



# TEST REPORT

No. 24B01N001531-001-HAC RF

For

**DIALN PRODUCTS INC**

**Smart Phone**

**Model Name: X68**

With

**Hardware Version: YK310-MB-V6.0**

**Software Version: Dialn\_X68\_Generic\_V4.0\_20240829\_1900**

**FCC ID: 2BAHU2024021**

**HAC-2019 Compliance: PASS**

**Issued Date: 2024-09-12**

**Designation Number: CN1210**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
24B01N001531-001-HAC RF	Rev.0	1st edition	2024-09-12

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## 1. Summary of Test Report

### 1.1. Test Items

Description:	Smart Phone
Model Name:	X68
Applicant's Name:	DIALN PRODUCTS INC
Manufacturer's Name:	DIALN PRODUCTS INC

### 1.2. Test Standards

ANSI C63.19:2019

### 1.3. Test Result

Pass

### 1.4. Testing Location

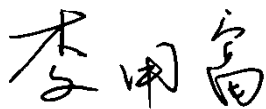
Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China

### 1.5. Project Data

Testing Start Date: 2024-09-04

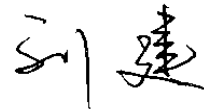
Testing End Date: 2024-09-04

### 1.6. Signature



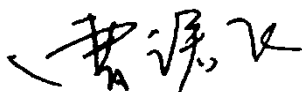
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Li Yongfu  
(Prepared this test report)



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Liu Jian  
(Reviewed this test report)



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Cao Junfei  
(Approved this test report)



## 2. Client Information

### 2.1. Applicant Information

Company Name:	DIALN PRODUCTS INC
Address:	2000 Walton Road, Saint Louis, Missouri 63114, United States
C	/
Email:	/
Telephone:	/

### 2.2. Manufacturer Information

Company Name:	DIALN PRODUCTS INC
Address:	2000 Walton Road, Saint Louis, Missouri 63114, United States
Contact:	/
Email:	/
Telephone:	/

### 3. Equipment under Test (EUT) and Ancillary Equipment (AE)

#### 3.1. About EUT

Description:	Smart Phone
Mode Name:	X68
Condition of EUT as received:	No obvious damage in appearance
Frequency Bands:	GSM 850/1900, WCDMA Band 2/4/5, LTE Band 2/4/5/12/13/17/41/66/71, Bluetooth, WLAN 2.4GHz/5GHz

#### 3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Receipt Date
UT01aa	55451200030126	YK310-MB-V6.0	Dialn_X68_Generic_V4.0_20240829_1900	2024-08-07

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

**Note:** It is performed to test HAC with the UT01aa.

#### 3.3. Internal Identification of AE used during the test

AE ID*	Description	Model	Manufacturer
AE1	Battery	EBT476591GV	Shenzhen Aerospace Electronic Co.,Ltd.

\*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	Name of Voice Service
GSM	GSM 850/1900	VO	Yes	BT, WLAN	CMRS Voice
	EDGE	DT	No	BT, WLAN	NA
WCDMA	B2/B4/B5	VO	No	BT, WLAN	CMRS Voice
	HSPA	VD	No	BT, WLAN	MEET
LTE (FDD)	2/4/5/12/13/17/66/71	VD	No	BT, WLAN	VoLTE, MEET
LTE (TDD)	41	VD	No	BT, WLAN	VoLTE, MEET
WLAN	2.4GHz	VD	No	WWAN	VoWiFi, MEET
WLAN	5GHz	VD	No	WWAN	VoWiFi, MEET
Bluetooth	2.4GHz	DT	No	WWAN	NA

VO: Voice CMRS/PSTN Service Only

VD: Voice CMRS/PSTN and Data Service

DT: Digital Transport

#### 4. Reference Documents

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

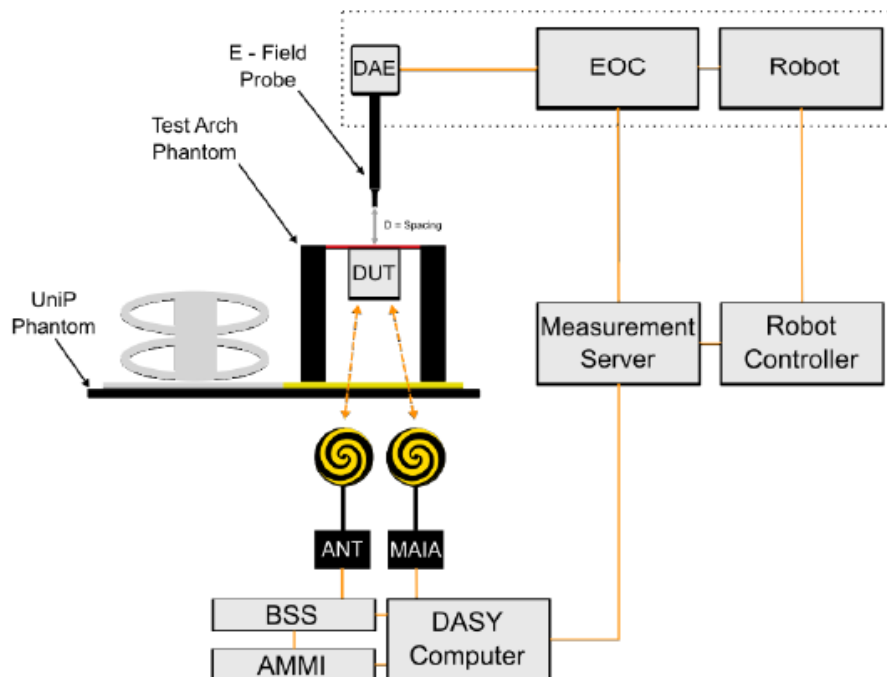
Reference	Title	Version
ANSI C63.19	American National Standard for Methods of Measurement of Compatibility Between Wireless Communication Devices and Hearing Aids	2019 Edition
KDB 285076 D01v06r04	Equipment Authorization Guidance for Hearing Aid Compatibility	2023 Edition
KDB 285076 D02v04	Guidance for performing T-Coil tests for air interfaces supporting voice over IP (e.g., LTE and WiFi) to support CMRS based telephone services	2022 Edition
KDB 285076 D03v01r06	Hearing Aid Compatibility Frequently Asked Questions	2022 Edition



## 5. Operational Conditions During Test

### 5.1. HAC Measurement Set-up

These measurements are performed using the DASY6/8 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 Core2 1.86 GHz computer with Windows 10 system and HAC Measurement Software DASY6/8, 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.



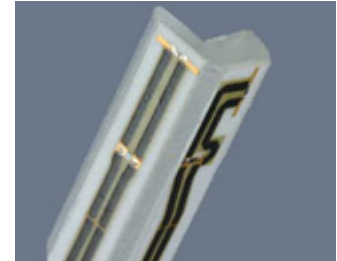
**Fig. 1 HAC Test Measurement Set-up**

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.

## 5.2. Probe Specification

### E-Field Probe Description

Construction	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges
Calibration	In air from 30 MHz to 6.0 GHz (absolute accuracy $\pm 6.0\%$ , $k=2$ )
Frequency	30 MHz to 6 GHz Linearity: $\pm 0.2$ dB (100 MHz to 3 GHz)
Directivity	$\pm 0.2$ dB in air (rotation around probe axis) $\pm 0.4$ dB in air (rotation normal to probe axis)
Dynamic Range	2 V/m to 1000 V/m; Linearity: $\pm 0.2$ dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 4 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.5 mm
Application	General near-field measurements up to 6 GHz Field component measurements Fast automatic scanning in phantoms



**[EF3DV3]**

### 5.3. Test Arch Phantom & Phone Positioner

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

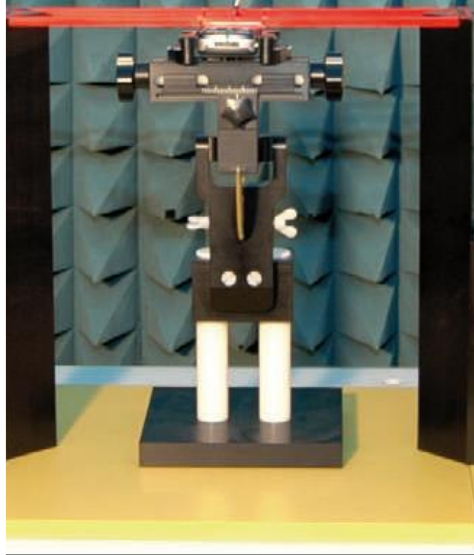


Fig. 2 HAC Phantom & Device Holder

### 5.4 Robotic System Specifications

#### Specifications

**Positioner:** Stäubli Unimation Corp. Robot Model: RX160L

**Repeatability:**  $\pm 0.02$  mm

**No. of Axis:** 6

#### Data Acquisition Electronic (DAE) System

##### Cell Controller

**Processor:** Intel Core2

**Clock Speed:** 1.86GHz

**Operating System:** Windows 10

##### Data Converter

**Features:** Signal Amplifier, multiplexer, A/D converter, and control logic

**Software:** DASY8 cD6 HAC

**Connecting Lines:** Optical downlink for data and status info.

Optical uplink for commands and clock

## 6. EUT Arrangement

### 6.1. WD RF Emission Measurements Reference and Plane

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

- The measurement area is 50.0 mm by 50.0 mm.
- The measurement area is centered on the audio frequency output transducer of the WD (speaker or T-Coil signal).
- The measurement area is in a reference plane, which is defined as the planar area tangent to the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver area of the phone and is defined by the points of the receiver-end of the WD handset, which, in normal handset use, rest against the ear.
- The measurement plane is parallel to, and 15.0 mm in front of, the reference plane.

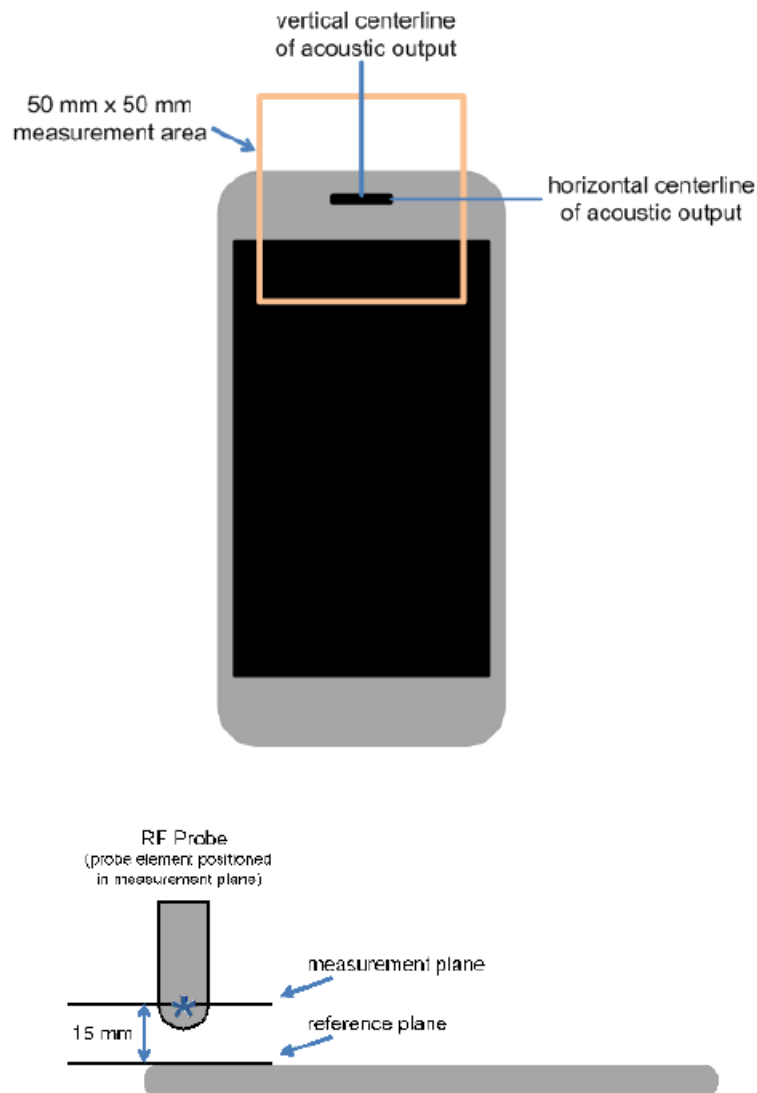


Fig. 3 WD measurement and reference planes for RF emission measurements

## 7. System Validation

### 7.1. 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.

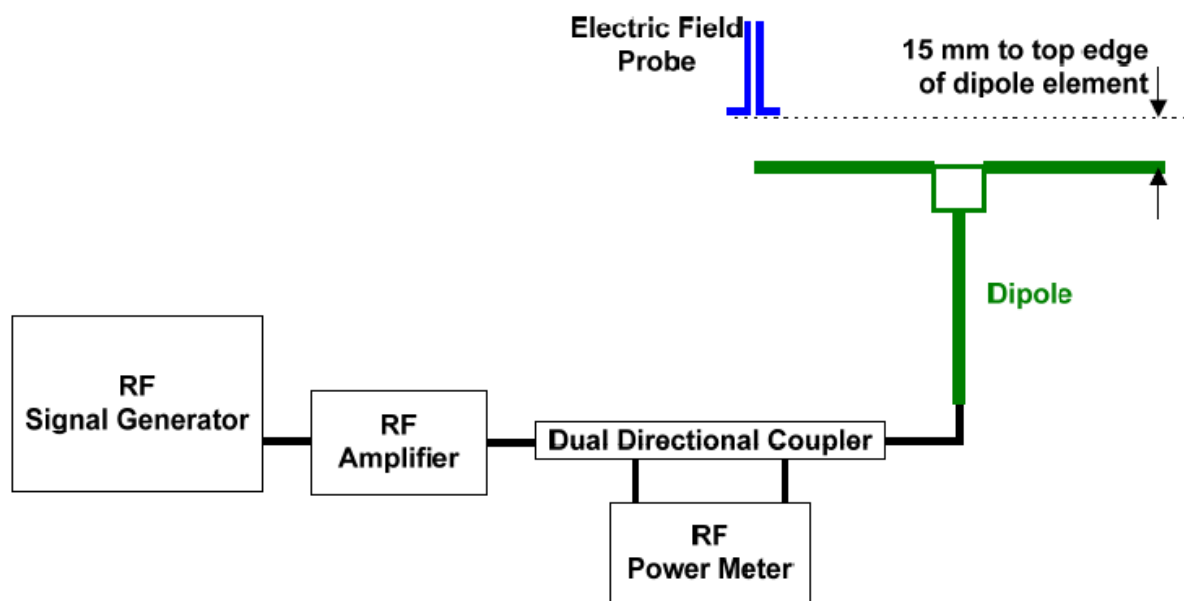


Fig. 4 Dipole Validation Setup

### 7.2. Validation Result

E-Field Scan						
Mode	Frequency (MHz)	Input Power (mW)	Measured <sup>1</sup> Value(V/m)	Target <sup>2</sup> Value(V/m)	Deviation <sup>3</sup> (%)	Limit <sup>4</sup> (%)
CW	835	100	116.0	110.6	4.88	±18
CW	1880	100	92.4	88.8	4.05	±18

Notes:

1. Please refer to the attachment for detailed measurement data and plot.
2. Target value is provided by SPEAG in the calibration certificate of specific dipoles.
3. Deviation (%) =  $100 \times (\text{Measured value minus Target value}) \div \text{Target value}$ .
4. ANSI C63.19 requires values within  $\pm 18\%$  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.

## 8. Modulation Interference Factor (MIF)

### 8.1 Introduction

The HAC Standard ANSI C63.19-2019 defines the MIF as a scaling factor to evaluate the Radio Frequency Audio Interference Level (RFail). It is applicable to any modulation scheme. The MIF (in dB) is added to the measured averaged E-field (in dBV/m) to obtain the RFail (also in dBV/m) which defines the audible amplitude of the measured RF signal strength. The RFail is then compared to the associated qualification level.

The MIF is defined in section D.7 of the ANSI C63.19-2019 as the interference potential of a signal to its steady state RMS signal level or average power level. This factor is a function only of the audio frequency amplitude modulation characteristics of the signal and is the same for field strength or conducted power measurements. The modulated signal is processed as described below:

- The full signal bandwidth is presented to a wideband square law detector which demodulates the signal.
- The baseband signal (after demodulation) is presented to a spectral weighting filter which is normalized to 1 kHz. The filter frequency response is shown in Section D.4 of the ANSI C63.19-2019 standard.
- The spectral weighted signal is presented to a temporal weighting filter consisting of rapid Root Mean Square (RMS) level detection followed by peak detection with a 550 ms decay time.

- The MIF is calculated as 
$$\frac{10 \cdot \log_{10}(\text{filtered signal})}{1.154 \cdot \text{RMS of demodulated signal}}$$

Measurements of the MIF value are conducted using the MAIA designed by SPEAG. The resulting deviations from the simulated values are within the requirements of the HAC standard.

MAIA is a hardware interface for evaluating the modulation and audio interference characteristics of RF signals in the frequency range 698–6000 MHz. It uses USB-powered active electronics to identify the modulation of the DUT. It can be operated with the over-the-air interface using the built-in ultra-broadband planar log spiral antenna (698–6000 MHz) or in the conducted mode using the coaxial SMA 50W connector (300–6000 MHz).



**Fig. 5 MAIA View**

## 8.2 DUT MIF results

Based on the KDB285076D01v06r02, the handset can also use the MIF values predetermined by the test equipment manufacturer. MIF values applied in this test report were provided by the HAC equipment provider of SPEAG, and the worst values for all air interface are listed below.

UID	Communication System Name	MIF (dB)
10021	GSM-FDD (TDMA, GMSK)	3.63
10460	UMTS-FDD (WCDMA, AMR)	-25.43
10225	UMTS-FDD (HSPA+)	-20.39
10170	LTE-FDD(SC-FDMA, 1RB, 20MHz, 16-QAM )	-9.76
10173	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16QAM)	-1.44
10061	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	-2.02
10077	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps)	0.12
10069	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	-3.15

## 9. Evaluation of RF Audio Interference Power Level

According to ANSIC 63.19-2019, the WD's conducted power must be at or below either the stated  $RF_{AIPL}$  (Table 12-1) or the stated peak power level (Table 12-2), or the average near-field emissions over the measurement area must be at or below the stated  $RF_{AIL}$  (Table 12-3), or the stated peak field strength (Table 12-4). The WD may demonstrate compliance by meeting any of these four requirements, but it must do so in each of its operating bands at its established worst-case normal speech-mode operating condition. This chapter will evaluate the RF audio interference power level of WD.

Band	Average Power <sub>max</sub> (dBm)	MIF <sub>worst</sub> (dB)	Power + MIF	C63.19 Lowest $RF_{AIPL}$ (dBm)	Compliance
GSM 850	33.5	3.63	37.13	29	To be tested
GSM 1900	30.5	3.63	34.13	26	To be tested
WCDMA Band 2	23.5	-25.43	-1.93	26	Pass
WCDMA Band 2 -HSPA	22.0	-20.39	1.61	26	Pass
WCDMA Band 4	23.5	-25.43	-1.93	26	Pass
WCDMA Band 4 -HSPA	22.0	-20.39	1.61	26	Pass
WCDMA Band 5	23.5	-25.43	-1.93	29	Pass
WCDMA Band 5 -HSPA	22.0	-20.39	1.61	29	Pass
LTE Band 2	23.5	-9.76	13.74	26	Pass
LTE Band 4	24.5	-9.76	14.74	26	Pass
LTE Band 5	25.0	-9.76	15.24	29	Pass
LTE Band 12	24.5	-9.76	14.74	29	Pass
LTE Band 13	24.5	-9.76	14.74	29	Pass
LTE Band 17	24.5	-9.76	14.74	29	Pass
LTE Band 66	24.5	-9.76	14.74	26	Pass
LTE Band 71	24.5	-9.76	14.74	29	Pass
LTE Band 41	24.0	-1.44	22.56	25	Pass
WLAN 2.4GHz	17.5	-2.02	15.48	25	Pass
WLAN 5GHz	13.0	-3.15	9.85	25	Pass

**Note:** Average Power = Max tune-up limit

According to the above table, the  $RF_{AIPL}$  for WCDMA, LTE and WIFI are less than the stated  $RF_{AIPL}$  (Table 12.1). Near field emission testing is required for the GSM bands.



## 10. Near-field Emission Test Procedures

**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) Set the WD to transmit a fixed and repeatable combination of signal power and modulation characteristic that is representative of the worst case (highest interference potential) encountered in normal use. Transiently occurring start-up, changeover, or termination conditions, or other operations likely to occur less than 1% of the time during normal operation, may be excluded from consideration.
- 4) The measurement area shall be centered on the acoustic output or the T-Coil mode measurement reference point, as appropriate. Locate the field probe at the initial test position in the 50 mm by 50 mm measurement area, 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 at the output of the measurement system.
- 6) Scan the entire 50 mm by 50 mm measurement area in equally spaced step sizes and record the reading at each measurement point.
- 7) Calculate the average of the measurements taken in Step 6)
- 8) The RF audio interference level in dB(V/m) is obtained by adding the Modulation Interference Factor (in decibels) to the average steady state rms field strength reading over the measurement area, in dB(V/m)
- 9) Compare this RF audio interference level to the limits in ANSI C63.19-2019 clause 4.7 and record the result.

## 11. Near-field Emission Test Results

Band	Channel	Frequency (MHz)	RFail (dBV/m)	Compliance
<b>GSM 850</b>	251	848.8	35.05	<b>Pass</b> (see Fig A.1)
	190	836.6	34.25	<b>Pass</b> (see Fig A.2)
	128	824.2	32.78	<b>Pass</b> (see Fig A.3)
<b>GSM 1900</b>	810	1909.8	33.56	<b>Pass</b> (see Fig A.4)
	661	1880.0	34.45	<b>Pass</b> (see Fig A.5)
	512	1850.2	34.88	<b>Pass</b> (see Fig A.6)

## 12. ANSI C 63.19-2019 Limits

### 12-1 Wireless device RF audio interference power level

Frequency range (MHz)	RF <sub>AIPL</sub> (dBm)
<960	29
960–2000	26
>2000	25

### 12-2 Wireless device RF peak power level

Frequency range (MHz)	RF <sub>Peak Power</sub> (dBm)
<960	35
960–2000	32
>2000	31

### 12-3 Wireless device RF audio interference level

Frequency range (MHz)	RF <sub>AIL</sub> [dB(V/m)]
<960	39
960–2000	36
>2000	35

### 12-4 Wireless device RF peak near-field level

Frequency range (MHz)	RF <sub>Peak</sub> [dB(V/m)]
<960	45
960–2000	42
>2000	41

### 13. Measurement Uncertainty

No.	Error source	Type	Uncertainty Value (%)	Prob. Dist.	k	c <sub>i</sub>	Standard Uncertainty (%) $u_i$ (%)	Degree of freedom $V_{eff}$ or $v_i$	source
1	System repeatability	A	0.24	N	1	1	0.24	9	Measurement
<b>Measurement System</b>									
2	Probe Calibration	B	5.1	N	1	1	5.1	∞	Manufacturer
3	Axial Isotropy	B	4.7	R	√3	1	2.7	∞	Cal report
4	Sensor Displacement	B	16.5	R	√3	1	9.5	∞	Manufacturer
5	Boundary Effects	B	2.4	R	√3	1	1.4	∞	Manufacturer
6	Linearity	B	4.7	R	√3	1	2.7	∞	Cal report
7	Scaling to Peak Envelope Power	B	2.0	R	√3	1	1.2	∞	Standard
8	System Detection Limit	B	1.0	R	√3	1	0.6	∞	Manufacturer
9	Readout Electronics	B	0.3	N	1	1	0.3	∞	Manufacturer
10	Response Time	B	0.8	R	√3	1	0.5	∞	Manufacturer
11	Integration Time	B	2.6	R	√3	1	1.5	∞	Manufacturer
12	RF Ambient Conditions	B	3.0	R	√3	1	1.7	∞	Measurement
13	RF Reflections	B	12.0	R	√3	1	6.9	∞	Measurement
14	Probe Positioner	A	1.2	R	√3	1	0.7	∞	Manufacturer
15	Probe Positioning	A	4.7	R	√3	1	2.7	∞	Manufacturer
16	Extra. And Interpolation	B	1.0	R	√3	1	0.6	∞	Manufacturer
<b>Test Sample Related</b>									
17	Device Positioning Vertical	B	4.7	R	√3	1	2.7	∞	Manufacturer
18	Device Positioning Lateral	B	1.0	R	√3	1	0.6	∞	Manufacturer
19	Device Holder and Phantom	B	2.4	R	√3	1	1.4	∞	Manufacturer
20	Power Drift	B	5.0	R	√3	1	2.9	∞	Measurement
<b>Phantom and Setup related</b>									
21	Phantom Thickness	B	2.4	R	√3	1	1.4	∞	Manufacturer
<b>MIF related</b>									
22	Monitor amplitude	B	2.8	R	√3	1	1.6	∞	Manufacturer
23	Setup repeatability	A	2.7	N	1	1	2.7	9	Manufacturer
24	Sensor amplitude	B	11.6	R	√3	1	6.7	∞	Manufacturer
Combined standard uncertainty (%)		$u_c = \sqrt{\sum_{i=1}^{24} c_i^2 u_i^2}$		18.3					
Expanded uncertainty (Confidence interval of 95 %)		$u_e = 2u_c$		N		k=2		36.6	

## 14. Main Test Instruments

**Table 14-1: List of Main Instruments**

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Signal Generator	E8257D	MY47461211	2024-01-12	One year
02	Power meter	NRP	102603	2023-12-28	One year
03	Power sensor	NRP-Z51	102211	2023-12-28	One year
04	Amplifier	VTL5400	0404	/	/
05	HAC Test Arch	N/A	1150	/	/
06	E-Field Probe	EF3DV3	4094	2023-08-10	Three years
07	DAE	DAE4	1790	2024-06-06	One year
08	HAC Dipole	CD835V3	1165	2024-04-15	Three years
09	HAC Dipole	CD1880V3	1149	2024-04-15	Three years
10	BTS	CMW500	152499	2024-07-12	One year
11	Software	DASY8	/	/	/

## ANNEX A: RF Emission Test Plot

### Near-field Emission - GSM 850 High

Measurement performed on 2024-09-04

#### Hardware Setup

Probe Name Probe	Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4094	2023-08-10	DAE4 Sn1790	2024-06-06

#### Communication Systems

Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	GSM-FDD (TDMA, GMSK)	251	848.8

#### Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

#### Results

E <sub>max</sub> [dB(V/m)]	E <sub>avg50x50 max</sub> [dB(V/m)]	MIF [dB]	RFail [dB(V/m)]
32.66	31.42	3.63	35.05

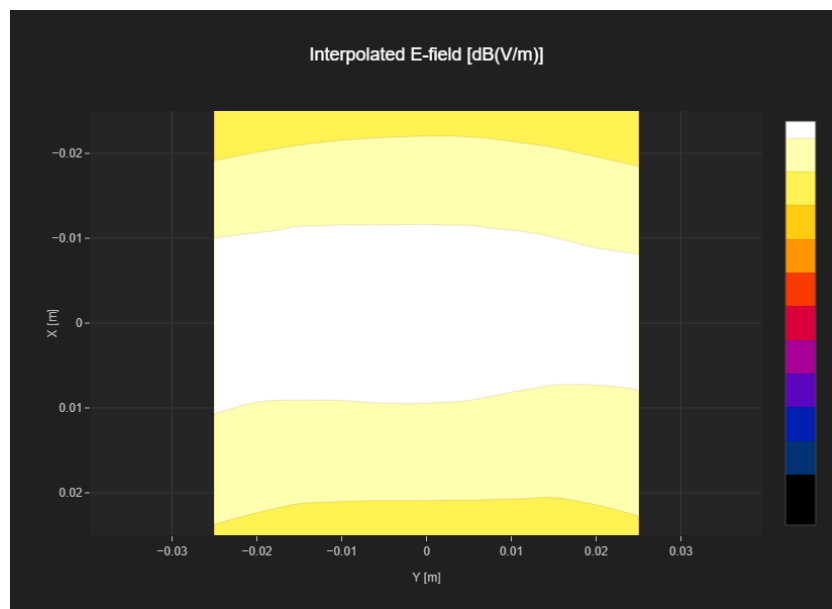


Fig A.1 GSM 850

## Near-field Emission - GSM 850 Middle

Measurement performed on 2024-09-04

### Hardware Setup

Probe Name Probe	Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4094	2023-08-10	DAE4 Sn1790	2024-06-06

### Communication Systems

Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	GSM-FDD (TDMA, GMSK)	190	836.6

### Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

### Results

E <sub>max</sub> [dB(V/m)]	E <sub>avg50x50 max</sub> [dB(V/m)]	MIF [dB]	RFail [dB(V/m)]
31.87	30.62	3.63	34.25

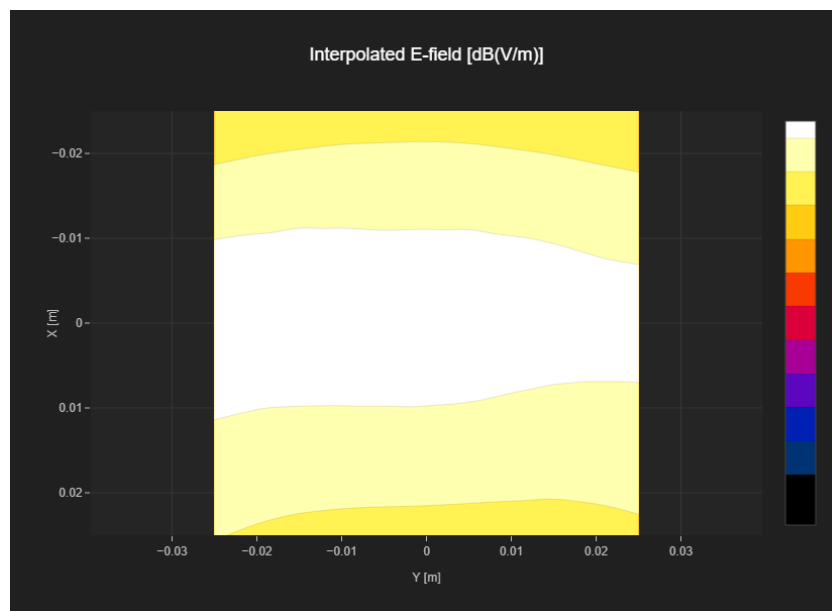


Fig A.2 GSM 850

## Near-field Emission - GSM 850 Low

Measurement performed on 2024-09-04

### Hardware Setup

Probe Name Probe	Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4094	2023-08-10	DAE4 Sn1790	2024-06-06

### Communication Systems

Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	GSM-FDD (TDMA, GMSK)	128	824.2

### Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

### Results

E <sub>max</sub> [dB(V/m)]	E <sub>avg50x50 max</sub> [dB(V/m)]	MIF [dB]	RFail [dB(V/m)]
30.39	29.15	3.63	32.78

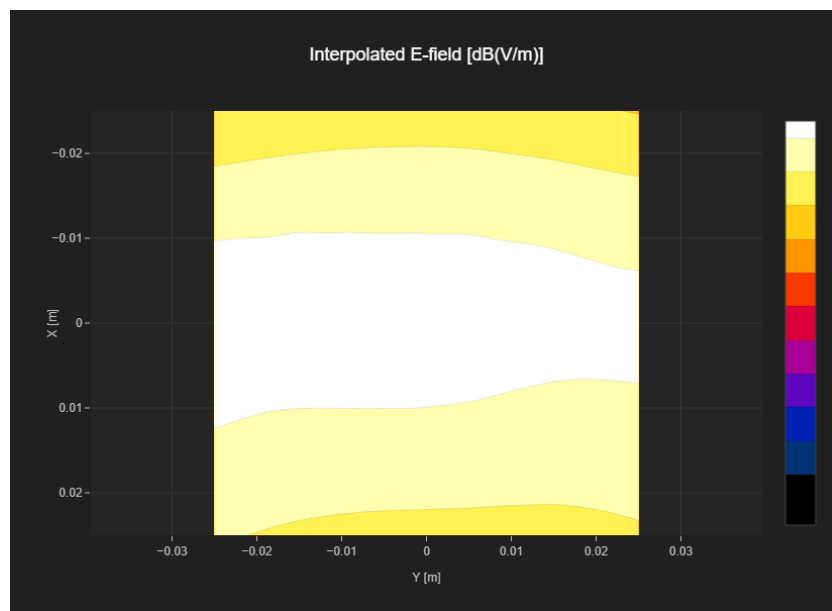


Fig A.3 GSM 850



## Near-field Emission - GSM 1900 High

Measurement performed on 2024-09-04

### Hardware Setup

Probe Name Probe	Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4094	2023-08-10	DAE4 Sn1790	2024-06-06

### Communication Systems

Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 1900	GSM-FDD (TDMA, GMSK)	810	1909.8

### Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

### Results

E <sub>max</sub> [dB(V/m)]	E <sub>avg50x50 max</sub> [dB(V/m)]	MIF [dB]	RFail [dB(V/m)]
33.96	29.93	3.63	33.56

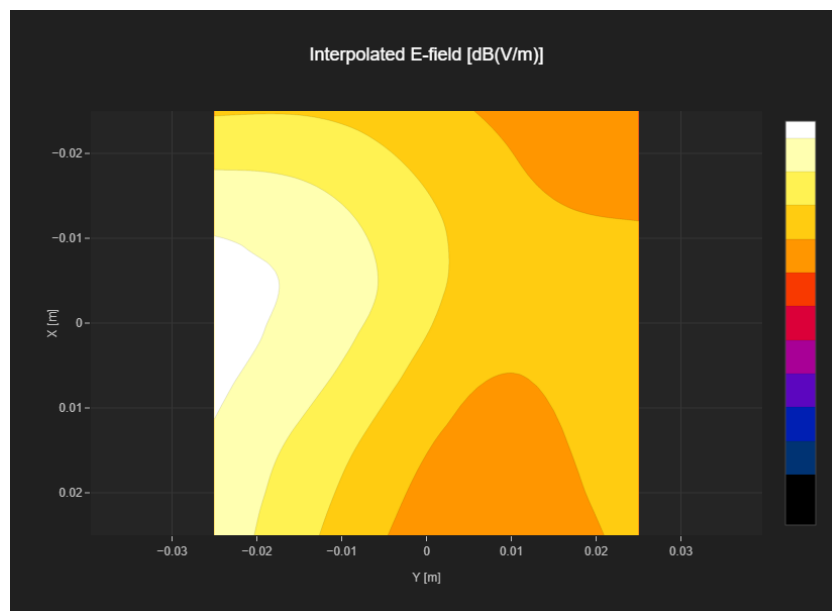


Fig A.4 GSM 1900

## Near-field Emission - GSM 1900 Middle

Measurement performed on 2024-09-04

### Hardware Setup

Probe Name Probe	Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4094	2023-08-10	DAE4 Sn1790	2024-06-06

### Communication Systems

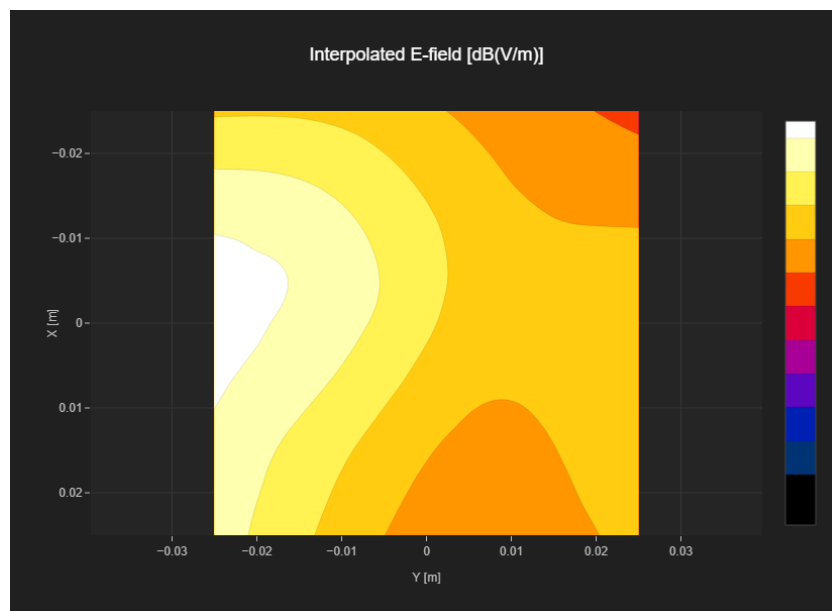
Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 1900	GSM-FDD (TDMA, GMSK)	661	1880.0

### Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

### Results

E <sub>max</sub> [dB(V/m)]	E <sub>avg50x50 max</sub> [dB(V/m)]	MIF [dB]	RFail [dB(V/m)]
34.85	30.82	3.63	34.45



**Fig A.5 GSM 1900**

## Near-field Emission - GSM 1900 Low

Measurement performed on 2024-09-04

### Hardware Setup

Probe Name Probe	Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4094	2023-08-10	DAE4 Sn1790	2024-06-06

### Communication Systems

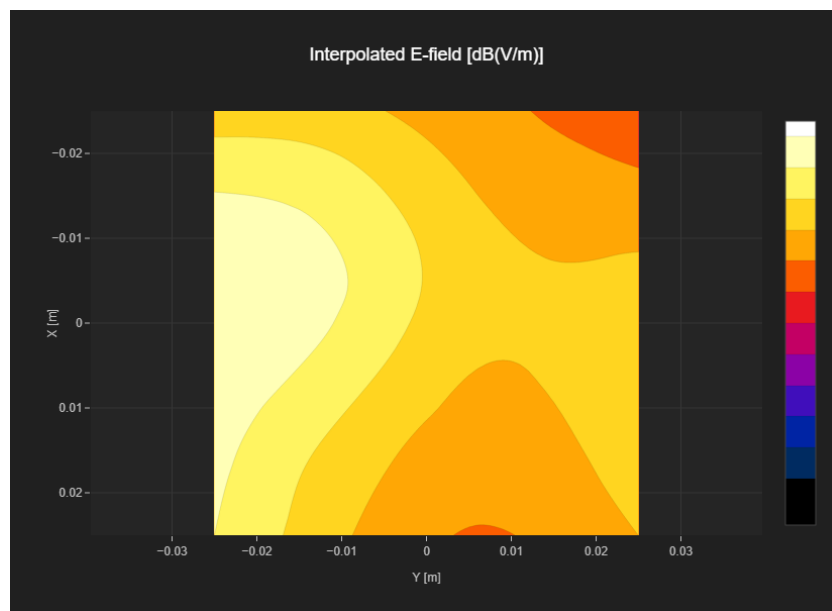
Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 1900	GSM-FDD (TDMA, GMSK)	512	1850.2

### Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

### Results

E <sub>max</sub> [dB(V/m)]	E <sub>avg50x50 max</sub> [dB(V/m)]	MIF [dB]	RFail [dB(V/m)]
35.0	31.25	3.63	34.88



**Fig A.6 GSM 1900**

## ANNEX B: System Validation Result

835MHz

Measurement performed on 2024-09-04

### Hardware Setup

Probe Name	Probe	Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4094		2023-08-10	DAE4 Sn1790	2024-06-06

### Communication Systems

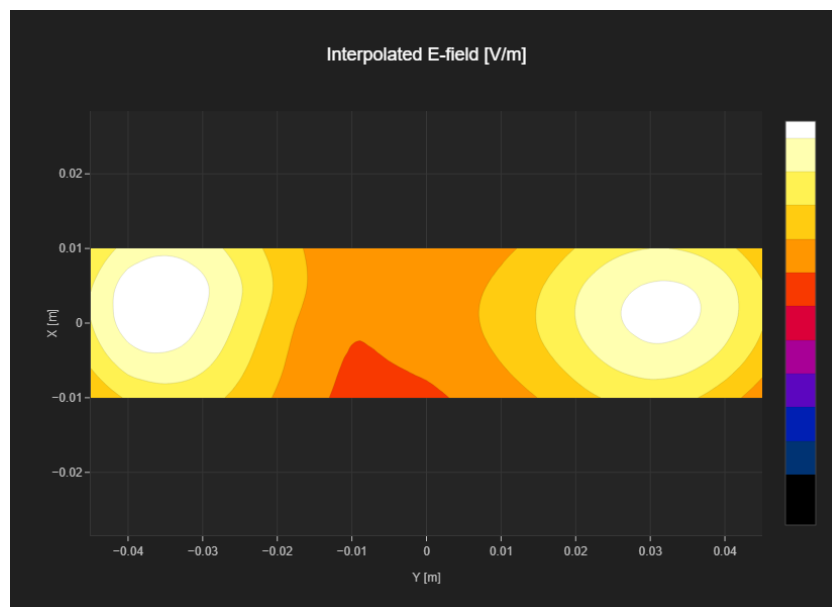
Band Name	Communication Systems Name	Channel	Frequency [MHz]
CD835	CW	50	835.0

### Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
20.0	180.0	5.0	5.0	15.0

### Results

Dipole Type	Dipole Serial Number	E <sub>max</sub> [V/m]	Drift [dB]
CD835	1165	116	0.05



## 1880MHz

Measurement performed on 2024-09-04

### Hardware Setup

Probe Name Probe	Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4094	2023-08-10	DAE4 Sn1790	2024-06-06

### Communication Systems

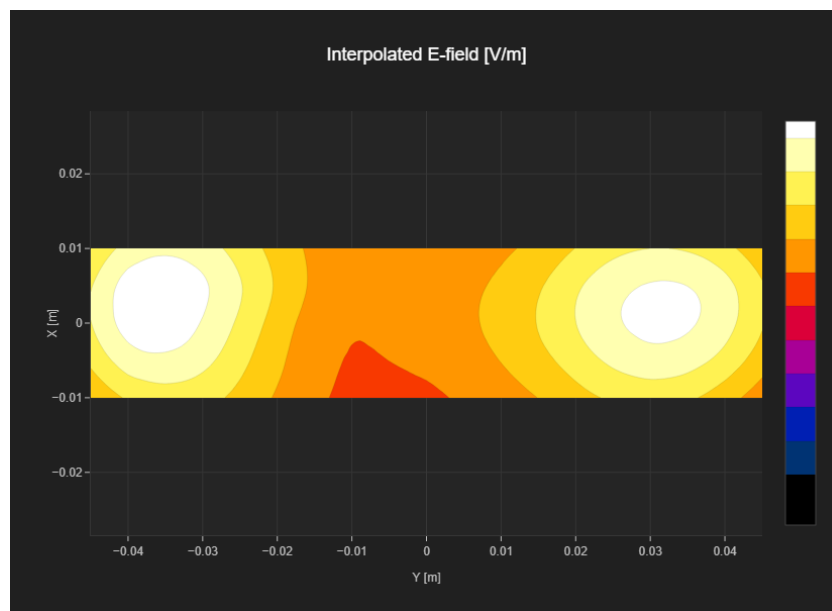
Band Name	Communication Systems Name	Channel	Frequency [MHz]
CD1880	CW	50	1880.0

### Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
20.0	90.0	5.0	5.0	15.0

### Results

Dipole Type	Dipole Serial Number	E <sub>max</sub> [V/m]	Drift [dB]
CD1880	1149	92.4	0.07



## ANNEX C: Dipole Calibration Certificate

CD835V3

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
 Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Client **SAICT**  
 Shenzhen

Certificate No. **CD835V3-1165\_Apr24**

### CALIBRATION CERTIFICATE

Object **CD835V3 - SN: 1165**

Calibration procedure(s) **QA CAL-20.v7**  
**Calibration Procedure for Validation Sources in air**

Calibration date: **April 15, 2024**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Probe EF3DV3	SN: 4013	28-Dec-23 (No. EF3-4013_Dec23)	Dec-24
DAE4	SN: 781	16-Feb-24 (No. DAE4-781_Feb24)	Feb-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter Agilent 4419B	SN: GB42420191	09-Oct-09 (in house check Nov-23)	In house check: Nov-24
Power sensor HP E4412A	SN: US38485102	05-Jan-10 (in house check Nov-23)	In house check: Nov-24
Power sensor HP 8482A	SN: US37295597	09-Oct-09 (in house check Nov-23)	In house check: Nov-24
RF generator R&S SMT-06	SN: 837633/005	10-Jan-19 (in house check Nov-23)	In house check: Nov-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Calibrated by: **Aldonia Georgiadou** **Laboratory Technician**

Approved by: **Sven Kühn** **Technical Manager**

Signature




Issued: April 17, 2024

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

**Calibration Laboratory of  
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Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



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**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

#### References

- [1] ANSI-C63.19-2019 (ANSI-C63.19-2011)  
American National Standard, Methods of Measurement of Compatibility between Wireless Communications  
Devices and Hearing Aids.

#### Methods Applied and Interpretation of Parameters:

- **Coordinate System:** y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with the standards [1], the measurement planes (probe sensor center) are selected to be at a distance of 15 mm above the top metal edge of the dipole arms.
- **Measurement Conditions:** Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- **Antenna Positioning:** The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections. It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY5 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- **Feed Point Impedance and Return Loss:** These parameters are measured using a Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminated by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- **E-field distribution:** E field is measured in the x-y-plane with an isotropic E-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 15 mm (in z) above the metal top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, in the plane above the dipole surface.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

### Measurement Conditions

DASY system configuration, as far as not given on page 1.

<b>DASY Version</b>	DASY5	V52.10.4
<b>Phantom</b>	HAC Test Arch	
<b>Distance Dipole Top - Probe Center</b>	15 mm	
<b>Scan resolution</b>	dx, dy = 5 mm	
<b>Frequency</b>	835 MHz $\pm$ 1 MHz	
<b>Input power drift</b>	< 0.05 dB	

### Maximum Field values at 835 MHz

<b>E-field 15 mm above dipole surface</b>	<b>condition</b>	<b>Interpolated maximum</b>
Maximum measured above high end	100 mW input power	110.6 V/m = 40.88 dBV/m
Maximum measured above low end	100 mW input power	110.3 V/m = 40.85 dBV/m
Averaged maximum above arm	100 mW input power	<b>110.5 V/m <math>\pm</math> 12.8 % (k=2)</b>

### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters

<b>Frequency</b>	<b>Return Loss</b>	<b>Impedance</b>
800 MHz	16.0 dB	39.3 $\Omega$ - 9.5 j $\Omega$
835 MHz	25.4 dB	52.6 $\Omega$ + 4.8 j $\Omega$
880 MHz	15.8 dB	61.3 $\Omega$ - 14.3 j $\Omega$
900 MHz	16.3 dB	49.8 $\Omega$ - 15.4 j $\Omega$
945 MHz	23.7 dB	44.8 $\Omega$ + 3.3 j $\Omega$

#### 3.2 Antenna Design and Handling

The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

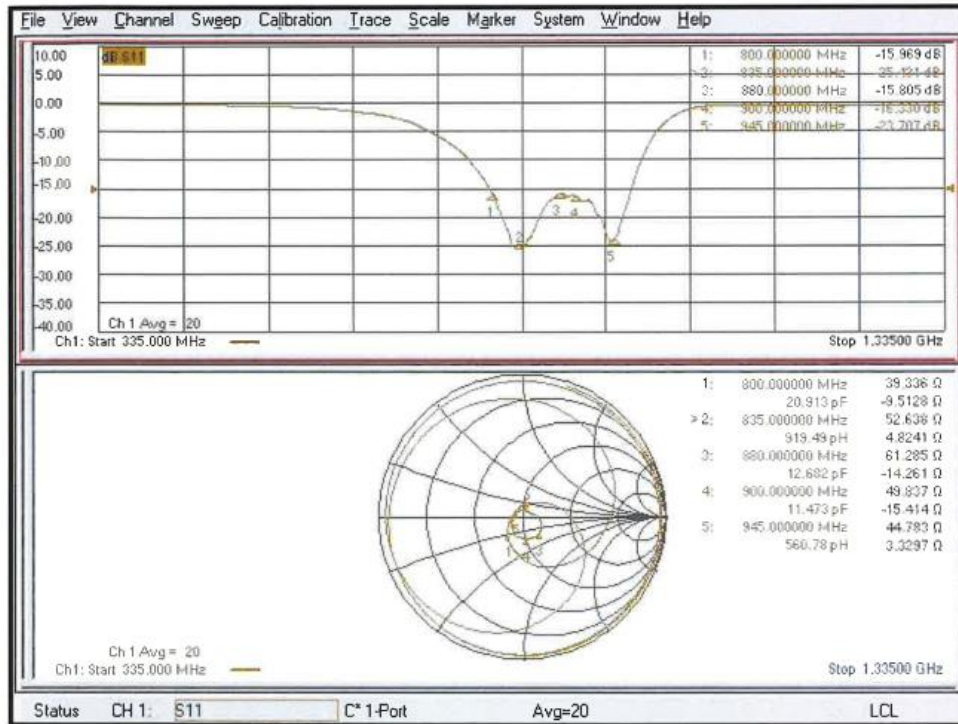
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.



### Impedance Measurement Plot



## DASY5 E-field Result

Date: 15.04.2024

Test Laboratory: SPEAG Lab2

**DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1165**

Communication System: UID 0 - CW ; Frequency: 835 MHz

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 835 MHz; Calibrated: 28.12.2023
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 16.02.2024
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**Dipole E-Field measurement @ 835MHz/E-Scan - 835MHz d=15mm/Hearing Aid Compatibility Test (41x361x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 132.5 V/m; Power Drift = 0.01 dB

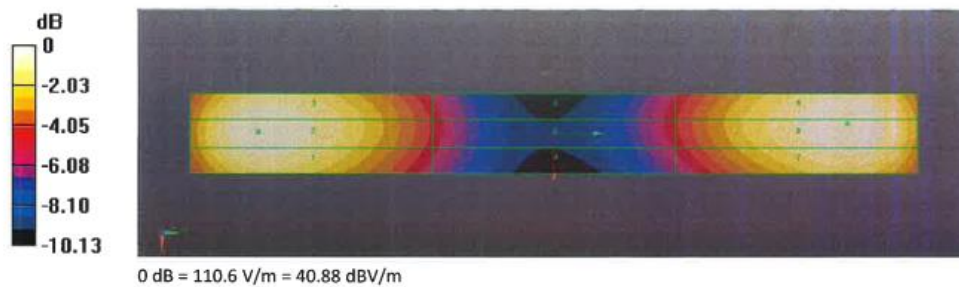
Applied MIF = 0.00 dB

RF audio interference level = 40.88 dBV/m

**Emission category: M3**

MIF scaled E-field

Grid 1 M3	Grid 2 M3	Grid 3 M3
40.55 dBV/m	40.85 dBV/m	40.73 dBV/m
Grid 4 M4	Grid 5 M4	Grid 6 M4
35.78 dBV/m	36.06 dBV/m	36.04 dBV/m
Grid 7 M3	Grid 8 M3	Grid 9 M3
40.41 dBV/m	40.88 dBV/m	40.85 dBV/m



CD1880V3

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



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 Swiss Calibration Service

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Accreditation No.: SCS 0108

Client **SAICT**  
 Shenzhen

Certificate No. CD1880V3-1149\_Apr24

## CALIBRATION CERTIFICATE

Object CD1880V3 - SN: 1149

Calibration procedure(s) QA CAL-20.v7  
 Calibration Procedure for Validation Sources in air

Calibration date: April 15, 2024

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Probe EF3DV3	SN: 4013	28-Dec-23 (No. EF3-4013_Dec23)	Dec-24
DAE4	SN: 781	16-Feb-24 (No. DAE4-781_Feb24)	Feb-25
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter Agilent 4419B	SN: GB42420191	09-Oct-09 (in house check Nov-23)	In house check: Nov-24
Power sensor HP E4412A	SN: US38485102	05-Jan-10 (in house check Nov-23)	In house check: Nov-24
Power sensor HP 8482A	SN: US37295597	09-Oct-09 (in house check Nov-23)	In house check: Nov-24
RF generator R&S SMT-06	SN: 837633/005	10-Jan-19 (in house check Nov-23)	In house check: Nov-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Calibrated by:	Name Aidonia Georgiadou	Function Laboratory Technician	Signature 
Approved by:	Sven Kühn	Technical Manager	

Issued: April 17, 2024

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Accreditation No.: **SCS 0108**

#### References

- [1] ANSI-C63.19-2019 (ANSI-C63.19-2011)  
American National Standard, Methods of Measurement of Compatibility between Wireless Communications  
Devices and Hearing Aids.

#### Methods Applied and Interpretation of Parameters:

- **Coordinate System:** y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with the standards [1], the measurement planes (probe sensor center) are selected to be at a distance of 15 mm above the top metal edge of the dipole arms.
- **Measurement Conditions:** Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- **Antenna Positioning:** The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections. It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY5 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- **Feed Point Impedance and Return Loss:** These parameters are measured using a Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminated by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- **E-field distribution:** E field is measured in the x-y-plane with an isotropic E-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 15 mm (in z) above the metal top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, in the plane above the dipole surface.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

### Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.4
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	15 mm	
Scan resolution	dx, dy = 5 mm	
Frequency	1880 MHz $\pm$ 1 MHz	
Input power drift	< 0.05 dB	

### Maximum Field values at 1880 MHz

E-field 15 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW input power	88.8 V/m = 38.97 dBV/m
Maximum measured above low end	100 mW input power	88.6 V/m = 38.95 dBV/m
Averaged maximum above arm	100 mW input power	<b>88.7 V/m <math>\pm</math> 12.8 % (k=2)</b>

### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters

Frequency	Return Loss	Impedance
1730 MHz	23.5 dB	54.4 $\Omega$ + 5.4 j $\Omega$
1880 MHz	22.2 dB	54.7 $\Omega$ + 6.6 j $\Omega$
1900 MHz	22.4 dB	56.6 $\Omega$ + 4.6 j $\Omega$
1950 MHz	30.8 dB	52.6 $\Omega$ - 1.4 j $\Omega$
2000 MHz	21.2 dB	44.1 $\Omega$ + 5.8 j $\Omega$

#### 3.2 Antenna Design and Handling

The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

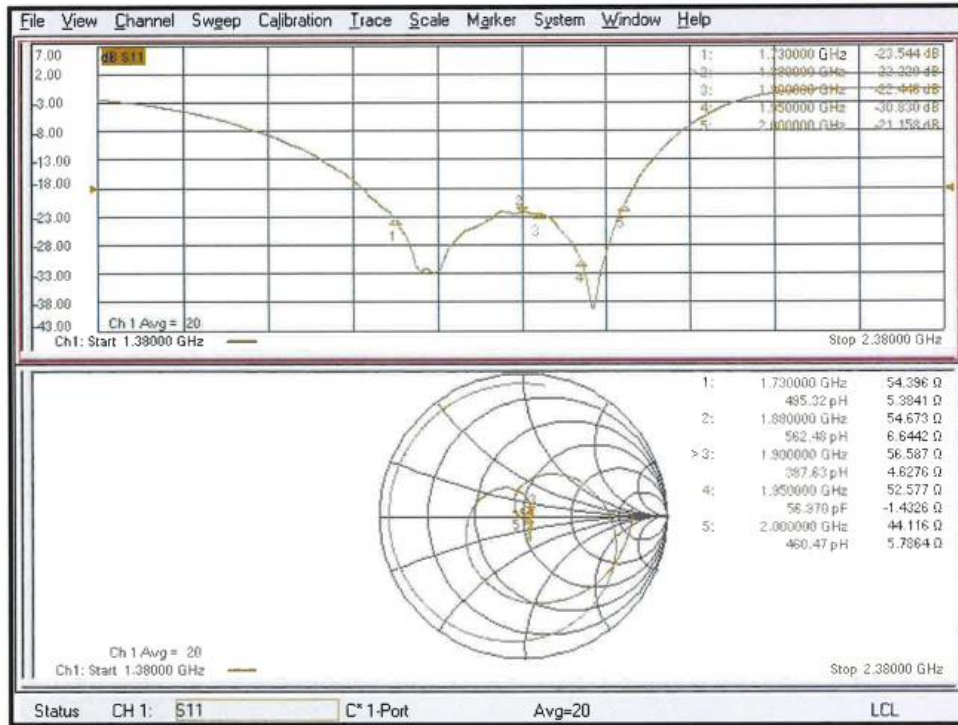
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.



### Impedance Measurement Plot



### DASY5 E-field Result

Test Laboratory: SPEAG Lab2

Date: 15.04.2024

**DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1149**

Communication System: UID 0 - CW ; Frequency: 1880 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>  
Phantom section: RF Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

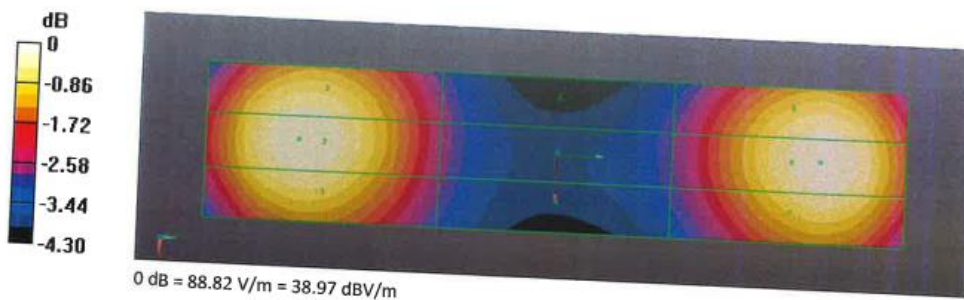
DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 1880 MHz; Calibrated: 28.12.2023
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 16.02.2024
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**Dipole E-Field measurement @ 1880MHz/E-Scan - 1880MHz d=15mm/Hearing Aid Compatibility Test (41x181x1):**  
Interpolated grid: dx=0.5000 mm, dy=0.5000 mm  
Device Reference Point: 0, 0, -6.3 mm  
Reference Value = 166.7 V/m; Power Drift = 0.02 dB  
Applied MIF = 0.00 dB  
RF audio interference level = 38.97 dBV/m  
**Emission category: M2**

MIF scaled E-field

Grid 1 M2	Grid 2 M2	Grid 3 M2
38.72 dBV/m	38.97 dBV/m	38.84 dBV/m
Grid 4 M2	Grid 5 M2	Grid 6 M2
36.29 dBV/m	36.43 dBV/m	36.41 dBV/m
Grid 7 M2	Grid 8 M2	Grid 9 M2
38.69 dBV/m	38.95 dBV/m	38.85 dBV/m



## ANNEX D: Probe Calibration Certificate

**Calibration Laboratory of**  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **SAICT**  
Shenzhen

Certificate No. **EF-4094\_Aug23**

### CALIBRATION CERTIFICATE

Object **EF3DV3 - SN:4094**

Calibration procedure(s) **QA CAL-02.v9, QA CAL-25.v8**  
Calibration procedure for E-field probes optimized for close near field  
evaluations in air

Calibration date **August 10, 2023**



This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: CC2552 (20x)	30-Mar-23 (No. 217-03809)	Mar-24
DAE4	SN: 789	03-Jan-23 (No. DAE4-789_Jan23)	Jan-24
Reference Probe ER3DV6	SN: 2328	06-Oct-22 (No. ER3-2328_Oct22)	Oct-23

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-22)	In house check: Jun-24
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by	Jeffrey Katzman	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: August 10, 2023

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



# Calibration Laboratory of Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

## Glossary

NORM <sub>x,y,z</sub>	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
E <sub>n</sub>	incident E-field orientation normal to probe axis
E <sub>p</sub>	incident E-field orientation parallel to probe axis
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\theta$	$\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

## Calibration is Performed According to the Following Standards:

- IEEE Std 1309-2005, "IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005
- CTIA Test Plan for Hearing Aid Compatibility, Rev 3.1.1, May 2017

## Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\theta = 0$  for XY sensors and  $\theta = 90$  for Z sensor ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz in R22 waveguide).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response** (see Frequency Response Chart).
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- Spherical isotropy (3D deviation from isotropy)**: in a locally homogeneous field realized using an open waveguide setup
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).

EF3DV3 - SN:4094

August 10, 2023

### Parameters of Probe: EF3DV3 - SN:4094

#### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k = 2)
Norm ( $\mu V/(V/m)^2$ )	1.01	1.05	1.85	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	106.0	102.0	103.5	$\pm 4.7\%$

#### Calibration Results for Frequency Response (30 MHz – 5.8 GHz)

Frequency MHz	Target E-field (En) V/m	Measured E-field (En) V/m	Deviation E-field (En)	Target E-field (Ep) V/m	Measured E-field (Ep) V/m	Deviation E-field (Ep)	Unc (k = 2)
30	77.1	76.9	-0.2%	77.2	77.7	0.7%	$\pm 5.1\%$
100	76.9	78.0	1.4%	77.0	78.1	1.4%	$\pm 5.1\%$
450	77.2	78.4	1.5%	76.8	77.9	1.4%	$\pm 5.1\%$
600	77.1	77.9	1.0%	77.2	77.8	0.8%	$\pm 5.1\%$
750	77.2	77.6	0.6%	77.2	77.5	0.4%	$\pm 5.1\%$
1800	143.1	140.1	-2.2%	143.2	140.2	-2.1%	$\pm 5.1\%$
2000	134.9	129.5	-4.0%	134.8	129.3	-4.0%	$\pm 5.1\%$
2200	127.5	124.4	-2.4%	127.7	125.8	-1.5%	$\pm 5.1\%$
2500	125.5	120.2	-4.2%	125.5	121.2	-3.4%	$\pm 5.1\%$
3000	79.3	76.0	-4.1%	79.3	77.2	-2.7%	$\pm 5.1\%$
3500	256.2	255.4	-0.3%	256.0	252.9	-1.2%	$\pm 5.1\%$
3700	249.6	244.1	-2.2%	249.7	242.9	-2.7%	$\pm 5.1\%$
5200	50.7	50.6	-0.3%	50.8	51.1	0.8%	$\pm 5.1\%$
5500	49.6	48.7	-1.8%	49.6	49.1	-1.0%	$\pm 5.1\%$
5800	48.9	47.9	-2.0%	48.9	47.6	-2.6%	$\pm 5.1\%$

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

<sup>B</sup> Linearization parameter uncertainty for maximum specified field strength.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

EF3DV3 - SN:4094

August 10, 2023

### Parameters of Probe: EF3DV3 - SN:4094

#### Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB $\sqrt{\mu V}$	C	D dB	VR mV	Max dev.	Max Unc <sup>E</sup> k = 2
0	CW	X	0.00	0.00	1.00	0.00	153.1	±2.7%	±4.7%
		Y	0.00	0.00	1.00		152.7		
		Z	0.00	0.00	1.00		127.1		
10352	Pulse Waveform (200Hz, 10%)	X	2.52	64.62	8.74	10.00	60.0	±3.3%	±9.6%
		Y	2.43	64.72	8.76		60.0		
		Z	2.54	64.89	8.96		60.0		
10353	Pulse Waveform (200Hz, 20%)	X	1.29	62.39	6.69	6.99	80.0	±1.1%	±9.6%
		Y	1.24	62.47	6.70		80.0		
		Z	1.23	62.42	6.80		80.0		
10354	Pulse Waveform (200Hz, 40%)	X	24.00	80.00	11.00	3.98	95.0	±1.1%	±9.6%
		Y	22.00	80.00	11.00		95.0		
		Z	22.00	80.00	11.00		95.0		
10355	Pulse Waveform (200Hz, 60%)	X	0.31	60.15	3.79	2.22	120.0	±1.0%	±9.6%
		Y	0.37	60.75	4.00		120.0		
		Z	0.27	60.00	3.82		120.0		
10387	QPSK Waveform, 1 MHz	X	0.72	69.10	15.26	1.00	150.0	±3.3%	±9.6%
		Y	1.05	71.53	16.10		150.0		
		Z	1.17	75.01	18.10		150.0		
10388	QPSK Waveform, 10 MHz	X	1.55	68.82	15.27	0.00	150.0	±1.2%	±9.6%
		Y	1.70	68.81	15.69		150.0		
		Z	1.76	70.21	16.41		150.0		
10396	64-QAM Waveform, 100 kHz	X	1.98	67.65	17.49	3.01	150.0	±1.0%	±9.6%
		Y	1.86	66.61	17.34		150.0		
		Z	1.67	65.01	16.62		150.0		
10399	64-QAM Waveform, 40 MHz	X	2.86	66.98	15.51	0.00	150.0	±2.2%	±9.6%
		Y	3.00	66.89	15.62		150.0		
		Z	2.99	67.30	15.87		150.0		
10414	WLAN CCDF, 64-QAM, 40 MHz	X	3.80	66.48	15.52	0.00	150.0	±3.7%	±9.6%
		Y	4.03	66.35	15.69		150.0		
		Z	3.96	66.58	15.79		150.0		

Note: For details on UID parameters see Appendix

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

<sup>B</sup> Linearization parameter uncertainty for maximum specified field strength.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



EF3DV3 - SN:4094

August 10, 2023

**Parameters of Probe: EF3DV3 - SN:4094****Sensor Frequency Model Parameters**

	Sensor X	Sensor Y	Sensor Z
Frequency Corr. (LF)	-0.28	-0.17	10.96
Frequency Corr. (HF)	2.82	2.82	2.82

**Sensor Model Parameters**

	C1 fF	C2 fF	$\alpha$ $V^{-1}$	T1 $ms V^{-2}$	T2 $ms V^{-1}$	T3 ms	T4 $V^{-2}$	T5 $V^{-1}$	T6
x	9.9	62.18	33.37	5.87	0.00	4.96	0.64	0.00	1.00
y	12.8	82.36	35.07	5.66	0.00	4.96	0.39	0.00	1.00
z	11.6	73.13	34.05	4.71	0.00	4.96	0.00	0.03	1.00

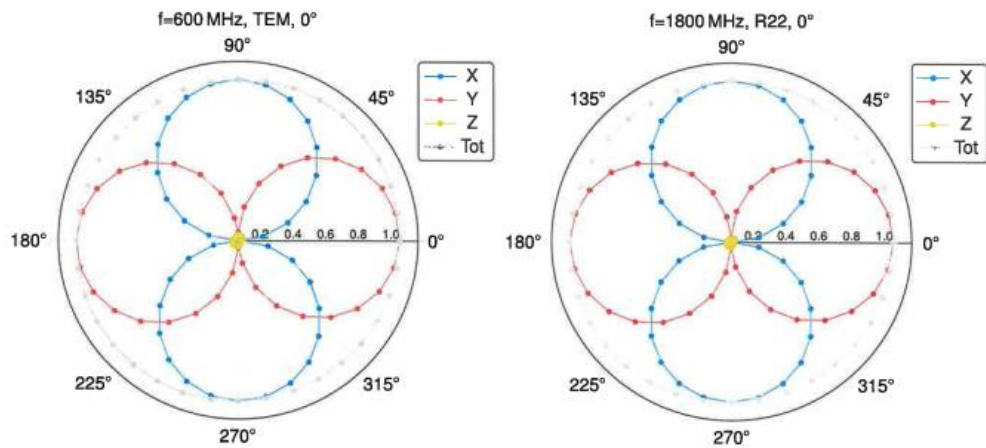
**Other Probe Parameters**

Sensor Arrangement	Rectangular
Connector Angle	-148.8°
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	12 mm
Tip Length	25 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	1.5 mm
Probe Tip to Sensor Y Calibration Point	1.5 mm
Probe Tip to Sensor Z Calibration Point	1.5 mm

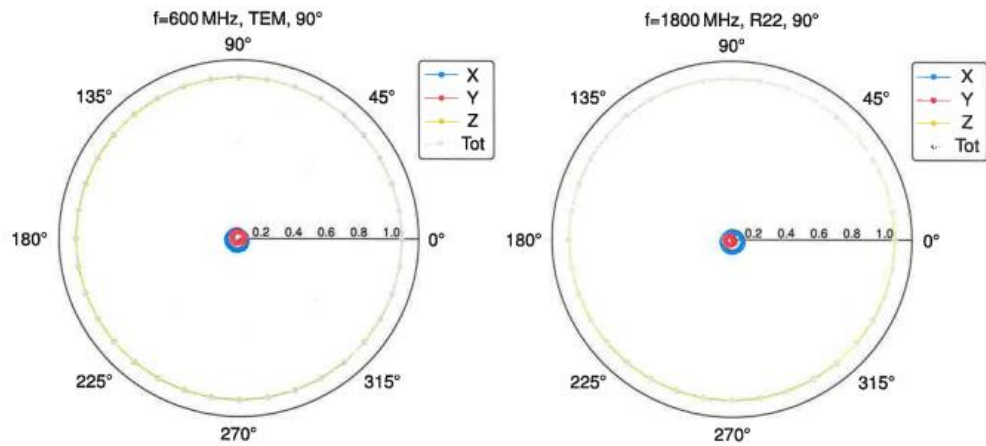
EF3DV3 - SN:4094

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### Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



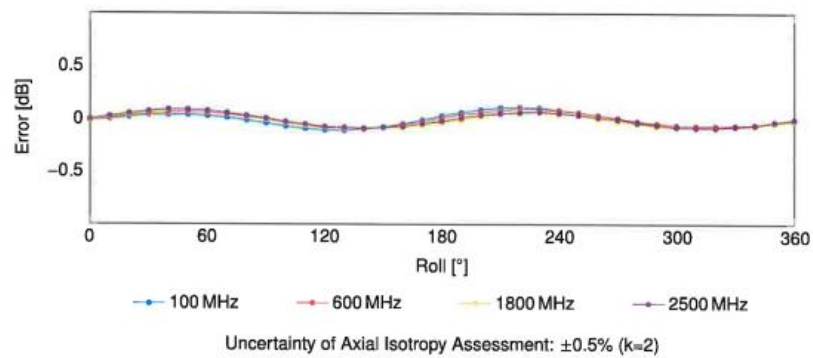
### Receiving Pattern ( $\phi$ ), $\theta = 90^\circ$



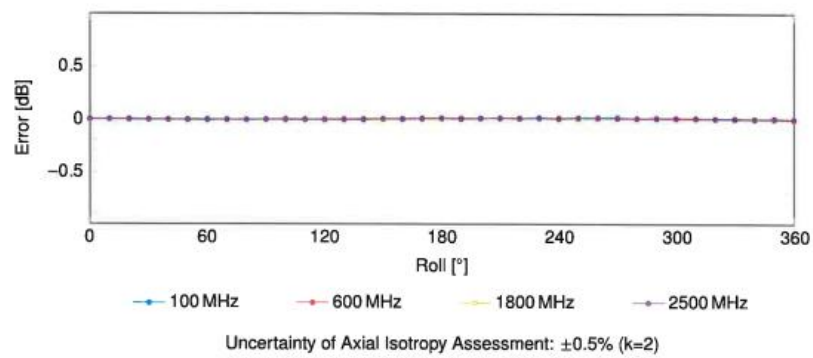
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### Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$

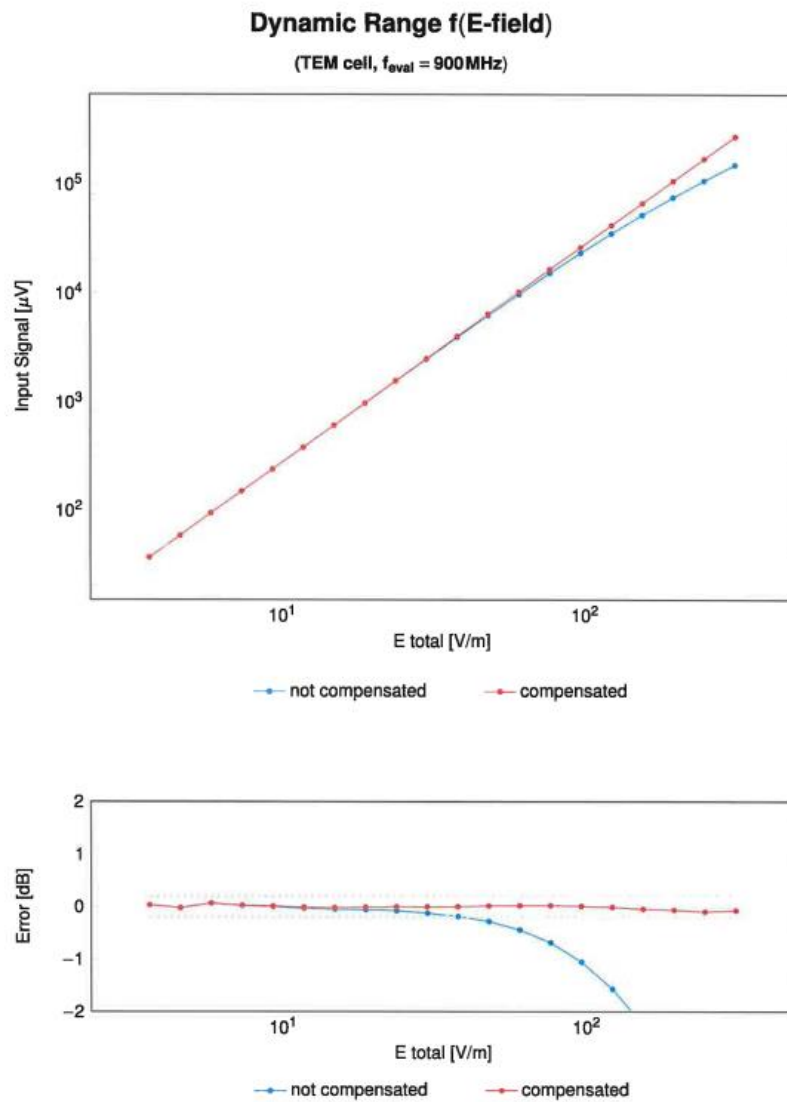


### Receiving Pattern ( $\phi$ ), $\theta = 90^\circ$

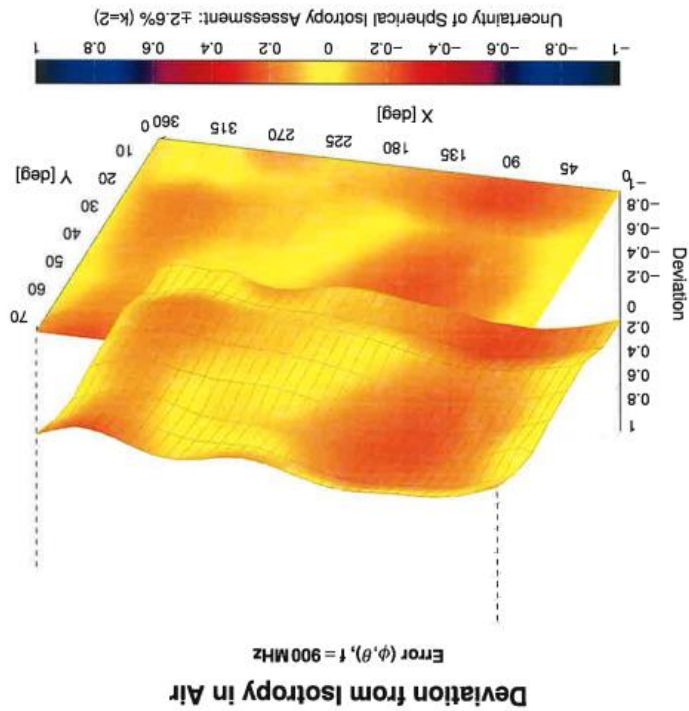


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Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )





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## Appendix: Modulation Calibration Parameters

UID	Rev	Communication System Name	Group	PAR (dB)	Unc <sup>E</sup> k = 2
0		CW	CW	0.00	±4.7
10010	CAB	SAR Validation (Square, 100 ms, 10 ms)	Test	10.00	±9.6
10011	CAC	UMTS-FDD (WCDMA)	WCDMA	2.91	±9.6
10012	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	WLAN	1.87	±9.6
10013	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	WLAN	9.46	±9.6
10021	DAC	GSM-FDD (TDMA, GMSK)	GSM	9.39	±9.6
10023	DAC	GPRS-FDD (TDMA, GMSK, TN 0)	GSM	9.57	±9.6
10024	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	GSM	6.56	±9.6
10025	DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	GSM	12.62	±9.6
10026	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	GSM	9.55	±9.6
10027	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	GSM	4.80	±9.6
10028	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	GSM	3.55	±9.6
10029	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	GSM	7.78	±9.6
10030	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	Bluetooth	5.30	±9.6
10031	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	Bluetooth	1.87	±9.6
10032	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	Bluetooth	1.16	±9.6
10033	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	Bluetooth	7.74	±9.6
10034	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	Bluetooth	4.53	±9.6
10035	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	Bluetooth	3.83	±9.6
10036	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	Bluetooth	8.01	±9.6
10037	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	Bluetooth	4.77	±9.6
10038	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	Bluetooth	4.10	±9.6
10039	CAB	CDMA2000 (1xRTT, RC1)	CDMA2000	4.57	±9.6
10042	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	AMPS	7.78	±9.6
10044	CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	AMPS	0.00	±9.6
10048	CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	DECT	13.80	±9.6
10049	CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	DECT	10.79	±9.6
10056	CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	TD-SCDMA	11.01	±9.6
10058	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	GSM	6.52	±9.6
10059	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	WLAN	2.12	±9.6
10060	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	WLAN	2.83	±9.6
10061	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	WLAN	3.60	±9.6
10062	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	WLAN	8.68	±9.6
10063	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	WLAN	8.63	±9.6
10064	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	WLAN	9.09	±9.6
10065	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	WLAN	9.00	±9.6
10066	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	WLAN	9.38	±9.6
10067	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	WLAN	10.12	±9.6
10068	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	WLAN	10.24	±9.6
10069	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	WLAN	10.56	±9.6
10071	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	WLAN	9.83	±9.6
10072	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	WLAN	9.62	±9.6
10073	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	WLAN	9.94	±9.6
10074	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	WLAN	10.30	±9.6
10075	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	WLAN	10.77	±9.6
10076	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	WLAN	10.94	±9.6
10077	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	WLAN	11.00	±9.6
10081	CAB	CDMA2000 (1xRTT, RC3)	CDMA2000	3.97	±9.6
10082	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	AMPS	4.77	±9.6
10090	DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	GSM	6.56	±9.6
10097	CAC	UMTS-FDD (HSDPA)	WCDMA	3.98	±9.6
10098	CAC	UMTS-FDD (HSUPA, Subtest 2)	WCDMA	3.98	±9.6
10099	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	GSM	9.55	±9.6
10100	CAF	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-FDD	5.67	±9.6
10101	CAF	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	±9.6
10102	CAF	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	±9.6
10103	CAH	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-TDD	9.29	±9.6
10104	CAH	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-TDD	9.97	±9.6
10105	CAH	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-TDD	10.01	±9.6
10108	CAH	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-FDD	5.80	±9.6
10109	CAH	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	±9.6
10110	CAH	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-FDD	5.75	±9.6
10111	CAH	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-FDD	6.44	±9.6

Certificate No: EF-4094\_Aug23

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August 10, 2023

UID	Rev	Communication System Name	Group	PAR (dB)	Unc <sup>E</sup> k = 2
10112	CAH	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-FDD	6.59	±9.6
10113	CAH	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-FDD	6.62	±9.6
10114	CAD	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	WLAN	8.10	±9.6
10115	CAD	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	WLAN	8.46	±9.6
10116	CAD	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	WLAN	8.15	±9.6
10117	CAD	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	WLAN	8.07	±9.6
10118	CAD	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	WLAN	8.59	±9.6
10119	CAD	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	WLAN	8.13	±9.6
10140	CAF	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-FDD	6.49	±9.6
10141	CAF	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-FDD	6.53	±9.6
10142	CAF	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-FDD	5.73	±9.6
10143	CAF	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-FDD	6.35	±9.6
10144	CAF	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-FDD	6.65	±9.6
10145	CAG	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-FDD	5.76	±9.6
10146	CAG	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.41	±9.6
10147	CAG	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.72	±9.6
10149	CAF	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	±9.6
10150	CAF	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	±9.6
10151	CAH	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-TDD	9.28	±9.6
10152	CAH	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-TDD	9.92	±9.6
10153	CAH	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-TDD	10.05	±9.6
10154	CAH	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-FDD	5.75	±9.6
10155	CAH	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	±9.6
10156	CAH	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-FDD	5.79	±9.6
10157	CAH	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-FDD	6.49	±9.6
10158	CAH	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-FDD	6.62	±9.6
10159	CAH	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-FDD	6.56	±9.6
10160	CAF	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-FDD	5.82	±9.6
10161	CAF	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-FDD	6.43	±9.6
10162	CAF	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-FDD	6.58	±9.6
10166	CAG	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-FDD	5.46	±9.6
10167	CAG	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.21	±9.6
10168	CAG	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.79	±9.6
10169	CAF	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-FDD	5.73	±9.6
10170	CAF	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-FDD	6.52	±9.6
10171	AAF	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-FDD	6.49	±9.6
10172	CAH	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-TDD	9.21	±9.6
10173	CAH	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-TDD	9.48	±9.6
10174	CAH	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-TDD	10.25	±9.6
10175	CAH	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-FDD	5.72	±9.6
10176	CAH	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-FDD	6.52	±9.6
10177	CAJ	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-FDD	5.73	±9.6
10178	CAH	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-FDD	6.52	±9.6
10179	CAH	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-FDD	6.50	±9.6
10180	CAH	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-FDD	6.50	±9.6
10181	CAF	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-FDD	5.72	±9.6
10182	CAF	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-FDD	6.52	±9.6
10183	AAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-FDD	6.50	±9.6
10184	CAF	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-FDD	5.73	±9.6
10185	CAF	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-FDD	6.51	±9.6
10186	AAF	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-FDD	6.50	±9.6
10187	CAG	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-FDD	5.73	±9.6
10188	CAG	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.52	±9.6
10189	AAG	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.50	±9.6
10193	CAD	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	WLAN	8.09	±9.6
10194	CAD	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	WLAN	8.12	±9.6
10195	CAD	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	WLAN	8.21	±9.6
10196	CAD	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	WLAN	8.10	±9.6
10197	CAD	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	WLAN	8.13	±9.6
10198	CAD	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	WLAN	8.27	±9.6
10219	CAD	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	WLAN	8.03	±9.6
10220	CAD	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	WLAN	8.13	±9.6
10221	CAD	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	WLAN	8.27	±9.6
10222	CAD	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	WLAN	8.06	±9.6
10223	CAD	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	WLAN	8.48	±9.6
10224	CAD	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	WLAN	8.08	±9.6

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UID	Rev	Communication System Name	Group	PAR (dB)	Unc <sup>5</sup> K = 2
10225	CAC	UMTS-FDD (HS-PA+)	WCDMA	5.97	±9.6
10226	CAC	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.49	±9.6
10227	CAC	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.26	±9.6
10228	CAC	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-TDD	9.22	±9.6
10229	CAE	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-TDD	9.48	±9.6
10230	CAE	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-TDD	10.25	±9.6
10231	CAE	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-TDD	9.19	±9.6
10232	CAH	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-TDD	9.48	±9.6
10233	CAH	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-TDD	10.25	±9.6
10234	CAH	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-TDD	9.21	±9.6
10235	CAH	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-TDD	9.21	±9.6
10236	CAH	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-TDD	9.48	±9.6
10237	CAH	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-TDD	9.21	±9.6
10238	CAG	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	±9.6
10239	CAG	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	±9.6
10240	CAG	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	±9.6
10241	CAC	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.82	±9.6
10242	CAC	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-TDD	9.86	±9.6
10243	CAC	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-TDD	9.46	±9.6
10244	CAE	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-TDD	10.06	±9.6
10245	CAE	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-TDD	10.06	±9.6
10246	CAE	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-TDD	9.30	±9.6
10247	CAH	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-TDD	9.91	±9.6
10248	CAH	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-TDD	10.09	±9.6
10249	CAH	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-TDD	9.29	±9.6
10250	CAH	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-TDD	9.81	±9.6
10251	CAH	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-TDD	10.17	±9.6
10252	CAH	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-TDD	9.24	±9.6
10253	CAG	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.90	±9.6
10254	CAG	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.14	±9.6
10255	CAG	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.20	±9.6
10256	CAC	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.96	±9.6
10257	CAC	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.08	±9.6
10258	CAC	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-TDD	9.34	±9.6
10259	CAE	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-TDD	9.98	±9.6
10260	CAE	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-TDD	9.97	±9.6
10261	CAE	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-TDD	9.24	±9.6
10262	CAH	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-TDD	9.83	±9.6
10263	CAH	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-TDD	10.16	±9.6
10264	CAH	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-TDD	9.23	±9.6
10265	CAH	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-TDD	9.92	±9.6
10266	CAH	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-TDD	10.07	±9.6
10267	CAH	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-TDD	9.30	±9.6
10268	CAG	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	10.06	±9.6
10269	CAG	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-TDD	10.13	±9.6
10270	CAG	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.58	±9.6
10274	CAC	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel14)	WCDMA	4.87	±9.6
10275	CAC	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel14)	WCDMA	3.96	±9.6
10277	CAH	PHS (QPSK)	PHS	11.81	±9.6
10278	CAH	PHS (QPSK, BW 884 MHz, Roll-off 0.5)	PHS	11.81	±9.6
10279	CAH	PHS (QPSK, BW 884 MHz, Roll-off 0.38)	PHS	12.18	±9.6
10290	AAB	CDMA2000, RC1, SO5, Full Rate	CDMA2000	3.91	±9.6
10291	AAB	CDMA2000, RC3, SO5, Full Rate	CDMA2000	3.46	±9.6
10292	AAB	CDMA2000, RC3, SO32, Full Rate	CDMA2000	3.39	±9.6
10293	AAB	CDMA2000, RC3, SO3, Full Rate	CDMA2000	3.50	±9.6
10295	AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 ft.	CDMA2000	12.49	±9.6
10297	AAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-FDD	5.81	±9.6
10298	AAE	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-FDD	5.72	±9.6
10299	AAE	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-FDD	6.39	±9.6
10300	AAE	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-FDD	6.60	±9.6
10301	AAA	IEEE 802.16e WIMAX (29:18, 5 ms, 10 MHz, QPSK, PUSC)	WIMAX	12.03	±9.6
10302	AAA	IEEE 802.16e WIMAX (29:18, 5 ms, 10 MHz, QPSK, PUSC, 3 CTRL symbols)	WIMAX	12.57	±9.6
10303	AAA	IEEE 802.16e WIMAX (31:15, 5 ms, 10 MHz, 64-QAM, PUSC)	WIMAX	12.52	±9.6
10304	AAA	IEEE 802.16e WIMAX (29:18, 5 ms, 10 MHz, 64-QAM, PUSC)	WIMAX	11.86	±9.6
10305	AAA	IEEE 802.16e WIMAX (31:15, 10 ms, 10 MHz, 64-QAM, PUSC, 15 symbols)	WIMAX	15.24	±9.6
10306	AAA	IEEE 802.16e WIMAX (29:18, 10 ms, 10 MHz, 64-QAM, PUSC, 18 symbols)	WIMAX	14.67	±9.6