ANSI C63.19-2006

FCC HAC TEST REPORT

For

PDA Phone

Trade Name / Model:
i-mate / ULTIMATE 8502,
Mobinnova / PP5401

Issued to

Mobinnova Corp.
11F, No.845, Jhongshan Rd., Tayouan City,
Taoyuan County 330, Taiwan (R.O.C.)

Issued by

Compliance Certification Services Inc.
No. 11, Wu-Kung 6 Rd, Wu-Ku Hsiang,
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Testing Laboratory
1309

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1. HEARING AID COMPATIBILITY CERTIFICATE

APPLICATION TYPE:	Original Grant
FCC RULE PART(s):	47 CFR PART §20.19(b)
APPLICANT:	Mobinnova Corp
ADDRESS:	11F, No.845, Jhongshan Rd., Tayouan City, Taoyuan County 330, Taiwan (R.O.C.)
TRADE NAME / MODEL :	i-mate / ULTIMATE 8502, Mobinnova / PP5401
TEST SAMPLE TYPE:	PDA Phone
Date of Test:	March 19~20, 2008

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
ANSI C63.19–2006	No non-compliance noted
HAC RATE CATEGORY	
M3 (RF EMISSION)	

The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in ANSI C63.19–2006. The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Reviewed by:

Rex Lai
Section Manager
Compliance Certification Services Inc.

2. EQUIPMENT UNDER TEST DESCRIPTION AND TEST SUMMARY

Product	PDA Phone	
Trade Name / Model Number	i-mate / ULTIMATE 8502, Mobinnova / PP5401	
Model Discrepancy	All the above models are identical except for the designation of model numbers.	
Normal operation:	Held to ear for close slide cover and open slide cover mode	
Radio modules	● CDMA: Manufacture by Qualcomm, model number: MSM7500 ● Bluetooth- Manufacture by Murata, model number: LBMA46LDC2	
Duty cycle of Transmitter	100% for GSM, WCDMA	
Power supply	Rechargeable Li-ion Polymer Battery Simplo Technology Co., Ltd. Model number: ULTIMATE 8502, 3.7VDC, 1530mAh. (only one type of battery to be used in the EUT)	
Accessories	1. Headset: MERRY (model name: EMC147-022-01), Unshielded, 2.5 mm 2. USB cable: MEC IMEX (model name: 60-4346-100), Unshielded, 1.2m 3. TV Out cable: MEC IMEX (model name: 60-4346-400D), Unshielded, 1.5m	
Power Supply	Trade Name / Model Number: PHIHONG / PSAA05R-050 I/P: AC 100-240V, 50-60Hz, 0.3A O/P: DC 5V, 1A MAX	
Frequency Range	GSM/GPRS/EDGE 850: 824 MHz to 849 MHz WCDMA Band V: 824 MHz to 849 MHz HSDPA/HSUPA Band V: 824 MHz to 849 MHz PCS/GPRS/EDGE1900: 1850 MHz to1910 MHz WCDMA Band II: 1850.2 MHz to1909.8 MHz HSDPA/HSUPA Band II: 1850.2 MHz to1909.8 MHz	
Transmit Power (Average)	850 Band: GSM 850: 32.72 dBm GPRS 850: 32.7 6 dBm EDGE850: 24.99 dBm WCDMA Band V: 25.60 dBm HSDPA Band V: 27.56 dBm HSUPA Band V: 28.25 dBm	1900 Band: GSM1900: 29.63 dBm GPRS1900: 29.53 dBm EDGE1900: 24.49 dBm WCDMA Band II: 24.47 dBm HSDPA Band II: 27.23 dBm HSUPA Band II: 28.77 dBm
Test Result	**GSM Cellular band:** E-Field: 42.46 dB V/m -M4 Phone H-Field: -8.19 dB A/m-M3 Phone **GSM PCS band:** E-Field: 30.38 dB V/m-M3 Phone H-Field: -17.92 dB A/m-M3 Phone **WCDMA Cellular band:** E-Field: 39.93 dB V/m -M4 Phone H-Field: -11.83 dB A/m-M4 Phone **WCDMA PCS band:** E-Field: 35.46 dB V/m-M4 Phone H-Field: -11.95 dB A/m-M3 Phone	
Modulation Technique	GSM / PCS: TDMA WCDMA: QPSK	
Antenna Specification	Antenna. Type: GSM / WCDMA: PIFA antenna	

3. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC

In July 2003, the Federal Communications Commission (FCC) modified the exemption for wireless phones under the Hearing Aid Compatibility Act of 1988 to require that wireless phone manufacturers and wireless phone service providers make digital wireless phones accessible to individuals who use hearing aids.

Since 2003, more people have come to rely on wireless phones for safety, business, and personal uses. For these reasons, it is vital for individuals with a hearing impairment have access to digital wireless phones. The FCC has taken steps to increase access to wireless telephones by requiring wireless carriers and equipment manufacturers to make more digital wireless phones hearing aid-compatible.

In June 2005, the FCC reaffirmed the timetable for the development and sale of digital wireless phones that are compatible with hearing aids. Specifically, the rules are as follows:

- By **September 16, 2005**, the five largest wireless carriers (Sprint, Nextel, Verizon Wireless, Cingular and T-Mobile) must:
  - either make **four** hearing aid-compatible handset models available for each air interface (an air interface the standard operating system of a wireless network that selects which radio channels are employed during a call) or
  - ensure that 25% of their handset models are hearing compatible.
- By **September 16, 2006**, the five largest wireless carriers must, per air interface, make **five** hearing aid-compatible handset models available for each air interface.
- **All** wireless carriers must ensure that 50% of their handset models are hearing aid-compatible by **February 18, 2008**.
- Hearing aid-compatible wireless phones must have prominent exterior labeling indicating the handset's technical rating and have more detailed information included inside the package. This information will allow you to quickly and easily determine which wireless phones are compatible with your hearing aid.
- All carrier owned and operated retail outlets must make live, in-store testing available to consumers. Carriers are encouraged to include hearing aid-compatible information on "call-out cards" as part of the handset display.
- Wireless service providers are encouraged to provide a 30-day trial period or adopt a flexible return policy. This allows individuals with hearing aids sufficient time to choose suitable wireless phones and become comfortable with them.

Note: Wireless carriers, service providers, and handset manufacturers are exempt from these rules if they only offer **two or fewer digital handset models** on a particular air interface.

The FCC also encourages digital wireless phone manufacturers and service providers to offer at least one compliant handset that is a lower-priced model and one that has higher-end features and encourages hearing-aid manufacturers to label their pre-customization products according to the ANSI standard.

4. SYSTEM DESCRIPTION

4.1 MEASUREMENT SYSTEM DIAGRAM

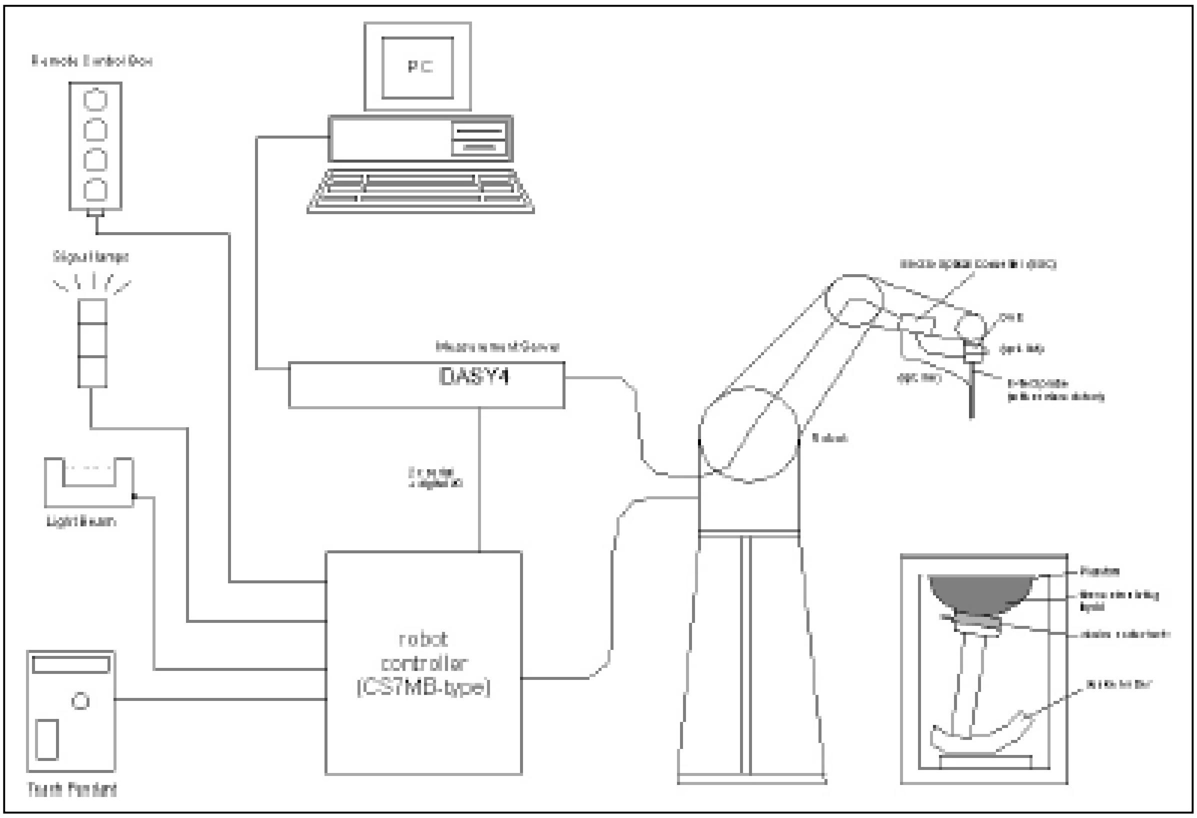


Figure 1: Measurement System diagram

The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- Validation dipole kits allowing validating the proper functioning of the system.

5. System Components

5.1 DASY4 MEASUREMENT SERVER

Figure 2:DASY4 Server

The DASY4 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

5.2 DATA ACQUISITION ELECTRONICS (DAE)

Figure 3: DAE

The data acquisition electronics (DAE3) 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 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 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 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

5.3 ER3DV6 ISOTROPIC E-FIELD PROBE FOR GENERAL NEAR-FILED MEASUREMENTS

Construction: One dipole parallel, two dipoles normal to probe axis
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., glycolether)

Calibration: In air from 100 MHz to 3.0 GHz (absolute accuracy ±6.0%, k=2)

Frequency: 100 MHz to > 6 GHz; Linearity: ± 0.2 dB (100 MHz to 3 GHz)

Directivity: ± 0.2 dB in air (rotation around probe axis)
± 0.4 dB in air (rotation normal to probe axis)

Dynamic Range: 2 V/m to > 1000 V/m; Linearity: ± 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 1.1 mm closer to the tip

Application: General near-field measurements up to 6 GHz
Field component measurements
Fast automatic scanning in phantoms

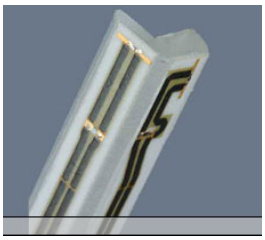


Figure 4 and 5: ER3DV6 E-Field Probe

5.4 H3DV6 ISOTROPIC E-FIELD PROBE FOR GENERAL NEAR-FILED MEASUREMENTS

Construction: Three concentric loop sensors with 3.8 mm loop diameters resistively loaded detector diodes for linear response
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., glycolether)

Frequency: 200 MHz to 3 GHz (absolute accuracy ± 6.0%, k=2); Output linearized

Directivity: ± 0.25 dB (spherical isotropy error)

Dynamic Range: 10 mA/m to 2 A/m at 1 GHz

E-Field Interference: < 10% at 3 GHz (for plane wave)

Dimensions: Overall length: 330 mm (Tip: 40 mm)
Tip diameter: 6 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 3 mm
The closest part of the sensor element is 1.9 mm closer to the tip

Application: General magnetic near-field measurements up to 3 GHz
Field component measurements
Surface current measurements
Measurements in air or liquids
Low interaction with the measured field

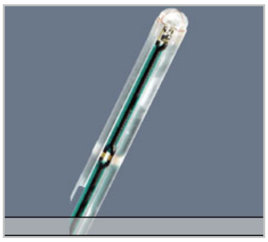


Figure 6 and 7: H3DV6 H-Field Probe

5.5 LIGHT BEAM UNIT

The light beam switch allows automatic ”tooling” of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, so that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

Figure 8: Light Beam Unit

5.6 TEST ARCH

Construction: 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 370mm

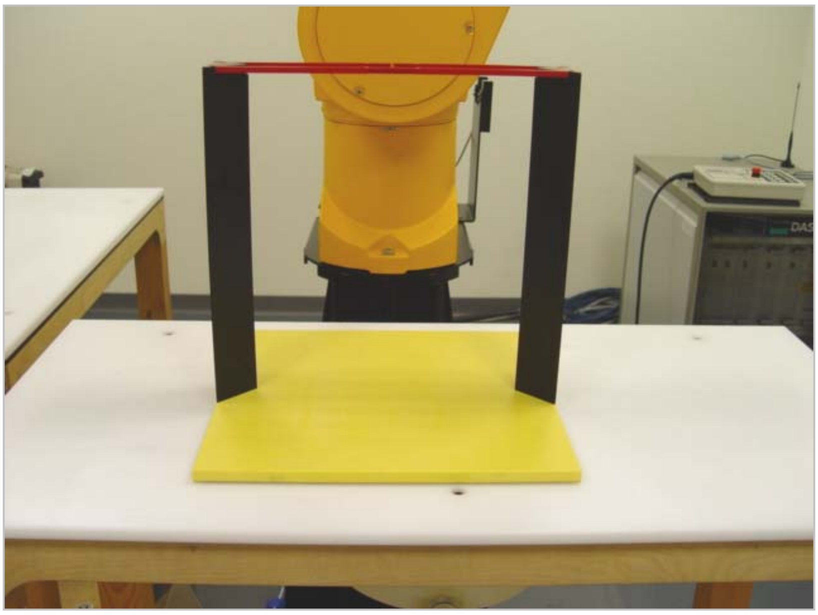


Figure 9: Test Arch

5.7 PHONE POSITIONER

Construction: Supports accurate and reliable positioning of any phone effect on near field <+/- 0.5dB

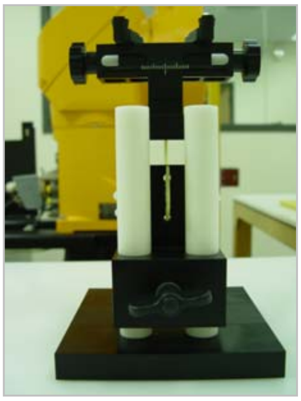


Figure 10: Phone positioner

5.8 SYSTEM VALIDATION KITS

Construction: Symmetrical dipole with built-in two step matching network and balun

CD835V3

Frequency Band: 800 - 960 MHz (free space)

Return Loss: > 15 dB

Calibrated at: 835MHz

Power Capability: 50W continuous

Length & Height: 166 x 330 mm

CD1880V3

Frequency Band: 1710 - 2000 MHz (free space)

Return Loss: > 18 dB

Calibrated at: 1880MHz

Power Capability: 50W continuous

Length & Height: 80.8 x 330 mm

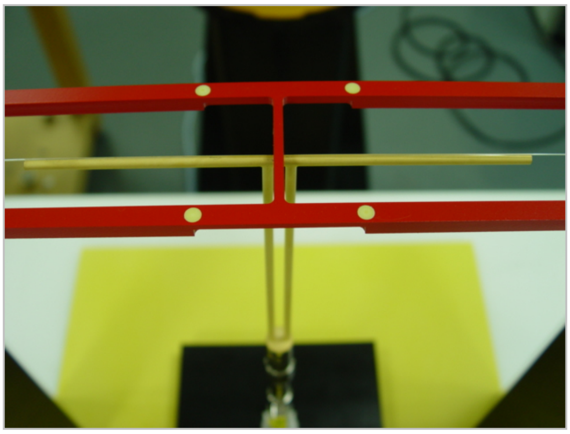


Figure 10: Dipole with Test Arch

CD2450V3

Frequency Band: 2250 - 2650 MHz (free space)

Return Loss: > 18 dB over frequency band in free space

Calibrated at: 2450MHz

Power Capability: 50W continuous

Length & Height: 59.9 x 330 mm

Dipole Holder: Tripod holder with adapter

Regular: Hight Range 205 - 300 mm

Shortened: Hight Range 160 - 210 mm

5.9 SOFTWARE HAC V4.5

Easy teaching of predefined ANSI C63.19 -2006 measurement area
Evaluation incorporates automatic exclusion of high-level areas
Documentation ready for inclusion into compliance report.

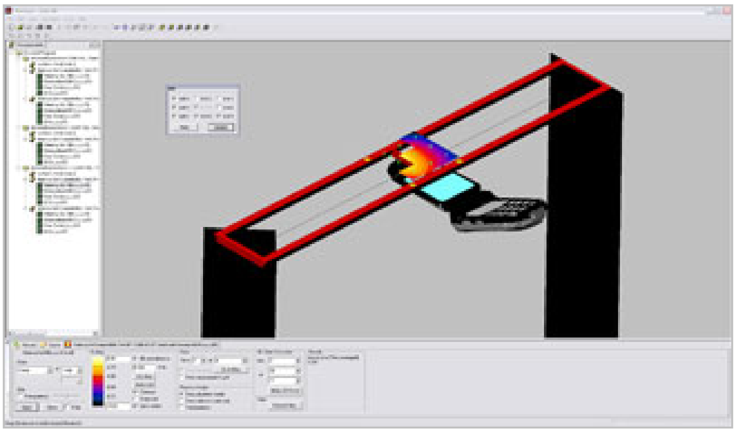


Figure 11: DASY4 software

6. EVALUATION PROCEDURES

DATA EVALUATION

The DASY4 post processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt 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
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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:

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

with
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:

E-field probes: $$E_i = \sqrt{\frac{V_i}{Norm_i \bullet ConvF}}$$

H-field probes: $$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with
V_i = Compensated signal of channel i (i = x, y, z)
$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z)
$\mu V/(V/m)^2$ for E0field Probes
$ConvF$ = Sensitivity enhancement in solution
aij = Sensor sensitivity factors for H-field probes
f = Carrier frequency (GHz)
Ei = Electric field strength of channel i in V/m
Hi = 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.

$$SAR = E_{tot}^{2} \cdot \frac{\sigma}{\rho \cdot 1000}$$

with SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^{2}}{3770} \quad \text{or} \quad P_{pwe} = H_{tot}^{2} \cdot 37.7$$

with P_{pwe} = Equivalent power density of a plane wave in mW/cm^2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

7. MEASUREMENT UNCERTAINTY

HAC UNCERTAINTY BUDGET ACCORDING TO ANSI C63.19-2006 [1]								
Error Description	**Uncertainty Value**	**Probability distribution**	**Divisor**	**(C_i) E**	**(C_i) H**	**Std. Unc. E**	**Std. Unc. H**
Measurement System							
Probe calibration	±5.1%	Normal	1	1	1	±5.1%	±5.1%
Axial isotropy	±4.7%	Rectangular	√3	1	1	±2.7%	±2.7%
Sensor Displacement	±16.5%	Rectangular	√3	1	0.145	±9.5%	±1.4%
Boundary Effects	±2.4%	Rectangular	√3	1	1	±1.4%	±1.4%
Linearity	±4.7%	Rectangular	√3	1	1	±2.7%	±2.7%
Scaling to Peak Envelope Power	±2.0%	Rectangular	√3	1	1	±1.2%	±1.2%
System Detection Limit	±1.0%	Rectangular	√3	1	1	±0.6%	±0.6%
Readout Electronics	±0.3%	Rectangular	√3	1	1	±0.3%	±0.3%
Response Time	±0.8%	Rectangular	√3	1	1	±0.5%	±0.5%
Integration Time	±2.6%	Rectangular	√3	1	1	±1.5%	±1.5%
RF Ambient Condition	±3.0%	Rectangular	√3	1	1	±1.7%	±1.7%
RF Reflections	±12.0%	Rectangular	√3	1	1	±6.9%	±6.9%
Probe Positioner	±1.2%	Rectangular	√3	1	0.67	±0.7%	±0.5%
Probe Positioning	±4.7%	Rectangular	√3	1	0.67	±2.7%	±1.8%
Extrap. And Interpolation	±1.0%	Rectangular	√3	1	1	±0.6%	±0.6%
Test Sample Related							
Device Positioning Vertical	±4.7%	Rectangular	√3	1	0.67	±2.7%	±1.8%
Device Positioning Lateral	±1.0%	Rectangular	√3	1	1	±0.6%	±0.6%
Device Holder and Phantom	±2.4%	Rectangular	√3	1	1	±1.4%	±1.4%
Power Drift	±5.0%	Rectangular	√3	1	1	±2.9%	±2.9%
Phantom and Setup Related							
Phantom Thickness	±2.4%	Rectangular	√3	1	0.67	±1.4%	±0.9%
Combined Std. Uncertainty						±14.7%	±10.9%
Expanded Std. Uncertainty on Power						±29.4%	±21.8%
Expanded Std. Uncertainty on Field						±14.7%	±10.9%

Table: Worst-case uncertainty budget for HAC free field assessment according to ANSI C63.19-2006) [1]. The budget is valid for the frequency range 800 MHz – 3GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerably smaller.

8. TEST PROCEDURES

The following are RF emission step-by-step test procedures:

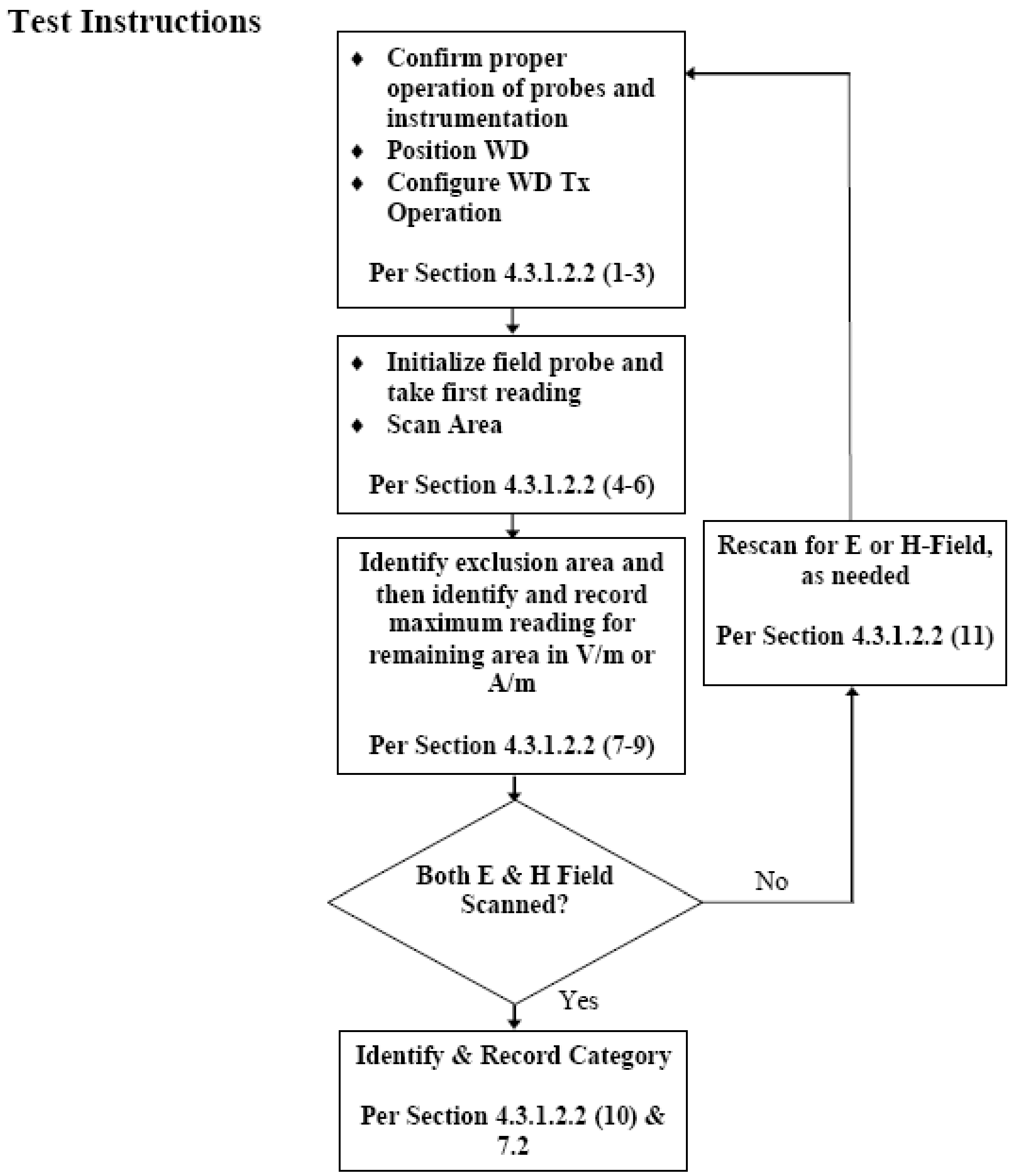
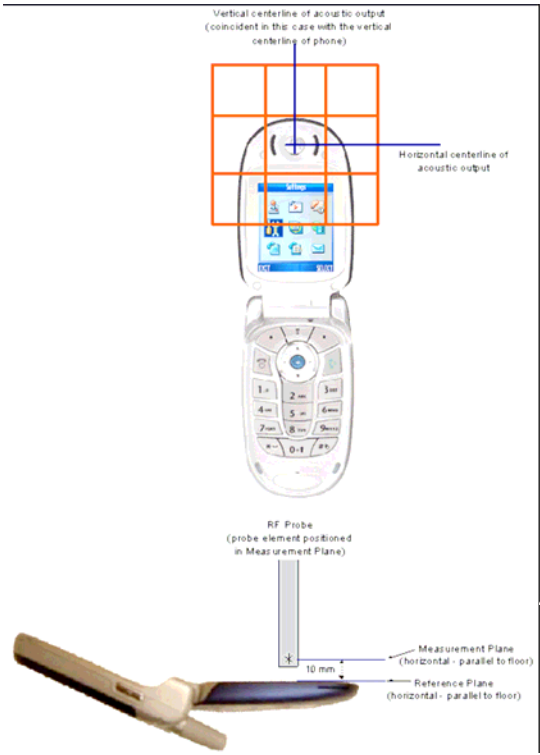


Figure 12: Near-field emission automated test flowchart

RF EMISSION TEST SETUP:



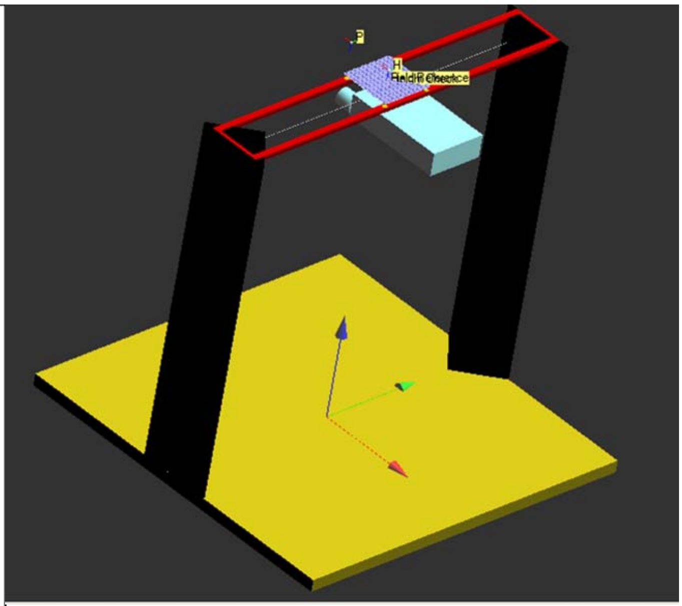


Figure 13: WD near-field emission test setup **Figure 14: HAC test arch with WD setup**

The following are measurement RF near field emission:

1. Confirm proper operation of the field probe, probe measurement system and other instrumentation and the positioning system.
2. Position the WD in its intended test position. The WD's acoustic output point perpendicular to the field probe with test arch (sees the figure 13 and figure 14).
3. Configure the WD normal operation for maximum rated RF output power, at the desired channel and other operating parameters, (e.g. test mode) as intended for the test. The fully charge battery was used for each test.
4. The center sub-grid was centered on the center of the WD output (acoustic or T-Coil output), as appropriate. The field probe at the initial test position in the 5 x 5 cm grid with a 5mm step size.
5. The field probe was aligned in the light beam. The phantom adjustment and verification procedure (1. surface check; 2. Verify Height 0.5mm above Center; 3. Verify Height 0.5mm above Center; 4 Verify Height for Scan) was performed before each setup change.
6. The measurement system was tested 5 x 5 cm grid with a 5mm step size. The probe was rotated 360° about the azimuth axis at the maximum interpolated position. The reading was recorded at each measurement procedure.
7. The power drift was measurement for each test. Power drift shall be below 5% or 0.25dB.If the power drift was higher than 5% or 0.25dB, the measurement was re-test.
8. Around the center sub-grid, five contiguous sub-grids around the center sub-grid with lowest maximum field strength reading. A maximum of five blocks can be excluded for both E- and H-field measurements for the WD output was measured.
9. The highest field strength reading was converted to peak V/m or A/m, as appropriate. This conversion was done using the appropriate probe modulation factor.
10. Repeat steps 1-9 for both the E- and H-field measurements.
11. The peak reading was according to the categories define in the C63.19-2006) using the appropriate AWF.
12. The DASY4 software will control the DASY4 system to carried out the follow procedure for each mode testing.

9. PERFORMANCE

9.1 ARTICULATION WEIGHTING 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 (50 Hz)	0
J-STD-007	GSM (217)	-5
T1/T1P1/3GPP	UMTS (WCDMA)	0
iDENTM	TDMA (22 and 11 Hz)	0

Table 8.1 Articulation Weighting Factor (AWF)

9.2 TELEPHONE N-FILED CATEGORY

The following was shows the M-rating for wireless telephone:

Category		Telephone RF parameters < 960 MHz			
Near field	AWF	E-field emissions		H-field emissions	
Category M1/T1	0	631.0 to 1122.0	V/m	1.91 to 3.39	A/m
	–5	473.2 to 841.4	V/m	1.43 to 2.54	A/m
Category M2/T2	0	354.8 to 631.0	V/m	1.07 to 1.91	A/m
	–5	266.1 to 473.2	V/m	0.80 to 1.43	A/m
Category M3/T3	0	199.5 to 354.8	V/m	0.60 to 1.07	A/m
	–5	149.6 to 266.1	V/m	0.45 to 0.80	A/m
Category M4/T4	0	< 199.5	V/m	< 0.60	A/m
	–5	< 149.6	V/m	< 0.45	A/m

Category		Telephone RF parameters > 960 MHz			
Near field	AWF	E-field emissions		H-field emissions	
Category M1/T1	0	199.5 to 354.8	V/m	0.60 to 1.07	A/m
	–5	149.6 to 266.1	V/m	0.45 to 0.80	A/m
Category M2/T2	0	112.2 to 199.5	V/m	0.34 to 0.60	A/m
	–5	84.1 to 149.6	V/m	0.25 to 0.45	A/m
Category M3/T3	0	63.1 to 112.2	V/m	0.19 to 0.34	A/m
	–5	47.3 to 84.1	V/m	0.14 to 0.25	A/m
Category M4/T4	0	< 63.1	V/m	< 0.19	A/m
	–5	< 47.3	V/m	< 0.14	A/m

Table 8.2 Telephone near-field categories in linear units

NOTE
The WD must be performed in the category M3

10.MEASUREMENT RESULTS

10.1 SYSTEM CHECK

The test setup should be validated when first configured and verified periodically thereafter to ensure proper function. The procedure consists of two parts: dipole validation and determination of probe modulation factor.

10.2 DIPOLE VALIDATION

The HAC validation dipole antenna serves as a known source for an electrical and magnetic RF output. Figure 2 shows the setup used for the dipole validation.
1. The dipole antenna was placed in the position normally occupied by the WD.
2. The dipole was energized with a 20 dBm un-modulated continuous-wave signal.
3. The length of the dipole was scanned with both E-field and H-field probes and the maximum value for each scan was recorded.
4. The readings were compared with the values provided by the probe manufacturer and were found to agree within the allowed tolerance of 10%.Figure 2: Dipole Validation Procedure

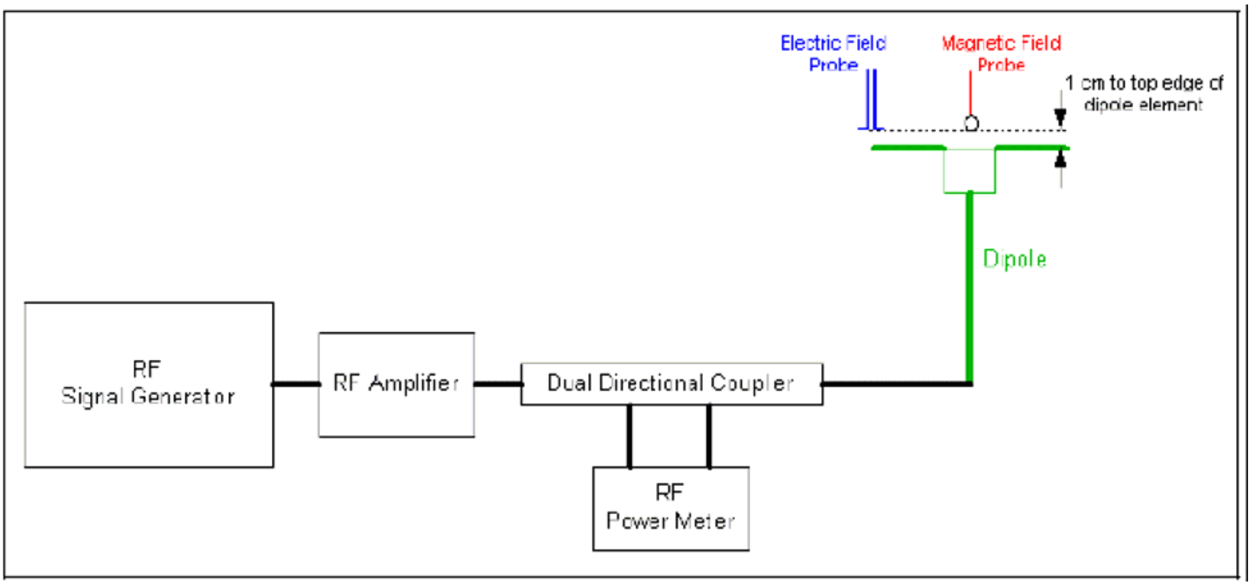


Figure 15: WD dipole calibration procedure

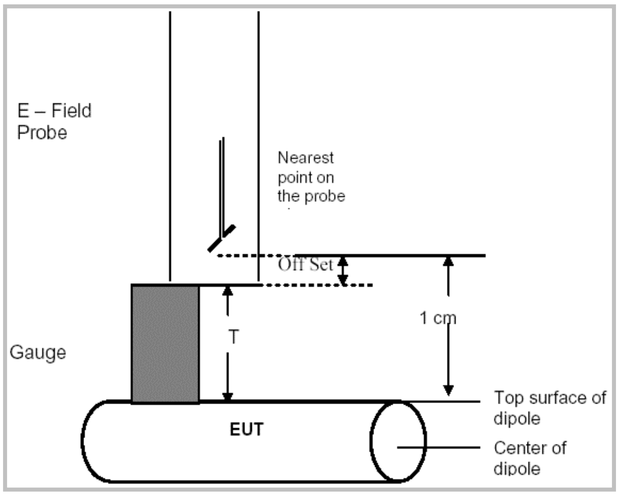


Figure 16

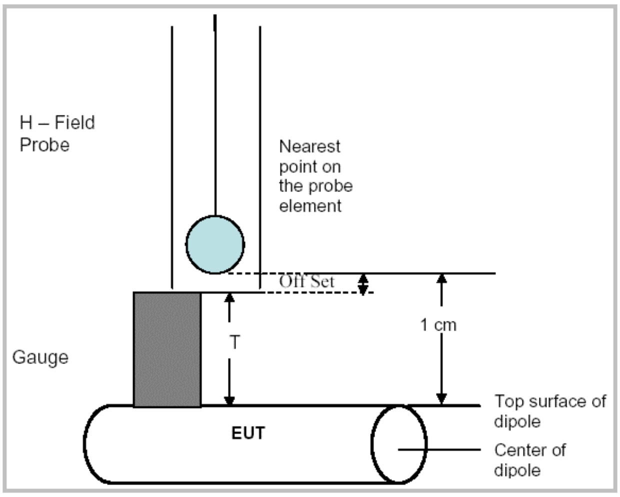


Figure 17

The probe is positioned over the illuminated dipole at 10 mm distance from the nearest point on the probe sensor element to the top surface (edge) of the dipole element.

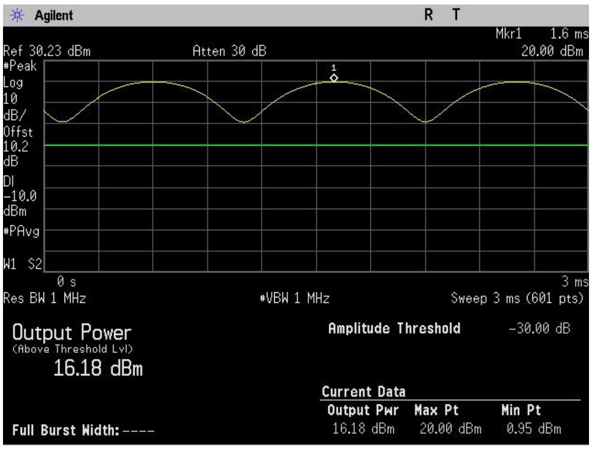
9.1.1 Probe Modulation Factor

In addition, a calibration shall be made of the modulation response of the probe and its instrumentation chain. This calibration shall be performed with the field probe, attached to the instrumentation that is to be used with it during the measurement. The response of the probe system to a CW field at the frequency(s) of interest is compared to its response to a modulated signal with equal peak amplitude. The field level of the test signals shall be more than 10 dB 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 field shall be applied to the readings taken of modulated fields of the specified type.
This was done using the following procedure:

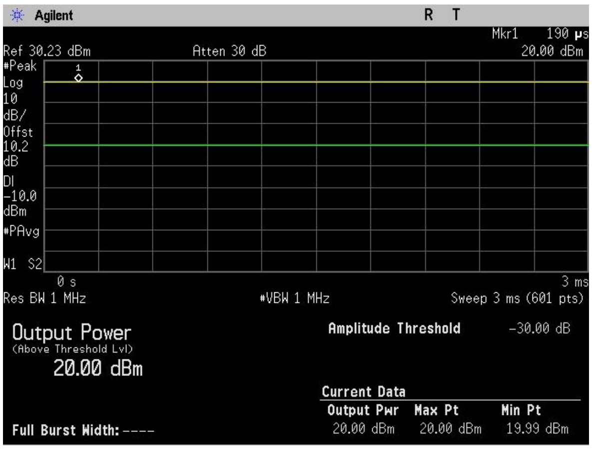
1. Fixing the probe in a set location relative to a field generating device, such as a reference dipole antenna, as illustrated in Figure 15.
2. Illuminate the probe with a CW signal at the intended measurement frequency.
3. Record the reading of the probe measurement system of the CW signal.
4. Determine the level of the CW signal being used to drive the field generating device.
5. Substitute a signal using the same modulation as that used by the intended WD for the CW signal.
6. Set the amplitude during transmission of the modulated signal to equal the amplitude of the CW signal.
7. Record the reading of the probe measurement system of the modulated signal.
8. The ratio of the CW to modulated signal reading is the modulation factor

9.1.2 Measurement Power

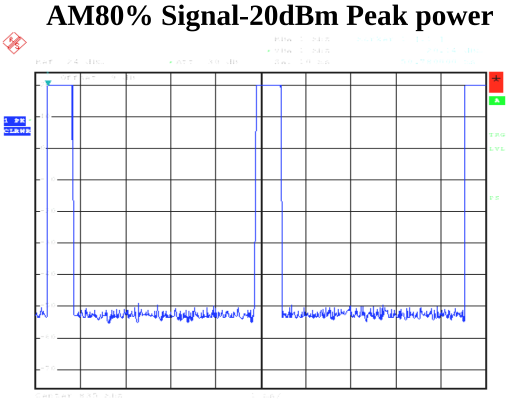
835MHz:



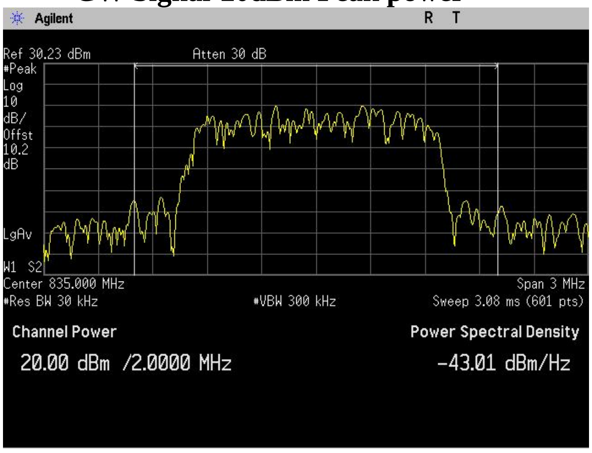
AM80% Signal-20dBm Peak power



CW Signal-20dBm Peak power

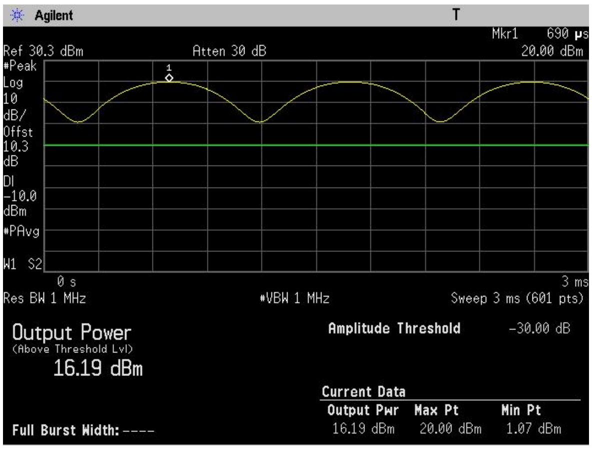


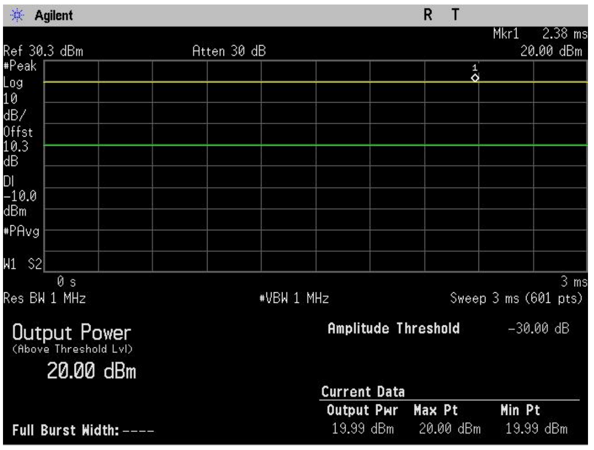
GSM Signal-20dBm Peak power

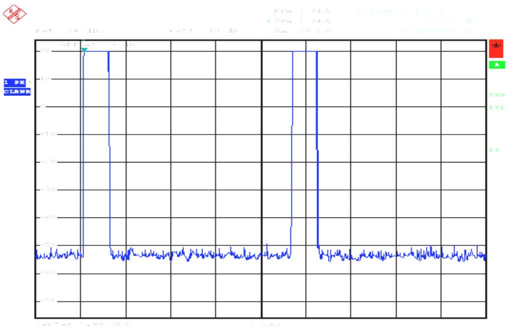


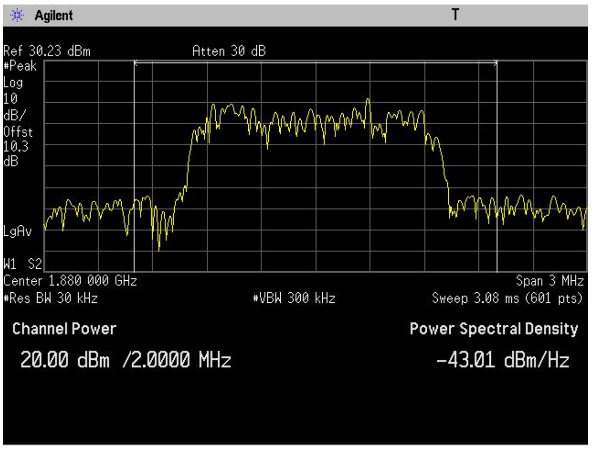
WCDMA Signal-20dBm Peak power

1880MHz:


Agilent
T
Mkr1 690 µs
Ref 30.3 dBm
Atten 30 dB
20.00 dBm
#Peak
Log
10
dB/
Offst
10.3
dB
DI
-10.0
dBm
#PAvg
W1 S2
0 s
3 ms
Res BW 1 MHz
#VBW 1 MHz
Sweep 3 ms (601 pts)
Output Power
(Above Threshold Lvl)
16.19 dBm
Amplitude Threshold
-30.00 dB
Current Data
Output Pwr
Max Pt
Min Pt
16.19 dBm
20.00 dBm
1.07 dBm
Full Burst Width: ----


Agilent
R T
Mkr1 2.38 ms
Ref 30.3 dBm
Atten 30 dB
20.00 dBm
#Peak
Log
10
dB/
Offst
10.3
dB
DI
-10.0
dBm
#PAvg
W1 S2
0 s
3 ms
Res BW 1 MHz
#VBW 1 MHz
Sweep 3 ms (601 pts)
Output Power
(Above Threshold Lvl)
20.00 dBm
Amplitude Threshold
-30.00 dB
Current Data
Output Pwr
Max Pt
Min Pt
19.99 dBm
20.00 dBm
19.99 dBm
Full Burst Width: ----




Agilent
T
Ref 30.23 dBm
Atten 30 dB
#Peak
Log
10
dB/
Offst
10.3
dB
LgAv
W1 S2
Center 1.880 000 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 300 kHz
Sweep 3.08 ms (601 pts)
Channel Power
Power Spectral Density
20.00 dBm /2.0000 MHz
-43.01 dBm/Hz

9.1.3 Validation and Modulation Factor

f(MHz)	Signal Type	Pulse Average Power (dBm)	Measurement H-field (A/m)	Target E-Field (V/m)	Deviation %	Mod. Factor Ration
835.00	CW	20.00	158.10	160.90	-1.74	–
835.00	AM80%	20.00	97.80	–	–	1.62
835.00	GSM	20.00	71.80	–	–	2.20
835.00	WCDMA	20.00	147.20	–	–	1.07
1880.00	CW	20.00	135.80	137.30	-1.09	–
1880.00	AM80%	20.00	83.60	–	–	1.62
1880.00	GSM	20.00	62.20	–	–	2.18
1880.00	WCDMA	20.00	125.60	–	–	1.08

f(MHz)	Signal Type	Pulse Average Power (dBm)	Measurement H-field (A/m)	Target E-Field (V/m)	Deviation %	Mod. Factor Ration
835.00	CW	20.00	0.463	0.452	2.43	–
835.00	AM80%	20.00	0.291	–	–	1.59
835.00	GSM	20.00	0.221			2.10
835.00	WCDMA	20.00	0.451	–	–	1.03
1880.00	CW	20.00	0.458	0.460	-0.43	–
1880.00	AM80%	20.00	0.323	–	–	1.42
1880.00	GSM	20.00	0.219			2.09
1880.00	WCDMA	20.00	0.446	–	–	1.03

Note:

1. Modulation Factor =Measured E/H Field (CW)/Measured E/H Field (Modulation)
2. The HAC measurement of peak V/m or A/m should be calculation by formula or insert crest factor in the day4 software.
3. Peak(dB V/m or dB A/m)=20 x log(Reading[time averaging V/m or A/m] x Probe Modulation Factor)

10.3 EUT TUNE-UP PROCEDURES

The following procedures had been used to prepare the EUT for the SAR test.

- To setup the desire channel frequency and the maximum output power. A Radio Communication Tester “Agilent, model: E5515C (8960 SERIES 10)” was used to program the EUT.

Measurement Conducted output power(dBm):

GSM		**GSM Ch power (dBm)**	**GPRS Ch power (dBm)**	**EGPRS Ch power (dBm)**
GSM850 band	**Ch 128**	31.93	31.77	24.26
	Ch 190	32.29	32.50	24.83
	Ch 251	**32.72**	**32.76**	**24.99**
PCS1900 band	**Ch 512**	29.59	29.12	24.05
	Ch 661	29.37	29.27	24.30
	Ch 810	**29.63**	**29.53**	**24.49**

WCDMA Band V	Frequency (MHz)	Ch Power (dBm)
Ch 4132	826.4	25.33
Ch 4183	836.6	24.20
Ch 4233	846.6	**25.60**

WCDMA Band II	Frequency (MHz)	Ch Power (dBm)
Ch 9262	1852.4	24.47
Ch 9400	1880.0	24.19
Ch 9538	1907.6	24.45

The following procedures has been used to prepare the Bluetooh for the HAC collocation test.

- The client supplied a special driving program to control the EUT to continually transmit the specified maximum power

- Maximum conducted power was measured by replacing the antenna with an adapter for conductive measurements, before and after the SAR measurements was done.

10.4 HAC MEASUREMENT RESULTS

1. E-Field Emission:

GSM PCS Band Duty cycle:12.5%

Mode	Channel	Antenna	Backlight	Time Avg. Field (V/m)	Peak Filed (dB V/m)	Power drift (dB)	Extrapolate Field (dB V/m)	Limit (dB V/m)	Margin (dB)	M-Rating Category Result
GSM	128	Fixed	ON	125.3	41.96	0.005	41.96	51	-9.04	M4
GSM	190	Fixed	ON	132.0	42.41	0.046	42.46	51	-8.54	M4
GSM	251	Fixed	ON	121.7	41.71	0.003	41.71	51	-9.29	M4

GSM PCS Band Duty cycle:12.5%

Mode	Channel	Antenna	Backlight	Time Avg. Field (V/m)	Peak Filed (dB V/m)	Power drift (dB)	Extrapolate Field (dB V/m)	Limit (dB V/m)	Margin (dB)	M-Rating Category Result
GSM	512	Fixed	ON	26.0	28.30	0.075	28.37	41	-12.63	M4
GSM	661	Fixed	ON	30.5	29.69	0.013	29.70	41	-11.30	M4
GSM	810	Fixed	ON	33.0	30.37	0.009	30.38	41	-10.62	M4

WCDMA Band v Duty cycle:100%

Mode	Channel	Antenna	Backlight	Time Avg. Field (V/m)	Peak Filed (dB V/m)	Power drift (dB)	Extrapolate Field (dB V/m)	Limit (dB V/m)	Margin (dB)	M-Rating Category Result
WCDMA	4132	Fixed	ON	78.4	37.89	0.006	37.89	51	-13.11	M4
WCDMA	4183	Fixed	ON	99.2	39.93	0.000	39.93	51	-11.07	M4
WCDMA	4233	Fixed	ON	83.7	38.45	0.009	38.46	51	-12.54	M4

WCDMA Band II Duty cycle:100%

Mode	Channel	Antenna	Backlight	Time Avg. Field (V/m)	Peak Filed (dB V/m)	Power drift (dB)	Extrapolate Field (dB V/m)	Limit (dB V/m)	Margin (dB)	M-Rating Category Result
WCDMA	9262	Fixed	ON	57.0	35.12	0.060	35.18	41	-5.82	M4
WCDMA	9400	Fixed	ON	59.1	35.43	0.060	35.49	41	-5.51	M4
WCDMA	9538	Fixed	ON	47.9	33.61	0.074	33.68	41	-7.32	M4

Note:

1. The extrapolate field value have including power drift value for worst case HAC test result.

2. H-Field Emission:

Mode	Channel	Antenna	Backlight	Time Avg. Field (V/m)	Peak Filed (dB V/m)	Power drift (dB)	Extrapolate Field (dB V/m)	Limit (dB V/m)	Margin (dB)	M-Rating Category Result
GSM	128	Fixed	ON	0.374	-8.54	0.040	-8.50	0.6	-9.10	M4
GSM	190	Fixed	ON	0.389	-8.20	0.008	-8.19	0.6	-8.79	M4
GSM	251	Fixed	ON	0.336	-9.47	0.045	-9.43	0.6	-10.03	M4

GSM PCS Band Duty cycle:12.5%

Mode	Channel	Antenna	Backlight	Time Avg. Field (V/m)	Peak Filed (dB V/m)	Power drift (dB)	Extrapolate Field (dB V/m)	Limit (dB V/m)	Margin (dB)	M-Rating Category Result
GSM	512	Fixed	ON	0.111	-19.09	0.009	-19.08	-9.4	-9.68	M4
GSM	661	Fixed	ON	0.121	-18.34	0.042	-18.30	-9.4	-8.90	M4
GSM	810	Fixed	ON	0.127	-17.92	0.004	-17.92	-9.4	-8.52	M4

WCDMA Band v Duty cycle:100%

Mode	Channel	Antenna	Backlight	Time Avg. Field (V/m)	Peak Filed (dB V/m)	Power drift (dB)	Extrapolate Field (dB V/m)	Limit (dB V/m)	Margin (dB)	M-Rating Category Result
WCDMA	4132	Fixed	ON	0.212	-13.47	0.017	-13.46	0.6	-14.06	M4
WCDMA	4183	Fixed	ON	0.256	-11.84	0.010	-11.83	0.6	-12.43	M4
WCDMA	4233	Fixed	ON	0.218	-13.23	0.045	-13.19	0.6	-13.79	M4

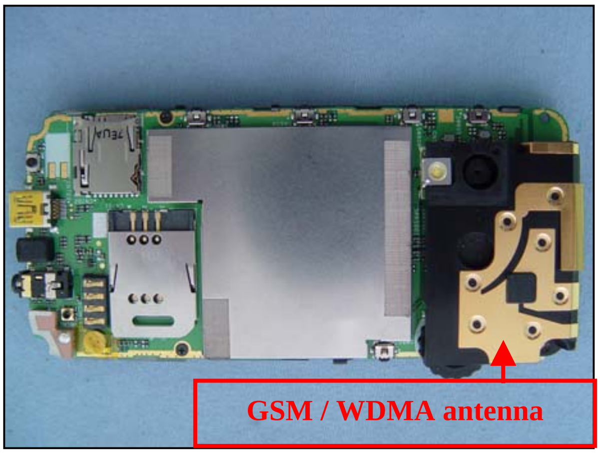
WCDMA Band II Duty cycle:100%

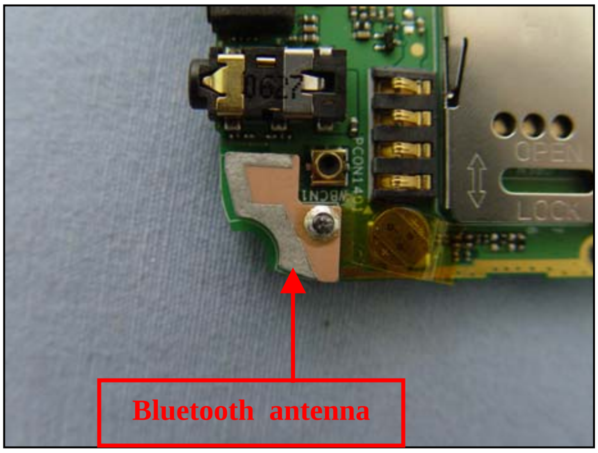
Mode	Channel	Antenna	Backlight	Time Avg. Field (V/m)	Peak Filed (dB V/m)	Power drift (dB)	Extrapolate Field (dB V/m)	Limit (dB V/m)	Margin (dB)	M-Rating Category Result
WCDMA	9262	Fixed	ON	0.252	-11.97	0.018	-11.95	-9.4	-2.55	M3
WCDMA	9400	Fixed	ON	0.245	-12.22	0.010	-12.21	-9.4	-2.81	M3
WCDMA	9538	Fixed	ON	0.234	-12.62	0.012	-12.60	-9.4	-3.20	M3

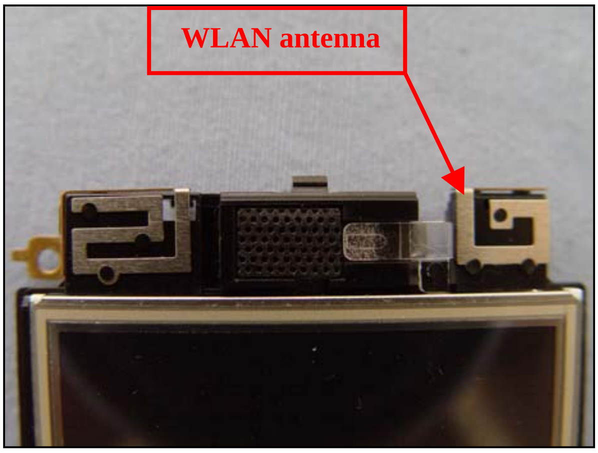
Note:

1. The extrapolate field value have including power drift value for worst case HAC test result.

11. EUT PHOTOS







12. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Cycle(days)	Calibration Due
S-Parameter Network Analyzer	Agilent	E8358A	US40260243	365	06/20/08
Electronic Probe kit	Hewlett Packard	85070D	N/A	N/A	N/A
Thermometer	Amarell	4046	25060	3650	10/02/14
Power Meter	Agilent	E4418B	GB43314078	365	02/27/09
Power Sensor	Agilent	E9327A	US40441097	365	06/07/08
Wireless Communication Test Set	Agilent	E5515C	GB44051665	365	06/20/08
Wireless Communication Test Set	R&S	CMU200	101245	365	04/24/08
Signal Generator	Agilent	83630B	3844A01022	365	04/08/08
Data Acquisition Electronics (DAE)	SPEAG	DAE4	558	365	08/29/08
HAC Test Arch	SPEAG	SD HAC P01 BA	1027	N/A	N/A
Devices Holder	SPEAG	N/A	N/A	N/A	N/A
835 MHz System Validation Dipole	SPEAG	CD835V3	1031	730	04/26/09
1880 MHz System Validation Dipole	SPEAG	CD1880V3	1024	730	04/26/09
Probe Alignment Unit	SPEAG	LB (V2)	348	N/A	N/A
Robot	Staubli	RX90B L	F02/5T69A1/A/01	N/A	N/A
Devices Holder	SPEAG	N/A	N/A	N/A	N/A
E-Field Probe	SPEAG	ER3DV6	2345	365	04/20/08
H-Field Probe	SPEAG	H3DV6	6163	365	04/20/08

13.LOCATION OF TEST SITE

All measurement facilities used to collect the measurement data are located at

☐ No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

☒ No. 11, Wu-Kung 6 Rd, Wu-Ku Hsiang, Wu-Ku Industrial District, Taipei Hsien, (248) Taiwan.

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

END OF REPORT