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CERTIFICATE OF COMPLIANCE
SAR EVALUATION

PCB Piezotronics, Inc.
Larson Davis Division
1681 West 820 North
Provo, UT 84601

Dates of Test: September 28, 2015
Test Report Number: SAR.20150913
Revision C

FCC ID:	ZOC-LDHVM200A
IC Certificate:	9732A-LDHVM200A
Model(s):	HVM200
Test Sample:	Engineering Unit Same as Production
Serial Number:	0000063
Equipment Type:	Wireless Human Vibration Meter
Classification:	Portable Transmitter Next to Body
TX Frequency Range:	2412 – 2462 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	2450 MHz – 17.5 dBm Conducted
Signal Modulation:	DSSS, OFDM
Antenna Type:	Internal Antenna
Application Type:	Certification
FCC Rule Parts:	Part 2, 15C
KDB Test Methodology:	KDB 447498 D01 v05r02, KDB248227 D01 v02
Industry Canada:	RSS-102 Issue 5, Safety Code 6
Maximum SAR Value:	0.39 W/kg Reported
Separation Distance:	0 mm

This wireless mobile and/or portable device has been shown to be compliant for localized specific absorption rate (SAR) for uncontrolled environment/general exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and IEC 62209-2:2010 (See test report).

I attest to the accuracy of the data. All measurements were performed by myself or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RF Exposure Lab, LLC certifies that no party to this application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

Jay M. Moulton
Vice President

ACCREDITED
Testing Cert. # 2387.01

Table of Contents

1. Introduction

This measurement report shows compliance of the PCB Piezotronics, Larson Davis Division Model HVM200 FCC ID: ZOC-LDHVM200A with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices and IC Certificate: 9732A- LDHVM200A with RSS102 Issue 5 & Safety Code 6. The FCC have adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on August 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC regulated portable devices. [1], [6]

The test results recorded herein are based on a single type test of PCB Piezotronics, Larson Davis Division Model HVM200 and therefore apply only to the tested sample.

The test procedures, as described in ANSI C95.1 – 1999 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [2], ANSI C95.3 – 2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields [3], IEEE Std.1528 – 2013 Recommended Practice [4], and Industry Canada Safety Code 6 Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz were employed.

The following table indicates all the wireless technologies operating in the HVM200 Wireless Human Vibration Meter. The table also shows the tolerance for the power level for each mode.

Band	Technology	Class	3GPP Nominal Power dBm	Setpoint Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
WLAN – 2.4 GHz	802.11b	N/A	N/A	N/A	N/A	N/A	17.0
WLAN – 2.4 GHz	802.11g	N/A	N/A	N/A	N/A	N/A	14.0

SAR Definition [5]

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (*dW*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element (*dV*) of a given density (ρ).

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dV}\right)$$

SAR is expressed in units of watts per kilogram (W/kg). *SAR* can be related to the electric field at a point by

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

where:

σ = conductivity of the tissue (S/m)

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

E = rms electric field strength (V/m)

2. SAR Measurement Setup

Robotic System

These measurements are performed using the DASY52 automated dosimetric assessment system. The DASY52 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, Intel Core2 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. 2.1).

System Hardware

A cell controller system contains the power supply, robot controller teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the HP Intel Core2 computer with Windows XP system and SAR Measurement Software DASY52, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is 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.

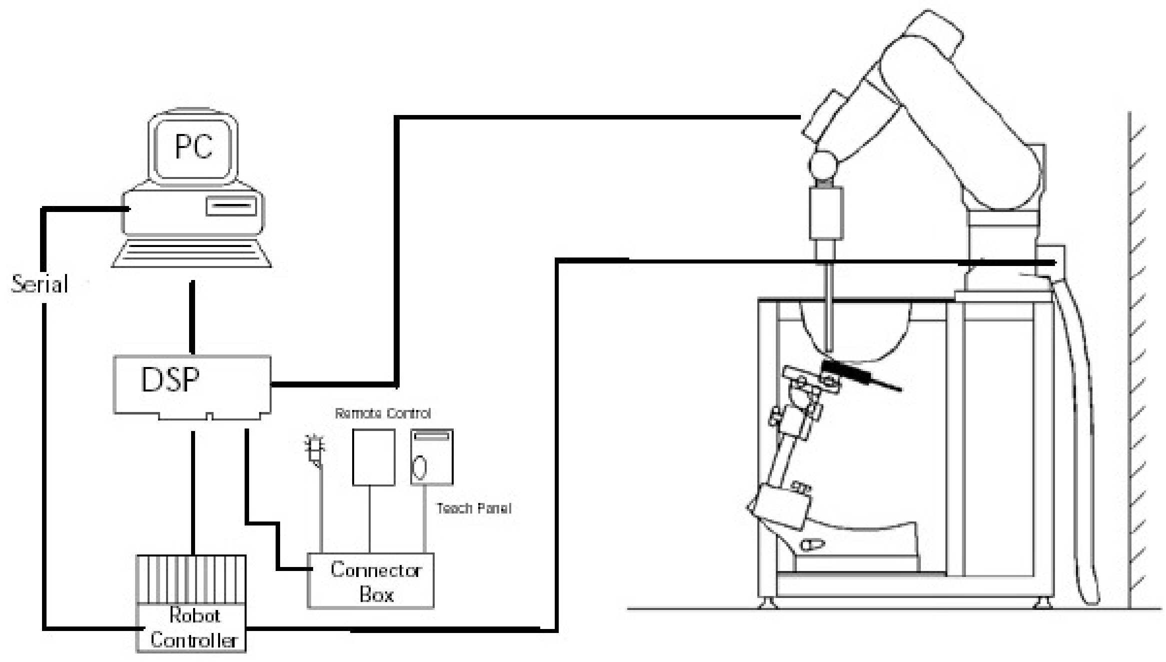


Figure 2.1 SAR Measurement System Setup

System Electronics

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 in.

Probe Measurement System

The SAR measurements were conducted with the dosimetric probe EX3DV4, designed in the classical triangular configuration (see Fig. 2.2) 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 multi fiber line ending at the front of the probe tip. (see Fig. 2.3) 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 DASY52 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.

DAE System

Probe Specifications

Calibration: In air from 10 MHz to 6.0 GHz
In brain and muscle simulating tissue at Frequencies of 450 MHz, 835 MHz, 1750 MHz, 1900 MHz, 2450 MHz, 2600 MHz, 3500 MHz, 5200 MHz, 5300 MHz, 5600 MHz, 5800 MHz

Frequency: 10 MHz to 6 GHz

Linearity: ±0.2dB (30 MHz to 6 GHz)

Dynamic: 10 mW/kg to 100 W/kg

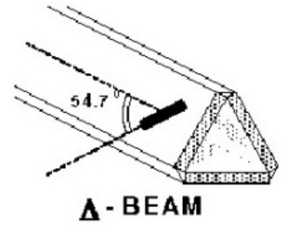


Figure 2.2 Triangular Probe Configurations

Range: Linearity: ±0.2dB

Dimensions: Overall length: 330 mm

Tip length: 20 mm

Body diameter: 12 mm

Tip diameter: 2.5 mm

Distance from probe tip to sensor center: 1 mm

Figure 2.3 Probe Thick-Film Technique

Application: SAR Dosimetry Testing
Compliance tests of wireless device

Probe Calibration Process

Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure described in with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in 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 until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

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 thermistor 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;

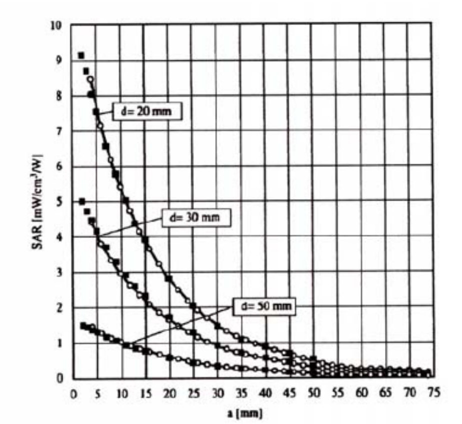


Figure 2.4 E-Field and Temperature Measurements at 900MHz

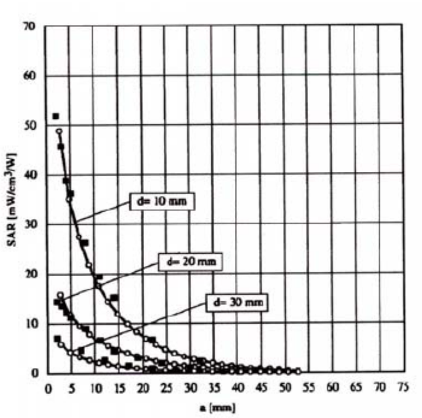


Figure 2.5 E-Field and Temperature Measurements at 1800MHz

Data Extrapolation

The DASY52 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

Scanning procedure

- The DASY installation includes predefined files with recommended procedures for measurements and system check. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The „reference" and „drift" measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT's output power and should vary max. +/- 5 %.

- The highest integrated SAR value is the main concern in compliance test applications. These values can mostly be found at the inner surface of the phantom and cannot be measured directly due to the sensor offset in the probe. To extrapolate the surface values, the measurement distances to the surface must be known accurately. A distance error of 0.5mm could produce SAR errors of 6% at 1800 MHz. Using predefined locations for measurements is not accurate enough. Any shift of the phantom (e.g., slight deformations after filling it with liquid) would produce high uncertainties. For an automatic and accurate detection of the phantom surface, the DASY5 system uses the mechanical surface detection. The detection is always at touch, but the probe will move backward from the surface the indicated distance before starting the measurement.

- The „area scan" measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The scan uses different grid spacings for different frequency measurements. Standard grid spacing for head measurements in frequency ranges ≤ 2GHz is 15 mm in x - and y- dimension. For higher frequencies a finer resolution is needed, thus for the grid spacing is reduced according the following table:

Area scan grid spacing for different frequency ranges	
Frequency range	Grid spacing
≤ 2 GHz	≤ 15 mm
2 – 4 GHz	≤ 12 mm
4 – 6 GHz	≤ 10 mm

Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation. Results of this coarse scan are shown in annex B.

- A „zoom scan" measures the field in a volume around the 2D peak SAR value acquired in the previous „coarse" scan. It uses a fine meshed grid where the robot moves the probe in steps along all the 3 axis (x,y and z-axis) starting at the bottom of the Phantom. The grid spacing for the cube measurement is varied according to the measured frequency range, the dimensions are given in the following table:

Zoom scan grid spacing and volume for different frequency ranges			
Frequency range	Grid spacing for x, y axis	Grid spacing for z axis	Minimum zoom scan volume
≤ 2 GHz	≤ 8 mm	≤ 5 mm	≥ 30 mm
2 – 3 GHz	≤ 5 mm	≤ 5 mm	≥ 28 mm
3 – 4 GHz	≤ 5 mm	≤ 4 mm	≥ 28 mm
4 – 5 GHz	≤ 4 mm	≤ 3 mm	≥ 25 mm
5 – 6 GHz	≤ 4 mm	≤ 2 mm	≥ 22 mm

DASY is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in annex B. Test results relevant for the specified standard (see section 3) are shown in table form in section 7.

Spatial Peak SAR Evaluation

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of all points in the three directions x, y and z. The algorithm that finds the maximal averaged volume is separated into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 1 to 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.

- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.

- All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff].

Volume Averaging

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

Advanced Extrapolation

DASY uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.

SAM PHANTOM

The SAM Twin Phantom V4.0 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. 2.6)

Phantom Specification

Phantom: SAM Twin Phantom (V4.0)
Shell Material: Vivac Composite
Thickness: 2.0 ± 0.2 mm

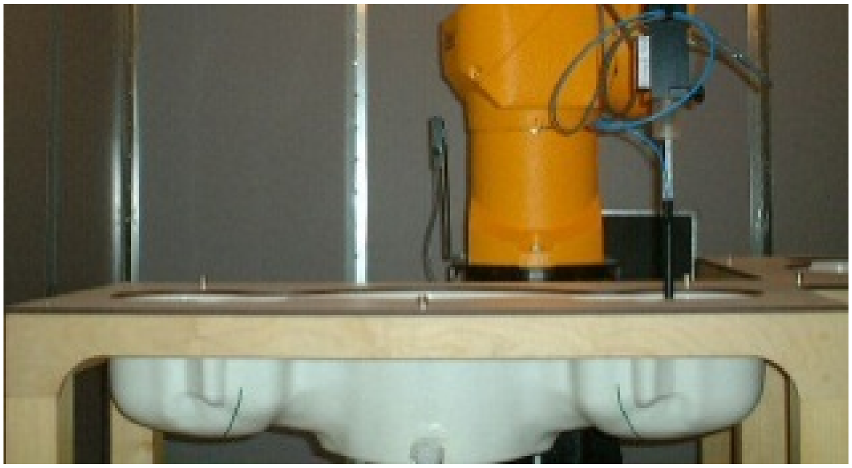


Figure 2.6 SAM Twin Phantom

Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0 the Mounting Device (see Fig. 2.7), enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation point is the ear opening. The devices can be easily, accurately, and repeat ably be positioned according to the FCC, CENELEC, IEC and IEEE specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Figure 2.7 Mounting Device

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.

3. Probe and Dipole Calibration

See Appendix D and E.

4. Phantom & Simulating Tissue Specifications

Head & Body Simulating Mixture Characterization

The head and body mixtures consist of the material based on the table listed below. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. Body tissue parameters that have not been specified in IEEE1528-2013 are derived from the issue dielectric parameters computed from the 4-Cole-Cole equations.

Table 4.1 Typical Composition of Ingredients for Tissue

Ingredients		Simulating Tissue
		2450 MHz Body
Mixing Percentage		
Water		73.20
Sugar		0.00
Salt		0.04
HEC		0.00
Bactericide		0.00
DGBE		26.76
Dielectric Constant	Target	52.70
Conductivity (S/m)	Target	1.95

5. ANSI/IEEE C95.1 – 1992 RF Exposure Limits [2]

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 applicable to situations in which persons are exposed as a consequence of their 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 5.1 Human Exposure Limits

	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIROMENT Professional Population (W/kg) or (mW/g)
SPATIAL PEAK SAR[1] Head	1.60	8.00
SPATIAL AVERAGE SAR[2] Whole Body	0.08	0.40
SPATIAL PEAK SAR[3] Hands, Feet, Ankles, Wrists	4.00	20.00

[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.

6. Measurement Uncertainty

Measurement uncertainty table is not required per KDB 865664 D01 v01 section 2.8.2 page 12. SAR measurement uncertainty analysis is required in the SAR report only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR. The equivalent ratio (1.5/1.6) should be applied to extremity and occupational exposure conditions. The highest reported value is less than 1.5 W/kg. Therefore, the measurement uncertainty table is not required.

7. System Validation

Tissue Verification

Table 7.1 Measured Tissue Parameters

		2450 MHz Body		2450 MHz Body	
Date(s)		Sept. 28, 2015		Nov. 16, 2015	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured
Dielectric Constant: ε		52.70	52.58	52.70	52.74
Conductivity: σ		1.95	2.00	1.95	1.98

See Appendix A for data printout.

Test System Verification

Prior to assessment, the system is verified to the ±10% of the specifications at the test frequency by using the system kit. Power is normalized to 1 watt. (Graphic Plots Attached)

Table 7.2 System Dipole Validation Target & Measured

	Test Frequency	Targeted SAR_{1g} (W/kg)	Measure SAR_{1g} (W/kg)	Tissue Used for Verification	Deviation Target and Fast SAR to SAR (%)	Plot Number
28-Sep-2015	2450 MHz	51.50	52.00	Body	+ 0.97	1
16-Nov-2015	2450 MHz	51.50	51.90	Body	+ 0.78	2

See Appendix A for data plots.5

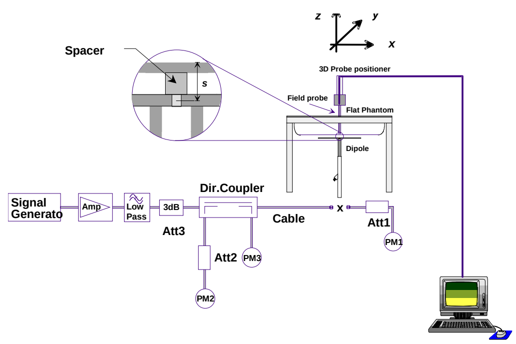


Figure 7.1 Dipole Validation Test Setup

8. SAR Test Data Summary

See Measurement Result Data Pages

See Appendix B for SAR Test Data Plots.
See Appendix C for SAR Test Setup Photos.

Procedures Used To Establish Test Signal

The device was either placed into simulated transmit mode using the manufacturer's test codes or the actual transmission is activated through a base station simulator or similar equipment. See data pages for actual procedure used in measurement.

Device Test Condition

In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power unless otherwise noted. If a conducted power deviation of more than 5% occurred, the test was repeated. The power drift of each test is measured at the start of the test and again at the end of the test. The drift percentage is calculated by the formula ((end/start)-1)*100 and rounded to three decimal places. The drift percentage is calculated into the resultant SAR value on the data sheet for each test.

The EUT was tested on all sides of the device. All measurements were conducted with the side of the device in direct contact with the phantom.

The maximum duty cycle of the signal was measured to be 98% (See measured data and setup procedure in Appendix H). The SAR measured values have been scaled to 100% duty cycle then to the upper end of the tune up tolerance resulting in the reported SAR value. Please see data sheet on page 22.

The antenna was on a minimum of 10 cm of Styrofoam during each test.

Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Data Rate	Antenna	Power (dBm)
2450 MHz	802.11b	20	1	2412	1 Mbps	Main	15.86
			6	2437			16.29
			11	2462			16.14
	802.11g	20	1	2412	6 Mbps	Main	12.92
			6	2437			12.26
			11	2462			12.34

Figure 8.1 Test Reduction Table – 2.4 GHz Main

Mode	Side	Required Channel	Tested/Reduced
802.11b	Side A	1 – 2412 MHz	Tested
		6 – 2437 MHz	Tested
		11 – 2462 MHz	Tested
	Side B	1 – 2412 MHz	Tested
		6 – 2437 MHz	Tested
		11 – 2462 MHz	Tested
	Side C	1 – 2412 MHz	Tested
		6 – 2437 MHz	Tested
		11 – 2462 MHz	Tested
	Side D	1 – 2412 MHz	Tested
		6 – 2437 MHz	Tested
		11 – 2462 MHz	Tested
	Side E	1 – 2412 MHz	Tested
		6 – 2437 MHz	Tested
		11 – 2462 MHz	Tested
	Side F	1 – 2412 MHz	Tested
		6 – 2437 MHz	Tested
		11 – 2462 MHz	Tested

SAR Data Summary – 2450 MHz Body

MEASUREMENT RESULTS									
Plot	**Gap**	**Position**	**Frequency**		**Modulation**	**Antenna**	**End Power**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
			MHz	**Ch.**			**(dBm)**		
-----	0 mm	Side A	2412	1	DSSS	Main	15.86	0.265	0.35
1			2437	6	DSSS		16.29	0.331	0.39
-----			2462	11	DSSS		16.14	0.298	0.36
-----		Side B	2412	1	DSSS		15.86	0.097	0.13
-----			2437	6	DSSS		16.29	0.141	0.17
-----			2462	11	DSSS		16.14	0.124	0.15
-----		Side C	2412	1	DSSS		15.86	0.158	0.21
-----			2437	6	DSSS		16.29	0.234	0.28
-----			2462	11	DSSS		16.14	0.186	0.23
-----		Side D	2412	1	DSSS		15.86	0.0249	0.03
-----			2437	6	DSSS		16.29	0.0308	0.04
-----			2462	11	DSSS		16.14	0.0268	0.03
-----		Side E	2412	1	DSSS		15.86	0.0085	0.01
-----			2437	6	DSSS		16.29	0.0138	0.02
-----			2462	11	DSSS		16.14	0.0102	0.01
-----		Side F	2412	1	DSSS		15.86	0.158	0.21
-----			2437	6	DSSS		16.29	0.268	0.32
-----			2462	11	DSSS		16.14	0.213	0.26

Body
1.6 W/kg (mW/g)
averaged over 1 gram

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

9. Test Equipment List

Table 9.1 Equipment Specifications

Type	Calibration Due Date	Calibration Done Date	Serial Number
Staubli Robot TX60L	N/A	N/A	F07/55M6A1/A/01
Measurement Controller CS8c	N/A	N/A	1012
ELI4 Flat Phantom	N/A	N/A	1065
Device Holder	N/A	N/A	N/A
Data Acquisition Electronics 4	04/15/2016	04/15/2015	1416
SPEAG E-Field Probe EX3DV4	04/27/2016	04/27/2015	3662
Speag Validation Dipole D2450V2	12/04/2015	12/04/2012	829
Agilent N1911A Power Meter	05/20/2017	05/20/2015	GB45100254
Agilent N1922A Power Sensor	06/25/2017	06/25/2015	MY45240464
Advantest R3261A Spectrum Analyzer	03/26/2017	03/26/2015	31720068
Agilent (HP) 8350B Signal Generator	03/26/2017	03/26/2015	2749A10226
Agilent (HP) 83525A RF Plug-In	03/26/2017	03/26/2015	2647A01172
Agilent (HP) 8753C Vector Network Analyzer	03/26/2017	03/26/2015	3135A01724
Agilent (HP) 85047A S-Parameter Test Set	03/26/2017	03/26/2015	2904A00595
Agilent (HP) 8960 Base Station Sim.	03/31/2017	03/31/2015	MY48360364
Anritsu MT8820C	07/28/2017	07/28/2015	6201176199
Agilent 778D Dual Directional Coupler	N/A	N/A	MY48220184
MiniCircuits BW-N20W5+ Fixed 20 dB Attenuator	N/A	N/A	N/A
MiniCircuits SPL-10.7+ Low Pass Filter	N/A	N/A	R8979513746
Aprel Dielectric Probe Assembly	N/A	N/A	0011
Body Equivalent Matter (2450 MHz)	N/A	N/A	N/A

10. Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC/IC. These measurements are taken to simulate the RF effects exposure under 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 is a very complex phenomena that depends 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 in possible biological effects 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.

11. References

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radio Frequency Radiation, August 1996

[2] ANSI/IEEE C95.1 – 1992, American National Standard Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300kHz to 100GHz, New York: IEEE, 1992.

[3] ANSI/IEEE C95.3 – 1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, 1992.

[4] International Electrotechnical Commission, IEC 62209-2 (Edition 1.0), Human Exposure to radio frequency fields from hand-held and body mounted wireless communication devices – Human models, instrumentation, and procedures – Part 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.

[5] IEEE Standard 1528 – 2013, IEEE Recommended Practice for Determining the Peak-Spatial Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques, June 2013.

[6] Industry Canada, RSS – 102 Issue 5, Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), March 2015.

[7] Health Canada, Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz, 2009.

Appendix A – System Validation Plots and Data

```
************************************************************
Test Result for UIM Dielectric Parameter
Tue 28/Sep/2015
Freq     Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
FCC_eB Limits for Body Epsilon
FCC_sB Limits for Body Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq         FCC_eB FCC_sB Test_e Test_s
2.4000       52.76  1.90   52.68  1.94
2.4100       52.75  1.91   52.66  1.95
2.4120       52.748 1.912  52.656 1.952*
2.4200       52.74  1.92   52.64  1.96
2.4300       52.73  1.93   52.62  1.97
2.4370       52.713 1.937  52.606 1.984*
2.4400       52.71  1.94   52.60  1.99
2.4500       52.70  1.95   52.58  2.00
2.4600       52.69  1.96   52.57  2.01
2.4620       52.686 1.964  52.566 2.012*
2.4700       52.67  1.98   52.55  2.02
2.4800       52.66  1.99   52.53  2.03

* value interpolated
```

```
************************************************************
Test Result for UIM Dielectric Parameter
Mon 16/Nov/2015
Freq     Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
FCC_eB Limits for Body Epsilon
FCC_sB Limits for Body Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
************************************************************
Freq         FCC_eB FCC_sB Test_e Test_s
2.4100       52.75  1.91   52.82  1.93
2.4120       52.748 1.912  52.816 1.932*
2.4200       52.74  1.92   52.80  1.94
2.4300       52.73  1.93   52.78  1.95
2.4370       52.716 1.937  52.766 1.964*
2.4400       52.71  1.94   52.76  1.97
2.4500       52.70  1.95   52.74  1.98
2.4600       52.69  1.96   52.73  1.99
2.4620       52.686 1.964  52.726 1.992*
2.4700       52.67  1.98   52.71  2.00
2.4800       52.66  1.99   52.69  2.01

* value interpolated
```

RF Exposure Lab

Plot 1

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN: 829

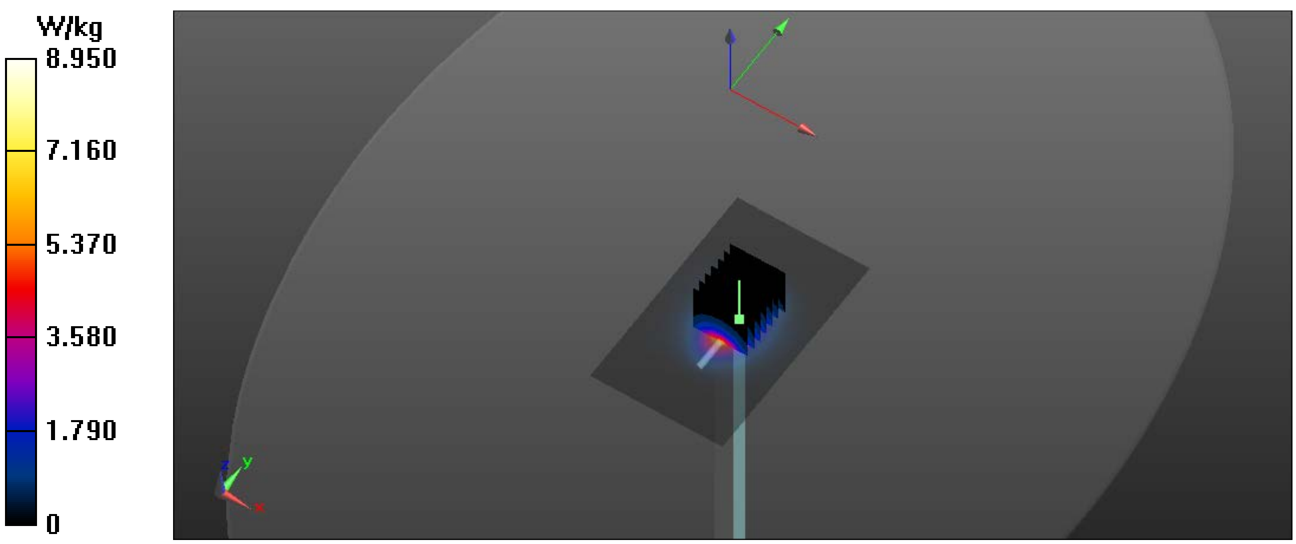
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL2450; Medium parameters used: f = 2450 MHz; σ = 2 S/m; ε_r = 52.58; ρ = 1000 kg/m^3
Phantom section: Flat Section

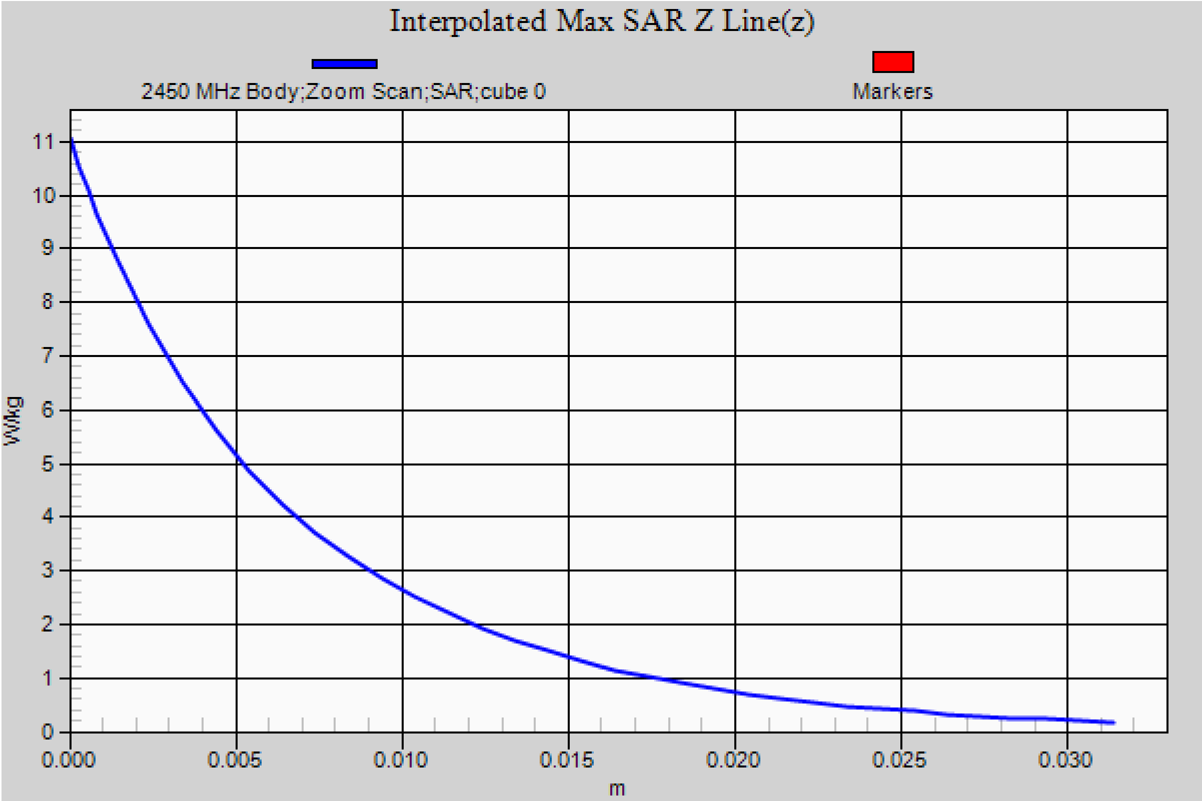
Test Date: Date: 9/28/2015; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3662; ConvF(7.08, 7.08, 7.08); Calibrated: 4/27/2015;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/15/2015
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Procedure Notes:

Body Verification/2450 MHz/Area Scan (61x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.85 W/kg

Body Verification/2450 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.243 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 11.1 W/kg
P_{in}=100 mW
SAR(1 g) = 5.2 W/kg; SAR(10 g) = 2.41 W/kg
Maximum value of SAR (measured) = 8.93 W/kg




Interpolated Max SAR Z Line(z)
2450 MHz Body;Zoom Scan;SAR;cube 0
Markers
W/kg
11
10
9
8
7
6
5
4
3
2
1
0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

RF Exposure Lab

Plot 2

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN: 829

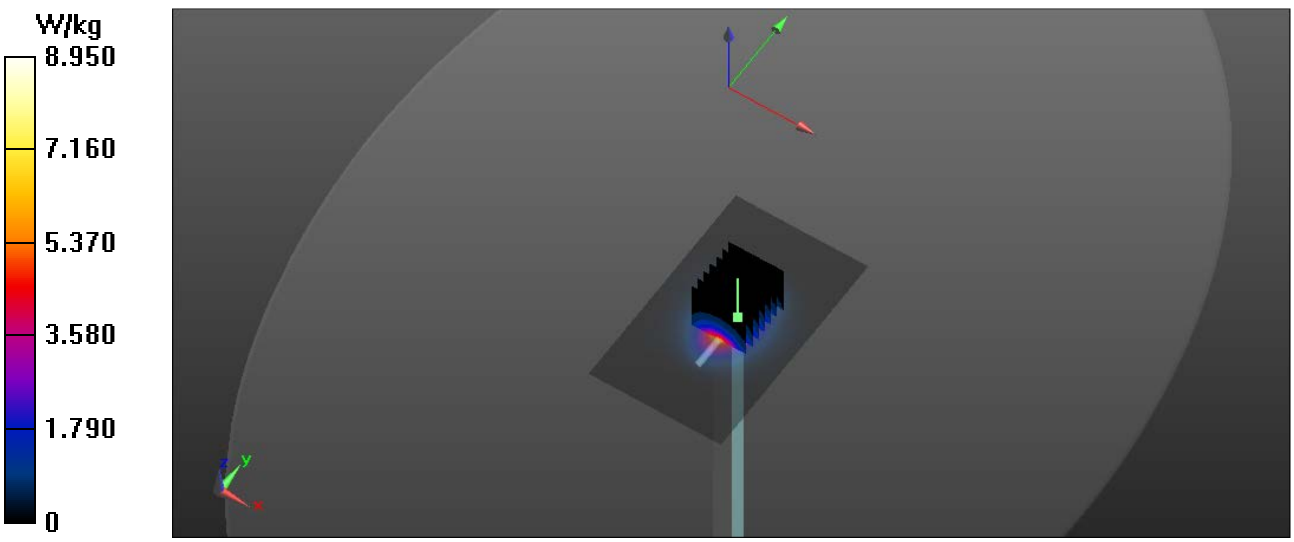
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL2450; Medium parameters used: f = 2450 MHz; σ = 1.98 S/m; ε_r = 52.74; ρ = 1000 kg/m^3
Phantom section: Flat Section

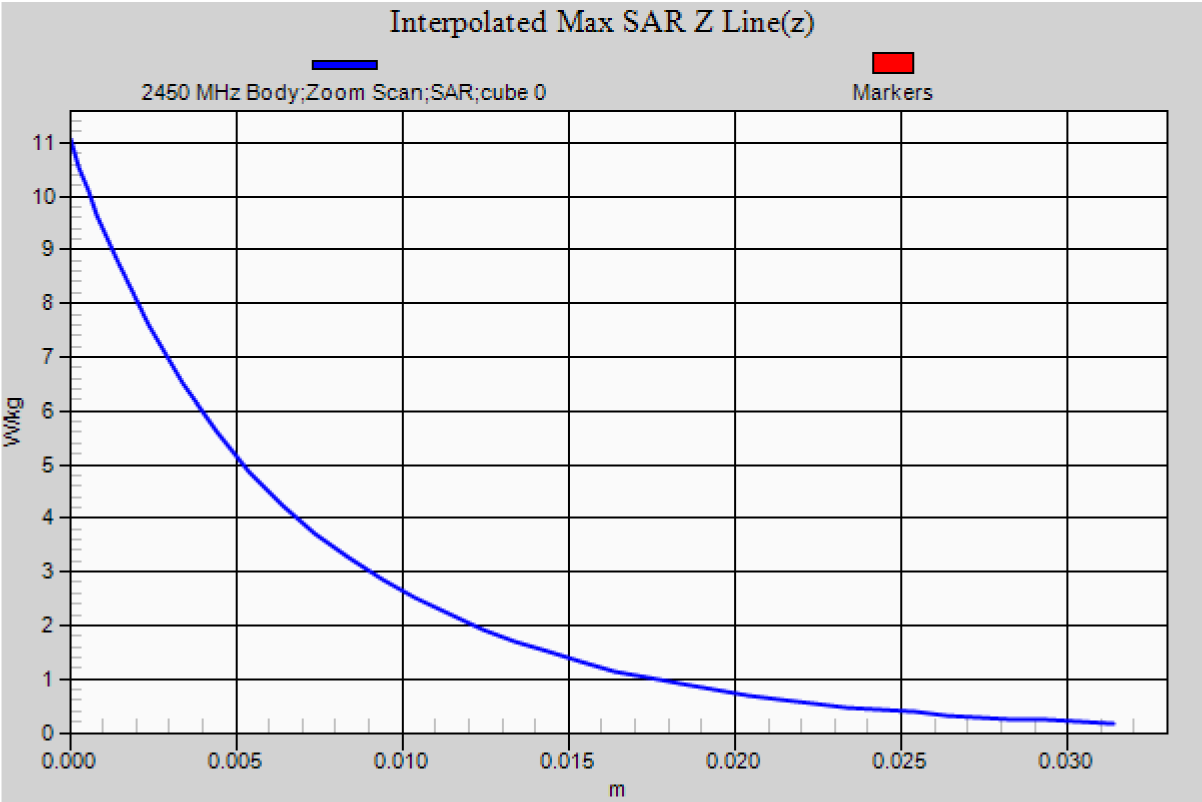
Test Date: Date: 11/16/2015; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3662; ConvF(7.08, 7.08, 7.08); Calibrated: 4/27/2015;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/15/2015
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Procedure Notes:

Body Verification/2450 MHz/Area Scan (61x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.93 W/kg

Body Verification/2450 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.578 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 11.08 W/kg
P_{in}=100 mW
SAR(1 g) = 5.19 W/kg; SAR(10 g) = 2.40 W/kg
Maximum value of SAR (measured) = 8.59 W/kg




Interpolated Max SAR Z Line(z)
2450 MHz Body;Zoom Scan;SAR;cube 0
Markers
W/kg
11
10
9
8
7
6
5
4
3
2
1
0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

Appendix B – SAR Test Data Plots

RF Exposure Lab

Plot 1

DUT: HVM200; Type: Human Vibration Meter; Serial: 0000063

Communication System: WiFi 802.11b (DSSS, 1 Mbps); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: MSL2450; Medium parameters used (interpolated): f = 2437 MHz; σ = 1.984 S/m; ε_r = 52.606; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 9/28/2015; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.08, 7.08, 7.08); Calibrated: 4/27/2015;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/15/2015
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1065
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

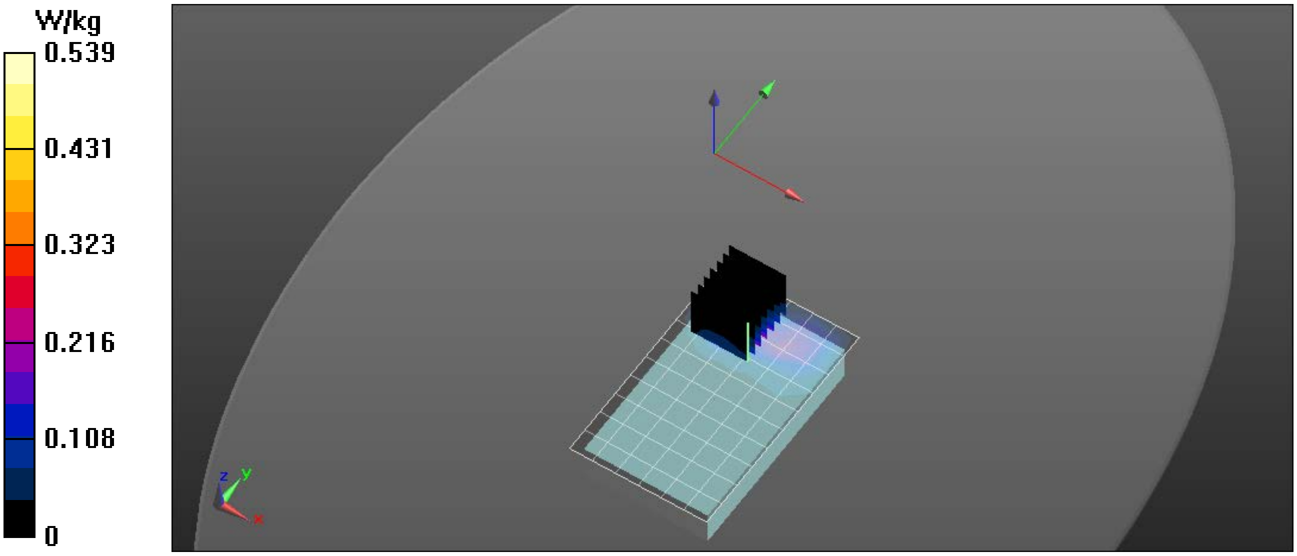
Procedure Notes:

2450 MHz Body Tissue/Side A Mid/Area Scan (7x11x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.528 W/kg

2450 MHz Body Tissue/Side A Mid/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.094 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.851 W/kg
SAR(1 g) = 0.331 W/kg; SAR(10 g) = 0.125 W/kg

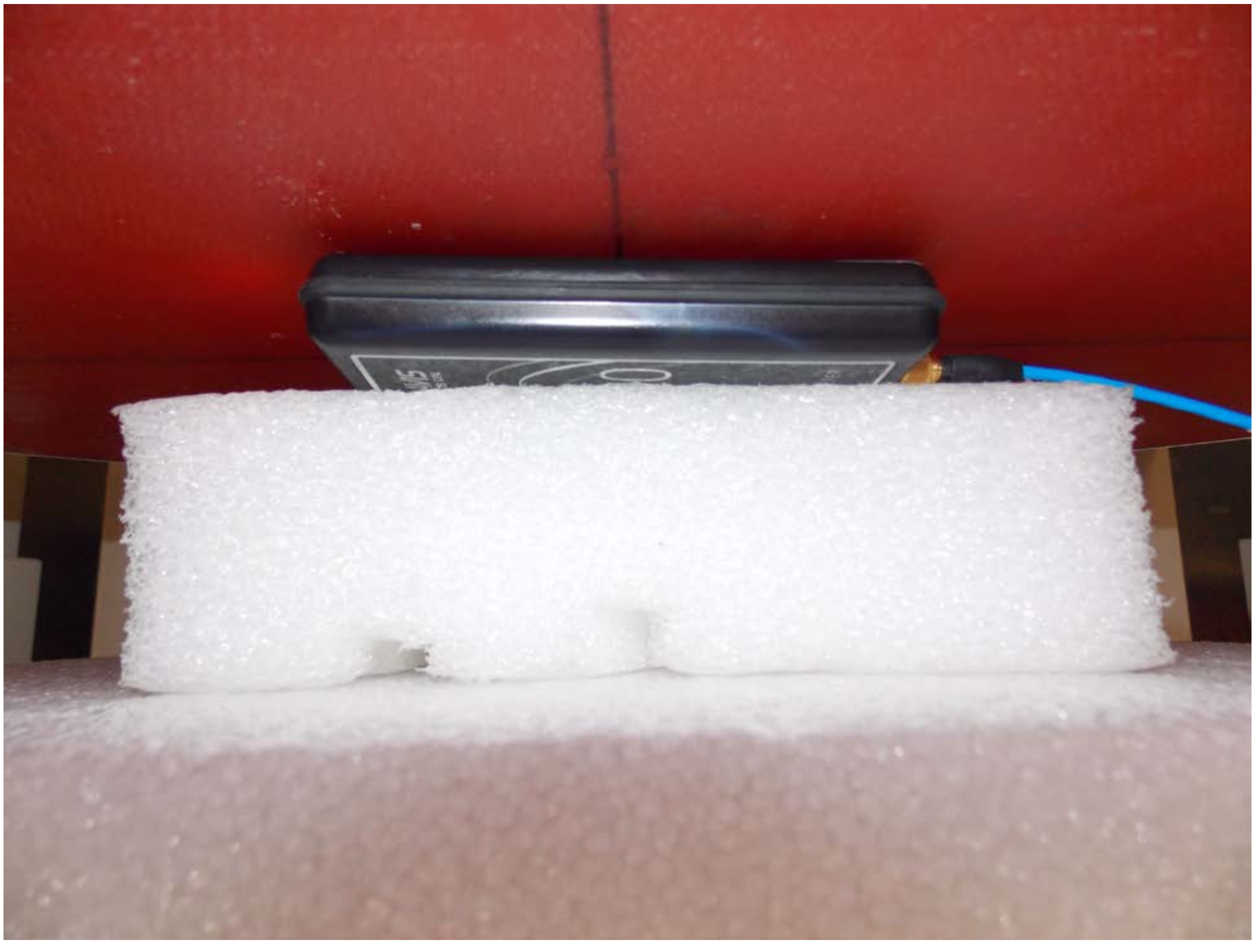
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.539 W/kg



Appendix C – SAR Test Setup Photos

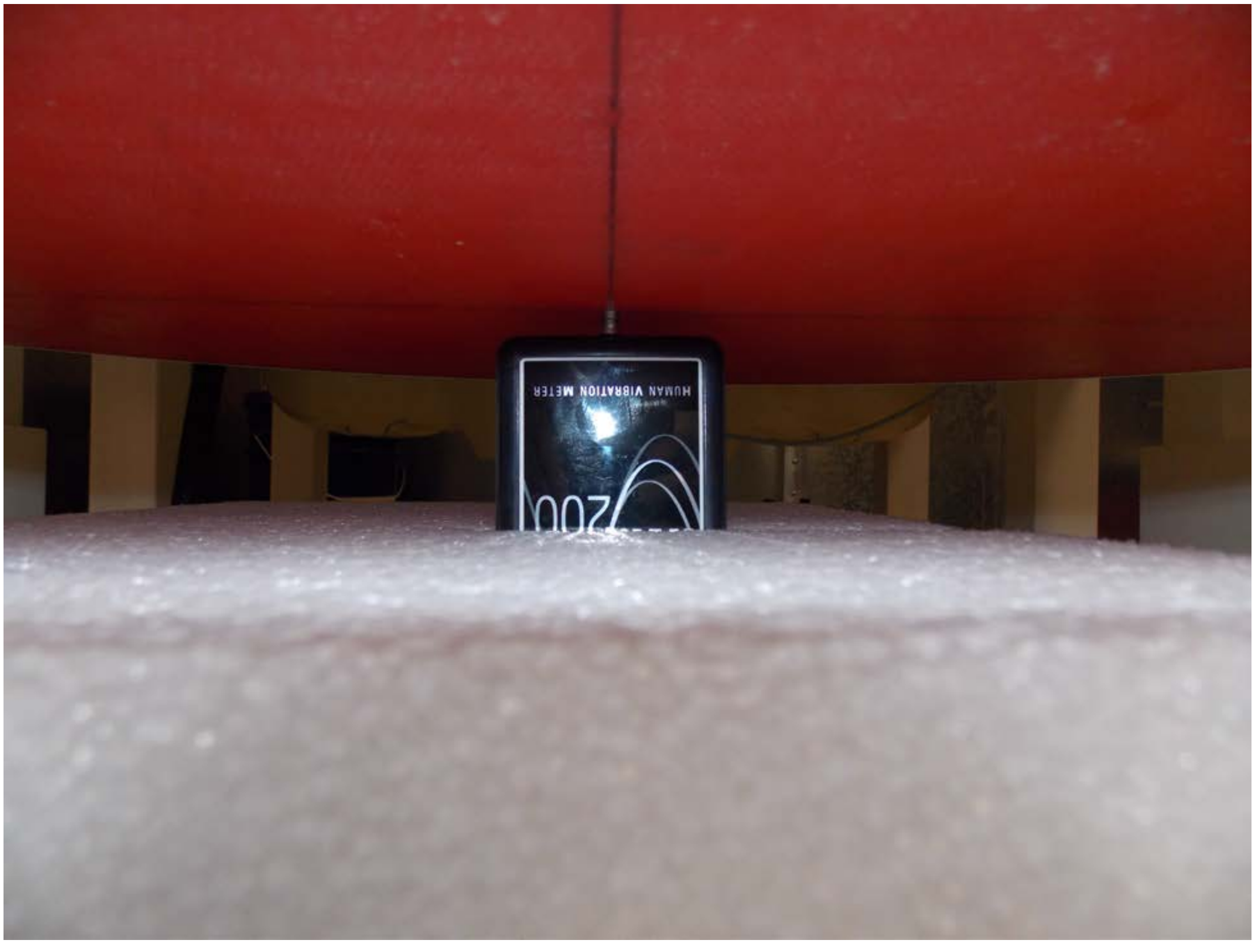
Test Position Side A 0 mm Gap

Test Position Side B 0 mm Gap



Test Position Side C 0 mm Gap

Test Position Side D 0 mm Gap



Test Position Side E 0 mm Gap

Test Position Side F 0 mm Gap

Front of Device

Back of Device

Appendix D – Probe Calibration Data Sheets

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

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

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

Accreditation No.: SCS 0108

Client RF Exposure Lab

Certificate No: EX3-3662_Apr15

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3662
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	April 27, 2015

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 E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: April 28, 2015

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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

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:3662

Manufactured: October 20, 2008
Calibrated: April 27, 2015

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3662

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.44	0.47	0.52	± 10.1 %
DCP (mV)[B]	101.9	95.6	97.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	153.2	±3.0 %
		Y	0.0	0.0	1.0		140.2	
		Z	0.0	0.0	1.0		142.2	

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 NormX,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:3662

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)	Unct. (k=2)
150	52.3	0.76	10.87	10.87	10.87	0.00	1.00	± 13.3 %
220	49.0	0.81	11.06	11.06	11.06	0.00	1.00	± 13.3 %
450	43.5	0.87	10.63	10.63	10.63	0.16	1.20	± 13.3 %
750	41.9	0.89	9.42	9.42	9.42	0.23	1.33	± 12.0 %
835	41.5	0.90	9.00	9.00	9.00	0.34	0.93	± 12.0 %
900	41.5	0.97	8.79	8.79	8.79	0.21	1.31	± 12.0 %
1750	40.1	1.37	7.76	7.76	7.76	0.19	1.18	± 12.0 %
1900	40.0	1.40	7.48	7.48	7.48	0.34	0.85	± 12.0 %
2450	39.2	1.80	6.95	6.95	6.95	0.37	0.80	± 12.0 %
2600	39.0	1.96	6.84	6.84	6.84	0.42	0.80	± 12.0 %
5200	36.0	4.66	5.05	5.05	5.05	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.81	4.81	4.81	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.81	4.81	4.81	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.73	4.73	4.73	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.68	4.68	4.68	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.

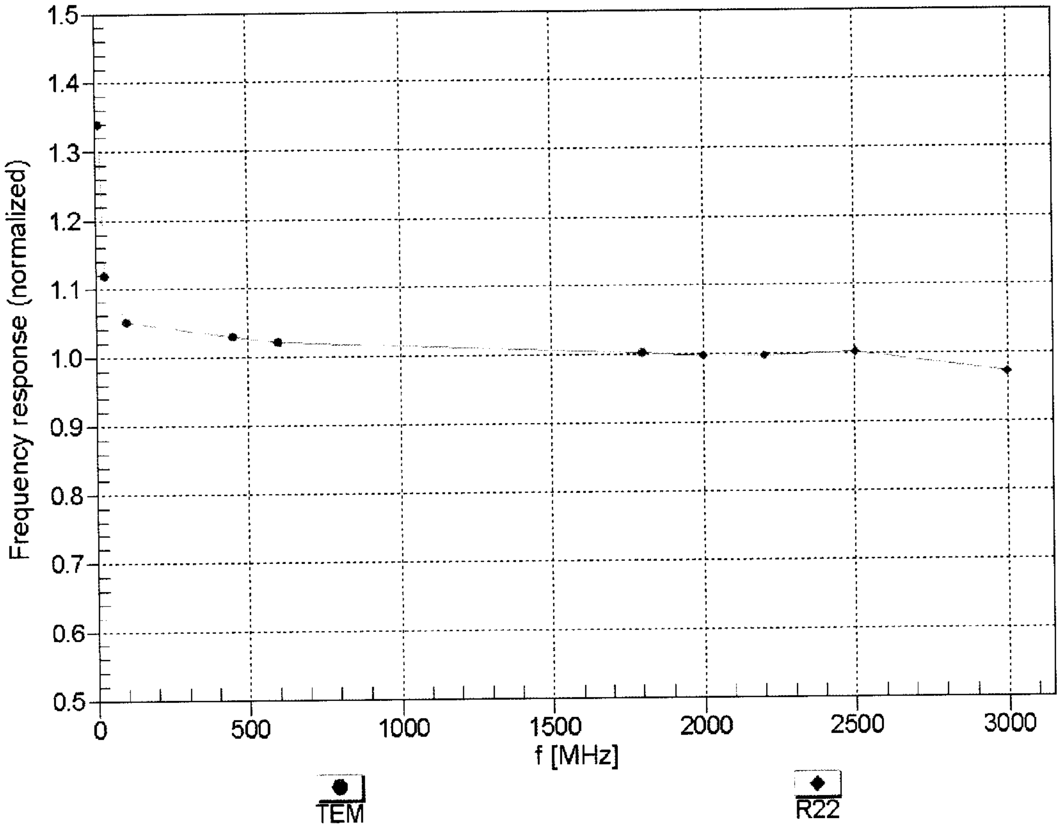
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3662

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)	Unct. (k=2)
150	61.9	0.80	10.83	10.83	10.83	0.00	1.00	± 13.3 %
220	60.2	0.86	10.42	10.42	10.42	0.00	1.00	± 13.3 %
450	56.7	0.94	10.37	10.37	10.37	0.08	1.20	± 13.3 %
750	55.5	0.96	8.92	8.92	8.92	0.25	1.26	± 12.0 %
835	55.2	0.97	8.86	8.86	8.86	0.41	0.88	± 12.0 %
900	55.0	1.05	8.59	8.59	8.59	0.35	1.07	± 12.0 %
1750	53.4	1.49	7.49	7.49	7.49	0.25	1.07	± 12.0 %
1900	53.3	1.52	7.31	7.31	7.31	0.37	0.89	± 12.0 %
2450	52.7	1.95	7.08	7.08	7.08	0.34	0.90	± 12.0 %
2600	52.5	2.16	6.84	6.84	6.84	0.34	0.90	± 12.0 %
5200	49.0	5.30	4.45	4.45	4.45	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.30	4.30	4.30	0.45	1.90	± 13.1 %
5500	48.6	5.65	3.89	3.89	3.89	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.80	3.80	3.80	0.50	1.90	± 13.1 %
5800	48.2	6.00	3.99	3.99	3.99	0.50	1.90	± 13.1 %

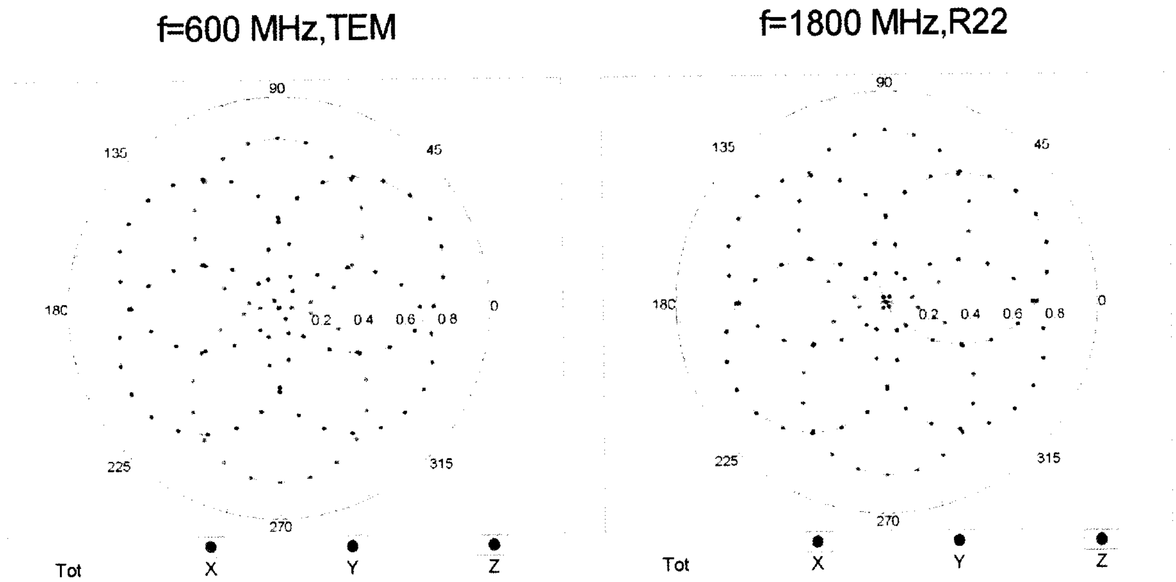
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz 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.

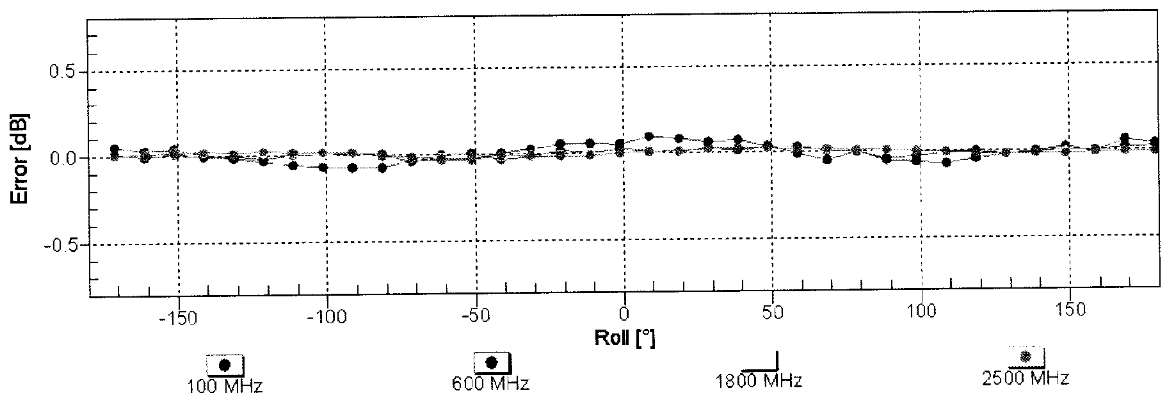
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

Receiving Pattern (ϕ), ϑ = 0°

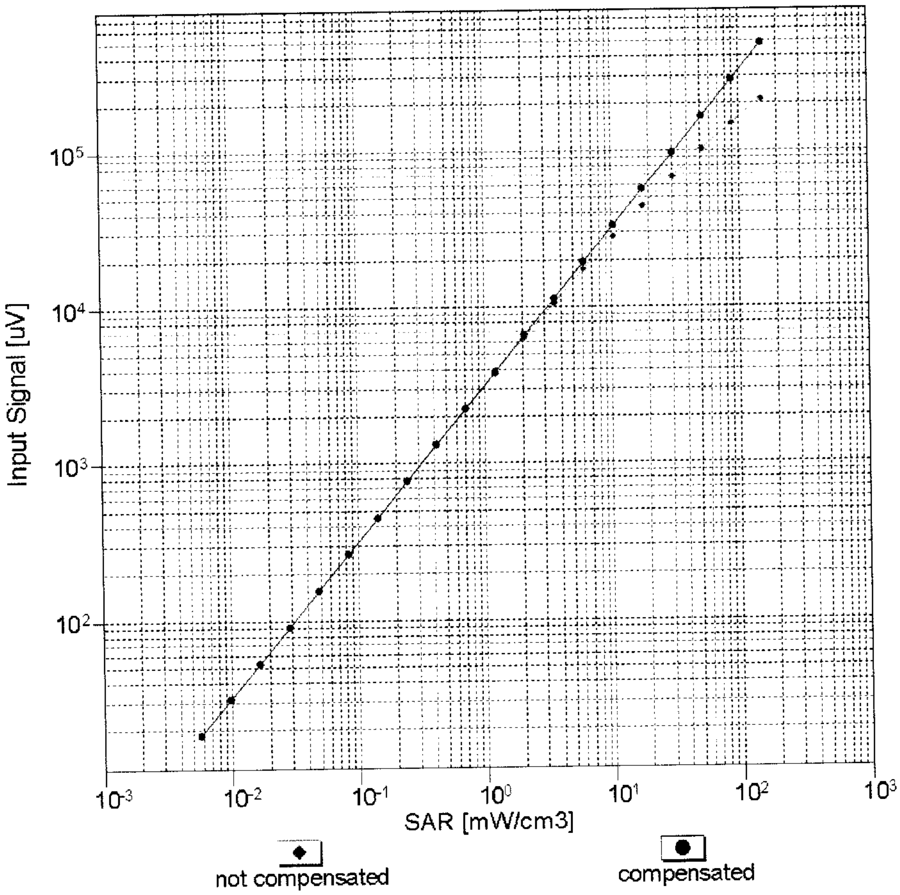


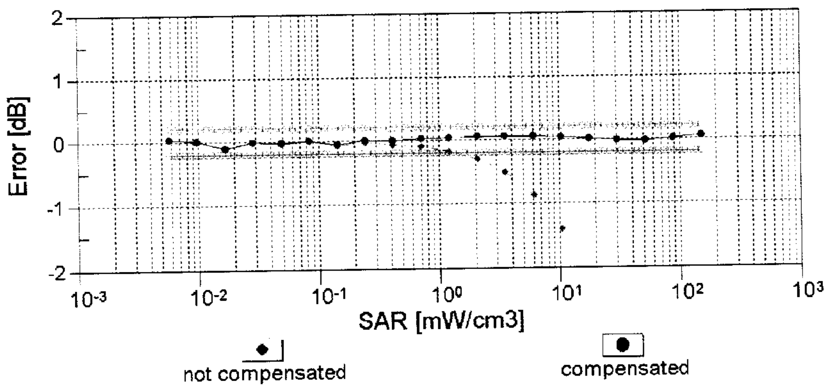


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)

(TEM cell , f$_{eval}$= 1900 MHz)

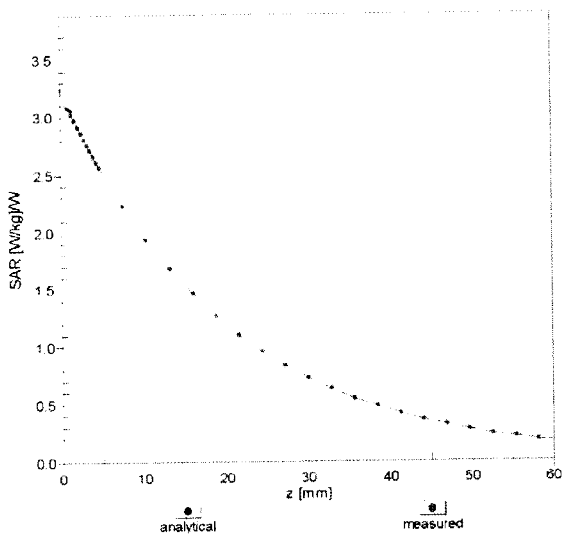




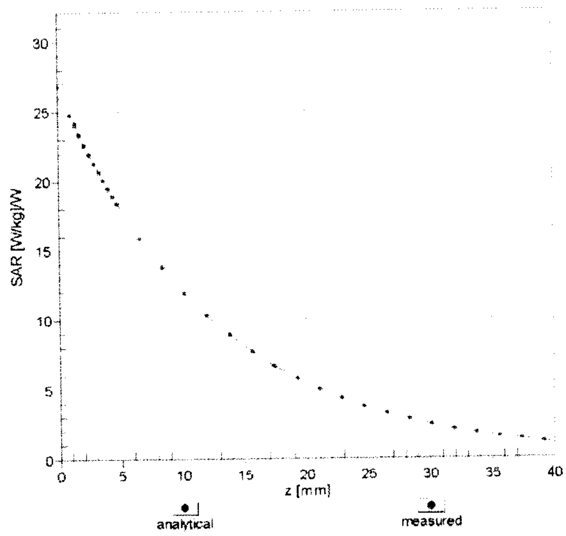
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

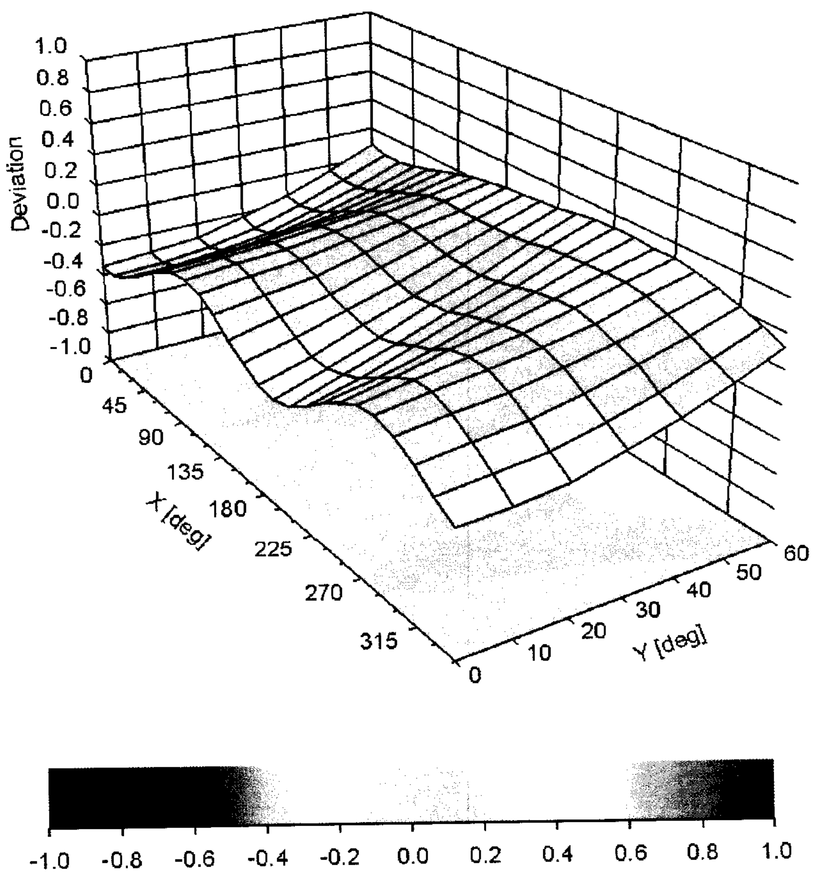


f = 1900 MHz,WGLS R22 (H_convF)



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:3662

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-31.2
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

Appendix E – Dipole Calibration Data Sheets

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 108

Client **RF Exposure Lab**

Certificate No: D2450V2-829_Dec12

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 829
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	December 04, 2012

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 EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	[signature]
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: December 4, 2012

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.2 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.1 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.7 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.0 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω + 4.2 jΩ
Return Loss	- 25.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7 Ω + 5.1 jΩ
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.158 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 11, 2008

DASY5 Validation Report for Head TSL

Date: 04.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

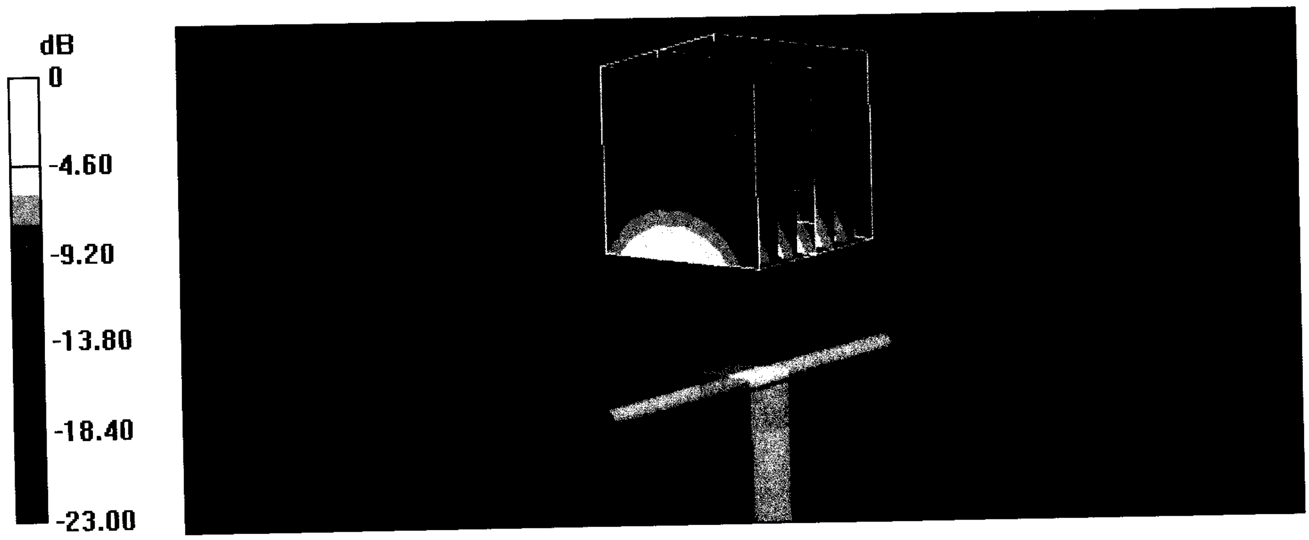
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 829

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 mho/m; ε_r = 38.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

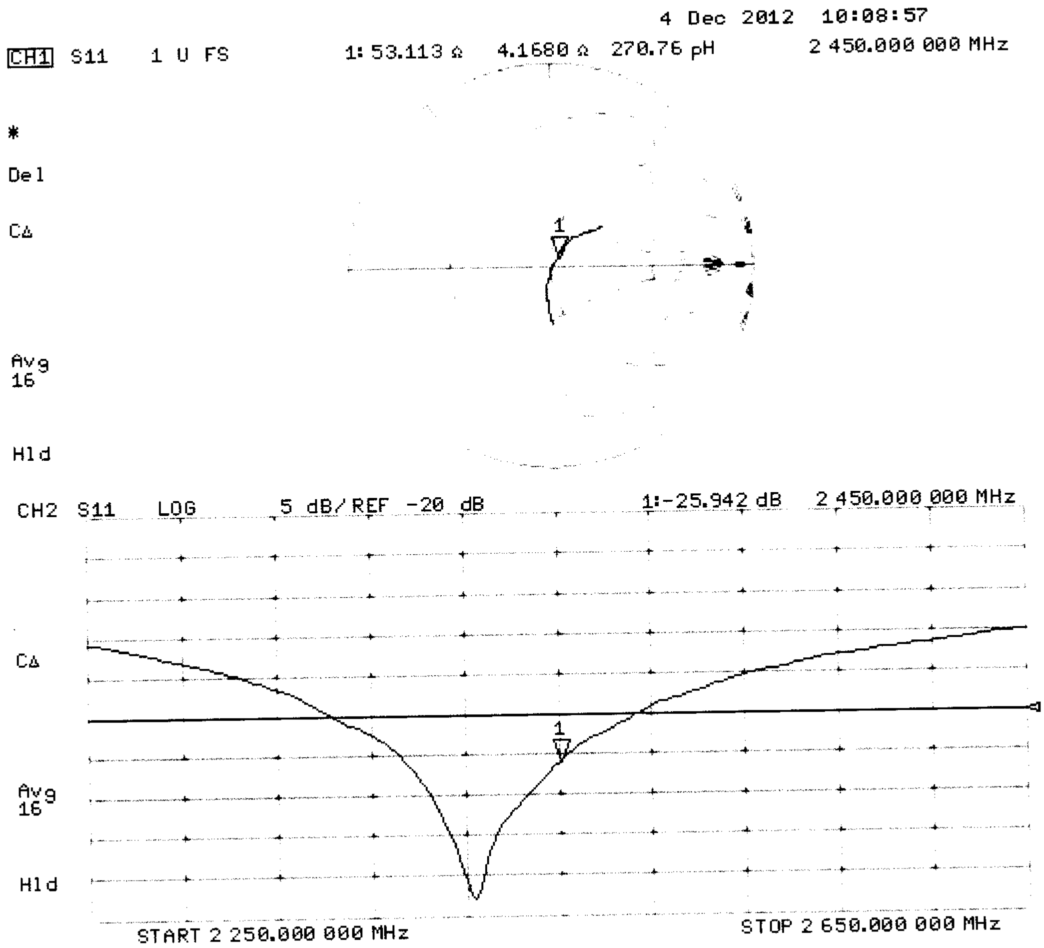
- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.1 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.33 W/kg
Maximum value of SAR (measured) = 17.8 W/kg



0 dB = 17.8 W/kg = 12.50 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 04.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

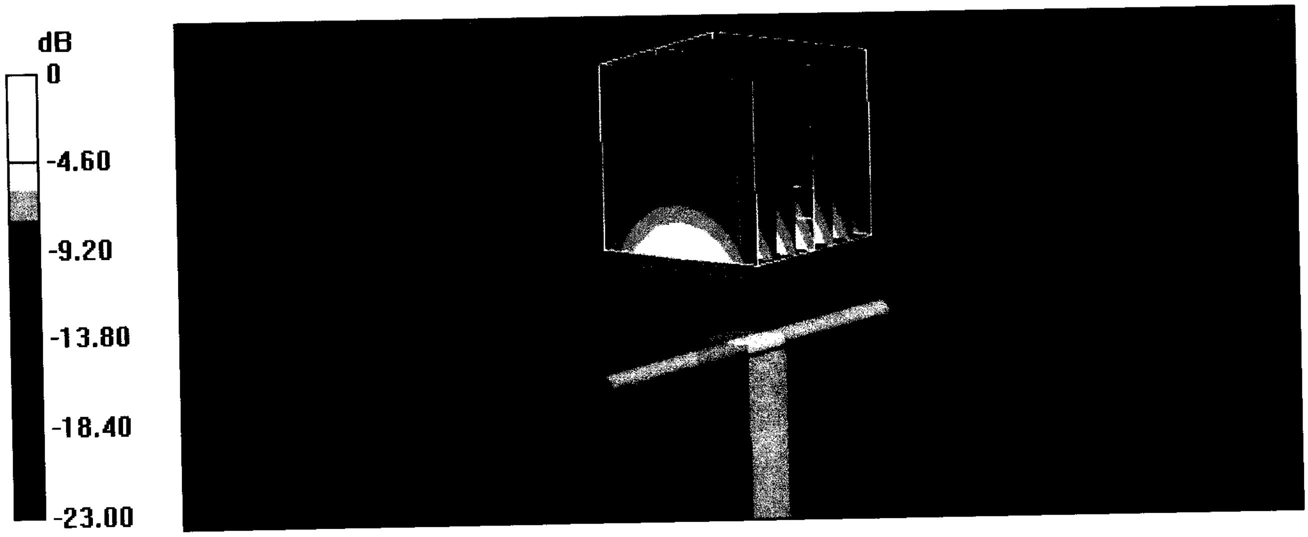
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 829

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 2.02$ mho/m; $\varepsilon_r = 50.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

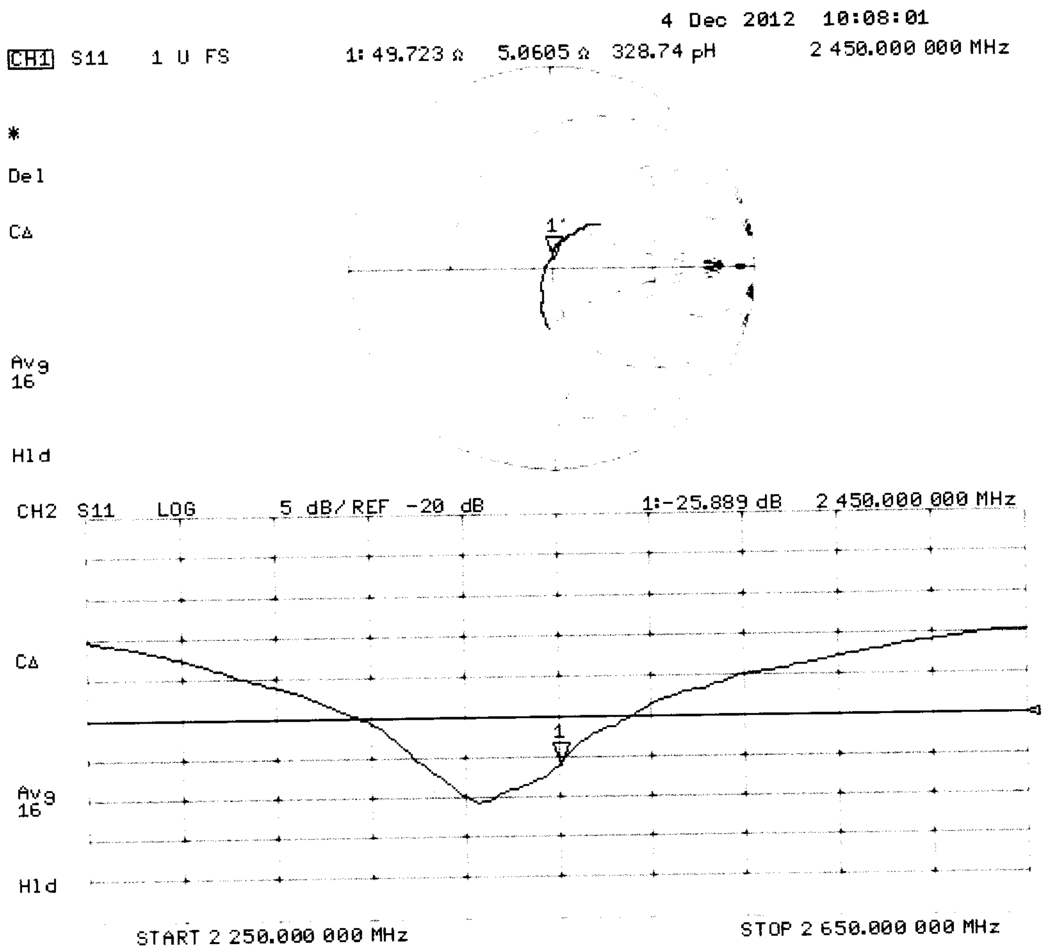
- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.1 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.08 W/kg
Maximum value of SAR (measured) = 17.5 W/kg



0 dB = 17.5 W/kg = 12.43 dBW/kg

Impedance Measurement Plot for Body TSL



Extended Calibration

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r03.

D2450V2 SN: 829 - Head						
Date of Measurement	Return Loss (dB)	Δ%	Impedance (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
12/4/2012	-25.9		53.1		4.2	
12/5/2013	-26.5	2.3	52.6	-0.5	3.8	-0.4
12/5/2014	-24.6	-5.0	51.6	-1.5	4.9	0.7

D2450V2 SN: 829 - Body						
Date of Measurement	Return Loss (dB)	Δ%	Impedance (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
12/4/2012	-25.9		49.7		5.1	
12/5/2013	-26.2	1.2	48.5	-1.2	4.6	-0.5
12/4/2014	-24.6	-5.0	47.6	-2.1	5.9	0.8

Appendix F – Phantom Calibration Data Sheets

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 4.0
Type No	QD OVA 001 B
Series No	1003 and higher
Manufacturer	Untersee Composites Knebelstrasse 8 CH-8268 Mannenbach, Switzerland

Tests

Complete tests were made on the prototype units QD OVA 001 AA 1001, QD OVA 001 AB 1002, pre-series units QD OVA 001 BA 1003-1005 as well as on the series units QD OVA 001 BB, 1006 ff.

Test	Requirement	Details	Units tested
Material thickness	Compliant with the standard requirements	Bottom plate: 2.0mm +/- 0.2mm	all
Material parameters	Dielectric parameters for required frequencies	< 6 GHz: Rel. permittivity = 4 +/-1, Loss tangent ≤ 0.05	Material sample
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions.	DGBE based simulating liquids. Observe Technical Note for material compatibility.	Equivalent phantoms, Material sample
Shape	Thickness of bottom material, Internal dimensions, Sagging compatible with standards from minimum frequency	Bottom elliptical 600 x 400 mm Depth 190 mm, Shape is within tolerance for filling height up to 155 mm, Eventual sagging is reduced or eliminated by support via DUT	Prototypes, Sample testing

Standards

[1] CENELEC EN 50361-2001, « Basic standard for the measurement of the Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz) », July 2001

[2] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003

[3] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005

[4] IEC 62209 – 2, Draft, "Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices – Human models, Instrumentation and Procedures – Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30 MHz to 6 GHz Handheld and Body-Mounted Devices used in close proximity to the Body.", February 2005

[5] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition January 2001

Based on the tests above, we certify that this item is in compliance with the standards [1] to [5] if operated according to the specific requirements and considering the thickness. The dimensions are fully compliant with [4] from 30 MHz to 6 GHz. For the other standards, the minimum lower frequency limit is limited due to the dimensional requirements ([1]: 450 MHz, [2]: 300 MHz, [3]: 800 MHz, [5]: 375 MHz) and possibly further by the dimensions of the DUT.

Date 28.4.2008 **Signature / Stamp**

s p e a g
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Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Appendix G – Validation Summary

Per FCC KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue equivalent media for system validation according to the procedures outlined in FCC KDB 865664 D01 v01 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point using the system that normally operates with the probe for routine SAR measurements and according to the required tissue equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Table G-1
SAR System Validation Summary

SAR System #	Freq. (MHz)	Date	Probe S/N	Probe Type	Probe Cal. Point		Cond. (σ)	Perm. (ε_r)	CW Validation			Modulation Validation		
									Sens-itivity	Probe Linearity	Probe Isotropy	Modulation Type	Duty Factor	PAR
1	2450	5/04/2015	3662	EX3DV4	2450	Body	2.00	52.31	Pass	Pass	Pass	GFSK	Pass	Pass

Appendix H – D.C. Measurements and Transmitter Setup

RF Test Procedure
H&D Wireless Linux Driver
Application Note

1 Introduction

This document is an instruction on how the WLAN interface on a Linux system can be controlled. In Linux the interface is called owl0.

2 Requirements

Things you need to have:

- H&D Wireless WLAN module on a Linux system
- A PC with a serial port and a terminal program for example TeraTerm
- A TTL-CMOS level to RS-232 converter board to connect a Linux system to the PC's serial port
- The Wi-Fi Linux driver version 1.0.6 or later including the raw driver.
- The owl-proxy archive.

3 Preparations

Compile the owl-proxy application for your platform.

To be able to control the WLAN module the driver is replaced with a test driver called raw.

Build the RAW driver included in the driver version 1.0.6 available on linux.hd-wireless.se.

```
>make MODE=raw
```

Replace the owl kernel module with the owl-raw module.

```
>rmmod owl
>insmod ./owl-raw.ko
```

If the owl-raw module is installed where modprobe can find it, the owl-testmode script is a convenient way to load the correct kernel module and run owl-proxy.

4 Set up for RF test

- Login on a Linux system with username

login: root

- To set a Linux system up for RF testing the processing using the wireless interface needs to be terminated. Stop all processes that are using the WLAN.

  Start the RF test mode

  Root$:~# owl-testmode

- the console will respond:

  net owl0: shutdown
  net owl0: ready
  interface:owl0
  using serial:

- Now a Linux system's WiFi transmitter and receiver can be controlled from the consol.

5 Test of transmitter

To set up the device to transmit, use the commands in the table in chapter 7.

- Example: Set the channel to ch. 7, 54 Mbit/s and 100% duty cycle use the below commd sequence. Use *txgen_stop* to turn off the transmitter.

Input:	Console response:
set_rf_channel=7	RFCHAN:7
txgen_start=13,1024,0,1,0x100,1,0	TXGEN_START
txgen_stop	TXGEN_STOP:1

6 Test of receiver

When the device is not in transmitting mode it is in receiving mode and receiver related tests can be done.

Stop the transmitting mode by typing: *txgen_stop*
Then set the channel as in the example above: *set_rf_channel=7*

7 List of Commands

Command	Comment	Reply
set_rf_channel=<n>	Set RF channel. n=channel from 1 to 14 (dec)	**RFCHAN:<n>**
rxstat=<rate index>	Read PER statistics. Rate index as follows. Normally = 5 or 13 for 11 and 54 Mbit/s respectively. 0=1 Mbit/s 1=2 Mb/s 2=5.5 Mbit/s 3=6 Mbit/s 4=9 Mbit/s **5=11 Mbit/s** 6=12 Mbit/s 7=18 Mbit/s 8=22 Mbit/s 9=24 Mbit/s 10=33 Mbit/s 11=36 Mbit/s 12=48 Mbit/s **13=54 Mbit/s**	**RXSTAT:<Rx rate [kbit/s]>,<multicast frames received>**
rxstat_clr	Reset PER counter	**RXSTAT_CLR**
txstat_clr	Reset Tx frame counter	**TXSTAT_CLR**
txgen_start=<rate index>,<payload size>,<number of frames>, <interspace time>,<payload pattern (one byte | 0 for random)>,<print txstat>, <enumerate frames>	Generate multicast frames. rate index = 1 or 13 for 2 and 54 Mbit/s respectively Number of frames=0x100 gives continuous transmission.	**At start: TXGEN_START After completion of all frames: TXGEN_COMPLETE TXSTAT:<Tx Rate [kbit/s]>,<multicast frames sent>**
txgen_stop	Stop transmitter	**If txgen_start is running: TXGEN_STOP:1 TXGEN_COMPLETE TXSTAT:<Tx Rate [kbit/s]>,<multicast frames sent> If txgen_start is not active: TXGEN_STOP:0**
Exit	Leave the test mode	

EMPower ETSI Burst Measurement System Report

Time of Measurement: 9/23/2015 9:08:49 AM

Number of Sensors: 1
Sensor 1 USB ID: 1.47.192.24.23.0.0.153

Operator: MF

EUT Info:
Equipment ID: BC20
Serial Number: N/A

Settings:

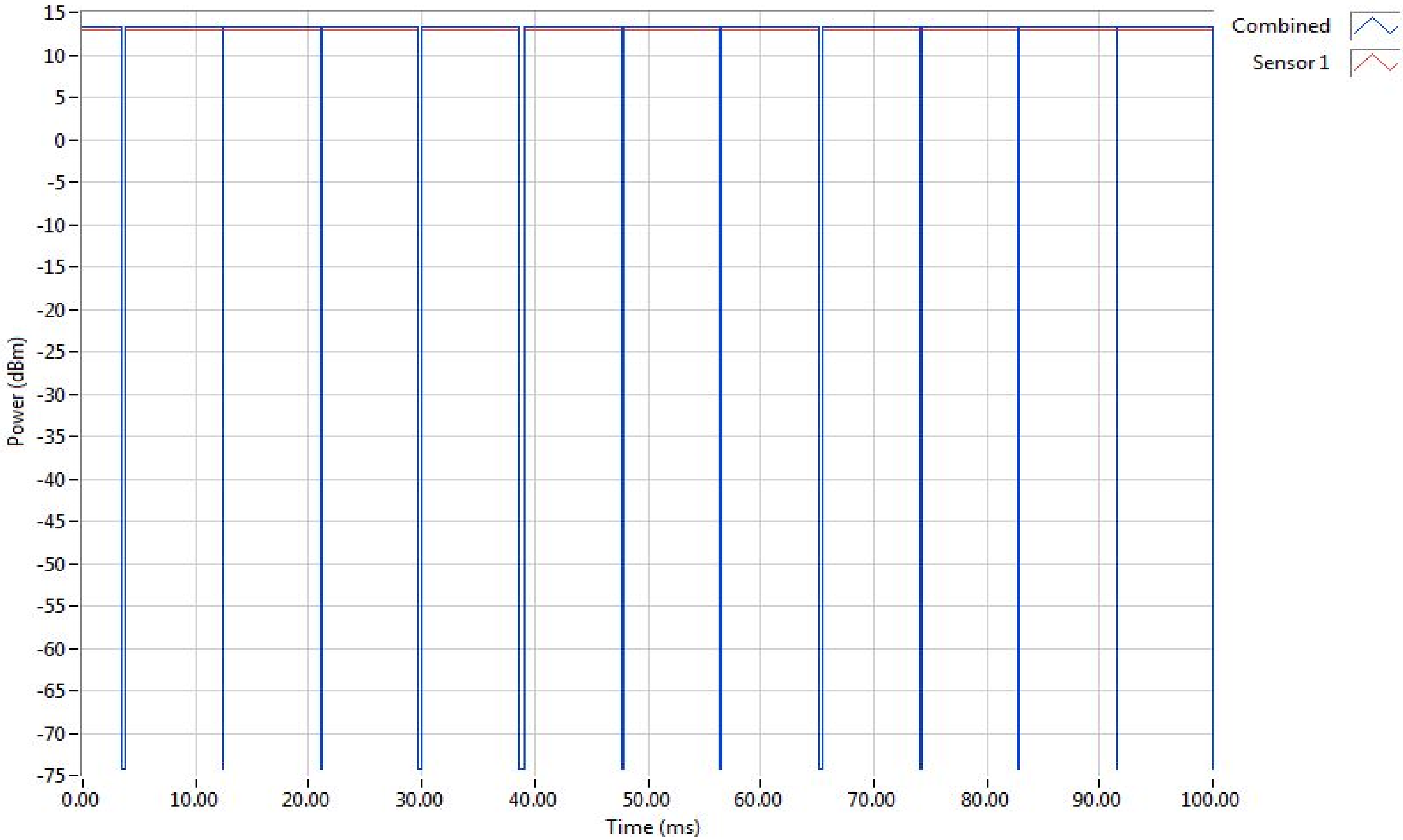
Carrier Frequency	Trigger Level (dBm	Measure Time (ms	Sample Rate (S/s)	Gap Time (ms)	Threshold Level (d	Assembly Gain (dB	Beamforming Gain (dB)
2412000000	-1	100	5000000	0	-30	0.5	0

Results:

Max e.i.r.p. (dBm)	Medium Utilisatio	Duty Cycle (%)	Min. Gap Time (ms	Max. Sequence Ti	RMS (dBm)
13.333	21.14	98.134	0	8.609	13.251

Data:

Burst #	Combined Start Ti	Combined Stop Ti	Combined Power (	TxOn Time (ms)	TxOff Time (ms)	Sensor 1 Start Tim	Sensor 1 Stop Tim	Sensor 1 Power (dBm)
1	0	3.517	13.332909	3.517	0.2342	0	3.517	12.832909
2	3.7512	12.3596	13.332909	8.6084	0.054	3.7512	12.3596	12.832909
3	12.4136	21.0218	13.332909	8.6082	0.114	12.4136	21.0218	12.832909
4	21.1358	29.7442	13.332909	8.6084	0.1942	21.1358	29.7442	12.832909
5	29.9384	38.5468	13.332909	8.6084	0.565	29.9384	38.5468	12.832909
6	39.1118	47.7204	13.332909	8.6086	0.0938	39.1118	47.7204	12.832909
7	47.8142	56.4224	13.332909	8.6082	0.1142	47.8142	56.4224	12.832909
8	56.5366	65.145	13.332909	8.6084	0.334	56.5366	65.145	12.832909
9	65.479	74.0876	13.332909	8.6086	0.094	65.479	74.0876	12.832909
10	74.1816	82.79	13.332909	8.6084	0.074	74.1816	82.79	12.832909
11	82.864	91.4722	13.332909	8.6082	0.074	82.864	91.4722	12.832909
12	91.5462	99.9998	13.332909	8.4536	0.0002	91.5462	99.9998	12.832909



Combined
Sensor 1
Power (dBm)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Time (ms)

EMPower ETSI Burst Measurement System Report

Time of Measurement: 9/23/2015 9:17:08 AM

Number of Sensors: 1
Sensor 1 USB ID: 1.47.192.24.23.0.0.153

Operator: MF

EUT Info:
Equipment ID: BC20
Serial Number: N/A

Settings:

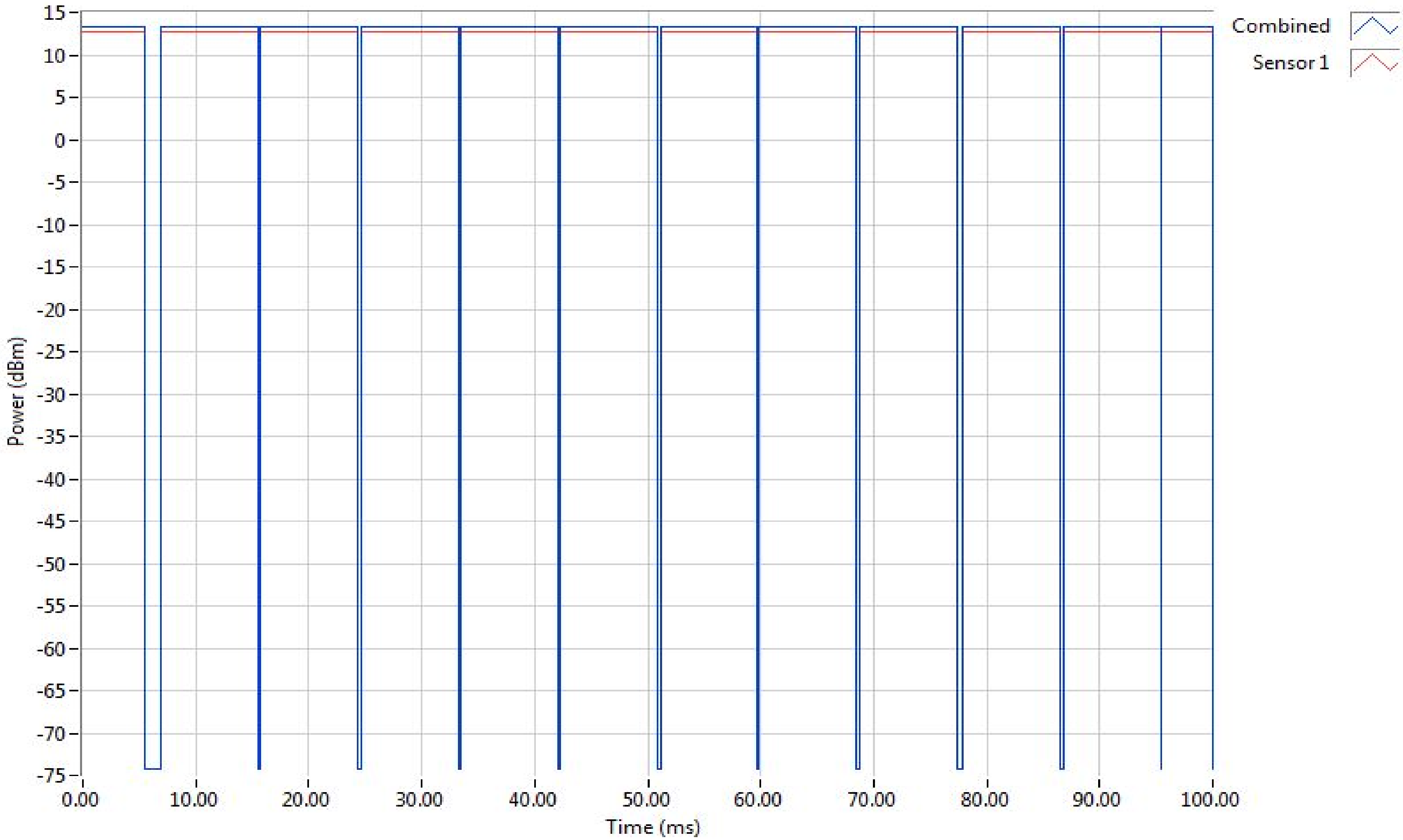
Carrier Frequency	Trigger Level (dBm	Measure Time (ms	Sample Rate (S/s)	Gap Time (ms)	Threshold Level (d	Assembly Gain (dB	Beamforming Gain (dB)
2437000000	-1	100	5000000	0	-30	0.5	0

Results:

Max e.i.r.p. (dBm)	Medium Utilisatio	Duty Cycle (%)	Min. Gap Time (ms	Max. Sequence Tir	RMS (dBm)
13.295	20.776	97.297	0	8.608	13.176

Data:

Burst #	Combined Start Ti	Combined Stop Tir	Combined Power (	TxOn Time (ms)	TxOff Time (ms)	Sensor 1 Start Tim	Sensor 1 Stop Tim	Sensor 1 Power (dBm)
1	0	5.5496	13.294664	5.5496	1.4202	0	5.5496	12.794664
2	6.9698	15.5782	13.294664	8.6084	0.174	6.9698	15.5782	12.794664
3	15.7522	24.3604	13.294664	8.6082	0.234	15.7522	24.3604	12.794664
4	24.5944	33.2028	13.294664	8.6084	0.194	24.5944	33.2028	12.794664
5	33.3968	42.0052	13.294664	8.6084	0.1942	33.3968	42.0052	12.794664
6	42.1994	50.8076	13.294664	8.6082	0.3142	42.1994	50.8076	12.794664
7	51.1218	59.7298	13.294664	8.608	0.0942	51.1218	59.7298	12.794664
8	59.824	68.4324	13.294664	8.6084	0.354	59.824	68.4324	12.794664
9	68.7864	77.3948	13.294664	8.6084	0.539	68.7864	77.3948	12.794664
10	77.9338	86.5422	13.294664	8.6084	0.294	77.9338	86.5422	12.794664
11	86.8362	95.4444	13.294664	8.6082	0.074	86.8362	95.4444	12.794664
12	95.5184	99.9998	13.294664	4.4814	0.0002	95.5184	99.9998	12.794664



Combined
Sensor 1
Power (dBm)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Time (ms)

EMPower ETSI Burst Measurement System Report

Time of Measurement: 9/23/2015 9:18:49 AM

Number of Sensors: 1
Sensor 1 USB ID: 1.47.192.24.23.0.0.153

Operator: MF

EUT Info:
Equipment ID: BC20
Serial Number: N/A

Settings:

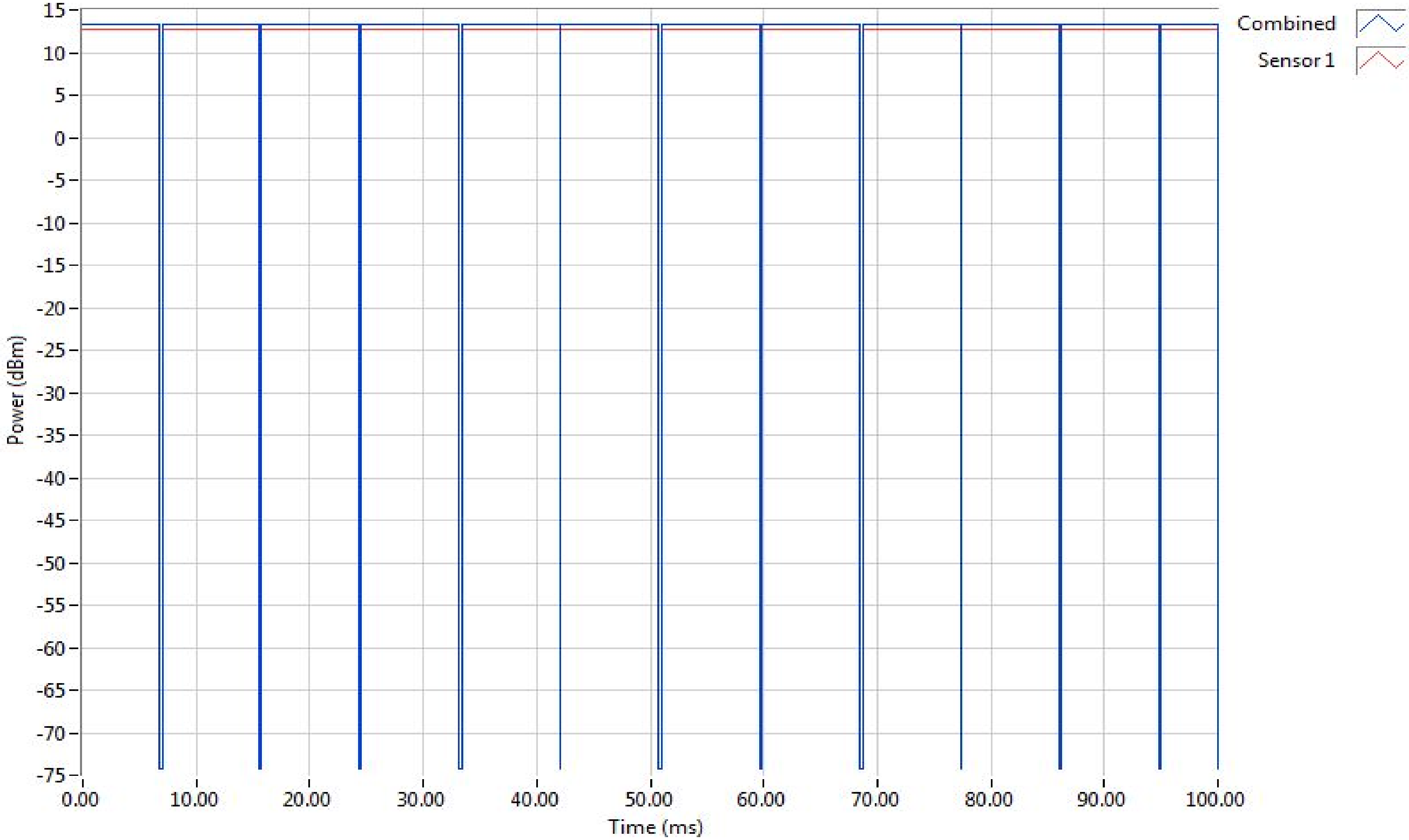
Carrier Frequency	Trigger Level (dBm	Measure Time (ms	Sample Rate (S/s)	Gap Time (ms)	Threshold Level (d	Assembly Gain (dB	Beamforming Gain (dB)
2462000000	-1	100	5000000	0	-30	0.5	0

Results:

Max e.i.r.p. (dBm)	Medium Utilisatio	Duty Cycle (%)	Min. Gap Time (ms	Max. Sequence Ti	RMS (dBm)
13.257	20.747	98.012	0	8.608	13.17

Data:

Burst #	Combined Start Ti	Combined Stop Ti	Combined Power (	TxOn Time (ms)	TxOff Time (ms)	Sensor 1 Start Tim	Sensor 1 Stop Tim	Sensor 1 Power (dBm)
1	0	6.7246	13.256809	6.7246	0.274	0	6.7246	12.756809
2	6.9986	15.607	13.256809	8.6084	0.134	6.9986	15.607	12.756809
3	15.741	24.3492	13.256809	8.6082	0.1542	15.741	24.3492	12.756809
4	24.5034	33.1116	13.256809	8.6082	0.2942	24.5034	33.1116	12.756809
5	33.4058	42.0142	13.256809	8.6084	0.054	33.4058	42.0142	12.756809
6	42.0682	50.6766	13.256809	8.6084	0.334	42.0682	50.6766	12.756809
7	51.0106	59.6188	13.256809	8.6082	0.214	51.0106	59.6188	12.756809
8	59.8328	68.4412	13.256809	8.6084	0.354	59.8328	68.4412	12.756809
9	68.7952	77.4036	13.256809	8.6084	0.054	68.7952	77.4036	12.756809
10	77.4576	86.066	13.256809	8.6084	0.154	77.4576	86.066	12.756809
11	86.22	94.8282	13.256809	8.6082	0.1742	86.22	94.8282	12.756809
12	95.0024	99.9998	13.256809	4.9974	0.0002	95.0024	99.9998	12.756809



Combined
Sensor 1
Power (dBm)
Time (ms)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00

EMPower ETSI Burst Measurement System Report

Time of Measurement: 9/23/2015 9:20:31 AM

Number of Sensors: 1
Sensor 1 USB ID: 1.47.192.24.23.0.0.153

Operator: MF

EUT Info:
Equipment ID: BC20
Serial Number: N/A

Settings:

Carrier Frequency	Trigger Level (dBm	Measure Time (ms	Sample Rate (S/s)	Gap Time (ms)	Threshold Level (d	Assembly Gain (dB	Beamforming Gain (dB)
2462000000	-1	100	5000000	0	-30	0.5	0

Results:

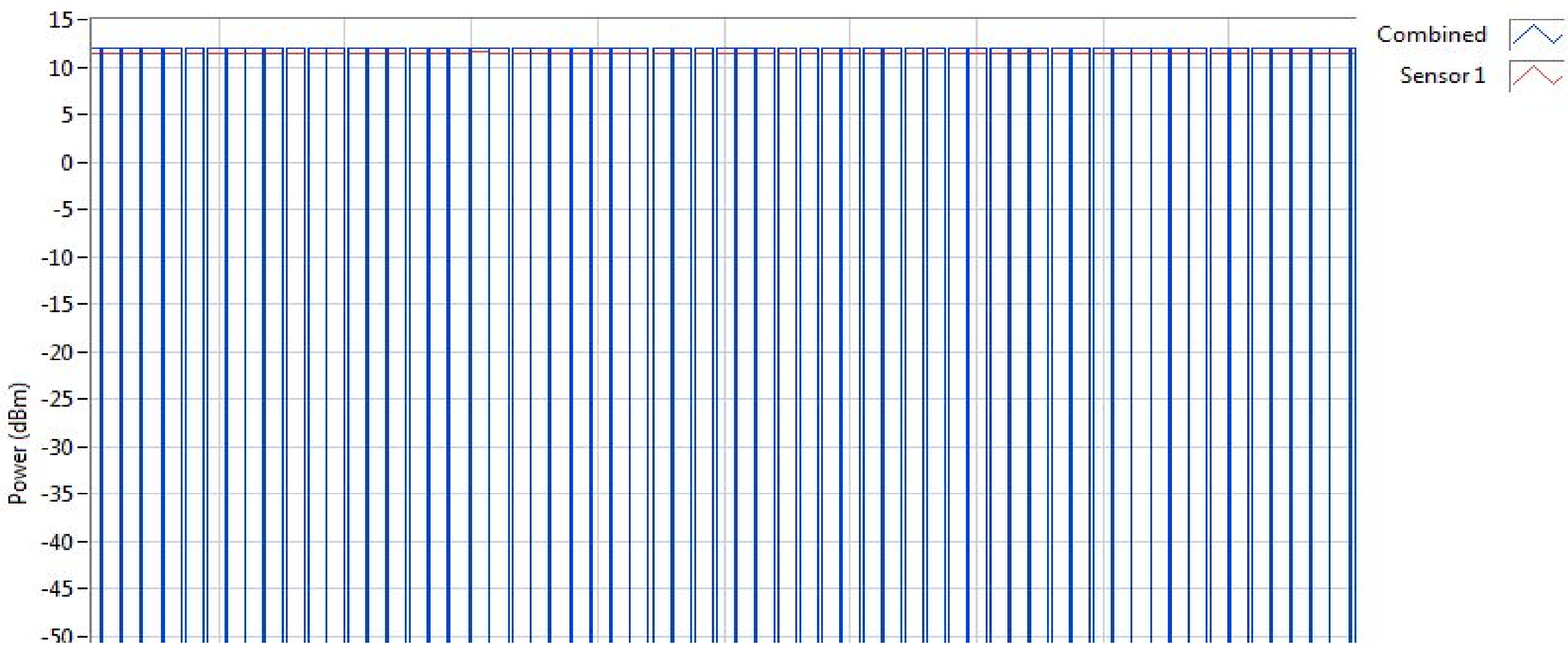
Max e.i.r.p. (dBm)	Medium Utilisatio	Duty Cycle (%)	Min. Gap Time (ms	Max. Sequence Tir	RMS (dBm)
12.027	13.934	88.22	0	1.428	11.441

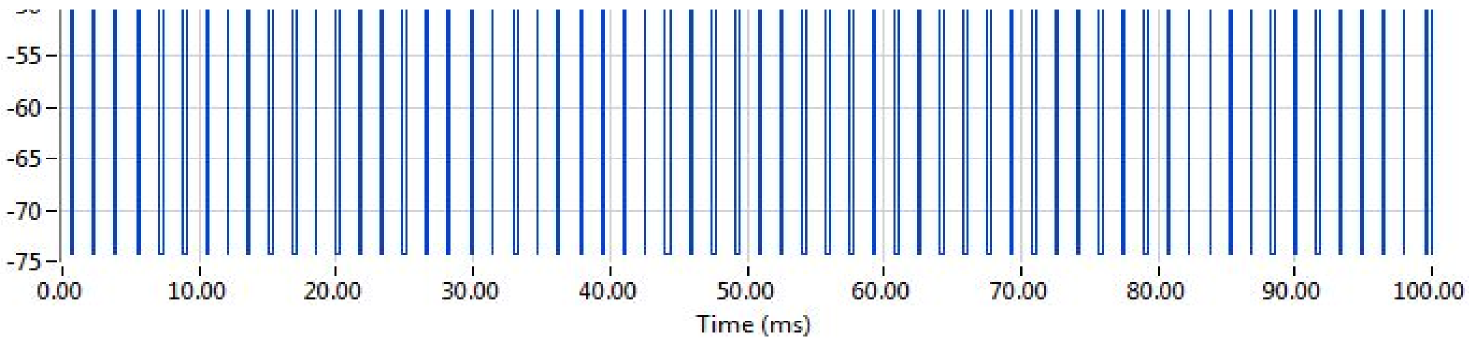
Data:

Burst #	Combined Start Ti	Combined Stop Tir	Combined Power (	TxOn Time (ms)	TxOff Time (ms)	Sensor 1 Start Tim	Sensor 1 Stop Tim	Sensor 1 Power (dBm)
1	0	0.5968	11.986809	0.5968	0.1138	0	0.5968	11.486809
2	0.7106	2.1388	11.986809	1.4282	0.154	0.7106	2.1388	11.486809
3	2.2928	3.721	11.996809	1.4282	0.2738	2.2928	3.721	11.496809
4	3.9948	5.423	11.996809	1.4282	0.194	3.9948	5.423	11.496809
5	5.617	7.0452	12.006809	1.4282	0.3338	5.617	7.0452	11.506809
6	7.379	8.807	11.976809	1.428	0.334	7.379	8.807	11.476809
7	9.141	10.5692	11.986809	1.4282	0.074	9.141	10.5692	11.486809
8	10.6432	12.0712	11.986809	1.428	0.054	10.6432	12.0712	11.486809
9	12.1252	13.5536	11.996809	1.4284	0.1338	12.1252	13.5536	11.496809
10	13.6874	15.1156	11.986809	1.4282	0.2338	13.6874	15.1156	11.486809
11	15.3494	16.7776	11.966809	1.4282	0.274	15.3494	16.7776	11.466809
12	17.0516	18.4796	11.986809	1.428	0.0938	17.0516	18.4796	11.486809

13	18.5734	20.0016	11.976809	1.4282	0.2938	18.5734	20.0016	11.476809
14	20.2954	21.7236	11.966809	1.4282	0.134	20.2954	21.7236	11.466809
15	21.8576	23.2858	11.966809	1.4282	0.0938	21.8576	23.2858	11.466809
16	23.3796	24.808	11.966809	1.4284	0.3338	23.3796	24.808	11.466809
17	25.1418	26.57	11.996809	1.4282	0.1138	25.1418	26.57	11.496809
18	26.6838	28.112	11.986809	1.4282	0.214	26.6838	28.112	11.486809
19	28.326	29.7542	11.976809	1.4282	0.2138	28.326	29.7542	11.476809
20	29.968	31.3962	12.026809	1.4282	0.074	29.968	31.3962	11.526809
21	31.4702	32.8984	11.986809	1.4282	0.3138	31.4702	32.8984	11.486809
22	33.2122	34.6404	11.966809	1.4282	0.054	33.2122	34.6404	11.466809
23	34.6944	36.1226	11.996809	1.4282	0.2138	34.6944	36.1226	11.496809
24	36.3364	37.7646	11.986809	1.4282	0.1738	36.3364	37.7646	11.486809
25	37.9384	39.3666	11.996809	1.4282	0.194	37.9384	39.3666	11.496809
26	39.5606	40.9886	11.996809	1.428	0.094	39.5606	40.9886	11.496809
27	41.0826	42.5108	11.976809	1.4282	0.074	41.0826	42.5108	11.476809
28	42.5848	44.0128	11.976809	1.428	0.445	42.5848	44.0128	11.476809
29	44.4578	45.886	11.956809	1.4282	0.114	44.4578	45.886	11.456809
30	46	47.428	11.976809	1.428	0.314	46	47.428	11.476809
31	47.742	49.1702	11.976809	1.4282	0.3138	47.742	49.1702	11.476809
32	49.484	50.9122	11.986809	1.4282	0.134	49.484	50.9122	11.486809
33	51.0462	52.4742	11.986809	1.428	0.154	51.0462	52.4742	11.486809
34	52.6282	54.0564	11.986809	1.4282	0.274	52.6282	54.0564	11.486809
35	54.3304	55.7586	11.986809	1.4282	0.2938	54.3304	55.7586	11.486809
36	56.0524	57.4804	11.976809	1.428	0.307	56.0524	57.4804	11.476809
37	57.7874	59.2156	11.986809	1.4282	0.1338	57.7874	59.2156	11.486809
38	59.3494	60.7776	11.966809	1.4282	0.214	59.3494	60.7776	11.466809
39	60.9916	62.4198	11.976809	1.4282	0.1738	60.9916	62.4198	11.476809
40	62.5936	64.0218	11.986809	1.4282	0.3138	62.5936	64.0218	11.486809
41	64.3356	65.764	11.966809	1.4284	0.3138	64.3356	65.764	11.466809
42	66.0778	67.506	11.966809	1.4282	0.354	66.0778	67.506	11.466809
43	67.86	69.2882	11.996809	1.4282	0.1538	67.86	69.2882	11.496809
44	69.442	70.8702	11.986809	1.4282	0.2538	69.442	70.8702	11.486809
45	71.124	72.5522	11.976809	1.4282	0.189	71.124	72.5522	11.476809
46	72.7412	74.1694	11.996809	1.4282	0.1338	72.7412	74.1694	11.496809
47	74.3032	75.7314	11.976809	1.4282	0.194	74.3032	75.7314	11.476809

48	75.9254	77.3536	11.976809	1.4282	0.1738	75.9254	77.3536	11.476809
49	77.5274	78.9554	11.986809	1.428	0.2942	77.5274	78.9554	11.486809
50	79.2496	80.6778	12.006809	1.4282	0.1338	79.2496	80.6778	11.506809
51	80.8116	82.2398	11.986809	1.4282	0.0938	80.8116	82.2398	11.486809
52	82.3336	83.762	11.996809	1.4284	0.0538	82.3336	83.762	11.496809
53	83.8158	85.244	11.996809	1.4282	0.0938	83.8158	85.244	11.496809
54	85.3378	86.766	11.986809	1.4282	0.074	85.3378	86.766	11.486809
55	86.84	88.2682	11.986809	1.4282	0.3138	86.84	88.2682	11.486809
56	88.582	90.0102	11.996809	1.4282	0.074	88.582	90.0102	11.496809
57	90.0842	91.5124	11.976809	1.4282	0.2538	90.0842	91.5124	11.476809
58	91.7662	93.1944	12.006809	1.4282	0.1538	91.7662	93.1944	11.506809
59	93.3482	94.7766	11.986809	1.4284	0.2338	93.3482	94.7766	11.486809
60	95.0104	96.4384	11.996809	1.428	0.0938	95.0104	96.4384	11.496809
61	96.5322	97.9604	11.976809	1.4282	0.074	96.5322	97.9604	11.476809
62	98.0344	99.4626	11.986809	1.4282	0.2738	98.0344	99.4626	11.486809
63	99.7364	99.9998	11.966809	0.2634	0.0002	99.7364	99.9998	11.466809

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-60
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-70
-75
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Time (ms)

EMPower ETSI Burst Measurement System Report

Time of Measurement: 9/23/2015 9:22:08 AM

Number of Sensors: 1
Sensor 1 USB ID: 1.47.192.24.23.0.0.153

Operator: MF

EUT Info:
Equipment ID: BC20
Serial Number: N/A

Settings:

Carrier Frequency	Trigger Level (dBm	Measure Time (ms	Sample Rate (S/s)	Gap Time (ms)	Threshold Level (d	Assembly Gain (dB	Beamforming Gain (dB)
2437000000	-1	100	5000000	0	-30	0.5	0

Results:

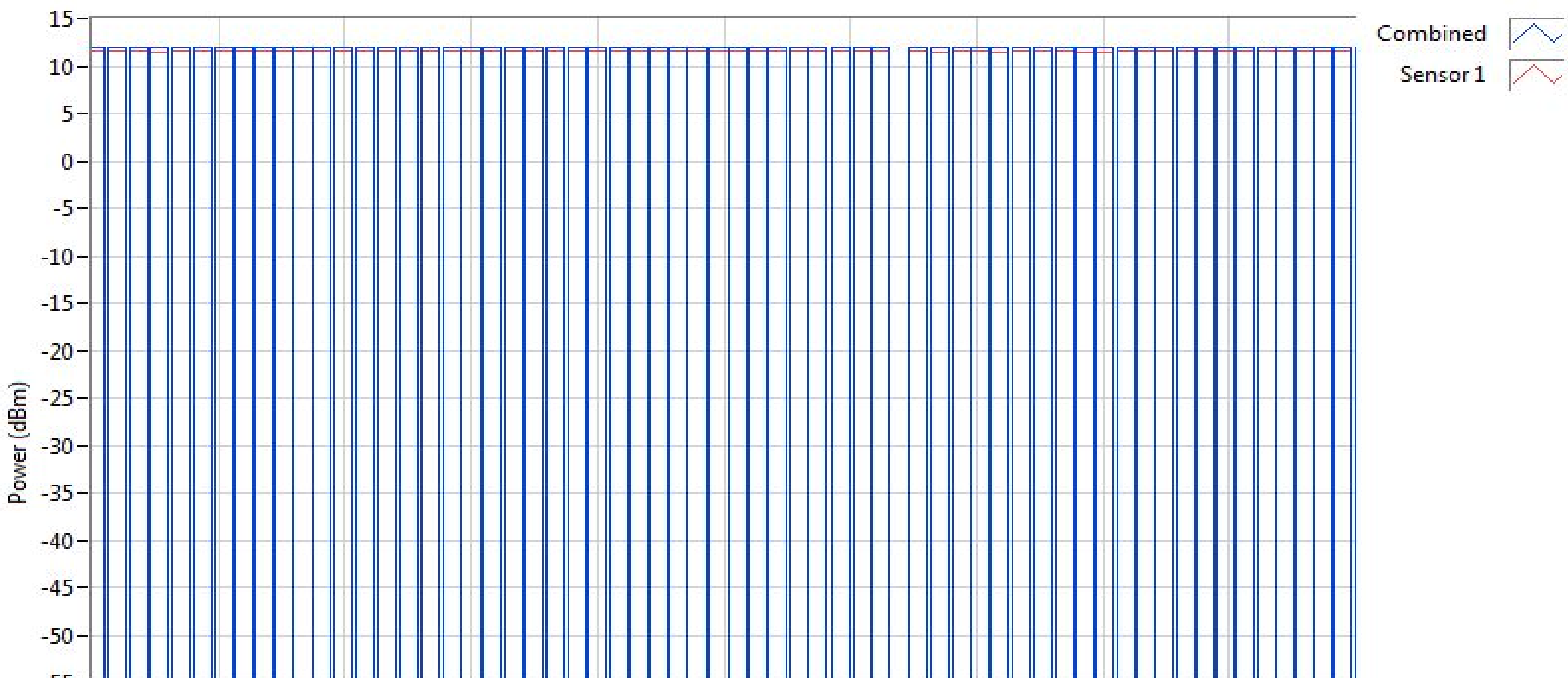
Max e.i.r.p. (dBm)	Medium Utilisatio	Duty Cycle (%)	Min. Gap Time (ms	Max. Sequence Tir	RMS (dBm)
12.065	13.906	87.109	0	1.428	11.432

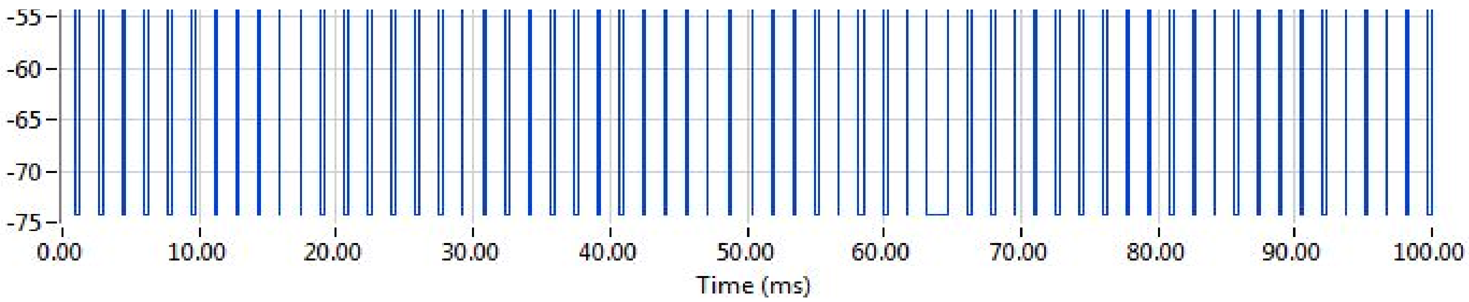
Data:

Burst #	Combined Start Ti	Combined Stop Tir	Combined Power (	TxOn Time (ms)	TxOff Time (ms)	Sensor 1 Start Tim	Sensor 1 Stop Tim	Sensor 1 Power (dBm)
1	0	0.9324	12.034664	0.9324	0.3608	0	0.9324	11.534664
2	1.2932	2.7216	12.034664	1.4284	0.2938	1.2932	2.7216	11.534664
3	3.0154	4.4434	12.054664	1.428	0.134	3.0154	4.4434	11.554664
4	4.5774	6.0056	12.004664	1.4282	0.334	4.5774	6.0056	11.504664
5	6.3396	7.7678	12.034664	1.4282	0.2538	6.3396	7.7678	11.534664
6	8.0216	9.4498	12.014664	1.4282	0.254	8.0216	9.4498	11.514664
7	9.7038	11.1318	12.034664	1.428	0.134	9.7038	11.1318	11.534664
8	11.2658	12.694	12.044664	1.4282	0.1138	11.2658	12.694	11.544664
9	12.8078	14.236	12.014664	1.4282	0.154	12.8078	14.236	11.514664
10	14.39	15.8182	12.014664	1.4282	0.1138	14.39	15.8182	11.514664
11	15.932	17.36	12.024664	1.428	0.074	15.932	17.36	11.524664
12	17.434	18.862	12.054664	1.428	0.254	17.434	18.862	11.554664

13	19.116	20.5442	12.044664	1.4282	0.3338	19.116	20.5442	11.544664
14	20.878	22.3062	12.064664	1.4282	0.294	20.878	22.3062	11.564664
15	22.6002	24.0282	12.034664	1.428	0.294	22.6002	24.0282	11.534664
16	24.3222	25.7504	12.014664	1.4282	0.314	24.3222	25.7504	11.514664
17	26.0644	27.4926	12.024664	1.4282	0.2738	26.0644	27.4926	11.524664
18	27.7664	29.1946	12.044664	1.4282	0.074	27.7664	29.1946	11.544664
19	29.2686	30.6968	12.044664	1.4282	0.2738	29.2686	30.6968	11.544664
20	30.9706	32.399	12.024664	1.4284	0.2536	30.9706	32.399	11.524664
21	32.6526	34.0806	12.044664	1.428	0.1342	32.6526	34.0806	11.544664
22	34.2148	35.643	12.034664	1.4282	0.3538	34.2148	35.643	11.534664
23	35.9968	37.425	12.044664	1.4282	0.254	35.9968	37.425	11.544664
24	37.679	39.1072	12.024664	1.4282	0.1938	37.679	39.1072	11.524664
25	39.301	40.7294	12.024664	1.4284	0.2338	39.301	40.7294	11.524664
26	40.9632	42.3914	12.024664	1.4282	0.1938	40.9632	42.3914	11.524664
27	42.5852	44.0134	12.034664	1.4282	0.0538	42.5852	44.0134	11.534664
28	44.0672	45.4954	12.024664	1.4282	0.194	44.0672	45.4954	11.524664
29	45.6894	47.1176	12.044664	1.4282	0.0538	45.6894	47.1176	11.544664
30	47.1714	48.5996	12.044664	1.4282	0.294	47.1714	48.5996	11.544664
31	48.8936	50.3216	12.034664	1.428	0.134	48.8936	50.3216	11.534664
32	50.4556	51.8838	12.024664	1.4282	0.1338	50.4556	51.8838	11.524664
33	52.0176	53.4458	12.024664	1.4282	0.0738	52.0176	53.4458	11.524664
34	53.5196	54.9478	12.044664	1.4282	0.2738	53.5196	54.9478	11.544664
35	55.2216	56.65	12.014664	1.4284	0.0538	55.2216	56.65	11.514664
36	56.7038	58.1318	12.044664	1.428	0.354	56.7038	58.1318	11.544664
37	58.4858	59.914	12.034664	1.4282	0.314	58.4858	59.914	11.534664
38	60.228	61.656	12.044664	1.428	0.094	60.228	61.656	11.544664
39	61.75	63.1782	12.054664	1.4282	1.516	61.75	63.1782	11.554664
40	64.6942	66.1224	12.024664	1.4282	0.3338	64.6942	66.1224	11.524664
41	66.4562	67.8846	12.004664	1.4284	0.1738	66.4562	67.8846	11.504664
42	68.0584	69.4864	12.024664	1.428	0.054	68.0584	69.4864	11.524664
43	69.5404	70.9686	12.024664	1.4282	0.1538	69.5404	70.9686	11.524664
44	71.1224	72.5508	12.004664	1.4284	0.2538	71.1224	72.5508	11.504664
45	72.8046	74.2328	12.034664	1.4282	0.3538	72.8046	74.2328	11.534664
46	74.5866	76.015	12.034664	1.4284	0.2538	74.5866	76.015	11.534664
47	76.2688	77.697	12.044664	1.4282	0.1938	76.2688	77.697	11.544664

48	77.8908	79.3192	11.994664	1.4284	0.1536	77.8908	79.3192	11.494664
49	79.4728	80.9012	12.004664	1.4284	0.2338	79.4728	80.9012	11.504664
50	81.135	82.563	12.024664	1.428	0.114	81.135	82.563	11.524664
51	82.677	84.1054	12.064664	1.4284	0.0738	82.677	84.1054	11.564664
52	84.1792	85.6074	12.034664	1.4282	0.2338	84.1792	85.6074	11.534664
53	85.8412	87.2694	12.034664	1.4282	0.094	85.8412	87.2694	11.534664
54	87.3634	88.7916	12.034664	1.4282	0.2338	87.3634	88.7916	11.534664
55	89.0254	90.4534	12.024664	1.428	0.0738	89.0254	90.4534	11.524664
56	90.5272	91.9556	12.034664	1.4284	0.2738	90.5272	91.9556	11.534664
57	92.2294	93.6576	12.024664	1.4282	0.0538	92.2294	93.6576	11.524664
58	93.7114	95.1394	12.014664	1.428	0.0942	93.7114	95.1394	11.514664
59	95.2336	96.6618	12.034664	1.4282	0.0738	95.2336	96.6618	11.534664
60	96.7356	98.1638	12.054664	1.4282	0.0738	96.7356	98.1638	11.554664
61	98.2376	99.6658	12.014664	1.4282	0.294	98.2376	99.6658	11.514664
62	99.9598	99.9998	12.044664	0.04	0.0002	99.9598	99.9998	11.544664

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50.00
60.00
70.00
80.00
90.00
100.00
Time (ms)

EMPower ETSI Burst Measurement System Report

Time of Measurement: 9/23/2015 9:23:09 AM

Number of Sensors: 1
Sensor 1 USB ID: 1.47.192.24.23.0.0.153

Operator: MF

EUT Info:
Equipment ID: BC20
Serial Number: N/A

Settings:

Carrier Frequency	Trigger Level (dBm	Measure Time (ms	Sample Rate (S/s)	Gap Time (ms)	Threshold Level (d	Assembly Gain (dB	Beamforming Gain (dB)
2462000000	-1	100	5000000	0	-30	0.5	0

Results:

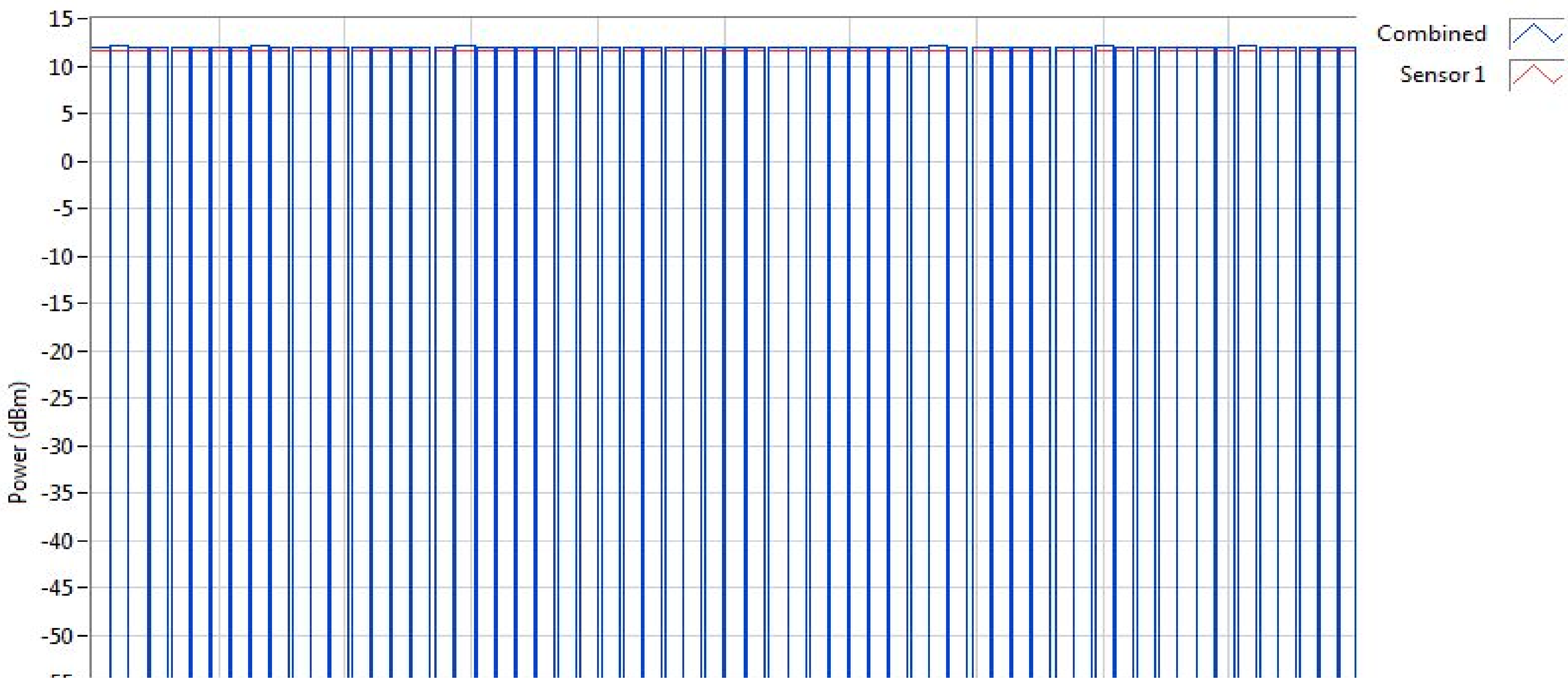
Max e.i.r.p. (dBm)	Medium Utilisatio	Duty Cycle (%)	Min. Gap Time (m	Max. Sequence Ti	RMS (dBm)
12.097	14.17	88.225	0	1.428	11.514

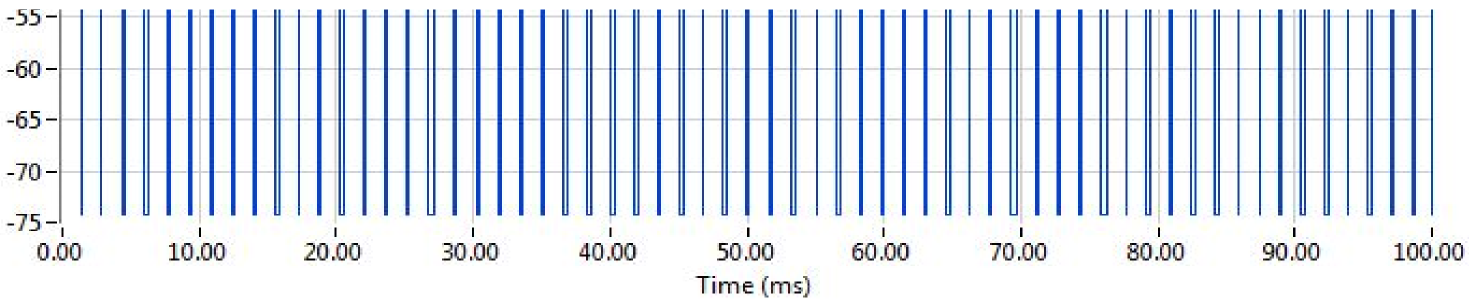
Data:

Burst #	Combined Start Ti	Combined Stop Ti	Combined Power (	TxOn Time (ms)	TxOff Time (ms)	Sensor 1 Start Tim	Sensor 1 Stop Tim	Sensor 1 Power (dBm)
1	0	1.3484	12.066809	1.3484	0.0538	0	1.3484	11.566809
2	1.4022	2.8304	12.086809	1.4282	0.0738	1.4022	2.8304	11.586809
3	2.9042	4.3326	12.046809	1.4284	0.1738	2.9042	4.3326	11.546809
4	4.5064	5.9346	12.046809	1.4282	0.2738	4.5064	5.9346	11.546809
5	6.2084	7.6366	12.036809	1.4282	0.234	6.2084	7.6366	11.536809
6	7.8706	9.2986	12.046809	1.428	0.054	7.8706	9.2986	11.546809
7	9.3526	10.7808	12.036809	1.4282	0.1938	9.3526	10.7808	11.536809
8	10.9746	12.4028	12.046809	1.4282	0.154	10.9746	12.4028	11.546809
9	12.5568	13.9848	12.076809	1.428	0.174	12.5568	13.9848	11.576809
10	14.1588	15.587	12.066809	1.4282	0.194	14.1588	15.587	11.566809
11	15.781	17.209	12.056809	1.428	0.074	15.781	17.209	11.556809
12	17.283	18.7112	12.056809	1.4282	0.1338	17.283	18.7112	11.556809

13	18.845	20.273	12.056809	1.428	0.274	18.845	20.273	11.556809
14	20.547	21.9752	12.056809	1.4282	0.2138	20.547	21.9752	11.556809
15	22.189	23.6172	12.046809	1.4282	0.1138	22.189	23.6172	11.546809
16	23.731	25.1592	12.046809	1.4282	0.174	23.731	25.1592	11.546809
17	25.3332	26.7614	12.066809	1.4282	0.3338	25.3332	26.7614	11.566809
18	27.0952	28.5236	12.046809	1.4284	0.2738	27.0952	28.5236	11.546809
19	28.7974	30.2254	12.076809	1.428	0.154	28.7974	30.2254	11.576809
20	30.3794	31.8076	12.066809	1.4282	0.1538	30.3794	31.8076	11.566809
21	31.9614	33.3898	12.056809	1.4284	0.1538	31.9614	33.3898	11.556809
22	33.5436	34.9718	12.056809	1.4282	0.1338	33.5436	34.9718	11.556809
23	35.1056	36.5338	12.036809	1.4282	0.334	35.1056	36.5338	11.536809
24	36.8678	38.296	12.056809	1.4282	0.2938	36.8678	38.296	11.556809
25	38.5898	40.018	12.046809	1.4282	0.3138	38.5898	40.018	11.546809
26	40.3318	41.76	12.056809	1.4282	0.334	40.3318	41.76	11.556809
27	42.094	43.5222	12.056809	1.4282	0.0938	42.094	43.5222	11.556809
28	43.616	45.0444	12.036809	1.4284	0.2538	43.616	45.0444	11.536809
29	45.2982	46.7264	12.066809	1.4282	0.0538	45.2982	46.7264	11.566809
30	46.7802	48.2084	12.056809	1.4282	0.2538	46.7802	48.2084	11.556809
31	48.4622	49.8906	12.056809	1.4284	0.2538	48.4622	49.8906	11.556809
32	50.1444	51.5726	12.046809	1.4282	0.2738	50.1444	51.5726	11.546809
33	51.8464	53.2746	12.036809	1.4282	0.334	51.8464	53.2746	11.536809
34	53.6086	55.0368	12.066809	1.4282	0.0738	53.6086	55.0368	11.566809
35	55.1106	56.5388	12.066809	1.4282	0.2938	55.1106	56.5388	11.566809
36	56.8326	58.2608	12.056809	1.4282	0.0938	56.8326	58.2608	11.556809
37	58.3546	59.7828	12.066809	1.4282	0.2338	58.3546	59.7828	11.566809
38	60.0166	61.4448	12.036809	1.4282	0.134	60.0166	61.4448	11.536809
39	61.5788	63.007	12.056809	1.4282	0.1138	61.5788	63.007	11.556809
40	63.1208	64.549	12.066809	1.4282	0.2338	63.1208	64.549	11.566809
41	64.7828	66.2112	12.046809	1.4284	0.0938	64.7828	66.2112	11.546809
42	66.305	67.7332	12.096809	1.4282	0.1338	66.305	67.7332	11.596809
43	67.867	69.2952	12.036809	1.4282	0.334	67.867	69.2952	11.536809
44	69.6292	71.0574	12.066809	1.4282	0.2138	69.6292	71.0574	11.566809
45	71.2712	72.6994	12.056809	1.4282	0.1938	71.2712	72.6994	11.556809
46	72.8932	74.3214	12.056809	1.4282	0.113	72.8932	74.3214	11.556809
47	74.4344	75.8624	12.066809	1.428	0.414	74.4344	75.8624	11.566809

48	76.2764	77.7046	12.056809	1.4282	0.054	76.2764	77.7046	11.556809
49	77.7586	79.1866	12.066809	1.428	0.274	77.7586	79.1866	11.566809
50	79.4606	80.8888	12.086809	1.4282	0.1138	79.4606	80.8888	11.586809
51	81.0026	82.431	12.066809	1.4284	0.2938	81.0026	82.431	11.566809
52	82.7248	84.1528	12.066809	1.428	0.234	82.7248	84.1528	11.566809
53	84.3868	85.8152	12.056809	1.4284	0.1338	84.3868	85.8152	11.556809
54	85.949	87.3772	12.056809	1.4282	0.1138	85.949	87.3772	11.556809
55	87.491	88.919	12.066809	1.428	0.114	87.491	88.919	11.566809
56	89.033	90.4614	12.056809	1.4284	0.3338	89.033	90.4614	11.556809
57	90.7952	92.2234	12.076809	1.4282	0.2138	90.7952	92.2234	11.576809
58	92.4372	93.8656	12.066809	1.4284	0.0536	92.4372	93.8656	11.566809
59	93.9192	95.3474	12.066809	1.4282	0.234	93.9192	95.3474	11.566809
60	95.5814	97.0094	12.066809	1.428	0.0938	95.5814	97.0094	11.566809
61	97.1032	98.5314	12.026809	1.4282	0.254	97.1032	98.5314	11.526809
62	98.7854	99.9998	12.066809	1.2144	0.0002	98.7854	99.9998	11.566809

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