802 N. Twin Oaks Valley Road, Suite 105 • San Marcos, CA 92069 • U.S.A.
TEL (760) 471-2100 • FAX (760) 471-2121
http://www.rfexposurelab.com

CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Inseego Corp.
9710 Scranton Road, Suite 200
San Diego, CA 92121

Dates of Test: Aug. 5-19, Oct. 14, 2022, July 8-10, 2024
Test Report Number: SAR.20220809
Revision I
Lab Designation Number: US1195

FCC ID:	PKRISGM3000B
HVIN/Model(s):	M3000B & M3000B-NA
Product Market Number (PMN):	M3000
Test Sample:	Engineering Unit Same as Production
Serial Number:	BI160522F00365
Equipment Type:	Portable Router (Hotspot)
Classification:	Portable Transmitter Next to Body
TX Frequency Range:	663 – 698 MHz, 699 – 716 MHz, 777 – 787 MHz, 814 – 849 MHz, 1710 – 1780 MHz, 1850 – 1915 MHz, 2305 – 2315 MHz, 2496 – 2690 MHz, 3550 – 3700 MHz, 2412 – 2462 MHz, 5150 – 5250 MHz, 5745 – 5825 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	600 MHz (LTE) – 24.0 dBm, 750 MHz (LTE) – 24.0 dBm, 850 MHz (WCDMA) – 24.0 dBm, 850 MHz (LTE) – 24.0 dBm, 1750 MHz (WCDMA) – 24.0 dBm, 1750 MHz (LTE) – 24.5 dBm, 1900 MHz (WCDMA) – 24.0 dBm, 1900 MHz (LTE) – 24.5 dBm, 2300 MHz (LTE) – 23.0 dBm, 2550 MHz (LTE) – 27.0 dBm, 3600 MHz (LTE) – 21.5 dBm, 2450 MHz (b) – 18.0 dB, 2450 MHz (g) – 18.0 dB, 2450 MHz (ax/n20) – 18.0 dB, 5250 MHz (a) – 12.0 dB, 5250 MHz (ax/n20) – 12.0 dB, 5250 MHz (ac20) – 12.0 dB, 5800 MHz (a) – 16.0 dB, 5800 MHz (ax/n20) – 16.0 dB, 5800 MHz (ac20) – 16.0 dB Conducted
Signal Modulation:	WCDMA, QPSK, 16QAM, DSSS, OFDM
Antenna Type:	Internal
Application Type:	Certification
FCC Rule Parts:	Part 2, 15C, 22, 24, 27, 90
KDB Test Methodology:	KDB 447498 D01 v06, KDB 248227 v02r02, KDB 941225 D01 v03r01, D02 v02r01, D05 v02r05 & D06 v02r01
Max. Stand Alone SAR Value:	1.36 W/kg Reported
Max. Simultaneous Value:	0.04 W/kg Separation Ratiio
Separation Distance:	10 mm

This wireless mobile and/or portable device has been shown to be compliant for localized specific absorption rate (SAR) for uncontrolled environment/general exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and IEC 62209-1528:2020 (See test report).

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

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

Jay M. Moulton
Vice President

ACCREDITED
Testing Cert. # 2387.01

Table of Contents

Comment/Revision	Date
Original Release	September 7, 2022
Revision A – Change the KDB44798 version to v06 and change the format for the simultaneous UL CA and ENDC	September 12, 2022
Revision B – Change MIMO on band n41 to Antenna 3 from Antenna 0	September 21, 2022
Revision C – Remove data for Ant8 band 7	October 5, 2022
Revision D – Correct simultaneous table in section 11	October 6, 2022
Revision E – Evaluate simultaneous for Band 71	October 8, 2022
Revision F – Add Volume scan for Band 71 and WiFi	October 16, 2022
Revision G – Add Bands B17 & B30 plus 9 CA Combinations	July 24, 2024
Revision H – Add Model M3000B-NA	July 24, 2024
Revision I – Correct company name and address	July 30, 2024

Note: The latest version supersedes all previous versions listed in the above table. The latest version shall be used.

1. Introduction

This measurement report shows compliance of the Inseego Corp. Model M3000B & M3000B-NA FCC ID: PKRISGM3000B with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices. The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation to protect the public and workers from the potential hazards of RF emissions due to FCC regulated portable devices. [1], [6]

The two models are electrically and mechanically identical.

The test results recorded herein are based on a single type test of Inseego Corp. Model M3000B and therefore apply only to the tested sample.

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

The following table indicates all the wireless technologies operating in the M3000B Portable Router (Hotspot). The table also shows the tolerance for the power level for each mode.

Band	Technology	Power	3GPP Nominal Power dBm	Calibrated Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 71 – 600 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 12 & 17 – 750 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 13 – 750 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 5 & 26 – 835 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 4 & 66 – 1750 MHz	LTE	Full	23.0	23.0	+1.5/-1.3	21.7	24.5
Band 4 & 66 – 1750 MHz	LTE	Backoff	18.0	18.0	+1.5/-1.3	16.7	19.5
Band 2 & 25 – 1900 MHz	LTE	Full	23.0	23.0	+1.5/-1.3	21.7	24.5
Band 2 & 25 – 1900 MHz	LTE	Backoff	16.0	16.0	+1.5/-1.3	14.7	17.5
Band 30 – 2300 MHz	LTE	Full	22.0	22.0	+1.0/-1.3	20.7	23.0
Band 7 – 2550 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 7 – 2550 MHz	LTE	Backoff	18.5	18.5	+1.0/-1.3	17.2	19.5
Band 38 – 2550 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 38 – 2550 MHz	LTE	Backoff	19.5	19.5	+1.0/-1.3	18.2	20.5
Band 41 – 2550 MHz PC3	LTE	Full	23.3	23.3	+1.2/-1.3	22.0	24.5
Band 41 – 2550 MHz PC3	LTE	Backoff	19.3	19.3	+1.2/-1.3	18.0	20.5
Band 41 – 2550 MHz PC2	LTE	Full	26.3	26.3	+0.7/-3.0	23.3	27.0
Band 41 – 2550 MHz PC2	LTE	Backoff	19.3	19.3	+0.7/-3.0	16.3	20.0
Band 48 – 3600 MHz	LTE	Full	20.5	20.5	+1.0/-1.3	19.2	21.5
Band 5 – 850 MHz	WCDMA/HSPA	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 4 – 1750 MHz	WCDMA/HSPA	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 4 – 1750 MHz	WCDMA/HSPA	Backoff	18.5	18.5	+1.0/-1.3	17.2	19.5
Band 2 – 1900 MHz	WCDMA/HSPA	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 2 – 1900 MHz	WCDMA/HSPA	Backoff	15.5	15.5	+1.0/-1.3	14.2	16.5

Band	Technology	3GPP Nominal Power dBm	Calibrated Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
WLAN – 2.4 GHz	802.11bgn/ac/ax20	N/A	16.0	±2.0	14.0	18.0
WLAN – 5 GHz UNII Band I	802.11an/ac/ax20	N/A	10.0	±2.0	8.0	12.0
WLAN – 5 GHz UNII Band III	802.11an/ac/ax20	N/A	14.0	±2.0	12.0	16.0

LTE UL CA Combinations (Aggregate Power)

Band UL 2CA Combination	Technology	Class	Nominal dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
2A-4A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
2A-5A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
2A-12A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
2A-13A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
2A-66A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
4A-5A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
4A-12A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
4A-13A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
5A-66A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
5B	LTE	3	23.0	+1.0/-1.3	21.7	24.0
12A-66A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
13A-66A	LTE	3	23.0	+1.0/-1.3	21.7	24.0
41C	LTE	3	23.0	+1.0/-1.3	21.7	24.0
41C	LTE	2	25.0	+1.0/-1.3	23.7	26.0
48C	LTE	3	16.0	+1.0/-1.3	14.7	17.0
66B	LTE	3	23.0	+1.0/-1.3	21.7	24.0
66C	LTE	3	23.0	+1.0/-1.3	21.7	24.0

FR1 NSA UL ENDC Combinations (Aggregate Power)

Band UL ENDC Combination	Technology	Class	Nominal dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
4A-n2A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
5A-n2A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
12A-n2A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
13A-n2A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
30A-n2A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
66A-n2A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
2A-n5A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
7A-n5A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
30A-n5A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
48A-n5A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
66A-n5A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
66A-n7A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
2A-n12A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
48A-n12A	LTE+FR1	3	20.0	+1.5/-3.0	17.0	21.5
66A-n12A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
12A-m25A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
48A-n25A	LTE+FR1	3	20.0	+1.5/-3.0	17.0	21.5
66A-n25A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
2A-n41A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
66A-n41A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
2A-n66A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
5A-n66A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
7A-n66A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
12A-n66A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
13A-n66A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
30A-n66A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
48A-n66A	LTE+FR1	3	20.0	+1.5/-3.0	17.0	21.5
2A-n71A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
48A-n71A	LTE+FR1	3	20.0	+1.5/-3.0	17.0	21.5
66A-n71A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
2A-n77A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
5A-n77A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
7A-n77A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
12A-n77A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
13A-n77A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
30A-n77A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
66A-n77A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0
71A-n77A	LTE+FR1	3	23.0	+1.0/-3.0	20.0	24.0

FR1 SA 2X2 UL Combinations (Aggregate Power)

Band UL ENDC Combination	Technology	Class	Nominal dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
n41	FR1	3	23.0	+1.5/-3.0	20.0	24.5
n48	FR1	3	15.5	+1.5/-3.0	12.5	17.0
n77	FR1	3	23.0	+1.5/-3.0	20.0	24.5

SAR Definition [5]

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

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

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

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

where:

σ = conductivity of the tissue (S/m)

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

E = rms electric field strength (V/m)

2. SAR Measurement Setup

Robotic System

These measurements are performed using the DASY52 automated dosimetric assessment system. The DASY52 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, Intel Core2 computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 2.1).

System Hardware

A cell controller system contains the power supply, robot controller teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the HP Intel Core2 computer with Windows XP system and SAR Measurement Software DASY52, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

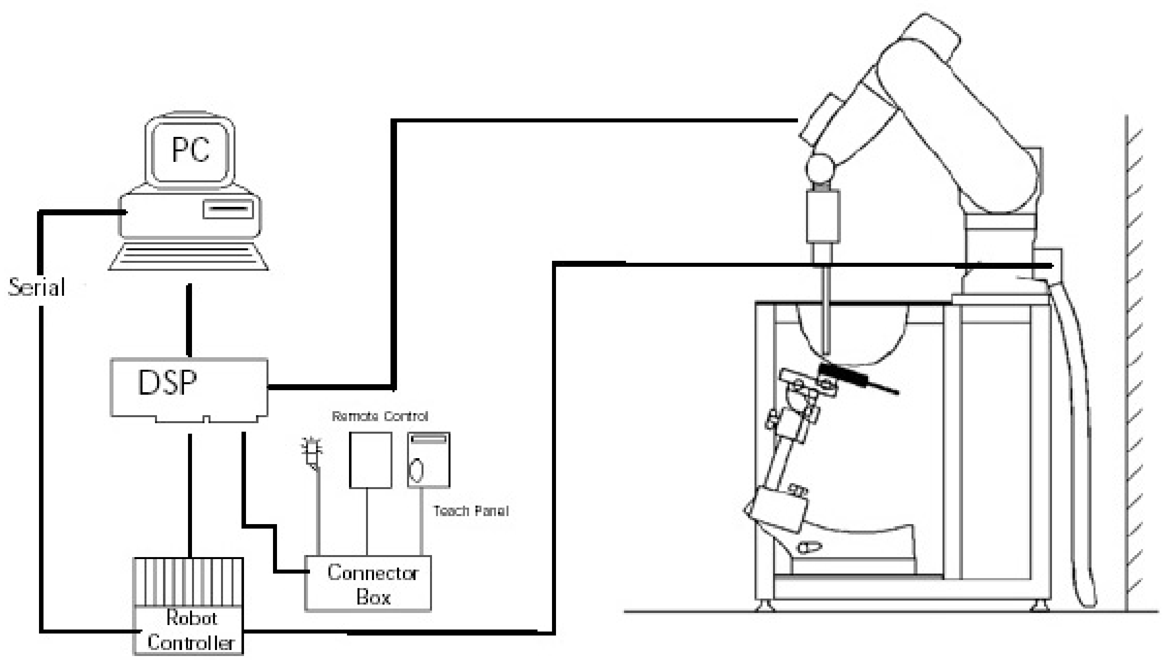


Figure 2.1 SAR Measurement System Setup

System Electronics

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in.

Probe Measurement System

The SAR measurements were conducted with the dosimetric probe EX3DV4, designed in the classical triangular configuration (see Fig. 2.2) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi fiber line ending at the front of the probe tip. (see Fig. 2.3) It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY52 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped at reaching the maximum.

DAE System

Probe Specifications

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

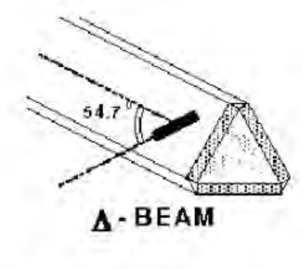


Figure 2.2 Triangular Probe Configurations

Frequency: 10 MHz to 6 GHz

Linearity: ±0.2dB (30 MHz to 6 GHz)

Dynamic: 10 mW/kg to 100 W/kg

Range: Linearity: ±0.2dB

Dimensions: Overall length: 330 mm

Tip length: 20 mm

Body diameter: 12 mm

Tip diameter: 2.5 mm

Distance from probe tip to sensor center: 1 mm

Figure 2.3 Probe Thick-Film Technique

Application: SAR Dosimetry Testing
Compliance tests of wireless device

Probe Calibration Process

Dosimetric Assessment Procedure

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

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a waveguide above 1GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

Temperature Assessment *

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

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

where:

Δt = exposure time (30 seconds),

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

ΔT = temperature increase due to RF exposure.

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

where:

σ = simulated tissue conductivity,

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

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

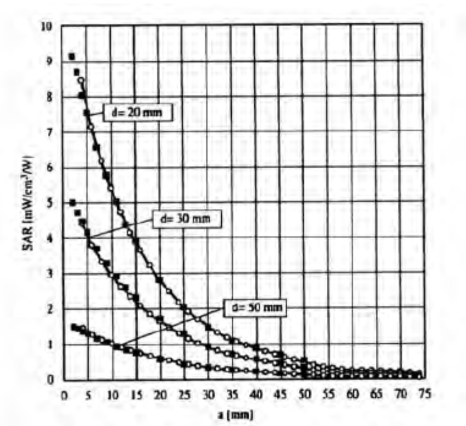


Figure 2.4 E-Field and Temperature Measurements at 900MHz

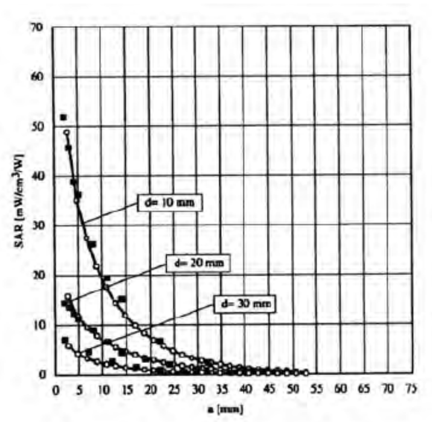


Figure 2.5 E-Field and Temperature Measurements at 1800MHz

Data Extrapolation

The DASY52 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given like below;

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

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

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

E-field probes:

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

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

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

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

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

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

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

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

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

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

Scanning procedure

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

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

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

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

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

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

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

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

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

Spatial Peak SAR Evaluation

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

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

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

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

Extrapolation

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

Interpolation

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

Volume Averaging

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

Advanced Extrapolation

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

SAM PHANTOM

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. (see Fig. 2.6)

Phantom Specification

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

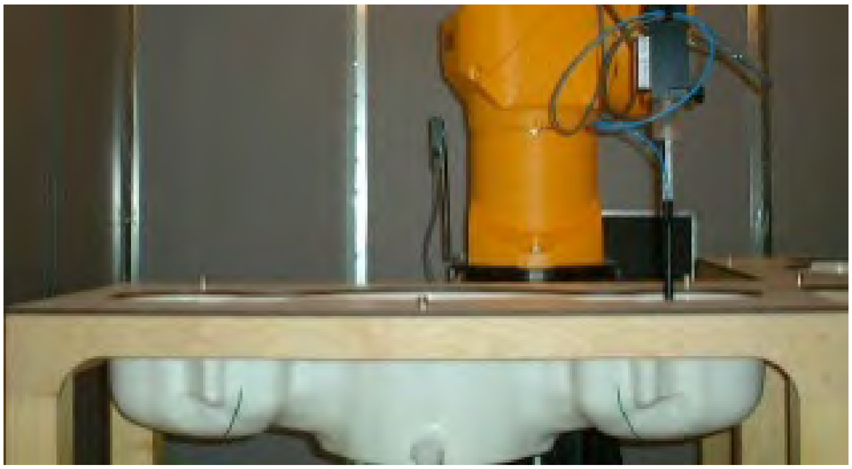


Figure 2.6 SAM Twin Phantom

Device Holder for Transmitters

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

Figure 2.7 Mounting Device

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

3. Probe and Dipole Calibration

See Appendix D and E.

4. Phantom & Simulating Tissue Specifications

Head & Body Simulating Mixture Characterization

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

Table 4.1 Typical Composition of Ingredients for Tissue

Ingredients		Simulating Tissue					
		600 MHz Head	750 MHz Head	900 MHz Head	1750 MHz Head	1900 MHz Head	2300 MHz Head
Mixing Percentage							
Water		Proprietary Purchased From Speag					
Sugar							
Salt							
HEC							
Bactericide							
DGBE							
Dielectric Constant	Target	42.72	41.94	41.50	40.08	40.00	39.47
Conductivity (S/m)	Target	0.88	0.89	0.97	1.37	1.40	1.67

Ingredients		Simulating Tissue					
		2550 MHz Head	3500 MHz Head	3700 MHz Head	2450 MHz Head	5250 MHz Head	5750 MHz Head
Mixing Percentage							
Water		Proprietary Purchased From Speag					
Sugar							
Salt							
HEC							
Bactericide							
DGBE							
Dielectric Constant	Target	39.07	37.93	37.70	39.20	35.93	35.36
Conductivity (S/m)	Target	1.91	2.91	3.12	1.80	4.71	5.22

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

Uncontrolled Environment

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

Controlled Environment

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

Table 5.1 Human Exposure Limits

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

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

6. Measurement Uncertainty

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

7. System Validation

Tissue Verification

Table 7.1 Measured Tissue Parameters

		600 MHz Head		750 MHz Head		900 MHz Head	
Date(s)		Aug. 8, 2022		Aug. 8, 2022		Aug. 10, 2022	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		42.72	41.54	41.94	40.89	41.50	40.71
Conductivity: σ		0.88	0.89	0.89	0.89	0.97	1.00
		1750 MHz Head		1900 MHz Head		2550 MHz Head	
Date(s)		Aug. 11, 2022		Aug. 15, 2022		Aug. 16, 2022	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		40.08	39.43	40.00	39.49	39.07	38.50
Conductivity: σ		1.37	1.37	1.40	1.44	1.91	1.95
		3500 MHz Head		3700 MHz Head		2450 MHz Head	
Date(s)		Aug. 5, 2022		Aug. 5, 2022		Aug. 18, 2022	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		37.93	36.78	37.70	36.31	39.20	38.71
Conductivity: σ		2.91	2.93	3.12	3.06	1.80	1.84
		5250 MHz Head		5750 MHz Head		5750 MHz Head	
Date(s)		Aug. 17, 2022		Aug. 17, 2022		Oct. 14, 2022	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		35.93	35.24	35.36	34.65	35.36	34.81
Conductivity: σ		4.71	4.71	5.22	5.26	5.22	5.30
		750 MHz Head		900 MHz Head		1750 MHz Head	
Date(s)		Jul. 9, 2024		Jul. 10, 2024		Jul. 10, 2024	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		41.94	40.97	41.50	40.61	40.08	39.44
Conductivity: σ		0.89	0.93	0.97	1.00	1.37	1.41
		2300 MHz Head					
Date(s)		Jul. 8, 2024					
Liquid Temperature (˚C)	20.0	Target	Measured				
Dielectric Constant: ε		39.47	38.18				
Conductivity: σ		1.67	1.69				

See Appendix A for data printout.

Test System Verification

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

Table 7.2 System Dipole Validation Target & Measured

	Test Frequency	Targeted SAR_{1g} (W/kg)	Measure SAR_{1g} (W/kg)	Tissue Used for Verification	Deviation (%)	Plot Number
08-Aug-2022	750 MHz	8.57	8.65	Head	+ 0.93	1
10-Aug-2022	900 MHz	11.20	11.20	Head	+ 0.00	2
11-Aug-2022	1750 MHz	37.70	38.10	Head	+ 1.06	3
15-Aug-2022	1900 MHz	40.40	39.80	Head	- 1.49	4
16-Aug-2022	2550 MHz	55.30	56.10	Head	+ 1.45	5
05-Aug-2022	3500 MHz	67.00	67.40	Head	+ 0.60	6
05-Aug-2022	3700 MHz	68.30	68.90	Head	+ 0.88	7
18-Aug-2022	2450 MHz	54.10	54.90	Head	+ 1.48	8
17-Aug-2022	5250 MHz	79.50	82.10	Head	+ 3.27	9
17-Aug-2022	5750 MHz	80.50	82.30	Head	+ 2.24	10
14-Oct-2022	5750 MHz	80.50	83.40	Head	+ 3.60	11
09-Jul-2024	750 MHz	8.76	8.65	Head	- 1.26	12
10-Jul-2024	900 MHz	11.00	11.50	Head	+ 4.55	13
10-Jul-2024	1750 MHz	36.70	37.90	Head	+ 3.27	14
08-Jul-2024	2300 MHz	48.40	49.80	Head	+ 2.89	15

See Appendix A for data plots.

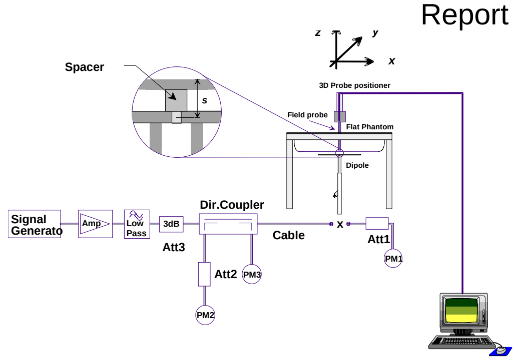


Figure 7.1 Dipole Validation Test Setup

8. LTE Document Checklist

1) Identify the operating frequency range of each LTE transmission band used by the device

LTE Operating Band	Uplink (transmit)	Downlink (Receive)	Duplex mode (FDD/TDD)
	Low - high	Low - high	
2	1850-1910	1930-1990	FDD
4	1710-1755	2110-2155	FDD
5	824-849	869-894	FDD
7	2500-2570	2620-2690	FDD
12	699-716	729-746	FDD
13	777-787	746-756	FDD
17	704-716	734-746	FDD
25	1850-1915	1930-1995	FDD
26	814-849	859-894	FDD
30	2305-2315	2350-2360	FDD
38	2570-2620	2570-2620	TDD
41	2496-2690	2496-2690	TDD
48	3550-3700	3550-3700	TDD
66	1710-1780	2110-2200	FDD
71	663-698	617-652	FDD

2) Identify the channel bandwidths used in each frequency band; 1.4, 3, 5, 10, 15, 20 MHz etc

LTE Band Class	Bandwidth (MHz)	Frequency or Freq. Band (MHz)
2	1.4, 3, 5, 10, 15, 20	1850-1910 MHz
4	1.4, 3, 5, 10, 15, 20	1710-1755 MHz
5	1.4, 3, 5, 10	824-849 MHz
7	5, 10, 15, 20	2500-2570 MHz
12	1.4, 3, 5, 10	699-716 MHz
13	5, 10	777-787 MHz
17	5, 10	704-716 MHz
25	1.4, 3, 5, 10, 15, 20	1850-1915 MHz
26	1.4, 3, 5, 10, 15	814-849 MHz
30	5, 10	2305-2315 MHz
38	5, 10, 15, 20	2570-2620 MHz
41	5, 10, 15, 20	2496-2690 MHz
48	5, 10, 15, 20	3550-3700 MHz
66	1.4, 3, 5, 10, 15, 20	1710-1780 MHz
71	5, 10, 15, 20	663-698 MHz

3) Identify the high, middle and low (H, M, L) channel numbers and frequencies in each LTE frequency band

LTE Band Class	Bandwidth (MHz)	Frequency (MHz)/Channel #					
		Low		Mid		High	
2	1.4	1850.7	18607	1880.0	18900	1909.3	19193
2	3	1851.5	18615	1880.0	18900	1908.5	19185
2	5	1852.5	18625	1880.0	18900	1907.5	19175
2	10	1855.0	18650	1880.0	18900	1905.0	19150
2	15	1857.5	18675	1880.0	18900	1902.5	19125
2	20	1860.0	18700	1880.0	18900	1900.0	19100
4	1.4	1710.7	19957	1732.5	20175	1754.3	20393
4	3	1711.5	19965	1732.5	20175	1753.5	20385
4	5	1712.5	19975	1732.5	20175	1752.5	20375
4	10	1715.0	20000	1732.5	20175	1750.0	20350
4	15	1717.5	20025	1732.5	20175	1747.5	20325
4	20	1720.0	20050	1732.5	20175	1745.0	20300
5	1.4	824.7	20407	836.5	20525	848.3	20643
5	3	825.5	20415	836.5	20525	847.5	20635
5	5	826.5	20425	836.5	20525	846.5	20625
5	10	829.0	20450	836.5	20525	844.0	20600
7	5	2502.5	20775	2535.0	21100	2567.5	21425
7	10	2505.0	20800	2535.0	21100	2565.0	21400
7	15	2507.5	20825	2535.0	21100	2562.5	21375
7	20	2510.0	20850	2535.0	21100	2560.0	21350
12	1.4	699.7	23017	707.5	23095	715.3	23173
12	3	700.5	23025	707.5	23095	714.5	23165
12	5	701.5	23035	707.5	23095	713.5	23155
12	10	704.0	23060	707.5	23095	711.0	23130
13	5	779.5	23205	782.0	23230	784.5	23225
13	10	-----	-----	782.0	23230	-----	-----
17	5	706.5	23755	710.0	23790	713.5	23825
17	10	709.0	23780	710.0	23790	711.0	23800
25	1.4	1850.7	26047	1882.5	26365	1914.3	26683
25	3	1851.5	26055	1882.5	26365	1913.5	26675
25	5	1852.5	26065	1882.5	26365	1912.5	26665
25	10	1855.0	26090	1882.5	26365	1910.0	26640
25	15	1857.5	26115	1882.5	26365	1907.5	26615
25	20	1860.0	26140	1882.5	26365	1905.0	26590
26	1.4	814.7	26697	831.5	26865	848.3	27033
26	3	815.5	26705	831.5	26865	847.5	27025
26	5	816.5	26715	831.5	26865	846.5	27015
26	10	819.0	26740	831.5	26865	844.0	26990
26	15	821.5	26765	831.5	26865	841.5	26995
30	5	2307.5	27685	2310.0	27710	2312.5	27735
30	10	-----	-----	2310.0	27710	-----	-----
38	5	2572.5	37775	2595.0	38000	2602.5	38075
38	10	2575.0	37800	2595.0	38000	2605.0	38100
38	15	2577.5	37825	2595.0	38000	2607.5	38125
38	20	2580.0	37850	2595.0	38000	2610.0	38150
41	5	2498.5	39675	2593	40620	2687.5	41565
41	10	2501.0	39700	2593	40620	2685.0	41540
41	15	2503.5	39725	2593	40620	2682.5	41515
41	20	2506.0	39750	2593	40620	2680.0	41490
48	5	3552.5	55265	3526.0	55990	3697.5	56715
48	10	3555.0	55290	3526.0	55990	3695.0	56690
48	15	3557.5	55315	3526.0	55990	3692.5	56665
48	20	3560.0	55340	3526.0	55990	3690.0	56640
66	1.4	1710.7	131979	1755.0	132422	1779.3	132665
66	3	1711.5	131987	1755.0	132422	1778.5	132657
66	5	1712.5	131997	1755.0	132422	1777.4	132646
66	10	1716.1	132033	1755.0	132422	1774.9	132621
66	15	1717.5	132047	1755.0	132422	1772.4	132596
66	20	1720.0	132072	1755.0	132422	1769.9	132571
71	5	665.5	133147	680.5	133297	695.5	133447
71	10	668.0	133172	680.5	133297	693.0	133422
71	15	670.5	133197	680.5	133297	690.5	133397
71	20	673.0	133222	680.5	133297	688.0	133372

4) Specify the UE category and uplink modulations used:
    - UE Category: 3
    - Uplink modulations: QPSK and 16QAM

5) Include descriptions of the LTE transmitter and antenna implementation; and also identify whether it is a standalone transmitter operating independently of other wireless transmitters in the device or sharing hardware components and/or antenna(s) with other transmitters etc

    The device has 13 antennas:
    - 5 – 3G, 4G, FR1 (Transmit and Receive) Antennas
    - 4 – 3G, 4G, FR1 (Receive Only) Antennas
    - 2 – WiFi (Transmit and Receive) Antennas
    - 2 – FR2 (Transmit and Receive) Antennas

6) Identify the LTE voice/data requirements in each operating mode and exposure condition with respect to head and body test configurations, antenna locations, handset flip-cover or slide positions, antenna diversity conditions etc

    The device is a data only. Data mode was tested in each operating mode and exposure condition in the body configuration. See test setup photos to see all configurations tested.

7) Identify if Maximum Power Reduction (MPR) is optional or mandatory, i.e. built-in by design:

    a) Only mandatory MPR may be considered during SAR testing, when the maximum output power is permanently limited by the MPR implemented within the UE; and only for the applicable RB (resource block) configurations specified in LTE standards

    MPR is mandatory, built-in by design on all production units. It was enabled during testing.

Modulation	Channel Bandwidth/transmission Bandwidth Configuration (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
16QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

    b) A-MPR (additional MPR) must be disabled
    c) A-MPR was disabled during testing.

8) Include the maximum average conducted output power measured on the required test channels for each channel bandwidth and UL modulation used in each frequency band:

The maximum average conducted output power measured for the testing is listed on pages 42-104 of this report. The below table shows the factory set point with the allowable tolerance.

Band	Technology	Power	3GPP Nominal Power dBm	Calibrated Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 71 – 600 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 12 & 17 – 750 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 13 – 750 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 5 & 26 – 835 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 4 & 66 – 1750 MHz	LTE	Full	23.0	23.0	+1.5/-1.3	21.7	24.5
Band 4 & 66 – 1750 MHz	LTE	Backoff	18.0	18.0	+1.5/-1.3	16.7	19.5
Band 2 & 25 – 1900 MHz	LTE	Full	23.0	23.0	+1.5/-1.3	21.7	24.5
Band 2 & 25 – 1900 MHz	LTE	Backoff	16.0	16.0	+1.5/-1.3	14.7	17.5
Band 30 – 2300 MHz	LTE	Full	22.0	22.0	+1.0/-1.3	20.7	23.0
Band 7 – 2550 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 7 – 2550 MHz	LTE	Backoff	18.5	18.5	+1.0/-1.3	17.2	19.5
Band 38 – 2550 MHz	LTE	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 38 – 2550 MHz	LTE	Backoff	19.5	19.5	+1.0/-1.3	18.2	20.5
Band 41 – 2550 MHz PC3	LTE	Full	23.3	23.3	+1.2/-1.3	22.0	24.5
Band 41 – 2550 MHz PC3	LTE	Backoff	19.3	19.3	+1.2/-1.3	18.0	20.5
Band 41 – 2550 MHz PC2	LTE	Full	26.3	26.3	+0.7/-3.0	23.3	27.0
Band 41 – 2550 MHz PC2	LTE	Backoff	19.3	19.3	+0.7/-3.0	16.3	20.0
Band 48 – 3600 MHz	LTE	Full	20.5	20.5	+1.0/-1.3	19.2	21.5

9) Identify all other U.S. wireless operating modes (3G, Wi-Fi, WiMax, Bluetooth etc), device/exposure configurations (head and body, antenna and handset flip-cover or slide positions, antenna diversity conditions etc.) and frequency bands used for these modes

Other wireless modes:

Band	Technology	Power	3GPP Nominal Power dBm	Calibrated Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 5 – 850 MHz	WCDMA/HSPA	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 4 – 1750 MHz	WCDMA/HSPA	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 4 – 1750 MHz	WCDMA/HSPA	Backoff	18.5	18.5	+1.0/-1.3	17.2	19.5
Band 2 – 1900 MHz	WCDMA/HSPA	Full	23.0	23.0	+1.0/-1.3	21.7	24.0
Band 2 – 1900 MHz	WCDMA/HSPA	Backoff	15.5	15.5	+1.0/-1.3	14.2	16.5
WLAN – 2.4 GHz	802.11bgn/ac/ax20	N/A	N/A	16.0	±2.0	14.0	18.0
WLAN – 5 GHz UNII Band I	802.11an/ac/ax20	N/A	N/A	10.0	±2.0	8.0	12.0
WLAN – 5 GHz UNII Band III	802.11an/ac/ax20	N/A	N/A	14.0	±2.0	12.0	16.0

10) Include the maximum average conducted output power measured for the other wireless modes and frequency bands.

The maximum average conducted output power measured for the testing is listed on pages 38-41 and 105-106 of this report. The table in item 9 shows the factory set point with the allowable tolerance.

11) When power reduction is applied to certain wireless modes to satisfy SAR compliance for simultaneous transmission conditions, other equipment certification or operating requirements, include the maximum average conducted output power measured in each power reduction mode applicable to the simultaneous voice/data transmission configurations for such wireless configurations and frequency bands; and also include details of the power reduction implementation and measurement setup

Power reduction is required to satisfy SAR compliance. The DUT has a capacitive coupling sensor to sense the body being close to the unit. When the sensor is triggered (at 21 mm), the maximum power is backed off based on the power levels listed on page 4 of this report. Only the cellular bands are backed off.

12) Include descriptions of the test equipment, test software, built-in test firmware etc. required to support testing the device when power reduction is applied to one or more transmitters/antennas for simultaneous voice/data transmission

The DUT back off was set in the firmware of the module using the existing AT commands. There was no special test equipment or test software required for the testing.

13) When appropriate, include a SAR test plan proposal with respect to the above

Testing was conduct at 10 mm with the sensor operational for all measurements. The sensor was tested by moving the DUT away from the phantom and slowly moving it closer to see when the sensor would trip. The closest distance the sensor trip was 21 mm. The highest SAR value in each band was then tested at 20 mm with the sensor disabled to insure it would not trip.

14) If applicable, include preliminary SAR test data and/or supporting information in laboratory testing inquiries to address specific issues and concerns or for requesting further test reduction considerations appropriate for the device; for example, simultaneous transmission configurations.

Not applicable.

9. SAR Test Data Summary

See Measurement Result Data Pages

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

Procedures Used To Establish Test Signal

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

Device Test Condition

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

Required Test Positions						
Antenna	Side A	Side B	Side C	Side D	Side E	Side F
Ant 0	Yes	Yes	Yes	Yes	No	Yes
Ant 1	Yes	Yes	Yes	Yes	Yes	No
Ant 4	Yes	Yes	Yes	No	No	Yes
Ant 8	Yes	No	Yes	Yes	No	No
WiFi 0	Yes	No	Yes	Yes	Yes	No
WiFi 1	Yes	Yes	Yes	No	No	Yes

This device uses a power reduction mechanism to reduce output powers in certain use conditions when the device is used close the user's body.

When the device's antenna is within a certain distance of the user, the sensor activates and reduces the maximum allowed output power. However, the sensor is not active when the device is moved beyond the sensor triggering distance and the maximum output power is no longer limited. Therefore, additional evaluation is needed in the vicinity of the triggering distance to ensure SAR is compliant when the device is allowed to operate at a non-reduced output power level. FCC KDB Publication 616217 D04v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device at these additional test positions. Sensor triggering distance summary data is included below.

The sensor is designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions since the sensor entirely covers the antennas. The device form factor will not allow the device to be sitting at an angle. Therefore, tilt measurements were not conducted on this device.

Per the May 2017 TCBC Workshop Notes, demonstration of proper functioning of the power reduction mechanisms is required to support the corresponding SAR configurations. The verification process was divided into two parts: (1) evaluation of the output power levels for individual or multiple triggering mechanisms and (2) evaluation of the triggering distances for proximity-based sensors.

9.1 Power Verification Procedure

The power verification was performed according to the following procedure.

- A base station simulator was used to establish a conducted RF connection and the output power was monitored. The power measurements were confirmed to be within the expected tolerances for all states before and after a power reduction mechanism was triggered.
- Step 1 was repeated for all relevant modes and frequency bands for the mechanism being investigated.
- Steps 1 and 2 were repeated for all individual power reduction mechanisms and combinations thereof. For the combination cases, one mechanism was switched to a "triggered" state at a time; powers were confirmed to be within the tolerances after each additional mechanism was activated.

9.2 Distance Verification Procedure

The distance verification procedure was performed according to the following procedure.

- A base station simulator was used to establish an RF connection and to monitor the power levels. The device being tested was placed below the relevant section of the phantom with the relevant side or edge of the device facing toward the phantom.
- The device was moved toward and away from the phantom to determine the distance at which the mechanism triggers and the output power is reduced, per KDB Publication 616217 D04v01r02 and FCC Guidance. Each applicable test position was evaluated. The distances were confirmed to be the same or larger (more conservative) than the minimum distances provided by the manufacturer.
- Steps 1 and 2 were repeated for low, mid and high bands, as appropriate.
- Steps 1 through 3 were repeated for all distance-based power reduction mechanisms.

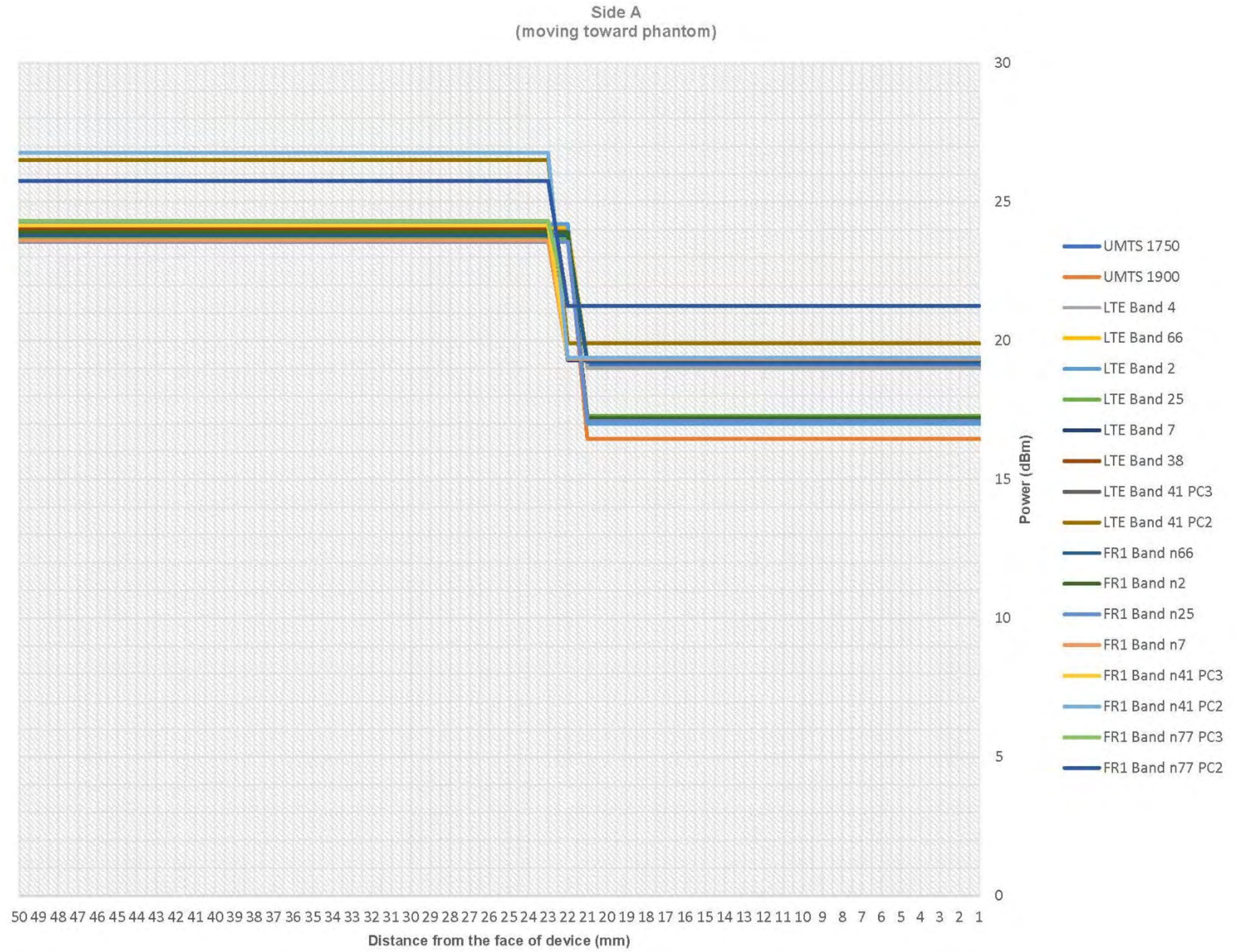
9.3 WWAN Antenna Verification Summary

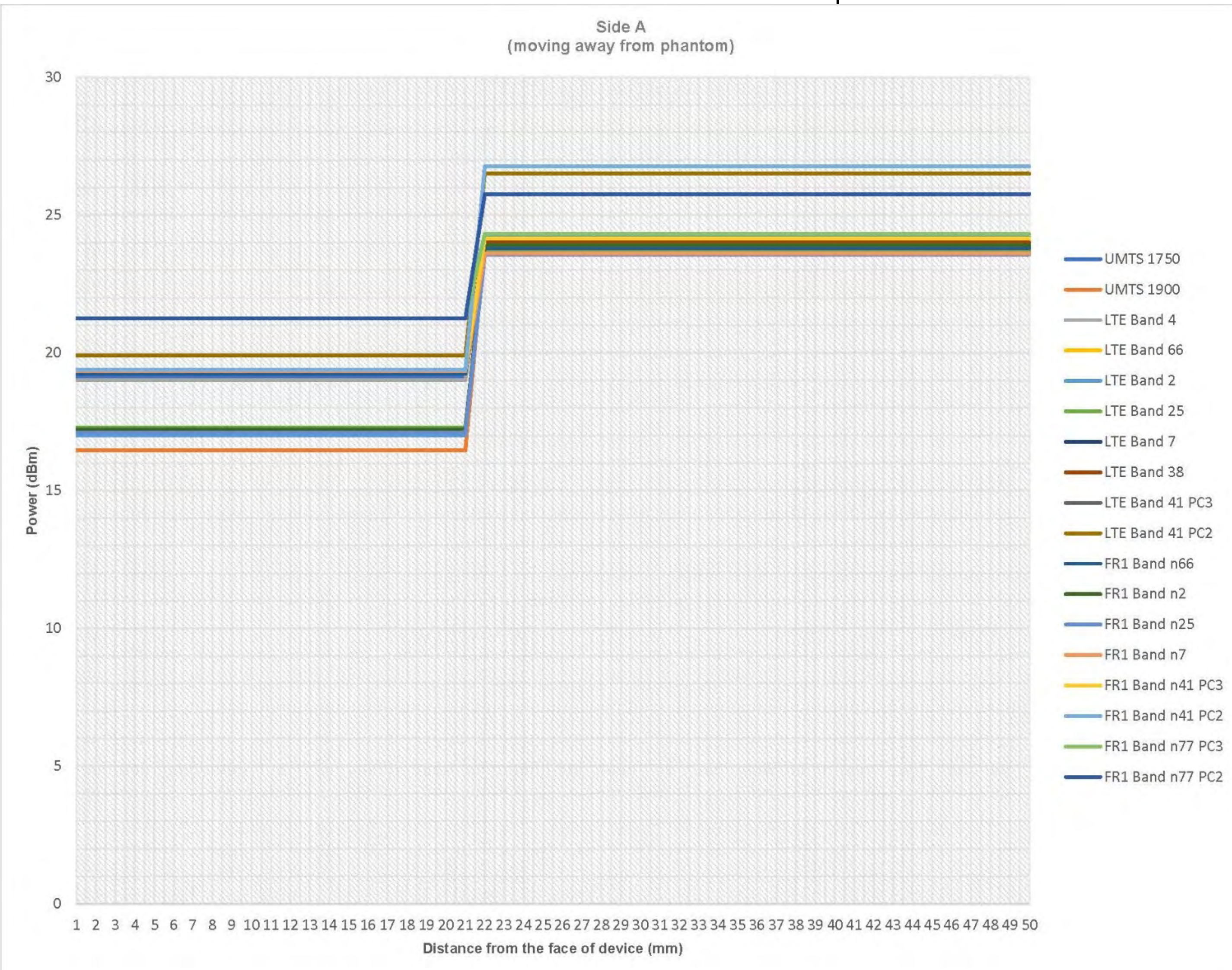
Table 9.1
Power Measurement Verification for WWAN Antenna

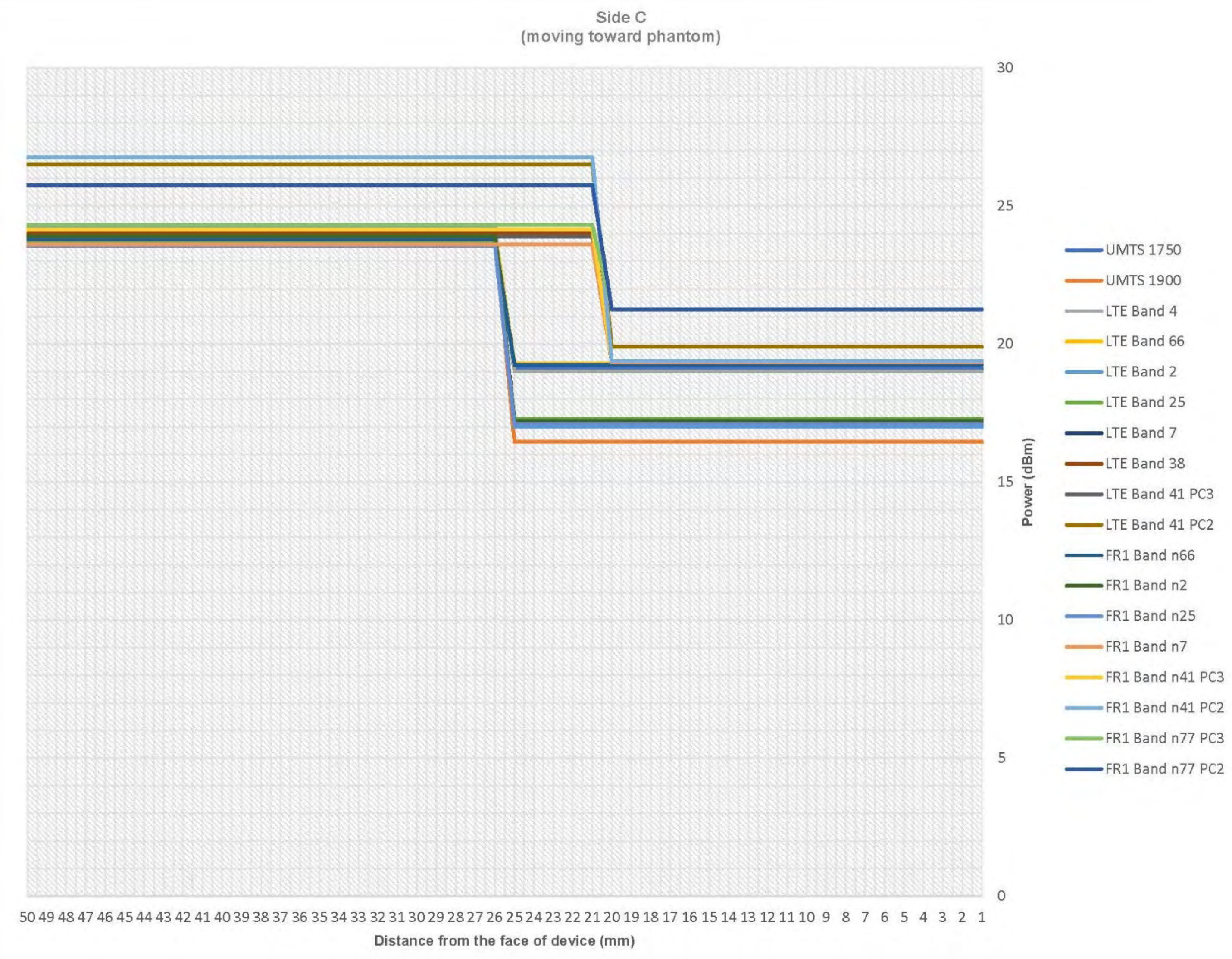
Mechanism	Mode/Band	Conducted Power (dBm)	
1st		Un-triggered (Max)	Mechanism #1 (Reduced)
Capacitive	UMTS 1750	23.65	19.12
	UMTS 1900	23.98	16.46
	LTE FDD Band 4	24.10	19.00
	LTE FDD Band 66	24.10	19.30
	LTE FDD Band 2	24.20	17.00
	LTE FDD Band 25	23.70	17.30
	LTE FDD Band 7	23.90	19.30
	LTE TDD Band 38	24.00	19.90
	LTE TDD Band 41 (PC3)	23.90	19.90
	LTE TDD Band 41 (PC2)	26.50	19.90
	FR1 FDD Band n66	23.80	19.25
	FR1 FDD Band n2	23.91	17.22
	FR1 FDD Band n25	23.57	17.11
	FR1 FDD Band n7	23..60	19.34
	FR1 TDD Band n41 (PC3)	24.16	19.39
	FR1 TDD Band n41 (PC2)	26.77	19.39
	FR1 TDD Band n77 (PC3)	24.32	21.25
	FR1 TDD Band n77 (PC2)	25.76	21.25

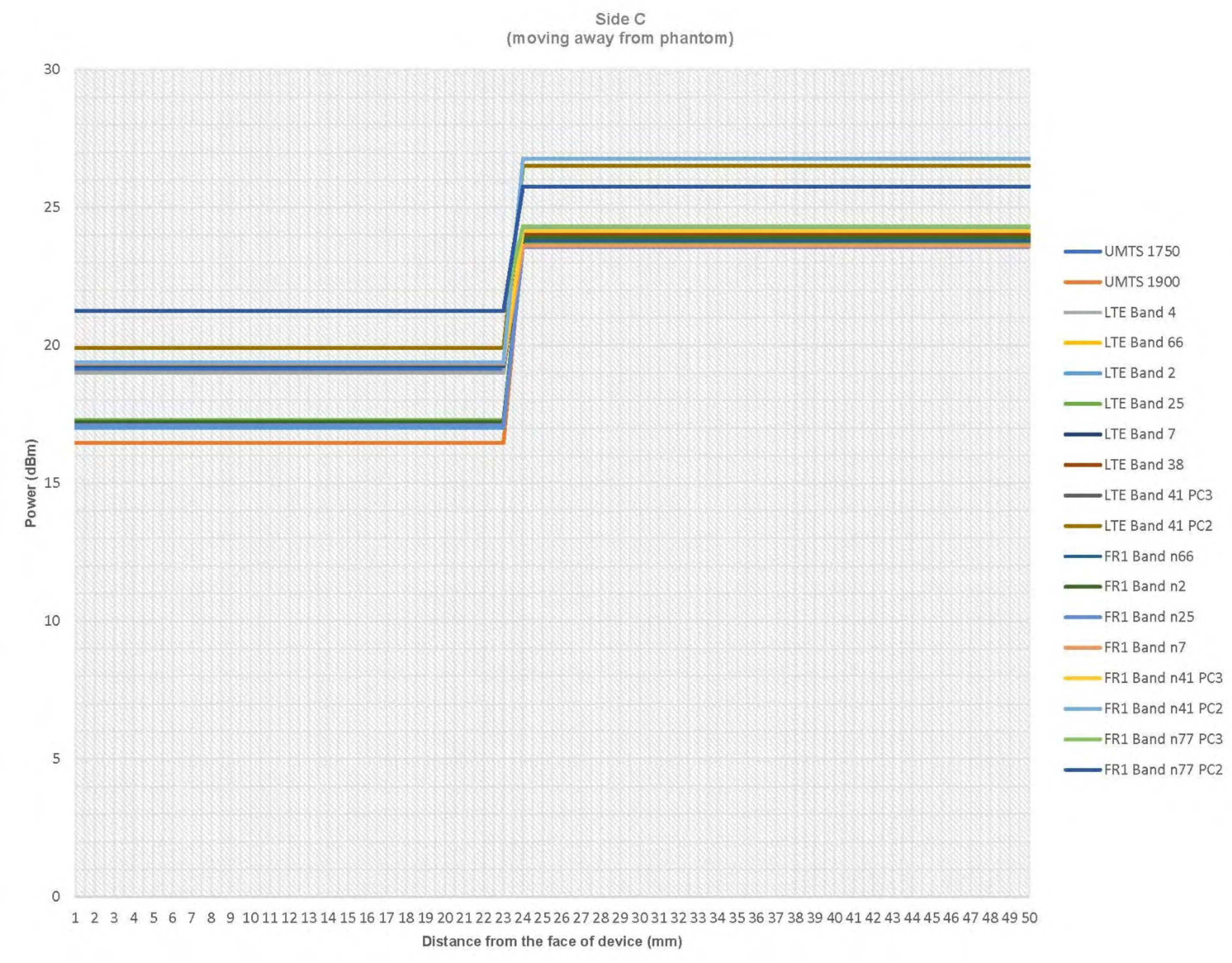
Table 9.2
Distance Measurement Verification for WWAN Antenna

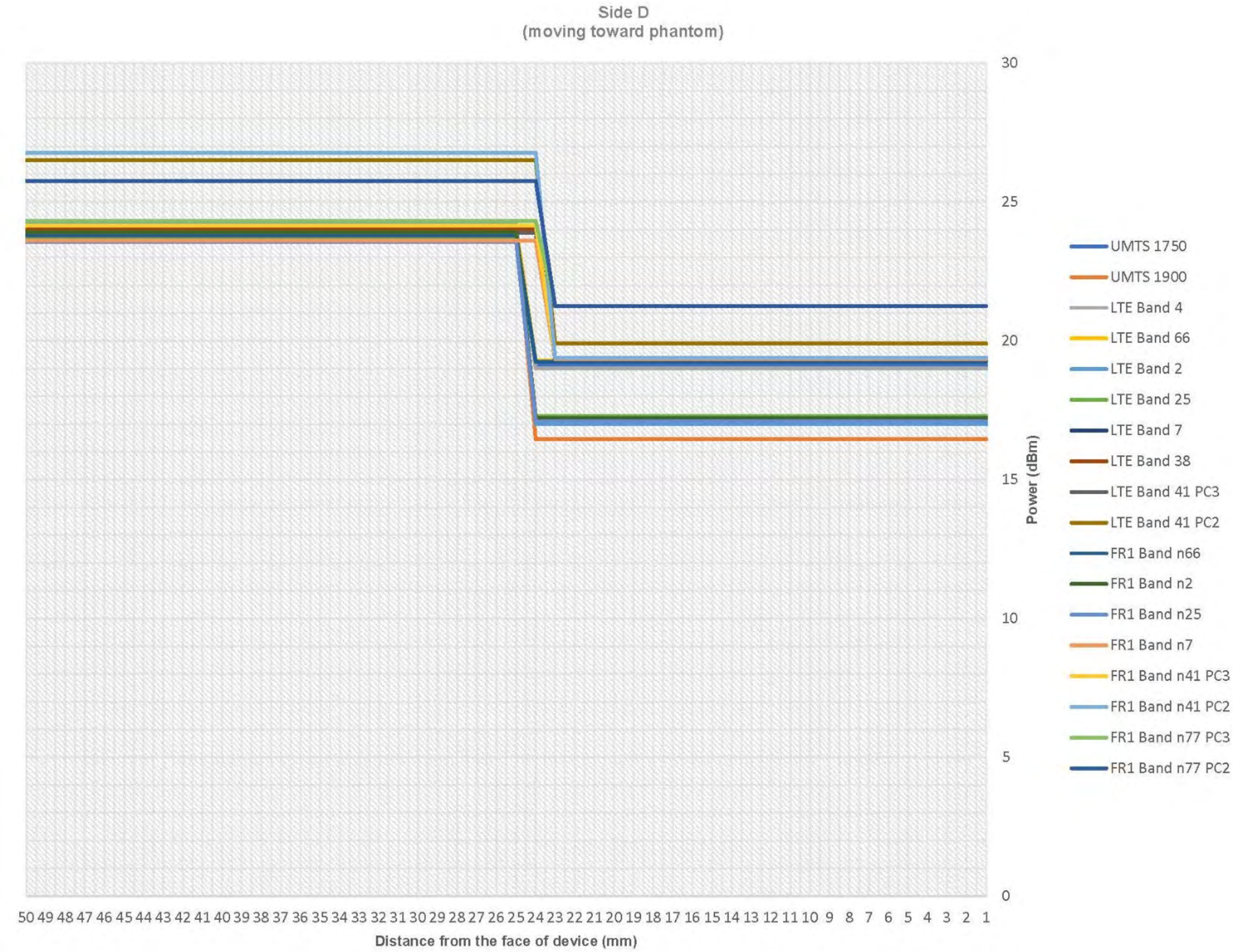
Mechanism	Test Condition	Band	Distance Measurements (mm)		Minimum Distance per Manufacturer (mm)
			Moving Toward	Moving Away	
Capacitive	Side A	Mid	22	22	20
	Side C	Mid	26	24	20
	Side D	Mid	25	21	20
	Side F	Mid	22	23	20
	Side A	High	23	22	20
	Side C	High	21	24	20
	Side D	High	24	23	20
	Side F	High	26	24	20

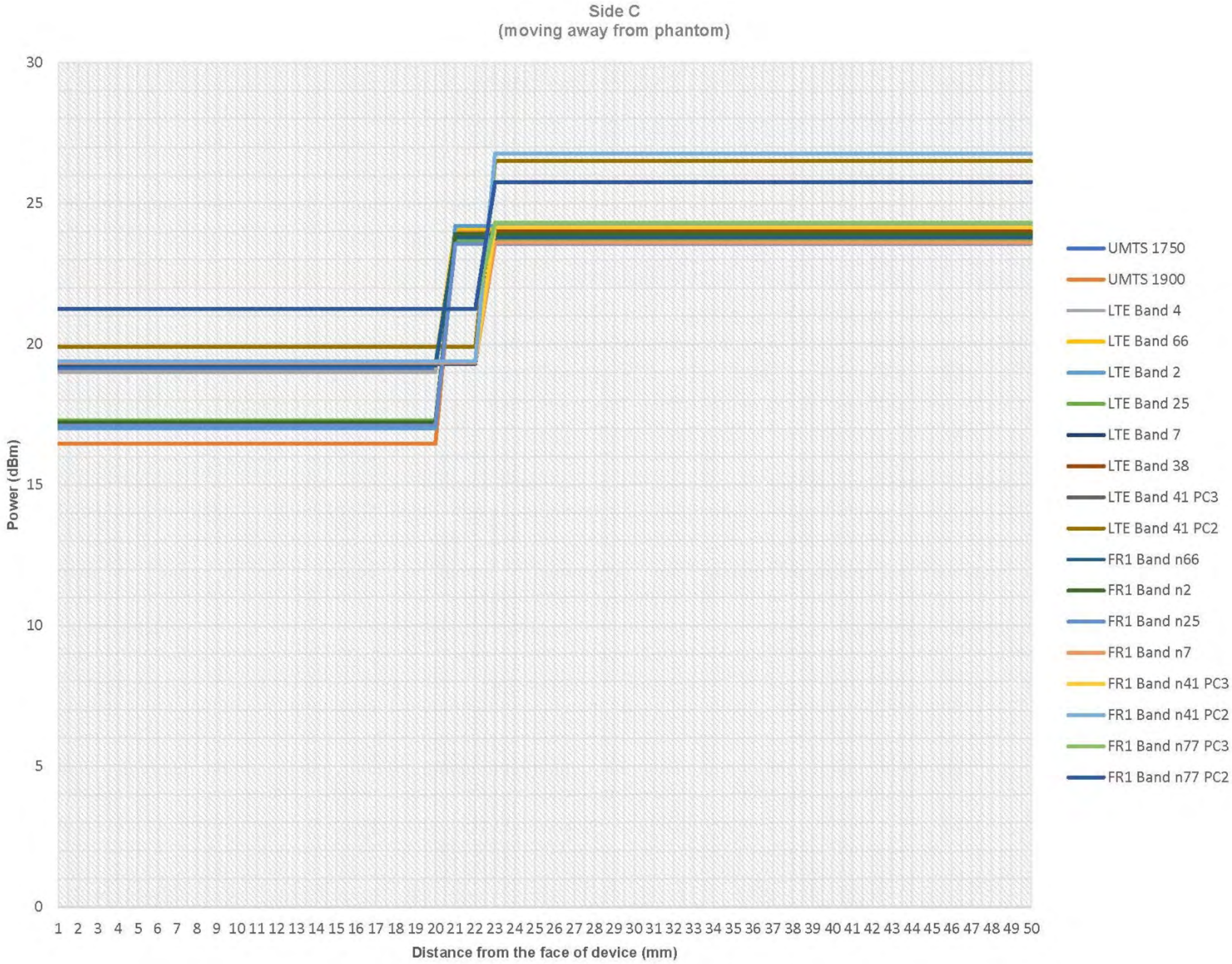

Side A
(moving toward phantom)
30
25
20
15
10
5
0
Power (dBm)
50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Distance from the face of device (mm)
UMTS 1750
UMTS 1900
LTE Band 4
LTE Band 66
LTE Band 2
LTE Band 25
LTE Band 7
LTE Band 38
LTE Band 41 PC3
LTE Band 41 PC2
FR1 Band n66
FR1 Band n2
FR1 Band n25
FR1 Band n7
FR1 Band n41 PC3
FR1 Band n41 PC2
FR1 Band n77 PC3
FR1 Band n77 PC2

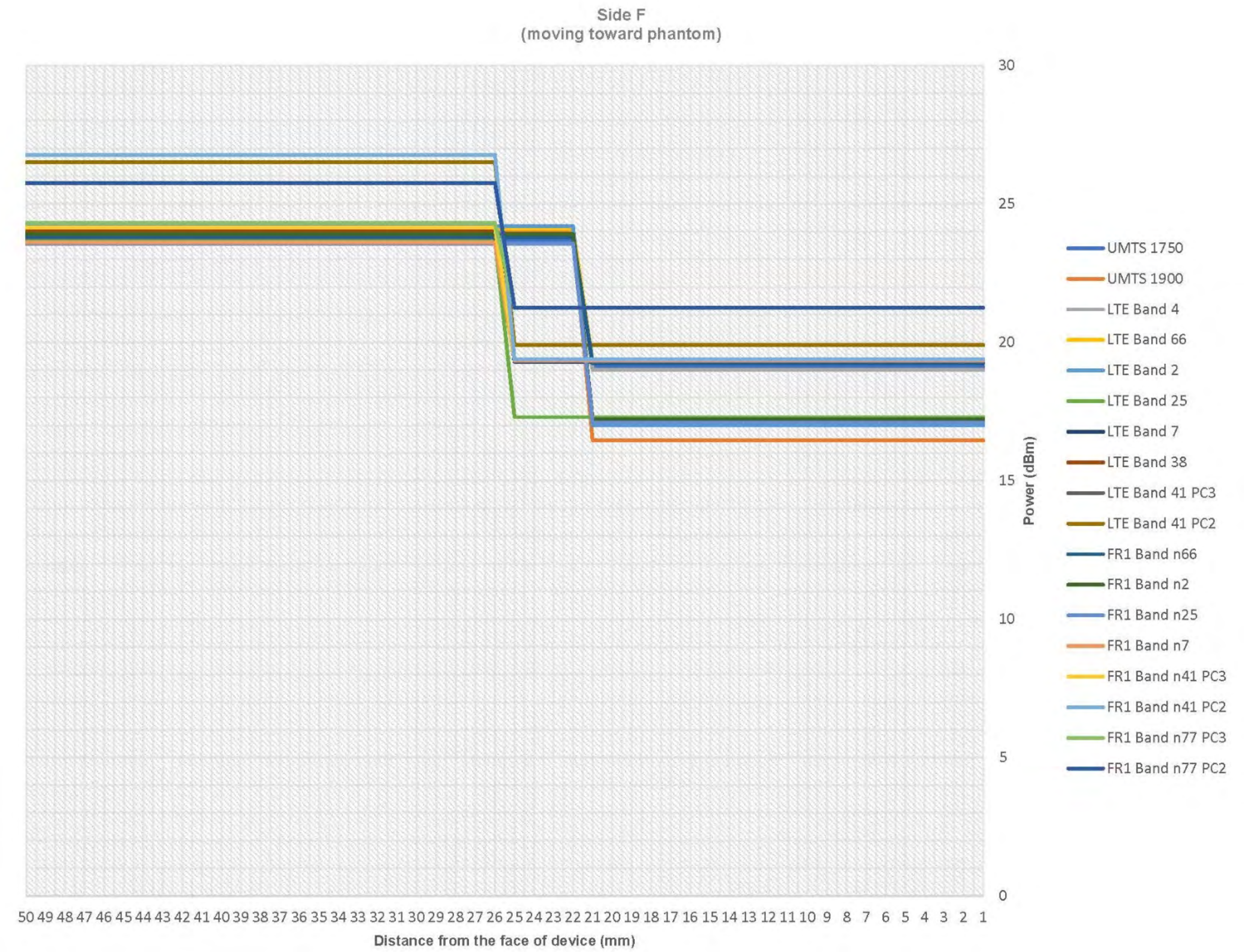

Side A
(moving away from phantom)
Power (dBm)
Distance from the face of device (mm)
30
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
UMTS 1750
UMTS 1900
LTE Band 4
LTE Band 66
LTE Band 2
LTE Band 25
LTE Band 7
LTE Band 38
LTE Band 41 PC3
LTE Band 41 PC2
FR1 Band n66
FR1 Band n2
FR1 Band n25
FR1 Band n7
FR1 Band n41 PC3
FR1 Band n41 PC2
FR1 Band n77 PC3
FR1 Band n77 PC2

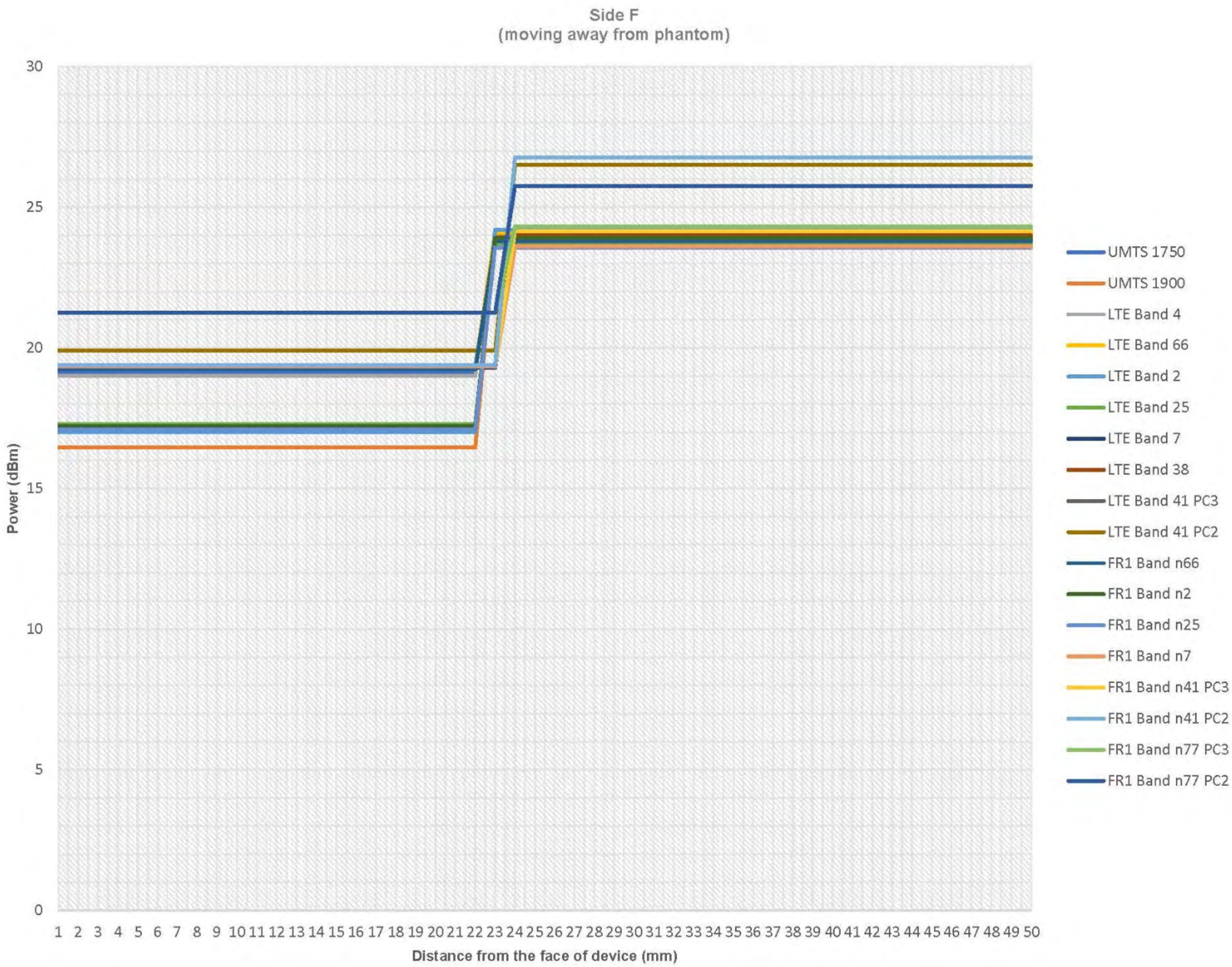

Side C
(moving toward phantom)
Power (dBm)
Distance from the face of device (mm)
0
5
10
15
20
25
30
50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
UMTS 1750
UMTS 1900
LTE Band 4
LTE Band 66
LTE Band 2
LTE Band 25
LTE Band 7
LTE Band 38
LTE Band 41 PC3
LTE Band 41 PC2
FR1 Band n66
FR1 Band n2
FR1 Band n25
FR1 Band n7
FR1 Band n41 PC3
FR1 Band n41 PC2
FR1 Band n77 PC3
FR1 Band n77 PC2


Side C
(moving away from phantom)
Power (dBm)
Distance from the face of device (mm)
UMTS 1750
UMTS 1900
LTE Band 4
LTE Band 66
LTE Band 2
LTE Band 25
LTE Band 7
LTE Band 38
LTE Band 41 PC3
LTE Band 41 PC2
FR1 Band n66
FR1 Band n2
FR1 Band n25
FR1 Band n7
FR1 Band n41 PC3
FR1 Band n41 PC2
FR1 Band n77 PC3
FR1 Band n77 PC2


Side D
(moving toward phantom)
Power (dBm)
30
25
20
15
10
5
0
50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Distance from the face of device (mm)
UMTS 1750
UMTS 1900
LTE Band 4
LTE Band 66
LTE Band 2
LTE Band 25
LTE Band 7
LTE Band 38
LTE Band 41 PC3
LTE Band 41 PC2
FR1 Band n66
FR1 Band n2
FR1 Band n25
FR1 Band n7
FR1 Band n41 PC3
FR1 Band n41 PC2
FR1 Band n77 PC3
FR1 Band n77 PC2


Side C
(moving away from phantom)
Power (dBm)
Distance from the face of device (mm)
UMTS 1750
UMTS 1900
LTE Band 4
LTE Band 66
LTE Band 2
LTE Band 25
LTE Band 7
LTE Band 38
LTE Band 41 PC3
LTE Band 41 PC2
FR1 Band n66
FR1 Band n2
FR1 Band n25
FR1 Band n7
FR1 Band n41 PC3
FR1 Band n41 PC2
FR1 Band n77 PC3
FR1 Band n77 PC2


Side F
(moving toward phantom)
30
25
20
15
10
5
0
Power (dBm)
50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Distance from the face of device (mm)
UMTS 1750
UMTS 1900
LTE Band 4
LTE Band 66
LTE Band 2
LTE Band 25
LTE Band 7
LTE Band 38
LTE Band 41 PC3
LTE Band 41 PC2
FR1 Band n66
FR1 Band n2
FR1 Band n25
FR1 Band n7
FR1 Band n41 PC3
FR1 Band n41 PC2
FR1 Band n77 PC3
FR1 Band n77 PC2


Side F
(moving away from phantom)
Power (dBm)
Distance from the face of device (mm)
UMTS 1750
UMTS 1900
LTE Band 4
LTE Band 66
LTE Band 2
LTE Band 25
LTE Band 7
LTE Band 38
LTE Band 41 PC3
LTE Band 41 PC2
FR1 Band n66
FR1 Band n2
FR1 Band n25
FR1 Band n7
FR1 Band n41 PC3
FR1 Band n41 PC2
FR1 Band n77 PC3
FR1 Band n77 PC2

WCDMA Conducted Power

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
3. For DC-HSDPA, the device was configured according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1, with the primary and the secondary serving HS-DSCH Cell enabled during the power measurement.

A summary of these settings are illustrated below:

HSDPA SETUP CONFIGURATION:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$, and Δ_{CQI} = 24/15 with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

SETUP CONFIGURATION

HSUPA SETUP CONFIGURATION:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c. For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with β_{hs} = 5/15 * β_c.
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

SETUP CONFIGURATION

DC-HSDPA 3GPP RELEASE 8 SETUP CONFIGURATION:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set RMC 12.2Kbps + HSDPA mode.
   ii. Set Cell Power = -25 dBm
   iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
   iv. Select HSDPA Uplink Parameters
   v. Set Gain Factors (β_c and β_d) and parameters were set according to each Specific sub-test in the following table,
      C10.1.4, quoted from the TS
      34.121 a). Subtest 1:
      β_c/β_d=2/15
      b). Subtest 2:
      β_c/β_d=12/15 c).
      Subtest 3: β_c/β_d=15/8
      d). Subtest 4:
      β_c/β_d=15/4
   vi. Set Delta ACK, Delta NACK and Delta CQI = 8
   vii. Set Ack-Nack Repetition Factor to 3
   viii. Set CQI Feedback Cycle (k) to 4 ms
   ix. Set CQI Repetition Factor to 2
   x. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification. A summary of these settings are illustrated below:

C.8.1.12 Fixed Reference Channel Definition H-Set 12

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

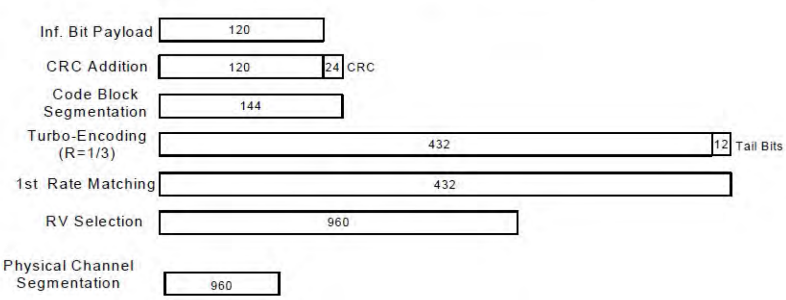


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

SETUP CONFIGURATION

<WCDMA Conducted Power>

GENERAL NOTE:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA, DC-HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

Full Power

Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)	WCDMA V			Tune-up Limit (dBm)
TX Channel		9262	9400	9538		1312	1413	1513		4132	4182	4233	
Rx Channel		9662	9800	9938		1537	1638	1738		4357	4407	4458	
Frequency (MHz)		1852.4	1880	1907.6		1712.4	1732.6	1752.6		826.4	836.4	846.6	
3GPP Rel 99	AMR 12.2Kbps	23.71	23.98	23.61	24.00	23.52	23.65	23.72	24.00	23.62	23.86	23.51	24.00
3GPP Rel 99	RMC 12.2Kbps	23.87	23.76	23.73	24.00	23.61	23.70	23.52	24.00	23.59	23.99	23.97	24.00
3GPP Rel 6	HSDPA Subtest-1	22.79	22.76	22.93	23.00	22.90	22.77	22.78	23.00	22.57	22.68	22.77	23.00
3GPP Rel 6	HSDPA Subtest-2	22.98	22.59	22.64	23.00	22.71	22.62	22.90	23.00	22.76	22.77	22.67	23.00
3GPP Rel 6	HSDPA Subtest-3	23.21	23.34	23.18	23.50	23.28	23.06	23.38	23.50	23.04	23.32	23.05	23.50
3GPP Rel 6	HSDPA Subtest-4	23.21	23.19	23.14	23.50	23.10	23.08	23.45	23.50	23.37	23.26	23.13	23.50
3GPP Rel 8	DC-HSDPA Subtest-1	22.76	22.56	22.87	23.00	22.98	22.68	22.98	23.00	22.94	22.75	22.68	23.00
3GPP Rel 8	DC-HSDPA Subtest-2	22.53	22.96	22.92	23.00	22.57	22.93	22.86	23.00	22.98	22.99	22.70	23.00
3GPP Rel 8	DC-HSDPA Subtest-3	23.35	23.41	23.08	23.50	23.04	23.28	23.10	23.50	23.03	23.15	23.15	23.50
3GPP Rel 8	DC-HSDPA Subtest-4	23.45	23.12	23.00	23.50	23.46	23.46	23.33	23.50	23.25	23.00	23.08	23.50
3GPP Rel 6	HSUPA Subtest-1	22.55	22.95	22.51	23.00	22.83	22.79	22.73	23.00	22.85	22.97	22.87	23.00
3GPP Rel 6	HSUPA Subtest-2	20.54	20.67	20.93	21.00	20.84	20.94	20.56	21.00	20.71	20.79	20.85	21.00
3GPP Rel 6	HSUPA Subtest-3	21.83	21.83	21.76	22.00	21.82	21.93	21.79	22.00	21.58	21.62	21.65	22.00
3GPP Rel 6	HSUPA Subtest-4	20.65	20.57	20.71	21.00	20.63	20.64	20.53	21.00	20.68	20.95	20.86	21.00
3GPP Rel 6	HSUPA Subtest-5	22.59	22.95	22.54	23.00	22.65	22.83	22.89	23.00	22.95	22.96	22.93	23.00

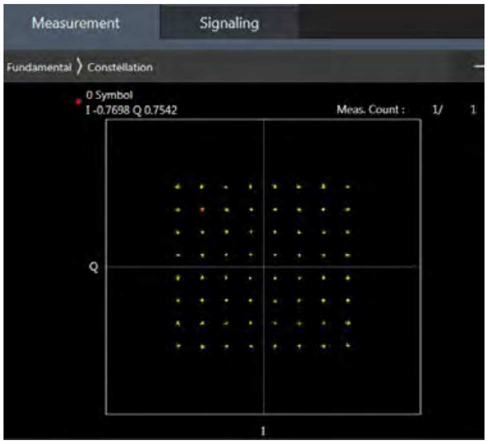
Backoff Power

Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)
TX Channel		9262	9400	9538		1312	1413	1513	
Rx Channel		9662	9800	9938		1537	1638	1738	
Frequency (MHz)		1852.4	1880	1907.6		1712.4	1732.6	1752.6	
3GPP Rel 99	AMR 12.2Kbps	16.07	16.46	16.27	16.50	19.28	19.12	19.14	19.50
3GPP Rel 99	RMC 12.2Kbps	16.07	16.14	16.41	16.50	19.09	19.46	19.32	19.50
3GPP Rel 6	HSDPA Subtest-1	15.18	15.19	15.35	15.50	18.39	18.22	18.23	18.50
3GPP Rel 6	HSDPA Subtest-2	15.49	15.40	15.20	15.50	18.22	18.22	18.29	18.50
3GPP Rel 6	HSDPA Subtest-3	15.82	15.85	15.58	16.00	18.96	18.76	18.83	19.00
3GPP Rel 6	HSDPA Subtest-4	15.85	15.74	15.81	16.00	18.86	18.75	18.52	19.00
3GPP Rel 8	DC-HSDPA Subtest-1	15.13	15.12	15.27	15.50	18.36	18.19	18.16	18.50
3GPP Rel 8	DC-HSDPA Subtest-2	15.47	15.11	15.06	15.50	18.09	18.35	18.27	18.50
3GPP Rel 8	DC-HSDPA Subtest-3	15.56	15.71	15.61	16.00	18.66	18.74	18.98	19.00
3GPP Rel 8	DC-HSDPA Subtest-4	15.98	15.85	15.88	16.00	18.56	18.90	18.72	19.00
3GPP Rel 6	HSUPA Subtest-1	15.24	15.21	15.43	15.50	18.07	18.45	18.16	18.50
3GPP Rel 6	HSUPA Subtest-2	13.28	13.48	13.49	13.50	16.37	16.10	16.01	16.50
3GPP Rel 6	HSUPA Subtest-3	14.37	14.15	14.30	14.50	17.17	17.50	17.47	17.50
3GPP Rel 6	HSUPA Subtest-4	13.25	13.39	13.45	13.50	16.33	16.07	16.41	16.50
3GPP Rel 6	HSUPA Subtest-5	15.43	15.06	15.36	15.50	18.17	18.09	18.07	18.50

LTE Conducted Power

General Note:

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r05, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
6. Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. LTE band 2/4/5/17/38 SAR test was covered by Band 25/66/26/12/41; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
   a. the maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion
   b. the channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band
9. According to 2017 TCB workshop, for 64 QAM and 16 QAM should be verified by checking the signal constellation with a call box to avoid incorrect maximum power levels due to MPR and other requirements associated with signal modulation, and the following figure is taken from the "Fundamental Measurement >> Modulation Analysis >> constellation" mode of the device connect to the MT8821C base station, therefore, the device 64QAM and 16QAM signal modulation are correct.



64QAM

16QAM

<TDD LTE SAR Measurement>

TDD LTE configuration setup for SAR measurement
SAR was tested with a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by 3GPP.

a. 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
b. “special subframe S” contains both uplink and downlink transmissions, it has been taken into consideration to determine the transmission duty factor according to the worst case uplink and downlink cyclic prefix requirements for UpPTS
c. Establishing connections with base station simulators ensure a consistent means for testing SAR and recommended for evaluating SAR. The Anritsu MT8820C (firmware: #22.52#004) was used for LTE output power measurements and SAR testing.

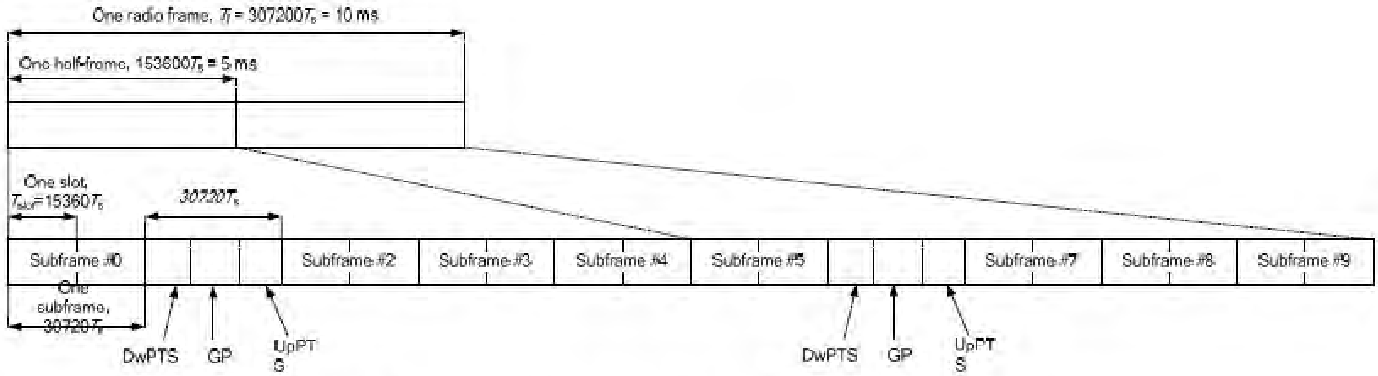


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).

Table 4.2-2: Uplink-downlink configurations.

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS).

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$			$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-

Special subframe ($30720 \cdot T_S$): Normal cyclic prefix in downlink (UpPTS)			
Uplink duty factor in one special subframe	**Special subframe configuration**	**Normal cyclic prefix in uplink**	**Extended cyclic prefix in uplink**
	0~4	7.13%	8.33%
	5~9	14.3%	16.7%

Special subframe($30720 \cdot T_S$): Extended cyclic prefix in downlink (UpPTS)			
Uplink duty factor in one special subframe	**Special subframe configuration**	**Normal cyclic prefix in uplink**	**Extended cyclic prefix in uplink**
	0~3	7.13%	8.33%
	4~7	14.3%	16.7%

The highest duty factor is resulted from:

i. Uplink-downlink configuration: 0. In a half-frame consisted of 5 subfames, uplink operation is in 3 uplink subframes and 1 special subframe.

ii. special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink

iii. for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (3+0.167)/5 = 63.3%

iv. for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (3+0.143)/5 = 62.9%

v. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The scaled TDD LTE SAR = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.

vi. The device supports Power Class 3 uplink-downlink configurations 0 and 6, and Power Class 2 uplink-downlink configurations 1 to 5 operations for LTE Band 41.

vii. The highest available duty cycle for Power Class 2 operation is 43.3% using UL-DL configuration 1, for Power Class 3 operation is 63.3% using UL-DL configuration 0. Per FCC Guidance, all SAR tests were performed using Power Class 3. SAR with Power Class 2 at the available duty factor was additionally performed for the Power Class 3 configuration with the highest SAR among all exposure condition.

Table 9.1 LTE Full Power Measurements

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
2	1.4 MHz	1	0	18607	1850.7	23.9	23.2
				18900	1880.0	24.0	22.8
				19193	1909.3	23.9	23.1
			3	18607	1850.7	23.9	23.0
				18900	1880.0	23.9	23.3
				19193	1909.3	23.9	23.2
			5	18607	1850.7	23.9	23.3
				18900	1880.0	24.4	22.9
				19193	1909.3	23.8	23.3
		3	0	18607	1850.7	23.9	22.9
				18900	1880.0	24.1	23.3
				19193	1909.3	24.3	23.3
			1	18607	1850.7	24.1	23.4
				18900	1880.0	24.4	23.2
				19193	1909.3	24.0	23.0
			3	18607	1850.7	24.3	23.5
				18900	1880.0	24.3	23.3
				19193	1909.3	24.5	23.4
		6	0	18607	1850.7	23.2	22.3
				18900	1880.0	22.9	22.4
				19193	1909.3	23.3	21.8
	3 MHz	1	0	18615	1851.5	24.3	23.2
				18900	1880.0	24.1	23.0
				19185	1908.5	24.1	23.5
			7	18615	1851.5	24.1	22.9
				18900	1880.0	24.5	22.9
				19185	1908.5	23.8	23.4
			14	18615	1851.5	24.0	23.4
				18900	1880.0	24.0	23.1
				19185	1908.5	24.0	23.4
		8	0	18615	1851.5	23.1	22.1
				18900	1880.0	22.9	21.9
				19185	1908.5	22.8	22.4
			7	18615	1851.5	23.3	22.0
				18900	1880.0	23.4	22.0
				19185	1908.5	23.4	22.3
			14	18615	1851.5	22.8	21.9
				18900	1880.0	22.9	22.4
				19185	1908.5	23.2	21.9
		15	0	18615	1851.5	23.2	22.5
				18900	1880.0	23.3	22.5
				19185	1908.5	23.3	21.9

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
2	5 MHz	1	0	18625	1852.5	24.4	22.8
				18900	1880.0	23.8	23.5
				19175	1907.5	23.9	23.5
			12	18625	1852.5	23.8	22.9
				18900	1880.0	24.5	23.5
				19175	1907.5	23.8	22.8
			24	18625	1852.5	24.2	23.2
				18900	1880.0	24.4	22.9
				19175	1907.5	24.2	22.9
		12	0	18625	1852.5	23.4	22.0
				18900	1880.0	23.4	22.0
				19175	1907.5	23.1	22.3
			6	18625	1852.5	22.8	22.4
				18900	1880.0	23.4	22.3
				19175	1907.5	23.3	22.4
			13	18625	1852.5	23.5	22.2
				18900	1880.0	23.1	22.4
				19175	1907.5	23.0	21.8
		25	0	18625	1852.5	23.2	21.9
				18900	1880.0	22.9	21.8
				19175	1907.5	22.8	22.0
	10 MHz	1	0	18650	1855.0	24.3	23.4
				18900	1880.0	24.4	23.2
				19150	1905.0	24.2	23.0
			24	18650	1855.0	23.9	23.3
				18900	1880.0	24.2	23.0
				19150	1905.0	24.0	23.2
			49	18650	1855.0	24.4	22.8
				18900	1880.0	23.9	22.9
				19150	1905.0	23.9	22.9
		25	0	18650	1855.0	22.9	21.8
				18900	1880.0	23.0	21.8
				19150	1905.0	23.2	21.9
			13	18650	1855.0	23.0	22.5
				18900	1880.0	23.3	22.1
				19150	1905.0	23.5	21.9
			25	18650	1855.0	23.2	22.3
				18900	1880.0	22.9	22.2
				19150	1905.0	23.3	21.9
		50	0	18650	1855.0	22.8	22.0
				18900	1880.0	22.8	21.8
				19150	1905.0	23.2	22.4

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
2	15 MHz	1	0	18675	1857.5	24.0	23.2
				18900	1880.0	24.1	23.5
				19125	1902.5	24.5	23.4
			37	18675	1857.5	23.9	23.0
				18900	1880.0	24.4	23.4
				19125	1902.5	24.3	23.1
			74	18675	1857.5	24.2	22.8
				18900	1880.0	24.4	23.2
				19125	1902.5	24.5	23.1
		36	0	18675	1857.5	22.9	22.4
				18900	1880.0	22.9	22.3
				19125	1902.5	23.2	22.2
			19	18675	1857.5	22.9	22.4
				18900	1880.0	23.1	22.2
				19125	1902.5	23.3	22.2
			39	18675	1857.5	23.0	21.8
				18900	1880.0	23.5	22.1
				19125	1902.5	23.0	22.5
		75	0	18675	1857.5	23.5	22.2
				18900	1880.0	23.0	21.9
				19125	1902.5	23.3	21.9
	20 MHz	1	0	18700	1860.0	24.1	23.4
				18900	1880.0	24.4	23.4
				19100	1900.0	24.4	23.4
			49	18700	1860.0	23.8	23.4
				18900	1880.0	24.2	23.3
				19100	1900.0	24.3	23.2
			99	18700	1860.0	23.8	22.9
				18900	1880.0	23.8	23.2
				19100	1900.0	24.4	22.8
		50	0	18700	1860.0	23.2	22.0
				18900	1880.0	23.5	22.4
				19100	1900.0	23.5	22.0
			24	18700	1860.0	23.1	22.0
				18900	1880.0	23.2	22.3
				19100	1900.0	22.9	22.4
			50	18700	1860.0	23.3	21.8
				18900	1880.0	23.4	22.0
				19100	1900.0	22.8	21.8
		100	0	18700	1860.0	23.4	22.3
				18900	1880.0	23.4	22.3
				19100	1900.0	23.4	21.8

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
4	1.4 MHz	1	0	19957	1710.7	23.8	23.5
				20175	1732.5	24.5	23.3
				20393	1754.3	23.9	22.9
			3	19957	1710.7	24.0	22.8
				20175	1732.5	24.0	23.2
				20393	1754.3	23.9	23.0
			5	19957	1710.7	24.5	23.2
				20175	1732.5	23.9	23.4
				20393	1754.3	24.4	23.3
		3	0	19957	1710.7	24.4	23.2
				20175	1732.5	24.1	23.0
				20393	1754.3	23.8	23.4
			1	19957	1710.7	24.3	23.4
				20175	1732.5	23.8	23.2
				20393	1754.3	24.4	22.9
			3	19957	1710.7	24.4	23.5
				20175	1732.5	24.1	23.1
				20393	1754.3	24.3	23.5
		6	0	19957	1710.7	23.0	22.0
				20175	1732.5	23.5	22.3
				20393	1754.3	22.9	22.3
	3 MHz	1	0	19965	1711.5	24.2	23.3
				20175	1732.5	24.3	23.3
				20385	1753.5	24.0	23.1
			7	19965	1711.5	24.0	22.8
				20175	1732.5	24.1	23.2
				20385	1753.5	24.1	23.4
			14	19965	1711.5	23.9	23.1
				20175	1732.5	24.2	23.0
				20385	1753.5	24.5	23.1
		8	0	19965	1711.5	23.3	22.2
				20175	1732.5	23.1	22.4
				20385	1753.5	23.0	22.0
			7	19965	1711.5	23.0	21.9
				20175	1732.5	22.9	22.3
				20385	1753.5	23.3	21.9
			14	19965	1711.5	23.4	22.1
				20175	1732.5	22.9	22.2
				20385	1753.5	23.5	22.1
		15	0	19965	1711.5	23.3	22.0
				20175	1732.5	23.3	22.5
				20385	1753.5	23.1	22.4

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
4	5 MHz	1	0	19975	1712.5	24.0	23.3
				20175	1732.5	24.0	23.1
				20375	1752.5	23.8	23.0
			12	19975	1712.5	24.5	22.9
				20175	1732.5	24.0	23.5
				20375	1752.5	24.3	23.0
			24	19975	1712.5	23.9	23.4
				20175	1732.5	24.2	23.4
				20375	1752.5	24.2	23.0
		12	0	19975	1712.5	22.8	21.9
				20175	1732.5	23.0	22.4
				20375	1752.5	23.5	22.0
			6	19975	1712.5	23.0	22.0
				20175	1732.5	23.1	22.5
				20375	1752.5	23.3	22.4
			13	19975	1712.5	23.3	21.9
				20175	1732.5	23.0	22.2
				20375	1752.5	23.4	22.4
		25	0	19975	1712.5	23.4	22.2
				20175	1732.5	23.2	22.3
				20375	1752.5	22.9	22.4
	10 MHz	1	0	20000	1715.0	24.0	22.9
				20175	1732.5	23.8	23.4
				20350	1750.0	24.0	23.0
			24	20000	1715.0	23.9	23.5
				20175	1732.5	23.9	22.8
				20350	1750.0	24.2	23.2
			49	20000	1715.0	24.1	23.2
				20175	1732.5	23.8	22.8
				20350	1750.0	24.2	23.4
		25	0	20000	1715.0	23.4	22.2
				20175	1732.5	23.2	22.5
				20350	1750.0	23.0	21.8
			13	20000	1715.0	23.2	22.0
				20175	1732.5	23.3	22.3
				20350	1750.0	23.0	22.4
			25	20000	1715.0	23.1	22.3
				20175	1732.5	23.2	22.2
				20350	1750.0	23.3	22.2
		50	0	20000	1715.0	23.2	21.9
				20175	1732.5	22.9	21.9
				20350	1750.0	23.0	22.3

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
4	15 MHz	1	0	20025	1717.5	24.3	23.3
				20175	1732.5	24.2	22.8
				20325	1747.5	24.1	23.0
			37	20025	1717.5	23.9	23.4
				20175	1732.5	24.4	23.5
				20325	1747.5	24.1	23.3
			74	20025	1717.5	23.9	23.1
				20175	1732.5	24.5	23.0
				20325	1747.5	24.2	23.2
		36	0	20025	1717.5	23.3	21.8
				20175	1732.5	23.3	21.9
				20325	1747.5	23.4	22.4
			19	20025	1717.5	22.9	22.5
				20175	1732.5	23.0	22.0
				20325	1747.5	23.3	22.1
			39	20025	1717.5	22.9	22.3
				20175	1732.5	23.1	22.4
				20325	1747.5	23.1	22.1
		75	0	20025	1717.5	22.8	22.2
				20175	1732.5	23.3	22.4
				20325	1747.5	23.4	22.1
	20 MHz	1	0	20050	1720.0	24.2	23.5
				20175	1732.5	24.5	22.8
				20300	1745.0	24.4	23.4
			49	20050	1720.0	24.1	23.3
				20175	1732.5	24.1	22.9
				20300	1745.0	24.3	23.1
			99	20050	1720.0	24.4	23.3
				20175	1732.5	24.0	23.2
				20300	1745.0	24.0	23.2
		50	0	20050	1720.0	23.0	22.2
				20175	1732.5	23.5	22.1
				20300	1745.0	23.2	22.3
			24	20050	1720.0	23.4	22.5
				20175	1732.5	22.9	21.8
				20300	1745.0	23.3	22.0
			50	20050	1720.0	22.9	22.3
				20175	1732.5	23.0	22.0
				20300	1745.0	23.4	22.5
		100	0	20050	1720.0	23.4	21.8
				20175	1732.5	23.2	22.1
				20300	1745.0	23.4	22.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
5	1.4 MHz	1	0	20407	824.7	23.5	22.7
				20525	836.5	23.9	22.9
				20643	848.3	23.9	22.6
			3	20407	824.7	23.6	22.8
				20525	836.5	23.7	22.5
				20643	848.3	23.8	22.6
			5	20407	824.7	23.6	22.7
				20525	836.5	23.9	23.0
				20643	848.3	23.7	22.5
		3	0	20407	824.7	23.6	22.5
				20525	836.5	23.7	22.5
				20643	848.3	23.9	22.3
			1	20407	824.7	23.4	22.5
				20525	836.5	23.5	22.8
				20643	848.3	23.5	22.8
			3	20407	824.7	24.0	22.4
				20525	836.5	23.9	22.3
				20643	848.3	24.0	22.7
		6	0	20407	824.7	22.9	21.4
				20525	836.5	22.3	21.4
				20643	848.3	22.4	21.8
	3 MHz	1	0	20415	825.5	23.5	22.8
				20525	836.5	23.8	23.0
				20635	847.5	23.5	22.5
			7	20415	825.5	23.6	22.3
				20525	836.5	23.4	22.4
				20635	847.5	23.5	22.4
			14	20415	825.5	23.9	22.7
				20525	836.5	23.3	22.3
				20635	847.5	23.8	22.9
		8	0	20415	825.5	22.9	22.0
				20525	836.5	22.8	21.4
				20635	847.5	22.4	21.3
			7	20415	825.5	22.8	21.5
				20525	836.5	22.8	21.3
				20635	847.5	22.5	21.9
			14	20415	825.5	22.3	21.7
				20525	836.5	22.7	21.9
				20635	847.5	22.8	21.4
		15	0	20415	825.5	23.0	21.8
				20525	836.5	22.3	21.7
				20635	847.5	22.9	21.6

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
5	5 MHz	1	0	20425	826.5	23.4	22.8
				20525	836.5	23.7	22.7
				20625	846.5	23.5	22.6
			12	20425	826.5	23.9	22.5
				20525	836.5	23.6	22.4
				20625	846.5	23.4	22.9
			24	20425	826.5	24.0	22.6
				20525	836.5	23.3	22.3
				20625	846.5	23.8	22.9
		12	0	20425	826.5	22.3	21.7
				20525	836.5	22.7	21.6
				20625	846.5	22.9	21.5
			6	20425	826.5	23.0	21.7
				20525	836.5	22.4	21.7
				20625	846.5	22.8	21.5
			13	20425	826.5	22.8	21.3
				20525	836.5	23.0	21.9
				20625	846.5	22.6	21.6
		25	0	20425	826.5	22.9	21.9
				20525	836.5	22.9	21.3
				20625	846.5	22.7	21.5
	10 MHz	1	0	20450	829.0	23.6	22.7
				20525	836.5	23.9	22.7
				20600	844.0	23.8	22.4
			24	20450	829.0	24.0	22.6
				20525	836.5	23.8	23.0
				20600	844.0	23.8	22.9
			49	20450	829.0	23.9	22.5
				20525	836.5	23.4	22.6
				20600	844.0	23.5	22.3
		25	0	20450	829.0	22.6	21.5
				20525	836.5	22.6	21.8
				20600	844.0	22.8	21.7
			13	20450	829.0	22.3	21.8
				20525	836.5	22.6	21.6
				20600	844.0	23.0	21.3
			25	20450	829.0	22.6	22.0
				20525	836.5	22.9	21.7
				20600	844.0	22.5	22.0
		50	0	20450	829.0	22.4	21.6
				20525	836.5	23.0	21.6
				20600	844.0	22.3	21.4

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
7	5 MHz	1	0	20775	2502.5	23.7	22.7
				21100	2535.0	23.5	22.8
				21425	2567.5	23.3	22.8
			12	20775	2502.5	23.9	22.9
				21100	2535.0	23.7	22.4
				21425	2567.5	23.9	23.0
			24	20775	2502.5	24.0	22.5
				21100	2535.0	23.8	22.6
				21425	2567.5	23.6	22.6
		12	0	20775	2502.5	22.8	21.9
				21100	2535.0	22.6	22.0
				21425	2567.5	22.8	21.8
			6	20775	2502.5	22.4	21.4
				21100	2535.0	22.9	21.4
				21425	2567.5	22.5	21.9
			13	20775	2502.5	22.6	21.7
				21100	2535.0	22.6	21.6
				21425	2567.5	22.7	21.4
		25	0	20775	2502.5	22.5	21.6
				21100	2535.0	22.4	21.6
				21425	2567.5	22.5	21.9
	10 MHz	1	0	20800	2505.0	23.6	22.6
				21100	2535.0	23.6	22.9
				21400	2565.0	23.9	22.9
			24	20800	2505.0	23.6	22.5
				21100	2535.0	23.3	23.0
				21400	2565.0	23.5	22.9
			49	20800	2505.0	23.8	22.5
				21100	2535.0	23.4	22.9
				21400	2565.0	23.9	22.4
		25	0	20800	2505.0	23.0	21.6
				21100	2535.0	22.4	21.5
				21400	2565.0	22.6	21.4
			13	20800	2505.0	22.7	21.9
				21100	2535.0	22.5	21.5
				21400	2565.0	22.5	21.7
			25	20800	2505.0	22.9	21.7
				21100	2535.0	22.7	21.6
				21400	2565.0	23.0	21.5
		50	0	20800	2505.0	22.8	21.6
				21100	2535.0	22.6	21.6
				21400	2565.0	22.6	21.4

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
7	15 MHz	1	0	20825	2507.5	23.4	22.9
				21100	2535.0	23.3	22.6
				21375	2562.5	23.7	22.3
			37	20825	2507.5	23.8	22.6
				21100	2535.0	24.0	22.6
				21375	2562.5	23.7	22.5
			74	20825	2507.5	23.9	22.7
				21100	2535.0	23.8	22.5
				21375	2562.5	23.9	22.9
		36	0	20825	2507.5	22.6	21.5
				21100	2535.0	22.3	21.4
				21375	2562.5	22.9	21.6
			19	20825	2507.5	22.8	21.3
				21100	2535.0	22.4	21.4
				21375	2562.5	22.7	21.7
			39	20825	2507.5	22.9	21.9
				21100	2535.0	22.9	21.6
				21375	2562.5	23.0	21.5
		75	0	20825	2507.5	22.9	22.0
				21100	2535.0	22.4	21.7
				21375	2562.5	22.6	21.5
	20 MHz	1	0	20850	2510.0	23.7	22.6
				21100	2535.0	23.7	22.8
				21350	2560.0	23.6	22.7
			49	20850	2510.0	23.7	22.5
				21100	2535.0	23.9	22.6
				21350	2560.0	24.0	22.4
			99	20850	2510.0	23.6	22.6
				21100	2535.0	23.5	22.5
				21350	2560.0	23.5	22.6
		50	0	20850	2510.0	22.7	21.4
				21100	2535.0	22.8	21.9
				21350	2560.0	22.8	22.0
			24	20850	2510.0	22.3	21.9
				21100	2535.0	22.6	21.4
				21350	2560.0	22.9	21.7
			50	20850	2510.0	22.9	22.0
				21100	2535.0	22.5	21.9
				21350	2560.0	22.6	21.5
		100	0	20850	2510.0	22.9	21.9
				21100	2535.0	22.7	21.6
				21350	2560.0	22.9	21.7

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
12	1.4 MHz	1	0	23017	699.7	23.4	22.7
				23095	707.5	23.4	22.8
				23173	715.3	23.6	22.5
			3	23017	699.7	24.0	22.3
				23095	707.5	23.7	22.4
				23173	715.3	23.7	22.8
			5	23017	699.7	23.9	22.7
				23095	707.5	23.6	22.5
				23173	715.3	24.0	22.9
		3	0	23017	699.7	23.6	22.8
				23095	707.5	23.9	22.3
				23173	715.3	23.7	22.6
			1	23017	699.7	23.5	22.4
				23095	707.5	23.6	22.4
				23173	715.3	23.8	22.4
			3	23017	699.7	23.5	22.9
				23095	707.5	23.3	22.4
				23173	715.3	23.8	22.7
		6	0	23017	699.7	22.9	21.7
				23095	707.5	22.4	21.7
				23173	715.3	23.0	22.0
	3 MHz	1	0	23025	700.5	23.3	22.5
				23095	707.5	24.0	22.6
				23165	714.5	23.4	22.7
			7	23025	700.5	23.5	22.8
				23095	707.5	23.9	22.4
				23165	714.5	23.8	22.8
			14	23025	700.5	23.6	22.3
				23095	707.5	23.5	22.7
				23165	714.5	23.8	22.6
		8	0	23025	700.5	22.4	21.3
				23095	707.5	22.6	21.6
				23165	714.5	22.4	21.3
			7	23025	700.5	22.9	21.7
				23095	707.5	22.9	21.8
				23165	714.5	22.5	21.7
			14	23025	700.5	22.4	21.7
				23095	707.5	22.8	21.6
				23165	714.5	22.7	21.6
		15	0	23025	700.5	22.5	21.5
				23095	707.5	23.0	21.8
				23165	714.5	22.7	22.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
12	5 MHz	1	0	23035	701.5	23.7	22.5
				23095	707.5	23.9	22.9
				23155	713.5	23.4	22.8
			12	23035	701.5	23.5	22.9
				23095	707.5	23.5	22.7
				23155	713.5	23.4	22.5
			24	23035	701.5	23.6	22.5
				23095	707.5	23.6	23.0
				23155	713.5	24.0	22.3
		12	0	23035	701.5	22.5	21.7
				23095	707.5	22.9	21.7
				23155	713.5	22.3	21.3
			6	23035	701.5	22.6	21.9
				23095	707.5	22.9	21.5
				23155	713.5	22.9	21.5
			13	23035	701.5	22.8	21.8
				23095	707.5	22.7	21.8
				23155	713.5	22.9	21.9
		25	0	23035	701.5	22.6	21.7
				23095	707.5	22.8	21.6
				23155	713.5	23.0	22.0
	10 MHz	1	0	23060	704.0	23.8	22.6
				23095	707.5	24.0	22.4
				23130	711.0	23.7	22.3
			24	23060	704.0	23.7	22.4
				23095	707.5	23.3	22.6
				23130	711.0	24.0	22.9
			49	23060	704.0	23.9	22.9
				23095	707.5	23.9	22.9
				23130	711.0	23.3	22.8
		25	0	23060	704.0	22.9	21.7
				23095	707.5	22.6	21.6
				23130	711.0	22.3	21.6
			13	23060	704.0	22.4	21.8
				23095	707.5	22.5	21.8
				23130	711.0	22.9	21.5
			25	23060	704.0	22.6	21.5
				23095	707.5	22.6	21.9
				23130	711.0	22.6	21.6
		50	0	23060	704.0	22.7	22.0
				23095	707.5	22.4	21.6
				23130	711.0	22.6	21.7

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
13	5 MHz	1	0	23205	779.5	23.7	23.0
				23230	782.0	23.9	22.3
				23129	784.5	23.8	22.5
			12	23205	779.5	23.6	22.8
				23230	782.0	23.9	22.5
				23129	784.5	23.8	22.5
			24	23205	779.5	23.4	22.6
				23230	782.0	23.7	23.0
				23129	784.5	23.9	22.4
		12	0	23205	779.5	22.7	22.0
				23230	782.0	22.9	21.3
				23129	784.5	22.3	21.9
			6	23205	779.5	22.5	21.7
				23230	782.0	22.3	21.7
				23129	784.5	22.9	21.5
			13	23205	779.5	22.6	21.7
				23230	782.0	22.5	21.5
				23129	784.5	22.4	21.7
		25	0	23205	779.5	22.8	21.4
				23230	782.0	22.4	21.8
				23129	784.5	22.7	22.0
	10 MHz	1	0	23230	782.0	23.8	22.6
			24	23230	782.0	23.4	22.8
			49	23230	782.0	23.5	22.8
		25	0	23230	782.0	22.6	21.9
			13	23230	782.0	22.6	21.6
			25	23230	782.0	22.5	21.5
		50	0	23230	782.0	22.8	21.8

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
17	5 MHz	1	0	23755	706.5	22.8	21.9
				23790	710.0	23.1	22.2
				23825	713.5	22.8	21.7
			12	23755	706.5	23.1	22.1
				23790	710.0	23.3	21.9
				23825	713.5	23.2	21.7
			24	23755	706.5	22.8	22.3
				23790	710.0	22.8	22.1
				23825	713.5	23.0	22.3
		12	0	23755	706.5	22.2	21.3
				23790	710.0	22.0	21.3
				23825	713.5	22.3	21.2
			6	23755	706.5	22.0	20.8
				23790	710.0	21.8	21.4
				23825	713.5	21.7	21.2
			13	23755	706.5	21.9	20.8
				23790	710.0	22.3	21.2
				23825	713.5	22.0	20.8
		25	0	23755	706.5	22.2	21.3
				23790	710.0	22.2	21.1
				23825	713.5	22.1	21.4
	10 MHz	1	0	23780	709.0	23.1	22.1
				23790	710.0	23.3	21.9
				23800	711.0	23.0	22.0
			24	23780	709.0	23.2	22.4
				23790	710.0	22.7	22.2
				23800	711.0	23.4	22.2
			49	23780	709.0	22.8	22.2
				23790	710.0	23.0	22.3
				23800	711.0	23.2	22.2
		25	0	23780	709.0	22.1	20.8
				23790	710.0	22.1	21.3
				23800	711.0	22.3	21.4
			13	23780	709.0	22.3	21.1
				23790	710.0	21.8	21.4
				23800	711.0	21.8	20.9
			25	23780	709.0	22.0	21.2
				23790	710.0	22.3	20.9
				23800	711.0	21.7	20.9
		50	0	23780	709.0	22.2	20.8
				23790	710.0	22.0	21.2
				23800	711.0	21.8	21.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
25	1.4 MHz	1	0	26047	1850.7	23.6	22.6
				26365	1882.5	24.0	22.3
				26683	1914.3	23.9	22.3
			3	26047	1850.7	23.5	22.4
				26365	1882.5	23.9	22.5
				26683	1914.3	23.8	22.9
			5	26047	1850.7	23.7	22.6
				26365	1882.5	23.3	22.5
				26683	1914.3	23.5	22.6
		3	0	26047	1850.7	23.5	22.9
				26365	1882.5	23.8	22.7
				26683	1914.3	23.7	22.7
			1	26047	1850.7	23.9	22.6
				26365	1882.5	23.6	22.6
				26683	1914.3	23.4	22.7
			3	26047	1850.7	23.8	22.7
				26365	1882.5	23.5	22.9
				26683	1914.3	23.5	22.9
		6	0	26047	1850.7	22.5	21.6
				26365	1882.5	22.5	21.5
				26683	1914.3	22.4	21.6
	3 MHz	1	0	26055	1851.5	23.3	23.0
				26365	1882.5	23.6	22.6
				26675	1913.5	23.8	22.6
			7	26055	1851.5	23.8	22.9
				26365	1882.5	24.0	22.3
				26675	1913.5	23.8	22.7
			14	26055	1851.5	24.0	22.7
				26365	1882.5	23.6	22.5
				26675	1913.5	23.8	22.4
		8	0	26055	1851.5	22.4	21.7
				26365	1882.5	22.5	21.8
				26675	1913.5	22.8	21.9
			7	26055	1851.5	22.8	21.6
				26365	1882.5	22.5	22.0
				26675	1913.5	22.3	21.9
			14	26055	1851.5	22.5	21.9
				26365	1882.5	22.4	22.0
				26675	1913.5	23.0	21.6
		15	0	26055	1851.5	22.7	21.7
				26365	1882.5	22.7	21.9
				26675	1913.5	22.9	21.7

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
25	5 MHz	1	0	26065	1852.5	23.6	22.7
				26365	1882.5	23.5	22.3
				26665	1912.5	23.8	23.0
			12	26065	1852.5	23.7	22.4
				26365	1882.5	23.9	22.7
				26665	1912.5	23.4	23.0
			24	26065	1852.5	23.6	22.6
				26365	1882.5	23.7	22.5
				26665	1912.5	24.0	23.0
		12	0	26065	1852.5	22.6	21.8
				26365	1882.5	22.9	21.4
				26665	1912.5	23.0	21.4
			6	26065	1852.5	22.6	21.7
				26365	1882.5	22.8	21.3
				26665	1912.5	22.7	21.5
			13	26065	1852.5	22.8	22.0
				26365	1882.5	22.4	21.7
				26665	1912.5	22.8	21.7
		25	0	26065	1852.5	22.6	21.4
				26365	1882.5	22.5	21.9
				26665	1912.5	22.7	21.5
	10 MHz	1	0	26090	1855.0	23.5	22.7
				26365	1882.5	23.6	22.6
				26640	1910.0	23.8	22.3
			24	26090	1855.0	23.9	22.9
				26365	1882.5	23.8	22.9
				26640	1910.0	23.7	22.9
			49	26090	1855.0	23.7	22.4
				26365	1882.5	23.9	22.8
				26640	1910.0	23.6	22.3
		25	0	26090	1855.0	22.4	21.4
				26365	1882.5	22.7	21.9
				26640	1910.0	22.5	21.4
			13	26090	1855.0	22.3	21.7
				26365	1882.5	23.0	21.8
				26640	1910.0	22.9	21.8
			25	26090	1855.0	22.9	21.5
				26365	1882.5	22.4	21.7
				26640	1910.0	22.4	21.4
		50	0	26090	1855.0	22.9	21.8
				26365	1882.5	22.7	21.3
				26640	1910.0	22.4	21.4

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
25	15 MHz	1	0	26115	1857.5	23.4	22.5
				26365	1882.5	23.7	23.0
				26615	1907.5	23.5	23.0
			37	26115	1857.5	23.7	22.5
				26365	1882.5	23.5	22.8
				26615	1907.5	23.3	22.5
			74	26115	1857.5	23.7	22.9
				26365	1882.5	23.8	22.3
				26615	1907.5	23.4	22.5
		36	0	26115	1857.5	23.0	21.9
				26365	1882.5	22.7	21.4
				26615	1907.5	22.5	22.0
			19	26115	1857.5	22.5	21.6
				26365	1882.5	22.9	21.4
				26615	1907.5	22.8	21.9
			39	26115	1857.5	22.6	21.7
				26365	1882.5	22.9	21.4
				26615	1907.5	22.8	21.9
		75	0	26115	1857.5	22.4	22.0
				26365	1882.5	22.5	21.6
				26615	1907.5	22.5	21.9
	20 MHz	1	0	26140	1860.0	23.9	22.7
				26365	1882.5	23.9	22.7
				26590	1905.0	23.9	22.8
			49	26140	1860.0	23.8	22.4
				26365	1882.5	23.7	22.8
				26590	1905.0	24.0	22.8
			99	26140	1860.0	23.8	22.6
				26365	1882.5	23.5	22.8
				26590	1905.0	24.0	22.9
		50	0	26140	1860.0	22.8	21.9
				26365	1882.5	22.9	21.7
				26590	1905.0	22.6	21.8
			24	26140	1860.0	23.0	21.9
				26365	1882.5	22.9	21.5
				26590	1905.0	22.7	21.7
			50	26140	1860.0	22.6	21.9
				26365	1882.5	22.7	21.8
				26590	1905.0	22.7	21.4
		100	0	26140	1860.0	22.5	21.5
				26365	1882.5	22.9	21.4
				26590	1905.0	22.9	21.9

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
26	1.4 MHz	1	0	26697	814.7	23.7	23.0
				26865	831.5	23.8	22.9
				27033	848.3	23.9	22.4
			3	26697	814.7	23.9	22.4
				26865	831.5	24.0	22.8
				27033	848.3	23.8	22.4
			5	26697	814.7	23.7	23.0
				26865	831.5	23.9	22.8
				27033	848.3	24.0	22.6
		3	0	26697	814.7	23.8	22.8
				26865	831.5	23.9	22.9
				27033	848.3	23.5	22.5
			1	26697	814.7	23.5	22.6
				26865	831.5	23.7	22.8
				27033	848.3	24.0	22.7
			3	26697	814.7	23.9	22.3
				26865	831.5	23.6	22.3
				27033	848.3	23.7	22.8
		6	0	26697	814.7	22.6	21.7
				26865	831.5	22.8	21.6
				27033	848.3	22.3	21.9
	3 MHz	1	0	26705	815.5	23.9	22.6
				26865	831.5	23.7	22.8
				27025	847.5	23.6	22.4
			7	26705	815.5	24.0	22.9
				26865	831.5	23.3	23.0
				27025	847.5	23.6	22.8
			14	26705	815.5	23.7	22.7
				26865	831.5	23.7	22.7
				27025	847.5	23.8	22.7
		8	0	26705	815.5	22.5	21.8
				26865	831.5	22.6	21.3
				27025	847.5	22.8	21.3
			7	26705	815.5	22.7	21.5
				26865	831.5	22.5	21.6
				27025	847.5	22.4	21.4
			14	26705	815.5	22.9	21.7
				26865	831.5	22.7	21.4
				27025	847.5	22.7	21.9
		15	0	26705	815.5	22.5	21.4
				26865	831.5	22.5	21.7
				27025	847.5	22.7	21.5

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
26	5 MHz	1	0	26715	816.5	23.4	22.4
				26865	831.5	23.6	22.7
				27015	846.5	23.5	22.4
			12	26715	816.5	23.8	22.5
				26865	831.5	23.4	22.3
				27015	846.5	23.4	22.8
			24	26715	816.5	24.0	22.8
				26865	831.5	23.5	22.4
				27015	846.5	23.5	22.8
		12	0	26715	816.5	23.0	21.6
				26865	831.5	22.6	21.6
				27015	846.5	22.6	21.6
			6	26715	816.5	22.6	21.6
				26865	831.5	22.8	21.9
				27015	846.5	23.0	21.6
			13	26715	816.5	23.0	21.9
				26865	831.5	22.7	21.3
				27015	846.5	22.5	21.7
		25	0	26715	816.5	22.9	21.4
				26865	831.5	22.9	21.5
				27015	846.5	22.8	21.4
	10 MHz	1	0	26740	819.0	23.4	22.6
				26865	831.5	23.6	22.7
				26990	844.0	23.7	22.7
			24	26740	819.0	23.7	22.8
				26865	831.5	23.8	22.5
				26990	844.0	23.4	22.5
			49	26740	819.0	23.5	22.9
				26865	831.5	23.9	22.3
				26990	844.0	23.9	22.7
		25	0	26740	819.0	23.0	21.8
				26865	831.5	22.3	21.6
				26990	844.0	22.3	21.7
			13	26740	819.0	22.4	21.5
				26865	831.5	23.0	21.8
				26990	844.0	22.5	21.5
			25	26740	819.0	22.4	21.7
				26865	831.5	22.6	21.9
				26990	844.0	22.3	21.3
		50	0	26740	819.0	22.8	21.4
				26865	831.5	22.8	21.5
				26990	844.0	22.6	21.9