune-up limit(dBm)
		1312CH	1413CH	1513CH	
	12.2kbps RMC	22.40	22.52	22.46	23.0
	64kbps RMC	22.38	22.44	22.47	
	144kbps RMC	22.44	22.43	22.50	
384kbps RMC	22.39	22.45	22.44		
UMTS Band V	Test Mode	Average Power (dBm)			Tune-up limit(dBm)
		4132CH	4182CH	4233CH	
	12.2kbps RMC	23.55	23.72	23.63	24.5
	64kbps RMC	23.47	23.62	23.60	
	144kbps RMC	23.46	23.67	23.55	
384kbps RMC	23.44	23.60	23.68		

Table 6: Conducted power measurement results of Main Antenna

## 6.2 Low-power Exemption Conclusions

According to ANSI C63.19-2011, a RF air interface technology of a device is exempt from testing when its average antenna input power plus its MIF is  $\leq 17$  dBm for any of its operation modes.

Air Interface	Test Mode	Maxium Average Power(dBm)	MIF(dB)	Total (Power + MIF,dB)	C63.19 HAC RF testing required
<b>Sub Antenna</b>					
GSM850	GSM	31.5	3.63	35.13	Yes
CDMA BC0	RC1 SO55	24.2	-19.47	4.73	No
	RC3 SO55	24.2	-19.70	4.50	No
CDMA BC10	RC1 SO55	24.2	-19.47	4.73	No
	RC3 SO55	24.2	-19.70	4.50	No
UMTS Band V	RMC	23.8	-27.23	-3.43	No
<b>Main Antenna</b>					
GSM850	GSM	33.5	3.63	37.13	Yes
GSM1900	GSM	31.0	3.63	34.63	Yes
CDMA BC0	RC1 SO55	25.0	-19.47	5.53	No
	RC3 SO55	25.0	-19.70	5.30	No
CDMA BC1	RC1 SO55	23.7	-19.47	4.23	No
	RC3 SO55	23.7	-19.70	4.00	No
CDMA BC10	RC1 SO55	25.0	-19.47	5.53	No
	RC3 SO55	25.0	-19.70	5.30	No
UMTS Band II	RMC	23.0	-27.23	-4.23	No
UMTS Band IV	RMC	23.0	-27.23	-4.23	No
UMTS Band V	RMC	24.5	-27.23	-2.73	No

Table 7: Low-power Exemption calculation

Per ANSI C63.19-2011, HAC RF Emission testing for this device is required only for GSM voice modes. All the other applicable air interfaces are exempt from HAC RF testing.

### 6.3 E-Field Emission Results

Band	Test Mode	Test channel /Freq.(MHz)	MIF (dB)	RF audio interference level [dB(V/m)]	Power Drift (dB)	FCC Limit [dB(V/m)]	Margin to the next lower rating(dB)	M-Rating
<b>Sub Antenna</b>								
<b>GSM850</b>	GSM	128/824.2	3.63	41.87	-0.06	45	3.13	M3
		190/836.6	3.63	42.65	-0.06	45	2.35	M3
		251/848.8	3.63	43.18	-0.05	45	1.82	M3
<b>Main Antenna</b>								
<b>GSM850</b>	GSM	128/824.2	3.63	35.64	-0.03	40	4.36	M4
		190/836.6	3.63	36.04	-0.03	40	3.96	M4
		251/848.8	3.63	36.30	0.01	40	3.70	M4
<b>GSM1900</b>	GSM	512/1850.2	3.63	25.39	0.18	30	4.61	M4
		661/1880	3.63	26.99	-0.15	30	3.01	M4
		810/1909.8	3.63	26.06	-0.07	30	3.94	M4

Table 8: Test Results of E-Field Emissions

Note:

- 1) The HAC measurement system applies MIF value onto the measured RMS E-field, which is indirect method in ANSI C63.19-2011 version, and reports the RF audio interference level.
- 2) The uncertainty is 0.2dB for MIF from -7 to +5dB, 0.5dB for MIF from -13dB to +11 dB, and 1dB for MIF ranges > -20dB. From the test results above and considering the uncertainty of MIF value, the margin is large enough and the device **M3** rating will not be changed.
- 3) CDMA &UMTS bands are exempted and HAC RF Emission rating is M4.
- 4) The Hearing Aid mode of the software on this DUT is turned on during the test.

**Appendix A. System Check Plots**

(Please See Appendix A)

**Appendix B. HAC Measurement Plots**

(Please See Appendix B)

**Appendix C. Calibration Certificate**

(Please See Appendix C)

**Appendix D. Photo documentation**

(Please See Appendix D)

**Appendix E. MIF Specification documentation**

(Please See Appendix E)

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**END**