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SAR TEST REPORT

FCC 47 CFR Part 2.1093
ISED RSS-102

RF-Exposure evaluation of portable equipment

Report Reference No. ..... :	G0M-1812-7888-TFC093SR-V01
Testing Laboratory ..... :	Eurofins Product Service GmbH
Address ..... :	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation ..... :	DAkkS - Registration number : D-PL-12092-01-03 (ISED) ISED Testing Laboratory site: 3470A-2 DAkkS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory. Reg.-No.: 96970
Applicant's name ..... :	Leica Geosystems AG
Address ..... :	Heinrich Wild Strasse 9435 Heerbrugg SWITZERLAND
Test specification:	
Standard..... :	FCC 47 CFR Part 2 §2.1093 447498 D01 General RF Exposure Guidance v06 IEEE Std. 1528 - 2013 ISED RSS-102 Issue 5
Non-standard test method……..:	None
Test scope…….. ..... :	complete Radio compliance test
Equipment under test (EUT):	
Product description	Field Controller Win EC7
Model No.	CS20 LTE Disto (US, CA)
Additional Model(s)	None
Brand Name(s)	Leica Geosystems
Hardware version	V1.0
Firmware / Software version	V4.97
	FCC-ID: RFD-CSNGG IC: 3177A-CSNGG
Test result	**Passed**

Possible test case verdicts:	
- neither assessed nor tested	N/N
- required by standard but not appl. to test object	N/A
- required by standard but not tested	N/T
- not required by standard for the test object	N/R
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement	F (Fail)

Testing:		
Date of receipt of test item	2019-05-13	
Date (s) of performance of tests	2019-05-13 - 2019-07-05	
Compiled by	Burkhard Pudell	
Tested by (+ signature) (Responsible for Test)	Burkhard Pudell	B. Pudell
Approved by (+ signature) (Head of Lab)	Christian Weber	C. Weber
Date of issue	2019-07-16	
Total number of pages	177	

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

Additional comments:

The BT/WLAN module has a time-shared antenna, only one technology could transmit at the same time.

ADDITIONAL VARIANTS

Additional Variants (not tested and not evaluated variants)		
Not-tested Variant	**Description**	
1	Product Type Description	Field Controller Win EC7
	Model name	CS20 LTE (US, CA)
	Brand name	Geosystems
	Hardware Version	V1.00
	Software Version	V4.97
Comment: Those named additional variants above have not been tested. Those additional variants of the series have been declared by the manufacturer. The test report explicitly states that those variants were neither tested nor assessed nor evaluated.		

Version History

Version	Issue Date	Remarks	Revised by
01	2019-07-16	Initial Release	

REPORT INDEX

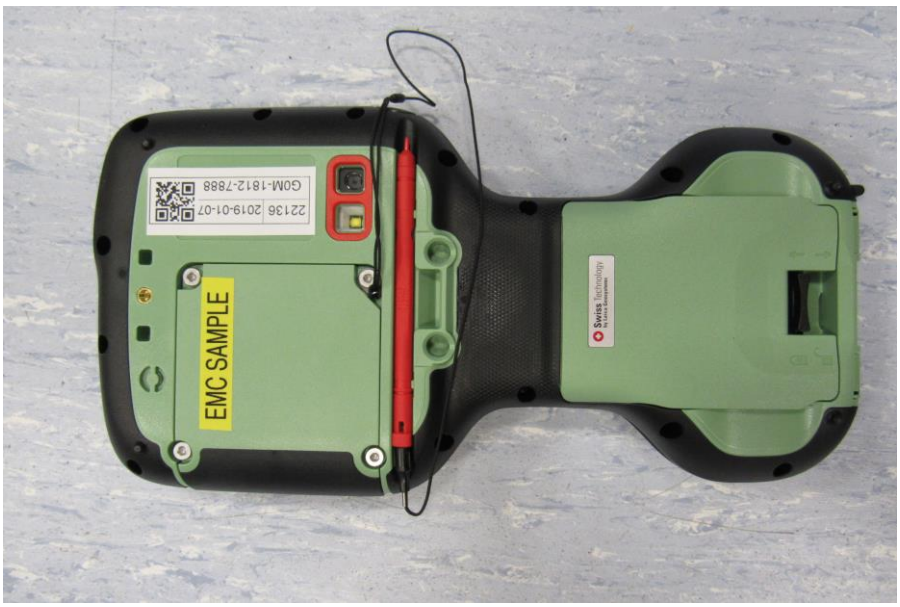
1 Equipment (Test item) Description

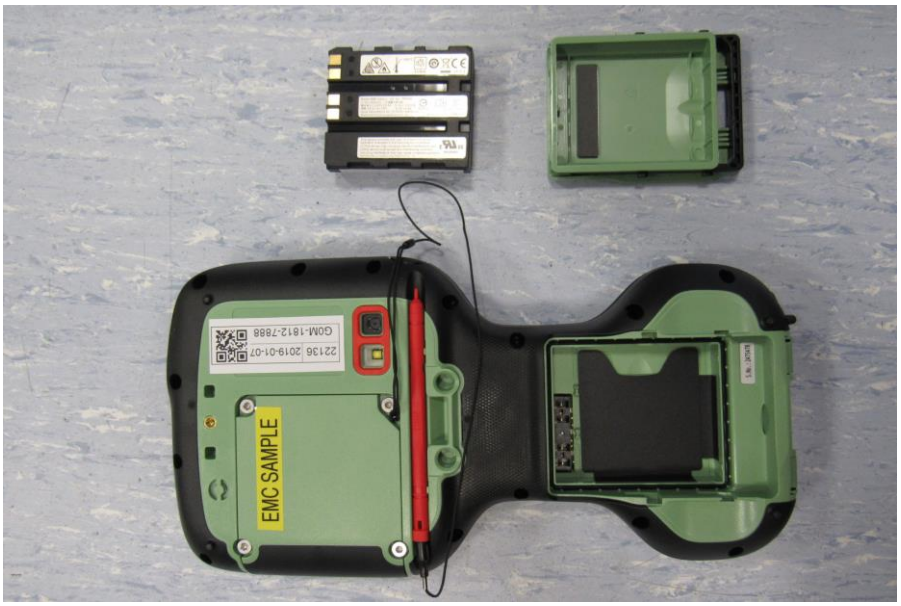
Description	Field Controller Win EC7
Model	CS20 LTE Disto (US, CA)
Additional Model(s)	None
Brand Name(s)	Leica Geosystems
Serial number	None
Hardware version	V1.0
Software / Firmware version	V4.97
PMN	N/A
HVIN	CS20 LTE Disto (US, CA)
FVIN	N/A
HMN	N/A
Contains FCC-ID	QIPPLAS9-X; RFD-BTWCO; PVH0946
Contains IC	7830A-PLAS9X; 3177A-BTWCO; 5325A-0946
Equipment type	End product
Prototype or production unit	Production Unit
Device category	Handset
Environment	General public
Radio technologies	2G / 3G FDD / 4G FDD WLAN IEEE 802.11b,g,n Bluetooth Classic
Operating frequency ranges	GSM850 : TX = 824 - 849 MHz, RX = 869 - 894 MHz W-CDMA FDD V : TX = 824 - 849 MHz, RX = 869 - 894 MHz LTE FDD 5 : TX = 824 - 849 MHz, RX = 869 - 894 MHz PCS1900 : TX = 1850 - 1910 MHz, RX = 1930 - 1990 MHz W-CDMA FDD II : TX = 1850 - 1910 MHz, RX = 1930 - 1990 MHz LTE FDD 2 : TX = 1850 - 1910 MHz, RX = 1930 - 1990 MHz W-CDMA FDD IV : TX = 1710 - 1755 MHz, RX = 2110 - 2155 MHz LTE FDD 4 : TX = 1710 - 1755 MHz, RX = 2110 - 2155 MHz LTE FDD 12 : TX = 699 - 716 MHz, RX = 729 - 746 MHz LTE FDD 13 : TX = 777 - 787 MHz, RX = 746 - 756 MHz LTE FDD 17 : TX = 704 - 716 MHz, RX = 734 - 746 MHz LTE FDD 29 : TX = none , RX = 717 - 728 MHz WLAN 2.4G: 2412 - 2462 MHz Bluetooth : 2402 - 2480 MHz
Modulations	GSM : GMSK / 8-PSK W-CDMA : QPSK / 16-QAM LTE : QPSK / 16-QAM WLAN 2.4G: DBPSK/ DQPSK/ QPSK/ BPSK /16-QAM Bluetooth : GFSK, PI/4-DQPSK, 8-DPSK

Carrier Aggregation/MIMO	Carrier-Aggregation : 2 CC, downlink only MIMO: 2x2 downlink only	
Antenna Mobile TX-RX	Type	integrated
	Model	W3796
	Manufacturer	Pulse Electronics
	Gain	680 - 980 MHz = <2 dBd 1700-2700 MHz = <5 dBi
Antenna Mobile RX	Type	integrated
	Model	W3796
	Manufacturer	Pulse Electronics
	Gain	680 - 980 MHz = <1 dBd 1700-2700 MHz = <3 dBi
Antenna WLAN/Bluetooth	Type	integrated
	Model	W3008C
	Manufacturer	Pulse Electronics
	Gain	1 dBi (manufacturer declaration)
Antenna Bluetooth LR	Type	integrated
	Model	1000146
	Manufacturer	AVX/Ethertronics
	Gain	< 1 dBi
Power supply	V_{NOM}	11.1 VDC (Lithium Battery)
AC/DC-Adaptor	Model	GEV276
	Vendor	Leica Geosystems
	Input	100 - 240 VAC
	Output	15 VDC
Accessories	None	
Manufacturer	Leica Geosystems AG Heinrich Wild Strasse 9435 Heerbrugg SWITZERLAND	
Comments:		

1.1 Equipment photos

EUT FRONT


EUT BACK


EUT BACK OPEN


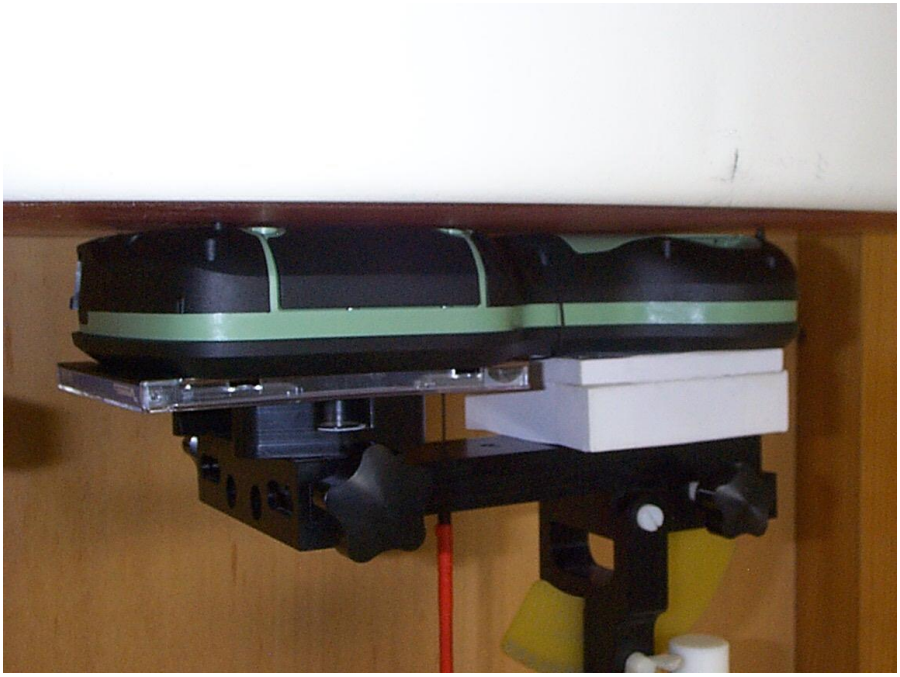
EUT BOTTOM INTERFACE


AC/DC ADAPTER


1.2 Equipment setup photos

CS20-Front-1


CS20-Front-2


CS20-Back-1


CS20-Back-2


CS20-Left-1


CS20-Left-2

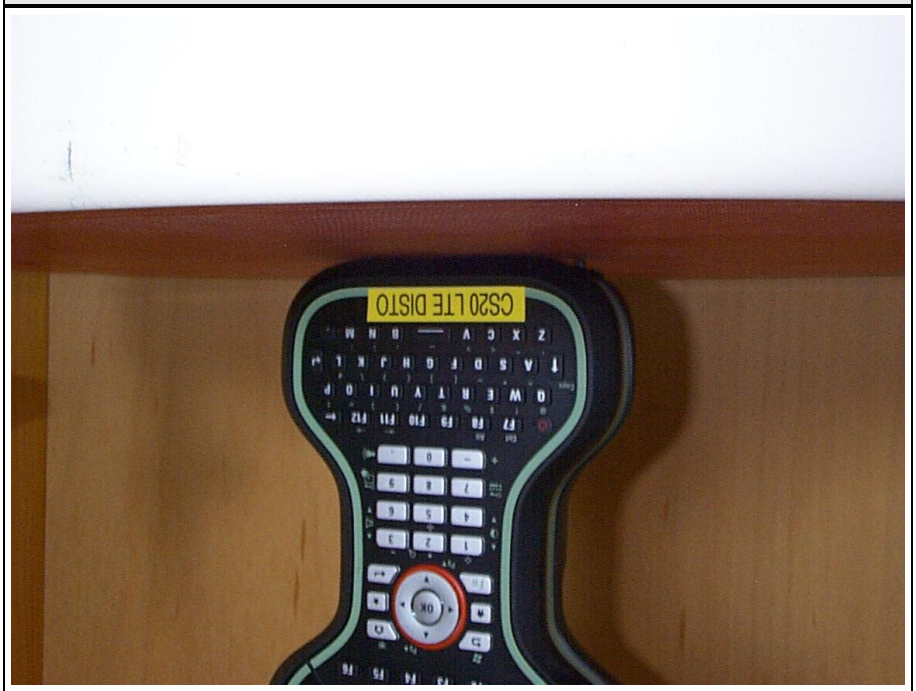

CS20-Right-1


CS20-Right-2


CS20-Top-1


CS20-Top-2


CS20-Bottom-1


CS20-Bottom-2


1.3 Reference Documents

Document
KDB Publication 447498 : Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Polices
KDB Publication 648474 : SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas
KDB Publication 648474 : Review and Approval Policies for SAR Evaluation of Handsets with Multiple Transmitters and Antennas
KDB Publication 865664 : SAR measurement procedures for devices operating between 100 MHz to 6 GHz
KDB Publication 941225: SAR Measurement Procedures for 3G Devices
KDB Publication 941225: 3GPP R6 HSPA and R7 HSPA+ SAR Guidance
KDB Publication 941225: Recommended SAR Test Reduction Procedures for GSM/GPRS/EDGE
KDB Publication 941225: SAR Test Consideration for LTE Handsets and Data Modems
KDB Publication 447498 : SAR Measurement Procedures for USB Dongle Transmitters
KDB Publication 248227 : SAR Measurement Procedures for 802.11 a/b/g Transmitters
KDB Publication 450824 : SAR Probe Calibration and System Verification considerations for measurements from 150 MHz to 3 GHz

1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
SIM	Network	R&S	CMW500	Mobile -Tester
SIM	Network	R&S	CBT	Bluetooth -Tester

***Note:** Use the following abbreviations:

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

1.5 Supported standalone operating modes

Bands	Modulation	Frequency range	Duty cycle
GSM 850	GMSK	824 MHz - 49 MHz	50%
PCS 1900	GMSK	1850 MHz - 1910 MHz	50%
W-CDMA FDD II	QPSK	1850 MHz - 1910 MHz	100%
W-CDMA FDD IV	QPSK	1710 MHz - 1755 MHz	100%
W-CDMA FDD V	QPSK	824 MHz - 49 MHz	100%
LTE FDD 2	QPSK	1850 MHz - 1910 MHz	100%
LTE FDD 4	QPSK	1710 MHz - 1755 MHz	100%
LTE FDD 5	QPSK	824 MHz - 49 MHz	100%
LTE FDD 12	QPSK	699 MHz - 716 MHz	100%
LTE FDD 13	QPSK	777 MHz - 787 MHz	100%
LTE FDD 17	QPSK	704 MHz - 716 MHz	100%
IEEE 802.11	DBPSK	2412 – 2462 MHz	95%
BT - BR	GFSK	2400 MHz - 2483.5 MHz	77%
Comment : Listed are only the maximum conducted ouput power modes applicable for SAR measurements after SAR test exclusion according to FCC KDB 447498 D01 and ISED RSS-102			

1.6 Conducted Power Values for supported standalone operating modes

According to FCC KDB 865664 D02 and 447498 the nominal and maximum conducted ouput power of all wireless modes and frequency band and tune-up tolerances must be specified.

When multiple maximum output power levels are specified for a wireless or operating mode; for example, different time slots, data rates or modulation requirements, such as GPRS, EDGE, 802.11, WiMax and various 3GPP implementations, the maximum output power of each configuration should be identified separately.

Bluetooth BR - LR – Average Output Power			
Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 1.0dB)		
	BR (GFSK)	EDR (PI/4-DQPSK)	EDR (8-DPSK)
	DH5	2-DH5	3-DH5
2402	9.49	6.19	5.69
2441	9.79	5.99	5.39
2480	**9.89**	6.09	5.49
Date, Operator:	21.05.2019 , B. Pudell		

Bluetooth BR+EDR – Average Output Power			
Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)		
	BR (GFSK)	EDR (PI/4-DQPSK)	EDR (8-DPSK)
	DH5	2-DH5	3-DH5
2402	7.87	5.39	5.39
2441	7.82	5.19	5.19
2480	**7.94**	5.16	5.16
Date, Operator:	15.03.2019 , B. Pudell		

Maximum output power for WiFi operational modes are measured according to FCC KDB 248227 D01 Section 4.

IEEE 802.11b – Average Output Power						
Antenna port			intern			
Band	Channel	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)			
			Data rate [Mbps]			
			1	2	5.5	11
2.4 GHz	1	2412	**17.0**	14.2	14.1	16.4
	6	2437	16.8	13.9	13.8	16.2
	7	2442				
	11	2462	16.8	13.9	13.9	16.2
	13	2472				
Date, Operator:			18.03.2019 , B. Pudell			

IEEE 802.11g – Average Output Power									
Antenna port			intern						
Band	Channel	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)						
			Data rate [Mbps]						
			6	9	12	18	24	36	48	54
2.4 GHz	1	2412	**14.4**	14.2	14.1	14.1	14.2	14.0	14.1	14.1
	6	2437	14.1	13.9	13.8	13.8	13.8	13.8	13.8	13.8
	7	2442								
	11	2462	14.1	13.8	13.9	13.8	13.9	13.8	13.9	13.8
	13	2472								
Date, Operator:			18.03.2019 , B. Pudell							

IEEE 802.11n HT20 1SS – Average Output Power										
Antenna port				intern						
Band	BW [MHz]	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)						
				Data rate [Mbps]						
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
2.4 GHz	20	1	2412	**14.0**	14.0	14.0	13.9	13.9	13.8	13.7	13.5
		6	2437	13.7	13.7	13.7	13.6	13.6	13.5	13.5	13.2
		7	2442								
		11	2462	13.8	13.8	13.7	13.6	13.6	13.6	13.6	13.2
		13	2472								
Date, Operator:				18.03.2019 , B. Pudell							

WiFi SAR Test Reduction

According to KDB 248227 D01:

The maximum output power specified for production units, including tune-up tolerance, are used to determine initial SAR test requirements for the 802.11 transmission modes in a frequency band. SAR is measured using the highest measured maximum output power channel for the initial test configuration. SAR measurement and test reduction for the remaining 802.11 modes and test channels are determined according to measured or specified maximum output power and reported SAR of the initial measurements.

2.4 GHz SAR procedure:

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

a) When the reported SAR of the highest measured maximum output power channel (see 3.1) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

b) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz OFDM SAR test exclusion:

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied. SAR is not required for the following 2.4 GHz OFDM conditions:

a) When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.

b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Applicable test reduction:

Due to the fact that the need for OFDM SAR testing depends on the SAR measurement results for DSSS, the DSSS mode is used for initial SAR testing.

Maximum output power for GSM/GRPS/EDGE operational modes are measured according to FCC KDB 941225 D01 Section 5.

GSM850 – Average Output Power										
Band	Mode	Coding	Active Timeslots	Ch.	Frequency [MHz]	TS1 [dBm]	TS2 [dBm]	TS3 [dBm]	TS4 [dBm]	Source-based average power [dBm]
850	GSM	FRV1	1	128	824.1	-	-	-	-	-
				190	836.6	-	-	-	-	-
				251	848.0	-	-	-	-	-
	GRPS	CS1	1	128	824.1	31.00				21.97
				190	836.6	31.11				22.08
				251	848.0	30.92				21.89
			2	128	824.1	30.87	30.79			24.81
				190	836.6	30.91	30.83			24.85
				251	848.0	30.70	30.57			24.62
			3	128	824.1	30.60	30.50	30.42		26.26
				190	836.6	30.70	30.60	30.50		26.35
				251	848.0	30.56	30.42	30.31		26.18
			4	128	824.1	30.52	30.40	30.32	30.26	27.38
				190	836.6	30.57	30.49	30.34	30.24	**27.41**
				251	848.0	30.45	30.28	30.17	30.10	27.25
	EGRPS	MCS1	1	128	824.1	30.88				21.85
				190	836.6	30.95				21.92
				251	848.0	30.75				21.72
			2	128	824.1	30.70	30.60			24.63
				190	836.6	30.80	30.70			24.73
				251	848.0	30.66	30.54			24.58
			3	128	824.1	30.65	30.55	30.47		26.31
				190	836.6	30.66	30.55	30.46		26.31
				251	848.0	30.67	30.54	30.43		26.30
			4	128	824.1	30.28	30.14	30.04	29.98	27.11
				190	836.6	30.36	30.20	30.09	30.02	27.17
				251	848.0	30.51	30.35	30.25	30.15	27.32
	EGRPS	MCS5	1	128	824.1	26.60	-	-	-	17.57
				190	836.6	26.45	-	-	-	17.42
				251	848.0	26.35	-	-	-	17.32
			2	128	824.1	26.55	26.41	-	-	20.46
				190	836.6	26.45	26.32	-	-	20.37
				251	848.0	26.30	26.20	-	-	20.23
			3	128	824.1	26.45	26.30	26.18	-	22.06
				190	836.6	26.30	26.13	25.98	-	21.89
				251	848.0	26.11	25.91	25.80	-	21.69
			4	128	824.1	26.13	25.98	25.85	25.73	22.93
				190	836.6	26.03	25.90	25.75	25.67	22.84
				251	848.0	26.05	25.80	25.70	25.60	22.79
Date, Operator:				19.06.2019 , B. Pudell						

PCS1900 – Average Output Power										
Band	Mode	Coding	Active Timeslots	Ch.	Frequency [MHz]	TS1 [dBm]	TS2 [dBm]	TS3 [dBm]	TS4 [dBm]	Source-based average power [dBm]
1900	GSM	FRV1	1	512	1850.2	-	-	-	-	-
				661	1880.0	-	-	-	-	-
				810	1909.8	-	-	-	-	-
	GRPS	CS1	1	512	1850.2	29.60	-	-	-	20.57
				661	1880.0	29.85	-	-	-	20.82
				810	1909.8	29.75	-	-	-	20.72
			2	512	1850.2	29.30	29.02	-	-	23.14
				661	1880.0	29.55	29.38	-	-	23.45
				810	1909.8	29.45	29.37	-	-	23.39
			3	512	1850.2	28.90	28.61	28.45	-	24.41
				661	1880.0	29.25	29.04	28.91	-	24.82
				810	1909.8	29.67	29.47	29.34	-	25.25
			4	512	1850.2	28.47	28.14	27.93	27.87	25.11
				661	1880.0	28.92	28.70	28.58	28.50	25.68
				810	1909.8	29.51	29.29	29.17	29.10	**26.27**
	EGRPS	MCS1	1	512	1850.2	29.40	-	-	-	20.37
				661	1880.0	29.65	-	-	-	20.62
				810	1909.8	29.60	-	-	-	20.57
			2	512	1850.2	29.88	29.70	-	-	23.77
				661	1880.0	29.45	29.25	-	-	23.33
				810	1909.8	29.82	29.63	-	-	23.71
			3	512	1850.2	28.75	28.42	28.25	-	24.23
				661	1880.0	29.16	28.94	28.81	-	24.72
				810	1909.8	29.62	29.42	29.30	-	25.20
			4	512	1850.2	28.43	28.09	27.92	27.85	25.08
				661	1880.0	28.83	28.59	28.46	28.38	25.57
				810	1909.8	29.26	29.03	28.90	28.81	26.00
	EGRPS	MCS5	1	512	1850.2	24.95	-	-	-	15.92
				661	1880.0	24.84	-	-	-	15.81
				810	1909.8	24.96	-	-	-	15.93
			2	512	1850.2	24.14	23.92	-	-	18.01
				661	1880.0	24.66	24.45	-	-	18.54
				810	1909.8	24.80	24.62	-	-	18.69
			3	512	1850.2	23.98	23.72	23.57	-	19.51
				661	1880.0	24.45	24.25	24.12	-	20.03
				810	1909.8	24.58	24.32	24.22	-	20.13
			4	512	1850.2	23.70	23.42	23.34	23.23	20.43
				661	1880.0	24.15	23.93	23.84	23.78	20.93
				810	1909.8	24.23	24.03	23.93	23.82	21.01
Date, Operator:				11.03.2019 , B. Pudell						

GSM/GRPS/EDGE SAR Test Reduction

According to KDB 941225 D01:

The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

The GMSK and 8-PSK EDGE configurations are considered separately for SAR compliance.

The GMSK EDGE configurations are grouped with GPRS and considered with respect to time-averaged maximum output power to determine compliance.

The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode.

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement Is not required for the secondary mode.

Applicable test reduction:

The GPRS and EDGE operational modes for all time slot configurations are not more than ¼ dB higher than the maximum output power GMSK mode. Hence only the mode with the highest time-averaged output power GMSK is tested for each frequency band.

Maximum output power for WCDMA/HSDPA/HSPA operational modes are measured according to FCC KDB 941225 D01 Section 4.

W-CDMA FDD II RMC – Average Output Power						
Band	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)			
			RMC 12.2	RMC 64	RMC 144	RMC 384
FDDII	9262	1852.6	24.2	24.0	24.0	23.9
	9400	1880.0	**24.3**	24.2	24.1	24.1
	9538	1907.4	23.9	23.8	23.8	24.7
Date, Operator:			09.05.2019 , B. Pudell			

W-CDMA FDD II HSDPA – Average Output Power						
Band	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)			
			HSDPA Subtest 1	HSDPA Subtest 2	HSDPA Subtest 3	HSDPA Subtest 4
FDDII	9262	1852.6	23.40	23.4	23.0	23.0
	9400	1880.0	23.30	23.2	23.0	22.8
	9538	1907.4	23.10	23.0	22.7	23.0
Date, Operator:			09.05.2019 , B. Pudell			

W-CDMA FDD II HSUPA – Average Output Power							
Band	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)				
			HSUPA Subtest 1	HSUPA Subtest 2	HSUPA Subtest 3	HSUPA Subtest 4	HSUPA Subtest 5
FDDII	9262	1852.6	23.0	23.5	23.5	23.0	23.1
	9400	1880.0	22.9	23.4	23.4	22.9	23.0
	9538	1907.4	22.7	23.0	23.4	22.7	22.9
Date, Operator:			09.05.2019 , B. Pudell				

W-CDMA FDD IV RMC – Average Output Power						
Band	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)			
			RMC 12.2	RMC 64	RMC 144	RMC 384
FDDIV	1312	1712.4	24.1	24.1	24.1	24.1
	1413	1732.6	24.2	24.3	24.3	24.2
	1513	1752.6	24.3	24.4	**24.4**	24.2
Date, Operator:			09.05.2019 , B. Pudell			

W-CDMA FDD IV HSDPA – Average Output Power						
Band	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)			
			HSDPA Subtest 1	HSDPA Subtest 2	HSDPA Subtest 3	HSDPA Subtest 4
FDDIV	1312	1712.4	23.2	23.3	22.9	22.8
	1413	1732.6	23.3	23.4	23.1	22.9
	1513	1752.6	23.4	23.4	23.0	23.0
Date, Operator:			09.05.2019 , B. Pudell			

W-CDMA FDD IV HSUPA – Average Output Power							
Band	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)				
			HSUPA Subtest 1	HSUPA Subtest 2	HSUPA Subtest 3	HSUPA Subtest 4	HSUPA Subtest 5
FDDIV	1312	1712.4	23.0	23.4	23.4	22.9	22.9
	1413	1732.6	23.0	23.5	23.5	22.9	23.0
	1513	1752.6	23.1	23.5	23.6	23.0	23.1
Date, Operator:			09.05.2019 , B. Pudell				

W-CDMA FDD V RMC – Average Output Power						
Band	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)			
			RMC 12.2	RMC 64	RMC 144	RMC 384
FDDV	4133	826.6	24.1	24.1	24.1	24.0
	4175	835.0	24.1	24.1	**24.1**	24.1
	4232	846.4	23.9	23.9	24.0	24.1
Date, Operator:			09.05.2019 , B. Pudell			

W-CDMA FDD V HSDPA – Average Output Power						
Band	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)			
			HSDPA Subtest 1	HSDPA Subtest 2	HSDPA Subtest 3	HSDPA Subtest 4
FDDV	4133	826.6	23.3	23.3	22.9	22.9
	4175	835.0	23.3	23.2	22.8	22.8
	4232	846.4	23.2	23.2	22.8	22.8
Date, Operator:			09.05.2019 , B. Pudell			

W-CDMA FDD V HSUPA – Average Output Power							
Band	Ch.	Frequency [MHz]	Source-base time-average power [dBm] (+ Tuneup= 0.5dB)				
			HSUPA Subtest 1	HSUPA Subtest 2	HSUPA Subtest 3	HSUPA Subtest 4	HSUPA Subtest 5
FDDV	4133	826.6	22.9	23.4	23.4	22.8	23.0
	4175	835.0	22.9	23.4	23.4	22.9	22.9
	4232	846.4	22.9	23.3	23.3	22.7	22.7
Date, Operator:			09.05.2019 , B. Pudell				

WCDMA/HSDPA/HSPA SAR Test Reduction

Body-worn according to KDB 941225 D01:

SAR for body-worn accessory configurations is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or DPDCHn, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When more than 2 DPDCHn are supported by the handset, it may be necessary to configure additional DPDCHn using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.

Handsets with Rel. 5 HSDPA according to KDB 941225 D01:

The 3G SAR test reduction procedure is applied to HSDPA body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures in the “Release 5 HSDPA Data Devices” section of this document, for the highest reported SAR body-worn accessory exposure configuration in 12.2 kbps RMC. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

Handsets with Rel. 6 HSPA according to KDB 941225 D01:

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures in the “Release 6 HSPA Data Devices” section of the KDB document, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC.

When VOIP is applicable for next to the ear head exposure in HSPA, the 3G SAR test reduction procedure is applied to HSPA with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body-worn accessory measurements is tested for next to the ear head exposure.

3G SAR test reduction procedure:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement Is not required for the secondary mode.

Applicable test reduction:

No other HSDUPA or HSUPA configuration has a maximum ouput power more than ¼ dB higher than the 12.2 kbps RMC mode. Hence only the 12.2 kbps RMC mode was used for 3G SAR evaluation

Maximum output power for LTE operational modes are measured according to FCC KDB 941225 D05 Section 5.

LTE FDD 2							
Configuration					Source-base time-average power [dBm] (+ Tuneup= 0.5dB)		
BW [MHz]	Mode	RB Configuration	RB	RB Offset	18607	18900	19193
					1850.70 MHz	1880.00 MHz	1909.30 MHz
1.4	QPSK	1 RB Low	1	0	22.5	**23.1**	21.3
		1 RB Mid	1	2	23.1	22.9	22.2
		1 RB High	1	5	23.1	23.1	22.0
		50 % RB Low	3	0	22.9	22.8	22.1
		50 % RB Mid	3	1	23.0	22.9	22.1
		50 % RB High	3	3	**23.0**	22.9	22.1
		100 % RB	6	0	22.0	21.8	21.0
	16-QAM	1 RB Low	1	0	21.9	22.3	21.1
		1 RB Mid	1	2	22.0	**22.4**	21.2
		1 RB High	1	5	21.9	22.2	21.1
		50 % RB Low	3	0	22.1	22.0	21.4
		50 % RB Mid	3	1	22.1	22.1	21.4
		50 % RB High	3	3	**22.2**	22.1	21.3
		100 % RB	6	0	21.0	20.9	20.2
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	18615	18900	19185
					1851.50 MHz	1880.00 MHz	1908.50 MHz
3.0	QPSK	1 RB Low	1	0	23.2	22.9	22.3
		1 RB Mid	1	7	**23.3**	22.9	22.4
		1 RB High	1	14	23.1	22.9	22.4
		50 % RB Low	8	0	**22.1**	21.8	21.1
		50 % RB Mid	8	4	22.1	21.8	21.1
		50 % RB High	8	7	22.1	21.7	21.0
		100 % RB	15	0	22.0	21.8	21.0
	16-QAM	1 RB Low	1	0	21.8	21.8	21.7
		1 RB Mid	1	7	21.9	21.8	21.6
		1 RB High	1	14	21.8	**21.9**	21.7
		50 % RB Low	8	0	**21.0**	20.8	20.2
		50 % RB Mid	8	4	21.0	20.8	20.2
		50 % RB High	8	7	21.0	20.8	20.1
		100 % RB	15	0	21.0	20.8	20.1
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	18625	18900	19175
					1852.50 MHz	1880.00 MHz	1907.50 MHz
5.0	QPSK	1 RB Low	1	0	**23.3**	22.9	23.1
		1 RB Mid	1	12	23.1	22.8	22.1
		1 RB High	1	24	23.0	22.8	22.2
		50 % RB Low	12	0	**22.1**	21.8	21.6
		50 % RB Mid	12	7	22.1	21.8	21.1
		50 % RB High	12	13	22.0	21.7	21.0
		100 % RB	25	0	22.0	21.8	21.4
	16-QAM	1 RB Low	1	0	**22.9**	21.9	21.8
		1 RB Mid	1	12	22.9	21.8	21.8
		1 RB High	1	24	22.8	21.8	22.0
		50 % RB Low	12	0	21.1	20.9	20.6
		50 % RB Mid	12	7	**21.2**	20.9	20.0
		50 % RB High	12	13	21.1	20.8	20.1
		100 % RB	25	0	21.2	20.9	20.5
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	12			
		1 RB High	1	24			
		50 % RB Low	12	0			
		50 % RB Mid	12	7			
		50 % RB High	12	13			
		100 % RB	25	0			

BW [MHz]	Mode	RB Configuration	RB	RB Offset	18650	18900	19150
					1855.00 MHz	1880.00 MHz	1905.00 MHz
10	QPSK	1 RB Low	1	0	**23.6**	23.5	22.8
		1 RB Mid	1	24	23.1	23.1	22.6
		1 RB High	1	49	23.0	23.1	22.2
		50 % RB Low	25	0	**22.1**	22.0	21.7
		50 % RB Mid	25	12	21.9	21.8	21.7
		50 % RB High	25	25	21.9	21.7	21.7
		100 % RB	50	0	22.0	21.9	21.7
	16-QAM	1 RB Low	1	0	**22.5**	22.1	22.2
		1 RB Mid	1	24	22.3	21.8	21.7
		1 RB High	1	49	22.3	21.7	21.4
		50 % RB Low	25	0	**21.2**	21.1	20.9
		50 % RB Mid	25	12	21.0	21.0	20.8
		50 % RB High	25	25	21.0	20.9	20.8
		100 % RB	50	0	21.0	21.0	20.7
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	24			
		1 RB High	1	49			
		50 % RB Low	25	0			
		50 % RB Mid	25	12			
		50 % RB High	25	25			
		100 % RB	50	0			

BW [MHz]	Mode	RB Configuration	RB	RB Offset	18675	18900	19125
					1857.50 MHz	1880.00 MHz	1902.50 MHz
15	QPSK	1 RB Low	1	0	**23.9**	23.5	23.3
		1 RB Mid	1	36	23.3	22.8	22.7
		1 RB High	1	74	23.2	22.6	22.1
		50 % RB Low	36	0	**22.5**	22.0	22.0
		50 % RB Mid	36	18	22.2	21.9	21.8
		50 % RB High	36	39	22.1	21.7	21.9
		100 % RB	75	0	22.2	21.9	21.9
	16-QAM	1 RB Low	1	0	**23.0**	22.3	22.2
		1 RB Mid	1	36	22.6	22.0	21.7
		1 RB High	1	74	22.5	21.6	21.2
		50 % RB Low	36	0	**21.4**	21.1	21.0
		50 % RB Mid	36	18	21.2	20.9	20.9
		50 % RB High	36	39	21.1	20.8	20.7
		100 % RB	75	0	21.3	20.9	20.9
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			

BW [MHz]	Mode	RB Configuration	RB	RB Offset	18700	18900	19100
					1860.00 MHz	1880.00 MHz	1900.00 MHz
20	QPSK	1 RB Low	1	0	**24.0**	23.5	23.5
		1 RB Mid	1	50	23.1	22.9	22.9
		1 RB High	1	99	23.0	22.7	22.1
		50 % RB Low	50	0	**22.5**	22.2	22.4
		50 % RB Mid	50	25	22.2	21.9	22.0
		50 % RB High	50	50	22.1	21.8	21.8
		100 % RB	100	0	22.4	22.0	22.0
	16-QAM	1 RB Low	1	0	**23.4**	23.4	22.7
		1 RB Mid	1	50	23.1	22.2	22.2
		1 RB High	1	99	22.6	21.9	21.6
		50 % RB Low	50	0	**21.6**	21.1	21.2
		50 % RB Mid	50	25	21.3	20.9	20.9
		50 % RB High	50	50	21.1	20.8	20.8
		100 % RB	100	0	21.4	21.0	21.1
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			

Date, Operator:	10.05.2019 , B. Pudell

LTE FDD 4							
Configuration					Source-base time-average power [dBm] (+ Tuneup= 0.5dB)		
BW [MHz]	Mode	RB Configuration	RB	RB Offset	19957	20175	20393
					1710.7 MHz	1732.5 MHz	1754.3 MHz
1.4	QPSK	1 RB Low	1	0	23.4	23.4	23.7
		1 RB Mid	1	2	23.1	**23.8**	23.4
		1 RB High	1	5	23.4	23.4	23.7
		50 % RB Low	3	0	23.0	23.3	23.4
		50 % RB Mid	3	1	23.2	23.4	23.5
		50 % RB High	3	3	23.1	23.2	**23.5**
		100 % RB	6	0	22.1	22.2	22.3
	16-QAM	1 RB Low	1	0	22.6	22.2	22.9
		1 RB Mid	1	2	22.8	22.4	**23.0**
		1 RB High	1	5	22.5	22.4	22.8
		50 % RB Low	3	0	22.4	22.5	22.7
		50 % RB Mid	3	1	22.5	22.6	**22.8**
		50 % RB High	3	3	22.4	22.5	22.7
		100 % RB	6	0	21.0	21.4	21.2
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	19965	20175	20385
					1711.5 MHz	1732.5 MHz	1753.5 MHz
3.0	QPSK	1 RB Low	1	0	23.3	**23.6**	23.4
		1 RB Mid	1	7	23.3	23.3	23.4
		1 RB High	1	14	23.3	23.4	23.5
		50 % RB Low	8	0	22.1	22.4	22.3
		50 % RB Mid	8	4	22.2	22.3	**22.5**
		50 % RB High	8	7	22.1	22.2	22.4
		100 % RB	15	0	21.1	22.3	22.3
	16-QAM	1 RB Low	1	0	**22.7**	22.3	22.4
		1 RB Mid	1	7	22.6	22.3	22.4
		1 RB High	1	14	22.7	22.1	22.5
		50 % RB Low	8	0	21.2	21.3	21.3
		50 % RB Mid	8	4	21.2	21.3	**21.5**
		50 % RB High	8	7	21.1	21.2	21.3
		100 % RB	15	0	22.1	21.2	21.4
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	19975	20175	20375
					1712.5 MHz	1732.5 MHz	1752.5 MHz
5.0	QPSK	1 RB Low	1	0	23.5	23.6	**23.6**
		1 RB Mid	1	12	23.2	23.5	23.6
		1 RB High	1	24	23.3	23.4	23.5
		50 % RB Low	12	0	22.1	22.3	**22.4**
		50 % RB Mid	12	7	22.2	22.3	22.4
		50 % RB High	12	13	22.1	22.3	22.3
		100 % RB	25	0	22.2	22.3	22.4
	16-QAM	1 RB Low	1	0	22.1	22.3	22.3
		1 RB Mid	1	12	22.3	22.2	22.3
		1 RB High	1	24	22.1	22.3	**22.4**
		50 % RB Low	12	0	21.1	21.4	**21.4**
		50 % RB Mid	12	7	21.2	21.4	21.4
		50 % RB High	12	13	21.1	21.4	21.3
		100 % RB	25	0	21.1	21.3	21.4
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	12			
		1 RB High	1	24			
		50 % RB Low	12	0			
		50 % RB Mid	12	7			
		50 % RB High	12	13			
		100 % RB	25	0			

BW [MHz]	Mode	RB Configuration	RB	RB Offset	20000	20175	20350
					1715.0 MHz	1732.5 MHz	1750.0 MHz
10	QPSK	1 RB Low	1	0	23.4	23.6	23.7
		1 RB Mid	1	24	23.2	23.6	23.5
		1 RB High	1	49	23.2	23.4	**23.8**
		50 % RB Low	25	0	22.2	22.3	22.4
		50 % RB Mid	25	12	22.1	22.4	22.3
		50 % RB High	25	25	22.1	22.2	**22.4**
		100 % RB	50	0	22.0	22.3	22.5
	16-QAM	1 RB Low	1	0	22.6	22.7	**22.9**
		1 RB Mid	1	24	22.3	22.6	22.7
		1 RB High	1	49	22.2	22.4	22.8
		50 % RB Low	25	0	21.3	21.4	**21.4**
		50 % RB Mid	25	12	21.2	21.4	21.4
		50 % RB High	25	25	21.2	21.3	21.4
		100 % RB	50	0	21.1	21.3	21.5
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	24			
		1 RB High	1	49			
		50 % RB Low	25	0			
		50 % RB Mid	25	12			
		50 % RB High	25	25			
		100 % RB	50	0			

BW [MHz]	Mode	RB Configuration	RB	RB Offset	20025	20175	20325
					1717.5 MHz	1732.5 MHz	1747.5 MHz
15	QPSK	1 RB Low	1	0	23.5	**23.9**	23.8
		1 RB Mid	1	36	23.2	23.5	23.5
		1 RB High	1	74	23.2	23.5	23.6
		50 % RB Low	36	0	22.3	**22.6**	22.6
		50 % RB Mid	36	18	22.3	22.5	22.5
		50 % RB High	36	39	22.1	22.4	22.3
		100 % RB	75	0	22.1	22.5	22.5
	16-QAM	1 RB Low	1	0	22.5	**22.8**	22.8
		1 RB Mid	1	36	22.3	22.5	22.4
		1 RB High	1	74	22.2	22.4	22.5
		50 % RB Low	36	0	21.3	**21.6**	21.5
		50 % RB Mid	36	18	21.3	21.5	21.5
		50 % RB High	36	39	21.1	21.4	21.3
		100 % RB	75	0	21.1	21.5	21.6
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			

BW [MHz]	Mode	RB Configuration	RB	RB Offset	20050	20175	20300
					1720.0 MHz	1732.5 MHz	1745.0 MHz
20	QPSK	1 RB Low	1	0	23.6	**24.3**	24.3
		1 RB Mid	1	50	23.2	23.4	23.4
		1 RB High	1	99	23.3	23.4	23.6
		50 % RB Low	50	0	22.3	**22.7**	22.7
		50 % RB Mid	50	25	22.2	22.5	22.6
		50 % RB High	50	50	22.1	22.4	22.4
		100 % RB	100	0	22.3	22.6	22.5
	16-QAM	1 RB Low	1	0	23.1	23.1	**23.2**
		1 RB Mid	1	50	23.0	22.6	22.7
		1 RB High	1	99	22.8	22.6	22.8
		50 % RB Low	50	0	21.4	21.5	**21.6**
		50 % RB Mid	50	25	21.2	21.4	21.5
		50 % RB High	50	50	21.2	21.4	21.3
		100 % RB	100	0	21.3	21.6	21.6
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			

Date, Operator:	13.05.2019 , B. Pudell

LTE FDD 5							
Configuration					Source-base time-average power [dBm] (+ Tuneup= 0.5dB)		
BW [MHz]	Mode	RB Configuration	RB	RB Offset	20407	20525	20643
					824.7 MHz	836.5 MHz	848.3 MHz
1.4	QPSK	1 RB Low	1	0	**23.7**	23.2	23.2
		1 RB Mid	1	2	23.4	23.0	23.3
		1 RB High	1	5	23.6	23.1	23.1
		50 % RB Low	3	0	**23.5**	23.0	23.1
		50 % RB Mid	3	1	23.5	23.0	23.0
		50 % RB High	3	3	23.5	23.0	23.1
		100 % RB	6	0	22.4	22.0	22.0
	16-QAM	1 RB Low	1	0	22.4	22.0	**22.5**
		1 RB Mid	1	2	22.3	22.0	22.1
		1 RB High	1	5	22.2	22.0	22.1
		50 % RB Low	3	0	**22.6**	22.2	22.3
		50 % RB Mid	3	1	22.4	22.0	22.3
		50 % RB High	3	3	22.4	22.0	22.2
		100 % RB	6	0	21.6	21.2	21.0
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	20415	20525	20635
					825.5 MHz	836.5 MHz	847.5 MHz
3.0	QPSK	1 RB Low	1	0	**23.6**	23.1	23.1
		1 RB Mid	1	7	23.4	23.0	23.3
		1 RB High	1	14	23.5	23.0	23.2
		50 % RB Low	8	0	22.4	22.0	22.0
		50 % RB Mid	8	4	**22.5**	22.0	22.4
		50 % RB High	8	7	22.4	22.0	22.1
		100 % RB	15	0	22.5	22.1	22.0
	16-QAM	1 RB Low	1	0	22.4	22.1	22.6
		1 RB Mid	1	7	22.4	22.1	22.6
		1 RB High	1	14	22.1	22.1	**22.7**
		50 % RB Low	8	0	**21.4**	21.1	21.1
		50 % RB Mid	8	4	21.3	21.0	21.2
		50 % RB High	8	7	21.3	21.0	21.1
		100 % RB	15	0	21.4	21.1	21.0
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	20425	20525	20625
					826.5 MHz	836.5 MHz	846.5 MHz
5.0	QPSK	1 RB Low	1	0	**23.6**	23.3	23.2
		1 RB Mid	1	12	23.5	23.0	22.9
		1 RB High	1	24	23.5	23.0	23.0
		50 % RB Low	12	0	**22.5**	22.1	22.0
		50 % RB Mid	12	7	22.4	22.0	22.0
		50 % RB High	12	13	22.3	21.9	22.0
		100 % RB	25	0	22.5	22.0	22.0
	16-QAM	1 RB Low	1	0	22.5	**22.9**	22.2
		1 RB Mid	1	12	22.4	22.8	21.8
		1 RB High	1	24	22.4	22.7	22.0
		50 % RB Low	12	0	**21.5**	21.2	21.1
		50 % RB Mid	12	7	21.4	21.2	21.1
		50 % RB High	12	13	21.5	21.0	21.1
		100 % RB	25	0	21.5	21.1	21.0
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	12			
		1 RB High	1	24			
		50 % RB Low	12	0			
		50 % RB Mid	12	7			
		50 % RB High	12	13			
		100 % RB	25	0			

BW [MHz]	Mode	RB Configuration	NRB	RB Offset	20450 829.0 MHz	20525 836.5 MHz	20600 844.0 MHz
10	QPSK	1 RB Low	1	0	**23.5**	23.4	23.2
		1 RB Mid	1	24	23.4	23.2	23.3
		1 RB High	1	49	23.2	23.1	23.2
		50 % RB Low	25	0	**22.4**	22.1	22.2
		50 % RB Mid	25	12	22.3	22.0	22.3
		50 % RB High	25	25	22.3	22.0	22.1
		100 % RB	50	0	22.2	22.1	22.1
	16-QAM	1 RB Low	1	0	22.4	**22.5**	22.5
		1 RB Mid	1	24	22.5	22.4	22.3
		1 RB High	1	49	22.2	22.4	22.3
		50 % RB Low	25	0	**21.5**	21.2	21.2
		50 % RB Mid	25	12	21.5	21.1	21.2
		50 % RB High	25	25	21.4	21.1	21.2
		100 % RB	50	0	21.3	21.2	21.2
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	24			
		1 RB High	1	49			
		50 % RB Low	25	0			
		50 % RB Mid	25	12			
		50 % RB High	25	25			
		100 % RB	50	0			
BW [MHz]	**Mode**	**RB Configuration**	**NRB**	**RB Offset**			
15	QPSK	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
BW [MHz]	**Mode**	**RB Configuration**	**NRB**	**RB Offset**			
20	QPSK	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
Date, Operator:			15.05.2019 , B. Pudell				

LTE FDD 12							
Configuration					Source-base time-average power [dBm] (+ Tuneup= 0.5dB)		
BW [MHz]	Mode	RB Configuration	RB	RB Offset	23017	23095	23173
					699.7 MHz	707.5 MHz	715.3 MHz
1,4	QPSK	1 RB Low	1	0	23.7	**24.2**	24.1
		1 RB Mid	1	2	23.7	24.2	24.1
		1 RB High	1	5	23.8	24.0	23.9
		50 % RB Low	3	0	22.6	22.7	22.0
		50 % RB Mid	3	1	22.8	22.7	22.7
		50 % RB High	3	3	22.7	22.8	**22.9**
		100 % RB	6	0	22.4	22.8	22.8
	16-QAM	1 RB Low	1	0	**23.1**	23.0	22.8
		1 RB Mid	1	2	22.7	23.0	22.6
		1 RB High	1	5	23.0	23.0	22.8
		50 % RB Low	3	0	22.0	22.0	22.0
		50 % RB Mid	3	1	22.2	**22.3**	22.1
		50 % RB High	3	3	22.2	22.2	23.1
		100 % RB	6	0	21.7	22.1	22.2
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	23025	23095	23165
					700.5 MHz	707.5 MHz	714.5 MHz
3,0	QPSK	1 RB Low	1	0	23.3	**24.0**	23.9
		1 RB Mid	1	7	23.4	23.8	24.0
		1 RB High	1	14	23.3	23.8	24.0
		50 % RB Low	8	0	22.6	23.1	22.9
		50 % RB Mid	8	4	22.7	**23.1**	23.0
		50 % RB High	8	7	22.7	23.0	23.0
		100 % RB	15	0	22.6	22.9	22.8
	16-QAM	1 RB Low	1	0	22.8	22.6	**23.4**
		1 RB Mid	1	7	22.7	22.3	23.3
		1 RB High	1	14	22.7	22.3	23.4
		50 % RB Low	8	0	21.8	22.2	22.0
		50 % RB Mid	8	4	22.1	**22.2**	22.1
		50 % RB High	8	7	22.0	22.1	22.1
		100 % RB	15	0	21.9	22.0	22.2
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	23035	23095	23155
					701.5 MHz	707.5 MHz	713.5 MHz
5.0	QPSK	1 RB Low	1	0	24.0	**24.3**	24.1
		1 RB Mid	1	12	24.1	23.7	23.7
		1 RB High	1	24	24.2	23.9	24.0
		50 % RB Low	12	0	22.9	22.8	22.9
		50 % RB Mid	12	7	22.9	22.9	23.0
		50 % RB High	12	13	**23.0**	22.8	23.0
		100 % RB	25	0	22.8	22.9	23.0
	16-QAM	1 RB Low	1	0	23.8	23.4	23.0
		1 RB Mid	1	12	**24.1**	23.6	23.3
		1 RB High	1	24	24.1	23.1	23.0
		50 % RB Low	12	0	22.0	22.1	22.1
		50 % RB Mid	12	7	22.2	22.1	22.2
		50 % RB High	12	13	**22.2**	22.0	22.2
		100 % RB	25	0	22.0	22.0	22.0
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	12			
		1 RB High	1	24			
		50 % RB Low	12	0			
		50 % RB Mid	12	7			
		50 % RB High	12	13			
		100 % RB	25	0			

BW [MHz]	Mode	RB Configuration	NRB	RB Offset	23060 704 MHz	23095 707.5 MHz	23130 711 MHz
10	QPSK	1 RB Low	1	0	24.1	23.9	23.6
		1 RB Mid	1	24	**24.3**	23.9	23.7
		1 RB High	1	49	24.1	23.8	23.7
		50 % RB Low	25	0	22.9	**23.1**	22.9
		50 % RB Mid	25	12	22.8	23.0	22.9
		50 % RB High	25	25	22.9	22.9	23.0
		100 % RB	50	0	22.9	23.0	22.9
	16-QAM	1 RB Low	1	0	23.2	22.1	23.0
		1 RB Mid	1	24	**23.2**	22.4	23.0
		1 RB High	1	49	23.1	22.2	22.8
		50 % RB Low	25	0	22.0	**22.3**	22.1
		50 % RB Mid	25	12	22.0	22.2	21.8
		50 % RB High	25	25	22.0	22.0	22.1
		100 % RB	50	0	22.0	22.0	22.1
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	24			
		1 RB High	1	49			
		50 % RB Low	25	0			
		50 % RB Mid	25	12			
		50 % RB High	25	25			
		100 % RB	50	0			
BW [MHz]	**Mode**	**RB Configuration**	**NRB**	**RB Offset**			
15	QPSK	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
BW [MHz]	**Mode**	**RB Configuration**	**NRB**	**RB Offset**			
20	QPSK	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
Date, Operator:			15.05.2019 , B. Pudell				

LTE FDD 13							
Configuration					Source-base time-average power [dBm] (+ Tuneup= 0.5dB)		
BW [MHz]	Mode	RB Configuration	RB	RB Offset			
1,4	QPSK	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset			
3,0	QPSK	1 RB Low	1	0			
		1 RB Mid	1	7			
		1 RB High	1	14			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	7			
		1 RB High	1	14			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	23205	23230	23255
					779.5 MHz	782 MHz	784.5 MHz
5.0	QPSK	1 RB Low	1	0	**23.0**	22.9	22.4
		1 RB Mid	1	12	22.5	22.5	22.3
		1 RB High	1	24	22.4	22.7	22.4
		50 % RB Low	12	0	21.6	21.5	21.3
		50 % RB Mid	12	7	21.6	**21.6**	21.4
		50 % RB High	12	13	21.5	21.5	21.3
		100 % RB	25	0	21.6	21.5	21.3
	16-QAM	1 RB Low	1	0	**22.8**	21.7	21.5
		1 RB Mid	1	12	22.3	21.6	21.3
		1 RB High	1	24	22.1	21.6	21.2
		50 % RB Low	12	0	**20.6**	20.6	20.5
		50 % RB Mid	12	7	20.6	20.4	20.5
		50 % RB High	12	13	20.6	20.5	20.4
		100 % RB	25	0	20.8	20.4	20.3
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	12			
		1 RB High	1	24			
		50 % RB Low	12	0			
		50 % RB Mid	12	7			
		50 % RB High	12	13			
		100 % RB	25	0			

BW [MHz]	Mode	RB Configuration	NRB	RB Offset		23230 782 MHz	
10	QPSK	1 RB Low	1	0		**23.2**	
		1 RB Mid	1	24		22.6	
		1 RB High	1	49		22.6	
		50 % RB Low	25	0		**21.7**	
		50 % RB Mid	25	12		21.5	
		50 % RB High	25	25		21.5	
		100 % RB	50	0		21.7	
	16-QAM	1 RB Low	1	0		21.7	
		1 RB Mid	1	24		**21.8**	
		1 RB High	1	49		21.6	
		50 % RB Low	25	0		**20.8**	
		50 % RB Mid	25	12		20.5	
		50 % RB High	25	25		20.5	
		100 % RB	50	0		20.8	
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	24			
		1 RB High	1	49			
		50 % RB Low	25	0			
		50 % RB Mid	25	12			
		50 % RB High	25	25			
		100 % RB	50	0			
BW [MHz]	**Mode**	**RB Configuration**	**NRB**	**RB Offset**			
15	QPSK	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
BW [MHz]	**Mode**	**RB Configuration**	**NRB**	**RB Offset**			
20	QPSK	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
Date, Operator:			15.05.2019 , B. Pudell				

LTE FDD 17							
Configuration					Source-base time-average power [dBm] (+ Tuneup= 0.5dB)		
BW [MHz]	Mode	RB Configuration	RB	RB Offset			
1,4	QPSK	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	3	0			
		50 % RB Mid	3	1			
		50 % RB High	3	3			
		100 % RB	6	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset			
3,0	QPSK	1 RB Low	1	0			
		1 RB Mid	1	7			
		1 RB High	1	14			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	7			
		1 RB High	1	14			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	2			
		1 RB High	1	5			
		50 % RB Low	8	0			
		50 % RB Mid	8	4			
		50 % RB High	8	7			
		100 % RB	15	0			
BW [MHz]	Mode	RB Configuration	RB	RB Offset	23755	23790	23825
					706.5 MHz	710 MHz	713.5 MHz
5.0	QPSK	1 RB Low	1	0		**24.3**	
		1 RB Mid	1	12		23.7	
		1 RB High	1	24		23.8	
		50 % RB Low	12	0		22.8	
		50 % RB Mid	12	7		**22.9**	
		50 % RB High	12	13		22.8	
		100 % RB	25	0		22.9	
	16-QAM	1 RB Low	1	0		23.5	
		1 RB Mid	1	12		**23.6**	
		1 RB High	1	24		23.1	
		50 % RB Low	12	0		22.1	
		50 % RB Mid	12	7		22.2	
		50 % RB High	12	13		22.0	
		100 % RB	25	0		22.0	
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	12			
		1 RB High	1	24			
		50 % RB Low	12	0			
		50 % RB Mid	12	7			
		50 % RB High	12	13			
		100 % RB	25	0			

BW [MHz]	Mode	RB Configuration	NRB	RB Offset	23780 709 MHz	23790 710 MHz	23800 711 MHz
10	QPSK	1 RB Low	1	0		**23.7**	
		1 RB Mid	1	24		23.7	
		1 RB High	1	49		23.6	
		50 % RB Low	25	0		22.9	
		50 % RB Mid	25	12		**22.8**	
		50 % RB High	25	25		23.0	
		100 % RB	50	0		22.7	
	16-QAM	1 RB Low	1	0		**23.0**	
		1 RB Mid	1	24		23.0	
		1 RB High	1	49		22.7	
		50 % RB Low	25	0		**22.1**	
		50 % RB Mid	25	12		21.8	
		50 % RB High	25	25		22.1	
		100 % RB	50	0		22.1	
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	24			
		1 RB High	1	49			
		50 % RB Low	25	0			
		50 % RB Mid	25	12			
		50 % RB High	25	25			
		100 % RB	50	0			
BW [MHz]	**Mode**	**RB Configuration**	**NRB**	**RB Offset**			
15	QPSK	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	36			
		1 RB High	1	74			
		50 % RB Low	36	0			
		50 % RB Mid	36	18			
		50 % RB High	36	39			
		100 % RB	75	0			
BW [MHz]	**Mode**	**RB Configuration**	**NRB**	**RB Offset**			
20	QPSK	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
	16-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
	64-QAM	1 RB Low	1	0			
		1 RB Mid	1	50			
		1 RB High	1	99			
		50 % RB Low	50	0			
		50 % RB Mid	50	25			
		50 % RB High	50	50			
		100 % RB	100	0			
Date, Operator:			15.05.2019 , B. Pudell				

SAR for LTE FDD 17 (Frequency range: 704 – 716 MHz) is covered by LTE FDD 12 (Frequency range: 699 – 716 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE SAR Test Reduction

According to FCC KDB 941225 D05:

The maximum average conducted output power measured according to the following configurations, for the required test channels, channel bandwidths and uplink modulations, in each frequency band, are used to support the SAR test reduction and exclusion.

a) 100% RB allocation
b) 1 RB, and also 50% RB allocation, offset to the upper edge, middle, and lower edge of the channel bandwidth of each required test channel

Start with the largest channel bandwidth then measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle, and lower edge of each required test channel.

The procedures required for 1 RB allocation are applied to measure the SAR for QPSK with 50% RB allocation.

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

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth to determine the channels and RB configurations that need SAR testing, then only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration, or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg. The equivalent channel configuration for the RB allocation, RB offset and modulation, etc., is determined for the smaller channel bandwidth according to the same number of RB allocated in the largest channel bandwidth

Applicable test reduction:

The ouput power for QPSK modulation with 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations. Hence the SAR measurements are started with 1 RB and 50 % RB allocation for QPSK modulation.

The highest maximum output power for the configuration in the higher order modulation is not > ½ dB higher than the same configuration in QPSK. Hence the SAR evaluation is started with QPSK modulation only.

The highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is not > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration. Hence the SAR evaluation is started with the highest channel bandwidth only.

1.7 Conducted Power Values for supported LTE CA DL operating modes

According to FCC KDB 941225 D05A, when carrier aggregation is limited to downlink only; i.e., there is no uplink carrier aggregation, uplink maximum output power (single carrier) is measured for the supported combinations of downlink carrier aggregation.

i. According to the frequency bands and channel bandwidths allowed for the uplink and downlink configuration combinations.

ii. Uplink maximum output power is measured with downlink carrier aggregation active, only for the channel with highest measured maximum output power when downlink carrier aggregation is inactive, to confirm that when downlink carrier aggregation is active uplink maximum output power remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output power measured when downlink carrier aggregation inactive

   a) The implemented CA configurations must be clearly identified along with the power measurement results; for example, CA_(band #)(bandwidth class) … for intra-band configurations and CA_(band #)(bandwidth class)-(band #)(bandwidth class) … for interband configurations, with respect to the number of carriers being aggregated. In some cases, multiple CA configurations are defined for different combinations of allowed channel bandwidth, which must be clearly identified to support the power measurement results. It should also be identified if all component carriers (CC) can be used as the primary and secondary carrier (PCC and SCC); therefore, uplink power measurements should be considered with the applicable combinations of PCC and SCC.

   b) The channel numbers and channel frequencies for both uplink and downlink must be clearly documented for the power measurement. The uplink channel is selected according to b) ii) above. The downlink channels selected to perform the uplink power measurement must satisfy 3GPP channel spacing (5.4.1A of 3GPP TS 36.521 or equivalent) and channel bandwidth (5.4.2A) requirements. The nominal channel spacing is determined by [BW1 + BW2 – 0.1*|BW1 – BW2|]/2 MHz, where BW1 and BW2 are the channel bandwidths of the CC in a 2-CC aggregation configuration.

   c) The downlink PCC channel should be paired with the uplink channel according to normal configurations, as if there is no carrier aggregation. The downlink SCC should be adjacent to the PCC and remain within the downlink transmission band for contiguous intra-band CA. For non-contiguous intra-band CA, the SCC should be selected to provide maximum separation from the PCC and must remain fully within the downlink transmission band. For inter-band CA, the SCC should be near the middle of its transmission band.

iii. When the uplink maximum output power conditions in ii) are not satisfied, a KDB inquiry is required to determine if SAR evaluation for the uplink with downlink carrier aggregation active may be necessary.

iv. When SAR is not required for downlink only carrier aggregation and provided it is fully documented in the SAR report according to procedures in this KDB, a PAG is also not required

Supported LTE CA DL operating modes:

E-UTRA CA configuration		
DL Inter-Band (2Bands, 2CC)	**DL Intra-Band (Non-Contignous)**	**DL Intra-Band (Contignous)**
CA_2A_5A	CA_2A_2A	CA_2C
CA_2A_12A	CA_4A_4A	
CA_2A_13A		
CA_2A_29A		
CA_4A_5A		
CA_4A_12A		
CA_4A_13A		
CA_4A_29A		

LTE Advanced CA combinations:

DL Intra-Band contignous (1 Bands, 2 CC_{Max}) acc. to 3GPP 36.521-1:

E-UTRA CA config	E-UTRA Band	Bandwidth						Aggregated BW_{max} [MHz]	BW combination set
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
CA_2C	Channel x			Yes				40	0
	Channel y						Yes		
	Channel x				Yes				
	Channel y					Yes	Yes		
	Channel x					Yes			
	Channel y				Yes	Yes	Yes		
	Channel x						Yes		
	Channel y			Yes	Yes	Yes	Yes		

DL Intra-Band non-contignous (1 Bands, 2 CC_{Max}) acc. to 3GPP 36.521-1:

E-UTRA CA config	E-UTRA Band	Bandwidth						Aggregated BW_{max} [MHz]	BW combination set
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
CA_2A_2A	Channel x			Yes	Yes	Yes	Yes	40	0
	Channel y			Yes	Yes	Yes	Yes		
CA_4A_4A	Channel x			Yes	Yes	Yes	Yes	40	0
	Channel y			Yes	Yes	Yes	Yes		
	Channel x			Yes	Yes			20	1
	Channel y			Yes	Yes				

DL Inter-Band (2 Bands, 2 CC_{Max}) acc. to 3GPP 36.521-1:

E-UTRA CA config	E-UTRA Band	Bandwidth						Aggregated BW_{max} [MHz]	BW combination set
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
CA_2A_5A	Band 2			Yes	Yes	Yes	Yes	30	0
	Band 5			Yes	Yes				
	Band 2			Yes	Yes			20	1
	Band 5			Yes	Yes				
CA_2A_12A	Band 2			Yes	Yes	Yes	Yes	30	0
	Band 12			Yes	Yes				
	Band 2			Yes	Yes	Yes	Yes	30	1
	Band 12		Yes	Yes	Yes				
	Band 2			Yes	Yes			20	2
	Band 12			Yes	Yes				
CA_2A_13A	Band 2			Yes	Yes	Yes	Yes	30	0
	Band 13				Yes				
	Band 2			Yes	Yes			20	1
	Band 13				Yes				
CA_2A_29A	Band 2			Yes	Yes			20	0
	Band 29		Yes	Yes	Yes				
	Band 2			Yes	Yes			20	1
	Band 29			Yes	Yes				
	Band 2			Yes	Yes	Yes	Yes	30	2
	Band 29			Yes	Yes				
CA_4A_5A	Band 2			Yes	Yes			20	0
	Band 5			Yes	Yes				
	Band 2			Yes	Yes	Yes	Yes	30	1
	Band 5			Yes	Yes				
CA_4A_12A	Band 4	Yes	Yes	Yes	Yes			30	0
	Band 12			Yes	Yes				
	Band 4	Yes	Yes	Yes	Yes	Yes	Yes	30	1
	Band 12			Yes	Yes				
	Band 4			Yes	Yes	Yes	Yes	30	2
	Band 12		Yes	Yes	Yes				
	Band 4			Yes	Yes			20	3
	Band 12			Yes	Yes				
	Band 4			Yes	Yes	Yes	Yes	30	4
	Band 12			Yes	Yes				
	Band 4			Yes	Yes	Yes		20	5
	Band 12			Yes					
CA_4A_13A	Band 4			Yes	Yes	Yes	Yes	30	0
	Band 13				Yes				
	Band 4			Yes	Yes			20	1
	Band 13				Yes				
CA_4A_29A	Band 4			Yes	Yes			20	0
	Band 29		Yes	Yes	Yes				
	Band 4			Yes	Yes			20	1
	Band 29			Yes	Yes				
	Band 4			Yes	Yes	Yes	Yes	30	2
	Band 29			Yes	Yes				

Testresults of conducted Power Values for supported LTE CA DL operating modes

DL Intra-Band (Contingnous) (1 Band, 2 CC_{Max})

E-UTRA CA configuration	Bands		DL						UL										
	PCC	SCC	PCC			SCC			PCC										
	1st	2nd	BW [MHz]	Freq [MHz]	Ch	BW [MHz]	Freq [MHz]	Ch	Mod	RB	Off set	BW [MHz]	Freq [MHz]	Ch	Aggr BW_{max}	MPR [dB]	PWR CA_{off}	PWR CA_{on}	Delta [dB]
CA_2C	2C	2C	20	1940.0	700	20	1959.8	898	QPSK	1	0	20	1860.0	18700	40	0	24.0	24.03	0.03

DL Intra-Band (Non-Contingnous) (1 Band, 2 CC_{Max})

E-UTRA CA configuration	Bands		DL						UL										
	PCC	SCC	PCC			SCC			PCC										
	1st	2nd	BW [MHz]	Freq [MHz]	Ch	BW [MHz]	Freq [MHz]	Ch	Mod	RB	Off set	BW [MHz]	Freq [MHz]	Ch	Aggr BW_{max}	MPR [dB]	PWR CA_{off}	PWR CA_{on}	Delta [dB]
CA_2A_2A	2A	2A	20	1940.0	700	20	1980.0	1100	QPSK	1	0	20	1860.0	18700	40	0	24.0	23.96	-0.04
CA_4A_4A	4A	4A	20	2145.0	2300	20	2120.0	2050	QPSK	1	0	20	1745.0	20300	40	0	24.3	24.2	-0.1

DL Inter-Band (2Bands, 2CC)

E-UTRA CA configuration	Bands		DL						UL										
	PCC	SCC	PCC			SCC			PCC										
	1st	2nd	BW [MHz]	Freq [MHz]	Ch	BW [MHz]	Freq [MHz]	Ch	Mod	RB	Off set	BW [MHz]	Freq [MHz]	Ch	Aggr BW_{max}	MPR [dB]	PWR CA_{off}	PWR CA_{on}	Delta [dB]
CA_2A_5A	2A	5A	20	1940.0	700	10	881.5	2525	QPSK	1	0	20	1860.0	18700	30	0	24.0	24.15	0.15
	5A	2A	5	871.5	2425	20	1960.0	900	QPSK	1	0	5	826.5	20425	30	0	23.6	23.73	0.13
CA_2A_12A	2A	12A	20	1940.0	700	10	737.5	5095	QPSK	1	0	20	1860.0	18700	30	0	24.0	24.05	0.05
	12A	2A	10	734.0	5060	20	1960.0	900	QPSK	1	24	10	704.0	23060	30	0	24.3	24.45	0.15
CA_2A_13A	2A	13A	20	1940.0	700	10	751.0	5230	QPSK	1	0	20	1860.0	18700	30	0	24.0	23.90	-0.10
	13A	2A	10	751.0	5230	20	1960.0	900	QPSK	1	0	10	782.0	23230	30	0	23.2	22.70	-0.50
CA_2A_29A	2A	29A	20	1940.0	700	10	722.5	9715	QPSK	1	0	20	1860.0	18700	30	0	24.0	24.14	0.14
	DL only																		
CA_4A_5A	4A	5A	20	2145.0	2300	10	881.5	2525	QPSK	1	0	20	1745.0	20300	30	0	24.3	24.05	-0.25
	5A	4A	5	871.5	2425	20	2132.5	2175	QPSK	1	0	5	826.5	20425	30	0	23.6	23.75	0.15
CA_4A_12A	4A	12A	20	2145.0	2300	10	737.5	5095	QPSK	1	0	20	1745.0	20300	30	0	24.3	24.09	-0.21
	12A	4A	10	734.0	5060	20	2132.5	2175	QPSK	1	24	10	704.0	23060	30	0	24.3	24.52	0.22
CA_4A_13A	4A	13A	20	2145.0	2300	10	751.0	5230	QPSK	1	0	20	1745.0	20300	30	0	24.3	24.00	-0.30
	13A	4A	10	751.0	5230	20	2132.5	2175	QPSK	1	0	10	782.0	23230	30	0	23.2	22.65	-0.55
CA_4A_29A	4A	29A	20	2145.0	2300	10	722.5	9715	QPSK	1	0	20	1745.0	20300	30	0	24.3	24.10	-0.10
	DL only																		

When downlink carrier aggregation is active, uplink maximum output power remains within the specified tune-up tolerance limits and is not more than ¼ dB higher than the maximum output power measured when downlink carrier aggregation inactive. Hence no SAR evaluation, KDB inquiry or PAG is needed according to 941225 D05A.

1.8 Standalone Operational Mode Test Exclusion for FCC

According to KDB 447498 D01 for standalone SAR evaluation the test exclusion power condition is given by

$$\frac{\max Power, mW}{test\ distance, mm} \cdot \sqrt{f_{GHz}} \leq 3.0$$

for test separation distance ≤ 50mm. For test separation distances > 50mm, the SAR test exclusion threshold is:

$$P_{TH}[mW] = Power\ allowed\ at\ numeric\ threshold\ for\ 50mm + (test\ distance, mm - 50mm) \cdot \frac{f[MHz]}{150}\ ,$$
$$100\ MHz < f < 1500\ MHz$$

$$P_{TH}[mW] = Power\ allowed\ at\ numeric\ threshold\ for\ 50mm + (test\ distance, mm - 50mm) \cdot 10\ ,$$
$$1500\ MHz < f < 6\ GHz$$

Maximum conducted output power of supported bands and modulation configurations (FCC):

Band	Modulation	Pcond $_{Max}$ [dBm] [mW]	Tune-up tolerance [dB]	Power Scaling Factor*	Pcond $_{Max}$ + tune-up [dBm] [mW]
GSM 850	GMSK	27.4 550	- 1 / +0.5	1.12	27.9 616
PCS 1900	GMSK	26.3 430	- 1 / +0.5	1.12	26.8 482
W-CDMA FDD II	QPSK	23.8 240	- 1 / +0.5	1.12	24.3 269
W-CDMA FDD IV	QPSK	23.9 250	- 1 / +0.5	1.12	24.4 280
W-CDMA FDD V	QPSK	23.6 230	- 1 / +0.5	1.12	24.1 258
LTE FDD 2	QPSK	23.5 220	- 1 / +0.5	1.12	24.0 246
LTE FDD 4	QPSK	23.8 240	- 1 / +0.5	1.12	24.3 269
LTE FDD 5	QPSK	23.1 200	- 1 / +0.5	1.12	23.6 224
LTE FDD 12	QPSK	23.8 240	- 1 / +0.5	1.12	24.3 269
LTE FDD 13	QPSK	22.7 190	- 1 / +0.5	1.12	23.2 213
IEEE 802.11b	DBPSK	16.5 45	- 1 / +0.5	1.12	17.0 50
BT - BR	QPSK	7.5 5.6	- 1 / +0.5	1.12	8.0 6.3
BT – BR (LR)	QPSK	8.9 7.8	- 1 / +1	1.26	9.9 9.8
* Scaling factor = Max. conducted power (including tune up tolerance) [mW] / measured conducted power [mW]					

Taking into account the defined antenna distances and conducted output power values and tune-up tolerances for all wireless transmission modes the following SAR test exclusion power values are determined for the EUT according to FCC KDB 447498 D01.

SAR Test Exclusion FCC

Mode	$Pcond_{Max}$ + tune-up [mW]	Antenna	Region	EUT Edge											
				Front		Back		Left		Right		Top		Bottom	
				Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]
BT – BR (LR)	9.8	Intern	FCC	25	48	5.5	11	45	86	55	145	**4**	**8**	255	2146
BT – BR	6.3	Intern	FCC	31.6	60	13	25	107	667	37	71	137	967	136	957
IEEE 802.11b	50	Intern	FCC	31.6	60	**13**	**25**	107	667	37	71	137	967	136	957
LTE 12-1	269	Main	FCC	**23**	**82**	**15.8**	**57**	106	442	**14**	**50**	220	977	**14.5**	**52**
LTE 13-1	213	Main	FCC	**23**	**78**	**15.8**	**54**	106	461	**14**	**48**	220	1056	**14.5**	**49**
GPRS (850)	616	Main	FCC	**23**	**76**	**15.8**	**52**	**106**	**473**	**14**	**46**	220	1113	**14.5**	**48**
UMTS 5	258	Main	FCC	**23**	**76**	**15.8**	**52**	106	473	**14**	**46**	220	1111	**14.5**	**48**
LTE 5-1	224	Main	FCC	**23**	**76**	**15.8**	**52**	106	473	**14**	**46**	220	1104	**14.5**	**48**
UMTS 4	280	Main	FCC	**23**	**53**	**15.8**	**36**	106	674	**14**	**32**	220	1813	**14.5**	**33**
LTE 4-1	269	Main	FCC	**23**	**53**	**15.8**	**36**	106	674	**14**	**32**	220	1814	**14.5**	**33**
GPRS (1900)	482	Main	FCC	**23**	**50**	**15.8**	**35**	106	669	**14**	**31**	220	1809	**14.5**	**32**
UMTS 2	269	Main	FCC	**23**	**50**	**15.8**	**35**	106	669	**14**	**31**	220	1809	**14.5**	**32**
LTE 2-1	246	Main	FCC	**23**	**50**	**15.8**	**35**	106	670	**14**	**31**	220	1810	**14.5**	**32**

Comments: All bold Threshold values are above the limit and have to be measured

Date, Operator:	17.05.2019 , B. Pudell

1.9 Standalone Operational Mode Exemption limits for ISED

According to ISED RSS-102 SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the Table below:

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW
Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

According to RSS-102, output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power.

Maximum radiated output power of supported bands and modulation configurations (ISED):

Band	Modulation	Antenna Gain [dB]	$Pcond_{Max}$ + Gain [dBm] / [mW]	Tune-up tolerance [dB]	$Pcond_{Max}$ + Gain + tune-up [dBm] / [mW]
GSM 850	GMSK	2	29.4 / 870	- 1 / +0.5	29.9 / 974
PCS 1900	GMSK	5	31.3 / 1300	- 1 / +0.5	31.8 / 1456
W-CDMA FDD II	QPSK	5	28.8 / 760	- 1 / +0.5	29.3 / 851
W-CDMA FDD IV	QPSK	5	28.9 / 780	- 1 / +0.5	29.4 / 874
W-CDMA FDD V	QPSK	2	25.6 / 360	- 1 / +0.5	26.1 / 403
LTE FDD 2	QPSK	5	28.5 / 710	- 1 / +0.5	29.0 / 795
LTE FDD 4	QPSK	5	28.8 / 760	- 1 / +0.5	29.3 / 851
LTE FDD 5	QPSK	2	25.1 / 320	- 1 / +0.5	25.6 / 358
LTE FDD 12	QPSK	2	25.8 / 380	- 1 / +0.5	26.3 / 426
LTE FDD 13	QPSK	2	24.7 / 300	- 1 / +0.5	25.2 / 336
IEEE 802.11	DBPSK	1	17.5 / 56	- 1 / +0.5	18.0/ 63
BT - BR	GFSK	1	8.5 / 7.1	- 1 / +0.5	9.0 / 8.0
BT – BR (LR)	GFSK	1	9.9 / 9.8	- 1 / +1	10.9 / 12
Comment:					

Taking into account the defined antenna distances and maximum conducted or radiated output power values and tune-up tolerances for all wireless transmission modes the following SAR test exclusion power values are determined for the EUT according to ISED RSS-102.

SAR Test Exclusion ISED

Mode	$Pcond_{Max}$ + Gain + tune-up [mW]	Antenna	Region	EUT Edge											
				Front		Back		Left		Right		Top		Bottom	
				Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]
BT – BR (LR)	12	Intern	ISED	25	52	**5.5**	**5**	45	235	55	<309	**4**	**4**	255	>309
BT - BR	8	Intern	ISED	31.6	95	13	12	107	>309	37	143	137	>309	136	>309
IEEE 802.11	63	Intern	ISED	31.6	95	**13**	**12**	107	>309	37	143	137	>309	136	>309
LTE 12	426	Main	ISED	**23**	**80**	**15.8**	**60**	**106**	>148	**14**	**54**	220	>158	**14.5**	**55**
LTE 13	336	Main	ISED	**23**	**70**	**15.8**	**51**	**106**	**>140**	**14**	**46**	220	>141	**14.5**	**47**
GPRS (850)	974	Main	ISED	**23**	**59**	**15.8**	**44**	**106**	**>130**	**14**	**40**	220	>130	**14.5**	**41**
UMTS 5	403	Main	ISED	**23**	**59**	**15.8**	**44**	**106**	**>130**	**14**	**40**	220	>130	**14.5**	**41**
LTE 5	358	Main	ISED	**23**	**59**	**15.8**	**44**	**106**	**>130**	**14**	**40**	220	>131	**14.5**	**41**
UMTS 4	874	Main	ISED	**23**	**43**	**15.8**	**23**	**106**	**>389**	**14**	**20**	220	>389	**14.5**	**21**
LTE 4	851	Main	ISED	**23**	**43**	**15.8**	**23**	**106**	**>389**	**14**	**20**	220	>383	**14.5**	**21**
GPRS (1900)	1456	Main	ISED	**23**	**50**	**15.8**	**20**	**106**	**>431**	**14**	**16**	220	>428	**14.5**	**17**
UMTS 2	851	Main	ISED	**23**	**50**	**15.8**	**20**	**106**	**>431**	**14**	**16**	220	>425	**14.5**	**17**
LTE 2	795	Main	ISED	**23**	**50**	**15.8**	**20**	**106**	**>431**	**14**	**16**	220	>419	**14.5**	**17**

Comments: All bold Threshold values are above the limit and have to be measured

Date, Operator:	17.05.2019 , B. Pudell

1.10 SAR value estimation for multi-transmitter evaluation

According to KDB 447498 D01 for standalone SAR evaluation the estimated SAR is given by

$$\frac{\max Power\ (including\ tune\ up\ tolerance), mW}{min.test\ separation\ distance, mm} \cdot \sqrt{\frac{f_{GHz}}{x}} \leq 0.4 \frac{W}{kg}$$

x=7.5 for 1-g SAR, and x=18.75 for 10-g SAR, for test separation ≤ 50mm.

For test separation distance > 50mm, the estimated SAR value is 0.4 W/kg

1.11 Supported concurrent (multi-transmitter) operating modes

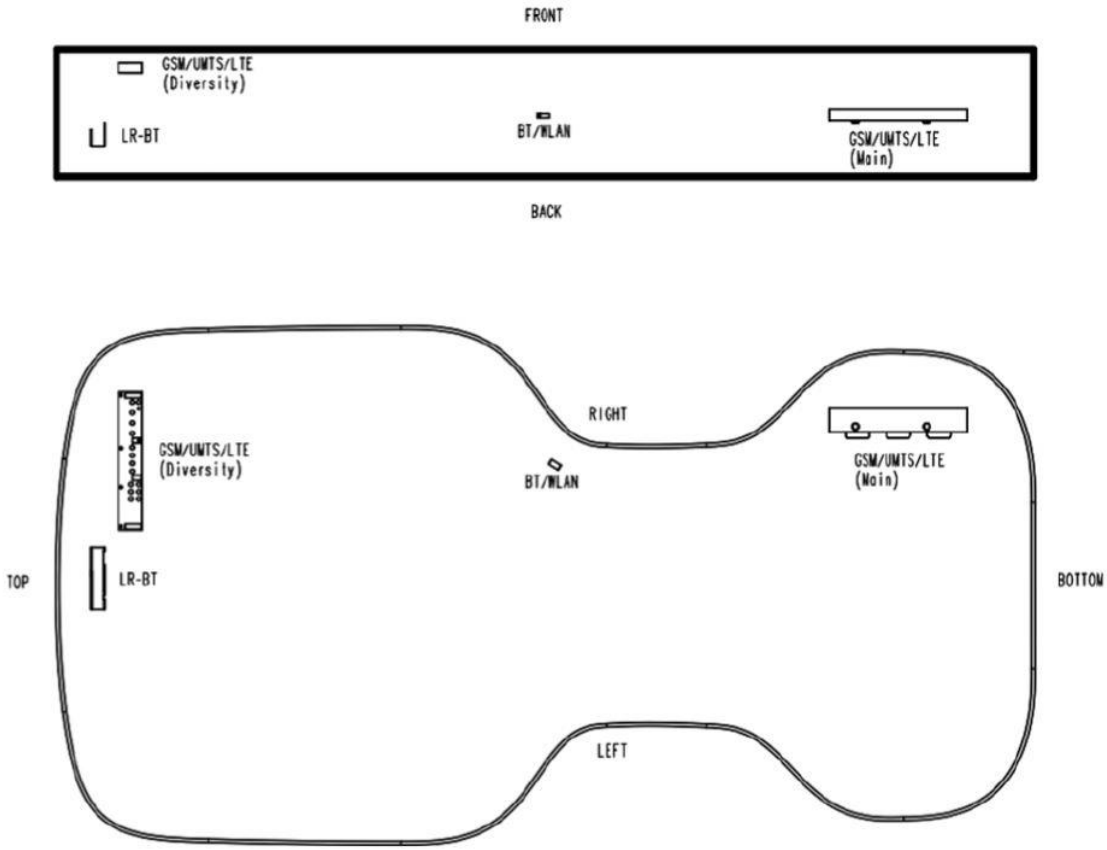
The ability of all other transmitters to transmit simultaneously is given in the following table:

	LR-BT module	IEEE 802.11+BT module	Mobile-module
LR-BT module	N/A	Yes	Yes
IEEE 802.11+BT module	Yes	N/A	Yes
Mobile-module	Yes	Yes	N/A

1.12 Supported use cases

Use case	Distance to human body	corresponding test configuration
EUT placed at human body	0 mm (worst case)	body-worn device

Antenna position inside EUT



Distance of each used antenna to the device surface and between

Antennas	to Back Side (mm)	to Front Side (mm)	to Bottom Side (mm)	to Top Side (mm)	to Left Side (mm)	to Right Side (mm)	to BT/WLAN (mm)	to LR-BT (mm)	to Main (mm)	to Diversity (mm)
GSM/UMTS/LTE (Main)	15.8	23	14.5	220	106	14	80	210		198
GSM/UMTS/LTE (Diversity)	25	10	245	15	90	15	122	18		
BT/WLAN	13	31.6	136	137	107	37		133		
LR-BT	5.5	25	255	4	45	55				

Antenna GSM/UMTS/LTE (Diversity) will be used for RX only.

1.13 Radio Test Modes

The following table summarizes the required wireless transmission modes for SAR evaluation after applicable SAR test reduction and SAR test exclusion according to FCC and ISED rules.

Mode	Settings
GPRS	Band = GSM 850 & PCS 1900 Mode = TX testmode Modulation = GMSK Time Slot = 4x UL Power level = maximum (Gamma3)
UMTS 2	Band = W-CDMA FDD II Mode = TX testmode Modulation = QPSK (12.2kbps) Duty cycle = 100% Power level = maximum (TPC=All1)
UMTS 4	Band = W-CDMA FDD IV Mode = TX testmode Modulation = QPSK (12.2kbps) Duty cycle = 100% Power level = maximum (TPC=All1)
UMTS 5	Band = W-CDMA FDD V Mode = TX testmode Modulation = QPSK (12.2kbps) Duty cycle = 100% Power level = maximum (TPC=All1)
LTE 2-1	Band = LTE FDD 2 Mode = TX testmode Modulation = QPSK (BW20, RB 1 start 0) Duty cycle = 100% Power level = maximum
LTE 2-2	Band = LTE FDD 2 Mode = TX testmode Modulation = QPSK (BW20, RB 50 start 0) Duty cycle = 100% Power level = maximum
LTE 4-1	Band = LTE FDD 4 Mode = TX testmode Modulation = QPSK (BW20, RB 1 start 0) Duty cycle = 100% Power level = maximum
LTE 4-2	Band = LTE FDD 4 Mode = TX testmode Modulation = QPSK (BW20, RB 50 start 0) Duty cycle = 100% Power level = maximum
LTE 5-1	Band = LTE FDD 5 Mode = TX testmode Modulation = QPSK (BW10, RB 1 start 0) Duty cycle = 100% Power level = maximum

LTE 5-2	Band = LTE FDD 5 Mode = TX testmode Modulation = QPSK (BW10, RB 25 start 0) Duty cycle = 100% Power level = maximum
LTE 12-1	Band = LTE FDD 12 Mode = TX testmode Modulation = QPSK (BW10, RB 1 start 24) Duty cycle = 100% Power level = maximum
LTE 12-2	Band = LTE FDD 12 Mode = TX testmode Modulation = QPSK (BW10, RB 25 start 0) Duty cycle = 100% Power level = maximum
LTE 13-1	Band = LTE FDD 13 Mode = TX testmode Modulation = QPSK (BW10, RB 1 start 0) Duty cycle = 100% Power level = maximum
LTE 13-2	Band = LTE FDD 13 Mode = TX testmode Modulation = QPSK (BW10, RB 25 start 0) Duty cycle = 100% Power level = maximum
BT – BR (LR)	Mode = TX testmode BT-LR Modulation = GFSK (DH5) Duty cycle = 77% Power level = maximum Antenna = integrated
IEEE 802.11b	Mode = TX testmode Modulation = DBPSK (1 Mbps) Duty cycle = 95% Power level = maximum Antenna = integrated
Comment:	

1.14 Test Positions

The following table summarizes the required test positions for SAR evaluation according to use case information from the customer.

Position	Description
Flat Front	antenna integral, fixed EUT front against body Distance between EUT and phantom surface 0 mm
Flat Back	antenna integral, fixed EUT back against body Distance between EUT and phantom surface 0 mm
Flat Left	antenna integral, fixed EUT left against body Distance between EUT and phantom surface 0 mm
Flat Right	antenna integral, fixed EUT right against body Distance between EUT and phantom surface 0 mm
Flat Top	antenna integral, fixed EUT top against body Distance between EUT and phantom surface 0 mm
Flat Bottom	antenna integral, fixed EUT bottom against body Distance between EUT and phantom surface 0 mm
Comment:	

1.15 Test Equipment Used During Testing

SAR Measurement					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Stäubli Robot	Stäubli	RX90B L	EF00271	functional test	functional test
Stäubli Robot Controller	Stäubli	CS7MB	EF00272	functional test	functional test
DASY 5 Measurement Server	Schmid & Partner		EF00273	functional test	functional test
Control Pendant	Stäubli		EF00274	functional test	functional test
Dell Computer	Schmid & Partner	Intel	EF00275	functional test	functional test
Data Acquisition Electronics	Schmid & Partner	DAE3V1	EF00276	2018-09	2019-09
Dosimetric E-Field Probe	Schmid & Partner	EX3DV4	EF00826	2018-09	2019-09
System Validation Kit	Schmid & Partner	D300V3	EF00299	2018-09	2021-09
System Validation Kit	Schmid & Partner	D450V3	EF00300	2018-09	2021-09
System Validation Kit	Schmid & Partner	D900V2	EF00281	2018-09	2021-09
System Validation Kit	Schmid & Partner	D1800V2	EF00282	2018-09	2021-09
System Validation Kit	Schmid & Partner	D1900V2	EF00283	2018-09	2021-09
System Validation Kit	Schmid & Partner	D2450V2	EF00284	2018-09	2021-09
System Validation Kit	Schmid & Partner	D5GHZV2	EF00827	2018-09	2021-09
Flat phantom	Schmid & Partner	V 4.4	EF00328	no calibration required	no calibration required
Oval flat phantom	Schmid & Partner	ELI 4	EF00289	functional test	functional test
Mounting Device	Schmid & Partner	V 3.1	EF00287	functional test	functional test
Millivoltmeter	Rohde & Schwarz	URV 5	EF00126	2016-08	2019-08
Power sensor	Rohde & Schwarz	NRV-Z2	EF00125	2017-07	2019-07
RF signal generator	Rohde & Schwarz	SMP 02	EF00165	2017-07	2019-07
Insertion unit	Rohde & Schwarz	URV5-Z4	EF00322	2017-08	2019-08
Directional Coupler	HP	HP 87300B	EF00288	functional test	functional test
Radio Communication Tester	Rohde & Schwarz	CMD65	EF00625	ICO (initial calibration only)	ICO (initial calibration only)
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	EF00304	2018-07	2019-07
Network Analyzer 300 kHz to 3 GHz	Agilent	8752C	EF00140	2018-07	2019-07
Dielectric Probe Kit	Agilent	85070C	EF00291	functional test	functional test
Dielectric Probe Kit	SPEAG	DAK-3.5	EF00945	2018-09	2019-09
DAK Measurement Software	SPEAG	DAKS	EF00965	-	-
Thermometer	LKM electronic GmbH	DTM3000	EF00967	2019-01	2020-01

2 Result Summary

447498 D01 General RF Exposure Guidance, RSS-102					
Product Specific Standard Section	**Requirement – Test**	**Reference Method**	**Maximum SAR [W/kg]**	**Result**	**Remarks**
447498 D01 General RF Exposure Guidance RSS-102 Section 3	Single-band conformity	KDB Publication 447498 KDB Publication 248227 KDB Publication 865664	**1.389**	PASS	Clause 6.4
447498 D01 General RF Exposure Guidance RSS-102 Section 3	Multi-band conformity	KDB Publication 447498 KDB Publication 648474 KDB Publication 865664	**1.389**	PASS	Clause 6.5
Remarks:					

3 Definitions

The specific absorption rate (SAR) is defined as the time derivative of the incremental energy (*dW*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element *(dV*) of a given density (ρ_t), expressed in watts per kilogram (W/kg)

$$SAR = d/dt\ (dW/dm) = d/dt\ (dW/\rho_t dV) = \sigma/\rho_t\ |E_t|^2$$

where

$$dW/dt = \int_V E\ J\ dV = \int_V \sigma E^2\ dV$$

3.1 Controlled 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. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category and the general population/uncontrolled exposure limits apply to these devices.

3.2 Uncontrolled Exposure

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. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on the risk of potential exposure and instructions on methods to minimize such exposure risks.

3.3 Localized SAR

Compliance with the localized SAR limits is demonstrated using the head and trunk limit because this SAR limit is only half the limbs limit value. The values are obtained by SAR measurements according to EN 62209-2.

4 Localized SAR Measurement Equipment

The measurements were performed with Dasy5 automated near-field scanning system comprised of high precision robot, robot controller, computer, e-field probe, probe alignment unit, phantoms, non-conductive phone positioned and software extension.

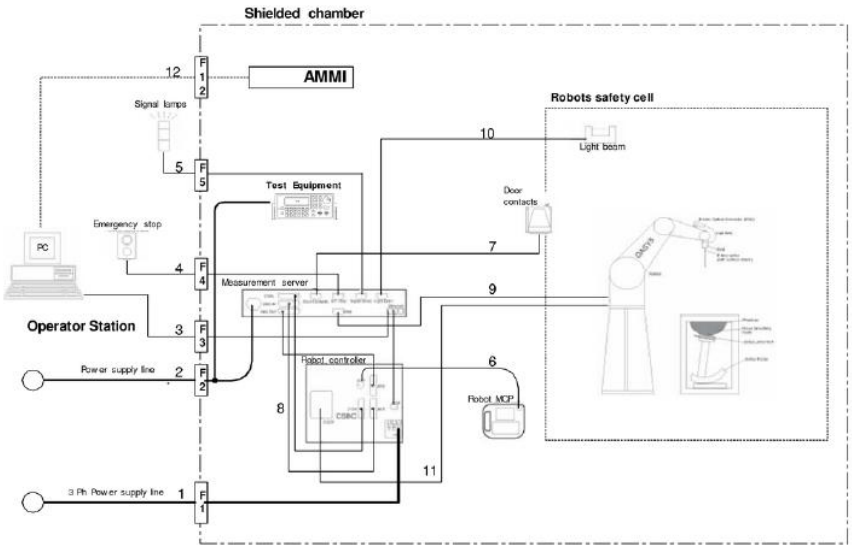
4.1 Complete SAR DASY5 Measurement System

Measurements are performed using the DASY5 automated assessment system made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland.

DASY 5 SAR Measurement Setup

The following Diagram show the elements involved in the measurement setup.

DASY 5 SAR Measurement Diagram



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

DASY5 SAR Measurement System	
Device	Description:
RX90BL	A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software.
Probe Alignment Unit	A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
Teach Pendant	The Manual Control Pendant (MCP), also called the manual teach pendant, is the user interface to the robot. In DASY, it is used for certain installation and teach procedures
Signal Lamps	External warning lamp which indicates when the robot arm is powered-on and if the robot is under software control or in manual mode (controlled with the teach pendant).
DAE	The data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
E-Field Probes	Isotropic E-Field probe optimized and calibrated for E-field measurements in free space.
EOC	The electro-optical converter (EOC) performs the conversion between optical and electrical signals
Measurement Server	The functions of the measurement server is to perform the time critical task such as signal filtering, surveillance of the robot operation, fast movement interrupts.
Control Computer	A computer operating Windows 2000 or Windows NT with DASY 4 Software.
Control Software	DASY4 and SEMCAD post processing Software
SAM Twin Phantom	The SAM twin phantom enabling testing left-hand and right-hand usage.
Flat Phantom	Flat Phantom (only for body-mounted transceivers operating below 800 MHz).
Tissue simulating liquid	Tissue simulating liquid mixed according to the given recipes.
Device Holder	The device holder for handheld mobile phones.
System Validation Dipoles	System validation dipoles allowing to validate the proper functioning of the system.

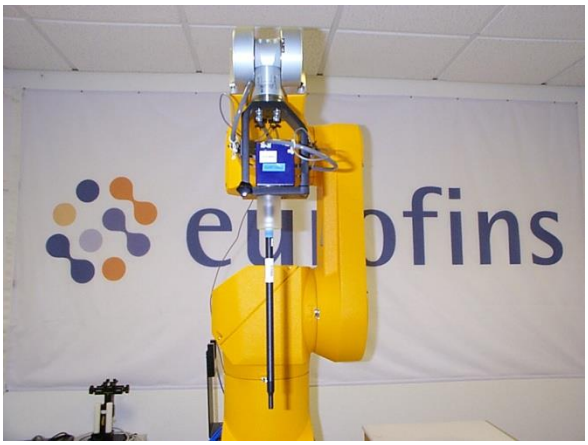
4.2 Robot Arm

The DASY5 system uses the high precision robots RX90BL type out of the newer series from Stäubli SA (France).

The RX robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

Robot arm

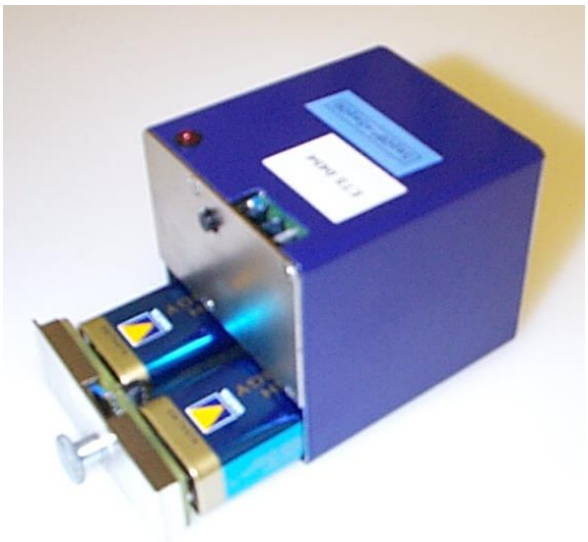


4.3 Data Acquisition Electronics

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. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

Data Acquisition Electronics



4.4 Isotropic E-Field Probe ≤ 3 GHz

Probe Specifications

Construction:

One dipole parallel, two dipoles normal to probe axis built-in shielding against static charges.

Calibration:

In air from 10 MHz to 2.5 GHz,
In brain and muscle simulating tissue at Frequencies of 835MHz, 900MHz, 1800MHz, 1900 MHz and 2450 MHz

Frequency:

10MHz to > 3GHz,
Linearity ±0.2dB (30MHz to 3GHz)

Directivity:

±0.2dB in HSL (rotation around probe axis)
±0.4dB in HSL (rotation normal to probe axis)

Dynamic Range:

5µW/g to > 100mW/g

Linearity:

±0.2dB

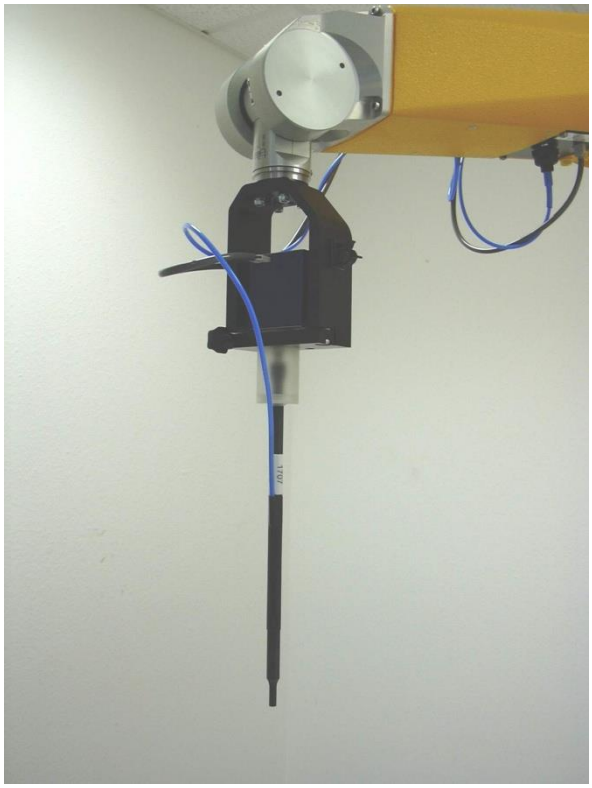
Dimensions:

Overall Length: 330mm (Tip: 16mm),
Tip Diameter: 6.8mm (Body: 12mm),
Distance from probe tip to dipole centers: 2.7mm

Application:

General dosimetry up to 3 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms

Isotropic E-Field Probe ET3DV6



4.5 Isotropic E-Field Probe ≤ 6 GHz

Probe Specifications

Construction:

One dipole parallel, two dipoles normal to probe axis built-in shielding against static charges.

Calibration:

In air from 10 MHz to 6 GHz,
In brain and muscle simulating tissue at Frequencies of 5200, 5500, 5800

Frequency:

10MHz to 6GHz,
Linearity ±0.2dB (30MHz to 6GHz)

Directivity:

±0.3dB in HSL (rotation around probe axis)
±0.5dB in tissue material (rotation normal to probe axis)

Dynamic Range:

10µW/g to > 100mW/g

Linearity:

±0.2dB

Dimensions:

Overall Length: 337mm (Tip: 20mm),
Tip Diameter: 2.5mm (Body: 12mm),
Distance from probe tip to dipole centers: 1mm

Application:

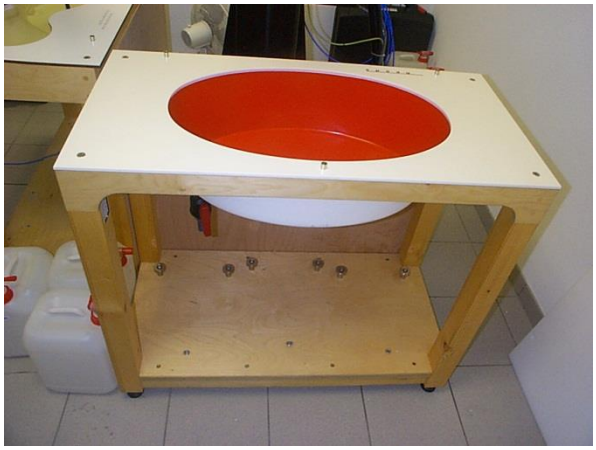
General dosimetry up to 6 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms

Isotropic E-Field Probe EX3DV4

4.6 Test phantom and positioner

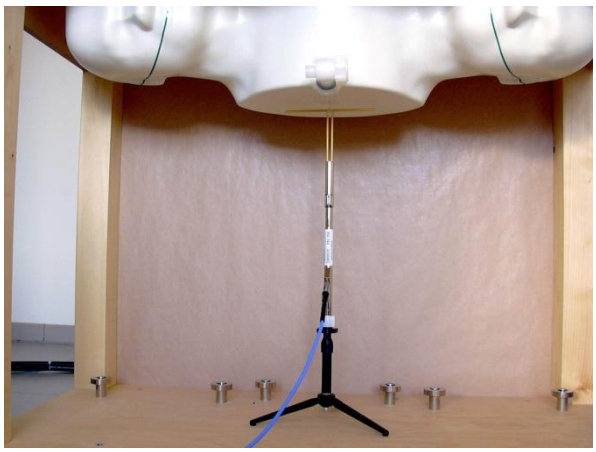
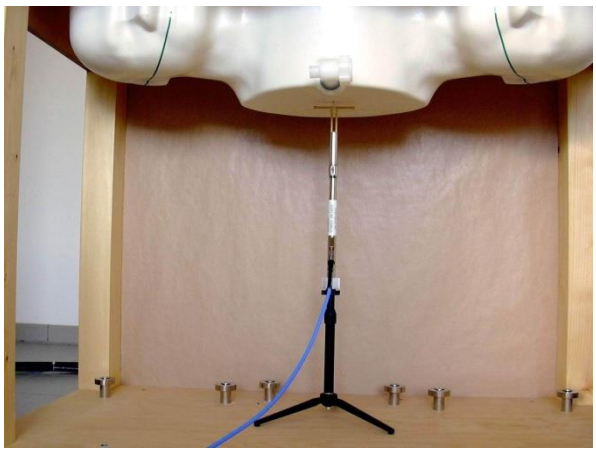
The positioner and test phantoms are manufactured by SPEAG. The test phantoms are used for all tests i.e. for both validation testing and device testing. The positioner and test phantom conforms to the requirements of EN 62209 and IEEE 1528.

The SPEAG device holder was used to position the test device in all tests whilst a tripod was used to position the validation dipoles in the test arch.

Probe Positioner	SAM Twin Phantom
	
ELI4 phantom	**Flat phantom**
	

4.7 System Validation Dipoles

A set of calibration dipoles (D900V2, D1900V2, D2450V2, D5GHzV2) is included as a part of the SAR measurement setup. These are used for the validation of the test setup after its installation and prior to the EUT measurements. The calibration dipole is placed in the position normally occupied by the EUT. All calibration dipoles have the same height which allows an exact fitting below the center point of the test phantom. The dipole center is 10mm below the surface of the test phantom.

900MHz Dipole	1900MHz Dipole
	
2450MHz Dipole	**5000MHz Dipole**
	

5 Single-band SAR Measurement

After successful completion of the tissue and system verification the SAR values of the EUT are measured according to the following description.

5.1 General measurement description

The measurement is performed for each frequency band of the device. If the width of the transmit frequency band exceeds 1% of its center frequency, than the channels at the lowest and highest frequencies should also be tested. Furthermore, if the width of the transmit band exceeds 10% of its center frequency the following formula is used to determine the number of channels:

$$N_C = 2 \cdot \text{roundup}[10 \cdot (f_{high} - f_{low})/f_c] + 1$$

First the device is tested on the center channel of each frequency band used by the device. An operation mode and configuration with maximum transmit power is established. If battery operated equipment is used, the batteries are fully charged.

SAR measurements are performed using the steps outlined in the next section for all relevant operational modes, EUT configurations and measurement positions.

For the condition (position, configuration, operational mode) that provides the highest spatial-average SAR value on the center channel, the other channels are also tested.

Additionally all other conditions where the spatial-average SAR value is within 3dB of the SAR limit are also tested on all determined test frequencies.

5.2 SAR measurement description

First the local SAR value at a test point within 10mm or less in normal direction from the inner surface of the phantom is measured. This SAR value is used to determine the measurement drift during SAR measurement.

Next an area scan is performed over an area larger than the projection of the EUT with antenna on the surface of the phantom with a spatial grid step of 10mm.

From the scanned SAR distribution the position of maximum SAR value is identified as well as any local SAR maxima within 2dB of the maximum value that are not within the zoom scan volume. (The additional peaks are only measured when the primary peak is within 2dB of the SAR limit.)

The zoom-scan volume constructed on the peak SAR position is scanned with a grid step of 5mm. The measured data are extracted and the local SAR value for each measurement point is calculated. The measured values are interpolated over a fine-mesh within the scan volume and the average SAR value over 10g mass is calculated.

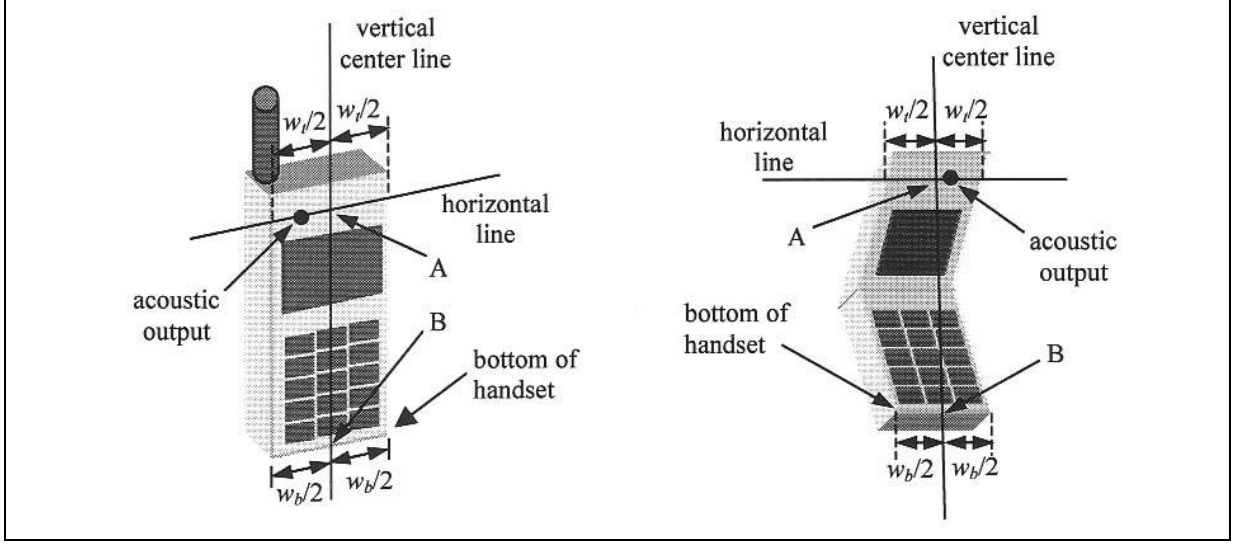
At the end of the measurement the reference point measured at the beginning of the measurement is measured again and from the difference the drift is calculated.

5.3 Reference lines and points for Handsets

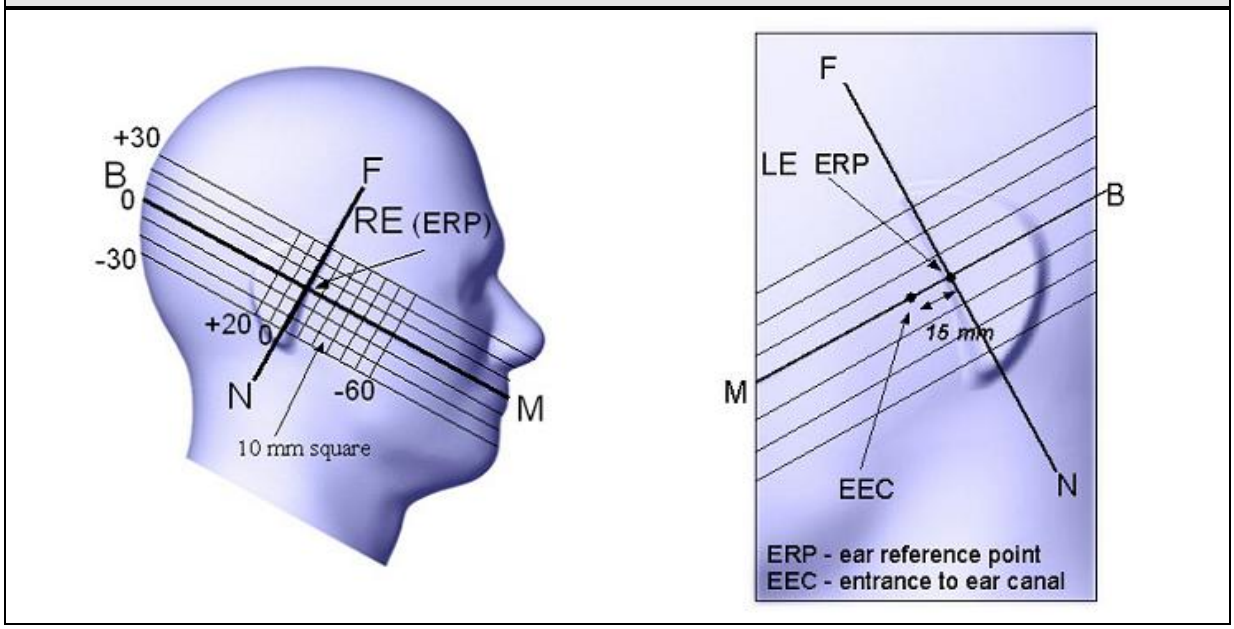
For all measurement positions of the EUT, the EUT has to be place in a specific orientation with respect to the phantom. The orientation of the EUT relative to the phantom is defined by reference lines and points.

According to IEEE 1528, the reference lines and points shall be positioned at the EUT as shown in the following figure.

Reference lines and points on EUT acc. to IEEE 1528



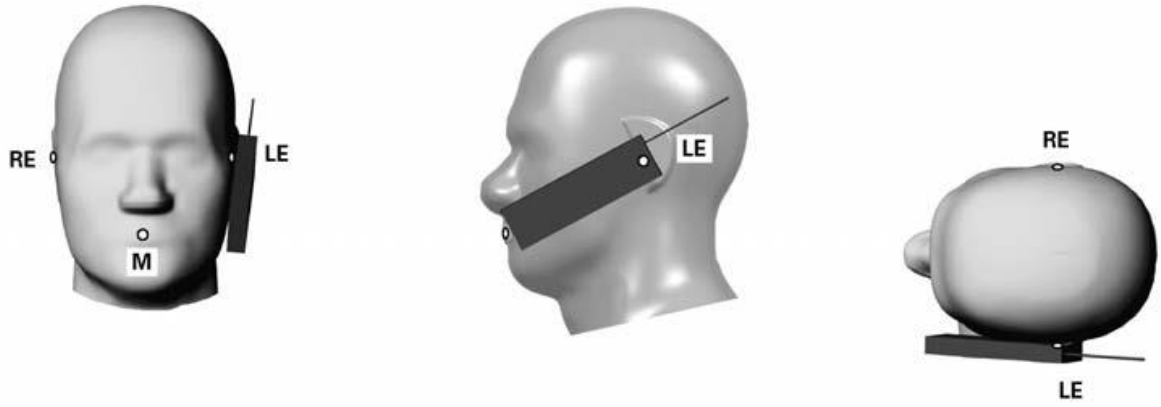
Reference lines and points on human head acc. to IEEE 1528



5.4 Test positions relative to the Head

Cheek position

Cheek positions according to IEEE 1528

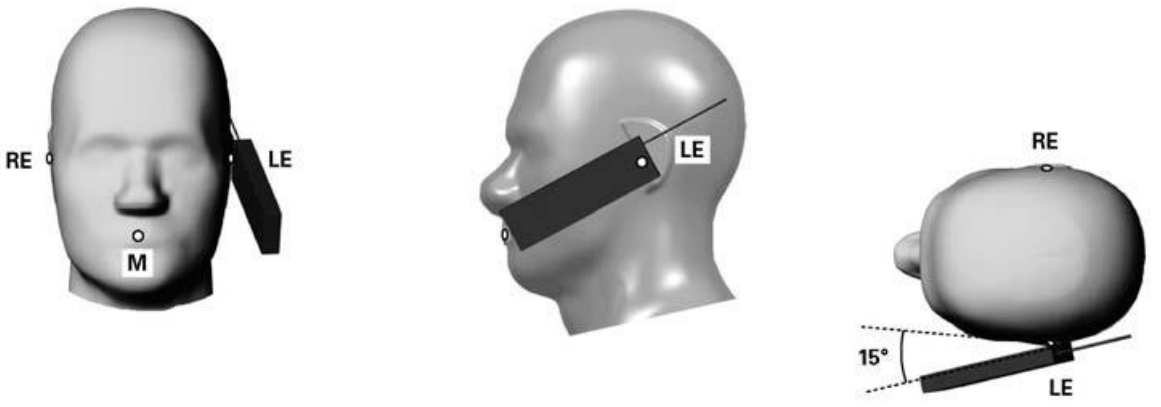


The handset is positioned close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom. Next the handset is translated towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.

While the handset is maintained in this plane, it is rotated around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane. Then it is rotated around the vertical centerline until the handset (horizontal line) is parallel to the N-F line. While the vertical centerline is maintained in the Reference Plane, point A is kept on the line passing through RE and LE, and the handset is maintained in contact with the pinna, the handset is rotated about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek.

Tilt position

Tilt positions according to IEEE 1528

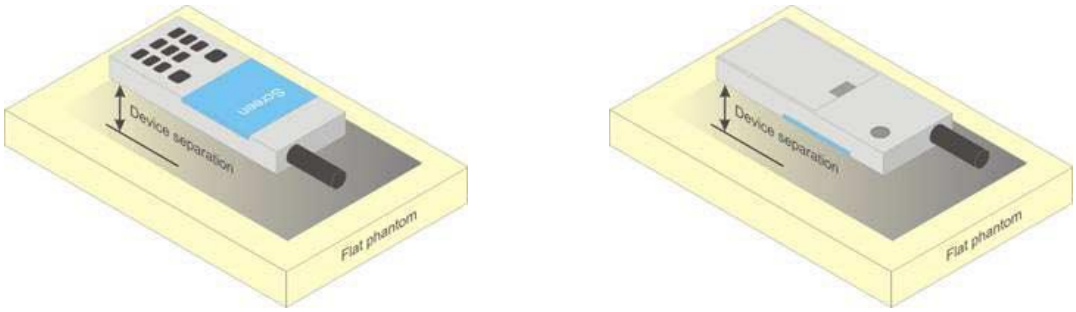


First the EUT is placed in the cheek position. Next the handset is moved away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°. Then the handset is rotated around the horizontal line by 15°.

The handset is moved towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point on the handset is in contact with the phantom, e.g., the antenna with the back of the head

5.5 Test positions relative to the human body

Body positions according to IEEE 1528



In body worn configuration the device is positioned parallel to the phantom surface with either top or bottom side of the EUT facing against the phantom.

The separation distance of the EUT is selected according to the use case of the EUT (e.g. with belt clip or holster).

5.6 Measurement Uncertainty

Measurement Uncertainty according to IEEE 1528							
Error Description	**Uncertainty Value**	**Probability Distribution**	**Div.**	**c_i (1g)**	**c_i (10g)**	**Std. Unc. 1g**	**Std. Unc. 10g**
Measurement System							
Probe Calibration	±6.55%	N	1	1	1	±6.55%	±6.55%
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%
Modulation Response	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Boundary effects	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
Probe Positioner	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Probe Positioning	±6.7%	R	$\sqrt{3}$	1	1	±3.9%	±3.9%
Post processing	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%
Test Sample Related							
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
Test Sample Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%
Power Scaling	±0%	R	$\sqrt{3}$	1	1	±0%	±0%
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%
Phantom and Setup Related							
Phantom Uncertainty	±7.9%	R	$\sqrt{3}$	1	1	±4.6%	±4.6%
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%
Liquid conductivity (measured)	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
Liquid permittivity (measured)	±2.5%	N	1	0.26	0.26	±0.1%	±0.1%
Temperature uncertainty - Conductivity	±5.2%	R	$\sqrt{3}$	0.78	0.71	±2.3%	±2.1%
Temperature uncertainty - Permittivity	±0.8%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%
Combined Standard Uncertainty						±12.8%	±12.7%
Expanded Standard Uncertainty						**±25.6%**	**±25.4%**

Measurement Uncertainty according to EN 62209-1							
Error Description	**Uncertainty Value**	**Probability Distribution**	**Div.**	**c_i (1g)**	**c_i (10g)**	**Std. Unc. 1g**	**Std. Unc. 10g**
Measurement System							
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%
Boundary effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
Max. SAR Evaluation	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%
Test Sample Related							
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%
Power Scaling	±0%	R	$\sqrt{3}$	1	1	±0.0%	±0.0%
Phantom and Setup Related							
Phantom Uncertainty	±6.1%	R	$\sqrt{3}$	1	1	±3.5%	±3.5%
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%
Liquid conductivity (measured)	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
Liquid permittivity (measured)	±2.5%	N	1	0.26	0.26	±0.6%	±0.7%
Temperature uncertainty - Conductivity	±5.2%	R	$\sqrt{3}$	0.78	0.71	±2.3%	±2.1%
Temperature uncertainty - Permittivity	±0.8%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%
Combined Standard Uncertainty						±11.4%	±11.3%
Expanded Standard Uncertainty						**±22.9%**	**±22.7%**

Measurement Uncertainty according to EN 62209-2							
Error Description	**Uncertainty Value**	**Probability Distribution**	**Div.**	**c_i (1g)**	**c_i (10g)**	**Std. Unc. 1g**	**Std. Unc. 10g**
Measurement System							
Probe Calibration	±6.55%	N	1	1	1	±6.55%	±6.55%
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%
Modulation Response	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Boundary effects	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
Probe Positioner	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Probe Positioning	±6.7%	R	$\sqrt{3}$	1	1	±3.9%	±3.9%
Post processing	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%
Test Sample Related							
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
Test Sample Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%
Power Scaling	±0%	R	$\sqrt{3}$	1	1	±0%	±0%
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%
Phantom and Setup Related							
Phantom Uncertainty	±7.9%	R	$\sqrt{3}$	1	1	±4.6%	±4.6%
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%
Liquid conductivity (measured)	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
Liquid permittivity (measured)	±2.5%	N	1	0.26	0.26	±0.1%	±0.1%
Temperature uncertainty - Conductivity	±5.2%	R	$\sqrt{3}$	0.78	0.71	±2.3%	±2.1%
Temperature uncertainty - Permittivity	±0.8%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%
Combined Standard Uncertainty						±12.8%	±12.7%
Expanded Standard Uncertainty						**±25.6%**	**±25.4%**

6 Test Conditions and Results

6.1 Recipes for Tissue Simulating Liquids

Body Tissue Simulating Liquids					
Ingredient	M 450-B weight (%)	M 900-B weight (%)	M 1800-B weight (%)	M 1950-A weight (%)	M 2450-B weight (%)
Water	46.21	50.75	70.17	69.79	68.64
Sugar	51.17	48.21			
Cellulose	0.18				
Salt	2.34		0.39	0.2	
Preventol	0.08	0.1			
DGBE			29.44	30	31.37
Head Tissue Simulating Liquids					
Ingredient	HSL 450-A weight (%)	HSL 900-B weight (%)	HSL 1800-F weight (%)	HSL 1950-B weight (%)	HSL 2450-B weight (%)
Water	38.91	40.29	55.24	55.41	55
Sugar	56.93	57.9			
Cellulose	0.25	0.24			
Salt	3.79	1.38	0.31	0.08	
Preventol	0.12	0.18			
DGBE			44.45	44.51	45

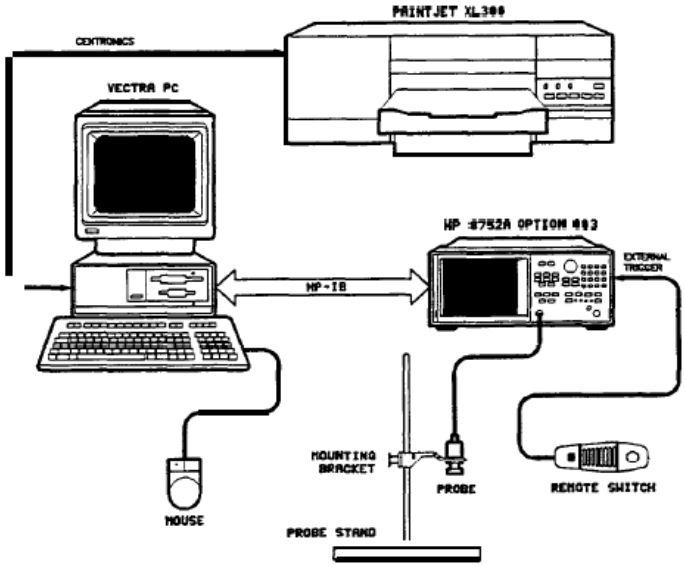
Water: deionized water, resistivity ≥ 16 MΩ
Sugar: refined white sugar
Salt: pure NaCl
Cellulose: Hydroxyethyl-cellulose
Preservative: Preventol D-7
DGBE: Diethylenglycol-monobuthyl ether

The parameters for the different frequencies are defined in the corresponding compliance standards (e.g., IEEE 1528-2003, IEC 62209-1)

The HBBL3-6GHz and MBBL 3-6 GHz liquids are directly from Speag.

6.2 Test Conditions and Results – Tissue Validation

Tissue Validation acc. to FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz / ISED RSS-102					**Verdict: PASS**
Test according to measurement reference	Reference Method				
	FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, ISED RSS-102				
Target Values					
Frequency [MHz]	Head		Body		Permitted tolerance [%]
	Relative dielectric constant ε_r	Conductivity σ [S/m]	Relative dielectric constant ε_r	Conductivity σ [S/m]	
150	52.3	0.76	61.9	0.80	≤ ±5
300	45.3	0.87	58.2	0.92	≤ ±5
450	43.5	0.87	56.7	0.94	≤ ±5
835	41.5	0.90	55.2	0.97	≤ ±5
900	41.5	0.97	55.0	1.05	≤ ±5
915	41.5	0.98	55.0	1.06	≤ ±5
1450	40.5	1.20	54.0	1.30	≤ ±5
1610	40.3	1.29	53.8	1.40	≤ ±5
1800 – 2000	40.0	1.40	53.3	1.52	≤ ±5
2450	39.2	1.80	52.7	1.95	≤ ±5
3000	38.5	2.40	52.0	2.73	≤ ±5
5200	36.0	4.66	49.0	5.30	≤ ±5
5500	35.6	4.96	48.6	5.65	≤ ±5
5800	35.3	5.27	48.2	6.00	≤ ±5

Test setup


Test procedure
1. The dielectric probe kit is calibrated using the standards air, short circuit and deionized water 2. The tissue simulating liquid is measured using the dielectric probe 3. Target values are compared to the measurement values and deviations are determined

According to FCC KDB 865664 D01 the dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within 5% of the required target values for a range of approximately 50 MHz at frequencies below 300 MHz. At above 3 GHz, 5% tolerance can usually be maintained for ± 100 MHz or more.

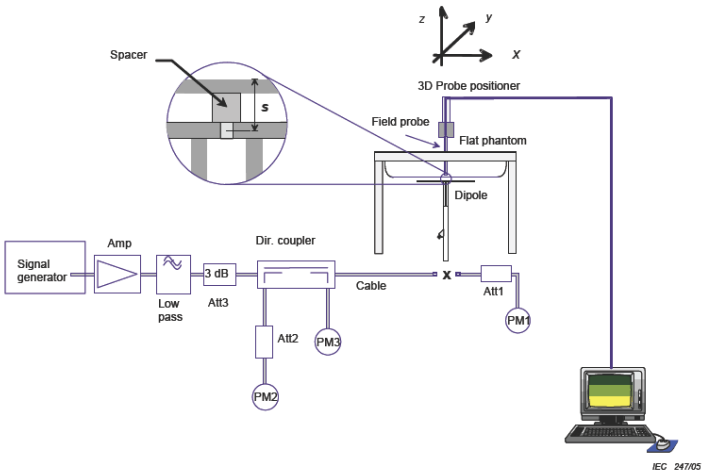
TISSUE VALIDATION									
Room Temperature [°C]					22.5 – 23.5 °C				
Tissue	Freq. [MHz]	Measured ε_r	Target ε_r *	Δ ε_r [%] **	Measured σ [S/m]	Target σ [S/m] *	Δ σ [%] **	Operator	Date
MSL-1800	1720.0	54.109	53.51	1.12	1.435	1.47	-2.38	B. Pudell	20.05.2019
MSL-1800	1732.5	54.024	53.40	1.17	1.451	1.49	-2.62	B. Pudell	16.05.2019
MSL-1800	1745.0	53.975	53.44	1.00	1.467	1.49	-1.54	B. Pudell	20.05.2019
MSL-1800	1750.0	53.953	53.40	1.03	1.473	1.49	-1.14	B. Pudell	20.05.2019
MSL-1800	1752.6	53.951	53.40	1.03	1.476	1.49	-0.09	B. Pudell	16.05.2019
MSL-750	704.0	54.624	55.71	-1.95	0.941	0.96	-1.98	B. Pudell	24.05.2019
MSL-750	707.5	54.582	55.70	-2.01	0.944	0.96	-1.67	B. Pudell	24.05.2019
MSL-750	711.0	54.535	55.68	-2.06	0.947	0.96	-1.35	B. Pudell	24.05.2019
MSL-750	750.0	54.145	55.50	-2.44	0.986	0.96	2.71	B. Pudell	24.05.2019
MSL-750	782.0	53.775	55.41	-2.95	1.015	0.97	4.64	B. Pudell	24.05.2019
MSL-1900	1860.0	53.538	53.4	0.26	1.503	1.51	-0.46	B. Pudell	04.06.2019
MSL-1900	1880.0	53.380	53.3	0.15	1.521	1.52	0.07	B. Pudell	04.06.2019
MSL-1900	1900.0	53.227	53.3	-0.14	1.532	1.52	0.79	B. Pudell	04.06.2019
MSL-1900	1909.8	53.232	53.3	-0.13	1.535	1.52	0.99	B. Pudell	04.06.2019
MSL-900	824.1	53.506	55.23	-3.12	0.946	0.96	-1.46	B. Pudell	19.06.2019
MSL-900	826.6	53.490	55.23	-3.15	0.949	0.96	-1.15	B. Pudell	19.06.2019
MSL-900	829.0	53.462	55.22	-3.18	0.952	0.96	-0.83	B. Pudell	18.06.2019
MSL-900	835.0	53.390	55.20	-3.28	0.958	0.97	-1.24	B. Pudell	07.06.2019
MSL-900	836.6	53.376	55.20	-3.30	0.960	0.97	-1.03	B. Pudell	18.06.2019
MSL-900	846.4	53.276	55.15	-3.40	0.970	0.99	-2.02	B. Pudell	07.06.2019
MSL-900	848.0	53.256	55.15	-3.43	0.971	0.99	-1.91	B. Pudell	19.06.2019
MSL-900	900.0	52.739	55.00	-4.11	1.027	1.05	-2.19	B. Pudell	07.06.2019
MSL-2450	2402	51.815	52.76	-1.79	1.929	1.90	1.53	B. Pudell	21.06.2019
MSL-2450	2412	51.769	52.75	-1.86	1.941	1.91	1.62	B. Pudell	21.06.2019
MSL-2450	2441	51.710	52.71	-1.90	1.976	1.94	1.89	B. Pudell	21.06.2019
MSL-2450	2450	51.674	52.70	-1.95	1.987	1.95	1.90	B. Pudell	21.06.2019
MSL-2450	2462	51.625	52.67	-1.98	2.002	1.97	1.62	B. Pudell	21.06.2019
MSL-2450	2480	51.603	52.66	-2.01	2.024	1.99	1.71	B. Pudell	21.06.2019

* The target tissue dielectric properties of the corresponding basic SAR measurement standard apply
** The deviation has to be 5% or lower

6.3 Test Conditions and Results – System Validation

System Validation acc. to FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz / ISED RSS-102	Verdict: PASS
Test according to measurement reference	Reference Method
	FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, ISED RSS-102, IEEE 1528
Test mode	Unmodulated CW

Test setup



Test procedure

1. The dipole antenna input power is set to 250mW
2. The reference dipole is positioned under the phantom
3. With the dipole antenna powered the SAR value is measured
4. The measured SAR values are compared to the target SAR values

According to FCC KDB 865664 the measured SAR, when normalized to 1.0 W net power, must be within 10% of the calibrated dipole SAR targets.

SYSTEM VALIDATION									
Room Temperature [°C]					22.5 – 23.5 °C				
TSL	Validation Dipole	Measurement Phantom	Validation Frequency [MHz]	Input Power [mW]	Measured SAR (1g) [W/kg]	Target SAR (1g) [W/kg] *	Δ SAR (1g) [%] **	Operator	Date
MSL-1800	D1750V2	ELI 4	1750	250 mW	9.46	9.15	3.39	B. Pudell	16.05.2019
MSL-1800	D1750V2	ELI 4	1750	250 mW	9.52	9.15	4.04	B. Pudell	17.05.2019
MSL-1800	D1750V2	ELI 4	1750	250 mW	9.35	9.15	2.19	B. Pudell	21.05.2019
MSL-750	D750V3	ELI 4	750	250 mW	2.19	2.13	2.82	B. Pudell	24.05.2019
MSL-750	D750V3	ELI 4	750	250 mW	2.19	2.13	2.82	B. Pudell	27.05.2019
MSL-1900	D1900V2	ELI 4	1900	250 mW	10.10	10.0	1.00	B. Pudell	04.06.2019
MSL-1900	D1900V2	ELI 4	1900	250 mW	9.97	10.0	-0.30	B. Pudell	05.06.2019
MSL-1900	D1900V2	ELI 4	1900	250 mW	10.2	10.0	2.00	B. Pudell	06.06.2019
MSL-900	D900V2	ELI 4	900	250 mW	2.82	2.78	1.44	B. Pudell	07.06.2019
MSL-900	D900V2	ELI 4	900	250 mW	2.79	2.78	0.36	B. Pudell	18.06.2019
MSL-900	D900V2	ELI 4	900	250 mW	2.74	2.78	-1.44	B. Pudell	19.06.2019
MSL-900	D900V2	ELI 4	900	250 mW	2.80	2.78	0.72	B. Pudell	20.06.2019
MSL-900	D900V2	ELI 4	900	250 mW	2.81	2.78	1.08	B. Pudell	22.06.2019
MSL-2450	D2450V2	ELI 4	2450	250 mW	13.1	12.73	2.91	B. Pudell	21.06.2019

* See calibration documents of system validation dipole
** The deviation has to be 10% or lower

6.4 Test Conditions and Results – Standalone SAR Measurement

Standalone SAR acc. to FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz / ISED RSS-102		**Verdict: PASS**
Test according to measurement reference	Reference Method	
	FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz / ISED RSS-102	
Liquid depth	15.5 cm	
Environment	general public	
Limits		
Region	Occupational SAR values [W/kg]	General public SAR values [W/kg]
Whole body average SAR	0.4	0.08
Localized SAR (Head and trunk) SAR averaging mass = 1g	8	1.6
Localized SAR (Limbs) SAR averaging mass = 10g	20	4

SINGLE TRANSMITTER SAR EVALUATION – 1g											
Room Temperature [°C]						22.5 – 23.5 °C					
Mode	Position	TSL	Phant.	Ch.	Freq. [MHz]	Power Drift [dB]	Measured SAR (1g) [W/kg]	Power Scaling Factor*	Reported SAR (1g) [W/kg] **	Operator	Date
UMTS 4	Front 0 mm	MSL-1800	ELI 4	1513	1752.6	-0.13	0.652	1.12	0.730	B. Pudell	16.05.2019
UMTS 4	Back 0 mm	MSL-1800	ELI 4	1513	1752.6	-0.06	0.286	1.12	0.320	B. Pudell	16.05.2019
UMTS 4	Left 0 mm	MSL-1800	ELI 4	1513	1752.6	0.11	0.036	1.12	0.040	B. Pudell	17.05.2019
UMTS 4	Right 0 mm	MSL-1800	ELI 4	1513	1752,6	-0.15	0.171	1.12	0.192	B. Pudell	16.05.2019
UMTS 4	Bottom 0 mm	MSL-1800	ELI 4	1513	1752.6	-0.06	0.731	1.12	0.819	B. Pudell	16.05.2019
LTE 4-1	Front 0 mm	MSL-1800	ELI 4	20175	1732.6	0.02	0.736	1.12	0.824	B. Pudell	17.05.2019
LTE 4-2	Front 0 mm	MSL-1800	ELI 4	20175	1732.6	-0.02	0.482	1.12	0.540	B. Pudell	17.05.2019
LTE 4-1	Back 0 mm	MSL-1800	ELI 4	20175	1732.6	0.05	0.348	1.12	0.390	B. Pudell	17.05.2019
LTE 4-2	Back 0 mm	MSL-1800	ELI 4	20175	1732.6	-0.15	0.203	1.12	0.227	B. Pudell	17.05.2019
LTE 4-1	Left 0 mm	MSL-1800	ELI 4	20175	1732.6	0.08	0.040	1.12	0.045	B. Pudell	17.05.2019
LTE 4-2	Left 0 mm	MSL-1800	ELI 4	20175	1732.6	0.11	0.031	1.12	0.035	B. Pudell	17.05.2019
LTE 4-1	Right 0 mm	MSL-1800	ELI 4	20175	1732.6	0.03	0.170	1.12	0.190	B. Pudell	16.05.2019
LTE 4-2	Right 0 mm	MSL-1800	ELI 4	20175	1732.6	-0.16	0.116	1.12	0.130	B. Pudell	16.05.2019
LTE 4-1	Bottom 0 mm	MSL-1800	ELI 4	20175	1732.6	-0.16	0.759	1.12	0.850	B. Pudell	17.05.2019
LTE 4-2	Bottom 0 mm	MSL-1800	ELI 4	20175	1732.6	-0.1	0.564	1.12	0.632	B. Pudell	17.05.2019
LTE 12-1	Front 0 mm	MSL-750	ELI 4	23060	704.0	-0.04	0.338	1.12	0.379	B. Pudell	24.05.2019
LTE 12-2	Front 0 mm	MSL-750	ELI 4	23095	707.5	-0.01	0.287	1.12	0.321	B. Pudell	24.05.2019
LTE 12-1	Back 0 mm	MSL-750	ELI 4	23060	704.0	0.01	0.228	1.12	0.255	B. Pudell	24.05.2019
LTE 12-2	Back 0 mm	MSL-750	ELI 4	23095	707.5	-0.06	0.172	1.12	0.193	B. Pudell	24.05.2019
LTE 12-1	Left 0 mm	MSL-750	ELI 4	23060	704.0	-0.11	0.012	1.12	0.013	B. Pudell	27.05.2019

Mode	Position	TSL	Phant.	Ch.	Freq. [MHz]	Power Drift [dB]	Measured SAR (1g) [W/kg]	Power Scaling Factor*	Reported SAR (1g) [W/kg] **	Operator	Date
LTE 12-2	Left 0 mm	MSL-750	ELI 4	23095	707.5	-0.19	0.010	1.12	0.011	B. Pudell	27.05.2019
LTE 12-1	Right 0 mm	MSL-750	ELI 4	23060	704.0	0.17	0.079	1.12	0.088	B. Pudell	27.05.2019
LTE 12-2	Right 0 mm	MSL-750	ELI 4	23095	707.5	0.04	0.072	1.12	0.081	B. Pudell	27.05.2019
LTE 12-1	Bottom 0 mm	MSL-750	ELI 4	23060	704.0	-0.05	0.486	1.12	0.544	B. Pudell	27.05.2019
LTE 12-2	Bottom 0 mm	MSL-750	ELI 4	23095	707.5	0.07	0.367	1.12	0.411	B. Pudell	27.05.2019
LTE 13-1	Front 0 mm	MSL-750	ELI 4	23230	782.0	0.11	0.346	1.12	0.388	B. Pudell	24.05.2019
LTE 13-2	Front 0 mm	MSL-750	ELI 4	23230	782.0	0.00	0.307	1.12	0.344	B. Pudell	24.05.2019
LTE 13-1	Back 0 mm	MSL-750	ELI 4	23230	782.0	0.07	0.202	1.12	0.226	B. Pudell	24.05.2019
LTE 13-2	Back 0 mm	MSL-750	ELI 4	23230	782.0	-0.19	0.185	1.12	0.207	B. Pudell	24.05.2019
LTE 13-1	Left 0 mm	MSL-750	ELI 4	23230	782.0	0.10	0.012	1.12	0.013	B. Pudell	27.05.2019
LTE 13-2	Left 0 mm	MSL-750	ELI 4	23230	782.0	-0.15	0.011	1.12	0.012	B. Pudell	27.05.2019
LTE 13-1	Right 0 mm	MSL-750	ELI 4	23230	782.0	0.09	0.074	1.12	0.083	B. Pudell	27.05.2019
LTE 13-2	Right 0 mm	MSL-750	ELI 4	23230	782.0	-0.18	0.078	1.12	0.087	B. Pudell	24.05.2019
LTE 13-1	Bottom 0 mm	MSL-750	ELI 4	23230	782.0	0.02	0.491	1.12	0.550	B. Pudell	27.05.2019
LTE 13-2	Bottom 0 mm	MSL-750	ELI 4	23230	782.0	0.05	0.433	1.12	0.485	B. Pudell	27.05.2019
GPRS	Front 0 mm	MSL-1900	ELI 4	810	1909.8	-0.16	0.446	1.12	0.500	B. Pudell	04.06.2019
GPRS	Back 0 mm	MSL-1900	ELI 4	810	1909.8	-0.11	0.411	1.12	0.460	B. Pudell	05.06.2019
GPRS	Left 0 mm	MSL-1900	ELI 4	810	1909.8	0.11	0.085	1.12	0.095	B. Pudell	06.06.2019
GPRS	Right 0 mm	MSL-1900	ELI 4	810	1909.8	0.11	0.364	1.12	0.408	B. Pudell	06.06.2019
GPRS	Bottom 0 mm	MSL-1900	ELI 4	810	1909.8	-0.13	0.742	1.12	0.831	B. Pudell	05.06.2019
UMTS 2	Front 0 mm	MSL-1900	ELI 4	9400	1880.0	-0.02	0.431	1.12	0.483	B. Pudell	04.06.2019
UMTS 2	Back 0 mm	MSL-1900	ELI 4	9400	1880.0	-0.07	0.305	1.12	0.342	B. Pudell	05.06.2019
UMTS 2	Left 0 mm	MSL-1900	ELI 4	9400	1880.0	0.02	0.034	1.12	0.038	B. Pudell	06.06.2019

Mode	Position	TSL	Phant.	Ch.	Freq. [MHz]	Power Drift [dB]	Measured SAR (1g) [W/kg]	Power Scaling Factor*	Reported SAR (1g) [W/kg] **	Operator	Date
UMTS 2	Right 0 mm	MSL-1900	ELI 4	9400	1880.0	-0.15	0.272	1.12	0.305	B. Pudell	05.06.2019
UMTS 2	Bottom 0 mm	MSL-1900	ELI 4	9400	1880.0	0.03	0.491	1.12	0.550	B. Pudell	05.06.2019
LTE 2-1	Front 0 mm	MSL-1900	ELI 4	18700	1860.0	-0.06	0.546	1.12	0.612	B. Pudell	04.06.2019
LTE 2-2	Front 0 mm	MSL-1900	ELI 4	18700	1860.0	-0.05	0.394	1.12	0.441	B. Pudell	04.06.2019
LTE 2-1	Back 0 mm	MSL-1900	ELI 4	18700	1860.0	0.06	0.285	1.12	0.319	B. Pudell	04.06.2019
LTE 2-2	Back 0 mm	MSL-1900	ELI 4	18700	1860.0	0.06	0.204	1.12	0.228	B. Pudell	04.06.2019
LTE 2-1	Left 0 mm	MSL-1900	ELI 4	18700	1860.0	0.08	0.040	1.12	0.045	B. Pudell	06.06.2019
LTE 2-2	Left 0 mm	MSL-1900	ELI 4	18700	1860.0	0.16	0.028	1.12	0.031	B. Pudell	06.06.2019
LTE 2-1	Right 0 mm	MSL-1900	ELI 4	18700	1860.0	0.04	0.219	1.12	0.245	B. Pudell	05.06.2019
LTE 2-2	Right 0 mm	MSL-1900	ELI 4	18700	1860.0	-0.07	0.162	1.12	0.181	B. Pudell	05.06.2019
LTE 2-1	Bottom 0 mm	MSL-1900	ELI 4	18700	1860.0	0.07	0.515	1.12	0.577	B. Pudell	05.06.2019
LTE 2-2	Bottom 0 mm	MSL-1900	ELI 4	18700	1860.0	-0.05	0.370	1.12	0.414	B. Pudell	05.06.2019
GPRS	Front 0 mm	MSL-900	ELI 4	190	836.6	-0.03	0.472	1.12	0.529	B. Pudell	19.06.2019
GPRS	Back 0 mm	MSL-900	ELI 4	190	836.6	-0.07	0.239	1.12	0.268	B. Pudell	20.06.2019
GPRS	Left 0 mm	MSL-900	ELI 4	190	836.6	-0.14	0.020	1.12	0.022	B. Pudell	20.06.2019
GPRS	Right 0 mm	MSL-900	ELI 4	190	836.6	0.02	0.096	1.12	0.108	B. Pudell	20.06.2019
GPRS	Bottom 0 mm	MSL-900	ELI 4	128	824.1	-0.12	0.783	1.12	0.877	B. Pudell	19.06.2019
GPRS	Bottom 0 mm	MSL-900	ELI 4	190	836.6	-0.12	1.220	1.12	1.366	B. Pudell	19.06.2019
GPRS	Bottom 0 mm	MSL-900	ELI 4	251	848.0	-0.04	0.811	1.12	0.908	B. Pudell	19.06.2019
UMTS 5	Front 0 mm	MSL-900	ELI 4	4175	835.0	-0.09	0.479	1.12	0.536	B. Pudell	19.06.2019
UMTS 5	Back 0 mm	MSL-900	ELI 4	4175	835.0	-0.07	0.238	1.12	0.267	B. Pudell	20.06.2019

Mode	Position	TSL	Phant.	Ch.	Freq. [MHz]	Power Drift [dB]	Measured SAR (1g) [W/kg]	Power Scaling Factor*	Reported SAR (1g) [W/kg] **	Operator	Date
UMTS 5	Left 0 mm	MSL-900	ELI 4	4175	835.0	0.07	0.021	1.12	0.024	B. Pudell	19.06.2019
UMTS 5	Right 0 mm	MSL-900	ELI 4	4175	835.0	0.13	0.076	1.12	0.085	B. Pudell	19.06.2019
UMTS 5	Bottom 0 mm	MSL-900	ELI 4	4133	826.6	0.06	0.878	1.12	0.983	B. Pudell	19.06.2019
UMTS 5	Bottom 0 mm	MSL-900	ELI 4	4175	835.0	-0.03	0.889	1.12	0.996	B. Pudell	07.06.2019
UMTS 5	Bottom 0 mm	MSL-900	ELI 4	4232	846.4	-0.18	0.694	1.12	0.777	B. Pudell	07.06.2019
LTE 5-1	Front 0 mm	MSL-900	ELI 4	20450	829.0	-0.17	0.353	1.12	0.395	B. Pudell	18.06.2019
LTE 5-2	Front 0 mm	MSL-900	ELI 4	20450	829.0	-0.15	0.311	1.12	0.348	B. Pudell	18.06.2019
LTE 5-1	Back 0 mm	MSL-900	ELI 4	20450	829.0	0.09	0.196	1.12	0.220	B. Pudell	18.06.2019
LTE 5-2	Back 0 mm	MSL-900	ELI 4	20450	829.0	0.15	0.168	1.12	0.188	B. Pudell	18.06.2019
LTE 5-1	Left 0 mm	MSL-900	ELI 4	20450	829.0	-0.01	0.016	1.12	0.018	B. Pudell	19.06.2019
LTE 5-2	Left 0 mm	MSL-900	ELI 4	20450	829.0	0.13	0.014	1.12	0.016	B. Pudell	19.06.2019
LTE 5-1	Right 0 mm	MSL-900	ELI 4	20450	829.0	-0.12	0.066	1.12	0.074	B. Pudell	18.06.2019
LTE 5-2	Right 0 mm	MSL-900	ELI 4	20450	829.0	-0.05	0.050	1.12	0.056	B. Pudell	18.06.2019
LTE 5-1	Bottom 0 mm	MSL-900	ELI 4	20450	829.0	-0.03	0.777	1.12	0.870	B. Pudell	18.06.2019
LTE 5-2	Bottom 0 mm	MSL-900	ELI 4	20450	829.0	0.00	0.612	1.12	0.685	B. Pudell	18.06.2019
BT – BR (LR)	Back 0 mm	MSL-2450	ELI 4	78	2480	0.10	0.008	1.12	0.010	B. Pudell	21.06.2019
BT – BR (LR)	Top 0 mm	MSL-2450	ELI 4	78	2480	-0.06	0.045	1.12	**0.050**	B. Pudell	21.06.2019
IEEE 802.11b	Back 0 mm	MSL-2450	ELI 4	1	2412	-0.17	0.017	1.26	**0.021**	B. Pudell	21.06.2019

* Scaling factor = Max. conducted power (including tune up tolerance) [mW] / measured conducted power [mW]
** Reported SAR = Measured SAR * Scaling Factor

SAR for LTE FDD 17 (Frequency range: 704 – 716 MHz) is covered by LTE FDD 12 (Frequency range: 699 – 716 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

According to KDB 865664 D02 only the SAR plots for the highest SAR results for each EUT configuration and operating condition are given in the “SAR Results” part of the report.

According to FCC KDB 248227 D01 no further WiFi SAR testing is required for DSSS because the reported SAR Value is ≤ 0.8 W/kg.

According to FCC KDB 248227 D01 no further WiFi SAR testing is required for OFDM because the reported SAR adjusted by the ratio of OFDM and DSSS maximum output power is ≤ 1.2 W/kg.

According to FCC KDB 941225 D01 when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg no additional SAR evaluation is required for the secondary modes.

According to FCC KDB 941225 D05 no further SAR evaluation for LTE is required because the highest reported SAR value ≤ 1.45 W/kg.

SAR measurement repeatability

Repeated measurements are required only when the measured SAR is ≥ 0.80 W/kg.18 If the measured SAR value of the initial repeated measurement is < 1.45 W/kg with ≤ 20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%.

The following procedure applies according to FCC KDB 865664 D01:

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

SINGLE TRANSMITTER SAR EVALUATION – 1g										
Room Temperature [°C]						22.5 – 23.5 °C				
Mode	Position	TSL	Phant.	Ch.	Freq. [MHz]	Power Drift [dB]	Measured SAR (1g) [W/kg]	Ratio of SAR values	Operator	Date
GPRS	Bottom 0 mm	MSL-900	ELI 4	190	836.6	-0.12	1.220	1.016	B. Pudell	19.06.2019
GPRS	Bottom 0 mm	MSL-900	ELI 4	190	836.6	0.04	1.240		B. Pudell	22.06.2019
GPRS	Bottom 0 mm	MSL-900	ELI 4	251	848.0	-0.04	0.811	1.056	B. Pudell	19.06.2019
GPRS	Bottom 0 mm	MSL-900	ELI 4	251	848.0	-0.13	0.768		B. Pudell	22.06.2019
UMTS 5	Bottom 0 mm	MSL-900	ELI 4	4133	826.6	0.06	0.878	1.039	B. Pudell	19.06.2019
UMTS 5	Bottom 0 mm	MSL-900	ELI 4	4133	826.6	-0.16	0.845		B. Pudell	22.06.2019
UMTS 5	Bottom 0 mm	MSL-900	ELI 4	4175	835.0	-0.03	0.889	1.008	B. Pudell	07.06.2019
UMTS 5	Bottom 0 mm	MSL-900	ELI 4	4175	835.0	-0.01	0.896		B. Pudell	22.06.2019

6.5 Test Conditions and Results – Multi-transmitter SAR Result

According to FCC KDB 447498 D01, when the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

When an antenna qualifies for the standalone SAR test exclusion and also transmits simultaneously with other antennas, the standalone SAR value must be estimated.

Position	LR-BT module	WLAN+BT module	Mobile-module	Sum of 1g SAR	Ri (mm)	SPLSR
Flat Front	0.070	0.418	0.824	1.312	N/A	N/A
Flat Back	0.050	0.021	0.460	0.531	N/A	N/A
Flat Left	0.040	0.232	0.095	0.367	N/A	N/A
Flat Right	0.400	0.400	0.408	1.208	N/A	N/A
Flat Top	0.010	0.400	0.400	0.810	N/A	N/A
Flat Bottom	0.400	0.400	1.389	2.189*	see below	
Comment:						

* According to FCC KDB 447498 D01, when the sum is greater than the SAR limit, the SAR to peak location separation ratio procedures described below may be applied to determine if simultaneous transmission SAR test exclusion applies

SAR to peak location separation ratio evaluation:

According to KDB 447498 D01, when the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The simultaneously transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion.

The ratio is determined by (SAR1 + SAR2)1.5/Ri, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

Position	LR-BT module SAR [W/kg]	WLAN+BT module SAR [W/kg]	Mobile-module SAR [W/kg]	Sum of 1g SAR	Ri (mm)	SPLSR
Flat Bottom	0.400	N/A	1.389	1.789	210	0.011
Flat Bottom	N/A	0.400	1.389	1.789	80	0.030
Flat Bottom	0.400	0.400	N/A	0.800	133	0.005
Comment:						

According to KDB 447498 D01 the mode is excluded from SAR evaluation because the SPLR values of all antenna combinations are below 0.04.