EMC Technologies Pty Ltd
ABN 82 057 105 549
176 Harrick Road
Keilor Park
Victoria Australia 3042

Ph: + 613 9365 1000
Fax: + 613 9331 7455
email: emc-general@emctech.com.au

Global Product Certification
EMC-EMF-Safety Approvals

SAR Test Report

Report Number: M2006031-5

Test Sample (host):	Walker Portable Transmitter
Radio Modules:	Sierra Wireless WP7610 WWAN and Digi XB9X Zigbee
Host Model:	W510
WWAN FCC ID:	2AXLO-WALKER510
ZigBee FCC ID:	MCQ-XBSX
Tested For:	Mentis Technologies Pty Ltd
Date of Issue:	10 September 2020

Table 1

Table of Revisions				
Report Number	Revision Number	Description	Pages affected	Date
M2006031-5	1	Original	N/A	10 Sept. 2020

CONTENTS

SAR TEST REPORT
Report Number: M2006031-5
WWAN FCC ID: 2AXLO-WALKER510 ZIGBEE FCC ID: MCQ-XBSX

1.0 GENERAL INFORMATION

Test Sample:		Walker Portable Transmitter
Radio Modules:		Sierra Wireless WP7610 WWAN and Digi XB9X Zigbee
IMSI:		0015250000176440
Hardware Version:		5.7
Software Version:		v7.4.0
Device Category:		Portable Transmitter
Host model:		W510
WWAN FCC ID:		2AXLO-WALKER510
ZigBee FCC ID:		MCQ-XBSX
RF exposure Category:		General Population/Uncontrolled
Manufacturer:		Mentis Technologies Pty Ltd
FCC KDB Procedures:	**1.**	447498 D01 General RF Exposure Guidance v06 941225 D01 3G SAR Procedures v03r01 941225 D05 SAR for LTE Devices v02r05 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 865664 D02 RF Exposure Reporting v01r02 KDB Enquiry Tracking Number 741317
Test Standard/s:	**2.**	**IEEE 1528: 2013** Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.
Statement Of Compliance:		The Walker Portable Transmitter, Model: W510 complied with the FCC General public/uncontrolled RF exposure limits of 1.6W/kg (1g body) and 4.0w/kg (10g extremities) per requirements of 47CFR2.1093(d).
Highest Reported SAR:		1g Head configuration 0.786 W/kg 10g Extremity configuration 1.994 W/kg
Test Dates:		11th August to 2nd September 2020

Test Officer: **Peter Jakubiec**

Authorised Signatory **Chris Zombolas**
Managing Director
EMC Technologies Pty Ltd

SAR TEST REPORT
Walker Portable Transmitter
Model: W510
Report Number: M2006031-5

2.0 INTRODUCTION

Testing was performed on the Mentis Technologies Walker Portable Transmitter, a cellular connected device (model: W510) which professional photographers use to send their photos instantly to the cloud. It mounts on the side of their DSLR camera and connects to the camera's USB port. It will be referred to as the Device Under Test (DUT) throughout this report. DUT contains also a low duty cycle ZigBee transmitter. ZigBee Transmitter tune-up power is 13 dBm (20mW) peak, the RF Duty Cycle is 0.39%. The average power is 0.078 mW.

Table 2

Applicable Head Configurations	: None
Applicable Body Configurations	: Back Side Position (0mm Separation, evaluated in 1g volume) : Front Side Position (0mm Separation, evaluated in 10g volume) : Top Side Position (0mm Separation, evaluated in 10g volume) : Bottom Side Position (0mm Separation, evaluated in 10g volume) : Top Side Position (0mm Separation, evaluated in 10g volume) : Left Side Position (0mm Separation, evaluated in 10g volume) : Right Side Position (0mm Separation, evaluated in 10g volume)

3.0 TEST SAMPLE TECHNICAL INFORMATION

(Information supplied by the client)

3.1 WWAN Details

Transmitter: Integrated Wireless WAN Module
FCC ID: 2AXLO-WALKER510
Wireless Module: WWAN (UMTS/LTE combo)
Model Number: WP7610
Manufacturer: SIERRA WIRELESS INC
Modulation Type: QPSK and QAM for UMTS
QPSK and 16-QAM for LTE
UMTS Frequency Bands: Band 2 (1900 MHz), Band 4 (1700 MHz), Band 5 (850 MHz)
LTE bands: Band 2 (1900 MHz), Band 4 (1700 MHz), Band 5 (850 MHz), Band 12 (700 MHz), Band 13 (700 MHz), Band 14 (700 MHz), Band 17 (700 MHz), Band 66 (1700 MHz
Antenna type: Chip Antenna
Antenna gain: 2.4 dBi
Antenna Part Number: Main: CP519214, AUX: CP519215

Transmitter: Integrated ZigBee Module
FCC ID: MCQ-XBSX
Wireless Module: ZigBee 900 MHz
Model Number: XB9X
Manufacturer: Digi
Modulation Type: DSSS
Antenna type: Chip Antenna
Antenna gain: 1.6 dBi

3.2 Test Signal, Frequency and Output Power

The DUT was provided by Mentis Technologies Pty Ltd. It was put into operation using a Rohde & Schwarz Radio Communication Testers CMU200, CMW500 and Agilent PXT E6621A. The channels utilised in the measurements were the traffic channels shown in the table below. The power level was set to class 3 for 850, UMTS bands, and class 3 for LTE bands.

Tune-up Power

Table 3

LTE Bands

Band	Channel	Lower Limit (dBm)	Upper Limit (dBm)
2	Low	20.00	24.00
	Middle	20.00	24.00
	High	20.00	24.00
4	Low	20.00	23.50
	Middle	20.00	23.50
	High	20.00	23.50
5	Low	21.00	24.50
	Middle	21.00	24.50
	High	21.00	24.50
12	Low	21.50	24.00
	Middle	21.50	24.00
	High	21.50	24.00
13	Low	22.00	24.00
	Middle	22.00	24.00
	High	22.00	24.00
14	Low	22.00	24.50
	Middle	22.00	24.50
	High	22.00	24.50
17	Low	21.50	24.00
	Middle	21.50	24.00
	High	21.50	24.00
66	Low	21.00	24.00
	Middle	21.00	24.00
	High	21.00	24.00

Table 4

UMTS Bands

Band	Channel	Lower Limit (dBm)	Upper Limit (dBm)
2	Low	20.50	23.50
	Middle	20.50	23.50
	High	20.50	23.50
4	Low	21.00	23.50
	Middle	21.00	23.50
	High	21.00	23.50
5	Low	21.50	24.00
	Middle	21.50	24.00
	High	21.50	24.00

3.3 Test sample Accessories

3.3.1 Battery Types

One type of Fujitsu Lithium Ion battery is used to power the DUT.

Standard Battery

BATTERY:	Li-ion 3.7V 3000mAh
Model No.:	Emaxcan 103665
Batch.:	2020/03/05

4.0 TEST SIGNAL, FREQUENCY AND OUTPUT POWER

For the SAR measurements the DUT was operating at full transmit power. The fixed frequency channels used in the testing are shown in Table Below.

The frequency span of the LTE and UMTS bands was more than 10MHz consequently; the SAR levels of the test sample were measured for lowest, centre and highest channels in the applicable modes. There were no wires or other connections to the DUT during the SAR measurements.
At the beginning of the SAR tests, the conducted power of the DUT was measured after temporary modification of antenna connector inside the DUT's TX RX compartment. Measurements were performed with a calibrated Power Meter. The results of this measurement are listed in tables below.

Conducted Power Measurement LTE WP7610 - IMEI – 015250000176440

Configuration (Agilent PTX E6621A):
Band selection: Frequency key (setup group) > Setting Method = EARFCN, > Band = 13, and > UL EARFCN = 23230 (UL channel number)
For QPSK: Mode Setup key (measurement/function group) > More soft key > PHY Settings soft key > Uplink Resource Allocation soft key > I_MCS = 5
For 16-QAM: Mode Setup key (measurement/function group) > More soft key > PHY Settings soft key > Uplink Resource Allocation soft key > I_MCS = 15
Resource Block settings: Mode Setup key (measurement/function group) > More soft key > PHY Settings soft key > Uplink Resource Allocation soft key > RB Size and RB Start
Channel Bandwidth: Mode Setup key (measurement/function group) > Ch Bandwidth
TTI configuration: Mode Setup key (measurement/function group) > More soft key > PHY Settings soft key > Uplink Resource Allocation soft key > RCT > UL Tx Pattern to ALL (to ensure that all available sub-frames are active and transmitting)
Mode Setup key> More 2/2 soft key>RRC Settings soft key> More 3/3 soft key> Additional Spectrum Emission = 1 (to ensure that Additional Maximum Power Reduction (A-MPR) is switched off)

Table 5

Band 2 Channel Bandwidth – 1.4 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 18607	Ch. 18900	Ch.19193
QPSK	1	0	22.31	22.90	22.84
16-QAM	1	0	20.96	21.69	21.47
QPSK	1	2	22.26	22.81	22.76
16-QAM	1	2	21.35	21.83	21.58
QPSK	1	5	22.25	22.64	22.59
16-QAM	1	5	21.18	21.64	21.52
QPSK	3	0	22.27	22.57	22.63
16-QAM	3	0	21.39	21.83	21.66
QPSK	3	1	22.30	22.61	22.59
16-QAM	3	1	21.39	21.90	21.68
QPSK	3	2	22.29	22.63	22.57
16-QAM	3	2	21.40	21.90	21.67
QPSK	6	0	21.34	21.62	21.53
16-QAM	6	0	20.31	20.72	20.69

Table 6

Band 2 Channel Bandwidth – 3 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 18615	Ch. 18900	Ch.19185
QPSK	1	0	23.14	23.53	23.18
16-QAM	1	0	21.46	22.05	21.58
QPSK	1	7	22.75	23.51	23.11
16-QAM	1	7	21.81	22.43	22.90
QPSK	1	14	22.54	23.33	22.82
16-QAM	1	14	21..58	21.15	21.86
QPSK	8	0	21.59	22.26	21.94
16-QAM	8	0	20.74	21.3	21.09
QPSK	8	4	21.61	22.25	21.93
16-QAM	8	4	20.81	21.35	21.09
QPSK	8	7	21.65	22.25	21.93
16-QAM	8	7	20.76	21.43	21.09
QPSK	15	0	21.65	22.23	22.01
16-QAM	15	0	20.79	21.41	21.10

Table 7

Band 2 Channel Bandwidth - 5 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 18625	Ch. 18900	Ch.19175
QPSK	1	0	22.80	23.07	22.99
16-QAM	1	0	21.53	21.94	21.80
QPSK	1	12	22.83	23.31	23.15
16-QAM	1	12	21.80	22.38	22.19
QPSK	1	24	22.50	23.09	22.79
16-QAM	1	24	21.40	22.04	21.86
QPSK	12	0	21.60	22.10	21.87
16-QAM	12	0	20.72	21.22	21.04
QPSK	12	6	21.66	22.09	21.99
16-QAM	12	6	20.72	21.25	21.06
QPSK	12	11	21.60	22.25	21.98
16-QAM	12	11	20.73	21.29	21.17
QPSK	25	0	21.58	22.24	21.96
16-QAM	25	0	20.71	21.31	21.14

Table 8

Band 2 Channel Bandwidth - 10 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 18650	Ch. 18900	Ch. 19150
QPSK	1	0	22.79	23.06	22.83
16-QAM	1	0	21.48	21.81	21.49
QPSK	1	24	22.73	23.32	23.11
16-QAM	1	24	21.60	22.18	21.92
QPSK	1	49	22.66	23.11	22.89
16-QAM	1	49	21.39	22.00	21.67
QPSK	25	0	21.48	22.07	21.57
16-QAM	25	0	20.58	21.08	20.68
QPSK	25	12	21.47	22.18	21.87
16-QAM	25	12	20.59	21.29	20.92
QPSK	25	24	21.45	22.18	21.92
16-QAM	25	24	20.54	21.37	20.94
QPSK	50	0	21.54	22.13	21.85
16-QAM	50	0	20.61	21.27	20.92

Table 9

Band 2 Channel Bandwidth – 15 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 18675	Ch. 18900	Ch.19125
QPSK	1	0	22.60	22.84	23.15
16-QAM	1	0	21.25	21.44	21.50
QPSK	1	37	22.65	23.15	23.12
16-QAM	1	37	21.46	22.01	21.68
QPSK	1	74	22.52	22.86	22.99
16-QAM	1	74	21.34	21.84	21.58
QPSK	36	0	21.45	21.71	21.54
16-QAM	36	0	20.49	20.71	21.47
QPSK	36	19	21.37	21.79	21.69
16-QAM	36	19	20.42	20.84	20.71
QPSK	36	38	21.39	21.89	21.90
16-QAM	36	38	20.45	20.94	20.86
QPSK	75	0	21.44	21.77	21.75
16-QAM	75	0	20.39	20.92	20.67

Table 10

Band 2 Channel Bandwidth – 20 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 18700	Ch. 18900	Ch.19100
QPSK	1	0	22.51	22.78	**22.76**
16-QAM	1	0	21.27	21.50	21.49
QPSK	1	49	**22.67**	**23.13**	22.54
16-QAM	1	49	21.53	22.01	21.33
QPSK	1	99	22.50	22.86	22.62
16-QAM	1	99	21.30	21.74	21.48
QPSK	50	0	21.48	21.61	21.45
16-QAM	50	0	20.60	20.72	20.54
QPSK	50	25	**22.03**	21.97	21.43
16-QAM	50	25	20.61	21.02	20.47
QPSK	50	49	21.40	**22.04**	**22.02**
16-QAM	50	49	20.61	20.05	20.49
QPSK	100	0	21.49	21.92	21.59
16-QAM	100	0	20.58	20.96	20.57

Table 11

Band 4 Channel Bandwidth – 1.4 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 19957	Ch. 20175	Ch.20393
QPSK	1	0	22.33	22.05	22.56
16-QAM	1	0	20.93	20.72	21.16
QPSK	1	2	22.26	21.95	22.49
16-QAM	1	2	21.08	20.87	21.21
QPSK	1	5	22.16	21.91	22.37
16-QAM	1	5	20.93	20.75	21.02
QPSK	3	0	22.22	21.91	22.35
16-QAM	3	0	21.21	20.92	21.23
QPSK	3	1	22.15	21.97	22.40
16-QAM	3	1	21.22	20.98	21.25
QPSK	3	2	22.16	22.01	22.30
16-QAM	3	2	21.24	21.02	21.26
QPSK	6	0	21.14	20.93	21.22
16-QAM	6	0	20.06	19.83	21.26

Table 12

Band 4 Channel Bandwidth – 3 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 19965	Ch. 20175	Ch.20385
QPSK	1	0	22.37	22.21	22.52
16-QAM	1	0	21.10	20.70	21.14
QPSK	1	7	22.26	22.08	22.51
16-QAM	1	7	21.32	19.74	21.34
QPSK	1	14	20.05	21.95	22.40
16-QAM	1	14	20.97	20.70	21.18
QPSK	8	0	21.18	20.70	21.34
16-QAM	8	0	20.15	19.78	20.37
QPSK	8	4	21.13	20.93	21.37
16-QAM	8	4	20.12	19.80	20.36
QPSK	8	7	21.14	20.93	21.36
16-QAM	8	7	20.20	19.80	20.34
QPSK	15	0	21.12	20.90	21.27
16-QAM	15	0	20.22	19.82	20.31

Table 13

Band 4 Channel Bandwidth - 5 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 19975	Ch. 20175	Ch.20375
QPSK	1	0	22.94	22.71	22.75
16-QAM	1	0	21.22	20.62	21.65
QPSK	1	12	22.51	22.42	22.53
16-QAM	1	12	21.38	20.94	21.44
QPSK	1	24	22.23	21.95	22.49
16-QAM	1	24	20.75	20.67	21.29
QPSK	12	0	22.16	20.76	21.26
16-QAM	12	0	20.22	19.76	20.23
QPSK	12	6	21.98	20.83	21.48
16-QAM	12	6	20.19	19.76	20.58
QPSK	12	11	21.87	20.87	21.45
16-QAM	12	11	20.15	19.78	20.50
QPSK	25	0	20.78	20.82	21.43
16-QAM	25	0	20.16	19.76	20.35

Table 14

Band 4 Channel Bandwidth - 10 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 20000	Ch. 20175	Ch. 20350
QPSK	1	0	22.57	21.65	22.40
16-QAM	1	0	20.77	20.52	20.99
QPSK	1	24	22.30	21.97	22.62
16-QAM	1	24	20.75	20.87	21.39
QPSK	1	49	21.62	21.71	22.65
16-QAM	1	49	20.21	20.62	21.46
QPSK	25	0	21.14	20.78	21.22
16-QAM	25	0	19.96	19.69	20.12
QPSK	25	12	20.97	20.84	21.36
16-QAM	25	12	19.82	19.77	20.35
QPSK	25	24	20.61	20.94	21.39
16-QAM	25	24	19.49	19.81	20.43
QPSK	50	0	20.81	20.83	21.33
16-QAM	50	0	19.76	19.76	20.31

Table 15

Band 4 Channel Bandwidth – 15 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 20025	Ch. 20175	Ch.20325
QPSK	1	0	22.27	22.01	22.18
16-QAM	1	0	21.04	20.37	21.00
QPSK	1	37	21.68	22.27	22.53
16-QAM	1	37	20.58	21.06	21.50
QPSK	1	74	21.42	21.79	22.66
16-QAM	1	74	20.32	20.45	21.51
QPSK	36	0	20.85	20.76	21.07
16-QAM	36	0	19.75	19.79	20.12
QPSK	36	19	20.54	20.90	21.25
16-QAM	36	19	19.45	19.86	20.27
QPSK	36	38	20.27	20.85	21.38
16-QAM	36	38	19.26	19.85	20.45
QPSK	75	0	20.64	20.74	21.28
16-QAM	75	0	19.56	19.67	20.31

Table 16

Band 4 Channel Bandwidth – 20 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 20050	Ch. 20175	Ch.20300
QPSK	1	0	**22.59**	22.03	22.03
16-QAM	1	0	20.92	20.85	21.04
QPSK	1	49	22.07	**22.37**	22.54
16-QAM	1	49	20.20	20.53	21.95
QPSK	1	99	21.77	21.76	**22.37**
16-QAM	1	99	20.73	19.57	21.40
QPSK	50	0	**20.65**	20.64	21.11
16-QAM	50	0	19.62	19.83	20.12
QPSK	50	25	20.25	20.92	21.18
16-QAM	50	25	19.26	19.82	20.27
QPSK	50	49	20.36	**21.80**	**21.56**
16-QAM	50	49	19.38	20.77	20.25
QPSK	100	0	20.51	21.75	21.26
16-QAM	100	0	19.47	19.75	20.15

Table 17

Band 5 Channel Bandwidth – 1.4 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 20407	Ch. 20525	Ch.20643
QPSK	1	0	23.11	23.90	23.49
16-QAM	1	0	22.01	22.62	22.40
QPSK	1	2	23.30	23.89	23.48
16-QAM	1	2	22.15	22.80	22.49
QPSK	1	5	23.28	23.85	23.32
16-QAM	1	5	22.14	22.65	22.43
QPSK	3	0	23.21	22.76	23.44
16-QAM	3	0	22.26	22.83	22.56
QPSK	3	1	23.26	23.83	23.45
16-QAM	3	1	22.22	22.84	22.74
QPSK	3	2	23.26	23.84	23.43
16-QAM	3	2	22.28	22.89	22.53
QPSK	6	0	23.20	22.75	22.36
16-QAM	6	0	21.23	21.75	21.45

Table 18

Band 5 Channel Bandwidth – 3 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 20415	Ch. 20525	Ch.20625
QPSK	1	0	23.18	23.81	23.59
16-QAM	1	0	22.12	22.69	22.51
QPSK	1	7	23.62	23.94	23.65
16-QAM	1	7	22.48	22.92	22.69
QPSK	1	14	23.51	23.83	23.36
16-QAM	1	14	22.47	22.72	22.25
QPSK	8	0	22.27	22.78	22.57
16-QAM	8	0	21.29	21.78	21.59
QPSK	8	4	22.38	22.77	22.56
16-QAM	8	4	21.38	21.77	21.58
QPSK	8	7	22.50	22.79	22.42
16-QAM	8	7	21.50	21.80	21.53
QPSK	15	0	22.36	22.78	22.54
16-QAM	15	0	21.37	21.77	21.56

Table 19

Band 5 Channel Bandwidth - 5 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 20425	Ch. 20525	Ch.20625
QPSK	1	0	23.11	23.90	23.49
16-QAM	1	0	22.01	22.62	22.40
QPSK	1	12	23.30	23.89	23.48
16-QAM	1	12	22.15	22.80	22.49
QPSK	1	24	23.28	23.85	23.32
16-QAM	1	24	22.14	22.65	22.93
QPSK	12	0	23.21	22.76	23.44
16-QAM	12	0	22.26	22.83	22.56
QPSK	12	6	23.26	23.83	23.45
16-QAM	12	6	22.22	22.89	22.74
QPSK	12	11	23.26	23.84	23.43
16-QAM	12	11	22.28	22.89	22.53
QPSK	25	0	23.20	22.75	22.56
16-QAM	25	0	21.23	21.75	21.45

Table 20

Band 5 Channel Bandwidth - 10 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 20450	Ch. 20525	Ch. 20600
QPSK	1	0	23.18	23.81	23.59
16-QAM	1	0	22.12	22.69	22.51
QPSK	1	24	**23.62**	**23.94**	**23.65**
16-QAM	1	24	22.48	22.92	22.69
QPSK	1	49	23.51	23.83	23.36
16-QAM	1	49	22.47	22.72	22.25
QPSK	25	0	22.27	22.78	**22.57**
16-QAM	25	0	21.29	21.78	21.59
QPSK	25	12	22.38	22.77	22.56
16-QAM	25	12	21.38	21.77	21.58
QPSK	25	24	**22.50**	**22.79**	22.42
16-QAM	25	24	21.50	21.80	21.53
QPSK	50	0	22.36	22.78	22.54
16-QAM	50	0	21.37	21.77	21.56

Table 21

Band 12 Channel Bandwidth – 1.4 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23017	Ch. 23095	Ch. 23173
QPSK	1	0	23.45	23.95	23.37
16-QAM	1	0	22.19	22.38	22.37
QPSK	1	2	23.47	23.99	23.85
16-QAM	1	2	22.29	22.45	22.25
QPSK	1	5	23.38	23.97	23.38
16-QAM	1	5	22.16	22.65	22.31
QPSK	3	0	23.22	23.84	23.31
16-QAM	3	0	22.35	22.82	22.45
QPSK	3	1	23.31	23.94	23.41
16-QAM	3	1	22.37	22.84	22.50
QPSK	3	2	23.29	23.72	23.28
16-QAM	3	2	22.40	22.89	22.52
QPSK	6	0	22.24	22.79	22.45
16-QAM	6	0	21.23	21.80	21.42

Table 22

Band 12 Channel Bandwidth – 3 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23025	Ch. 23095	Ch. 23165
QPSK	1	0	23.46	23.70	23.68
16-QAM	1	0	22.35	22.64	22.70
QPSK	1	7	23.32	23.86	23.70
16-QAM	1	7	22.29	22.96	22.67
QPSK	1	14	23.19	23.68	23.48
16-QAM	1	14	22.15	22.82	22.47
QPSK	8	0	22.30	22.76	22.68
16-QAM	8	0	21.27	21.82	21.56
QPSK	8	4	22.29	22.75	22.61
16-QAM	8	4	21.26	21.80	21.55
QPSK	8	7	22.29	22.81	22.56
16-QAM	8	7	21.28	21.85	21.50
QPSK	15	0	22.27	22.75	22.54
16-QAM	15	0	21.28	21.81	21.56

Table 23

Band 12 Channel Bandwidth - 5 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23035	Ch. 23095	Ch.23155
QPSK	1	0	23.39	23.71	23.75
16-QAM	1	0	22.30	22.60	22.84
QPSK	1	12	23.35	23.98	23.74
16-QAM	1	12	22.31	22.80	22.81
QPSK	1	24	23.37	23.65	23.29
16-QAM	1	24	22.39	22.57	22.36
QPSK	12	0	22.31	22.74	22.79
16-QAM	12	0	21.25	21.76	21.75
QPSK	12	6	22.30	22.75	22.78
16-QAM	12	6	21.25	21.77	21.76
QPSK	12	11	22.31	22.81	22.55
16-QAM	12	11	21.30	21.85	21.64
QPSK	25	0	22.27	22.83	22.67
16-QAM	25	0	21.28	21.81	21.71

Table 24

Band 12 Channel Bandwidth - 10 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23060	Ch. 23095	Ch. 23130
QPSK	1	0	23.19	23.10	23.54
16-QAM	1	0	22.22	22.15	22.61
QPSK	1	24	**23.42**	**23.76**	**23.80**
16-QAM	1	24	22.50	22.79	22.94
QPSK	1	49	23.40	23.69	23.32
16-QAM	1	49	22.28	22.75	22.33
QPSK	25	0	22.65	22.57	22.75
16-QAM	25	0	21.23	21.62	21.75
QPSK	25	12	22.46	22.70	**22.92**
16-QAM	25	12	21.52	21.76	21.93
QPSK	25	24	**22.74**	**22.75**	22.72
16-QAM	25	24	21.76	21.95	21.73
QPSK	50	0	22.61	22.64	22.65
16-QAM	50	0	21.58	21.67	21.71

Table 25

Band 13 Channel Bandwidth - 5 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23205	Ch. 23230	Ch.23255
QPSK	1	0	23.31	23.19	23.30
16-QAM	1	0	22.09	21.98	21.77
QPSK	1	12	**23.46**	23.23	**23.30**
16-QAM	1	12	22.38	22.14	22.13
QPSK	1	24	23.13	23.91	23.13
16-QAM	1	24	22.00	21.73	21.94
QPSK	12	0	22.10	22.08	21.90
16-QAM	12	0	21.11	21.05	20.94
QPSK	12	6	22.16	22.07	21.97
16-QAM	12	6	21.15	21.05	20.96
QPSK	12	11	**22.21**	21.88	**22.05**
16-QAM	12	11	21.19	20.93	20.05
QPSK	25	0	22.19	21.91	21.95
16-QAM	25	0	21.19	20.94	20.95

Table 26

Band 13 Channel Bandwidth - 10 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23230	Ch. 23230	Ch. 23230
QPSK	1	0	-	**23.76**	-
16-QAM	1	0	-	22.66	-
QPSK	1	24	-	23.67	-
16-QAM	1	24	-	22.58	-
QPSK	1	49	-	23.52	-
16-QAM	1	49	-	22.35	-
QPSK	25	0	-	**22.57**	-
16-QAM	25	0	-	21.51	-
QPSK	25	12	-	22.39	-
16-QAM	25	12	-	21.56	-
QPSK	25	24	-	22.41	-
16-QAM	25	24	-	21.50	-
QPSK	50	0	-	22.51	-
16-QAM	50	0	-	21.53	-

Table 27

Band 14 Channel Bandwidth - 5 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23305	Ch. 23330	Ch. 23355
QPSK	1	0	23.85	23.83	23.94
16-QAM	1	0	22.78	22.73	22.89
QPSK	1	12	**24.18**	**24.15**	**24.21**
16-QAM	1	12	22.97	23.18	23.22
QPSK	1	24	23.98	23.91	23.99
16-QAM	1	24	22.92	22.91	22.89
QPSK	12	0	22.88	22.87	23.02
16-QAM	12	0	21.90	21.90	21.97
QPSK	12	6	**22.92**	22.97	**23.08**
16-QAM	12	6	21.93	22.01	22.01
QPSK	12	11	22.90	**22.99**	23.07
16-QAM	12	11	21.94	22.00	22.01
QPSK	25	0	22.89	23.08	23.04
16-QAM	25	0	21.94	21.98	22.02

Table 28

Band 14 Channel Bandwidth - 10 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23330	Ch. 23330	Ch. 23330
QPSK	1	0	-	23.94	-
16-QAM	1	0	-	22.80	-
QPSK	1	24	-	**24.13**	-
16-QAM	1	24	-	23.01	-
QPSK	1	49	-	23.99	-
16-QAM	1	49	-	22.92	-
QPSK	25	0	-	22.92	-
16-QAM	25	0	-	21.91	-
QPSK	25	12	-	**23.09**	-
16-QAM	25	12	-	21.92	-
QPSK	25	24	-	23.01	-
16-QAM	25	24	-	21.94	-
QPSK	50	0	-	22.94	-
16-QAM	50	0	-	21.93	-

Table 29

Band 17 Channel Bandwidth - 5 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23755	Ch. 23790	Ch.23825
QPSK	1	0	23.51	23.56	23.69
16-QAM	1	0	22.41	22.63	22.62
QPSK	1	12	23.80	23.95	23.88
16-QAM	1	12	22.38	22.90	22.88
QPSK	1	24	23.50	23.63	23.56
16-QAM	1	24	22.43	22.50	22.52
QPSK	12	0	22.65	22.75	22.77
16-QAM	12	0	21.62	21.68	21.75
QPSK	12	6	22.76	22.78	22.75
16-QAM	12	6	21.75	21.73	21.72
QPSK	12	11	22.74	22.77	22.70
16-QAM	12	11	21.70	21.73	21.66
QPSK	25	0	22.75	22.74	22.71
16-QAM	25	0	21.72	21.71	21.68

Table 30

Band 17 Channel Bandwidth - 10 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 23780	Ch. 23790	Ch. 23800
QPSK	1	0	23.52	23.55	23.59
16-QAM	1	0	22.60	22.49	22.48
QPSK	1	24	23.69	**23.82**	**23.81**
16-QAM	1	24	22.70	22.73	22.64
QPSK	1	49	**23.77**	23.64	23.48
16-QAM	1	49	22.71	22.50	22.32
QPSK	25	0	22.68	22.59	**22.77**
16-QAM	25	0	21.73	21.61	21.64
QPSK	25	12	22.81	**22.78**	22.75
16-QAM	25	12	21.80	21.75	21.75
QPSK	25	24	**22.84**	22.64	22.70
16-QAM	25	24	21.81	21.75	21.68
QPSK	50	0	22.65	22.65	22.64
16-QAM	50	0	21.72	21.64	21.63

Table 31

Band 66 Channel Bandwidth – 1.4 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch.131979	Ch.132322	Ch.132665
QPSK	1	0	23.37	23.22	23.18
16-QAM	1	0	22.36	21.96	21.99
QPSK	1	2	23.42	23.32	23.26
16-QAM	1	2	22.39	22.16	22.15
QPSK	1	5	23.34	23.30	23.25
16-QAM	1	5	22.28	22.08	22.00
QPSK	3	0	23.31	23.26	23.24
16-QAM	3	0	22.45	22.14	22.01
QPSK	3	1	23.38	23.23	23.21
16-QAM	3	1	22.40	22.25	22.15
QPSK	3	2	23.37	23.22	23.20
16-QAM	3	2	22.45	22.20	22.13
QPSK	6	0	22.29	22.06	22.05
16-QAM	6	0	21.34	21.18	21.20

Table 32

Band 66 Channel Bandwidth – 3 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 131987	Ch. 132322	132657
QPSK	1	0	23.51	23.11	23.05
16-QAM	1	0	22.28	22.08	22.00
QPSK	1	7	23.43	23.49	23.37
16-QAM	1	7	22.36	22.42	22.15
QPSK	1	14	23.21	23.38	23.30
16-QAM	1	14	22.12	22.17	22.10
QPSK	8	0	22.39	22.16	22.03
16-QAM	8	0	21.41	21.21	22.13
QPSK	8	4	22.31	22.22	22.12
16-QAM	8	4	22.38	21.29	21.17
QPSK	8	7	22.33	22.30	22.10
16-QAM	8	7	21.40	21.34	21.21
QPSK	15	0	22.35	22.25	22.15
16-QAM	15	0	21.39	21.27	21.20

Table 33

Band 66 Channel Bandwidth - 5 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 131997	Ch. 132322	Ch. 132647
QPSK	1	0	23.46	23.17	23.11
16-QAM	1	0	22.26	21.95	21.73
QPSK	1	12	23.43	23.56	23.34
16-QAM	1	12	22.34	22.37	22.05
QPSK	1	24	22.87	23.47	23.30
16-QAM	1	24	21.72	22.22	22.07
QPSK	12	0	22.24	22.08	22.00
16-QAM	12	0	21.24	21.11	21.03
QPSK	12	6	22.19	22.13	21.99
16-QAM	12	6	21.24	21.21	21.11
QPSK	12	11	22.08	22.19	21.97
16-QAM	12	11	21.26	21.27	21.07
QPSK	25	0	22.16	22.20	21.95
16-QAM	25	0	21.19	21.21	21.05

Table 34

Band 66 Channel Bandwidth - 10 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 132022	Ch. 132322	Ch. 132622
QPSK	1	0	23.48	23.25	23.11
16-QAM	1	0	22.15	22.02	21.95
QPSK	1	24	22.97	23.48	23.36
16-QAM	1	24	21.79	22.20	22.05
QPSK	1	49	22.36	23.58	23.35
16-QAM	1	49	21.31	22.34	22.16
QPSK	25	0	21.95	22.23	22.15
16-QAM	25	0	21.14	21.77	21.00
QPSK	25	12	21.76	22.25	22.07
16-QAM	25	12	20.92	21.28	21.10
QPSK	25	24	21.47	22.31	22.21
16-QAM	25	24	20.62	21.39	21.20
QPSK	50	0	21.79	22.25	22.20
16-QAM	50	0	20.77	21.30	21.05

Table 35

Band 66 Channel Bandwidth – 15 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 132047	Ch. 132322	Ch. 132597
QPSK	1	0	23.46	23.15	23.05
16-QAM	1	0	22.01	21.92	21.77
QPSK	1	37	22.88	23.55	23.37
16-QAM	1	37	21.57	22.19	21.09
QPSK	1	74	22.63	23.59	23.90
16-QAM	1	74	21.30	22.24	22.14
QPSK	36	0	21.76	22.14	22.00
16-QAM	36	0	20.72	21.18	21.06
QPSK	36	19	21.48	22.13	22.05
16-QAM	36	19	20.43	21.18	21.03
QPSK	36	38	21.29	22.28	22.15
16-QAM	36	38	20.25	21.37	21.15
QPSK	75	0	21.57	22.16	22.11
16-QAM	75	0	20.55	21.23	21.15

Table 36

Band 66 Channel Bandwidth – 20 MHz

Modulation scheme	Resource Block size	Resource Block start (offset)	Result (dBm)		
			Ch. 132072	Ch. 132322	Ch. 132572
QPSK	1	0	**23.49**	23.33	23.16
16-QAM	1	0	21.90	22.07	22.00
QPSK	1	49	22.59	23.56	**23.38**
16-QAM	1	49	21.15	22.05	21.97
QPSK	1	99	22.97	**23.81**	23.33
16-QAM	1	99	21.74	22.47	21.95
QPSK	50	0	**22.01**	22.12	**22.10**
16-QAM	50	0	20.66	21.13	21.01
QPSK	50	25	21.26	22.15	22.03
16-QAM	50	25	20.25	21.14	21.05
QPSK	50	49	21.42	**22.40**	22.05
16-QAM	50	49	20.40	21.45	21.15
QPSK	100	0	21.58	22.26	22.13
16-QAM	100	0	20.55	21.30	21.15

Conducted Power Measurement UMTS 850 MHz

Configuration:
12.2 kbps RMC
Test Loop Mode 1
βc = 8, βd = 15 (3GPP default)
TPC (Transmit Power Control) = All 1s

Table 37

Channel No.	βc	βd	Result (dBm)
4132	8	15	**22.37**
4183	8	15	**23.02**
4233	8	15	**23.05**

Conducted Power Measurement UMTS + HSDPA 850 MHz

Configuration:
Device HSDPA Category 6 (Downlink 3.6 Mbps and Uplink 384 kbps)
H-Set = 1
QPSK in H-Set (1)
CQI Fidback Cycle = 4ms; CQI Repetition Rate = 2ms

Table 38

Sub Test No.	βc	βd	ΔAKN	ΔNAKN	ΔCQI	Result (dBm)			MPR (dB)
						4132	4183	4233	
1	2	15	8	8	8	21.92	22.63	22.79	0.0
2	12	15	8	8	8	21.87	22.61	22.75	0.0
3	15	8	8	8	8	21.30	22.31	22.51	0.5
4	15	4	8	8	8	21.33	22.31	22.53	0.5

Conducted Power Measurement UMTS + HSDPA + HSUPA 850 MHz

Configuration:
Device HSUPA Release 6 (5.7 Mbps)
RMC 12.2 kbps + HSPA 34.108 with loop mode 1
HS-DPCCH, E-DPCCH, E-DPDCH Enabled
DPCH Channel Code {βd (SF)} = 64
Power Control – TPC algorithm 2
3GPP default HS-DPCCH power offset parameters Δ_{AKN} = 5; Δ_{NAKN} = 5; Δ_{CQI} = 2
E-TFCI table index = 0
E-DCH minimum set E-TFCI = 9
PLnon-max = 0.84
Maximum Channelisation Code {βed (SF) and βed (codes)} – Subtests 1,2,4,5 = SF4; Subtest 3 = 2xSF4
Initial Serving Grant Value = Off
Δ HARQ =0
Number of Ref.E-TFCIs – Subtests 1,2,4,5 = 5; Subtest 3 = 2
Set1 Patern Type = Closed Loop

Table 39

Sub Test	βc	βd	Δ AKN	Δ NAKN	Δ CQI	Δ E-DPCCH	βed (SF)	βed (codes)	AG Index	Result (dBm)			MPR (dB)
										4132	4183	4233	
1	10	15	8	8	8	6	4	1	20	21.52	22.21	22.29	0.0
2	6	15	8	8	8	8	4	1	12	20.91	21.55	21.65	2.0
3	15	9	8	8	8	8	4	2	15	21.39	22.03	21.47	1.0
4	2	15	8	8	8	5	4	1	17	21.11	21.48	21.02	2.0
5	15	15	8	8	8	7	4	1	21	21.93	22.37	22.11	0.0

HSPA+ : Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., CAT 6 Rel 6

Conducted Power Measurement UMTS 1700 MHz (AT&T) - Generic 3G firmware used

Configuration:
12.2 kbps RMC
Test Loop Mode 1
βc = 8, βd = 15 (3GPP default)
TPC (Transmit Power Control) = All 1s

Table 40

Channel No.	βc	βd	Result (dBm)
1312	8	15	**22.92**
1427	8	15	**22.57**
1513	8	15	**22.60**

Conducted Power Measurement UMTS + HSDPA 1700 MHz

Configuration:
Device HSDPA Category 6 (Downlink 3.6 Mbps and Uplink 384 kbps)
H-Set = 1
QPSK in H-Set (1)
CQI Fidback Cycle = 4ms; CQI Repetition Rate = 2ms
3GPP default HS-DPCCH power offset parameters Δ_{AKN} = 5; Δ_{NAKN} = 5; Δ_{CQI} = 2

Table 41

Sub Test No.	βc	βd	ΔAKN	ΔNAKN	ΔCQI	Result (dBm)			MPR (dB)
						1312	1427	1513	
1	2	15	8	8	8	22.07	21.92	22.05	0.0
2	12	15	8	8	8	22.27	21.71	22.03	0.0
3	15	8	8	8	8	21.53	21.35	21.73	0.5
4	15	4	8	8	8	21.65	21.47	21.92	0.5

Conducted Power Measurement UMTS + HSDPA + HSUPA 1700 MHz

Configuration:
Device HSUPA Release 6 (5.7 Mbps)
RMC 12.2 kbps + HSPA 34.108 with loop mode 1
HS-DPCCH, E-DPCCH, E-DPDCH Enabled
DPCH Channel Code {βd (SF)} = 64
Power Control – TPC algorithm 2
3GPP default HS-DPCCH power offset parameters Δ_{AKN} = 5; Δ_{NAKN} = 5; Δ_{CQI} = 2
E-TFCI table index = 0
E-DCH minimum set E-TFCI = 9
PLnon-max = 0.84
Maximum Channelisation Code {βed (SF) and βed (codes)} – Subtests 1,2,4,5 = SF4; Subtest 3 = 2xSF4
Initial Serving Grant Value = Off
Δ HARQ =0
Number of Ref.E-TFCIs – Subtests 1,2,4,5 = 5; Subtest 3 = 2
Set1 Patern Type = Closed Loop

Table 42

Sub Test	βc	βd	Δ AKN	Δ NAKN	Δ CQI	Δ E-DPCCH	βed (SF)	βed (codes)	AG Index	Result (dBm)			MPR (dB)
										1312	1427	1513	
1	10	15	8	8	8	6	4	1	20	22.29	21.90	22.10	0.0
2	6	15	8	8	8	8	4	1	12	20.95	20.67	20.71	2.0
3	15	9	8	8	8	8	4	2	15	21.60	21.35	21.26	1.0
4	2	15	8	8	8	5	4	1	17	20.99	20.42	20.41	2.0
5	15	15	8	8	8	7	4	1	21	22.14	21.90	21.89	0.0

HSPA+ : Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., CAT 6 Rel 6

Conducted Power Measurement UMTS 1900 MHz (AT&T)
Configuration:
12.2 kbps RMC
Test Loop Mode 1
βc = 8, βd = 15 (3GPP default)
TPC (Transmit Power Control) = All 1s

Table 43

Channel No.	βc	βd	Result (dBm)
9262	8	15	**23.10**
9400	8	15	**22.56**
9538	8	15	**22.37**

Conducted Power Measurement UMTS + HSDPA 1900 MHz

Configuration:
Device HSDPA Category 6 (Downlink 3.6 Mbps and Uplink 384 kbps)
H-Set = 1
QPSK in H-Set (1)
CQI Fidback Cycle = 4ms; CQI Repetition Rate = 2ms
3GPP default HS-DPCCH power offset parameters Δ_{AKN} = 5; Δ_{NAKN} = 5; Δ_{CQI} = 2

Table 44

Sub Test No.	βc	βd	ΔAKN	ΔNAKN	ΔCQI	Result (dBm)			MPR (dB)
						9262	9400	9538	
1	2	15	8	8	8	23.02	22.50	22.21	0.0
2	12	15	8	8	8	22.70	22.08	22.01	0.0
3	15	8	8	8	8	22.36	21.99	21.68	0.5
4	15	4	8	8	8	22.51	21.98	21.65	0.5

Conducted Power Measurement UMTS + HSDPA + HSUPA 1900 MHz

Configuration:
Device HSUPA Release 6 (5.7 Mbps)
RMC 12.2 kbps + HSPA 34.108 with loop mode 1
HS-DPCCH, E-DPCCH, E-DPDCH Enabled
DPCH Channel Code {βd (SF)} = 64
Power Control – TPC algorithm 2
3GPP default HS-DPCCH power offset parameters Δ_{AKN} = 5; Δ_{NAKN} = 5; Δ_{CQI} = 2
E-TFCI table index = 0
E-DCH minimum set E-TFCI = 9
PLnon-max = 0.84
Maximum Channelisation Code {βed (SF) and βed (codes)} – Subtests 1,2,4,5 = SF4; Subtest 3 = 2xSF4
Initial Serving Grant Value = Off
Δ HARQ =0
Number of Ref.E-TFCIs – Subtests 1,2,4,5 = 5; Subtest 3 = 2
Set1 Patern Type = Closed Loop

Table 45

Sub Test	βc	βd	Δ AKN	Δ NAKN	Δ CQI	Δ E-DPCCH	βed (SF)	βed (codes)	AG Index	Result (dBm)			MPR (dB)
										9262	9400	9538	
1	10	15	8	8	8	6	4	1	20	22.75	22.21	22.15	0.0
2	6	15	8	8	8	8	4	1	12	21.28	20.80	20.60	2.0
3	15	9	8	8	8	8	4	2	15	21.89	21.29	21.22	1.0
4	2	15	8	8	8	5	4	1	17	21.15	20.63	20.04	2.0
5	15	15	8	8	8	7	4	1	21	22.71	22.19	21.89	0.0

HSPA+ : Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., CAT 6 Rel 6

4.1 Battery Status

The DUT battery was fully charged prior to commencement of measurement. The battery condition was monitored by measuring the RF field at a defined position inside the phantom before the commencement of each test and again after the completion of the test. It was not possible to perform conducted power measurements at the output of the DUT, at the beginning and end of each scan due to lack of a suitable antenna port. The uncertainty associated with the power drift was less than 5% and was assessed in the uncertainty budget.

5.0 DETAILS OF TEST LABORATORY

5.1 Location

EMC Technologies Pty Ltd
176 Harrick Road
Keilor Park, (Melbourne) Victoria
Australia 3042

Telephone: +61 3 9365 1000
Facsimile: +61 3 9331 7455
email: melb@emctech.com.au
website: www.emctech.com.au

5.2 Accreditations

EMC Technologies Pty. Ltd. is accredited by the National Association of Testing Authorities, Australia (NATA).
NATA Accredited Laboratory Number: 5292
Last assessed in October 2019, next scheduled assessment in February 2021

EMC Technologies Pty Ltd is NATA accredited for the following standards:

Table 46

AS/NZS 2772.2 2016:	Radiofrequency Fields. **Part 2:** Principles and methods of measurement and computation - 3kHz to 300 GHz.
ACMA:	Radiocommunications (Electromagnetic Radiation — Human Exposure) Standard 2014
EN 50360: 2017	Product standard to demonstrate the compliance of Mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)
EN 62209-1:2016	Human Exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models instrumentation and procedures. **Part 1:** Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (300 MHz to 6 GHz)
EN 62209-2:2010	Human Exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models instrumentation and procedures **Part 2:** Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz
IEEE 1528: 2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.
FCC Knowledge Database:	KDB measurement procedures publications
RSS-102:	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

Refer to NATA website www.nata.asn.au for the full scope of accreditation.

5.3 Environmental Factors

The measurements were performed in a shielded room with no background RF signals. The temperature in the laboratory was controlled to within 21±1°C, the humidity was in the range 28% to 41%. The liquid parameters are measured daily prior to the commencement of each test. Tissue dielectric liquid parameters were measured within 24 hours before the start of testing. Tests were performed to check that reflections within the environment did not influence the SAR measurements. The noise floor of the DASY5 SAR measurement system using the SN1380 probe was less than 5μV in both air and liquid mediums.

6.0 CALIBRATION AND VERIFICATION PROCEDURES AND DATA

6.1 System Verification

6.1.1 Deviation from reference validation values

The following table lists the results of the System Verification. The forward power into the reference dipole for SAR System Verification was adjusted to 250 mW.

The reference SAR values are derived using a reference dipoles and flat section of the phantom suitable for the frequencies listed below. These reference SAR values are obtained from the IEEE Std 1528-2013 and are normalized to 1W.

The SPEAG calibration reference SAR value is the SAR validation result obtained in a specific dielectric liquid using the validation dipole during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in table below.

Table 47

Frequency and Date	Measured SAR 1g (W/kg)	Measured SAR 1g (Normalized to 1W)	SPEAG Calibration reference SAR Value 1g (W/kg)	Deviation From SPEAG Reference 1g (%)	IEEE Std 1528 reference SAR value 1g (W/kg)	Deviation From IEEE 1g (%)
750MHz 11 Aug 20	2.28	9.12	8.59	6.17	8.49	7.42
750MHz 12 Aug 20	2.12	8.48	8.59	-1.28	8.49	-0.12
750MHz 13 Aug 20	2.16	8.64	8.59	0.58	8.49	1.77
750MHz 14 Aug 20	2.23	8.92	8.59	3.84	8.49	5.06
750MHz 17 Aug 20	2.22	8.88	8.59	3.38	8.49	4.59
900MHz 17 Aug 20	2.64	10.56	10.9	-3.12	10.8	-2.22
900MHz 18 Aug 20	2.68	10.72	10.9	-1.65	10.8	-0.74
1800MHz 26 Aug 20	9.49	37.96	39.6	-4.14	38.1	-0.37
1800MHz 27 Aug 20	9.54	38.16	39.6	-3.64	38.1	0.16
1800MHz 31 Aug 20	9.29	37.16	39.6	-6.16	38.1	-2.47
1950MHz 1 Sep 20	10.5	42.00	41.1	2.19	40.5	3.70
1950MHz 2 Sep 20	10.5	42.00	41.1	2.19	40.5	3.70

NOTE: All reference validation values are referenced to 1W input power.

Table 48

System Validation

Frequency	Date	Probe S/N	Cal. Signal type	∈r target 41.9 ±5% 39.8 to 44.0	σ target 0.89 ±5% 0.85 to 0.93
750MHz	24 April 2020	1380	CW	39.9	0.92
Frequency	Date	Probe S/N	Cal. Signal type	∈r target 41.5 ±5% 39.4 to 43.6	σ target 0.97 ±5% 0.92 to 1.02
900MHz	20 April 2020	1380	CW	40.7	0.96
Frequency	Date	Probe S/N	Cal. Signal type	∈r target 40.0 ±5% 38.0 to 42.0	σ target 1.40 ±5% 1.33 to 1.47
1800MHz	4 May 2020	1380	CW	38.2	1.37
Frequency	Date	Probe S/N	Cal. Signal type	∈r target 40.0 ±5% 38.0 to 42.0	σ target 1.40 ±5% 1.33 to 1.47
1950MHz	30 April 2020	1380	CW	39.2	1.45

6.1.2 Liquid Temperature and Humidity

The humidity and dielectric/ambient temperatures were recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than |2|°C.

Table: Temperature and Humidity recorded for each day

Table 49

Date	Ambient Temperature (°C)	Liquid Temperature (°C)	Humidity (%)
11 August 2020	21.7	21.4	28
12 August 2020	21.6	21.5	29
13 August 2020	21.3	21.7	40
14 August 2020	21.8	21.4	41
17 August 2020	21.7	21.5	31
18 August 2020	21.1	21.5	40
26 August 2020	21.4	21.4	33
27 August 2020	21.2	21.4	35
31 August 2020	21.7	21.4	34
1 September 2020	21.6	21.7	33
2 September 2020	21.6	21.4	33

7.0 SAR MEASUREMENT PROCEDURE USING DASY5

The SAR evaluation was performed with the SPEAG DASY5 system. A summary of the procedure follows:

a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the DUT. The SAR at this point is measured at the start of the test, and then again at the end of the test.

b) The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 4.0 mm from the inner surface of the shell. The area covers the entire dimension of the DUT and the horizontal grid spacing is 15 mm x 15 mm. The actual largest Area Scan has dimensions of 150 mm x 105 mm surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation.

c) Around this point, a volume of 32 mm x 32 mm x 30 mm is assessed by measuring 5 x 5 x 7 points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:

(i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 4 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.

d)

(i) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot”- condition (in x, y and z-direction). The volume is integrated with the trapezoidal – algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.

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

(iv) The SAR value at the same location as in Step (a) is again measured to evaluate the actual power drift.

8.0 MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE Std 1528-2013 for both Handset SAR tests and System Verification uncertainty. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95% confidence level) must be less than 30%.

Table 50**: Uncertainty Budget for DASY5 Version 52 (Build 1476) – DUT SAR**

Error Description	Uncert. Value	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i	10g u_i	v_i
Measurement System								
Probe Calibration	6	N	1.00	1	1	6.00	6.00	∞
Axial Isotropy	4.7	R	1.73	0.7	0.7	1.90	1.90	∞
Hemispherical Isotropy	9.6	R	1.73	0.7	0.7	3.88	3.88	∞
Boundary Effects	1	R	1.73	1	1	0.58	0.58	∞
Linearity	4.7	R	1.73	1	1	2.71	2.71	∞
System Detection Limits	1	R	1.73	1	1	0.58	0.58	∞
Modulation response	2.4	R	1.73	1	1	1.39	1.39	∞
Readout Electronics	0.3	N	1.00	1	1	0.30	0.30	∞
Response Time	0.8	R	1.73	1	1	0.46	0.46	∞
Integration Time	2.6	R	1.73	1	1	1.50	1.50	∞
RF Ambient Noise	3	R	1.73	1	1	1.73	1.73	∞
RF Ambient Reflections	3	R	1.73	1	1	1.73	1.73	∞
Probe Positioner	0.4	R	1.73	1	1	0.23	0.23	∞
Probe Positioning	2.9	R	1.73	1	1	1.67	1.67	∞
Post Processing	2	R	1.73	1	1	1.15	1.15	∞
Test Sample Related								
Power Scaling	0	R	1.73	1	1	0.00	0.00	∞
Test Sample Positioning	2.9	N	1.00	1	1	2.90	2.90	145
Device Holder Uncertainty	3.6	N	1.00	1	1	3.60	3.60	5
Output Power Variation – SAR Drift Measurement	4.28	R	1.73	1	1	2.47	2.47	∞
Phantom and Setup								
Phantom Uncertainty	7.6	R	1.73	1	1	4.39	4.39	∞
Liquid Conductivity – Deviation from target values	5	R	1.73	0.64	0.43	1.85	1.24	∞
Liquid Permittivity – Deviation from target values	5	R	1.73	0.6	0.49	1.73	1.41	∞
Liquid Conductivity – Measurement uncertainty	2.5	N	1.00	0.64	0.71	1.60	1.78	∞
Liquid Permittivity – Measurement uncertainty	2.5	N	1.00	0.6	0.26	1.50	0.65	∞
Temp.unc. - Conductivity	3.4	R	1.73	0.78	0.71	0.77	0.70	∞
Temp. unc. - Permittivity	0.4	R	1.73	0.23	0.26	0.04	0.05	∞
Combined standard Uncertainty (u_c)						11.66	11.48	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=	2		23.32	23.32	

Estimated total measurement uncertainty for the DASY5 measurement system was ±11.66%. The expanded uncertainty (K = 2) was assessed to be ±23.32% based on 95% confidence level. The uncertainty is not added to the measurement result.

Table 51: Uncertainty Budget for DASY5 Version 52 (Build 1476) – System Verification

Error Description	Uncert. Value	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i	10g u_i	v_i
Measurement System								
Probe Calibration	6	N	1.00	1	1	6.00	6.00	∞
Axial Isotropy	4.7	R	1.73	1	1	2.71	2.71	∞
Hemispherical Isotropy	9.6	R	1.73	0	0	0.00	0.00	∞
Boundary Effects	1	R	1.73	1	1	0.58	0.58	∞
Linearity	4.7	R	1.73	1	1	2.71	2.71	∞
System Detection Limits	1	R	1.73	1	1	0.58	0.58	∞
Modulation response	0	R	1.73	1	1	0.00	0.00	∞
Readout Electronics	0.3	N	1.00	1	1	0.30	0.30	∞
Response Time	0	R	1.73	1	1	0.00	0.00	∞
Integration Time	0	R	1.73	1	1	0.00	0.00	∞
RF Ambient Noise	1	R	1.73	1	1	0.58	0.58	∞
RF Ambient Reflections	1	R	1.73	1	1	0.58	0.58	∞
Probe Positioner	0.8	R	1.73	1	1	0.46	0.46	∞
Probe Positioning	6.7	R	1.73	1	1	3.87	3.87	∞
Post Processing	2	R	1.73	1	1	1.15	1.15	∞
Dipole Related								
Deviation of exp. dipole	5.5	R	1.73	1	1	3.18	3.18	##
Dipole Axis to Liquid Dist.	2	R	1.73	1	1	1.15	1.15	##
Input power & SAR drift	3.40	R	1.73	1	1	1.96	1.96	∞
Phantom and Setup								
Phantom Uncertainty	4	R	1.73	1	1	2.31	2.31	∞
Liquid Conductivity – Deviation from target values	5	R	1.73	0.64	0.43	1.85	1.24	∞
Liquid Permittivity – Deviation from target values	5	R	1.73	0.6	0.49	1.73	1.41	∞
Liquid Conductivity – Measurement uncertainty	2.5	N	1.00	0.78	0.71	1.95	1.78	∞
Liquid Permittivity – Measurement uncertainty	2.5	N	1.00	0.26	0.26	0.65	0.65	∞
Temp.unc. - Conductivity	3.4	R	1.73	0.78	0.71	0.77	0.70	∞
Temp. unc. - Permittivity	0.4	R	1.73	0.23	0.26	0.04	0.05	∞
Combined standard Uncertainty (u_c)						10.02	9.84	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=	2		20.05	19.68	

Estimated total measurement uncertainty for the DASY5 measurement system was ±10.02%. The expanded uncertainty (K = 2) was assessed to be ±20.05% based on 95% confidence level. The uncertainty is not added to the System Verification measurement result.

9.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table 52: **SPEAG DASY5 Version 52 (Build 1476)**

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX90BL	N/A	Not applicable	✓
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	✓
SAM Phantom	SPEAG	N/A	1260	Not applicable	✓
SAM Phantom	SPEAG	N/A	1060	Not applicable	
Flat Phantom	AndreT	10.1	P 10.1	Not Applicable	
Flat Phantom	AndreT	9.1	P 9.1	Not Applicable	
Flat Phantom	SPEAG	ELI 4.0	1101	Not Applicable	✓
Data Acquisition Electronics	SPEAG	DAE3 V1	359	12-May-2021	
Data Acquisition Electronics	SPEAG	DAE3 V1	442	06-Dec-2020	✓
Probe E-Field	SPEAG	ET3DV6	1380	09-Dec-2020	✓
Probe E-Field	SPEAG	ET3DV6	1377	12-May-2021	
Probe E-Field	SPEAG	EX3DV4	3956	15-May-2021	
Probe E-Field	SPEAG	EX3DV4	7358	10-Dec-2020	
Validation Source 6 MHz	SPEAG	CLA6	1010	07-Aug-2024	
Validation Source 13 MHz	SPEAG	CLA13	1010	11-Aug-2024	
Validation Source 30 MHz	SPEAG	CLA30	1007	06-June-2021	
Validation Source 64 MHz	SPEAG	CLA64	2007	06-June-2021	
Validation Source 150 MHz	SPEAG	CLA150	4003	06-Dec-2022	
Antenna Dipole 300 MHz	SPEAG	D300V3	1012	07-Dec-2021	
Antenna Dipole 450 MHz	SPEAG	D450V3	1074	07-Dec-2021	
Antenna Dipole 600 MHz	SPEAG	D600V3	1008	06-Dec-2021	
Antenna Dipole 750 MHz	SPEAG	D750V2	1051	09-Dec-2022	✓
Antenna Dipole 900 MHz	SPEAG	D900V2	047	05-Dec-2020	✓
Antenna Dipole 1300 MHz	SPEAG	D1300V2	1002	11-June-2021	
Antenna Dipole 1450 MHz	SPEAG	D1450V2	1073	11-June-2021	
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	06-Dec-2020	
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	06-Dec-2020	✓
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	06-Dec-2021	✓
Antenna Dipole 2100 MHz	SPEAG	D2100V2	1054	19-June-2021	
Antenna Dipole 2300 MHz	SPEAG	D2300V2	1032	04-Dec-2021	
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	04-Dec-2021	
Antenna Dipole 2600 MHz	SPEAG	D2600V2	1044	10-Dec-2022	
Antenna Dipole 3000 MHz	SPEAG	D3000V2	1006	11-June-2021	
Antenna Dipole 3300 MHz	SPEAG	D3300V2	1002	11-June-2021	
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	08-June-2021	
Antenna Dipole 3700 MHz	SPEAG	D3700V2	1021	11-June-2021	
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	06-Dec-2022	
RF Amplifier	EIN	603L	N/A	*In test	
RF Amplifier	Mini-Circuits	ZHL-42	N/A	*In test	✓
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	*In test	
Synthesized signal generator	Hewlett Packard	86630A	3250A00328	*In test	✓
RF Power Meter	Hewlett Packard	437B	3125012786	22-Nov-2020	✓
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	10-Dec-2020	✓
RF Power Meter Dual	Hewlett Packard	435A	1733A05847	*In test	✓
RF Power Sensor	Hewlett Packard	8482A	2349A10114	*In test	✓
Network Analyser	Keysight	N9917A	MY56071412	27-Aug-2020	
Network Analyser	Keysight	N9912A	MY49101673	20-Sept-2020	✓
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	*In test	

Dual Directional Coupler	NARDA	3202B-20	75453	*In test	✓
Thermometer	Elitech	GSP-6	T-164	5-Sep-2020	
Thermometer	KLM Electronic	DTM3000	T-155	7-Nov-2020	✓
Thermometer	Jumbo Stationary	M288-TH	T-127	15-May-2021	✓
RF Cables	HUBER+SUHNER	RG-223	C-186; C-241; C-242 C-243; C-263	*In test	✓
RF Attenuator 3dB	Omni Spectra	3082-6191-03	A-282; A-283	*In test	✓
RF Attenuator 6dB	Weinschel	1B	A-284; A-285; A-286	*In test	✓
Radio Communication Test Set	Rohde & Schwarz	CMU200	101573	Not Applicable	✓
Radio Communication Test Set	Anritsu	MT8820A	6200240559	Not Applicable	
Radio Communication Test Set	Agilent	PXT E6621A	MY51100168	Not Applicable	✓
Radio Communication Test Set	Rohde & Schwarz	CMW500	123466-SJ	Not Applicable	✓

* Calibrated during the test for the relevant parameters.

10.0 TEST METHODOLOGY

Refer to the KDB inquiry for the physical configuration requirements: KDB Enquiry Tracking Number 741317.
Quoted physical configuration:
“For the surface of the device that faces the human head during normal operation (we will call that the back side of the device), 1-g SAR (limit 1.6 W/kg) should be tested at a 0 mm test separation distance from the flat phantom For the other 5 sides of the device (front, top, bottom, right left) you should test 10-g Extremity SAR (limit 4.0 W/kg) at a 0 mm test separation distance from the flat phantom. The tests should be done with the metal bracket attached as this will be the normal installation condition.”
Quoted liquid requirements:
“Use of head TSL for all tests is appropriate, per the TCB Workshop guidance”

10.1 Positions

10.1.1 “Back Side” Position Definition (0mm spacing)

The DUT was tested in the 2.00 mm flat section of the ELI4 Flat phantom for the “Back Side” position. The Transceiver was placed at the bottom of the phantom and suspended in such way that the back of the DUT was touching the phantom. This device orientation simulates the DUT’s normal use – attached to the LSR host camera with L bracket. A spacing of 0mm ensures that the SAR results are conservative and represent a worst-case position.

10.1.2 “Front, Top, Bottom, Right, Left ” Positions

The DUT was tested in the (2.00 mm) flat section of the ELI4 Flat phantom for the “Front, Top, Bottom, Right Left” positions. The respective side of the Transceiver was placed underneath the flat section of the phantom and suspended until the DUT touched the phantom. The positions represent configuration where user holds the DUT in their hand (as a handle) *Refer to Appendix A for photos of measurement positions.*

10.1.3 Antenna location

The below image shows DUT in use - LTE antenna is marked in red and the ZigBee antenna in green:

10.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)

The DUT has a fixed antenna. Depending on the measured SAR level up to three test channels with the test sample operating at maximum power were recorded. The following table represents the matrix used to determine what testing was required. All relevant provisions of KDB 447498 and KDB 941225 are applied for SAR measurements of the host system. SAR measurement for the HSDPA and HSUPA modes were not conducted because SAR results in WWAN bands are lower than 1.2 W/kg (75% of the SAR limit) therefore only UMTS configuration (worst case RF power) was measured.

Table: Testing configurations

Table 53

Phantom Configuration	Device Mode WWAN Band Name	Test Configurations		
		Channel (Low)	Channel (Middle)	Channel (High)
Back, Front, Top, Bottom, Right Left 3G Bands:	Band 2 (1900 MHz)	X		
	Band 4 (1700 MHz)	X		
	Band 5 (850 MHz)			X
Back, Front, Top, Bottom, Right Left LTE Bands:	Band 2 (1900 MHz)		X	
	Band 4 (1700 MHz)	X		
	Band 5 (850 MHz)		X	
	Band 12 (700 MHz)			X
	Band 13 (700 MHz)		X	
	Band 14 (700 MHz)		X	
	Band 17 (700 MHz)		X	
	Band 66 (1700 MHz)		X	

Legend

X	Testing Required in this configuration
	Testing required in this configuration only if SAR of highest channel is more than 3dB below the SAR limit.
X	Additional SAR measurement for the HSDPA and HSUPA modes

11.0 SAR MEASUREMENT RESULTS

The SAR values averaged over 1g and 10g tissue masses were determined for the sample DUT for all test configurations listed in section 10.2. Please note: the dielectric parameters of the human tissue simulating liquids are listed in the results tables along with the target values. Variability check was not required because no SAR levels exceeded the 3dB below the limit threshold.

11.1 SAR Results

Table: SAR MEASUREMENT RESULTS – 1900MHz UMTS (Band 2)

Table 54

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 40.0 ±5% 38.0 to 42.0	σ target 1.40 ±5% 1.33 to 1.47	Tune –Up SAR (W/kg)
Back 0mm Spacing 02-09-20	-	WCDMA - UMTS	9262	1852	0.293	0	40.0	1.40	0.321
Back 0mm Spacing 02-09-20	-	WCDMA - UMTS	9400	1880	0.282	-0.01	39.9	1.42	0.350
Back 0mm Spacing 02-09-20	1.	WCDMA - UMTS	9538	1908	0.497	0.09	39.9	1.43	**0.645**

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 55

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 40.0 ±5% 38.0 to 42.0	σ target 1.40 ±5% 1.33 to 1.47	Tune –Up SAR (W/kg)
Front 0mm Spacing 02-09-20	-	WCDMA - UMTS	9262	1852	1.09	0.07	40.0	1.40	1.341
Bottom 0mm Spacing 02-09-20	-	WCDMA - UMTS	9262	1852	0.154	-0.18	40.0	1.40	0.189
Top 0mm Spacing 02-09-20	-	WCDMA - UMTS	9262	1852	0.458	0.19	40.0	1.40	0.563
Left 0mm Spacing 02-09-20	-	WCDMA - UMTS	9262	1852	1.46	-0.17	40.0	1.40	1.796
Left 0mm Spacing 02-09-20	-	WCDMA - UMTS	9400	1880	1.3	0.07	39.9	1.42	1.811
Left 0mm Spacing 02-09-20	2.	WCDMA - UMTS	9538	1908	1.37	-0.07	39.9	1.43	**1.994**
Right 0mm Spacing 02-09-20	-	WCDMA - UMTS	9262	1852	0.116	0.05	40.0	1.40	0.143
Front 0mm Spacing 02-09-20	-	WCDMA - UMTS	9262	1852	1.09	0.07	40.0	1.40	1.341
Bottom 0mm Spacing 02-09-20	-	WCDMA - UMTS	9262	1852	0.154	-0.18	40.0	1.40	0.189
Top 0mm Spacing 02-09-20	-	WCDMA - UMTS	9262	1852	0.458	0.19	40.0	1.40	0.563
System Check 02-09-20	3.	CW	1	1950	10.5	0.05	39.8	1.46	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 1700MHz UMTS (Band 4)

Table 56

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 40.1 ±5% 38.1 to 42.1	σ target 1.37 ±5% 1.30 to 1.44	Tune – Up SAR (W/kg)
Back 0mm Spacing 31-08-20	4.	WCDMA - UMTS	1312	1712	0.688	-0.08	38.7	1.33	**0.786**
Back 0mm Spacing 31-08-20	-	WCDMA - UMTS	1427	1735	0.571	-0.03	38.7	1.34	0.707
Back 0mm Spacing 31-08-20	-	WCDMA - UMTS	1513	1753	0.472	0.05	38.6	1.35	0.581

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 57

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 40.1 ±5% 38.1 to 42.1	σ target 1.37 ±5% 1.30 to 1.44	Tune – Up SAR (W/kg)
Front 0mm Spacing 31-08-20	-	WCDMA - UMTS	1312	1712	0.824	0.05	38.7	1.33	0.865
Bottom 0mm Spacing 31-08-20	-	WCDMA - UMTS	1312	1712	0.151	-0.13	38.7	1.33	0.137
Top 0mm Spacing 31-08-20	-	WCDMA - UMTS	1312	1712	0.477	0	38.7	1.33	0.433
Left 0mm Spacing 31-08-20	-	WCDMA - UMTS	1312	1712	1.14	-0.1	38.7	1.33	1.035
Left 0mm Spacing 31-08-20	5.	WCDMA - UMTS	1427	1735	0.987	-0.11	38.7	1.34	**1.223**
Left 0mm Spacing 31-08-20	-	WCDMA - UMTS	1513	1753	0.978	-0.02	38.6	1.35	1.203
Right 0mm Spacing 31-08-20	-	WCDMA - UMTS	1312	1712	0.271	-0.07	38.7	1.33	0.310
System Check 31-08-20	6.	CW	1	1800	9.29	0.03	38.4	1.39	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 850MHz UMTS (Band 5)

Table 58

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 41.5 ±5% 39.4 to 43.6	σ target 0.90 ±5% 0.86 to 0.95	Tune – Up SAR (W/kg)
Back 0mm Spacing 18-08-20	-	WCDMA - UMTS	4132	826.4	0.248	0.02	40.8	0.88	0.322
Back 0mm Spacing 18-08-20	7.	WCDMA - UMTS	4183	836.6	0.26	0.02	40.6	0.88	**0.326**
Back 0mm Spacing 18-08-20	-	WCDMA - UMTS	4233	846.6	0.243	0.02	40.5	0.89	0.302

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 59

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 41.5 ±5% 39.4 to 43.6	σ target 0.90 ±5% 0.86 to 0.95	Tune – Up SAR (W/kg)
Front 0mm Spacing 18-08-20	-	WCDMA - UMTS	4233	846.6	0.586	-0.1	40.5	0.89	0.729
Bottom 0mm Spacing 18-08-20	-	WCDMA - UMTS	4233	846.6	0.0428	0.02	40.5	0.89	0.053
Top 0mm Spacing 18-08-20	-	WCDMA - UMTS	4233	846.6	0.374	-0.08	40.5	0.89	0.465
Left 0mm Spacing 18-08-20	-	WCDMA - UMTS	4132	826.4	0.859	0	40.8	0.88	1.114
Left 0mm Spacing 18-08-20	8.	WCDMA - UMTS	4183	836.6	0.914	0.03	40.6	0.88	**1.145**
Left 0mm Spacing 18-08-20	-	WCDMA - UMTS	4233	846.6	0.892	-0.06	40.5	0.89	1.110
Right 0mm Spacing 18-08-20	-	WCDMA - UMTS	4233	846.6	0.124	0.09	40.5	0.89	0.154
System Check 18-08-20	9.	CW	1	900	2.68	0.06	39.8	0.95	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 1900MHz LTE (Band 2)

Table 60

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 40.0 ±5% 38.0 to 42.0	σ target 1.40 ±5% 1.33 to 1.47	Tune –Up SAR (W/kg)
Back 0mm Spacing 1 RB 01-09-20	-	LTE FDD 20MHz QPSK (1RB Mid)	18900	1880	0.215	-0.1	39.3	1.40	0.263
Back 0mm Spacing 50 RB 01-09-20	-	LTE FDD 20MHz QPSK (50RB Mid)	18700	1860	0.169	0.11	39.3	1.39	0.266
Back 0mm Spacing 50 RB 01-09-20	-	LTE FDD 20MHz QPSK (50RB High)	18900	1880	0.192	0.03	39.3	1.40	0.302
Back 0mm Spacing 50 RB 01-09-20	10.	LTE FDD 20MHz QPSK (50RB High)	19100	1900	0.262	0.01	39.2	1.42	**0.413**

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 61

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 40.0 ±5% 38.0 to 42.0	σ target 1.40 ±5% 1.33 to 1.47	Tune –Up SAR (W/kg)
Front 0mm Spacing 1 RB 01-09-20	-	LTE FDD 20MHz QPSK (1RB Mid)	18900	1880	1.08	-0.08	39.3	1.40	1.320
Font 0mm Spacing 50 RB 01-09-20	-	LTE FDD 20MHz QPSK (50RB High)	18900	1880	0.85	-0.09	39.3	1.40	1.335
Bottom 0mm Spacing 1 RB 11-08-20	-	LTE FDD 20MHz QPSK (1RB Mid)	18900	1880	0.087	-0.06	39.3	1.40	0.106
Bottom 0mm Spacing 50 RB 01-09-20	-	LTE FDD 20MHz QPSK (50RB High)	18900	1880	0.065	-0.19	39.3	1.40	0.102
Top 0mm Spacing 1 RB 01-09-20	-	LTE FDD 20MHz QPSK (1RB Mid)	18900	1880	0.504	-0.07	39.3	1.40	0.616
Top 0mm Spacing 5 0 RB 01-09-20	-	LTE FDD 20MHz QPSK (50RB High)	18900	1880	0.424	-0.02	39.3	1.40	0.666
Left 0mm Spacing 1 RB 01-09-20	-	LTE FDD 20MHz QPSK (1RB Mid)	18900	1880	1.29	-0.12	39.3	1.40	1.576
Left 0mm Spacing 50 RB 01-09-20	-	LTE FDD 20MHz QPSK (50RB Mid)	18700	1860	0.977	-0.02	39.3	1.39	1.538
Left 0mm Spacing 50 RB 01-09-20	-	LTE FDD 20MHz QPSK (50RB High)	18900	1880	1.04	-0.06	39.3	1.40	1.633
Left 0mm Spacing 50 RB 01-09-20	11.	LTE FDD 20MHz QPSK (50RB High)	19100	1900	1.15	0.02	39.2	1.42	**1.814**
Right 0mm Spacing 1 RB 01-09-20	-	LTE FDD 20MHz QPSK (1RB Mid)	18900	1880	0.097	0.14	39.3	1.40	0.119
Right 0mm Spacing 50 RB 01-09-20	-	LTE FDD 20MHz QPSK (50RB High)	18900	1880	0.073	0.11	39.3	1.40	0.114
System Check 01-09-20	12.	CW	1	1950	10.5	-0.02	39.1	1.45	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 1700MHz LTE (Band 4)

Table 62

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 40.1 ±5% 38.1 to 42.1	σ target 1.37 ±5% 1.30 to 1.44	Tune – Up SAR (W/kg)
Back 0mm Spacing 1 RB 27-08-20	13.	LTE FDD 20MHz QPSK (1RB Low)	20050	1720	0.54	0.09	39.2	1.33	**0.666**
Back 0mm Spacing 1 RB 27-08-20	-	LTE FDD 20MHz QPSK (1RB Mid)	20175	1733	0.439	0.12	39.1	1.34	0.569
Back 0mm Spacing 1 RB 27-08-20	-	LTE FDD 20MHz QPSK (1RB High)	20300	1745	0.371	0.15	39.1	1.35	0.481
Back 0mm Spacing 50 RB 27-08-20	-	LTE FDD 20MHz QPSK (50RB High)	20175	1733	0.321	-0.04	39.1	1.34	0.475

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 63

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 40.1 ±5% 38.1 to 42.1	σ target 1.37 ±5% 1.30 to 1.44	Tune – Up SAR (W/kg)
Front 0mm Spacing 1 RB 27-08-20	-	LTE FDD 20MHz QPSK (1RB Low)	20050	1720	0.631	-0.09	39.2	1.33	0.778
Font 0mm Spacing 50 RB 27-08-20	-	LTE FDD 20MHz QPSK (50RB High)	20175	1733	0.516	-0.03	39.1	1.34	0.763
Bottom 0mm Spacing 1 RB 27-08-20	-	LTE FDD 20MHz QPSK (1RB Low)	20050	1720	0.186	0.02	39.2	1.33	0.229
Bottom 0mm Spacing 50 RB 27-08-20	-	LTE FDD 20MHz QPSK (50RB High)	20175	1733	0.0893	-0.13	39.1	1.34	0.132
Top 0mm Spacing 1 RB 27-08-20	-	LTE FDD 20MHz QPSK (1RB Low)	20050	1720	0.348	-0.17	39.2	1.33	0.429
Top 0mm Spacing 50 RB 27-08-20	-	LTE FDD 20MHz QPSK (50RB High)	20175	1733	0.196	-0.05	39.1	1.34	0.290
Left 0mm Spacing 1 RB 27-08-20	-	LTE FDD 20MHz QPSK (1RB Low)	20050	1720	0.818	0.13	39.2	1.33	1.009
Left 0mm Spacing 1 RB 27-08-20	14.	LTE FDD 20MHz QPSK (1RB Mid)	20175	1733	0.803	0.03	39.1	1.34	**1.042**
Left 0mm Spacing 1 RB 27-08-20	-	LTE FDD 20MHz QPSK (1RB High)	20300	1745	0.859	-0.13	39.1	1.35	0.931
Left 0mm Spacing 50 RB 27-08-20	-	LTE FDD 20MHz QPSK (50RB Low)	20175	1733	0.652	-0.08	39.1	1.34	0.964
Right 0mm Spacing 1 RB 27-08-20	-	LTE FDD 20MHz QPSK (1RB Low)	20050	1720	0.0684	0.12	39.2	1.33	0.084
Right 0mm Spacing 50 RB 27-08-20	-	LTE FDD 20MHz QPSK (50RB High)	20175	1733	0.0538	0.02	39.1	1.34	0.080
System Check 27-08-20	15.	CW	1	1800	9.54	0	38.9	1.38	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 850MHz LTE (Band 5)

Table 64

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 41.5 ±5% 39.4 to 43.6	σ target 0.90 ±5% 0.86 to 0.95	Tune – Up SAR (W/kg)
Back 0mm Spacing 1 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	20450	829	0.183	0	40.9	0.88	0.225
Back 0mm Spacing 1 RB 17-08-20	16.	LTE FDD 10MHz QPSK (1RB Mid)	20525	836.5	0.235	-0.09	40.8	0.89	**0.276**
Back 0mm Spacing 1 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Low)	20600	844	0.184	0.02	40.8	0.89	0.224
Back 0mm Spacing 25 RB 17-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	20525	836.5	0.184	-0.02	40.8	0.89	0.271

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 65

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 41.5 ±5% 39.4 to 43.6	σ target 0.90 ±5% 0.86 to 0.95	Tune – Up SAR (W/kg)
Front 0mm Spacing 1 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	20525	836.5	0.48	-0.14	40.8	0.89	0.564
Font 0mm Spacing 25 RB 17-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	20525	836.5	0.387	-0.06	40.8	0.89	0.570
Bottom 0mm Spacing 1 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	20525	836.5	0.034	-0.04	40.8	0.89	0.040
Bottom 0mm Spacing 25 RB 17-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	20525	836.5	0.027	0.07	40.8	0.89	0.039
Top 0mm Spacing 1 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	20525	836.5	0.439	-0.04	40.8	0.89	0.516
Top 0mm Spacing 25 RB 17-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	20525	836.5	0.347	-0.16	40.8	0.89	0.511
Left 0mm Spacing 1 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	20450	829	0.586	0.17	40.9	0.88	0.721
Left 0mm Spacing 1 RB 17-08-20	17.	LTE FDD 10MHz QPSK (1RB Mid)	20525	836.5	0.723	0.06	40.8	0.89	**0.849**
Left 0mm Spacing 1 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Low)	20600	844	0.587	0.01	40.8	0.89	0.717
Left 0mm Spacing 25 RB 17-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	20525	836.5	0.564	-0.1	40.8	0.89	0.830
Right 0mm Spacing 1 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	20525	836.5	0.108	0.01	40.8	0.89	0.127
Right 0mm Spacing 25 RB 17-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	20525	836.5	0.0883	-0.1	40.8	0.89	0.130
System Check 17-08-20	18.	CW	1	900	2.64	0	40.1	0.94	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 700MHz LTE (Band 12)

Table 66

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 41.9 ±5% 39.8 to 44.0	σ target 0.89 ±5% 0.85 to 0.93	Tune – Up SAR (W/kg)
Back 0mm Spacing 1 RB 11-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23060	704	0.058	0.05	41	0.88	0.066
Back 0mm Spacing 1 RB 11-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23095	707.5	0.064	0.01	40	0.89	0.067
Back 0mm Spacing 1 RB 11-08-20	19.	LTE FDD 10MHz QPSK (1RB Mid)	23130	711	0.088	0.17	40	0.89	**0.092**
Back 0mm Spacing 25 RB 11-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23130	711	0.067	-0.11	40	0.89	0.085

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 67

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 41.9 ±5% 39.8 to 44.0	σ target 0.89 ±5% 0.85 to 0.93	Tune – Up SAR (W/kg)
Front 0mm Spacing 1 RB 11-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23130	711	0.218	-0.06	40.4	0.89	0.228
Font 0mm Spacing 25 RB 11-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23130	711	0.171	0.02	40.4	0.89	0.219
Bottom 0mm Spacing 1 RB 11-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23130	711	0.027	0.06	40.4	0.89	0.028
Bottom 0mm Spacing 25 RB 11-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23130	711	0.022	-0.07	40.4	0.89	0.029
Top 0mm Spacing 1 RB 11-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23130	711	0.171	0.05	40.4	0.89	0.179
Top 0mm Spacing 25 RB 11-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23130	711	0.137	0.04	40.4	0.89	0.176
Left 0mm Spacing 1 RB 11-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23130	711	0.241	-0.02	40.4	0.89	0.252
Left 0mm Spacing 25 RB 11-08-20	-	LTE FDD 10MHz QPSK (25RB High)	23060	704	0.177	-0.03	40.5	0.88	0.237
Left 0mm Spacing 25 RB 11-08-20	-	LTE FDD 10MHz QPSK (25RB High)	23095	707.5	0.189	0.03	40.4	0.89	0.252
Left 0mm Spacing 25 RB 11-08-20	20.	LTE FDD 10MHz QPSK (25RB Mid)	23130	711	0.198	0.06	40.4	0.89	**0.254**
Right 0mm Spacing 1 RB 11-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23130	711	0.062	0.04	40.4	0.89	0.065
Right 0mm Spacing 25 RB 11-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23130	711	0.050	0.03	40.4	0.89	0.064
System Check 11-08-20	21.	CW	1	750	2.28	-0.05	40	0.93	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 700MHz LTE (Band 13)

Table 68

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 41.9 ±5% 39.8 to 44.0	σ target 0.89 ±5% 0.85 to 0.93	Tune – Up SAR (W/kg)
Back 0mm Spacing 1 RB 12-08-20	-	LTE FDD 10MHz QPSK (1RB Low)	23230	782	0.158	0.02	40.1	0.90	0.167
Back 0mm Spacing 25 RB 12-08-20	-	LTE FDD 5MHz QPSK (25RB Mid)	23205	779.5	0.143	-0.06	40.2	0.90	0.208
Back 0mm Spacing 25 RB 12-08-20	-	LTE FDD 10MHz QPSK (25RB Low)	23230	782	0.128	0.01	40.1	0.90	0.178
Back 0mm Spacing 25 RB 12-08-20	22.	LTE FDD 5MHz QPSK (25RB Mid)	23255	784.5	0.149	0.06	40.1	0.89	**0.229**

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 69

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 41.9 ±5% 39.8 to 44.0	σ target 0.89 ±5% 0.85 to 0.93	Tune – Up SAR (W/kg)
Front 0mm Spacing 1 RB 12-08-20	-	LTE FDD 10MHz QPSK (1RB Low)	23230	782	0.34	-0.05	40.1	0.90	0.359
Font 0mm Spacing 25 RB 12-08-20	-	LTE FDD 10MHz QPSK (25RB Low)	23230	782	0.276	-0.06	40.1	0.90	0.384
Bottom 0mm Spacing 1 RB 12-08-20	-	LTE FDD 10MHz QPSK (1RB Low)	23230	782	0.0409	-0.07	40.1	0.90	0.043
Bottom 0mm Spacing 25 RB 12-08-20	-	LTE FDD 10MHz QPSK (25RB Low)	23230	782	0.0326	0.01	40.1	0.90	0.045
Top 0mm Spacing 1 RB 12-08-20	-	LTE FDD 10MHz QPSK (1RB Low)	23230	782	0.301	-0.05	40.1	0.90	0.318
Top 0mm Spacing 25 RB 12-08-20	-	LTE FDD 10MHz QPSK (25RB Low)	23230	782	0.244	-0.05	40.1	0.90	0.339
Left 0mm Spacing 1 RB 12-08-20	-	LTE FDD 10MHz QPSK (1RB Low)	23230	782	0.462	0.02	40.1	0.90	0.488
Left 0mm Spacing 25 RB 12-08-20	-	LTE FDD 5MHz QPSK (25RB Mid)	23205	779.5	0.341	0.07	40.2	0.90	0.495
Left 0mm Spacing 25 RB 12-08-20	-	LTE FDD 10MHz QPSK (25RB Low)	23230	782	0.37	0.01	40.1	0.90	0.514
Left 0mm Spacing 25 RB 12-08-20	23.	LTE FDD 5MHz QPSK (25RB Mid)	23255	784.5	0.393	0	40.1	0.89	**0.604**
Right 0mm Spacing 1 RB 12-08-20	-	LTE FDD 10MHz QPSK (1RB Low)	23230	782	0.0809	0.06	40.1	0.90	0.085
Right 0mm Spacing 25 RB 12-08-20	-	LTE FDD 10MHz QPSK (25RB Low)	23230	782	0.0329	0.05	40.1	0.90	0.046
System Check 12-08-20	24.	CW	1	750	2.12	0.11	40.0	0.90	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 700MHz LTE (Band 14)

Table 70

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 41.9 ±5% 39.8 to 44.0	σ target 0.89 ±5% 0.85 to 0.93	Tune – Up SAR (W/kg)
Back 0mm Spacing 1 RB 13-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23330	793	0.198	0	40.1	0.90	0.216
Back 0mm Spacing 25 RB 13-08-20	25.	LTE FDD 5MHz QPSK (25RB Mid)	23305	790.5	0.157	0	40.1	0.90	**0.226**
Back 0mm Spacing 25 RB 13-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23330	793	0.162	0.01	40.1	0.90	0.224
Back 0mm Spacing 25 RB 13-08-20	-	LTE FDD 5MHz QPSK (25RB Mid)	23355	795.5	0.154	0.01	40.0	0.90	0.214

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 71

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 41.9 ±5% 39.8 to 44.0	σ target 0.89 ±5% 0.85 to 0.93	Tune – Up SAR (W/kg)
Front 0mm Spacing 1 RB 13-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23330	793	0.438	-0.01	40.1	0.90	0.477
Font 0mm Spacing 25 RB 13-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23330	793	0.377	-0.05	40.1	0.90	0.454
Bottom 0mm Spacing 1 RB 13-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23330	793	0.049	-0.04	40.1	0.90	0.053
Bottom 0mm Spacing 25 RB 13-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23330	793	0.038	0.06	40.1	0.90	0.046
Top 0mm Spacing 1 RB 13-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23330	793	0.36	-0.07	40.1	0.90	0.392
Top 0mm Spacing 25 RB 13-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23330	793	0.283	-0.11	40.1	0.90	0.341
Left 0mm Spacing 1 RB 13-08-20	-	LTE FDD 5MHz QPSK (1RB Mid)	23305	790.5	0.555	-0.06	40.1	0.90	0.597
Left 0mm Spacing 1 RB 13-08-20	26.	LTE FDD 10MHz QPSK (1RB Mid)	23330	793	0.677	-0.03	40.1	0.90	**0.737**
Left 0mm Spacing 1 RB 13-08-20	-	LTE FDD 5MHz QPSK (1RB Mid)	23355	795.5	0.502	-0.02	40.0	0.90	0.537
Left 0mm Spacing 25 RB 13-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23330	793	0.531	-0.04	40.1	0.90	0.640
Right 0mm Spacing 1 RB 13-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23330	793	0.093	-0.02	40.1	0.90	0.128
Right 0mm Spacing 25 RB 13-08-20	-	LTE FDD 10MHz QPSK (25RB Mid)	23330	793	0.111	-0.1	40.1	0.90	0.134
System Check 13-08-20	27.	CW	1	750	2.16	0.03	40.3	0.88	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 700MHz LTE (Band 17)

Table 72

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 41.9 ±5% 39.8 to 44.0	σ target 0.89 ±5% 0.85 to 0.93	Tune – Up SAR (W/kg)
Back 0mm Spacing 1 RB 11-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23790	710	0.081	-0.03	40.6	0.89	0.084
Back 0mm Spacing 25 RB 14-08-20	28.	LTE FDD 10MHz QPSK (25RB High)	23780	709	0.075	-0.01	40.6	0.89	**0.098**
Back 0mm Spacing 25 RB 14-08-20 2	-	LTE FDD 10MHz QPSK (25RB High)	23780	709	0.066	-0.05	40.6	0.89	0.077
Back 0mm Spacing 25 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Low)	23800	711	0.064	0.06	40.3	0.88	0.078

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 73

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 41.9 ±5% 39.8 to 44.0	σ target 0.89 ±5% 0.85 to 0.93	Tune – Up SAR (W/kg)
Front 0mm Spacing 1 RB 14-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23790	710	0.226	-0.02	40.6	0.89	0.236
Font 0mm Spacing 25 RB 14-08-20	-	LTE FDD 10MHz QPSK (25RB High)	23780	709	0.154	-0.17	40.6	0.89	0.201
Bottom 0mm Spacing 1 RB 14-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23790	710	0.028	0	40.6	0.89	0.030
Bottom 0mm Spacing 25 RB 14-08-20	-	LTE FDD 10MHz QPSK (25RB High)	23780	709	0.023	-0.02	40.6	0.89	0.030
Top 0mm Spacing 1 RB 14-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23790	710	0.187	-0.11	40.6	0.89	0.195
Top 0mm Spacing 25 RB 14-08-20	-	LTE FDD 10MHz QPSK (25RB High)	23780	709	0.158	-0.12	40.6	0.89	0.206
Left 0mm Spacing 1 RB 17-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23780	709	0.233	-0.15	40.4	0.88	0.246
Left 0mm Spacing 1 RB 14-08-20	29.	LTE FDD 10MHz QPSK (1RB Mid)	23790	710	0.259	0.03	40.6	0.89	**0.271**
Left 0mm Spacing 1 RB 17-08-20 2	-	LTE FDD 10MHz QPSK (1RB Mid)	23800	711	0.242	0.07	40.3	0.88	0.253
Left 0mm Spacing 25 RB 14-08-20	-	LTE FDD 10MHz QPSK (25RB High)	23780	709	0.203	-0.15	40.6	0.89	0.265
Right 0mm Spacing 1 RB 14-08-20	-	LTE FDD 10MHz QPSK (1RB Mid)	23790	710	0.040	-0.01	40.6	0.89	0.042
Right 0mm Spacing 25 RB 14-08-20	-	LTE FDD 10MHz QPSK (25RB High)	23780	709	0.034	0.1	40.6	0.89	0.044
System Check 14-08-20	30.	CW	1	750	2.23	0.12	40.0	0.92	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 1700MHz LTE (Band 66)

Table 74

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) W/kg	Drift (dB)	∈r target 40.1 ±5% 38.1 to 42.1	σ target 1.37 ±5% 1.30 to 1.44	Tune – Up SAR (W/kg)
Back 0mm Spacing 1 RB 26-08-20	-	LTE FDD 20MHz QPSK (1RB High)	132322	1745	0.369	0.06	39.01	1.315	0.386
Back 0mm Spacing 50 RB 26-08-20	31.	LTE FDD 20MHz QPSK (50RB Low)	132072	1720	0.328	0.02	39.12	1.314	**0.519**
Back 0mm Spacing 50 RB 26-08-20	-	LTE FDD 20MHz QPSK (50RB High)	132322	1745	0.306	0	39.01	1.315	0.442
Back 0mm Spacing 50 RB 26-08-20	-	LTE FDD 20MHz QPSK (50RB Low)	132572	1770	0.287	-0.03	38.83	1.328	0.445

NOTE: The measurement uncertainty of 23.32% was not added to the result.

Table 75

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) W/kg	Drift (dB)	∈r target 40.1 ±5% 38.1 to 42.1	σ target 1.37 ±5% 1.30 to 1.44	Tune – Up SAR (W/kg)
Front 0mm Spacing 1 RB 26-08-20	-	LTE FDD 20MHz QPSK (1RB High)	132322	1745	0.615	-0.09	39.01	1.315	0.643
Font 0mm Spacing 50 RB 26-08-20	-	LTE FDD 20MHz QPSK (50RB High)	132322	1745	0.486	-0.05	39.01	1.315	0.702
Bottom 0mm Spacing 1 RB 26-08-20	-	LTE FDD 20MHz QPSK (1RB High)	132322	1745	0.0988	0.01	39.01	1.315	0.103
Bottom 0mm Spacing 50 RB 26-08-20	-	LTE FDD 20MHz QPSK (50RB High)	132322	1745	0.0839	0.01	39.01	1.315	0.121
Top 0mm Spacing 1 RB 26-08-20	-	LTE FDD 20MHz QPSK (1RB High)	132322	1745	0.236	-0.03	39.01	1.315	0.247
Top 0mm Spacing 50 RB 26-08-20	-	LTE FDD 20MHz QPSK (50RB High)	132322	1745	0.194	-0.01	39.01	1.315	0.280
Left 0mm Spacing 1 RB 26-08-20	-	LTE FDD 20MHz QPSK (1RB Low)	132072	1720	0.723	0.03	39.12	1.314	0.813
Left 0mm Spacing 1 RB 26-08-20	32.	LTE FDD 20MHz QPSK (1RB High)	132322	1745	0.905	-0.09	39.01	1.315	**0.945**
Left 0mm Spacing 1 RB 26-08-20	-	LTE FDD 20MHz QPSK (1RB Mid)	132572	1770	0.654	-0.16	38.83	1.328	0.754
Left 0mm Spacing 50 RB 26-08-20	-	LTE FDD 20MHz QPSK (50RB High)	132322	1745	0.578	-0.2	39.01	1.315	0.835
Right 0mm Spacing 1 RB 26-08-20	-	LTE FDD 20MHz QPSK (1RB High)	132322	1745	0.243	-0.06	39.01	1.315	0.254
Right 0mm Spacing 50 RB 26-08-20	-	LTE FDD 20MHz QPSK (50RB High)	132322	1745	0.196	0.04	39.01	1.315	0.283
System Check 26-08-20	33.	CW	1	1800	9.29	-0.09	38.74	1.363	-

NOTE: The measurement uncertainty of 23.32% was not added to the result.

12.0 COMPLIANCE STATEMENT

The Mentis Technologies Walker Portable Transmitter, Model: W510 with SIERRA WIRELESS Wireless WAN Module, Model: WP7610 was found to comply with the FCC SAR requirements.

The highest SAR level measured was 1.37 W/kg for a 10g cube. The manufacturer's tune up power is stated to be 23.5 dBm. Scaling the SAR value, the maximum SAR value is **1.994 W/kg.** This value was measured at 1908 MHz (channel 9538) in the "Left Side" position in UMTS transmission mode. This was below the limit of 4.0 W/kg for uncontrolled exposure for extremities, even taking into account the measurement uncertainty of 23.32 %.

The SAR test Variability check was not required because the highest measured SAR was less than 2.0 W/kg.

The highest SAR level measured was for head configuration was 0.688 W/kg for a 1g cube. The manufacturer's tune up power is stated to be 23.5 dBm. Scaling the SAR value, the maximum SAR value is **0.786 W/kg.** This value was measured at 1712 MHz (channel 1312) in the "Back Side" position in UMTS transmission mode. This was below the limit of 1.6 W/kg for uncontrolled exposure, even taking into account the measurement uncertainty of 23.32 %.

The SAR test Variability check was not required because the highest measured SAR was less than 0.8 W/kg.

13.0 MULTIBAND EVALUATION CONSIDERATIONS & EXEMPTIONS

According to the FCC SAR evaluation procedures mentioned in KDB 447498 D01 General RF Exposure Guidance v06 Appendix A, stand-alone SAR evaluation is NOT required for the ZigBee transmitter. The threshold from Exclusion Power Thresholds table for 900 MHz at the distance of 5mm or less is 16mW. The ZigBee Transmitter tune-up power is 13 dBm (20mW) peak, the RF Duty Cycle is 0.39%. The average power is 0.078 mW. The closest distance from the user is 3mm.

Multiband evaluation was not required for WWAN and ZigBee because the sum of highest SAR results of WWAN and estimated SAR of ZiBee was below the SAR limit.

Estimated SAR for the ZigBee transmitter was calculated according to the below formula from the KDB 447498 D01:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)]·[$\sqrt{f_{(GHz)}}/x$] W/kg, for *test separation distances* ≤ 50 mm;
where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR.

The estimated worst-case ZigBee SAR 1g = {(0.078mW)/(3mm)} x {0.95/7.5} = 0.026 x 0.127 = 0.00033 mW/g
The estimated worst-case ZigBee SAR 10g = {(0.078mW)/(3mm)} x {0.95/18.75} = 0.026 x 0.127 = 0.00064 mW/g

Worst-case reported WWAN 1g SAR 0.786mW/g + worst-case ZigBee estimated 1g SAR 0.00033mW/g = 0.78633 mW/g < 1.6 mW/g
Worst-case reported WWAN 10g SAR 1.994mW/g + worst-case ZigBee estimated 1g SAR 0.00064mW/g = 1.99464 mW/g < 4.0 mW/g

APPENDIX A PHOTOGRAPHS

Test sample photographs – External, Internal and Setup are provided as separate exhibits:

M2006031-5 APPENDIX A1 Test Sample Photographs_External

M2006031-5 APPENDIX A2 Test Sample Photographs_Internal

M2006031-5 APPENDIX A3 Test Sample Photographs_Test Setup

APPENDIX B DESCRIPTION OF SAR MEASUREMENT SYSTEM

Probe Positioning System

The measurements were performed with the state of the art automated near-field scanning system **DASY5 Version 52 (Build 1476)** from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision 6-axis robot (working range greater than 1.1m), which positions the SAR measurement probes with a positional repeatability of better than ±0.02 mm. The DASY5 fully complies with the IEEE 1528 and EN62209 SAR measurement requirements.

E-Field Probe Type and Performance

The SAR measurements were conducted with the dosimetric probe ET3DV6 was used (manufactured by SPEAG). The SAR probes are designed in the classical triangular configuration and optimised for dosimetric evaluation. The probe has been calibrated and found to be accurate to better than ±0.25 dB. The probe is suitable for measurements close to material discontinuity at the surface of the phantom.

Data Acquisition Electronics

The data acquisition electronics (DAE3) 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. The input impedance of the DAE3 box is 200 MΩ; the inputs are symmetrical and floating. Common mode rejection is above 80dB.Transmission to the PC-card is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The mechanical probe-mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

Device Holder for DASY5

The DASY5 device holder supplied by SPEAG is designed to cope with different positions given in the standard. The DASY5 device holder is made of low-loss material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device.

Refer to Appendix A for photograph of device positioning.

Liquid Depth 15cm

During the SAR measurement process the liquid level was maintained to a level of 15cm with a tolerance of 0.5cm.

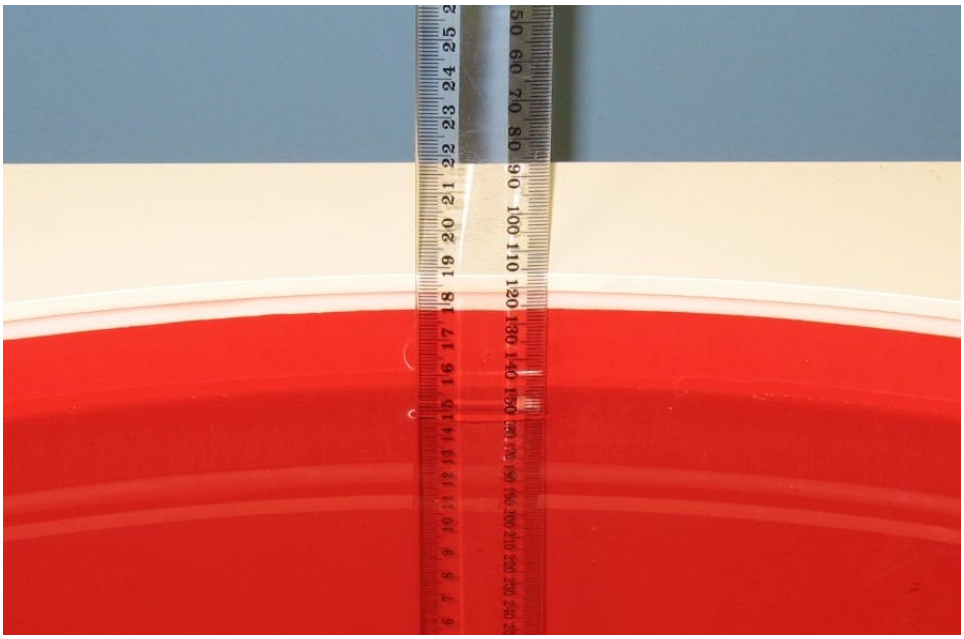

Photo of liquid Depth in Flat Phantom

Phantom Properties

The phantom used during the testing complies with the IEEE 1528 and EN62209-1 and EN62209-2 SAR measurement requirements.

Table 76 Phantom Properties

Phantom Properties	
Depth of Phantom	19 cm
Width of flat section	40 cm
Length of flat section	60 cm
Thickness of flat section	2.0mm +/-0.2mm (flat section)
Dielectric Constant	<5.0
Loss Tangent	<0.05

Tissue Material Properties

The dielectric parameters of the human tissue simulating liquid were measured prior to SAR assessment using the SPEAG DAK2 dielectric probe kit and PNA-L N5230C Network Analyser. The actual dielectric parameters are shown in the following table.

Table: Measured Head Simulating Liquid Dielectric Values at 750MHz

Table 77

Frequency Band	∈r (target)	σ (target)	ρ kg/m^3
709 MHz Body	41.9 ±5% 39.8 to 44.0	0.89 ±5% 0.85 to 0.93	1000
710 MHz Body	41.9 ±5% 39.8 to 44.0	0.89 ±5% 0.85 to 0.93	1000
711 MHz Body	41.9 ±5% 39.8 to 44.0	0.89 ±5% 0.85 to 0.93	1000
782 MHz Body	41.9 ±5% 39.8 to 44.0	0.89 ±5% 0.85 to 0.93	1000

Note: The head liquid parameters were within the required tolerances of ±5

Table: Measured Head Simulating Liquid Dielectric Values at 850MHz

Table 78

Frequency Band	∈r (target)	σ (target)	ρ kg/m^3
825 MHz Body	41.5 ±5% (39.4 to 43.6)	0.90 ±5% (0.86 to 0.95)	1000
835 MHz Body	41.5 ±5% (39.4 to 43.6)	0.90 ±5% (0.86 to 0.95)	1000
850 MHz Body	41.5 ±5% (39.4 to 43.6)	0.90 ±5% (0.86 to 0.95)	1000

Note: The body liquid parameters were within the required tolerances of ±5%.

Table: Measured Head Simulating Liquid Dielectric Values at 1750MHz

Table 79

Frequency Band	∈r (target)	σ (target)	ρ kg/m^3
1710 MHz Body	40.1 ±5% (38.1 to 42.1)	1.37 ±5% (1.30 to 1.44)	1000
1747 MHz Body	40.1 ±5% (38.1 to 42.1)	1.37 ±5% (1.30 to 1.44)	1000
1785 MHz Body	40.1 ±5% (38.1 to 42.1)	1.37 ±5% (1.30 to 1.44)	1000

Note: The head liquid parameters were within the required tolerances of ±5%.

Table: Measured Head Simulating Liquid Dielectric Values at 1880MHz

Table 80

Frequency Band	∈r (target)	σ (target)	ρ kg/m^3
1850 MHz Body	40.0 ±5% (38.0 to 42.0)	1.40 ±5% (1.33 to 1.47)	1000
1880.0 MHz Body	40.0 ±5% (38.0 to 42.0)	1.40 ±5% (1.33 to 1.47)	1000
1910 MHz Body	40.0 ±5% (38.0 to 42.0)	1.40 ±5% (1.33 to 1.47)	1000

Note: The head liquid parameters were within the required tolerances of ±5%.

Simulated Tissue Composition Used for SAR Test

The tissue simulating liquids are created prior to the SAR evaluation and often require slight modification each day to obtain the correct dielectric parameters.

Table: Tissue Type: Brain @ 750/850MHz
Volume of Liquid: 30 Litres

Table 81

Approximate Composition	% By Weight
Distilled Water	41.05
Salt	1.35
Sugar	56.5
HEC	1.0
Bactericide	0.1

Table: Tissue Type: Brain @ 1800/1950MHz MHz
Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	61.17
Salt	0.31
Bactericide	0.29
Triton X-100	38.23