S T S LAB

# Hearing Aid Compatibility （HAC） RF Emissions TEST REPORT

**Report No: STS2009191H03**

Issued for

**Excellus Communications, LLC**

**27298 Wetland Road, Suite 101 Harrisburg, SD 57032 USA**

| | |
|---|---|
| **Product Name:** | 4G phone |
| **Brand Name:** | Snapfon |
| **Model No.:** | Snapfon ez4G |
| **Series Model:** | N/A |
| **FCC ID:** | 2AW56-EZ4G |
| **Test Standard:** | ANSI C63.19: 2011 |
| | FCC 47 CFR Part 20.19 |
| **RF Emission Rating:** | M4 |
| **Test Result:** | Pass |

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# Test Report Certification

**Applicant's name** ..... : Excellus Communications, LLC

Address ..... : 27298 Wetland Road, Suite 101 Harrisburg, SD 57032 USA

**Manufacture's Name**..... : Ying Tai Electronics Co., Ltd

Address ..... : ROOM 803, CHEVALIER HOUSE 45-51 CHATHAM ROAD SOUTH, TSIM SHA TSUI, KOWLOON, HONG KONG

**Product description**

Product name ..... : 4G phone

Brand name ..... : Snapfon

Model name ..... : Snapfon ez4G

Serial Model : N/A

**Standards**..... : ANSI C63.19:2011
FCC 47 CFR Part 20.19

The device was tested by Shenzhen STS Test Services Co., Ltd. in accordance with the measurement methods and procedures specified in KDB 865664 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.

**Date of Test** ..... :

Date (s) of performance of tests..... : 05 Oct. 2020

Date of Issue..... : 07 Oct. 2020

Test Result ..... : **Pass**

Testing Engineer : Aaron Bu

(Aaron Bu)

Technical Manager : Sean She

(Sean she)

Authorized Signatory : Vita Li

(Vita Li)

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# Table of Contents


**1. General Information** **4**

1.1 EUT Description 4

1.2 Test Environment 5

1.3 Test Facility 5

1.4 Test Standards 5

**2. System Components** **6**

2.1 SATIMO System Description 6

2.2 E-Field Probe Specification 6

2.3 Axis Articulated Robot 6

2.4 Universal Device Positioner 7

2.5 Test Equipment List 8

2.6 Measurement Uncertainty 9

**3. HAC RF Emission Measurement Evaluation** **10**

3.1 System Check 10

3.2 Dipole validation 10

3.3 System Validation Results 10

**4. Hearing AID Compatibility** **11**

**5. Modulation Interference Factor (MIF)** **12**

**6. HAC Test Procedures** **14**

**7. Test Flowchart Per ANSI-PC63.19 2011** **15**

**8. Schematic Test Configuration** **16**

**9. RF Emissions** **17**

**10 HAC RF Emission Test Results** **18**

10.1 Conducted Power (Unit: dBm) 18

10.2 M-Rating 18

10.3 E-Field Emission for GSM: 19

**11. HAC Test Photographs** **27**

**12. System Validation Results** **28**

**13. Probe Calibration And Dipole Calibration Report** **29**

# 1. General Information

## 1.1 EUT Description

| | | |
|---|---|---|
| Product Name | 4G phone | |
| Brand Name | Snapfon | |
| Model Name | Snapfon ez4G | |
| Series Model | N/A | |
| Model Difference | N/A | |
| Hardware Version | G1-MB-V1.1 | |
| Software Version | Snapfon_ez4G_v2.0_20200821_1249 | |
| Device Type | Portable Device | |
| EUT Stage | Production Unit | |
| Frequency Range (TX) | GSM 850: 824.2~848.8MHz<br>PCS1900: 1850.2~1909.8MHz<br>WCDMA Band II: 1852.4~1907.6MHz<br>WCDMA Band IV:1712.4~1752.6 MHz<br>WCDMA Band V: 826.4~846.6MHz<br>WLAN802.11b/g/n(HT20): 2412~2462MHz<br>WLAN802.11n(HT40): 2422~2452MHz<br>Bluetooth: 2402~ 2480MHz<br>GPS: 1575.42MHz<br>FM: 87.5 MHz to 108 MHz | |
| Band | E-field dB(V/m) | M-Rating |
| GSM 850 | 35.02 | M4 |
| PCS1900 | 29.81 | M4 |
| WCDMA Band II | 32.73 | M3 |
| WCDMA Band IV | 33.81 | M3 |
| WCDMA Band V | 34.87 | M4 |
| Operating Mode: | GSM: GSM Voice; GPRS; Class 12<br>WCDMA: RMC, HSDPA, HSUPA Release 6<br>WLAN: 802.11 b/g/n(HT20) /n(HT40)<br>Bluetooth: 4.2+EDR (GFSK +π/4DQPSK+8DPSK)<br>BLE:GFSK | |
| Antenna Specification: | GSM, WCDMA: PIFA Antenna<br>BT, WLAN: PIFA Antenna | |
| SIM Card | Only supports one SIM card | |
| Battery | Rated Voltage: 3.7V<br>Charge Limit: 4.2V<br>Capacity :1500mAh | |

## 1.2 Test Environment

Ambient conditions in the SAR laboratory:

| Items | Required |
|---|---|
| Temperature (℃) | 18-25 |
| Humidity (%RH) | 30-70 |

## 1.3 Test Facility

ShenZhen STS Test Services Co.,Ltd.

A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC Registration No.: 625569

A2LA Certificate No.: 4338.01

IC Registration No.: 12108A

## 1.4 Test Standards

| No. | Identity | Document Title |
|---|---|---|
| 1 | FCC 47 CFR Part 20.19 | Hearing aid-compatible mobile handsets. |
| 2 | ANSI C63.19:2011 | American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids |
| 3 | 285076 D01 HAC Guidance v05r01 | Equipment authorization Guidance For Hearing Aid Compatibility |

# 2. System Components

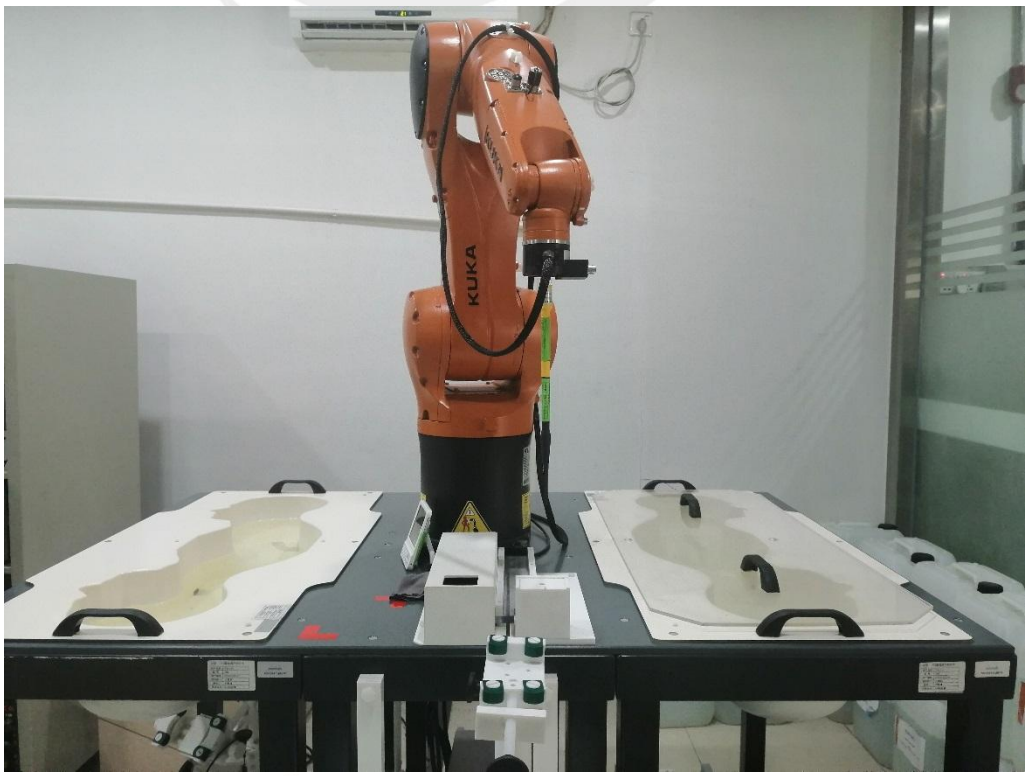
## 2.1 SATIMO System Description

SATIMO is fully compliant with the technical and scientific requirements of IEEE 1528, IEC 62209, CENELEC, ARIB, ACA, and the Federal Communications Commission. The system comprises of a six axes articulated robot which utilizes a dedicated controller.
SATIMO uses the latest methodologies and FDTD order to provide a platform which is repeatable with minimum uncertainty.

## 2.2 E-Field Probe Specification

| Device Under Test | |
|---|---|
| Device Type | COMOHAC E FIELD PROBE |
| Manufacturer | Satimo |
| Model | SCE |
| Serial Number | SN 06/14 EPH42 |
| Product Condition (new / used) | new |
| Frequency Range of Probe | 0.7GHz-2.5GHz |
| Resistance of Three Dipoles at Connector | Dipole 1: R1=0.214 MΩ<br>Dipole 2: R2=0.213 MΩ<br>Dipole 3: R3=0.204 MΩ |

## 2.3 Axis Articulated Robot



SATIMO utilizes a six articulated robot, which is controlled using a Pentium based real-time movement controller. The movement kinematics engine utilizes proprietary (Thermo CRS) interpolation and extrapolation algorithms, which allow full freedom of movement for each of the six joints within the working envelop. Utilization of joint 6 allows for full probe rotation with a tolerance better than 0.05mm around the central axis.

| | |
|---|---|
| Robot /Controller Manufacturer | KUKA |
| Number of Axis | Six independently controlled axis |
| Positioning Repeatability | ＜±0.03mm |
| Controller Type | KR C4 compact |
| Robot Reach | 901mm |
| Communication | RS232 and LAN compatible |

### 2.4 Universal Device Positioner

The universal device positioner allows complete freedom of movement of the EUT. Developed to hold a EUT in a free-space scenario any additional loading attributable to the material used in the construction of the positioner has been eliminated. Repeatability has been enhanced through the linear scales which form the design used to indicate positioning for any given test scenario in all major axes.

## 2.5 Test Equipment List

| Instrument | Manufacturer | Model | S/N | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|
| E-Field Probe | MVG | SCE | SN 06/14 EPH42 | 2020.07.14 | 2021.07.13 |
| Reference Validation Dipole 835MHz | MVG | SID835 | SN 13/14 DHA55 | 2020.07.14 | 2023.07.13 |
| Reference Validation Dipole 1900MHz | MVG | SIDB1900 | SN 13/14 DHB59 | 2020.07.14 | 2023.07.13 |
| Magnetic Field Simulator | MVG | STMFS | SN 07/14 TMFS24 | 2020.07.14 | 2023.07.13 |
| Network Analyzer | Agilent | 8753ES | US38432810 | 2019.10.11 | 2020.10.10 |
| Multi Meter | Keithley | Multi Meter 2000 | 4050073 | 2019.10.11 | 2020.10.10 |
| Wireless Communication Test Set | R&S | CMW500 | 117239 | 2019.10.09 | 2020.10.08 |
| Power Amplifier | DESAY | ZHL-42W | 9638 | 2019.10.09 | 2020.10.08 |
| Power Meter | R&S | NRP | 100510 | 2019.10.16 | 2020.10.15 |
| Power Meter | Agilent | E4418B | GB43312526 | 2019.10.16 | 2020.10.15 |
| Power Sensor | R&S | NRP-Z11 | 101919 | 2019.10.09 | 2020.10.08 |
| Power Sensor | Agilent | E9301A | MY41497725 | 2019.10.09 | 2020.10.08 |
| Temperature hygrometer | SuWei | SW-108 | N/A | 2019.10.13 | 2020.10.12 |

## 2.6 Measurement Uncertainty

| Measurement Uncertainty of RF Emission Test | | | | | |
|---|---|---|---|---|---|
| Uncertainty Component | Tol. (±dB) | Prob. Dst. | Dvi | Uncertainty (dB) | Uncertainty (%) |
| Measurement System | | | | | |
| RF reflections | 0.1 | R | √3 | 0.06 | |
| Field Probe conv. Factor | 0.4 | R | √3 | 0.23 | |
| Field Probe anisotropy | 0.25 | R | √3 | 0.14 | |
| Positioning accuracy | 0.1 | R | √3 | 0.12 | |
| Probe cable placement | 0.2 | R | √3 | 0.06 | |
| System repeatability | 0.2 | R | √3 | 0.12 | |
| EUT repeatability | 0.4 | N | 1 | 0.40 | |
| Combined Standard Uncertainty | | N | 1 | 0.52 | |
| Expanded uncertainty (95% CONFIDENCE INTERVAL) | | N | k=2 | 1.03 | 12.65 |
| REPORTED Expanded uncertainty (confidence level of 95%，k=2) | | N | k=2 | 1.03 | 13.00 |

| Measurement Uncertainty of T-Coil Test | | | | | |
|---|---|---|---|---|---|
| Uncertainty Component | Tol. (±dB) | Prob. Dst. | Dvi | Uncertainty (dB) | Uncertainty (%) |
| Measurement System | | | | | |
| RF reflections | 0.1 | R | √3 | 0.06 | |
| Acoustic noise | 0.1 | R | √3 | 0.06 | |
| Probe coil sensitivity | 0.49 | R | √3 | 0.28 | |
| Reference signal level | 0.25 | R | √3 | 0.14 | |
| Positioning accuracy | 0.4 | R | √3 | 0.23 | |
| Cable loss | 0.1 | N | 2 | 0.05 | |
| Frequency analyzer | 0.15 | R | √3 | 0.09 | |
| System repeatability | 0.2 | N | 1 | 0.20 | |
| Repeatability of the WD | 0.4 | N | 1 | 0.40 | |
| Combined Standard Uncertainty | | N | 1 | 0.61 | |
| Expanded uncertainty (confidence level of 95%，k=2) | | N | k=2 | 1.22 | 15.05 |
| REPORTED Expanded uncertainty (confidence level of 95%，k=2) | | N | k=2 | 1.20 | 15.00 |

# 3. HAC RF Emission Measurement Evaluation

## 3.1 System Check

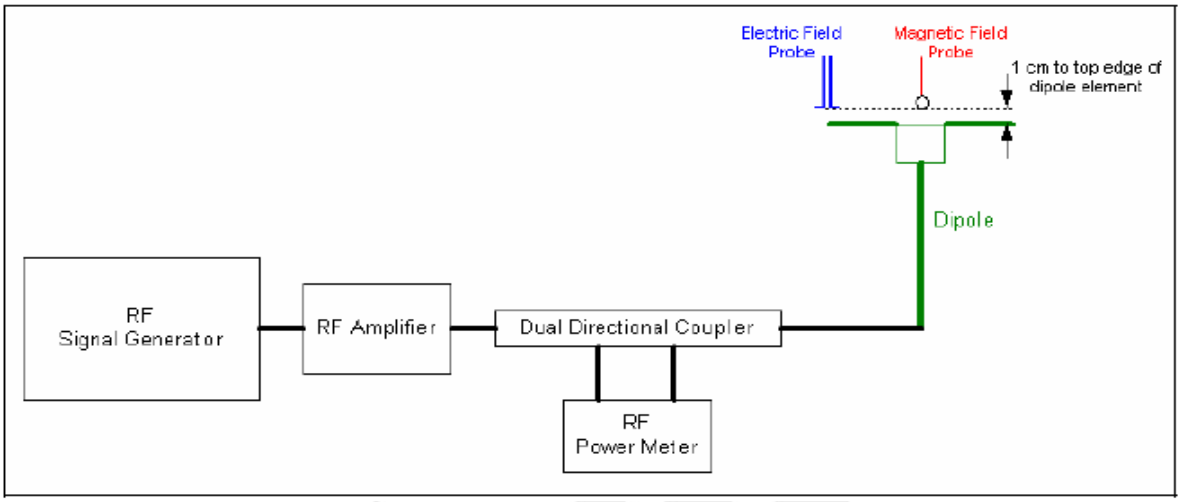
The test setup should be validated when first configured and verified periodically thereafter to ensure proper function. The procedure consists of two parts: dipole validation and determination of probe modulation factor

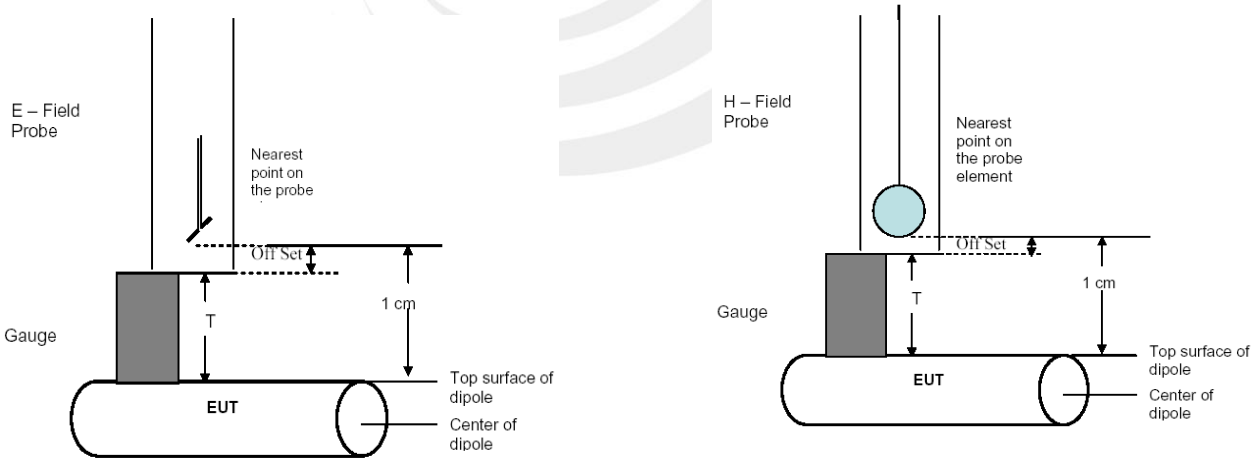
## 3.2 Dipole validation

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




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.

## 3.3 System Validation Results

Lab Temperature: 23℃, Lab Humidity: 57%.

| Date | Calibration Dipole | Frequency (MHz) | Input Power (dBm) | Target Value(V/m) | Measured (V/m) | Deviation (%) |
|---|---|---|---|---|---|---|
| 2020/10/05 | SN 06/14 EPH42 E-field | 850 | 20 | 220.4 | 217.5 | -1.32 |
| 2020/10/05 | | 1900 | 20 | 153.4 | 151.6 | -1.17 |

Note: Deviation=(( Measured Result)-(Target Value))/(Target Value)*100%

# 4. Hearing AID Compatibility

The purpose of the Hearing Aid Compatibility extension is to enable measurements of the near electric and magnetic fields generated by wireless communication devices in the region controlled for use by a hearing aid in accordance with ANSI-C63.19-2011 FCC has granted a request for waiver of the HAC rules in section 20.19 for dual band GSM handsets. The waiver has specific conditions, as stated in the order (FCC 05-166).
The purpose of this standard is to establish categories for hearing aids and for WD (wireless communications devices) that can indicate to health care practitioners and hearing aid users which hearing aids are compatible with which WD, and to provide tests that can be used to assess the electromagnetic characteristics of hearing aids and WD and assign them to these categories. The various parameters required, in order to demonstrate compatibility and accessibility are measured. The design of the standard is such that when a hearing aid and WD achieve one of the categories specified, as measured by the methodology of this standard, the indicated performance is realized.

In order to provide for the usability of a hearing aid with a WD, several factors must be coordinated:
a) Radio frequency (RF) measurements of the near-field electric and magnetic fields emitted by a WD to categorize these emissions for correlation with the RF immunity of a hearing aid.
b) Magnetic field measurements of a WD emitted via the audio transducer associated with the T-coil mode of the hearing aid, for assessment of hearing aid performance.
c) Measurements with the hearing aid and a simulation of the categorized WD T-coil emissions to assess the hearing aid RF immunity in the T-coil mode.

The WD radio frequency (RF) and audio band emissions are measured.

Hence, the following are measurements made for the WD:
a) RF E-Field emissions
c) T-coil mode, magnetic signal strength in the audio band
d) T-coil mode, magnetic signal and noise articulation index
e) T-coil mode, magnetic signal frequency response through the audio band

Corresponding to the WD measurements, the hearing aid is measured for:
a) RF immunity in microphone mode
b) RF immunity in T-coil mode

# 5. Modulation Interference Factor (MIF)

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 dBV/m) and converts it to the RF Audio Interference level (in dBV/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 C63-2007.

Definitions, E-field probes have a bandwidth <10 kHz and can therefore not evaluate the RF envelope in the full audio band. OPENHAC 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. OPENHAC uses well defined signals for PMR calibration. The MIF of these signals has been determined by simulation and is automatically applied.

MIF values were not tested by a probe or as specified in the standards but are based on analysis provided by SATIMO for all the air interfaces (GSM, WCDMA). The data included in this report are for the worst case operating modes.

| Transmission protocol | Modulation interference factor |
|---|---|
| GSM; full-rate version 2; speech codec/handset low | +3.5dB |
| WCDMA; speech; speech codec low; AMR 12.2 kb/s | -20.0dB |
| CDMA; speech; SO3; RC3; full frame rate: 8kEVRC | -19.0dB |
| CDMA; speech; SO3; RC1;1/8th frame rate; 8kEVRC | +3.3dB |

A PMR calibrated probe is linearized for the selected waveform over the full dynamic range within the uncertainty.

Specified in its calibration certificate. E-field probes have a bandwidth <10 kHz and can therefore not evaluate the RF envelope in the full audio band. OPENHAC 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 PMR calibration in order to not overestimate the field reading. The evaluation method for 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 scaled 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 constant and characteristic for a communication signal. OPENHAC uses well-defined signals for PMR calibration. The MIF of these signals has been determined by simulation and is automatically applied. The MIF measurement uncertainty is estimated as follows, for modulation frequencies from slotted waveforms with fundamental frequency and at least 2 harmonics within 10

kHz:

0.2 dB for MIF -7 to +5 dB, 0.5 dB for MIF -13 to +11 dB

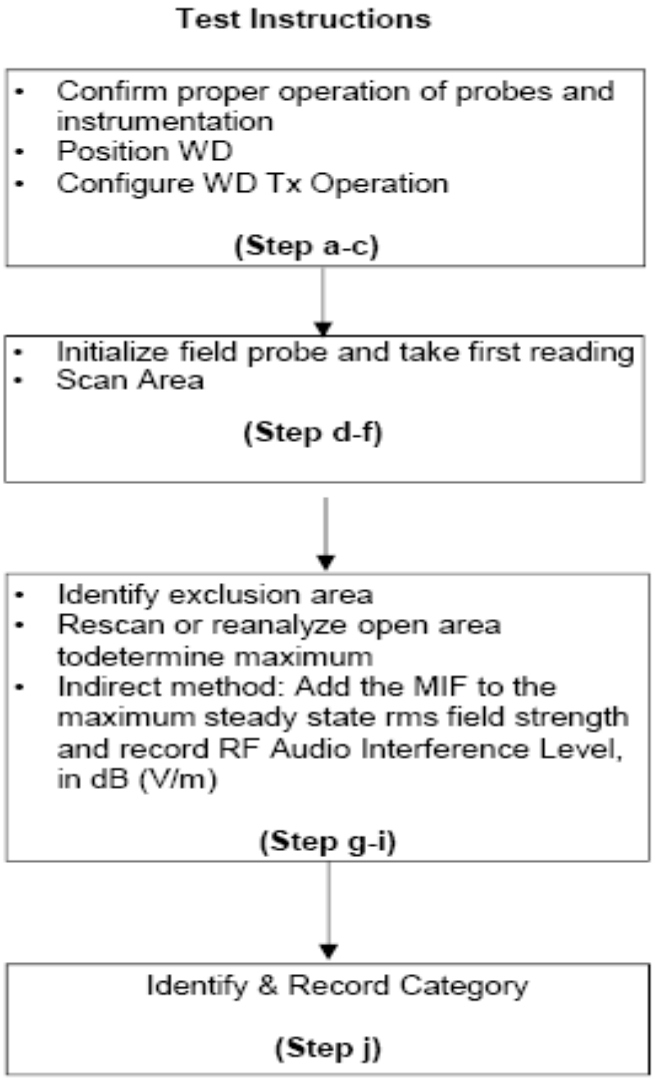
1 dB for MIF > -20

## 6. HAC Test Procedures

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

1. Proper operation of the field probe, probe measurement system, other instrumentation, and the positioning system was confirmed.
2. DUT is positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.
3. The DUT operation for maximum rated RF output power was configured and confirmed with the base station simulator, at the test channel and other normal operating parameters as intended for the test. The battery was ensured to be fully charged before each test.
4. The center sub-grid was centered over the center of the acoustic output (also audio band magnetic output, if applicable). The DUT audio output was positioned tangent (as physically possible) to the measurement plane.
5. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the test Arch.
6. The measurement system measured the field strength at the reference location.
7. Measurements at 5 mm increments in the 5 x 5 cm 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.
8. The system performed a drift evaluation by measuring the field at the reference location.
9. Steps 1 ~ 8 were done for both the E and H-Field measurements.

# 7. Test Flowchart Per ANSI-PC63.19 2011



## 8. Schematic Test Configuration

During HAC test, EUT was operating in Traffic Mode (Channel Allocated) at Normal Voltage Condition. A communication link is set up with a System Simulator (SS) by air link, and a call is established.

The Absolute Radio Frequency Channel Number (ARFCN) was allocated to 128, 190 and 251 respectively in the case of GSM 850MHz, or to 512, 661 and 810 respectively in the case of PCS 1900MHz, or to 4132, 4183 and 4233 respectively in the case of WCDMA 850MHz, or to 9262, 9400 and 9538 respectively in the case of WCDMA 1900MHz. or to 1312, 1413 and 1513 respectively in the case of WCDMA 1700MHz. The EUT was commanded to operate at maximum transmitting power.

The EUT should use its internal transmitter. The antenna(s), battery and accessories shall be those specified by the manufacturer. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. If a wireless link was used, the antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the handset.

The signal transmitted by the simulator to the antenna feeding point should be lower than the output power level of the handset by at least 35 dB

| Air-interface | Band (MHz) | Type | C63.19-2011 Tested | Simultaneous Transmissions Scenarios invoice (Not to be tested) | Reduced power |
|---|---|---|---|---|---|
| GSM | 850 | Voice | Yes | Yes: WIFI or BT | N/A |
| | 1900 | Voice | Yes | Yes: WIFI or BT | N/A |
| | GPRS | Data | N/A | N/A | N/A |
| WCDMA | 850 | Voice | Yes | Yes: WIFI or BT | N/A |
| | 1900 | Voice | Yes | Yes: WIFI or BT | N/A |
| | HSDPA | Data | N/A | N/A | N/A |
| | HSUPA | Data | N/A | N/A | N/A |
| WIFI | 2.4G | Data | N/A | Yes GSM or WCDMA | N/A |
| BT | 2.4G | Data | N/A | Yes GSM or WCDMA | N/A |

The volume is at the maximum value, and the backlight of the phone is turned off. The Manufacturer doesn't design HAC mode software on the EUT

Note: The EUT 4G only supports data mode, not 4G voice mode.

## 9. RF Emissions

| 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) |

# 10 HAC RF Emission Test Results

## 10.1 Conducted Power (Unit: dBm)

| Burst Average Power (dBm) | | | | | | |
|---|---|---|---|---|---|---|
| Band | GSM 850 | | | PCS 1900 | | |
| Channel | 128 | 190 | 251 | 512 | 661 | 810 |
| Frequency (MHz) | 824.2 | 836.6 | 848.8 | 1850.2 | 1880 | 1909.8 |
| GSM(GMSK, 1-Slot) | 32.17 | 32.32 | 32.42 | 29.39 | 29.24 | 29.21 |

| Band | WCDMA Band V | | | WCDMA Band IV | | | WCDMA Band II | | |
|---|---|---|---|---|---|---|---|---|---|
| Channel | 4132 | 4183 | 4233 | 1312 | 1413 | 1513 | 9262 | 9400 | 9538 |
| Frequency (MHz) | 826.4 | 836.6 | 846.6 | 1712.6 | 1740.0 | 1752.4 | 1852.4 | 1880.0 | 1907.6 |
| RMC 12.2Kbps | 21.93 | 21.35 | 22.39 | 22.98 | 22.56 | 23.84 | 22.60 | 22.55 | 23.19 |

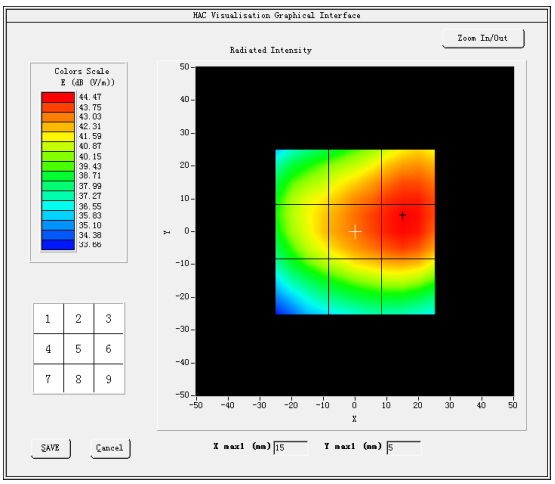
## 10.2 M-Rating

| Band | GSM 850 | | | PCS 1900 | | |
|---|---|---|---|---|---|---|
| Channel | 128 | 190 | 251 | 512 | 661 | 810 |
| Frequency (MHz) | 824.2 | 836.6 | 848.8 | 1850.2 | 1880 | 1909.8 |
| Result(dB V/m) | 34.52 | 34.94 | 35.07 | 29.82 | 29.67 | 29.45 |
| M-Rating | M4 | M4 | M4 | M4 | M4 | M4 |

| Band | WCDMA Band II | | | WCDMA Band IV | | | WCDMA Band V | | |
|---|---|---|---|---|---|---|---|---|---|
| Channel | 9262 | 9400 | 9538 | 1312 | 1413 | 1513 | 4132 | 4183 | 4233 |
| Frequency (MHz) | 1852.4 | 1880.0 | 1907.6 | 1712.6 | 1740.0 | 1752.4 | 826.4 | 836.6 | 846.6 |
| Result(dB V/m) | 32.75 | 32.64 | 32.57 | 33.58 | 33.86 | 33.42 | 34.86 | 34.65 | 34.65 |
| M-Rating | M3 | M3 | M3 | M3 | M3 | M3 | M4 | M4 | M4 |

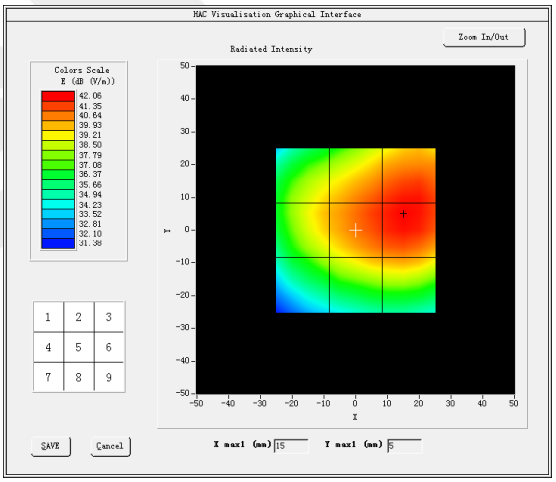
## 10.3 E-Field Emission for GSM:

| | | |
|---|---|---|
| Grid 1: 31.92 | Grid 2: 32.74 | Grid 3: 33.85 |
| Grid 4: 32.13 | Grid 5: 33.17 | Grid 6: 34.78 |
| Grid 7: 31.42 | Grid 8: 32.42 | Grid 9: 32.64 |



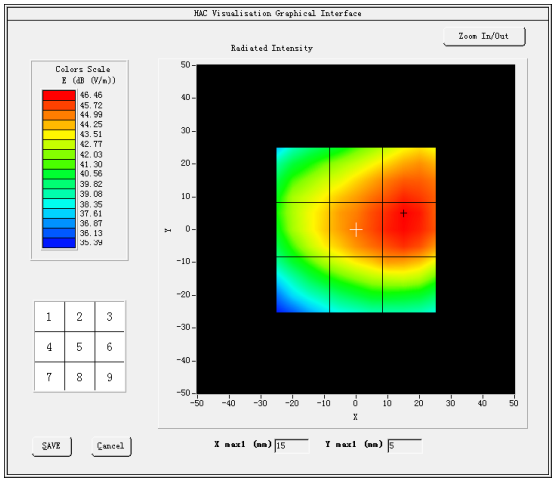

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| GSM850 | 128 | 824.2 | 34.78 | M4 |

| | | |
|---|---|---|
| Grid 1: 32.54 | Grid 2: 33.79 | Grid 3: 34.24 |
| Grid 4:32.84 | Grid 5: 34.06 | Grid 6: 34.81 |
| Grid 7: 32.40 | Grid 8: 33.08 | Grid 9: 33.24 |



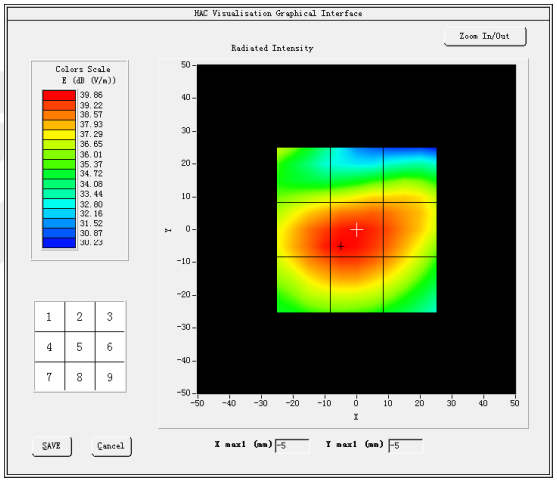

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| GSM850 | 190 | 836.4 | 34.81 | M4 |

| | | |
|---|---|---|
| Grid 1: 32.51 | Grid 2: 33.29 | Grid 3: 34.74 |
| Grid 4: 33.20 | Grid 5: 34.05 | Grid 6: 35.02 |
| Grid 7: 32.18 | Grid 8: 33.27 | Grid 9: 33.15 |



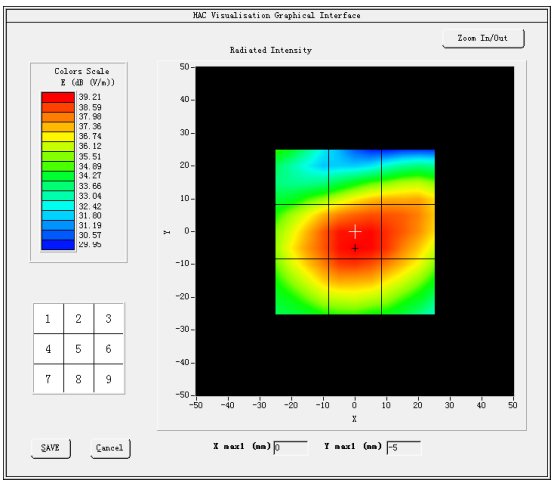

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| GSM850 | 251 | 848.8 | 35.02 | M4 |

| | | |
|---|---|---|
| Grid 1: 27.92 | Grid 2: 28.14 | Grid 3: 27.61 |
| Grid 4: 29.47 | Grid 5: 29.81 | Grid 6: 28.05 |
| Grid 7: 28.42 | Grid 8: 28.47 | Grid 9: 27.73 |



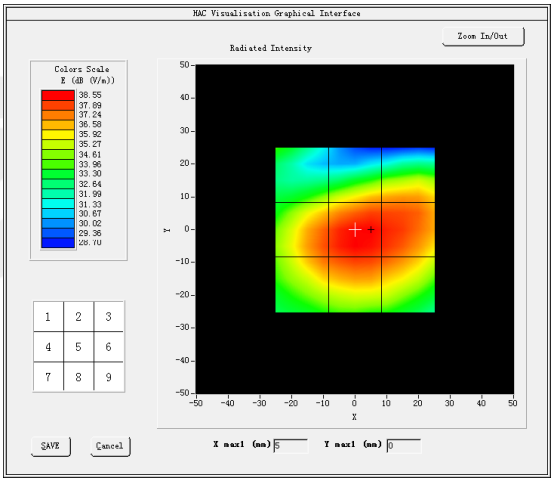

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| PCS1900 | 512 | 1850.2 | 29.81 | M3 |

| | | |
|---|---|---|
| Grid 1: 27.04 | Grid 2: 28.12 | Grid 3: 27.44 |
| Grid 4: 28.59 | Grid 5: 29.67 | Grid 6: 28.34 |
| Grid 7: 27.88 | Grid 8: 28.18 | Grid 9: 27.43 |



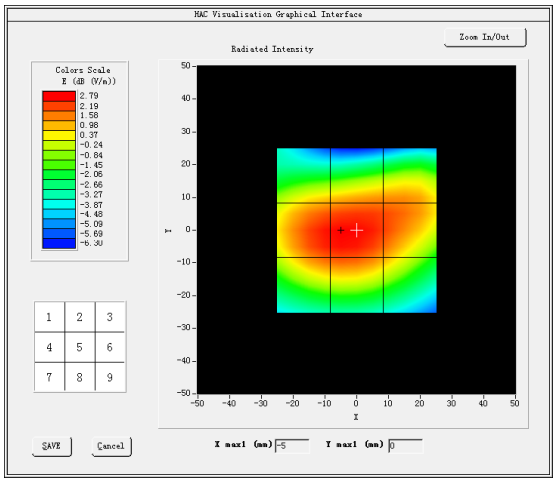

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| PCS1900 | 661 | 1880.0 | 29.67 | M4 |

| | | |
|---|---|---|
| Grid 1: 26.97 | Grid 2: 27.76 | Grid 3: 27.78 |
| Grid 4: 28.48 | Grid 5: 29.65 | Grid 6: 28.75 |
| Grid 7: 27.84 | Grid 8: 28.46 | Grid 9: 27.72 |



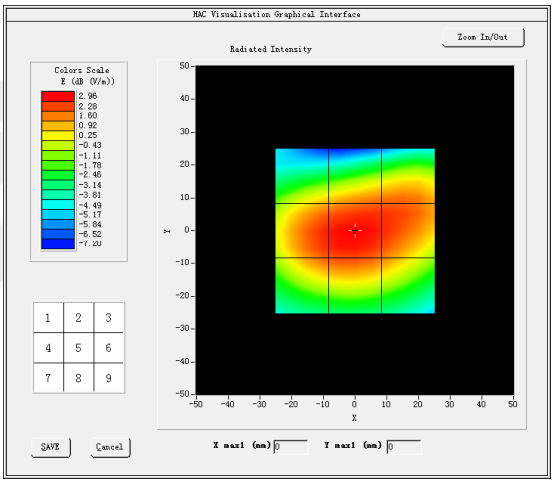

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| PCS1900 | 810 | 1909.8 | 29.65 | M4 |

| | | |
|---|---|---|
| Grid 1: 30.90 | Grid 2: 31.31 | Grid 3: 31.92 |
| Grid 4: 32.04 | Grid 5: 32.73 | Grid 6: 32.27 |
| Grid 7: 31.43 | Grid 8: 31.62 | Grid 9: 31.02 |



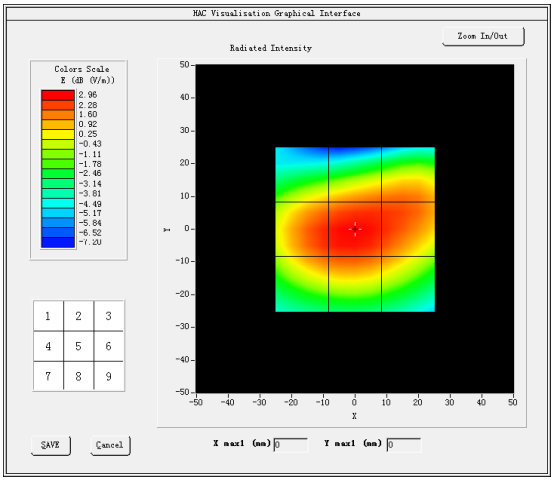

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| WCDMA II | 9262 | 1852.4 | 32.73 | M3 |

| | | |
|---|---|---|
| Grid 1: 30.48 | Grid 2: 31.52 | Grid 3: 31.36 |
| Grid 4: 31.60 | Grid 5: 32.31 | Grid 6: 31.97 |
| Grid 7: 30.72 | Grid 8: 31.17 | Grid 9: 30.88 |



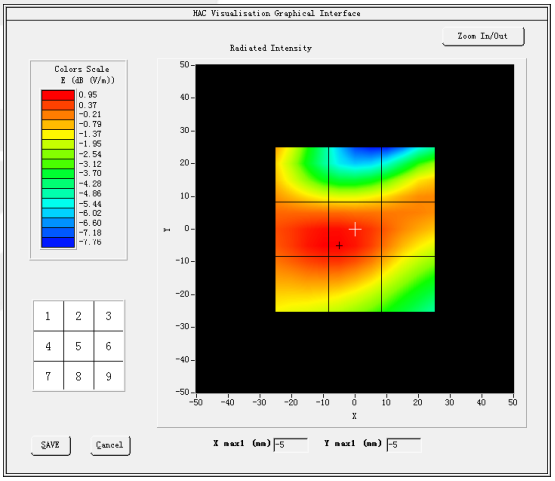

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| WCDMA II | 9400 | 1880.0 | 32.31 | M3 |

| | | |
|---|---|---|
| Grid 1: 30.48 | Grid 2: 31.52 | Grid 3: 31.47 |
| Grid 4: 31.77 | Grid 5: 32.51 | Grid 6: 31.78 |
| Grid 7: 31.22 | Grid 8: 31.47 | Grid 9: 30.68 |



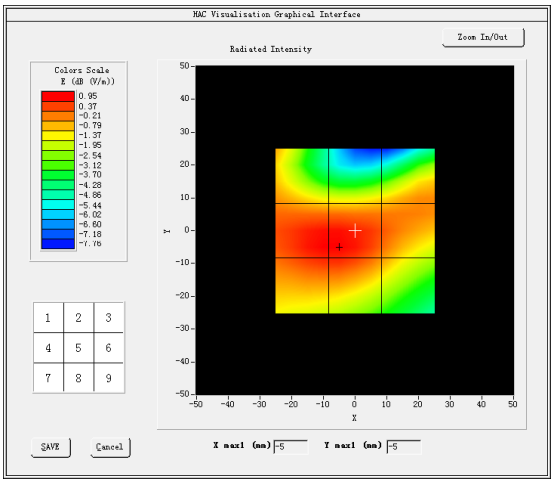

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| WCDMA II | 9538 | 1907.6 | 32.51 | M3 |

| | | |
|---|---|---|
| Grid 1: 31.12 | Grid 2: 30.67 | Grid 3: 30.56 |
| Grid 4: 32.84 | Grid 5: 33.50 | Grid 6: 30.94 |
| Grid 7: 31.77 | Grid 8: 31.48 | Grid 9: 30.30 |



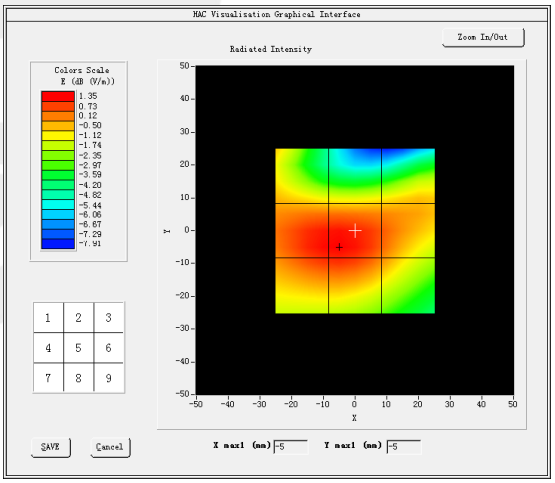

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| WCDMA IV | 1312 | 1712.6 | 33.50 | M3 |

| | | |
|---|---|---|
| Grid 1: 30.42 | Grid 2: 20.17 | Grid 3: 30.78 |
| Grid 4: 33.72 | Grid 5: 33.81 | Grid 6: 31.27 |
| Grid 7: 31.95 | Grid 8: 31.32 | Grid 9: 30.45 |



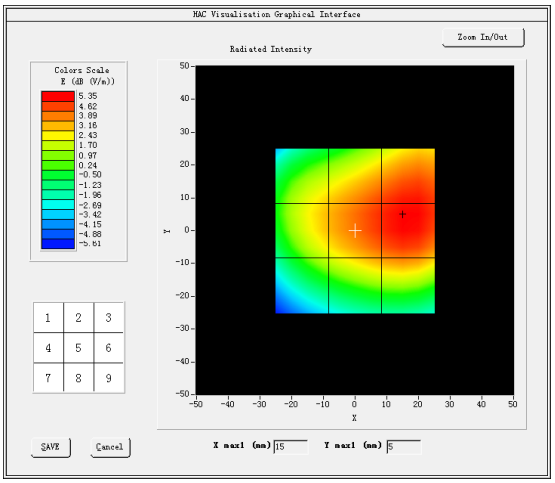

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| WCDMA IV | 1413 | 1740.0 | 33.81 | M3 |

| | | |
|---|---|---|
| Grid 1: 30.86 | Grid 2: 29.76 | Grid 3: 30.42 |
| Grid 4: 32.28 | Grid 5: 33.64 | Grid 6: 31.22 |
| Grid 7: 31.76 | Grid 8: 31.97 | Grid 9: 30.74 |



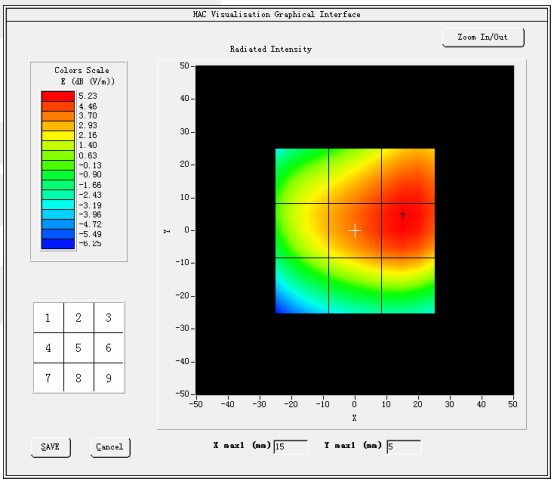

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| WCDMA IV | 1513 | 1752.4 | 33.64 | M3 |

| | | |
|---|---|---|
| Grid 1: 31.68 | Grid 2: 32.75 | Grid 3: 33.98 |
| Grid 4: 31.84 | Grid 5: 33.54 | Grid 6: 34.87 |
| Grid 7: 31.14 | Grid 8: 31.68 | Grid 9: 32.42 |



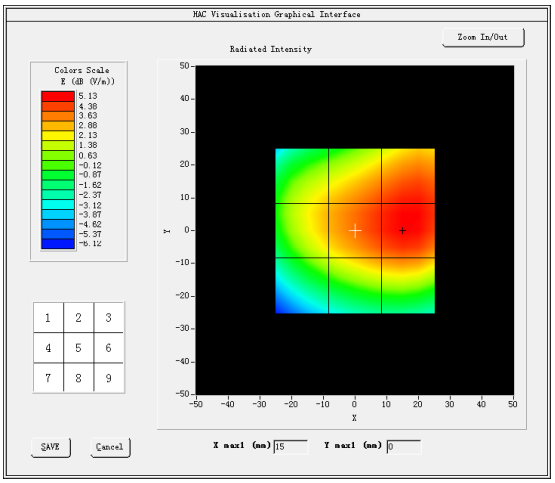

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| WCDMA V | 4132 | 826.4 | 34.87 | M4 |

| | | |
|---|---|---|
| Grid 1: 32.08 | Grid 2: 33.31 | Grid 3: 33.92 |
| Grid 4: 32.46 | Grid 5: 33.72 | Grid 6: 34.79 |
| Grid 7: 31.87 | Grid 8: 32.45 | Grid 9: 32.72 |



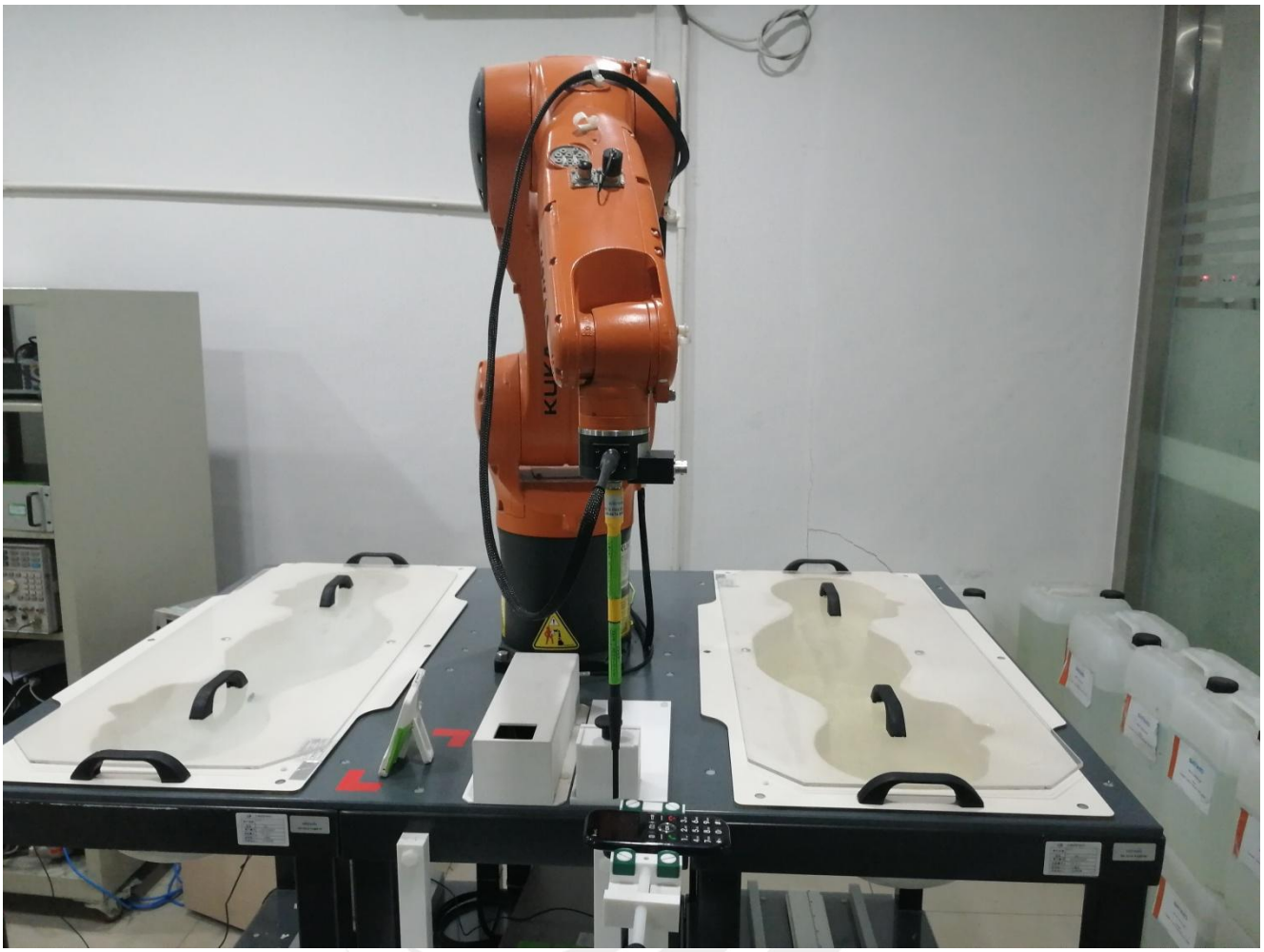

| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| WCDMA V | 4183 | 836.6 | 34.79 | M4 |

| | | |
|---|---|---|
| Grid 1: 31.96 | Grid 2: 32.83 | Grid 3: 33.84 |
| Grid 4: 32.36 | Grid 5: 33.56 | Grid 6: 34.57 |
| Grid 7: 31.85 | Grid 8: 32.24 | Grid 9: 32.78 |




| Operation mode | Channel | f(MHz) | Maximum value of total field (dB V/m) | M-Rating |
|---|---|---|---|---|
| WCDMA V | 4233 | 846.6 | 34.57 | M4 |

# 11. HAC Test Photographs

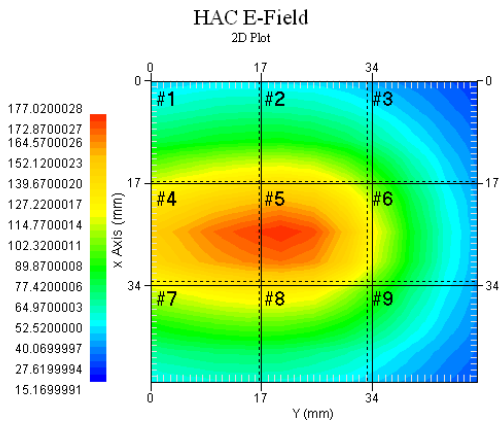


**E-field**

## 12. System Validation Results

| | | |
|---|---|---|
| #1 125.495 | #2 127.052 | #3 92.282 |
| #4 172.750 | #5 176.757 | #6 121.142 |
| #7 133.195 | #8 133.841 | #9 96.000 |

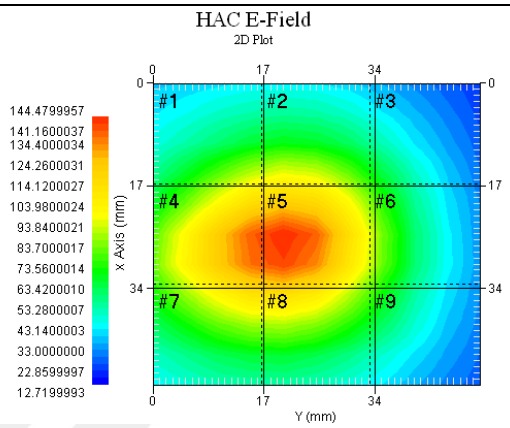
V/m




| Frequency(MHz) | Input power (dBm) | Target Value (dB V/m) | E-Field (dB V/m) | Deviation(%) | data |
|---|---|---|---|---|---|
| 835 | 20 | 220.4 | 217.5 | -1.32 | Oct.05.2020 |

| | | |
|---|---|---|
| #1 94.368 | #2 99.291 | #3 68.469 |
| #4 138.307 | #5 144.484 | #6 87.539 |
| #7 114.989 | #8 117.448 | #9 75.501 |

V/m




| Frequency(MHz) | Input power (dBm) | Target Value (dB V/m) | E-Field (dB V/m) | Deviation(%) | data |
|---|---|---|---|---|---|
| 1880 | 20 | 153.4 | 151.6 | -1.17 | Oct.05.2020 |

# 13. Probe Calibration And Dipole Calibration Report

The following pages include the probe calibration used to evaluate HAC for the DUT.