FCC TEST REPORT

For

ZONAR CONNECT

Model: ZONARCONNECT

Issued to

Zonar Systems Inc

18200 Cascade Ave South Suite 200
Seattle Washington United States

Issued by

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Report No.: T180821W01-SF

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2018/10/05	Initial Issue	ALL	Stella Chang
01	2018/10/31	Added KDB standard Revise Simulating Liquids Parameter date	5,73	Stella Chang

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1 Certificate of Compliance (SAR Evaluation)

Applicant	Zonar Systems Inc. 18200 Cascade Ave South Suite 200 Seattle Washington United States.
Equipment Under Test:	ZONAR CONNECT
Trade Name:	ZONAR
Model Number:	ZONARCONNECT
Date of Test:	Sep 13~Oct 1, 2018
Device Category:	PORTABLE DEVICES
Exposure Category:	GENERAL POPULATION/UNCONTROLLED EXPOSURE

Applicable Standards	
FCC	● IEEE 1528 2013 ● KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 ● KDB 865664 D02 RF Exposure Reporting v01r02 ● KDB 447498 D01 General RF Exposure Guidance v06 ● KDB 616217 D04 SAR for laptop and tablets v01r02 ● KDB 248227 D01 SAR Meas for 802.11 v02r02 ● KDB 941225 D05 SAR for LTE Device v02r05 ● KDB 941225 D01 3G SAR procedure v03r01
Limit	
1.6 W/kg	
Test Result	
Pass	

The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Scott Hsu
Section Manager
Compliance Certification Services Inc.

Tested by:

Stella Chang
SAR Engineer
Compliance Certification Services Inc.

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2 Description of Equipment Under Test

Product	ZONAR CONNECT			
Trade Name	ZONAR			
Model Number	ZONARCONNECT			
WWAN Module	U-BLOX		Model:	TOBY-L200
Transmitter	UMTS & LTE			
Modulation Technique	Operatind Mode		TX Freq Range(MHz)	
	WCDMA Band II		1850 ~ 1910	
	WCDMA Band IV		1710 ~ 1755	
	WCDMA Band V		824 ~ 849	
	LTE Band 2		1850 ~ 1910	
	LTE Band 4		1710 ~ 1755	
	LTE Band 5		824 ~ 849	
	LTE Band 17		705 ~ 714	
WWAN Antenna Specification	Brand name	SAN JOSE TECHNOLOGY,INC.		
	Parts Number	Main:21-93157-01		
		Aux: 21-93148-01		
	Type	Dipole		
WLAN Module	AMPAK		Model:	AP6212
Transmitters	Wi-Fi & Bluetooth			
Modulation Technique	Bluetooth:GFSK for 1Mbps;π/4-DQPSK for 2Mbps;8DPSK for 3Mbps			
	802.11b: Direct Sequence Spread Spectrum(DSSS)			
	802.11g: Orthogonal Frequency Division Multiplexing (OFDM)			
	802.11n: Orthogonal Frequency Division Multiplexing (OFDM)			
WLAN Antenna Specification	Brand name	SAN JOSE TECHNOLOGY,INC.		
	Parts Number	Main:21-93151-01		
	Type	Dipole		
Rechargeable Li-polymer Battery–alternate	Brand:BAK ENERGY CO.,LTD.(TWN) Model:TZS3944102P Rating:3.7V / 4720mAh			

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Remark:
1.The sample selected for test was prototype that representative to production product and was provided by manufacturer

2.1 Summary of Highest SAR Values

Results for highest reported SAR values for each frequency band and mode.

Technology/Band	Test configuration	Mode	Highest Reported 1g-SAR (W/kg)
WCDMA Band II	Edge 1	12.2Kbps	1.383
WCDMA Band IV	Edge 1	12.2Kbps	1.010
WCDMA band V	Edge 1	12.2Kbps	0.626
LTE band 2	Edge 1	QPSK BW 20M	1.236
LTE band 4	Edge 1	QPSK BW 20M	0.977
LTE band 5	Rear	QPSK BW 10M	0.685
LTE band 17	Rear	QPSK BW 10M	0.359
WiFi 2.4 GHz	Rear	802.11b	1.393
Bluetooth	Rear	DH5	0.001

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3 Requirements for Compliance Testing Defined

3.1 Requirements for Compliance Testing Defined by the FCC

The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996 [1]. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 W/kg for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the FCC 47 CFR §2.1093 and IEEE Std 1528-2013.

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4 Dosimetric Assessment System

These measurements were performed with the automated near-field scanning system DASY4/DASY5 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9 m) which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the dosimetric probe EX3DV4-SN: 3665 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure and found to be better than ±0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEEE 1528 2013.

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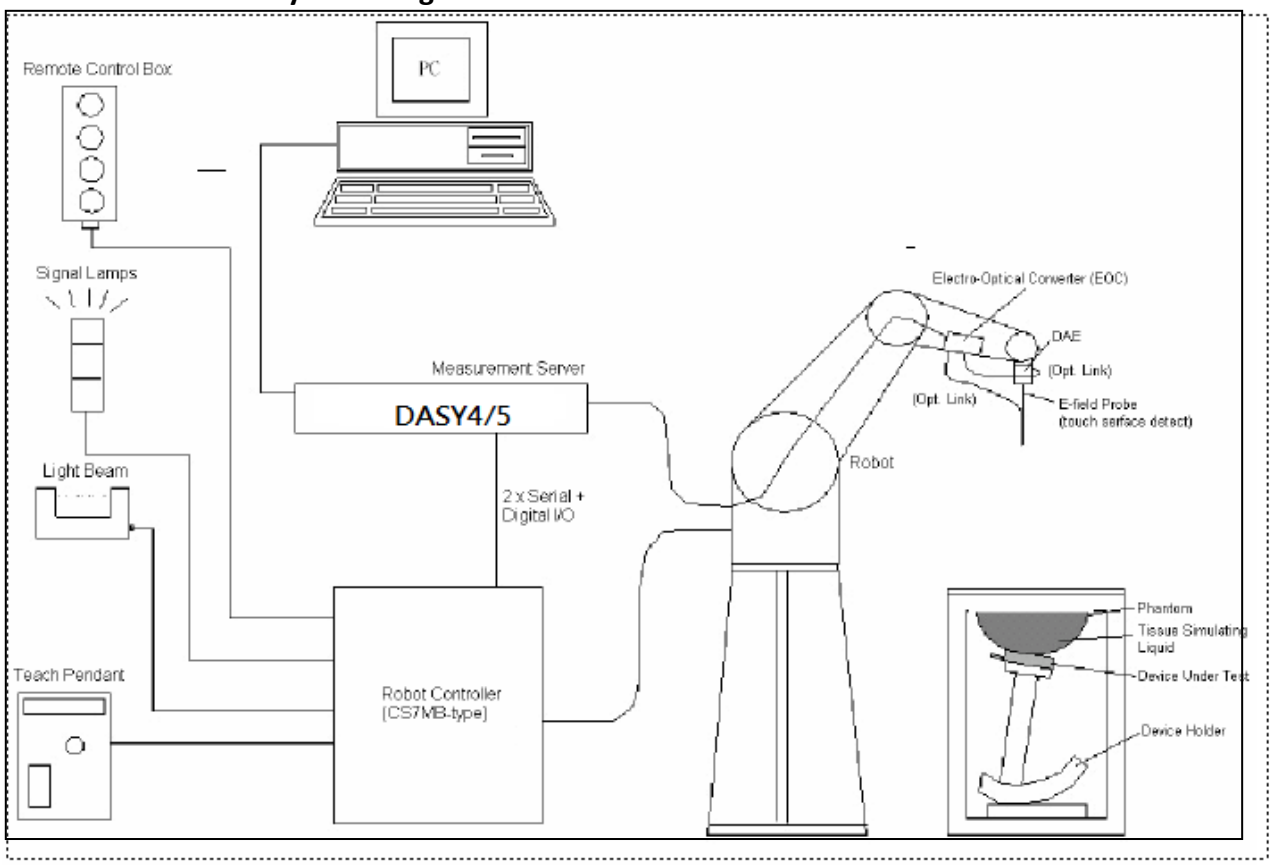
4.1 Measurement System Diagram



The DASY4/5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- 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.
- A data acquisition electronics (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.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7 or Windows XP.
- DASY4 software version: 4.7, Build 80. DASY5 software version: 52.8.8.1258.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

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4.2 System Components

DASY4/DASY5 Measurement Server	
	The DASY4/DASY5 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4/DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.
	The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

Data Acquisition Electronics (DAE)	
	The data acquisition electronics (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 measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

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EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements

Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration:	Basic Broad Band Calibration in air: 10-3000 MHz. Conversion Factors (CF) for HSL 900 and HSL 1800 CF-Calibration for other liquids and frequencies upon request.
Frequency:	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in HSL (rotation normal to probe axis)
Dynamic Range:	10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions:	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1 mm
Application:	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

SAM Phantom (V4.0)

Construction:	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 2013, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
Shell Thickness:	2 ±0.2 mm
Filling Volume:	Approx. 25 liters
Dimensions:	Height: 810mm; Length: 1000mm; Width: 500mm

SAM Phantom (ELI4)

Construction:	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 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 supported by software version DASY4/DASY5 and higher and is compatible with all SPEAG dosimetric probes and dipoles
Shell Thickness:	2.0 ± 0.2 mm (sagging: <1%)
Filling Volume:	Approx. 25 liters
Dimensions:	Major ellipse axis: 600 mm
Minor axis:	400 mm 500mm

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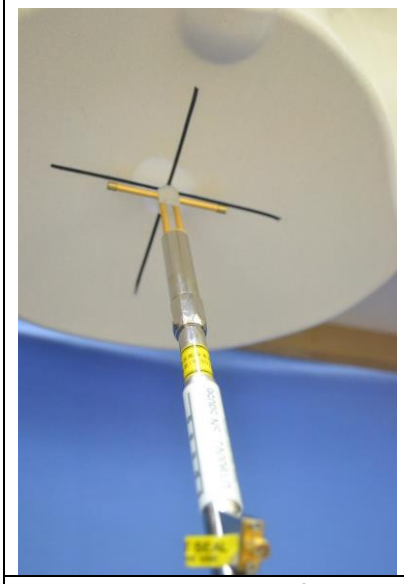
Device Holder for SAM Twin Phantom

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

System Validation Kits for SAM Phantom (V4.0)



Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

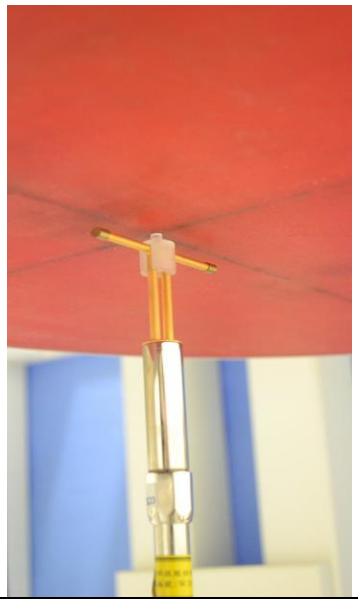
Frequency: 750, 835, 1750, 1900, 2450 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions:
D750V3: dipole length: 178 mm; overall height: 330 mm
D835V2: dipole length: 161 mm; overall height: 340 mm
D1750V2: dipole length: 75.2 mm; overall height: 302 mm
D1900V2: dipole length: 67.7 mm; overall height: 300 mm
D2450V2: dipole length: 51.5 mm; overall height: 290 mm

System Validation Kits for ELI4 phantom



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5 Evaluation Procedures

Data Evaluation

The DASY4/DASY5 post processing software (SEMCAD) 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	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter 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:

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

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: $$E_i = \sqrt{\frac{V_i}{Norm_i \bullet ConvF}}$$

H-field probes: $$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with	V_i	= Compensated signal of channel i	(i = x, y, z)
	$Norm_i$	= Sensor sensitivity of channel i	(i = x, y, z)

$\mu V/(V/m)^2$ for E0field Probes

$ConvF$	= Sensitivity enhancement in solution
aij	= Sensor sensitivity factors for H-field probes
f	= Carrier frequency (GHz)
Ei	= Electric field strength of channel i in V/m
Hi	= Magnetic field strength of channel i in A/m

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The RSS value of the field components gives the total field strength (Hermitian 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/kg
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

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 as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{377} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with
P_{pwe} = Equivalent power density of a plane wave in mW/cm^2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

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6 SAR Measurement Procedures

6.1 Normal SAR Test Procedure

- **Power Reference Measurement**

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- **Area Scan**

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4/DASY5 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, the grid resolution has to less than 15 mm by 15 mm at frequency ≤2GHz; the grid resolution has to less than 12mm by 12 mm at frequency between 2GHz to 4GHz; grid resolution has to less than 10 mm by 10 mm at frequency between 4GHz to 6GHz.

According to KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe abgle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

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- **Zoom Scan**

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures points in accordance with the frequency can be divided into three parts. (1)The zoom scan volume was set to 5x5x7 points at frequency ≤ 2GHz. (2) The zoom scan volume was set to 7x7x7 points at frequency between 2GHz to 4GHz (3) The zoom scan volume was set to 7x7x12 points at frequency between 4GHz to 6GHz. The measures points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly.

According to KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm</td><td>3 – 4 GHz: ≤ 5 mm
4 – 6 GHz: ≤ 4 mm</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">Uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$:between 1st two points losest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Maximum zoom scan volume</td><td>x, y, z</td><td>≥ 30 mm</td><td colspan="2">3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
</table>

- **Power Drift Measurement**

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY4/DASY5 software stop the measurements if this limit is exceeded.

- **Z-Scan**

The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

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7 Device Under Test

7.1 Wireless Technologies

Wireless technologies	Tx Frequency Bands	Operating mode	Duty Cycle used for testing
WCDMA (UMTS)	Band II Band IV Band V	UMTS Rel. 99 HSDPA HSUPA	100%
LTE	Band 2 Band 4 Band 5 Band 17	QPSK 16QAM (Rel. 9, LTE Category 4)	100%
WI-FI	2.4GHz Band	802.11b 802.11g 802.11n(HT20)	100%
Bluetooth	2.4GHz	V2.1 V3.0 V4.0	100%

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7.2 Maximum Tune-up Power

Band	RF Output Power (dBm)	
	Target	Max. tune-up power
WCDMA Band II	23.0	24.0
	23.0	24.0
	23.0	24.0
WCDMA Band IV	23.0	24.0
	23.0	24.0
	23.0	24.0
WCDMA Band V	23.0	24.0
	23.0	24.0
	23.0	24.0
LTE Band 2	22.0	23.0
LTE Band 4	22.0	23.0
LTE Band 5	22.0	23.0
LTE Band 17	22.0	23.0

Tolerance (dB): ± 1.5		RF Output Power (dBm)	
Band	Mode	Target	Max. tune-up power
2.4GHz	802.11b	14.5	16.0
	802.11g	13.5	15.0
	802.11n	12.5	14.0
Mode		Max. tune-up power	
Bluetooth		8.0	

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7.3 Simultaneous Transmission

RF Exposure Condition	Transmit Configurations
WWAN + Wi-Fi	**WCDMA + Wi-Fi / BT** WCDMA Band II/IV/V + BT (Chain 0) WCDMA Band II/IV/V + 2.4GHz (Chain 0) **LTE + Wi-Fi / BT** LTE Band 2/4/5/17 + BT (Chain 0) LTE Band 2/4/5/17 + 2.4GHz (Chain 0)

Note(s):

1. For WWAN mode only Chain 0 can be used as transmitting and Chain 1 only be used as receiving.

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8 General LTE SAR Test and Reporting Considerations

KDB 941225 D05 SAR for LTE Devices V02

Item	Description	Information						
1	Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 2	Channel Bandwidth					
			1.4 MHz	3MHz	5MHz	10MHz	15MHz	20MHz
		Low	18607/ 1850.7	18615/ 1851.5	18625/ 1852.5	18650/ 1855	18675/ 1857.5	18700/ 1860
		Mid	18900/ 1880	18900/ 1880	18900/ 1880	18900/ 1880	18900/ 1880	18900/ 1880
		High	19192/ 1909.2	19184/ 1908.4	19175/ 1907.5	19150/ 1905	19125/ 1902.5	19100/ 1900
		Band 4	Channel Bandwidth					
			1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz
		Low	19957/ 1710.7	19965/ 1711.5	19975/ 1712.5	20000/ 1715	20025/ 1717.5	20050/ 1720
		Mid	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5
		High	20392/ 1754.2	20384/ 1753.4	20375/ 1752.5	20350/ 1750	20325/ 1747.5	20300/ 1745
		Band 5	Channel Bandwidth					
			1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz
		Low	20407/ 824.7	20415/ 825.5	20425/ 826.5	20450/ 829		
		Mid	20525/ 836.5	20525/ 836.5	20525/ 836.5	20525/ 836.5		
		High	20642/ 848.2	20643/ 847.4	20625/ 846.5	20600/ 844		
		Band 17	Channel Bandwidth					
			1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz
		Low			23755/ 706.5	23780/ 709		
		Mid			23790/ 710	23790/ 710		
		High			23825/ 713.5	23800/ 711		

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<table>
<tr><th>Item</th><th>Description</th><th>Information</th></tr>
<tr><td>2</td><td>Descriptions of the LTE transmitter and antenna implementation;</td><td>A single antenna is used for LTE and other wireless modes (UMTS) for both Transmit and Receive.

A Secondary antenna is used for LTE and other wireless modes (UMTS) for Receive Only.</td></tr>
<tr><td>3</td><td>Maximum power reduction (MPR)</td><td>As per 3GPP 36.101 v9.11.0 (2012-03), Release 9

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (N_{RB})</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr>
</table>
MPR is permanently built-in by design

A-MPR was disabled</td></tr>
<tr><td>4</td><td>Power Reduction</td><td>No.</td></tr>
<tr><td>5</td><td>Spectrum plots for RB configurations</td><td>Refer to Section 9.2</td></tr>
</table>

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9 RF Output Power Measurement

9.1 WCDMA

Release 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 V8.5.0 specification. The EUT supports power Class 3, which has a nominal maximum output power of 23 dBm (+1.0/-1.0) 12.2kps RMC is used for this testing. Power control set to all bits up. A summary of these settings are illustrated below:

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

Output power table

Band	Mode	UL/DL Channel No.	Frequency(MHz)	Average power(dBm)
WCDMA Band II	Rel 99	9262/9662	1852.4	22.6
		9400/9800	1880.0	23.1
		9538/9983	1907.6	23.2
WCDMA Band IV	Rel 99	1312/1537	1712.4	22.7
		1413/1638	1732.6	23.0
		1513/1738	1752.6	22.5
WCDMA Band V	Rel 99	4132/4157	826.4	22.1
		4183/4407	836.4	22.8
		4233/4458	846.6	22.4

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HSDPA

The following 4 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	8/15	4/15
	βhs	4/15	24/15	30/15	30/15
	CM (dB)	0	1	1.5	1.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs =βhs/βc	30/15			

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Output power table

Band	Sub-test	UL/DL Channel No.	Frequency(MHz)	Average power(dBm)
HSDPA II	1	9262/9662	1852.4	22.5
		9400/9800	1880.0	22.9
		9538/9983	1907.6	22.8
	2	9262/9662	1852.4	22.5
		9400/9800	1880.0	22.3
		9538/9983	1907.6	22.7
	3	9262/9662	1852.4	22.1
		9400/9800	1880.0	22.5
		9538/9983	1907.6	22.3
	4	9262/9662	1852.4	22.1
		9400/9800	1880.0	22.5
		9538/9983	1907.6	22.1
HSDPA IV	1	1312/1537	1712.4	22.8
		1413/1638	1732.6	22.5
		1513/1738	1752.6	22.3
	2	1312/1537	1712.4	22.1
		1413/1638	1732.6	22.4
		1513/1738	1752.6	22.6
	3	1312/1537	1712.4	22.4
		1413/1638	1732.6	22.0
		1513/1738	1752.6	22.4
	4	1312/1537	1712.4	22.4
		1413/1638	1732.6	22.0
		1513/1738	1752.6	22.3
HSDPA V	1	4132/4157	826.4	22.3
		4182/4407	836.4	22.6
		4233/4458	846.6	22.6
	2	4132/4157	826.4	22.1
		4182/4407	836.4	22.5
		4233/4458	846.6	22.3
	3	4132/4157	826.4	22.1
		4182/4407	836.4	22.2
		4233/4458	846.6	22.1
	4	4132/4157	826.4	22.1
		4182/4407	836.4	22.2
		4233/4458	846.6	22.1

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HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSPA	HSPA	HSPA	HSPA	HSPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	15/15
	βec	209/225	12/15	30/15	2/15	24/15
	βc/βd	11/15	6/15	9/15	2/15	15/15
	βhs	22/15	12/15	30/15	4/15	30/15
	βed	1309/225	94/75	47/15	56/75	134/15
	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11		E-TFCI 11	E-TFCI 11	
		E-TFCI PO 4		E-TFCI PO 4	E-TFCI PO 4	
		E-TFCI 67		E-TFCI 92	E-TFCI 67	
		E-TFCI PO 18		E-TFCI PO 18	E-TFCI PO 18	
		E-TFCI 71			E-TFCI 71	
		E-TFCI PO 23			E-TFCI PO 23	
		E-TFCI 75			E-TFCI 75	
		E-TFCI PO 26			E-TFCI PO 26	
		E-TFCI 81			E-TFCI 81	
		E-TFCI PO 27			E-TFCI PO 27	

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Output power table

Band	Sub-test	UL/DL Channel No.	Frequency(MHz)	Average power(dBm)
HSUPA II	1	9262/9662	1852.4	22.6
		9400/9800	1880.0	22.9
		9538/9983	1907.6	22.9
	2	9262/9662	1852.4	21.2
		9400/9800	1880.0	21.5
		9538/9983	1907.6	21.4
	3	9262/9662	1852.4	22.1
		9400/9800	1880.0	22.5
		9538/9983	1907.6	22.3
	4	9262/9662	1852.4	21.3
		9400/9800	1880.0	21.5
		9538/9983	1907.6	21.4
	5	9262/9662	1852.4	22.6
		9400/9800	1880.0	23.1
		9538/9983	1907.6	23.0
HSUPA IV	1	1312/1537	1712.4	22.9
		1413/1638	1732.6	22.6
		1513/1738	1752.6	22.8
	2	1312/1537	1712.4	21.5
		1413/1638	1732.6	21.1
		1513/1738	1752.6	21.4
	3	1312/1537	1712.4	22.4
		1413/1638	1732.6	22.0
		1513/1738	1752.6	22.3
	4	1312/1537	1712.4	21.4
		1413/1638	1732.6	21.1
		1513/1738	1752.6	21.4
	5	1312/1537	1712.4	23.0
		1413/1638	1732.6	22.6
		1513/1738	1752.6	23.0

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Report No.: T180821W01-SF

Band	Sub-test	UL/DL Channel No.	Frequency(MHz)	Average power(dBm)
HSUPA V	1	4132/4157	826.4	22.6
		4182/4407	836.4	22.5
		4233/4458	846.6	22.3
	2	4132/4157	826.4	21.1
		4182/4407	836.4	21.1
		4233/4458	846.6	21.1
	3	4132/4157	826.4	22.1
		4182/4407	836.4	22.2
		4233/4458	846.6	22.1
	4	4132/4157	826.4	21.1
		4182/4407	836.4	21.1
		4233/4458	846.6	21.1
	5	4132/4157	826.4	22.6
		4182/4407	836.4	22.8
		4233/4458	846.6	22.7

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9.2 LTE

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (22 +/- 1dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of “NS_01”.

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Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.					

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9.2.1 LTE Band 2

Output power table

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
2	20	18700	1860.0	QPSK	1	0	0	22.8
					1	49	0	22.6
					1	99	0	22.7
					50	0	1	22.0
					50	24	1	21.8
					50	49	1	21.8
					100	0	1	21.8
				16QAM	1	0	1	22.0
					1	49	1	21.7
					1	99	1	21.8
					50	0	2	21.0
					50	24	2	20.7
					50	49	2	20.7
					100	0	2	20.8
		18900	1880.0	QPSK	1	0	0	22.8
					1	49	0	22.8
					1	99	0	22.6
					50	0	1	22.0
					50	24	1	21.8
					50	49	1	21.6
					100	0	1	21.6
				16QAM	1	0	1	22.0
					1	49	1	22.0
					1	99	1	21.6
					50	0	2	21.0
					50	24	2	21.0
					50	49	2	20.7
					100	0	2	20.7
		19100	1900.0	QPSK	1	0	0	22.6
					1	49	0	22.5
					1	99	0	22.6
					50	0	1	21.7
					50	24	1	21.6
					50	49	1	21.6
					100	0	1	21.7
				16QAM	1	0	1	21.8
					1	49	1	21.7
					1	99	1	21.6
					50	0	2	20.8
					50	24	2	20.7
					50	49	2	20.8
					100	0	2	20.7

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
2	15	18675	1857.5	QPSK	1	0	0	22.8
					1	37	0	22.6
					1	74	0	22.7
					36	0	1	22.0
					36	18	1	21.8
					36	35	1	21.8
					75	0	1	21.8
				16QAM	1	0	1	22.0
					1	37	1	21.7
					1	74	1	21.8
					36	0	2	21.0
					36	18	2	20.7
					36	35	2	20.7
					75	0	2	20.8
		18900	1880.0	QPSK	1	0	0	22.8
					1	37	0	22.8
					1	74	0	22.6
					36	0	1	22.0
					36	18	1	21.8
					36	35	1	21.6
					75	0	1	21.6
				16QAM	1	0	1	22.0
					1	37	1	22.0
					1	74	1	21.6
					36	0	2	21.0
					36	18	2	21.0
					36	35	2	20.7
					75	0	2	20.7
		19125	1902.5	QPSK	1	0	0	22.6
					1	37	0	22.5
					1	74	0	22.6
					36	0	1	21.7
					36	18	1	21.6
					36	35	1	21.6
					75	0	1	21.7
				16QAM	1	0	1	21.8
					1	37	1	21.7
					1	74	1	21.6
					36	0	2	20.8
					36	18	2	20.7
					36	35	2	20.8
					75	0	2	20.7

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
2	10	18650	1855.0	QPSK	1	0	0	22.7
					1	24	0	22.5
					1	49	0	22.6
					25	0	1	21.9
					25	12	1	21.7
					25	24	1	21.7
					50	0	1	21.7
				16QAM	1	0	1	21.9
					1	24	1	21.6
					1	49	1	21.7
					25	0	2	20.9
					25	12	2	20.6
					25	24	2	20.6
					50	0	2	20.7
		18900	1880.0	QPSK	1	0	0	22.7
					1	24	0	22.7
					1	49	0	22.5
					25	0	1	21.9
					25	12	1	21.7
					25	24	1	21.5
					50	0	1	21.5
				16QAM	1	0	1	21.9
					1	24	1	21.9
					1	49	1	21.5
					25	0	2	20.9
					25	12	2	20.9
					25	24	2	20.6
					50	0	2	20.6
		19150	1905.0	QPSK	1	0	0	22.5
					1	24	0	22.4
					1	49	0	22.5
					25	0	1	21.6
					25	12	1	21.5
					25	24	1	21.5
					50	0	1	21.6
				16QAM	1	0	1	21.7
					1	24	1	21.6
					1	49	1	21.5
					25	0	2	20.7
					25	12	2	20.6
					25	24	2	20.7
					50	0	2	20.6

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Report No.: T180821W01-SF

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
2	5	18625	1852.5	QPSK	1	0	0	22.7
					1	12	0	22.5
					1	24	0	22.6
					12	0	1	21.9
					12	6	1	21.7
					12	11	1	21.7
					25	0	1	21.7
				16QAM	1	0	1	21.9
					1	12	1	21.6
					1	24	1	21.7
					12	0	2	20.9
					12	6	2	20.6
					12	11	2	20.6
					25	0	2	20.7
		18900	1880.0	QPSK	1	0	0	22.7
					1	12	0	22.7
					1	24	0	22.5
					12	0	1	21.9
					12	6	1	21.7
					12	11	1	21.5
					25	0	1	21.5
				16QAM	1	0	1	21.9
					1	12	1	21.9
					1	24	1	21.5
					12	0	2	20.9
					12	6	2	20.9
					12	11	2	20.6
					25	0	2	20.6
		19175	1907.5	QPSK	1	0	0	22.5
					1	12	0	22.4
					1	24	0	22.5
					12	0	1	21.6
					12	6	1	21.5
					12	11	1	21.5
					25	0	1	21.6
				16QAM	1	0	1	21.7
					1	12	1	21.6
					1	24	1	21.5
					12	0	2	20.7
					12	6	2	20.6
					12	11	2	20.7
					25	0	2	20.6

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
2	3	18615	1851.5	QPSK	1	0	0	22.6
					1	7	0	22.4
					1	14	0	22.5
					8	0	1	21.8
					8	4	1	21.6
					8	7	1	21.6
					15	0	1	21.6
				16QAM	1	0	1	21.8
					1	7	1	21.5
					1	14	1	21.6
					8	0	2	20.8
					8	4	2	20.5
					8	7	2	20.5
					15	0	2	20.6
		18900	1880.0	QPSK	1	0	0	22.6
					1	7	0	22.6
					1	14	0	22.4
					8	0	1	21.8
					8	4	1	21.6
					8	7	1	21.4
					15	0	1	21.4
				16QAM	1	0	1	21.8
					1	7	1	21.8
					1	14	1	21.4
					8	0	2	20.8
					8	4	2	20.8
					8	7	2	20.5
					15	0	2	20.5
		19184	1908.4	QPSK	1	0	0	22.4
					1	7	0	22.3
					1	14	0	22.4
					8	0	1	21.5
					8	4	1	21.4
					8	7	1	21.4
					15	0	1	21.5
				16QAM	1	0	1	21.6
					1	7	1	21.5
					1	14	1	21.4
					8	0	2	20.6
					8	4	2	20.5
					8	7	2	20.6
					15	0	2	20.6

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Report No.: T180821W01-SF

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
2	1.4	18607	1850.7	QPSK	1	0	0	22.6
					1	2	0	22.4
					1	5	0	22.5
					3	0	0	22.6
					3	1	0	22.4
					3	2	0	22.5
					6	0	1	21.6
				16QAM	1	0	1	21.8
					1	2	1	21.5
					1	5	1	21.6
					3	0	1	21.8
					3	1	1	21.5
					3	2	1	21.6
					6	0	2	20.6
		18900	1880.0	QPSK	1	0	0	22.6
					1	2	0	22.6
					1	5	0	22.4
					3	0	0	22.6
					3	1	0	22.6
					3	2	0	22.4
					6	0	1	21.4
				16QAM	1	0	1	21.8
					1	2	1	21.8
					1	5	1	21.4
					3	0	1	21.8
					3	1	1	21.8
					3	2	1	21.4
					6	0	2	20.5
		19192	1909.2	QPSK	1	0	0	22.4
					1	2	0	22.3
					1	5	0	22.4
					3	0	0	22.4
					3	1	0	22.3
					3	2	0	22.4
					6	0	1	21.5
				16QAM	1	0	1	21.6
					1	2	1	21.5
					1	5	1	21.4
					3	0	1	21.6
					3	1	1	21.5
					3	2	1	21.4
					6	0	2	20.6

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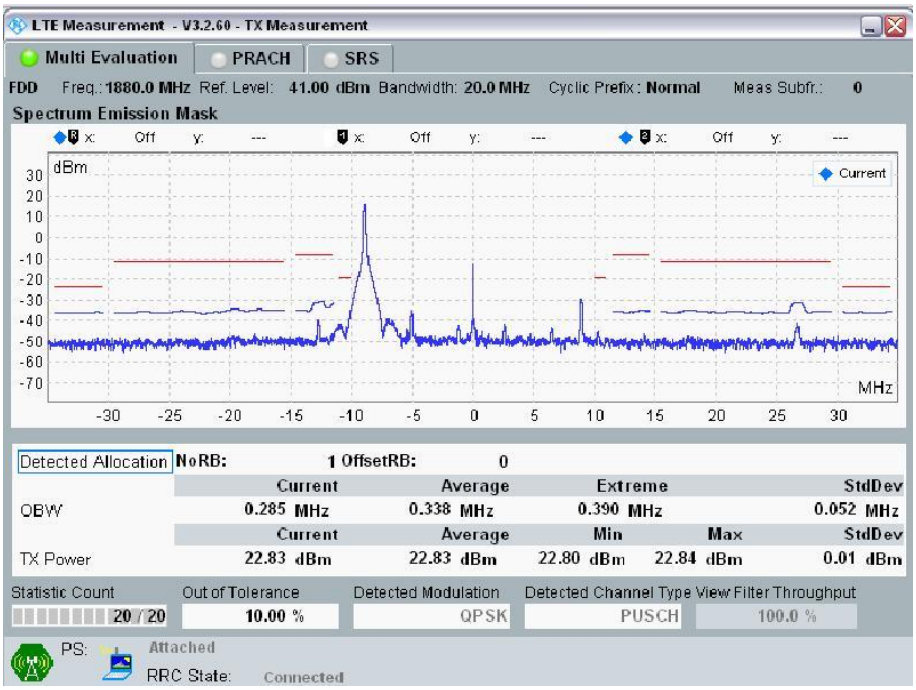
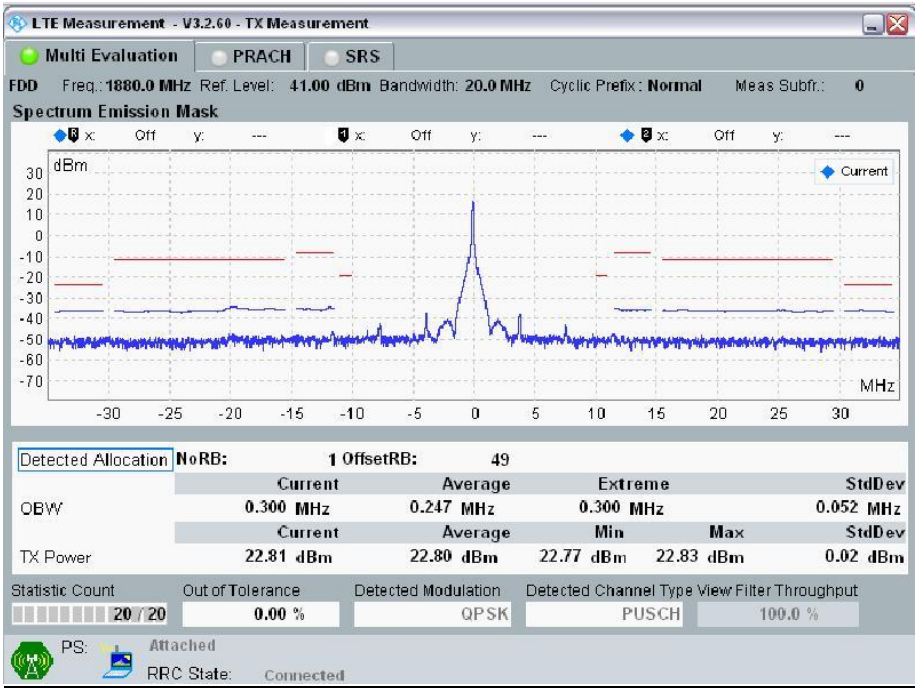
Spectrum Plots for the Test RB allocations



20MHz Band Width: Ch 18900, RB Size=1; RB Offset = 0



20MHz Band Width: Ch 18900, RB Size=1; RB Offset = 49

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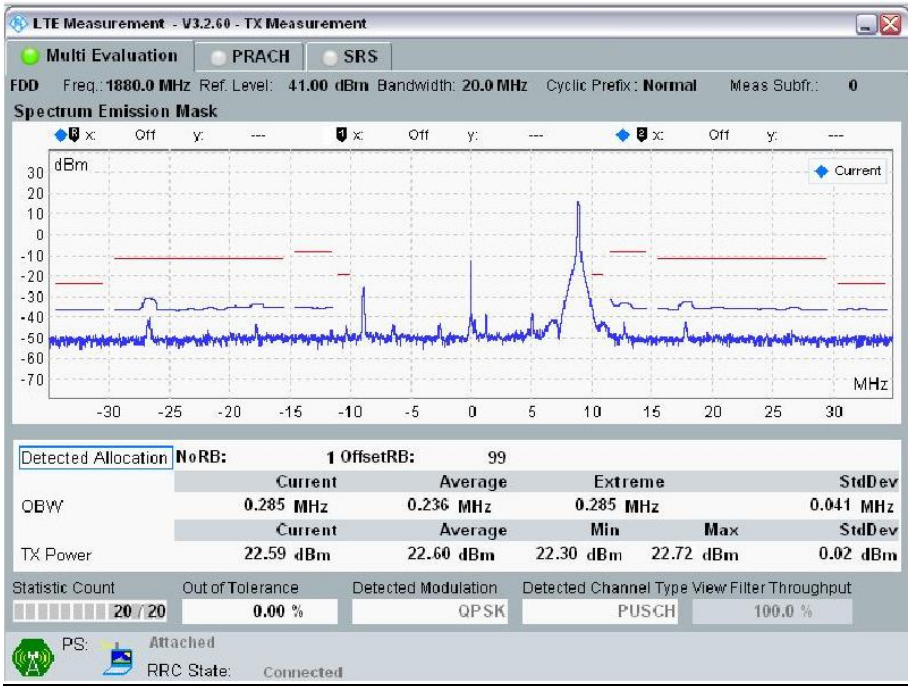
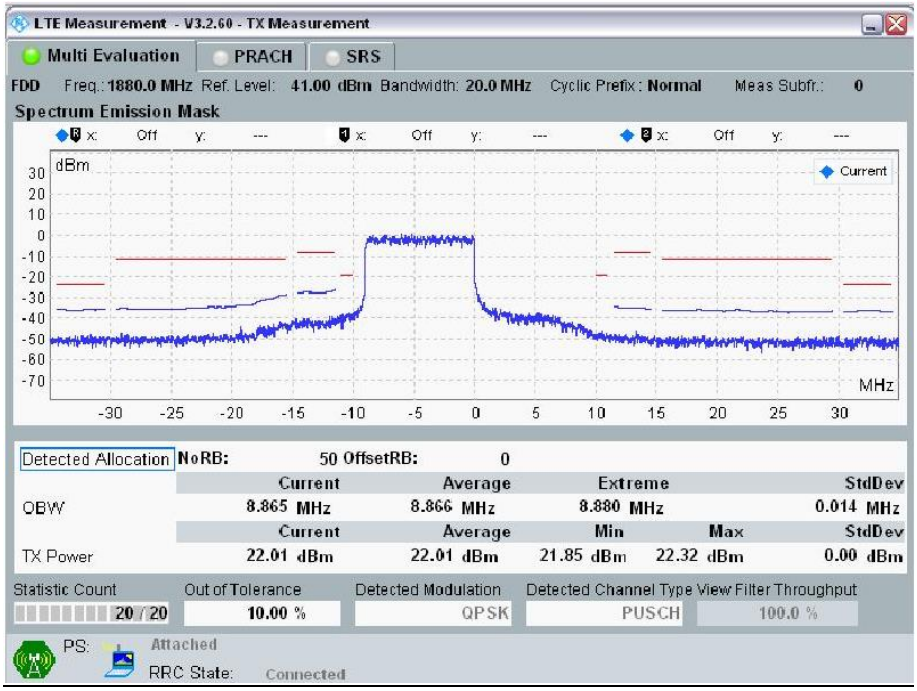


20MHz Band Width: Ch 18900, RB Size=1; RB Offset = 99



20MHz Band Width: Ch 18900, RB Size=50; RB Offset = 0

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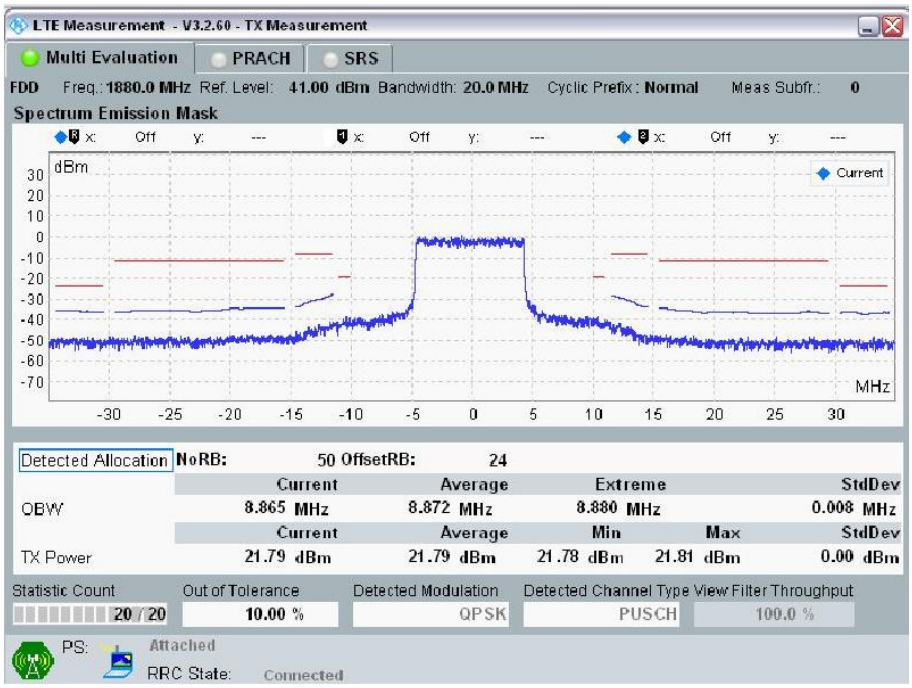
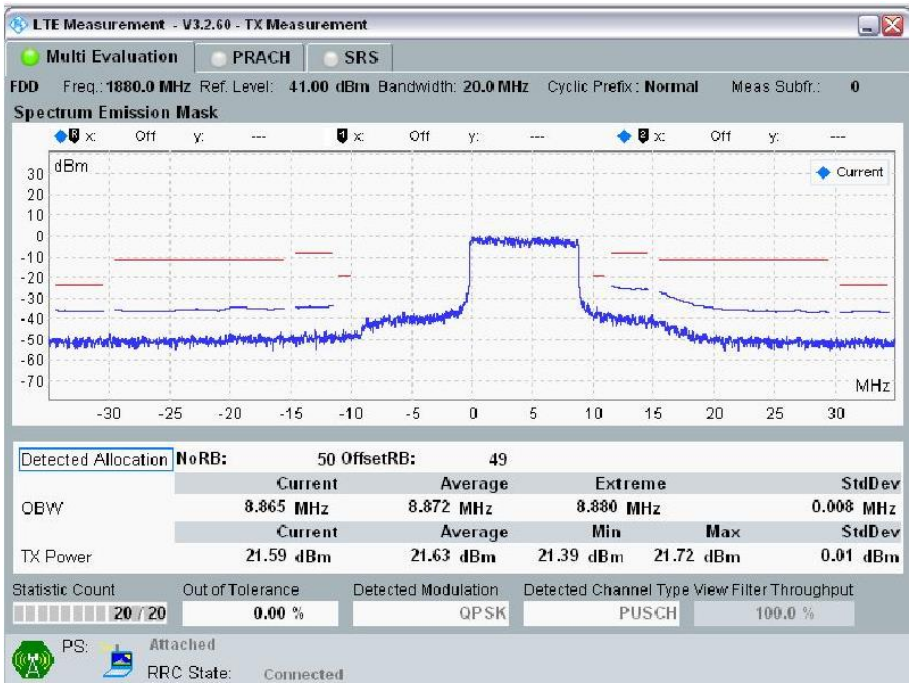


20MHz Band Width: Ch 18900, RB Size=50; RB Offset = 24



20MHz Band Width: Ch 18900, RB Size=50; RB Offset = 49

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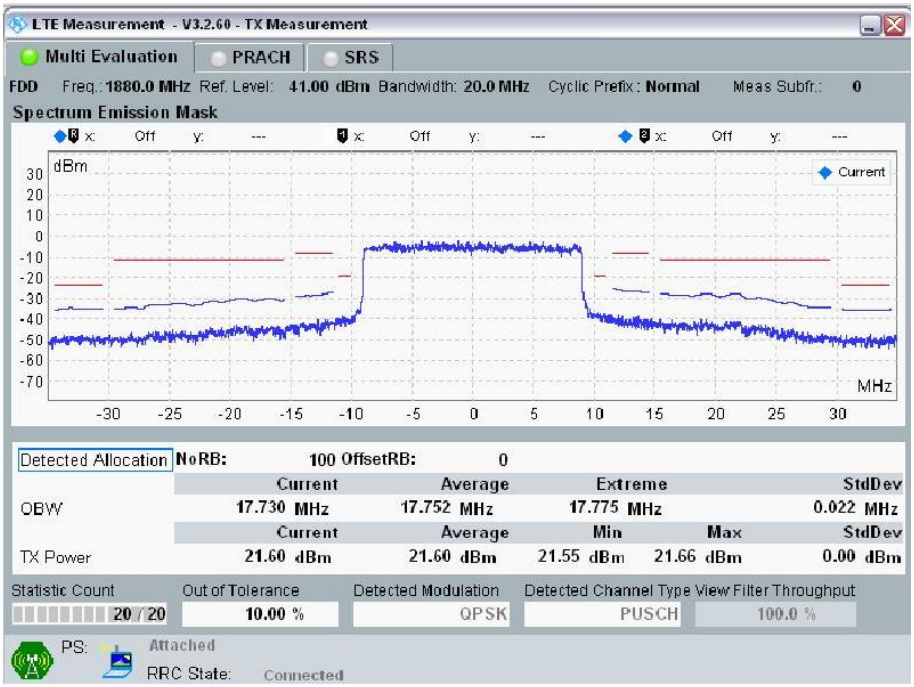

20MHz Band Width: Ch 18900, RB Size=100; RB Offset = 0

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9.2.2 LTE Band 4

Output power table

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
4	20	20050	1720.0	QPSK	1	0	0	22.9
					1	49	0	22.6
					1	99	0	22.5
					50	0	1	22.0
					50	24	1	21.8
					50	49	1	21.8
					100	0	1	21.7
				16QAM	1	0	1	22.0
					1	49	1	21.8
					1	99	1	21.7
					50	0	2	21.0
					50	24	2	20.8
					50	49	2	20.8
					100	0	2	20.7
		20175	1732.5	QPSK	1	0	0	22.7
					1	49	0	22.5
					1	99	0	22.5
					50	0	1	21.9
					50	24	1	21.7
					50	49	1	21.7
					100	0	1	21.6
				16QAM	1	0	1	21.7
					1	49	1	21.7
					1	99	1	21.6
					50	0	2	20.8
					50	24	2	20.6
					50	49	2	20.7
					100	0	2	20.6
		20300	1745.0	QPSK	1	0	0	22.8
					1	49	0	22.6
					1	99	0	22.6
					50	0	1	21.9
					50	24	1	21.8
					50	49	1	21.8
					100	0	1	21.7
				16QAM	1	0	1	21.8
					1	49	1	21.7
					1	99	1	21.7
					50	0	2	20.9
					50	24	2	20.8
					50	49	2	20.8
					100	0	2	20.7

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
4	15	20025	1717.5	QPSK	1	0	0	22.9
					1	37	0	22.6
					1	74	0	22.5
					36	0	1	22.0
					36	18	1	21.8
					36	35	1	21.8
					75	0	1	21.7
				16QAM	1	0	1	22.0
					1	37	1	21.8
					1	74	1	21.7
					36	0	2	21.0
					36	18	2	20.8
					36	35	2	20.8
					75	0	2	20.7
		20175	1732.5	QPSK	1	0	0	22.7
					1	37	0	22.5
					1	74	0	22.5
					36	0	1	21.9
					36	18	1	21.7
					36	35	1	21.7
					75	0	1	21.6
				16QAM	1	0	1	21.7
					1	37	1	21.7
					1	74	1	21.6
					36	0	2	20.8
					36	18	2	20.6
					36	35	2	20.7
					75	0	2	20.6
		20325	1747.5	QPSK	1	0	0	22.8
					1	37	0	22.6
					1	74	0	22.6
					36	0	1	21.9
					36	18	1	21.8
					36	35	1	21.8
					75	0	1	21.7
				16QAM	1	0	1	21.8
					1	37	1	21.7
					1	74	1	21.7
					36	0	2	20.9
					36	18	2	20.8
					36	35	2	20.8
					75	0	2	20.7

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Report No.: T180821W01-SF

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
4	10	20000	1715.0	QPSK	1	0	0	22.8
					1	24	0	22.5
					1	49	0	22.4
					25	0	1	21.9
					25	12	1	21.7
					25	24	1	21.7
					50	0	1	21.6
				16QAM	1	0	1	21.9
					1	24	1	21.7
					1	49	1	21.6
					25	0	2	20.9
					25	12	2	20.7
					25	24	2	20.7
					50	0	2	20.6
		20175	1732.5	QPSK	1	0	0	22.6
					1	24	0	22.4
					1	49	0	22.4
					25	0	1	21.8
					25	12	1	21.6
					25	24	1	21.6
					50	0	1	21.5
				16QAM	1	0	1	21.6
					1	24	1	21.6
					1	49	1	21.5
					25	0	2	20.7
					25	12	2	20.5
					25	24	2	20.6
					50	0	2	20.5
		20350	1750.0	QPSK	1	0	0	22.7
					1	24	0	22.5
					1	49	0	22.5
					25	0	1	21.8
					25	12	1	21.7
					25	24	1	21.7
					50	0	1	21.6
				16QAM	1	0	1	21.7
					1	24	1	21.6
					1	49	1	21.6
					25	0	2	20.8
					25	12	2	20.7
					25	24	2	20.7
					50	0	2	20.6

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
4	5	19975	1712.5	QPSK	1	0	0	22.8
					1	12	0	22.5
					1	24	0	22.4
					12	0	1	21.9
					12	6	1	21.7
					12	11	1	21.7
					25	0	1	21.6
				16QAM	1	0	1	21.9
					1	12	1	21.7
					1	24	1	21.6
					12	0	2	20.9
					12	6	2	20.7
					12	11	2	20.7
					25	0	2	20.6
		20175	1732.5	QPSK	1	0	0	22.6
					1	12	0	22.4
					1	24	0	22.4
					12	0	1	21.8
					12	6	1	21.6
					12	11	1	21.6
					25	0	1	21.5
				16QAM	1	0	1	21.6
					1	12	1	21.6
					1	24	1	21.5
					12	0	2	20.7
					12	6	2	20.5
					12	11	2	20.6
					25	0	2	20.5
		20375	1752.5	QPSK	1	0	0	22.7
					1	12	0	22.5
					1	24	0	22.5
					12	0	1	21.8
					12	6	1	21.7
					12	11	1	21.7
					25	0	1	21.6
				16QAM	1	0	1	21.7
					1	12	1	21.6
					1	24	1	21.6
					12	0	2	20.8
					12	6	2	20.7
					12	11	2	20.7
					25	0	2	20.6

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
4	3	19965	1711.5	QPSK	1	0	0	22.7
					1	7	0	22.4
					1	14	0	22.3
					8	0	1	21.8
					8	4	1	21.6
					8	7	1	21.6
					15	0	1	21.5
				16QAM	1	0	1	21.8
					1	7	1	21.6
					1	14	1	21.5
					8	0	2	20.8
					8	4	2	20.6
					8	7	2	20.6
					15	0	2	20.5
		20175	1732.5	QPSK	1	0	0	22.5
					1	7	0	22.3
					1	14	0	22.3
					8	0	1	21.7
					8	4	1	21.5
					8	7	1	21.5
					15	0	1	21.4
				16QAM	1	0	1	21.5
					1	7	1	21.5
					1	14	1	21.4
					8	0	2	20.6
					8	4	2	20.4
					8	7	2	20.5
					15	0	2	20.4
		20384	1753.4	QPSK	1	0	0	22.6
					1	7	0	22.4
					1	14	0	22.4
					8	0	1	21.7
					8	4	1	21.6
					8	7	1	21.6
					15	0	1	21.5
				16QAM	1	0	1	21.6
					1	7	1	21.5
					1	14	1	21.5
					8	0	2	20.7
					8	4	2	20.6
					8	7	2	20.6
					15	0	2	20.5

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
4	1.4	19957	1710.7	QPSK	1	0	0	22.7
					1	2	0	22.4
					1	5	0	22.3
					3	0	0	22.7
					3	1	0	22.4
					3	2	0	22.3
					6	0	1	21.5
				16QAM	1	0	1	21.8
					1	2	1	21.6
					1	5	1	21.5
					3	0	1	21.8
					3	1	1	21.6
					3	2	1	21.5
					6	0	2	20.5
		20175	1732.5	QPSK	1	0	0	22.5
					1	2	0	22.3
					1	5	0	22.3
					3	0	0	22.5
					3	1	0	22.3
					3	2	0	22.3
					6	0	1	21.4
				16QAM	1	0	1	21.5
					1	2	1	21.5
					1	5	1	21.4
					3	0	1	21.5
					3	1	1	21.5
					3	2	1	21.4
					6	0	2	20.5
		20392	1754.2	QPSK	1	0	0	22.6
					1	2	0	22.4
					1	5	0	22.4
					3	0	0	22.6
					3	1	0	22.4
					3	2	0	22.4
					6	0	1	21.5
				16QAM	1	0	1	21.6
					1	2	1	21.5
					1	5	1	21.5
					3	0	1	21.6
					3	1	1	21.5
					3	2	1	21.5
					6	0	2	20.6

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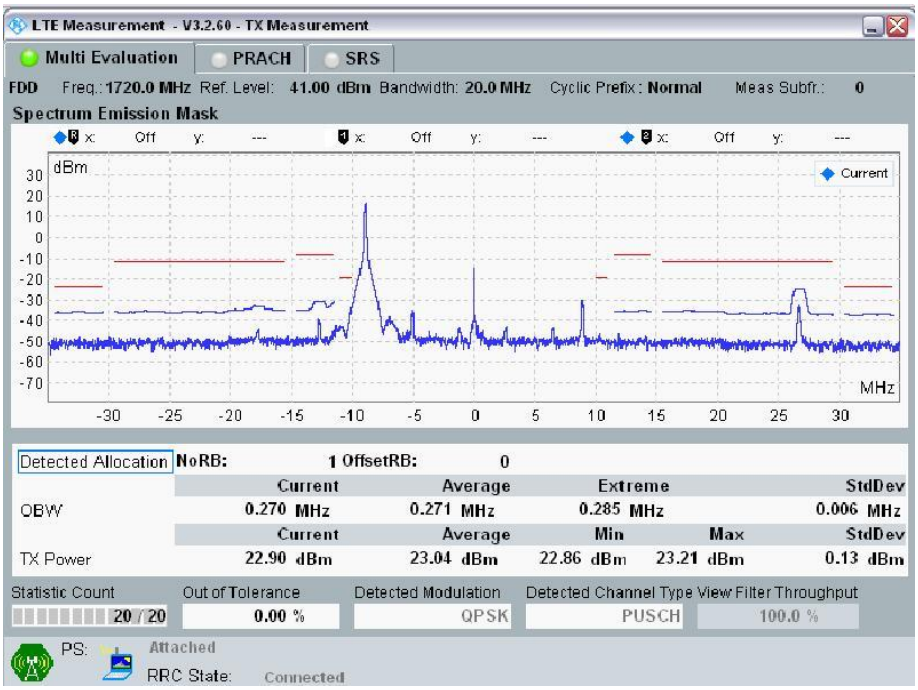
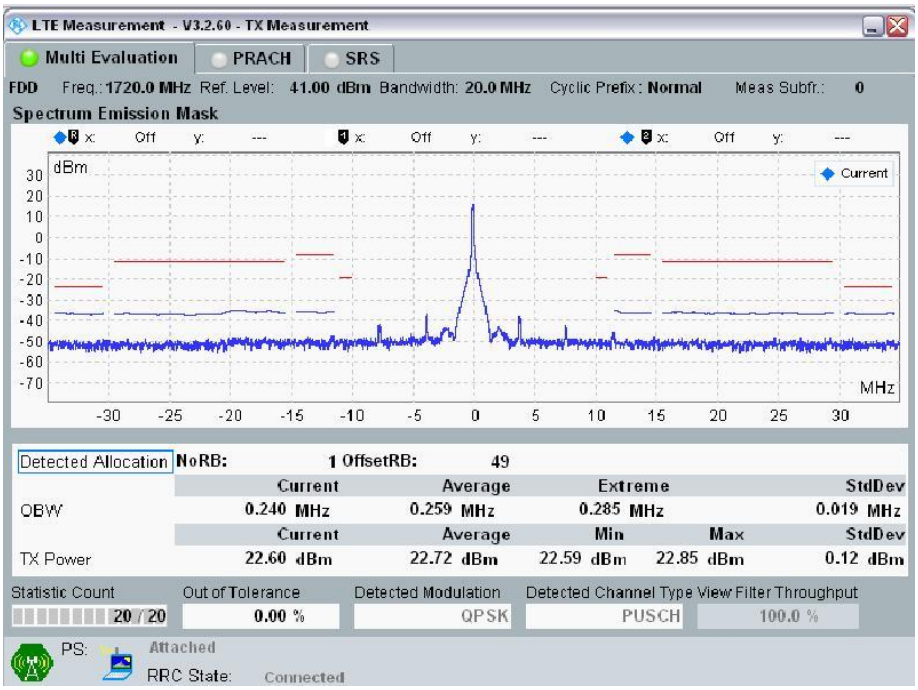
Spectrum Plots for the Test RB allocations



20MHz Band Width: Ch 20050, RB Size=1; RB Offset = 0



20MHz Band Width: Ch 20050, RB Size=1; RB Offset = 49

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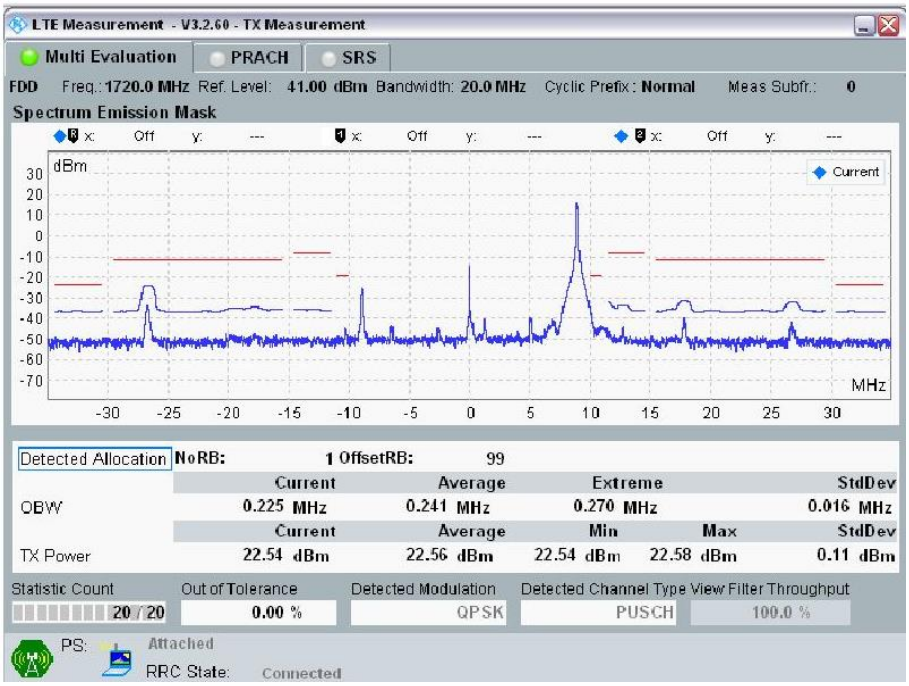
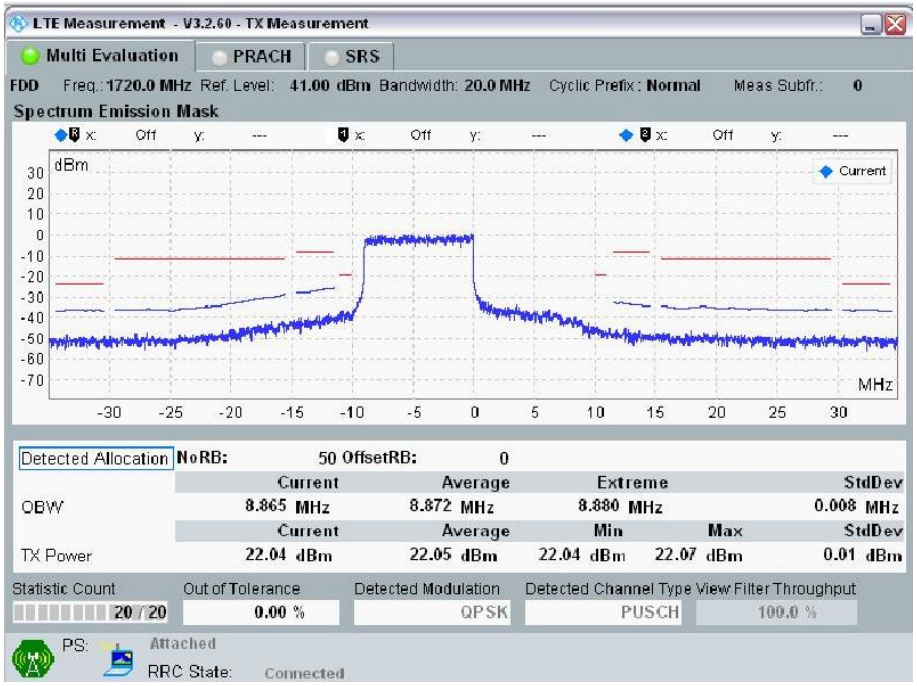


20MHz Band Width: Ch 20050, RB Size=1; RB Offset = 99



20MHz Band Width: Ch 20050, RB Size=50; RB Offset = 0

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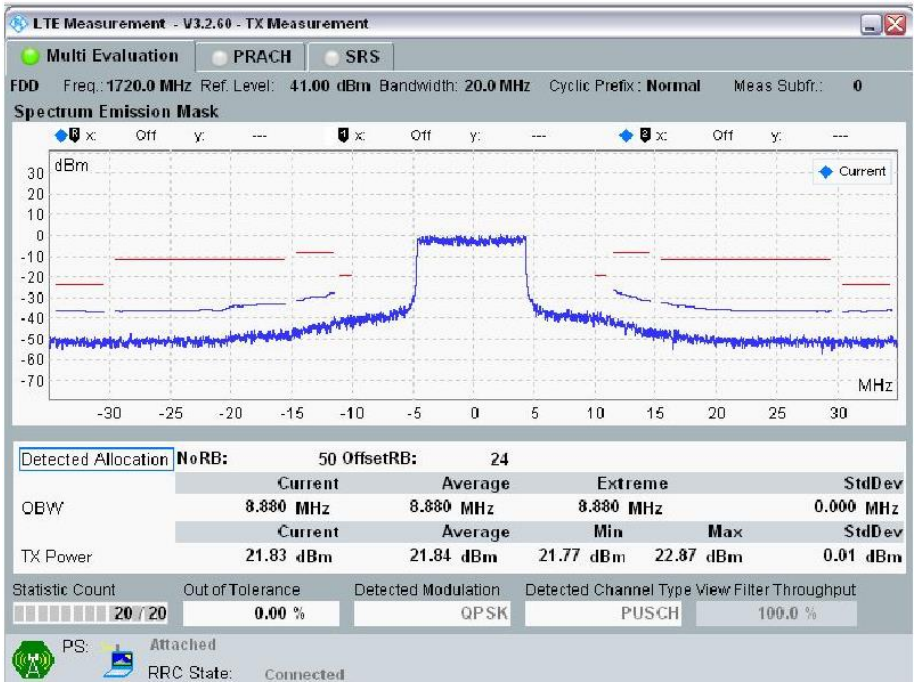
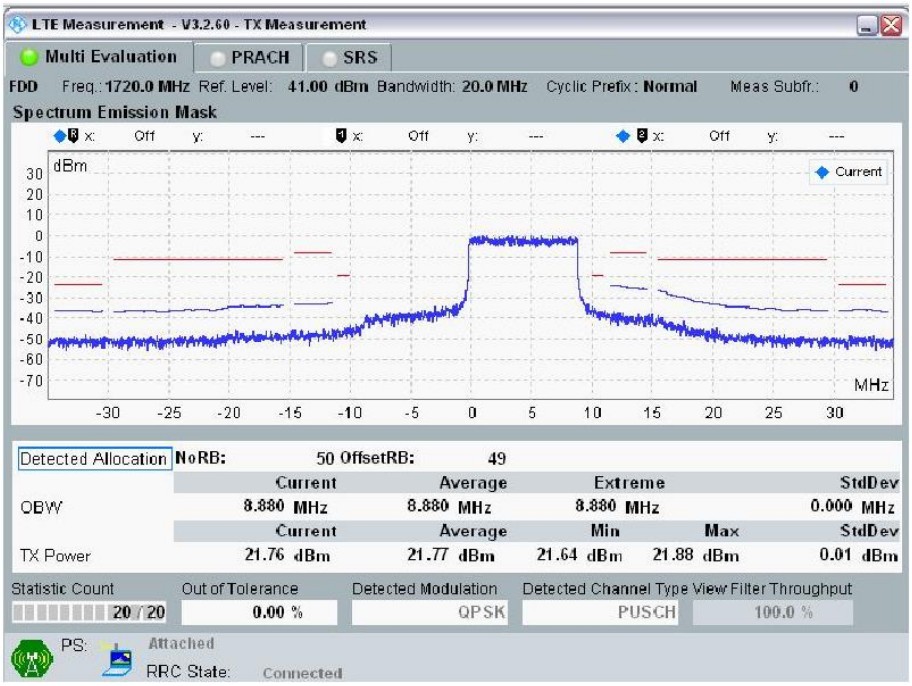


20MHz Band Width: Ch 20050, RB Size=50; RB Offset = 24



20MHz Band Width: Ch 20050, RB Size=50; RB Offset = 49

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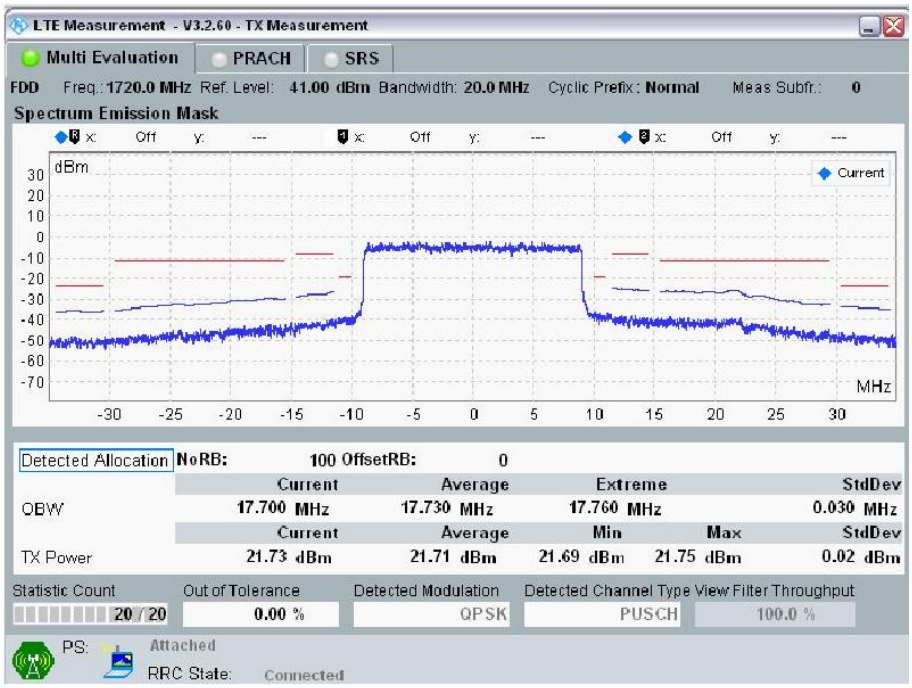

20MHz Band Width: Ch 20050, RB Size=100; RB Offset = 0

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9.2.3 LTE Band 5

Output power table

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
5	10	20450	829.0	QPSK	1	0	0	22.5
					1	24	0	22.0
					1	49	0	22.0
					25	0	1	21.8
					25	12	1	21.3
					25	24	1	21.3
					50	0	1	21.2
				16QAM	1	0	1	21.8
					1	24	1	21.4
					1	49	1	21.4
					25	0	2	20.8
					25	12	2	20.4
					25	24	2	20.4
					50	0	2	20.3
		20525	836.5	QPSK	1	0	0	22.5
					1	24	0	22.2
					1	49	0	22.0
					25	0	1	21.8
					25	12	1	21.5
					25	24	1	21.4
					50	0	1	21.3
				16QAM	1	0	1	21.7
					1	24	1	21.3
					1	49	1	21.3
					25	0	2	20.8
					25	12	2	20.5
					25	24	2	20.4
					50	0	2	20.3
		20600	844.0	QPSK	1	0	0	22.6
					1	24	0	22.3
					1	49	0	22.0
					25	0	1	21.8
					25	12	1	21.6
					25	24	1	21.3
					50	0	1	21.2
				16QAM	1	0	1	21.8
					1	24	1	21.6
					1	49	1	21.4
					25	0	2	21.0
					25	12	2	20.6
					25	24	2	20.4
					50	0	2	20.3

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
5	5	20425	826.5	QPSK	1	0	0	22.5
					1	12	0	22.0
					1	24	0	22.0
					12	0	1	21.8
					12	6	1	21.3
					12	11	1	21.3
					25	0	1	21.2
				16QAM	1	0	1	21.8
					1	12	1	21.4
					1	24	1	21.4
					12	0	2	20.8
					12	6	2	20.4
					12	11	2	20.4
					25	0	2	20.3
		20525	836.5	QPSK	1	0	0	22.5
					1	12	0	22.2
					1	24	0	22.0
					12	0	1	21.8
					12	6	1	21.5
					12	11	1	21.4
					25	0	1	21.3
				16QAM	1	0	1	21.7
					1	12	1	21.3
					1	24	1	21.3
					12	0	2	20.8
					12	6	2	20.5
					12	11	2	20.4
					25	0	2	20.3
		20625	846.5	QPSK	1	0	0	22.6
					1	12	0	22.3
					1	24	0	22.0
					12	0	1	21.8
					12	6	1	21.6
					12	11	1	21.3
					25	0	1	21.2
				16QAM	1	0	1	21.8
					1	12	1	21.6
					1	24	1	21.4
					12	0	2	21.0
					12	6	2	20.6
					12	11	2	20.4
					25	0	2	20.3

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
5	3	20415	825.5	QPSK	1	0	0	22.4
					1	7	0	21.9
					1	14	0	21.9
					8	0	1	21.7
					8	4	1	21.2
					8	7	1	21.2
					15	0	1	21.1
				16QAM	1	0	1	21.7
					1	7	1	21.3
					1	14	1	21.3
					8	0	2	20.7
					8	4	2	20.3
					8	7	2	20.3
					15	0	2	20.2
		20525	836.5	QPSK	1	0	0	22.4
					1	7	0	22.1
					1	14	0	21.9
					8	0	1	21.7
					8	4	1	21.4
					8	7	1	21.3
					15	0	1	21.2
				16QAM	1	0	1	21.6
					1	7	1	21.2
					1	14	1	21.2
					8	0	2	20.7
					8	4	2	20.4
					8	7	2	20.3
					15	0	2	20.2
		20634	847.4	QPSK	1	0	0	22.5
					1	7	0	22.2
					1	14	0	21.9
					8	0	1	21.7
					8	4	1	21.5
					8	7	1	21.2
					15	0	1	21.1
				16QAM	1	0	1	21.7
					1	7	1	21.5
					1	14	1	21.3
					8	0	2	20.9
					8	4	2	20.5
					8	7	2	20.3
					15	0	2	20.2

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Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
5	1.4	20407	824.7	QPSK	1	0	0	22.4
					1	2	0	21.9
					1	5	0	21.9
					3	0	0	22.4
					3	1	0	21.9
					3	2	0	21.9
					6	0	1	21.1
				16QAM	1	0	1	21.7
					1	2	1	21.3
					1	5	1	21.3
					3	0	1	21.7
					3	1	1	21.3
					3	2	1	21.3
					6	0	2	20.2
		20525	836.5	QPSK	1	0	0	22.4
					1	2	0	22.1
					1	5	0	21.9
					3	0	0	22.4
					3	1	0	22.1
					3	2	0	21.9
					6	0	1	21.2
				16QAM	1	0	1	21.6
					1	2	1	21.2
					1	5	1	21.2
					3	0	1	21.6
					3	1	1	21.2
					3	2	1	21.2
					6	0	2	20.5
		20642	848.2	QPSK	1	0	0	22.5
					1	2	0	22.2
					1	5	0	21.9
					3	0	0	22.5
					3	1	0	22.2
					3	2	0	21.9
					6	0	1	21.1
				16QAM	1	0	1	21.7
					1	2	1	21.5
					1	5	1	21.3
					3	0	1	21.7
					3	1	1	21.5
					3	2	1	21.3
					6	0	2	20.6

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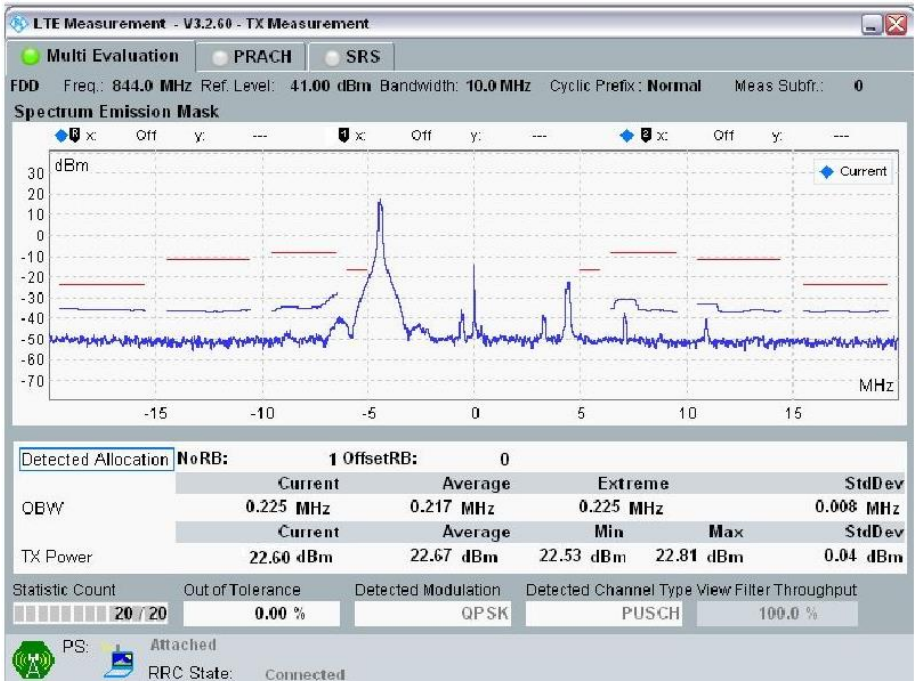
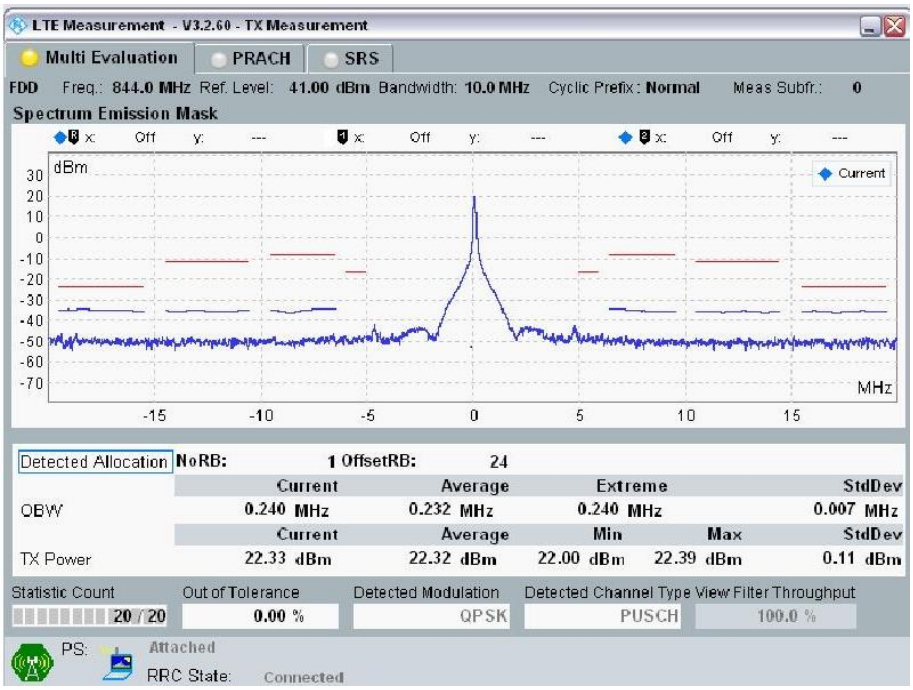
Spectrum Plots for the Test RB allocations



10MHz Band Width: Ch 20600, RB Size=1; RB Offset = 0



10MHz Band Width: Ch 20600, RB Size=1; RB Offset = 24

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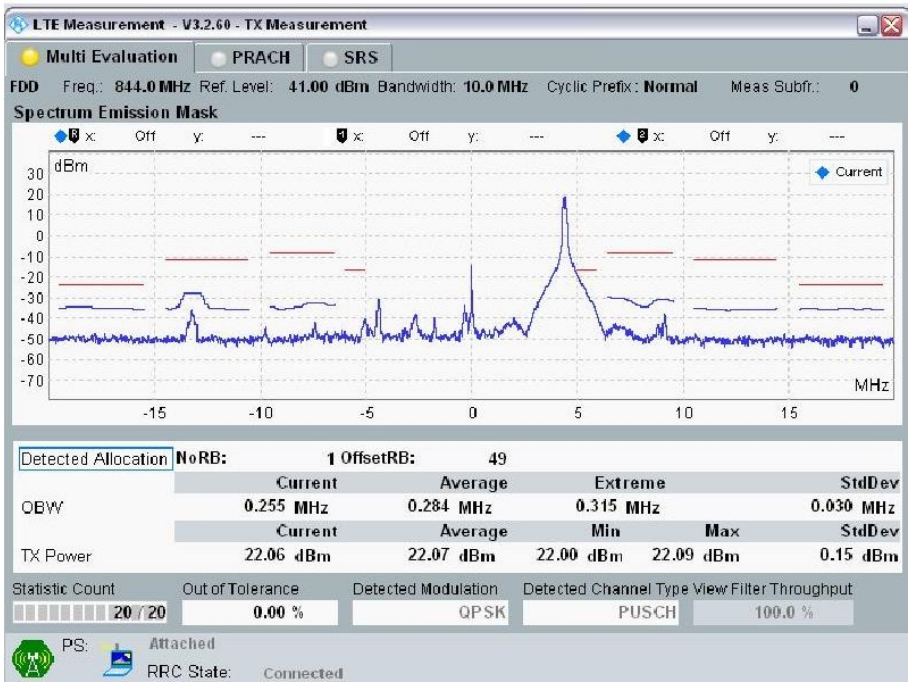
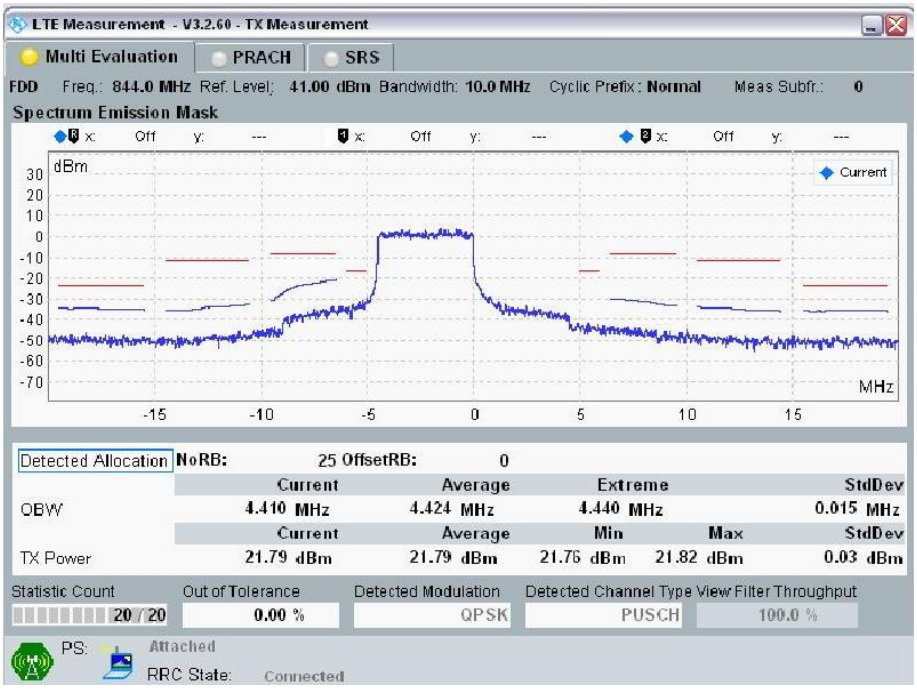


10MHz Band Width: Ch 20600, RB Size=1; RB Offset = 49



10MHz Band Width: Ch 20600, RB Size=25; RB Offset = 0

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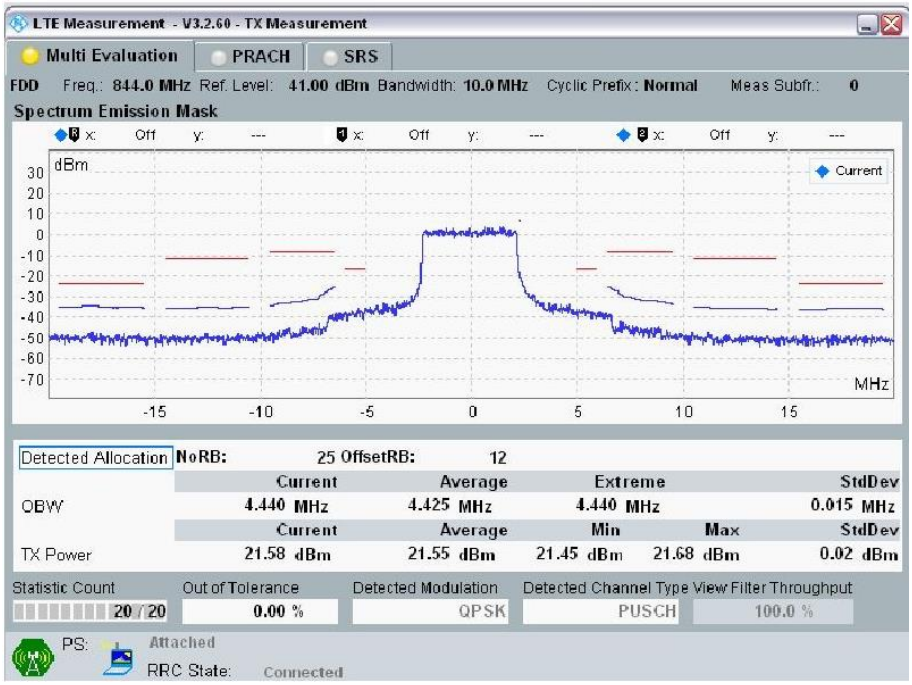
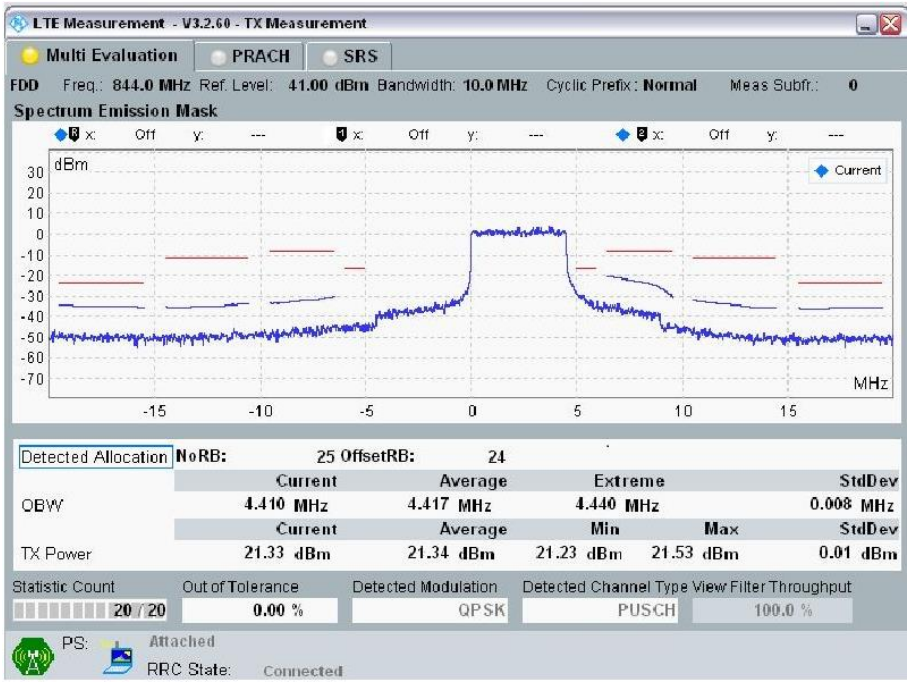


10MHz Band Width: Ch 20600, RB Size=25; RB Offset = 12



10MHz Band Width: Ch 20600, RB Size=25; RB Offset = 24

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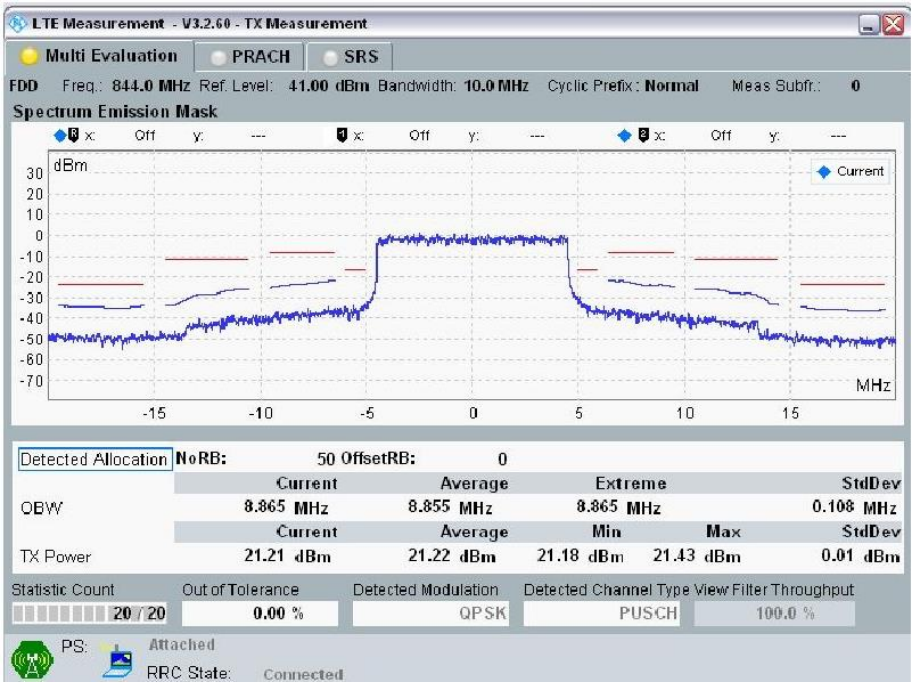

10MHz Band Width: Ch 20600, RB Size=50; RB Offset = 0

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9.2.4 LTE Band 17

Output power table

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
17	5	23755	706.5	QPSK	1	0	0	22.5
					1	12	0	22.0
					1	24	0	22.0
					12	0	1	21.8
					12	6	1	21.4
					12	11	1	21.3
					25	0	1	21.3
				16QAM	1	0	1	21.7
					1	12	1	21.4
					1	24	1	21.3
					12	0	2	20.8
					12	6	2	20.3
					12	11	2	20.4
					25	0	2	20.3
		23790	710.0	QPSK	1	0	0	22.7
					1	12	0	22.2
					1	24	0	22.5
					12	0	1	21.9
					12	6	1	21.4
					12	11	1	21.6
					25	0	1	21.8
				16QAM	1	0	1	22.0
					1	12	1	21.5
					1	24	1	21.7
					12	0	2	20.8
					12	6	2	20.5
					12	11	2	20.7
					25	0	2	20.7
		23825	713.5	QPSK	1	0	0	22.6
					1	12	0	22.0
					1	24	0	22.0
					12	0	1	21.8
					12	6	1	21.4
					12	11	1	21.3
					25	0	1	21.3
				16QAM	1	0	1	21.7
					1	12	1	21.3
					1	24	1	21.4
					12	0	2	20.8
					12	6	2	20.4
					12	11	2	20.3
					25	0	2	20.3

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Report No.: T180821W01-SF

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB offset	MPR	Average power(dBm)
17	10	23780	709.0	QPSK	1	0	0	22.5
					1	24	0	22.0
					1	49	0	22.0
					25	0	1	21.8
					25	12	1	21.4
					25	24	1	21.3
					50	0	1	21.3
				16QAM	1	0	1	21.7
					1	24	1	21.4
					1	49	1	21.3
					25	0	2	20.8
					25	12	2	20.3
					25	24	2	20.4
					50	0	2	20.3
		23790	710.0	QPSK	1	0	0	22.7
					1	24	0	22.2
					1	49	0	22.5
					25	0	1	21.9
					25	12	1	21.4
					25	24	1	21.6
					50	0	1	21.8
				16QAM	1	0	1	22.0
					1	24	1	21.5
					1	49	1	21.7
					25	0	2	20.8
					25	12	2	20.5
					25	24	2	20.7
					50	0	2	20.7
		23800	711.0	QPSK	1	0	0	22.6
					1	24	0	22.0
					1	49	0	22.0
					25	0	1	21.8
					25	12	1	21.4
					25	24	1	21.3
					50	0	1	21.3
				16QAM	1	0	1	21.7
					1	24	1	21.3
					1	49	1	21.4
					25	0	2	20.8
					25	12	2	20.4
					25	24	2	20.3
					50	0	2	20.3

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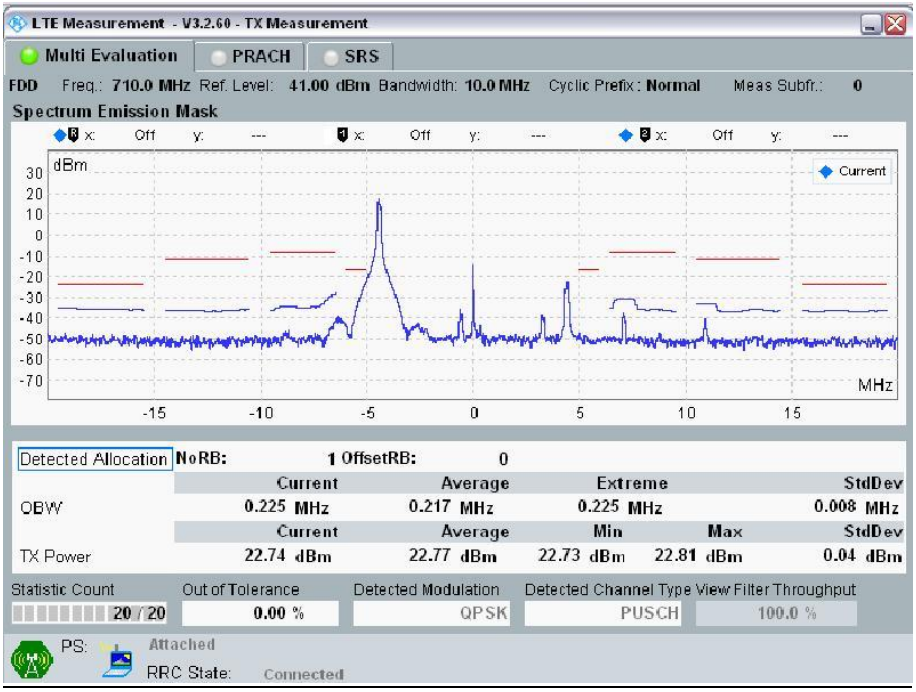
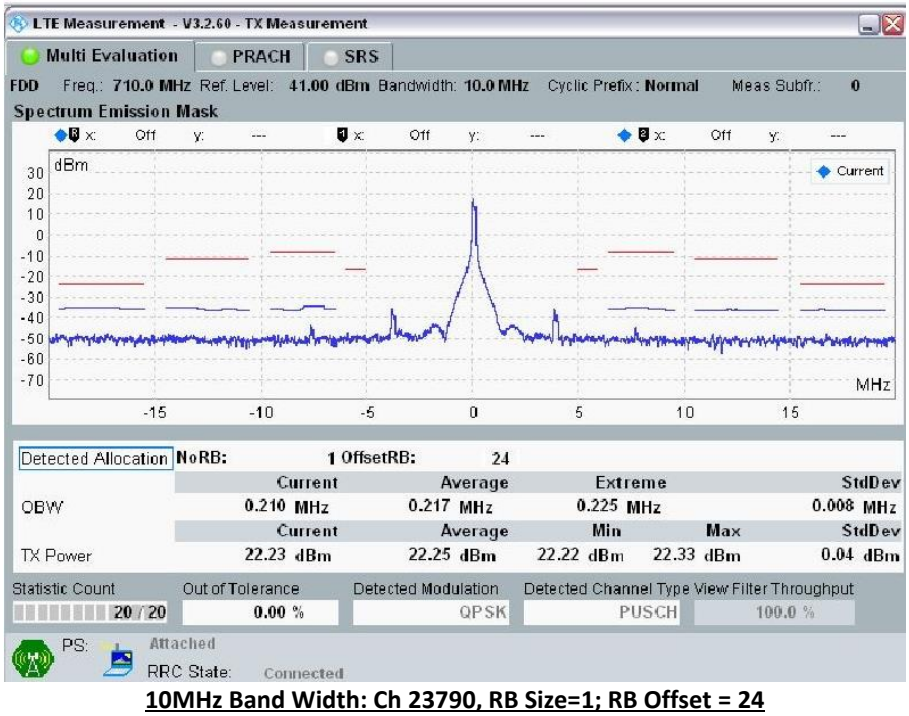
Report No.: T180821W01-SF

Spectrum Plots for the Test RB allocations



10MHz Band Width: Ch 23790, RB Size=1; RB Offset = 0



10MHz Band Width: Ch 23790, RB Size=1; RB Offset = 24

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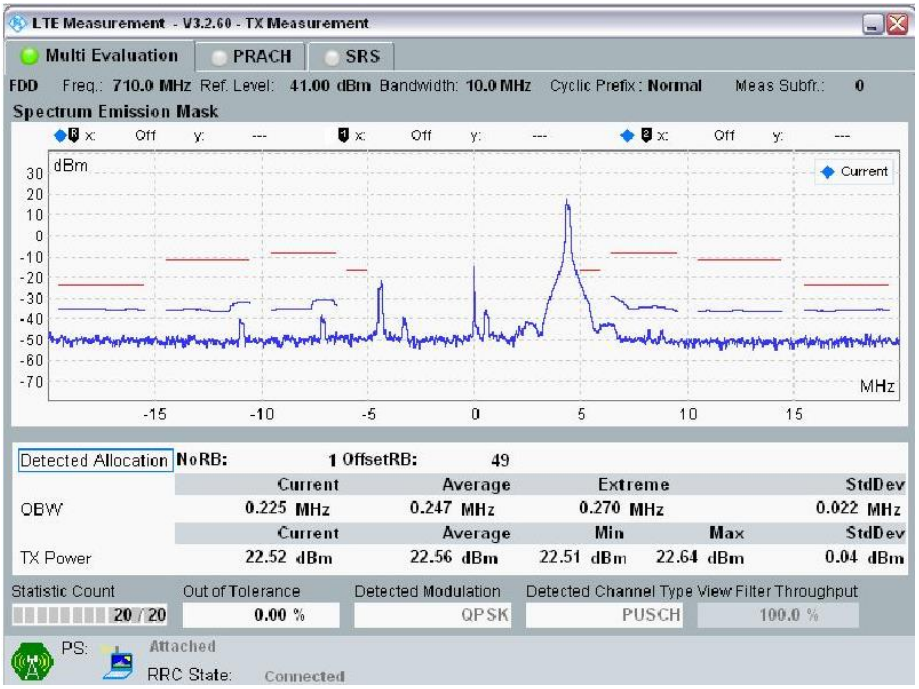
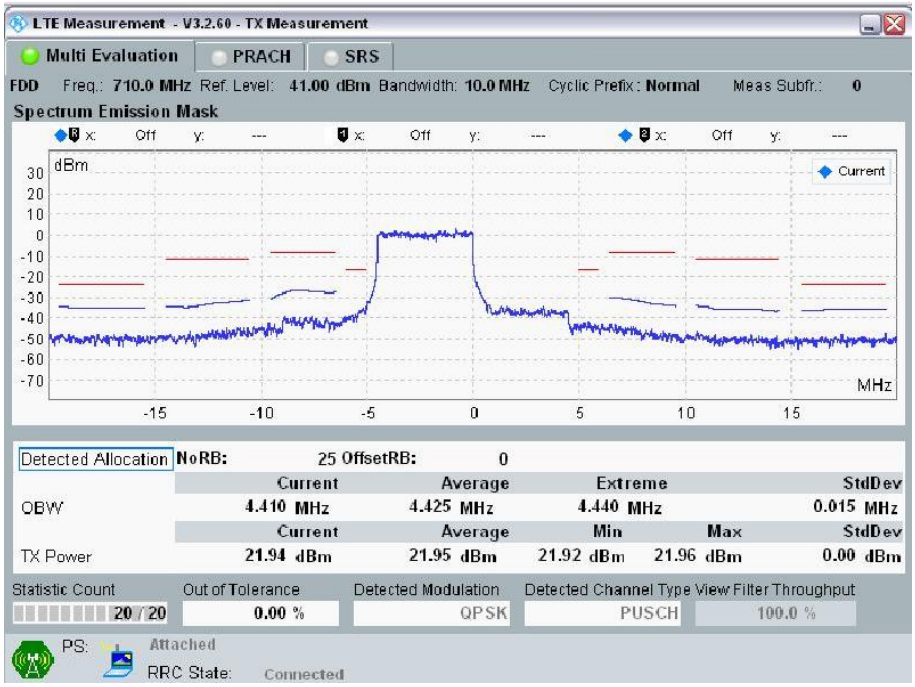


10MHz Band Width: Ch 23790, RB Size=1; RB Offset = 49



10MHz Band Width: Ch 23790, RB Size=25; RB Offset = 0

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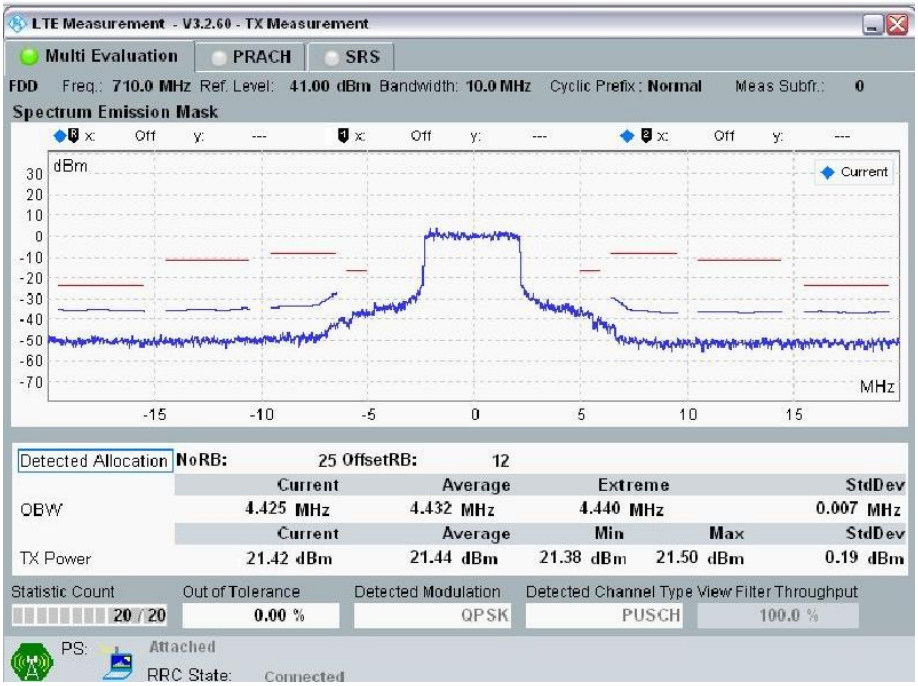
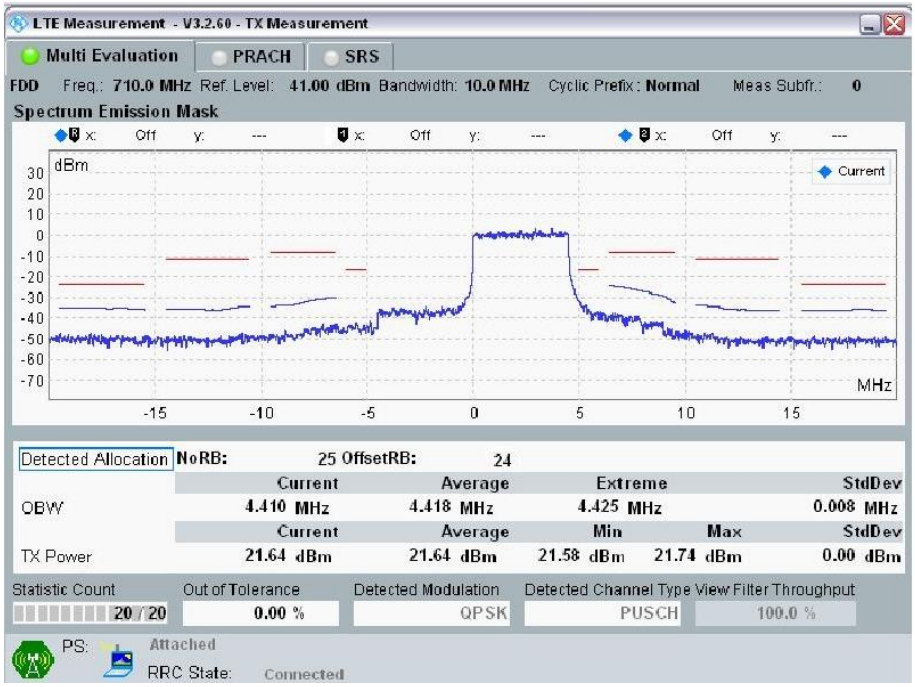


10MHz Band Width: Ch 23790, RB Size=25; RB Offset = 12



10MHz Band Width: Ch 23790, RB Size=25; RB Offset = 24

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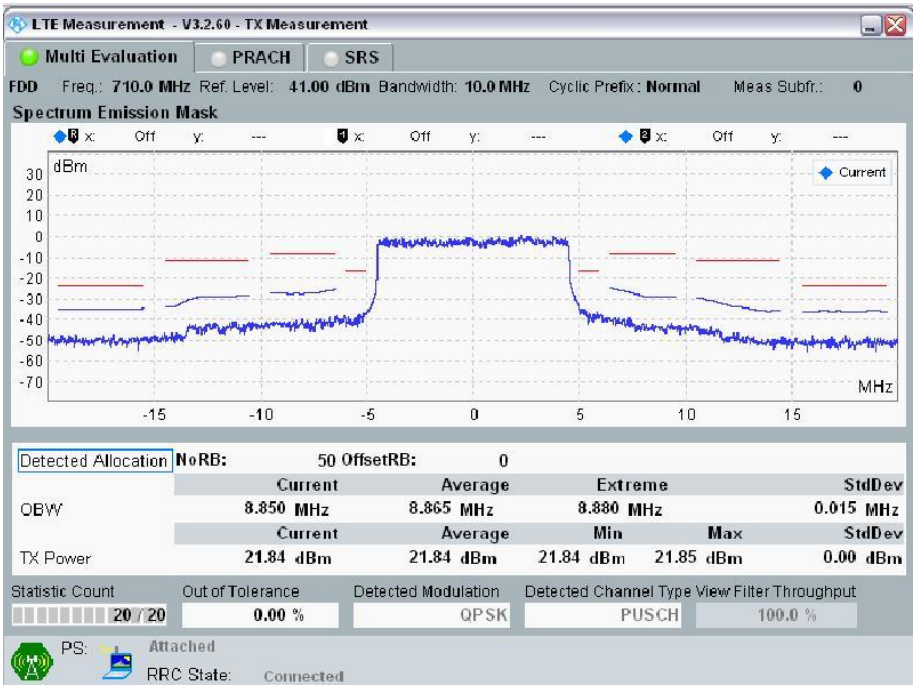

10MHz Band Width: Ch 23790, RB Size=50; RB Offset = 0

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9.3 Wi-Fi (2.4GHz Band)

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Avg. Pwr (dBm)	Maximum Tune-up Pwr (dBm)	SAR Test (Yes/No)	Note
2.4	802.11b	1	1	2412	14.8	16.0	Yes	
			6	2437	15.4	16.0		
			11	2462	15.6	16.0		
	802.11g	6	1-11	2412-2462	No Required	15.0	No	
	802.11n HT20	MCS0	1-11	2412-2462	No Required	14.0	No	

9.4 Bluetooth

Band (GHz)	Mode	Freq. (MHz)	Maximum Avg. Pwr (dBm)	Maximum Tune-up Pwr (dBm)
2.4	DH5	2402	7.3	8.0
		2441	7.7	8.0
		2480	7.7	8.0
	3DH5	2402-2480	No Required	5.5
	LE	2402-2480	No Required	6.5

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10 Summary of SAR Test Exclusion Configurations

10.1 Standalone SAR Test Exclusion Calculations

Since the Dedicated Host Approach is applied, the standalone SAR test exclusion procedure in KDB 447498 section4.3.1 is applied in conjunction with KDB 616217 section 4.3 to determine the minimum test separation distance:

1. According to KDB 447498 Section 4.1 5) if the antenna is at close proximity to user then the outer surface of the DUT should be treated as the radiating surface. The test separation distance is then determined by the smallest distance between the outer surface of the device and the user. For the purposes of this report close proximity has been defined as closer than 50 mm. For antennas <50 mm from the rear or edge the separation distance used for the estimated SAR calculations is 0 mm.
2. When the minimum test separation distance is < 5mm, a distance of 5mm is applied to determine SAR test exclusion.
3. When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.
4. If the antenna to DUT adjacent edge or bottom separation distance >50mm the actual antenna to user separation distance is used to determine SAR exclusion and estimated SAR value.

Refer to Appendix for the specific details on the antenna-to-antenna and antenna-to-edge distances used for test exclusion calculations.

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10.1.1 SAR Exclusion Calculations for WWAN & WLAN Antenna < 50mm from the User

According to KDB 447498 v06 in section 4.3.1, if the calculated threshold value is > 3 then SAR testing is required.

For WWAN

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
WWAN	WCDMA Band II	1852.4	24.0	251	8.8	11.8	24.6	140	140	38.8	29.0	13.9	>50mm	>50mm
WWAN	WCDMA Band IV	1852.4	24.0	251	8.8	11.8	24.6	140	140	38.8	29.0	13.9	>50mm	>50mm
WWAN	WCDMA Band V	826.4	24.0	251	8.8	11.8	24.6	140	140	25.9	19.3	9.3	>50mm	>50mm
WWAN	LTE Band 2	1880	23.0	200	8.8	11.8	24.6	140	140	31.2	23.2	11.1	>50mm	>50mm
WWAN	LTE Band 4	1732.5	23.0	200	8.8	11.8	24.6	140	140	29.9	22.3	10.7	>50mm	>50mm
WWAN	LTE Band 5	824.7	23.0	200	8.8	11.8	24.6	140	140	20.6	15.4	7.4	>50mm	>50mm
WWAN	LTE Band 17	710	23.0	200	8.8	11.8	24.6	140	140	19.2	14.3	6.9	>50mm	>50mm

For WLAN & BLUETOOTH

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
Wi-Fi Main	2.4GHz	2437	16.0	40	6.7	137	182	9.0	24.5	9.4	>50mm	>50mm	6.9	2.5
Wi-Fi Main	Bluetooth	2402	8.0	6	6.7	137	182	9.0	24.5	1.4	>50mm	>50mm	1.0	0.4

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10.1.2 SAR Exclusion Calculations for WWAN & WLAN Antenna > 50mm from the User

According to KDB 447498 v06 , if the calculated Power threshold is less than the output power then SAR testing is required.

For WWAN

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
WWAN	WCDMA Band II	1852.4	24.0	251	8.8	11.8	24.6	140	140	<50mm	<50mm	<50mm	1010.21	1010.21
WWAN	WCDMA Band IV	1852.4	24.0	251	8.8	11.8	24.6	140	140	<50mm	<50mm	<50mm	1010.21	1010.21
WWAN	WCDMA Band V	826.4	24.0	251	8.8	11.8	24.6	140	140	<50mm	<50mm	<50mm	660.84	660.84
WWAN	LTE Band 2	782	23.0	200	8.8	11.8	24.6	140	140	<50mm	<50mm	<50mm	1069.62	1069.62
WWAN	LTE Band 4	1732.5	23.0	200	8.8	11.8	24.6	140	140	<50mm	<50mm	<50mm	1013.96	1013.96
WWAN	LTE Band 5	824.7	23.0	200	8.8	11.8	24.6	140	140	<50mm	<50mm	<50mm	659.99	659.99
WWAN	LTE Band 17	710	23.0	200	8.8	11.8	24.6	140	140	<50mm	<50mm	<50mm	604.02	604.02

For WLAN & BLUETOOTH

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
Wi-Fi Main	2.4GHz	2437	16.0	40	6.66	137	182.0	9	24.5	<50mm	966.09	1416.09	<50mm	<50mm
Wi-Fi Main	Bluetooth	2402	8.0	6	6.66	137	182.0	9	24.5	<50mm	966.78	1416.78	<50mm	<50mm

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10.1.3 SAR Required Test Configuration

Per KDB 616217D04 v01, front side will need to be tested when overall diagonal is less than 200mm. The overall diagonal length of this device is 258 mm; therefore, test with front side is not required.

For WWAN

Test Configurations	Rear	Edge1	Edge2	Edge3	Edge4	Front
WCDMA Band II	Yes	Yes	Yes	No	No	No
WCDMA Band IV	Yes	Yes	Yes	No	No	No
WCDMA Band V	Yes	Yes	Yes	No	No	No
LTE Band 2	Yes	Yes	Yes	No	No	No
LTE Band 4	Yes	Yes	Yes	No	No	No
LTE Band 5	Yes	Yes	Yes	No	No	No
LTE Band 17	Yes	Yes	Yes	No	No	No

Note(s):

1. Yes = SAR is required.
2. No = SAR is not required.

For WLAN & BLUETOOTH

Test Configurations	Rear	Edge1	Edge2	Edge3	Edge4	Front
Wi-Fi Main 2.4GHz	YES	No	No	YES	No	No
Bluetooth	No	No	No	No	No	No

Note(s):

1 Yes = SAR is required.
2 No = SAR is not required.
3 For Bluetooth is not required to performed SAR test, but we have to assess the simultaneous transmission, so we selected the worst configurations to performed the SAR test.

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11 Exposure Limit

(A). Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	2.0

(B). Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

NOTE: **Whole-Body SAR** is averaged over the entire body, **partial-body SAR** is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. **SAR for hands, wrists, feet and ankles** is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments:

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

Occupational/Controlled Environments:

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

NOTE
GENERAL POPULATION/UNCONTROLLED EXPOSURE
PARTIAL BODY LIMIT
1.6 W/kg

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12 Tissue Dielectric Properties

12.1 Test Liquid Confirmation

Simulating Liquids Parameter Check

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values

The relative permittivity and conductivity of the tissue material should be within ± 5% of the values given in the table below 5% may not be easily achieved at certain frequencies.

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE 1528 2013 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in IEEE 1528 2013 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE 1528 2013

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

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12.2 Typical Composition of Ingredients for Liquid Tissue Phantoms

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

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

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

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12.3 Simulating Liquids Parameter Check Results

Date	Band	Freq(MHz)	Measured			Standard		Δ		Limit (%)
			e' (εr)	e''	σ	e' (εr)	σ	e' (εr)	σ	±5
2018/9/13	Body 1800	1712.4	53.05	15.57	1.48	53.53	1.46	-0.90%	1.15%	±5
		1732.4	52.87	15.64	1.51	53.48	1.48	-1.13%	1.91%	±5
		1752.6	52.80	15.74	1.53	53.43	1.49	-1.17%	2.89%	±5
2018/9/13	Body 1800	1715	53.03	15.57	1.48	53.52	1.47	-0.91%	1.18%	±5
		1732.5	52.94	15.60	1.50	53.48	1.48	-1.01%	1.67%	±5
		1750	52.86	15.65	1.52	53.43	1.49	-1.07%	2.21%	±5
2018/9/13	Body 1900	1852.4	51.12	14.04	1.45	53.30	1.52	-4.10%	-4.93%	±5
		1880	51.02	13.98	1.46	53.30	1.52	-4.27%	-3.91%	±5
		1907.6	50.87	14.16	1.50	53.30	1.52	-4.55%	-1.30%	±5
2018/9/13	Body 1900	1855	51.12	14.02	1.44	53.30	1.52	-4.10%	-4.94%	±5
		1880	51.02	13.98	1.46	53.30	1.52	-4.27%	-3.91%	±5
		1905	50.89	14.13	1.50	53.30	1.52	-4.52%	-1.63%	±5
2018/9/14	Body 750	709	53.59	23.33	0.92	55.69	0.96	-3.77%	-4.29%	±5
		710	53.59	23.33	0.92	55.69	0.96	-3.76%	-4.16%	±5
		711	53.59	23.33	0.92	55.68	0.96	-3.75%	-4.04%	±5
2018/9/14	Body 900	826.4	55.18	21.24	0.97	55.24	0.97	-0.10%	0.58%	±5
		836.6	55.08	21.20	0.99	55.20	0.97	-0.22%	1.47%	±5
		846.6	54.99	21.16	1.00	55.17	0.98	-0.32%	1.19%	±5
2018/9/14	Body 900	829	55.14	21.23	0.98	55.22	0.97	-0.14%	0.83%	±5
		836.5	55.08	21.20	0.99	55.20	0.97	-0.22%	1.46%	±5
		844	54.99	21.16	0.99	55.17	0.98	-0.33%	1.13%	±5
2018/10/1	Body 2450	2412	51.02	14.93	2.00	52.75	1.91	-3.28%	4.55%	±5
		2437	50.95	15.01	2.03	52.72	1.94	-3.35%	4.90%	±5
		2442	50.94	15.02	2.04	52.71	1.94	-3.36%	4.94%	±5
		2462	50.87	15.09	2.06	52.68	1.97	-3.45%	4.91%	±5
		2472	50.82	15.12	2.08	52.67	1.98	-3.51%	4.80%	±5

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13 Measurement Uncertainty

According to KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz section 2.8.2, SAR measurement uncertainty analysis is required in SAR reports only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

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14 System Performance Check

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Body simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm
- The DASY4/DASY5 system with an E-field probe EX3DV4 SN: 3665 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 mm (below 1 GHz) and 10 mm (above 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration (dx=dy= 5 mm, dz= 5 mm).
- Distance between probe sensors and phantom surface was set to 3.0 mm.
- The dipole input power (forward power) was 100 mW±3%.
- The results are normalized to 1 W input power.

Reference SAR Values for System Performance Check

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D750V2	1020	2018/01/18	750	1g	8.36	8.66
				10g	5.50	5.75
D835V2	4d015	2018/03/19	835	1g	9.46	9.55
				10g	6.11	6.27
D1750V2	1158	2018/03/23	1800	1g	37.30	36.20
				10g	19.50	19.20
D1900V2	5d056	2018/02/22	1900	1g	40.20	39.60
				10g	21.00	20.90
D2450V2	735	2017/12/15	2450	1g	51.40	50.60
				10g	23.90	23.90

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14.1 System Performance Check Results

Date	System Dipole			Parameters	Target[W/kg]	Measured [W/kg]	Deviation[%]	Limited[%]
	Type	Serial No.	Liquid					
2018/9/13	D1750V2	1158	Body	1g SAR:	37.30	38.50	3.22	± 5
				10g SAR:	19.50	20.10	3.08	± 5
2018/9/13	D1900V2	5d056	Body	1g SAR:	39.60	40.20	1.52	± 5
				10g SAR:	20.90	21.70	3.83	± 5
2018/9/14	D750V2	1020	Body	1g SAR:	8.66	8.96	3.46	± 5
				10g SAR:	5.75	5.91	2.78	± 5
2018/9/14	D835V2	4d015	Body	1g SAR:	9.55	9.96	4.29	± 5
				10g SAR:	6.27	6.51	3.83	± 5
2018/10/1	D2450V2	735	Body	1g SAR:	50.60	51.30	1.38	± 5
				10g SAR:	23.90	24.50	2.51	± 5

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15 SAR Measurements Results

WCDMA Band II:

Band	Mode	Test Position	Channel	Freq. (MHz)	Dist. (mm)	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note	Plot No.
						Tune up limit	Measured				
WCDMA Band II	Rel 99 RMC 12.2Kbps	Edge 1	9538	1907.6	0	24.0	23.2	1.150	1.383		1
		Edge 1	9262	1852.4	0	24.0	22.6	0.607	0.838	1	
		Edge 1	9400	1880.0	0	24.0	23.1	0.753	0.926	1	
		Edge 2	9538	1907.6	0	24.0	23.2	0.058	0.069		
		Rear	9538	1907.6	0	24.0	23.2	0.452	0.543		
		Edge 1	9538	1907.6	0	24.0	23.2	1.020	1.226	2	

Note(s):

1. Testing of other required channels within the operating mode of a frequency band is required when the reported 1-g SAR for the mid-band or highest output power channel. ≥0.8 W/kg and transmission band ≤ 100 MHz (Per KDB 447498 D01 v06 section 4.3.3)
2. Repeated measurements are required only when the measured SAR is ≥0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04)
   2.1 Original SAR = 1.15 W/kg, therefore two times repeat SAR is required.
   2.2 Repeat SAR = 1.02 W/kg < 1.45W/kg
   2.3 SAR variation= 11.3 % < 20%

WCDMA Band IV:

Band	Mode	Test Position	Channel	Freq. (MHz)	Dist. (mm)	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note	Plot No.
						Tune up limit	Measured				
WCDMA Band IV	Rel 99 RMC 12.2Kbps	Edge 1	1413	1732.6	0	24.0	23.0	0.802	1.010		2
		Edge 1	1312	1712.4	0	24.0	22.7	0.584	0.788	1	
		Edge 1	1513	1752.6	0	24.0	22.5	0.499	0.705	1	
		Edge 2	1413	1732.6	0	24.0	23.0	0.070	0.088		
		Rear	1413	1732.6	0	24.0	23.0	0.620	0.781		

Note(s):

1. Testing of other required channels within the operating mode of a frequency band is required when the reported 1-g SAR for the mid-band or highest output power channel. ≥0.8 W/kg and transmission band ≤ 100 MHz (Per KDB 447498 D01 v06 section 4.3.3)

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WCDMA Band V:

Band	Mode	Test Position	Channel	Freq. (MHz)	Dist. (mm)	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note	Plot No.
						Tune up limit	Measured				
WCDMA Band V	Rel 99 RMC 12.2Kbps	Edge 1	4183	836.6	0	24.0	22.8	0.475	0.626		3
		Edge 1	4132	826.4	0	24.0	22.1	0.378	0.585		
		Edge 1	4233	846.6	0	24.0	22.4	0.364	0.526		
		Edge 2	4183	836.6	0	24.0	22.8	0.111	0.146		
		Rear	4183	836.6	0	24.0	22.8	0.313	0.413		

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LTE Band 2 (20MHz Bandwidth):

Band	Mode	Test Position	Channel	Freq. (MHz)	Dist. (mm)	UL RB Allocation	UL RB Start	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note	Plot No.
								Tune up limit	Measured				
LTE Band 2	QPSK	Edge 1	18900	1880.0	0	1	0	23.0	22.8	1.180	1.236		4
			18900	1880.0	0	1	49	23.0	22.8	1.070	1.120	2	
			18900	1880.0	0	1	99	23.0	22.6	0.902	0.989	2	
			18900	1880.0	0	50	0	22.0	22.0	0.772	0.772		
			18900	1880.0	0	50	24	22.0	21.8	0.766	0.802	2	
			18900	1880.0	0	50	49	22.0	21.6	0.729	0.799	2	
			18900	1880.0	0	100	0	22.0	21.6	0.825	0.905		
			18700	1860.0	0	1	0	23.0	22.8	0.932	0.976	2	
			18700	1860.0	0	50	0	22.0	22.0	0.880	0.880	2	
			18700	1860.0	0	100	0	22.0	21.8	0.793	0.830	2	
			19100	1900.0	0	1	0	23.0	22.6	1.050	1.151	2	
			19100	1900.0	0	50	0	22.0	21.7	0.834	0.894	2	
			19100	1900.0	0	100	0	22.0	21.7	0.799	0.856	2	
		Edge 1	18900	1880.0	0	1	0	23.0	22.8	1.100	1.152	3	
		Edge 2	18900	1880.0	0	1	0	23.0	22.8	0.060	0.063		
			18900	1880.0	0	50	0	22.0	22.0	0.047	0.047		
			18900	1880.0	0	100	0	22.0	21.6	0.062	0.068		
		Rear	18900	1880.0	0	1	0	23.0	22.8	0.156	0.163		
			18900	1880.0	0	50	0	22.0	22.0	0.154	0.154		
			18900	1880.0	0	100	0	22.0	21.6	0.149	0.163		

Note(s):

1. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. (Per KDB 941225 D05 v02r05 section 4.2.1)
2. The highest reported SAR for 1 RB and 50% RB allocation are ≥ 0.8 W/kg, SAR is required of 100% RB. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg. (Per KDB 941225 D05 v02r05 section 4.2.3)
3. Repeated measurements are required only when the measured SAR is ≥0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04)
   3.1 Original SAR = 1.18 W/kg, therefore two times repeat SAR is required.
   3.2 Repeat SAR = 1.10 W/kg < 1.45W/kg
   3.3 SAR variation= 6.7 % < 20%

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LTE Band 4 (20MHz Bandwidth):

Band	Mode	Test Position	Channel	Freq. (MHz)	Dist. (mm)	UL RB Allocation	UL RB Start	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note	Plot No.
								Tune up limit	Measured				
LTE Band 4	QPSK	Edge1	20050	1720.0	0	1	0	23.0	22.9	0.889	0.910		
			20050	1720.0	0	1	49	23.0	22.6	0.877	0.962	2	
			20050	1720.0	0	1	99	23.0	22.5	0.871	0.977	2	5
			20050	1720.0	0	50	0	22.0	22.0	0.593	0.593		
			20050	1720.0	0	100	0	22.0	21.7	0.616	0.660		
			20175	1732.5	0	1	0	23.0	22.7	0.770	0.825	2	
			20300	1745.0	0	1	0	23.0	22.8	0.868	0.909	2	
			20050	1720.0	0	1	0	23.0	22.9	0.939	0.961	3	
		Edge 2	20050	1720.0	0	1	0	23.0	22.9	0.062	0.064		
			20050	1720.0	0	50	0	22.0	22.0	0.047	0.047		
			20050	1720.0	0	100	0	22.0	21.7	0.057	0.061		
		Rear	20050	1720.0	0	1	0	23.0	22.9	0.614	0.628		
			20050	1720.0	0	50	0	22.0	22.0	0.542	0.542		
			20050	1720.0	0	100	0	22.0	21.7	0.545	0.584		

Note(s):

1. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. (Per KDB 941225 D05 v02r05 section 4.2.1)
2. The highest reported SAR for 1 RB and 50% RB allocation are ≥ 0.8 W/kg, SAR is required of 100% RB. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg. (Per KDB 941225 D05 v02r05 section 4.2.3)
3. Repeated measurements are required only when the measured SAR is ≥0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04)
   3.1 Original SAR = 0.889 W/kg, therefore two times repeat SAR is required.
   3.2 Repeat SAR = 0.939 W/kg < 1.45W/kg
   3.3 SAR variation= -5.6 % < 20%

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LTE Band 5 (10MHz Bandwidth):

Band	Mode	Test Position	Channel	Freq. (MHz)	Dist. (mm)	UL RB Allocation	UL RB Start	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note	Plot No.
								Tune up limit	Measured				
LTE Band 5	QPSK	Edge1	20600	844.0	0	1	0	23.0	22.6	0.523	0.573		
			20600	844.0	0	25	0	22.0	21.8	0.424	0.444		
		Edge2	20600	844.0	0	1	0	23.0	22.6	0.095	0.104		
			20600	844.0	0	25	0	22.0	21.8	0.080	0.084		
		Rear	20600	844.0	0	1	0	23.0	22.6	0.625	0.685		6
			20600	844.0	0	25	0	22.0	21.8	0.557	0.583		
			20450	829.0	0	1	0	23.0	22.6	0.408	0.447		
			20525	836.5	0	1	0	23.0	22.5	0.497	0.558		

LTE Band 17 (10MHz Bandwidth):

Band	Mode	Test Position	Channel	Freq. (MHz)	Dist. (mm)	UL RB Allocation	UL RB Start	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note	Plot No.
								Tune up limit	Measured				
LTE Band 17	QPSK	Edge1	23790	710.0	0	1	0	23.0	22.7	0.305	0.327		
			23790	710.0	0	25	0	22.0	21.9	0.315	0.322		
		Edge 2	23790	710.0	0	1	0	23.0	22.7	0.023	0.025		
			23790	710.0	0	25	0	22.0	21.9	0.024	0.025		
		Rear	23790	710.0	0	1	0	23.0	22.7	0.335	0.359		7
			23790	710.0	0	25	0	22.0	21.9	0.324	0.332		
			23780	709.0	0	1	0	23.0	22.7	0.247	0.265		
			23800	711.0	0	1	0	23.0	22.6	0.270	0.296		

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Wi-Fi (2.4GHz Band):

Band (GHz)	Mode	Dist. (mm)	Test Position	Ch#	Freq. (MHz)	Chain	Power (dBm)		Area Scan (W/Kg)	Meas. 1g SAR (W/kg)	Reported SAR (W/kg)	Note	Plot No.
							Tune up limit	Meas.					
2.4GHz	802.11b	0	Rear	11	2462	0	16.0	15.6	1.140	1.270	1.393		8
		0	Edge 3	11	2462	0	16.0	15.6	0.374	0.383	0.420		
		0	Rear	6	2437	0	16.0	15.4	0.979	1.150	1.320	2	
		0	Rear	1	2412	0	16.0	14.8	0.883	1.030	1.358	2	
		0	Rear	11	2462	0	16.0	15.6	1.040	1.190	1.305	3	

Note(s):

1. Highest reported SAR is > 0.4 W/kg. Due to the highest reported SAR for this test position, other test positions in this exposure condition were evaluated until a SAR ≤ 0.8 W/kg was reported.
2. Highest reported SAR is > 0.8 W/kg. Added second highest power channel for this test position
3 Repeated measurements are required only when the measured SAR is ≥0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04)
   3.1 Original SAR = 1.270 W/kg, therefore two times repeat SAR is required.
   3.2 Repeat SAR = 1.160 W/kg < 1.45W/kg
   3.3 SAR variation= 8.6 % < 20%

Bluetooth

Band (GHz)	Mode	Dist. (mm)	Test Position	Ch#	Freq. (MHz)	Power (dBm)		Area Scan (W/Kg)	Meas. 1g SAR (W/kg)	Reported SAR (W/kg)	Note	Plot No.
						Tune up limit	Meas.					
2.4GHz	DH5	0	Rear	39	2441	8.0	7.7	0.002	0.001	0.001		9

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16 Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance v06, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / R_i$$

Where:

SAR₁ is the highest Reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR₂ is the highest Reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Rᵢ is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

A new threshold of 0.04 is also introduced in the draft KDB. Thus, in order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of: $(SAR_1 + SAR_2)^{1.5} / R_i < 0.04$

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16.1 Sum of the SAR for WCDMA II, Wi-Fi & BT

Test Position	1	2	3	1+2		1+3	
	WWAN	Wi-Fi 2.4GHz	Bluetooth	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)
Rear	0.543	1.393	0.001	1.94	Yes	0.54	No
Edge1	1.383			1.38	No	1.38	No
Edge2	0.069			0.07	No	0.07	No
Edge3		0.420		0.42	No	0.00	No
Edge4							

WCDMA Band II + 2.4GHz Band

Test Position	Simulataneous Transmission Scenario		∑ 1-g SAR (W/kg)	Calculated distance (cm)	SPLSR	Figure
	WCDMA Band II	Wi-Fi 2.4 GHz Band				
Rear	0.543	1.393	1.936	14.40	0.02	1

Note(s):

The SPLSR is rounded to two decimal digits and ≦0.04

16.2 Sum of the SAR for WCDMA IV, Wi-Fi & BT

Test Position	1	2	3	1+2		1+3	
	WWAN	Wi-Fi 2.4GHz	Bluetooth	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)
Rear	0.620	1.393	0.001	2.01	Yes	0.62	No
Edge1	0.802			0.80	No	0.80	No
Edge2	0.070			0.07	No	0.07	No
Edge3		0.420		0.42	No	0.00	No
Edge4							

WCDMA Band IV + 2.4GHz Band

Test Position	Simulataneous Transmission Scenario		∑ 1-g SAR (W/kg)	Calculated distance (cm)	SPLSR	Figure
	WCDMA Band IV	Wi-Fi 2.4 GHz Band				
Rear	0.620	1.393	2.013	15.04	0.02	2

Note(s):

The SPLSR is rounded to two decimal digits and ≦0.04

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16.3 Sum of the SAR for WCDMA V, Wi-Fi & BT

Test Position	1	2	3	1+2		1+3	
	WWAN	Wi-Fi 2.4GHz	Bluetooth	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)
Rear	0.413	1.393	0.001	1.81	Yes	0.41	No
Edge1	0.626			0.63	No	0.63	No
Edge2	0.070			0.07	No	0.07	No
Edge3		0.420		0.42	No	0.00	No
Edge4							

WCDMA Band V + 2.4GHz Band

Test Position	Simulataneous Transmission Scenario		∑ 1-g SAR (W/kg)	Calculated distance (cm)	SPLSR	Figure
	WCDMA Band V	Wi-Fi 2.4 GHz Band				
Rear	0.413	1.393	1.806	13.26	0.02	3

Note(s):
The SPLSR is rounded to two decimal digits and ≦0.04

16.4 Sum of the SAR for LTE Band 2, Wi-Fi & BT

Test Position	1	2	3	1+2		1+3	
	WWAN	Wi-Fi 2.4GHz	Bluetooth	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)
Rear	0.163	1.393	0.001	1.56	No	0.16	No
Edge1	1.236			1.24	No	1.24	No
Edge2	0.068			0.07	No	0.07	No
Edge3		0.420		0.42	No	0.00	No
Edge4							

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16.5 Sum of the SAR for LTE Band 4, Wi-Fi & BT

Test Position	1	2	3	1+2		1+3	
	WWAN	Wi-Fi 2.4GHz	Bluetooth	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)
Rear	0.628	1.393	0.001	2.02	Yes	0.63	No
Edge1	0.825			0.83	No	0.83	No
Edge2	0.064			0.06	No	0.06	No
Edge3		0.420		0.42	No	0.00	No
Edge4							

LTE Band 4 + 2.4GHz Band

Test Position	Simulataneous Transmission Scenario		∑ 1-g SAR (W/kg)	Calculated distance (cm)	SPLSR	Figure
	LTE Band 4	Wi-Fi 2.4GHz Band				
Rear	0.628	1.393	2.021	15.48	0.02	4

Note(s):
The SPLSR is rounded to two decimal digits and ≦0.04

16.6 Sum of the SAR for LTE Band 5, Wi-Fi & BT

Test Position	1	2	3	1+2		1+3	
	WWAN	Wi-Fi 2.4GHz	Bluetooth	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)
Rear	0.685	1.393	0.001	2.08	Yes	0.69	No
Edge1	0.573			0.57	No	0.57	No
Edge2	0.104			0.10	No	0.10	No
Edge3		0.420		0.42	No	0.00	No
Edge4							

LTE Band 5 + 2.4GHz Band

Test Position	Simulataneous Transmission Scenario		∑ 1-g SAR (W/kg)	Calculated distance (cm)	SPLSR	Figure
	LTE Band 5	Wi-Fi 2.4GHz Band				
Rear	0.775	1.361	2.136	17.40	0.02	5

Note(s):
The SPLSR is rounded to two decimal digits and ≦0.04

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16.7 Sum of the SAR for LTE Band 17, Wi-Fi & BT

Test Position	1	2	3	1+2		1+3	
	WWAN	Wi-Fi 2.4GHz	Bluetooth	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)	Σ 1-g SAR (W/kg)	SPLSR (Yes/No)
Rear	0.359	1.393	0.001	1.75	Yes	0.36	No
Edge1	0.327			0.33	No	0.33	No
Edge2	0.025			0.03	No	0.03	No
Edge3		0.420		0.42	No	0.00	No
Edge4							

LTE Band 17 + 2.4GHz Band

Test Position	Simulataneous Transmission Scenario		∑ 1-g SAR (W/kg)	Calculated distance (cm)	SPLSR	Figure
	LTE Band 17	Wi-Fi 2.4GHz Band				
Rear	0.359	1.393	1.752	17.29	0.01	6

Note(s):
The SPLSR is rounded to two decimal digits and ≦0.04

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17 Equipment List & Calibration Status

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Cycle(year)	Calibration Due
S-Parameter Network Analyzer	Agilent	E5071C	MY46107234	1	2018/10/17
Electronic Probe kit	Hewlett Packard	85070D	N/A	N/A	N/A
Power Meter	Agilent	4416A	GB41291611	1	2019/08/19
Power Sensor	Agilent	8481H	MY41091956	1	2019/08/19
Data Acquisition Electronics (DAE)	SPEAG	DAE4	877	1	2019/03/19
Dosimetric E-Field Probe	SPEAG	EX3DV4	3665	1	2019/08/05
750MHz System Validation Dipole	SPEAG	D750V2	1020	1	2019/01/17
835MHz System Validation Dipole	SPEAG	D835V2	4d015	1	2019/03/18
1750MHz System Validation Dipole	SPEAG	D1750V2	1158	1	2019/03/22
1900MHz System Validation Dipole	SPEAG	D1900V2	5d056	1	2019/02/21
2450 MHz System Validation Dipole	SPEAG	D2450V2	735	1	2018/12/14
Robot	Staubli	RX90L	F02/5T69A1/A/01	N/A	N/A
Amplifier	Mini-Circuit	ZVE-8G	665500309	N/A	N/A
Amplifier	Mini-Circuit	ZHL-1724HLN	D072602#2	N/A	N/A
Thermometer	Comet	S3120	12932714	1	2019/03/01
Signal Grenerator	Aglient	83630B	3844A01022	1	2020/05/27
Directional Couplers	Aglient	87301D	MY44350252	1	2019/07/23

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18 Facilities

All measurement facilities used to collect the measurement data are located at

☐ No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

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20 Attachments

Exhibit	Content
1	System Performance Check Plots
2	SAR Test Data Plots
3	SPLSR Plots
4	SAR Equipment calibration report
5	T180821W01-SF PHOTOs

END OF REPORT

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