SAR, APD and IPD Evaluation Report for FCC

Applicant Name	:	**PepperlFuchs SE**
Applicant Address	:	**Lilienthalstrasse 200, 68307 Mannheim, Germany**
Product Name	:	**Phone**
Brand Name	:	**PEPPERL+FUCHS**
Model Number	:	**Smart-Ex 03**
FCC ID	:	**2AXZAS03GR01**
Report Number	:	**USSC236135001**
Compliant Standards	:	**FCC 47 CFR §2.1093**
Sample Received Date	:	**Apr. 20, 2023**
Date of Testing	:	**Oct. 11 ~ Nov. 24, 2023**
Report Issue Date	:	**Nov. 28, 2023**

*The above equipment has been tested by **Eurofins E&E Wireless Taiwan Co., Ltd.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Device Under Test (DUT) configurations represented herein are true and accurate accounts of the measurements of the sample's characteristics under the conditions specified in this report.*

Note:
1. The test results are valid only for samples provided by customers and under the test conditions described in this report.
2. This report shall not be reproduced except in full, without the written approval of Eurofins E&E Wireless Taiwan Co., Ltd.
3. The relevant information is provided by customers in this test report. According to the correctness, appropriateness or completeness of the information provided by the customer, if there is any doubt or error in the information which affects the validity of the test results, the laboratory does not take the responsibility.

Approved By：

Roy Wu / SAR Technical Director

Testing Laboratory
1330

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Revision History

Rev.	Issue Date	Description	Revised by
00	Nov. 28, 2023	Initial release	Rowan Hsieh

1. Compliance Statement

This device (FCC ID: ***2AXZAS03GR01***) has been tested by ***Eurofins E&E Wireless Taiwan Co., Ltd.*** in accordance with the measurement procedures specified in FCC KDB procedures, and the results shown in below are capable of demonstrating compliance for localized specific absorption rate (SAR) for general population / uncontrolled environment exposure limits specified in *FCC 47 CFR §1.1310*.

Equipment Class	Mode	Highest Reported SAR				
		Head standalone $SAR_{1\ g}$ (W/kg)	Hotspot standalone $SAR_{1\ g}$ (W/kg)	Body standalone $SAR_{1\ g}$ (W/kg)	Extremity standalone $SAR_{10\ g}$ (W/kg)	Simultaneous Transmission SAR1 g (W/kg)
Licensed	GSM850	0.37	0.70	0.90	-	1.59
	GSM1900	0.29	0.48	0.65	-	
	WCDMA Band II	0.31	0.54	0.51	-	
	WCDMA Band IV	0.26	0.39	0.41	-	
	WCDMA Band V	0.24	0.28	0.56	-	
	LTE Band 5	0.20	0.33	0.58	-	
	LTE Band 7	0.54	0.56	0.42	-	
	LTE Band 12	0.19	0.27	0.40	-	
	LTE Band 13	0.14	0.17	0.34	-	
	LTE Band 14	0.17	0.13	0.38	-	
	LTE Band 25	0.56	0.52	0.47	-	
	LTE Band 26	0.21	0.31	0.58	-	
	LTE Band 30	0.24	0.45	0.50	-	
	LTE Band 38	0.56	0.59	0.47	-	
	LTE Band 40	0.46	0.59	0.53	-	
	LTE Band 41	0.58	0.58	0.47	-	
	LTE Band 42	0.57	0.59	0.50	0.65	
	LTE Band 43	0.62	0.59	0.50	-	
	LTE Band 48	0.61	0.59	0.50	0.72	
	LTE Band 66	0.27	0.59	0.44	-	
	LTE Band 71	0.10	0.29	0.34	-	
	NR Band n5	0.19	0.29	0.65	-	
	NR Band n7	0.56	0.59	0.44	-	
	NR Band n12	0.15	0.59	0.49	-	
	NR Band n13	0.16	0.31	0.48	-	
	NR Band n14	0.15	0.33	0.53	-	
	NR Band n25	0.34	0.59	0.46	-	
	NR Band n30	0.40	0.55	0.51	-	
	NR Band n66	0.37	0.59	0.60	-	
	NR Band n71	0.09	0.40	0.36	-	
	NR Band n38	0.54	0.59	0.58	-	
	NR Band n41	0.60	0.60	0.49	-	
	NR Band n48	0.59	0.59	0.50	1.40	
	NR Band n77	0.53	0.58	0.52	1.47	
	NR Band n78	0.60	0.59	0.50	-	
DTS	WLAN 2.4 GHz	0.41	0.36	0.31	-	1.59
NII	WLAN 5 GHz	0.40	0.33	0.40	0.81	1.59
6XD	WLAN 6 GHz	0.26	-	0.38	0.29	1.56
DSS / DTS	Bluetooth	0.00	0.00	0.00	-	1.59

2. Test Regulations

2.1. Reference Standard and Guidance

The Specific Absorption Rate (SAR) testing documented in this report were performed in accordance with following FCC published KDB guidance and standard：

KDB Publication 248227 D01 – IEEE 802.11 Wi-Fi SAR v02r02
KDB Publication 447498 D01 – General RF Exposure Guidance v06
KDB Publication 447498 D04 – Interim General RF Exposure Guidance v01
KDB Publication 648474 D04 – Handset SAR v01r03
KDB Publication 865664 D01 – SAR measurement 100 MHz to 6 GHz v01r04
KDB Publication 865664 D02 – RF Exposure Reporting v01r02
KDB Publication 941225 D01 – 3G SAR Procedures v03r01
KDB Publication 941225 D05 – SAR for LTE Devices v02r05
KDB Publication 941225 D05A – LTE Rel.10 KDB Inquiry Sheet v01r02
KDB Publication 941225 D06 – Hotspot Mode v02r01
IEEE Std 1528-2013

In addition to the above, the following guideline was used：

TCB Workshop Oct 2013 – Guidelines for GPRS Testing Considerations
TCB Workshop Oct 2014 – Guidelines for Other LTE Considerations
TCB Workshop Apr 2015 – Guidelines for Overlapping LTE Bands
TCB Workshop Oct 2015 – Guidelines for KDB 941225 D05A
TCB Workshop Apr 2016 – Guidelines for LTE DL Carrier Aggregation
TCB Workshop Oct 2016 – Guidelines for LTE UL Carrier Aggregation
TCB Workshop Oct 2016 – Guidelines for Bluetooth Duty Factor
TCB Workshop May 2017 – Guidelines for Broadband Liquid Above 3 GHz
TCB Workshop May 2017 – Guidelines for LTE Band 41 Power Class 2
TCB Workshop May 2017 – Guidelines for LTE Test Conditions
TCB Workshop Nov 2017 – Guidelines for LTE UL/DL Carrier Aggregation SAR
TCB Workshop Apr 2018 – Guidelines for LTE DL CA SAR Test Exclusion
TCB Workshop Oct 2018 – Guidelines for Near-Field Power Density
TCB Workshop Oct 2018 – Guidelines for LTE Inter-Band Uplink Carrier Aggregation
TCB Workshop Apr 2019 – Guidelines for Tissue Simulating Liquids (TSL)
TCB Workshop Apr 2019 – Guidelines for IEEE 802.11ax SAR Testing
TCB Workshop Nov 2019 – Guidelines for 5G NR FR1 NSA EN-DC SAR Evaluations
TCB Workshop Oct 2020 – Guidelines for Intra-band and Inter-band NSA EN-DC Evaluation
TCB Workshop Oct 2020 – Guidelines for U-NII 6-7 GHz SAR Testing
TCB Workshop Apr 2022 – Guidelines for 5G NR FR1 Measurement
TCB Workshop Oct 2022 – Guidelines for SAR test frequencies in multi-rule
TCB Workshop Oct 2022 – Guidelines for f-above-6 GHz Portable Devices

2.2. RF Exposure Limits

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

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

The Radiofrequency Radiation Exposure Limits Specified in FCC 47 CFR §1.1310

Exposure Scenario	Frequency Range	Local Head/Body SAR (1g-SAR, W/kg)	Local Extremity SAR (10g-SAR, W/kg)	Local Power Density (4 cm^2, mW/cm^2)
Population / Uncontrolled	100 kHz to 6 GHz	1.6	4.0	
	1.5 GHz to 100 GHz			1.0
Occupational / Controlled	100 kHz to 6 GHz	8.0	20.0	
	1.5 GHz to 100 GHz			5.0

3. Information of Testing Laboratory

Test Facilities

Company Name: Eurofins E&E Wireless Taiwan Co., Ltd.
Address No.: 140-1, Changan Street, Bade District, Taoyuan City 334025, Taiwan
Website: https://www.atl.com.tw
Telephone: +886-3-271-0188
Fax: +886-3-271-0190
E-mail: infoEETW@eurofins.com

Test Site Location

☐ No. 140-1, Changan Street, Bade District, Taoyuan City 334025, Taiwan
■ No. 2, Wuquan 5th Rd. Wugu Dist., New Taipei City, Taiwan

Laboratory Accreditation

Location	TAF	FCC	ISED
No. 140-1, Changan Street, Bade District, Taoyuan City 334025, Taiwan	Accreditation No.: 1330	Designation No.: TW0010	Company No.: 7381A CAB ID: TW1330
No. 2, Wuquan 5th Rd. Wugu Dist., New Taipei City, Taiwan	Accreditation No.: 1330	Designation No.: TW0034	Company No.: 28922 CAB ID: TW1330

4. DUT (Device Under Test) Information

4.1. Device Overview

Product Name	Phone
Brand Name	PEPPERL+FUCHS
Model Name	Smart-Ex 03
Variants Description	Smart-Ex 03 is provided to the end user in two variants, one with camera features and the other as a non-camera variant. The camera modules are also populated in the non-camera variant; only SW deactivation and assembling physical camera opening covers, which are not metal, are required. Therefore, the testing was completed on the DUT with the camera features only.
FCC ID	2AXZAS03GR01

<table>
<tr><td rowspan="7">Supported Wireless Technologies</td><td>Tx Frequency (MHz)</td><td>Operating Mode</td></tr>
<tr><td>GSM
850 : 824.2 ~ 848.8
1900 : 1850.2 ~ 1909.8</td><td>Voice : GMSK
GPRS : GMSK
EDGE : 8PSK</td></tr>
<tr><td>WCDMA
Band 2 : 1852.4 ~ 1907.6
Band 4 : 1712.4 ~ 1752.6
Band 5 : 826.4 ~ 846.6</td><td>UMTS Rel. 99 (Voice / Data)
HSDPA (Rel. 5)
HSUPA (Rel. 6)
HSPA+ (Rel. 7)
DC-HSDPA (Rel. 8)</td></tr>
<tr><td>LTE
Band 2 : 1850.7 ~ 1909.3
Band 4 : 1710.7 ~ 1754.3
Band 5 : 824.7 ~ 848.3
Band 7 : 2502.5 ~ 2567.5
Band 12 : 699.7 ~ 715.3
Band 13 : 779.5 ~ 784.5
Band 14 : 790.5 ~ 795.5
Band 25 : 1850.7 ~ 1914.3
Band 26 : 814.7 ~ 848.3
Band 30 : 2307.5 ~ 2312.5
Band 38 : 2572.5 ~ 2617.5
Band 40 : 2302.5 ~ 2397.5
Band 41 : 2498.5 ~ 2687.5
Band 42 : 3552.5 ~ 3597.5
Band 48 : 3552.5 ~ 3697.5
Band 66 : 1710.7 ~ 1779.3
Band 71 : 665.5 ~ 695.5</td><td>QPSK, 16QAM, 64QAM, 256QAM
Carrier Aggregation (DL : 6CC, UL: 2CC)</td></tr>
<tr><td>5G NR FR1
n2 : 1852.5 ~ 1907.5
n5 : 826.5 ~ 846.5
n7 : 2502.5 ~ 2567.5
n12 : 701.5 ~ 713.5
n13 : 777 ~ 787
n14 : 790.5 ~ 795.5
n25 : 1852.5 ~ 1912.5
n26 : 816.5 ~ 846.5
n30 : 2307.5 ~ 2312.5
n38 : 2575 ~ 2615
n41 : 2501.01 ~ 2685, 2506.02 ~ 2679.99
n48 : 3555 ~ 3694.98
n66 : 1712.5 ~ 1777.5
n71 : 665.5 ~ 695.5
n77 : 3455.01 ~ 3645, 3705 ~ 3975
n78 : 3455.01 ~ 3544.98, 3705 ~ 3795</td><td>DFT-s-OFDM：
π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM

CP-OFDM：
QPSK, 16QAM, 64QAM, 256QAM</td></tr>
<tr><td>WLAN
2.4G : 2412 ~ 2472
5G : 5180 ~ 5240, 5260 ~ 5320, 5500 ~ 5720, 5745 ~ 5825, 5845 ~ 5885
6G : 5935 ~ 6415, 6435 ~ 6515, 6535 ~ 6875, 6895 ~ 7115</td><td>2.4G : 802.11b/g/n/ac/ax
5G : 802.11a/n/ac/ax
6G : 802.11a/ax</td></tr>
<tr><td>Bluetooth
2402 ~ 2480</td><td>BR, EDR, LE</td></tr>
</table>

Note:
The above DUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

4.2. General Information for LTE

Modulations Supported in Uplink	QPSK / 16QAM / 64QAM / 256QAM
LTE MPR Permanently Implemented per 3GPP TS 36.101 section 6.2.3~6.2.5?	Yes
A-MPR (Additional MPR) Disabled for SAR Testing?	Yes
LTE Carrier Aggregation Possible Combinations	The technical description includes all the possible carrier aggregation combinations
LTE Additional Information	This device does not support full CA features on 3GPP Release 16. It supports carrier aggregation, downlink MIMO, LAA features as shown in the RF Conducted Powers section of this report and the Downlink LTE CA RF Conducted Powers Appendix. All uplink communications are identical to the Release 8 Specifications. Uplink communications are done on the PCC. The following LTE Release 16 features are not supported: Relay, HetNet, Enhanced MIMO, eICIC, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.

4.3. General Information for 5G NR FR1

SCS	FDD：15 kHz; TDD：30 kHz
Modulations Supported in Uplink	DFT-s-OFDM：π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM CP-OFDM：QPSK, 16QAM, 64QAM, 256QAM
NR MIMO mode	n41, n48, n77, n78
A-MPR (Additional MPR) Disabled for SAR Testing?	Yes
EN-DC Carrier Aggregation Possible Combinations	The technical description includes all the possible carrier aggregation combinations
LTE Anchor Bands for NR n2	LTE Band 4, 30, 48, 66
LTE Anchor Bands for NR n5	LTE Band 2, 7, 12, 30, 48, 66
LTE Anchor Bands for NR n7	LTE Band 71
LTE Anchor Bands for NR n12	LTE Band 2, 7, 30, 48, 66
LTE Anchor Bands for NR n14	LTE Band 2, 66
LTE Anchor Bands for NR n25	LTE Band 5, 13, 26, 48, 66, 71
LTE Anchor Bands for NR n30	LTE Band 2, 66
LTE Anchor Bands for NR n38	LTE Band 2, 4, 66
LTE Anchor Bands for NR n41	LTE Band 2, 4, 5, 25, 26, 40, 66
LTE Anchor Bands for NR n48	LTE Band 2, 66
LTE Anchor Bands for NR n66	LTE Band 2, 30, 48
LTE Anchor Bands for NR n71	LTE Band 2, 7, 41, 48, 66
LTE Anchor Bands for NR n77	LTE Band 2, 7, 30, 40, 41, 66, 71
LTE Anchor Bands for NR n78	LTE Band 2, 4, 7, 13, 38, 40, 41, 66

4.4. DSI (Device State Index) Scenarios

This device uses different Device State Index (DSI) to configure different time-averaged power levels based on exposure scenarios. Below table lists the DSI and RF exposure condition for various transmit conditions.

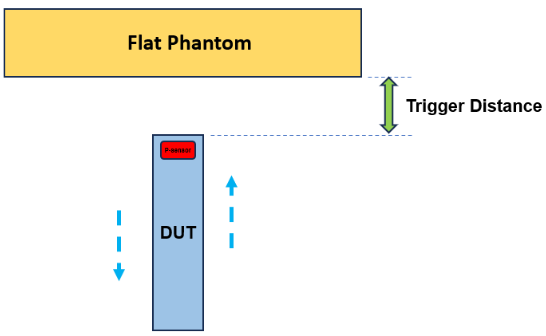
RF Exposure Scenario	Technologuies Supported	Supported Power Back-off mode	DSI conditions	Description
Head	All Band WWAN	Receiver on	DSI = 2	Device positioned next to head and receiver active
Body & Limbs	All Band WWAN	Proximity sensor Not triggering	DSI = 4	Device being used with a body and held with hand, and grip sensor is not triggered
	All Band WWAN	Proximity sensor triggering	DSI = 1	Device being used with a body and held with hand, and grip sensor is triggered
Hotspot	All Band WWAN	Hotspot On	DSI-3	Device transmits in hotspot mode near body. Hotspot Mode Active.

4.5. Proximity Sensor and Power Verification

This device implemented with proximity sensor used to trigger power reduction for RF exposure compliance. Per KDB Publication 616217 D04, the triggering conditions for both normal maximum output power and reduced maximum output power must be confirmed for the sensor and antenna combinations to verify proper triggering at the specified triggering distances. The smallest separation distance determined by the sensor triggering and sensor coverage for normal and tilt positions in KDB Publication 616217 D04 §6.2, §6.3 and §6.4 for surfaces and/or edges triggering conditions, minus 1 mm, must be used as the test separation distance for SAR testing.

Testing for Determining Proximity Sensor Triggering Distances per KDB 616217 D04 §6.2

Per KDB Publication 616217 D04 §6.2, the proximity sensor of the DUT was moved toward the flat phantom to determine the trigger distance for enabling power reduction and moved away from the flat phantom to determine the trigger distance for resuming full power. The DUT featured a visual indicator on its display screen that showed the status of the proximity sensor (triggered or not triggered). This was used to determine the status of the sensor during the proximity sensor assessment.



The proximity sensor triggering distance was determined per KDB Publication 616217 for rear face and applicable edge. Summary for power verification per distance was tabulated in the below table.

WWAN :

Output Power Verification in dBm for DUT Front Face											
Distance (mm)	11	12	13	14	15	16	17	18	19	20	21
LTE 7	18.3	18.0	18.3	18.4	18.0	18.5	23.0	22.9	22.9	23.2	23.0
LTE 25	20.2	20.5	20.2	20.4	20.3	20.1	23.3	23.3	23.2	23.0	23.3
LTE 30	20.3	20.2	20.4	20.3	20.2	20.2	22.4	22.9	22.4	22.6	22.7
LTE 38	20.4	20.1	20.4	20.1	20.3	20.2	22.9	23.0	23.1	22.8	23.3
LTE 40	22.5	22.1	22.0	22.2	22.1	22.3	23.1	23.1	23.3	22.8	23.1
LTE 41	20.2	20.4	20.1	20.4	20.4	20.0	23.2	23.1	23.0	22.9	23.3
5GNR_n7	18.1	17.9	18.2	18.2	18.3	18.0	23.3	23.0	22.9	23.3	22.8
5GNR_n25	20.0	20.2	20.1	20.1	20.1	20.1	22.1	22.4	22.1	22.4	21.9
5GNR_n66	21.2	21.0	21.0	21.5	21.4	21.5	23.2	23.6	23.2	23.4	23.6
5GNR_n38	20.1	20.0	20.2	19.9	20.3	20.0	23.2	23.2	23.2	23.1	23.4
5GNR_n41	20.4	20.4	20.0	19.9	20.0	20.3	23.5	23.5	23.3	23.4	23.1
5GNR_n78	21.4	21.0	21.3	20.9	21.3	21.0	24.4	24.4	24.2	24.4	24.4

Output Power Verification in dBm for DUT Rear Face											
Distance (mm)	11	12	13	14	15	16	17	18	19	20	21
LTE 7	18.4	18.0	18.0	18.4	18.3	18.1	22.8	22.9	22.8	23.3	23.0
LTE 25	20.4	20.2	20.3	20.5	20.0	20.1	22.9	22.9	23.1	23.1	22.8
LTE 30	20.4	20.1	20.5	20.0	20.5	20.3	22.4	22.9	22.6	22.7	22.9
LTE 38	20.4	20.2	20.3	20.0	20.3	19.9	22.8	22.9	23.1	23.0	23.2
LTE 40	22.2	22.5	22.4	22.3	22.4	22.5	22.9	23.3	23.3	23.0	23.2
LTE 41	20.4	20.3	20.0	20.5	20.0	20.0	22.8	23.1	23.1	23.3	23.0
5GNR_n7	17.9	18.3	18.3	18.1	17.8	17.9	23.2	23.2	22.9	23.1	23.2
5GNR_n25	20.4	20.0	20.3	20.4	20.4	20.4	22.2	22.0	21.9	22.0	22.1
5GNR_n66	21.5	21.5	21.0	21.4	21.4	21.5	23.4	23.4	23.7	23.4	23.4
5GNR_n38	20.2	20.2	20.2	20.2	20.4	20.1	23.2	23.0	23.1	23.0	23.3
5GNR_n41	20.3	20.3	19.9	19.9	20.0	20.4	23.1	23.4	23.5	23.1	23.0
5GNR_n78	21.4	20.9	21.2	21.3	21.1	21.2	24.4	24.0	24.1	24.0	24.5

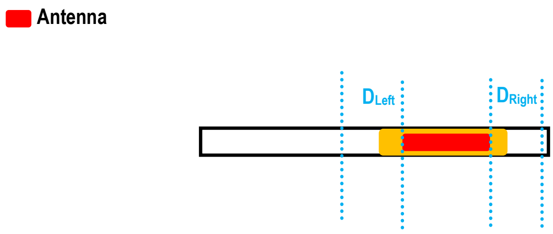
WLAN :

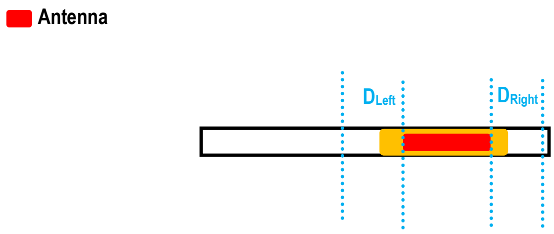
Output Power Verification in dBm for DUT Front Face											
Distance (mm)	11	12	13	14	15	16	17	18	19	20	21
WLAN 2.4G	16.4	16.3	16.3	16.7	16.6	16.7	19.8	19.7	19.5	19.9	19.4
WLAN 5.3G	15.5	15.3	15.7	15.3	15.8	15.6	17.5	17.7	17.5	17.7	17.3
WLAN 5.6G	16.4	16.7	16.9	16.4	16.4	16.7	17.8	17.6	17.5	17.7	17.5
WLAN 5.8G	15.6	15.7	15.7	15.3	15.5	15.4	17.4	17.8	17.4	17.7	17.5

Output Power Verification in dBm for DUT Rear Face											
Distance (mm)	11	12	13	14	15	16	17	18	19	20	21
WLAN 2.4G	16.6	16.5	16.6	16.7	16.6	16.3	19.4	19.9	19.8	19.5	19.5
WLAN 5.3G	15.6	15.3	15.4	15.3	15.4	15.8	17.2	17.6	17.7	17.4	17.6
WLAN 5.6G	16.4	16.7	16.5	16.6	16.6	16.8	17.8	17.4	17.5	17.7	17.3
WLAN 5.8G	15.5	15.6	15.3	15.4	15.8	15.7	17.9	17.8	17.5	17.9	17.8

Testing for Determining Proximity Sensor Coverage per KDB 616217 D04 §6.3

Per KDB Publication 616217 D04 §6.3, the proximity sensor coverage was determined for rear face and applicable edge. Summary for proximity sensor active region is illustrated in below.





P-sensor Coverage for Front Face:

D_{Left} is 4 mm, D_{Right} is 3 mm

P-sensor Coverage for Rear Face:

D_{Left} is 6 mm, D_{Right} is 5 mm

Testing for Determining Proximity Sensor Tilt Angle Influences per KDB 616217 D04 §6.4

There is no need to evaluate this test item as there is no side proximity sensor functionality imported.

Summary for Proximity Sensor Triggering Tests

According to the procedures noticed in KDB Publication 616217 D04, the proximity sensor triggering distance is 16 mm for DUT Front Face and Rear Face. The Testing for Determining Proximity Sensor Coverage is 15 mm for DUT Front Face and Rear Face. The conservation triggering distances based on the separation distance for the sensor trigger / not triggered as DUT with power reduction at 0 mm, and DUT without power reduction at 14 mm for DUT Front and Rear Face were used to test SAR. The power reduction depends on the proximity sensor input. For a steady SAR test, the power reduction was enabled or disabled manually by engineering software during SAR testing.

Position	§7.7.2.2 Trigger Distance (mm)	§7.7.3 Sensor Coverage	§7.7.2.3 Tilt Angle Influence (mm)	Worst-case Distance for SAR (mm)
Front	16	15	N/A	**14**
Rear	16	15	N/A	**14**

Note. Although the Front face and Rear face can be tested up to a distance of 14 mm, in our test report, we use a more conservative distance test with 10 mm for both position test.

5. Measurement System Description

5.1. SAR Definition

The Specific Absorption Rate (SAR) is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational / controlled and general population / uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational / controlled exposure limits are higher than the limits for general population / uncontrolled. The SAR is defined as the time derivative (rate) of the incremental energy (*dW*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element (*dV*) of a given density (*ρ*) as shown in the following equation:

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

The SAR is expressed in units of watts per kilogram (W/kg) or equivalently milliwatts per gram (mW/g), and it is related to the E-field at a point by the following equation:

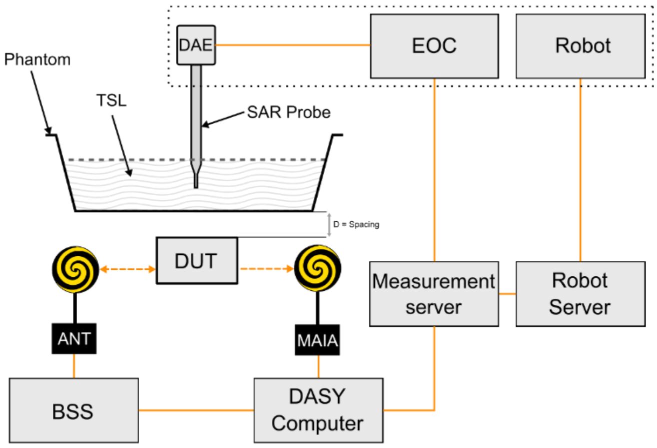
$$SAR = \frac{\sigma |E|^2}{\rho}$$

Where:
σ = conductivity of the tissue (S/m)
ρ = mass density of the tissue (kg/m^3)
E = RMS electrical field strength (V/m)

5.2. SAR Measurement Setup

The SAR measurements are performed using Dosimetric Assessment System (DASY) made by Schmid & Partner Engineering AG, which is a robot-based high precision electromagnetic (EM) near-field scanning platform. The DASY system measures the precise locations of the near-field radiators of highly non-isotropic fields. A sophisticated measurement system with a variety of probes (SAR, E-field, H-field etc.) combined with a high-precision 6-axis robot positioner allows for completely automated measurement scans and evaluations with both field and position information, e.g., volume averages, peak search, and extrapolations.

SPEAG DASY8 SAR Measurement System Setup



The DASY8 system for SAR measurements consists of:

- 6-axis robotic arm (Stäubli TX2-90XL) for positioning the probe.
- Mounting Platform for keeping the phantoms at a fixed location relative to the robot.
- Measurement Server for handling all time-critical tasks, such as measurement data acquisition and supervision of safety features.
- EOC (Electrical to Optical Converter) for converting the optical signal from the DAE to electrical before being transmitted to the measurement server.
- LB (Light-Beam unit) for probe alignment (measurement of the exact probe length and eccentricity).
- SAR probe (EX3D, ES3D probes) for measuring the E-field distribution in the phantom. The SAR distribution and the psSAR (peak spatial averaged SAR) are derived from the E-field measurement.
- SAR phantom that represents a physical model with an equivalent human anatomy. A Specific Anthropomorphic Mannequin (SAM) head is usually used for handheld devices, and a Flat phantom is used for body-worn devices. Specific phantoms are available if the Device Under Test (DUT) is intended for operation on different parts of the body other than the head or torso (e.g., the wrist).
- TSL (Tissue Simulating Liquid) representing the dielectric properties of used tissue.
- DAE (Data Acquisition Electronics) for reading the probe voltages and transmitting it to the DASY8 control PC.
- Device Holder for positioning the DUT beneath the phantom.
- MAIA (Modulation and Interference Analyzer) for confirming the accuracy of the probe linearization parameters.
- ANT (wide-band Antenna) for broadcasting the downlink signals emitted by base station simulators to the DUT.
- Control PC for running the DASY8 software to define/execute the measurements.
- System validation kits for system check / validation purposes.

5.2.1 E-Field Probes

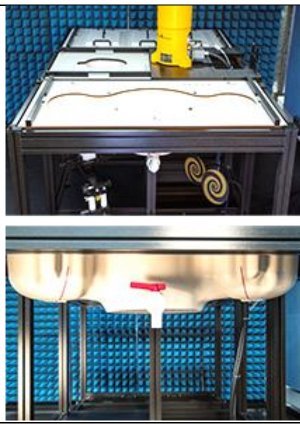
Model	EX3DV4
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	4 MHz to 10 GHz Linearity: ± 0.2 dB
Directivity	± 0.1 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

5.2.2 Data Acquisition Electronics (DAE)

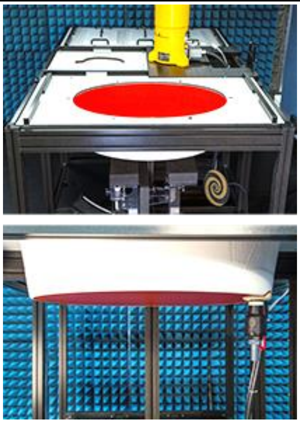
Model	DAE3, DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16-bit resolution and two range settings: 4mV, 400mV)
Input Offset Voltage	< 5µV (with auto zero)
Input Bias Current	< 50 fA
Dimensions	60 x 60 x 68 mm

5.2.3 Phantoms

Model	SAM-Twin Phantom
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE Std 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body-mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.
Material	Vinylester, fiberglass reinforced (VE-GF)
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters



Model	ELI
Construction	The ELI phantom is used for compliance testing of handheld and body-mounted wireless devices. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.
Material	Vinylester, fiberglass reinforced (VE-GF)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters



5.2.4 Device Holder

Model	MD4HHTV5 - Mounting Device for Hand-Held Transmitters
Construction	In combination with the Twin SAM or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).
Material	Polyoxymethylene (POM)

Model	MDA4WTV5 - Mounting Device Adaptor for Ultra-Wide Transmitters
Construction	An upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.
Material	Polyoxymethylene (POM)

Model	MDA4SPV6 - Mounting Device Adaptor for Smart Phones
Construction	The solid low-density MDA4SPV6 adaptor assuring no impact on the DUT radiation performance and is conform with any DUT design and shape.
Material	ROHACELL

Model	MD4LAPV5 - Mounting Device for Laptops and other Body-Worn Transmitters
Construction	In combination with the Twin SAM or ELI phantoms, the Mounting Device (Body-Worn) enables testing of transmitter devices according to IEC 62209-2 specifications. The device holder can be locked for positioning at a flat phantom section.
Material	Polyoxymethylene (POM), PET-G, Foam

5.2.5 Power Source

Model	Powersource1
Signal Type	Continuous Wave
Operating Frequencies	600 MHz to 5850 MHz
Output Power	-5.0 dBm to +17.0 dBm
Power Supply	5V DC, via USB jack
Power Consumption	<3 W
Applications	System performance check and validation with a CW signal.

5.2.6 System Validation Dipoles

Model	D-Serial
Construction	Symmetrical dipole with l/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.
Frequency	750 MHz to 5800 MHz
Return Loss	> 20 dB
Power Capability	> 100 W (f < 1GHz), > 40 W (f > 1GHz)

5.2.7 Tissue Simulating Liquids

The dielectric properties of the tissue simulating liquids are referred to KDB 865664 D01, IEEE Std 1528 and IEC/IEEE 62209-1528. For SAR measurement of the field distribution inside the phantom, the phantom has been filled with head tissue-equivalent medium. To minimize reflections within the phantom, the depth of the homogeneous medium is greater than or equal to 15 cm. For head SAR testing, the liquid height was measured from the phantom ear reference point (ERP) to the top surface of the tissue simulating liquid. For body and extremity SAR testing, the liquid height was measured from the center of the flat phantom to the top surface of the tissue simulating liquid.

The following table gives the recipes for tissue simulating liquids.

Tissue Type	Water	Tween 20	Oxidized Mineral Oil	Diethylenglycol Monohexylether	Triton X-100	NaCl
835	50.36 %	48.39 %				1.25 %
900	50.31 %	48.34 %				1.35 %
1800	56.00 %		44.00 %			
2450	56.00 %		44.00 %			
4000	56.00 %		44.00 %			
5000	56.00 %		44.00 %			
5200	65.53 %			17.24 %	17.24 %	
5800	65.53 %			17.24 %	17.24 %	
6000	56.00 %		44.00 %			
8000	67.80 %	31.10 %				
10000	66.00 %	33.00 %				

Before SAR measurement, the dielectric properties of the tissue simulating liquid were verified using a dielectric assessment kit and a network analyzer. Since the range of ±10 % of the required target values is used to measure relative permittivity and conductivity, the SAR correction procedure is applied to correct measured SAR for the deviations in permittivity and conductivity. Only positive correction has been used to scale up the measured SAR, and SAR result would not be corrected if the correction ΔSAR has a negative sign. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 10 % are listed in below.

Frequency (MHz)	Target Permittivity	±10 % Range of Permittivity	Target Conductivity	±10 % Range of Conductivity
750	41.9	37.7 ~ 46.1	0.89	0.80 ~ 0.98
835	41.5	37.4 ~ 45.7	0.90	0.81 ~ 0.99
900	41.5	37.4 ~ 45.7	0.97	0.87 ~ 1.07
1450	40.5	36.5 ~ 44.6	1.20	1.08 ~ 1.32
1800	40.0	36.0 ~ 44.0	1.40	1.26 ~ 1.54
1900	40.0	36.0 ~ 44.0	1.40	1.26 ~ 1.54
1950	40.0	36.0 ~ 44.0	1.40	1.26 ~ 1.54
2000	40.0	36.0 ~ 44.0	1.40	1.26 ~ 1.54
2100	39.8	35.8 ~ 43.8	1.49	1.34 ~ 1.64
2450	39.2	35.3 ~ 43.1	1.80	1.62 ~ 1.98
2600	39.0	35.1 ~ 42.9	1.96	1.76 ~ 2.16
3000	38.5	34.7 ~ 42.4	2.40	2.16 ~ 2.64
3500	37.9	34.1 ~ 41.7	2.91	2.62 ~ 3.20
4000	37.4	33.7 ~ 41.1	3.43	3.09 ~ 3.77
4500	36.8	33.1 ~ 40.5	3.94	3.55 ~ 4.33
5000	36.2	32.6 ~ 39.8	4.45	4.01 ~ 4.90
5200	36.0	32.4 ~ 39.6	4.66	4.19 ~ 5.13
5400	35.8	32.2 ~ 39.4	4.86	4.37 ~ 5.35
5600	35.5	32.0 ~ 39.1	5.07	4.56 ~ 5.58
5800	35.3	31.8 ~ 38.8	5.27	4.74 ~ 5.80
6000	35.1	31.6 ~ 38.6	5.48	4.93 ~ 6.03
6500	34.5	31.1 ~ 38.0	6.07	5.46 ~ 6.68
7000	33.9	30.5 ~ 37.3	6.65	5.99 ~ 7.32
7500	33.3	30.0 ~ 36.6	7.24	6.52 ~ 7.96
8000	32.7	29.4 ~ 36.0	7.84	7.06 ~ 8.62
8500	32.1	28.9 ~ 35.3	8.46	7.61 ~ 9.31
9000	31.6	28.4 ~ 34.8	9.08	8.17 ~ 9.99
9500	31.0	27.9 ~ 34.1	9.71	8.74 ~ 10.68
10000	30.4	27.4 ~ 33.4	10.40	9.36 ~ 11.44

5.3. SAR Test Procedures

According to the SAR test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

[1] Power Reference measurement

[2] Area Scan

[3] Zoom Scan

[4] Power Drift measurement

5.3.1 Power Reference Measurement

The Power Reference measurement and Power Drift measurement are for monitoring the power drift of the DUT in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

5.3.2 Area Scan Measurement

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEC/IEEE 62209-1528. If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly. Following table provides the measurement parameters required for the area scan.

Parameter	f ≤ 3 GHz	f > 3 GHz
Maximum distance from closest measurement point to phantom surface	5 ±1 mm	½ δ ln(2) ±0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ±1°	20° ±1°
Maximum area scan spatial resolution：Δx_{Area}, Δy_{Area}	≤ 2 GHz：≤ 15 mm 2 ~ 3 GHz：≤ 12 mm	3 ~ 4 GHz：≤ 12 mm 4 ~ 6 GHz：≤ 10 mm 6 ~ 7 GHz：≤ 7.5 mm

From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that will not be within the zoom scan of other peaks. Additional peaks shall be measured only when the primary peak is within 2 dB of the SAR compliance limit (e.g., 1.0 W/kg for 1.6 W/kg 1g SAR limit; or 1.26 W/kg for 2.0 W/kg 10g SAR limit).

5.3.3 Zoom Scan Measurement

The Zoom Scan are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

The Zoom Scan (three-dimensional SAR distribution) is performed at the local maxima locations identified in previous area scan procedure. The zoom scan volume must be larger than the required minimum dimensions. When graded grids are used, which only applies in the direction normal to the phantom surface, the initial grid separation closest to the phantom surface and subsequent graded grid increment ratios must satisfy the required protocols. The 1 g SAR averaging volume must be fully contained within the zoom scan measurement volume boundaries; otherwise, the measurement must be repeated by shifting or expanding the zoom scan volume. The similar requirements also apply to 10 g SAR measurements. Following table provides the measurement parameters required for the zoom scan.

Parameter		f ≤ 3 GHz	f > 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}		≤ 2 GHz : ≤ 8 mm 2 ~ 3 GHz : ≤ 5 mm	3 ~ 4 GHz : ≤ 5.0 mm 4 ~ 6 GHz : ≤ 4.0 mm 6 ~ 7 GHz : ≤ 3.4 mm
Maximum zoom scan spatial resolution, normal to phantom surface	*uniform grid* : $\Delta z_{Zoom}(n)$	≤ 5 mm	3 ~ 4 GHz : ≤ 4.0 mm 4 ~ 5 GHz : ≤ 3.0 mm 5 ~ 7 GHz : ≤ 2.0 mm
	graded grids : $\Delta z_{Zoom}(1)$	≤ 4 mm	3 ~ 4 GHz : ≤ 3.0 mm 4 ~ 5 GHz : ≤ 2.5 mm 5 ~ 6 GHz : ≤ 2.0 mm 6 ~ 7 GHz : ≤ 1.7 mm
	$\Delta z_{Zoom}(n>1)$	≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume (x, y, z)		≥ 30 mm	3 ~ 4 GHz : ≥ 28 mm 4 ~ 5 GHz : ≥ 25 mm 5 ~ 7 GHz : ≥ 22 mm

Per IEC 62209-2 AMD1, the successively higher resolution zoom scan is required if the zoom scan measured as defined above complies with both of the following criteria, or if the peak spatial-average SAR is below 0.1 W/kg, no additional measurements are needed:

[1] The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak shall be larger than the horizontal grid steps in both x and y directions (Δx, Δy). This shall be checked for the measured zoom scan plane conformal to the phantom at the distance zM1.

[2] The ratio of the SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the x-y location of the measured maximum SAR value shall be at least 30 %.

If one or both of the above criteria are not met, the zoom scan measurement shall be repeated using a finer resolution. New horizontal and vertical grid steps shall be determined from the measured SAR distribution so that the above criteria are met. Compliance with the above two criteria shall be demonstrated for the new measured zoom scan.

5.3.4 Power Drift Measurement

The Power Drift measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift measurement gives the field difference in dB from the reading conducted within the last Power Reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Power Reference measurement. If the power drift more than 5 %, the SAR measurement will be retested.

5.3.5 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1 g and 10 g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1 g and 10 g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

[1] Extraction of the measured data (grid and values) from the Zoom Scan
[2] Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
[3] Generation of a high-resolution mesh within the measured volume
[4] Interpolation of all measured values form the measurement grid to the high-resolution grid
[5] Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
[6] Calculation of the averaged SAR within masses of 1 g and 10 g

5.3.6 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1 % for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

5.3.8 Absorbed Power Density Conversion

The Absorbed Power Density (APD) will be derived from the measured SAR values. According to SPEAG application note and DASY8 manual, the APD is evaluated numerically using the FDTD method of Sim4Life software and averaged over square surface areas of 1 cm^2 and 4 cm^2 in the lowermost voxel layer of a flat phantom at a frequency of 6.5 GHz. The phantom consists of a dielectric shell of 2 mm thickness and a relative permittivity 3.7.

5.4. Incident Power Density Definition

The incident power density for an electromagnetic field represents the rate of energy transfer per unit area. The local power density (i.e., Poynting vector) at a given spatial point is deduced from electromagnetic fields by the following formula:

$$S = \frac{1}{2} Re\{E \times H^{*}\} \cdot \vec{n}$$

Where: E is the complex electric field peak phasor and H is the complex conjugate magnetic field peak phasor.

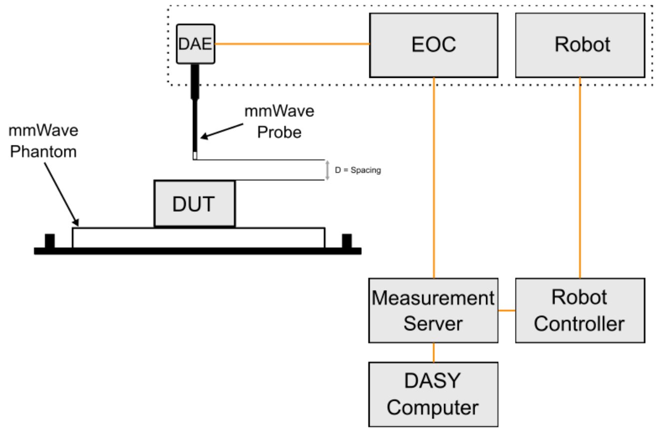
The spatial-average power density distribution on the evaluation surface is determined per the IEC TR 63170. The spatial area, A is specified by the applicable exposure limit or regulatory requirements. The circular shape was used.

$$S = \frac{1}{2A} \Re \left(\int E \times H^{*} \cdot \hat{n} dA \right)$$

5.5. Incident Power Density Measurement Setup

The DASY8 system combines a sophisticated measurement system with a variety of probes (SAR, E- field, H-field, temperature, etc.) and a high-precision 6-axis robot positioner. The combination allows for completely automated measurement scans and evaluations with both field and position information, e.g., volume averages, peak search, and extrapolations. The main purpose is to perform near-field measurements of radiators of highly non-isotropic fields for which the exact measurement location is critical.
The special application area described in the system handbook is IPD measurement in the 6 GHz– 110 GHz frequency range.

SPEAG DASY8 Power Density Measurement System Setup



The DASY8 system for Incident Power Density measurements consists of:

- 6-axis robotic arm (Stäubli TX2-90XL) for positioning the probe.
- Mounting Platform for maintaining the phantoms at a fixed location relative to the robot.
- Measurement Server that handles all time-critical tasks, such as measurement data acquisition and supervision of safety features.
- Electrical to Optical Converter (EOC) for converting the optical signal from the DAE to electrical before being transmitted to the measurement server.
- Light Beam unit for probe alignment (measurement of the exact probe length and eccentricity).

- A millimeter Wave (mm-Wave) probe (EummWVx) for measuring the E-field magnitude. The polarization ellipses and the power density are then derived.
- A mm-Wave phantom used as the test bed.
- DAE that reads the probe voltages and transmits it to the DASY8 control PC.
- A mm-Wave Device Holder for positioning the DUT on top of the phantom.
- Control PC that runs the DASY8 software for defining / executing the measurements.
- System verification sources for system performance checks.

5.5.1 mm-Wave E-Field Probe

Model	EUmmWVx	
Frequency	750 MHz to 110 GHz	
Dynamic Range	< 20 V/m ~ 10000 V/m with PRE-10 (min < 20 V/m ~ 2000 V/m)	
Linearity	< ±0.2 dB	
Hemispherical Isotropy	< 0.5 dB	
Position Precision	< 0.2 mm	
Dimensions	Overall length: 320 mm (tip: 20 mm) Tip diameter: encapsulation 8 mm (internal sensor < 1 mm) Distance from probe tip to dipole centers: < 2 mm Sensor displacement to probe's calibration point: < 0.3 mm	

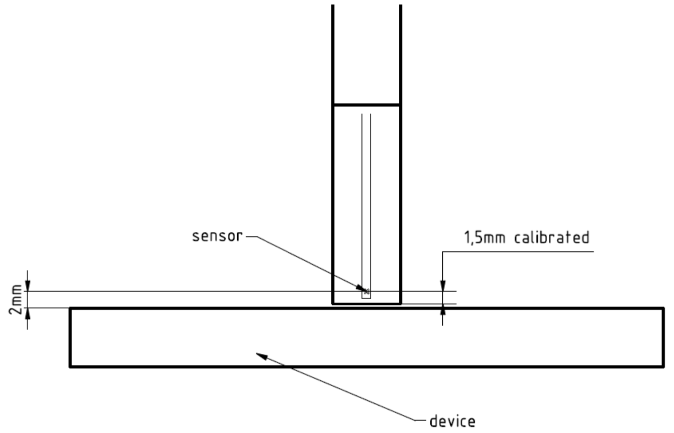
The EUmmWVx probe is an electric (E) universal (U) field probe with two dipole sensors for field measurements at frequencies up to 110 GHz and as close as 2 mm from any field source or transmitter. The sensors consist of two diode-loaded small dipoles that provide the rectified voltage from the coupled E-field. From the voltages at three different orientations in the field at known angles, both the magnitude of the field component and the field polarization can be calculated. Due to the small size of the sensors, the probe can be used for measurements over an extremely wide frequency range from 750 MHz to 110 GHz. The probe sensors are protected by non-removable 8 mm high-density foam.

The EUmmWVx probe is based on the pseudo-vector probe design, which not only measures the field magnitude but also derives its polarization ellipse. This probe concept also has the advantage that the sensor angle errors or distortions of the field by the substrate can be largely nullified by calibration. This is particularly important as, at these very high frequencies, field distortions by the substrate are dependent on the wavelength. The design entails two small 0.8 mm dipole sensors mechanically protected by high-density foam, printed on both sides of a 0.9 mm wide and 0.12 mm thick glass substrate. The body of the probe is specifically constructed to minimize distortion by the scattered fields.

The probe consists of two sensors with different angles arranged in the same plane in the probe axis. Three or more measurements of the two sensors are taken for different probe rotational angles to derive the amplitude and polarization information. These probes are the most flexible and accurate probes currently available for measuring field amplitude.

The probe design allows measurements at distances as small as 2 mm from the sensors to the surface of the device under test (DUT). The typical sensor to probe tip distance is 1.5 mm. The exact distance is calibrated.

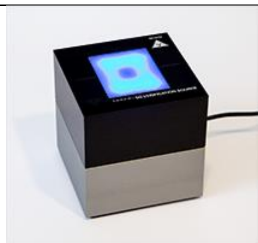
Illustration of the Distance Sensor to the DUT Surface



5.5.2 System Verification Sources

Model	System Verification for X-band
Calibrated Frequency	10 GHz
E-field Polarization	Linear
Max Input Power	20 W
Connector	SMA
Operation	requires a stable source with known forward power to perform system performance check or validation
Weight	700 g

Model	System Verification for Ka-band, V-band, W-band
Calibrated Frequency	30 GHz, 60 GHz
Frequency Accuracy	±100 MHz
Harmonics	-20 dBc
Total Radiated Power	14 dBm for 30 GHz, 20 dBm for 60 GHz
Power Stability	0.05 dB for 30 GHz, 0.1 dB for 60 GHz
Dimensions	100 x 100 x 100 mm



5.6. Incident Power Density Measurement Procedure

Within a short distance from the transmitting source, power density is determined based on both electric and magnetic fields. Generally, the magnitude and phase of two components of either the E-field or H-field are needed on a sufficiently large surface to fully characterize the total E-field and H-field distributions. Nevertheless, solutions based on direct measurement of E-field and H-field can be used to compute power density. When the measurement surface does not correspond to the evaluation surface, reconstruction algorithms are necessary to project or transform the fields from the measurement surface to the evaluation surface. The general measurement approach is summarized in following:

[1] Measure the E-field on the measurement surface at a reference location where the field is well above the noise level. This reference level will be used at the end of this procedure to assess output power drift of the DUT during the measurement.

[2] Scan the electric field on the measurement surface. The requirements of measurement surface dimensions and spatial resolution are dependent on the measurement system and assessment methodology applied. Measurements are therefore conducted according to the instructions provided by the measurement system manufacturer.

[3] Measurement spatial resolution can depend on the measured field characteristic and measurement methodology used by the system. Planar scanners typically require a step size of less than λ/2. When measurements are acquired in regions where evanescent modes are not negligible, smaller spatial resolution may be required. Similar criteria also apply to cylindrical scanning systems where the spatial resolution in the vertical direction should be less than λ/2.

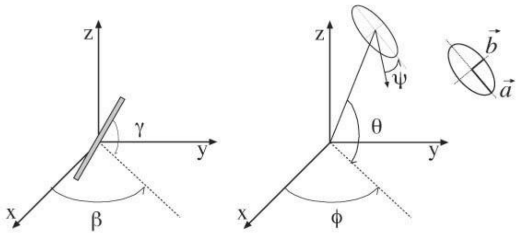
[4] Since only E-field is measured on the measurement system, the H-field is calculated from the measured field using a reconstruction algorithm. As power density requires knowledge of both amplitude and phase, reconstruction algorithms can also be used to obtain field information from the measured data (e.g., the phase from the amplitude if only the amplitude is measured). The measurement involves two planes with three different probe rotations on two measurement planes separated by λ/4. The grid steps are optimized by the software based on the test frequency. The location of the lowest measurement plane is defined by the distance of first measurement layer from device under test entered by the user. In addition, when the measurement surface does not correspond to the evaluation surface, reconstruction algorithms are employed to project or transform the fields from the measurement surface to the evaluation surface. In substance, reconstruction algorithms are the set of algorithms, mathematical techniques and procedures that are applied to the measured field on the measurement surface to determine E- and H-field (amplitude and phase) on the evaluation surface.

[5] To determine the spatial-average power density distribution on the evaluation surface. The spatial averaging area, A, is specified by the applicable exposure limits or regulatory requirements. If the shape of the area is not provided by the relevant regulatory requirements, a circular shape is recommended.

[6] Measure the E-field on the measurement surface position at the reference location chosen in step [1]. The power drift of the DUT is estimated as the difference between the squared amplitude of the field values taken in steps [1] and [6]. When the drift is smaller than ±5 %, this term should be considered in the uncertainty budget. Drifts larger than 5 % due to the design and operating characteristics of the device should be accounted for or addressed according to regulatory requirements to determine compliance.

5.6.1 Computation of the Electric Field Polarization Ellipse

For the numerical description of an arbitrarily oriented ellipse in three-dimensional space, five parameters are needed: the semi-major axis (*a*), the semi-minor axis (*b*), two angles describing the orientation of the normal vector of the ellipse (Φ, θ), and one angle describing the tilt of the semi-major axis (ψ). For the two extreme cases, i.e., circular and linear polarizations, only three parameters (*a*, Φ, and θ) are sufficient for the description of the incident field.



For the reconstruction of the ellipse parameters from measured data, the problem can be reformulated as a nonlinear search problem. The semi-major and semi-minor axes of an elliptical field can be expressed as functions of the three angles (Φ, θ, and ψ). The parameters can be uniquely determined to minimize the error based on least-squares for the given set of angles and the measured data. In this way, the number of free parameters is reduced from five to three, which means that at least three sensor readings are necessary to gain sufficient information for the reconstruction of the ellipse parameters. However, to suppress the noise and increase the reconstruction accuracy, it is desirable to overdetermine the system of equations. The solution to use a probe consisting of two sensors angled by γ_1 and γ_2 toward the probe axis and to perform measurements at three angular positions of the probe, i.e., at β_1, β_2, and β_3, results in overdeterminations by a factor of two. If more information or increased accuracy is required, more rotation angles can be added.

The reconstruction of the ellipse parameters can be separated into linear and non-linear parts that are best solved by the Givens algorithm combined with a downhill simplex algorithm. To minimize the mutual coupling, sensor angles are set with a shift of 90° ($\gamma_2 = \gamma_1 + 90°$), and, for simplification, the first rotation angle of the probe (β_1) can be set to 0°.

5.6.2 Total Field and Power Flux Density Reconstruction

Plane-to-Plane Phase Reconstruction (PTP-PR)

Computation of the IPD in general requires knowledge of the electric (E-) and magnetic (H-) field amplitudes and phases in the plane of incidence. Reconstruction of these quantities from pseudo-vector E-field measurements is feasible, as they are constrained by Maxwell's equations.

The Plane-to-Plane Phase Reconstruction (PTP-PR) reconstruction approach based on the Gerchberg-Saxton algorithm, which benefits from the availability of the E-field polarization ellipse information obtained with the EUmmWVx probe. This reconstruction algorithm, together with the ability of the probe to measure extremely close to the source without perturbing the field, permits reconstruction of the E- and H-fields and the IPD on measurement planes located as near as λ/2π. At closer distances, the uncertainty might be larger.

Equivalent Source Reconstruction (ESR) (Recommended)

In order to overcome the main limitations of PTP-PR at distances d ≤ λ/2π from the DUT, i.e., in the reactive near-field and beyond planar evaluation surfaces, SPEAG have joined forces in a research collaboration to develop a novel equivalent source reconstruction (ESR) algorithm, that models an unknown and inaccessible transmitter not anymore in terms of plane waves but as a set of distributed known auxiliary sources below the surface of the device enclosure. The locations, amplitudes, and phases of these sources are then determined to reconstruct the measured near-fields optimally. As a result, the transmitters inside any enclosure can be replaced with these equivalent sources in any radiation problem, including exposure assessment scenarios. ESR even enables back transformation within a limited range.

This approach has three main advantages:

- Lower reconstruction errors in the reactive near-field regions, which ease compliance testing of DUT operating in the 6 ~ 24 GHz frequency range.
- Evaluation of phones with non-planar surfaces, e.g., a flat surface with a protruding camera module.
- Possibility to perform phase reconstruction in any parts of the radiation region without any limitation to planar measurement domains. In other words, measurements can be done on a conformal surface or even on scattered points in the radiation domain and still obtain reliable data on the phase variations. This opens the way for evaluations on non-planar device surfaces (e.g., virtual- reality goggles) and enables full-wave simulations using measurement results only, i.e., without requiring models for the transmitters.

5.6.3 Power Flux Density Averaging

The average of the reconstructed power density is evaluated on the measurement plane. Two averaging geometries are available: a circle and a rotating square. The averaging area is defined by the user; typical values are 1 cm^2 and 4 cm^2. The three variants of the spatial-average Power Density (sPD) defined in the IEC 63195 standard are computed by integration of the Poynting vector:

- sPD_{n+}：Surface normal propagating power flux density into the phantom.
- sPD_{tot+}：Total propagating power flux density into the phantom.
- sPD_{mod+}：Total power flux density into the phantom considering near-field exposure.

6. System Verification

6.1. SAR Tissue Simulating Liquid Verification

The tissue dielectric parameters of tissue-equivalent media used for SAR measurements must be characterized within a temperature range of 18 °C to 25 °C, measured with calibrated instruments and apparatuses, such as network analyzers and temperature probes. The temperature of the tissue-equivalent medium during SAR measurement must also be within 18 °C to 25 °C and within ±2 °C of the temperature when the tissue parameters are characterized. The tissue dielectric measurement system must be calibrated before use. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 ~ 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

The dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ±5 % of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ can be relaxed to ±10 %.

Frequency (MHz)	Ambient Temp. (℃)	Tissue Temp. (℃)	Permittivity (εr)	Conductivity (σ)	Targeted Permittivity (εr)	Targeted Conductivity (σ)	Deviation Permittivity (εr) (%)	Deviation Conductivity (σ) (%)	Date
750	22.3	22.1	41.9	0.890	41.9	0.89	0.00	0.00	Oct. 24, 2023
750	22.1	21.6	44.3	0.909	41.9	0.89	5.73	2.13	Oct. 27, 2023
750	22.3	22.2	43.0	0.903	41.9	0.89	2.63	1.46	Oct. 27, 2023
750	22.7	22.3	44.2	0.925	41.9	0.89	5.49	3.93	Oct. 29, 2023
750	22.4	22.0	39.8	0.868	41.9	0.89	-5.01	-2.47	Oct. 31, 2023
750	22.4	22.3	43.0	0.903	41.9	0.89	2.63	1.46	Oct. 31, 2023
750	22.0	21.6	44.3	0.909	41.9	0.89	5.73	2.13	Nov. 10, 2023
750	22.3	22.1	44.1	0.911	41.9	0.89	5.25	2.36	Nov. 11, 2023
750	22.4	22.2	44.2	0.933	41.9	0.89	5.49	4.83	Nov. 17, 2023
750	22.3	22.0	44.1	0.883	41.9	0.89	5.16	-0.79	Nov. 21, 2023
835	22.7	22.3	43.5	0.953	41.5	0.9	4.82	5.89	Oct. 23, 2023
835	21.9	21.6	43.3	0.919	41.5	0.9	4.34	2.11	Oct. 25, 2023
835	22.6	22.4	44.1	0.942	41.5	0.9	6.27	4.67	Oct. 30, 2023
835	22.3	21.8	39.5	0.900	41.5	0.9	-4.82	0.00	Nov. 02, 2023
835	22.1	21.7	42.4	0.885	41.5	0.9	2.17	-1.67	Nov. 09, 2023
835	22.4	22.2	43.1	0.966	41.5	0.9	3.86	7.33	Nov. 10, 2023
1800	22.4	22.2	42.6	1.390	40	1.4	6.50	-0.71	Oct. 25, 2023
1800	22.6	22.4	42.1	1.410	40	1.4	5.25	0.71	Oct. 30, 2023
1800	22.3	21.8	37.4	1.330	40	1.4	-6.50	-5.00	Nov. 02, 2023
1800	21.9	21.7	40.5	1.350	40	1.4	1.25	-3.57	Nov. 08, 2023
1800	22.2	22.1	41.5	1.480	40	1.4	3.75	5.71	Nov. 18, 2023
1800	22.4	22.1	37.4	1.330	40	1.4	-6.50	-5.00	Nov. 20, 2023
1900	22.5	22.2	41.4	1.450	40	1.4	3.50	3.57	Oct. 31, 2023
1900	22.4	22.0	37.2	1.380	40	1.4	-7.00	-1.43	Oct. 31, 2023
1900	22.4	22.3	42.0	1.470	40	1.4	5.00	5.00	Nov. 01, 2023
1900	22.0	21.7	41.5	1.460	40	1.4	3.75	4.29	Nov. 01, 2023
1900	22.3	21.8	37.2	1.380	40	1.4	-7.00	-1.43	Nov. 02, 2023
1900	22.7	22.3	40.8	1.430	40	1.4	2.00	2.14	Nov. 16, 2023
1900	22.2	20.0	37.2	1.380	40	1.4	-7.00	-1.43	Nov. 16, 2023
1900	22.5	22.2	41.1	1.470	40	1.4	2.75	5.00	Nov. 19, 2023
2300	22.2	21.8	36.7	1.630	39.5	1.67	-7.09	-2.40	Oct. 30, 2023
2300	22.6	22.5	40.8	1.710	39.5	1.67	3.29	2.40	Nov. 02, 2023
2300	22.7	22.4	41.6	1.740	39.5	1.67	5.32	4.19	Nov. 03, 2023
2300	22.5	22.2	39.8	1.680	39.5	1.67	0.76	0.60	Nov. 06, 2023
2300	22.8	22.3	39.9	1.710	39.5	1.67	1.01	2.40	Nov. 13, 2023
2300	22.3	21.9	41.5	1.720	39.5	1.67	5.06	2.99	Nov. 17, 2023
2450	22.6	21.7	40.0	1.830	39.2	1.8	2.04	1.67	Oct. 11, 2023
2450	22.5	22.2	40.5	1.840	39.2	1.8	3.32	2.22	Oct. 13, 2023
2450	22.6	22.3	40.8	1.880	39.2	1.8	4.08	4.44	Oct. 13, 2023
2450	22.1	21.6	36.5	1.740	39.2	1.8	-6.89	-3.33	Nov. 03, 2023

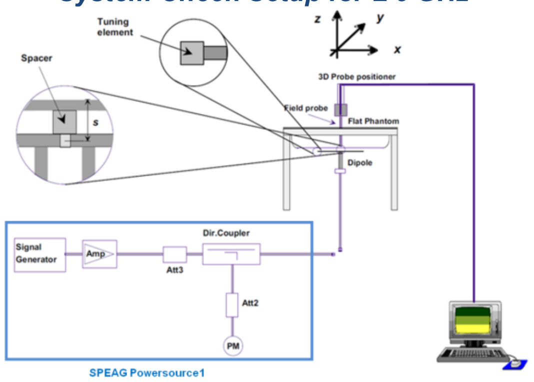
Frequency (MHz)	Ambient Temp. (℃)	Tissue Temp. (℃)	Permittivity (εr)	Conductivity (σ)	Targeted Permittivity (εr)	Targeted Conductivity (σ)	Deviation Permittivity (εr) (%)	Deviation Conductivity (σ) (%)	Date
2600	21.9	21.5	40.2	1.970	39	1.96	3.08	0.51	Oct. 24, 2023
2600	22.7	22.3	40.8	1.910	39	1.96	4.62	-2.55	Oct. 26, 2023
2600	22.3	21.7	40.2	1.970	39	1.96	3.08	0.51	Oct. 26, 2023
2600	22.4	22.2	40.7	1.970	39	1.96	4.36	0.51	Nov. 04, 2023
2600	22.2	21.7	38.8	1.950	39	1.96	-0.51	-0.51	Nov. 04, 2023
2600	22.5	22.1	40.6	1.940	39	1.96	4.10	-1.02	Nov. 05, 2023
2600	22.2	21.8	39.3	1.920	39	1.96	0.77	-2.04	Nov. 07, 2023
2600	21.9	21.5	40.2	1.970	39	1.96	3.08	0.51	Nov. 15, 2023
2600	22.6	22.4	38.0	1.940	39	1.96	-2.56	-1.02	Nov. 20, 2023
2600	22.5	22.3	39.5	1.970	39	1.96	1.28	0.51	Nov. 21, 2023
2600	22.4	21.9	40.5	1.990	39	1.96	3.85	1.53	Nov. 22, 2023
2600	22.2	21.8	41.0	2.010	39	1.96	5.13	2.55	Nov. 23, 2023
3500	22.6	22.2	40.0	2.740	37.9	2.91	5.54	-5.84	Oct. 27, 2023
3500	22.5	22.2	39.7	2.770	37.9	2.91	4.75	-4.81	Oct. 28, 2023
3500	22.8	22.4	38.9	2.660	37.9	2.91	2.64	-8.59	Nov. 06, 2023
3500	22.3	22.2	38.3	2.690	37.9	2.91	1.06	-7.56	Nov. 07, 2023
3500	22.3	22.1	38.9	2.720	37.9	2.91	2.64	-6.53	Nov. 11, 2023
3500	22.8	22.4	39.5	2.730	37.9	2.91	4.22	-6.19	Nov. 13, 2023
3500	22.6	22.4	39.7	2.720	37.9	2.91	4.75	-6.53	Nov. 14, 2023
3500	22.5	22.1	38.9	2.660	37.9	2.91	2.64	-8.59	Nov. 15, 2023
3500	22.7	22.3	39.4	2.730	37.9	2.91	3.96	-6.19	Nov. 16, 2023
3500	22.5	21.7	38.3	2.690	37.9	2.91	1.06	-7.56	Nov. 16, 2023
3500	22.5	22.0	39.4	2.720	37.9	2.91	3.96	-6.53	Nov. 19, 2023
3500	22.1	21.7	39.4	2.700	37.9	2.91	3.96	-7.22	Nov. 21, 2023
3500	22.1	21.5	39.4	2.720	37.9	2.91	3.96	-6.53	Nov. 22, 2023
3500	22.4	21.9	39.1	2.730	37.9	2.91	3.17	-6.19	Nov. 24, 2023
3700	22.6	22.2	39.7	2.930	37.7	3.12	5.31	-6.09	Oct. 27, 2023
3700	22.5	22.2	39.3	2.960	37.7	3.12	4.24	-5.13	Oct. 28, 2023
3700	22.6	22.5	39.1	2.860	37.7	3.12	3.71	-8.33	Nov. 02, 2023
3700	22.3	22.2	38.0	2.870	37.7	3.12	0.80	-8.01	Nov. 07, 2023
3700	22.6	22.4	39.4	2.910	37.7	3.12	4.51	-6.73	Nov. 14, 2023
3700	22.6	22.2	39.1	2.880	37.7	3.12	3.71	-7.69	Nov. 14, 2023
3700	22.5	22.1	38.6	2.850	37.7	3.12	2.39	-8.65	Nov. 15, 2023
3700	22.7	22.3	39.1	2.920	37.7	3.12	3.71	-6.41	Nov. 16, 2023
3700	22.5	21.7	37.7	2.870	37.7	3.12	0.00	-8.01	Nov. 16, 2023
3700	22.5	22.0	39.0	2.890	37.7	3.12	3.45	-7.37	Nov. 19, 2023
3700	22.1	21.7	39.1	2.880	37.7	3.12	3.71	-7.69	Nov. 21, 2023
3700	22.1	21.5	39.0	2.890	37.7	3.12	3.45	-7.37	Nov. 22, 2023
3700	22.4	21.9	38.8	2.900	37.7	3.12	2.92	-7.05	Nov. 24, 2023
3900	22.6	22.2	39.4	3.130	37.5	3.32	5.07	-5.72	Oct. 27, 2023
3900	22.5	22.2	39.1	3.150	37.5	3.32	4.27	-5.12	Oct. 28, 2023
3900	22.5	22.1	38.4	3.040	37.5	3.32	2.40	-8.43	Nov. 15, 2023
3900	22.7	22.3	38.8	3.110	37.5	3.32	3.47	-6.33	Nov. 16, 2023
3900	22.5	21.7	37.4	3.050	37.5	3.32	-0.27	-8.13	Nov. 16, 2023
3900	22.5	22.0	38.8	3.080	37.5	3.32	3.47	-7.23	Nov. 19, 2023
3900	22.1	21.7	38.9	3.070	37.5	3.32	3.73	-7.53	Nov. 21, 2023
5250	22.6	21.7	35.6	4.410	35.9	4.71	-0.84	-6.37	Oct. 11, 2023
5250	22.6	21.6	36.4	4.550	35.9	4.71	1.39	-3.40	Oct. 11, 2023
5250	22.5	22.2	35.8	4.610	35.9	4.71	-0.28	-2.12	Oct. 13, 2023
5250	22.4	22.1	36.7	4.560	35.9	4.71	2.23	-3.18	Nov. 20, 2023
5600	22.6	21.7	35.1	4.770	35.5	5.07	-1.13	-5.92	Oct. 11, 2023
5600	22.6	21.6	35.8	4.940	35.5	5.07	0.85	-2.56	Oct. 11, 2023
5600	22.6	22.3	35.7	4.790	35.5	5.07	0.56	-5.52	Oct. 13, 2023
5800	22.6	21.7	34.8	4.980	35.4	5.22	-1.69	-4.60	Oct. 11, 2023
5800	22.6	22.3	35.4	4.970	35.4	5.22	0.00	-4.79	Oct. 13, 2023
5800	22.4	22.1	35.8	5.180	35.4	5.22	1.13	-0.77	Nov. 23, 2023
6500	22.3	22.1	34.3	5.990	34.5	6.07	-0.58	-1.32	Oct. 12, 2023

6.2. SAR Test System Verification

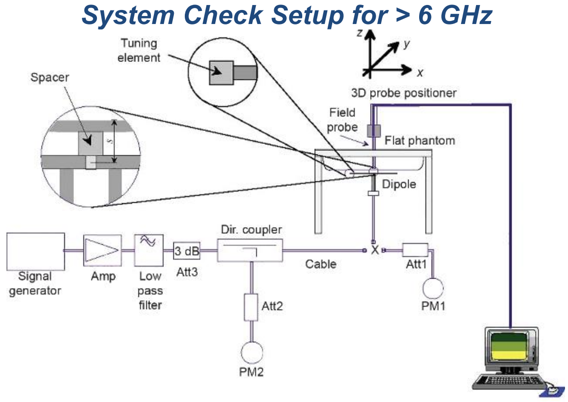
The SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium.

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. For frequency ≤ 6 GHz, the SPEAG Powersource1 is used as signal source. For frequency > 6 GHz, the signal generator is used as signal source. The Powersource1 is a portable and very stable RF source providing a continuous wave (CW) signal. It is designed for conducting system checks and system validation and is compatible with international standards, and has been calibrated by SPEAG's ISO 17025 accredited calibration center. When using Powersource1, the setup can be simplified. The signal purity is warranted by design. Since the Powersource1 is calibrated, no additional equipment is needed and the Powersource1 can directly be connected to the SMA connector of the dipole without a cable as all separate components (signal generator, amplifier, coupler and power meter) are built into the unit. The system verification setup is shown as below.

System Check Setup for ≤ 6 GHz



System Check Setup for > 6 GHz



The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touched the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. Before the system check testing, the Powersource1 will be adjusted for the desired forward power of 17 dBm (50 mW) or the signal generator will be adjusted for desired forward power of 20 dBm (100 mW) at the dipole connector and the RF output power would be turned on. After system check testing, the SAR result will be normalized to 1 W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

Date	Frequency (MHz)	Targeted 1g SAR (W/kg)	Measured 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)	Targeted 10g SAR (W/kg)	Measured 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
Oct. 24, 2023	750	8.56	0.436	8.70	1.63	5.61	0.29	5.79	3.14
Oct. 27, 2023	750	8.56	0.418	8.34	-2.57	5.61	0.276	5.51	-1.84
Oct. 27, 2023	750	8.56	0.438	8.74	2.09	5.61	0.292	5.83	3.85
Oct. 29, 2023	750	8.56	0.434	8.66	1.16	5.61	0.289	5.77	2.79
Oct. 31, 2023	750	8.56	0.414	8.26	-3.50	5.61	0.271	5.41	-3.62
Oct. 31, 2023	750	8.56	0.442	8.82	3.03	5.61	0.294	5.87	4.56
Nov. 10, 2023	750	8.56	0.415	8.28	-3.27	5.61	0.271	5.41	-3.62
Nov. 11, 2023	750	8.56	0.419	8.36	-2.33	5.61	0.278	5.55	-1.13
Nov. 17, 2023	750	8.56	0.431	8.60	0.46	5.61	0.286	5.71	1.72
Nov. 21, 2023	750	8.56	0.411	8.20	-4.20	5.61	0.269	5.37	-4.33
Oct. 23, 2023	835	9.64	0.512	10.22	5.97	6.28	0.337	6.72	7.07
Oct. 25, 2023	835	9.64	0.49	9.78	1.42	6.28	0.323	6.44	2.62
Oct. 30, 2023	835	9.64	0.51	10.18	5.56	6.28	0.337	6.72	7.07
Nov. 02, 2023	835	9.64	0.476	9.50	-1.48	6.28	0.312	6.23	-0.87
Nov. 09, 2023	835	9.64	0.485	9.68	0.38	6.28	0.317	6.32	0.72
Nov. 10, 2023	835	9.64	0.504	10.06	4.32	6.28	0.332	6.62	5.48
Oct. 25, 2023	1800	38	1.78	35.52	-6.54	19.8	0.931	18.58	-6.18
Oct. 30, 2023	1800	38	1.84	36.71	-3.39	19.8	0.973	19.41	-1.95
Nov. 02, 2023	1800	38	1.76	35.12	-7.59	19.8	0.924	18.44	-6.89
Nov. 08, 2023	1800	38	1.79	35.72	-6.01	19.8	0.943	18.82	-4.97
Nov. 18, 2023	1800	38	1.87	37.31	-1.81	19.8	0.994	19.83	0.17
Nov. 20, 2023	1800	38	1.73	34.52	-9.16	19.8	0.921	18.38	-7.19
Oct. 31, 2023	1900	40.4	1.95	38.91	-3.69	21.2	1.02	20.35	-4.00
Oct. 31, 2023	1900	40.4	1.84	36.71	-9.13	21.2	0.974	19.43	-8.33
Nov. 01, 2023	1900	40.4	1.97	39.31	-2.71	21.2	1.04	20.75	-2.12
Nov. 01, 2023	1900	40.4	1.85	36.91	-8.63	21.2	0.966	19.27	-9.08
Nov. 02, 2023	1900	40.4	1.86	37.11	-8.14	21.2	0.97	19.35	-8.71
Nov. 16, 2023	1900	40.4	1.87	37.31	-7.65	21.2	0.979	19.53	-7.86
Nov. 16, 2023	1900	40.4	1.83	36.51	-9.62	21.2	0.968	19.31	-8.90
Nov. 19, 2023	1900	40.4	1.93	38.51	-4.68	21.2	1.01	20.15	-4.94
Oct. 30, 2023	2300	49.1	2.53	50.48	2.81	24.2	1.23	24.54	1.41
Nov. 02, 2023	2300	49.1	2.38	47.49	-3.28	24.2	1.15	22.95	-5.18
Nov. 03, 2023	2300	49.1	2.41	48.09	-2.07	24.2	1.16	23.15	-4.36
Nov. 06, 2023	2300	49.1	2.41	48.09	-2.07	24.2	1.31	26.14	8.01
Nov. 13, 2023	2300	49.1	2.29	45.69	-6.94	24.2	1.16	23.15	-4.36
Nov. 17, 2023	2300	49.1	2.43	48.48	-1.25	24.2	1.15	22.95	-5.18
Oct. 11, 2023	2450	52.5	2.54	50.68	-3.47	24.6	1.19	23.74	-3.48
Oct. 13, 2023	2450	52.5	2.46	49.08	-6.51	24.6	1.15	22.95	-6.73
Oct. 13, 2023	2450	52.5	2.54	50.68	-3.47	24.6	1.19	23.74	-3.48
Nov. 03, 2023	2450	51.7	2.38	47.49	-8.15	24.5	1.11	22.15	-9.60
Oct. 24, 2023	2600	57.1	2.69	53.67	-6.00	25.8	1.22	24.34	-5.65
Oct. 26, 2023	2600	57.1	2.67	53.27	-6.70	25.8	1.2	23.94	-7.20
Oct. 26, 2023	2600	57.1	2.67	53.27	-6.70	25.8	1.21	24.14	-6.42
Nov. 04, 2023	2600	57.1	2.73	54.47	-4.60	25.8	1.24	24.74	-4.10
Nov. 04, 2023	2600	57.1	2.62	52.28	-8.45	25.8	1.19	23.74	-7.97
Nov. 05, 2023	2600	57.1	2.7	53.87	-5.65	25.8	1.22	24.34	-5.65
Nov. 07, 2023	2600	57.1	2.61	52.08	-8.80	25.8	1.17	23.34	-9.52
Nov. 15, 2023	2600	57.1	2.61	52.08	-8.80	25.8	1.19	23.74	-7.97
Nov. 20, 2023	2600	57.1	2.59	51.68	-9.50	25.8	1.19	23.74	-7.97
Nov. 21, 2023	2600	57.1	2.58	51.48	-9.85	25.8	1.17	23.34	-9.52
Nov. 22, 2023	2600	57.1	2.65	52.87	-7.40	25.8	1.21	24.14	-6.42
Nov. 23, 2023	2600	57.1	2.58	51.48	-9.85	25.8	1.18	23.54	-8.74
Oct. 27, 2023	3500	65.7	2.98	59.46	-9.50	24.7	1.13	22.55	-8.72
Oct. 28, 2023	3500	65.7	2.99	59.66	-9.20	24.7	1.14	22.75	-7.91
Nov. 06, 2023	3500	65.7	2.98	59.46	-9.50	24.7	1.13	22.55	-8.72
Nov. 07, 2023	3500	65.7	2.97	59.26	-9.80	24.7	1.12	22.35	-9.53
Nov. 11, 2023	3500	65.7	2.99	59.66	-9.20	24.7	1.19	23.74	-3.87
Nov. 13, 2023	3500	65.7	2.98	59.46	-9.50	24.7	1.18	23.54	-4.68
Nov. 14, 2023	3500	65.7	2.97	59.26	-9.80	24.7	1.17	23.34	-5.49
Nov. 15, 2023	3500	65.7	2.98	59.46	-9.50	24.7	1.19	23.74	-3.87
Nov. 16, 2023	3500	65.7	2.99	59.66	-9.20	24.7	1.19	23.74	-3.87
Nov. 16, 2023	3500	65.7	3.01	60.06	-8.59	24.7	1.17	23.34	-5.49
Nov. 19, 2023	3500	65.7	3.06	61.06	-7.07	24.7	1.15	22.95	-7.10
Nov. 21, 2023	3500	65.7	3.02	60.26	-8.28	24.7	1.16	23.15	-6.30
Nov. 22, 2023	3500	65.7	3.02	60.26	-8.28	24.7	1.16	23.15	-6.30
Nov. 24, 2023	3500	65.7	3.04	60.66	-7.68	24.7	1.28	25.54	3.40

Date	Frequency (MHz)	Targeted 1g SAR (W/kg)	Measured 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)	Targeted 10g SAR (W/kg)	Measured 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
Oct. 27, 2023	3700	66.4	3.05	60.86	-8.35	24.2	1.13	22.55	-6.83
Oct. 28, 2023	3700	66.4	3.08	61.45	-7.45	24.2	1.14	22.75	-6.01
Nov. 02, 2023	3700	66.4	3.01	60.06	-9.55	24.2	1.14	22.75	-6.01
Nov. 07, 2023	3700	66.4	3.03	60.46	-8.95	24.2	1.12	22.35	-7.66
Nov. 14, 2023	3700	66.4	3.03	60.46	-8.95	24.2	1.19	23.74	-1.89
Nov. 14, 2023	3700	66.4	3.05	60.86	-8.35	24.2	1.25	24.94	3.06
Nov. 15, 2023	3700	66.4	3.01	60.06	-9.55	24.2	1.21	24.14	-0.24
Nov. 16, 2023	3700	66.4	3.04	60.66	-8.65	24.2	1.22	24.34	0.59
Nov. 16, 2023	3700	66.4	3.07	61.25	-7.75	24.2	1.14	22.75	-6.01
Nov. 19, 2023	3700	66.4	3.07	61.25	-7.75	24.2	1.19	23.74	-1.89
Nov. 21, 2023	3700	66.4	3.04	60.66	-8.65	24.2	1.23	24.54	1.41
Nov. 22, 2023	3700	66.4	3.15	62.85	-5.35	24.2	1.24	24.74	2.24
Nov. 24, 2023	3700	66.4	3.01	60.06	-9.55	24.2	1.11	22.15	-8.48
Oct. 27, 2023	3900	67.8	3.06	61.06	-9.95	23.9	1.09	21.75	-9.00
Oct. 28, 2023	3900	67.8	3.11	62.05	-8.48	23.9	1.16	23.15	-3.16
Nov. 15, 2023	3900	67.8	3.06	61.06	-9.95	23.9	1.24	24.74	3.52
Nov. 16, 2023	3900	67.8	3.07	61.25	-9.65	23.9	1.23	24.54	2.69
Nov. 16, 2023	3900	67.8	3.06	61.06	-9.95	23.9	1.08	21.55	-9.84
Nov. 19, 2023	3900	67.8	3.09	61.65	-9.07	23.9	1.17	23.34	-2.32
Nov. 21, 2023	3900	67.8	3.07	61.25	-9.65	23.9	1.13	22.55	-5.66
Oct. 11, 2023	5250	79.7	3.61	72.03	-9.62	22.9	1.05	20.95	-8.51
Oct. 11, 2023	5250	79.7	3.62	72.23	-9.37	22.9	1.06	21.15	-7.64
Oct. 13, 2023	5250	79.7	3.65	72.83	-8.62	22.9	1.09	21.75	-5.03
Nov. 20, 2023	5250	79.7	3.61	72.03	-9.62	22.9	1.08	21.55	-5.90
Oct. 11, 2023	5600	81.8	3.74	74.62	-8.77	23.6	1.11	22.15	-6.16
Oct. 11, 2023	5600	81.8	3.75	74.82	-8.53	23.6	1.12	22.35	-5.31
Oct. 13, 2023	5600	81.8	3.82	76.22	-6.82	23.6	1.09	21.75	-7.85
Oct. 11, 2023	5800	81.5	3.75	74.82	-8.19	23.2	1.09	21.75	-6.26
Oct. 13, 2023	5800	81.5	3.68	73.43	-9.91	23.2	1.11	22.15	-4.54
Nov. 23, 2023	5800	81.5	3.68	73.43	-9.91	23.2	1.13	22.55	-2.82
Oct. 12, 2023	6500	290	26.3	263.00	-9.31	53.7	4.89	48.90	-8.94

6.3. IPD Test System Verification

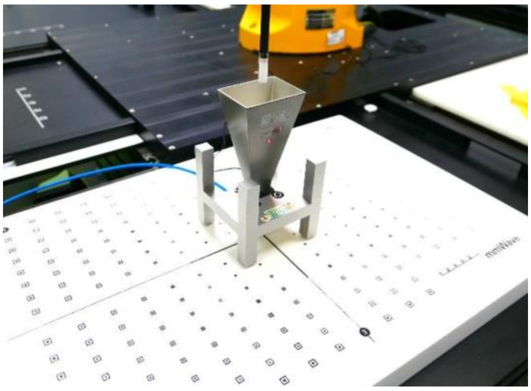
The system was verified to be within ±0.66 dB of the power density targets on the calibration certificate according to the test system specification in the user's manual and calibration facility recommendation. The 0.66 dB deviation threshold represents the expanded uncertainty for system performance checks using SPEAG's mm-Wave verification sources. The same spatial resolution and measurement region used in the source calibration was applied during the system check.

The system check provides a fast and reliable method to routinely verify that the measurement system is operational with no system component failures, including probe defects, drifts or deviation from target performance requirements. A system check also verifies the repeatability of the measurement system before compliance testing.

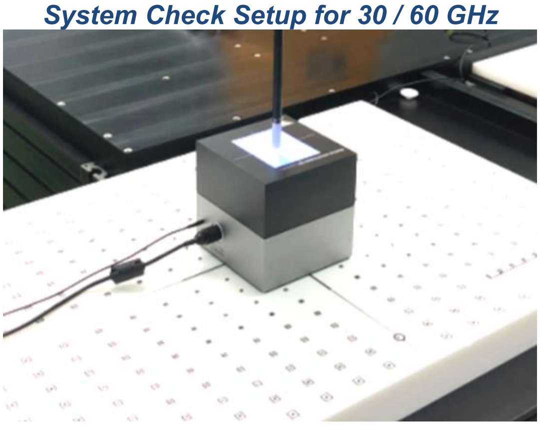
The measurement of a verification source is started from 5G probe installed and the phantom taught. The verification source is placed on the 5G phantom. Due to the internal distance from the horn to the outer surface of the verification source, the measurement distance set in the software should be offset by -4.45 mm; e.g., for measurement of the verification source at 10 mm, the measurement distance set in the software should be 5.55 mm (10 mm - 4.45 mm).

The system check is a complete measurement using simple well-defined reference sources. Per the DASY8 specification in the user's manual and SPEAG's recommendation, the deviation threshold of ±0.66 dB represents the expanded standard uncertainty for system performance check. The system check is successful if the measured results are within ±0.66 dB tolerances to the target value shown in the calibration certificate of the verification source. The instrumentation and procedures used for system check should ensure the system is ready for performing compliance tests.

System Check Setup for 10 GHz



System Check Setup for 30 / 60 GHz



Settings for the Measurement of Verification Sources

Frequency (GHz)	Grid Step	Grid Extent X/Y (mm)	Measurement Points
10	0.125 (λ/8)	60 / 60	18 x 18
30	0.25 (λ/4)	60 / 60	26 x 26
60	0.25 (λ/4)	32.5 / 32.5	28 x 28

Date	*Frequency (MHz)*	*Targeted Avg PD 4 cm2 (W/kg)*	*psPDn+ 4 cm2 (W/kg)*	*psPDtot+ 4 cm2 (W/kg)*	*psPDmod+ 4 cm2 (W/kg)*	*Measured Avg PD 4 cm2 (W/kg)*	*Deviation (%)*	*Dipole S/N*	*Probe S/N*	*DAE S/N*
Nov. 11, 2023	10G	56.7	55.2	52.6	53	53.60	-5.47	1060	9403	1669

7. Test Configurations

7.1. Description of Test Position

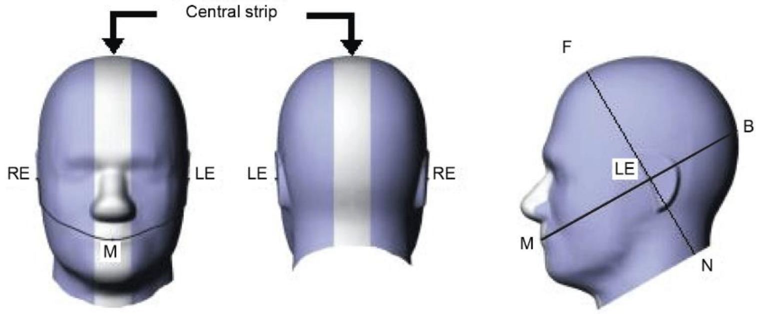
According to KDB 648474 D04, handsets are tested for SAR compliance in head, body-worn accessory and other use configurations described in the following subsections.

7.1.1 Head Exposure Conditions

EAR Reference Point

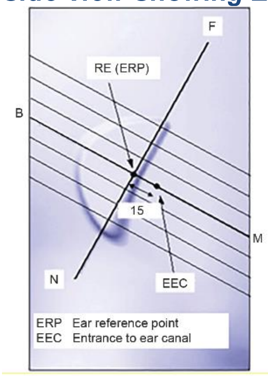
Below Figure shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M”, the left ear reference point (ERP) is marked “LE”, and the right ERP is marked “RE”.

Front, Back and Side View of SAM Twin Phantom

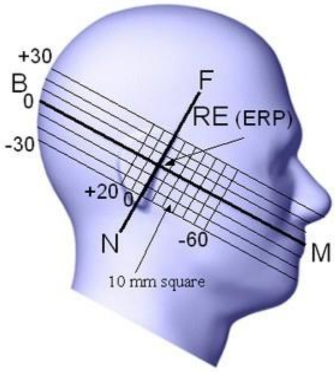


Each ERP is on the B-M (back-mouth) line located 15 mm behind the entrance-to-ear-canal (EEC) point, as shown in Figure 5. The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is along the front truncated edge of the ear spacer (see Figure 6). The N-F line is not perpendicular to the Reference Plane because the N-F edge of the ear spacer is at a slight angle to the Reference Plane when conforming to the contour of SAM at this location. Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 5. The ear truncation is introduced to preclude the ear lobe from interfering with handset positioning in the cheek position, which could lead to unstable positioning at the cheek.

Close-up Side View Showing Ear Region



Side View of the Phantom

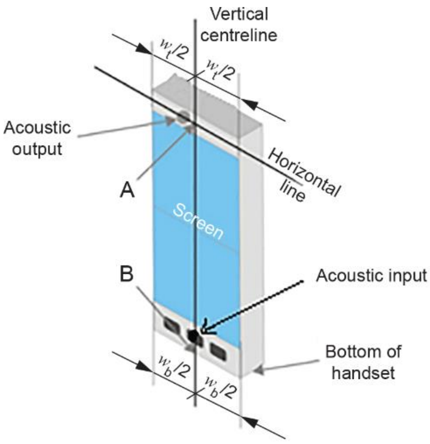


Definition of the Cheek Position

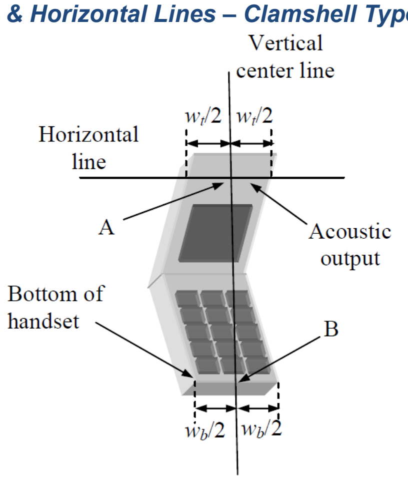
[1] Configure the DUT for voice operation, if necessary. For example, for a DUT with a flip, swivel, or slide cover piece, open the cover if this is consistent with voice operation. If the DUT can also be used with the cover closed, both configurations shall be tested.

[2] Define two imaginary lines on the DUT, the vertical centerline and the horizontal line, relative to the DUT in vertical orientation as shown in below Figure. The vertical centerline passes through two points on the front side of the DUT: the midpoint of the width w_t of the DUT at the level of the acoustic output (Point A), and the midpoint of the width w_b at the bottom of the DUT (Point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The two lines intersect at Point A. Note that for many DUTs, Point A coincides with the center of the acoustic output. However, the acoustic output could be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the DUT, especially for clamshell DUTs, DUTs with flip cover pieces, and other irregularly shaped DUTs.

Vertical & Horizontal Lines – Bar Type Case



Vertical & Horizontal Lines – Clamshell Type Case



[3] Position the DUT close to the surface of the phantom such that Point A is on the (virtual) extension of the line passing through points RE (right-ear ear reference point) and LE (left-ear ear reference point) on the phantom (see below Figure). The plane determined by the vertical centerline and the horizontal line of the DUT shall be parallel to the sagittal plane of the phantom.

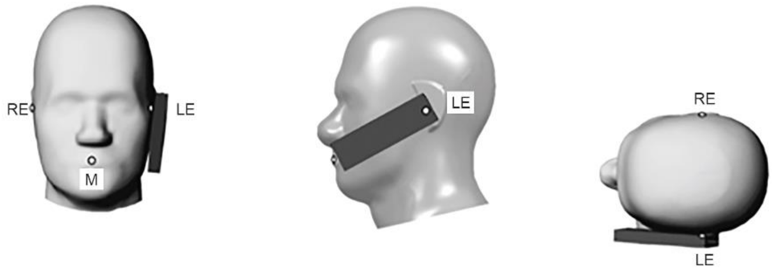
[4] Translate the DUT towards the phantom along the line passing through RE and LE until the DUT touches the ear.

[5] Rotate the DUT around the (virtual) LE-RE Line until the DUT vertical centerline is in the reference plane.

[6] Rotate the DUT around its vertical centerline until the plane established by the DUT vertical centerline and horizontal line is parallel to the N-F line, and then translate the DUT towards the phantom along the LE-RE line until DUT Point A touches the ear at the ERP (ear reference point).

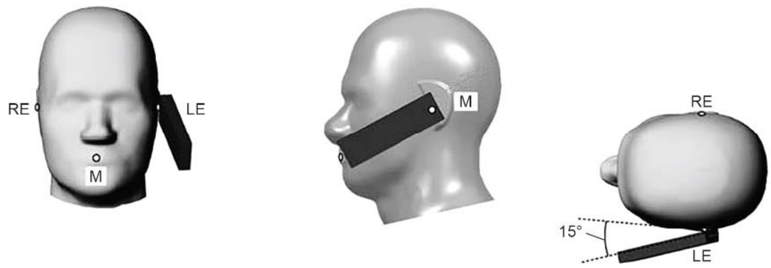
[7] While keeping Point A on the line passing through RE and LE and maintaining the DUT in contact with the pinna, rotate the DUT about the N-F line until any point on the DUT is in contact with a phantom point below the pinna (cheek). The physical angles of rotation shall be documented.

[8] While keeping DUT Point A in contact with the ERP, rotate the DUT around a line perpendicular to the plane established by the DUT vertical centerline and horizontal line and passing through DUT Point A, until the DUT vertical centerline is in the reference plane.



Definition of the Tilt Position

1. To position the DUT in the “cheek” position described above.
2. While maintaining the orientation of the DUT, move the DUT away from the pinna along the line passing through RE and LE far enough to allow a rotation of the DUT away from the cheek by 15°.
3. Rotate the DUT around the horizontal line by 15° (see below Figure).
4. While maintaining the orientation of the DUT, move the DUT towards the phantom on a line passing through RE and LE until any part of the DUT touches the ear. The tilt position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, e.g., an extended antenna in contact with the back of the head phantom, the angle of the DUT shall be reduced. In this case, the tilt position is obtained if any part of the DUT is in contact with the pinna and a second point on the DUT is in contact with the phantom, e.g., the antenna in contact with the back of the head.



7.1.2 Body-worn Exposure Conditions

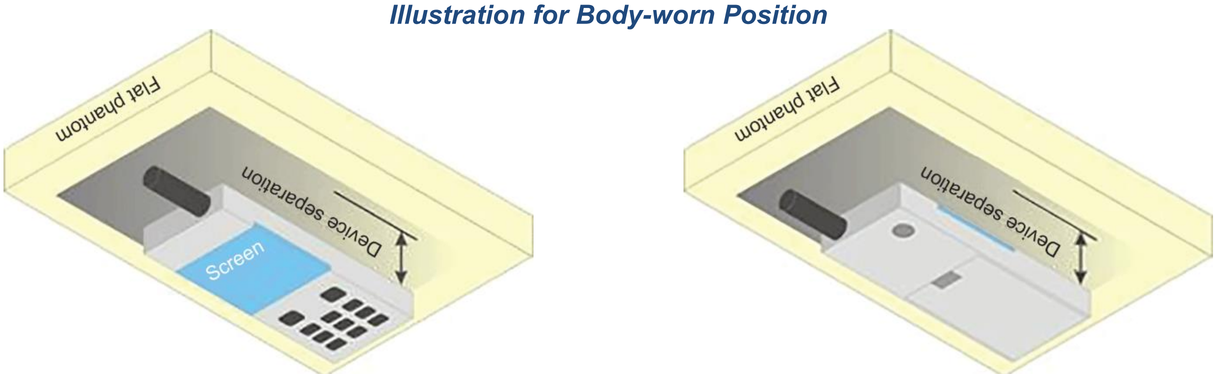
Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB Publication 447498 D01 are used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics. All body-worn accessories containing metallic components are tested in conjunction with the host device.

Body-worn accessory SAR compliance is based on a single minimum test separation distance for all wireless and operating modes applicable to each body-worn accessory used by the host, and according to the relevant voice and/or data mode transmissions and operations. If a body-worn accessory supports voice only operations in its normal and expected use conditions, testing of data mode for body-worn compliance is not required.

A conservative minimum test separation distance for supporting off-the-shelf body-worn accessories that may be acquired by users of consumer handsets is used to test for body-worn accessory SAR compliance. This distance is determined by the handset manufacturer. Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body-worn accessories, will be tested using a conservative minimum test separation distance ≤ 5 mm to support compliance.

Illustration for Body-worn Position



7.1.4 Product Specific (Phablet) Exposure Conditions

For smart phones with a display diagonal dimension > 15 cm or an overall diagonal dimension > 16 cm, that can provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets and support voice calls next to the ear, the Phablet procedures outlined in KDB Publication 648474 D04 should be applied to evaluate SAR compliance. A device marketed as Phablets, regardless of form factors and operating characteristics must be tested as a Phablet to determine SAR compliance.

In addition to the normally required head and body-worn accessory SAR test procedures required for handsets, the UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna ≤ 25 mm from that surface or edge, in direct contact with the flat phantom for 10 g extremity SAR. The UMPC mini-tablet 1 g SAR at 5 mm is not required. When hotspot mode applies, 10 g SAR is required only for the surfaces and edges with hotspot mode 1 g SAR > 1.2 W/kg.

7.2. FCC General Test Procedures

7.3.1 Measured and Reported SAR

Per KDB Publication 447498 D01, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported SAR. The highest reported SAR results are identified on the grant of equipment authorization according to procedures in KDB Publication 690783 D01.

7.3.2 3G SAR Test Reduction Procedure

In KDB Publication 941225 D01, certain transmission modes within a frequency band and wireless mode evaluated for SAR are defined as primary modes. The equivalent modes considered for SAR test reduction are denoted as secondary modes. When the maximum output power including tune-up tolerance specified for production units in a secondary mode is ≤ 0.25 dB higher than the primary mode or when the highest reported SAR of the primary mode, scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode, is ≤ 1.2 W/kg, SAR measurements are not required for the secondary mode. When the 3G SAR test reduction procedure is not satisfied, SAR measurements are additionally required for the secondary mode.

7.3.3 Test Reduction Consideration for GSM / GPRS / EDGE / DTM

Per KDB Publication 941225 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. 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.

SAR may be evaluated for DTM with the device operating in DTM using one CS plus the number of PS time-slots that result in the highest source-based time-averaged maximum output or by summing the single time-slot CS and highest maximum output multi-slot PS SAR. When different maximum output power applies to GSM voice or GPRS / EDGE time slots, GSM voice and GPRS / EDGE time slots should be tested separately to determine compliance by summing the corresponding reported SAR.

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

7.3.4 Measurement Condition for WCDMA

Output Power Verification

Maximum output power is verified on the high, middle and low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC with TPC (transmit power control) set to all “1s” or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, $DPDCH_n$ and spreading codes, HSDPA, DSPA) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

Head SAR

SAR for next to the ear head exposure 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 AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

Body SAR

SAR for body-worn 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 $DPDCH_n$ 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 $DPDCH_n$, for the highest reported SAR configuration in 12.2 kbps RMC.

Handsets with Release 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, body SAR is measured for HSDPA using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

Handsets with Release 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA / HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA. When VOIP applies to head exposure, the 3G SAR test reduction procedure is applied with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body SAR measurements are applied to head exposure testing.

Release 5 HSDPA Data Devices

The 3G SAR test reduction procedure is applied to body SAR with 12.2 kbps RMC as the primary mode. Otherwise, body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA.HSDPA is configured according to the applicable UE category of a test device. The number of HS-DSCH / HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms and a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors (βc, βd), and HS-DPCCH power offset parameters (Δ_{ACK}, Δ_{NACK}, Δ_{CQI}) are set according to values indicated in below. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

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

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{HS} = 30/15*β_c.
Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{HS} = 30/15*β_c, and Δ_{CQI} = 24/15 with β_{HS} = 24/15*β_c.
Note 3: CM = 1 for β_c/β_d = 12/15, β_{HS}/β_c = 24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.
Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Release 6 HSUPA Data Devices

The 3G SAR test reduction procedure is applied to body SAR with 12.2 kbps RMC as the primary mode. Otherwise, body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA. When VOIP applies to head exposure, the 3G SAR test reduction procedure is applied with 12.2 kbps RMC as the primary mode. Otherwise, the same HSPA configuration used for body SAR measurements are applied to head exposure testing. Due to inner loop power control requirements in HSPA, a communication test set is required for output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA are configured according to the β values indicated in below.

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

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

HSPA+ SAR Guidance

The 3G SAR test reduction procedure is applied to HSPA+ (uplink) with 12.2 kbps RMC as the primary mode. Otherwise, when SAR is required for Rel. 6 HSPA, SAR is required for Rel. 7 HSPA+. Power is measured for HSPA+ that supports uplink 16QAM according to configurations in Table C.11.1.4 of 3GPP TS 34.121-1 to determine SAR test reduction.

Sub-test	β_c(3)	β_d	β_{HS}(1)	β_{ec}	β_{ed}(4) (2xSF2)	β_{ed}(4) (2xSF4)	CM(2) (dB)	MPR(2) (dB)	AG(4) Index	E-TFCI (5)	E-TFCI (boost)
1	1	0	30/15	30/15	β_{ed}1: 30/15 β_{ed}2: 30/15	β_{ed}3: 24/15 β_{ed}4: 24/15	3.5	2.5	14	105	105

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{HS} = 30/15*β_c.
Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).
Note 3: DPDCH is not configured, therefore the β_c is set to 1 and β_d = 0 by default.
Note 4: β_{ed} cannot be set directly; it is set by Absolute Grant Value.
Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2 ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signaled to use the extrapolation algorithm.

DC-HSDPA SAR Guidance

The 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Otherwise, when SAR is required for Rel. 5 HSDPA, SAR is required for Rel. 8 DC-HSDPA. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.

7.3.5 Measurement Condition for CDMA2000

Head SAR

SAR for next to the ear head exposure is measured in RC3 with the handset configured to transmit at full rate in SO55. The 3G SAR test reduction procedure is applied to RC1 with RC3 as the primary mode. Otherwise, SAR is required for the channel with maximum measured output in RC1 using the head exposure configuration that results in the highest reported SAR in RC3.

Body SAR

Body-worn SAR is measured in RC3 with the handset configured in TDSO/SO32 to transmit at full rate on FCH only with all other code channels disabled. The 3G SAR test reduction procedure is applied to the multiple code channel configuration (FCH+SCH_n), with FCH only as the primary mode. Otherwise, SAR is required for multiple code channel configuration (FCH + SCHn), with FCH at full rate and SCH0 enabled at 9600 bps, using the highest reported SAR configuration for FCH only. The 3G SAR test reduction procedure is applied to body-worn SAR in RC1 with RC3 as the primary mode. Otherwise, SAR is required for RC1, with SO55 and full rate, using the highest reported SAR configuration for body-worn exposure in RC3.

7.3.6 Measurement Condition for LTE

Per KDB Publication 941225 D05, LTE establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR. The Anritsu MT8821C or MT8000 simulators are used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

The LTE Maximum Power Reduction (MPR) in accordance with 3GPP TS 36.101 is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. The MPR is enabled for this device and the allowed MPR is specified in below.

Modulation	Channel Bandwidth / Transmission Bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256QAM	≥ 1						≤ 5

The device is compliant with Additional Maximum Power Reduction (A-MPR) requirements defined in 3GPP TS 36.101 section 6.2.4 that has been disabled for all SAR tests by setting “NS=01” on the base station simulator.

LTE SAR Test Requirement

[1] Start SAR testing for QPSK with 1 RB allocation with the largest bandwidth using offset and required channel combination with the highest maximum output power. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.

[2] For QPSK with 50% RB allocation, the 1 RB allocation procedures in step 1 are applied to measure the SAR.

[3] For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100% RB allocation is less than the highest maximum output power in 50% and 1 RB allocations, and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

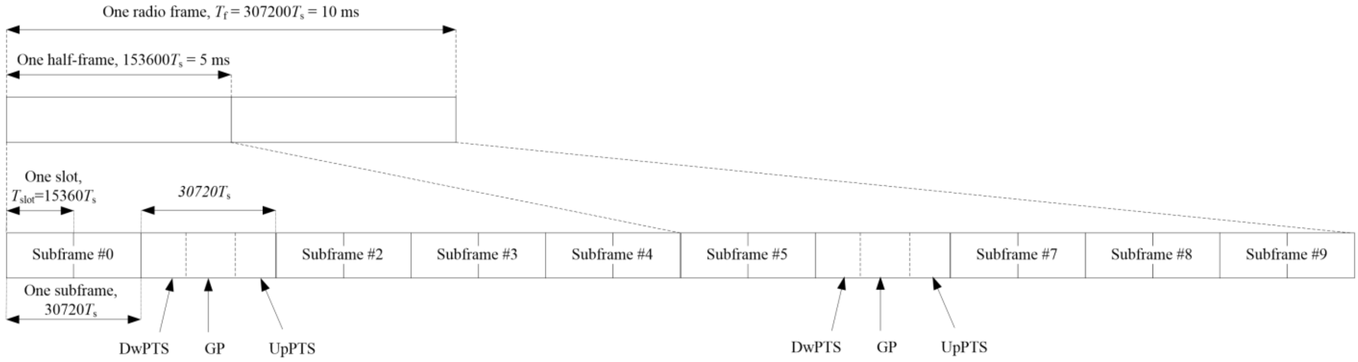
[4] For higher order modulations and lower bandwidths configurations, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > 0.5 dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

[5] Per KDB Publication 941225 D05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

TDD-LTE Considerations

According to KDB Publication 941225 D05, SAR testing for TDD-LTE device must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by the defined 3GPP TDD-LTE configurations. The TDD-LTE of this device supports frame structure type 2 defined in 3GPP TS 36.211 section 4.2, and the frame structure configuration can be referred to below.

3GPP TS 36.211 Figure 4.2-1: Frame Structure Type 2



3GPP TS 36.211 Table 4.2-1: Configuration of Special Subframe

Special Subframe Configuration	Normal Cyclic Prefix in Downlink			Extended Cyclic Prefix in Downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal Cyclic Prefix in Uplink	Extended Cyclic Prefix in Uplink		Normal Cyclic Prefix in Uplink	Extended Cyclic Prefix in Uplink
0	$6592 \cdot T_s$	$(1+X) \cdot 2192 \cdot T_s$	$(1+X) \cdot 2560 \cdot T_s$	7680 • Ts	$(1+X) \cdot 2192 \cdot T_s$	$(1+X) \cdot 2560 \cdot T_s$
1	$19760 \cdot T_s$			20480 • Ts		
2	$21952 \cdot T_s$			23040 • Ts		
3	$24144 \cdot T_s$			25600 • Ts		
4	$26336 \cdot T_s$			7680 • Ts	$(2+X) \cdot 2192 \cdot T_s$	$(2+X) \cdot 2560 \cdot T_s$
5	$6592 \cdot T_s$	$(2+X) \cdot 2192 \cdot T_s$	$(2+X) \cdot 2560 \cdot T_s$	20480 • Ts		
6	$19760 \cdot T_s$			23040 • Ts		
7	$21952 \cdot T_s$			12800 • Ts		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-
10	$13168 \cdot T_s$	$13152 \cdot T_s$	$12800 \cdot T_s$	-	-	-

3GPP TS 36.211 Table 4.2-2: Uplink-Downlink Configurations

UL-DL Configuration	DL-to-UL Switch Point Periodicity	Subframe Number										Duty Cycle (%)
		0	1	2	3	4	5	6	7	8	9	
0	5 ms	D	S	U	U	U	D	S	U	U	U	63.33
1	5 ms	D	S	U	U	D	D	S	U	U	D	43.33
2	5 ms	D	S	U	D	D	D	S	U	D	D	23.33
3	10 ms	D	S	U	U	U	D	D	D	D	D	31.67
4	10 ms	D	S	U	U	D	D	D	D	D	D	21.67
5	10 ms	D	S	U	D	D	D	D	D	D	D	11.67
6	5 ms	D	S	U	U	U	D	S	U	U	D	53.33

Note: Calculated Duty Cycle = Extended cyclic prefix in UL * (T_s) * # of S + # of U / period

Considering the highest transmission duty cycle, TDD-LTE was tested using Uplink-Downlink Configuration 0 with 6 uplink subframe and 2 special subframe. The special subframe was set to special subframe configuration 7 using extended cyclic prefix uplink. Therefore, SAR testing for TDD-LTE was performed at the maximum output power with highest transmission duty cycle of 63.33 %.

LTE Uplink Carrier Aggregation (CA) Consideration

<LTE Intra-Band Contiguous Carrier Aggregation>

UL CA shall be tested based on the worst-case SAR configuration determined from non-CA SAR testing result. The channel BW, channel number, RB allocation, etc. would be selected to allow contiguous CA of PCC and SCC. Uplink output power for UL CA is the total power measured across the PCC and SCC. UL CA power measurements were performed for each antenna at with QPSK modulation based on the worst-case standalone SAR.

The UL CA mode power measurements represent the total power across both carriers. Measurements were made for all supported PCC bandwidths using the channel / RB combination resulting in the highest standalone output power at the least MPR (0 dB). SCCs were set to use configurations similar to the PCC to establish conservative or worst-case equivalent SAR test conditions (highest maximum output power with MPR of 0 dB and RB allocation setting).

Per November 2017 TCB Workshop, Uplink CA SAR test guidance as follows:

[1] When the maximum output power for UL CA is ≤ standalone LTE mode (without CA),
- PCC is configured according to the highest standalone SAR configuration tested.
- SCC and subsequent CCs are configured according to procedures used for power measurement and parameters (BW, RB etc.) similar to that used for the PCC.

[2] When the Reported SAR for UL CA configuration, described above, is > 1.2 W/kg, UL CA SAR is also required for all required test channels (PCC based).

[3] UL CA SAR is also required for standalone SAR configurations > 1.2 W/kg when they are scaled to the UL CA power level.

<LTE Inter-Band Carrier Aggregation>

Per October 2018 TCB Workshop, Uplink CA SAR test guidance as follows:

[1] Provide the single uplink SAR values you have obtained for the relevant SAR configurations and frequency bands that employ inter-band uplink carrier aggregation.

[2] If the single uplink 1g SAR values for each band are both less than 0.8 W/kg and the algebraic summation of the 1g SAR values are less than 1.45 W/kg, no additional measurements need to be performed.

[3] If one of the single Uplink 1g SAR values is greater than 0.8 W/kg, instead of algebraically summing the 1g SAR values, sum up the SAR distributions, similar to the enlarged zoom scan (volume scan) procedures found in KDB Publication 865664 D01.

[4] If the algebraic sum of the 1g SAR values is > 1.45 W/kg, additional measurements may have to be made. Submit a KDB inquiry for additional guidance.

Maximum Output Power (Tune-up Limit) and SAR Test Exemption for LTE UL Carrier Aggregation

The maximum UL CA transmit power is reduced by 3 dB from the standalone values for both carriers therefore SAR will be reduced accordingly.

The reported 1g SAR for any standalone LTE configuration does not exceed 1.2 W/kg. The worst-case UL CA SAR per band will therefore be < 0.6 W/kg. As the SAR for each individual band is < 0.6 W/kg and the algebraic summation cannot exceed 1.2 W/kg no further measurements are needed.

The combined SAR contribution cannot exceed the highest standalone SAR：

$$(SAR_{LTE1} / 2 + SAR_{LTE2} / 2 \leq Max\ (SAR_{LTE1}, SAR_{LTE2})$$

Therefore, simultaneous transmission analysis of UL CA and WLAN / BT transmitters can be done using either of the standalone LTE SAR values alone.

7.3.7 Measurement Condition for 5G NR FR1

[1] Per October 2020 TCB Workshop guidance, 5G NR FR1 SAR evaluations are being generally based on adapting the existing LTE SAR procedures (KDB Publication 941225 D05).

[2] Start SAR testing for π/2 BPSK with 1 RB allocation with the largest bandwidth using offset and required channel combination with the highest maximum output power. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.

[3] For π/2 BPSK with 50% RB allocation, the 1 RB allocation procedures in step 1 are applied to measure the SAR.

[4] For π/2 BPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100% RB allocation is less than the highest maximum output power in 50% and 1 RB allocations, and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

[5] For higher order modulations and lower bandwidths configurations, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > 0.5 dB higher than the same configuration in π/2 BPSK or when the reported SAR for the π/2 BPSK configuration is > 1.45 W/kg.

[6] Per KDB Publication 941225 D05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

7.3.8 Measurement Condition for Wi-Fi

General Considerations

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. Various vendor specific external test software and chipset based internal test modes are typically used for SAR measurement. Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 ~ 96 % is typically achievable in most test mode configurations. A minimum transmission duty factor of 85 % is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. In addition, a periodic transmission duty factor is required for current generation SAR systems to measure SAR correctly. The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

According to KDB Publication 248227 D01, this device has installed WLAN engineering testing software which can provide continuous transmitting RF signal. During WLAN SAR testing, this device was operated to transmit continuously at the maximum transmission duty with specified transmission mode, operating frequency, lowest data rate, and maximum output power.

2.4 GHz Band

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 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 position 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 802.11 g/n/ax OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

U-NII-1 and U-NII-2A Bands

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is > 1.2 W/kg. When different maximum output powers are specified for the bands, SAR measurement for the U-NII band with the lower maximum output power is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is > 1.2 W/kg. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

U-NII-2C and U-NII-3 Bands

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 ~ 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 ~ 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification. Unless band gap channels are permanently disabled, SAR must be considered for these channels. Each band is tested independently according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

Initial Test Position SAR Test Reduction Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are tested. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

OFDM Transmission Mode SAR Test and Channel Selection

When the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a, 802.11n and 802.11ac or 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 802.11n and 802.11ac or 802.11g then 802.11n, is used for SAR measurement. Per April 2019 TCB Workshop guidance, 802.11ax was considered the highest order 802.11 mode. When the maximum output power is the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

Initial Test Configuration Procedure

For OFDM, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order IEEE 802.11 mode. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

Subsequent Test Configuration Procedure

For OFDM configurations in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure. When the highest reported SAR (for the initial test configuration), adjusted by the ratio of the specified maximum output power of the subsequent test configuration to initial test configuration, is ≤ 1.2 W/kg, no additional SAR tests for the subsequent test configurations are required. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

MIMO SAR considerations

Per KDB Publication 248227 D01, the simultaneous SAR provisions in KDB Publication 447498 D01 should be applied to determine simultaneous transmission SAR test exclusion for Wi-Fi MIMO. If the sum of 1g single transmission chain SAR measurements is < 1.6 W/kg, no additional SAR measurements for MIMO are required. Alternatively, SAR for MIMO can be measured with all antennas transmitting simultaneously at the specified maximum output power of MIMO operation. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

SAR Test Exclusion for IEEE 802.11ax

To make the most efficient use of the additional available subcarriers (data tones), IEEE 802.11ax can utilize Orthogonal Frequency-Division Multiple Access (OFDMA) which divides the existing 802.11 channels into smaller subchannels called Resource Units (RUs). Possible RU sizes are: 26T, 52T, 106T, 242T, 484T, 996T and 996Tx2.

Per FCC Guidance, 802.11ax was considered a higher order 802.11 mode when compared to a/b/g/n/ac to apply KDB Publication 248227 D01 for OFDM mode selection. Therefore, SAR tests were not required for 802.11ax based on the maximum allowed output powers of OFDM modes and the reported SAR values. Per FCC Guidance, maximum conducted powers were performed for each RU size to demonstrate that the output powers would not be higher than the other OFDM 802.11 modes.

When SAR testing for 802.11ax is required, the following procedures are applied to measure the SAR.

- If the maximum output power is highest for OFDMA scenarios, choose the tone size with the maximum number of tones and the highest maximum output power.
- Otherwise, consider the fully allocated channel for SAR testing.
- When SAR testing is required on RU sizes less than the fully allocated channel, use the RU number closest to the middle of the channel, choosing the higher RU number when two RUs are equidistant to the middle of the channel.

8. RF Output Power Specification and Measurement

8.1. Nominal and Maximum Output Power Specifications

<MAX Tune-up Power-Head Mode DSI-2>

GSM Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
GSM850	GSM	33	33	-	-
	GPRS 1TX Slot	33	33	-	-
	GPRS 2TX Slot	33	33	-	-
	GPRS 3TX Slot	31.5	32.5	-	-
	GPRS 4TX Slot	30.5	31.5	-	-
	EGPRS 1TX Slot	27	27	-	-
	EGPRS 2TX Slot	27	27	-	-
	EGPRS 3TX Slot	24.5	25.5	-	-
	EGPRS 4TX Slot	23.5	24.5	-	-

GSM Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
GSM1900	GSM	30	30	30	30
	GPRS 1TX Slot	30	30	30	30
	GPRS 2TX Slot	27.5	29.5	27.5	30
	GPRS 3TX Slot	25.5	26.5	25.5	30
	GPRS 4TX Slot	24.5	25.5	24.5	29.5
	EGPRS 1TX Slot	23	23	23	23
	EGPRS 2TX Slot	20.5	22.5	20.5	23
	EGPRS 3TX Slot	18.5	19.5	18.5	23
	EGPRS 4TX Slot	17.5	18.5	17.5	22.5

WCDMA Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
II	RMC12.2K	23.5	24	23.5	24
	HSDPA DC-HSDPA	23	23.5	23	23.5
	HSUPA HSPA+	23	23.5	23	23.5
IV	RMC12.2K	23.5	24	23.5	24
	HSDPA DC-HSDPA	23	23.5	23	23.5
	HSUPA HSPA+	23	23.5	23	23.5
V	RMC12.2K	23.5	24	-	-
	HSDPA DC-HSDPA	23	23.5	-	-
	HSUPA HSPA+	23	23.5	-	-

LTE Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3	Ant 4	Ant 5	Ant 6	Ant 7
2	FDD	23.5	24	23.5	24	-	-	-	-
4	FDD	23.5	24	23.5	24	-	-	-	-
5	FDD	23.5	24	-	-	-	-	-	-
7	FDD	24	24	24	24	-	-	-	-
12	FDD	24	24	-	-	-	-	-	-
13	FDD	24	24	-	-	-	-	-	-
14	FDD	24	24	-	-	-	-	-	-
25	FDD	23.5	24	23.5	24	-	-	-	-
26	FDD	23.5	24	-	-	-	-	-	-
30	FDD	23.5	23.5	24	23.5	-	-	-	-
38	TDD	24	24	24	24	-	-	-	-
40	TDD	24	24	24	24	-	-	-	-
41	TDD	24	24	24	24	-	-	-	-
42	TDD	-	-	-	-	18	24	24	24
43	TDD	-	-	-	-	20	24	24	24
48	TDD	-	-	-	-	18	24	24	24
66	FDD	23.5	23.5	23.5	24	-	-	-	-
71	FDD	24	24	-	-	-	-	-	-

NR Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3	Ant 4	Ant 5	Ant 6	Ant 7
n2	FDD	23.5	24	23.5	24	-	-	-	-
n5	FDD	23.5	24	-	-	-	-	-	-
n7	FDD	24	24	24	24	-	-	-	-
n12	FDD	24	24	-	-	-	-	-	-
n13	FDD	24	24	-	-	-	-	-	-
n14	FDD	24	24	-	-	-	-	-	-
n25	FDD	23.5	24	23.5	24	-	-	-	-
n30	FDD	23.5	23.5	24	23	-	-	-	-
n66	FDD	23.5	23.5	23.5	24	-	-	-	-
n71	FDD	24	24	-	-	-	-	-	-
n38	TDD	24	24	24	24	-	-	-	-
n41	TDD	24	24	24	24	-	-	-	-
n48	TDD	-	-	-	-	19	24	24	24
n77	TDD	-	-	-	-	19.5	24	24	24
n78	TDD	-	-	-	-	20.5	25	25	25

<MAX Tune-up Power-Body Mode DSI 4>

GSM Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
GSM850	GSM	33.0	33.0	-	-
	GPRS 1TX Slot	33.0	33.0	-	-
	GPRS 2TX Slot	33.0	33.0	-	-
	GPRS 3TX Slot	31.5	32.5	-	-
	GPRS 4TX Slot	30.5	31.5	-	-
	EGPRS 1TX Slot	27.0	27.0	-	-
	EGPRS 2TX Slot	27.0	27.0	-	-
	EGPRS 3TX Slot	24.5	25.5	-	-
	EGPRS 4TX Slot	23.5	24.5	-	-
GSM1900	GSM	30.0	30.0	30.0	30.0
	GPRS 1TX Slot	30.0	30.0	30.0	30.0
	GPRS 2TX Slot	27.5	29.5	27.5	30.0
	GPRS 3TX Slot	25.5	26.5	25.5	30.0
	GPRS 4TX Slot	24.5	25.5	24.5	29.5
	EGPRS 1TX Slot	23.0	23.0	23.0	23.0
	EGPRS 2TX Slot	20.5	22.5	20.5	23.0
	EGPRS 3TX Slot	18.5	19.5	18.5	23.0
	EGPRS 4TX Slot	17.5	18.5	17.5	22.5

WCDMA Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
II	RMC12.2K	24.0	24.0	24.0	24.0
	HSDPA DC-HSDPA	23.5	23.5	23.5	23.5
	HSUPA HSPA+	23.5	23.5	23.5	23.5
IV	RMC12.2K	24.0	24.0	24.0	24.0
	HSDPA DC-HSDPA	23.5	23.5	23.5	23.5
	HSUPA HSPA+	23.5	23.5	23.5	23.5
V	RMC12.2K	24.0	24.0	-	-
	HSDPA DC-HSDPA	23.5	23.5	-	-
	HSUPA HSPA+	23.5	23.5	-	-

LTE Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3	Ant 4	Ant 5	Ant 6	Ant 7
2	FDD	24.0	24.0	24.0	24.0	-	-	-	-
4	FDD	24.0	24.0	24.0	24.0	-	-	-	-
5	FDD	24.0	24.0	-	-	-	-	-	-
7	FDD	24.0	24.0	24.0	24.0	-	-	-	-
12	FDD	24.0	24.0	-	-	-	-	-	-
13	FDD	24.0	24.0	-	-	-	-	-	-
14	FDD	24.0	24.0	-	-	-	-	-	-
25	FDD	24.0	24.0	24.0	24.0	-	-	-	-
26	FDD	24.0	24.0	-	-	-	-	-	-
30	FDD	24.0	24.0	24.0	24.0	-	-	-	-
38	TDD	24.0	24.0	24.0	24.0	-	-	-	-
40	TDD	24.0	24.0	24.0	24.0	-	-	-	-
41	TDD	24.0	24.0	24.0	24.0	-	-	-	-
42	TDD	-	-	-	-	24.0	24.0	24.0	24.0
43	TDD	-	-	-	-	24.0	24.0	24.0	24.0
48	TDD	-	-	-	-	24.0	24.0	24.0	24.0
66	FDD	24.0	24.0	24.0	24.0	-	-	-	-
71	FDD	24.0	24.0	-	-	-	-	-	-

NR Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3	Ant 4	Ant 5	Ant 6	Ant 7
n2	FDD	24.0	24.0	24.0	24.0	-	-	-	-
n5	FDD	24.0	24.0	-	-	-	-	-	-
n7	FDD	24.0	24.0	24.0	24.0	-	-	-	-
n12	FDD	24.0	24.0	-	-	-	-	-	-
n13	FDD	24.0	24.0	-	-	-	-	-	-
n14	FDD	25.0	25.0	-	-	-	-	-	-
n25	FDD	24.0	24.0	24.0	24.0	-	-	-	-
n30	FDD	24.0	24.0	24.0	24.0	-	-	-	-
n66	FDD	24.0	24.0	24.0	24.0	-	-	-	-
n71	FDD	24.0	24.0	-	-	-	-	-	-
n38	TDD	24.0	24.0	24.0	24.0	-	-	-	-
n41	TDD	24.0	24.0	24.0	24.0	-	-	-	-
n48	TDD	-	-	-	-	24.0	24.0	24.0	24.0
n77	TDD	-	-	-	-	24.0	24.0	24.0	24.0
n78	TDD	-	-	-	-	25.0	25.0	25.0	25.0

<MAX Tune-up Power-Body Mode DSI-1>

GSM Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
GSM850	GSM	33	33	-	-
	GPRS 1TX Slot	33	33	-	-
	GPRS 2TX Slot	33	33	-	-
	GPRS 3TX Slot	31.5	32.5	-	-
	GPRS 4TX Slot	30.5	31.5	-	-
	EGPRS 1TX Slot	27	27	-	-
	EGPRS 2TX Slot	27	27	-	-
	EGPRS 3TX Slot	24.5	25.5	-	-
	EGPRS 4TX Slot	23.5	24.5	-	-

GSM Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
GSM1900	GSM	30	30	30	30
	GPRS 1TX Slot	30	30	30	30
	GPRS 2TX Slot	27.5	29.5	27.5	30
	GPRS 3TX Slot	25.5	26.5	25.5	30
	GPRS 4TX Slot	24.5	25.5	24.5	29.5
	EGPRS 1TX Slot	23	23	23	23
	EGPRS 2TX Slot	20.5	22.5	20.5	23
	EGPRS 3TX Slot	18.5	19.5	18.5	23
	EGPRS 4TX Slot	17.5	18.5	17.5	22.5

WCDMA Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
II	RMC12.2K	20.5	21.5	20.5	22.5
	HSDPA DC-HSDPA	20	21	20	22
	HSUPA HSPA+	20	21	20	22
IV	RMC12.2K	21.5	21.5	21.5	23.5
	HSDPA DC-HSDPA	21	21	21	23
	HSUPA HSPA+	21	21	21	23
V	RMC12.2K	23.5	24	-	-
	HSDPA DC-HSDPA	23	23.5	-	-
	HSUPA HSPA+	23	23.5	-	-

LTE Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3	Ant 4	Ant 5	Ant 6	Ant 7
2	FDD	20.5	21.5	20.5	22.5	-	-	-	-
4	FDD	21.5	21.5	21.5	23.5	-	-	-	-
5	FDD	23.5	24	-	-	-	-	-	-
7	FDD	18.5	19.5	21.5	18.5	-	-	-	-
12	FDD	24	21.5	-	-	-	-	-	-
13	FDD	22.5	20.5	-	-	-	-	-	-
14	FDD	22.5	20.5	-	-	-	-	-	-
25	FDD	20.5	21.5	20.5	22.5	-	-	-	-
26	FDD	23.5	24	-	-	-	-	-	-
30	FDD	20.5	20.5	21.5	20.5	-	-	-	-
38	TDD	20.5	21.5	23.5	20.5	-	-	-	-
40	TDD	22.5	22.5	23.5	22.5	-	-	-	-
41	TDD	20.5	21.5	23.5	20.5	-	-	-	-
42	TDD	-	-	-	-	24	24	24	24
43	TDD	-	-	-	-	24	24	24	24
48	TDD	-	-	-	-	24	24	24	24
66	FDD	21.5	21.5	21.5	23.5	-	-	-	-
71	FDD	24	21.5	-	-	-	-	-	-

NR Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3	Ant 4	Ant 5	Ant 6	Ant 7
n2	FDD	20.5	21.5	20.5	22.5	-	-	-	-
n5	FDD	23.5	24	-	-	-	-	-	-
n7	FDD	18.5	19.5	21.5	18.5	-	-	-	-
n12	FDD	24	21.5	-	-	-	-	-	-
n13	FDD	22.5	20.5	-	-	-	-	-	-
n14	FDD	22.5	20.5	-	-	-	-	-	-
n25	FDD	20.5	21.5	20.5	22.5	-	-	-	-
n30	FDD	20.5	20.5	21.5	20.5	-	-	-	-
n66	FDD	21.5	21.5	21.5	23.5	-	-	-	-
n71	FDD	24	24	-	-	-	-	-	-
n38	TDD	20.5	21.5	23.5	20.5	-	-	-	-
n41	TDD	20.5	21.5	23.5	20.5	-	-	-	-
n48	TDD	-	-	-	-	24	24	24	24
n77	TDD	-	-	-	-	24	24	24	24
n78	TDD	-	-	-	-	21.5	25	25	24.5

<MAX Tune-up Power-HotSpot Mode DSI-3>

GSM Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
GSM850	GSM	33	33	-	-
	GPRS 1TX Slot	33	33	-	-
	GPRS 2TX Slot	33	33	-	-
	GPRS 3TX Slot	31.5	32.5	-	-
	GPRS 4TX Slot	30.5	31.5	-	-
	EGPRS 1TX Slot	27	27	-	-
	EGPRS 2TX Slot	27	27	-	-
	EGPRS 3TX Slot	24.5	25.5	-	-
	EGPRS 4TX Slot	23.5	24.5	-	-

GSM Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
GSM1900	GSM	30	30	30	30
	GPRS 1TX Slot	30	30	30	30
	GPRS 2TX Slot	27.5	29.5	27.5	30
	GPRS 3TX Slot	25.5	26.5	25.5	30
	GPRS 4TX Slot	24.5	25.5	24.5	29.5
	EGPRS 1TX Slot	23	23	23	23
	EGPRS 2TX Slot	20.5	22.5	20.5	23
	EGPRS 3TX Slot	18.5	19.5	18.5	23
	EGPRS 4TX Slot	17.5	18.5	17.5	22.5

WCDMA Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3
II	RMC12.2K	21.5	22.5	21.5	23.5
	HSDPA DC-HSDPA	21	22	21	23
	HSUPA HSPA+	21	22	21	23
IV	RMC12.2K	23.5	23.5	23.5	24
	HSDPA DC-HSDPA	23	23	23	23.5
	HSUPA HSPA+	23	23	23	23.5
V	RMC12.2K	23.5	24	-	-
	HSDPA DC-HSDPA	23	23.5	-	-
	HSUPA HSPA+	23	23.5	-	-

LTE Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3	Ant 4	Ant 5	Ant 6	Ant 7
2	FDD	21.5	22.5	21.5	23.5	-	-	-	-
4	FDD	23.5	23.5	23.5	24	-	-	-	-
5	FDD	23.5	24	-	-	-	-	-	-
7	FDD	17.5	18.5	20.5	17.5	-	-	-	-
12	FDD	24	24	-	-	-	-	-	-
13	FDD	24	24	-	-	-	-	-	-
14	FDD	24	24	-	-	-	-	-	-
25	FDD	21.5	22.5	21.5	23.5	-	-	-	-
26	FDD	23.5	24	-	-	-	-	-	-
30	FDD	18.5	18.5	20.5	18.5	-	-	-	-
38	TDD	17	20.5	22.5	19.5	-	-	-	-
40	TDD	20.5	20.5	22.5	20.5	-	-	-	-
41	TDD	17	20.5	22.5	19.5	-	-	-	-
42	TDD	-	-	-	-	17.5	24	24	24
43	TDD	-	-	-	-	19.5	24	24	24
48	TDD	-	-	-	-	18	24	24	24
66	FDD	23.5	23.5	23.5	24	-	-	-	-
71	FDD	24	24	-	-	-	-	-	-

NR Band		Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up	Maximum Tune-up
Antenna		Ant 0	Ant 1	Ant 2	Ant 3	Ant 4	Ant 5	Ant 6	Ant 7
n2	FDD	21.5	22.5	21.5	23.5	-	-	-	-
n5	FDD	23.5	24	-	-	-	-	-	-
n7	FDD	17.5	18.5	20.5	17.5	-	-	-	-
n12	FDD	24	24	-	-	-	-	-	-
n13	FDD	24	24	-	-	-	-	-	-
n14	FDD	24	24	-	-	-	-	-	-
n25	FDD	21.5	22.5	21.5	23.5	-	-	-	-
n30	FDD	18.5	18.5	20.5	18.5	-	-	-	-
n66	FDD	23.5	23.5	23.5	24	-	-	-	-
n71	FDD	24	24	-	-	-	-	-	-
n38	TDD	18.5	20.5	22.5	19.5	-	-	-	-
n41	TDD	18.5	20.5	22.5	19.5	-	-	-	-
n48	TDD	-	-	-	-	18	24	24	24
n77	TDD	-	-	-	-	18	24	24	24
n78	TDD	-	-	-	-	18	18.5	24.5	21.5

WLAN 2.4 GHz MAX Tune-up Power_P-Sensor Off					
Mode	Channel	Frequency	ANT 0	ANT 1	ANT 0+1
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11b	1	2412	20.0	20.0	23.0
	6	2437	20.0	20.0	23.0
	11	2462	20.0	20.0	23.0
	12	2467	20.0	20.0	23.0
	13	2472	16.0	16.0	19.0
802.11g	1	2412	20.0	20.0	23.0
	6	2437	20.0	20.0	23.0
	11	2462	20.0	20.0	23.0
	12	2467	20.0	20.0	23.0
	13	2472	11.5	11.5	14.5
802.11n HT20	1	2412	20.0	20.0	23.0
	6	2437	20.0	20.0	23.0
	11	2462	20.0	20.0	23.0
	12	2467	17.0	17.0	20.0
	13	2472	5.0	5.0	8.0
802.11n HT40	3	2422	20.0	20.0	23.0
	6	2437	20.0	20.0	23.0
	9	2452	20.0	20.0	23.0
	10	2457	20.0	20.0	23.0
	11	2462	12.5	12.5	15.5
VHT20	1	2412	20.0	20.0	23.0
	6	2437	20.0	20.0	23.0
	11	2462	20.0	20.0	23.0
	12	2467	17.0	17.0	20.0
	13	2472	5.5	5.5	8.5
VHT40	3	2422	20.0	20.0	23.0
	6	2437	20.0	20.0	23.0
	9	2452	20.0	20.0	23.0
	10	2457	20.0	20.0	23.0
	11	2462	12.5	12.5	15.5
802.11ax HE20	1	2412	20.0	20.0	23.0
	6	2437	20.0	20.0	23.0
	11	2462	20.0	20.0	23.0
	12	2467	17.0	17.0	20.0
	13	2472	5.5	5.5	8.5
802.11ax HE40	3	2422	20.0	20.0	23.0
	6	2437	20.0	20.0	23.0
	9	2452	20.0	20.0	23.0
	10	2457	20.0	20.0	23.0
	11	2462	12.5	12.5	15.5

WLAN 5.2 GHz MAX Tune-up Power_P-Sensor Off					
Mode	Channel	Frequency	ANT 0	ANT 1	ANT 0+1
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	36	5180	18	18	21
	40	5200	18	18	21
	44	5220	18	18	21
	48	5240	18	18	21
802.11n HT20	36	5180	18	18	21
	40	5200	18	18	21
	44	5220	18	18	21
	48	5240	18	18	21
802.11n HT40	38	5190	15	15	18
	46	5230	18	18	21
802.11ac VHT20	36	5180	18	18	21
	40	5200	18	18	21
	44	5220	18	18	21
	48	5240	18	18	21
802.11ac VHT40	38	5190	15	15	18
	46	5230	18	18	21
802.11ac VHT80	42	5210	14	14	17
802.11ax HE20	36	5180	18	18	21
	40	5200	18	18	21
	44	5220	18	18	21
	48	5240	18	18	21
802.11ax HE40	38	5190	15	15	18
	46	5230	18	18	21
802.11ax HE80	42	5210	14	14	17

WLAN 5.3 GHz MAX Tune-up Power_P-Sensor Off					
Mode	Channel	Frequency	ANT 0	ANT 1	ANT 0+1
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	52	5260	18	18	21
	56	5280	18	18	21
	60	5300	18	18	21
	64	5320	18	18	21
802.11n HT20	52	5260	18	18	21
	56	5280	18	18	21
	60	5300	18	18	21
	64	5320	18	18	21
802.11n HT40	54	5270	18	18	21
	62	5310	15	15	18
802.11ac VHT20	52	5260	18	18	21
	56	5280	18	18	21
	60	5300	18	18	21
	64	5320	18	18	21
802.11ac VHT40	54	5270	18	18	21
	62	5310	15	15	18
802.11ac VHT80	58	5290	14	14	17
802.11ac VHT160	50	5250	11	11	14
802.11ax HE20	52	5260	18	18	21
	56	5280	18	18	21
	60	5300	18	18	21
	64	5320	18	18	21
802.11ax HE40	54	5270	18	18	21
	62	5310	15	15	18
802.11ax HE80	58	5290	14	14	17
802.11ax HE160	50	5250	11	11	14

WLAN 5.6 GHz MAX Tune-up Power_P-Sensor Off					
Mode	Channel	Frequency	ANT 0	ANT 1	ANT 0+1
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	100	5500	18	18	21
	116	5580	18	18	21
	124	5620	18	18	21
	132	5660	18	18	21
	140	5700	18	18	21
	144	5720	18	18	21
802.11n HT20	100	5500	18	18	21
	116	5580	18	18	21
	124	5620	18	18	21
	132	5660	18	18	21
	140	5700	18	18	21
	144	5720	18	18	21
802.11n HT40	102	5510	15	15	18
	110	5550	18	18	21
	126	5630	18	18	21
	134	5670	18	18	21
	142	5710	18	18	21
802.11ac VHT20	100	5500	18	18	21
	116	5580	18	18	21
	124	5620	18	18	21
	132	5660	18	18	21
	140	5700	18	18	21
	144	5720	18	18	21
802.11ac VHT40	102	5510	15	15	18
	110	5550	18	18	21
	126	5630	18	18	21
	134	5670	18	18	21
	142	5710	18	18	21
802.11ac VHT80	106	5530	14.5	14.5	17.5
	122	5610	18	18	21
	138	5690	18	18	21
802.11ac VHT160	114	5570	14.5	14.5	17.5
802.11ax HE20	100	5500	18	18	21
	116	5580	18	18	21
	124	5620	18	18	21
	132	5660	18	18	21
	140	5700	18	18	21
	144	5720	18	18	21
802.11ax HE40	102	5510	15	15	18
	110	5550	18	18	21
	126	5630	18	18	21
	134	5670	18	18	21
	142	5710	18	18	21
802.11ax HE80	106	5530	14.5	14.5	17.5
	122	5610	18	18	21
	138	5690	18	18	21
802.11ax HE160	114	5570	14.5	14.5	17.5

WLAN 5.8 GHz MAX Tune-up Power_P-Sensor Off					
Mode	Channel	Frequency	ANT 0	ANT 1	ANT 0+1
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	149	5745	18	18	21
	157	5785	18	18	21
	165	5825	18	18	21
	169	5845	18	18	21
	173	5865	18	18	21
	177	5885	18	18	21
802.11n HT20	149	5745	18	18	21
	157	5785	18	18	21
	165	5825	18	18	21
	169	5845	18	18	21
	173	5865	18	18	21
	177	5885	18	18	21
802.11n HT40	151	5755	18	18	21
	159	5795	18	18	21
	167	5835	18	18	21
	175	5875	18	18	21
802.11ac VHT20	149	5745	18	18	21
	157	5785	18	18	21
	165	5825	18	18	21
	169	5845	18	18	21
	173	5865	18	18	21
	177	5885	18	18	21
802.11ac VHT40	151	5755	18	18	21
	159	5795	18	18	21
	167	5835	18	18	21
	175	5875	18	18	21
802.11ac VHT80	155	5775	18	18	21
	171	5855	18	18	21
802.11ac VHT160	163	5815	18	18	21
802.11ax HE20	149	5745	18	18	21
	157	5785	18	18	21
	165	5825	18	18	21
	169	5845	18	18	21
	173	5865	18	18	21
	177	5885	18	18	21
802.11ax HE40	151	5755	18	18	21
	159	5795	18	18	21
	167	5835	18	18	21
	175	5875	18	18	21
802.11ax HE80	155	5775	18	18	21
	171	5855	18	18	21
802.11ax HE160	163	5815	18	18	21

U-NII 5 MAX Tune-up Power_P-Sensor Off					
Mode	Channel	Frequency	ANT 0	ANT 1	ANT 0+1
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	1	5955	3	3	6.00
	45	6175	3	3	6
	93	6415	3	3	6
802.11ax HE20	1	5955	2	2	5
	45	6175	2	2	5
	93	6415	2	2	5
802.11ax HE40	3	5965	5	5	8
	43	6165	5	5	8
	91	6405	5	5	8
802.11ax HE80	7	5985	8.5	8.5	11.5
	39	6145	8.5	8.5	11.5
	87	6385	8.5	8.5	11.5
802.11ax HE160	15	6025	11.5	11.5	14.5
	47	6185	11.5	11.5	14.5
	79	6345	11.5	11.5	14.5

U-NII 6 MAX Tune-up Power_P-Sensor Off					
Mode	Channel	Frequency	ANT 0	ANT 1	ANT 0+1
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	97	6435	3	3	6
	105	6475	3	3	6
	113	6515	3	3	6
802.11ax HE20	97	6435	2	2	5
	105	6475	2	2	5
	113	6515	2	2	5
802.11ax HE40	99	6445	5	5	8
	107	6485	5	5	8
802.11ax HE80	103	6465	8.5	8.5	11.5
	119	6545	8.5	8.5	11.5
802.11ax HE160	111	6505	11.5	11.5	14.5

U-NII 7 MAX Tune-up Power_P-Sensor Off					
Mode	Channel	Frequency	ANT 0	ANT 1	ANT 0+1
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	117	6535	3	3	6
	149	6695	3	3	6
	181	6855	3	3	6
802.11ax HE20	117	6535	2	2	5
	149	6695	2	2	5
	181	6855	2	2	5
802.11ax HE40	115	6525	5	5	8
	147	6685	5	5	8
	179	6845	5	5	8
802.11ax HE80	135	6625	8.5	8.5	11.5
	151	6705	8.5	8.5	11.5
	167	6785	8.5	8.5	11.5
	183	6865	8.5	8.5	11.5
802.11ax HE160	143	6665	11.5	11.5	14.5
	175	6825	11.5	11.5	14.5

U-NII 8 MAX Tune-up Power_P-Sensor Off					
Mode	Channel	Frequency	ANT 0	ANT 1	ANT 0+1
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	185	6875	3	3	6
	209	6995	3	3	6
	233	7115	3	3	6
802.11ax HE20	185	6875	2	2	5
	209	6995	2	2	5
	233	7115	-2.5	-2.5	0.5
802.11ax HE40	187	6885	5	5	8
	211	7005	5	5	8
	227	7085	5	5	8
802.11ax HE80	199	6945	8.5	8.5	11.5
	215	7025	8.5	8.5	11.5
802.11ax HE160	207	6985	11.5	11.5	14.5

Bluetooth MAX Tune-up Power_P-Sensor Off					
Mode		Channel	Frequency	ANT 0	ANT 1
				MAX Tune-up	MAX Tune-up
BR / EDR	1Mbps (GFSK)	0	2402	8.5	8.5
		39	2441	8.5	8.5
		78	2480	8.5	8.5
	2Mbps (π/4 DQPSK)	0	2402	6.5	6.5
		39	2441	6.5	6.5
		78	2480	6.5	6.5
	3Mbps (8-DPSK)	0	2402	6.5	6.5
		39	2441	6.5	6.5
		78	2480	6.5	6.5
LE	1Mbps (GFSK)	0	2402	8.5	8.5
		19	2440	8.5	8.5
		39	2480	8.5	8.5
	2Mbps (π/4 DQPSK)	1	2404	6.5	6.5
		19	2440	6.5	6.5
		38	2478	6.5	6.5

WLAN 2.4 GHz MAX Tune-up Power_P-Sensor On					
Mode	Channel	Frequency	ANT 1	ANT 2	ANT 1+2
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11b	1	2412	17.0	17.0	20.0
	6	2437	17.0	17.0	20.0
	11	2462	17.0	17.0	20.0
	12	2467	17.0	17.0	20.0
	13	2472	16.0	16.0	19.0
802.11g	1	2412	17.0	17.0	20.0
	6	2437	17.0	17.0	20.0
	11	2462	17.0	17.0	20.0
	12	2467	17.0	17.0	20.0
	13	2472	11.5	11.5	14.5
802.11n HT20	1	2412	17.0	17.0	20.0
	6	2437	17.0	17.0	20.0
	11	2462	17.0	17.0	20.0
	12	2467	17.0	17.0	20.0
	13	2472	5.0	5.0	8.0
802.11n HT40	3	2422	17.0	17.0	20.0
	6	2437	17.0	17.0	20.0
	9	2452	17.0	17.0	20.0
	10	2457	17.0	17.0	20.0
	11	2462	12.5	12.5	15.5
802.11ac VHT20	1	2412	17.0	17.0	20.0
	6	2437	17.0	17.0	20.0
	11	2462	17.0	17.0	20.0
	12	2467	17.0	17.0	20.0
	13	2472	5.5	5.5	8.5
802.11ac VHT40	3	2422	17.0	17.0	20.0
	6	2437	17.0	17.0	20.0
	9	2452	17.0	17.0	20.0
	10	2457	17.0	17.0	20.0
	11	2462	12.5	12.5	15.5
802.11ax HE20	1	2412	17.0	17.0	20.0
	6	2437	17.0	17.0	20.0
	11	2462	17.0	17.0	20.0
	12	2467	17.0	17.0	20.0
	13	2472	5.5	5.5	8.5
802.11ax HE40	3	2422	17.0	17.0	20.0
	6	2437	17.0	17.0	20.0
	9	2452	17.0	17.0	20.0
	10	2457	17.0	17.0	20.0
	11	2462	12.5	12.5	15.5

WLAN 5.2 GHz MAX Tune-up Power_P-Sensor On					
Mode	Channel	Frequency	ANT 1	ANT 2	ANT 1+2
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	36	5180	16	16	19
	40	5200	16	16	19
	44	5220	16	16	19
	48	5240	16	16	19
802.11n HT20	36	5180	16	16	19
	40	5200	16	16	19
	44	5220	16	16	19
	48	5240	16	16	19
802.11n HT40	38	5190	15	15	18
	46	5230	16	16	19
802.11ac VHT20	36	5180	16	16	19
	40	5200	16	16	19
	44	5220	16	16	19
	48	5240	16	16	19
802.11ac VHT40	38	5190	15	15	18
	46	5230	16	16	19
802.11ac VHT80	42	5210	14	14	17
802.11ax HE20	36	5180	16	16	19
	40	5200	16	16	19
	44	5220	16	16	19
	48	5240	16	16	19
802.11ax HE40	38	5190	15	15	18
	46	5230	16	16	19
802.11ax HE80	42	5210	14	14	17

WLAN 5.3 GHz MAX Tune-up Power_P-Sensor On					
Mode	Channel	Frequency	ANT 1	ANT 2	ANT 1+2
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	52	5260	16	16	19
	56	5280	16	16	19
	60	5300	16	16	19
	64	5320	16	16	19
802.11n HT20	52	5260	16	16	19
	56	5280	16	16	19
	60	5300	16	16	19
	64	5320	16	16	19
802.11n HT40	54	5270	16	16	19
	62	5310	15	15	18
802.11ac VHT20	52	5260	16	16	19
	56	5280	16	16	19
	60	5300	16	16	19
	64	5320	16	16	19
802.11ac VHT40	54	5270	16	16	19
	62	5310	15	15	18
802.11ac VHT80	58	5290	14	14	17
802.11ac VHT160	50	5250	11	11	14
802.11ax HE20	52	5260	16	16	19
	56	5280	16	16	19
	60	5300	16	16	19
	64	5320	16	16	19
802.11ax HE40	54	5270	16	16	19
	62	5310	15	15	18
802.11ax HE80	58	5290	14	14	17
802.11ax HE160	50	5250	11	11	14

WLAN 5.6 GHz MAX Tune-up Power_P-Sensor On					
Mode	Channel	Frequency	ANT 1	ANT 2	ANT 1+2
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	100	5500	17	17	20
	116	5580	17	17	20
	124	5620	17	17	20
	132	5660	17	17	20
	140	5700	17	17	20
	144	5720	17	17	20
802.11n HT20	100	5500	17	17	20
	116	5580	17	17	20
	124	5620	17	17	20
	132	5660	17	17	20
	140	5700	17	17	20
	144	5720	17	17	20
802.11n HT40	102	5510	15	15	18
	110	5550	17	17	20
	126	5630	17	17	20
	134	5670	17	17	20
	142	5710	17	17	20
802.11ac VHT20	100	5500	17	17	20
	116	5580	17	17	20
	124	5620	17	17	20
	132	5660	17	17	20
	140	5700	17	17	20
	144	5720	17	17	20
802.11ac VHT40	102	5510	15	15	18
	110	5550	17	17	20
	126	5630	17	17	20
	134	5670	17	17	20
	142	5710	17	17	20
802.11ac VHT80	106	5530	14.5	14.5	17.5
	122	5610	17	17	20
	138	5690	17	17	20
802.11ac VHT160	114	5570	14.5	14.5	17.5
802.11ax HE20	100	5500	17	17	20
	116	5580	17	17	20
	124	5620	17	17	20
	132	5660	17	17	20
	140	5700	17	17	20
	144	5720	17	17	20
802.11ax HE40	102	5510	15	15	18
	110	5550	17	17	20
	126	5630	17	17	20
	134	5670	17	17	20
	142	5710	17	17	20
802.11ax HE80	106	5530	14.5	14.5	17.5
	122	5610	17	17	20
	138	5690	17	17	20
802.11ax HE160	114	5570	14.5	14.5	17.5

WLAN 5.8 GHz MAX Tune-up Power_P-Sensor On					
Mode	Channel	Frequency	ANT 1	ANT 2	ANT 1+2
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	149	5745	16	16	19
	157	5785	16	16	19
	165	5825	16	16	19
	169	5845	16	16	19
	173	5865	16	16	19
	177	5885	16	16	19
802.11n HT20	149	5745	16	16	19
	157	5785	16	16	19
	165	5825	16	16	19
	169	5845	16	16	19
	173	5865	16	16	19
	177	5885	16	16	19
802.11n HT40	151	5755	16	16	19
	159	5795	16	16	19
	167	5835	16	16	19
	175	5875	16	16	19
802.11ac VHT20	149	5745	16	16	19
	157	5785	16	16	19
	165	5825	16	16	19
	169	5845	16	16	19
	173	5865	16	16	19
	177	5885	16	16	19
802.11ac VHT40	151	5755	16	16	19
	159	5795	16	16	19
	167	5835	16	16	19
	175	5875	16	16	19
802.11ac VHT80	155	5775	16	16	19
	171	5855	16	16	19
802.11ac VHT160	163	5815	16	16	19
802.11ax HE20	149	5745	16	16	19
	157	5785	16	16	19
	165	5825	16	16	19
	169	5845	16	16	19
	173	5865	16	16	19
	177	5885	16	16	19
802.11ax HE40	151	5755	16	16	19
	159	5795	16	16	19
	167	5835	16	16	19
	175	5875	16	16	19
802.11ax HE80	155	5775	16	16	19
	171	5855	16	16	19
802.11ax HE160	163	5815	16	16	19

U-NII 5 MAX Tune-up Power_P-Sensor On					
Mode	Channel	Frequency	ANT 1	ANT 2	ANT 1+2
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	1	5955	3	3	6.00
	45	6175	3	3	6
	93	6415	3	3	6
802.11ax HE20	1	5955	2	2	5
	45	6175	2	2	5
	93	6415	2	2	5
802.11ax HE40	3	5965	5	5	8
	43	6165	5	5	8
	91	6405	5	5	8
802.11ax HE80	7	5985	8.5	8.5	11.5
	39	6145	8.5	8.5	11.5
	87	6385	8.5	8.5	11.5
802.11ax HE160	15	6025	11.5	11.5	14.5
	47	6185	11.5	11.5	14.5
	79	6345	11.5	11.5	14.5

U-NII 6 MAX Tune-up Power_P-Sensor On					
Mode	Channel	Frequency	ANT 1	ANT 2	ANT 1+2
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	97	6435	3	3	6
	105	6475	3	3	6
	113	6515	3	3	6
802.11ax HE20	97	6435	2	2	5
	105	6475	2	2	5
	113	6515	2	2	5
802.11ax HE40	99	6445	5	5	8
	107	6485	5	5	8
802.11ax HE80	103	6465	8.5	8.5	11.5
	119	6545	8.5	8.5	11.5
802.11ax HE160	111	6505	11.5	11.5	14.5

U-NII 7 MAX Tune-up Power_P-Sensor On					
Mode	Channel	Frequency	ANT 1	ANT 2	ANT 1+2
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	117	6535	3	3	6
	149	6695	3	3	6
	181	6855	3	3	6
802.11ax HE20	117	6535	2	2	5
	149	6695	2	2	5
	181	6855	2	2	5
802.11ax HE40	115	6525	5	5	8
	147	6685	5	5	8
	179	6845	5	5	8
802.11ax HE80	135	6625	8.5	8.5	11.5
	151	6705	8.5	8.5	11.5
	167	6785	8.5	8.5	11.5
	183	6865	8.5	8.5	11.5
802.11ax HE160	143	6665	11.5	11.5	14.5
	175	6825	11.5	11.5	14.5

U-NII 8 MAX Tune-up Power_P-Sensor On					
Mode	Channel	Frequency	ANT 1	ANT 2	ANT 1+2
			MAX Tune-up	MAX Tune-up	MAX Tune-up
802.11a	185	6875	3	3	6
	209	6995	3	3	6
	233	7115	3	3	6
802.11ax HE20	185	6875	2	2	5
	209	6995	2	2	5
	233	7115	-2.5	-2.5	0.5
802.11ax HE40	187	6885	5	5	8
	211	7005	5	5	8
	227	7085	5	5	8
802.11ax HE80	199	6945	8.5	8.5	11.5
	215	7025	8.5	8.5	11.5
802.11ax HE160	207	6985	11.5	11.5	14.5

Bluetooth MAX Tune-up Power_P-Sensor On					
Mode		Channel	Frequency	ANT 1	ANT 2
				MAX Tune-up	MAX Tune-up
BR / EDR	1Mbps (GFSK)	0	2402	8.5	8.5
		39	2441	8.5	8.5
		78	2480	8.5	8.5
	2Mbps (π/4 DQPSK)	0	2402	6.5	6.5
		39	2441	6.5	6.5
		78	2480	6.5	6.5
	3Mbps (8-DPSK)	0	2402	6.5	6.5
		39	2441	6.5	6.5
		78	2480	6.5	6.5
LE	1Mbps (GFSK)	0	2402	8.5	8.5
		19	2440	8.5	8.5
		39	2480	8.5	8.5
	2Mbps (π/4 DQPSK)	1	2404	6.5	6.5
		19	2440	6.5	6.5
		38	2478	6.5	6.5

8.2. Measured Conducted Power Results for GSM

Test Notes:

[1] The device supports GSM Class: B, GPRS Multi-slot class: 33 (Max 4 Tx uplink slots), EDGE Multi-slot class: 33 (Max 4 Tx uplink slots), DTM Multi-slot Class: N/A.

[2] Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

[3] GPRS / EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 ~ CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.

[4] EDGE (8PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.

<Head Mode DSI-2>

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 0	GSM	32.12	32.08	32.15	33
	GPRS/EGPRS(GMSK)_1TX Slot	32.03	32.01	32.04	33
	GPRS/EGPRS(GMSK)_2TX Slot	31.91	31.89	31.92	33
	GPRS/EGPRS(GMSK)_3TX Slot	31.31	31	31.18	31.5
	GPRS/EGPRS(GMSK)_4TX Slot	30.13	30.09	30.39	30.5
	EGPRS(8PSK)_1TX Slot	25.96	26	26.02	27
	EGPRS(8PSK)_2TX Slot	25.81	25.88	25.87	27
	EGPRS(8PSK)_3TX Slot	24.05	24.34	24.18	24.5
	EGPRS(8PSK)_4TX Slot	23.15	23.23	23.33	23.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 0	GSM	29.26	29.37	29.21	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.15	29.29	29.09	30
	GPRS/EGPRS(GMSK)_2TX Slot	27.27	27.46	27.43	27.5
	GPRS/EGPRS(GMSK)_3TX Slot	25	25.39	25.27	25.5
	GPRS/EGPRS(GMSK)_4TX Slot	24.18	24.18	24.05	24.5
	EGPRS(8PSK)_1TX Slot	22.79	22.53	22.96	23
	EGPRS(8PSK)_2TX Slot	20.42	20.4	20.06	20.5
	EGPRS(8PSK)_3TX Slot	18.24	18.16	18.48	18.5
	EGPRS(8PSK)_4TX Slot	17.41	17.3	17.11	17.5

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 0	GSM	23.12	23.08	23.15	24
	GPRS/EGPRS(GMSK)_1TX Slot	23.03	23.01	23.04	24
	GPRS/EGPRS(GMSK)_2TX Slot	25.91	25.89	25.92	27
	GPRS/EGPRS(GMSK)_3TX Slot	27.05	26.74	26.92	27.24
	GPRS/EGPRS(GMSK)_4TX Slot	27.13	27.09	27.39	27.5
	EGPRS(8PSK)_1TX Slot	16.96	17	17.02	18
	EGPRS(8PSK)_2TX Slot	19.81	19.88	19.87	21
	EGPRS(8PSK)_3TX Slot	19.79	20.08	19.92	20.24
	EGPRS(8PSK)_4TX Slot	20.15	20.23	20.33	20.5

GSM1900 Ant 0	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
	GSM	20.26	20.37	20.21	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.15	20.29	20.09	21
	GPRS/EGPRS(GMSK)_2TX Slot	21.27	21.46	21.43	21.5
	GPRS/EGPRS(GMSK)_3TX Slot	20.74	21.13	21.01	21.24
	GPRS/EGPRS(GMSK)_4TX Slot	21.18	21.18	21.05	21.5
	EGPRS(8PSK)_1TX Slot	13.79	13.53	13.96	14
	EGPRS(8PSK)_2TX Slot	14.42	14.4	14.06	14.5
	EGPRS(8PSK)_3TX Slot	13.98	13.9	14.22	14.24
	EGPRS(8PSK)_4TX Slot	14.41	14.3	14.11	14.5

GSM850 Ant 1	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
	GSM	32.15	32	32.38	33
	GPRS/EGPRS(GMSK)_1TX Slot	32.28	32.23	32.32	33
	GPRS/EGPRS(GMSK)_2TX Slot	32.02	32.13	32.12	33
	GPRS/EGPRS(GMSK)_3TX Slot	32.24	32.23	32.3	32.5
	GPRS/EGPRS(GMSK)_4TX Slot	30.98	30.85	31.1	31.5
	EGPRS(8PSK)_1TX Slot	26.78	26.81	26.51	27
	EGPRS(8PSK)_2TX Slot	26.62	26.66	26.84	27
	EGPRS(8PSK)_3TX Slot	25.31	25.2	25.39	25.5
	EGPRS(8PSK)_4TX Slot	24.45	24.45	24.39	24.5

GSM1900 Ant 1	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
	GSM	29.51	29.92	29.85	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.59	29.75	29.52	30
	GPRS/EGPRS(GMSK)_2TX Slot	29.31	29.36	29.16	29.5
	GPRS/EGPRS(GMSK)_3TX Slot	26	26.18	26.38	26.5
	GPRS/EGPRS(GMSK)_4TX Slot	25.12	25.25	24.76	25.5
	EGPRS(8PSK)_1TX Slot	23	22.79	22.55	23
	EGPRS(8PSK)_2TX Slot	22.2	22.34	22.24	22.5
	EGPRS(8PSK)_3TX Slot	19.1	19.44	19.23	19.5
	EGPRS(8PSK)_4TX Slot	17.68	18.48	18.09	18.5

GSM850 Ant 1	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
	GSM	23.15	23	23.38	24
	GPRS/EGPRS(GMSK)_1TX Slot	23.28	23.23	23.32	24
	GPRS/EGPRS(GMSK)_2TX Slot	26.02	26.13	26.12	27
	GPRS/EGPRS(GMSK)_3TX Slot	27.98	27.97	28.04	28.24
	GPRS/EGPRS(GMSK)_4TX Slot	27.98	27.85	28.1	28.5
	EGPRS(8PSK)_1TX Slot	17.78	17.81	17.51	18
	EGPRS(8PSK)_2TX Slot	20.62	20.66	20.84	21
	EGPRS(8PSK)_3TX Slot	21.05	20.94	21.13	21.24
	EGPRS(8PSK)_4TX Slot	21.45	21.45	21.39	21.5

GSM1900 Ant 1	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
	GSM	20.51	20.92	20.85	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.59	20.75	20.52	21
	GPRS/EGPRS(GMSK)_2TX Slot	23.31	23.36	23.16	23.5
	GPRS/EGPRS(GMSK)_3TX Slot	21.74	21.92	22.12	22.24
	GPRS/EGPRS(GMSK)_4TX Slot	22.12	22.25	21.76	22.5
	EGPRS(8PSK)_1TX Slot	14	13.79	13.55	14
	EGPRS(8PSK)_2TX Slot	16.2	16.34	16.24	16.5
	EGPRS(8PSK)_3TX Slot	14.84	15.18	14.97	15.24
	EGPRS(8PSK)_4TX Slot	14.68	15.48	15.09	15.5

	Uplink Channel	512	661	810	Tune up (dBm)
GSM1900 Ant 2	Uplink Frequency	1850.2	1880	1909.8	
	GSM	29.89	29.91	29.81	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.73	29.71	29.83	30
	GPRS/EGPRS(GMSK)_2TX Slot	27.29	27.46	27.25	27.5
	GPRS/EGPRS(GMSK)_3TX Slot	25.12	25.29	25.37	25.5
	GPRS/EGPRS(GMSK)_4TX Slot	24.09	24.37	24.1	24.5
	EGPRS(8PSK)_1TX Slot	22.85	22.66	22.69	23
	EGPRS(8PSK)_2TX Slot	20.27	20.36	20.39	20.5
	EGPRS(8PSK)_3TX Slot	18.1	18.08	18.37	18.5
	EGPRS(8PSK)_4TX Slot	17.07	17.09	17.3	17.5

	Uplink Channel	512	661	810	Tune up (dBm)
GSM1900 Ant 2	Uplink Frequency	1850.2	1880	1909.8	
	GSM	20.89	20.91	20.81	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.73	20.71	20.83	21
	GPRS/EGPRS(GMSK)_2TX Slot	21.29	21.46	21.25	21.5
	GPRS/EGPRS(GMSK)_3TX Slot	20.86	21.03	21.11	21.24
	GPRS/EGPRS(GMSK)_4TX Slot	21.09	21.37	21.1	21.5
	EGPRS(8PSK)_1TX Slot	13.85	13.66	13.69	14
	EGPRS(8PSK)_2TX Slot	14.27	14.36	14.39	14.5
	EGPRS(8PSK)_3TX Slot	13.84	13.82	14.11	14.24
	EGPRS(8PSK)_4TX Slot	14.07	14.09	14.3	14.5

	Uplink Channel	512	661	810	Tune up (dBm)
GSM1900 Ant 3	Uplink Frequency	1850.2	1880	1909.8	
	GSM	29.11	29.85	29.48	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.02	29.64	29.26	30
	GPRS/EGPRS(GMSK)_2TX Slot	29.39	29.72	29.78	30
	GPRS/EGPRS(GMSK)_3TX Slot	29.27	29.77	29.03	30
	GPRS/EGPRS(GMSK)_4TX Slot	29.16	29.34	29.04	29.5
	EGPRS(8PSK)_1TX Slot	22.59	23	22.72	23
	EGPRS(8PSK)_2TX Slot	22.83	22.56	22.5	23
	EGPRS(8PSK)_3TX Slot	22.82	22.88	22.66	23
	EGPRS(8PSK)_4TX Slot	22.38	22.39	22.39	22.5

	Uplink Channel	512	661	810	Tune up (dBm)
GSM1900 Ant 3	Uplink Frequency	1850.2	1880	1909.8	
	GSM	20.11	20.85	20.48	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.02	20.64	20.26	21
	GPRS/EGPRS(GMSK)_2TX Slot	23.39	23.72	23.78	24
	GPRS/EGPRS(GMSK)_3TX Slot	25.01	25.51	24.77	25.74
	GPRS/EGPRS(GMSK)_4TX Slot	26.16	26.34	26.04	26.5
	EGPRS(8PSK)_1TX Slot	13.59	14	13.72	14
	EGPRS(8PSK)_2TX Slot	16.83	16.56	16.5	17
	EGPRS(8PSK)_3TX Slot	18.56	18.62	18.4	18.74
	EGPRS(8PSK)_4TX Slot	19.38	19.39	19.39	19.5

<Body Mode DSI-4>

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 0	GSM	32.12	32.08	32.15	33
	GPRS/EGPRS(GMSK)_1TX Slot	32.03	32.01	32.04	33
	GPRS/EGPRS(GMSK)_2TX Slot	31.91	31.89	31.92	33
	GPRS/EGPRS(GMSK)_3TX Slot	31.31	31	31.18	31.5
	GPRS/EGPRS(GMSK)_4TX Slot	30.13	30.09	30.39	30.5
	EGPRS(8PSK)_1TX Slot	25.96	26	26.02	27
	EGPRS(8PSK)_2TX Slot	25.81	25.88	25.87	27
	EGPRS(8PSK)_3TX Slot	24.05	24.34	24.18	24.5
	EGPRS(8PSK)_4TX Slot	23.15	23.23	23.33	23.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 0	GSM	29.26	29.37	29.21	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.15	29.29	29.09	30
	GPRS/EGPRS(GMSK)_2TX Slot	27.27	27.46	27.43	27.5
	GPRS/EGPRS(GMSK)_3TX Slot	25	25.39	25.27	25.5
	GPRS/EGPRS(GMSK)_4TX Slot	24.18	24.18	24.05	24.5
	EGPRS(8PSK)_1TX Slot	22.79	22.53	22.96	23
	EGPRS(8PSK)_2TX Slot	20.42	20.4	20.06	20.5
	EGPRS(8PSK)_3TX Slot	18.24	18.16	18.48	18.5
	EGPRS(8PSK)_4TX Slot	17.41	17.3	17.11	17.5

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 0	GSM	23.12	23.08	23.15	24
	GPRS/EGPRS(GMSK)_1TX Slot	23.03	23.01	23.04	24
	GPRS/EGPRS(GMSK)_2TX Slot	25.91	25.89	25.92	27
	GPRS/EGPRS(GMSK)_3TX Slot	27.05	26.74	26.92	27.24
	GPRS/EGPRS(GMSK)_4TX Slot	27.13	27.09	27.39	27.5
	EGPRS(8PSK)_1TX Slot	16.96	17	17.02	18
	EGPRS(8PSK)_2TX Slot	19.81	19.88	19.87	21
	EGPRS(8PSK)_3TX Slot	19.79	20.08	19.92	20.24
	EGPRS(8PSK)_4TX Slot	20.15	20.23	20.33	20.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 0	GSM	20.26	20.37	20.21	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.15	20.29	20.09	21
	GPRS/EGPRS(GMSK)_2TX Slot	21.27	21.46	21.43	21.5
	GPRS/EGPRS(GMSK)_3TX Slot	20.74	21.13	21.01	21.24
	GPRS/EGPRS(GMSK)_4TX Slot	21.18	21.18	21.05	21.5
	EGPRS(8PSK)_1TX Slot	13.79	13.53	13.96	14
	EGPRS(8PSK)_2TX Slot	14.42	14.4	14.06	14.5
	EGPRS(8PSK)_3TX Slot	13.98	13.9	14.22	14.24
	EGPRS(8PSK)_4TX Slot	14.41	14.3	14.11	14.5

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 1	GSM	32.15	32	32.38	33
	GPRS/EGPRS(GMSK)_1TX Slot	32.28	32.23	32.32	33
	GPRS/EGPRS(GMSK)_2TX Slot	32.02	32.13	32.12	33
	GPRS/EGPRS(GMSK)_3TX Slot	32.24	32.23	32.3	32.5
	GPRS/EGPRS(GMSK)_4TX Slot	30.98	30.85	31.1	31.5
	EGPRS(8PSK)_1TX Slot	26.78	26.81	26.51	27
	EGPRS(8PSK)_2TX Slot	26.62	26.66	26.84	27
	EGPRS(8PSK)_3TX Slot	25.31	25.2	25.39	25.5
	EGPRS(8PSK)_4TX Slot	24.45	24.45	24.39	24.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 1	GSM	29.51	29.92	29.85	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.59	29.75	29.52	30
	GPRS/EGPRS(GMSK)_2TX Slot	29.31	29.36	29.16	29.5
	GPRS/EGPRS(GMSK)_3TX Slot	26	26.18	26.38	26.5
	GPRS/EGPRS(GMSK)_4TX Slot	25.12	25.25	24.76	25.5
	EGPRS(8PSK)_1TX Slot	23	22.79	22.55	23
	EGPRS(8PSK)_2TX Slot	22.2	22.34	22.24	22.5
	EGPRS(8PSK)_3TX Slot	19.1	19.44	19.23	19.5
	EGPRS(8PSK)_4TX Slot	17.68	18.48	18.09	18.5

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 1	GSM	23.15	23	23.38	24
	GPRS/EGPRS(GMSK)_1TX Slot	23.28	23.23	23.32	24
	GPRS/EGPRS(GMSK)_2TX Slot	26.02	26.13	26.12	27
	GPRS/EGPRS(GMSK)_3TX Slot	27.98	27.97	28.04	28.24
	GPRS/EGPRS(GMSK)_4TX Slot	27.98	27.85	28.1	28.5
	EGPRS(8PSK)_1TX Slot	17.78	17.81	17.51	18
	EGPRS(8PSK)_2TX Slot	20.62	20.66	20.84	21
	EGPRS(8PSK)_3TX Slot	21.05	20.94	21.13	21.24
	EGPRS(8PSK)_4TX Slot	21.45	21.45	21.39	21.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 1	GSM	20.51	20.92	20.85	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.59	20.75	20.52	21
	GPRS/EGPRS(GMSK)_2TX Slot	23.31	23.36	23.16	23.5
	GPRS/EGPRS(GMSK)_3TX Slot	21.74	21.92	22.12	22.24
	GPRS/EGPRS(GMSK)_4TX Slot	22.12	22.25	21.76	22.5
	EGPRS(8PSK)_1TX Slot	14	13.79	13.55	14
	EGPRS(8PSK)_2TX Slot	16.2	16.34	16.24	16.5
	EGPRS(8PSK)_3TX Slot	14.84	15.18	14.97	15.24
	EGPRS(8PSK)_4TX Slot	14.68	15.48	15.09	15.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 2	GSM	29.89	29.91	29.81	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.73	29.71	29.83	30
	GPRS/EGPRS(GMSK)_2TX Slot	27.29	27.46	27.25	27.5
	GPRS/EGPRS(GMSK)_3TX Slot	25.12	25.29	25.37	25.5
	GPRS/EGPRS(GMSK)_4TX Slot	24.09	24.37	24.1	24.5
	EGPRS(8PSK)_1TX Slot	22.85	22.66	22.69	23
	EGPRS(8PSK)_2TX Slot	20.27	20.36	20.39	20.5
	EGPRS(8PSK)_3TX Slot	18.1	18.08	18.37	18.5
	EGPRS(8PSK)_4TX Slot	17.07	17.09	17.3	17.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 2	GSM	20.89	20.91	20.81	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.73	20.71	20.83	21
	GPRS/EGPRS(GMSK)_2TX Slot	21.29	21.46	21.25	21.5
	GPRS/EGPRS(GMSK)_3TX Slot	20.86	21.03	21.11	21.24
	GPRS/EGPRS(GMSK)_4TX Slot	21.09	21.37	21.1	21.5
	EGPRS(8PSK)_1TX Slot	13.85	13.66	13.69	14
	EGPRS(8PSK)_2TX Slot	14.27	14.36	14.39	14.5
	EGPRS(8PSK)_3TX Slot	13.84	13.82	14.11	14.24
	EGPRS(8PSK)_4TX Slot	14.07	14.09	14.3	14.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 3	GSM	29.11	29.85	29.48	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.02	29.64	29.26	30
	GPRS/EGPRS(GMSK)_2TX Slot	29.39	29.72	29.78	30
	GPRS/EGPRS(GMSK)_3TX Slot	29.27	29.77	29.03	30
	GPRS/EGPRS(GMSK)_4TX Slot	29.16	29.34	29.04	29.5
	EGPRS(8PSK)_1TX Slot	22.59	23	22.72	23
	EGPRS(8PSK)_2TX Slot	22.83	22.56	22.5	23
	EGPRS(8PSK)_3TX Slot	22.82	22.88	22.66	23
	EGPRS(8PSK)_4TX Slot	22.38	22.39	22.39	22.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 3	GSM	20.11	20.85	20.48	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.02	20.64	20.26	21
	GPRS/EGPRS(GMSK)_2TX Slot	23.39	23.72	23.78	24
	GPRS/EGPRS(GMSK)_3TX Slot	25.01	25.51	24.77	25.74
	GPRS/EGPRS(GMSK)_4TX Slot	26.16	26.34	26.04	26.5
	EGPRS(8PSK)_1TX Slot	13.59	14	13.72	14
	EGPRS(8PSK)_2TX Slot	16.83	16.56	16.5	17
	EGPRS(8PSK)_3TX Slot	18.56	18.62	18.4	18.74
	EGPRS(8PSK)_4TX Slot	19.38	19.39	19.39	19.5

<Body Mode DSI-1>

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 0	GSM	32.72	32.79	32.85	33
	GPRS/EGPRS(GMSK)_1TX Slot	32.43	32.41	32.44	33
	GPRS/EGPRS(GMSK)_2TX Slot	32.31	32.29	32.32	33
	GPRS/EGPRS(GMSK)_3TX Slot	31.31	31	31.18	31.5
	GPRS/EGPRS(GMSK)_4TX Slot	30.13	30.09	30.39	30.5
	EGPRS(8PSK)_1TX Slot	25.96	26	26.02	27
	EGPRS(8PSK)_2TX Slot	25.81	25.88	25.87	27
	EGPRS(8PSK)_3TX Slot	24.05	24.34	24.18	24.5
	EGPRS(8PSK)_4TX Slot	23.15	23.23	23.33	23.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 0	GSM	29.26	29.37	29.21	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.15	29.29	29.09	30
	GPRS/EGPRS(GMSK)_2TX Slot	27.27	27.46	27.43	27.5
	GPRS/EGPRS(GMSK)_3TX Slot	25	25.39	25.27	25.5
	GPRS/EGPRS(GMSK)_4TX Slot	24.18	24.18	24.05	24.5
	EGPRS(8PSK)_1TX Slot	22.79	22.53	22.96	23
	EGPRS(8PSK)_2TX Slot	20.42	20.4	20.06	20.5
	EGPRS(8PSK)_3TX Slot	18.24	18.16	18.48	18.5
	EGPRS(8PSK)_4TX Slot	17.41	17.3	17.11	17.5

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 0	GSM	23.72	23.79	23.85	24
	GPRS/EGPRS(GMSK)_1TX Slot	23.43	23.41	23.44	24
	GPRS/EGPRS(GMSK)_2TX Slot	26.31	26.29	26.32	27
	GPRS/EGPRS(GMSK)_3TX Slot	27.05	26.74	26.92	27.24
	GPRS/EGPRS(GMSK)_4TX Slot	27.13	27.09	27.39	27.5
	EGPRS(8PSK)_1TX Slot	16.96	17	17.02	18
	EGPRS(8PSK)_2TX Slot	19.81	19.88	19.87	21
	EGPRS(8PSK)_3TX Slot	19.79	20.08	19.92	20.24
	EGPRS(8PSK)_4TX Slot	20.15	20.23	20.33	20.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 0	GSM	20.26	20.37	20.21	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.15	20.29	20.09	21
	GPRS/EGPRS(GMSK)_2TX Slot	21.27	21.46	21.43	21.5
	GPRS/EGPRS(GMSK)_3TX Slot	20.74	21.13	21.01	21.24
	GPRS/EGPRS(GMSK)_4TX Slot	21.18	21.18	21.05	21.5
	EGPRS(8PSK)_1TX Slot	13.79	13.53	13.96	14
	EGPRS(8PSK)_2TX Slot	14.42	14.4	14.06	14.5
	EGPRS(8PSK)_3TX Slot	13.98	13.9	14.22	14.24
	EGPRS(8PSK)_4TX Slot	14.41	14.3	14.11	14.5

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 1	GSM	32.55	32.4	32.78	33
	GPRS/EGPRS(GMSK)_1TX Slot	32.68	32.63	32.72	33
	GPRS/EGPRS(GMSK)_2TX Slot	32.42	32.53	32.52	33
	GPRS/EGPRS(GMSK)_3TX Slot	32.24	32.23	32.3	32.5
	GPRS/EGPRS(GMSK)_4TX Slot	30.98	30.85	31.1	31.5
	EGPRS(8PSK)_1TX Slot	26.78	26.81	26.51	27
	EGPRS(8PSK)_2TX Slot	26.62	26.66	26.84	27
	EGPRS(8PSK)_3TX Slot	25.31	25.2	25.39	25.5
	EGPRS(8PSK)_4TX Slot	24.45	24.45	24.39	24.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 1	GSM	29.51	29.92	29.85	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.59	29.75	29.52	30
	GPRS/EGPRS(GMSK)_2TX Slot	29.31	29.36	29.16	29.5
	GPRS/EGPRS(GMSK)_3TX Slot	26	26.18	26.38	26.5
	GPRS/EGPRS(GMSK)_4TX Slot	25.12	25.25	24.76	25.5
	EGPRS(8PSK)_1TX Slot	23	22.79	22.55	23
	EGPRS(8PSK)_2TX Slot	22.2	22.34	22.24	22.5
	EGPRS(8PSK)_3TX Slot	19.1	19.44	19.23	19.5
	EGPRS(8PSK)_4TX Slot	17.68	18.48	18.09	18.5

	Uplink Channel	128	189	251	Tune up (dBm)
	Uplink Frequency	824.2	836.4	848.8	
GSM850 Ant 1	GSM	23.55	23.4	23.78	24
	GPRS/EGPRS(GMSK)_1TX Slot	23.68	23.63	23.72	24
	GPRS/EGPRS(GMSK)_2TX Slot	26.42	26.53	26.52	27
	GPRS/EGPRS(GMSK)_3TX Slot	27.98	27.97	28.04	28.24
	GPRS/EGPRS(GMSK)_4TX Slot	27.98	27.85	28.1	28.5
	EGPRS(8PSK)_1TX Slot	17.78	17.81	17.51	18
	EGPRS(8PSK)_2TX Slot	20.62	20.66	20.84	21
	EGPRS(8PSK)_3TX Slot	21.05	20.94	21.13	21.24
	EGPRS(8PSK)_4TX Slot	21.45	21.45	21.39	21.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 1	GSM	20.51	20.92	20.85	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.59	20.75	20.52	21
	GPRS/EGPRS(GMSK)_2TX Slot	23.31	23.36	23.16	23.5
	GPRS/EGPRS(GMSK)_3TX Slot	21.74	21.92	22.12	22.24
	GPRS/EGPRS(GMSK)_4TX Slot	22.12	22.25	21.76	22.5
	EGPRS(8PSK)_1TX Slot	14	13.79	13.55	14
	EGPRS(8PSK)_2TX Slot	16.2	16.34	16.24	16.5
	EGPRS(8PSK)_3TX Slot	14.84	15.18	14.97	15.24
	EGPRS(8PSK)_4TX Slot	14.68	15.48	15.09	15.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 2	GSM	29.89	29.91	29.81	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.73	29.71	29.83	30
	GPRS/EGPRS(GMSK)_2TX Slot	27.29	27.46	27.25	27.5
	GPRS/EGPRS(GMSK)_3TX Slot	25.12	25.29	25.37	25.5
	GPRS/EGPRS(GMSK)_4TX Slot	24.09	24.37	24.1	24.5
	EGPRS(8PSK)_1TX Slot	22.85	22.66	22.69	23
	EGPRS(8PSK)_2TX Slot	20.27	20.36	20.39	20.5
	EGPRS(8PSK)_3TX Slot	18.1	18.08	18.37	18.5
	EGPRS(8PSK)_4TX Slot	17.07	17.09	17.3	17.5

	Uplink Channel	512	661	810	Tune up (dBm)
	Uplink Frequency	1850.2	1880	1909.8	
GSM1900 Ant 2	GSM	20.89	20.91	20.81	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.73	20.71	20.83	21
	GPRS/EGPRS(GMSK)_2TX Slot	21.29	21.46	21.25	21.5
	GPRS/EGPRS(GMSK)_3TX Slot	20.86	21.03	21.11	21.24
	GPRS/EGPRS(GMSK)_4TX Slot	21.09	21.37	21.1	21.5
	EGPRS(8PSK)_1TX Slot	13.85	13.66	13.69	14
	EGPRS(8PSK)_2TX Slot	14.27	14.36	14.39	14.5
	EGPRS(8PSK)_3TX Slot	13.84	13.82	14.11	14.24
	EGPRS(8PSK)_4TX Slot	14.07	14.09	14.3	14.5

	Uplink Channel	512	661	810	Tune up (dBm)
GSM1900 Ant 3	Uplink Frequency	1850.2	1880	1909.8	
	GSM	29.11	29.85	29.48	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.02	29.64	29.26	30
	GPRS/EGPRS(GMSK)_2TX Slot	29.39	29.72	29.78	30
	GPRS/EGPRS(GMSK)_3TX Slot	29.27	29.77	29.03	30
	GPRS/EGPRS(GMSK)_4TX Slot	29.16	29.34	29.04	29.5
	EGPRS(8PSK)_1TX Slot	22.59	23	22.72	23
	EGPRS(8PSK)_2TX Slot	22.83	22.56	22.5	23
	EGPRS(8PSK)_3TX Slot	22.82	22.88	22.66	23
	EGPRS(8PSK)_4TX Slot	22.38	22.39	22.39	22.5

	Uplink Channel	512	661	810	Tune up (dBm)
GSM1900 Ant 3	Uplink Frequency	1850.2	1880	1909.8	
	GSM	20.11	20.85	20.48	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.02	20.64	20.26	21
	GPRS/EGPRS(GMSK)_2TX Slot	23.39	23.72	23.78	24
	GPRS/EGPRS(GMSK)_3TX Slot	25.01	25.51	24.77	25.74
	GPRS/EGPRS(GMSK)_4TX Slot	26.16	26.34	26.04	26.5
	EGPRS(8PSK)_1TX Slot	13.59	14	13.72	14
	EGPRS(8PSK)_2TX Slot	16.83	16.56	16.5	17
	EGPRS(8PSK)_3TX Slot	18.56	18.62	18.4	18.74
	EGPRS(8PSK)_4TX Slot	19.38	19.39	19.39	19.5

<HotSpot Mode DSI-3>

	Uplink Channel	128	189	251	Tune up
	Uplink Frequency	824.2	836.4	848.8	(dBm)
GSM850 Ant 0	GSM	32.12	32.08	32.15	33
	GPRS/EGPRS(GMSK)_1TX Slot	32.03	32.01	32.04	33
	GPRS/EGPRS(GMSK)_2TX Slot	31.91	31.89	31.92	33
	GPRS/EGPRS(GMSK)_3TX Slot	31.31	31	31.18	31.5
	GPRS/EGPRS(GMSK)_4TX Slot	30.13	30.09	30.39	30.5
	EGPRS(8PSK)_1TX Slot	25.96	26	26.02	27
	EGPRS(8PSK)_2TX Slot	25.81	25.88	25.87	27
	EGPRS(8PSK)_3TX Slot	24.05	24.34	24.18	24.5
	EGPRS(8PSK)_4TX Slot	23.15	23.23	23.33	23.5

	Uplink Channel	512	661	810	Tune up
	Uplink Frequency	1850.2	1880	1909.8	(dBm)
GSM1900 Ant 0	GSM	29.26	29.37	29.21	30
	GPRS/EGPRS(GMSK)_1TX Slot	29.15	29.29	29.09	30
	GPRS/EGPRS(GMSK)_2TX Slot	27.27	27.46	27.43	27.5
	GPRS/EGPRS(GMSK)_3TX Slot	25	25.39	25.27	25.5
	GPRS/EGPRS(GMSK)_4TX Slot	24.18	24.18	24.05	24.5
	EGPRS(8PSK)_1TX Slot	22.79	22.53	22.96	23
	EGPRS(8PSK)_2TX Slot	20.42	20.4	20.06	20.5
	EGPRS(8PSK)_3TX Slot	18.24	18.16	18.48	18.5
	EGPRS(8PSK)_4TX Slot	17.41	17.3	17.11	17.5

	Uplink Channel	128	189	251	Tune up
	Uplink Frequency	824.2	836.4	848.8	(dBm)
GSM850 Ant 0	GSM	23.12	23.08	23.15	24
	GPRS/EGPRS(GMSK)_1TX Slot	23.03	23.01	23.04	24
	GPRS/EGPRS(GMSK)_2TX Slot	25.91	25.89	25.92	27
	GPRS/EGPRS(GMSK)_3TX Slot	27.05	26.74	26.92	27.24
	GPRS/EGPRS(GMSK)_4TX Slot	27.13	27.09	27.39	27.5
	EGPRS(8PSK)_1TX Slot	16.96	17	17.02	18
	EGPRS(8PSK)_2TX Slot	19.81	19.88	19.87	21
	EGPRS(8PSK)_3TX Slot	19.79	20.08	19.92	20.24
	EGPRS(8PSK)_4TX Slot	20.15	20.23	20.33	20.5

	Uplink Channel	512	661	810	Tune up
	Uplink Frequency	1850.2	1880	1909.8	(dBm)
GSM1900 Ant 0	GSM	20.26	20.37	20.21	21
	GPRS/EGPRS(GMSK)_1TX Slot	20.15	20.29	20.09	21
	GPRS/EGPRS(GMSK)_2TX Slot	21.27	21.46	21.43	21.5
	GPRS/EGPRS(GMSK)_3TX Slot	20.74	21.13	21.01	21.24
	GPRS/EGPRS(GMSK)_4TX Slot	21.18	21.18	21.05	21.5
	EGPRS(8PSK)_1TX Slot	13.79	13.53	13.96	14
	EGPRS(8PSK)_2TX Slot	14.42	14.4	14.06	14.5
	EGPRS(8PSK)_3TX Slot	13.98	13.9	14.22	14.24
	EGPRS(8PSK)_4TX Slot	14.41	14.3	14.11	14.5

	Uplink Channel	128	189	251	Tune up
	Uplink Frequency	824.2	836.4	848.8	(dBm)
GSM850 Ant 1	GSM	32.15	32	32.38	33
	GPRS/EGPRS(GMSK)_1TX Slot	32.28	32.23	32.32	33
	GPRS/EGPRS(GMSK)_2TX Slot	32.02	32.13	32.12	33
	GPRS/EGPRS(GMSK)_3TX Slot	32.24	32.23	32.3	32.5
	GPRS/EGPRS(GMSK)_4TX Slot	30.98	30.85	31.1	31.5
	EGPRS(8PSK)_1TX Slot	26.78	26.81	26.51	27
	EGPRS(8PSK)_2TX Slot	26.62	26.66	26.84	27
	EGPRS(8PSK)_3TX Slot	25.31	25.2	25.39	25.5
	EGPRS(8PSK)_4TX Slot	24.45	24.45	24.39	24.5