



FCC SAR Test Report

FCC ID: T58WF2190R

Project No. : 1307C140A
Equipment : AC1200 Wireless Dual Band USB Adapter
Model Name : WF2190
Applicant : NETIS SYSTEMS CO., LTD
Address : 4F&5F R&D Building, Oriental Cyberport, High-Tech Industrial Park, Nanshan, Shenzhen, China.

Tested by: Neutron Engineering Inc. EMC Laboratory

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REPORT ISSUED HISTORY

| Issued No. | Description | Issued Date |
|-----------------------|-----------------|---------------|
| NEI-FCC-SAR-1307C140A | Original Issue. | Nov. 21, 2013 |
| - | - | - |



1. GENERAL SUMMARY

| | |
|------------------|---|
| Equipment | AC1200 Wireless Dual Band USB Adapter |
| Model Name | netis |
| Brand Name | WF2190 |
| Model Difference | N/A |
| Manufacturer | Shenzhen Netcore Industrial Ltd. |
| Address | 4F&5F R&D Building, Oriental Cyberport, High-Tech Industrial Park, Nanshan, Shenzhen, China. |
| Factory | Dongguan City Netcore Network Technology Co., Ltd. |
| Address | No.10-1,Sankeng Road,Qinghutou,Tangxia Town, Dongguan City |
| Standard(s) | <p>FCC 47CFR §2.1093 Radio frequency Radiation Exposure Evaluation: Portable Devices</p> <p>ANSI C95.1, 1999 Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1999)</p> <p>IEEE 1528 2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques</p> <p>KDB248227 D01 v01r02 SAR meas for 802 11 a b g v01r02: SAR Measurement Procedures for 802.11a/b/g Transmitters</p> <p>KDB 447498 D01 General RF Exposure Guidance v05r01: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies.</p> <p>447498 D02 SAR Procedures for Dongle Xmtr v02 :SAR Measurement Procedures for USB Dongle Transmitters</p> <p>Tracking number: 400012</p> |

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory. The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-FCC-SAR-1307C140A) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).



2. RF EMISSIONS MEASUREMENT

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is **SAR room** at the location of No.3, Jinshagang 1st Road, ShiXia, Dalang Town, Dong Guan, China.523792

2.2 MEASUREMENT UNCERTAINTY

| Uncertainty Component | Uncertainty Value | Probability Distribution | Divisor | C _i (1g) | Standard Uncertainty ±1% | V _i or V _{eff} |
|---|-------------------|--------------------------|---------|---------------------|--------------------------|------------------------------------|
| Measurement System | | | | | | |
| Probe Calibration (k=1) | 5.9 | Normal | 1 | 1 | 5.9 | ∞ |
| Axial Isotropy | 4.7 | Rectangular | √3 | √0.5 | 1.9 | ∞ |
| Hemispherical Isotropy | 9.6 | Rectangular | √3 | √0.5 | 3.9 | ∞ |
| Boundary Effect | 1.0 | Rectangular | √3 | 1 | 0.6 | ∞ |
| Linearity | 4.7 | Rectangular | √3 | 1 | 2.7 | ∞ |
| System Detection Limit | 1.0 | Rectangular | √3 | 1 | 0.6 | ∞ |
| Readout Electronics | 0.3 | Normal | 1 | 1 | 0.3 | ∞ |
| Response Time | 0.8 | Rectangular | √3 | 1 | 0.5 | ∞ |
| Integration Time | 2.6 | Rectangular | √3 | 1 | 1.5 | ∞ |
| RF Ambient Conditions-Noise | 3.0 | Rectangular | √3 | 1 | 1.7 | ∞ |
| RF Ambient Reflections | 3.0 | Rectangular | √3 | 1 | 1.7 | ∞ |
| Probe Positioner Mechanical Tolerances | 0.4 | Rectangular | √3 | 1 | 0.2 | ∞ |
| Probe Positioning with respect to Phantom Shell | 2.9 | Rectangular | √3 | 1 | 1.7 | ∞ |
| Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation | 1.0 | Rectangular | √3 | 1 | 0.6 | ∞ |
| Test Sample Related | | | | | | |
| Test sample Positioning | 2.9 | Normal | 1 | 1 | 2.9 | 145 |
| Device Holder Uncertainty | 3.6 | Normal | 1 | 1 | 3.6 | 5 |
| Output Power Variation - SAR drift measurement | 5.0 | Rectangular | √3 | 1 | 2.9 | ∞ |
| Phantom and Setup | | | | | | |
| Phantom Uncertainty (shape and thickness tolerances) | 4.0 | Rectangular | √3 | 1 | 2.3 | ∞ |
| Liquid Conductivity - deviation from target values | 5.0 | Rectangular | √3 | 0.64 | 1.8 | ∞ |
| Liquid Conductivity - measurement uncertainty | 2.5 | Normal | 1 | 0.64 | 1.6 | ∞ |
| Liquid Permittivity - deviation from target values | 5.0 | Rectangular | √3 | 0.6 | 1.7 | ∞ |
| Liquid Permittivity - measurement uncertainty | 2.5 | Normal | 1 | 0.6 | 1.5 | ∞ |
| Combined standard uncertainty | | RSS | | | 10.9 | 387 |
| Expanded uncertainty | | k=2 | | | 21.9 | |



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

| | |
|-------------------------|--|
| Operation Frequency | 2412MHz~2462 MHz 5150MHz~5250 MHz 5745MHz~5825 MHz |
| Modulation Technology | 802.11b:DSSS 802.11g:OFDM 802.11n:OFDM |
| Bit Rate of Transmitter | 802.11b: 11/5.5/2/1 Mbps 802.11g: 54/48/36/24/18/12/9/6 Mbps 802.11n up to 300 Mbps 802.11ac up to 867 Mbps |
| Number Of Channel | Please refer to note 1 (Page 9) |
| Antenna Type | Please refer to note 2 (Page 9) |



Note:

- 1. CH 01 – CH 11 for 802.11b, 802.11g, 802.11n(20MHz)
- CH 03 – CH 09 for 802.11n(40MHz)

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| 01 | 2412 | 04 | 2427 | 07 | 2442 | 10 | 2457 |
| 02 | 2417 | 05 | 2432 | 08 | 2447 | 11 | 2462 |
| 03 | 2422 | 06 | 2437 | 09 | 2452 | | |





| 802.11a / 802.11n 20MHz / 802.11ac 20MHz | | 802.11n 40M / 802.11ac 40MHz | | 802.11ac 80MHz | |
|--|-----------------|------------------------------|-----------------|----------------|-----------------|
| Band 1 | | Band 1 | | Band 1 | |
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 36 | 5180 | 38 | 5190 | 42 | 5210 |
| 40 | 5200 | 46 | 5230 | | |
| 44 | 5220 | | | | |
| 48 | 5240 | | | | |

| 802.11a / 802.11n 20M / 802.11ac 20M | | | | | |
|--------------------------------------|-----------------|------------|-----------------|------------|-----------------|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 149 | 5745 | 153 | 5765 | 157 | 5785 |
| 161 | 5805 | 165 | 5825 | | |

| 802.11n 40M / 802.11ac 40M | | | |
|----------------------------|-----------------|------------|-----------------|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 151 | 5755 | 159 | 5795 |

| 802.11ac 80M | | | |
|--------------|-----------------|--|--|
| Channel | Frequency (MHz) | | |
| 155 | 5775 | | |

2. Table for Filed Antenna

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) | Note |
|------|---|------------|----------------|-----------|------------|------|
| 0 |  | N/A | Dipole Antenna | N/A | 4.6 | 2.4G |
| 1 |  | N/A | Dipole Antenna | N/A | 4.6 | 2.4G |
| 0 |  | N/A | Dipole Antenna | N/A | 5.2 | 5G |
| 1 |  | N/A | Dipole Antenna | N/A | 5.2 | 5G |



3.2 THE MAXIMUM SAR_{1G} VALUES

Body SAR Configuration

| Mode | Frequency (MHz) | Position | Separation distance | SAR _{1g} (W/kg) |
|---------|-----------------|----------------------------|---------------------|--------------------------|
| 802.11b | 2412 | Test Position 2/Front Side | 10mm | 0.179 |

Note:

(1) Equipment Under Test (EUT) has a WIFI antenna that can be used for TX/RX. During SAR test of the EUT, SAR is only tested for 802.11b. SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

(2) KDB 248227 - SAR is not required for 802.11a HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels.

3.3 LABORATORY ENVIRONMENT

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



3.4 MAIN TEST INSTRUMENTS

| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Calibrated until |
|------|------------------------------|--------------|-------------------|------------|------------------|
| 1 | Data Acquisition Electronics | Speag | DAE4 | 1390 | Sep. 10, 2014 |
| 2 | E-field Probe | Speag | EX3DV4 | 3932 | Sep. 16, 2014 |
| 3 | Electro Optical Converter | Speag | ECO90 | 1151 | N/A |
| 4 | ELI4 Phantom | Speag | ELI4 Phantom V5.0 | 1222 | N/A |
| 5 | System Validation Dipole | Speag | D2450V2 | 919 | Sep. 05, 2014 |
| 6 | Power Amplifier | Speag | ZHL-42W | N/A | N/A |
| 7 | Power Amplifier | Speag | ZVE-8G | N/A | N/A |
| 8 | ENA Network Analyzer | Agilent | E5071C | MY46102965 | Apr. 25, 2014 |
| 9 | Dielectric Probe Kit | Agilent | 85070E | 2593 | N/A |
| 10 | P-series power meter | Agilent | N1911A | MY45100473 | Apr. 25, 2014 |
| 11 | wideband power sensor | Agilent | N1921A | MY51100041 | Apr. 25, 2014 |
| 12 | power Meter | ANRITSU | ML2495A | 1128009 | May. 24, 2014 |
| 13 | Pulse Power Sensor | ANRITSU | MA 2411B | 1027500 | May. 24, 2014 |
| 14 | MXG Analog Signal Generator | Agilent | N5181A | MY49060710 | Nov. 09, 2014 |
| 15 | System Validation Dipole | Speag | D5GHzV2 | 1160 | Sep. 18, 2014 |

Remark: " N/A" denotes no model name, serial No. or calibration specified.
 All calibration period of Equipment List is One Year.

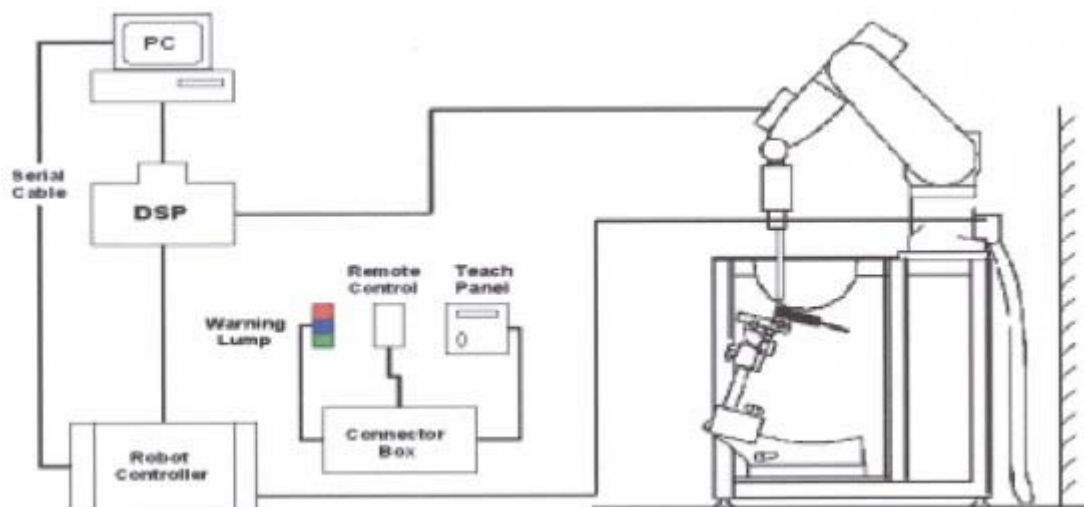
4. SAR MEASUREMENTS SYSTEM CONFIGURATION

4.1 SAR MEASUREMENT SET-UP

The DASY5 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6. The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 7
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

4.1.1 Test Setup Layout





4.2 DASY5 E-FIELD PROBE SYSTEM

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

4.2.1 ES3DV3 PROBE SPECIFICATION

| | |
|---------------|---|
| Construction | Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| Calibration | ISO/IEC 17025 calibration service available |
| Frequency | 10 MHz to 4 GHz Linearity: ± 0.2 dB (30 MHz to 4 GHz) |
| Directivity | ± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis) |
| Dynamic Range | 5 μ W/g to > 100 mW/g Linearity: ± 0.2 dB |
| Dimensions | Overall length: 330 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm |



EX3DV4 E-field Probe



4.2.2 E-FIELD PROBE CALIBRATION

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy was evaluated and found to be better than $\pm 0.25\text{dB}$. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

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 wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

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.

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

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).



4.2.3 OTHER TEST EQUIPMENT

4.2.3.1. Device Holder for Transmitters

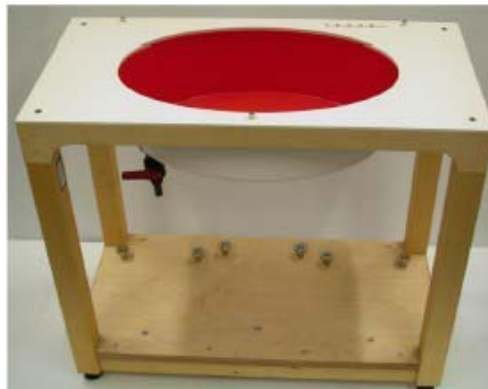
Construction: Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices (e.g., laptops, cameras, etc.) It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.

Material: POM, Acrylic glass, Foam

4.2.3.2 Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible all known tissuesimulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

| | |
|-----------------|------------------------------|
| Shell Thickness | 2±0.1 mm |
| Filling Volume | Approx. 30 liters |
| Dimensions | 190 X 600 X 0 mm (H x L x W) |
| Available | Special |



ELI4 Phantom



4.2.4 SCANNING PROCEDURE

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. 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. $\pm 5\%$.

The "surface check" measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above $\pm 0.1\text{mm}$). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^\circ$.)

- **Area Scan**

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 10 mm x 10 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

- **Zoom Scan**

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

- **Spatial Peak Detection**

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.



4.2.5 DATA STORAGE AND EVALUATION

4.2.5.1 Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DAE4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.



4.4.2 Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

| | | |
|--------------------|-------------------------|--|
| Probe parameters: | Sensitivity | Normi, a ₁₀ , a ₁₁ , a ₁₂ |
| | Conversion factor | ConvF _i |
| | Diode compression point | Dcp _i |
| Device parameters: | Frequency | f |
| | Crest factor | cf |
| Media parameters: | Conductivity | |
| | Density | |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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 as:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

| | | |
|------|--|------------------|
| 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:

$$\text{E-field probes: } E_i = (V_i / \text{Norm}_i \cdot \text{ConvF})^{1/2}$$

$$\text{H-field probes: } H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$$

With V_i = compensated signal of channel i ($i = x, y, z$)

Norm_i = sensor sensitivity of channel i ($i = x, y, z$)
 [mV/(V/m)²] for E-field Probes

ConvF = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

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

$$E_{\text{tot}} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

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

$$\text{SAR} = (E_{\text{tot}})^2 \cdot \sigma / (\rho \cdot 1000)$$

With SAR = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m
 = conductivity in [mho/m] or [Siemens/m]
 = equivalent tissue density in g/cm³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{\text{pwe}} = E_{\text{tot}}^2 / 3770 \text{ or } P_{\text{pwe}} = H_{\text{tot}}^2 \cdot 37.7$$

With P_{pwe} = equivalent power density of a plane wave in mW/cm²

E_{tot} = total field strength in V/m

H_{tot} = total magnetic field strength in A/m



5. TISSUE-EQUIVALENT LIQUID

5.1 TISSUE-EQUIVALENT LIQUID INGREDIENTS

The liquid is consisted of water, salt and Glycol. The liquid has previously been proven to be suited for worst-case. The Table 2 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed

Composition of the Tissue Equivalent Matter

| MIXTURE% | FREQUENCY 2450MHZ |
|------------------------------------|--|
| Water | 62.7 |
| Glycol | 36.8 |
| Salt | 0.5 |
| Dielectric Parameters Target Value | f=2450MHz $\epsilon=39.20$ $\sigma=1.80$ |

5.2 TISSUE-EQUIVALENT LIQUID PROPERTIES

Dielectric Performance of Tissue Simulating Liquid

| Frequency (MHz) | Description | Dielectric Parameters | | Temp °C |
|-----------------|---------------------------------|-----------------------|--------------------|---------|
| | | ϵ_r | σ (s/m) | |
| 2450 | Target value ±5% within | 52.70 50.07-41.16 | 1.95 1.85-2.048 | 22.0 |
| | Measurement value 2013-11-21 | 51.81 | 2.01 | 22.7 |
| 5200 | Target value ±5% within | 49.00 46.55~51.45 | 5.30 5.04~5.57 | 22.0 |
| | Measurement value 2013-11-21 | 49.40 | 5.38 | 23.6 |
| 5800 | Target value ±5% within | 48.20 45.79~50.61 | 6.00 5.70~6.30 | 22.0 |
| | Measurement value 2013-11-21 | 48.30 | 6.22 | 23.6 |

6. SYSTEM CHECK

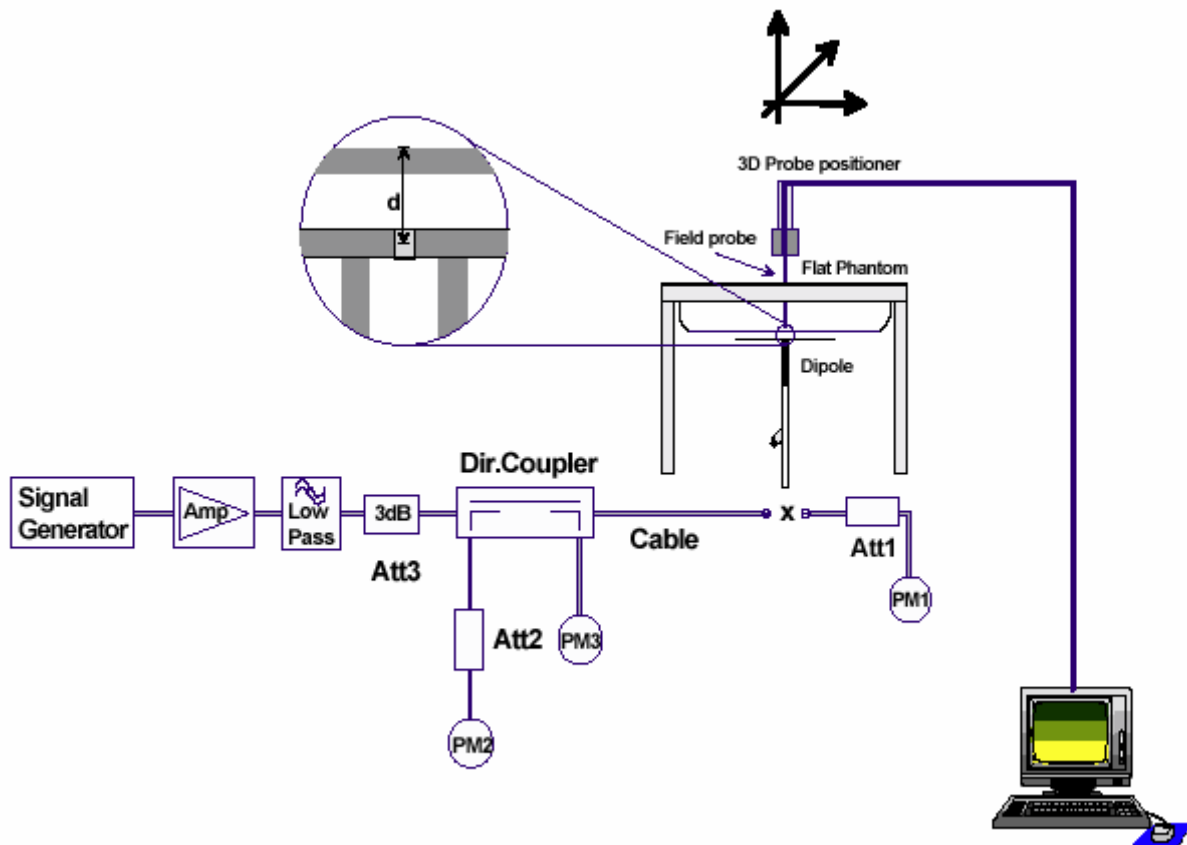
6.1 DESCRIPTION OF SYSTEM CHECK

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the 6.2.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ($\pm 10\%$).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.

System Check Set-up





6.2 DESCRIPTION OF SYSTEM CHECK

System Check in Tissue Simulating Liquid

| Frequency (MHz) | Test Date | Dielectric Parameters | | Temp | 250mW Measured SAR _{1g} | 1W Normalized SAR _{1g} | 1W Target SAR _{1g} (±10% deviation) |
|-----------------|------------|-----------------------|----------------|-------|----------------------------------|---------------------------------|--|
| | | ϵ_r | σ (s/m) | (°C) | (W/kg) | | |
| 2450 | 2013-11-21 | 51.81 | 2.01 | 22.70 | 12.80 | 51.20 | 49.30 |
| 5200 | 2013-11-21 | 49.40 | 5.38 | 23.10 | 7.00 | 70.00 | 74.00 |
| 5800 | 2013-11-21 | 48.30 | 6.22 | 23.10 | 7.22 | 72.20 | 72.50 |

Note: 1. The graph results see Appendix 2.
 2. Target Value derives from the calibration certificate



7. OPERATIONAL CONDITIONS DURING TEST

7.1 General Description of Test Procedures

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.

For the 802.11b/g/n SAR tests, a communication link is set up with the test mode software for WIFI mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate. Testing at higher data rates is not required when the maximum average output power is less than 0.25dB higher than those measured at the lowest data rate.

802.11b/g operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g modes are tested on channels 1, 6, 11; however, if output power reduction is necessary for channels 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

KDB 248227 - SAR is not required for 802.11a HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels.

7.2 Test Position

For each channel, the EUT is tested at the following 2 test positions:

Test Position 1: The bottom side of the EUT towards the bottom of the flat phantom distance 5mm.

(APPENDIX 7)

Test Position 2: The front side of the EUT towards the bottom of the flat phantom distance 10mm.

(APPENDIX 7)



8. TEST RESULT

8.1 CONDUCTED POWER RESULTS

| Mode | Data rate(Mbps) | Test results(dBm) | | |
|---------|-----------------|-------------------|-------------------|--------------------|
| | | CONDUCTED AV | | |
| | | 2412MHz (CH01) | 2437MHz (CH06) | 2462 MHz (CH11) |
| 802.11b | 1 | 17.46 | 17.35 | 17.38 |
| | 2 | 17.41 | 17.31 | 17.35 |
| | 5.5 | 17.43 | 17.28 | 17.28 |
| | 11 | 17.35 | 17.22 | 17.24 |
| 802.11g | 6 | 20.72 | 20.61 | 20.81 |
| | 9 | 20.71 | 20.57 | 20.79 |
| | 12 | 20.65 | 20.54 | 20.72 |
| | 18 | 20.63 | 20.56 | 20.75 |
| | 24 | 20.59 | 20.53 | 20.71 |
| | 36 | 20.48 | 20.51 | 20.69 |
| | 48 | 20.45 | 20.46 | 20.65 |
| | 54 | 20.41 | 20.43 | 20.63 |

Note: (1) SAR is not required for 802.11g/n channels when the maximum average output power is less than that measured on the corresponding 802.11b channels.



| Mode | Data rate(Mbps) | Test results(dBm) CONDUCTED AV | | |
|-----------------------|-----------------|-----------------------------------|-------------------|--------------------|
| | | 2412MHz (CH01) | 2437MHz (CH06) | 2462 MHz (CH11) |
| 802.11n HT20 ANT 0 | MCS0 | 16.76 | 16.73 | 16.65 |
| | MCS1 | 16.72 | 16.71 | 16.60 |
| | MCS2 | 16.73 | 16.64 | 16.52 |
| | MCS3 | 16.68 | 14.63 | 16.55 |
| | MCS4 | 16.69 | 14.61 | 16.52 |
| | MCS5 | 16.62 | 14.57 | 16.53 |
| | MCS6 | 16.64 | 14.55 | 16.49 |
| | MCS7 | 16.58 | 14.53 | 16.45 |
| | MCS8 | 16.59 | 14.51 | 16.42 |
| | MCS9 | 16.53 | 14.46 | 16.41 |
| | MCS10 | 16.54 | 14.42 | 16.38 |
| | MCS11 | 16.52 | 14.45 | 16.36 |
| | MCS12 | 16.49 | 14.38 | 16.37 |
| | MCS13 | 16.42 | 14.36 | 16.35 |
| | MCS14 | 16.38 | 14.33 | 16.3 |
| MCS15 | 16.35 | 14.31 | 16.31 | |



| Mode | Date rata(Mbps) | Test results(dBm) CONDUCTED AV | | |
|-----------------------|-----------------|-----------------------------------|-------------------|--------------------|
| | | 2412MHz (CH01) | 2437MHz (CH06) | 2462 MHz (CH11) |
| 802.11n HT20 ANT 1 | MCS0 | 16.56 | 16.68 | 16.57 |
| | MCS1 | 16.50 | 16.62 | 16.55 |
| | MCS2 | 16.48 | 16.6 | 16.51 |
| | MCS3 | 16.47 | 16.57 | 16.5 |
| | MCS4 | 16.43 | 16.53 | 16.42 |
| | MCS5 | 16.42 | 16.55 | 16.46 |
| | MCS6 | 16.38 | 16.51 | 16.45 |
| | MCS7 | 16.35 | 16.49 | 16.4 |
| | MCS8 | 16.34 | 16.46 | 16.38 |
| | MCS9 | 16.29 | 16.45 | 16.34 |
| | MCS10 | 16.28 | 16.42 | 16.35 |
| | MCS11 | 16.27 | 16.4 | 16.32 |
| | MCS12 | 16.25 | 16.38 | 16.31 |
| | MCS13 | 16.26 | 16.37 | 16.28 |
| | MCS14 | 16.22 | 16.35 | 16.26 |
| MCS15 | 16.18 | 16.32 | 16.24 | |



| Mode | Date rata(Mbps) | Test results(dBm) CONDUCTED AV | | |
|-------------------------------|-----------------|-----------------------------------|-------------------|--------------------|
| | | 2412MHz (CH01) | 2437MHz (CH06) | 2462 MHz (CH11) |
| 802.11n HT20 ANT 0 + ANT 1 | MCS0 | 19.67 | 19.72 | 19.62 |
| | MCS1 | 19.62 | 19.68 | 19.59 |
| | MCS2 | 19.62 | 19.63 | 19.53 |
| | MCS3 | 19.59 | 18.72 | 19.54 |
| | MCS4 | 19.57 | 18.69 | 19.48 |
| | MCS5 | 19.53 | 18.68 | 19.51 |
| | MCS6 | 19.52 | 18.65 | 19.48 |
| | MCS7 | 19.477 | 18.63 | 19.44 |
| | MCS8 | 19.48 | 18.60 | 19.41 |
| | MCS9 | 19.42 | 18.58 | 19.39 |
| | MCS10 | 19.42 | 18.54 | 19.38 |
| | MCS11 | 19.41 | 18.54 | 19.35 |
| | MCS12 | 19.38 | 18.50 | 19.35 |
| | MCS13 | 19.35 | 18.49 | 19.33 |
| | MCS14 | 19.31 | 18.47 | 19.29 |
| MCS15 | 19.28 | 18.44 | 19.29 | |



| Mode | Data rate(Mbps) | Test results(dBm) CONDUCTED AV | | |
|-----------------------|-----------------|-----------------------------------|-------------------|--------------------|
| | | 2422MHz (CH03) | 2437MHz (CH06) | 2452 MHz (CH09) |
| 802.11n HT40 ANT 0 | MCS0 | 16.92 | 16.97 | 16.92 |
| | MCS1 | 16.82 | 16.84 | 16.85 |
| | MCS2 | 16.86 | 16.90 | 16.84 |
| | MCS3 | 16.85 | 16.82 | 16.82 |
| | MCS4 | 16.76 | 16.78 | 16.79 |
| | MCS5 | 16.74 | 16.75 | 16.75 |
| | MCS6 | 16.72 | 16.73 | 16.73 |
| | MCS7 | 16.68 | 16.68 | 16.70 |
| | MCS8 | 16.64 | 16.64 | 16.67 |
| | MCS9 | 16.63 | 16.62 | 16.65 |
| | MCS10 | 16.6 | 16.55 | 16.60 |
| | MCS11 | 16.58 | 16.53 | 16.58 |
| | MCS12 | 16.52 | 16.54 | 16.52 |
| | MCS13 | 16.55 | 16.50 | 16.50 |
| | MCS14 | 16.48 | 16.48 | 16.45 |
| MCS15 | 16.46 | 16.45 | 16.42 | |



| Mode | Date rata(Mbps) | Test results(dBm) CONDUCTED AV | | |
|-----------------------|-----------------|-----------------------------------|-------------------|--------------------|
| | | 2422MHz (CH03) | 2437MHz (CH06) | 2452 MHz (CH09) |
| 802.11n HT40 ANT 1 | MCS0 | 16.46 | 16.35 | 16.42 |
| | MCS1 | 16.42 | 16.32 | 16.38 |
| | MCS2 | 16.40 | 16.28 | 16.35 |
| | MCS3 | 16.38 | 16.27 | 16.34 |
| | MCS4 | 16.35 | 16.25 | 16.31 |
| | MCS5 | 16.37 | 16.22 | 16.28 |
| | MCS6 | 16.32 | 16.18 | 16.22 |
| | MCS7 | 16.28 | 16.16 | 16.25 |
| | MCS8 | 16.25 | 16.17 | 16.24 |
| | MCS9 | 16.24 | 16.12 | 16.20 |
| | MCS10 | 16.20 | 16.10 | 16.18 |
| | MCS11 | 16.23 | 16.90 | 16.15 |
| | MCS12 | 16.18 | 16.04 | 16.14 |
| | MCS13 | 16.12 | 16.06 | 16.12 |
| | MCS14 | 16.11 | 16.02 | 16.06 |
| MCS15 | 16.14 | 16.01 | 16.04 | |



| Mode | Date rata(Mbps) | Test results(dBm) CONDUCTED AV | | |
|-------------------------------|-----------------|-----------------------------------|-------------------|--------------------|
| | | 2422MHz (CH03) | 2437MHz (CH06) | 2452 MHz (CH09) |
| 802.11n HT40 ANT 0 + ANT 1 | MCS0 | 19.71 | 19.68 | 19.69 |
| | MCS1 | 19.63 | 19.60 | 19.63 |
| | MCS2 | 19.65 | 19.61 | 19.61 |
| | MCS3 | 19.63 | 19.56 | 19.60 |
| | MCS4 | 19.57 | 19.53 | 19.57 |
| | MCS5 | 19.57 | 19.50 | 19.53 |
| | MCS6 | 19.53 | 19.47 | 19.49 |
| | MCS7 | 19.49 | 19.44 | 19.49 |
| | MCS8 | 19.46 | 19.42 | 19.47 |
| | MCS9 | 19.45 | 19.39 | 19.44 |
| | MCS10 | 19.41 | 19.34 | 19.41 |
| | MCS11 | 19.42 | 19.73 | 19.38 |
| | MCS12 | 19.36 | 19.31 | 19.34 |
| | MCS13 | 19.35 | 19.30 | 19.32 |
| | MCS14 | 19.31 | 19.27 | 19.27 |
| MCS15 | 19.31 | 19.25 | 19.24 | |



| Mode | Date rata (Mbps) | Test results(dBm) | | | | | | | |
|---------|------------------|-------------------|-------|-------|-------|-------|-------|-------|-------|
| | | CONDUCTED AV | | | | | | | |
| | | 5180 | 5200 | 5220 | 5240 | 5745 | 5765 | 5785 | 5825 |
| 802.11A | 6 | 14.88 | 14.92 | 14.76 | 14.93 | 14.85 | 14.94 | 14.76 | 14.94 |
| | 9 | 14.85 | 14.87 | 14.74 | 14.82 | 14.78 | 14.9 | 14.72 | 14.9 |
| | 12 | 14.81 | 14.85 | 17.73 | 14.75 | 14.74 | 14.86 | 14.65 | 14.85 |
| | 18 | 14.75 | 14.86 | 14.75 | 14.74 | 14.72 | 14.82 | 14.62 | 14.82 |
| | 24 | 14.72 | 14.82 | 14.66 | 14.72 | 14.65 | 14.8 | 14.61 | 14.81 |
| | 36 | 14.76 | 14.8 | 14.64 | 14.66 | 14.62 | 14.75 | 14.58 | 14.76 |
| | 48 | 14.7 | 14.76 | 14.62 | 14.63 | 14.58 | 14.74 | 14.53 | 14.74 |
| | 54 | 14.65 | 14.74 | 14.61 | 14.59 | 14.55 | 14.72 | 14.5 | 14.67 |

| Mode | Date rata (Mbps) | Test results(dBm) | | | | | | | |
|--------------------------|------------------|-------------------|-------|-------|-------|-------|-------|-------|-------|
| | | CONDUCTED AV | | | | | | | |
| | | 5180 | 5200 | 5220 | 5240 | 5745 | 5765 | 5785 | 5825 |
| 802.11N HT20 ANT 0 | MCS0 | 10.85 | 10.93 | 10.82 | 10.95 | 10.97 | 10.81 | 10.95 | 10.86 |
| | MCS1 | 10.82 | 10.86 | 10.79 | 10.91 | 10.94 | 10.75 | 10.92 | 10.82 |
| | MCS2 | 10.8 | 10.85 | 10.75 | 10.88 | 10.92 | 10.77 | 10.88 | 10.83 |
| | MCS3 | 10.76 | 10.82 | 10.72 | 10.85 | 10.87 | 10.73 | 10.82 | 10.79 |
| | MCS4 | 10.74 | 10.76 | 10.68 | 10.86 | 10.85 | 10.65 | 10.85 | 10.76 |
| | MCS5 | 10.71 | 10.78 | 10.67 | 10.82 | 10.83 | 10.64 | 10.8 | 10.74 |
| | MCS6 | 10.66 | 10.74 | 10.63 | 10.81 | 10.8 | 10.62 | 10.76 | 10.72 |
| | MCS7 | 10.65 | 10.72 | 10.61 | 10.75 | 10.79 | 10.59 | 10.75 | 10.65 |
| | MCS8 | 10.62 | 10.7 | 10.58 | 10.78 | 10.75 | 10.55 | 10.71 | 10.62 |
| | MCS9 | 10.63 | 10.64 | 10.59 | 10.76 | 10.76 | 10.53 | 10.64 | 10.64 |
| | MCS10 | 10.61 | 10.63 | 10.54 | 10.72 | 10.74 | 10.51 | 10.65 | 10.6 |
| | MCS11 | 10.58 | 10.68 | 10.52 | 10.71 | 10.72 | 10.47 | 10.62 | 10.59 |
| | MCS12 | 10.57 | 10.6 | 10.53 | 10.73 | 10.71 | 10.46 | 10.6 | 10.52 |
| | MCS13 | 10.54 | 10.59 | 10.5 | 10.69 | 10.69 | 10.42 | 10.59 | 10.54 |
| | MCS14 | 10.52 | 10.52 | 10.46 | 10.66 | 10.64 | 10.41 | 10.56 | 10.53 |
| MCS15 | 10.5 | 10.51 | 10.42 | 10.64 | 10.63 | 10.37 | 10.52 | 10.47 | |



| Mode | Date rata (Mbps) | Test results(dBm) | | | | | | | |
|--------------------------|---------------------|-------------------|-------|-------|-------|-------|-------|-------|-------|
| | | CONDUCTED AV | | | | | | | |
| | | 5180 | 5200 | 5220 | 5240 | 5745 | 5765 | 5785 | 5825 |
| 802.11N HT20 ANT 1 | MCS0 | 10.91 | 10.95 | 10.86 | 10.84 | 10.87 | 10.85 | 10.91 | 10.97 |
| | MCS1 | 10.85 | 10.92 | 10.82 | 10.8 | 10.85 | 10.82 | 10.86 | 10.93 |
| | MCS2 | 10.82 | 10.85 | 10.79 | 10.76 | 10.82 | 10.76 | 10.85 | 10.9 |
| | MCS3 | 10.8 | 10.84 | 10.75 | 10.72 | 10.75 | 10.74 | 10.82 | 10.82 |
| | MCS4 | 10.64 | 10.82 | 10.76 | 10.71 | 10.76 | 10.72 | 10.73 | 10.85 |
| | MCS5 | 10.62 | 10.76 | 10.74 | 10.67 | 10.71 | 10.66 | 10.72 | 10.76 |
| | MCS6 | 10.61 | 10.74 | 10.65 | 10.66 | 10.65 | 10.63 | 10.7 | 10.74 |
| | MCS7 | 10.58 | 10.72 | 10.63 | 10.62 | 10.64 | 10.6 | 10.65 | 10.72 |
| | MCS8 | 10.54 | 10.69 | 10.66 | 10.63 | 10.62 | 10.58 | 10.62 | 10.68 |
| | MCS9 | 10.53 | 10.64 | 10.58 | 10.52 | 10.58 | 10.54 | 10.64 | 10.66 |
| | MCS10 | 10.49 | 10.62 | 10.52 | 10.48 | 10.54 | 10.52 | 10.48 | 10.62 |
| | MCS11 | 10.44 | 10.55 | 10.46 | 10.42 | 10.5 | 10.5 | 10.45 | 10.6 |
| | MCS12 | 10.38 | 10.53 | 10.43 | 10.37 | 10.46 | 10.46 | 10.43 | 10.55 |
| | MCS13 | 10.35 | 10.51 | 10.44 | 10.4 | 10.42 | 10.48 | 10.4 | 10.51 |
| | MCS14 | 10.32 | 10.45 | 10.37 | 10.37 | 10.4 | 10.45 | 10.35 | 10.46 |
| MCS15 | 10.31 | 10.44 | 10.35 | 10.35 | 10.35 | 10.43 | 10.31 | 10.45 | |



| Mode | Date rata (Mbps) | Test results(dBm) | | | | | | | |
|--------------------------|---------------------|-------------------|-------|-------|-------|-------|-------|-------|-------|
| | | CONDUCTED AV | | | | | | | |
| | | 5180 | 5200 | 5220 | 5240 | 5745 | 5765 | 5785 | 5825 |
| 802.11N HT20 Total | MCS0 | 13.89 | 13.95 | 13.85 | 13.91 | 13.93 | 13.84 | 13.94 | 13.93 |
| | MCS1 | 13.85 | 13.90 | 13.82 | 13.87 | 13.91 | 13.80 | 13.90 | 13.89 |
| | MCS2 | 13.82 | 13.86 | 13.78 | 13.83 | 13.88 | 13.78 | 13.88 | 13.88 |
| | MCS3 | 13.79 | 13.84 | 13.75 | 13.80 | 13.82 | 13.75 | 13.83 | 13.82 |
| | MCS4 | 13.70 | 13.80 | 13.73 | 13.80 | 13.82 | 13.70 | 13.80 | 13.82 |
| | MCS5 | 13.68 | 13.78 | 13.72 | 13.76 | 13.78 | 13.66 | 13.77 | 13.76 |
| | MCS6 | 13.65 | 13.75 | 13.65 | 13.75 | 13.74 | 13.64 | 13.74 | 13.74 |
| | MCS7 | 13.63 | 13.73 | 13.63 | 13.70 | 13.73 | 13.61 | 13.71 | 13.70 |
| | MCS8 | 13.59 | 13.71 | 13.63 | 13.72 | 13.70 | 13.58 | 13.68 | 13.66 |
| | MCS9 | 13.59 | 13.65 | 13.60 | 13.65 | 13.68 | 13.55 | 13.65 | 13.66 |
| | MCS10 | 13.56 | 13.64 | 13.54 | 13.61 | 13.65 | 13.53 | 13.58 | 13.62 |
| | MCS11 | 13.52 | 13.63 | 13.50 | 13.58 | 13.62 | 13.50 | 13.55 | 13.61 |
| | MCS12 | 13.49 | 13.58 | 13.49 | 13.56 | 13.60 | 13.47 | 13.53 | 13.55 |
| | MCS13 | 13.46 | 13.56 | 13.48 | 13.56 | 13.57 | 13.46 | 13.51 | 13.54 |
| | MCS14 | 13.43 | 13.50 | 13.43 | 13.53 | 13.53 | 13.44 | 13.47 | 13.51 |
| MCS15 | 13.42 | 13.49 | 13.40 | 13.51 | 13.50 | 13.41 | 13.43 | 13.47 | |



| Mode | Date rata (Mbps) | Test results(dBm) | | | |
|--------------------------|---------------------|-------------------|-------|-------|-------|
| | | CONDUCTED AV | | | |
| | | 5190 | 5230 | 5755 | 5795 |
| 802.11N HT40 ANT 0 | MCS0 | 10.95 | 10.83 | 10.84 | 10.76 |
| | MCS1 | 10.94 | 10.8 | 10.79 | 10.72 |
| | MCS2 | 10.87 | 10.76 | 10.72 | 10.69 |
| | MCS3 | 10.85 | 10.74 | 10.74 | 10.64 |
| | MCS4 | 10.82 | 10.75 | 10.65 | 10.63 |
| | MCS5 | 10.8 | 10.72 | 10.62 | 10.59 |
| | MCS6 | 10.75 | 10.65 | 10.61 | 10.52 |
| | MCS7 | 10.74 | 10.63 | 10.59 | 10.54 |
| | MCS8 | 10.71 | 10.64 | 10.56 | 10.46 |
| | MCS9 | 10.65 | 10.59 | 10.54 | 10.45 |
| | MCS10 | 10.62 | 10.52 | 10.51 | 10.41 |
| | MCS11 | 10.58 | 10.48 | 10.47 | 10.35 |
| | MCS12 | 10.54 | 10.45 | 10.43 | 10.34 |
| | MCS13 | 10.53 | 10.44 | 10.4 | 10.38 |
| | MCS14 | 10.48 | 10.41 | 10.35 | 10.3 |
| MCS15 | 10.44 | 10.38 | 10.33 | 10.25 | |



| Mode | Date rata (Mbps) | Test results(dBm) | | | |
|--------------------------|---------------------|-------------------|-------|-------|-------|
| | | CONDUCTED AV | | | |
| | | 5190 | 5230 | 5755 | 5795 |
| 802.11N HT40 ANT 1 | MCS0 | 10.94 | 10.99 | 10.86 | 10.95 |
| | MCS1 | 10.85 | 10.85 | 10.82 | 10.9 |
| | MCS2 | 10.82 | 10.83 | 10.76 | 10.87 |
| | MCS3 | 10.81 | 10.81 | 10.78 | 10.85 |
| | MCS4 | 10.76 | 10.76 | 10.72 | 10.86 |
| | MCS5 | 10.74 | 10.75 | 10.7 | 10.82 |
| | MCS6 | 10.72 | 10.72 | 10.64 | 10.8 |
| | MCS7 | 10.65 | 10.65 | 10.65 | 10.76 |
| | MCS8 | 10.62 | 10.63 | 10.63 | 10.74 |
| | MCS9 | 10.59 | 10.69 | 10.59 | 10.71 |
| | MCS10 | 10.53 | 10.58 | 10.52 | 10.68 |
| | MCS11 | 10.51 | 10.52 | 10.55 | 10.65 |
| | MCS12 | 10.46 | 10.46 | 10.46 | 10.62 |
| | MCS13 | 10.42 | 10.44 | 10.42 | 10.59 |
| | MCS14 | 10.38 | 10.41 | 10.43 | 10.55 |
| MCS15 | 10.35 | 10.38 | 10.35 | 10.51 | |



| Mode | Date rata (Mbps) | Test results(dBm) | | | |
|--------------------------|---------------------|-------------------|-------|-------|-------|
| | | CONDUCTED AV | | | |
| | | 5190 | 5230 | 5755 | 5795 |
| 802.11N HT40 Total | MCS0 | 13.96 | 13.92 | 13.86 | 13.87 |
| | MCS1 | 13.91 | 36.35 | 36.23 | 36.18 |
| | MCS2 | 13.86 | 36.10 | 35.82 | 35.85 |
| | MCS3 | 13.84 | 35.96 | 35.88 | 35.72 |
| | MCS4 | 13.80 | 35.71 | 35.33 | 35.55 |
| | MCS5 | 13.78 | 35.55 | 35.17 | 35.28 |
| | MCS6 | 13.75 | 35.22 | 34.90 | 34.88 |
| | MCS7 | 13.71 | 34.79 | 34.68 | 34.85 |
| | MCS8 | 13.68 | 34.68 | 34.50 | 34.54 |
| | MCS9 | 13.63 | 34.63 | 34.50 | 34.32 |
| | MCS10 | 13.59 | 34.00 | 33.95 | 33.96 |
| | MCS11 | 13.56 | 33.69 | 33.77 | 33.80 |
| | MCS12 | 13.51 | 33.33 | 33.28 | 33.47 |
| | MCS13 | 13.49 | 33.15 | 33.05 | 33.38 |
| | MCS14 | 13.44 | 32.89 | 32.87 | 33.11 |
| | MCS15 | 13.41 | 32.67 | 32.54 | 32.68 |



| Mode | Data rate (Mbps) | Test results(dBm) | | | | | | | |
|---------------------------|---------------------|-------------------|-------|-------|-------|-------|-------|-------|-------|
| | | CONDUCTED AV | | | | | | | |
| | | 5180 | 5200 | 5220 | 5240 | 5745 | 5765 | 5785 | 5825 |
| 802.11AC HT20 ANT 0 | MCS0NSS 1 | 10.79 | 10.87 | 10.94 | 10.92 | 10.97 | 10.79 | 10.88 | 10.96 |
| | MCS1NSS 1 | 10.76 | 10.85 | 10.9 | 10.87 | 10.92 | 10.75 | 10.82 | 10.92 |
| | MCS2NSS 1 | 10.72 | 10.81 | 10.86 | 10.86 | 10.88 | 10.72 | 10.8 | 10.91 |
| | MCS3NSS 1 | 10.71 | 10.73 | 10.84 | 10.82 | 10.85 | 10.71 | 10.72 | 10.82 |
| | MCS4NSS 1 | 10.65 | 10.71 | 10.87 | 10.85 | 10.84 | 10.66 | 10.75 | 10.83 |
| | MCS5NSS 1 | 10.66 | 10.66 | 10.82 | 10.76 | 10.82 | 10.63 | 10.68 | 10.76 |
| | MCS6NSS 1 | 10.62 | 10.64 | 10.75 | 10.74 | 10.76 | 10.61 | 10.65 | 10.72 |
| | MCS7NSS 1 | 10.6 | 10.62 | 10.76 | 10.75 | 10.72 | 10.58 | 10.66 | 10.73 |
| | MCS8NSS 1 | 10.53 | 10.59 | 10.72 | 10.72 | 10.65 | 10.57 | 10.62 | 10.67 |
| | MCS0NSS 2 | 10.55 | 10.55 | 10.7 | 10.66 | 10.63 | 10.52 | 10.58 | 10.64 |
| | MCS1NSS 2 | 10.51 | 10.52 | 10.68 | 10.68 | 10.61 | 10.49 | 10.59 | 10.62 |
| | MCS2NSS 2 | 10.48 | 10.5 | 10.64 | 10.62 | 10.52 | 40.42 | 10.53 | 10.58 |
| | MCS3NSS 2 | 10.45 | 10.46 | 10.62 | 10.61 | 10.55 | 10.38 | 10.52 | 10.54 |
| | MCS4NSS 2 | 10.43 | 10.4 | 10.63 | 10.57 | 10.48 | 10.4 | 10.54 | 10.52 |
| | MCS5NSS 2 | 10.41 | 10.35 | 10.58 | 10.56 | 10.46 | 10.36 | 10.49 | 10.5 |
| | MCS6NSS 2 | 10.38 | 10.38 | 10.55 | 10.5 | 10.45 | 10.35 | 10.46 | 10.46 |
| MCS7NSS 2 | 10.35 | 10.32 | 10.54 | 10.45 | 10.43 | 10.32 | 10.45 | 10.4 | |
| MCS8NSS 2 | 10.32 | 10.03 | 10.53 | 10.43 | 10.41 | 10.3 | 10.42 | 10.41 | |



| Mode | Data rate (Mbps) | Test results(dBm) | | | | | | | |
|---------------------------|---------------------|-------------------|-------|-------|-------|-------|-------|-------|-------|
| | | CONDUCTED AV | | | | | | | |
| | | 5180 | 5200 | 5220 | 5240 | 5745 | 5765 | 5785 | 5825 |
| 802.11AC HT20 ANT 1 | MCS0NSS 1 | 13.86 | 13.86 | 13.91 | 13.94 | 13.90 | 13.84 | 13.92 | 13.93 |
| | MCS1NSS 1 | 13.80 | 13.84 | 13.86 | 13.89 | 13.85 | 13.81 | 13.87 | 13.90 |
| | MCS2NSS 1 | 13.77 | 13.79 | 13.81 | 13.85 | 13.82 | 13.78 | 13.84 | 13.89 |
| | MCS3NSS 1 | 13.74 | 13.76 | 13.79 | 13.80 | 13.76 | 13.75 | 13.79 | 13.82 |
| | MCS4NSS 1 | 13.70 | 13.72 | 13.80 | 13.81 | 13.75 | 13.73 | 13.80 | 13.80 |
| | MCS5NSS 1 | 13.69 | 13.68 | 13.75 | 13.75 | 13.72 | 13.69 | 13.75 | 13.77 |
| | MCS6NSS 1 | 13.65 | 13.65 | 13.73 | 13.71 | 13.65 | 13.65 | 13.71 | 13.73 |
| | MCS7NSS 1 | 13.64 | 13.63 | 13.70 | 13.71 | 13.66 | 13.62 | 13.71 | 13.73 |
| | MCS8NSS 1 | 13.54 | 13.60 | 13.67 | 13.68 | 13.58 | 13.61 | 13.68 | 13.67 |
| | MCS0NSS 2 | 13.54 | 13.55 | 13.65 | 13.64 | 13.56 | 13.56 | 13.63 | 13.65 |
| | MCS1NSS 2 | 13.51 | 13.53 | 13.62 | 13.64 | 13.53 | 13.55 | 13.63 | 13.65 |
| | MCS2NSS 2 | 13.48 | 13.50 | 13.60 | 13.59 | 13.47 | 40.42 | 13.58 | 13.56 |
| | MCS3NSS 2 | 13.45 | 13.47 | 13.52 | 13.57 | 13.46 | 13.46 | 13.57 | 13.55 |
| | MCS4NSS 2 | 13.43 | 13.42 | 13.51 | 13.54 | 13.44 | 13.44 | 13.55 | 13.51 |
| | MCS5NSS 2 | 13.39 | 13.38 | 13.48 | 13.52 | 13.40 | 13.41 | 13.51 | 13.49 |
| | MCS6NSS 2 | 13.36 | 13.39 | 13.44 | 13.49 | 13.38 | 13.40 | 13.47 | 13.46 |
| | MCS7NSS 2 | 13.37 | 13.35 | 13.39 | 13.45 | 13.35 | 13.36 | 13.45 | 13.41 |
| | MCS8NSS 2 | 13.33 | 13.16 | 13.40 | 13.43 | 13.35 | 13.33 | 13.41 | 13.40 |



| Mode | Data rate (Mbps) | Test results(dBm) | | | | | | | |
|---------------------------|---------------------|-------------------|-------|-------|-------|-------|-------|-------|-------|
| | | CONDUCTED AV | | | | | | | |
| | | 5180 | 5200 | 5220 | 5240 | 5745 | 5765 | 5785 | 5825 |
| 802.11AC HT20 Total | MCS0NSS 1 | 10.9 | 10.82 | 10.85 | 10.93 | 10.8 | 10.87 | 10.94 | 10.88 |
| | MCS1NSS 1 | 10.82 | 10.81 | 10.8 | 10.89 | 10.76 | 10.85 | 10.9 | 10.85 |
| | MCS2NSS 1 | 10.79 | 10.75 | 10.74 | 10.82 | 10.74 | 10.82 | 10.85 | 10.84 |
| | MCS3NSS 1 | 10.75 | 10.76 | 10.72 | 10.76 | 10.65 | 10.76 | 10.84 | 10.8 |
| | MCS4NSS 1 | 10.72 | 10.71 | 10.7 | 10.74 | 10.63 | 10.77 | 10.82 | 10.75 |
| | MCS5NSS 1 | 10.7 | 10.68 | 10.65 | 10.72 | 10.59 | 10.72 | 10.79 | 10.76 |
| | MCS6NSS 1 | 10.65 | 10.63 | 10.68 | 10.65 | 10.52 | 10.66 | 10.75 | 10.72 |
| | MCS7NSS 1 | 10.66 | 10.62 | 10.62 | 10.64 | 10.57 | 10.64 | 10.74 | 10.7 |
| | MCS8NSS 1 | 10.53 | 10.58 | 10.6 | 10.62 | 10.48 | 10.63 | 10.72 | 10.64 |
| | MCS0NSS 2 | 10.5 | 10.53 | 10.58 | 10.59 | 10.46 | 10.58 | 10.66 | 10.63 |
| | MCS1NSS 2 | 10.48 | 10.51 | 10.54 | 10.57 | 10.42 | 10.59 | 10.64 | 10.65 |
| | MCS2NSS 2 | 10.46 | 10.48 | 10.53 | 10.53 | 10.4 | 10.52 | 10.61 | 10.52 |
| | MCS3NSS 2 | 10.42 | 10.45 | 10.39 | 10.51 | 10.35 | 10.51 | 10.59 | 10.54 |
| | MCS4NSS 2 | 10.4 | 10.42 | 10.37 | 10.49 | 10.37 | 10.45 | 10.53 | 10.48 |
| | MCS5NSS 2 | 10.35 | 10.38 | 10.35 | 10.46 | 10.32 | 10.44 | 10.51 | 10.46 |
| | MCS6NSS 2 | 10.32 | 10.37 | 10.3 | 10.45 | 10.28 | 10.42 | 10.45 | 10.43 |
| MCS7NSS 2 | 10.36 | 10.35 | 10.22 | 10.42 | 10.25 | 10.38 | 10.42 | 10.4 | |
| MCS8NSS 2 | 10.31 | 10.26 | 10.24 | 10.4 | 10.26 | 10.34 | 10.37 | 10.37 | |



| Mode | Date rata (Mbps) | Test results(dBm) | | | |
|---------------------------|---------------------|-------------------|-------|-------|-------|
| | | CONDUCTED AV | | | |
| | | 5190 | 5230 | 5755 | 5795 |
| 802.11AC HT40 ANT 0 | MCS0NSS1 | 10.89 | 10.91 | 10.98 | 10.95 |
| | MCS1NSS1 | 10.85 | 10.85 | 10.91 | 10.9 |
| | MCS2NSS1 | 10.8 | 10.9 | 10.87 | 10.82 |
| | MCS3NSS1 | 10.74 | 10.82 | 10.82 | 10.83 |
| | MCS4NSS1 | 10.72 | 10.76 | 10.85 | 10.76 |
| | MCS5NSS1 | 10.7 | 10.75 | 10.86 | 10.74 |
| | MCS6NSS1 | 10.69 | 10.72 | 10.81 | 10.72 |
| | MCS7NSS1 | 10.62 | 10.71 | 10.72 | 10.62 |
| | MCS8NSS1 | 10.65 | 10.65 | 10.7 | 10.65 |
| | MCS9NSS1 | 10.67 | 10.63 | 10.73 | 10.6 |
| | MCS0NSS2 | 10.58 | 10.58 | 10.64 | 10.57 |
| | MCS1NSS2 | 10.53 | 10.56 | 10.66 | 10.54 |
| | MCS2NSS2 | 10.54 | 10.52 | 10.62 | 10.51 |
| | MCS3NSS2 | 10.49 | 10.46 | 10.58 | 10.42 |
| | MCS4NSS2 | 10.46 | 10.43 | 10.54 | 10.38 |
| | MCS5NSS2 | 10.42 | 10.41 | 10.51 | 10.35 |
| | MCS6NSS2 | 10.47 | 10.38 | 10.46 | 10.32 |
| | MCS7NSS2 | 10.4 | 10.39 | 10.49 | 10.29 |
| | MCS8NSS2 | 10.38 | 10.35 | 10.43 | 10.25 |
| MCS9NSS2 | 10.33 | 10.37 | 10.41 | 10.26 | |



| Mode | Date rata (Mbps) | Test results(dBm) | | | |
|---------------------------|---------------------|-------------------|-------|-------|-------|
| | | CONDUCTED AV | | | |
| | | 5190 | 5230 | 5755 | 5795 |
| 802.11AC HT40 ANT 1 | MCS0NSS1 | 10.88 | 10.99 | 10.89 | 10.76 |
| | MCS1NSS1 | 10.85 | 10.95 | 10.84 | 10.74 |
| | MCS2NSS1 | 10.83 | 10.92 | 10.82 | 10.65 |
| | MCS3NSS1 | 10.79 | 10.87 | 10.86 | 10.67 |
| | MCS4NSS1 | 10.76 | 10.85 | 10.78 | 10.66 |
| | MCS5NSS1 | 10.75 | 10.8 | 10.75 | 10.62 |
| | MCS6NSS1 | 10.72 | 10.76 | 10.74 | 10.63 |
| | MCS7NSS1 | 10.69 | 10.74 | 10.72 | 10.59 |
| | MCS8NSS1 | 10.66 | 10.72 | 10.65 | 10.55 |
| | MCS9NSS1 | 10.67 | 10.7 | 10.67 | 10.52 |
| | MCS0NSS2 | 10.62 | 10.63 | 10.63 | 10.48 |
| | MCS1NSS2 | 10.58 | 10.64 | 10.6 | 10.43 |
| | MCS2NSS2 | 10.55 | 10.61 | 10.58 | 10.37 |
| | MCS3NSS2 | 10.54 | 10.52 | 10.55 | 10.35 |
| | MCS4NSS2 | 10.49 | 10.55 | 10.56 | 10.32 |
| | MCS5NSS2 | 10.46 | 10.53 | 10.52 | 10.3 |
| | MCS6NSS2 | 10.43 | 10.46 | 10.46 | 10.29 |
| | MCS7NSS2 | 10.4 | 10.42 | 10.48 | 10.28 |
| | MCS8NSS2 | 10.35 | 10.44 | 10.45 | 10.25 |
| MCS9NSS2 | 10.34 | 10.4 | 10.42 | 10.24 | |



| Mode | Date rata (Mbps) | Test results(dBm) | | | |
|---------------------------|---------------------|-------------------|-------|-------|-------|
| | | CONDUCTED AV | | | |
| | | 5190 | 5230 | 5755 | 5795 |
| 802.11AC HT40 Total | MCS0NSS1 | 13.90 | 13.96 | 13.95 | 13.87 |
| | MCS1NSS1 | 13.86 | 13.91 | 13.89 | 13.83 |
| | MCS2NSS1 | 13.83 | 13.92 | 13.86 | 13.75 |
| | MCS3NSS1 | 13.78 | 13.86 | 13.85 | 13.76 |
| | MCS4NSS1 | 13.75 | 13.82 | 13.83 | 13.72 |
| | MCS5NSS1 | 13.74 | 13.79 | 13.82 | 13.69 |
| | MCS6NSS1 | 13.72 | 13.75 | 13.79 | 13.69 |
| | MCS7NSS1 | 13.67 | 13.74 | 13.73 | 13.62 |
| | MCS8NSS1 | 13.67 | 13.70 | 13.69 | 13.61 |
| | MCS9NSS1 | 13.68 | 13.68 | 13.71 | 13.57 |
| | MCS0NSS2 | 13.61 | 13.62 | 13.65 | 13.54 |
| | MCS1NSS2 | 13.57 | 13.61 | 13.64 | 13.50 |
| | MCS2NSS2 | 13.56 | 13.58 | 13.61 | 13.45 |
| | MCS3NSS2 | 13.53 | 13.50 | 13.58 | 13.40 |
| | MCS4NSS2 | 13.49 | 13.50 | 13.56 | 13.36 |
| | MCS5NSS2 | 13.45 | 13.48 | 13.53 | 13.34 |
| | MCS6NSS2 | 13.46 | 13.43 | 13.47 | 13.32 |
| | MCS7NSS2 | 13.41 | 13.42 | 13.50 | 13.30 |
| | MCS8NSS2 | 13.38 | 13.41 | 13.45 | 13.26 |
| | MCS9NSS2 | 13.35 | 13.40 | 13.43 | 13.26 |



| Mode | Date rata (Mbps) | Test results(dBm) | |
|---------------------------|---------------------|-------------------|-------|
| | | CONDUCTED AV | |
| | | 5210 | 5775 |
| 802.11AC HT80 ANT 0 | MCS0NSS1 | 10.94 | 10.76 |
| | MCS1NSS1 | 10.9 | 10.72 |
| | MCS2NSS1 | 10.84 | 10.75 |
| | MCS3NSS1 | 10.82 | 10.62 |
| | MCS4NSS1 | 10.76 | 10.6 |
| | MCS5NSS1 | 10.71 | 10.58 |
| | MCS6NSS1 | 10.72 | 10.54 |
| | MCS7NSS1 | 10.68 | 10.52 |
| | MCS8NSS1 | 10.67 | 10.49 |
| | MCS9NSS1 | 10.62 | 10.46 |
| | MCS0NSS2 | 10.56 | 10.45 |
| | MCS1NSS2 | 10.52 | 10.43 |
| | MCS2NSS2 | 10.49 | 10.38 |
| | MCS3NSS2 | 10.45 | 10.35 |
| | MCS4NSS2 | 10.42 | 10.36 |
| | MCS5NSS2 | 10.35 | 10.28 |
| | MCS6NSS2 | 10.38 | 10.3 |
| | MCS7NSS2 | 10.35 | 10.25 |
| | MCS8NSS2 | 10.28 | 10.26 |
| | MCS9NSS2 | 10.29 | 10.21 |



| Mode | Date rata (Mbps) | Test results(dBm) | |
|---------------------------|---------------------|-------------------|-------|
| | | CONDUCTED AV | |
| | | 5210 | 5775 |
| 802.11AC HT80 ANT 1 | MCS0NSS1 | 10.99 | 10.84 |
| | MCS1NSS1 | 10.89 | 10.8 |
| | MCS2NSS1 | 10.85 | 10.76 |
| | MCS3NSS1 | 10.86 | 10.75 |
| | MCS4NSS1 | 10.82 | 10.74 |
| | MCS5NSS1 | 10.77 | 10.72 |
| | MCS6NSS1 | 10.75 | 10.65 |
| | MCS7NSS1 | 10.71 | 10.62 |
| | MCS8NSS1 | 10.65 | 10.66 |
| | MCS9NSS1 | 10.68 | 10.61 |
| | MCS0NSS2 | 10.62 | 10.58 |
| | MCS1NSS2 | 10.59 | 10.54 |
| | MCS2NSS2 | 10.53 | 10.56 |
| | MCS3NSS2 | 10.55 | 10.51 |
| | MCS4NSS2 | 10.48 | 10.46 |
| | MCS5NSS2 | 10.49 | 10.38 |
| | MCS6NSS2 | 10.46 | 10.35 |
| | MCS7NSS2 | 10.42 | 10.31 |
| | MCS8NSS2 | 10.4 | 10.29 |
| | MCS9NSS2 | 10.35 | 10.22 |



| Mode | Date rata (Mbps) | Test results(dBm) | |
|---------------------------|---------------------|-------------------|-------|
| | | CONDUCTED AV | |
| | | 5210 | 5775 |
| 802.11AC HT80 Total | MCS0NSS1 | 13.98 | 13.81 |
| | MCS1NSS1 | 13.91 | 13.77 |
| | MCS2NSS1 | 13.86 | 13.77 |
| | MCS3NSS1 | 13.85 | 13.70 |
| | MCS4NSS1 | 13.80 | 13.68 |
| | MCS5NSS1 | 13.75 | 13.66 |
| | MCS6NSS1 | 13.75 | 13.61 |
| | MCS7NSS1 | 13.71 | 13.58 |
| | MCS8NSS1 | 13.67 | 13.59 |
| | MCS9NSS1 | 13.66 | 13.55 |
| | MCS0NSS2 | 13.60 | 13.53 |
| | MCS1NSS2 | 13.57 | 13.50 |
| | MCS2NSS2 | 13.52 | 13.48 |
| | MCS3NSS2 | 13.51 | 13.44 |
| | MCS4NSS2 | 13.46 | 13.42 |
| | MCS5NSS2 | 13.43 | 13.34 |
| | MCS6NSS2 | 13.43 | 13.34 |
| | MCS7NSS2 | 13.40 | 13.29 |
| | MCS8NSS2 | 13.35 | 13.29 |
| | MCS9NSS2 | 13.33 | 13.23 |



8.2 SAR TEST RESULTS

| 802.11/b/g/n/a/ac | | | | | | | |
|-------------------|----------------|-------------------------|---------------|------------|---------------|---------------------|---------------|
| Test Position | Test Mode | Channel Frequency (MHz) | Distance (mm) | Duty Cycle | Drift±0.21dB | Limit SAR 1.6W/kg | |
| | | | | | Drift(dB) | Measured SAR (W/kg) | Graph Results |
| 1 | 802.11b | 2412 | 5 | 1:1 | 0.040 | 0.015 | 1 |
| 2 | 802.11b | 2412 | 10 | 1:1 | -0.090 | 0.179 | 2 |
| 1 | 802.11g | 2462 | 5 | 1:1 | 0.080 | 0.011 | 3 |
| 2 | 802.11g | 2462 | 10 | 1:1 | 0.030 | 0.095 | 4 |
| 1 | 802.11n HT20 | 2437 | 5 | 1:1 | 0.093 | 0.025 | 5 |
| 2 | 802.11n HT20 | 2437 | 10 | 1:1 | 0.140 | 0.047 | 6 |
| 1 | 802.11n HT40 | 2422 | 5 | 1:1 | 0.060 | 0.005 | 7 |
| 2 | 802.11n HT40 | 2422 | 10 | 1:1 | 0.110 | 0.047 | 8 |
| 1 | 802.11a | 5200 | 5 | 1:1 | 0.140 | 0.080 | 9 |
| 2 | 802.11a | 5200 | 10 | 1:1 | 0.079 | 0.135 | 10 |
| 1 | 802.11a | 5785 | 5 | 1:1 | 0.060 | 0.021 | 11 |
| 2 | 802.11a | 5785 | 10 | 1:1 | 0.110 | 0.114 | 12 |
| 1 | 802.11ac HT80 | 5210 | 5 | 1:1 | 0.120 | 0.042 | 13 |
| 2 | 802.11ac HT80 | 5210 | 10 | 1:1 | 0.089 | 0.043 | 14 |
| 1 | 802.11ac HT80 | 5775 | 5 | 1:1 | 0.014 | 0.006 | 15 |
| 2 | 802.11ac HT80 | 5775 | 10 | 1:1 | 0.013 | 0.037 | 16 |

Note: 1.The value with boldface is the maximum SAR Value of each test band.

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3. KDB 248227-SAR is not required for 802.11g/n channels when the maximum average output power is less than 1/4dB higher than measured on the corresponding 802.11b channels.

4. KDB 248227-SAR is not required for 802.11a HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels

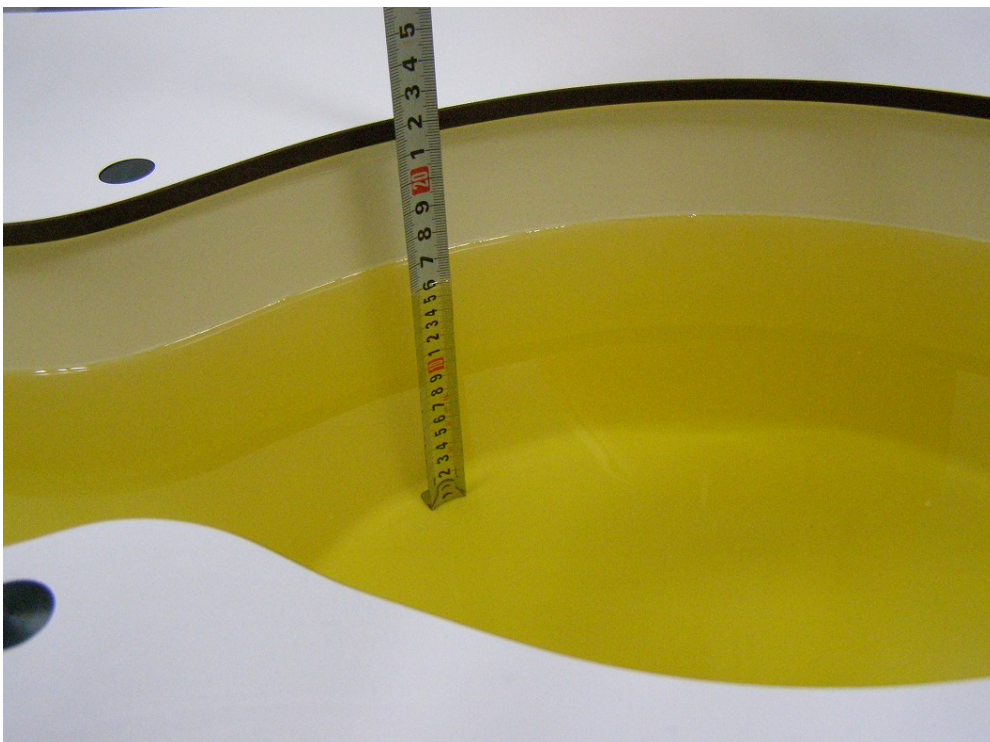
APPENDIX

1. Test Layout

Specific Absorption Rate Test Layout



Liquid depth in the flat Phantom (2450 MHz, 16cm depth)





2. System Check Results

Date/Time: 11/21/2013 10:49:28

Test Laboratory: Neutron Engineering Inc.

Body 2450MHz 1106

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

Communication System: UID 0, CW (0); Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ S/m; $\epsilon_r = 50.71$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at 2450MHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 16.7 W/kg

System Performance Check at 2450MHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

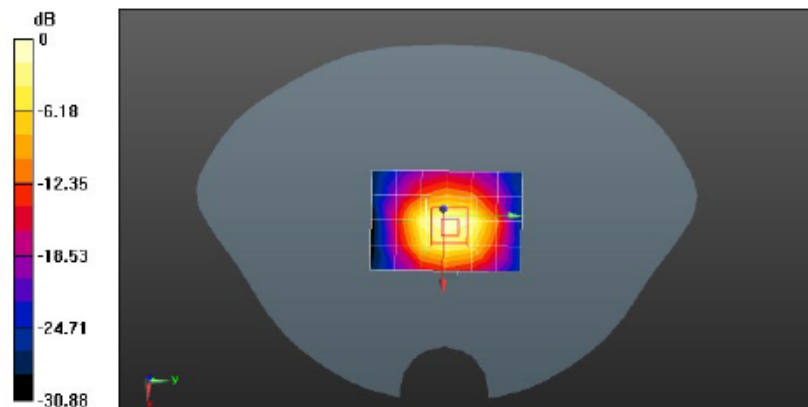
Measurement grid dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.816 V/m; Power Drift = -0.20 dB

Peak SAR (extrapolated) = 26.6 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.94 W/kg

Maximum value of SAR (measured) = 19.6 W/kg



0 dB = 16.7 W/kg = 12.22 dBW/kg



Test Laboratory: Neutron Engineering Inc.

System Performance Check- 5200MHz made by BTL 1111

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1160

Communication System: UID 0, CW (0); Frequency: 5200 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.38$ S/m; $\epsilon_r = 49.4$; $\rho = 996$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(4.69, 4.69, 4.69); Calibrated: 09/16/2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390, Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASYS2 52.8.7(1137); SEMCAD X 14.6.10(7164)

Configuration 2/System Check MSL 5200/Area Scan (6x6x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 12.6 W/kg

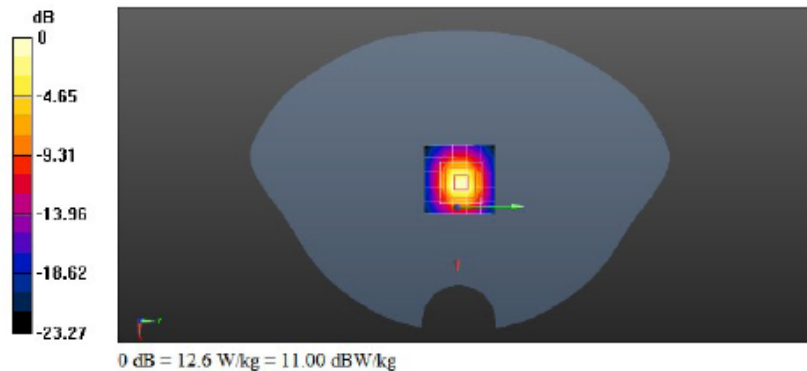
Configuration 2/System Check MSL 5200/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 38.290 V/m, Power Drift = 0.04 dB

Peak SAR (extrapolated) = 27.9 W/kg

SAR(1 g) = 7 W/kg; SAR(10 g) = 1.98 W/kg

Maximum value of SAR (measured) = 14.7 W/kg





Test Laboratory: Neutron Engineering Inc.

D5800MHz 1102

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1160

Communication System: UID 0, CW (0); Frequency: 5800 MHz

Medium parameters used: $f = 5800$ MHz; $\sigma = 6.22$ S/m; $\epsilon_r = 48.3$; $\rho = 996$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(4.19, 4.19, 4.19); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Configuration 2/System Check MSL 5800GHz/Area Scan (3x5x1): Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (measured) = 14.5 W/kg

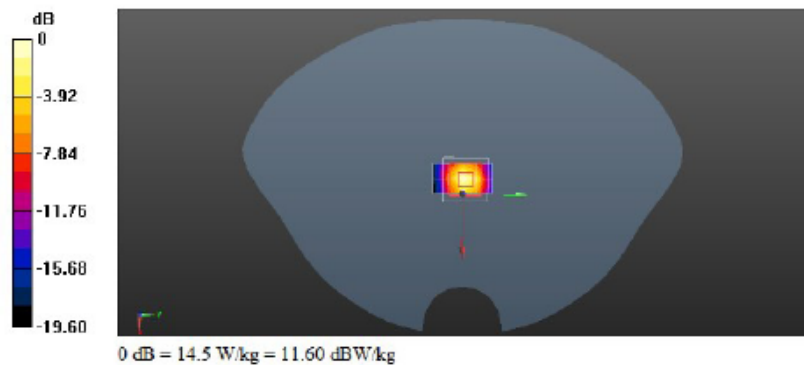
Configuration 2/System Check MSL 5800GHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 34.403 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 33.7 W/kg

SAR(1 g) = 7.22 W/kg; SAR(10 g) = 1.98 W/kg

Maximum value of SAR (measured) = 15.5 W/kg





3. Graph Results

Date/Time: 11/21/2013 10:42:02

Test Laboratory: Neutron Engineering Inc.

WF2190 802.11b mode ant B 5mm

DUT: WF2190-5mm; Type: Sample; Serial: 1307C140A

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS, 1Mbps) (0); Frequency: 2412 MHz

Medium parameters used (interpolated): $f = 2412$ MHz, $\sigma = 1.972$ S/m, $\epsilon_r = 52.676$, $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

802.11B CH1/802.11B CH1/Area Scan (111x91x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Reference Value = 0.809 V/m; Power Drift = 0.04 dB

Fast SAR: SAR(1 g) = 0.021 W/kg; SAR(10 g) = 0.00947 W/kg

Maximum value of SAR (interpolated) = 0.0354 W/kg

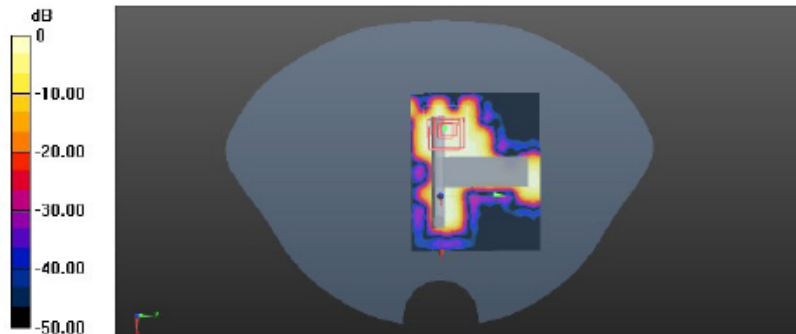
802.11B CH1/802.11B CH1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 0.809 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.0560 W/kg

SAR(1 g) = 0.015 W/kg; SAR(10 g) = 0.00634 W/kg

Maximum value of SAR (measured) = 0.0180 W/kg





Test Laboratory: Neutron Engineering Inc.

WF2190 802.11b mode ant B 10mm

DUT: WF2190-10mm; Type: Sample; Serial: 1307C140A

Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS, 1Mbps) (0); Frequency: 2412 MHz

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.972$ S/m; $\epsilon_r = 52.676$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

802.11b CH1 ant B 10mm/802.11b CH1 ant B 10mm/Area Scan (91x131x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Reference Value = 0.243 V/m; Power Drift = -0.09dB

Fast SAR: SAR(1 g) = 0.179 W/kg; SAR(10 g) = 0.091 W/kg

Maximum value of SAR (interpolated) = 0.262 W/kg

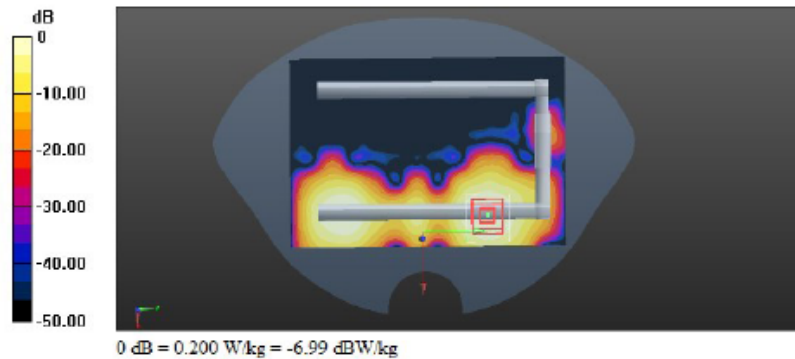
802.11b CH1 ant B 10mm/802.11b CH1 ant B 10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 0.243 V/m; Power Drift = -0.09dB

Peak SAR (extrapolated) = 0.329 W/kg

SAR(1 g) = 0.179 W/kg; SAR(10 g) = 0.090 W/kg

Maximum value of SAR (measured) = 0.200 W/kg





Test Laboratory: Neutron Engineering Inc.

WF2190 802.11g mode ant B 5mm

DUT: WF2190-5mm; Type: Sample; Serial: 1307C140A

Communication System: UID 0, IEEE 802.11g WiFi 2.4GHz(DSSS-OFDM,6Mbps) (0); Frequency: 2462 MHz

Medium parameters used (interpolated): $f = 2462$ MHz; $\sigma = 2.024$ S/m; $\epsilon_r = 52.576$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM I; Type: SAM; Serial: 1784
- DASYS2 52.8.7(1137); SEMCAD X 14.6.10(7164)

WF2190 802.11g CH11/802.11g CH11/Area Scan (71x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Reference Value = 0.469 V/m; Power Drift = 0.08 dB

Fast SAR: SAR(1 g) = 0.021 W/kg; SAR(10 g) = 0.00753 W/kg

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.0422 W/kg

WF2190 802.11g CH11/802.11g CH11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

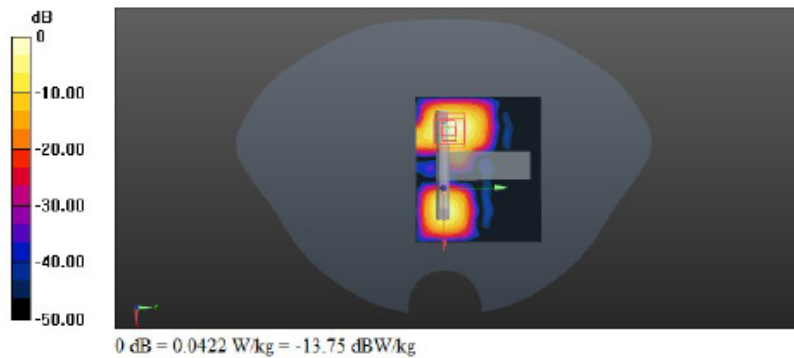
Reference Value = 0.469 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.0430 W/kg

SAR(1 g) = 0.011 W/kg; SAR(10 g) = 0.00354 W/kg

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.0109 W/kg





Test Laboratory: Neutron Engineering Inc.

WF2190 802.11g mode ant B 10mm

DUT: WF2190-10mm; Type: Sample; Serial: 1307C140A

Communication System: UID 0, IEEE 802.11g WiFi 2.4GHz(DSSS-OFDM,6Mbps) (0); Frequency: 2462 MHz

Medium parameters used (interpolated): $f = 2462$ MHz; $\sigma = 2.024$ S/m; $\epsilon_r = 52.576$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASYS2 52.8.7(1137); SEMCAD X 14.6.10(7164)

802.11b CH11 ant g 10mm/802.11b CH11 ant g 10mm/Area Scan (91x131x1): Interpolated grid: $dx=10.00$ mm, $dy=10.00$ mm

Reference Value = 0.00142 V/m; Power Drift = 0.03 dB

Fast SAR: SAR(1 g) = 0.121 W/kg; SAR(10 g) = 0.061 W/kg

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.184 W/kg

802.11b CH11 ant g 10mm/802.11b CH11 ant g 10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

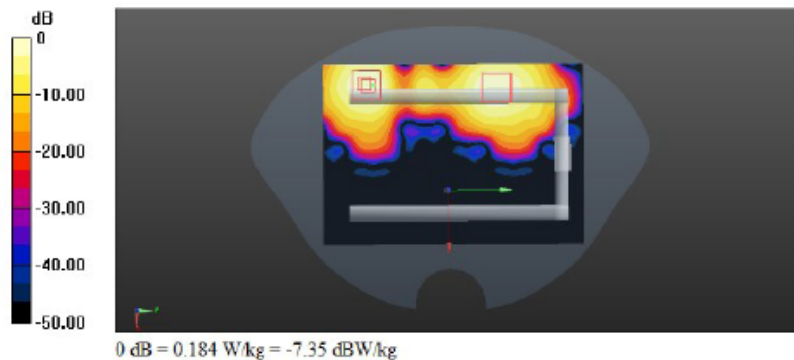
Reference Value = 0.00142 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.189 W/kg

SAR(1 g) = 0.095 W/kg; SAR(10 g) = 0.044 W/kg

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.114 W/kg





Test Laboratory: Neutron Engineering Inc.

WF2190 802.11n mode HT20 ant A+B 5mm

DUT: WF2190-5mm; Type: Sample; Serial: 1307C140A

Communication System: UID 0, IEEE 802.11n (HT20,6.5Mbps,BPSK) (0); Frequency: 2437 MHz
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.997$ S/m; $\epsilon_r = 52.626$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection), z = -9.0, 31.0
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASYS2 52.8.7(1137); SEMCAD X 14.6.10(7164)

802.11n CH6 5mm/802.11n CH6 ant A+B 5mm/Area Scan (81x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 1.138 V/m; Power Drift = 0.093 dB

Fast SAR: SAR(1 g) = 0.027 W/kg; SAR(10 g) = 0.012 W/kg

Maximum value of SAR (interpolated) = 0.0449 W/kg

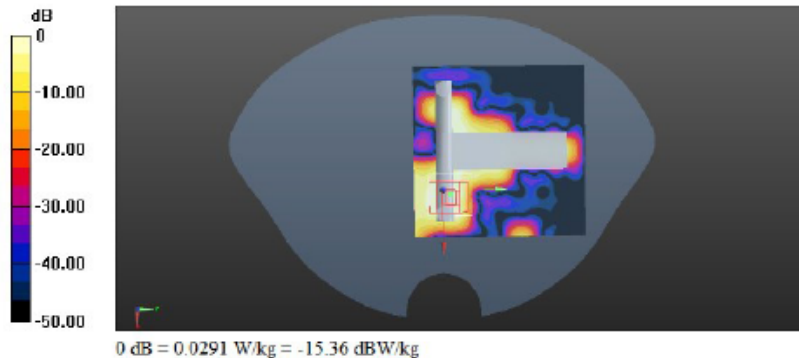
802.11n CH6 5mm/802.11n CH6 ant A+B 5mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.138 V/m; Power Drift = 0.093 dB

Peak SAR (extrapolated) = 0.0500 W/kg

SAR(1 g) = 0.025 W/kg; SAR(10 g) = 0.010 W/kg

Maximum value of SAR (measured) = 0.0291 W/kg





Test Laboratory: Neutron Engineering Inc.

WF2190 802.11n mode HT20 ant A+B 10mm

DUT: WF2190-10mm; Type: Sample; Serial: 1307C140A

Communication System: UID 0, IEEE 802.11n (HT20,6.5Mbps,BPSK) (0); Frequency: 2437 MHz
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.997$ S/m; $\epsilon_r = 52.626$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

802.11n CH6 10mm/802.11n CH6 ant A+B 10mm/Area Scan (91x131x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Reference Value = 0.215 V/m; Power Drift = 0.14 dB
Fast SAR: SAR(1 g) = 0.063 W/kg; SAR(10 g) = 0.029 W/kg
Maximum value of SAR (interpolated) = 0.0981 W/kg

802.11n CH6 10mm/802.11n CH6 ant A+B 10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 0.215V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.0860 W/kg
SAR(1 g) = 0.047 W/kg; SAR(10 g) = 0.022 W/kg
Maximum value of SAR (measured) = 0.0533 W/kg

