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HAC (RF Emission) TEST REPORT

Summary Result: M-Rating Category = M3

REPORT NO.: SA120713C03-1

MODEL NO.: PM36100

FCC ID: NM8PM36100

RECEIVED: Jul. 13, 2012

TESTED: Aug. 06, 2012

ISSUED: Aug. 10, 2012

APPLICANT: HTC Corporation

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TABLE OF CONTENTS

RELEASE CONTROL RECORD.....	3
1. CERTIFICATION	4
2. GENERAL INFORMATION.....	5
2.1 GENERAL DESCRIPTION OF EUT.....	5
2.2 DESCRIPTION OF SUPPORT UNITS	6
2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS	6
3. GENERAL INFORMATION OF THE DASY5 SYSTEM.....	7
3.1. GENERAL INFORMATION OF TEST EQUIPMENT	7
3.2. TEST EQUIPMENT LIST.....	10
3.3. MEASUREMENT UNCERTAINTY	11
3.4. GENERAL DESCRIPTION OF THE HAC EVALUATION	12
4. PERFORMANCE CATEGORIES	14
5. SYSTEM CHECK	16
5.1. VALIDATION STRUCTURE	16
5.2. SYSTEM CHECK PROCEDURE	17
5.3. VALIDATION RESULTS	18
6. MODULATION FACTOR	19
6.1 MODULATION FACTOR TEST RESULTS	20
7. RF EMISSION TEST PROCEDURES.....	21
7.1. TEST INSTRUCTION.....	21
7.2. TEST PROCEDURES.....	22
7.3. DESCRIPTION OF TEST POSITION AND CONFIGURATIONS	23
7.4. SUMMARY OF MEASURED HAC RESULTS	24
8. INFORMATION ON THE TESTING LABORATORIES.....	25
APPENDIX A: TEST CONFIGURATIONS AND TEST DATA	
APPENDIX B: SYSTEM CERTIFICATE & CALIBRATION	



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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
SA120713C03-1	Original Release	Aug. 10, 2012

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

EUT	Smart Phone
MODEL NO.	PM36100
CLASSIFICATION	Production Unit
MODULATION TYPE	GSM : GMSK WCDMA : QPSK
TX FREQUENCY RANGE (MHz)	GSM850 : 824 ~ 849 GSM1900 : 1850 ~ 1910 WCDMA Band II : 1850 ~ 1910 WCDMA Band V : 824 ~ 849
MAXIMUM AVG CONDUCTED POWER (UNIT: dBm)	GSM850 : 34.74 GSM1900 : 31.36 WCDMA Band II : 24.16 WCDMA Band V : 23.97
ANTENNA TYPE	Fixed Internal Antenna

Air Interfaces/Bands List						
Air Interface	Band	Type	C63.19 Tested	Simultaneous Transmissions	Reduced Power	VOIP
GSM	850	Voice	Yes	WLAN / BT	N/A	N/A
	1900	Voice	Yes	WLAN / BT	N/A	N/A
WCDMA	II	Voice	Yes	WLAN / BT	N/A	N/A
	V	Voice	Yes	WLAN / BT	N/A	N/A
GSM	850	Data	N/A	WLAN / BT	N/A	Yes
	1900	Data	N/A	WLAN / BT	N/A	Yes
WCDMA	II	Data	N/A	WLAN / BT	N/A	Yes
	V	Data	N/A	WLAN / BT	N/A	Yes
LTE	2	Data	N/A	WLAN / BT	N/A	Yes
	4	Data	N/A	WLAN / BT	N/A	Yes
	5	Data	N/A	WLAN / BT	N/A	Yes
	17	Data	N/A	WLAN / BT	N/A	Yes
WLAN	2.4G	Data	N/A	GSM / WCDMA / LTE + BT	N/A	Yes
	5G	Data	N/A	GSM / WCDMA / LTE + BT	N/A	Yes
BT	2.4G	Data	N/A	GSM / WCDMA / LTE + WLAN	N/A	N/A

Note: The HAC rating was evaluated for voice mode only.

NOTE:

1. The EUT's accessories list refers to Ext Pho.pdf.
2. Conducted power list as below:

Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
Frequency (MHz)	824.2	836.4	848.8	1850.2	1880.0	1909.8
Maximum Burst-Averaged Output Power						
GSM (GMSK, 1 slot)	34.55	34.48	34.74	30.81	31.36	30.94

Band	WCDMA Band II			WCDMA Band V		
Channel	9262	9400	9538	4132	4182	4233
Frequency (MHz)	1852.4	1880.0	1907.6	826.4	836.4	846.6
RMC 12.2K	24.03	24.16	23.82	23.95	23.82	23.97

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

2.2 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.
1	Universal Radio Communication Tester	R&S	CMU200	104484

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

NOTE: All power cords of the above support units are non shielded (1.8m).

2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to the specifications of the manufacturer, this product must comply with the requirements of the following standards:

FCC 47 CFR Part 20.19

ANSI C63.19 – 2007

All test items have been performed and recorded as per the above standards.

3. GENERAL INFORMATION OF THE DASY5 SYSTEM

3.1. GENERAL INFORMATION OF TEST EQUIPMENT

DASY5 consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY5 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC.

ER3DV6 E-FIELD PROBE

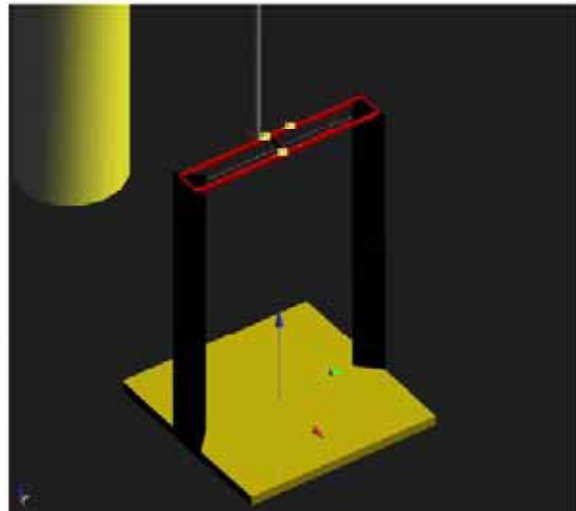
CONSTRUCTION	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges
CALIBRATION	In air from 100MHz to 3.0GHz (absolute accuracy $\pm 6.0\%$, $k = 2$)
FREQUENCY	100MHz to > 6GHz; Linearity: $\pm 0.2\text{dB}$ (100MHz to 3GHz)
DIRECTIVITY	$\pm 0.2\text{dB}$ in air (rotation around probe axis) $\pm 0.4\text{dB}$ in air (rotation normal to probe axis)
DYNAMIC RANGE	2V/m to > 1000V/m (M3 or better device readings fall well below diode compression point) Linearity: $\pm 0.2\text{dB}$
DIMENSIONS	Overall length: 330mm (Tip: 16mm) Tip diameter: 8mm (Body: 12mm) Distance from probe tip to dipole centers: 2.5mm

H3DV6 H-FIELD PROBE

CONSTRUCTION	Three concentric loop sensors with 3.8mm loop diameters Resistively loaded detector diodes for linear response Built-in shielding against static charges
FREQUENCY	200MHz to 3GHz (absolute accuracy $\pm 6.0\%$, $k = 2$); Output linearized
DIRECTIVITY	$\pm 0.25\text{dB}$ (spherical isotropy error)
DYNAMIC RANGE	10mA/m to 2A/m at 1GHz (M3 or better device readings fall well below diode compression point)
DIMENSIONS	Overall length: 330mm (Tip: 40mm) Tip diameter: 6mm (Body: 12mm) Distance from probe tip to dipole centers: 3mm
E-FIELD INTERFERENCE	< 10% at 3GHz (for plane wave)

NOTE: The Probe parameters have been calibrated by the SPEAG. Please reference "APPENDIX B" for the Calibration Certification Report.

HAC ARCH



DIMENSIONS 370 x 370 x 370mm

SYSTEM VALIDATION KITS:

CD835V3 Frequency Band: 800 ~ 960MHz (free space)
Return Loss: > 15dB
Calibrated at: 835MHz
Power Capability: 50W continuous
Length & Height: 166 x 330mm

CD1880V3 Frequency Band: 1710 ~ 2000MHz (free space)
Return Loss: > 18dB
Calibrated at: 1880MHz
Power Capability: 50W continuous
Length & Height: 80.8 x 330mm



DEVICE HOLDER



CONSTRUCTION Supports accurate and reliable positioning of any phone effect on near field $\pm 0.5\text{dB}$

DATA ACQUISITION ELECTRONICS (DAE)



CONSTRUCTION The data acquisition electronics (DAE3) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplex, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe is mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 box is $200\text{M}\Omega$; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

3.2. TEST EQUIPMENT LIST

NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
E-Field Probe	SPEAG	ER3DV6	2445	Feb. 17, 2012	Feb. 16, 2013
H-Field Probe	SPEAG	H3DV6	6274	Feb. 17, 2012	Feb. 16, 2013
DAE	SPEAG	DAE3	579	Apr. 27, 2012	Apr. 26, 2013
DAE	SPEAG	DAE4	910	Dec. 07, 2011	Dec. 06, 2012
Validation Dipole	SPEAG	CD835V3	1041	Mar. 19, 2012	Mar. 18, 2013
Validation Dipole	SPEAG	CD1880V3	1032	Apr. 26, 2012	Apr. 25, 2013

NOTE: Before starting the measurement, all test equipment shall be warmed up for 30min.

3.3. MEASUREMENT UNCERTAINTY

HAC UNCERTAINTY BUDGET ACCORDING TO ANSI C63.19[1]							
ERROR DESCRIPTION	UNCERTAINTY VALUE	PROBABILITY DISTRIBUTION	DIVISOR	(Ci) E	(Ci) H	STD. UNC. E (%)	STD. UNC. H (%)
MEASUREMENT SYSTEM							
Probe calibration	5.1	Normal	1	1	1	5.1	5.1
Axial isotropy	0.5	Rectangular	$\sqrt{3}$	1	1	0.3	0.3
Sensor Displacement	16.5	Rectangular	$\sqrt{3}$	1	0.145	9.5	1.4
Boundary Effects	2.4	Rectangular	$\sqrt{3}$	1	1	1.4	1.4
Linearity	0.6	Rectangular	$\sqrt{3}$	1	1	0.3	0.3
Scaling to Peak Envelope Power	2.0	Rectangular	$\sqrt{3}$	1	1	1.2	1.2
System Detection Limit	1.0	Rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	0.3	Rectangular	$\sqrt{3}$	1	1	0.2	0.2
Response Time	0.8	Rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	2.6	Rectangular	$\sqrt{3}$	1	1	1.5	1.5
RF Ambient Condition	3.0	Rectangular	$\sqrt{3}$	1	1	1.7	1.7
RF Reflections	12.0	Rectangular	$\sqrt{3}$	1	1	6.9	6.9
Probe Positioner	1.2	Rectangular	$\sqrt{3}$	1	0.67	0.7	0.5
Probe Positioning	4.7	Rectangular	$\sqrt{3}$	1	0.67	2.7	1.8
Extrap. And Interpolation	1.0	Rectangular	$\sqrt{3}$	1	1	0.6	0.6
TEST SAMPLE RELATED							
Device Positioning Vertical	2.6	Normal	1	1	1	2.6	2.6
Device Positioning Lateral	2.6	Normal	1	1	1	2.6	2.6
Device Holder and Phantom	2.4	Rectangular	$\sqrt{3}$	1	1	1.4	1.4
Power Drift	5.0	Rectangular	$\sqrt{3}$	1	1	2.9	2.9
PHANTOM AND SETUP RELATED							
Phantom Thickness	2.4	Rectangular	$\sqrt{3}$	1	0.67	1.4	0.9
COMBINED STD. UNCERTAINTY						14.4	10.7
EXPANDED STD. UNCERTAINTY ON POWER						28.8	21.3
EXPANDED STD. UNCERTAINTY ON FIELD						14.4	10.7

NOTE: Worst-case uncertainty budget for HAC free field assessment according to ANSI C63.19 [1]. The budget is valid for the frequency range 800MHz ~ 3GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerably smaller.

3.4. GENERAL DESCRIPTION OF THE HAC EVALUATION

The DASY5 post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the micro-volt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters: - Sensitivity	Norm _i , a _{i0} , a _{i1} , a _{i2}
- Conversion factor	ConvF _i
- Diode compression point	dcp _i
Device parameters: - Frequency	F
- Crest factor	Cf

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

V _i = compensated signal of channel i	(i = x, y, z)
U _i = input signal of channel i	(i = x, y, z)
Cf = crest factor of exciting field	(DASY parameter)
dcp _i = diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E-field probes: } E_i = \sqrt{\frac{V_i}{\text{Norm}_i \cdot \text{ConvF}}}$$

$$\text{H-field probes: } H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

V_i = compensated signal of channel i ($i = x, y, z$)

Norm_i = sensor sensitivity of channel i $\mu\text{V}/(\text{V/m})^2$ for E-field Probes ($i = x, y, z$)

ConvF = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

F = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

E = field strength in V/m

E_{tot} = total field strength in V/m

NOTE: The signal response time is evaluated as the time required by the system to reach 90% of the expected final value after an on/off switch of the power source with an integration time of 500ms and a probe response time of < 5ms. In the current implementation, DASY5 waits longer than 100ms after having reached the grid point before starting a measurement, i.e., the response time uncertainty is negligible.

4. PERFORMANCE CATEGORIES

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

CATEGORY NEAR FIELD	TELEPHONE RF PARAMETERS < 960MHz				
	AWF	E-FIELD EMISSION CW (dBV/m)	E-FIELD EMISSION CW (V/m)	H-FIELD EMISSION CW (dBA/m)	H-FIELD EMISSION CW (A/m)
M1	0	56.0 to 61.0	631.0 to 1122.0	5.6 to 10.6	1.91 to 3.39
	-5	53.5 to 58.5	473.2 to 841.4	3.1 to 8.1	1.43 to 2.54
M2	0	51.0 to 56.0	354.8 to 631.0	0.6 to 5.6	1.07 to 1.91
	-5	48.5 to 53.5	266.1 to 473.2	-1.9 to 3.1	0.80 to 1.43
M3	0	46.0 to 51.0	199.5 to 354.8	-4.4 to 0.6	0.60 to 1.07
	-5	43.5 to 48.5	149.6 to 266.1	-6.9 to -1.9	0.45 to 0.80
M4	0	< 46.0	< 199.5	< -4.4	< 0.60
	-5	< 43.5	< 149.6	< -6.9	< 0.45

CATEGORY NEAR FIELD	TELEPHONE RF PARAMETERS > 960MHz				
	AWF	E-FIELD EMISSION CW (dBV/m)	E-FIELD EMISSION CW (V/m)	H-FIELD EMISSION CW (dBA/m)	H-FIELD EMISSION CW (A/m)
M1	0	46.0 to 51.0	199.5 to 354.8	-4.4 to 0.6	0.60 to 1.07
	-5	43.5 to 48.5	149.6 to 266.1	-6.9 to -1.9	0.45 to 0.80
M2	0	41.0 to 46.0	112.2 to 199.5	-9.4 to -4.4	0.34 to 0.60
	-5	48.5 to 53.5	84.1 to 149.6	-11.9 to -6.9	0.25 to 0.45
M3	0	36.0 to 41.0	63.1 to 112.2	-14.4 to -9.4	0.19 to 0.34
	-5	33.5 to 38.5	47.3 to 84.1	-16.9 to -11.9	0.14 to 0.25
M4	0	< 36.0	< 63.1	< -14.4	< 0.19
	-5	< 33.5	< 47.3	< -16.9	< 0.14

ARTICULATION WEIGHING FACTOR (AWF)

The following AWF factors shall be used for the standard transmission protocols:

STANDARD	TECHNOLOGY	AWF (dB)
TIA/EIA/IS-2000	CDMA	0
TIA/EIA-136	TDMA (50Hz)	0
iDENTM	TDMA (22 and 11Hz)	0
J-STD-007	GSM (217)	-5
T1/T1P1/3GPP	UMTS (WCDMA)	0

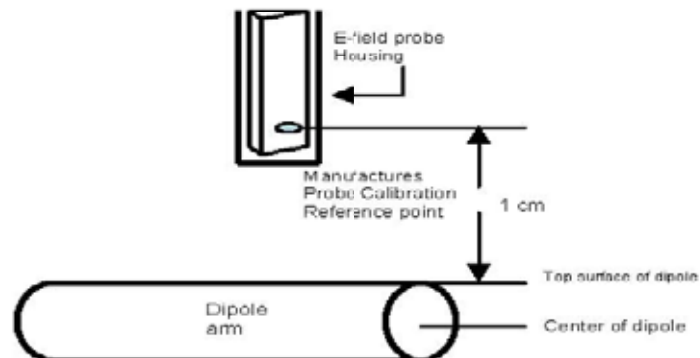
5. SYSTEM CHECK

The measured values (E-field and H-field) were compared with the values provided by the probe manufacturer and must within the allowed tolerance of **25%**.

5.1. VALIDATION STRUCTURE

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

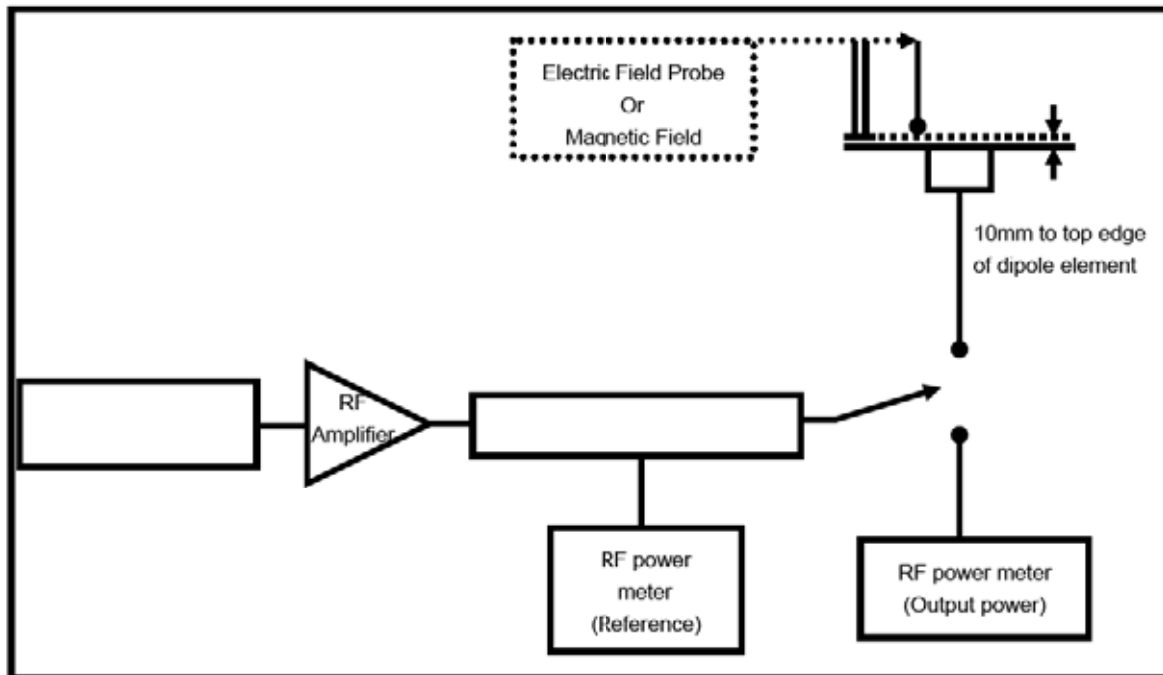
- Average Input Power $P = 100\text{mW RMS}$ (20dBm RMS) after adjustment for return loss
- The test fixture must meet the 2 wavelength separation criterion
- The proper measurement of the 1cm probe to dipole separation, which is measured from top surface of the dipole to the calibration reference point of the sensor, defined by the probe manufacturer is shown in the following diagram:



5.2. SYSTEM CHECK PROCEDURE

1. Before you start the system performance check, need only to tell the system with which components (probe type, validation dipole and HAC arch) are performing the system performance check; the system will take care of all parameters.

The system check configuration is shown in the following figure:



2. The dipole was energized with a 20dBm un-modulated continuous-wave signal.
3. The length of the dipole was scanned with both E-field and H-field probes and the maximum values for each were recorded.

5.3. VALIDATION RESULTS

Frequency (MHz)	Input Power (dBm)	Target Value (V/m)	E-Field 1 (V/m)	E-Field 2 (V/m)	Average Value (V/m)	Deviation (%)	Date
835	20	168.0	154.6	156.7	155.65	-7.35	Aug. 06, 2012
1880	20	140.1	144.2	142.4	143.3	2.28	Aug. 06, 2012
Frequency (MHz)	Input Power (dBm)	Target Value (A/m)	H-Field (A/m)			Deviation (%)	Date
835	20	0.471	0.436			-7.43	Aug. 06, 2012
1880	20	0.461	0.438			-4.99	Aug. 06, 2012

NOTE: Please see Appendix A for the system validation test data.

6. MODULATION FACTOR

A calibration was made of the modulation response of the probe and its instrumentation chain. This calibration was performed with the field probe, attached to its instrumentation. The response of the probe system to a CW field at the frequency of interest is compared to its response to a modulated signal with equal peak amplitude to that of a CW signal. The field level of the test signals are ensured to be more than 10dB above the ambient level and the noise floor of the instrumentation being used. The ratio of the CW reading to that taken with a modulated reading was applied to the DUT measurements.

This was done using the following procedure:

1. Fixing the probe in a set location relative to a field generating device, such as a reference dipole antenna, as illustrated in the system check procedure.
2. Illuminate the probe using the wireless device connected to the reference dipole with a test signal at the intended measurement frequency, Ensure there is sufficient field coupling between the probe and the antenna so the resulting reading is greater than 10dB above the probe system noise floor but within the systems operating range.
3. Record the amplitude applied to the antenna during transmission and the field strength measured by the E-field probe located near the tip of the dipole antenna.
4. Replace the wireless device with an RF signal generator producing an unmodulated CW signal and set to the wireless device operating frequency.
5. Set the amplitude of the unmodulated signal to equal that recorded from the wireless device.
6. Record the reading of the probe measurement system of the unmodulated signal.
7. The RF signal generator producing an 80%AM signal and set to the wireless device operating frequency. Set the amplitude of the signal to equal that recorded from the wireless device.
8. Record the reading of the probe measurement system of the 80%AM signal.
9. The ratio, in linear units, of the probe reading in Step 3) or 8) to the reading in Step 6) is the E-field modulation factor.
10. Steps 1-9 were repeated at all frequency bands and for both E and H field probes.

NOTE: The ratio of the CW to modulated signal reading is the modulation factor. The modulation factors obtained were applied to readings taken of the actual wireless device, in order to obtain an accurate peak field reading using the formula:

$$\text{Peak} = 20 \cdot \log(\text{Raw} \cdot \text{ProbeModulationFactor})$$



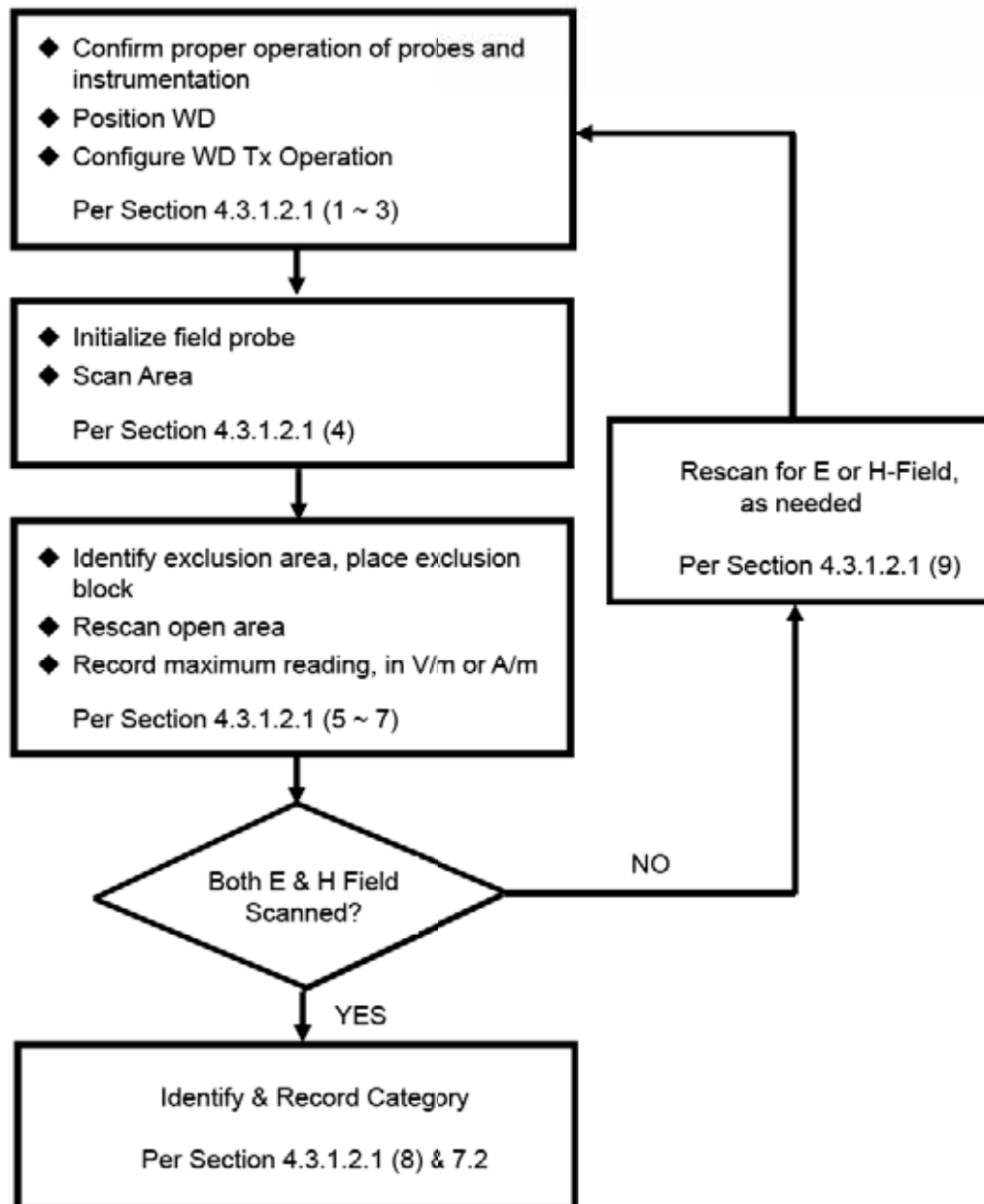
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6.1 MODULATION FACTOR TEST RESULTS

TEST FREQUENCY (MHz)	PROTOCOL	MODULATION FACTOR
835 / 1880	GSM	2.948
835 / 1880	WCDMA	1.02

7. RF EMISSION TEST PROCEDURES

7.1. TEST INSTRUCTION



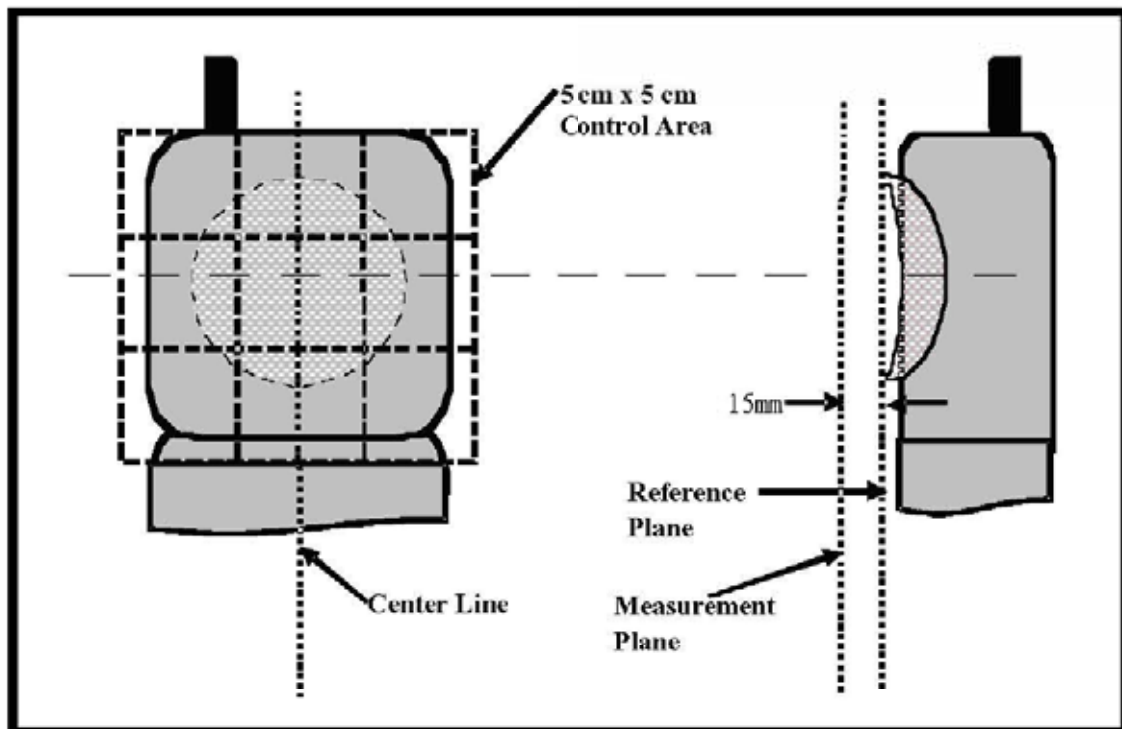
7.2. TEST PROCEDURES

The EUT makes a phone call to the GSM base station. Establish the simulation communication configuration rather the actual communication. Then the EUT could continuous the transmission mode. Adjust the PCL of the base station could controlled the EUT to transmitted the maximum output power. The base station also could control the transmission channel.

The recommended procedure for assessing the RF emission value consists of the following steps:

1. Proper operation of the field probe, probe measurement system, other instrumentation, and the positioning system was confirmed.
2. WD is positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.
3. 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.
4. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the HAC arch.
5. The measurement system measured the field strength at the reference location.
6. Measurements at 2mm increments in the 5 x 5cm region were performed and recorded. A 360° rotation about the azimuth axis at the maximum interpolated position was measured. For the worst-case condition, the peak reading from this rotation was used in re-evaluating the HAC category.
7. Steps 1-6 were done for both the E and H-Field measurements.

7.3. DESCRIPTION OF TEST POSITION AND CONFIGURATIONS



7.4. SUMMARY OF MEASURED HAC RESULTS

E-FIELD EMISSION

Plot No.	Band	Mode	Channel	Peak E-Field (V/m)	E-Field M Rating
4	GSM850	GSM	128	96.3	M4
6	GSM850	GSM	189	112.5	M4
7	GSM850	GSM	251	96	M4
18	GSM1900	GSM	512	76.4	M3
19	GSM1900	GSM	661	75.8	M3
20	GSM1900	GSM	810	70.7	M3
24	WCDMA II	RMC12.2K	9232	34.4	M4
25	WCDMA II	RMC12.2K	9400	35.0	M4
26	WCDMA II	RMC12.2K	9538	34.8	M4
21	WCDMA V	RMC12.2K	4132	36.5	M4
22	WCDMA V	RMC12.2K	4132	37.3	M4
23	WCDMA V	RMC12.2K	4233	30.5	M4

NOTE: Please see the Appendix A for the measured data and test plots.

H-FIELD EMISSION

Plot No.	Band	Mode	Channel	Peak E-Field (V/m)	H-Field M Rating
27	GSM850	GSM	128	0.185	M4
28	GSM850	GSM	189	0.139	M4
29	GSM850	GSM	251	0.117	M4
30	GSM1900	GSM	512	0.21	M3
31	GSM1900	GSM	661	0.21	M3
32	GSM1900	GSM	810	0.196	M3
36	WCDMA II	RMC12.2K	9232	0.087	M4
37	WCDMA II	RMC12.2K	9400	0.095	M4
38	WCDMA II	RMC12.2K	9538	0.093	M4
33	WCDMA V	RMC12.2K	4132	0.047	M4
34	WCDMA V	RMC12.2K	4132	0.067	M4
35	WCDMA V	RMC12.2K	4233	0.039	M4

NOTE: Please see the Appendix A for the measured data and test plots.



8. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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