TEST REPORT

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1. Report No : DRRFCC1807-0069(1)
2. Customer
   - Name : i3-Technologeies N.V.
   - Address : Nijverheidslaan 60 Deerlijk Belgium 8540
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : i3SYNC Touch Transmitter / i3SYNC Touch TX
   FCC ID : 2ALTTSY-X300TX
5. Test Method Used : IEEE 1528-2013 , FCC SAR KDB Publications (Details in test report)
   Test Specification : CFR §2.1093
6. Date of Test : 2018.07.02 ~ 2018.07.03
7. Testing Environment : See appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by Name : HoSik Sim	Reviewed by Name : HakMin Kim

2018 . 07 . 20 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRRFCC1807-0069	Jul. 10, 2018	Initial issue
DRRFCC1807-0069(1)	Jul. 20, 2018	Add simultaneous transmission evaluation

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1. DESCRIPTION OF DEVICE

Environmental evaluation measurements of specific absorption rate (SAR) distributions in emulated human head and body tissues exposed to radio frequency (RF) radiation from wireless portable devices for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC).

General Information

<table>
<tr><td>EUT type</td><td colspan="5">i3SYNC Touch Transmitter</td></tr>
<tr><td>FCC ID</td><td colspan="5">2ALTTSY-X300TX</td></tr>
<tr><td>Equipment model name</td><td colspan="5">i3SYNC Touch TX</td></tr>
<tr><td>Equipment add model name</td><td colspan="5">N/A</td></tr>
<tr><td>Equipment serial no.</td><td colspan="5">Identical prototype</td></tr>
<tr><td>Mode(s) of Operation</td><td colspan="5">5 G W-LAN (802.11n-HT20)</td></tr>
<tr><td rowspan="4">TX Frequency Range</td><th>Band</th><th>Mode</th><th>Operating Modes</th><th>Bandwidth</th><th>Frequency</th></tr>
<tr><td>5.2 GHz W-LAN</td><td>802.11n</td><td>Data</td><td>HT20</td><td>5180 ~ 5220 MHz</td></tr>
<tr><td>5.8 GHz W-LAN</td><td>802.11n</td><td>Data</td><td>HT20</td><td>5745 ~ 5825 MHz</td></tr>
<tr><td>Bluetooth</td><td>-</td><td>Data</td><td>-</td><td>2402 ~ 2480 MHz</td></tr>
<tr><td rowspan="3">RX Frequency Range</td><td>5.2 GHz W-LAN</td><td>802.11n</td><td>Data</td><td>HT20</td><td>5180 ~ 5220 MHz</td></tr>
<tr><td>5.8 GHz W-LAN</td><td>802.11n</td><td>Data</td><td>HT20</td><td>5745 ~ 5825 MHz</td></tr>
<tr><td>Bluetooth</td><td>-</td><td>Data</td><td>-</td><td>2402 ~ 2480 MHz</td></tr>
<tr><th rowspan="3">Equipment Class</th><th rowspan="3">Band</th><th colspan="4">Reported SAR</th></tr>
<tr><th colspan="4">1g SAR (W/kg)</th></tr>
<tr><th colspan="4">Body</th></tr>
<tr><td>U-NII-1</td><td>5.2 GHz W-LAN</td><td colspan="4">0.19</td></tr>
<tr><td>U-NII-3</td><td>5.8 GHz W-LAN</td><td colspan="4">< 0.1</td></tr>
<tr><td>DSS</td><td>Bluetooth</td><td colspan="4">< 0.1 Note1</td></tr>
<tr><td colspan="2">Simultaneous SAR per KDB 690783 D01v01r03</td><td colspan="4">0.23</td></tr>
<tr><td>FCC Equipment Class</td><td colspan="5">Unlicensed National Information Infrastructure (UNII)
Part 15 Spread Spectrum Transmitter (DSS)</td></tr>
<tr><td>Note</td><td colspan="5">1. Estimated SAR
2. Bluetooth is included in the i3SYNC Touch USB Dongle(FCC ID: 2ALTTSY-T300UD).</td></tr>
<tr><td>Date(s) of Tests</td><td colspan="5">2018.07.02 ~ 2018.07.03</td></tr>
<tr><td>Antenna Type</td><td colspan="5">Internal Type Antenna</td></tr>
</table>

1.1 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 248227 D01v02r02 (802.11 Wi-Fi SAR)
- FCC KDB Publication 447498 D01v06 (General RF Exposure Guidance)
- FCC KDB Publication 447498 D02 v02r01 (SAR Procedures for Dongle Xmtr)
- FCC KDB Publication 690783 D01v01r03 (SAR Listings on Grants)
- FCC KDB Publication 865664 D01v01r04 (SAR Measurement 100 MHz to 6 GHz)
- FCC KDB Publication 865664 D02v01r02 (RF Exposure Reporting)

1.2 SAR Test Configurations and Exclusions

(A) WIFI & BT

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Table 1.1 SAR exclusion threshold for distances < 50 mm

Band	Mode	Equation	Result	SAR exclusion threshold	Required SAR
DSS	Bluetooth	[(1/5)* √2.441]	0.3	3.0	X
U-NII-1	5.2 GHz W-LAN	[(11/5)* √5.220]	5.1	3.0	O
U-NII-3	5.8 GHz W-LAN	[(11/5)* √5.825]	5.4	3.0	O

Note(s)

1. Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.
2. BT is included in the i3SYNC Touch USB Dongle(FCC ID: 2ALTTSY-T300UD).

(B) SAR Exclusion Positions

(Top Side Position)

Per FCC KDB 447498 D01v06, the SAR exclusion threshold for distances > 50 mm is defined by the following equation:
(The SAR test exclusion threshold is determined according to the following, and as illustrated in KDB 447498 Appendix b)

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Band	Mode	Equation	Result	SAR exclusion threshold	Determine of Body SAR
U-NII-1	5.2 GHz W-LAN	[(11/5)* √5.220]	5.1	3.0	O
U-NII-3	5.8 GHz W-LAN	[(11/5)* √5.825]	5.4	3.0	O

(Bottom Side Position)

Per FCC KDB 447498 D01v06, the SAR exclusion threshold for distances > 50 mm is defined by the following equation:
(The SAR test exclusion threshold is determined according to the following, and as illustrated in KDB 447498 Appendix b)

b) For 100 MHz to 6 GHz and *test separation distances* > 50 mm, the 1-g and 10-g *SAR test exclusion thresholds* are determined by the following (also illustrated in Appendix B):[32]

1) {[Power allowed at *numeric threshold* for 50 mm in step a)] + [(test separation distance – 50 mm)·($f_{(MHz)}$/150)]} mW, for 100 MHz to 1500 MHz

2) {[Power allowed at *numeric threshold* for 50 mm in step a)] + [(test separation distance – 50 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz

Band	Mode	Equation	Calculated Threshold Power [mW]	Maximum Allowed Power [mW]	Determine of Body SAR
U-NII-1	5.2 GHz W-LAN	[(66)+(67-50)*10]	236	> 11	X
U-NII-3	5.8 GHz W-LAN	[(62)+(67-50)*10]	232	> 11	X

(Right Side Position)
Per FCC KDB 447498 D01v06, the SAR exclusion threshold for distances > 50 mm is defined by the following equation:
(The SAR test exclusion threshold is determined according to the following, and as illustrated in KDB 447498 Appendix b)

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Band	Mode	Equation	Result	SAR exclusion threshold	Determine of Body SAR
U-NII-1	5.2 GHz W-LAN	[(11/24)* √5.220]	1.1	3.0	X
U-NII-3	5.8 GHz W-LAN	[(11/24)* √5.825]	1.1	3.0	X

(Left Side Position)
Per FCC KDB 447498 D01v06, the 1g SAR exclusion threshold for distances < 50 mm is defined by the following equation:

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Band	Mode	Equation	Result	SAR exclusion threshold	Determine of Body SAR
U-NII-1	5.2 GHz W-LAN	[(11/17)* √5.220]	1.5	3.0	X
U-NII-3	5.8 GHz W-LAN	[(11/17)* √5.825]	1.6	3.0	X

Table 1.2 Determined EUT sides for SAR Testing

Mode	EUT Sides for SAR Testing					
	Top	Bottom	Front	Rear	Right	Left
5 GHz W-LAN (802.11a/n)	O	X	O	O	X	X

Note: Particular DUT edges were not required to be evaluated for SAR based on the SAR exclusion threshold in KDB 447498 D01v06.

1.3 Power Reduction for SAR

There is no power reduction used for any band/mode implemented in this device for SAR purposes.

1.4 Device Serial Numbers

Band & Mode	Serial Number
5 GHz WLAN	FCC #1

2. INTROCUCTION

The FCC and Industry Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave is used for guidance in measuring SAR due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86 NCRP, 1986, Bethesda, MD 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ) It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Fig. 2.1)

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

Fig. 2.1 SAR Mathematical Equation

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)

ρ = mass density of the tissue-simulating material (kg/m^3)

E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.

3. DESCRIPTION OF TEST EQUIPMENT

3.1 SAR MEASUREMENT SETUP

Measurements are performed using the DASY5 automated dosimetric assessment system. The DASY5 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, desktop computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 3.1).

A cell controller system contains the power supply, robot controller each pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the Intel Core i7-2600 3.40 GHz desktop computer with Windows 7 system and SAR Measurement Software DASY5,A/D interface card, monitor, mouse, and keyboard. The Staubli Robotis connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that 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.

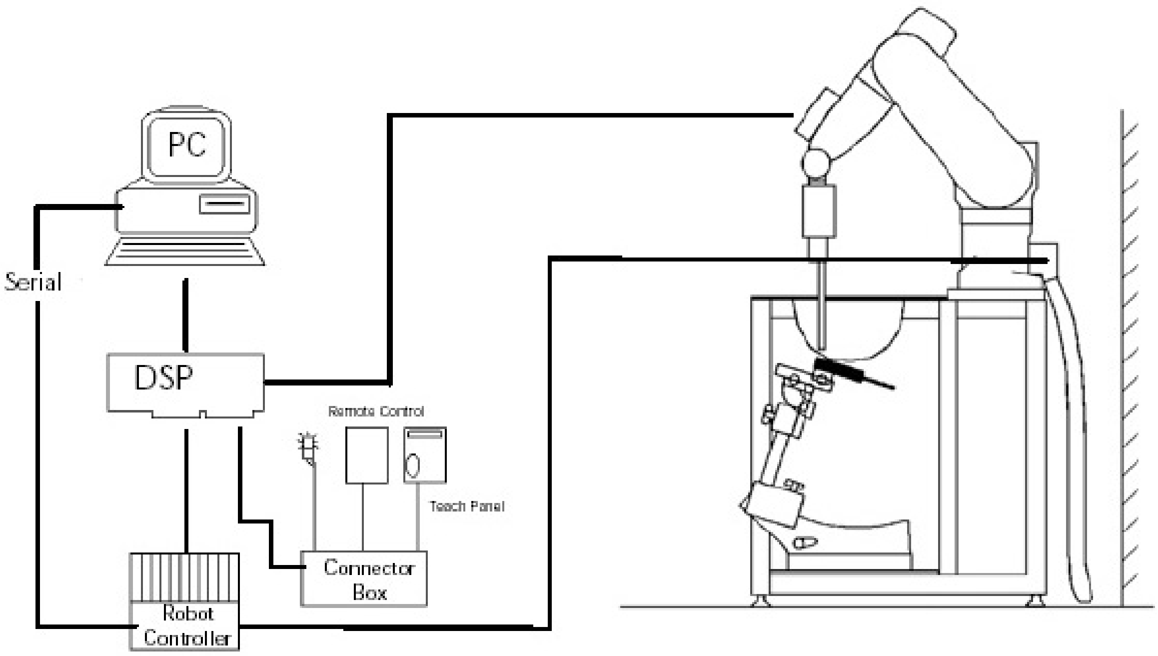


Figure 3.1 SAR Measurement System Setup

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. The system is described in detail.

3.2 EX3DV4 Probe Specification

Calibration	In air from 10 MHz to 6 GHz In brain and muscle simulating tissue at Frequencies of 750 MHz, 835 MHz, 900 MHz, 1750 MHz, 1900 MHz, 2300 MHz, 2450 MHz 2600 MHz, 3500 MHz, 5200 MHz, 5300 MHz, 5500 MHz, 5600 MHz, 5800 MHz
Frequency	10 MHz to 6 GHz
Linearity	± 0.2 dB(30 MHz to 6 GHz)
Dynamic	10 μW/g to > 100 mW/g
Range	Linearity : ±0.2dB
Dimensions	Overall length : 337 mm
Tip length	20 mm
Body diameter	12 mm
Tip diameter	2.5 mm
Distance from probe tip to sensor center	1.0 mm
Application	SAR Dosimetry Testing Compliance tests of mobile phones

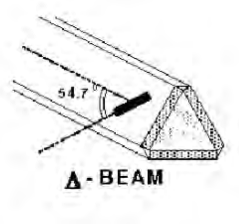
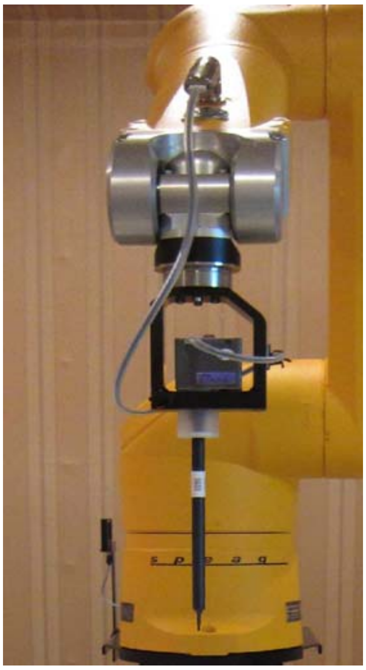


Figure 3.2 Triangular Probe Configurations


Figure 3.3 Probe Thick-Film Technique


DAE System

The SAR measurements were conducted with the dosimetric probe EX3DV4 designed in the classical triangular configuration(see Fig. 3.2) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multitier line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY5 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped at reaching the maximum.

3.3 Probe Calibration Process

3.3.1 E-Probe Calibration

Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure and found to be better than +/-0.25dB. The sensitivity parameters (Norm X, Norm Y, Norm Z), the diode compression parameter (DCP) and the conversion factor (Conv F) of the probe is tested.

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a waveguide above 1GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity at the proper orientation with the field. The probe is then rotated 360 degrees.

Temperature Assessment *

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium, correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent the remits or based temperature probe is used in conjunction with the E-field probe.

$$\text{SAR} = C\frac{\Delta T}{\Delta t}$$

where:

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

$$\text{SAR} = \frac{|E|^2 \cdot \sigma}{\rho}$$

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm^3 for brain tissue)

SAR is proportional to ΔT / Δt , the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

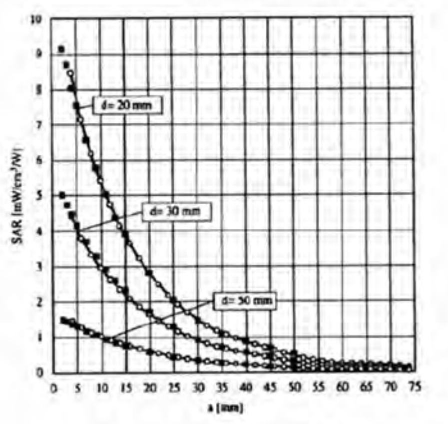


Figure 3.4 E-Field and Temperature Measurements at 900MHz

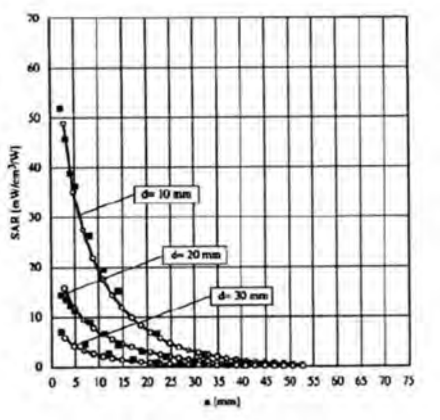


Figure 3.5 E-Field and Temperature Measurements at 1800MHz

3.4 Data Extrapolation

The DASY5 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given like below;

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

with
- V_i = compensated signal of channel i (i=x,y,z)
- U_i = input signal of channel i (i=x,y,z)
- cf = crest factor of exciting field (DASY parameter)
- dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

with
- V_i = compensated signal of channel i (i = x,y,z)
- $Norm_i$ = sensor sensitivity of channel i (i = x,y,z) $\mu V/(V/m)^2$ for E-field probes
- ConvF = sensitivity of enhancement in solution
- E_i = electric field strength of channel i in V/m

The RSS value of the field components gives the total field strength (Hermetian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

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

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

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

$$P_{pwe} = \frac{E_{tot}^2}{3770}$$

with
- P_{pwe} = equivalent power density of a plane wave in W/cm^2
- E_{tot} = total electric field strength in V/m

3.5 SAM Twin PHANTOM

The SAM Twin Phantom V5.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid.

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. (see Fig. 3.6)

Figure 3.6 SAM Twin Phantom

SAM Twin Phantom Specification:

Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot. Twin SAM V5.0 has the same shell geometry and is manufactured from the same material as Twin SAM V4.0, but has reinforced top structure.
Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet

Specific Anthropomorphic Mannequin (SAM) Specifications:

The phantom for handset SAR assessment testing is a low-loss dielectric shell, with shape and dimensions derived from the anthropometric data of the 90th percentile adult male head dimensions as tabulated by the US Army. The SAM Twin Phantom shell is bisected along the mid-sagittal plane into right and left halves (see Fig. 3.7). The perimeter sidewalls of each phantom halves are extended to allow filling with liquid to a depth that is sufficient to minimized reflections from the upper surface. The liquid depth is maintained at a minimum depth of 15cm to minimize reflections from the upper surface.

Figure 3.7 Sam Twin Phantom shell

3.6 Device Holder for Transmitters

In combination with the Twin SAM Phantom V4.0/V4.0c, V5.0 or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).

Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produce infinite number of configurations. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Figure 3.8 Mounting Device

3.7 Brain Simulation Mixture Characterization

The brain and muscle mixtures consist of a viscous gel using hydrox-ethylcellulose (HEC) gelling agent and saline solution (see Table 3.1). Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The mixture characterizations used for the brain and muscle tissue simulating liquids are according to the data by C. Gabriel and G. Harts grove.

Figure 3.9 Simulated Tissue

Table 3.1 Composition of the Tissue Equivalent Matter

Ingredients (% by weight)	**Frequency (MHz)**
	5200 ~ 5800
Tissue Type	**Body**
Water	80.00
Salt (NaCl)	-
Sugar	-
HEC	-
Bactericide	-
Triton X-100	-
DGBE	-
Diethylene glycol hexyl ether	-
Polysorbate (Tween) 80	20.00
Target for Dielectric Constant	-
Target for Conductivity (S/m)	-

Salt:	99 % Pure Sodium Chloride	Sugar:	98 % Pure Sucrose
Water:	De-ionized, 16M resistivity	HEC:	Hydroxyethyl Cellulose
DGBE:	99 % Di(ethylene glycol) butyl ether,[2-(2-butoxyethoxy) ethanol]		
Triton X-100(ultra pure):	Polyethylene glycol mono[4-(1,1,3,3-tetramethylbutyl)phenyl] ether		

3.8 SAR TEST EQUIPMENT

Table 3.2 Test Equipment Calibration

	Type	Manufacturer	Model	Cal.Date	Next.Cal.Date	S/N
☒	SEMITEC Engineering	SEMITEC	N/A	N/A	N/A	Shield Room
☒	Robot	SCHMID	TX60L	N/A	N/A	F12/5LP5A1/A/01
☒	Robot Controller	SCHMID	CS8C	N/A	N/A	F12/5LP5A1/C/01
☒	Joystick	SCHMID	N/A	N/A	N/A	S-12030401
☒	IntelCorei7-2600 3.40 GHz Windows 7 Professional	N/A	N/A	N/A	N/A	N/A
☒	Probe Alignment Unit LB	N/A	N/A	N/A	N/A	SE UKS 030 AA
☒	Device Holder	SCHMID	Holder	N/A	N/A	SD000H01KA
☒	Twin SAM Phantom	SCHMID	QD000P40CD	N/A	N/A	1679
☒	Data Acquisition Electronics	SCHMID	DAE4V1	2017-08-16	2018-08-16	1396
☒	Dosimetric E-Field Probe	SCHMID	EX3DV4	2018-05-31	2019-05-31	3866
☒	5GHz SAR Dipole	SCHMID	D5GHzV2	2018-02-15	2020-02-15	1212
☒	Network Analyzer	Agilent	E5071C	2018-02-02	2019-02-02	MY46111534
☒	Signal Generator	Agilent	E4438C	2017-09-05	2018-09-05	US41461520
☒	Amplifier	EMPOWER	BBS3Q7ELU	2017-09-06	2018-09-06	1020
☒	High Power RF Amplifier	EMPOWER	BBS3Q8CCJ	2017-09-05	2018-09-05	1005
☒	Power Meter	HP	EPM-442A	2017-12-27	2018-12-27	GB37170267
☒	Power Meter	HP	EPM-442A	2017-12-27	2018-12-27	GB37170413
☒	Power Sensor	HP	8481A	2017-12-27	2018-12-27	US37294267
☒	Power Sensor	HP	8481A	2017-12-27	2018-12-27	3318A96566
☒	Power Sensor	HP	8481A	2017-12-27	2018-12-27	2702A65976
☒	Directional Coupler	HP	772D	2017-07-13	2018-07-13	2889A01064
☒	Low Pass Filter 6.0GHz	Micro LAB	LA-60N	2017-12-27	2018-12-27	03942
☒	Attenuators(3 dB)	Agilent	8491B	2017-12-27	2018-12-27	MY39260700
☒	Attenuators(10 dB)	WEINSCHEL	23-10-34	2017-12-27	2018-12-27	BP4387
☒	Dielectric Probe kit	SCHMID	DAK-3.5	2017-11-21	2018-11-21	1092
☒	Dielectric Probe kit	SCHMID	DAK-3.5	2017-07-18	2018-07-18	1046

NOTE: The E-field probe was calibrated by SPEAG, by temperature measurement procedure. Dipole Verification measurement is performed by DT&C before each test. The muscle simulating material was calibrated by DT&C using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the muscle-equivalent material. Each equipment item was used solely within its respective calibration period.

4. TEST SYSTEM SPECIFICATIONS

Automated TEST SYSTEM SPECIFICATIONS:

Positioner

Robot	Stäubli Unimation Corp. Robot Model: TX60L
Repeatability	0.02 mm
No. of axis	6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor	Intel Core i7-2600
Clock Speed	3.40 GHz
Operating System	Windows 7 Professional
Data Card	DASY5 PC-Board

Data Converter

Features	Signal, multiplexer, A/D converter. & control logic
Software	DASY5
Connecting Lines	Optical downlink for data and status info Optical uplink for commands and clock

PC Interface Card

Function	24 bit (64 MHz) DSP for real time processing Link to DAE 4 16 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot

E-Field Probes

Model	EX3DV4 S/N: 3866
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	± 0.2 dB (30 MHz to 6 GHz)

Phantom

Phantom	SAM Twin Phantom (V5.0)
Shell Material	Composite
Thickness	2.0 ± 0.2 mm

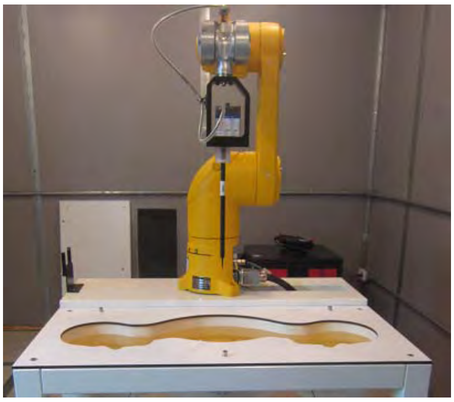


Figure 4.1 DASY5 Test System

5. SAR MEASUREMENT PROCEDURE

5.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 5.1) and IEEE1528-2013.

2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.

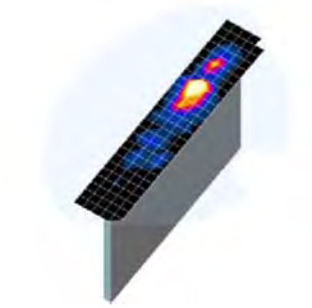


Figure 5.1
Sample SAR Area Scan

3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 5.1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

   a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 5.1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.

   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 mm ± 1 mm</td><td>$\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

Table 5.1 Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

6. RF EXPOSURE LIMITS

Uncontrolled Environment:

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environment:

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 6.1.SAR Human Exposure Specified in ANSI/IEEE C95.1-1992

	HUMAN EXPOSURE LIMITS	
	General Public Exposure (W/kg) or (mW/g)	Occupational Exposure (W/kg) or (mW/g)
SPATIAL PEAK SAR * (Brain)	1.60	8.00
SPATIAL AVERAGE SAR ** (Whole Body)	0.08	0.40
SPATIAL PEAK SAR *** (Hands / Feet / Ankle / Wrist)	4.00	20.0

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e.as a result of employment or occupation).

7. SAR MEASUREMENT PROCEDURES

7.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, When SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported SAR. The highest reported SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

7.2 SAR Testing with 802.11 Transmitters

The normal network operating configurations are not suitable for measuring the SAR of 802.11 b/g/n transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227D01v02r02 for more details.

7.2.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the in the transmission, a maximum transmission duty factor of 92-96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

7.2.2 U-NII and U-NII-2A

For devices that operate in only one of the U-NII-1 and U-NII-2A bands, the normally required SAR procedures for OFDM configurations are applied. For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following, with respect to the highest reported SAR and maximum output power specified for production units. The procedures are applied independently to each exposure configuration; for example, head, body, hotspot mode etc.

1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.
2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

7.2.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements.
When Terminal Doppler Weather Rader (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification.
Unless band gap channels are permanently disabled, SAR must be considered for these channels. When band gap channels are disabled, each band is tested independently according to the normally required OFDM SAR measurements and probe calibration frequency points requirements.

7.2.4 OFDM Transmission Mode and SAR Test Channel Selection

For the 5 GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 80211n is used for SAR measurement. When the maximum output power ware the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

7.2.5 Initial Test Configuration Procedure

For OFDM, in both 5 GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, and lowest data rate. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required.
Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured.

7.2.6 Subsequent Test Configuration Procedures

For OFDM configurations, in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure, when applicable. When the highest reported SAR for the initial test configuration, adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power is ≤ 1.2 W/kg, no additional SAR testing for the subsequent test configurations is required.

7.3 Same Dongle Procedure

Test all USB orientations [see figure below: (A) Horizontal-Up, (B) Horizontal-Down, (C) Vertical-Front, and (D) Vertical-Back] with a device-to-phantom separation distance of 5 mm or less, according to KDB Publication 447498 D01 requirements. These test orientations are intended for the exposure conditions found in typical laptop/notebook/netbook or tablet computers with either horizontal or vertical USB connector configurations at various locations in the keyboard section of the computer. Current generation portable host computers should be used to establish the required SAR measurement separation distance. The same test separation distance must be used to test all frequency bands and modes in each USB orientation. The typical Horizontal-Up USB connection (A), found in the majority of host computers, must be tested using an appropriate host computer. A host computer with either Vertical-Front (C) or Vertical-Back (D) USB connection should be used to test one of the vertical USB orientations. If a suitable host computer is not available for testing the Horizontal-Down (B) or the remaining Vertical USB orientation, a high quality USB cable, 12 inches or less, may be used for testing these other orientations. It must be documented that the USB cable does not influence the radiating characteristics and output power of the transmitter.

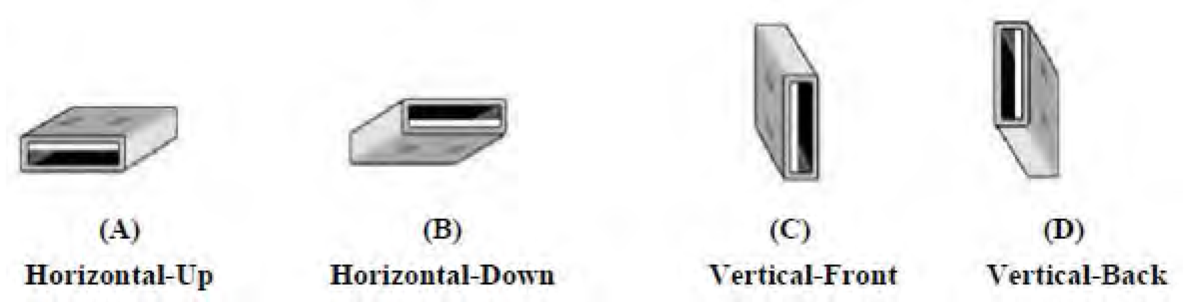


Figure 7.1 USB Connector Orientations Implemented on Laptop Computers

Note: These are USB connector orientations on laptop computers; USB dongles have the reverse configuration for plugging into the corresponding laptop computers.

8. Nominal and Maximum Output Power Spec and RF Conducted Powers

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

8.1 WLAN Nominal and Maximum Output Power Spec and Conducted Powers

Band (GHz)	Mode	Frequency [MHz]	Modulated Average[dBm]	
			Maximum	Nominal
5.2	802.11n(20MHz)	5180 ~ 5220	10.50	9.50
5.8	802.11n(20MHz)	5745 ~ 5825	10.50	9.50

Table 8.1.1 WLAN 5GHz Nominal and Maximum Output Power Spec

Mode	Freq. (MHz)	Channel	IEEE 802.11n HT20 (5 GHz) Conducted Power (dBm)
802.11n (HT-20)	5180	36	9.54
	5200	**40**	**9.74**
	5220	44	9.59
	5745	**149**	**9.61**
	5785	157	9.53
	5825	165	9.37

Table 8.1.2 IEEE 802.11n Average RF Power

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, duo to an even number of channels, both channels were measured.
- The underlined data rate and channel above were tested for SAR.

The average output powers of this device were tested by below configuration.

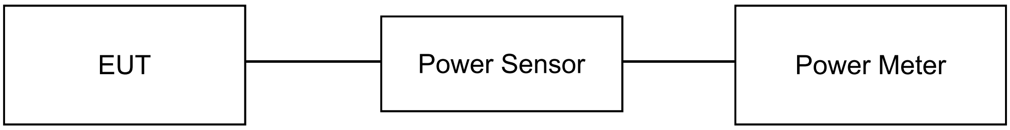


Figure 8.1.1 Power Measurement Setup

8.2 Bluetooth Nominal and Maximum Output Power Spec and Conducted Powers

Band & Mode		Modulated Average[dBm]		
		Ch Low	Ch Mid	Ch High
Bluetooth 1 Mbps	Maximum	-2.0	0.0	-1.0
	Nominal	-3.0	-1.0	-2.0
Bluetooth 2 Mbps	Maximum	-4.0	-2.0	-3.0
	Nominal	-5.0	-3.0	-4.0
Bluetooth 3 Mbps	Maximum	-4.0	-2.0	-3.0
	Nominal	-5.0	-3.0	-4.0

Table 8.2.1 Bluetooth Nominal and Maximum Output Power Spec

Channel	Frequency	Frame AVG Output Power[1Mbps]	Frame AVG Output Power [2Mbps]	Frame AVG Output Power[3Mbps]
	[MHz]	[dBm]	[dBm]	[dBm]
Low	2402	-3.99	-5.49	-5.46
Mid	2441	-1.54	-3.49	-3.45
High	2480	-2.71	-4.33	-4.32

Table 8.2.2 Bluetooth Frame Average RF Power

- **Bluetooth Conducted Powers procedures**

1. Bluetooth (BDR, EDR)
   1) Enter DUT mode in EUT and operate it.
   When it operating, The EUT is transmitting at maximum power level and duty cycle fixed.
   2) Instruments and EUT were connected like Figure 8.2.1.
   3) The maximum output powers of BDR(1 Mbps), EDR(2, 3 Mbps) and each frequency were set by a Bluetooth Tester.
   4) Power levels were measured by a Power Meter.

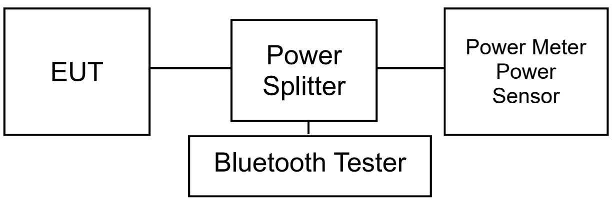


Figure 8.2.1 Average Power Measurement Setup

The average conducted output powers of Bluetooth were measured using above test setup and a wideband gated RF power meter when the EUT is transmitting at its maximum power level.

9. SYSTEM VERIFICATION

9.1 Tissue Verification

MEASURED TISSUE PARAMETERS										
Date(s)	Tissue Type	Ambient Temp.[°C]	Liquid Temp.[°C]	Measured Frequency [MHz]	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	Er Deviation [%]	σ Deviation [%]
Jul. 02. 2018	5200 Body	21.8	22.1	5180.0	49.041	5.276	47.810	5.321	-2.51	0.85
				5200.0	49.014	5.299	47.758	5.350	-2.56	0.96
				5220.0	48.987	5.323	47.739	5.382	-2.55	1.11
Jul. 03. 2018	5800 Body	22.2	22.5	5745.0	48.275	5.936	46.548	6.081	-3.58	2.44
				5785.0	48.220	5.982	46.458	6.134	-3.65	2.54
				5800.0	48.200	6.000	46.423	6.158	-3.69	2.63
				5825.0	48.166	6.029	46.388	6.199	-3.69	2.82

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB 865664 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

Measurement Procedure for Tissue verification:

1) The network analyzer and probe system was configured and calibrated.
2) The probe was immersed in the sample which was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
3) The complex admittance with respect to the probe aperture was measured
4) The complex relative permittivity , for example from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\varepsilon_r\varepsilon_0}{[\ln(b/a)]^2}\int_a^b\int_a^b\int_0^\pi \cos\phi' \frac{\exp\left[-j\omega r(\mu_0\varepsilon_r'\varepsilon_0)^{1/2}\right]}{r} d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

9.2 Test System Verification

Prior to assessment, the system is verified to the ± 10 % of the specifications at 5GHz by using the SAR Dipole kit(s). (Graphic Plots Attached)

Table 9.2.1 System Verification Results

SYSTEM DIPOLE VERIFICATION TARGET & MEASURED												
SAR System #	Freq. [MHz]	SAR Dipole kits	Date(s)	Tissue Type	Ambient Temp. [°C]	Liquid Temp. [°C]	Probe S/N	Input Power (mW)	1 W Target SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	Deviation [%]
A	5200	D5GHzV2, SN:1212	Jul. 02. 2018	Body	21.8	22.1	3866	100	72.7	7.21	72.1	-0.83
A	5800	D5GHzV2, SN:1212	Jul. 03. 2018	Body	22.2	22.5	3866	100	75.7	7.68	76.8	1.45

Note: Full system validation status and results can be found in Attachment 3.

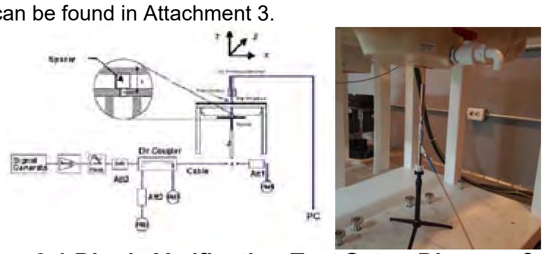


Figure 9.1 Dipole Verification Test Setup Diagram & Photo

10. SAR TEST RESULTS

10.1 Body SAR Results

Table 10.1.1 UNII Body SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5200	40	802.11n	10.50	9.74	0.140	5 mm [Top]	FCC #1	0.2070	MCS0	100	0.155	1.191	1.000	**0.185**	A1
5200	40	802.11n	10.50	9.74	-0.010	5 mm [Front]	FCC #1	0.0031	MCS0	100	0.011	1.191	1.000	0.013	
5200	40	802.11n	10.50	9.74	-0.010	5 mm [Rear]	FCC #1	0.0768	MCS0	100	0.075	1.191	1.000	0.089	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Body 1.6 W/kg (mW/g)** averaged over 1 gram							

Note: The test was performed using an HDMI cable of 12 inches or less.

Table 10.1.2 UNII Body SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5745	149	802.11n	10.50	9.61	0.000	5 mm [Top]	FCC #1	0.01340	MCS0	100	0.028	1.227	1.000	**0.034**	A2
5745	149	802.11n	10.50	9.61	0.030	5 mm [Front]	FCC #1	0.00458	MCS0	100	0.022	1.227	1.000	0.027	
5745	149	802.11n	10.50	9.61	-0.120	5 mm [Rear]	FCC #1	0.00348	MCS0	100	0.014	1.227	1.000	0.017	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Body 1.6 W/kg (mW/g)** averaged over 1 gram							

Note: The test was performed using an HDMI cable of 12 inches or less.

10.2 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.

WLAN Notes:

1. The initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg.
3. When the maximum reported 1g averaged SAR ≤ 0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg or all test channels were measured.
4. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor to determine compliance.

11. FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

11.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to handsets with built-in unlicensed transmitters such as 802.11b/g/n and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

11.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v06 4.3.2 and IEEE 1528-2013 Section 6.3.4.1.2,simultaneous transmission SAR test exclusion may be applied when the sum of the sum 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is $\leq$ 1.6 W/kg. The different test positon in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1-g or 10-g SAR.

$$\text{Estimated SAR} = \frac{\sqrt{f(GHz)}}{7.5} * \frac{(\text{Max Power of channel, mW})}{\text{Min. Separation Distance, mm}}$$

Table 11.2.1 Estimated SAR

Mode	Frequency	Maximum Allowed Power		Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mW]	[mm]	[W/kg]
Bluetooth	2441	0	1	5	0.042

11.3 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the DUT are shown in Figure 11.1 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.

Path 1	Path 2
WIFI	Bluetooth

Figure 11.1 Simultaneous Transmission Paths

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06.

Table 11.3.1 Simultaneous Transmission Scenarios

No.	Capable TX Configuration	WIFI	Bluetooth
1	WIFI		Yes
2	Bluetooth	Yes	

Table 11.3.2 Simultaneous SAR Cases

No.	Capable Transmit Configuration	Body SAR	Note
1	WLAN + Bluetooth	Yes	

Notes:
1. Bluetooth is included in the i3SYNC Touch USB Dongle(FCC ID: 2ALTTSY-T300UD).

11.4 Body Simultaneous Transmission Analysis

Table 11.1.1 Simultaneous Transmission Scenario for 5.2G W-LAN with Bluetooth (5 mm)

Simult TX	Configuration	5.2G W-LAN SAR (W/kg)	Bluetooth SAR (W/kg)	ΣSAR (W/kg)
Body SAR	Top	0.185	0.042	**0.227**
	Bottom	-	0.042	0.042
	Front	0.013	0.042	0.055
	Rear	0.089	0.042	0.131
	Right	-	0.042	0.042
	Left	-	0.042	0.042

Table 11.1.2 Simultaneous Transmission Scenario for 5.8G W-LAN with Bluetooth (5 mm)

Simult TX	Configuration	5.8G W-LAN SAR (W/kg)	Bluetooth SAR (W/kg)	ΣSAR (W/kg)
Body SAR	Top	0.034	0.042	**0.076**
	Bottom	-	0.042	0.042
	Front	0.027	0.042	0.069
	Rear	0.017	0.042	0.059
	Right	-	0.042	0.042
	Left	-	0.042	0.042

Note: Bluetooth is included in the i3SYNC Touch USB Dongle(FCC ID: 2ALTTSY-T300UD).

12. MEASUREMENT UNCERTAINTIES

5200 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	Standard (1g)	vi 2 or Veff
Measurement System						
Probe calibration	± 6.55	Normal	1	1	± 6.6 %	∞
Axial isotropy	± 4.7	Rectangular	√3	1	± 2.7 %	∞
Hemispherical isotropy	± 9.6	Rectangular	√3	1	± 5.5 %	∞
Boundary Effects	± 0.8	Rectangular	√3	1	± 0.46 %	∞
Probe Linearity	± 4.7	Rectangular	√3	1	± 2.7 %	∞
Probe modulation response	± 2.4	Rectangular	√3	1	± 1.4 %	∞
Detection limits	± 0.25	Rectangular	√3	1	± 0.14 %	∞
Readout Electronics	± 1.0	Normal	1	1	± 1.0 %	∞
Response time	± 0.8	Rectangular	√3	1	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	± 1.7 %	∞
Probe Positioner	± 0.4	Rectangular	√3	1	± 0.23 %	∞
Probe Positioning	± 2.9	Rectangular	√3	1	± 1.7 %	∞
Algorithms for Max. SAR Eval.	± 1.0	Rectangular	√3	1	± 0.58 %	∞
Test Sample Related						
Device Positioning	± 2.9	Normal	1	1	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	± 2.9 %	∞
SAR Scaling	± 2.0	Rectangular	√3	1	± 1.2 %	∞
Physical Parameters						
Phantom Shell	± 4.0	Rectangular	√3	1	± 2.3 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	± 2.9 %	∞
Liquid conductivity (Meas.)	± 3.9	Normal	1	0.64	± 3.9 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.6	± 2.9 %	∞
Liquid permittivity (Meas.)	± 4.3	Normal	1	0.6	± 4.3 %	10
Temp. unc. - Conductivity	± 1.8	Rectangular	√3	0.78	± 1.0 %	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	√3	0.23	± 1.0 %	∞
Combined Standard Uncertainty					**± 13 %**	330
Expanded Uncertainty (k=2)					**± 26 %**	

The above measurement uncertainties are according to IEEE Std 1528

5800 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	Standard (1g)	vi 2 or Veff
Measurement System						
Probe calibration	± 6.55	Normal	1	1	± 6.6 %	∞
Axial isotropy	± 4.7	Rectangular	√3	1	± 2.7 %	∞
Hemispherical isotropy	± 9.6	Rectangular	√3	1	± 5.5 %	∞
Boundary Effects	± 0.8	Rectangular	√3	1	± 0.46 %	∞
Probe Linearity	± 4.7	Rectangular	√3	1	± 2.7 %	∞
Probe modulation response	± 2.4	Rectangular	√3	1	± 1.4 %	∞
Detection limits	± 0.25	Rectangular	√3	1	± 0.14 %	∞
Readout Electronics	± 1.0	Normal	1	1	± 1.0 %	∞
Response time	± 0.8	Rectangular	√3	1	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	± 1.7 %	∞
Probe Positioner	± 0.4	Rectangular	√3	1	± 0.23 %	∞
Probe Positioning	± 2.9	Rectangular	√3	1	± 1.7 %	∞
Algorithms for Max. SAR Eval.	± 1.0	Rectangular	√3	1	± 0.58 %	∞
Test Sample Related						
Device Positioning	± 2.9	Normal	1	1	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	± 2.9 %	∞
SAR Scaling	± 2.0	Rectangular	√3	1	± 1.2 %	∞
Physical Parameters						
Phantom Shell	± 4.0	Rectangular	√3	1	± 2.3 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	± 2.9 %	∞
Liquid conductivity (Meas.)	± 4.0	Normal	1	0.64	± 4.0 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.6	± 2.9 %	∞
Liquid permittivity (Meas.)	± 4.2	Normal	1	0.6	± 4.2 %	10
Temp. unc. - Conductivity	± 1.8	Rectangular	√3	0.78	± 1.0 %	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	√3	0.23	± 1.0 %	∞
Combined Standard Uncertainty					**± 13 %**	330
Expanded Uncertainty (k=2)					**± 26 %**	

The above measurement uncertainties are according to IEEE Std 1528

13. CONCLUSION

Measurement Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under the worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are every complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role impossible biological effect are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease).

Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

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Attachment 1. – Probe Calibration Data

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

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

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

Accreditation No.: **SCS 0108**

Client **DT&C (Dymstec)**

Certificate No: **EX3-3866_May18**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3866

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: May 31, 2018

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 31, 2018

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

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

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

Accreditation No.: SCS 0108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 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 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW 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.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *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 *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3866

Manufactured: February 2, 2012
Calibrated: May 31, 2018

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3866

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.43	0.32	0.35	± 10.1 %
DCP (mV)[B]	98.7	101.4	105.4	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	129.5	±3.3 %
		Y	0.0	0.0	1.0		142.9	
		Z	0.0	0.0	1.0		132.3	

Note: For details on UID parameters see Appendix.

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $ms.V^{-2}$	T2 $ms.V^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	61.34	450.3	34.79	20.71	0.897	5.071	0.953	0.532	1.007
Y	35.97	270.0	35.93	7.616	0.990	4.996	0.120	0.508	1.005
Z	34.59	248.7	33.42	8.463	0.617	4.987	2.000	0.071	1.005

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%.

[A] The uncertainties of Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3866

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	10.16	10.16	10.16	0.49	0.80	± 12.0 %
835	41.5	0.90	9.62	9.62	9.62	0.39	0.93	± 12.0 %
900	41.5	0.97	9.40	9.40	9.40	0.40	0.92	± 12.0 %
1750	40.1	1.37	8.38	8.38	8.38	0.34	0.84	± 12.0 %
1900	40.0	1.40	8.03	8.03	8.03	0.27	0.87	± 12.0 %
2300	39.5	1.67	7.86	7.86	7.86	0.30	0.85	± 12.0 %
2450	39.2	1.80	7.45	7.45	7.45	0.34	0.82	± 12.0 %
2600	39.0	1.96	7.22	7.22	7.22	0.38	0.85	± 12.0 %
3500	37.9	2.91	6.89	6.89	6.89	0.20	1.25	± 13.1 %
5200	36.0	4.66	5.14	5.14	5.14	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.95	4.95	4.95	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.61	4.61	4.61	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.52	4.52	4.52	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.69	4.69	4.69	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3866

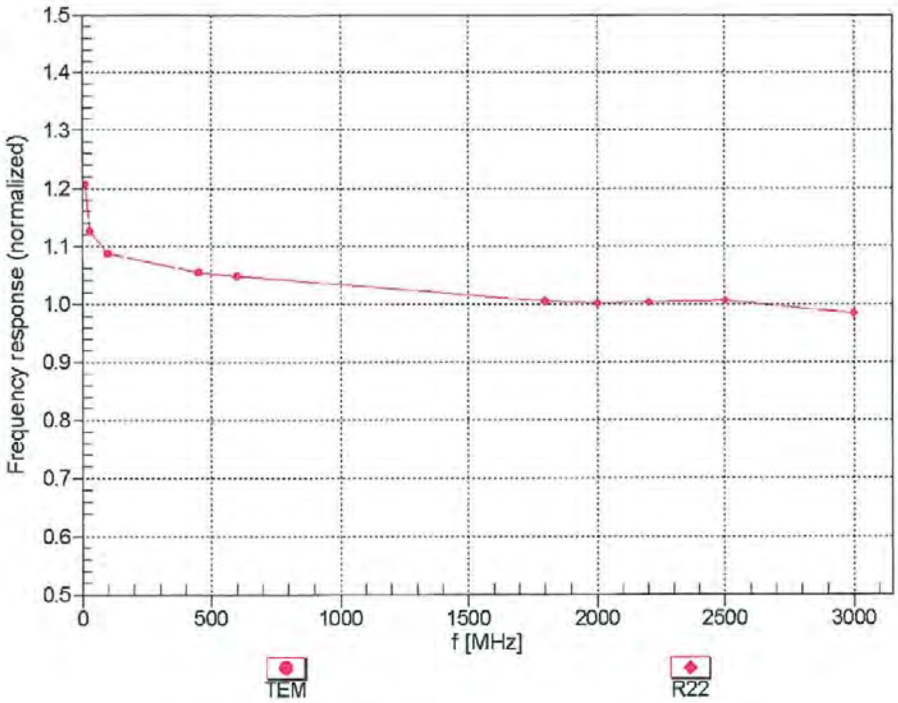
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	9.69	9.69	9.69	0.33	0.97	± 12.0 %
835	55.2	0.97	9.43	9.43	9.43	0.42	0.80	± 12.0 %
900	55.0	1.05	9.57	9.57	9.57	0.48	0.80	± 12.0 %
1750	53.4	1.49	7.95	7.95	7.95	0.39	0.80	± 12.0 %
1900	53.3	1.52	7.68	7.68	7.68	0.30	0.85	± 12.0 %
2300	52.9	1.81	7.50	7.50	7.50	0.39	0.85	± 12.0 %
2450	52.7	1.95	7.40	7.40	7.40	0.43	0.90	± 12.0 %
2600	52.5	2.16	7.28	7.28	7.28	0.25	1.05	± 12.0 %
3500	51.3	3.31	6.43	6.43	6.43	0.28	1.20	± 13.1 %
5200	49.0	5.30	4.69	4.69	4.69	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.50	4.50	4.50	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.95	3.95	3.95	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.87	3.87	3.87	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.16	4.16	4.16	0.50	1.90	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

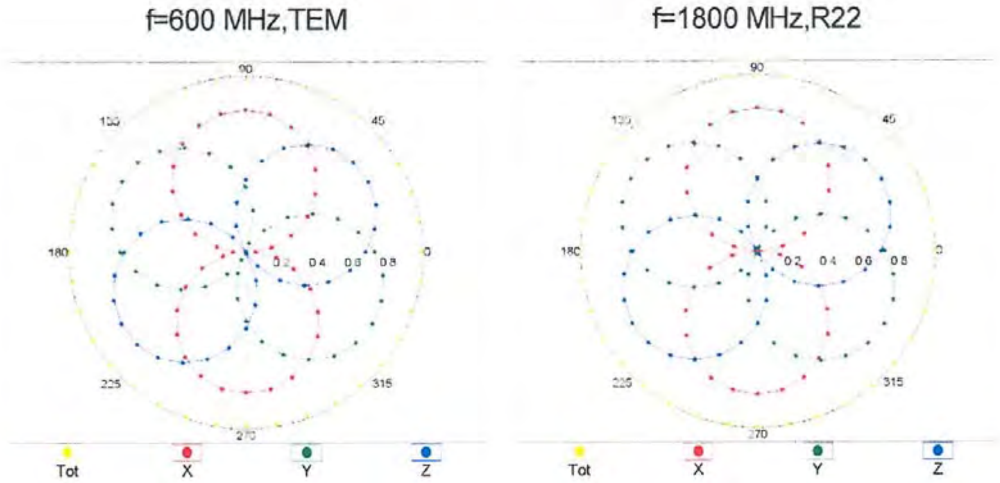
Frequency Response of E-Field

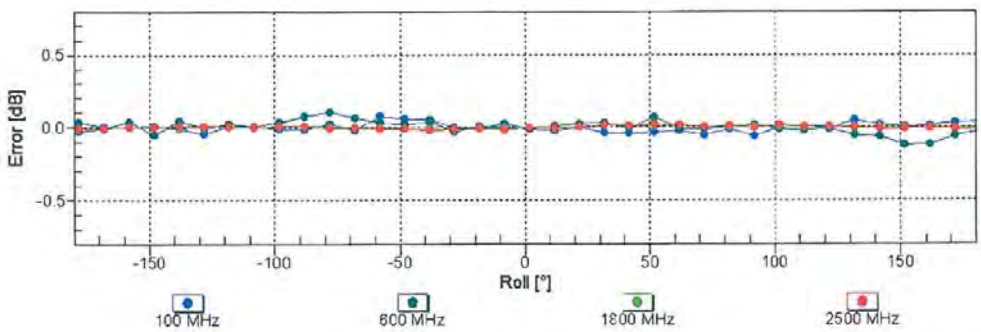
(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

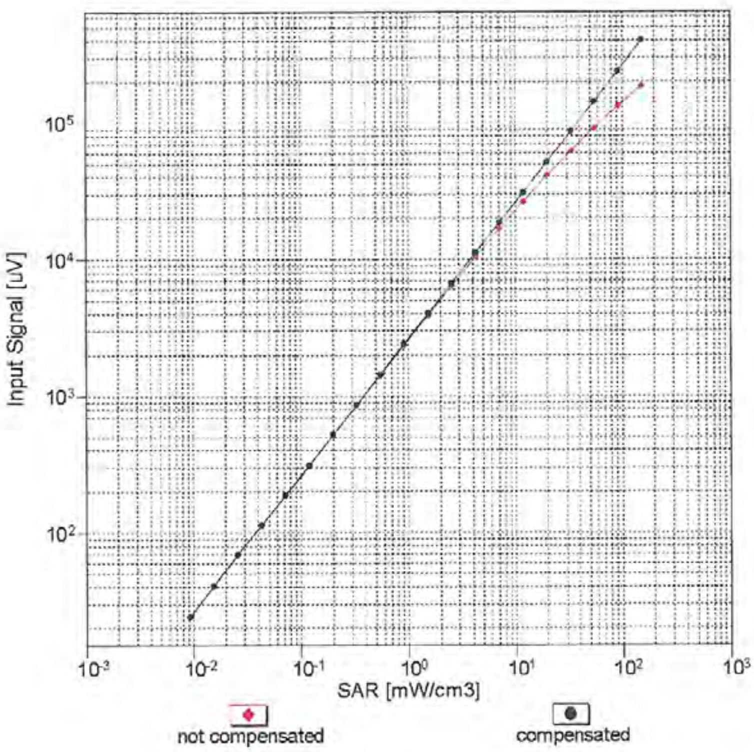
Receiving Pattern (ϕ), ϑ = 0°

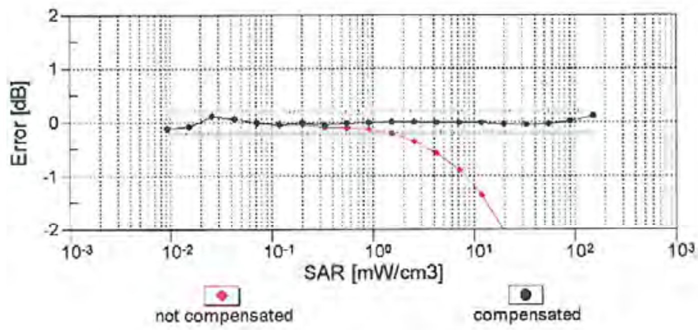




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

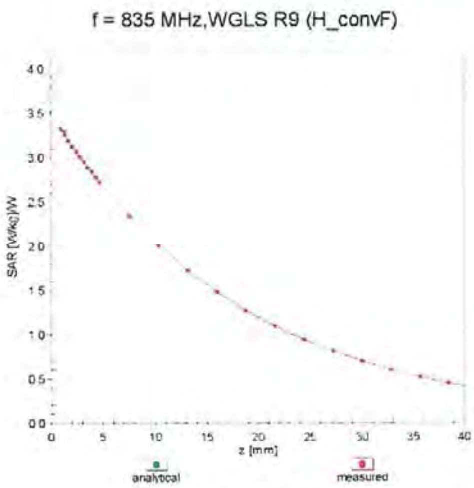
Dynamic Range f(SAR$_{head}$)
(TEM cell , f_{eval}= 1900 MHz)

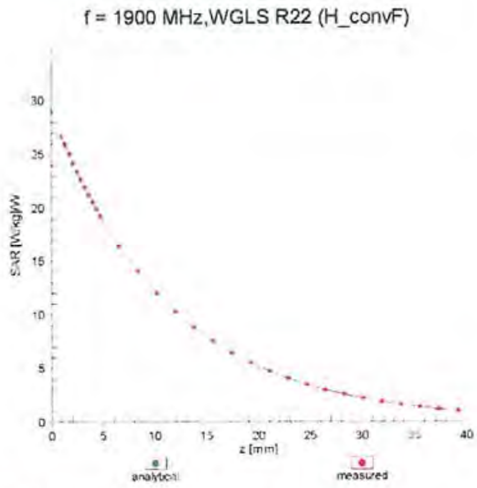




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

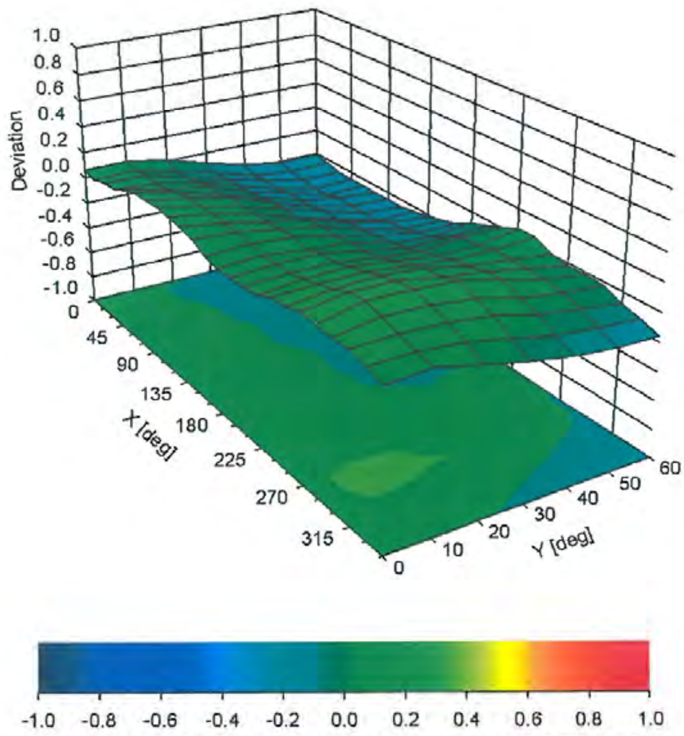
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3866

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	61.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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Appendix: Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max Unc^E (k=2)
0	CW	X	0.00	0.00	1.00	0.00	129.5	± 3.3 %
		Y	0.00	0.00	1.00		142.9	
		Z	0.00	0.00	1.00		132.3	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	4.96	74.03	14.55	10.00	20.0	± 9.6 %
		Y	1.96	62.67	8.25		20.0	
		Z	1.98	63.61	8.75		20.0	
10011-CAB	UMTS-FDD (WCDMA)	X	1.46	74.36	19.19	0.00	150.0	± 9.6 %
		Y	0.84	66.93	14.18		150.0	
		Z	1.06	69.91	16.41		150.0	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	1.27	66.19	17.07	0.41	150.0	± 9.6 %
		Y	1.01	63.39	14.61		150.0	
		Z	1.12	64.44	15.48		150.0	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	5.02	66.95	17.37	1.46	150.0	± 9.6 %
		Y	4.56	66.54	16.75		150.0	
		Z	4.61	66.83	16.87		150.0	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	100.00	116.34	28.99	9.39	50.0	± 9.6 %
		Y	4.35	71.51	13.58		50.0	
		Z	10.49	82.17	17.30		50.0	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	100.00	116.24	28.99	9.57	50.0	± 9.6 %
		Y	4.08	70.51	13.19		50.0	
		Z	7.34	77.92	15.91		50.0	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	100.00	114.37	27.13	6.56	60.0	± 9.6 %
		Y	2.47	68.27	11.00		60.0	
		Z	99.64	104.22	21.52		60.0	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	7.29	85.63	33.51	12.57	50.0	± 9.6 %
		Y	3.34	62.89	20.63		50.0	
		Z	4.59	72.89	26.66		50.0	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	19.51	108.37	37.98	9.56	60.0	± 9.6 %
		Y	6.99	84.48	28.68		60.0	
		Z	7.40	87.18	30.26		60.0	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	100.00	114.69	26.54	4.80	80.0	± 9.6 %
		Y	1.47	65.78	9.10		80.0	
		Z	100.00	103.55	20.47		80.0	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	100.00	116.57	26.68	3.55	100.0	± 9.6 %
		Y	0.75	62.53	6.91		100.0	
		Z	100.00	103.86	19.98		100.0	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	10.84	94.12	31.96	7.80	80.0	± 9.6 %
		Y	4.68	76.74	24.63		80.0	
		Z	4.76	77.76	25.40		80.0	
10030-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	X	100.00	113.28	26.21	5.30	70.0	± 9.6 %
		Y	1.50	64.87	8.87		70.0	
		Z	14.61	85.51	16.17		70.0	
10031-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	X	100.00	120.46	26.88	1.88	100.0	± 9.6 %
		Y	0.28	60.00	3.77		100.0	
		Z	100.00	97.01	16.04		100.0	

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10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	100.00	134.94	31.61	1.17	100.0	± 9.6 %
		Y	2.98	214.36	19.03		100.0	
		Z	100.00	96.12	15.00		100.0	
10033-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	X	100.00	129.71	35.52	5.30	70.0	± 9.6 %
		Y	3.37	73.07	15.63		70.0	
		Z	5.18	79.83	18.59		70.0	
10034-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	X	38.25	116.38	31.11	1.88	100.0	± 9.6 %
		Y	1.32	66.13	11.17		100.0	
		Z	2.19	72.52	14.56		100.0	
10035-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	X	10.07	97.58	26.00	1.17	100.0	± 9.6 %
		Y	1.02	64.74	10.26		100.0	
		Z	1.68	70.82	13.73		100.0	
10036-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	X	100.00	130.10	35.71	5.30	70.0	± 9.6 %
		Y	3.79	74.73	16.33		70.0	
		Z	6.44	82.95	19.72		70.0	
10037-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	X	33.36	114.28	30.54	1.88	100.0	± 9.6 %
		Y	1.25	65.67	10.94		100.0	
		Z	1.95	71.33	14.08		100.0	
10038-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	X	11.00	99.37	26.64	1.17	100.0	± 9.6 %
		Y	1.03	65.03	10.52		100.0	
		Z	1.72	71.30	14.06		100.0	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.41	85.41	21.99	0.00	150.0	± 9.6 %
		Y	0.86	64.63	9.97		150.0	
		Z	1.99	74.44	15.11		150.0	
10042-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	X	100.00	112.07	26.26	7.78	50.0	± 9.6 %
		Y	2.24	65.83	9.99		50.0	
		Z	4.60	73.72	13.31		50.0	
10044-CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	X	0.01	122.05	4.07	0.00	150.0	± 9.6 %
		Y	0.35	142.03	0.00		150.0	
		Z	0.02	123.73	10.80		150.0	
10048-CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	X	100.00	117.95	31.07	13.80	25.0	± 9.6 %
		Y	4.50	67.37	13.41		25.0	
		Z	5.19	70.06	14.31		25.0	
10049-CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	X	100.00	116.36	29.33	10.79	40.0	± 9.6 %
		Y	4.23	69.49	13.02		40.0	
		Z	5.27	72.87	14.27		40.0	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	77.81	121.32	33.78	9.03	50.0	± 9.6 %
		Y	6.03	75.76	17.19		50.0	
		Z	9.07	82.59	19.86		50.0	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	7.57	86.51	28.41	6.55	100.0	± 9.6 %
		Y	3.72	73.02	22.40		100.0	
		Z	3.78	73.63	22.92		100.0	
10059-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	1.41	68.44	18.21	0.61	110.0	± 9.6 %
		Y	1.03	64.26	15.02		110.0	
		Z	1.14	65.37	15.93		110.0	
10060-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	100.00	140.28	36.98	1.30	110.0	± 9.6 %
		Y	5.52	92.10	22.15		110.0	
		Z	23.32	116.45	30.29		110.0	

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10061-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	32.15	121.96	35.02	2.04	110.0	± 9.6 %
		Y	2.04	75.39	19.12		110.0	
		Z	2.36	78.14	20.85		110.0	
10062-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	4.83	66.99	16.83	0.49	100.0	± 9.6 %
		Y	4.37	66.55	16.24		100.0	
		Z	4.43	66.90	16.40		100.0	
10063-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	X	4.85	67.11	16.95	0.72	100.0	± 9.6 %
		Y	4.38	66.62	16.31		100.0	
		Z	4.44	66.97	16.47		100.0	
10064-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	X	5.19	67.41	17.17	0.86	100.0	± 9.6 %
		Y	4.62	66.81	16.50		100.0	
		Z	4.67	67.13	16.63		100.0	
10065-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	X	5.05	67.34	17.29	1.21	100.0	± 9.6 %
		Y	4.49	66.66	16.55		100.0	
		Z	4.54	66.96	16.68		100.0	
10066-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	X	5.08	67.39	17.47	1.46	100.0	± 9.6 %
		Y	4.50	66.65	16.68		100.0	
		Z	4.54	66.92	16.80		100.0	
10067-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	X	5.35	67.39	17.83	2.04	100.0	± 9.6 %
		Y	4.79	66.90	17.13		100.0	
		Z	4.82	67.14	17.23		100.0	
10068-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	X	5.44	67.63	18.14	2.55	100.0	± 9.6 %
		Y	4.82	66.81	17.26		100.0	
		Z	4.85	67.03	17.35		100.0	
10069-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	X	5.51	67.49	18.27	2.67	100.0	± 9.6 %
		Y	4.89	66.85	17.46		100.0	
		Z	4.91	67.04	17.53		100.0	
10071-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	5.12	67.05	17.68	1.99	100.0	± 9.6 %
		Y	4.66	66.59	17.01		100.0	
		Z	4.70	66.85	17.11		100.0	
10072-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	5.14	67.52	17.95	2.30	100.0	± 9.6 %
		Y	4.62	66.83	17.17		100.0	
		Z	4.65	67.08	17.27		100.0	
10073-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	5.21	67.69	18.29	2.83	100.0	± 9.6 %
		Y	4.68	67.01	17.47		100.0	
		Z	4.71	67.23	17.56		100.0	
10074-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	5.18	67.59	18.46	3.30	100.0	± 9.6 %
		Y	4.69	66.95	17.60		100.0	
		Z	4.71	67.17	17.70		100.0	
10075-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	5.26	67.87	18.86	3.82	90.0	± 9.6 %
		Y	4.73	66.99	17.83		90.0	
		Z	4.74	67.18	17.92		90.0	
10076-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	5.23	67.53	18.89	4.15	90.0	± 9.6 %
		Y	4.77	66.89	18.00		90.0	
		Z	4.78	67.06	18.08		90.0	
10077-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	5.25	67.58	18.98	4.30	90.0	± 9.6 %
		Y	4.81	66.98	18.11		90.0	
		Z	4.81	67.15	18.19		90.0	

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10081-CAB	CDMA2000 (1xRTT, RC3)	X	1.61	75.86	18.26	0.00	150.0	± 9.6 %
		Y	0.40	60.59	6.95		150.0	
		Z	0.70	65.91	10.99		150.0	
10082-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	X	0.97	60.00	5.20	4.77	80.0	± 9.6 %
		Y	6.26	66.77	5.69		80.0	
		Z	1.47	63.08	5.04		80.0	
10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	100.00	114.42	27.18	6.56	60.0	± 9.6 %
		Y	2.51	68.39	11.07		60.0	
		Z	91.59	103.46	21.38		60.0	
10097-CAB	UMTS-FDD (HSDPA)	X	2.10	70.41	17.58	0.00	150.0	± 9.6 %
		Y	1.66	67.98	15.08		150.0	
		Z	1.92	70.17	16.49		150.0	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	2.06	70.42	17.57	0.00	150.0	± 9.6 %
		Y	1.62	67.91	15.04		150.0	
		Z	1.88	70.12	16.47		150.0	
10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	19.63	108.47	38.01	9.56	60.0	± 9.6 %
		Y	7.02	84.55	28.70		60.0	
		Z	7.45	87.29	30.29		60.0	
10100-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	3.76	73.52	18.27	0.00	150.0	± 9.6 %
		Y	2.83	69.91	16.35		150.0	
		Z	3.08	71.35	17.24		150.0	
10101-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	3.49	68.90	16.77	0.00	150.0	± 9.6 %
		Y	2.97	67.19	15.62		150.0	
		Z	3.10	67.97	16.12		150.0	
10102-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	3.59	68.75	16.81	0.00	150.0	± 9.6 %
		Y	3.08	67.24	15.76		150.0	
		Z	3.21	67.97	16.22		150.0	
10103-CAD	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	8.41	79.82	22.06	3.98	65.0	± 9.6 %
		Y	4.84	71.96	18.48		65.0	
		Z	5.42	74.19	19.53		65.0	
10104-CAD	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	7.70	76.73	21.71	3.98	65.0	± 9.6 %
		Y	5.32	71.47	19.01		65.0	
		Z	5.48	72.25	19.42		65.0	
10105-CAD	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	7.04	74.96	21.27	3.98	65.0	± 9.6 %
		Y	4.70	68.99	18.19		65.0	
		Z	5.14	70.85	19.09		65.0	
10108-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	3.28	72.58	18.09	0.00	150.0	± 9.6 %
		Y	2.43	69.27	16.18		150.0	
		Z	2.65	70.70	17.10		150.0	
10109-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	3.17	68.85	16.81	0.00	150.0	± 9.6 %
		Y	2.61	67.16	15.46		150.0	
		Z	2.76	68.08	16.06		150.0	
10110-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	2.68	71.66	17.86	0.00	150.0	± 9.6 %
		Y	1.91	68.41	15.56		150.0	
		Z	2.13	70.09	16.68		150.0	
10111-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	2.94	70.01	17.44	0.00	150.0	± 9.6 %
		Y	2.36	68.46	15.69		150.0	
		Z	2.60	69.97	16.63		150.0	

10112-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	3.28	68.68	16.79	0.00	150.0	± 9.6 %
		Y	2.74	67.25	15.57		150.0	
		Z	2.89	68.13	16.13		150.0	
10113-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	3.09	69.94	17.46	0.00	150.0	± 9.6 %
		Y	2.52	68.70	15.88		150.0	
		Z	2.75	70.13	16.75		150.0	
10114-CAC	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	5.23	67.48	16.65	0.00	150.0	± 9.6 %
		Y	4.84	67.00	16.28		150.0	
		Z	4.90	67.34	16.43		150.0	
10115-CAC	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	X	5.59	67.72	16.77	0.00	150.0	± 9.6 %
		Y	5.08	67.08	16.32		150.0	
		Z	5.13	67.37	16.44		150.0	
10116-CAC	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	X	5.36	67.74	16.70	0.00	150.0	± 9.6 %
		Y	4.92	67.20	16.31		150.0	
		Z	4.98	67.52	16.45		150.0	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	5.24	67.49	16.68	0.00	150.0	± 9.6 %
		Y	4.83	66.95	16.28		150.0	
		Z	4.89	67.29	16.43		150.0	
10118-CAC	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	X	5.66	67.87	16.85	0.00	150.0	± 9.6 %
		Y	5.16	67.27	16.43		150.0	
		Z	5.20	67.52	16.53		150.0	
10119-CAC	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	X	5.33	67.68	16.69	0.00	150.0	± 9.6 %
		Y	4.92	67.19	16.31		150.0	
		Z	4.97	67.51	16.46		150.0	
10140-CAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	3.64	68.73	16.72	0.00	150.0	± 9.6 %
		Y	3.10	67.23	15.65		150.0	
		Z	3.23	67.98	16.12		150.0	
10141-CAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	3.75	68.73	16.84	0.00	150.0	± 9.6 %
		Y	3.23	67.43	15.88		150.0	
		Z	3.36	68.16	16.32		150.0	
10142-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	2.50	72.12	17.94	0.00	150.0	± 9.6 %
		Y	1.65	68.10	14.67		150.0	
		Z	1.94	70.53	16.23		150.0	
10143-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	2.95	71.49	17.71	0.00	150.0	± 9.6 %
		Y	2.12	68.46	14.53		150.0	
		Z	2.52	71.14	16.09		150.0	
10144-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	2.62	68.66	15.91	0.00	150.0	± 9.6 %
		Y	1.78	65.25	12.38		150.0	
		Z	2.00	66.87	13.49		150.0	
10145-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	2.08	72.58	16.71	0.00	150.0	± 9.6 %
		Y	0.62	60.00	6.54		150.0	
		Z	0.76	61.85	8.27		150.0	
10146-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	4.74	77.79	17.95	0.00	150.0	± 9.6 %
		Y	0.91	59.91	6.14		150.0	
		Z	1.03	60.93	6.75		150.0	
10147-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	8.02	85.30	20.79	0.00	150.0	± 9.6 %
		Y	0.95	60.19	6.39		150.0	
		Z	1.09	61.38	7.09		150.0	

10149-CAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	3.18	68.92	16.86	0.00	150.0	± 9.6 %
		Y	2.63	67.24	15.52		150.0	
		Z	2.78	68.16	16.12		150.0	
10150-CAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	3.29	68.74	16.83	0.00	150.0	± 9.6 %
		Y	2.75	67.32	15.62		150.0	
		Z	2.90	68.21	16.19		150.0	
10151-CAD	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.25	82.93	23.38	3.98	65.0	± 9.6 %
		Y	5.36	75.32	19.83		65.0	
		Z	5.77	76.93	20.64		65.0	
10152-CAD	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.33	77.04	21.65	3.98	65.0	± 9.6 %
		Y	4.81	71.16	18.40		65.0	
		Z	4.98	72.05	18.88		65.0	
10153-CAD	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	7.72	77.89	22.37	3.98	65.0	± 9.6 %
		Y	5.21	72.44	19.38		65.0	
		Z	5.39	73.30	19.82		65.0	
10154-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	2.79	72.40	18.27	0.00	150.0	± 9.6 %
		Y	1.96	68.90	15.86		150.0	
		Z	2.20	70.63	16.99		150.0	
10155-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	2.94	70.00	17.44	0.00	150.0	± 9.6 %
		Y	2.37	68.50	15.72		150.0	
		Z	2.60	70.02	16.66		150.0	
10156-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	2.45	73.08	18.25	0.00	150.0	± 9.6 %
		Y	1.44	67.52	13.85		150.0	
		Z	1.79	70.64	15.81		150.0	
10157-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	2.55	70.02	16.44	0.00	150.0	± 9.6 %
		Y	1.56	65.08	11.79		150.0	
		Z	1.83	67.35	13.31		150.0	
10158-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	3.10	70.01	17.51	0.00	150.0	± 9.6 %
		Y	2.53	68.81	15.95		150.0	
		Z	2.76	70.25	16.83		150.0	
10159-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	2.72	70.68	16.81	0.00	150.0	± 9.6 %
		Y	1.63	65.40	12.01		150.0	
		Z	1.94	67.86	13.59		150.0	
10160-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	3.08	70.55	17.46	0.00	150.0	± 9.6 %
		Y	2.48	68.64	16.02		150.0	
		Z	2.64	69.71	16.74		150.0	
10161-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	3.19	68.68	16.82	0.00	150.0	± 9.6 %
		Y	2.64	67.29	15.48		150.0	
		Z	2.80	68.24	16.09		150.0	
10162-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	3.29	68.68	16.85	0.00	150.0	± 9.6 %
		Y	2.76	67.53	15.64		150.0	
		Z	2.91	68.48	16.24		150.0	
10166-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	4.04	71.00	19.90	3.01	150.0	± 9.6 %
		Y	3.16	69.13	18.77		150.0	
		Z	3.39	70.78	19.66		150.0	
10167-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	5.36	74.73	20.65	3.01	150.0	± 9.6 %
		Y	3.79	71.67	18.97		150.0	
		Z	4.56	75.64	20.76		150.0	

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10168-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	6.03	77.24	22.03	3.01	150.0	± 9.6 %
		Y	4.43	75.05	20.89		150.0	
		Z	5.62	80.10	23.00		150.0	
10169-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	3.82	73.12	20.79	3.01	150.0	± 9.6 %
		Y	2.61	67.68	18.06		150.0	
		Z	2.91	70.50	19.54		150.0	
10170-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	6.54	82.37	24.08	3.01	150.0	± 9.6 %
		Y	3.53	73.51	20.46		150.0	
		Z	5.29	82.18	24.01		150.0	
10171-AAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	4.84	75.97	20.60	3.01	150.0	± 9.6 %
		Y	2.80	68.67	17.18		150.0	
		Z	3.59	74.12	19.63		150.0	
10172-CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	30.51	113.43	34.95	6.02	65.0	± 9.6 %
		Y	3.52	75.21	21.66		65.0	
		Z	4.81	82.95	25.11		65.0	
10173-CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	81.01	124.21	35.55	6.02	65.0	± 9.6 %
		Y	6.10	82.01	22.32		65.0	
		Z	15.21	99.20	28.02		65.0	
10174-CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	42.22	110.92	31.54	6.02	65.0	± 9.6 %
		Y	3.34	72.20	18.19		65.0	
		Z	7.70	87.16	23.71		65.0	
10175-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	3.75	72.64	20.47	3.01	150.0	± 9.6 %
		Y	2.57	67.33	17.78		150.0	
		Z	2.86	70.07	19.23		150.0	
10176-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	6.55	82.40	24.09	3.01	150.0	± 9.6 %
		Y	3.54	73.53	20.47		150.0	
		Z	5.31	82.22	24.03		150.0	
10177-CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	3.79	72.88	20.60	3.01	150.0	± 9.6 %
		Y	2.59	67.48	17.87		150.0	
		Z	2.89	70.25	19.33		150.0	
10178-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	6.40	81.92	23.88	3.01	150.0	± 9.6 %
		Y	3.51	73.32	20.36		150.0	
		Z	5.22	81.88	23.87		150.0	
10179-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	5.57	78.86	22.14	3.01	150.0	± 9.6 %
		Y	3.10	70.80	18.61		150.0	
		Z	4.30	77.75	21.59		150.0	
10180-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	4.81	75.81	20.51	3.01	150.0	± 9.6 %
		Y	2.79	68.61	17.14		150.0	
		Z	3.58	74.03	19.58		150.0	
10181-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	3.79	72.85	20.59	3.01	150.0	± 9.6 %
		Y	2.59	67.46	17.86		150.0	
		Z	2.88	70.23	19.32		150.0	
10182-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	6.39	81.89	23.87	3.01	150.0	± 9.6 %
		Y	3.50	73.29	20.34		150.0	
		Z	5.21	81.83	23.85		150.0	
10183-AAC	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	4.80	75.78	20.50	3.01	150.0	± 9.6 %
		Y	2.79	68.59	17.13		150.0	
		Z	3.57	74.00	19.56		150.0	

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10184-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	3.80	72.91	20.62	3.01	150.0	± 9.6 %
		Y	2.59	67.50	17.89		150.0	
		Z	2.90	70.28	19.35		150.0	
10185-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	6.43	81.99	23.91	3.01	150.0	± 9.6 %
		Y	3.52	73.38	20.39		150.0	
		Z	5.25	81.97	23.91		150.0	
10186-AAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	4.82	75.87	20.54	3.01	150.0	± 9.6 %
		Y	2.80	68.65	17.16		150.0	
		Z	3.60	74.09	19.61		150.0	
10187-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	3.81	72.95	20.67	3.01	150.0	± 9.6 %
		Y	2.61	67.59	17.98		150.0	
		Z	2.91	70.39	19.45		150.0	
10188-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	6.79	83.15	24.45	3.01	150.0	± 9.6 %
		Y	3.65	74.15	20.83		150.0	
		Z	5.58	83.26	24.51		150.0	
10189-AAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	4.99	76.54	20.90	3.01	150.0	± 9.6 %
		Y	2.86	69.07	17.45		150.0	
		Z	3.73	74.78	20.00		150.0	
10193-CAC	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	4.67	66.95	16.48	0.00	150.0	± 9.6 %
		Y	4.24	66.64	15.97		150.0	
		Z	4.33	67.09	16.19		150.0	
10194-CAC	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	X	4.87	67.32	16.59	0.00	150.0	± 9.6 %
		Y	4.38	66.89	16.11		150.0	
		Z	4.47	67.32	16.32		150.0	
10195-CAC	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	X	4.91	67.33	16.59	0.00	150.0	± 9.6 %
		Y	4.42	66.91	16.13		150.0	
		Z	4.50	67.33	16.33		150.0	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	4.69	67.05	16.52	0.00	150.0	± 9.6 %
		Y	4.23	66.65	15.96		150.0	
		Z	4.31	67.09	16.18		150.0	
10197-CAC	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	X	4.89	67.34	16.60	0.00	150.0	± 9.6 %
		Y	4.39	66.89	16.12		150.0	
		Z	4.47	67.32	16.32		150.0	
10198-CAC	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	X	4.92	67.34	16.60	0.00	150.0	± 9.6 %
		Y	4.41	66.91	16.13		150.0	
		Z	4.49	67.32	16.33		150.0	
10219-CAC	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	4.64	67.08	16.49	0.00	150.0	± 9.6 %
		Y	4.18	66.68	15.93		150.0	
		Z	4.27	67.14	16.16		150.0	
10220-CAC	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	X	4.89	67.33	16.60	0.00	150.0	± 9.6 %
		Y	4.38	66.85	16.10		150.0	
		Z	4.46	67.28	16.31		150.0	
10221-CAC	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	X	4.92	67.27	16.59	0.00	150.0	± 9.6 %
		Y	4.43	66.85	16.12		150.0	
		Z	4.51	67.26	16.32		150.0	
10222-CAC	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	5.22	67.52	16.68	0.00	150.0	± 9.6 %
		Y	4.80	66.93	16.26		150.0	
		Z	4.86	67.28	16.41		150.0	