





# **TEST REPORT**

## No.I20N02439-HAC RF

For

TCL Communication Ltd.

## LTE/UMTS/GSM Smartphone

Model Name: 4187M

With

## Hardware Version: FS180-MB-V0.2A

## Software Version: 4187M\_LCAR\_1SIM\_V1.0\_20200814\_UNLOCK

## FCC ID: 2ACCJB118

## **Results Summary: M Category = M3**

## Issued Date: 2020-09-18

#### 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.

#### **Test Laboratory:**

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## **REPORT HISTORY**

Report Number	Revision	Description	Issue Date
I20N02439-HAC RF	Rev.0	1st edition	2020-09-18

This EUT is a variant product and the report of original sample is No.I20N00391-HAC RF. According to client's description, all results are cited from the initial model.





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## 1. Summary of Test Report

#### 1.1. Test Items

Description	LTE/UMTS/GSM Smartphone
Model Name	4187M
Applicant's name	TCL Communication Ltd.
Manufacturer's Name	TCL Communication Ltd.

### 1.2. Test Standards

ANSI C63.19-2011

#### 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 518026

#### 1.5. Project Data

Testing Start Date: 2020-03-12

Testing End Date: 2020-03-12

#### 1.6. Signature

孝闲富

Li Yongfu (Prepared this test report)

史派化

Cao Junfei (Approved this test report)

Zhang Yunzhuan (Reviewed this test report)





## 2. Client Information

## 2.1. Applicant Information

Company Name:	TCL Communication Ltd.
Address /Post:	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science
Address /Post.	Park, Shatin, NT, Hong Kong
City:	/
Country:	/
Telephone:	0086-755-36611722

### 2.2. Manufacturer Information

Company Name:	TCL Communication Ltd.
Address /Post:	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science
	Park, Shatin, NT, Hong Kong
City:	/
Country:	/
Telephone:	0086-755-36611722





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

#### 3.1. About EUT

Description:	LTE/UMTS/GSM Smartphone
Model Name:	4187M
Marketing Name:	TCL L10 Lite
	GSM850/1900, WCDMA Band2/4/5, LTE Band2/4/7,Bluetooth,
Operating mode(s): WLAN2.4G	WLAN2.4G
Condition of EUT as received	No obvious damage in appearance

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

EUT ID*	ID*         IMEI         HW Version		SW Version	
	IT0600 254927110000202/01 ES190 MP \/0.2		5030J_OFAR_1SIM_V1.4_20200	
UT06aa	354827110000203/01	FS180-MB-V0.2	331_UNLOCK	

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

Note: It is performed to test HAC with the UT06aa.

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

AE ID*	Description	Туре	Manufacturer	
AE1	Battery	TLp038D7	VENKE	
AE2	Battery	TLp038DA	TIANMAO	

\*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)	Туре	C63.19 / tested	Simultaneous Transmissions	Name of Voice Service	Power Reduction
GSM	850 /1900	VO	Yes	BT,WLAN	CMRS Voice	
EDGE	850 /1900	DT	No	BT,WLAN	NA	No
	B2 / B4/ B5	VO	Yes	BT,WLAN	CMRS Voice	Ne
WCDMA	HDSPA	VD	Yes	BT,WLAN	Google Duo	No
LTE (FDD)	2/4/7	VD	Yes	BT,WLAN	VoLTE Google Duo	No
WLAN	2.4G	VD	Yes	WWAN	Google Duo	No
BT	2.4G	DT	No	WWAN	NA	No

VO: Voice CMRS/PSTN Service Only

VD: Voice CMRS/PSTN and Data Service

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





## 4. Reference Documents

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
KDB 285076 D01	Equipment Authorization Guidance for Hearing Aid Compatibility	v05





## **5. Operational Conditions During Test**

#### 5.1. 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 Core2 1.86 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.

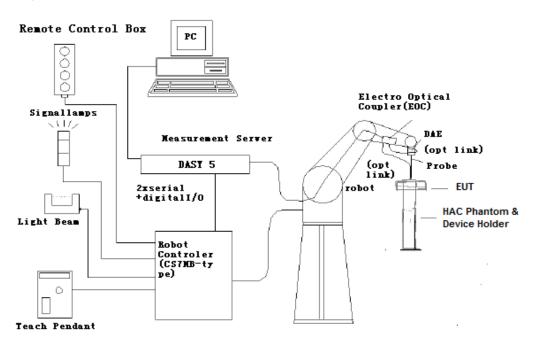


Fig. 1 HAC Test Measurement Set-up

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.





## 5.2. Probe Specification

#### E-Field Probe Description

Construction Calibration	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges PEEK enclosure material In air from 100 MHz to 3.0 GHz (absolute accuracy ±6.0%, k=2)	A A A A A A A A A A A A A A A A A A A
Frequency	40 MHz to > 6 GHz (can be extended to < 20 MHz) Linearity: ± 0.2 dB (100 MHz to 3 GHz)	[ER3DV6]
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: 330 mm (Tip: 16 mm) Tip diameter: 8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.5 mm	
Application	General near-field measurements up to 6 GHz Field component measurements Fast automatic scanning in phantoms	





#### 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).

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

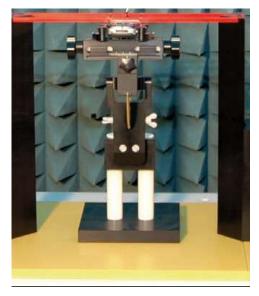


Fig. 2 HAC Phantom & Device Holder

### 5.4. Robotic System Specifications

#### Specifications

Positioner: Stäubli Unimation Corp. Robot Model: RX160XL Repeatability: ±0.02 mm No. of Axis: 6 Data Acquisition Electronic (DAE) System Cell Controller Processor: Intel Core2 Clock Speed: 1.86 GHz 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





## 6. EUT Arrangement

#### 6.1. 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.

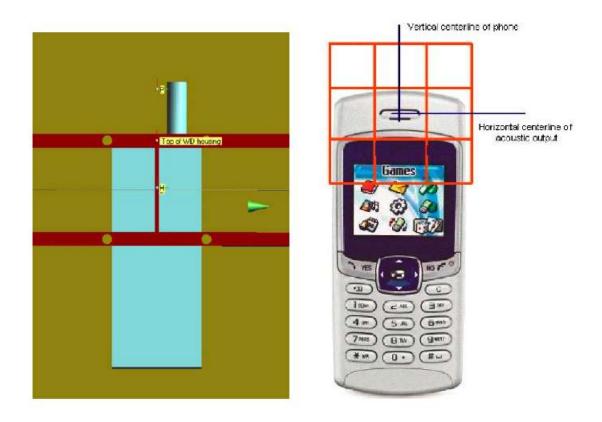


Fig. 3 WD reference and plane for RF emission measurements





## 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.

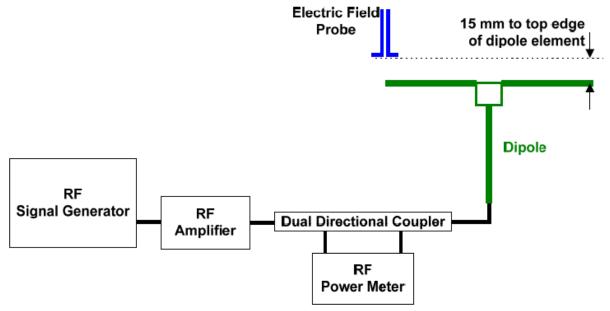


Fig. 4 Dipole Validation Setup

#### 7.2. Validation Result

E-Field Scan							
Made         Frequency         Input Power         Measured <sup>1</sup> Target <sup>2</sup> Deviation <sup>3</sup> Lin						Limit⁴	
Mode	(MHz)	(mW)	Value(dBV/m)	Value(dBV/m)	(%)	(%)	
CW	835	100	42.16	40.72	3.5	±25	
CW	1880	100	39.59	39.06	1.4	±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  $\pm$  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.





## 8. Modulation Interference Factor (MIF)

The HAC Standard ANSI C63.19-2011 defines a new scaling using the Modulation Interference Factor (MIF) which replaces the need for the Articulation Weighting Factor (AWF) during the evaluation and is applicable to any modulation scheme.

The Modulation Interference factor (MIF, in dB) is added to the measured average E-field (in dBV/m) and converts it to the RF Audio Interference level (in dBV/m). This level considers the audible amplitude modulation components in the RF E-field. CW fields without amplitude modulation are assumed to not interfere with the hearing aid electronics. Modulations without time slots and low fluctuations at low frequencies have low MIF values, TDMA modulations with narrow transmission and repetition rates of few 100 Hz have high MIF values and give similar classifications as ANSI C63-2007.

#### Definitions

ER3D, E-field probes have a bandwidth <10 kHz and can therefore not evaluate the RF envelope in the full audio band. DASY52 is therefore using the "indirect" measurement method according to ANSI C63.19-2011 which is the primary method. These near field probes read the averaged E-field measurement. Especially for the new high peak-to-average (PAR) signal types, the probes shall be linearized by probe modulation response (PMR) calibration in order to not overestimate the field reading.

The evaluation method or the MIF is defined in ANSI C63.19-2011 section D.7. An RMS demodulated RF signal is fed to a spectral filter (similar to an A weighting filter) and forwarded to a temporal filter acting as a quasi-peak detector. The averaged output of these filtering is called to a 1 kHz 80% AM signal as reference. MIF measurement requires additional instrumentation and is not well suited for evaluation by the end user with reasonable uncertainty It may alternatively be determined through analysis and simulation, because it is constraint and characteristic for a communication signal. DASY52 uses well defined signals for PMR calibration. The MIF of these signals has been determined by simulation and is automatically applied.

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

UID	Communication System Name	MIF (dB)
10021	GSM-FDD (TDMA, GMSK)	3.63
10011	UMTS-FDD (WCDMA)	-27.23
10097	UMTS-FDD (HSDPA)	-20.75
10170	LTE-FDD(SC-FDMA, 1RB, 20MHz, 16-QAM)	-9.76
10176	LTE-FDD(SC-FDMA, 1RB, 10MHz, 16-QAM)	-9.76
10061	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	-2.02

A PMR calibrated probe is linearized for the selected waveform over the full dynamic range within the uncertainty specified in its calibration certificate. ER3D, EF3D and EU2D E-field probes have a ©Copyright. All rights reserved by SAICT. Page 14 of 61





bandwidth <10 kHz and can therefore not evaluate the RF envelope in the full audio band. DASY52 is therefore using the \indirect" measurement method according to ANSI C63.19-2011 which is the primary method. These near field probes read the averaged E-field measurement. Especially for the new high peak-to-average (PAR) signal types, the probes shall be linearized by PMR calibration in order to not overestimate the field reading.

The MIF measurement uncertainty is estimated as follows, for modulation frequencies from slotted waveforms with fundamental frequency and at least 2 harmonics within 10 kHz:

0.2 dB for MIF -7 to +5 dB, 0.5 dB for MIF -13 to +11 dB 1 dB for MIF > -20 dB





## 9. Evaluation for low-power exemption

#### 9.1. 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  $\leq$ 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  $\leq$ 50 µs20, is  $\leq$ 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.

Band	power (dBm)	MIF (dB)	Sum (dBm)	HAC Test
GSM 850	34.0	3.63	37.63	Yes
GSM 1900	30.5	3.63	34.13	Yes
WCDMA B2	24.0	-27.23	-3.23	No
WCDMA B2 -HSDPA	24.0	-20.75	3.25	No
WCDMA B4	24.0	-27.23	-3.23	No
WCDMA B4 -HSDPA	23.0	-20.75	2.25	No
WCDMA B5	23.5	-27.23	-3.73	No
WCDMA B5 -HSDPA	23.0	-20.75	2.25	No
LTE Band 2	24.0	-9.76	14.24	No
LTE Band 4	24.0	-9.76	14.24	No
LTE Band 7	24.0	-9.76	14.24	No
WIFI 2.4G	13.0	-2.02	10.98	No

#### 9.2. Conducted power

Note:

1. Power = Max tune-up limit.





## **10. RF 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) 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 the 50 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.





## 11. Measurement Results (E-Field)

Free	quency	Measured Value	Power Drift	Cotogony			
MHz	Channel	(dBV/m)	(dB)	Category			
	GSM 850						
848.8	251	37.56	-0.02	M4 (see Fig A.1)			
836.6	190	37.18	-0.01	M4 (see Fig A.2)			
824.2	128	37.51	-0.04	M4 (see Fig A.3)			
		GSM 19	00				
1909.8	810	32.49	-0.05	M3 (see Fig A.4)			
1880	661	31.54	-0.08	M3 (see Fig A.5)			
1850.2	512	31.67	-0.03	M3 (see Fig A.6)			

## 12. ANSI C 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	> 96	60 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)			





## **13. Measurement Uncertainty**

No.	Error source	Туре	Uncert ainty Value (%)	Prob. Dist.	k	C <sub>i</sub> E	Standard Uncertainty (%) $u_i^{(\%)}$ E	Degree of freedom V <sub>eff</sub> or v <sub>i</sub>	source
1	System repeatability	А	0.24	Ν	1	1	0.24	9	Measurement
Meas	surement System								
2	Probe Calibration	В	10.1	N	1	1	10.1	8	Manufacturer
3	Axial Isotropy	В	0.5	R	$\sqrt{3}$	1	0.5	8	Cal report
4	Sensor Displacement	В	16.5	R	$\sqrt{3}$	1	9.5	8	Manufacturer
5	Boundary Effects	В	2.4	R	$\sqrt{3}$	1	1.4	8	Manufacturer
6	Linearity	В	0.6	R	$\sqrt{3}$	1	0.35	8	Cal report
7	Scaling to Peak Envolope Power	В	2.0	R	$\sqrt{3}$	1	1.2	œ	Standard
8	System Detection Limit	В	1.0	R	$\sqrt{3}$	1	0.6	∞	Manufacturer
9	Readout Electronics	В	0.3	Ν	1	1	0.3	∞	Manufacturer
10	Response Time	В	0.8	R	$\sqrt{3}$	1	0.5	∞	Manufacturer
11	Integration Time	В	2.6	R	$\sqrt{3}$	1	1.5	∞	Manufacturer
12	RF Ambient Conditions	В	3.0	R	$\sqrt{3}$	1	1.7	∞	Measurement
13	RF Reflections	В	12.0	R	$\sqrt{3}$	1	6.9	∞	Measurement
14	Probe Positioner	А	1.2	R	$\sqrt{3}$	1	0.7	8	Manufacturer
15	Probe Positioning	А	4.7	R	$\sqrt{3}$	1	2.7	8	Manufacturer
16	Extra. And Interpolation	В	1.0	R	$\sqrt{3}$	1	0.6	8	Manufacturer
Test	Sample Related								
17	Device Positioning Vertical	В	4.7	R	$\sqrt{3}$	1	2.7	8	Manufacturer
18	Device Positioning Lateral	В	1.0	R	$\sqrt{3}$	1	0.6	∞	Manufacturer
19	Device Holder and Phantom	В	2.4	R	$\sqrt{3}$	1	1.4	∞	Manufacturer
20	Power Drift	В	5.0	R	$\sqrt{3}$	1	2.9	∞	Measurement
Phar	ntom and Setup related								
21	Phantom Thickness	В	2.4	R	$\sqrt{3}$	1	1.4	∞	Manufacturer
PMF	PMF related								
22	Monitor amplitude	В	3.5	R	$\sqrt{3}$	1	2.02	∞	Manufacturer
23	Setup repeatability	А	2.3	Ν	1	1	2.3	9	Manufacturer
24	Sensor amplitude	В	12	R	$\sqrt{3}$	1	6.93	∞	Manufacturer
	Combined standard uncertaint	y(%)					18.3		
	Expanded uncertainty (confidence interval of 95 %)	u <sub>e</sub>	$=2u_c$	Ν	k=	=2	36.6		





## 14. Main Test Instruments

No.	Name	Туре	Serial Number	Calibration Date	Valid Period		
01	Signal Generator	E8257D	MY47461211	2019-06-03	One year		
02	Power meter	E4418B	MY50000366	2019-12-14	One veer		
03	Power sensor	E9304A	MY50000188	2019-12-14	One year		
04	Amplifier	VTL5400	0404	/			
05	HAC Test Arch	N/A	1150	/			
06	DAE	DAE4	786	2020-03-03	One year		
07	E-Field Probe	ER3DV6	2424	2018-02-23	Three year		
08	HAC Dipole	CD835V3	1165	2018-07-19	Three year		
09	HAC Dipole	CD1880V3	1149	2018-07-19	Three year		
10	BTS	CMU200	114544	2019-09-02	One year		
11	Software	DASY5	52.8.8.1222	/	/		

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





## ANNEX A: RF Emission Test Plot

#### HAC RF E-Field GSM 850 High

Date: 2020-3-12 Electronics: DAE4 Sn786 Medium: Air Medium parameters used:  $\sigma = 0$  S/m,  $\varepsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup> Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C Communication System: UID 0, GSM Frequency: 848.8 MHz Duty Cycle: 1:8.3 Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

#### 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

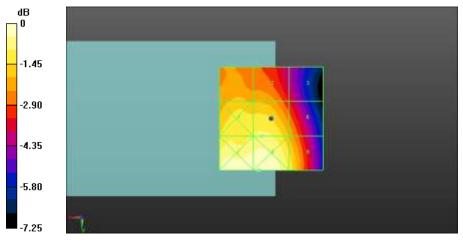
Reference Value = 57.95 V/m; Power Drift = -0.02 dB

Applied MIF = 3.63 dB

RF audio interference level = 37.56 dBV/m

**Emission category: M4** 

Grid 1 <b>M4</b>	Grid 2 <b>M4</b>	Grid 3 <b>M4</b>
36.63 dBV/m	36.42 dBV/m	35.03 dBV/m
Grid 4 M4	Grid 5 <b>M4</b>	Grid 6 <b>M4</b>
37.48 dBV/m	37.56 dBV/m	36.47 dBV/m
Grid 7 M4	Grid 8 <b>M4</b>	Grid 9 <b>M4</b>
38.38 dBV/m	38.41 dBV/m	37.3 dBV/m



0 dB = 83.24 V/m = 38.41 dBV/m







#### HAC RF E-Field GSM 850 Middle

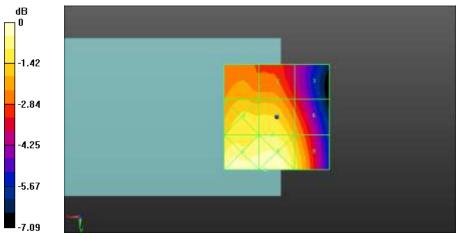
Date: 2020-3-12 Electronics: DAE4 Sn786 Medium: Air Medium parameters used:  $\sigma = 0$  S/m,  $\varepsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup> Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C Communication System: UID 0, GSM Frequency: 836.6 MHz Duty Cycle: 1:8.3 Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

#### 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 = 55.93 V/m; Power Drift = -0.01 dB Applied MIF = 3.63 dB RF audio interference level = 37.18 dBV/m **Emission category: M4** 

MIF scaled E-field

Grid 1 <b>M4</b>	Grid 2 <b>M4</b>	Grid 3 <b>M4</b>
36.19 dBV/m	36.04 dBV/m	34.81 dBV/m
Grid 4 M4	Grid 5 <b>M4</b>	Grid 6 <b>M4</b>
37.09 dBV/m	37.18 dBV/m	36.17 dBV/m
Grid 7 M4	Grid 8 <b>M4</b>	Grid 9 <b>M4</b>
38.05 dBV/m	38.09 dBV/m	36.96 dBV/m



0 dB = 80.27 V/m = 38.09 dBV/m







#### HAC RF E-Field GSM 850 Low

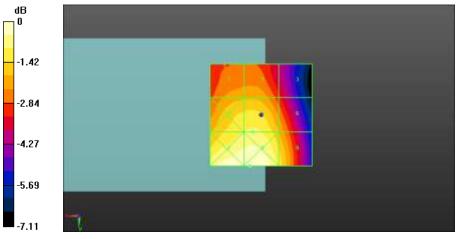
Date: 2020-3-12 Electronics: DAE4 Sn786 Medium: Air Medium parameters used:  $\sigma = 0$  S/m,  $\varepsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup> Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C Communication System: UID 0, GSM Frequency: 824.2 MHz Duty Cycle: 1:8.3 Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

#### 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 = 57.55 V/m; Power Drift = -0.04 dB Applied MIF = 3.63 dB RF audio interference level = 37.51 dBV/m **Emission category: M4** 

MIF scaled E-field

Grid 1 <b>M4</b>	Grid 2 <b>M4</b>	Grid 3 <b>M4</b>
36.36 dBV/m	36.41 dBV/m	35.24 dBV/m
Grid 4 M4	Grid 5 <b>M4</b>	Grid 6 <b>M4</b>
37.43 dBV/m	37.51 dBV/m	36.5 dBV/m
Grid 7 M4	Grid 8 <b>M4</b>	Grid 9 <b>M4</b>
38.32 dBV/m	38.36 dBV/m	37.27 dBV/m



0 dB = 82.84 V/m = 38.36 dBV/m







#### HAC RF E-Field GSM 1900 High

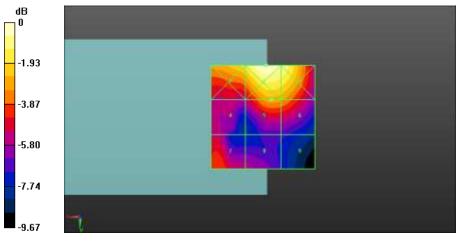
Date: 2020-3-12 Electronics: DAE4 Sn786 Medium: Air Medium parameters used:  $\sigma = 0$  S/m,  $\varepsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup> Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C Communication System: UID 0, GSM Frequency: 1910 MHz Duty Cycle: 1:8.3 Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

#### 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 = 25.52 V/m; Power Drift = -0.05 dB Applied MIF = 3.63 dB RF audio interference level = 32.49 dBV/m **Emission category: M3** 

MIF scaled E-field

Grid 1 M3	Grid 2 <b>M2</b>	Grid 3 M3
33.84 dBV/m	35.33 dBV/m	34.77 dBV/m
Grid 4 <b>M3</b>	Grid 5 <b>M3</b>	Grid 6 <b>M3</b>
30.16 dBV/m	32.49 dBV/m	32.29 dBV/m
Grid 7 <b>M3</b>	Grid 8 <b>M4</b>	Grid 9 <b>M4</b>
31.45 dBV/m	29.85 dBV/m	28.56 dBV/m



0 dB = 58.44 V/m = 35.33 dBV/m







#### HAC RF E-Field GSM 1900 Middle

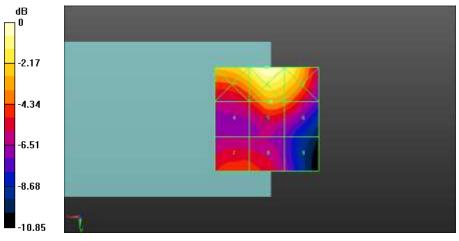
Date: 2020-3-12 Electronics: DAE4 Sn786 Medium: Air Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup> Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C Communication System: UID 0, GSM Frequency: 1880 MHz Duty Cycle: 1:8.3 Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

#### 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 = 21.73 V/m; Power Drift = -0.08 dB Applied MIF = 3.63 dB RF audio interference level = 31.54 dBV/m **Emission category: M3** 

MIF scaled E-field

Grid 1 M3	Grid 2 <b>M3</b>	Grid 3 M3
33.61 dBV/m	34.82 dBV/m	33.91 dBV/m
Grid 4 <b>M4</b>	Grid 5 <b>M3</b>	Grid 6 <b>M3</b>
29.73 dBV/m	31.54 dBV/m	31.02 dBV/m
Grid 7 <b>M3</b>	Grid 8 <b>M3</b>	Grid 9 <b>M4</b>
30.26 dBV/m	30.11 dBV/m	28.21 dBV/m



0 dB = 55.11 V/m = 34.82 dBV/m







#### HAC RF E-Field GSM 1900 Low

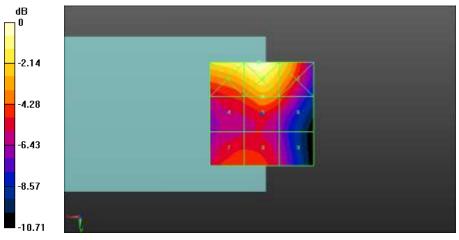
Date: 2020-3-12 Electronics: DAE4 Sn786 Medium: Air Medium parameters used:  $\sigma = 0$  S/m,  $\varepsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup> Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C Communication System: UID 0, GSM Frequency: 1850.2 MHz Duty Cycle: 1:8.3 Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

#### 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 = 23.34 V/m; Power Drift = -0.03 dB Applied MIF = 3.63 dB RF audio interference level = 31.67 dBV/m **Emission category: M3** 

MIF scaled E-field

Grid 1 M3	Grid 2 <b>M3</b>	Grid 3 M3
34.28 dBV/m	34.96 dBV/m	33.25 dBV/m
Grid 4 <b>M3</b>	Grid 5 <b>M3</b>	Grid 6 <b>M3</b>
30.52 dBV/m	31.67 dBV/m	30.65 dBV/m
Grid 7 <b>M3</b>	Grid 8 <b>M3</b>	Grid 9 <b>M4</b>
30.52 dBV/m	30.52 dBV/m	29.04 dBV/m



0 dB = 55.99 V/m = 34.96 dBV/m







## **ANNEX B: System Validation Result**

#### 835 MHz

Date: 2020-3-12 Electronics: DAE4 Sn786 Medium: Air Medium parameters used:  $\sigma$  = 0 mho/m,  $\epsilon$ r = 1;  $\rho$  = 1000 kg/m3 Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1 Probe: ER3DV6 - SN2424; ConvF (1, 1, 1)

#### E Scan - measurement distance from the probe sensor center to CD835 Dipole = 15mm /Hearing Aid Compatibility Test (41x361x1): Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

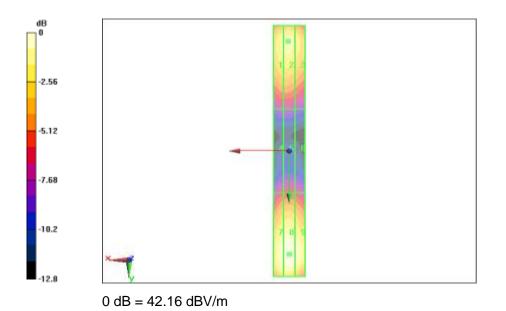
Device Reference Point: 0, 0, -6.3 mm Reference Value = 108.6 V/m; Power Drift = 0.03 dB Applied MIF = 0.00 dB

RF audio interference level = 42.16 dBV/m

**Emission category: M3** 

MIF scaled E-field

Grid 1 <b>M3</b>	Grid 2 <b>M3</b>	Grid 3 <b>M3</b>
41.55 dBV/m	42.03 dBV/m	41.94 dBV/m
Grid 4 <b>M4</b>	Grid 5 <b>M4</b>	Grid 6 <b>M4</b>
37.00 dBV/m	37.33 dBV/m	37.25 dBV/m
Grid 7 <b>M3</b>	Grid 8 <b>M3</b>	Grid 9 <b>M3</b>
41.64 dBV/m	42.16 dBV/m	41.98 dBV/m





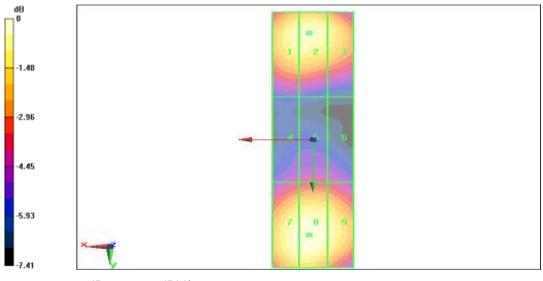


**1880 MHz** Date: 2020-3-12 Electronics: DAE4 Sn786 Medium: Air Medium parameters used:  $\sigma = 0$  mho/m,  $\varepsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup> Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1 Probe: ER3DV6 - SN2424; ConvF (1, 1, 1)

E Scan - measurement distance from the probe sensor center to CD1880 Dipole = 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 = 105.6 V/m; Power Drift = 0.08 dB Applied MIF = 0.00 dB RF audio interference level = 39.59 dBV/m Emission category: M2

MIF scaled E-field

Grid 1 <b>M2</b>	Grid 2 <b>M2</b>	Grid 3 <b>M2</b>
39.09 dBV/m	39.59 dBV/m	39.50 dBV/m
Grid 4 <b>M2</b>	Grid 5 <b>M2</b>	Grid 6 <b>M2</b>
37.33 dBV/m	37.68 dBV/m	37.62 dBV/m
Grid 7 <b>M2</b>	Grid 8 <b>M2</b>	Grid 9 <b>M2</b>
39.07 dBV/m	39.52 dB V/m	39.46 dBV/m







## **ANNEX C: Probe Calibration Certificate**

#### E\_Probe ER3DV6

Calibration Laboratory of Schmid & Partner Engineering AG Zoughausstrasse 43, 8004 Zorich, Switzerland



S Schweizenischer Kalibrierdienst C Service misse d'étalormage S Service svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

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

Client CTTL-SZ (Auden)

Certificate No: ER3-2424\_Feb18

Object	ER3DV6 - SN:2424						
Calibration procedure(s)	QA CAL-02.v8, QA CAL-25.v6 Calibration procedure for E-field probes optimized for close near field evaluations in air						
Celibration date February 23, 2018							
This calibration certificate docur The measurements and the unc	ments the traceability to nation certainties with confidence pro	tal standarts, which realize the physical units bability are given on the following pages and	of measurements (BI) are part of the cwrtificate				
All calibrations have been cond Calibration Equipment used (M		facility: environment temperature (22 $\pm$ 3)°C i	and humidity < 20%.				
Primary Standards	D	Cal Date (Certificate No.)	Scheduled Calibration				
Power meter NRP	SN 104778	04-Apr-17 (Nn: 217-02621:02522)	Apr-18				
Power sensor NRP-291	514 103244	04-Apr-17 (No. 217-02521)	Apr-18				
Power sensor NRP-291	SN 103245	04-Apr-17 (No. 277-02525)	Apr-18				
Reference 20 dB Attenuator	SN: \$5277 (20x)	07-Apt-17 (No. 217-02528)	Api-18				
Reference Probe ER3DVB	SN: 2328	10-Oct-17 (No. ER3-2328, Oct17)	0d-18				
	SN: 789	2-Aug-17 (No. DAE4-789, Aug17)	Aug-18				
the second se	014, 200						
DAE4	10	Check Date (in house)	Scherbaut Chiera				
DAE4 Secondary Standards		Check Date (in house) 06-Apr-16 (in house theck Jun 16)	Scheduled Chiece				
DAE4 Secondary Standards Power meter E44108 Power sensor E4412A	ID	06-Apr-16 (in house check Jun-16)	In house check, Jun-18				
DAE4 Secondary Standards Power meter E44108	ID \$N: GB41293874	06-Apr-16 (in house check Jun-16) 06-Apr-16 (in house check Jun-16)	In house check, Jun-18 In house check, Jun-18				
DAE4 Secondary Standards Power meter E44108 Power sensor E4412A Power sensor E4412A	ID SN: GB41293874 SN: MY41498087	06-Apr-16 (in house check Jun-16)	In tiduse check, Jun-18 In house check, Jun-18 In house check, Jun-18				
DAE4 Secondary Standards Power sensor E44198 Power sensor E4412A RP generator HP 6648C	1D SN: GB41293874 SN: MY41498087 SN: 000110210	06-Apr-16 (in house check Jun-16) 06-Apr-16 (in house check Jun-16) 06-Apr-16 (in house check Jun-16)	In house check, Jun-18 In house check, Jun-18				
DAE4 Secondary Standards Power meter E44108 Power sensor E4412A	ID SN: GB41293874 SN: MY41498067 SN: 000110210 SN: US3642U01700	06-Apr-16 (in house check Jun-16) 06-Apr-16 (in house check Jun-16) 06-Apr-16 (in house check Jun-18) 04-Aug-99 (in house check Jun-18)	In house check Jun-18 In house check Col-18				
DAE4 Secondary Standards Power meter E44108 Power sensor E4412A Power sensor E4412A RF generator HP 6648C	ID SN: GB41293874 SN: MY41498687 SN: 000110210 SN: U53642001700 SN: U537390585	06-Apr-16 (in house check Jun-16) 06-Apr-16 (in house check Jun-16) 06-Apr-16 (in house check Jun-18) 04-Aug-99 (in house check Jun-18) 18-Oct-81 (in house check Oct-17)	In house check, Jun-18 In house check, Jun-18 In house check, Jun-18 In house check, Jun-18				
DAE4 Secondary Standards Power meter E44198 Power sensor E4412A Power sensor E4412A RF generator HP 8646C Network Analyzer HP 6753E	ID SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700 SN: US3642U01700 SN: US3642U01700 SN: US37390585 Name	06-Apr-16 (in house check Jun-16) 06-Apr-16 (in house check Jun-16) 06-Apr-16 (in house check Jun-16) 04-Aug-99 (in house check Jun-16) 18-Oct-01 (in house check Oct-17) Function	In house check Jun-18 In house check Col-18				

Certificate No: ER3-2424\_Feb18

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#### Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

ilac-MRA

Schweizerischer Kalibrierdienst s Service suisse d'étaionnage C Servizio svizzero di taratura s Swiss Calibration Service

Accreditation No.: SCS 0108

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

Glossary: NORMx.y.z DCP CF A, B, C, D Polarization @	sensitivity in free space diode compression point crest factor (1/duty, cycle) of the RF signal modulation dependent linearization parameters g rotation around probe axis
Polarization 8	9 rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., 9 = 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:

- a) IEEE Std 1309-2005, \* IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz<sup>+</sup>, December 2005
- b) CTIA Test Plan for Hearing Aid Compatibility, Rev 3.0, November 2013

#### Methods Applied and Interpretation of Parameters:

- NORMx, y, z: Assessed for E-field polarization  $\vartheta = 0$  for XY sensors and  $\vartheta = 90$  for Z sensor (f  $\le 900$  MHz in TEM-cell; f > 1800 MHz; R22 waveguide). ٠
- NORM(f)x,y,z = NORMx,y,z \* frequency\_response (see Frequency Response Chart).
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW ٠ signal (no uncertainty required). 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
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z; 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 NORMs (no uncertainty required).

Certificate No. ER3-2424\_Feb18

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ER3DV6 - SN:2424			February 23, 201
D			
Р	robe E	R3DV6	)
	01-0	404	
	SN:24	424	
		November 12, 2007 February 23, 2018	
	Gailbrated.	rebludiy 23, 2016	
	Calibrated for DASY (Note: non-compatible with	(/EASY Systems th DASY2 system!)	
Certificate No: ER3-2424_Feb18	Page 3 of	10	





ER3DV6 - SN:2424

February 23, 2018

## DASY/EASY - Parameters of Probe: ER3DV6 - SN:2424

#### **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m) <sup>2</sup> ) DCP (mV) <sup>®</sup>	1.46	1.51	1.82	±10.1 %
DCP (mV) <sup>6</sup>	100.0	98.3	100.6	

#### Modulation Calibration Parameters

vio	Communication System Name		A	B dBõV	C	D dB	VR mV	Unc <sup>h</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	3.691	13.5 %
		Y	0.0	0.0	1.0		204.8	
		-Z,	0.0	0.0	1.0		200.6	
10021- DAC	GSM-FDD (TDMA, GMSK)	×	21.68	99.9	28.7	9.39	106.2	12.2 %
		Y	10.41	99.7	28.8		111.3	
		Z	24.71	99.5	28.2		119.2	
10051- CAB	IEEE 802.11b W/Fi 2.4 GHz (DSSS, 11 Mbps)	x	8.35	84.6	25.4	3.60	146.9	±1.9 %
		Y	4.81	74.8	21.7		112.9	
1.00		Z	6.43	78.8	22.9		111.9	
10077- CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	x	13.28	77.7	29.3	11.00	139.0	#3.8 %
		Y	11.65	73.4	26.9		100.8	
1000		Z	11.41	72.1	25.6		99.2	
10172- CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	×	9.48	80.8	29.7	9.21	125.2	±3.8 %
		Y	9.49	81.9	30.6		134.1	-
		Z	10.82	83.6	30.5		136.8	
10173- CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	x	9.87	81.2	29.9	9.48	125.1	12.5 %
		Y	10.11	83.1	31.3		134.2	
		Z	11.30	84.2	30.8		136.9	
10295- AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	х	16.69	99.5	40.3	12.49	96.6	\$2.5 %
		Y.	15.42	99.3	41.1		100.6	
_		Z	17.91	99,9	-39.8		104.3	

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%.

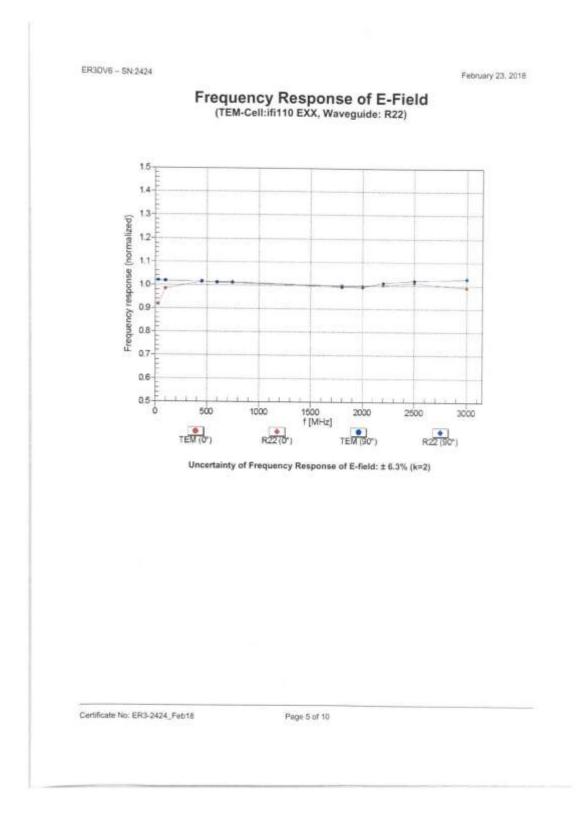
\* Numerical linearization parameter: uncertainty not required.
\* Uncertainty is determined using the mox: deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Certificate No: ER3-2424\_Feb18

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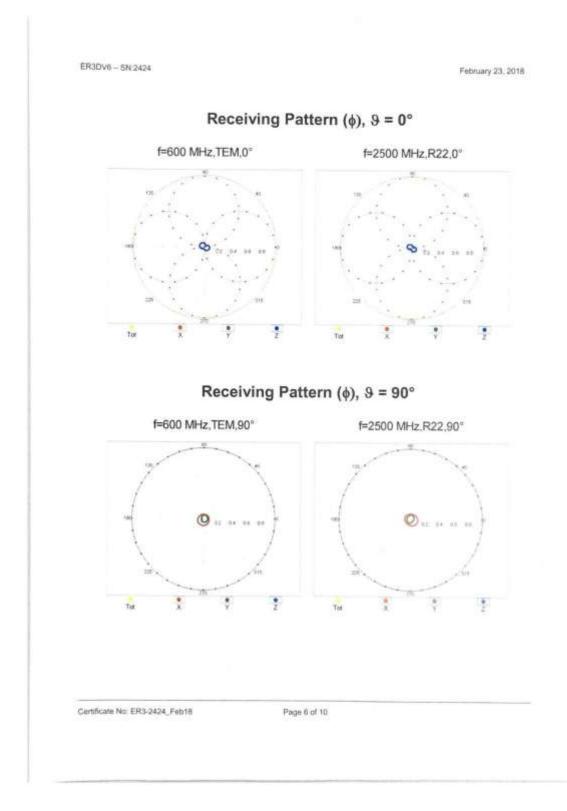






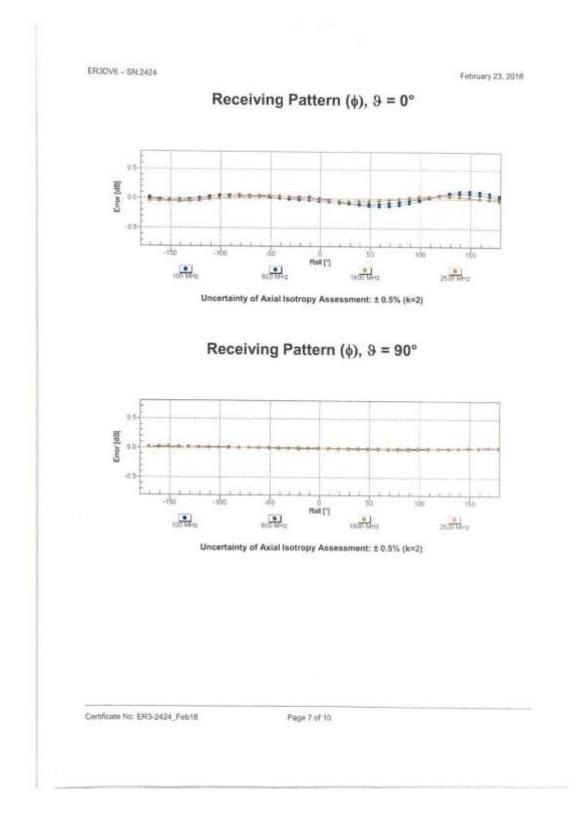






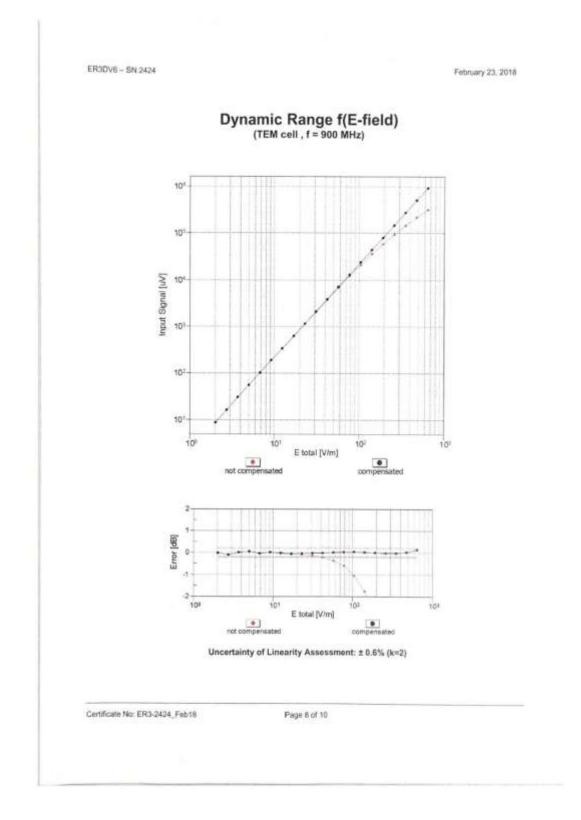






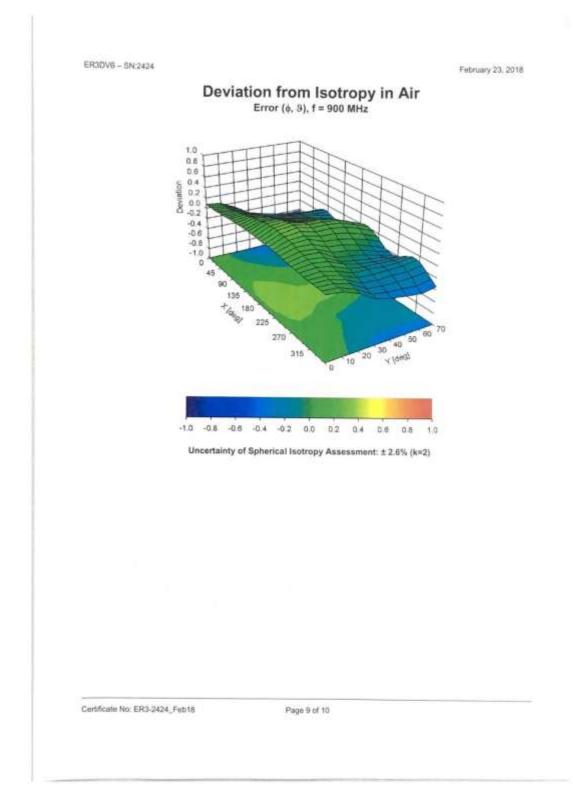
















ER3DV6 - SN:2424

February 23, 2018

# DASY/EASY - Parameters of Probe: ER3DV6 - SN:2424

## Other Probe Parameters

Sensor Arrangement	Rectangular
Connector Angle (*)	-11.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	537 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	8 mm
Probe Tip to Sensor X Calibration Point	2.5 mm
Probe Tip to Sensor Y Calibration Point	2.5 mm
Probe Tip to Sensor Z Calibration Point	2.5 mm

Certificate No: ER3-2424\_Feb18

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# **ANNEX D: Dipole Calibration Certificate**

# Dipole 835 MHz

redited by the Swiss Accreditation swiss Accreditation Service Is tillateral Agreement for the reco ent CTTL (Auden)	one of the signatories	to the EA	creditation No.: SCS 0108
	a	A 1/2 / 1 / 2 / 2	
UTIL MUGGII		Cartificate No:	CD835V3-1165_Jul18
(PED/ORANO/ED/10/01			
ALIBRATION CI	ERTIFICATE		
bject	CD835V3 - SN: 1	165	
alibration procedure(s)	QA CAL-20.v6 Calibration proce	dure for dipoles in air	
Calibration date:	July 19, 2018		
		and a second	(2) strammum react to at
his calibration certificate document	ts the traceability to natio	real standards, which realize the physical uni	d are part of the partilicate
his cullbration certificate documen The measurements and the uncertainty	its the traceability to nate anties with confidence p	wal standards, which realize the physical un obability are given on the following pages an	d are part of the certificate.
The measurements and the uncerta	ainties with confidence p	obability are given on the following pages an	d are part of the certificate.
The measurements and the uncerta	ainties with confidence p	obability are given on the following pages an	d are part of the certificate.
The measurements and the uncerta	ainties with confidence p	snal staedards, which realize the physical un obability are given on the following pages an $\gamma$ facility: environment temperature (22 $\pm$ 3) °C	d are part of the certificate.
The measurements and the uncerta	ainties with confidence p	obability are given on the following pages an	d are part of the certificate.
The measurements and the uncerta III calibrations have been conducte Calibration Equipment used (M&TE	ainties with confidence p ad in the closed laborator E critical for calibration)	obability are given on the following pages an y tacility: environment temperature (22 $\pm$ 3) $^{\circ}$	d are part of the cartificate. 3 and humidity < 70%.
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards	ainties with confidence p ad in the closed laborator E critical for calibration)	obability are given on the following pages an y tacility: environment temperature (22 ± 3)*( Cal Date (Certificate No.)	d are part of the cartificate. 3 and humidity < 70%. Scheduled Calibration
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NEP	anties with confidence p ad in the closed laborator critical for calibration) [ ID # ] SN: 104778	obability are given on the following pages an y tacility: environment temperature (22 ± 3)*( Cal Date (Certificate No.) 04-Apr-18 (No. 217-02672/02573)	d are part of the cartificate. 2 and humidity < 70%. Scheduled Calibration Apr-19
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91	anties with confidence p ad in the closed laborator critical for calibration) [ ID # [ SN: 104778 [ SN: 103244	Obability are given on the following pages an y tacility: environment temperature (22 ± 3)*0 Cal Date (Certificate No.) 04-Apr-18 (No. 217-02672/02573) 04-Apr-18 (No. 217-02672)	d are part of the cartificate. 2 and humidity < 70%. Scheduled Calibration Apr-19 Apr-19
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Certificate No: CD835V3+1165\_Jul18

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Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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Schweizerischer Kalibrierdienst Service suisse d'étalonnage 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

#### References

 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 HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating 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 ER3D-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 (160 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 85%.

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## Measurement Conditions

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

DASY Version	DASY5	V52.10.1
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	15 mm	
Scan resolution	dx, dy = 5 mm	
Frequency	835 MHz ± 1 MHz	
Input power drift	< 0.05 dB	

## Maximum Field values at 835 MHz

E-field 15 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW input power	108.7 V/m = 40.72 dBV/m
Maximum measured above low end	100 mW input power	108.6 V/m = 40.72 dBV/m
Averaged maximum above arm	100 mW input power	108.7 V/m ± 12.8 % (k=2)

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

### Antenna Parameters

Frequency	Return Loss	Impedance
800 MHz	16.4 dB	40.0 Ω - 9.2 jΩ
835 MHz	25.5 dB	53.7 $\Omega$ + 4.0 j $\Omega$
880 MHz	17.8 dB	60.3 Ω - 9.8 jΩ
900 MHz	16.5 dB	51.6 Ω - 15.3 jΩ
945 MHz	21.7 dB	43.9 Ω + 4.8 jΩ

#### 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 anterina 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.

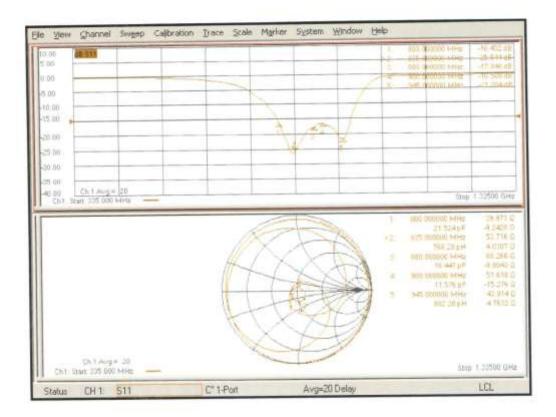
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## Impedance Measurement Plot



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## **DASY5 E-field Result**

Date: 19.07.2018

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,  $a_e = 1$ ;  $\rho = 0$  kg/m<sup>3</sup> Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63,19-2011)

DASY52 Configuration:

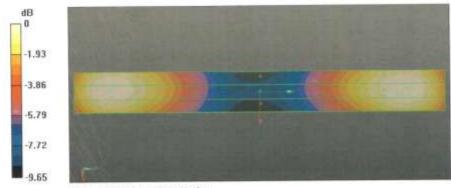
- Probe: EF3DV3 5N4013; ConvF(1, 1, 1) @ 835 MHz; Calibrated: 05.03.2018
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 17.01.2018
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

## 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 = 130.9 V/m; Power Drift = 0.02 dB Applied MHF = 0.00 dB RF audio interference level = 40.73 dBV/m Emission category: M3

#### MIF scaled E-field

Grid 1 M3	Grid 2 M3	Grid 3 M3
40.28 dBV/m	40.72 dBV/m	40.67 dBV/m
Grid 4 M4	Grid 5 M4	Grid 6 M4
35.61 dBV/m	35.96 dBV/m	35.94 dBV/m
Grid 7 M3	Grid 8 M3	Grid 9 M3
40.41 dBV/m	40.73 dBV/m	40.67 dBV/m



0 dB = 108.7 V/m = 40.72 dBV/m

Certificate No: CD835V3-1165\_Jul18

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## Dipole 1880 MHz

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# Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweiz C Service S Servizio S Swiss C

Schweizerischer Kalibrierdienst Service suisse d'étalonnage 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 CTTL (Auden)

Certificate No: CD1880V3-1149\_Jul18

alibration procedure(s)	QA CAL-20.v6 Calibration proce	dure for dipoles in air	
alibration data:	July 19, 2018		
his calibration certificate documer	ts the traceability to nati	onal standards, which realize the physical uni	ts of measurements (SI).
he measurements and the uncerta	ainties with confidence p	robability are given on the following pages an	d are part of the certificate.
Il celibrations have been conducts	ed in the closed laborator	y facility: environment temperature (22 $\pm$ 3) $^{\circ}$	and humidity < 70%.
I PORTOTO INTERPORT SUBJECT	COLUMN STOCKE IN COMPANY		
alibration Equipment used (M&TE	eritical for calibration)		
rimary Standards	10#	Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
ower sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
wer sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
eterance 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
pe-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
tobe EF3DV3	SN: 4013	05-Mar-18 (No. EF3-4013_Mar18)	Mar-19
robe H3DV6	SN: 6065	30-Dec-17 (No. H3-6065_Dec17)	Dec-18
AE4	SIN: 781	17-Jan-18 (No. DAE4-781_Jan18)	Jan-19
econdary Standards	10#	Check Date (in house)	Scheduled Check
owar motor Agilent 4419B	SN: GB42420191	09-Oct-09 (in house check Oct-17)	In house check: Oct-20
ower sensor HP E4412A	SN: US38485102	05-Jan-10 (in house check. Oct-17)	In house check: Oct-20
ower sensor HP 8482A	SN: US37295597	09-Oct-09 (in house check Oct-17)	In house check: Oct-20
F generator R&S SMT-06	SN: 832283/011	27-Aug-12 (in house check Oct-17)	In house check: Oct-20
Hetwork Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18
	Name	Function	Signature
alibrated by:	Leif Klysner	Laboratory Technician	- D-100
anorated try.	can reparter		Set Thear
		Technical Manager	as in
Approved by:	Katja Pokovic	Technical Manager	blill

Certificate No: CD1880V3-1149\_Jul18

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



Schweizerischer Kalibrierdienst Service suisse d'étalonnage

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Accreditation No.: SCS 0108

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#### References

[1]

- 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 HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating 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 ER3D-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%.

Certificate No: CD1880V3-1149\_Jul18

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## Measurement Conditions

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

DASY Version	DASY5	V52.10.1
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	15 mm	
Scan resolution	dx, dy = 5 mm	
Frequency	1880 MHz ± 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	89.8 V/m = 39.06 dBV/m
Maximum measured above low end	100 mW input power	89,3 V/m = 39.02 dBV/m
Averaged maximum above arm	100 mW input power	89.5 V/m ± 12.8 % (k=2)

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

### Antenna Parameters

Frequency	Return Loss	Impedance
1730 MHz	23.9 dB	53.9 Ω + 5.4 jΩ
1880 MHz	22.5 dB	54.7 Ω + 6.3 jΩ
1900 MHz	23.4 dB	55.6 Ω + 4.5 jΩ
1950 MHz	30.3 dB	52.9 Ω - 1.3 jΩ
2000 MHz	21.3 dB	44.2 Ω + 5.7 JΩ

#### 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.

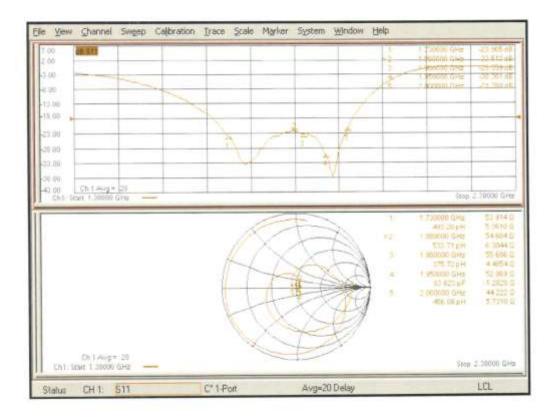
Certificate No: CD1880V3-1149 Jul18

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## Impedance Measurement Plot



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#### **DASY5 E-field Result**

Date: 19.07.2018

Test Laboratory: SPEAG Lab2

## 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,  $z_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup> Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

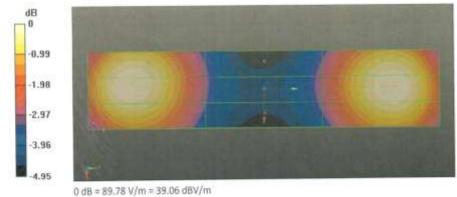
- Probe: EF3DV3 SN4013; ConvF(1, 1, 1) @ 1880 MHz; Calibrated: 05.03.2018
- Sensor-Surface: (Fix Surface) .
- Electronics: DAE4 Sn781; Calibrated: 17.01.2018
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

#### 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 = 160.1 V/m: Power Drift = -0.04 dB Applied MIF = 0.00 dB RF audio interference level = 39.06 dBV/m Emission category: M2

MIF scaled E-field

Grid 1 M2	Grid 2 M2	Grid 3 M2
38.67 dBV/m	39.06 dBV/m	39.01 dBV/m
Grid 4 M2	Grid 5 M2	Grid 6 M2
36 dBV/m	36.15 dBV/m	36.1 dBV/m
	Grid 8 M2 39.02 dBV/m	Grid 9 M2 38.91 dBV/m



Certificate No: CD1880V3-1149\_Jul18

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# **ANNEX E: UID Specification**

# Calibration Laboratory of

Schmid & Partner Engineering AG

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Name:	GSM-FDD (TDMA, GMSK)
Group: UID:	0.8M 10021-DAC
PAR: 1 MF: 8	9.39.dB 3.63.dB
Standard Reference Galegory: Notbalation: Frequency Band	ETBI T5 100 909 V8:8.0 (2005-01) FCC OET KDB 541225, D03 and D04 Periodic pulsati motulation GMSK GSM 450 (450.4 - 457.6 MHz) GSM 450 (478.8 - 486.0 MHz) GSM 710 (788.0 - 778.0 MHz) GSM 750 (784.0 - 783.0 MHz) GSM 500 (880.0 - 915.0 MHz) F-GSM 900 (880.0 - 915.0 MHz) P-GSM 900 (880.0 - 915.0 MHz) PCS 1900 (1850.0 - 115.0 MHz) PCS 1900 (1850.0 - 115.0 MHz) EF-GSM 900 (171.0 - 115.0 MHz) PCS 1900 (1850.0 - 115.0 MHz) EF-GSM 900 (171.0 - 115.0 MHz) EF-GSM 900 (171.0 - 115.0 MHz)
Detailed Specification:	Active Slot: TNO Data: PNS continuous Frans: composed out of 8 Slots Muthrame: 29th (IDLE) Franse set blank
Bandwidth: Integration Time:	Sisttype & -timing: Normal bunst for GMSK 5.2 MHz 120.0ms

 PAR (0.1%) in accordance with FDC KDB 971168. Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"
 Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response innerization calibration for the same communication system (same UID and version).

UID Specification Sheet

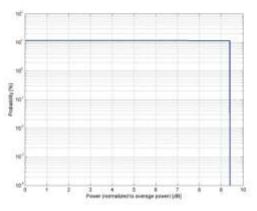
UID 10021-DAC page 1/2

16.11.2016

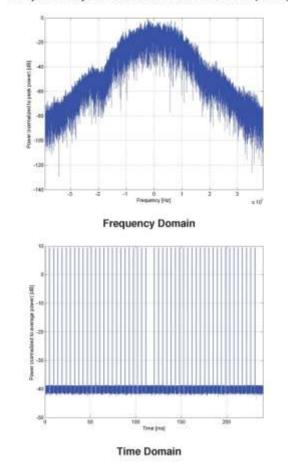




Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Complementary Cumulative Distribution Function (CCDF)



**UID Specification Sheet** 

UID 10021-DAC page 2/2

16.11.2016





Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Name:

#### UMTS-FDD (WCDMA)

Group: UID: WCDMA 10011-CAB

2.91 dB

-27.23 dB

PAR: 1 MIF: 2

Standard Reference:	3GPP TS 25.141 Annex A
Category:	FCC OET KDB 941225 D01 SAR test for 3G devices v02 Random amplitude modulation
Modulation:	OPSK
Frequency Band:	Band 1, UTRA/FDD (1920.0-1980.0 MHz, 20000)
	Band 2, UTRA/FDD (1850.0-1910.0 MHz, 20001)
	Band 3, UTRA/FDD (1710.0-1785.0 MHz, 20002)
	Band 4, UTRA/FDD (1710.0-1755.0 MHz, 20003)
	Band 5, UTRA/FDD (824.0-849.0 MHz, 20004)
	Band 6, UTRA/FDD (830.0-840.0 MHz, 20005)
	Band 7, UTRA/FDD (2500.0-2570.0 MHz, 20006)
	Band 8, UTRA/FDD (880.0-915.0 MHz, 20007)
	Band 9, UTRA/FDD (1749.9-1784.9 MHz, 20008)
	Band 10, UTRA/FDD (1710.0-1770.0 MHz, 20009)
	Band 11, UTRA/FDD (1427.9-1452.9 MHz, 20010)
	Band 12, UTRA/FDD (698.0-716.0 MHz, 20011)
	Band 13, UTRA/FDD (777.0-787.0 MHz, 20012)
	Band 14, UTRA/FDD (788.0-798.0 MHz, 20013)
	Band 19, UTRA/FDD (830.0-845.0 MHz, 20130)
	Band 20, UTRA/FDD (832.0-862.0 MHz, 20131)
	Band 21, UTRA/FDD (1447.9-1462.9 MHz, 20132)
	Band 22, UTRA/FDD (3410.0-3490.0 MHz, 20217)
	Band 25, UTRA/FDD (1850.0-1915.0 MHz, 20218)
	Band 26, UTRA/FDD (814,0-849.0 MHz, 20219)
Detailed Specification:	Dedicated Channel Type: RMC
	Bitrate: 12.2 kbps
	DPDCH: 60 kbps
	DPCCH: 15 kbps
	DPCCH/DPDCH power ratio: -5.46 dB
Bandwidth:	5.0 MHz
Integration Time:	100.0 ms

PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"
 Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version).

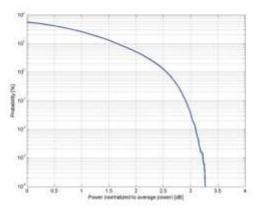
**UID Specification Sheet** 

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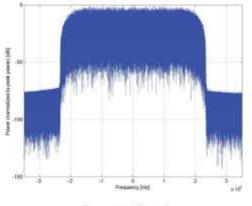




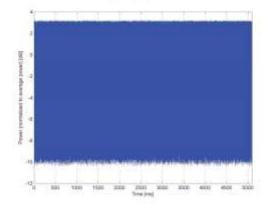
Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Complementary Cumulative Distribution Function (CCDF)









**UID** Specification Sheet

UID 10011-CAB page 2/2





Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

UMTS-FDD (HSDPA) Name: Group: WCDMA UID: 10097-CAB PAR: 1 3.98 dB MIF: 2 -20.75 dB Standard Reference: ETSI-3GPP TS 134.121 Rel. 5 FCC OET KDB 941225 D01 SAR test for 3G devices v02 Category: Random amplitude modulation Modulation: **QPSK** Frequency Band: Band 1, UTRA/FDD (1920.0-1980.0 MHz, 20000) Band 2, UTRA/FDD (1850.0-1910.0 MHz, 20001) Band 3, UTRA/FDD (1710.0-1785.0 MHz, 20002) Band 4, UTRA/FDD (1710.0-1755.0 MHz, 20003) Band 5, UTRA/FDD (824.0-849.0 MHz, 20004) Band 6, UTRA/FDD (830.0-840.0 MHz, 20005) Band 7, UTRA/FDD (2500.0-2570.0 MHz, 20006) Band 8, UTRA/FDD (880.0-915.0 MHz, 20007) Band 9, UTRA/FDD (1749.9-1784.9 MHz, 20008) Band 10, UTRA/FDD (1710.0-1770.0 MHz, 20009) Band 11, UTRA/FDD (1427.9-1452.9 MHz, 20010) Band 12, UTRA/FDD (698.0-716.0 MHz, 20011) Band 13, UTRA/FDD (777.0-787.0 MHz, 20012) Band 14, UTRA/FDD (788.0-798.0 MHz, 20013) Band 19, UTRA/FDD (830.0-845.0 MHz, 20130) Band 20, UTRA/FDD (832.0-862.0 MHz, 20131) Band 21, UTRA/FDD (1447.9-1462.9 MHz, 20132) Band 22, UTRA/FDD (3410.0-3490.0 MHz, 20217) Band 25, UTRA/FDD (1850.0-1915.0 MHz, 20218) Band 26, UTRA/FDD (814.0-849.0 MHz, 20219) Detailed Specification: CQI value: 2 Sub-test 2 Conditions: DPCCH gain factor (Beta \_ c) = 12/15 DPDCH gain factor (Beta \_d): 15/15 5.0 MHz Bandwidth: Integration Time: 100.0 ms

 PAR (0.1%) in accordance with FCC KD8 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"
 Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version).

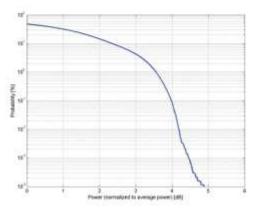
**UID Specification Sheet** 

UID 10097-CAB page 1/2

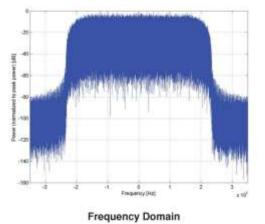


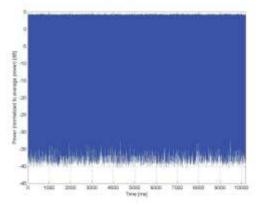


Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Complementary Cumulative Distribution Function (CCDF)







**UID Specification Sheet** 

UID 10097-CAB page 2/2





## Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Name:

#### LTE-FDD (SC-FDMA, 1 R8, 10 MHz, 16-QAM)

Group: UID:

LTE-FDO 10176-CAE

PAR: 1 MIF: 7       3.52 dB 3.276 dB         Standard Reference:       3GPP / ETSI TS 136,101 V8.4.0 3GPP / ETSI TS 138,213 V8.4.0 FCC DET KDB 34125 X05 SAR for LTE Devices the Random amplitude modulation Modulation: Frequency Band:       3GPP / ETSI TS 138,101 V8.4.0 3GPP / ETSI TS 138,213 V8.4.0 FCC DET KDB 34125 X05 SAR for LTE Devices the Random amplitude modulation 16-QAM         Frequency Band:       Band 1, E-UTRA/FDD (1920.0 - 1980.0 MHz) Band 3, E-UTRA/FDD (1710.0 - 1785.0 MHz) Band 4, E-UTRA/FDD (1710.0 - 1785.0 MHz) Band 5, E-UTRA/FDD (1800.0 - 840.0 MHz) Band 5, E-UTRA/FDD (1800.0 - 955.0 MHz) Band 8, E-UTRA/FDD (190.0 - 1770.0 MHz) Band 10, E-UTRA/FDD (190.0 - 1770.0 MHz) Band 11, E-UTRA/FDD (190.0 - 1770.0 MHz) Band 13, E-UTRA/FDD (190.0 - 1770.0 MHz) Band 13, E-UTRA/FDD (1740.9 - 1770.0 MHz) Band 13, E-UTRA/FDD (1740.9 - 1770.0 MHz) Band 14, E-UTRA/FDD (1740.9 - 1770.0 MHz) Band 13, E-UTRA/FDD (190.0 - 200.0 - 200.0 MHz) Band 14, E-UTRA/FDD (190.0 - 340.0 MHz) Band 15, E-UTRA/FDD (190.0 - 340.0 MHz) Band 22, E-UTRA/FDD (190.0 - 340.0 MHz) Band 22, E-UTRA/FDD (190.0 - 340.0 MHz) Band 23, E-UTRA/FDD (190.0 - 340.0 MHz) Band 24, E-UTRA/FDD (190.0 - 340.0 MHz) Band 25, E-UTRA/FDD (190.0 - 340.0 MHz) Band 25, E-UTRA/FDD (190.0 - 340.0 MHz) Band 26, E-UTRA/FDD (190.0 - 201.0 MHz) Band 26, E-UTRA/FDD (190.0 - 201.0 MHz) Band 26, E-UTRA/FDD (190.0 - 201.0 MHz) Band 30, E-UTRA/FDD (190.0 - 170.0 MHz) Band 30, E-UTRA/FDD (190.0 - 201.0 MHz) Band 30, E-UTRA/FDD (190.0 - 201.0 MHz) Band 30, E-UTRA/FDD (190.0 - 170.0 MHz) Band 30, E-UTRA/FDD (190.0 - 201.0 MHz) Band 30, E-UTRA/FDD (190.0 - 201.0 MHz) Band 30, E-UTRA/FDD (190.0 - 170.0 MHz) Band 30, E-UTRA/FDD (190.0 - 170.0 MHz) Band 30, E-UTRA/F		
Standard Petersna:     3GPP / ETSI TS 136,101 V8.4.0       Category:     Frequency Band       Modulation:     Frequency Band:       Prequency Band:     Bind 1. E-UTRA/FDD (1920.0 - 1980.0 MHz)       Band 2. E-UTRA/FDD (1710.0 - 1765.0 MHz)       Band 3. E-UTRA/FDD (1710.0 - 1765.0 MHz)       Band 5. E-UTRA/FDD (170.0 - 1765.0 MHz)       Band 6. E-UTRA/FDD (170.0 - 1765.0 MHz)       Band 7. E-UTRA/FDD (170.0 - 1765.0 MHz)       Band 8. E-UTRA/FDD (170.0 - 1765.0 MHz)       Band 7. E-UTRA/FDD (170.0 - 1765.0 MHz)       Band 8. E-UTRA/FDD (170.0 - 1770.0 MHz)       Band 10. E-UTRA/FDD (170.0 - 1770.0 MHz)       Band 11. E-UTRA/FDD (170.0 - 1770.0 MHz)       Band 12. E-UTRA/FDD (170.0 - 170.0 MHz)       Band 13. E-UTRA/FDD (180.0 - 900.0 MHz)       Band 14. E-UTRA/FDD (180.0 - 486.0 MHz)       Band 12. E-UTRA/FDD (180.0 - 486.0 MHz)       Band 22. E-UTRA/FDD (180.0 - 340.0 MHz)       Band 23. E-UTRA/FDD (180.0 - 1015.0 MHz)       Band 24. E-UTRA/FDD (180.0 - 1015.0 MHz)       Band 25. E-UTRA/FDD (182.0 - 1015.0 MHz)       Band 26. E-UTRA/FDD (182.0 - 1015.0 MHz)       Band 27. E-UTRA/FDD (182.0 - 1015.0 MHz)       Band 28. E-UTRA/FDD (182.0 - 1015.0 MHz)       Band 29. E-UTRA/FDD (182.0 - 1015.0 MHz)	PAR: 1	6.52 dB
Oategory; Modulation:       9GPP / ETSI TS 136.213 VB.4.0 PCC CC TKDB 941225 Cos SAR for LTE Devices - Random amplitude modulation         Frequency Band:       Band 1, E-UTRA/FDD (1920.0 - 1960.0 MHz) Band 2, E-UTRA/FDD (1850.0 - 1960.0 MHz) Band 3, E-UTRA/FDD (1800.0 - 1960.0 MHz) Band 4, E-UTRA/FDD (1800.0 - 1960.0 MHz) Band 4, E-UTRA/FDD (1800.0 - 1960.0 MHz) Band 5, E-UTRA/FDD (1800.0 - 1960.0 MHz) Band 5, E-UTRA/FDD (1800.0 - 1960.0 MHz) Band 6, E-UTRA/FDD (1800.0 - 1960.0 MHz) Band 6, E-UTRA/FDD (1800.0 - 1770.0 MHz) Band 10, E-UTRA/FDD (1800.0 - 1770.0 MHz) Band 11, E-UTRA/FDD (1990.0 - 716.0 MHz) Band 12, E-UTRA/FDD (1990.0 - 716.0 MHz) Band 13, E-UTRA/FDD (1990.0 - 716.0 MHz) Band 14, E-UTRA/FDD (1990.0 - 716.0 MHz) Band 15, E-UTRA/FDD (1900.0 - 196.0 MHz) Band 14, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 15, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 25, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 26, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 27, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 28, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 20, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 30, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 66, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 66, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 66, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 70, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 66, E-UTRA/FDD (1900.0 - 202.0 MHz) Band 70, E-UTRA/FDD (1900.0 - 200.0 MHz) Waldation band (0.0 - 600.0 MHz) Waldation ban	MIF: #	-9.76 dB
Outegory; Modulation:       9GPP / ETSI TS 136.213 V8.4.0 PCC OET KDB 941225 Doc SAR for LTE Devices - Random amplitude modulation         Frequency Band:       Band 1, E-UTRA/FDD (1920.0 - 1960.0 MHz) Band 2, E-UTRA/FDD (1710.0 - 1785.0 MHz) Band 3, E-UTRA/FDD (1710.0 - 1785.0 MHz) Band 4, E-UTRA/FDD (1800.0 - 840.0 MHz) Band 5, E-UTRA/FDD (1800.0 - 840.0 MHz) Band 5, E-UTRA/FDD (1800.0 - 840.0 MHz) Band 5, E-UTRA/FDD (1800.0 - 840.0 MHz) Band 6, E-UTRA/FDD (1800.0 - 840.0 MHz) Band 6, E-UTRA/FDD (1800.0 - 1770.0 MHz) Band 10, E-UTRA/FDD (1800.0 - 1770.0 MHz) Band 11, E-UTRA/FDD (1800.0 - 1770.0 MHz) Band 12, E-UTRA/FDD (1800.0 - 1770.0 MHz) Band 13, E-UTRA/FDD (1800.0 - 1847.9 MHz) Band 14, E-UTRA/FDD (1800.0 - 1847.9 MHz) Band 15, E-UTRA/FDD (1800.0 - 1847.9 MHz) Band 14, E-UTRA/FDD (1800.0 - 1840.0 MHz) Band 15, E-UTRA/FDD (1800.0 - 1840.0 MHz) Band 16, E-UTRA/FDD (1800.0 - 1840.0 MHz) Band 17, E-UTRA/FDD (1800.0 - 1840.0 MHz) Band 12, E-UTRA/FDD (1800.0 - 1840.0 MHz) Band 23, E-UTRA/FDD (1800.0 - 1840.0 MHz) Band 23, E-UTRA/FDD (1800.0 - 1915.0 MHz) Band 23, E-UTRA/FDD (1800.0 - 1915.0 MHz) Band 23, E-UTRA/FDD (1800.0 - 1915.0 MHz) Band 26, E-UTRA/FDD (1800.0 - 1915.0 MHz) Band 26, E-UTRA/FDD (1800.0 - 1915.0 MHz) Band 27, E-UTRA/FDD (1800.0 - 1915.0 MHz) Band 28, E-UTRA/FDD (1800.0 - 1915.0 MHz) Band 28, E-UTRA/FDD (1800.0 - 1915.0 MHz) Band 28, E-UTRA/FDD (1920.0 - 2910.0 MHz) Band 28, E-UTRA/FDD (1920.0 - 2910.0 MHz) Band 28, E-UTRA/FDD (1920.0 - 2910.0 MHz) Band 66, E-UTRA/FDD (1920.0 - 2915.0 MHz) Band 66, E-UTRA/FDD (1920.0 - 2910.0 MHz) Band 70, E-UTRA/FDD (1980.0 - 1910.0 MHz) Band 70, E-UTRA/FDD (1980.0 - 1910.0 MHz) Band 70, E-UTRA/FDD (1980.0 - 1910.0 MHz) Band 70, E-UTRA/FD	Standard Beferenze	SOPP / ETS) TS 135 101 Ve 4.0
Category: Modulation:       FCC OET KDB 941225 DOS SAR for LTE Devices : Fandom amplitude modulation         Frequency Band:       Band 1. E-UTRAFDD (1920.0 - 1980.0 MHz) Band 2. E-UTRAFDD (1950.0 - 1910.0 MHz) Band 3. E-UTRAFDD (1710.0 - 1765.0 MHz) Band 3. E-UTRAFDD (1710.0 - 1765.0 MHz) Band 4. E-UTRAFDD (1800.0 e80.0 MHz) Band 5. E-UTRAFDD (1800.0 e80.0 MHz) Band 6. E-UTRAFDD (1800.0 e80.0 MHz) Band 9. E-UTRAFDD (1800.0 e80.0 MHz) Band 9. E-UTRAFDD (1740.9 - 1764.9 MHz) Band 10. E-UTRAFDD (1740.9 - 1764.9 MHz) Band 11. E-UTRAFDD (1740.9 - 1766.0 MHz) Band 12. E-UTRAFDD (1990.0 - 786.0 MHz) Band 13. E-UTRAFDD (1990.0 - 786.0 MHz) Band 14. E-UTRAFDD (1850.0 e80.0 MHz) Band 15. E-UTRAFDD (1850.0 e80.0 MHz) Band 16. E-UTRAFDD (1800.0 - 845.0 MHz) Band 20. E-UTRAFDD (1800.0 - 845.0 MHz) Band 20. E-UTRAFDD (1800.0 - 845.0 MHz) Band 20. E-UTRAFDD (1800.0 - 186.0 MHz) Band 20. E-UTRAFDD (1800.0 - 186.0 MHz) Band 22. E-UTRAFDD (1800.0 - 2020.0 MHz) Band 23. E-UTRAFDD (1800.0 - 186.0 MHz) Band 24. E-UTRAFDD (1800.0 - 1915.0 MHz) Band 25. E-UTRAFDD (1800.0 - 1915.0 MHz) Band 26. E-UTRAFDD (1800.0 - 2010.0 MHz) Band 26. E-UTRAFDD (1800.0 - 2010.0 MHz) Band 26. E-UTRAFDD (1800.0 - 2010.0 MHz) Band 60. E-UTRAFDD (1900.0 - 2010.0 MHz) Band 60. E-UTRAFDD (1900.0 - 2010.0 MHz) Band 70. E-UTRAFDD (1900.0 - 2	Suman Panenti Cit.	
Category:       Andom amplitude modulation         Modulation:       16-QAM         Frequency Band:       Band 1, E-UTRAFDD (1920.0 - 1980.0 MHz)         Band 2, E-UTRAFDD (1920.0 - 1980.0 MHz)       Band 3, E-UTRAFDD (1710.0 - 1785.0 MHz)         Band 4, E-UTRAFDD (1710.0 - 1785.0 MHz)       Band 5, E-UTRAFDD (1710.0 - 1785.0 MHz)         Band 5, E-UTRAFDD (1800.0 - 849.0 MHz)       Band 6, E-UTRAFDD (1800.0 - 915.0 MHz)         Band 6, E-UTRAFDD (1800.0 - 915.0 MHz)       Band 7, E-UTRAFDD (1800.0 - 915.0 MHz)         Band 7, E-UTRAFDD (1800.0 - 915.0 MHz)       Band 11, E-UTRAFDD (1900.0 - 716.0 MHz)         Band 11, E-UTRAFDD (1900.0 - 716.0 MHz)       Band 11, E-UTRAFDD (1900.0 - 716.0 MHz)         Band 11, E-UTRAFDD (1900.0 - 915.0 MHz)       Band 11, E-UTRAFDD (1900.0 - 716.0 MHz)         Band 11, E-UTRAFDD (1900.0 - 716.0 MHz)       Band 11, E-UTRAFDD (1900.0 - 716.0 MHz)         Band 12, E-UTRAFDD (1900.0 - 945.0 MHz)       Band 12, E-UTRAFDD (1900.0 - 945.0 MHz)         Band 13, E-UTRAFDD (1900.0 - 945.0 MHz)       Band 22, E-UTRAFDD (1900.0 - 200.0 MHz)         Band 22, E-UTRAFDD (1900.0 - 945.0 MHz)       Band 23, E-UTRAFDD (1900.0 - 200.0 MHz)         Band 23, E-UTRAFDD (1900.0 - 200.0 MHz)       Band 24, E-UTRAFDD (1900.0 - 200.0 MHz)         Band 24, E-UTRAFDD (1900.0 - 201.0 MHz)       Band 26 E-UTRAFDD (1900.0 - 201.0 MHz)         Band 26 E-UTRAFDD (1900.0 - 201.0 MHz)       Band 26, E-UTRAFDD (1900.0 - 20		
Frequency Band:         Band 1, E-UTRA/FDD (1920.0 - 1980.0 MHz) Band 2, E-UTRA/FDD (1950.0 - 1910.0 MHz) Band 4, E-UTRA/FDD (1710.0 - 1785.0 MHz) Band 5, E-UTRA/FDD (830.0 - 840.0 MHz) Band 5, E-UTRA/FDD (830.0 - 840.0 MHz) Band 5, E-UTRA/FDD (830.0 - 840.0 MHz) Band 6, E-UTRA/FDD (170.0 - 1770.0 MHz) Band 7, E-UTRA/FDD (170.0 - 1770.0 MHz) Band 10, E-UTRA/FDD (170.0 - 1770.0 MHz) Band 11, E-UTRA/FDD (180.0 - 980.0 MHz) Band 12, E-UTRA/FDD (180.0 - 980.0 MHz) Band 14, E-UTRA/FDD (180.0 - 980.0 MHz) Band 15, E-UTRA/FDD (180.0 - 980.0 MHz) Band 16, E-UTRA/FDD (180.0 - 980.0 MHz) Band 20, E-UTRA/FDD (180.0 - 980.0 MHz) Band 21, E-UTRA/FDD (180.0 - 980.0 MHz) Band 22, E-UTRA/FDD (180.0 - 980.0 MHz) Band 23, E-UTRA/FDD (180.0 - 980.0 MHz) Band 24, E-UTRA/FDD (180.0 - 980.0 MHz) Band 25, E-UTRA/FDD (180.0 - 980.0 MHz) Band 26, E-UTRA/FDD (180.0 - 980.0 MHz) Band 27, E-UTRA/FDD (180.0 - 980.0 MHz) Band 28, E-UTRA/FDD (180.0 - 1915.0 MHz) Band 30, E-UTRA/FDD (180.0 - 1915.0 MHz) Band 60, E-UTRA/FDD (180.0 - 1710.0 MHz) Band 60, E-UTRA/FDD (190.0 - 2210.0 MHz) Band 70, E-UTRA/FDD (190.0 - 2210.0 MHz) Band 70, E-UTRA/FDD (190.0 - 2210.0 MHz) Band 70, E-UTRA/FDD (190.0 - 278.0 MHz) Band 70, E-UTRA/FDD (190.0 - 278.0 MHz) Band 70, E-UTRA/FDD (190.0 - 278.0 MHz) Band 70, E-UTRA/FDD (190.0 - 178.0 MHz) Band 70, E-	Category:	Random amplitude modulation
Band 2, E-UTRA/FDD (1890.0 - 1910.0 MHz)           Band 3, E-UTRA/FDD (1710.0 - 1785.0 MHz)           Band 4, E-UTRA/FDD (1710.0 - 1785.0 MHz)           Band 5, E-UTRA/FDD (880.0 - 849.0 MHz)           Band 5, E-UTRA/FDD (880.0 - 915.0 MHz)           Band 7, E-UTRA/FDD (880.0 - 915.0 MHz)           Band 7, E-UTRA/FDD (1710.0 - 1770.0 MHz)           Band 10, E-UTRA/FDD (1710.0 - 1770.0 MHz)           Band 11, E-UTRA/FDD (1710.0 - 1770.0 MHz)           Band 11, E-UTRA/FDD (170.0 - 1770.0 MHz)           Band 11, E-UTRA/FDD (170.0 - 1770.0 MHz)           Band 12, E-UTRA/FDD (990.0 - 710.0 MHz)           Band 13, E-UTRA/FDD (990.0 - 710.0 MHz)           Band 14, E-UTRA/FDD (900.0 - 916.0 MHz)           Band 15, E-UTRA/FDD (900.0 - 916.0 MHz)           Band 16, E-UTRA/FDD (980.0 - 945.0 MHz)           Band 17, E-UTRA/FDD (980.0 - 945.0 MHz)           Band 21, E-UTRA/FDD (980.0 - 945.0 MHz)           Band 22, E-UTRA/FDD (980.0 - 945.0 MHz)           Band 23, E-UTRA/FDD (980.0 - 945.0 MHz)           Band 24, E-UTRA/FDD (980.0 - 916.0 MHz)           Band 25, E-UTRA/FDD (1710.0 + 1780.0 MHz)           Band 26, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 28, E-UTRA/FDD (1820.0 - 201.0 MHz)           Band 29, E-UTRA/FDD (1920.0 - 231.0 MHz)           Band 30, E-UTRA/FDD (1920.0 - 23	Modulation:	16-QAM
Band 3, E-UTRA/FDD (1710.0 - 1785.0 MHz)           Band 4, E-UTRA/FDD (1710.0 - 1785.0 MHz)           Band 5, E-UTRA/FDD (884.0 840.0 MHz)           Band 5, E-UTRA/FDD (884.0 840.0 MHz)           Band 5, E-UTRA/FDD (880.0 - 840.0 MHz)           Band 6, E-UTRA/FDD (1740.9 - 1785.0 MHz)           Band 7, E-UTRA/FDD (1800.0 - 185.0 MHz)           Band 9, E-UTRA/FDD (1740.9 - 1770.0 MHz)           Band 10, E-UTRA/FDD (1740.9 - 1770.0 MHz)           Band 11, E-UTRA/FDD (172.9 - 1770.0 MHz)           Band 12, E-UTRA/FDD (172.9 - 1770.0 MHz)           Band 13, E-UTRA/FDD (172.9 - 1770.0 MHz)           Band 14, E-UTRA/FDD (172.9 - 1770.0 MHz)           Band 15, E-UTRA/FDD (172.9 - 1770.0 MHz)           Band 16, E-UTRA/FDD (185.0 - 880.0 MHz)           Band 17, E-UTRA/FDD (185.0 - 800.0 MHz)           Band 18, E-UTRA/FDD (185.0 - 800.0 MHz)           Band 20, E-UTRA/FDD (180.0 - 3480.0 MHz)           Band 21, E-UTRA/FDD (180.0 - 3480.0 MHz)           Band 22, E-UTRA/FDD (185.0 - 1915.0 MHz)           Band 23, E-UTRA/FDD (180.0 - 1915.0 MHz)           Band 24, E-UTRA/FDD (180.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (180.0 - 1915.0 MHz)           Band 26, E-UTRA/FDD (180.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (192.0 - 201.0 MHz)           Band 28, E-UTRA/FDD (192.0 - 201.0 MHz)           Band 28, E-UTRA/FDD (192.0 - 201.0 M	Frequency Band:	Band 1, E-UTRA/FDD (1920.0 - 1980.0 MHz)
Band 4, E-UTRA/FDD (1710.0 - 1765.0 MHz)           Band 5, E-UTRA/FDD (880.0 - 840.0 MHz)           Band 5, E-UTRA/FDD (800.0 - 860.0 MHz)           Band 6, E-UTRA/FDD (800.0 - 915.0 MHz)           Band 8, E-UTRA/FDD (1740.9 - 1764.9 MHz)           Band 9, E-UTRA/FDD (1740.9 - 1764.9 MHz)           Band 10, E-UTRA/FDD (1740.9 - 1770.0 MHz)           Band 11, E-UTRA/FDD (1740.9 - 1764.9 MHz)           Band 11, E-UTRA/FDD (1740.9 - 176.0 MHz)           Band 11, E-UTRA/FDD (772.0 - 177.0 MHz)           Band 11, E-UTRA/FDD (1740.9 - 176.0 MHz)           Band 12, E-UTRA/FDD (1760.0 - 786.0 MHz)           Band 13, E-UTRA/FDD (1850.0 80.0 MHz)           Band 14, E-UTRA/FDD (1850.0 80.0 MHz)           Band 15, E-UTRA/FDD (1850.0 80.0 MHz)           Band 16, E-UTRA/FDD (1850.0 - 862.0 MHz)           Band 20, E-UTRA/FDD (1850.0 - 862.0 MHz)           Band 20, E-UTRA/FDD (1850.0 - 186.0 MHz)           Band 21, E-UTRA/FDD (1850.0 - 186.0 MHz)           Band 22, E-UTRA/FDD (1850.0 - 186.0 MHz)           Band 23, E-UTRA/FDD (1800.0 - 2020.0 MHz)           Band 24, E-UTRA/FDD (1800.0 - 2020.0 MHz)           Band 25, E-UTRA/FDD (1800.0 - 176.0 MHz)           Band 26, E-UTRA/FDD (1800.0 - 2010.0 MHz)           Band 27, E-UTRA/FDD (1800.0 - 2010.0 MHz)           Band 30, E-UTRA/FDD (1800.0 - 2010.0 MHz)           Band 60, E-UTRA/FDD (1800.0 -		Band 2, E-UTRA/FDD (1850.0 - 1910.0 MHz)
Band 5, E-UTRA/FDD (824.0 - 849.0 MHz)           Band 5, E-UTRA/FDD (850.0 - 2570.0 MHz)           Band 6, E-UTRA/FDD (250.0 - 2570.0 MHz)           Band 7, E-UTRA/FDD (1749.9 - 1784.9 MHz)           Band 9, E-UTRA/FDD (1749.9 - 1784.9 MHz)           Band 11, E-UTRA/FDD (1427.9 - 1447.9 MHz)           Band 11, E-UTRA/FDD (1427.9 - 1447.9 MHz)           Band 11, E-UTRA/FDD (190.0 - 716.0 MHz)           Band 13, E-UTRA/FDD (788.0 - 786.0 MHz)           Band 14, E-UTRA/FDD (786.0 - 786.0 MHz)           Band 15, E-UTRA/FDD (1407.9 - 168.0 MHz)           Band 16, E-UTRA/FDD (1650.0 - 860.0 MHz)           Band 17, E-UTRA/FDD (1600.0 - 946.0 MHz)           Band 18, E-UTRA/FDD (1630.0 - 946.0 MHz)           Band 20, E-UTRA/FDD (1647.9 - 1462.9 MHz)           Band 21, E-UTRA/FDD (1647.9 - 1462.9 MHz)           Band 22, E-UTRA/FDD (1640.0 - 948.0 MHz)           Band 23, E-UTRA/FDD (1640.0 - 194.0 MHz)           Band 24, E-UTRA/FDD (1640.0 - 194.0 MHz)           Band 25, E-UTRA/FDD (1940.0 - 194.0 MHz)           Band 26 E-UTRA/FDD (190.0 - 210.0 MHz)           Band 27, E-UTRA/FDD (1920.0 - 2110.0 MHz)           Band 30, E-UTRA/FDD (1920.0 - 2210.0 MHz)           Band 26, E-UTRA/FDD (1920.0 - 2210.0 MHz)           Band 66, E-UTRA/FDD (1920.0 - 2210.0 MHz)           Band 66, E-UTRA/FDD (1960.0 - 720.0 MHz)           Band 66, E-UTRA/FDD (1		Band 3, E-UTRA/FDD (1710.0 - 1785.0 MHz)
Band 6, E-UTRA/FDD (800.0 - 840.0 MHz)           Band 7, E-UTRA/FDD (800.0 - 2570.0 MHz)           Band 7, E-UTRA/FDD (800.0 - 157.0 MHz)           Band 9, E-UTRA/FDD (147.9 - 1770.0 MHz)           Band 10, E-UTRA/FDD (147.9 - 1770.0 MHz)           Band 11, E-UTRA/FDD (147.9 - 1447.9 MHz)           Band 12, E-UTRA/FDD (147.9 - 1447.9 MHz)           Band 13, E-UTRA/FDD (770.0 - 770.0 MHz)           Band 14, E-UTRA/FDD (770.0 - 770.0 MHz)           Band 15, E-UTRA/FDD (780.0 - 786.0 MHz)           Band 14, E-UTRA/FDD (780.0 - 786.0 MHz)           Band 15, E-UTRA/FDD (832.0 - 862.0 MHz)           Band 16, E-UTRA/FDD (832.0 - 862.0 MHz)           Band 21, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 21, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 22, E-UTRA/FDD (1450.0 - 349.0 MHz)           Band 23, E-UTRA/FDD (1450.0 - 1915.0 MHz)           Band 24, E-UTRA/FDD (1620.0 - 2020.0 MHz)           Band 25, E-UTRA/FDD (1620.0 - 1915.0 MHz)           Band 26, E-UTRA/FDD (1620.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (1620.0 - 1915.0 MHz)           Band 28, E-UTRA/FDD (1620.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (1620.0 - 1915.0 MHz)           Band 28, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 28, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 66, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 66, E-UTRA/FDD (		
Band 7, E-UTRA/FDD (2500.0 - 95.0 MHz)           Band 8, E-UTRA/FDD (1800 915.0 MHz)           Band 9, E-UTRA/FDD (1740.9 - 1774.9 MHz)           Band 10, E-UTRA/FDD (1740.9 - 1774.9 MHz)           Band 11, E-UTRA/FDD (1990 710.0 MHz)           Band 11, E-UTRA/FDD (1770.0 MHz)           Band 11, E-UTRA/FDD (1770.0 MHz)           Band 12, E-UTRA/FDD (1880 788.0 MHz)           Band 13, E-UTRA/FDD (770.0 788.0 MHz)           Band 14, E-UTRA/FDD (788.0 - 788.0 MHz)           Band 15, E-UTRA/FDD (788.0 - 788.0 MHz)           Band 16, E-UTRA/FDD (1850.0 - 682.0 MHz)           Band 17, E-UTRA/FDD (1850.0 - 682.0 MHz)           Band 20, E-UTRA/FDD (1850.0 - 682.0 MHz)           Band 20, E-UTRA/FDD (1850.0 - 186.0 MHz)           Band 22, E-UTRA/FDD (1800.0 - 2020.0 MHz)           Band 23, E-UTRA/FDD (1800.0 - 186.0 MHz)           Band 24, E-UTRA/FDD (1800.0 - 2020.0 MHz)           Band 25, E-UTRA/FDD (1800.0 - 1915.0 MHz)           Band 26, E-UTRA/FDD (1800.0 - 2010.0 MHz)           Band 27, E-UTRA/FDD (1800.0 - 2010.0 MHz)           Band 30, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 66, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 66, E-UTRA/FDD (1900.0 - 780.0 MHz)           Band 60, E-UTRA/FDD (1900.0 - 780.0 MHz)           Band 70, E-UTRA/FDD (1965.0 - 1780.0 MHz)           Band 70, E-UTRA/FDD (1965.0 - 1780.0 MHz)<		
Band 8, E-UTRA/FDD (880.0 - 915.0 MHz)           Band 9, E-UTRA/FDD (1710.0 - 1774.9 MHz)           Band 11, E-UTRA/FDD (1427.9 - 1774.9 MHz)           Band 11, E-UTRA/FDD (1427.9 - 1774.0 MHz)           Band 11, E-UTRA/FDD (990.0 - 716.0 MHz)           Band 12, E-UTRA/FDD (778.0 - 778.0 MHz)           Band 13, E-UTRA/FDD (788.0 - 798.0 MHz)           Band 14, E-UTRA/FDD (788.0 - 798.0 MHz)           Band 15, E-UTRA/FDD (780.0 - 786.0 MHz)           Band 16, E-UTRA/FDD (800.0 - 645.0 MHz)           Band 18, E-UTRA/FDD (800.0 - 645.0 MHz)           Band 18, E-UTRA/FDD (800.0 - 645.0 MHz)           Band 20, E-UTRA/FDD (800.0 - 645.0 MHz)           Band 22, E-UTRA/FDD (9410.0 - 349.0 MHz)           Band 23, E-UTRA/FDD (3410.0 - 349.0 MHz)           Band 24, E-UTRA/FDD (1447.9 - 1482.9 MHz)           Band 25, E-UTRA/FDD (1450.0 - 191.6 MHz)           Band 26 E-UTRA/FDD (1450.0 - 191.6 MHz)           Band 27 E-UTRA/FDD (1900.0 - 209.0 MHz)           Band 28 E-UTRA/FDD (1900.0 - 201.0 MHz)           Band 30, E-UTRA/FDD (1900.0 - 201.0 MHz)           Band 66, E-UTRA/FDD (1920.0 - 201.0 MHz)           Band 66, E-UTRA/FDD (1900.0 - 201.0 MHz)           Band 66, E-UTRA/FDD (1900.0 - 201.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 600.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 600.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 17		
Band 9, E-UTRA/FDD (1748.9 - 1764.9 MHz)           Band 10, E-UTRA/FDD (1770.0 - 1770.0 MHz)           Band 11, E-UTRA/FDD (1427.9 - 1447.9 MHz)           Band 12, E-UTRA/FDD (1427.9 - 1447.9 MHz)           Band 13, E-UTRA/FDD (770.0 - 780.0 MHz)           Band 14, E-UTRA/FDD (780.0 - 780.0 MHz)           Band 15, E-UTRA/FDD (780.0 - 780.0 MHz)           Band 14, E-UTRA/FDD (780.0 - 780.0 MHz)           Band 17, E-UTRA/FDD (780.0 - 780.0 MHz)           Band 18, E-UTRA/FDD (832.0 - 862.0 MHz)           Band 20, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 21, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 23, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 23, E-UTRA/FDD (1450.0 - 3490.0 MHz)           Band 24, E-UTRA/FDD (1450.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (1620.0 - 2020.0 MHz)           Band 26, E-UTRA/FDD (1620.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (1620.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 28, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 28, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 66, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 66, E-UTRA/FDD (1920.0 - 2010.0 MHz)           Band 66, E-UTRA/FDD (1980.0 - 2020.0 MHz)           Band 71, E-UTRA/FDD (1980.0 - 2020.0 MHz)           Band 71, E-UTRA/FDD (1980.0 - 2010.0 MHz)           Band 70,		
Band 10, E-UTRA/FDD (1710.0 - 1770.0 MHz)           Band 11, E-UTRA/FDD (1427.9 - 1447.9 MHz)           Band 13, E-UTRA/FDD (999.0 - 710.0 MHz)           Band 13, E-UTRA/FDD (777.0 - 787.0 MHz)           Band 14, E-UTRA/FDD (788.0 - 788.0 MHz)           Band 14, E-UTRA/FDD (788.0 - 788.0 MHz)           Band 14, E-UTRA/FDD (788.0 - 788.0 MHz)           Band 17, E-UTRA/FDD (788.0 - 788.0 MHz)           Band 18, E-UTRA/FDD (815.0 - 880.0 MHz)           Band 18, E-UTRA/FDD (832.0 - 862.0 MHz)           Band 20, E-UTRA/FDD (832.0 - 862.0 MHz)           Band 21, E-UTRA/FDD (180.0 - 1482.9 MHz)           Band 22, E-UTRA/FDD (180.0 - 1482.9 MHz)           Band 23, E-UTRA/FDD (180.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (180.0 - 1915.0 MHz)           Band 26, E-UTRA/FDD (180.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (180.0 - 1915.0 MHz)           Band 28, E-UTRA/FDD (180.0 - 201.0 MHz)           Band 28, E-UTRA/FDD (192.0 - 201.0 MHz)           Band 30, E-UTRA/FDD (192.0 - 201.0 MHz)           Band 60, E-UTRA/FDD (192.0 - 201.0 MHz)           Band 70, E-UTRA/FDD (198.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (198.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (198.0 - 728.0 MHz)           Band 60, E-UTRA/FDD (198.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (198.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (198.0 - 728.0 MH		그는 것이 같은 것이 같이 있다. 것이 같아요. 가지 않는 것이 같이 많이 많이 많이 가지 않는 것이 있다.
Band 11, E-UTRA/FDD (1427.9 - 1447.9 MHz)           Band 12, E-UTRA/FDD (990.0 - 710.0 MHz)           Band 14, E-UTRA/FDD (778.0 - 780.0 MHz)           Band 15, E-UTRA/FDD (778.0 - 780.0 MHz)           Band 14, E-UTRA/FDD (904.0 - 716.0 MHz)           Band 15, E-UTRA/FDD (904.0 - 716.0 MHz)           Band 18, E-UTRA/FDD (904.0 - 716.0 MHz)           Band 19, E-UTRA/FDD (905.0 - 645.0 MHz)           Band 19, E-UTRA/FDD (930.0 - 645.0 MHz)           Band 20, E-UTRA/FDD (932.0 - 645.0 MHz)           Band 21, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 22, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 23, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 24, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 25, E-UTRA/FDD (1645.5 - 1660.5 MHz)           Band 26, E-UTRA/FDD (1655.1 660.5 MHz)           Band 27, E-UTRA/FDD (1650.0 - 1915.0 MHz)           Band 26 E-UTRA/FDD (1605.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (1605.0 - 178.0 MHz)           Band 26, E-UTRA/FDD (1605.0 - 178.0 MHz)           Band 30, E-UTRA/FDD (1605.0 - 178.0 MHz)           Band 66, E-UTRA/FDD (1605.0 - 178.0 MHz)           Band 70, E-UTRA/FDD (1605.0 - 178.0 MHz)           Band 70, E-UTRA/FDD (1605.0 - 698.0 MHz)           Band 70, E-UTRA/FDD (1605.0 - 178.0 MHz)           Band 70, E-UTRA/FDD (1605.0 - 698.0 MHz)           Band 71, E-UTRA/FDD (1605		
Bind 12, E-UTRA/FDD (999.0 - 710.0 MHz)           Band 14, E-UTRA/FDD (772.0 - 787.0 MHz)           Band 14, E-UTRA/FDD (786.0 - 788.0 MHz)           Band 17, E-UTRA/FDD (780.0 - 788.0 MHz)           Band 17, E-UTRA/FDD (850.0 - 645.0 MHz)           Band 18, E-UTRA/FDD (832.0 - 865.0 MHz)           Band 20, E-UTRA/FDD (832.0 - 865.0 MHz)           Band 21, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 22, E-UTRA/FDD (3410.0 - 349.0 MHz)           Band 23, E-UTRA/FDD (1450.0 - 1985.0 - 1985.0 MHz)           Band 24, E-UTRA/FDD (1650.0 - 1985.0 MHz)           Band 25, E-UTRA/FDD (1650.0 - 1985.0 MHz)           Band 26, E-UTRA/FDD (1650.0 - 1985.0 MHz)           Band 27, E-UTRA/FDD (1780.0 - 284.0 MHz)           Band 27, E-UTRA/FDD (170.0 - 178.0 MHz)           Band 28, E-UTRA/FDD (192.0 - 281.0 MHz)           Band 66, E-UTRA/FDD (192.0 - 281.0 MHz)           Band 66, E-UTRA/FDD (198.0 - 178.0 MHz)           Band 71, E-UTRA/FDD (198.0 - 281.0 MHz)           Band 70, E-UTRA/FDD (198.0 - 178.0 MHz)           Band 71, E-UTRA/FDD (198.0 - 178.0 MHz)           Band 71, E-UTRA/FDD (198.0 - 188.0 MHz)           Band 71, E-UTRA/FDD (198.0 - 188.0 MHz)           Band 71, E-UTRA/FDD (198.0		
Band 13, E-UTRA/FDD (777.0 - 787.0 MHz)           Band 14, E-UTRA/FDD (788.0 - 788.0 MHz)           Band 17, E-UTRA/FDD (786.0 - 788.0 MHz)           Band 18, E-UTRA/FDD (780.0 - 786.0 MHz)           Band 18, E-UTRA/FDD (815.0 - 880.0 MHz)           Band 20, E-UTRA/FDD (832.0 - 965.0 MHz)           Band 21, E-UTRA/FDD (832.0 - 965.0 MHz)           Band 22, E-UTRA/FDD (340.0 - 1462.9 MHz)           Band 23, E-UTRA/FDD (340.0 - 1462.9 MHz)           Band 22, E-UTRA/FDD (340.0 - 2480.0 MHz)           Band 23, E-UTRA/FDD (340.0 - 3480.0 MHz)           Band 25, E-UTRA/FDD (350.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (350.0 - 1915.0 MHz)           Band 26, E-UTRA/FDD (360.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (360.0 - 1915.0 MHz)           Band 28, E-UTRA/FDD (360.0 - 2816.0 MHz)           Band 27, E-UTRA/FDD (360.0 - 2816.0 MHz)           Band 30, E-UTRA/FDD (360.0 - 2816.0 MHz)           Band 66, E-UTRA/FDD (360.0 - 2816.0 MHz)           Band 66, E-UTRA/FDD (360.0 - 2816.0 MHz)           Band 66, E-UTRA/FDD (369.0 - 728.0 MHz)           Band 60, E-UTRA/FDD (693.0 - 178.0 MHz)           Band 70, E-UTRA/FDD (693.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (693.0 - 178.0 MHz)           Band 70, E-UTRA/FDD (693.0 - 698.0 MHz)           Band 70, E-UTRA/FDD (698.0 GH0.0 MHz)           Band 70, E-UTRA/FDD (698.0 GH0.0 MHz		
Band 14, E-UTRA/FDD (788.0 - 796.0 MHz)           Band 17, E-UTRA/FDD (850.0 - 645.0 MHz)           Band 18, E-UTRA/FDD (850.0 - 645.0 MHz)           Band 19, E-UTRA/FDD (830.0 - 645.0 MHz)           Band 20, E-UTRA/FDD (830.0 - 645.0 MHz)           Band 21, E-UTRA/FDD (830.0 - 645.0 MHz)           Band 22, E-UTRA/FDD (340.0 - 3480.0 MHz)           Band 23, E-UTRA/FDD (340.0 - 3480.0 MHz)           Band 25, E-UTRA/FDD (1626.5 - 1660.5 MHz)           Band 26, E-UTRA/FDD (1626.5 - 1660.5 MHz)           Band 27, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 28, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (1800.0 - 1915.0 MHz)           Band 28, E-UTRA/FDD (1800.0 - 1915.0 MHz)           Band 29, E-UTRA/FDD (1800.0 - 1915.0 MHz)           Band 20, E-UTRA/FDD (1900.0 - 2010.0 MHz)           Band 30, E-UTRA/FDD (1900.0 - 2010.0 MHz)           Band 60, E-UTRA/FDD (1900.0 - 2010.0 MHz)           Band 60, E-UTRA/FDD (1900.0 - 2010.0 MHz)           Band 70, E-UTRA/FDD (1905.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1905.0 - 1710.0 MHz)           Band 71, E-UTRA/FDD (1605.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1605.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1605.0 - 1710.0 MHz)           Band 71, E-UTRA/FDD (1605.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1605.0 - 1710.0 MHz)           Band 71,		
Band 17, E-UTRA/FDD (704.0 - 716.0 MHz)           Band 18, E-UTRA/FDD (855.0 - 830.0 MHz)           Band 18, E-UTRA/FDD (850.0 465.0 MHz)           Band 20, E-UTRA/FDD (832.0 - 865.0 MHz)           Band 21, E-UTRA/FDD (340.0 - 349.0 MHz)           Band 22, E-UTRA/FDD (340.0 - 349.0 MHz)           Band 23, E-UTRA/FDD (340.0 - 349.0 MHz)           Band 24, E-UTRA/FDD (155.0 - 839.0 MHz)           Band 25, E-UTRA/FDD (155.0 - 106.0 5 MHz)           Band 26 E-UTRA/FDD (1650.0 - 1015.0 MHz)           Band 27 E-UTRA/FDD (170.0 - 178.0 MHz)           Band 27 E-UTRA/FDD (170.0 - 748.0 MHz)           Band 28 E-UTRA/FDD (170.0 - 748.0 MHz)           Band 28 E-UTRA/FDD (170.0 - 748.0 MHz)           Band 28 E-UTRA/FDD (170.0 - 748.0 MHz)           Band 30, E-UTRA/FDD (192.0 - 221.0 MHz)           Band 66, E-UTRA/FDD (192.0 - 221.0 MHz)           Band 66, E-UTRA/FDD (198.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (198.0 - 728.0 MHz)           Band 71, E-UTRA/FDD (198.0 - 280.0 MHz)           Band 71, E-UTRA/FDD (198.0 - 280.0 MHz)           Band 71, E-UTRA/FDD (198.0 - 280.0 MHz)           Band 70, E-UTRA/FDD (198.0 - 280.0 MHz)           Waldation band (0.0 - 600.0 MHz)           Waldation band (0.0 - 600.0 MHz)           Band 71, E-UTRA/FDD (198.0 - 280.0 MHz)           Band 71, E-UTRA/FDD (198.0 - 180.0 MHz)		
Band 18, E-UTRA/FDD (815.0 - 830.0 MHz)           Band 20, E-UTRA/FDD (830.0 - 645.0 MHz)           Band 21, E-UTRA/FDD (832.0 465.0 MHz)           Band 22, E-UTRA/FDD (3410.0 - 3460.0 MHz)           Band 22, E-UTRA/FDD (3410.0 - 3460.0 MHz)           Band 22, E-UTRA/FDD (340.0 - 3460.0 MHz)           Band 23, E-UTRA/FDD (340.0 - 3460.0 MHz)           Band 24, E-UTRA/FDD (360.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (360.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (360.0 - 1915.0 MHz)           Band 26, E-UTRA/FDD (360.0 - 281.0 MHz)           Band 27, E-UTRA/FDD (360.0 - 281.0 MHz)           Band 30, E-UTRA/FDD (305.0 - 281.0 MHz)           Band 30, E-UTRA/FDD (305.0 - 281.0 MHz)           Band 66, E-UTRA/FDD (360.0 - 281.0 MHz)           Band 66, E-UTRA/FDD (1800.0 - 270.0 MHz)           Band 60, E-UTRA/FDD (190.0 - 1780.0 MHz)           Band 70, E-UTRA/FDD (680.0 - 280.0 MHz)           Band 70, E-UTRA/FDD (680.0 - 680.0 MHz)           Band 70, E-UTRA/FDD (680.0 F80.0 MHz)           Band 70, E-UTRA/FDD (680.0 F80.0 MHz)           Band 70, E-UTRA/FDD (680.0 F80.0 MHz)		
Band 19, E-UTRA/FDD (830.0 - 845.0 MHz)           Band 20, E-UTRA/FDD (342.0 - 862.0 MHz)           Band 21, E-UTRA/FDD (3410.0 - 3480.0 MHz)           Band 22, E-UTRA/FDD (3400.0 - 3480.0 MHz)           Band 23, E-UTRA/FDD (3400.0 - 3480.0 MHz)           Band 23, E-UTRA/FDD (1656.5 - 1660.5 MHz)           Band 25, E-UTRA/FDD (1656.7 - 1660.5 MHz)           Band 25, E-UTRA/FDD (1650.7 - 884.0 MHz)           Band 26, E-UTRA/FDD (1650.7 - 884.0 MHz)           Band 27, E-UTRA/FDD (1650.7 - 884.0 MHz)           Band 27, E-UTRA/FDD (1905.0 - 2110.0 MHz)           Band 26, E-UTRA/FDD (1900.7 - 284.0 MHz)           Band 30, E-UTRA/FDD (1900.0 - 2010.0 MHz)           Band 66, E-UTRA/FDD (1900.0 - 210.0 MHz)           Band 66, E-UTRA/FDD (1900.0 - 780.0 MHz)           Band 70, E-UTRA/FDD (1905.0 - 1780.0 MHz)           Band 70, E-UTRA/FDD (1905.0 - 1780.0 MHz)           Band 70, E-UTRA/FDD (1905.0 - 1780.0 MHz)           Band 70, E-UTRA/FDD (1605.0 - 1780.0 MHz)           Band 71, E-UTRA/FDD (1605.0 - 1780.0 MHz)           Band 73, E-UTRA/FDD (1605.0 - 1780.0 MHz)           Band 74, E-UTRA/FDD (1605.0 - 1780.0 MHz)           Band 75, E-UTRA/FDD (1605.0 - 1780.0 MHz)           Band		
Band 20, E-UTRA/FDD (832.0 - 862.0 MHz)           Band 21, E-UTRA/FDD (341.0 - 349.0 MHz)           Band 22, E-UTRA/FDD (340.0 - 349.0 MHz)           Band 23, E-UTRA/FDD (300.0 - 2020.0 MHz)           Band 24, E-UTRA/FDD (1625.5 - 1660.5 MHz)           Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 26, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 27, E-UTRA/FDD (300.0 - 2310.0 MHz)           Band 26, E-UTRA/FDD (300.0 - 2316.0 MHz)           Band 27, E-UTRA/FDD (300.0 - 2316.0 MHz)           Band 28, E-UTRA/FDD (300.0 - 2316.0 MHz)           Band 30, E-UTRA/FDD (1920.0 - 2316.0 MHz)           Band 66, E-UTRA/FDD (1920.0 - 2310.0 MHz)           Band 66, E-UTRA/FDD (1963.0 - 1710.0 MHz)           Band 66, E-UTRA/FDD (1963.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1963.0 - 1710.0 MHz)           Band 71, E-UTRA/FDD (1963.0 - 1800.0 MHz)           Validation band (0.0 - 6000.0 MHz)           Validation band (0.0 - 6000.0 MHz)           Detailed Specification:           Modulation Scheme: SC-FDMA           Number of PUSCHs: 1           Settings for Subframe #0 to #9:           Modulation Scheme: QPSK           Data Type: UL-SCH		
Band 21, E-UTRA/FDD (1447.9 - 1462.9 MHz)           Band 22, E-UTRA/FDD (3410.0 - 3490.0 MHz)           Band 23, E-UTRA/FDD (1626.5 - 1660.5 MHz)           Band 24, E-UTRA/FDD (1626.5 - 1660.5 MHz)           Band 25, E-UTRA/FDD (1626.5 - 1660.5 MHz)           Band 25, E-UTRA/FDD (1626.5 - 1660.5 MHz)           Band 26 E-UTRA/FDD (1626.5 - 1660.5 MHz)           Band 27 E-UTRA/FDD (1620.5 - 160.5 MHz)           Band 28 E-UTRA/FDD (1670.0 - 1780.0 MHz)           Band 26 E-UTRA/FDD (1700.0 - 748.0 MHz)           Band 30, E-UTRA/FDD (1700.0 - 1780.0 MHz)           Band 66, E-UTRA/FDD (1710.0 - 1780.0 MHz)           Band 60, E-UTRA/FDD (1695.0 - 1710.0 MHz)           Band 60, E-UTRA/FDD (1696.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1696.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1696.0 - 680.0 MHz)           Validation band (0.0 - 6000.0 MHz)           Validation Scheme: SC-FDMA           Number of PUSCHs: 1           Settings for Subframe #0 to #9:           Modulation Schemet: QPSK           Data Type: U-SCH           Number RB: 1           Transport Block Size: 258           TBS Index: 14		
Band 22, E-UTRA/FDD (3410.0 - 3490.0 MHz)           Band 23, E-UTRA/FDD (3000.0 - 2020.0 MHz)           Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (301.0 - 849.0 MHz)           Band 26 E-UTRA/FDD (507.0 - 824.0 MHz)           Band 27 E-UTRA/FDD (507.0 - 824.0 MHz)           Band 28 E-UTRA/FDD (703.0 - 748.0 MHz)           Band 30, E-UTRA/FDD (1920.0 - 201.0 MHz)           Band 65, E-UTRA/FDD (1920.0 - 201.0 MHz)           Band 66, E-UTRA/FDD (1920.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 728.0 MHz)           Band 70, E-UTRA/FDD (1965.0 - 178.0 MHz)           Band 70, E-UTRA/FDD (196		에 가지 같은 것은 것이 있다고 있는 것을 알았다. 이렇게 말했다고 있는 것이 가지 않는 것을 것을 것 같아요. 또는 것은 것이 있다. 이렇게 있는 것은 것이 있는 것이 있다. 이렇게 가지 않는 것이 있는 것이 있다. 이렇게 가지 않는 것이 있는 것이 있는 것이 있다. 이렇게 가지 않는 것이 있는 것이 있는 것이 있는 것이 있는 것이 있는 것이 있다. 이렇게 말했다. 것이 있는 것이 없는 것이 있는 것이 없는 것이 있는 것이 없는 것이 있는 것이 없는 것이 없다. 않은 것이 없는 것이 있 않은 것이 없는 것 것이 않아, 것이 않아, 것이 않아, 것이 않아, 것이 없는 것이 없는 것이 없다. 것이 않아, 것이 않아, 것이 없는 것이 없는 것이 없는 것이 없는 것이 않아, 것이 않아, 것이 없는 것이 없다. 것이 않아, 것이 않아, 않아, 것이 않아, 않아, 것이 않아, 것이 않아, 않아, 있 않아, 것이 않아, 것이 않아, 않아, 것이 않아, 것이 않아, 않아, 것이 않아, 것이 않아, 것이 않아, 않아, 것이 않아, 않아, 것이 않아, 않아, 것이 않아, 않아, 않아, 않아, 않이 않이 않이 않아, 않아, 않이
Band 23, E-UTRA/FDD (2000.0 - 2020.0 MHz)           Band 24, E-UTRA/FDD (1552.5 - 1660.5 MHz)           Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 25, E-UTRA/FDD (1915.0 MHz)           Band 27, E-UTRA/FDD (2000.0 - 284.0 MHz)           Band 27, E-UTRA/FDD (2000.0 - 284.0 MHz)           Band 26, E-UTRA/FDD (2000.0 - 281.0 MHz)           Band 30, E-UTRA/FDD (1920.0 - 2810.0 MHz)           Band 66, E-UTRA/FDD (1920.0 - 2810.0 MHz)           Band 66, E-UTRA/FDD (1950.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1965.0 - 1710.0 MHz)           Band 71, E-UTRA/FDD (1965.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1965.0 - 1710.0 MHz)           Band 71, E-UTRA/FD (1965.0 - 1710.0 MHz)           Band 71, E-		
Band 24, E-UTRA/FDD (1626.5 - 1660.5 MHz)           Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)           Band 26 E-UTRA/FDD (814.0 - 649.0 MHz)           Band 27 E-UTRA/FDD (807.0 - 684.0 MHz)           Band 28 E-UTRA/FDD (2005.0 - 2315.0 MHz)           Band 28 E-UTRA/FDD (2005.0 - 2315.0 MHz)           Band 30, E-UTRA/FDD (2005.0 - 2315.0 MHz)           Band 30, E-UTRA/FDD (2005.0 - 2315.0 MHz)           Band 66, E-UTRA/FDD (1710.0 - 1780.0 MHz)           Band 66, E-UTRA/FDD (1960.0 - 220.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 1780.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 278.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 1780.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 1780.0 MHz)           Band 70, E-UTRA/FDD (1965.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1960.0 - 600.0 MHz)           Band 70, E-UTRA/FDD (1965.0 - 1710.0 MHz)           Band 7		
Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)         Band 26 E-UTRA/FDD (814.0 - 849.0 MHz)         Band 27 E-UTRA/FDD (807.0 - 824.0 MHz)         Band 30, E-UTRA/FDD (2050.0 - 2315.0 MHz)         Band 30, E-UTRA/FDD (2050.0 - 2315.0 MHz)         Band 65, E-UTRA/FDD (1820.0 - 201.0 MHz)         Band 66, E-UTRA/FDD (1900.0 - 201.0 MHz)         Band 66, E-UTRA/FDD (1900.0 - 2210.0 MHz)         Band 66, E-UTRA/FDD (1900.0 - 2210.0 MHz)         Band 60, E-UTRA/FDD (1900.0 - 221.0 MHz)         Band 70, E-UTRA/FDD (1905.0 - 178.0 MHz)         Band 71, E-UTRA/FDD (1905.0 - 178.0 MHz)         Band 71, E-UTRA/FD (1905.0 - 178.0 MHz)		승규가 내는 가지 않고 있는 것 같아? 이렇게 나가지 않는 것 같아. 나는 것 같아? 나는 것이 같아?
Band 26 E-UTRA/FDD (814.0 - 649.0 MHz)         Band 27 E-UTRA/FDD (807.0 - 824.0 MHz)         Band 28 E-UTRA/FDD (907.0 - 824.0 MHz)         Band 30, E-UTRA/FDD (902.0 - 2315.0 MHz)         Band 65, E-UTRA/FDD (1710.0 -1780.0 MHz)         Band 66, E-UTRA/FDD (1710.0 -1780.0 MHz)         Band 66, E-UTRA/FDD (1963.0 - 1780.0 MHz)         Band 66, E-UTRA/FDD (1665.0 - 1780.0 MHz)         Band 70, E-UTRA/FDD (1665.0 - 1780.0 MHz)         Band 70, E-UTRA/FDD (1665.0 - 1780.0 MHz)         Band 70, E-UTRA/FDD (1665.0 - 180.0 MHz)         Validation band (0.0 - 600.0 MHz)         Validation Scheme: SC-FDMA         Number of PUSCHs: 1         Settings for Subframe #0 to #9.         Modulation Scheme: QPSK         Data Type: UL-SCH         Number 0B: 1         Transport Block Size: 258         TBS Index: 14		
Band 27 E-UTRA/FDD (507.0 - 624.0 MHz)           Band 28 E-UTRA/FDD (703.0 - 748.0 MHz)           Band 30, E-UTRA/FDD (2030.0 - 2010.0 MHz)           Band 66, E-UTRA/FDD (1710.0 - 1780.0 MHz)           Band 66, E-UTRA/FDD (1710.0 - 1780.0 MHz)           Band 66, E-UTRA/FDD (1980.0 - 2210.0 MHz)           Band 70, E-UTRA/FDD (1980.0 - 1710.0 MHz)           Band 70, E-UTRA/FDD (1980.0 - 1710.0 MHz)           Band 71, E-UTRA/FDD (1980.0 - 1710.0 MHz)           Band 71, E-UTRA/FDD (1980.0 MHz)           Detailed Specification:           Modulation Scheme: SC-FDMA           Numbar of PUSCHs: 1           Settings for Subframe #0 to #9:           Modulation Scheme: QPSK           Data Type: UL-SCH           Numbar AB: 1           Transport Block Size: 258           TBS Index: 14		
Band 28 E-UTRA/FDD (703.0 - 748.0 MHz)         Band 30, E-UTRA/FDD (730.0 - 2315.0 MHz)         Band 65, E-UTRA/FDD (730.0 - 2010.0 MHz)         Band 66, E-UTRA/FDD (1710.0 - 1780.0 MHz)         Band 60, E-UTRA/FDD (980.0 - 728.0 MHz)         Band 70, E-UTRA/FDD (980.0 - 728.0 MHz)         Band 70, E-UTRA/FDD (1695.0 - 1780.0 MHz)         Band 70, E-UTRA/FDD (1695.0 - 680.0 MHz)         Band 70, E-UTRA/FDD (1695.0 - 680.0 MHz)         Band 70, E-UTRA/FDD (1695.0 - 680.0 MHz)         Validation band (0.0 - 6000.0 MHz)         Detailed Specification:         Modulation Scheme: SC-FDMA         Number of PUSCHs: 1         Settings for Subframe #0 to #9:         Modulation Schemet: QPSK         Data Type: UL-SCH         Number AB: 1         Transport Block Size: 258         TBS Index: 14		
Band 30, E-UTRA/FDD (2305.0 - 2315.0 MHz) Band 65, E-UTRA/FDD (1920.0 - 2010.0 MHz) Band 66, E-UTRA/FDD (1710.0 1780.0 MHz) Band 70, E-UTRA/FDD (1905.0 - 1710.0 MHz) Band 71, E-UTRA/FDD (1905.0 - 1710.0 MHz) Validation band (0.0 - 6000.0 MHz) Validation band (0.0 - 6000.0 MHz) Validation Scheme: SC-FDMA Number of PUSCHa: 1 Settings for Subframe #0 to #9. Modulation Scheme: QPSK Data Type: UL-SCH Number RB: 1 Transport Block Size: 256 TBS Index: 14		그는 것 같이 가지 않는 것이 많이
Band 65, E-UTRA/FDD (1920.0 - 2010.0 MHz) Band 66, E-UTRA/FDD (0980.0 - 728.0 MHz) Band 70, E-UTRA/FDD (0980.0 - 728.0 MHz) Band 70, E-UTRA/FDD (663.0 - 608.0 MHz) Validation band (0.0 - 6000.0 MHz) Validation band (0.0 - 6000.0 MHz) Validation band (0.0 - 6000.0 MHz) Validation Scheme: SC-FDMA Numbar of PUSCHs: 1 Settings for Subtrame #0 to #9: Modulation Scheme: QPSK Data Type: UL-SCH Numbar RB: 1 Transport Block Size: 258 TBS Index: 14		
Band 66, E-UTRA/FDD (1710.0 - 1780.0 MHz) Band 70, E-UTRA/FDD (698.0 - 228.0 MHz) Band 70, E-UTRA/FDD (698.0 - 128.0 MHz) Band 71, E-UTRA/FDD (668.0 - 698.0 MHz) Validation band (0.0 - 6000.0 MHz) Validation band (0.0 - 6000.0 MHz) Detailed Specification: Modulation Scheme: SC-FDMA Number of PUSCHs: 1 Settings for Subframe #0 to #9: Modulation Scheme: QPSK Data Type: UL-SCH Number RB: 1 Transport Block Size: 258 TBS Index: 14		
Band 68, E-UTRA/FDD (998.0 - 728.0 MHz) Band 70, E-UTRA/FDD (1995.0 - 1710.0 MHz) Band 71, E-UTRA/FDD (693.0 - 698.0 MHz) Validation band (0.0 - 6000.0 MHz) Validation Scheme: SC-FDMA Number of PUSCHa: 1 Settings for Subframe #0 to #9. Modulation Scheme: QPSK Data Type: UL-SCH Number RB: 1 Transport Block Size: 258 TBS Index: 14		
Band 70, E-UTRA/FDD (1695.0 - 1710.0 MHz) Band 71, E-UTRA/FDD (663.0 - 698.0 MHz) Validation band (0.0 - 6000.0 MHz) Detailed Specification: Modulation Scheme: SC-FDMA Number of PUSCHs: 1 Settings for Subframe #0 to #9: Modulation Scheme: QPSK Data Type: UL-SCH Number RB: 1 Transport Block Size: 258 TBS Index: 14		
Band 71, E-UTRA/FDD (663.0 - 699.0 MHz) Validation band (0.0 - 6000.0 MHz) Detailed Specification: Modulation Scheme: SC-FDMA Numbar of PUSCHs: 1 Settings for Subtrame #0 to #9: Modulation Scheme: QPSK Data Type: UL-SCH Numbar RB: 1 Transport Block Size: 258 TBS Index: 14		
Validation band (0.0 - 6000.0 MHz) Detailed Specification: Modulation Scheme: SC-FDMA Number of PUSCHs: 1 Settings for Subframe #0 to #9: Modulation Schemet, 0PSK Data Type: UL-SCH Number RB: 1 Transport Block Size: 256 TBS Index: 14		
Detailed Specification: Modulation Scheme: SC-FDMA Number of PUSCHs: 1 Settings for Subframe #0 to #9: Modulation Scheme: QPSK Data Type: UL-SCH Number RB: 1 Transport Block Size: 256 TBS Index: 14		
Number of PUSCHs: 1 Settings for Subframe #0 to #9: Modulation Schemew OPSK Data Type: UL-SCH Number RB: 1 Transport Block Size: 256 TBS Index: 14		validation dana (c.o. dodd.o write)
Settings for Subframe #0 to #9: Modulation Scheme: QPSK Data Type: UL-SCH Number RB: 1 Transport Block Size: 258 TBS Index: 14	Detailed Specification:	
Modulation Scheme: QPSK Data Type: UL-SCH Number RB: UL-SCH Transport Block Size: 256 TBS Index: 14		
Data Type: UL-SCH Number RB: 1 Transport Block Size: 256 TBS Index: 14		
Number PB: 1 Transport Block Size: 256 TBS Index: 14		
Transport Block Size: 258 TBS Index: 14		
TBS Index: 14		
MCS Index: 15		
Data Type: PN9	Provide Lands	
Bandwidth. 10.0 MHz		
Integration Time: 10.0 ms	megration (ime:	10.0 ms

PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)" Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version). z

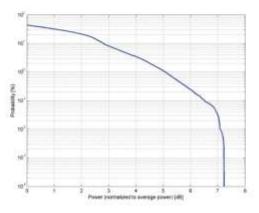
**UID Specification Sheet** 

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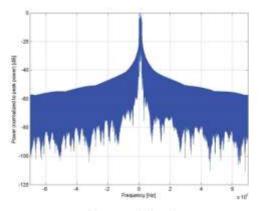




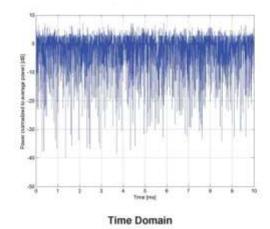
Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Complementary Cumulative Distribution Function (CCDF)







**UID Specification Sheet** 

UID 10176-CAE page 2/2





## Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

#### LTE-FDD (SC-FDMA, 1 R8, 20 MHz, 16-QAM)

Group	10	
uin-		
UID:		

LTE-FDO 10170-CAD

6.52 dB

PAR:		
MIF-		

1011	-9.1000
Standard Reference:	3GPP / ETSI TS 136.101 V8.4.0 3GPP / ETSI TS 136.213 V8.4.0
	FCC OET KDB 941225 D05 SAR for LTE Devices v01
Category:	Random amplitude modulation
Modulation:	16-QAM
Frequency Band:	Band 1, E-UTRA/FDD (1920.0 - 1980.0 MHz)
	Band 2, E-UTRA/FDD (1850.0 - 1910.0 MHz)
	Band 3, E-UTRA/FDD (1710.0 - 1765.0 MHz)
	Band 4, E-UTRA/FDD (1710.0 - 1755.0 MHz)
	Band 7, E-UTRA/FDD (2500.0 - 2570.0 MHz)
	Band 9, E-UTRA/FDD (1749.9 - 1784.9 MHz)
	Band 10; E-UTRA/FDD (1710.0 - 1770.0 MHz)
	Band 20, E-UTRA/FDD (832.0 - 862.0 MHz)
	Band 22, E-UTRA/FOD (3410.0 - 3490.0 MHz)
	Band 23, E-UTRA/FDD (2000.0 - 2020.0 MHz)
	Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)
	Band 28 E-UTRA/FDD (703.0 - 748.0 MHz)
	Band 65, E-UTRA/FDD (1820.0 - 2010.0 MHz)
	Band 66, E-UTRA/FDD (1710.0 - 1780.0 MHz)
	Band 70, E-UTRA/FDD (1695.0 - 1710.0 MHz)
	Band 71, E-UTRA/FDD (663.0 - 698.0 MHz)
	Validation band (0.0 - 6000.0 MHz)
Detailed Specification:	Modulation Scheme: SC-FDMA
	Number of PUSCHs: 1
	Settings for Subframe #0 to #9:
	Modulation Scheme: 16QAM
	Data Type: UL-SCH
	Number RB: 1
	Transport Block Size: 258
	TBS Indui: 14
	MCS Index: 15
	Data Type: PN9
Bandwidth:	20.0 MHz

10.0 ma

Bandwidth: Integration Time:

PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)" Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version). z

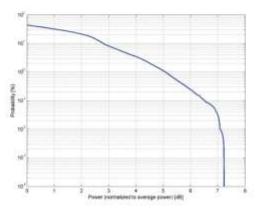
**UID Specification Sheet** 

UID 10170-CAD page 1/2

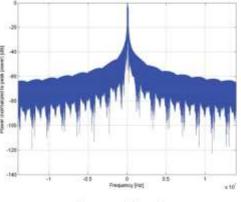




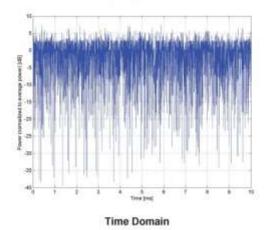
Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Complementary Cumulative Distribution Function (CCDF)







**UID Specification Sheet** 

UID 10170-CAD page 2/2





Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Name:

### IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)

Group: UID: WLAN 10061-CAB

PAR: 1 MIF: 2 3.60 dB -2.02 dB

Standard Reference:	IEEE 802.11b-1999 , Part 11, FCC SAR meas for 802 11 a b g
10000000	v01r02 (248227 D01)
Category:	Random amplitude modulation
Modulation:	DQPSK
Frequency Band:	WLAN 2.4GHz (2412.0-2484.0 MHz, 20230)
Detailed Specification:	Data Rate: 11 Mbps
	Spreading, Coding: CCK
	PPDU format: Long Preamble & Heading
	PSDU Length: 1024
	PSDU Data: PN9
Bandwidth:	20.0 MHz
Integration Time:	1.5 ms

PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"
 Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version).

**UID Specification Sheet** 

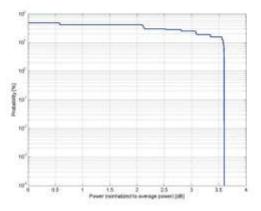
UID 10061-CAB page 1/2

26.11.2014

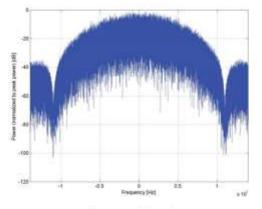




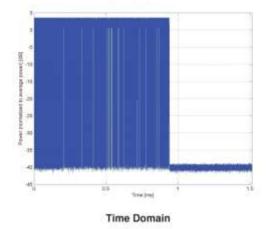
Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Complementary Cumulative Distribution Function (CCDF)







**UID** Specification Sheet

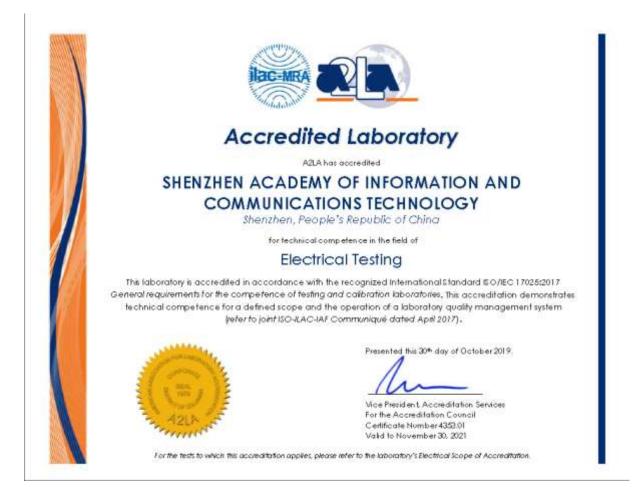
UID 10061-CAB page 2/2

26.11.2014





# **ANNEX F: Accreditation Certificate**



\*\*\*END OF REPORT\*\*\*