# HAC RF TEST REPORT

## No. I19Z61094-SEM02

**For**

**TCL Communication Ltd**

**Smart Phone**

**Model name: 5032W**

**With**

**Hardware Version: 06**

**Software Version: 3E5H**

**FCC ID: 2ACCJB111**

**Results Summary: M Category = M3**

**Issued Date: 2019-8-29**

TESTING
NVLAP LAB CODE 600118-0

**Note:**

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**Test Laboratory:**

CTTL, Telecommunication Technology Labs, CAICT

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## REPORT HISTORY

| Report Number | Revision | Issue Date | Description |
|---|---|---|---|
| I19Z61094-SEM02 | Rev.0 | 2019-8-29 | Initial creation of test report |

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# 1 Test Laboratory

## 1.1 Testing Location

| | |
|---|---|
| CompanyName: | CTTL(Shouxiang) |
| Address: | No. 51 Shouxiang Science Building, Xueyuan Road, Haidian District, Beijing, P. R. China100191 |

## 1.2 Testing Environment

| | |
|---|---|
| Temperature: | 18°C~25°C, |
| Relative humidity: | 30%~ 70% |
| Ground system resistance: | < 0.5 Ω |
| Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards. | |

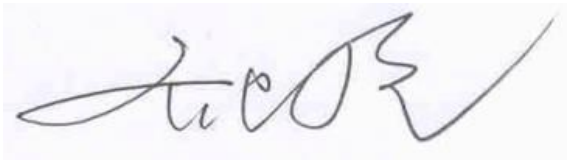
## 1.3 Project Data

| | |
|---|---|
| Project Leader: | Qi Dianyuan |
| Test Engineer: | Lin Hao |
| Testing Start Date: | August 12, 2019 |
| Testing End Date: | August 13, 2019 |

## 1.4 Signature

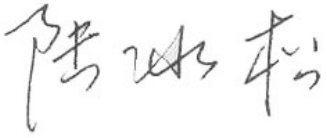
**Lin Xiaojun**

**(Prepared this test report)**



**Qi Dianyuan**

**(Reviewed this test report)**



**Lu Bingsong**

**Deputy Director of the laboratory**

**(Approved this test report)**

# 2 Client Information

## 2.1 Applicant Information

| | |
|---|---|
| Company Name: | TCL Communication Ltd |
| Address /Post: | 7/F, Block F4, TCL Communication Technology Building, TCL International E City, Zhong Shan Yuan Road, Nanshan District, Shenzhen, Guangdong, P.R. China 518052 |
| Contact: | Gong Zhizhou |
| Email: | zhizhou.gong@tcl.com |
| Telephone: | 0086-755-36611722 |
| Fax: | \ |

## 2.2 Manufacturer Information

| | |
|---|---|
| Company Name: | TCL Communication Ltd. |
| Address /Post: | 7/F, Block F4, TCL Communication Technology Building, TCL International E City, Zhong Shan Yuan Road, Nanshan District, Shenzhen, Guangdong, P.R. China 518052 |
| Contact: | Gong Zhizhou |
| Email: | zhizhou.gong@tcl.com |
| Telephone: | 0086-755-36611722 |
| Fax: | \ |

# 3 Equipment Under Test (EUT) and Ancillary Equipment (AE)

## 3.1 About EUT

| | |
|---|---|
| Description: | Smart Phone |
| Model name: | 5032W |
| Operating mode(s): | GSM850/900/1800/1900, WCDMA850/1700/1900/2100, BT, Wi-Fi<br>LTE Band 1/2/3/4/5/7/12/13/20/25/26/41/66/71 |

## 3.2 Internal Identification of EUT used during the test

| EUT ID* | IMEI | HW Version | SW Version |
|---|---|---|---|
| EUT1 | 015552000001530 | 06 | 3E5H |
| EUT2 | 015552000202955 | 06 | 3E5H |
| EUT3 | 015552000001746 | 06 | 3E5H |

*EUT ID: is used to identify the test sample in the lab internally.

**Note:** It is performed to test HAC with the EUT1&2 and conducted power with the EUT3.

## 3.3 Internal Identification of AE used during the test

| AE ID* | Description | Model | SN | Manufacturer |
|---|---|---|---|---|
| AE1 | Battery | CAC3860001C1 | / | BYD |

*AE ID: is used to identify the test sample in the lab internally.

## 3.4 Air Interfaces / Bands Indicating Operating Modes

| Air-interface | Band(MHz) | Type | C63.19/tested | Simultaneous Transmissions | OTT |
|---|---|---|---|---|---|
| GSM | 850 | VO | Yes | BT, WLAN | NA |
| | 1900 | | | | |
| GPRS/EDGE | 850 | DT | Yes | | Google duo |
| | 1900 | | | | |
| WCDMA (UMTS) | 850 | VO | Yes | BT, WLAN | NA |
| | 1700 | | | | |
| | 1900 | | | | |
| | HSPA | DT | Yes | | Google duo |
| LTE TDD | Band41 | V/D | Yes | BT, WLAN | Google duo |
| LTE FDD | Band7/12/13/25/26/66/71 | V/D | Yes | BT, WLAN | Google duo |
| BT | 2450 | DT | NA | GSM,WCDMA, LTE | NA |
| WLAN | 2450 | V/D | Yes | GSM,WCDMA, LTE | Google duo |
| WLAN | 5G | V/D | Yes | GSM,WCDMA, LTE | Google duo |

NA: Not Applicable VO: Voice Only V/D: CMRS and IP Voice Service over Digital Transport
DT: Digital Transport
* HAC Rating was not based on concurrent voice and data modes, Non current mode was found to represent worst case rating for both M and T rating
Note1 = No Associated T-Coil measurement has been made in accordance with 285076 D02 T-Coil testing for CMRS IP

# 4 CONDUCTED OUTPUT POWER MEASUREMENT

| GSM 850MHz | Conducted Power (dBm) | | |
|---|---|---|---|
| | Channel 251(848.8MHz) | Channel 190(836.6MHz) | Channel 128(824.2MHz) |
| Voice | 32.18 | 32.17 | 32.14 |
| EDGE | 28.99 | 28.96 | 28.92 |
| GSM 1900MHz | Conducted Power(dBm) | | |
| | Channel 810(1909.8MHz) | Channel 661(1880MHz) | Channel 512(1850.2MHz) |
| Voice | 30.19 | 30.20 | 30.21 |
| EDGE | 29.47 | 29.48 | 29.43 |
| WCDMA 850MHz | Conducted Power (dBm) | | |
| | Channel 4233(846.6MHz) | Channel 4182(836.4MHz) | Channel 4132(826.4MHz) |
| RMC | 23.53 | 23.51 | 23.48 |
| HSPA | 21.49 | 21.41 | 21.41 |
| WCDMA 1700MHz | Conducted Power (dBm) | | |
| | Channel 1513 (1752.6MHz) | Channel 1412 (1732.4MHz) | Channel 1312 (1712.4MHz) |
| RMC | 23.61 | 23.55 | 23.58 |
| HSPA | 21.27 | 21.24 | 21.24 |
| WCDMA 1900MHz | Conducted Power (dBm) | | |
| | Channel 9538(1907.6MHz) | Channel 9400(1880MHz) | Channel 9262(1852.4MHz) |
| RMC | 23.68 | 23.64 | 23.57 |
| HSPA | 21.62 | 21.60 | 21.57 |
| LTE Band7 | Conducted Power (dBm) | | |
| | Channel 21350(2560Hz) | Channel 21100(2535MHz) | Channel20850(2510MHz) |
| QPSK | 23.43 | 23.38 | 23.27 |
| 16QAM | 22.83 | 22.58 | 22.75 |
| 64QAM | 21.74 | 21.81 | 21.61 |
| LTE Band12 | Conducted Power (dBm) | | |
| | Channel 23130(711MHz) | Channel 23095(707.5MHz) | Channel23060(704MHz) |
| QPSK | 22.98 | 22.96 | 22.94 |
| 16QAM | 21.80 | 22.22 | 21.89 |
| 64QAM | 21.23 | 21.30 | 21.26 |
| LTE Band13 | Conducted Power (dBm) | | |
| | Channel 23230(782MHz) | | |
| QPSK | 22.98 | | |
| 16QAM | 21.83 | | |
| 64QAM | 21.24 | | |
| LTE Band25 | Conducted Power (dBm) | | |
| | Channel 26590(1905MHz) | Channel 26365(1883MHz) | Channel 26140(1860MHz) |
| QPSK | 23.53 | 23.49 | 23.41 |

| | | | |
|---|---|---|---|
| 16QAM | 22.91 | 22.82 | 22.59 |
| 64QAM | 21.79 | 21.81 | 21.78 |
| **LTE Band26** | **Conducted Power (dBm)** | | |
| | **Channel 26965(841.5MHz)** | **Channel 26865(831.5MHz)** | **Channel 26775(822.5MHz)** |
| QPSK | 22.99 | 22.98 | 22.91 |
| 16QAM | 22.32 | 22.26 | 21.86 |
| 64QAM | 21.33 | 21.25 | 21.31 |
| **LTE Band41 Power Class 2** | **Conducted Power (dBm)** | | |
| | **Channel 41490(2680MHz)** | **Channel 40620(2593MHz)** | **Channel 39750(2506MHz)** |
| QPSK | 26.23 | 26.63 | 26.45 |
| 16QAM | 25.48 | 25.99 | 25.59 |
| 64QAM | 24.15 | 24.58 | 24.28 |
| **LTE Band41 Power Class 3** | **Conducted Power (dBm)** | | |
| | **Channel 41490(2680MHz)** | **Channel 40620(2593MHz)** | **Channel 39750(2506MHz)** |
| QPSK | 23.19 | 23.57 | 23.49 |
| 16QAM | 22.18 | 22.68 | 22.25 |
| 64QAM | 21.17 | 21.57 | 21.31 |
| **LTE Band66** | **Conducted Power (dBm)** | | |
| | **Channel 132572(1770MHz)** | **Channel 132322(1745MHz)** | **Channel 133072(1720MHz)** |
| QPSK | 23.27 | 23.26 | 23.24 |
| 16QAM | 22.53 | 22.67 | 22.54 |
| 64QAM | 21.47 | 21.45 | 21.38 |
| **LTE Band71** | **Conducted Power (dBm)** | | |
| | **Channel 133372(688MHz)** | **Channel 133322(683MHz)** | **Channel 133222(673MHz)** |
| QPSK | 22.92 | 22.93 | 22.88 |
| 16QAM | 22.47 | 22.50 | 22.34 |
| 64QAM | 21.31 | 21.37 | 21.38 |
| **2.4GHz 802.11b 5.5M** | **Conducted Power (dBm)** | | |
| | **Channel 11 (2462MHz)** | **Channel 6 (2437MHz)** | **Channel 1 (2412MHz)** |
| | 20.25 | 20.98 | 20.45 |
| **5GHz 802.11a 6M** | **Conducted Power (dBm)** | | |
| | **Channel 165 (5825MHz)** | **Channel 157 (5785MHz)** | **Channel 149 (5745MHz)** |
| | 18.45 | 18.86 | 18.54 |

Note: For LTE Band 41, UL-DL Configuration 1 was used to evaluate Power Class 2 and UL-DL Configuration 1 was used to evaluate Power Class 3.

# 5 Reference Documents

## 5.1 Reference Documents for testing

The following document listed in this section is referred for testing.

| Reference | Title | Version |
|---|---|---|
| ANSI C63.19-2011 | American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids | 2011 Edition |
| FCC 47 CFR §20.19 | Hearing Aid Compatible Mobile Headsets | 2015 Edition |
| KDB 285076 D01 | Equipment Authorization Guidance for Hearing Aid Compatibility | v05 |

# 6 OPERATIONAL CONDITIONS DURING TEST

## 6.1 HAC MEASUREMENT SET-UP

These measurements are performed using the DASY5 NEO automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Stäubli), robot controller, Intel Core2 computer, near-field probe, probe alignment sensor. The robot is a six-axis industrial robot performing precise movements. A cell controller system contains the power supply, robot controller, teach pendant (Joystick),and remote control, is used to drive the robot motors. The PC consists of the HP Intel Core21.86 GHz computer with Windows XP system and HAC Measurement Software DASY5 NEO, A/D interface card, monitor, mouse, and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE)circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

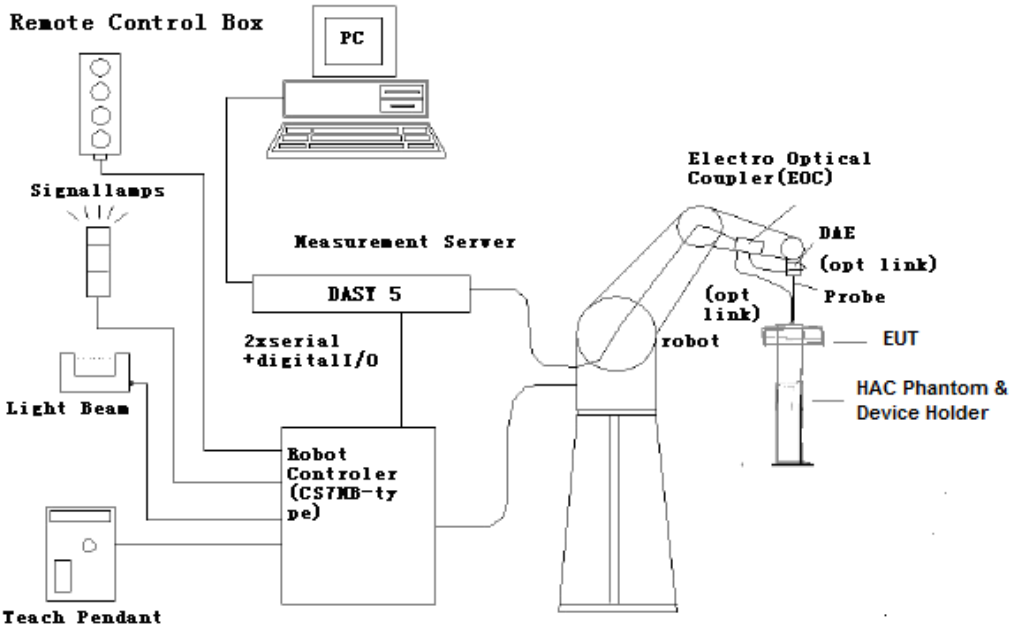


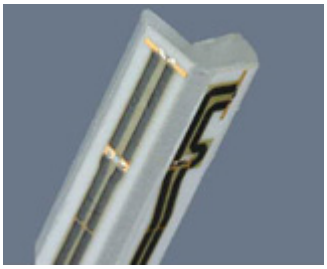

**Fig. 1 HAC Test Measurement Set-up**

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

## 6.2 Probe Specification

E-Field Probe Description

| | |
|---|---|
| Construction | One dipole parallel, two dipoles normal to probe axis<br>Built-in shielding against static charges<br>PEEK enclosure material |
| Calibration | In air from 100 MHz to 3.0 GHz (absolute accuracy ±6.0%, k=2) |
| Frequency | 40 MHz to > 6 GHz (can be extended to < 20 MHz)<br>Linearity: ± 0.2 dB (100 MHz to 3 GHz) |
| Directivity | ± 0.2 dB in air (rotation around probe axis)<br>± 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)<br>Tip diameter: 8 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 2.5 mm |
| Application | General near-field measurements up to 6 GHz<br>Field component measurements<br>Fast automatic scanning in phantoms |



**[ER3DV6]**

## 6.3Test Arch Phantom &Phone Positioner

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

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

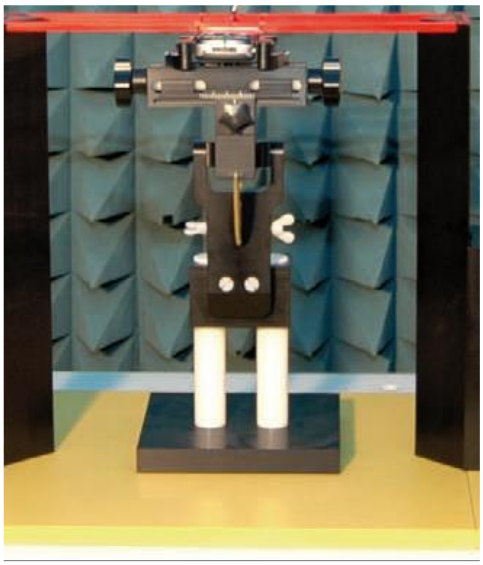


**Fig. 2 HAC Phantom & Device Holder**

## 6.4Robotic System Specifications

### Specifications

**Positioner:** Stäubli Unimation Corp. Robot Model: RX160L
**Repeatability:** ±0.02 mm
**No. of Axis:** 6

### Data Acquisition Electronic (DAE) System

**Cell Controller**
**Processor:** Intel Core2
**Clock Speed:** 1.86GHz
**Operating System:** Windows XP
**Data Converter**
**Features:**Signal Amplifier, multiplexer, A/D converter, and control logic
**Software:** DASY5 software
**Connecting Lines:** Optical downlink for data and status info.
Optical uplink for commands and clock

# 7 EUT ARRANGEMENT

## 7.1 WD RF Emission Measurements Reference and Plane

Figure 4 illustrates the references and reference plane that shall be used in the WD emissions measurement.

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

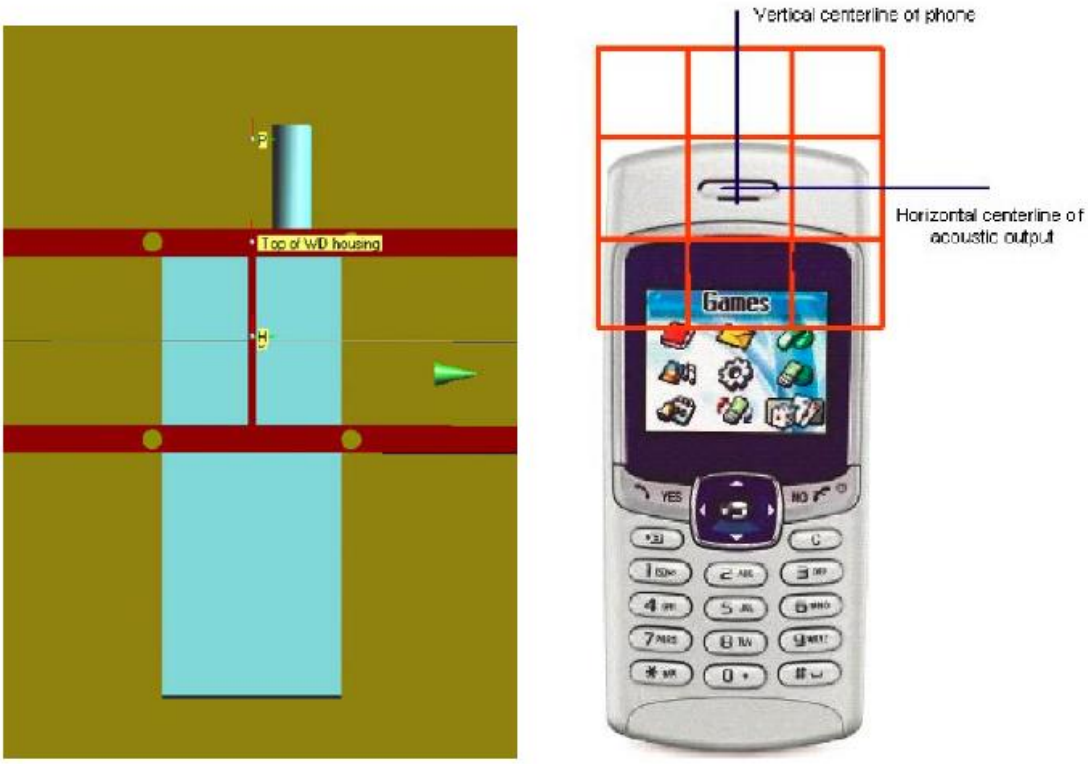



**Fig. 3 WD reference and plane for RF emission measurements**

# 8 SYSTEM VALIDATION

## 8.1 Validation Procedure

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

•The probes and their cables are parallel to the coaxial feed of the dipole antenna

•The probe cables and the coaxial feed of the dipole antenna approach the measurement area from opposite directions

• The center point of the probe element(s) are 15 mm from the closest surface of the dipole elements.

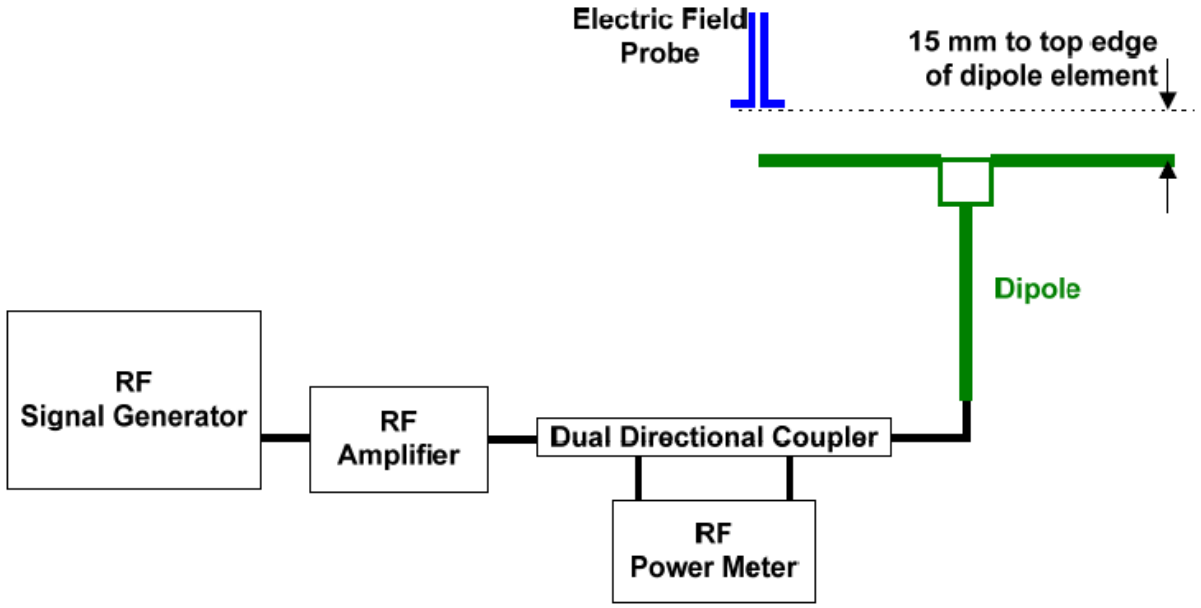



**Fig. 4 Dipole Validation Setup**

## 8.2 Validation Result

| E-Field Scan | | | | | | |
|---|---|---|---|---|---|---|
| **Mode** | **Frequency (MHz)** | **Input Power (mW)** | **Measured[1] Value(dBV/m)** | **Target[2] Value(dBV/m)** | **Deviation[3] (%)** | **Limit[4] (%)** |
| CW | 835 | 100 | 40.81 | 40.91 | -1.14 | ±25 |
| CW | 1880 | 100 | 39.22 | 39.01 | 2.45 | ±25 |
| CW | 2600 | 100 | 38.81 | 38.72 | 1.04 | ±25 |

Notes:

1. Please refer to the attachment for detailed measurement data and plot.

2. Target value is provided by SPEAD in the calibration certificate of specific dipoles.

3. Deviation (%) = 100 * (Measured value minus Target value) divided by Target value.

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

# 9 Evaluation of MIF

## 9.1 Introduction

The MIF (Modulation Interference Factor) is used to classify E-field emission to determine Hearing Aid Compatibility (HAC). It scales the power-averaged signal to the RF audio interference level and is characteristic to a modulation scheme. The HAC standard preferred "indirect" measurement method is based on average field measurement with separate scaling by the MIF. With an Audio Interference Analyzer (AIA) designed by SPEAG specifically for the MIF measurement, these values have been verified by practical measurements on an RF signal modulated with each of the waveforms. The resulting deviations from the simulated values are within the requirements of the HAC standard.

The AIA (Audio Interference Analyzer) is an USB powered electronic sensor to evaluate signals in the frequency range 698MHz - 6 GHz. It contains RMS detector and audio frequency circuits for sampling of the RF envelope.

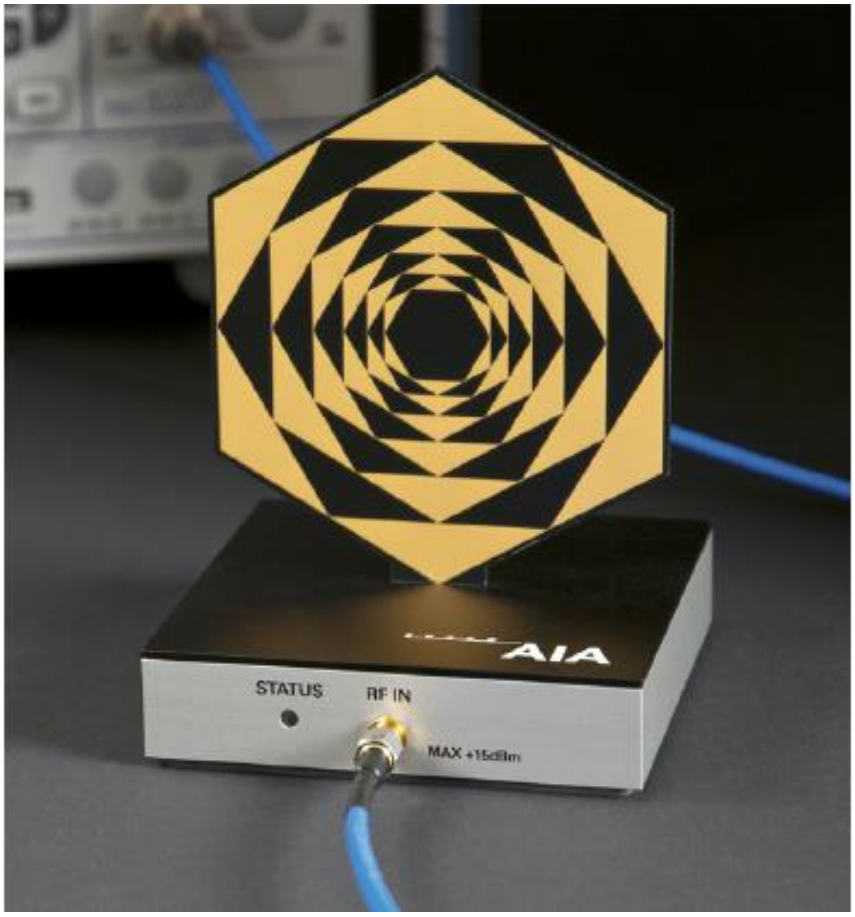



**Fig. 5 AIA Front View**

## 9.2 MIF measurement with the AIA

The MIF is measured with the AIA as follows:

1. Connect the AIA via USB to the DASY5 PC and verify the configuration settings.
2. Couple the RF signal to be evaluated to an AIA via cable or antenna.
3. Generate a MIF measurement job for the unknown signal and select the measurement port and timing settings.
4. Document the results via the post processor in a report.

## 9.3 Test equipment for the MIF measurement

| No. | Name | Type | Serial Number | Manufacturer |
|---|---|---|---|---|
| 01 | Signal Generator | E4438C | MY49071430 | Agilent |
| 02 | AIA | SE UMS 170 CB | 1029 | SPEAG |
| 03 | BTS | E5515C | MY50263375 | Agilent |

## 9.4 Test signal validation

The signal generator (E4438C) is used to generate a 1GHz signal with different modulation in the below table based on the ANSI C63.19-2011. The measured MIF with AIA are compared with the target values given in ANSI C63.19-2011 table D.3, D.4 and D5.

| **Pulse modulation** | **Target MIF** | **Measured MIF** | **Deviation** |
|---|---|---|---|
| 0.5ms pulse, 1000Hz repetition rate | -0.9 dB | -0.9 dB | 0 dB |
| 1ms pulse, 100Hz repetition rate | +3.9 dB | +3.7 dB | 0.2 dB |
| 0.1ms pulse, 100Hz repetition rate | +10.1 dB | +10.0 dB | 0.1 dB |
| 10ms pulse, 10Hz repetition rate | +1.6 dB | +1.7 dB | 0.1 dB |
| **Sine-wave modulation** | **Target MIF** | **Measured MIF** | **Deviation** |
| 1 kHz, 80% AM | -1.2 dB | -1.3 dB | 0.1 dB |
| 1 kHz, 10% AM | -9.1 dB | -9.0 dB | 0.1 dB |
| 1 kHz, 1% AM | -19.1 dB | -18.9 dB | 0.2 dB |
| 100 Hz, 10% AM | -16.1 dB | -16.0 dB | 0.1 dB |
| 10 kHz, 10% AM | -21.5 dB | -21.6 dB | 0.1 dB |
| **Transmission protocol** | **Target MIF** | **Measured MIF** | **Deviation** |
| GSM; full-rate version 2; speech codec/handset low | +3.5 dB | +3.47 dB | 0.03 dB |
| WCDMA; speech; speech codec low; AMR 12.2 kb/s | -20.0 dB | -19.8 dB | 0.2 dB |
| CDMA; speech; SO3; RC3; full frame rate; 8kEVRC | -19.0 dB | -19.1 dB | 0.1 dB |
| CDMA; speech; SO3; RC1; 1/8$^{th}$ frame rate; 8kEVRC | +3.3 dB | +3.44 dB | 0.14 dB |

## 9.5 DUT MIF results

| Typical MIF levels in ANSI C63.19-2011 | |
|---|---|
| Transmission protocol | Modulation interference factor |
| GSM; full-rate version 2; speech codec/handset low | +3.5 dB |
| EDGE-FDD (TDMA, 8PSK, TN 0-1) | +1.23dB |
| EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3) | -2.05dB |
| WCDMA; speech; speech codec low; AMR 12.2 kb/s | -20.0 dB |
| UMTS-FDD (HSPA) | -20.75dB |
| LTE-FDD (SC-FDMA, 1RB, 20MHz, QPSK) | -15.63 dB |
| LTE-FDD (SC-FDMA, 1RB, 20MHz, 16QAM) | -9.76 dB |
| LTE-FDD (SC-FDMA, 1RB, 20MHz, 64QAM) | -9.93 dB |
| LTE-TDD (SC-FDMA, 1RB, 20MHz, QPSK) | -1.62 dB |
| LTE-TDD (SC-FDMA, 1RB, 20MHz, 16QAM) | -1.44 dB |
| LTE-TDD (SC-FDMA, 1RB, 20MHz, 64QAM) | -1.54 dB |
| CDMA; speech; SO3; RC1; 1/8$^{th}$ frame rate; 8kEVRC | +3.3 dB |

| Measured MIF for GSM | | | | | | | |
|---|---|---|---|---|---|---|---|
| Band | | GSM 850 4TX | | | GSM 1900 2TX | | |
| Channel | | 251 | 190 | 128 | 810 | 661 | 512 |
| Mode | Voice | 3.41 | 3.48 | 3.40 | 3.49 | 3.49 | 3.47 |
| | EDGE | -2.12 | -1.98 | -2.03 | 1.03 | 1.00 | 1.04 |

| Measured MIF for WCDMA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Band | | WCDMA 850 | | | WCDMA 1700 | | | WCDMA 1900 | | |
| Channel | | 4458 | 4407 | 4357 | 1738 | 1637 | 1537 | 9938 | 9800 | 9662 |
| Mode | RMC | -21.98 | -21.95 | -23.41 | -22.29 | -23.14 | -22.34 | -22.30 | -23.44 | -23.36 |
| | HSUPA | -19.41 | -19.65 | -19.34 | -19.71 | -19.25 | -19.42 | -19.18 | -19.83 | -19.91 |

| Measured MIF levels | | |
|---|---|---|
| Band | Channel | Modulation interference factor (dB) |
| LTE Band7 QPSK | 21350 | -14.30 |
| | 21100 | -14.50 |
| | 20850 | -14.11 |
| LTE Band12 QPSK | 23130 | -14.18 |
| | 23095 | -14.43 |
| | 23060 | -14.78 |
| LTE Band13 QPSK | 23230 | -14.03 |
| LTE Band25 QPSK | 26590 | -14.25 |
| | 26365 | -14.47 |
| | 26140 | -14.01 |
| LTE Band26 QPSK | 26965 | -15.05 |
| | 26865 | -14.73 |
| | 26775 | -14.94 |
| LTE Band66 QPSK | 132572 | -14.59 |
| | 132322 | -14.17 |
| | 132072 | -14.66 |
| LTE Band71 QPSK | 133372 | -14.25 |
| | 133322 | -14.68 |
| | 133222 | -14.58 |
| LTE Band41 Power Class 2 QPSK | 41490 | -1.85 |
| | 41055 | -1.93 |
| | 40620 | -1.87 |
| | 40185 | -1.82 |
| | 39750 | -1.89 |
| LTE Band41 Power Class 3 QPSK | 41490 | -1.88 |
| | 41055 | -1.93 |
| | 40620 | -1.91 |
| | 40185 | -1.86 |
| | 39750 | -1.89 |
| LTE Band7 16QAM | 21350 | -10.75 |
| | 21100 | -10.72 |
| | 20850 | -10.30 |
| LTE Band12 16QAM | 23130 | -11.17 |
| | 23095 | -10.08 |
| | 23060 | -9.68 |
| LTE Band13 16QAM | 23230 | -10.63 |
| LTE Band25 16QAM | 26590 | -10.04 |
| | 26365 | -10.62 |

| | | |
|---|---|---|
| | 26140 | -10.78 |
| LTE Band26 16QAM | 26965 | -10.76 |
| | 26865 | -10.43 |
| | 26775 | -9.86 |
| LTE Band66 16QAM | 132572 | -10.10 |
| | 132322 | -10.71 |
| | 132072 | -10.61 |
| LTE Band71 16QAM | 133372 | -10.71 |
| | 133322 | -10.54 |
| | 133222 | -9.95 |
| LTE Band41 Power Class 2 16QAM | 41490 | -1.81 |
| | 41055 | -1.94 |
| | 40620 | -1.84 |
| | 40185 | -1.95 |
| | 39750 | -1.83 |
| LTE Band41 Power Class 3 16QAM | 41490 | -1.87 |
| | 41055 | -1.94 |
| | 40620 | -1.88 |
| | 40185 | -1.84 |
| | 39750 | -1.90 |
| LTE Band7 64QAM | 21350 | -10.74 |
| | 21100 | -10.74 |
| | 20850 | -10.30 |
| LTE Band12 64QAM | 23130 | -11.14 |
| | 23095 | -10.08 |
| | 23060 | -9.68 |
| LTE Band13 64QAM | 23230 | -10.94 |
| LTE Band25 64QAM | 26590 | -10.05 |
| | 26365 | -10.61 |
| | 26140 | -10.75 |
| LTE Band26 64QAM | 26965 | -10.77 |
| | 26865 | -10.40 |
| | 26775 | -9.84 |
| LTE Band66 64QAM | 132572 | -10.11 |
| | 132322 | -10.71 |
| | 132072 | -10.60 |
| LTE Band71 64QAM | 133372 | -10.72 |
| | 133322 | -10.53 |
| | 133222 | -9.97 |
| LTE Band41 Power Class 2 64QAM | 41490 | -1.81 |
| | 41055 | -1.87 |
| | 40620 | -1.85 |

| | | |
|---|---|---|
| | 40185 | -1.95 |
| | 39750 | -1.91 |
| LTE Band41<br>Power Class 3<br>64QAM | 41490 | -1.88 |
| | 41055 | -1.93 |
| | 40620 | -1.91 |
| | 40185 | -1.86 |
| | 39750 | -1.89 |
| 2.4GHz<br>802.11b<br>5.5M | 11 | -7.75 |
| | 6 | -8.06 |
| | 1 | -7.24 |
| 5GHz<br>802.11a<br>6M | 157 | -8.36 |

Note: For LTE Band 41, UL-DL Configuration 1 was used to evaluate Power Class 2 and UL-DL Configuration 1 was used to evaluate Power Class 3.

# 10 Evaluation for low-power exemption

## 10.1 Product testing threshold

There are two methods for exempting an RF air interface technology from testing. The first method requires evaluation of the MIF for the worst-case operating mode. An RF air interface technology of a device is exempt from testing when its average antenna input power plus its MIF is≤17 dBm for any of its operating modes. The second method does not require determination of the MIF. The RF emissions testing exemption shall be applied to an RF air interface technology in a device whose peak antenna input power, averaged over intervals ≤50 μs20, is ≤23 dBm. An RF air interface technology that is exempted from testing by either method shall be rated as M4.
The first method is used to be exempt from testing for the RF air interface technology in this report.

## 10.2 Conducted power

| Band | Average power (dBm) | MIF (dB) | Sum (dBm) | C63.19 Tested |
|---|---|---|---|---|
| GSM 850 - Voice | 32.18 | 3.48 | 35.66 | Yes |
| GSM 850 - EDGE | 28.99 | -1.98 | 27.01 | Yes* |
| GSM 1900 - Voice | 30.21 | 3.49 | 33.7 | Yes |
| GSM 1900 - EDGE | 29.48 | 1.04 | 30.52 | Yes* |
| WCDMA 850 - RMC | 23.53 | -21.95 | 1.58 | No |
| WCDMA 850 - HSPA | 21.49 | -19.34 | 2.15 | No |
| WCDMA 1700 - RMC | 23.61 | -22.29 | 1.32 | No |
| WCDMA 1700 - HSPA | 21.27 | -19.25 | 2.02 | No |
| WCDMA 1900 - RMC | 23.68 | -22.30 | 1.38 | No |
| WCDMA 1900 - HSPA | 21.62 | -19.18 | 2.44 | No |
| LTE Band 7 QPSK | 23.43 | -14.11 | 9.32 | No |
| LTE Band 12 QPSK | 22.98 | -14.18 | 8.8 | No |
| LTE Band 13 QPSK | 22.98 | -14.03 | 8.95 | No |
| LTE Band 25 QPSK | 22.53 | -14.01 | 8.52 | No |
| LTE Band 26 QPSK | 22.99 | -14.73 | 8.26 | No |
| LTE Band 66 QPSK | 23.27 | -14.17 | 9.1 | No |
| LTE Band 71 QPSK | 22.93 | -14.25 | 8.68 | No |
| LTE Band 41 Power Class 2 QPSK | 26.63 | -1.82 | 24.81 | Yes |
| LTE Band 41 Power Class 3 QPSK | 23.57 | -1.86 | 21.71 | Yes |
| LTE Band 7 16QAM | 22.83 | -10.30 | 12.53 | No |
| LTE Band 12 16QAM | 22.22 | -9.68 | 12.54 | No |
| LTE Band 13 16QAM | 21.83 | -10.63 | 11.2 | No |
| LTE Band 25 16QAM | 22.91 | -10.04 | 12.87 | No |
| LTE Band 26 16QAM | 22.32 | -9.86 | 12.46 | No |
| LTE Band 66 16QAM | 22.67 | -10.10 | 12.57 | No |

| | | | | |
|---|---|---|---|---|
| LTE Band 71 16QAM | 22.50 | -9.95 | 12.55 | No |
| LTE Band 41 Power Class 2 16QAM | 25.99 | -1.81 | 24.18 | Yes |
| LTE Band 41 Power Class 3 16QAM | 22.68 | -1.84 | 20.84 | Yes |
| LTE Band 7 64QAM | 21.81 | -10.30 | 11.51 | No |
| LTE Band 12 64QAM | 21.30 | -9.68 | 11.62 | No |
| LTE Band 13 64QAM | 21.24 | -10.94 | 10.3 | No |
| LTE Band 25 64QAM | 21.81 | -10.05 | 11.76 | No |
| LTE Band 26 64QAM | 21.33 | -9.84 | 11.49 | No |
| LTE Band 66 64QAM | 21.47 | -10.11 | 11.36 | No |
| LTE Band 71 64QAM | 21.38 | -9.97 | 11.41 | No |
| LTE Band 41 Power Class 2 64QAM | 24.58 | -1.81 | 22.77 | Yes |
| LTE Band 41 Power Class 3 64QAM | 21.57 | -1.86 | 19.71 | Yes |
| WiFi-2.4G | 20.98 | -7.24 | 13.74 | No |
| WiFi-5G | 18.86 | -8.36 | 10.5 | No |

*Note: For GSM bands, EDGE modes were not evaluated as Voice modes were found to the worst-case modes for the GSM air interface.

## 10.3 Conclusion

According to the above table, the sums of average power and MIF for WCDMA, LTE FDD and WiFi are less than 17dBm. So it is measured for GSM and LTE TDD bands. The WCDMA, LTE FDD and WiFi are exempt from testing and rated as M4.

# 11 RF TEST PROCEDUERES

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

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 gauge block can simplify this positioning.

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.

4) The center sub-grid shall centered on the center of the T-Coil mode axial measurement point or the acoustic output, as appropriate. Locate the field probe at the initial test position in the50 mm by 50 mm grid, which is contained in the measurement plane. If the field alignment method is used, align the probe for maximum field reception.

5) Record the reading.

6) Scan the entire 50 mm by 50 mm region in equally spaced increments and record the reading at each measurement point. The distance between measurement points shall be sufficient to assure the identification of the maximum reading.

7) Identify the five contiguous sub-grids around the center sub-grid whose maximum reading is the lowest of all available choices. This eliminates the three sub-grids with the maximum readings. Thus, the six areas to be used to determine the WD’s highest emissions are identified.

8) Identify the maximum field reading within the non-excluded sub-grids identified in Step 7)

9) Evaluate the MIF and add to the maximum steady-state rms field-strength reading to obtain the RF audio interference level..

10) Compare this RF audio interference level with the categories and record the resulting WD category rating.

## 12 Measurement Results (E-Field)

| Frequency | | Measured Value(dBV/m) | Power Drift (dB) | Category |
|---|---|---|---|---|
| MHz | Channel | | | |
| **GSM 850** | | | | |
| 848.8 | 251 | 31.56 | -0.12 | **M4** (see Fig B.1) |
| 836.6 | 190 | 32.52 | -0.05 | **M4** (see Fig B.2) |
| 824.2 | 128 | 34.11 | -0.07 | **M4** (see Fig B.3) |
| **GSM 1900** | | | | |
| 1909.8 | 810 | 29.83 | 0.03 | **M4** (see Fig B.4) |
| 1880 | 661 | 30.37 | -0.1 | **M3** (see Fig B.5) |
| 1850.2 | 512 | 31.37 | 0.02 | **M3** (see Fig B.6) |
| **LTE Band 41 QPSK Power Class 2** | | | | |
| 2680 | 41490 | 17.12 | -0.16 | **M4** (see Fig B.7) |
| 2636.5 | 41055 | 19.66 | -0.04 | **M4** (see Fig B.8) |
| 2593 | 40620 | 20.54 | -0.08 | **M4** (see Fig B.9) |
| 2549.5 | 40185 | 20.74 | -0.17 | **M4** (see Fig B.10) |
| 2506 | 39750 | 21.42 | -0.07 | **M4** (see Fig B.11) |
| **LTE Band 41 16QAM Power Class 2** | | | | |
| 2680 | 41490 | 15.78 | -0.04 | **M4** (see Fig B.12) |
| 2636.5 | 41055 | 18.56 | -0.09 | **M4** (see Fig B.13) |
| 2593 | 40620 | 19.50 | 0.19 | **M4** (see Fig B.14) |
| 2549.5 | 40185 | 19.73 | -0.04 | **M4** (see Fig B.15) |
| 2506 | 39750 | 20.23 | -0.03 | **M4** (see Fig B.16) |
| **LTE Band 41 64QAM Power Class 2** | | | | |
| 2680 | 41490 | 16.30 | -0.03 | **M4** (see Fig B.17) |
| 2636.5 | 41055 | 18.94 | -0.06 | **M4** (see Fig B.18) |
| 2593 | 40620 | 19.20 | 0.09 | **M4** (see Fig B.19) |
| 2549.5 | 40185 | 19.78 | 0.02 | **M4** (see Fig B.20) |
| 2506 | 39750 | 20.08 | -0.06 | **M4** (see Fig B.21) |
| **LTE Band 41 QPSK Power Class 3** | | | | |
| 2680 | 41490 | 15.75 | -0.1 | **M4** (see Fig B.22) |
| 2636.5 | 41055 | 18.50 | -0.19 | **M4** (see Fig B.23) |
| 2593 | 40620 | 19.28 | -0.04 | **M4** (see Fig B.24) |
| 2549.5 | 40185 | 19.40 | -0.19 | **M4** (see Fig B.25) |
| 2506 | 39750 | 20.53 | -0.02 | **M4** (see Fig B.26) |
| **LTE Band 41 16QAM Power Class 3** | | | | |
| 2680 | 41490 | 14.92 | -0.02 | **M4** (see Fig B.27) |
| 2636.5 | 41055 | 17.65 | -0.04 | **M4** (see Fig B.28) |
| 2593 | 40620 | 18.35 | 0.03 | **M4** (see Fig B.29) |
| 2549.5 | 40185 | 18.43 | -0.03 | **M4** (see Fig B.30) |
| 2506 | 39750 | 19.75 | -0.01 | **M4** (see Fig B.31) |

| LTE Band 41 64QAM Power Class 3 | | | | |
|---|---|---|---|---|
| 2680 | 41490 | 14.84 | -0.01 | **M4** (see Fig B.32) |
| 2636.5 | 41055 | 17.53 | 0.05 | **M4** (see Fig B.33) |
| 2593 | 40620 | 18.39 | 0.03 | **M4** (see Fig B.34) |
| 2549.5 | 40185 | 18.37 | 0.02 | **M4** (see Fig B.35) |
| 2506 | 39750 | 19.36 | -0.07 | **M4** (see Fig B.36) |

Note: For LTE Band 41, UL-DL Configuration 1 was used to evaluate Power Class 2 and UL-DL Configuration 1 was used to evaluate Power Class 3.

# 13 ANSIC 63.19-2011 LIMITS

**WD RF audio interference level categories in logarithmic units**

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

# 14 MEASUREMENT UNCERTAINTY

| No. | Error source | Type | Uncertainty Value(%) | Prob. Dist. | k | $c_i$E | Standard Uncertainty (%) $u_i'$ (%)E | Degree of freedom $V_{eff}$or $v_i$ |
|---|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | | |
| 1 | Probe Calibration | B | 5. | N | 1 | 1 | 5.1 | ∞ |
| 2 | Axial Isotropy | B | 4.7 | R | $\sqrt{3}$ | 1 | 2.7 | ∞ |
| 3 | Sensor Displacement | B | 16.5 | R | $\sqrt{3}$ | 1 | 9.5 | ∞ |
| 4 | Boundary Effects | B | 2.4 | R | $\sqrt{3}$ | 1 | 1.4 | ∞ |
| 5 | Linearity | B | 4.7 | R | $\sqrt{3}$ | 1 | 2.7 | ∞ |
| 6 | Scaling to Peak Envelope Power | B | 2.0 | R | $\sqrt{3}$ | 1 | 1.2 | ∞ |
| 7 | System Detection Limit | B | 1.0 | R | $\sqrt{3}$ | 1 | 0.6 | ∞ |
| 8 | Readout Electronics | B | 0.3 | N | 1 | 1 | 0.3 | ∞ |
| 9 | Response Time | B | 0.8 | R | $\sqrt{3}$ | 1 | 0.5 | ∞ |
| 10 | Integration Time | B | 2.6 | R | $\sqrt{3}$ | 1 | 1.5 | ∞ |
| 11 | RF Ambient Conditions | B | 3.0 | R | $\sqrt{3}$ | 1 | 1.7 | ∞ |
| 12 | RF Reflections | B | 12.0 | R | $\sqrt{3}$ | 1 | 6.9 | ∞ |
| 13 | Probe Positioner | B | 1.2 | R | $\sqrt{3}$ | 1 | 0.7 | ∞ |
| 14 | Probe Positioning | A | 4.7 | R | $\sqrt{3}$ | 1 | 2.7 | ∞ |
| 15 | Extra. And Interpolation | B | 1.0 | R | $\sqrt{3}$ | 1 | 0.6 | ∞ |
| **Test Sample Related** | | | | | | | | |
| 16 | Device Positioning Vertical | B | 4.7 | R | $\sqrt{3}$ | 1 | 2.7 | ∞ |
| 17 | Device Positioning Lateral | B | 1.0 | R | $\sqrt{3}$ | 1 | 0.6 | ∞ |
| 18 | Device Holder and Phantom | B | 2.4 | R | $\sqrt{3}$ | 1 | 1.4 | ∞ |
| 19 | Power Drift | B | 5.0 | R | $\sqrt{3}$ | 1 | 2.9 | ∞ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 20 | AIA measurement | B | 12 | R | $\sqrt{3}$ | 1 | 6.9 | ∞ |
| **Phantom and Setup related** | | | | | | | | |
| 21 | Phantom Thickness | B | 2.4 | R | $\sqrt{3}$ | 1 | 1.4 | ∞ |
| Combined standard uncertainty(%) | | | | | | | 16.2 | |
| Expanded uncertainty (confidence interval of 95 %) | | $u_e = 2u_c$ | | N | k=2 | | 32.4 | |

# 15 MAIN TEST INSTRUMENTS

**Table 1: List of Main Instruments**

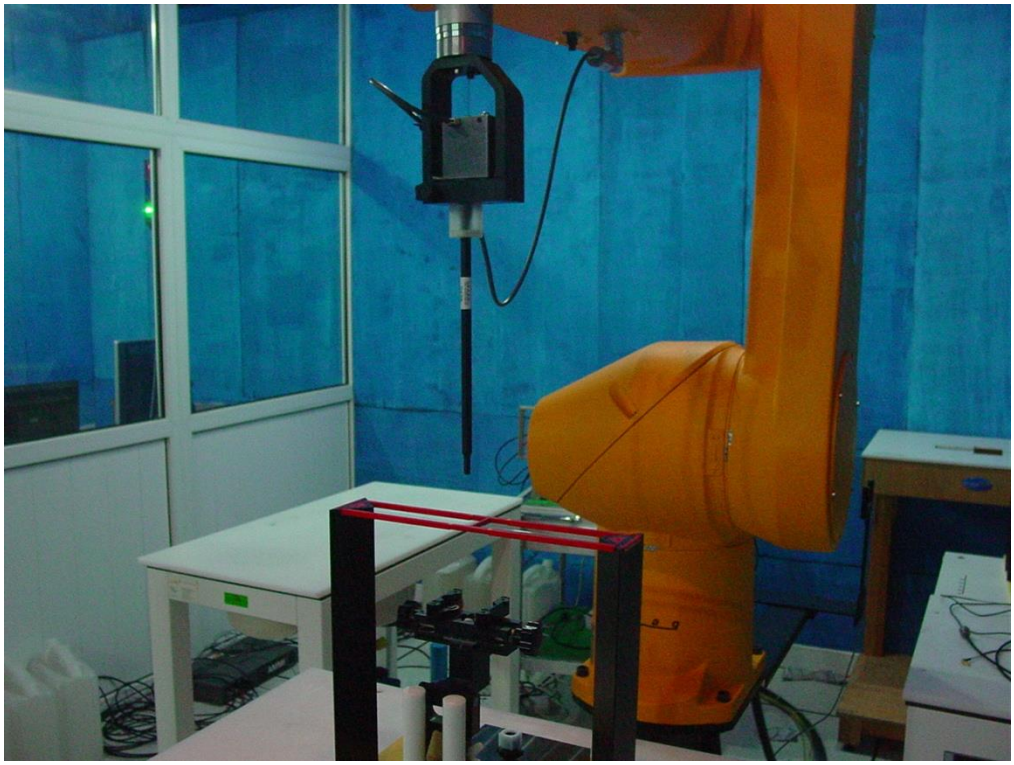
| No. | Name | Type | Serial Number | Calibration Date | Valid Period |
|---|---|---|---|---|---|
| 01 | Signal Generator | E4438C | MY49071430 | January 23, 2019 | One Year |
| 02 | Power meter | NRVD | 102083 | October 24, 2018 | One year |
| 03 | Power sensor | NRV-Z5 | 100542 | | |
| 04 | Amplifier | 60S1G4 | 0331848 | No Calibration Requested | |
| 05 | E-Field Probe | EF3DV3 | 4060 | May 17, 2019 | One year |
| 06 | DAE | SPEAG DAE4 | 771 | January 11, 2019 | One year |
| 07 | HAC Dipole | CD835V3 | 1023 | August 28, 2018 | One year |
| 08 | HAC Dipole | CD1880V3 | 1018 | August 28, 2018 | One year |
| 09 | HAC Dipole | CD2600V3 | 1017 | August 22, 2018 | One year |
| 10 | BTS | E5515C | MY50263375 | January 17, 2019 | One year |
| 11 | AIA | SE UMS 170 CB | 1029 | No Calibration Requested | |

# 16 CONCLUSION

The HAC measurement indicates that the EUT complies with the HAC limits of the ANSIC63.19-2011. The total M-rating is **M3.**

***END OF REPORT BODY***

# ANNEX A TEST LAYOUT



**Picture A1:HAC RF System Layout**

# ANNEX B TEST PLOTS

## HAC RF E-Field GSM 850 High

**Date: 2019-8-12**

Electronics: DAE4 Sn771

Medium: Air

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$

Ambient Temperature: 22.0°C

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**GSM850/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 33.43 V/m; Power Drift = -0.12 dB

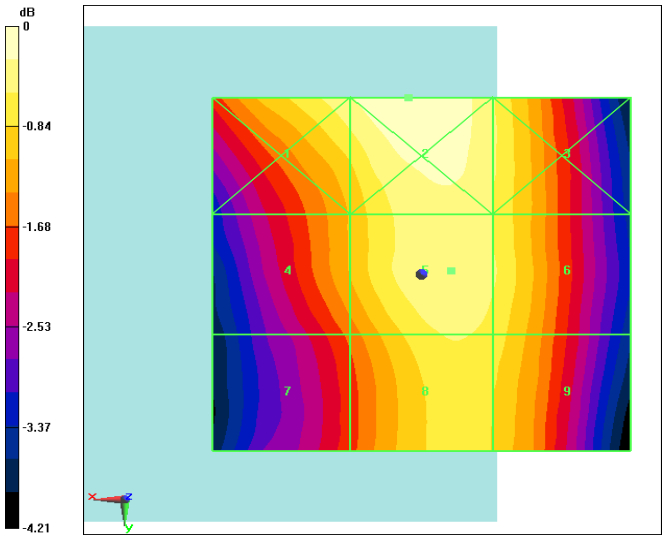
Applied MIF = 3.28 dB

RF audio interference level = 31.56 dBV/m

**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **31.55 dBV/m** | Grid 2 **M4** **31.86 dBV/m** | Grid 3 **M4** **31.36 dBV/m** |
| Grid 4 **M4** **30.78 dBV/m** | Grid 5 **M4** **31.56 dBV/m** | Grid 6 **M4** **31.34 dBV/m** |
| Grid 7 **M4** **30.29 dBV/m** | Grid 8 **M4** **31.33 dBV/m** | Grid 9 **M4** **31.17 dBV/m** |




0 dB = 39.16 V/m = 31.86 dBV/m

**Fig B.1 HAC RF E-Field GSM 850 High**

## HAC RF E-Field GSM 850 Middle

**Date: 2019-8-12**

Electronics: DAE4 Sn771

Medium: Air

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$

Ambient Temperature: 22.0°C

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**GSM850/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 2/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 34.62 V/m; Power Drift = -0.05 dB

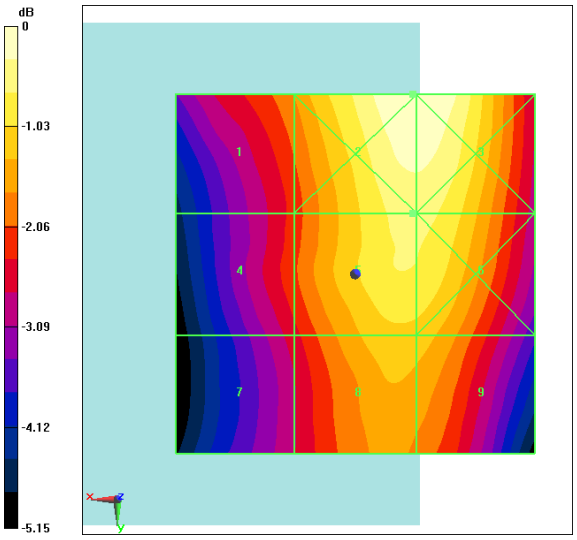
Applied MIF = 3.31 dB

RF audio interference level = 32.52 dBV/m

**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **31.37 dBV/m** | Grid 2 **M4** **33.07 dBV/m** | Grid 3 **M4** **33.07 dBV/m** |
| Grid 4 **M4** **30.95 dBV/m** | Grid 5 **M4** **32.52 dBV/m** | Grid 6 **M4** **32.52 dBV/m** |
| Grid 7 **M4** **30.55 dBV/m** | Grid 8 **M4** **31.95 dBV/m** | Grid 9 **M4** **31.9 dBV/m** |




0 dB = 45.03 V/m = 33.07 dBV/m

**Fig B.2 HAC RF E-Field GSM 850 Middle**

## HAC RF E-Field GSM 850 Low

**Date: 2019-8-12**

Electronics: DAE4 Sn771

Medium: Air

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$

Ambient Temperature: 22.0°C

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3

Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**GSM850/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 3/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 40.67 V/m; Power Drift = -0.07 dB

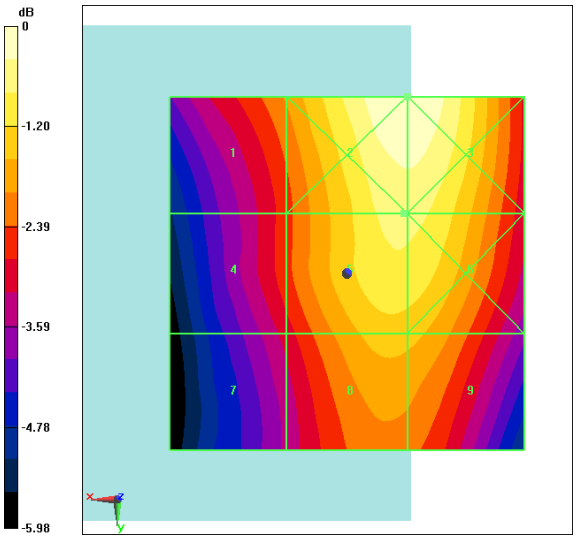
Applied MIF = 3.40 dB

RF audio interference level = 34.11 dBV/m

**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **32.84 dBV/m** | Grid 2 **M4** **34.75 dBV/m** | Grid 3 **M4** **34.75 dBV/m** |
| Grid 4 **M4** **32.26 dBV/m** | Grid 5 **M4** **34.11 dBV/m** | Grid 6 **M4** **34.1 dBV/m** |
| Grid 7 **M4** **31.77 dBV/m** | Grid 8 **M4** **33.37 dBV/m** | Grid 9 **M4** **33.32 dBV/m** |




0 dB = 54.66 V/m = 34.75 dBV/m

**Fig B.3 HAC RF E-Field GSM 850 Low**

## HAC RF E-Field GSM 1900 High

**Date: 2019-8-12**

Electronics: DAE4 Sn771

Medium: Air

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$

Ambient Temperature: 22.0°C

Communication System: PCS 1900; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3

Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**GSM1900/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 18.09 V/m; Power Drift = 0.03 dB

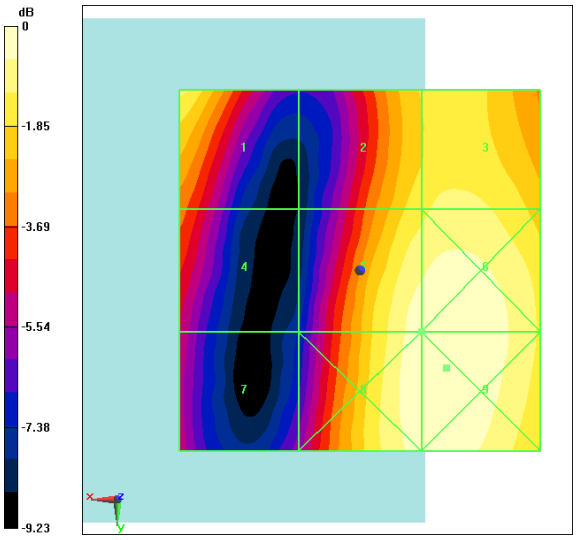
Applied MIF = 3.46 dB

RF audio interference level = 29.83 dBV/m

**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **29.1 dBV/m** | Grid 2 **M4** **28.71 dBV/m** | Grid 3 **M4** **29.07 dBV/m** |
| Grid 4 **M4** **26.72 dBV/m** | Grid 5 **M4** **29.83 dBV/m** | Grid 6 **M3** **30.07 dBV/m** |
| Grid 7 **M4** **25.28 dBV/m** | Grid 8 **M4** **29.9 dBV/m** | Grid 9 **M3** **30.11 dBV/m** |




0 dB = 32.02 V/m = 30.11 dBV/m

**Fig B.4 HAC RF E-Field GSM 1900 High**

## HAC RF E-Field GSM 1900 Middle

**Date: 2019-8-12**

Electronics: DAE4 Sn771

Medium: Air

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$

Ambient Temperature: 22.0°C

Communication System: PCS 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**GSM1900/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 2/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 20.83 V/m; Power Drift = -0.10 dB

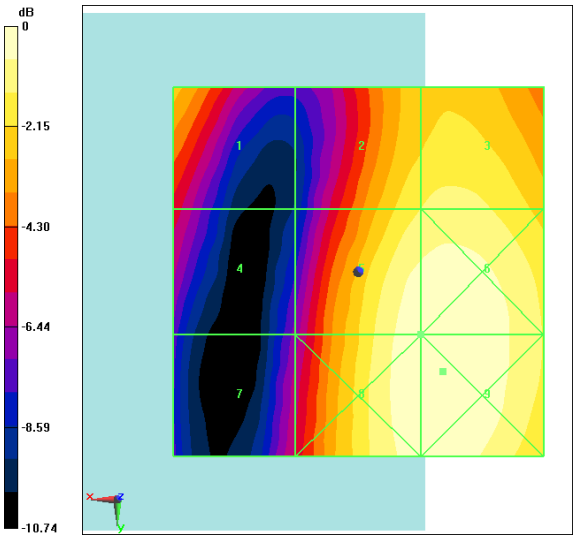
Applied MIF = 3.47 dB

RF audio interference level = 30.37 dBV/m

**Emission category: M3**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **28.07 dBV/m** | Grid 2 **M4** **29.16 dBV/m** | Grid 3 **M4** **29.44 dBV/m** |
| Grid 4 **M4** **25.35 dBV/m** | Grid 5 **M3** **30.37 dBV/m** | Grid 6 **M3** **30.53 dBV/m** |
| Grid 7 **M4** **25.04 dBV/m** | Grid 8 **M3** **30.43 dBV/m** | Grid 9 **M3** **30.57 dBV/m** |




0 dB = 33.76 V/m = 30.57 dBV/m

**Fig B.5 HAC RF E-Field GSM 1900 Middle**

## HAC RF E-Field GSM 1900 Low

**Date: 2019-8-12**

Electronics: DAE4 Sn771

Medium: Air

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$

Ambient Temperature: 22.0°C

Communication System: PCS 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3

Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**GSM1900/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 3/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 24.18 V/m; Power Drift = 0.02 dB

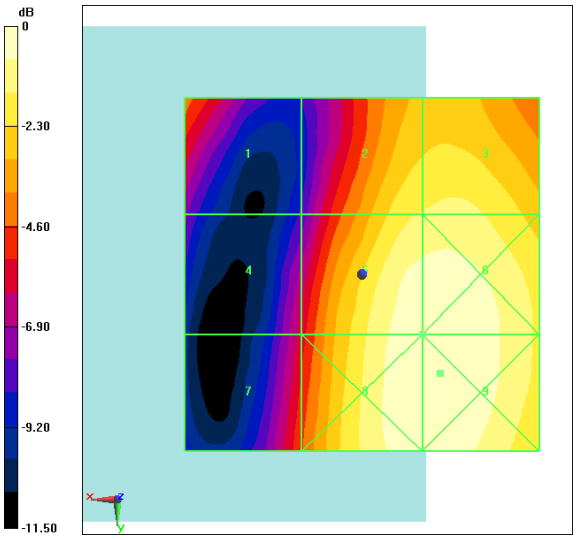
Applied MIF = 3.45 dB

RF audio interference level = 31.37 dBV/m

**Emission category: M3**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **27.39 dBV/m** | Grid 2 **M3** **30.04 dBV/m** | Grid 3 **M3** **30.23 dBV/m** |
| Grid 4 **M4** **25.8 dBV/m** | Grid 5 **M3** **31.37 dBV/m** | Grid 6 **M3** **31.46 dBV/m** |
| Grid 7 **M4** **26.87 dBV/m** | Grid 8 **M3** **31.44 dBV/m** | Grid 9 **M3** **31.51 dBV/m** |




0 dB = 37.63 V/m = 31.51 dBV/m

**Fig B.6 HAC RF E-Field GSM 1900 Low**

## HAC RF E-Field LTE Band41 Power Class 2 QPSK CH41490

**Date: 2019-8-13**

Electronics: DAE4 Sn771

Medium: Air

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$

Ambient Temperature: 22.0°C

Communication System: LTE Band41; Frequency: 2680 MHz; Duty Cycle: 1:1.58

Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 8.315 V/m; Power Drift = -0.16 dB

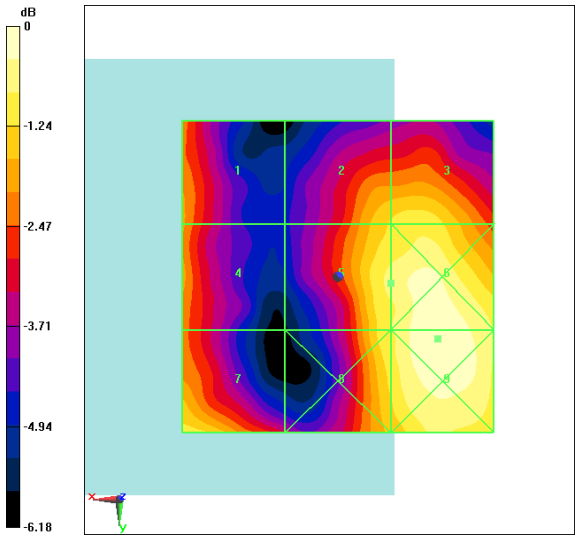
Applied MIF = -1.85 dB

RF audio interference level = 17.12 dBV/m

**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **15.93 dBV/m** | Grid 2 **M4** **16.63 dBV/m** | Grid 3 **M4** **16.87 dBV/m** |
| Grid 4 **M4** **15.98 dBV/m** | Grid 5 **M4** **17.12 dBV/m** | Grid 6 **M4** **17.77 dBV/m** |
| Grid 7 **M4** **16.81 dBV/m** | Grid 8 **M4** **16.95 dBV/m** | Grid 9 **M4** **17.82 dBV/m** |




0 dB = 7.777 V/m = 17.82 dBV/m

**Fig B.7 HAC RF E-Field LTE Band41 Power Class 2 QPSK CH41490**

## HAC RF E-Field LTE Band41 Power Class 2 QPSK CH41055

**Date: 2019-8-13**

Electronics: DAE4 Sn771

Medium: Air

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$

Ambient Temperature: 22.0°C

Communication System: LTE Band41; Frequency: 2636.5 MHz; Duty Cycle: 1:1.58

Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 2/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 9.888 V/m; Power Drift = -0.04 dB

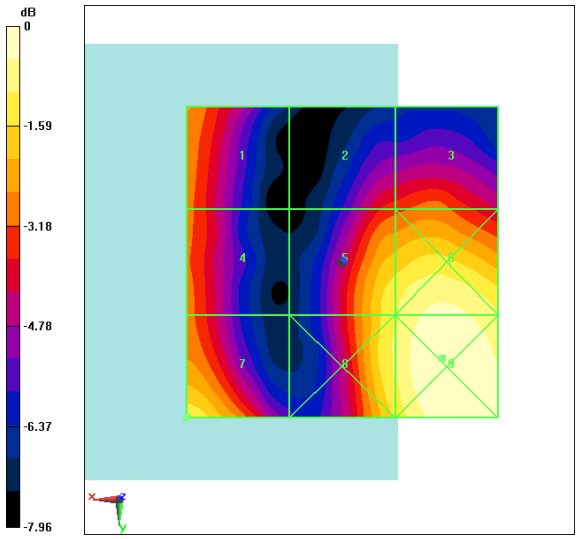
Applied MIF = -1.93 dB

RF audio interference level = 19.66 dBV/m

**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **18.19 dBV/m** | Grid 2 **M4** **17.36 dBV/m** | Grid 3 **M4** **17.85 dBV/m** |
| Grid 4 **M4** **17.85 dBV/m** | Grid 5 **M4** **19.63 dBV/m** | Grid 6 **M4** **20.39 dBV/m** |
| Grid 7 **M4** **19.66 dBV/m** | Grid 8 **M4** **19.78 dBV/m** | Grid 9 **M4** **20.75 dBV/m** |




0 dB = 10.90 V/m = 20.75 dBV/m

**Fig B.8 HAC RF E-Field LTE Band41 Power Class 2 QPSK CH41055**

## HAC RF E-Field LTE Band41 Power Class 2 QPSK CH40620

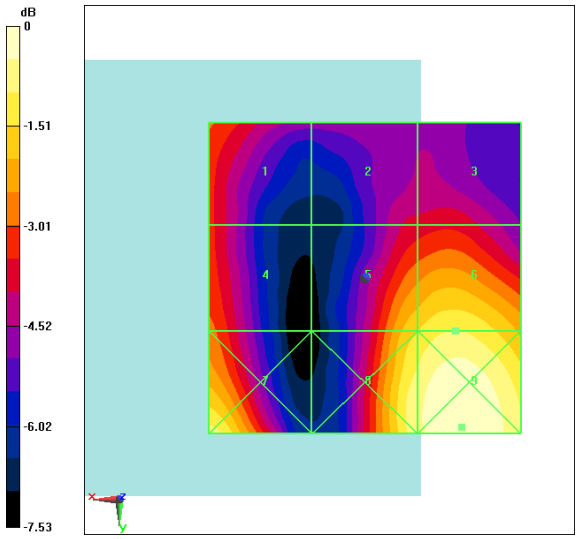
**Date: 2019-8-13**

Electronics: DAE4 Sn771
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature: 22.0°C
Communication System: LTE Band41; Frequency: 2593 MHz; Duty Cycle: 1:1.58
Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 3/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 9.460 V/m; Power Drift = -0.08 dB
Applied MIF = -1.87 dB
RF audio interference level = 20.54 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **18.63 dBV/m** | Grid 2 **M4** **17.73 dBV/m** | Grid 3 **M4** **17.92 dBV/m** |
| Grid 4 **M4** **18.74 dBV/m** | Grid 5 **M4** **20.02 dBV/m** | Grid 6 **M4** **20.54 dBV/m** |
| Grid 7 **M4** **20.81 dBV/m** | Grid 8 **M4** **20.92 dBV/m** | Grid 9 **M4** **21.53 dBV/m** |




0 dB = 11.92 V/m = 21.53 dBV/m

**Fig B.9 HAC RF E-Field LTE Band41 Power Class 2 QPSK CH40620**

## HAC RF E-Field LTE Band41 Power Class 2 QPSK CH40185

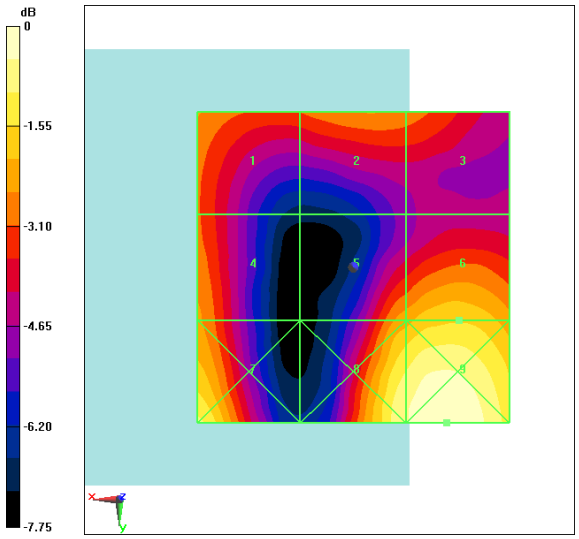
**Date: 2019-8-13**

Electronics: DAE4 Sn771
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature: 22.0°C
Communication System: LTE Band41; Frequency: 2549.5 MHz; Duty Cycle: 1:1.58
Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 3 3/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 8.419 V/m; Power Drift = -0.17 dB
Applied MIF = -1.82 dB
RF audio interference level = 20.74 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **19.83 dBV/m** | Grid 2 **M4** **19.81 dBV/m** | Grid 3 **M4** **19.56 dBV/m** |
| Grid 4 **M4** **19.88 dBV/m** | Grid 5 **M4** **20.1 dBV/m** | Grid 6 **M4** **20.74 dBV/m** |
| Grid 7 **M4** **21.49 dBV/m** | Grid 8 **M4** **21.76 dBV/m** | Grid 9 **M4** **22.33 dBV/m** |




0 dB = 13.08 V/m = 22.33 dBV/m

**Fig B.10 HAC RF E-Field LTE Band41 Power Class 2 QPSK CH40185**

## HAC RF E-Field LTE Band41 Power Class 2 QPSK CH39750

**Date: 2019-8-13**

Electronics: DAE4 Sn771

Medium: Air

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$

Ambient Temperature: 22.0°C

Communication System: LTE Band41; Frequency: 2506 MHz; Duty Cycle: 1:1.58

Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 3 2/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 8.493 V/m; Power Drift = -0.07 dB

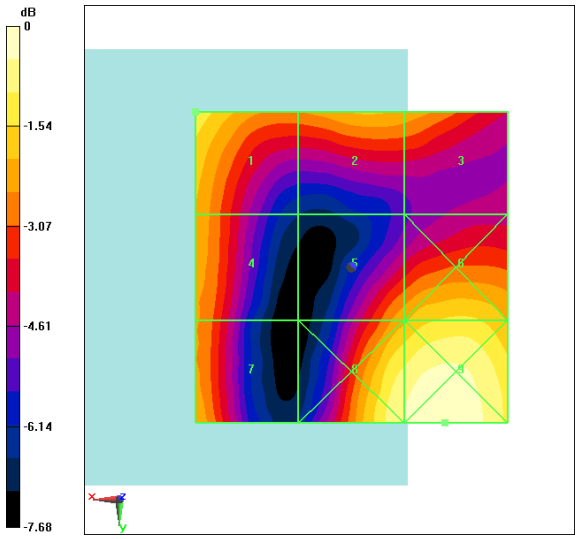
Applied MIF = -1.89 dB

RF audio interference level = 21.42 dBV/m

**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **21.42 dBV/m** | Grid 2 **M4** **20.56 dBV/m** | Grid 3 **M4** **20.33 dBV/m** |
| Grid 4 **M4** **20.4 dBV/m** | Grid 5 **M4** **20.36 dBV/m** | Grid 6 **M4** **21.07 dBV/m** |
| Grid 7 **M4** **20.51 dBV/m** | Grid 8 **M4** **22.01 dBV/m** | Grid 9 **M4** **22.49 dBV/m** |




0 dB = 13.32 V/m = 22.49 dBV/m

**Fig B.11 HAC RF E-Field LTE Band41 Power Class 2 QPSK CH39750**

## HAC RF E-Field LTE Band41 Power Class 2 16QAM CH41490

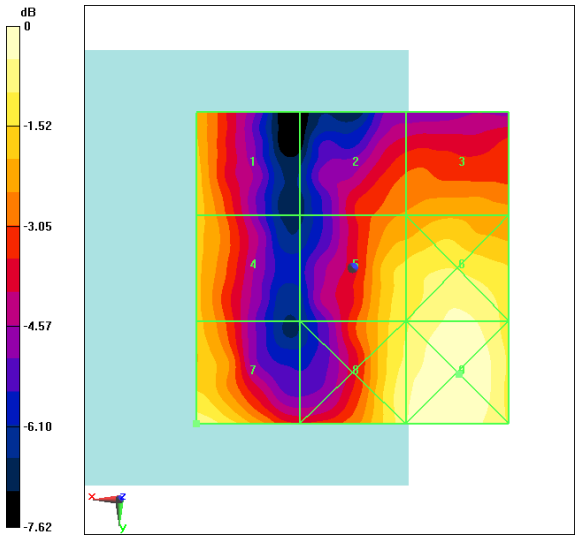
**Date: 2019-8-13**

Electronics: DAE4 Sn771
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature: 22.0°C
Communication System: LTE Band41; Frequency: 2680 MHz; Duty Cycle: 1:1.58
Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 6.483 V/m; Power Drift = -0.04 dB
Applied MIF = -1.81 dB
RF audio interference level = 15.78 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **14.71 dBV/m** | Grid 2 **M4** **13.94 dBV/m** | Grid 3 **M4** **14.3 dBV/m** |
| Grid 4 **M4** **14.67 dBV/m** | Grid 5 **M4** **15.29 dBV/m** | Grid 6 **M4** **15.98 dBV/m** |
| Grid 7 **M4** **15.78 dBV/m** | Grid 8 **M4** **15.82 dBV/m** | Grid 9 **M4** **16.39 dBV/m** |




0 dB = 6.602 V/m = 16.39 dBV/m

**Fig B.12 HAC RF E-Field LTE Band41 Power Class 2 16QAM CH41490**

## HAC RF E-Field LTE Band41 Power Class 2 16QAM CH41055

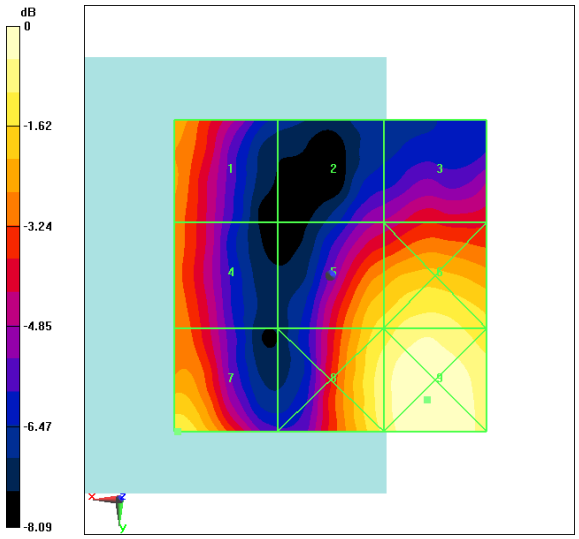
**Date: 2019-8-13**

Electronics: DAE4 Sn771
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature: 22.0°C
Communication System: LTE Band41; Frequency: 2636.5 MHz; Duty Cycle: 1:1.58
Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 2/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 8.073 V/m; Power Drift = -0.09 dB
Applied MIF = -1.94 dB
RF audio interference level = 18.56 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **17.38 dBV/m** | Grid 2 **M4** **14.95 dBV/m** | Grid 3 **M4** **15.92 dBV/m** |
| Grid 4 **M4** **16.94 dBV/m** | Grid 5 **M4** **18.29 dBV/m** | Grid 6 **M4** **18.95 dBV/m** |
| Grid 7 **M4** **18.56 dBV/m** | Grid 8 **M4** **18.91 dBV/m** | Grid 9 **M4** **19.67 dBV/m** |




0 dB = 9.624 V/m = 19.67 dBV/m

**Fig B.13 HAC RF E-Field LTE Band41 Power Class 2 16QAM CH41055**

## HAC RF E-Field LTE Band41 Power Class 2 16QAM CH40620

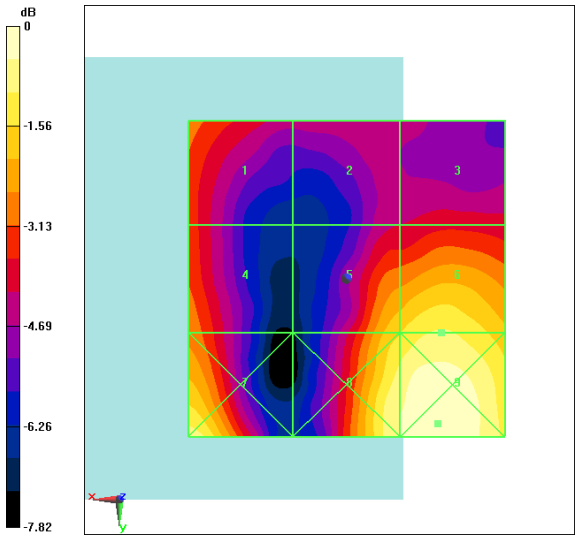
**Date: 2019-8-13**

Electronics: DAE4 Sn771
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature: 22.0°C
Communication System: LTE Band41; Frequency: 2593 MHz; Duty Cycle: 1:1.58
Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 3/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 8.185 V/m; Power Drift = 0.19 dB
Applied MIF = -1.84 dB
RF audio interference level = 19.50 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **17.7 dBV/m** | Grid 2 **M4** **16.33 dBV/m** | Grid 3 **M4** **16.7 dBV/m** |
| Grid 4 **M4** **17.77 dBV/m** | Grid 5 **M4** **18.9 dBV/m** | Grid 6 **M4** **19.5 dBV/m** |
| Grid 7 **M4** **19.75 dBV/m** | Grid 8 **M4** **20 dBV/m** | Grid 9 **M4** **20.48 dBV/m** |




0 dB = 10.57 V/m = 20.48 dBV/m

**Fig B.14 HAC RF E-Field LTE Band41 Power Class 2 16QAM CH40620**

## HAC RF E-Field LTE Band41 Power Class 2 16QAM CH40185

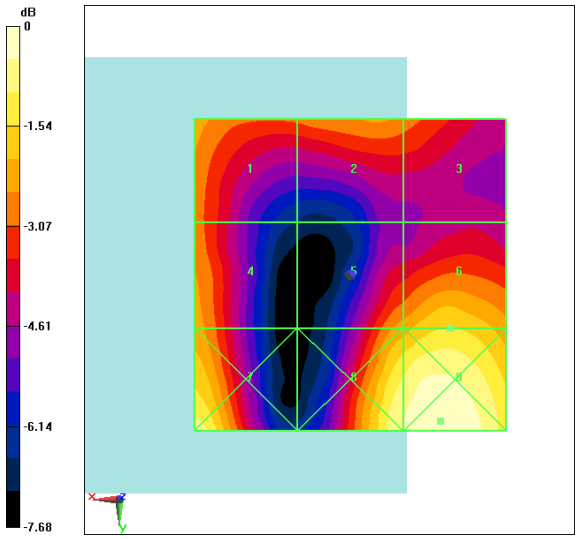
**Date: 2019-8-13**

Electronics: DAE4 Sn771
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature: 22.0°C
Communication System: LTE Band41; Frequency: 2549.5 MHz; Duty Cycle: 1:1.58
Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 3 3/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 7.509 V/m; Power Drift = -0.04 dB
Applied MIF = -1.95 dB
RF audio interference level = 19.73 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **19.03 dBV/m** | Grid 2 **M4** **18.79 dBV/m** | Grid 3 **M4** **18.47 dBV/m** |
| Grid 4 **M4** **18.95 dBV/m** | Grid 5 **M4** **18.96 dBV/m** | Grid 6 **M4** **19.73 dBV/m** |
| Grid 7 **M4** **20.56 dBV/m** | Grid 8 **M4** **20.76 dBV/m** | Grid 9 **M4** **21.24 dBV/m** |




0 dB = 11.53 V/m = 21.24 dBV/m

**Fig B.15 HAC RF E-Field LTE Band41 Power Class 2 16QAM CH40185**

## HAC RF E-Field LTE Band41 Power Class 2 16QAM CH39750

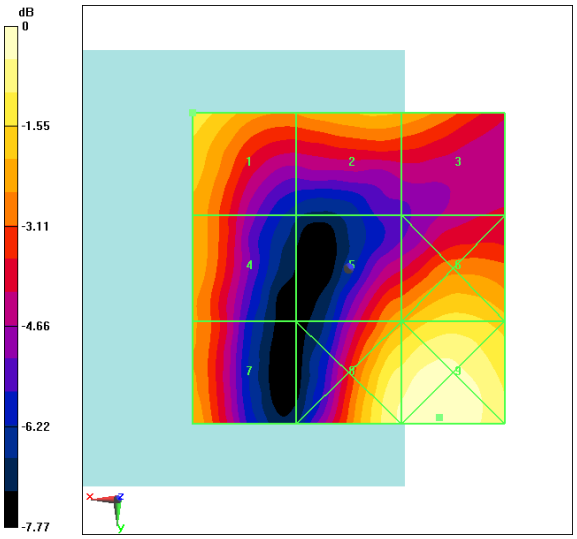
**Date: 2019-8-13**

Electronics: DAE4 Sn771
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature: 22.0°C
Communication System: LTE Band41; Frequency: 2506 MHz; Duty Cycle: 1:1.58
Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 3 2/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 7.374 V/m; Power Drift = -0.03 dB
Applied MIF = -1.83 dB
RF audio interference level = 20.23 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **20.23 dBV/m** | Grid 2 **M4** **19.39 dBV/m** | Grid 3 **M4** **19.23 dBV/m** |
| Grid 4 **M4** **19.15 dBV/m** | Grid 5 **M4** **19.15 dBV/m** | Grid 6 **M4** **20 dBV/m** |
| Grid 7 **M4** **19.34 dBV/m** | Grid 8 **M4** **20.92 dBV/m** | Grid 9 **M4** **21.33 dBV/m** |




0 dB = 11.66 V/m = 21.33 dBV/m

**Fig B.16 HAC RF E-Field LTE Band41 Power Class 2 16QAM CH39750**

## HAC RF E-Field LTE Band41 Power Class 2 64QAM CH41490

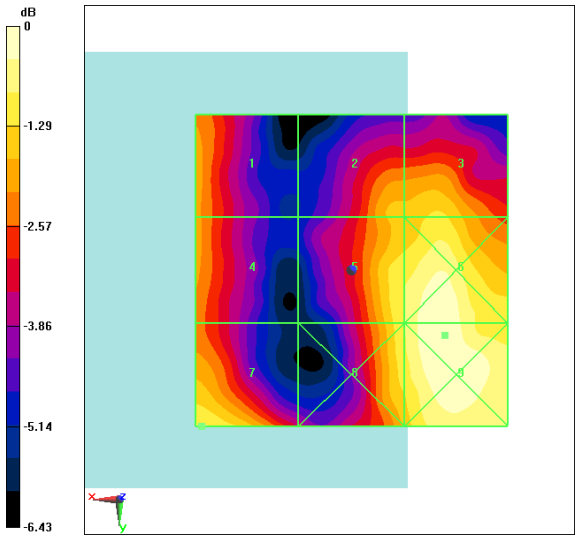
**Date: 2019-8-13**

Electronics: DAE4 Sn771
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature: 22.0°C
Communication System: LTE Band41; Frequency: 2680 MHz; Duty Cycle: 1:1.58
Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 7.888 V/m; Power Drift = -0.03 dB
Applied MIF = -1.81 dB
RF audio interference level = 16.30 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **15.29 dBV/m** | Grid 2 **M4** **15.58 dBV/m** | Grid 3 **M4** **15.91 dBV/m** |
| Grid 4 **M4** **15.23 dBV/m** | Grid 5 **M4** **16.28 dBV/m** | Grid 6 **M4** **17.04 dBV/m** |
| Grid 7 **M4** **16.3 dBV/m** | Grid 8 **M4** **16.26 dBV/m** | Grid 9 **M4** **17.1 dBV/m** |




0 dB = 7.158 V/m = 17.10 dBV/m

**Fig B.17 HAC RF E-Field LTE Band41 Power Class 2 64QAM CH41490**

## HAC RF E-Field LTE Band41 Power Class 2 64QAM CH41055

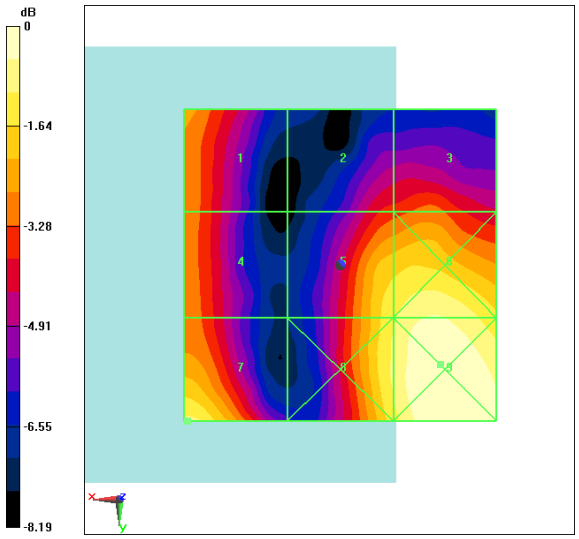
**Date: 2019-8-13**

Electronics: DAE4 Sn771
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature: 22.0°C
Communication System: LTE Band41; Frequency: 2636.5 MHz; Duty Cycle: 1:1.58
Probe: EF3DV3 - SN4060;ConvF(1, 1, 1)

**B41/E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device 2/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 8.678 V/m; Power Drift = -0.06 dB
Applied MIF = -1.87 dB
RF audio interference level = 18.94 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **17.45 dBV/m** | Grid 2 **M4** **16.33 dBV/m** | Grid 3 **M4** **16.83 dBV/m** |
| Grid 4 **M4** **17.04 dBV/m** | Grid 5 **M4** **18.68 dBV/m** | Grid 6 **M4** **19.36 dBV/m** |
| Grid 7 **M4** **18.94 dBV/m** | Grid 8 **M4** **18.89 dBV/m** | Grid 9 **M4** **19.85 dBV/m** |




0 dB = 9.834 V/m = 19.85 dBV/m

**Fig B.18 HAC RF E-Field LTE Band41 Power Class 2 64QAM CH41055**