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Accreditation No.: **SCS 0108**

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization ϕ	ϕ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe EX3DV4

SN:3693

Manufactured: April 22, 2009
Calibrated: August 18, 2017

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3693

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.39	0.32	0.35	± 10.1 %
DCP (mV) ^B	95.1	97.9	107.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/ μV	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	153.2	±3.5 %
		Y	0.0	0.0	1.0		144.5	
		Z	0.0	0.0	1.0		151.4	

Note: For details on UID parameters see Appendix.

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $\text{ms} \cdot \text{V}^{-2}$	T2 $\text{ms} \cdot \text{V}^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	33.42	257.2	37.63	9.549	1.014	5.071	0	0.481	1.008
Y	36.13	269.4	35.53	11.22	0.702	5.041	0.308	0.41	1.005
Z	28.36	204.6	33.61	4.581	0.465	5.032	0.705	0.298	1.004

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of Norm X,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3693

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) c	Relative Permittivity	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	AlphaG	Depth G (mm)	Unc (k=2)
150	52.3	0.76	11.31	11.31	11.31	0.00	1.00	± 13.3 %
220	49.0	0.81	10.54	10.54	10.54	0.00	1.00	+ 13.3 %
450	43.5	0.87	9.78	9.78	9.78	0.13	1.60	± 13.3 %
750	41.9	0.89	9.55	9.55	9.55	0.36	1.03	± 12.0 %
1750	40.1	1.37	8.15	8.15	8.15	0.28	0.85	± 12.0 %
1900	40.0	1.40	7.85	7.85	7.85	0.30	0.85	± 12.0 %
2300	39.5	1.67	7.44	7.44	7.44	0.38	0.84	± 12.0 %
2450	39.2	1.80	7.05	7.05	7.05	0.31	0.84	± 12.0 %
2600	39.0	1.96	6.55	6.55	6.55	0.32	0.80	± 12.0 %
3500	37.9	2.91	6.75	6.75	6.75	0.25	1.25	± 13.1 %
3700	37.7	3.12	6.66	6.66	6.66	0.25	1.25	± 13.1 %
5200	36.0	4.66	5.09	5.09	5.09	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.83	4.83	4.83	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.85	4.85	4.85	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.70	4.70	4.70	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.65	4.65	4.65	0.40	1.80	± 13.1 %

c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

F At frequencies below 3 GHz, the validity of tissue parameters (c and er) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (i; and er) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3693

Calibration Parameter Determined in Body Tissue Simulating Media

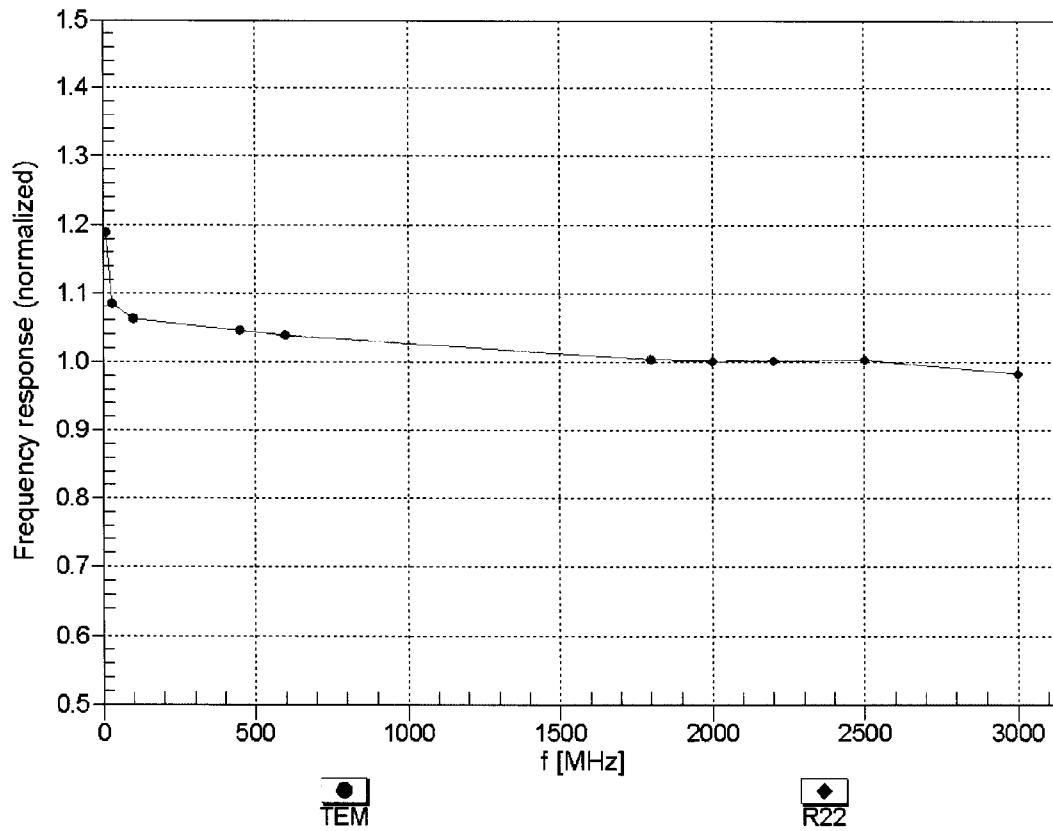
f (MHz) ^c	Relative Permittivity	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	AlphaG	Depth G (mm)	Unc (k=2)
150	61.9	0.80	10.76	10.76	10.76	0.00	1.00	± 13.3 %
220	60.2	0.86	10.08	10.08	10.08	0.00	1.00	+ 13.3 %
450	56.7	0.94	10.19	10.19	10.19	0.10	1.30	± 13.3 %
750	55.5	0.96	9.35	9.35	9.35	0.50	0.85	± 12.0 %
1750	53.4	1.49	7.77	7.77	7.77	0.37	0.85	± 12.0 %
1900	53.5	1.52	7.54	7.54	7.54	0.30	0.96	± 12.0 %
2300	52.9	1.81	7.41	7.41	7.41	0.38	0.84	± 12.0 %
2450	52.7	1.95	7.26	7.26	7.26	0.34	0.89	± 12.0 %
2600	52.5	2.16	6.67	6.67	6.67	0.31	0.80	± 12.0 %
3500	51.3	3.31	6.60	6.60	6.60	0.30	1.20	± 13.1 %
3700	51.0	3.55	6.39	6.39	6.39	0.30	1.20	± 13.1 %
5200	49.0	5.30	4.70	4.70	4.70	0.35	1.90	± 13.1 %
5300	48.9	5.42	4.46	4.46	4.46	0.40	1.90	± 13.1 %
5500	48.6	5.65	4.04	4.04	4.04	0.40	1.90	± 13.1 %
5600	48.5	5.77	4.00	4.00	4.00	0.40	1.90	± 13.1 %
5800	48.2	6.00	4.21	4.21	4.21	0.40	1.90	± 13.1 %

c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

F At frequencies below 3 GHz, the validity of tissue parameters (c and er) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (i; and er) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

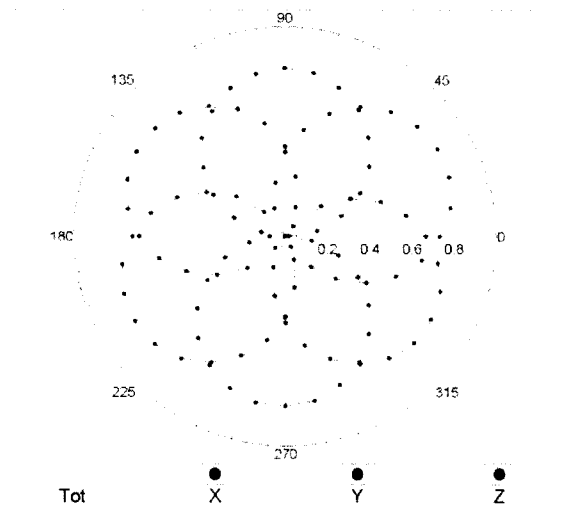
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



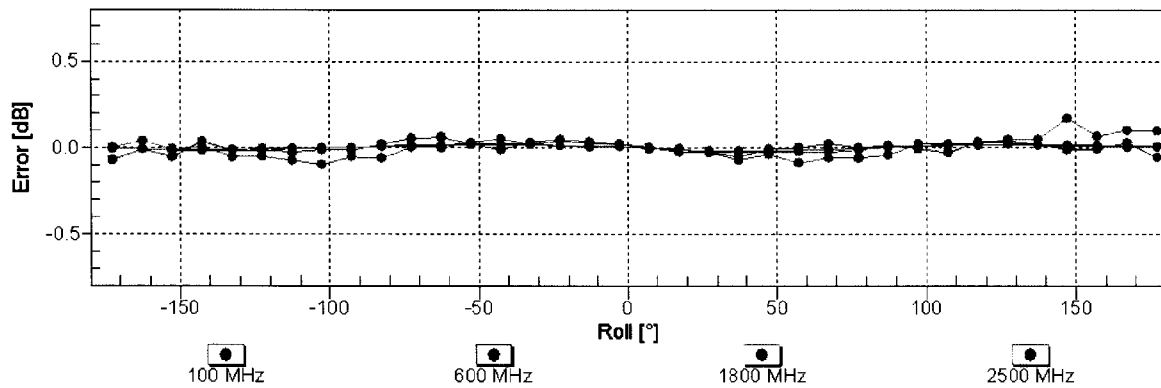
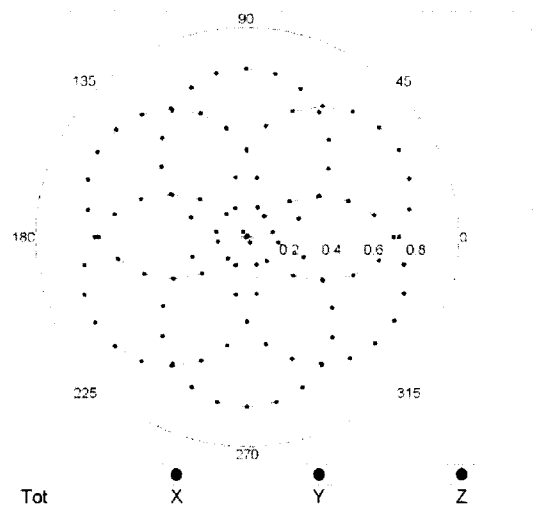
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz, TEM

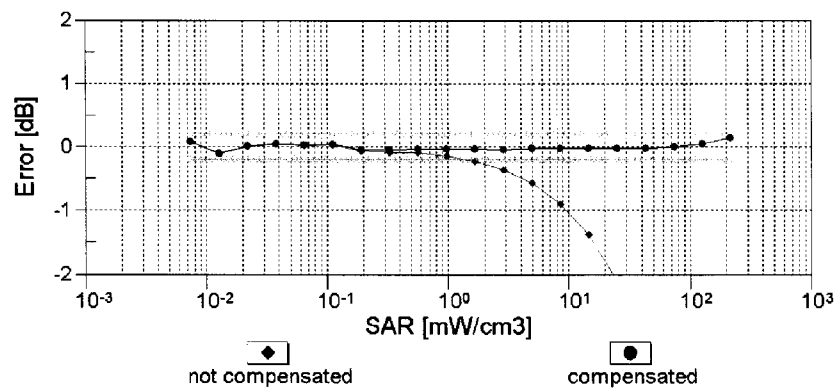
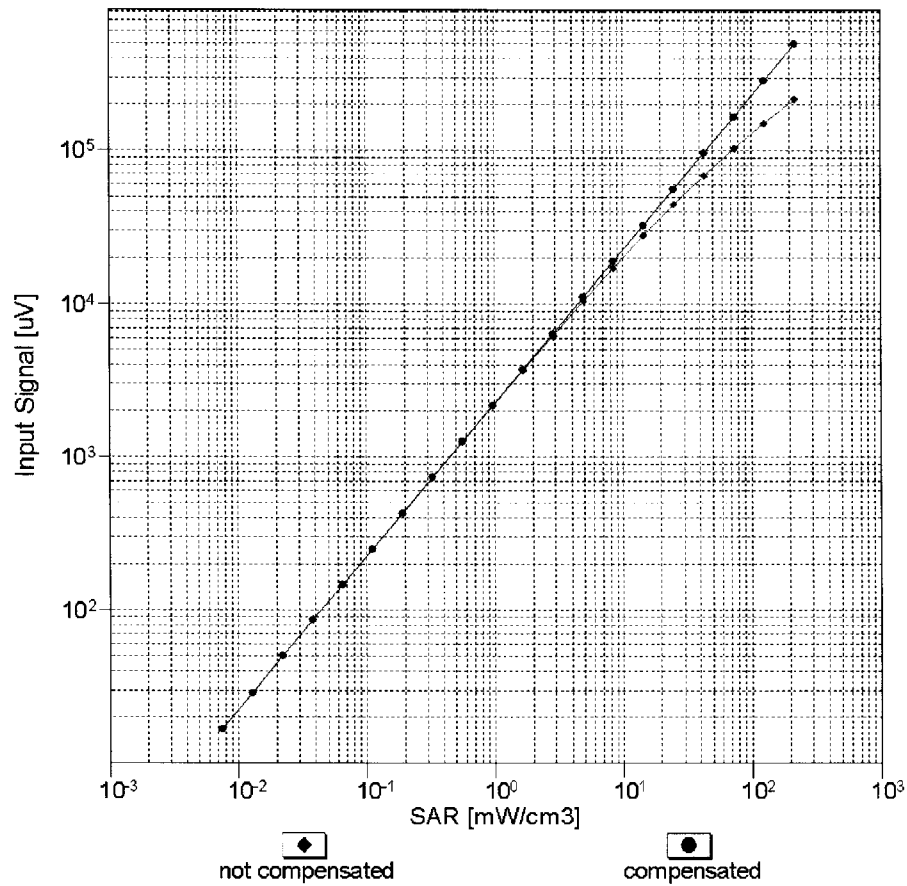


f=1800 MHz, R22



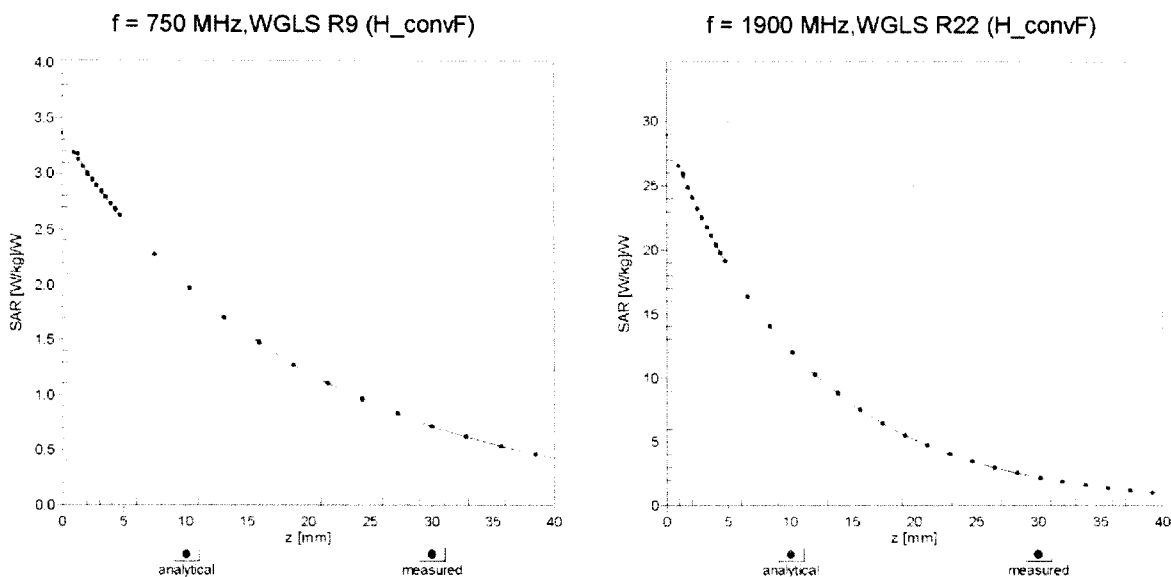
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$)



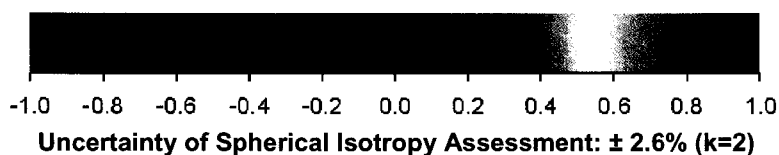
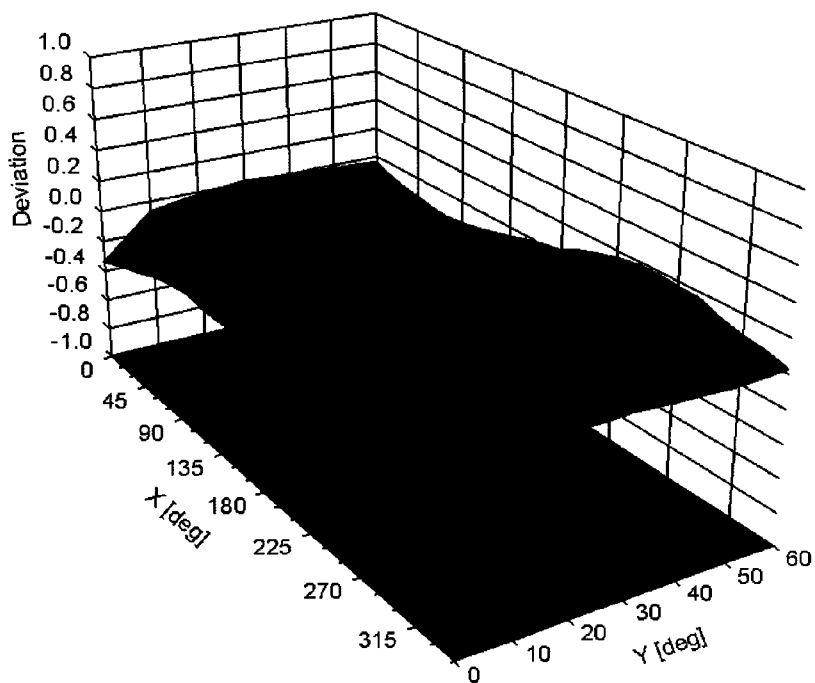
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3693

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	107.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Appendix: Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/μV	C	D dB	VR mV	Max Unc ^E (k=2)
0	CW	X	0.00	0.00	1.00	0.00	153.2	± 3.5 %
		Y	0.00	0.00	1.00		144.5	
		Z	0.00	0.00	1.00		151.4	
10010- CAA	SAR Validation (Square, 100ms, 10ms)	X	2.46	65.57	10.33	10.00	20.0	± 9.6 %
		Y	2.58	66.85	10.94		20.0	
		Z	1.86	62.99	8.17		20.0	
10011- CAB	UMTS-FDD (WCDMA)	X	0.96	69.29	15.51	0.00	150.0	± 9.6 %
		Y	0.93	66.88	14.68		150.0	
		Z	0.96	69.60	15.68		150.0	
10012- CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	1.07	64.52	15.65	0.41	150.0	± 9.6 %
		Y	1.12	63.74	15.00		150.0	
		Z	1.05	64.42	15.37		150.0	
10013- CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	4.64	67.04	17.28	1.46	150.0	± 9.6 %
		Y	4.69	66.78	16.99		150.0	
		Z	4.48	67.08	16.97		150.0	
10021- DAC	GSM-FDD (TDMA, GMSK)	X	100.00	113.55	27.40	9.39	50.0	± 9.6 %
		Y	100.00	113.18	27.01		50.0	
		Z	100.00	106.64	23.61		50.0	
10023- DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	100.00	113.06	27.24	9.57	50.0	± 9.6 %
		Y	100.00	112.70	26.84		50.0	
		Z	32.97	94.20	20.54		50.0	
10024- DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	100.00	111.50	25.18	6.56	60.0	± 9.6 %
		Y	100.00	111.79	25.25		60.0	
		Z	100.00	104.88	21.52		60.0	
10025- DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	3.89	66.96	23.84	12.57	50.0	± 9.6 %
		Y	4.25	70.19	25.75		50.0	
		Z	3.28	63.68	21.63		50.0	
10026- DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	8.05	89.16	31.60	9.56	60.0	± 9.6 %
		Y	7.77	88.25	31.17		60.0	
		Z	5.87	82.94	28.96		60.0	
10027- DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	100.00	110.68	23.90	4.80	80.0	± 9.6 %
		Y	100.00	112.16	24.62		80.0	
		Z	100.00	104.54	20.49		80.0	
10028- DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	100.00	109.55	22.62	3.55	100.0	± 9.6 %
		Y	100.00	113.50	24.48		100.0	
		Z	100.00	104.05	19.54		100.0	
10029- DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	5.29	80.16	27.01	7.80	80.0	± 9.6 %
		Y	5.14	79.09	26.35		80.0	
		Z	3.96	74.93	24.59		80.0	
10030- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	X	100.00	108.68	23.35	5.30	70.0	± 9.6 %
		Y	100.00	109.67	23.80		70.0	
		Z	100.00	101.79	19.60		70.0	
10031- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	X	0.42	62.17	5.93	1.88	100.0	± 9.6 %
		Y	100.00	107.91	20.81		100.0	
		Z	0.20	60.00	3.98		100.0	

10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	0.21	60.00	3.06	1.17	100.0	± 9.6 %
		Y	100.00	108.51	20.18		100.0	
		Z	17.50	60.55	1.43		100.0	
10033-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	X	26.75	102.90	26.12	5.30	70.0	± 9.6 %
		Y	11.41	91.98	23.49		70.0	
		Z	8.40	86.52	20.27		70.0	
10034-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	X	3.04	75.65	15.32	1.88	100.0	± 9.6 %
		Y	2.84	75.48	16.17		100.0	
		Z	1.44	68.36	11.69		100.0	
10035-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	X	1.53	69.13	12.32	1.17	100.0	± 9.6 %
		Y	1.81	71.22	14.21		100.0	
		Z	0.97	65.45	10.03		100.0	
10036-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	X	68.65	116.35	29.55	5.30	70.0	± 9.6 %
		Y	17.31	98.26	25.40		70.0	
		Z	14.64	93.89	22.52		70.0	
10037-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	X	2.53	73.73	14.61	1.88	100.0	± 9.6 %
		Y	2.51	74.11	15.65		100.0	
		Z	1.27	67.18	11.19		100.0	
10038-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	X	1.60	69.92	12.78	1.17	100.0	± 9.6 %
		Y	1.84	71.62	14.51		100.0	
		Z	0.99	65.91	10.38		100.0	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	0.74	63.41	8.92	0.00	150.0	± 9.6 %
		Y	1.23	68.14	12.51		150.0	
		Z	0.60	62.45	7.98		150.0	
10042-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	X	100.00	108.18	24.00	7.78	50.0	± 9.6 %
		Y	100.00	108.88	24.22		50.0	
		Z	10.97	81.94	15.63		50.0	
10044-CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	X	0.00	65.90	22.17	0.00	150.0	± 9.6 %
		Y	0.01	122.92	0.71		150.0	
		Z	0.13	128.48	4.69		150.0	
10048-CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	X	14.87	85.35	21.09	13.80	25.0	± 9.6 %
		Y	23.17	91.69	22.64		25.0	
		Z	6.22	71.44	14.68		25.0	
10049-CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	X	24.31	94.02	22.62	10.79	40.0	± 9.6 %
		Y	43.77	101.49	24.30		40.0	
		Z	6.49	74.97	14.88		40.0	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	18.56	94.19	24.49	9.03	50.0	± 9.6 %
		Y	19.55	95.88	25.17		50.0	
		Z	13.54	87.88	21.18		50.0	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	4.17	75.85	24.49	6.55	100.0	± 9.6 %
		Y	4.09	74.81	23.76		100.0	
		Z	3.25	71.57	22.39		100.0	
10059-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	1.13	66.04	16.48	0.61	110.0	± 9.6 %
		Y	1.16	64.80	15.58		110.0	
		Z	1.07	65.37	15.92		110.0	
10060-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	100.00	137.72	34.95	1.30	110.0	± 9.6 %
		Y	14.15	108.54	28.54		110.0	
		Z	100.00	142.16	36.45		110.0	

10061-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	5.68	93.99	26.90	2.04	110.0	± 9.6 %
		Y	2.72	79.85	21.80		110.0	
		Z	2.32	80.40	22.21		110.0	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	4.40	66.89	16.61	0.49	100.0	± 9.6 %
		Y	4.48	66.72	16.41		100.0	
		Z	4.27	67.05	16.40		100.0	
10063-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	X	4.43	67.03	16.74	0.72	100.0	± 9.6 %
		Y	4.50	66.82	16.51		100.0	
		Z	4.29	67.16	16.50		100.0	
10064-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	X	4.66	67.22	16.93	0.86	100.0	± 9.6 %
		Y	4.74	67.02	16.71		100.0	
		Z	4.50	67.31	16.67		100.0	
10065-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	X	4.55	67.11	17.04	1.21	100.0	± 9.6 %
		Y	4.62	66.89	16.79		100.0	
		Z	4.38	67.12	16.73		100.0	
10066-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	X	4.57	67.14	17.22	1.46	100.0	± 9.6 %
		Y	4.64	66.91	16.95		100.0	
		Z	4.38	67.08	16.86		100.0	
10067-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	X	4.87	67.48	17.74	2.04	100.0	± 9.6 %
		Y	4.93	67.19	17.44		100.0	
		Z	4.65	67.30	17.29		100.0	
10068-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	X	4.92	67.43	17.92	2.55	100.0	± 9.6 %
		Y	4.97	67.13	17.61		100.0	
		Z	4.70	67.27	17.49		100.0	
10069-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	X	4.98	67.46	18.11	2.67	100.0	± 9.6 %
		Y	5.04	67.15	17.79		100.0	
		Z	4.74	67.23	17.63		100.0	
10071-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	4.75	67.16	17.60	1.99	100.0	± 9.6 %
		Y	4.79	66.87	17.29		100.0	
		Z	4.57	67.14	17.25		100.0	
10072-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	4.72	67.47	17.83	2.30	100.0	± 9.6 %
		Y	4.76	67.14	17.49		100.0	
		Z	4.51	67.32	17.42		100.0	
10073-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	4.81	67.75	18.22	2.83	100.0	± 9.6 %
		Y	4.83	67.34	17.84		100.0	
		Z	4.58	67.54	17.76		100.0	
10074-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	4.84	67.77	18.41	3.30	100.0	± 9.6 %
		Y	4.84	67.30	18.00		100.0	
		Z	4.61	67.56	17.94		100.0	
10075-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	4.88	67.82	18.68	3.82	90.0	± 9.6 %
		Y	4.87	67.35	18.27		90.0	
		Z	4.64	67.56	18.18		90.0	
10076-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	4.93	67.72	18.87	4.15	90.0	± 9.6 %
		Y	4.91	67.23	18.44		90.0	
		Z	4.68	67.42	18.33		90.0	
10077-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	4.97	67.84	18.99	4.30	90.0	± 9.6 %
		Y	4.95	67.34	18.55		90.0	
		Z	4.72	67.54	18.46		90.0	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	0.36	60.00	6.17	0.00	150.0	± 9.6 %
		Y	0.59	63.42	9.69		150.0	
		Z	0.32	60.00	5.85		150.0	
10082-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	X	0.70	60.00	4.28	4.77	80.0	± 9.6 %
		Y	0.71	60.00	4.47		80.0	
		Z	0.69	60.00	2.91		80.0	
10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	100.00	111.63	25.26	6.56	60.0	± 9.6 %
		Y	100.00	111.84	25.29		60.0	
		Z	100.00	104.97	21.57		60.0	
10097-CAB	UMTS-FDD (HSDPA)	X	1.79	69.48	15.83	0.00	150.0	± 9.6 %
		Y	1.75	68.01	15.37		150.0	
		Z	1.85	70.58	16.07		150.0	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	1.75	69.43	15.81	0.00	150.0	± 9.6 %
		Y	1.71	67.95	15.34		150.0	
		Z	1.81	70.51	16.05		150.0	
10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	8.10	89.27	31.64	9.56	60.0	± 9.6 %
		Y	7.82	88.37	31.21		60.0	
		Z	5.91	83.06	29.00		60.0	
10100-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	2.93	70.65	16.93	0.00	150.0	± 9.6 %
		Y	2.91	69.88	16.50		150.0	
		Z	2.88	71.00	17.02		150.0	
10101-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	3.00	67.51	15.97	0.00	150.0	± 9.6 %
		Y	3.06	67.25	15.75		150.0	
		Z	2.95	67.78	15.94		150.0	
10102-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	3.11	67.54	16.09	0.00	150.0	± 9.6 %
		Y	3.17	67.28	15.86		150.0	
		Z	3.06	67.84	16.07		150.0	
10103-CAD	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.12	76.61	21.08	3.98	65.0	± 9.6 %
		Y	6.02	75.69	20.46		65.0	
		Z	5.04	74.42	19.98		65.0	
10104-CAD	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	5.76	73.36	20.41	3.98	65.0	± 9.6 %
		Y	5.82	73.01	20.04		65.0	
		Z	4.97	71.67	19.37		65.0	
10105-CAD	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	5.43	72.01	20.10	3.98	65.0	± 9.6 %
		Y	5.60	72.12	19.94		65.0	
		Z	4.63	70.08	18.95		65.0	
10108-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	2.52	70.18	16.82	0.00	150.0	± 9.6 %
		Y	2.51	69.21	16.32		150.0	
		Z	2.46	70.52	16.90		150.0	
10109-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	2.65	67.63	15.85	0.00	150.0	± 9.6 %
		Y	2.71	67.20	15.60		150.0	
		Z	2.60	68.02	15.83		150.0	
10110-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	2.00	69.56	16.26	0.00	150.0	± 9.6 %
		Y	2.00	68.38	15.78		150.0	
		Z	1.95	69.96	16.28		150.0	
10111-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	2.44	69.32	16.14	0.00	150.0	± 9.6 %
		Y	2.45	68.42	15.85		150.0	
		Z	2.47	70.27	16.29		150.0	

10112-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	2.78	67.70	15.93	0.00	150.0	± 9.6 %
		Y	2.84	67.29	15.69		150.0	
		Z	2.74	68.15	15.94		150.0	
10113-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	2.59	69.51	16.30	0.00	150.0	± 9.6 %
		Y	2.60	68.63	16.01		150.0	
		Z	2.62	70.47	16.44		150.0	
10114-CAB	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	4.85	67.15	16.53	0.00	150.0	± 9.6 %
		Y	4.92	67.07	16.34		150.0	
		Z	4.74	67.31	16.39		150.0	
10115-CAB	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	X	5.09	67.20	16.55	0.00	150.0	± 9.6 %
		Y	5.17	67.14	16.39		150.0	
		Z	4.96	67.32	16.38		150.0	
10116-CAB	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	X	4.93	67.32	16.54	0.00	150.0	± 9.6 %
		Y	5.01	67.26	16.37		150.0	
		Z	4.80	67.45	16.39		150.0	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	4.83	67.05	16.49	0.00	150.0	± 9.6 %
		Y	4.92	67.03	16.34		150.0	
		Z	4.72	67.21	16.36		150.0	
10118-CAB	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	X	5.18	67.45	16.68	0.00	150.0	± 9.6 %
		Y	5.24	67.32	16.48		150.0	
		Z	5.01	67.45	16.45		150.0	
10119-CAB	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	X	4.93	67.35	16.56	0.00	150.0	± 9.6 %
		Y	5.00	67.26	16.38		150.0	
		Z	4.81	67.49	16.41		150.0	
10140-CAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	3.12	67.54	15.99	0.00	150.0	± 9.6 %
		Y	3.19	67.29	15.77		150.0	
		Z	3.06	67.85	15.96		150.0	
10141-CAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	3.25	67.75	16.21	0.00	150.0	± 9.6 %
		Y	3.32	67.47	15.98		150.0	
		Z	3.20	68.12	16.21		150.0	
10142-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	1.74	69.31	15.23	0.00	150.0	± 9.6 %
		Y	1.76	68.27	15.08		150.0	
		Z	1.70	69.77	15.16		150.0	
10143-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	2.16	69.07	14.68	0.00	150.0	± 9.6 %
		Y	2.25	68.80	15.00		150.0	
		Z	2.14	69.68	14.51		150.0	
10144-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	1.74	65.28	12.23	0.00	150.0	± 9.6 %
		Y	1.92	65.76	12.95		150.0	
		Z	1.60	65.02	11.63		150.0	
10145-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	0.58	60.00	6.08	0.00	150.0	± 9.6 %
		Y	0.77	61.39	8.08		150.0	
		Z	0.51	60.00	5.48		150.0	
10146-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	0.86	60.00	5.96	0.00	150.0	± 9.6 %
		Y	1.06	60.98	7.22		150.0	
		Z	0.74	60.00	5.02		150.0	
10147-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	0.87	60.00	6.02	0.00	150.0	± 9.6 %
		Y	1.11	61.42	7.56		150.0	
		Z	0.75	60.00	5.07		150.0	

10149-CAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	2.66	67.71	15.91	0.00	150.0	± 9.6 %
		Y	2.72	67.28	15.65		150.0	
		Z	2.62	68.12	15.90		150.0	
10150-CAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	2.79	67.78	15.99	0.00	150.0	± 9.6 %
		Y	2.84	67.35	15.74		150.0	
		Z	2.75	68.24	16.00		150.0	
10151-CAD	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.77	80.29	22.54	3.98	65.0	± 9.6 %
		Y	6.33	78.29	21.53		65.0	
		Z	5.47	77.85	21.33		65.0	
10152-CAD	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	5.33	73.49	19.97	3.98	65.0	± 9.6 %
		Y	5.34	72.96	19.59		65.0	
		Z	4.49	71.58	18.77		65.0	
10153-CAD	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	5.80	74.93	21.00	3.98	65.0	± 9.6 %
		Y	5.76	74.19	20.51		65.0	
		Z	4.93	73.13	19.88		65.0	
10154-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	2.06	70.10	16.57	0.00	150.0	± 9.6 %
		Y	2.05	68.80	16.03		150.0	
		Z	2.02	70.56	16.62		150.0	
10155-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	2.44	69.38	16.19	0.00	150.0	± 9.6 %
		Y	2.45	68.46	15.88		150.0	
		Z	2.48	70.36	16.35		150.0	
10156-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	1.50	68.47	14.19	0.00	150.0	± 9.6 %
		Y	1.57	67.97	14.49		150.0	
		Z	1.45	68.72	13.95		150.0	
10157-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	1.49	64.88	11.44	0.00	150.0	± 9.6 %
		Y	1.72	65.90	12.60		150.0	
		Z	1.33	64.34	10.66		150.0	
10158-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	2.60	69.64	16.38	0.00	150.0	± 9.6 %
		Y	2.61	68.72	16.07		150.0	
		Z	2.64	70.64	16.53		150.0	
10159-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	1.55	65.11	11.61	0.00	150.0	± 9.6 %
		Y	1.80	66.26	12.82		150.0	
		Z	1.39	64.54	10.79		150.0	
10160-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	2.57	69.60	16.63	0.00	150.0	± 9.6 %
		Y	2.56	68.57	16.14		150.0	
		Z	2.47	69.70	16.54		150.0	
10161-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	2.67	67.78	15.84	0.00	150.0	± 9.6 %
		Y	2.73	67.32	15.62		150.0	
		Z	2.63	68.26	15.83		150.0	
10162-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	2.79	68.04	16.00	0.00	150.0	± 9.6 %
		Y	2.85	67.55	15.77		150.0	
		Z	2.75	68.57	16.01		150.0	
10166-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	3.17	69.79	19.57	3.01	150.0	± 9.6 %
		Y	3.20	68.89	18.78		150.0	
		Z	2.95	69.14	18.87		150.0	
10167-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	3.80	72.70	19.93	3.01	150.0	± 9.6 %
		Y	3.79	71.51	19.09		150.0	
		Z	3.55	72.23	19.31		150.0	

10168-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	4.49	76.44	22.00	3.01	150.0	± 9.6 %
		Y	4.31	74.34	20.75		150.0	
		Z	4.29	76.38	21.59		150.0	
10169-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	2.59	68.04	18.76	3.01	150.0	± 9.6 %
		Y	2.62	67.42	18.09		150.0	
		Z	2.53	67.98	18.27		150.0	
10170-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	3.49	74.23	21.37	3.01	150.0	± 9.6 %
		Y	3.41	72.75	20.32		150.0	
		Z	3.58	75.13	21.26		150.0	
10171-AAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	2.78	69.29	18.02	3.01	150.0	± 9.6 %
		Y	2.80	68.69	17.44		150.0	
		Z	2.71	69.37	17.54		150.0	
10172-CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.88	87.05	27.69	6.02	65.0	± 9.6 %
		Y	5.30	83.58	25.79		65.0	
		Z	3.26	76.76	23.19		65.0	
10173-CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	13.70	99.60	29.81	6.02	65.0	± 9.6 %
		Y	8.94	90.25	26.22		65.0	
		Z	7.04	88.51	25.48		65.0	
10174-CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	8.59	90.19	26.23	6.02	65.0	± 9.6 %
		Y	7.13	85.48	24.05		65.0	
		Z	3.88	78.05	21.26		65.0	
10175-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	2.56	67.69	18.48	3.01	150.0	± 9.6 %
		Y	2.59	67.13	17.84		150.0	
		Z	2.49	67.60	17.97		150.0	
10176-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	3.50	74.26	21.39	3.01	150.0	± 9.6 %
		Y	3.41	72.77	20.34		150.0	
		Z	3.59	75.16	21.28		150.0	
10177-CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	2.58	67.83	18.56	3.01	150.0	± 9.6 %
		Y	2.61	67.26	17.92		150.0	
		Z	2.51	67.74	18.05		150.0	
10178-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	3.47	74.07	21.28	3.01	150.0	± 9.6 %
		Y	3.39	72.61	20.24		150.0	
		Z	3.55	74.95	21.17		150.0	
10179-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	3.09	71.56	19.53	3.01	150.0	± 9.6 %
		Y	3.06	70.57	18.74		150.0	
		Z	3.07	71.92	19.18		150.0	
10180-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	2.77	69.24	17.98	3.01	150.0	± 9.6 %
		Y	2.80	68.64	17.41		150.0	
		Z	2.71	69.32	17.51		150.0	
10181-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	2.57	67.81	18.56	3.01	150.0	± 9.6 %
		Y	2.61	67.24	17.92		150.0	
		Z	2.50	67.72	18.05		150.0	
10182-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	3.47	74.04	21.27	3.01	150.0	± 9.6 %
		Y	3.38	72.59	20.23		150.0	
		Z	3.55	74.92	21.15		150.0	
10183-AAC	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	2.77	69.22	17.97	3.01	150.0	± 9.6 %
		Y	2.79	68.62	17.39		150.0	
		Z	2.70	69.30	17.49		150.0	

10184-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	2.58	67.85	18.58	3.01	150.0	± 9.6 %
		Y	2.61	67.28	17.94		150.0	
		Z	2.51	67.77	18.07		150.0	
10185-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	3.48	74.12	21.31	3.01	150.0	± 9.6 %
		Y	3.40	72.66	20.27		150.0	
		Z	3.57	75.02	21.20		150.0	
10186-AAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	2.78	69.28	18.01	3.01	150.0	± 9.6 %
		Y	2.80	68.68	17.43		150.0	
		Z	2.72	69.36	17.53		150.0	
10187-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	2.59	67.95	18.68	3.01	150.0	± 9.6 %
		Y	2.63	67.36	18.02		150.0	
		Z	2.53	67.88	18.18		150.0	
10188-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	3.60	74.88	21.75	3.01	150.0	± 9.6 %
		Y	3.49	73.27	20.64		150.0	
		Z	3.72	75.91	21.69		150.0	
10189-AAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	2.84	69.72	18.31	3.01	150.0	± 9.6 %
		Y	2.86	69.05	17.69		150.0	
		Z	2.78	69.83	17.84		150.0	
10193-CAB	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	4.24	66.83	16.19	0.00	150.0	± 9.6 %
		Y	4.33	66.71	16.05		150.0	
		Z	4.17	67.21	16.12		150.0	
10194-CAB	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	X	4.38	67.05	16.33	0.00	150.0	± 9.6 %
		Y	4.48	66.96	16.18		150.0	
		Z	4.29	67.37	16.25		150.0	
10195-CAB	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	X	4.41	67.06	16.34	0.00	150.0	± 9.6 %
		Y	4.51	66.98	16.20		150.0	
		Z	4.31	67.35	16.24		150.0	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	4.22	66.81	16.17	0.00	150.0	± 9.6 %
		Y	4.32	66.72	16.04		150.0	
		Z	4.14	67.17	16.09		150.0	
10197-CAB	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	X	4.38	67.05	16.33	0.00	150.0	± 9.6 %
		Y	4.48	66.96	16.19		150.0	
		Z	4.29	67.37	16.25		150.0	
10198-CAB	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	X	4.40	67.05	16.34	0.00	150.0	± 9.6 %
		Y	4.51	66.98	16.20		150.0	
		Z	4.30	67.34	16.24		150.0	
10219-CAB	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	4.18	66.86	16.15	0.00	150.0	± 9.6 %
		Y	4.27	66.75	16.01		150.0	
		Z	4.10	67.24	16.08		150.0	
10220-CAB	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	X	4.38	67.01	16.32	0.00	150.0	± 9.6 %
		Y	4.48	66.92	16.17		150.0	
		Z	4.28	67.32	16.23		150.0	
10221-CAB	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	X	4.42	67.00	16.33	0.00	150.0	± 9.6 %
		Y	4.52	66.92	16.19		150.0	
		Z	4.32	67.30	16.23		150.0	
10222-CAB	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	4.81	67.05	16.49	0.00	150.0	± 9.6 %
		Y	4.89	67.00	16.32		150.0	
		Z	4.70	67.21	16.35		150.0	

10223-CAB	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	X	5.06	67.21	16.57	0.00	150.0	± 9.6 %
		Y	5.16	67.20	16.44		150.0	
		Z	4.91	67.28	16.38		150.0	
10224-CAB	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	X	4.85	67.17	16.47	0.00	150.0	± 9.6 %
		Y	4.93	67.12	16.31		150.0	
		Z	4.74	67.36	16.35		150.0	
10225-CAB	UMTS-FDD (HSPA+)	X	2.51	66.34	14.80	0.00	150.0	± 9.6 %
		Y	2.61	66.13	14.83		150.0	
		Z	2.46	66.75	14.59		150.0	
10226-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	15.41	101.95	30.62	6.02	65.0	± 9.6 %
		Y	9.61	91.66	26.78		65.0	
		Z	7.80	90.47	26.24		65.0	
10227-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	15.19	100.12	29.36	6.02	65.0	± 9.6 %
		Y	9.40	90.05	25.60		65.0	
		Z	7.35	88.27	24.80		65.0	
10228-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	7.70	93.10	29.94	6.02	65.0	± 9.6 %
		Y	6.07	86.55	26.97		65.0	
		Z	4.20	82.08	25.39		65.0	
10229-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	13.82	99.74	29.86	6.02	65.0	± 9.6 %
		Y	9.01	90.36	26.26		65.0	
		Z	7.11	88.67	25.54		65.0	
10230-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	13.48	97.89	28.61	6.02	65.0	± 9.6 %
		Y	8.74	88.75	25.10		65.0	
		Z	6.65	86.51	24.13		65.0	
10231-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	7.23	91.68	29.37	6.02	65.0	± 9.6 %
		Y	5.81	85.62	26.55		65.0	
		Z	4.00	81.04	24.89		65.0	
10232-CAD	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	13.79	99.72	29.85	6.02	65.0	± 9.6 %
		Y	8.99	90.35	26.26		65.0	
		Z	7.09	88.64	25.54		65.0	
10233-CAD	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	13.43	97.83	28.60	6.02	65.0	± 9.6 %
		Y	8.72	88.71	25.09		65.0	
		Z	6.62	86.46	24.12		65.0	
10234-CAD	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	6.91	90.59	28.86	6.02	65.0	± 9.6 %
		Y	5.61	84.84	26.14		65.0	
		Z	3.86	80.24	24.45		65.0	
10235-CAD	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	13.83	99.78	29.87	6.02	65.0	± 9.6 %
		Y	9.00	90.38	26.27		65.0	
		Z	7.09	88.66	25.55		65.0	
10236-CAD	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	13.62	98.04	28.65	6.02	65.0	± 9.6 %
		Y	8.81	88.86	25.13		65.0	
		Z	6.70	86.60	24.16		65.0	
10237-CAD	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	7.24	91.74	29.39	6.02	65.0	± 9.6 %
		Y	5.81	85.65	26.56		65.0	
		Z	3.99	81.03	24.90		65.0	
10238-CAD	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	13.76	99.70	29.84	6.02	65.0	± 9.6 %
		Y	8.97	90.32	26.25		65.0	
		Z	7.07	88.61	25.52		65.0	

10239-CAD	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	13.37	97.78	28.58	6.02	65.0	± 9.6 %
		Y	8.69	88.67	25.08		65.0	
		Z	6.59	86.40	24.10		65.0	
10240-CAD	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	7.22	91.71	29.38	6.02	65.0	± 9.6 %
		Y	5.80	85.63	26.55		65.0	
		Z	3.99	81.03	24.89		65.0	
10241-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	7.92	83.31	26.43	6.98	65.0	± 9.6 %
		Y	7.39	80.86	25.11		65.0	
		Z	6.39	80.34	24.81		65.0	
10242-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	7.05	80.89	25.37	6.98	65.0	± 9.6 %
		Y	6.86	79.38	24.43		65.0	
		Z	5.31	76.70	23.25		65.0	
10243-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	5.61	76.83	24.61	6.98	65.0	± 9.6 %
		Y	5.60	75.93	23.88		65.0	
		Z	4.41	73.05	22.53		65.0	
10244-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	4.02	70.41	14.69	3.98	65.0	± 9.6 %
		Y	4.13	70.49	14.93		65.0	
		Z	2.49	65.11	11.00		65.0	
10245-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	3.85	69.59	14.25	3.98	65.0	± 9.6 %
		Y	4.01	69.84	14.58		65.0	
		Z	2.45	64.72	10.74		65.0	
10246-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	4.04	73.92	16.51	3.98	65.0	± 9.6 %
		Y	4.21	74.30	17.06		65.0	
		Z	2.46	68.40	13.32		65.0	
10247-CAD	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	4.12	71.43	16.28	3.98	65.0	± 9.6 %
		Y	4.26	71.62	16.65		65.0	
		Z	3.07	68.30	14.10		65.0	
10248-CAD	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	3.99	70.52	15.86	3.98	65.0	± 9.6 %
		Y	4.18	70.90	16.31		65.0	
		Z	2.99	67.51	13.71		65.0	
10249-CAD	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	7.21	83.53	21.70	3.98	65.0	± 9.6 %
		Y	6.04	80.32	20.70		65.0	
		Z	4.60	77.74	18.93		65.0	
10250-CAD	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	5.73	77.13	21.21	3.98	65.0	± 9.6 %
		Y	5.49	75.70	20.56		65.0	
		Z	4.71	74.90	19.83		65.0	
10251-CAD	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	5.08	73.68	19.28	3.98	65.0	± 9.6 %
		Y	5.08	73.10	19.02		65.0	
		Z	4.15	71.43	17.80		65.0	
10252-CAD	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	7.72	84.95	23.95	3.98	65.0	± 9.6 %
		Y	6.57	81.27	22.47		65.0	
		Z	5.73	81.18	22.23		65.0	
10253-CAD	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	5.25	73.10	19.66	3.98	65.0	± 9.6 %
		Y	5.27	72.57	19.33		65.0	
		Z	4.44	71.27	18.45		65.0	
10254-CAD	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	5.65	74.31	20.52	3.98	65.0	± 9.6 %
		Y	5.63	73.63	20.11		65.0	
		Z	4.81	72.54	19.36		65.0	

10255-CAD	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.41	79.52	22.36	3.98	65.0	± 9.6 %
		Y	6.03	77.61	21.41		65.0	
		Z	5.18	77.05	21.09		65.0	
10256-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	2.62	64.77	10.66	3.98	65.0	± 9.6 %
		Y	2.89	65.71	11.45		65.0	
		Z	1.74	61.55	7.76		65.0	
10257-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	2.56	64.22	10.26	3.98	65.0	± 9.6 %
		Y	2.83	65.16	11.06		65.0	
		Z	1.73	61.29	7.50		65.0	
10258-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	2.33	65.98	11.67	3.98	65.0	± 9.6 %
		Y	2.74	67.85	13.09		65.0	
		Z	1.55	62.66	9.04		65.0	
10259-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	4.78	73.82	18.19	3.98	65.0	± 9.6 %
		Y	4.76	73.30	18.14		65.0	
		Z	3.71	70.96	16.29		65.0	
10260-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	4.75	73.36	17.98	3.98	65.0	± 9.6 %
		Y	4.77	72.96	17.98		65.0	
		Z	3.71	70.59	16.10		65.0	
10261-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	7.00	83.14	22.24	3.98	65.0	± 9.6 %
		Y	5.96	79.88	21.10		65.0	
		Z	4.89	78.58	20.00		65.0	
10262-CAD	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	5.70	77.00	21.13	3.98	65.0	± 9.6 %
		Y	5.47	75.60	20.50		65.0	
		Z	4.68	74.76	19.75		65.0	
10263-CAD	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	5.08	73.66	19.27	3.98	65.0	± 9.6 %
		Y	5.07	73.07	19.02		65.0	
		Z	4.15	71.42	17.80		65.0	
10264-CAD	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	7.58	84.58	23.79	3.98	65.0	± 9.6 %
		Y	6.49	81.02	22.35		65.0	
		Z	5.63	80.83	22.06		65.0	
10265-CAD	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	5.33	73.50	19.98	3.98	65.0	± 9.6 %
		Y	5.34	72.96	19.60		65.0	
		Z	4.49	71.58	18.78		65.0	
10266-CAD	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	5.80	74.91	20.98	3.98	65.0	± 9.6 %
		Y	5.76	74.17	20.50		65.0	
		Z	4.93	73.11	19.87		65.0	
10267-CAD	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.75	80.22	22.51	3.98	65.0	± 9.6 %
		Y	6.31	78.24	21.51		65.0	
		Z	5.45	77.78	21.30		65.0	
10268-CAD	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	5.93	73.37	20.49	3.98	65.0	± 9.6 %
		Y	5.99	73.01	20.12		65.0	
		Z	5.16	71.83	19.50		65.0	
10269-CAD	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	5.93	72.96	20.33	3.98	65.0	± 9.6 %
		Y	5.99	72.64	20.00		65.0	
		Z	5.19	71.51	19.38		65.0	
10270-CAD	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.27	76.42	21.20	3.98	65.0	± 9.6 %
		Y	6.15	75.42	20.55		65.0	
		Z	5.37	74.84	20.32		65.0	

10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	2.38	67.09	14.90	0.00	150.0	± 9.6 %
		Y	2.44	66.67	14.85		150.0	
		Z	2.34	67.57	14.77		150.0	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	1.49	69.19	15.59	0.00	150.0	± 9.6 %
		Y	1.48	67.68	15.09		150.0	
		Z	1.49	69.77	15.72		150.0	
10277-CAA	PHS (QPSK)	X	2.09	60.92	6.52	9.03	50.0	± 9.6 %
		Y	1.99	60.88	6.43		50.0	
		Z	1.56	59.12	4.50		50.0	
10278-CAA	PHS (QPSK, BW 884MHz, Rolloff 0.5)	X	3.33	66.21	11.58	9.03	50.0	± 9.6 %
		Y	3.45	67.40	12.36		50.0	
		Z	2.52	63.38	9.00		50.0	
10279-CAA	PHS (QPSK, BW 884MHz, Rolloff 0.38)	X	3.39	66.39	11.72	9.03	50.0	± 9.6 %
		Y	3.53	67.62	12.52		50.0	
		Z	2.56	63.50	9.12		50.0	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	0.61	61.53	7.60	0.00	150.0	± 9.6 %
		Y	0.95	65.07	10.75		150.0	
		Z	0.49	60.68	6.68		150.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	0.35	60.00	6.15	0.00	150.0	± 9.6 %
		Y	0.58	63.25	9.58		150.0	
		Z	0.32	60.00	5.83		150.0	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	0.39	61.31	7.18	0.00	150.0	± 9.6 %
		Y	0.79	67.34	11.99		150.0	
		Z	0.36	61.33	6.91		150.0	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	0.70	66.46	10.24	0.00	150.0	± 9.6 %
		Y	1.84	77.49	16.58		150.0	
		Z	0.96	69.80	11.25		150.0	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	24.25	96.58	25.60	9.03	50.0	± 9.6 %
		Y	13.21	88.89	23.79		50.0	
		Z	17.74	90.30	22.44		50.0	
10297-AAC	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	2.54	70.33	16.91	0.00	150.0	± 9.6 %
		Y	2.52	69.32	16.40		150.0	
		Z	2.48	70.69	17.00		150.0	
10298-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	0.87	62.84	9.39	0.00	150.0	± 9.6 %
		Y	1.14	64.99	11.49		150.0	
		Z	0.74	62.03	8.44		150.0	
10299-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	1.31	62.98	9.06	0.00	150.0	± 9.6 %
		Y	1.60	64.50	10.42		150.0	
		Z	0.95	60.67	6.76		150.0	
10300-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	1.06	60.58	7.00	0.00	150.0	± 9.6 %
		Y	1.28	61.71	8.21		150.0	
		Z	0.80	59.16	5.20		150.0	
10301-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	X	4.72	67.05	17.86	4.17	50.0	± 9.6 %
		Y	4.49	65.52	17.15		50.0	
		Z	4.22	65.84	16.97		50.0	
10302-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3 CTRL symbols)	X	5.04	66.76	18.08	4.96	50.0	± 9.6 %
		Y	5.00	66.22	17.91		50.0	
		Z	4.64	66.13	17.51		50.0	

10303-AAA	IEEE 802.16e WiMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	X	4.99	67.71	18.65	4.96	50.0	± 9.6 %
		Y	4.76	65.90	17.73		50.0	
		Z	4.52	66.56	17.75		50.0	
10304-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	X	4.61	66.36	17.42	4.17	50.0	± 9.6 %
		Y	4.57	65.80	17.25		50.0	
		Z	4.26	65.88	16.92		50.0	
10305-AAA	IEEE 802.16e WiMAX (31:15, 10ms, 10MHz, 64QAM, PUSC, 15 symbols)	X	5.19	72.10	20.50	6.02	35.0	± 9.6 %
		Y	4.47	68.84	19.43		35.0	
		Z	4.13	68.52	18.41		35.0	
10306-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 64QAM, PUSC, 18 symbols)	X	5.03	69.52	19.81	6.02	35.0	± 9.6 %
		Y	4.66	67.41	19.03		35.0	
		Z	4.34	67.36	18.35		35.0	
10307-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, PUSC, 18 symbols)	X	4.97	69.79	19.79	6.02	35.0	± 9.6 %
		Y	4.56	67.54	18.97		35.0	
		Z	4.24	67.41	18.25		35.0	
10308-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	X	5.00	70.20	20.02	6.02	35.0	± 9.6 %
		Y	4.56	67.81	19.14		35.0	
		Z	4.23	67.67	18.42		35.0	
10309-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3, 18 symbols)	X	5.04	69.58	19.90	6.02	35.0	± 9.6 %
		Y	4.68	67.50	19.12		35.0	
		Z	4.34	67.37	18.43		35.0	
10310-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3, 18 symbols)	X	5.02	69.73	19.86	6.02	35.0	± 9.6 %
		Y	4.62	67.52	19.04		35.0	
		Z	4.31	67.48	18.38		35.0	
10311-AAC	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	2.89	69.32	16.51	0.00	150.0	± 9.6 %
		Y	2.88	68.58	16.07		150.0	
		Z	2.84	69.69	16.60		150.0	
10313-AAA	iDEN 1:3	X	3.64	73.80	16.25	6.99	70.0	± 9.6 %
		Y	3.53	73.47	16.27		70.0	
		Z	2.54	70.98	14.85		70.0	
10314-AAA	iDEN 1:6	X	11.36	92.32	25.29	10.00	30.0	± 9.6 %
		Y	6.23	84.01	23.01		30.0	
		Z	14.41	96.78	26.22		30.0	
10315-AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	0.98	64.50	15.61	0.17	150.0	± 9.6 %
		Y	1.03	63.67	14.93		150.0	
		Z	0.98	64.65	15.49		150.0	
10316-AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	4.29	66.82	16.34	0.17	150.0	± 9.6 %
		Y	4.37	66.68	16.16		150.0	
		Z	4.17	67.03	16.16		150.0	
10317-AAB	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	4.29	66.82	16.34	0.17	150.0	± 9.6 %
		Y	4.37	66.68	16.16		150.0	
		Z	4.17	67.03	16.16		150.0	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	4.33	67.02	16.29	0.00	150.0	± 9.6 %
		Y	4.44	66.95	16.15		150.0	
		Z	4.21	67.24	16.15		150.0	
10401-AAC	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	4.99	66.73	16.28	0.00	150.0	± 9.6 %
		Y	5.10	66.79	16.18		150.0	
		Z	4.87	66.89	16.13		150.0	

10402-AAC	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	5.36	67.33	16.49	0.00	150.0	± 9.6 %
		Y	5.44	67.34	16.35		150.0	
		Z	5.26	67.52	16.37		150.0	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	0.61	61.53	7.60	0.00	115.0	± 9.6 %
		Y	0.95	65.07	10.75		115.0	
		Z	0.49	60.68	6.68		115.0	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	0.61	61.53	7.60	0.00	115.0	± 9.6 %
		Y	0.95	65.07	10.75		115.0	
		Z	0.49	60.68	6.68		115.0	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	100.00	120.88	29.11	0.00	100.0	± 9.6 %
		Y	100.00	119.48	28.73		100.0	
		Z	100.00	111.63	24.58		100.0	
10410-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	127.51	32.08	3.23	80.0	± 9.6 %
		Y	31.82	108.36	26.95		80.0	
		Z	62.35	116.51	27.82		80.0	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	0.90	63.50	14.92	0.00	150.0	± 9.6 %
		Y	0.97	62.93	14.41		150.0	
		Z	0.93	63.99	15.00		150.0	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	4.23	66.80	16.26	0.00	150.0	± 9.6 %
		Y	4.33	66.70	16.12		150.0	
		Z	4.15	67.12	16.17		150.0	
10417-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	4.23	66.80	16.26	0.00	150.0	± 9.6 %
		Y	4.33	66.70	16.12		150.0	
		Z	4.15	67.12	16.17		150.0	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preamble)	X	4.23	67.03	16.33	0.00	150.0	± 9.6 %
		Y	4.32	66.91	16.17		150.0	
		Z	4.14	67.37	16.26		150.0	
10419-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preamble)	X	4.24	66.95	16.31	0.00	150.0	± 9.6 %
		Y	4.34	66.84	16.16		150.0	
		Z	4.16	67.28	16.23		150.0	
10422-AAA	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	X	4.35	66.91	16.32	0.00	150.0	± 9.6 %
		Y	4.45	66.82	16.17		150.0	
		Z	4.26	67.23	16.23		150.0	
10423-AAA	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	X	4.47	67.16	16.40	0.00	150.0	± 9.6 %
		Y	4.57	67.08	16.26		150.0	
		Z	4.36	67.46	16.30		150.0	
10424-AAA	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	X	4.40	67.11	16.38	0.00	150.0	± 9.6 %
		Y	4.50	67.03	16.24		150.0	
		Z	4.30	67.40	16.28		150.0	
10425-AAA	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	X	5.04	67.26	16.58	0.00	150.0	± 9.6 %
		Y	5.13	67.22	16.42		150.0	
		Z	4.89	67.32	16.38		150.0	
10426-AAA	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	X	5.08	67.43	16.66	0.00	150.0	± 9.6 %
		Y	5.14	67.30	16.46		150.0	
		Z	4.92	67.46	16.45		150.0	

10427-AAA	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	X	5.02	67.13	16.51	0.00	150.0	± 9.6 %
		Y	5.11	67.10	16.36		150.0	
		Z	4.90	67.29	16.36		150.0	
10430-AAB	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	X	4.47	74.13	19.05	0.00	150.0	± 9.6 %
		Y	4.27	72.47	18.45		150.0	
		Z	5.08	77.10	19.89		150.0	
10431-AAB	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	X	3.84	67.47	16.10	0.00	150.0	± 9.6 %
		Y	3.94	67.28	15.99		150.0	
		Z	3.74	67.83	15.98		150.0	
10432-AAB	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	X	4.16	67.25	16.30	0.00	150.0	± 9.6 %
		Y	4.27	67.12	16.16		150.0	
		Z	4.06	67.58	16.20		150.0	
10433-AAB	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	X	4.42	67.15	16.40	0.00	150.0	± 9.6 %
		Y	4.52	67.06	16.26		150.0	
		Z	4.32	67.45	16.31		150.0	
10434-AAA	W-CDMA (BS Test Model 1, 64 DPCH)	X	4.64	75.00	18.70	0.00	150.0	± 9.6 %
		Y	4.40	73.39	18.26		150.0	
		Z	5.41	78.17	19.50		150.0	
10435-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	127.19	31.93	3.23	80.0	± 9.6 %
		Y	27.78	106.36	26.40		80.0	
		Z	42.85	111.62	26.64		80.0	
10447-AAB	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	X	3.04	67.08	14.65	0.00	150.0	± 9.6 %
		Y	3.18	67.05	14.85		150.0	
		Z	2.91	67.25	14.30		150.0	
10448-AAB	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	X	3.71	67.27	15.98	0.00	150.0	± 9.6 %
		Y	3.81	67.07	15.86		150.0	
		Z	3.62	67.65	15.87		150.0	
10449-AAB	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	X	4.01	67.09	16.21	0.00	150.0	± 9.6 %
		Y	4.11	66.95	16.06		150.0	
		Z	3.92	67.43	16.12		150.0	
10450-AAB	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	X	4.22	66.93	16.26	0.00	150.0	± 9.6 %
		Y	4.32	66.84	16.11		150.0	
		Z	4.14	67.24	16.18		150.0	
10451-AAA	W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)	X	2.79	66.50	13.63	0.00	150.0	± 9.6 %
		Y	2.98	66.79	14.09		150.0	
		Z	2.59	66.31	13.04		150.0	
10456-AAA	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc duty cycle)	X	6.00	67.78	16.73	0.00	150.0	± 9.6 %
		Y	6.04	67.74	16.57		150.0	
		Z	6.02	68.38	16.82		150.0	
10457-AAA	UMTS-FDD (DC-HSDPA)	X	3.60	65.57	16.01	0.00	150.0	± 9.6 %
		Y	3.68	65.45	15.84		150.0	
		Z	3.57	66.00	15.95		150.0	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	2.28	64.00	11.72	0.00	150.0	± 9.6 %
		Y	2.41	64.11	12.28		150.0	
		Z	1.90	62.62	10.39		150.0	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	4.90	70.07	18.22	0.00	150.0	± 9.6 %
		Y	4.93	69.48	18.09		150.0	
		Z	5.05	71.41	18.27		150.0	

10460-AAA	UMTS-FDD (WCDMA, AMR)	X	0.94	72.42	17.37	0.00	150.0	± 9.6 %
		Y	0.82	67.88	15.60		150.0	
		Z	0.96	72.94	17.69		150.0	
10461-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	133.76	34.95	3.29	80.0	± 9.6 %
		Y	22.54	106.56	27.45		80.0	
		Z	100.00	126.80	31.21		80.0	
10462-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.53	66.28	11.09	3.23	80.0	± 9.6 %
		Y	0.98	61.72	9.01		80.0	
		Z	0.66	60.00	6.84		80.0	
10463-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	0.79	60.00	7.60	3.23	80.0	± 9.6 %
		Y	0.83	60.00	7.56		80.0	
		Z	0.36	55.81	3.91		80.0	
10464-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	130.06	33.08	3.23	80.0	± 9.6 %
		Y	13.20	97.62	24.36		80.0	
		Z	92.51	120.86	28.60		80.0	
10465-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.21	64.05	10.09	3.23	80.0	± 9.6 %
		Y	0.92	61.09	8.63		80.0	
		Z	0.66	60.00	6.77		80.0	
10466-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	0.79	60.00	7.55	3.23	80.0	± 9.6 %
		Y	0.83	60.00	7.52		80.0	
		Z	0.35	55.73	3.83		80.0	
10467-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	130.58	33.30	3.23	80.0	± 9.6 %
		Y	16.52	100.70	25.21		80.0	
		Z	100.00	122.35	29.03		80.0	
10468-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.29	64.72	10.40	3.23	80.0	± 9.6 %
		Y	0.94	61.28	8.75		80.0	
		Z	0.66	60.00	6.80		80.0	
10469-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	0.79	60.00	7.55	3.23	80.0	± 9.6 %
		Y	0.83	60.00	7.52		80.0	
		Z	0.35	55.73	3.83		80.0	
10470-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	130.62	33.31	3.23	80.0	± 9.6 %
		Y	16.78	100.92	25.26		80.0	
		Z	100.00	122.35	29.02		80.0	
10471-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.27	64.59	10.33	3.23	80.0	± 9.6 %
		Y	0.93	61.24	8.72		80.0	
		Z	0.66	60.00	6.79		80.0	
10472-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	0.79	60.00	7.53	3.23	80.0	± 9.6 %
		Y	0.83	60.00	7.50		80.0	
		Z	0.35	55.70	3.80		80.0	
10473-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	130.57	33.29	3.23	80.0	± 9.6 %
		Y	16.58	100.74	25.21		80.0	
		Z	100.00	122.30	29.00		80.0	
10474-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.26	64.53	10.31	3.23	80.0	± 9.6 %
		Y	0.93	61.22	8.71		80.0	
		Z	0.66	60.00	6.78		80.0	
10475-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	0.79	60.00	7.54	3.23	80.0	± 9.6 %
		Y	0.83	60.00	7.50		80.0	
		Z	0.35	55.70	3.80		80.0	

10477-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.20	64.02	10.06	3.23	80.0	± 9.6 %
		Y	0.91	61.06	8.60		80.0	
		Z	0.66	60.00	6.75		80.0	
10478-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	0.79	60.00	7.52	3.23	80.0	± 9.6 %
		Y	0.83	60.00	7.49		80.0	
		Z	0.35	55.68	3.77		80.0	
10479-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	126.79	33.21	3.23	80.0	± 9.6 %
		Y	10.38	91.55	23.92		80.0	
		Z	100.00	123.17	30.88		80.0	
10480-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	111.12	25.93	3.23	80.0	± 9.6 %
		Y	4.86	75.90	16.60		80.0	
		Z	2.50	69.40	12.93		80.0	
10481-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	17.33	89.29	19.94	3.23	80.0	± 9.6 %
		Y	3.20	70.44	14.16		80.0	
		Z	1.42	63.47	9.98		80.0	
10482-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	2.01	67.85	13.24	2.23	80.0	± 9.6 %
		Y	2.00	67.46	13.68		80.0	
		Z	1.08	62.21	9.90		80.0	
10483-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	2.20	65.59	11.72	2.23	80.0	± 9.6 %
		Y	2.17	65.07	11.85		80.0	
		Z	1.15	60.00	7.79		80.0	
10484-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	2.02	64.43	11.18	2.23	80.0	± 9.6 %
		Y	2.09	64.36	11.51		80.0	
		Z	1.17	60.00	7.77		80.0	
10485-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	4.53	79.22	19.45	2.23	80.0	± 9.6 %
		Y	2.84	72.10	17.06		80.0	
		Z	2.60	72.67	16.45		80.0	
10486-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	2.56	67.74	14.01	2.23	80.0	± 9.6 %
		Y	2.53	67.08	14.11		80.0	
		Z	1.74	64.04	11.62		80.0	
10487-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	2.49	67.00	13.65	2.23	80.0	± 9.6 %
		Y	2.51	66.63	13.88		80.0	
		Z	1.72	63.54	11.33		80.0	
10488-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	4.03	76.67	20.22	2.23	80.0	± 9.6 %
		Y	3.18	71.86	18.18		80.0	
		Z	2.98	73.13	18.53		80.0	
10489-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.48	70.97	17.69	2.23	80.0	± 9.6 %
		Y	3.17	68.69	16.67		80.0	
		Z	2.92	69.30	16.55		80.0	
10490-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.52	70.58	17.52	2.23	80.0	± 9.6 %
		Y	3.25	68.52	16.59		80.0	
		Z	2.96	68.98	16.39		80.0	
10491-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	3.82	73.14	19.18	2.23	80.0	± 9.6 %
		Y	3.42	70.39	17.81		80.0	
		Z	3.09	70.86	17.98		80.0	
10492-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.66	69.39	17.61	2.23	80.0	± 9.6 %
		Y	3.51	67.96	16.83		80.0	
		Z	3.20	68.22	16.75		80.0	

10493-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.70	69.16	17.50	2.23	80.0	± 9.6 %
		Y	3.57	67.83	16.77		80.0	
		Z	3.24	68.04	16.65		80.0	
10494-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	4.24	74.94	19.81	2.23	80.0	± 9.6 %
		Y	3.67	71.70	18.26		80.0	
		Z	3.36	72.30	18.54		80.0	
10495-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.69	69.69	17.88	2.23	80.0	± 9.6 %
		Y	3.54	68.22	17.04		80.0	
		Z	3.22	68.45	17.03		80.0	
10496-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.75	69.34	17.76	2.23	80.0	± 9.6 %
		Y	3.62	68.01	16.98		80.0	
		Z	3.30	68.22	16.94		80.0	
10497-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	0.96	60.00	7.89	2.23	80.0	± 9.6 %
		Y	1.15	61.18	9.30		80.0	
		Z	0.83	60.00	6.90		80.0	
10498-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.15	60.00	6.67	2.23	80.0	± 9.6 %
		Y	1.20	60.00	7.47		80.0	
		Z	1.06	60.00	5.55		80.0	
10499-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	1.17	60.00	6.51	2.23	80.0	± 9.6 %
		Y	1.22	60.00	7.31		80.0	
		Z	1.10	60.00	5.36		80.0	
10500-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	4.27	78.15	19.77	2.23	80.0	± 9.6 %
		Y	2.97	71.96	17.50		80.0	
		Z	2.82	73.28	17.46		80.0	
10501-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.13	69.97	15.82	2.23	80.0	± 9.6 %
		Y	2.87	68.14	15.28		80.0	
		Z	2.33	67.02	13.92		80.0	
10502-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.10	69.46	15.52	2.23	80.0	± 9.6 %
		Y	2.89	67.91	15.09		80.0	
		Z	2.32	66.58	13.62		80.0	
10503-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	3.94	76.31	20.06	2.23	80.0	± 9.6 %
		Y	3.14	71.64	18.07		80.0	
		Z	2.92	72.80	18.38		80.0	
10504-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.45	70.79	17.60	2.23	80.0	± 9.6 %
		Y	3.15	68.57	16.60		80.0	
		Z	2.89	69.12	16.44		80.0	
10505-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.49	70.43	17.43	2.23	80.0	± 9.6 %
		Y	3.23	68.41	16.53		80.0	
		Z	2.93	68.82	16.30		80.0	
10506-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	4.19	74.72	19.70	2.23	80.0	± 9.6 %
		Y	3.64	71.54	18.18		80.0	
		Z	3.32	72.09	18.43		80.0	
10507-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.67	69.60	17.83	2.23	80.0	± 9.6 %
		Y	3.52	68.16	17.00		80.0	
		Z	3.21	68.36	16.97		80.0	

10508-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.73	69.24	17.70	2.23	80.0	± 9.6 %
		Y	3.60	67.93	16.93		80.0	
		Z	3.28	68.12	16.88		80.0	
10509-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	4.33	72.38	18.83	2.23	80.0	± 9.6 %
		Y	4.02	70.46	17.77		80.0	
		Z	3.67	70.70	17.93		80.0	
10510-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	4.06	68.76	17.68	2.23	80.0	± 9.6 %
		Y	3.99	67.84	17.05		80.0	
		Z	3.63	67.77	16.97		80.0	
10511-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.12	68.51	17.60	2.23	80.0	± 9.6 %
		Y	4.06	67.66	17.00		80.0	
		Z	3.70	67.61	16.92		80.0	
10512-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	4.60	74.13	19.39	2.23	80.0	± 9.6 %
		Y	4.14	71.72	18.16		80.0	
		Z	3.79	72.01	18.34		80.0	
10513-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.97	68.97	17.79	2.23	80.0	± 9.6 %
		Y	3.88	67.99	17.12		80.0	
		Z	3.53	67.87	17.05		80.0	
10514-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.99	68.53	17.64	2.23	80.0	± 9.6 %
		Y	3.92	67.65	17.02		80.0	
		Z	3.57	67.54	16.93		80.0	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	0.86	63.76	15.01	0.00	150.0	± 9.6 %
		Y	0.93	63.09	14.45		150.0	
		Z	0.89	64.24	15.10		150.0	
10516-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc duty cycle)	X	1.36	87.46	22.75	0.00	150.0	± 9.6 %
		Y	0.54	69.72	16.60		150.0	
		Z	0.87	81.18	21.47		150.0	
10517-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc duty cycle)	X	0.73	66.61	16.01	0.00	150.0	± 9.6 %
		Y	0.76	64.78	14.94		150.0	
		Z	0.75	66.85	16.09		150.0	
10518-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	4.22	66.92	16.26	0.00	150.0	± 9.6 %
		Y	4.32	66.81	16.11		150.0	
		Z	4.14	67.26	16.18		150.0	
10519-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc duty cycle)	X	4.36	67.07	16.34	0.00	150.0	± 9.6 %
		Y	4.47	66.97	16.20		150.0	
		Z	4.26	67.39	16.25		150.0	
10520-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc duty cycle)	X	4.22	67.01	16.26	0.00	150.0	± 9.6 %
		Y	4.32	66.91	16.11		150.0	
		Z	4.13	67.32	16.17		150.0	
10521-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc duty cycle)	X	4.15	66.96	16.24	0.00	150.0	± 9.6 %
		Y	4.26	66.88	16.09		150.0	
		Z	4.06	67.26	16.14		150.0	
10522-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc duty cycle)	X	4.20	67.07	16.32	0.00	150.0	± 9.6 %
		Y	4.31	66.99	16.18		150.0	
		Z	4.08	67.30	16.18		150.0	

10523-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc duty cycle)	X	4.14	67.14	16.28	0.00	150.0	± 9.6 %
		Y	4.23	67.00	16.11		150.0	
		Z	4.06	67.51	16.23		150.0	
10524-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc duty cycle)	X	4.15	67.07	16.34	0.00	150.0	± 9.6 %
		Y	4.26	66.95	16.18		150.0	
		Z	4.06	67.37	16.24		150.0	
10525-AAA	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	4.20	66.19	15.97	0.00	150.0	± 9.6 %
		Y	4.29	66.07	15.81		150.0	
		Z	4.13	66.56	15.92		150.0	
10526-AAA	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	4.31	66.45	16.08	0.00	150.0	± 9.6 %
		Y	4.41	66.35	15.92		150.0	
		Z	4.22	66.77	16.00		150.0	
10527-AAA	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc duty cycle)	X	4.25	66.43	16.02	0.00	150.0	± 9.6 %
		Y	4.34	66.31	15.86		150.0	
		Z	4.16	66.77	15.96		150.0	
10528-AAA	IEEE 802.11ac WiFi (20MHz, MCS3, 99pc duty cycle)	X	4.26	66.44	16.06	0.00	150.0	± 9.6 %
		Y	4.36	66.33	15.89		150.0	
		Z	4.17	66.77	15.98		150.0	
10529-AAA	IEEE 802.11ac WiFi (20MHz, MCS4, 99pc duty cycle)	X	4.26	66.44	16.06	0.00	150.0	± 9.6 %
		Y	4.36	66.33	15.89		150.0	
		Z	4.17	66.77	15.98		150.0	
10531-AAA	IEEE 802.11ac WiFi (20MHz, MCS6, 99pc duty cycle)	X	4.22	66.45	16.02	0.00	150.0	± 9.6 %
		Y	4.32	66.35	15.87		150.0	
		Z	4.12	66.75	15.94		150.0	
10532-AAA	IEEE 802.11ac WiFi (20MHz, MCS7, 99pc duty cycle)	X	4.11	66.31	15.96	0.00	150.0	± 9.6 %
		Y	4.21	66.22	15.80		150.0	
		Z	4.02	66.64	15.89		150.0	
10533-AAA	IEEE 802.11ac WiFi (20MHz, MCS8, 99pc duty cycle)	X	4.27	66.54	16.06	0.00	150.0	± 9.6 %
		Y	4.36	66.41	15.90		150.0	
		Z	4.17	66.88	15.99		150.0	
10534-AAA	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	4.83	66.36	16.12	0.00	150.0	± 9.6 %
		Y	4.92	66.33	15.96		150.0	
		Z	4.73	66.59	16.01		150.0	
10535-AAA	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	4.87	66.48	16.17	0.00	150.0	± 9.6 %
		Y	4.96	66.46	16.02		150.0	
		Z	4.75	66.66	16.05		150.0	
10536-AAA	IEEE 802.11ac WiFi (40MHz, MCS2, 99pc duty cycle)	X	4.76	66.48	16.15	0.00	150.0	± 9.6 %
		Y	4.85	66.46	16.00		150.0	
		Z	4.66	66.70	16.05		150.0	
10537-AAA	IEEE 802.11ac WiFi (40MHz, MCS3, 99pc duty cycle)	X	4.84	66.54	16.18	0.00	150.0	± 9.6 %
		Y	4.91	66.45	16.00		150.0	
		Z	4.73	66.74	16.07		150.0	
10538-AAA	IEEE 802.11ac WiFi (40MHz, MCS4, 99pc duty cycle)	X	4.89	66.44	16.17	0.00	150.0	± 9.6 %
		Y	4.98	66.41	16.02		150.0	
		Z	4.77	66.62	16.04		150.0	
10540-AAA	IEEE 802.11ac WiFi (40MHz, MCS6, 99pc duty cycle)	X	4.82	66.39	16.17	0.00	150.0	± 9.6 %
		Y	4.91	66.37	16.02		150.0	
		Z	4.71	66.59	16.05		150.0	

10541-AAA	IEEE 802.11ac WiFi (40MHz, MCS7, 99pc duty cycle)	X	4.81	66.32	16.11	0.00	150.0	± 9.6 %
		Y	4.89	66.29	15.96		150.0	
		Z	4.71	66.57	16.02		150.0	
10542-AAA	IEEE 802.11ac WiFi (40MHz, MCS8, 99pc duty cycle)	X	4.96	66.42	16.18	0.00	150.0	± 9.6 %
		Y	5.05	66.39	16.03		150.0	
		Z	4.85	66.63	16.06		150.0	
10543-AAA	IEEE 802.11ac WiFi (40MHz, MCS9, 99pc duty cycle)	X	5.05	66.57	16.28	0.00	150.0	± 9.6 %
		Y	5.12	66.46	16.09		150.0	
		Z	4.92	66.71	16.13		150.0	
10544-AAA	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	5.19	66.38	16.08	0.00	150.0	± 9.6 %
		Y	5.26	66.41	15.96		150.0	
		Z	5.09	66.58	15.97		150.0	
10545-AAA	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	5.38	66.91	16.31	0.00	150.0	± 9.6 %
		Y	5.43	66.83	16.13		150.0	
		Z	5.23	66.94	16.11		150.0	
10546-AAA	IEEE 802.11ac WiFi (80MHz, MCS2, 99pc duty cycle)	X	5.22	66.50	16.11	0.00	150.0	± 9.6 %
		Y	5.29	66.53	15.99		150.0	
		Z	5.11	66.68	15.99		150.0	
10547-AAA	IEEE 802.11ac WiFi (80MHz, MCS3, 99pc duty cycle)	X	5.33	66.73	16.22	0.00	150.0	± 9.6 %
		Y	5.37	66.64	16.03		150.0	
		Z	5.21	66.86	16.08		150.0	
10548-AAA	IEEE 802.11ac WiFi (80MHz, MCS4, 99pc duty cycle)	X	5.45	67.31	16.49	0.00	150.0	± 9.6 %
		Y	5.51	67.24	16.31		150.0	
		Z	5.25	67.19	16.22		150.0	
10550-AAA	IEEE 802.11ac WiFi (80MHz, MCS6, 99pc duty cycle)	X	5.32	66.85	16.30	0.00	150.0	± 9.6 %
		Y	5.35	66.71	16.09		150.0	
		Z	5.18	66.94	16.14		150.0	
10551-AAA	IEEE 802.11ac WiFi (80MHz, MCS7, 99pc duty cycle)	X	5.20	66.44	16.06	0.00	150.0	± 9.6 %
		Y	5.29	66.50	15.95		150.0	
		Z	5.09	66.62	15.94		150.0	
10552-AAA	IEEE 802.11ac WiFi (80MHz, MCS8, 99pc duty cycle)	X	5.19	66.51	16.09	0.00	150.0	± 9.6 %
		Y	5.27	66.53	15.96		150.0	
		Z	5.10	66.75	16.00		150.0	
10553-AAA	IEEE 802.11ac WiFi (80MHz, MCS9, 99pc duty cycle)	X	5.24	66.43	16.08	0.00	150.0	± 9.6 %
		Y	5.33	66.48	15.97		150.0	
		Z	5.14	66.64	15.98		150.0	
10554-AAB	IEEE 802.11ac WiFi (160MHz, MCS0, 99pc duty cycle)	X	5.62	66.70	16.16	0.00	150.0	± 9.6 %
		Y	5.68	66.74	16.03		150.0	
		Z	5.52	66.86	16.02		150.0	
10555-AAB	IEEE 802.11ac WiFi (160MHz, MCS1, 99pc duty cycle)	X	5.71	66.93	16.26	0.00	150.0	± 9.6 %
		Y	5.77	66.97	16.13		150.0	
		Z	5.58	67.01	16.08		150.0	
10556-AAB	IEEE 802.11ac WiFi (160MHz, MCS2, 99pc duty cycle)	X	5.77	67.11	16.34	0.00	150.0	± 9.6 %
		Y	5.81	67.07	16.17		150.0	
		Z	5.62	67.15	16.14		150.0	
10557-AAB	IEEE 802.11ac WiFi (160MHz, MCS3, 99pc duty cycle)	X	5.70	66.90	16.25	0.00	150.0	± 9.6 %
		Y	5.77	66.95	16.13		150.0	
		Z	5.59	67.04	16.11		150.0	

10558-AAB	IEEE 802.11ac WiFi (160MHz, MCS4, 99pc duty cycle)	X	5.69	66.90	16.26	0.00	150.0	± 9.6 %
		Y	5.78	67.01	16.18		150.0	
		Z	5.56	67.00	16.10		150.0	
10560-AAB	IEEE 802.11ac WiFi (160MHz, MCS6, 99pc duty cycle)	X	5.72	66.86	16.28	0.00	150.0	± 9.6 %
		Y	5.80	66.93	16.18		150.0	
		Z	5.60	66.99	16.14		150.0	
10561-AAB	IEEE 802.11ac WiFi (160MHz, MCS7, 99pc duty cycle)	X	5.66	66.87	16.32	0.00	150.0	± 9.6 %
		Y	5.73	66.92	16.20		150.0	
		Z	5.53	66.96	16.15		150.0	
10562-AAB	IEEE 802.11ac WiFi (160MHz, MCS8, 99pc duty cycle)	X	5.70	66.99	16.38	0.00	150.0	± 9.6 %
		Y	5.78	67.08	16.28		150.0	
		Z	5.57	67.08	16.21		150.0	
10563-AAB	IEEE 802.11ac WiFi (160MHz, MCS9, 99pc duty cycle)	X	5.83	67.06	16.38	0.00	150.0	± 9.6 %
		Y	5.88	67.05	16.23		150.0	
		Z	5.69	67.13	16.21		150.0	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	4.54	66.89	16.37	0.46	150.0	± 9.6 %
		Y	4.63	66.82	16.23		150.0	
		Z	4.43	67.15	16.24		150.0	
10565-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc duty cycle)	X	4.73	67.33	16.71	0.46	150.0	± 9.6 %
		Y	4.83	67.24	16.56		150.0	
		Z	4.62	67.61	16.60		150.0	
10566-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc duty cycle)	X	4.57	67.12	16.50	0.46	150.0	± 9.6 %
		Y	4.67	67.04	16.35		150.0	
		Z	4.45	67.36	16.36		150.0	
10567-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc duty cycle)	X	4.61	67.61	16.94	0.46	150.0	± 9.6 %
		Y	4.71	67.49	16.76		150.0	
		Z	4.52	67.92	16.85		150.0	
10568-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc duty cycle)	X	4.44	66.77	16.18	0.46	150.0	± 9.6 %
		Y	4.56	66.75	16.07		150.0	
		Z	4.30	66.87	15.96		150.0	
10569-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc duty cycle)	X	4.62	67.93	17.13	0.46	150.0	± 9.6 %
		Y	4.70	67.74	16.91		150.0	
		Z	4.54	68.30	17.08		150.0	
10570-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc duty cycle)	X	4.60	67.62	16.96	0.46	150.0	± 9.6 %
		Y	4.69	67.48	16.77		150.0	
		Z	4.49	67.91	16.87		150.0	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	1.06	65.12	15.94	0.46	130.0	± 9.6 %
		Y	1.10	64.13	15.18		130.0	
		Z	1.03	64.76	15.54		130.0	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	1.08	65.91	16.43	0.46	130.0	± 9.6 %
		Y	1.12	64.69	15.54		130.0	
		Z	1.04	65.49	16.01		130.0	
10573-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc duty cycle)	X	100.00	148.16	38.24	0.46	130.0	± 9.6 %
		Y	1.56	82.04	21.65		130.0	
		Z	5.25	106.01	29.47		130.0	
10574-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc duty cycle)	X	1.42	75.83	21.21	0.46	130.0	± 9.6 %
		Y	1.20	70.29	18.45		130.0	
		Z	1.26	74.01	20.40		130.0	

10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	4.33	66.73	16.43	0.46	130.0	± 9.6 %
		Y	4.42	66.59	16.25		130.0	
		Z	4.21	66.91	16.24		130.0	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	4.37	66.97	16.54	0.46	130.0	± 9.6 %
		Y	4.45	66.81	16.35		130.0	
		Z	4.25	67.19	16.37		130.0	
10577-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc duty cycle)	X	4.52	67.20	16.69	0.46	130.0	± 9.6 %
		Y	4.61	67.05	16.50		130.0	
		Z	4.39	67.40	16.51		130.0	
10578-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc duty cycle)	X	4.44	67.39	16.83	0.46	130.0	± 9.6 %
		Y	4.52	67.21	16.62		130.0	
		Z	4.32	67.63	16.68		130.0	
10579-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc duty cycle)	X	4.17	66.41	15.97	0.46	130.0	± 9.6 %
		Y	4.27	66.33	15.82		130.0	
		Z	4.03	66.48	15.71		130.0	
10580-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc duty cycle)	X	4.20	66.45	15.97	0.46	130.0	± 9.6 %
		Y	4.30	66.37	15.83		130.0	
		Z	4.03	66.43	15.66		130.0	
10581-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc duty cycle)	X	4.36	67.52	16.83	0.46	130.0	± 9.6 %
		Y	4.43	67.28	16.58		130.0	
		Z	4.25	67.77	16.69		130.0	
10582-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc duty cycle)	X	4.09	66.15	15.71	0.46	130.0	± 9.6 %
		Y	4.19	66.07	15.58		130.0	
		Z	3.93	66.16	15.43		130.0	
10583-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	4.33	66.73	16.43	0.46	130.0	± 9.6 %
		Y	4.42	66.59	16.25		130.0	
		Z	4.21	66.91	16.24		130.0	
10584-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	4.37	66.97	16.54	0.46	130.0	± 9.6 %
		Y	4.45	66.81	16.35		130.0	
		Z	4.25	67.19	16.37		130.0	
10585-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc duty cycle)	X	4.52	67.20	16.69	0.46	130.0	± 9.6 %
		Y	4.61	67.05	16.50		130.0	
		Z	4.39	67.40	16.51		130.0	
10586-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc duty cycle)	X	4.44	67.39	16.83	0.46	130.0	± 9.6 %
		Y	4.52	67.21	16.62		130.0	
		Z	4.32	67.63	16.68		130.0	
10587-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc duty cycle)	X	4.17	66.41	15.97	0.46	130.0	± 9.6 %
		Y	4.27	66.33	15.82		130.0	
		Z	4.03	66.48	15.71		130.0	
10588-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc duty cycle)	X	4.20	66.45	15.97	0.46	130.0	± 9.6 %
		Y	4.30	66.37	15.83		130.0	
		Z	4.03	66.43	15.66		130.0	
10589-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc duty cycle)	X	4.36	67.52	16.83	0.46	130.0	± 9.6 %
		Y	4.43	67.28	16.58		130.0	
		Z	4.25	67.77	16.69		130.0	
10590-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc duty cycle)	X	4.09	66.15	15.71	0.46	130.0	± 9.6 %
		Y	4.19	66.07	15.58		130.0	
		Z	3.93	66.16	15.43		130.0	

10591-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	4.49	66.83	16.58	0.46	130.0	± 9.6 %
		Y	4.58	66.69	16.39		130.0	
		Z	4.38	67.05	16.41		130.0	
10592-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	4.60	67.11	16.70	0.46	130.0	± 9.6 %
		Y	4.70	66.98	16.51		130.0	
		Z	4.47	67.30	16.52		130.0	
10593-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc duty cycle)	X	4.52	66.97	16.54	0.46	130.0	± 9.6 %
		Y	4.61	66.85	16.36		130.0	
		Z	4.39	67.15	16.35		130.0	
10594-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc duty cycle)	X	4.58	67.18	16.73	0.46	130.0	± 9.6 %
		Y	4.67	67.04	16.54		130.0	
		Z	4.45	67.37	16.56		130.0	
10595-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc duty cycle)	X	4.54	67.16	16.64	0.46	130.0	± 9.6 %
		Y	4.63	67.01	16.44		130.0	
		Z	4.41	67.33	16.45		130.0	
10596-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc duty cycle)	X	4.47	67.10	16.62	0.46	130.0	± 9.6 %
		Y	4.56	66.97	16.43		130.0	
		Z	4.33	67.23	16.41		130.0	
10597-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc duty cycle)	X	4.42	66.95	16.45	0.46	130.0	± 9.6 %
		Y	4.51	66.83	16.28		130.0	
		Z	4.29	67.09	16.24		130.0	
10598-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc duty cycle)	X	4.43	67.26	16.77	0.46	130.0	± 9.6 %
		Y	4.51	67.10	16.57		130.0	
		Z	4.32	67.48	16.62		130.0	
10599-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	5.20	67.31	16.86	0.46	130.0	± 9.6 %
		Y	5.25	67.14	16.63		130.0	
		Z	5.07	67.41	16.66		130.0	
10600-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	5.32	67.75	17.05	0.46	130.0	± 9.6 %
		Y	5.35	67.47	16.76		130.0	
		Z	5.09	67.50	16.68		130.0	
10601-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc duty cycle)	X	5.22	67.51	16.96	0.46	130.0	± 9.6 %
		Y	5.25	67.27	16.68		130.0	
		Z	5.07	67.56	16.73		130.0	
10602-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc duty cycle)	X	5.29	67.46	16.84	0.46	130.0	± 9.6 %
		Y	5.35	67.29	16.61		130.0	
		Z	5.08	67.29	16.50		130.0	
10603-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc duty cycle)	X	5.35	67.74	17.13	0.46	130.0	± 9.6 %
		Y	5.42	67.61	16.91		130.0	
		Z	5.13	67.56	16.79		130.0	
10604-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc duty cycle)	X	5.20	67.21	16.84	0.46	130.0	± 9.6 %
		Y	5.30	67.25	16.71		130.0	
		Z	5.02	67.15	16.55		130.0	
10605-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc duty cycle)	X	5.28	67.48	16.97	0.46	130.0	± 9.6 %
		Y	5.34	67.34	16.74		130.0	
		Z	5.07	67.33	16.64		130.0	
10606-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc duty cycle)	X	5.08	66.97	16.56	0.46	130.0	± 9.6 %
		Y	5.12	66.78	16.32		130.0	
		Z	4.92	66.93	16.28		130.0	

10607-AAA	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	4.35	66.22	16.25	0.46	130.0	± 9.6 %
		Y	4.42	66.04	16.04		130.0	
		Z	4.24	66.46	16.10		130.0	
10608-AAA	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	4.48	66.53	16.39	0.46	130.0	± 9.6 %
		Y	4.56	66.36	16.18		130.0	
		Z	4.35	66.73	16.22		130.0	
10609-AAA	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc duty cycle)	X	4.38	66.34	16.19	0.46	130.0	± 9.6 %
		Y	4.46	66.19	15.99		130.0	
		Z	4.25	66.53	16.02		130.0	
10610-AAA	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc duty cycle)	X	4.43	66.55	16.39	0.46	130.0	± 9.6 %
		Y	4.51	66.37	16.17		130.0	
		Z	4.31	66.77	16.23		130.0	
10611-AAA	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc duty cycle)	X	4.34	66.31	16.21	0.46	130.0	± 9.6 %
		Y	4.42	66.16	16.01		130.0	
		Z	4.21	66.50	16.03		130.0	
10612-AAA	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc duty cycle)	X	4.32	66.43	16.24	0.46	130.0	± 9.6 %
		Y	4.41	66.27	16.04		130.0	
		Z	4.18	66.54	16.03		130.0	
10613-AAA	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc duty cycle)	X	4.31	66.21	16.06	0.46	130.0	± 9.6 %
		Y	4.40	66.08	15.88		130.0	
		Z	4.17	66.33	15.85		130.0	
10614-AAA	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc duty cycle)	X	4.30	66.52	16.37	0.46	130.0	± 9.6 %
		Y	4.38	66.35	16.16		130.0	
		Z	4.18	66.74	16.22		130.0	
10615-AAA	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc duty cycle)	X	4.32	66.10	15.94	0.46	130.0	± 9.6 %
		Y	4.41	65.96	15.76		130.0	
		Z	4.18	66.24	15.73		130.0	
10616-AAA	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	4.99	66.43	16.42	0.46	130.0	± 9.6 %
		Y	5.06	66.34	16.22		130.0	
		Z	4.86	66.54	16.23		130.0	
10617-AAA	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	5.03	66.54	16.45	0.46	130.0	± 9.6 %
		Y	5.10	66.46	16.25		130.0	
		Z	4.87	66.58	16.22		130.0	
10618-AAA	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc duty cycle)	X	4.94	66.60	16.49	0.46	130.0	± 9.6 %
		Y	5.02	66.54	16.31		130.0	
		Z	4.80	66.71	16.31		130.0	
10619-AAA	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc duty cycle)	X	4.99	66.52	16.38	0.46	130.0	± 9.6 %
		Y	5.03	66.34	16.14		130.0	
		Z	4.83	66.55	16.15		130.0	
10620-AAA	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc duty cycle)	X	5.03	66.43	16.38	0.46	130.0	± 9.6 %
		Y	5.10	66.34	16.19		130.0	
		Z	4.87	66.44	16.14		130.0	
10621-AAA	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc duty cycle)	X	5.04	66.55	16.58	0.46	130.0	± 9.6 %
		Y	5.11	66.48	16.39		130.0	
		Z	4.92	66.71	16.42		130.0	
10622-AAA	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc duty cycle)	X	5.03	66.66	16.63	0.46	130.0	± 9.6 %
		Y	5.10	66.57	16.42		130.0	
		Z	4.89	66.76	16.44		130.0	

10623-AAA	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc duty cycle)	X	4.92	66.17	16.23	0.46	130.0	± 9.6 %
		Y	4.99	66.10	16.04		130.0	
		Z	4.79	66.29	16.04		130.0	
10624-AAA	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc duty cycle)	X	5.11	66.45	16.44	0.46	130.0	± 9.6 %
		Y	5.19	66.37	16.25		130.0	
		Z	4.97	66.53	16.23		130.0	
10625-AAA	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc duty cycle)	X	5.22	66.67	16.62	0.46	130.0	± 9.6 %
		Y	5.28	66.51	16.38		130.0	
		Z	5.06	66.71	16.39		130.0	
10626-AAA	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	5.33	66.38	16.34	0.46	130.0	± 9.6 %
		Y	5.39	66.36	16.17		130.0	
		Z	5.21	66.49	16.15		130.0	
10627-AAA	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	5.59	67.13	16.68	0.46	130.0	± 9.6 %
		Y	5.61	66.95	16.43		130.0	
		Z	5.40	67.02	16.39		130.0	
10628-AAA	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc duty cycle)	X	5.32	66.34	16.21	0.46	130.0	± 9.6 %
		Y	5.38	66.33	16.05		130.0	
		Z	5.18	66.39	16.00		130.0	
10629-AAA	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc duty cycle)	X	5.47	66.71	16.39	0.46	130.0	± 9.6 %
		Y	5.48	66.50	16.13		130.0	
		Z	5.31	66.69	16.14		130.0	
10630-AAA	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc duty cycle)	X	5.68	67.55	16.82	0.46	130.0	± 9.6 %
		Y	5.71	67.40	16.59		130.0	
		Z	5.39	67.16	16.39		130.0	
10631-AAA	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc duty cycle)	X	5.64	67.57	17.04	0.46	130.0	± 9.6 %
		Y	5.70	67.49	16.83		130.0	
		Z	5.46	67.53	16.79		130.0	
10632-AAA	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc duty cycle)	X	5.63	67.44	16.99	0.46	130.0	± 9.6 %
		Y	5.62	67.15	16.68		130.0	
		Z	5.46	67.43	16.75		130.0	
10633-AAA	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc duty cycle)	X	5.33	66.40	16.29	0.46	130.0	± 9.6 %
		Y	5.42	66.45	16.15		130.0	
		Z	5.20	66.49	16.10		130.0	
10634-AAA	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc duty cycle)	X	5.37	66.64	16.46	0.46	130.0	± 9.6 %
		Y	5.44	66.63	16.29		130.0	
		Z	5.25	66.79	16.30		130.0	
10635-AAA	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc duty cycle)	X	5.21	65.78	15.73	0.46	130.0	± 9.6 %
		Y	5.29	65.83	15.61		130.0	
		Z	5.07	65.82	15.50		130.0	
10636-AAB	IEEE 802.11ac WiFi (160MHz, MCS0, 90pc duty cycle)	X	5.77	66.72	16.42	0.46	130.0	± 9.6 %
		Y	5.82	66.71	16.25		130.0	
		Z	5.64	66.78	16.21		130.0	
10637-AAB	IEEE 802.11ac WiFi (160MHz, MCS1, 90pc duty cycle)	X	5.90	67.05	16.57	0.46	130.0	± 9.6 %
		Y	5.94	67.01	16.39		130.0	
		Z	5.72	66.99	16.30		130.0	
10638-AAB	IEEE 802.11ac WiFi (160MHz, MCS2, 90pc duty cycle)	X	5.93	67.14	16.59	0.46	130.0	± 9.6 %
		Y	5.96	67.07	16.40		130.0	
		Z	5.77	67.13	16.35		130.0	

10639-AAB	IEEE 802.11ac WiFi (160MHz, MCS3, 90pc duty cycle)	X	5.87	66.96	16.54	0.46	130.0	± 9.6 %
		Y	5.92	66.95	16.38		130.0	
		Z	5.72	67.01	16.33		130.0	
10640-AAB	IEEE 802.11ac WiFi (160MHz, MCS4, 90pc duty cycle)	X	5.80	66.76	16.38	0.46	130.0	± 9.6 %
		Y	5.88	66.84	16.27		130.0	
		Z	5.64	66.74	16.13		130.0	
10641-AAB	IEEE 802.11ac WiFi (160MHz, MCS5, 90pc duty cycle)	X	5.94	66.98	16.51	0.46	130.0	± 9.6 %
		Y	5.97	66.91	16.32		130.0	
		Z	5.75	66.87	16.22		130.0	
10642-AAB	IEEE 802.11ac WiFi (160MHz, MCS6, 90pc duty cycle)	X	5.94	67.12	16.76	0.46	130.0	± 9.6 %
		Y	6.00	67.14	16.61		130.0	
		Z	5.80	67.17	16.56		130.0	
10643-AAB	IEEE 802.11ac WiFi (160MHz, MCS7, 90pc duty cycle)	X	5.79	66.79	16.48	0.46	130.0	± 9.6 %
		Y	5.85	66.80	16.33		130.0	
		Z	5.62	66.75	16.21		130.0	
10644-AAB	IEEE 802.11ac WiFi (160MHz, MCS8, 90pc duty cycle)	X	5.83	66.94	16.57	0.46	130.0	± 9.6 %
		Y	5.90	67.00	16.44		130.0	
		Z	5.67	66.93	16.32		130.0	
10645-AAB	IEEE 802.11ac WiFi (160MHz, MCS9, 90pc duty cycle)	X	5.99	67.10	16.62	0.46	130.0	± 9.6 %
		Y	6.03	67.04	16.43		130.0	
		Z	5.79	66.98	16.32		130.0	
10646-AAD	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,7)	X	10.99	100.29	34.81	9.30	60.0	± 9.6 %
		Y	9.88	96.69	33.11		60.0	
		Z	5.76	86.83	29.52		60.0	
10647-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,7)	X	9.57	97.81	34.14	9.30	60.0	± 9.6 %
		Y	8.70	94.40	32.46		60.0	
		Z	5.05	84.45	28.75		60.0	
10648-AAA	CDMA2000 (1x Advanced)	X	0.33	60.00	5.57	0.00	150.0	± 9.6 %
		Y	0.47	61.19	7.86		150.0	
		Z	0.30	60.00	5.23		150.0	
10652-AAB	LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	X	3.46	67.89	16.64	2.23	80.0	± 9.6 %
		Y	3.39	66.82	16.12		80.0	
		Z	3.15	67.36	16.00		80.0	
10653-AAB	LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	X	3.92	66.65	16.80	2.23	80.0	± 9.6 %
		Y	3.92	66.10	16.41		80.0	
		Z	3.65	66.30	16.32		80.0	
10654-AAB	LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	X	3.93	66.16	16.82	2.23	80.0	± 9.6 %
		Y	3.94	65.72	16.45		80.0	
		Z	3.68	65.81	16.36		80.0	
10655-AAB	LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	X	4.00	66.00	16.84	2.23	80.0	± 9.6 %
		Y	4.01	65.63	16.48		80.0	
		Z	3.76	65.63	16.38		80.0	

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Appendix E – Dipole Calibration Data Sheets

gm

**Calibration Laboratory of
Schmid & Partner
Engineering AG**
Zeughausstrasse 43, 8004 Zurich, Switzerland



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S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Client **RF Exposure Lab**

Certificate No: **D750V3-1053_Aug15**

CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1053**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 10, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Name** Michael Weber **Function** Laboratory Technician

Signature

Approved by: **Name** Katja Pokovic **Function** Technical Manager

Issued: August 12, 2015

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	42.1 $\pm$ 6 %	0.91 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.03 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.25 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	56.3 $\pm$ 6 %	1.00 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.48 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.59 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.4 Ω - 0.4 j Ω
Return Loss	- 27.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.5 Ω - 2.5 j Ω
Return Loss	- 32.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.035 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 08, 2011

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D750V3 SN: 1053 - Head						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/10/2015	-27.5		54.4		-0.4	
8/9/2016	-25.9	-5.8	54.3	-0.1	-0.5	-0.1
8/10/2017	-26.9	-2.2	54.1	-0.3	-0.3	0.1

D750V3 SN: 1053 - Body						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/10/2015	-32.0		49.5		-2.5	
8/9/2016	-31.5	-1.6	51.0	1.5	-2.9	-0.4
8/10/2017	-31.2	-2.5	50.3	0.8	-2.8	-0.3

DASY5 Validation Report for Head TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1053

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.91$ S/m; $\epsilon_r = 42.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.44, 6.44, 6.44); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

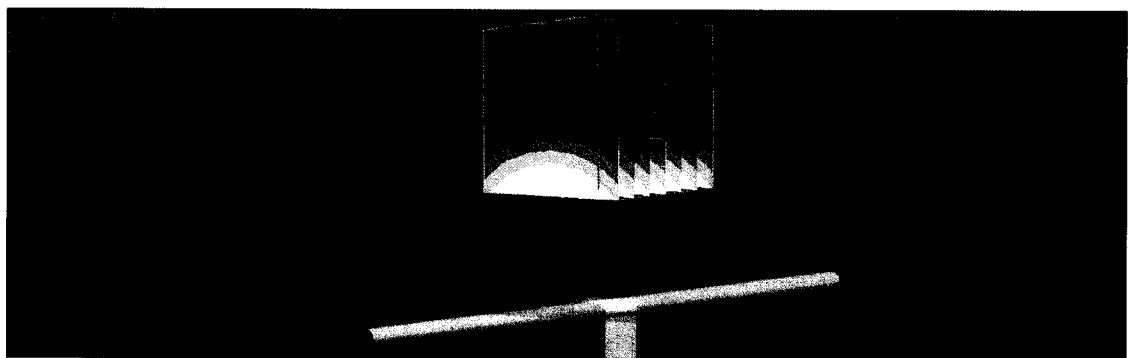
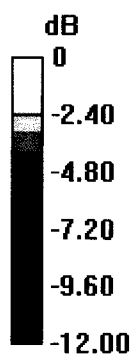
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.03 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.06 W/kg

SAR(1 g) = 2.04 W/kg; SAR(10 g) = 1.33 W/kg

Maximum value of SAR (measured) = 2.39 W/kg



0 dB = 2.39 W/kg = 3.78 dBW/kg

Impedance Measurement Plot for Head TSL

10 Aug 2015 11:47:25
 CH1 S11 1 U FS 1: 54.371 Ω -375.00 m Ω 565.88 pF 750.000 000 MHz

*

De1

CA

Avg
16

H1d

CH2 S11 L06 5 dB/REF -20 dB 1:-27.524 dB 750.000 000 MHz

De1

CA

Avg
16

H1d

START 550.000 000 MHz

STOP 950.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1053

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 1 \text{ S/m}$; $\epsilon_r = 56.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.21, 6.21, 6.21); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

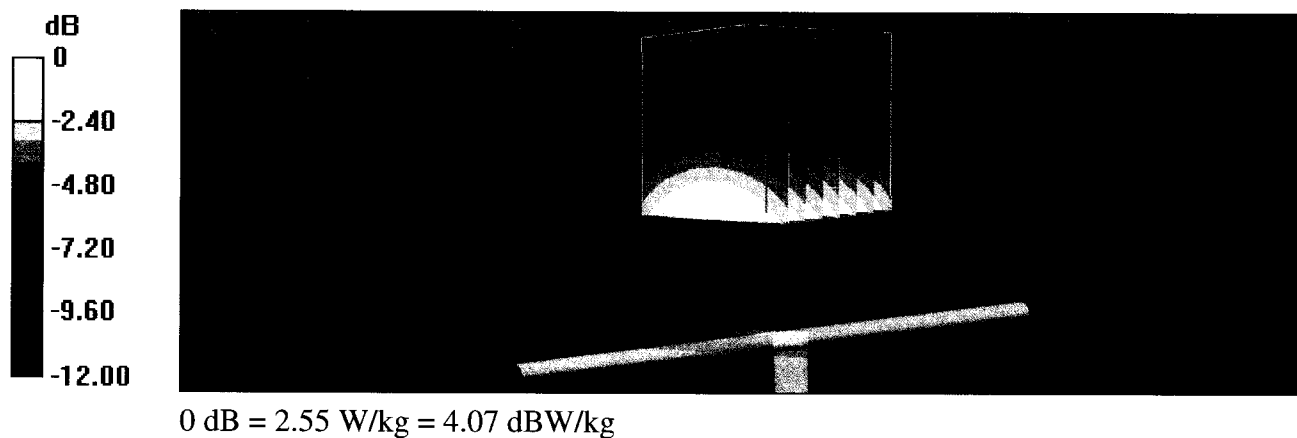
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 52.22 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.19 W/kg

SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.43 W/kg

Maximum value of SAR (measured) = 2.55 W/kg



Impedance Measurement Plot for Body TSL

CH1

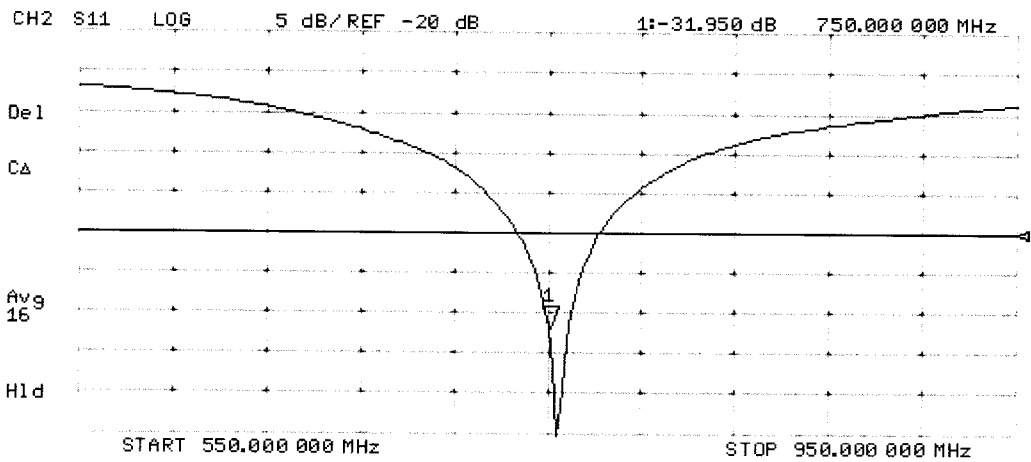
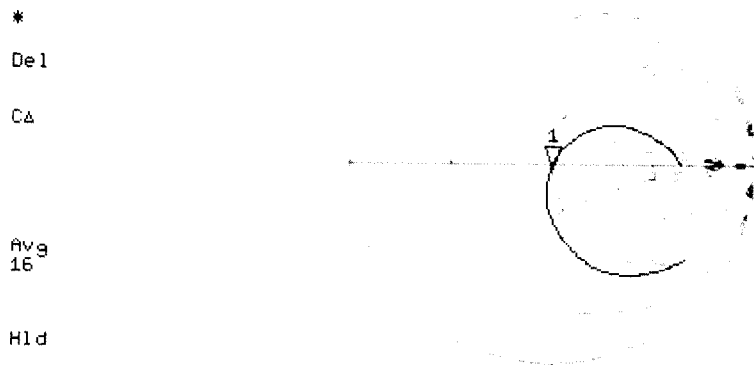
S11

1 U FS

1: 49.469 Ω -2.4551 Ω 86.436 pF

10 Aug 2015 10:58:10

750.000 000 MHz



gm

**Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Client **RF Exposure Lab**

Certificate No: **D835V2-4d131_Aug15**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d131**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 10, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Name**
Michael Weber **Function**
Laboratory Technician

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: August 12, 2015

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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.9 $\pm$ 6 %	0.93 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.23 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.01 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	56.1 $\pm$ 6 %	1.02 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.28 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.11 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.3 Ω - 1.6 j Ω
Return Loss	- 31.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.7 Ω - 3.8 j Ω
Return Loss	- 26.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.394 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 22, 2011

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D835V2 SN: 4d131 - Head						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/10/2015	-31.2		52.3		-1.6	
8/9/2016	-29.2	-6.4	51.3	-1.0	-1.8	-0.2
8/10/2017	-30.4	-2.6	50.6	-1.7	-1.5	0.1

D835V2 SN: 4d131 - Body						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/10/2015	-26.8		47.7		-3.8	
8/9/2016	-28.5	6.3	51.2	3.5	-3.8	0.0
8/10/2017	-27.6	3.0	48.4	0.7	-3.6	0.2

DASY5 Validation Report for Head TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d131

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.93$ S/m; $\epsilon_r = 41.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.2, 6.2, 6.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

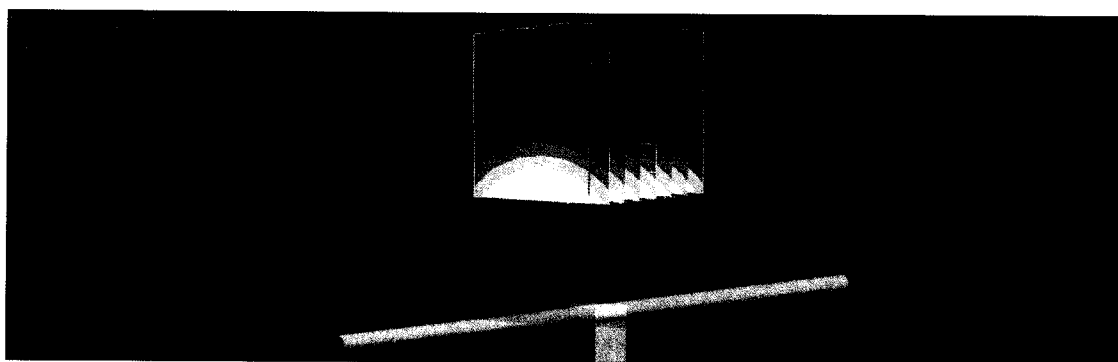
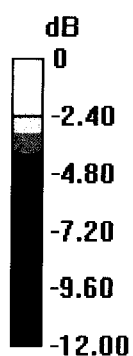
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.25 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.53 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.53 W/kg

Maximum value of SAR (measured) = 2.77 W/kg



0 dB = 2.77 W/kg = 4.42 dBW/kg

Impedance Measurement Plot for Head TSL

10 Aug 2015 11:56:53
 CH1 S11 1 U FS 1: 52.279 Ω -1.6289 Ω 117.01 pF 835.000 000 MHz

*

De1

CA

Avg
16

H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-31.234 dB 835.000 000 MHz

De1

CA

Avg
16

H1d

START 635.000 000 MHz

STOP 1 035.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d131

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 1.02 \text{ S/m}$; $\epsilon_r = 56.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.17, 6.17, 6.17); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

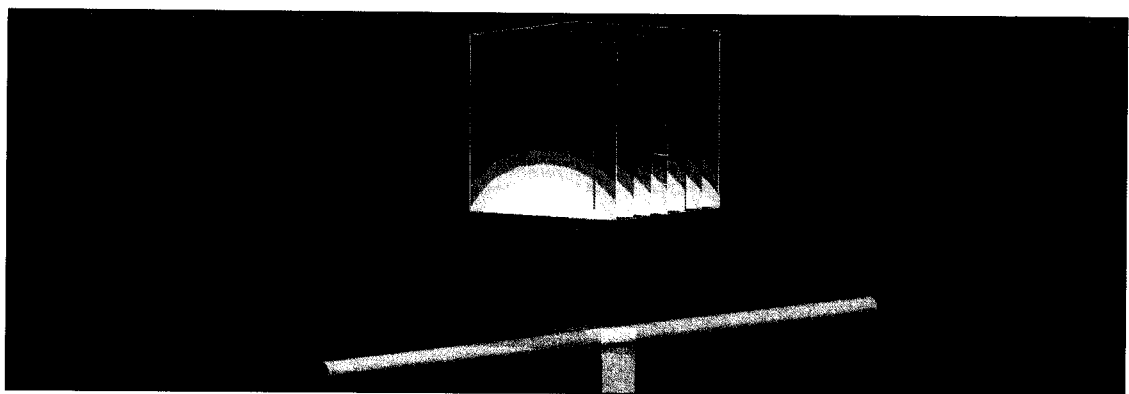
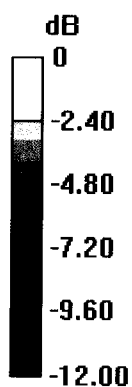
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 54.25 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.51 W/kg

SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 2.80 W/kg

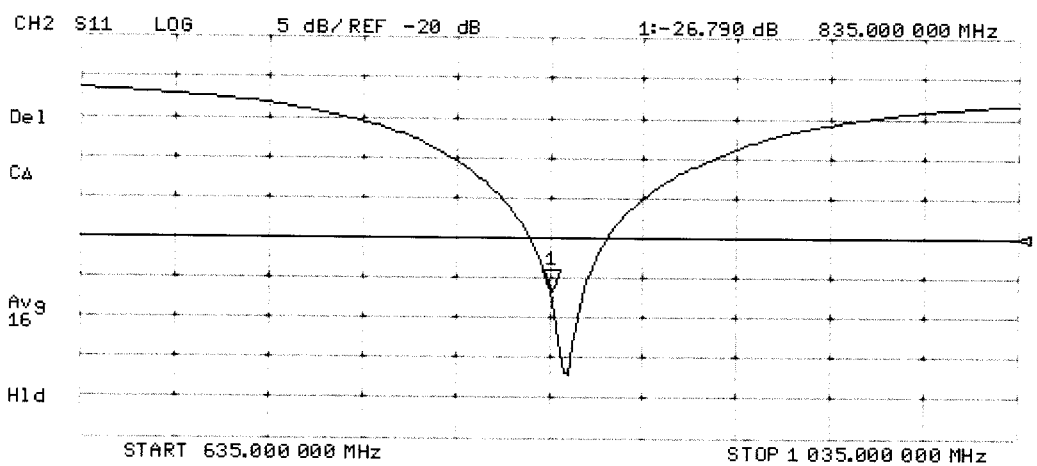
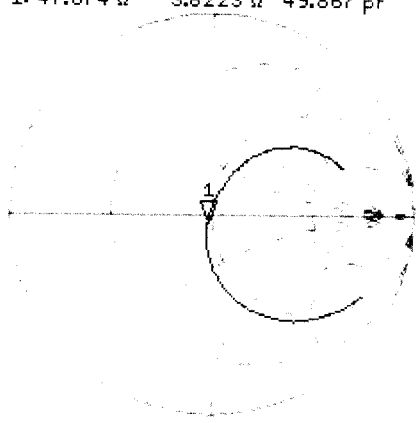


0 dB = 2.80 W/kg = 4.47 dBW/kg

Impedance Measurement Plot for Body TSL

10 Aug 2015 11:11:59
[CH1] S11 1 U FS 1: 47.674 Ω -3.8223 Ω 49.867 pF 835.000 000 MHz

*
De1
Ca
Avg
16
H1d





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Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Client **RF Exposure Lab**

Certificate No: **D1750V2-1061_Aug15**

CALIBRATION CERTIFICATE

Object **D1750V2 - SN:1061**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 13, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Jeton Kastrati** **Laboratory Technician** 

Approved by: **Katja Pokovic** **Technical Manager** 

Issued: August 13, 2015

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.8 $\pm$ 6 %	1.36 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.8 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.6 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.1 $\pm$ 6 %	1.48 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.7 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.3 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.5 Ω + 1.2 j Ω
Return Loss	- 37.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.3 Ω + 0.8 j Ω
Return Loss	- 30.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.220 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 15, 2010

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D1750V2 SN: 1061 - Head						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/13/2015	-37.8		50.5		1.2	
8/12/2016	-39.4	4.2	49.2	-1.3	0.7	-0.5
8/13/2017	-38.2	1.1	48.2	-2.3	1.1	-0.1

D1750V2 SN: 1061 - Body						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/13/2015	-30.7		47.3		0.8	
8/12/2016	-29.4	-4.2	46.1	-1.2	0.6	-0.2
8/13/2017	-30.1	-2.0	45.8	-1.5	0.7	-0.1

DASY5 Validation Report for Head TSL

Date: 13.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1061

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.36$ S/m; $\epsilon_r = 39.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

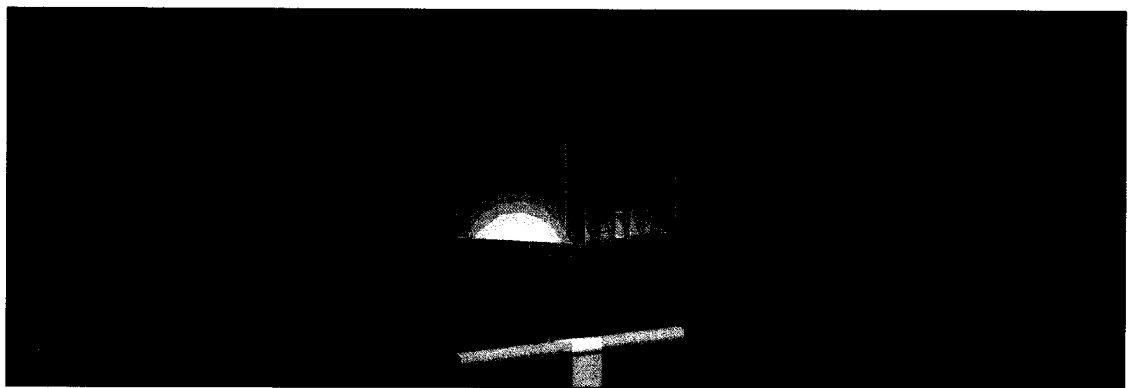
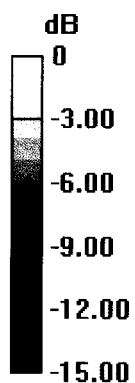
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.55 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 16.4 W/kg

SAR(1 g) = 9.18 W/kg; SAR(10 g) = 4.9 W/kg

Maximum value of SAR (measured) = 11.6 W/kg



0 dB = 11.6 W/kg = 10.64 dBW/kg

Impedance Measurement Plot for Head TSL

13 Aug 2015 13:43:33
 CH1 S11 1 U FS 1: 50.514 Ω 1.1777 Ω 107.11 μH 1 750.000 000 MHz

*

Del

CA

Avg
16

H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-37.844 dB 1 750.000 000 MHz

CA

Avg
16

H1d

START 1 550.000 000 MHz

STOP 1 950.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 13.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1061

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.48$ S/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.88, 4.88, 4.88); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

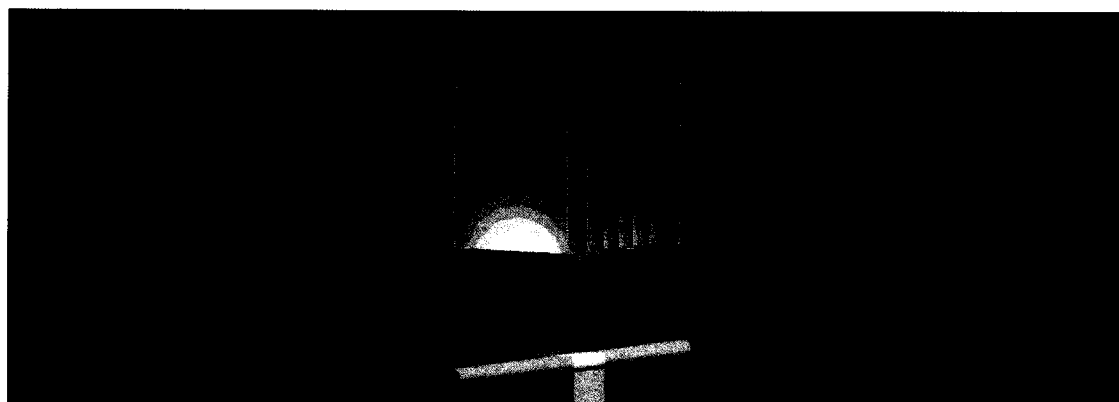
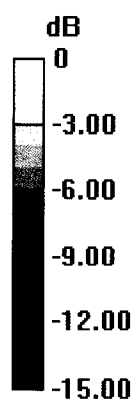
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.33 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 16.1 W/kg

SAR(1 g) = 9.43 W/kg; SAR(10 g) = 5.09 W/kg

Maximum value of SAR (measured) = 11.8 W/kg



0 dB = 11.8 W/kg = 10.72 dBW/kg

Impedance Measurement Plot for Body TSL

13 Aug 2015 13:42:55
 CH1 S11 1 U FS 1: 47.281 Ω 0.7871 Ω 71.584 μH 1 750.000 000 MHz

*

Del

CA

Avg
16

H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-30.723 dB 1 750.000 000 MHz

CA

Avg
16

H1d

START 1 550.000 000 MHz

STOP 1 950.000 000 MHz

gm

Calibration Laboratory of
Schmid & Partner
Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **RF Exposure Lab**

Certificate No: **D1900V2-5d147_Aug15**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN:5d147**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 13, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 13, 2015

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Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.9 $\pm$ 6 %	1.39 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	41.5 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.8 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.5 $\pm$ 6 %	1.51 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.5 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω + 6.2 j Ω
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.9 Ω + 6.5 j Ω
Return Loss	- 23.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.193 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D1900V2 SN: 5d147 - Head						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/13/2015	-23.5		53.1		6.2	
8/12/2016	-24.9	6.0	53.9	0.8	5.4	-0.8
8/13/2017	-23.8	1.3	52.7	-0.4	5.9	-0.3

D1900V2 SN: 5d147 - Body						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/13/2015	-23.5		48.9		6.5	
8/12/2016	-22.8	-3.0	46.3	-2.6	6.9	0.4
8/13/2017	-22.4	-4.7	47.5	-1.4	6.7	0.2

DASY5 Validation Report for Head TSL

Date: 13.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d147

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.39$ S/m; $\epsilon_r = 38.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.3 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 19.0 W/kg

SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.47 W/kg

Maximum value of SAR (measured) = 13.2 W/kg



0 dB = 13.2 W/kg = 11.21 dBW/kg

Impedance Measurement Plot for Head TSL

13 Aug 2015 13:23:19
 CH1 S11 1 U FS 3: 53.094 Ω 6.2012 Ω 519.45 μH 1 900.000 000 MHz

*
 Del

CΔ

Avg
 16

H1d

CH2 S11 LOG 5 dB/REF -20 dB 3:-23.465 dB 1 900.000 000 MHz

CΔ

Avg
 16

H1d

START 1 700.000 000 MHz

STOP 2 100.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 13.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d147

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.51$ S/m; $\epsilon_r = 52.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

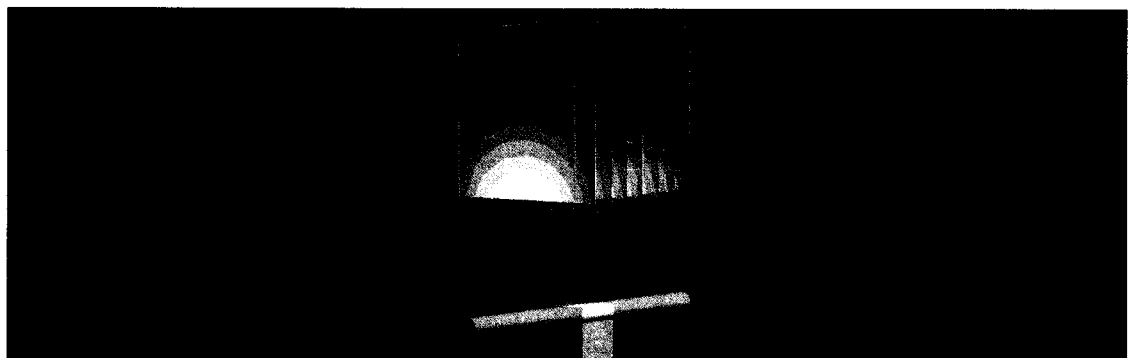
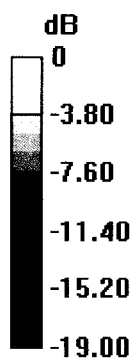
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.00 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 17.2 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.37 W/kg

Maximum value of SAR (measured) = 12.8 W/kg



0 dB = 12.8 W/kg = 11.07 dBW/kg

Impedance Measurement Plot for Body TSL

13 Aug 2015 13:22:49
 CH1 S11 1 U FS 3: 48.922 Ω 6.5039 Ω 544.80 μ H 1 900.000 000 MHz

*

De1

CA

Avg
16

H1d

CH2 S11 LOG 5 dB/REF -20 dB 3:-23.539 dB 1 900.000 000 MHz

CA

Avg
16

H1d

START 1 700.000 000 MHz

STOP 2 100.000 000 MHz

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **RF Exposure Lab**

Certificate No: **D2300V2-1060_Sep15**

CALIBRATION CERTIFICATE

Object **D2300V2 - SN: 1060**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **September 17, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	30-Dec-14 (No. EX3-7349_Dec14)	Dec-15
DAE4	SN: 601	17-Aug-15 (No. DAE4-601_Aug15)	Aug-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Name** **Israe Elnaouq** **Function** **Laboratory Technician**

Approved by: **Katja Pokovic** **Technical Manager**

Signature

Issued: September 17, 2015

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2300 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.7 $\pm$ 6 %	1.69 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	48.2 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.9	1.81 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.6 $\pm$ 6 %	1.84 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	48.1 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.83 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.3 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.4 Ω - 3.8 j Ω
Return Loss	- 27.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.3 Ω - 3.1 j Ω
Return Loss	- 23.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.170 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 20, 2015

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohms from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D2300V2 SN: 1060 - Head						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
9/17/2015	-27.5		48.4		-3.8	
10/17/2016	-26.9	-2.2	49.7	1.3	-3.4	0.4
9/18/2017	-27.2	1.1	49.5	-0.2	-3.3	0.1
D2300V2 SN: 1060 - Body						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
9/17/2015	-23.2		44.3		-3.1	
10/17/2016	-24.5	5.6	42.6	-1.7	-3.9	-0.8
9/18/2017	24.2	-198.8	43.5	0.9	-3.6	0.3

DASY5 Validation Report for Head TSL

Date: 08.09.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1060

Communication System: UID 0 - CW; Frequency: 2300 MHz

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.69$ S/m; $\epsilon_r = 39.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.94, 7.94, 7.94); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 112.1 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 23.9 W/kg

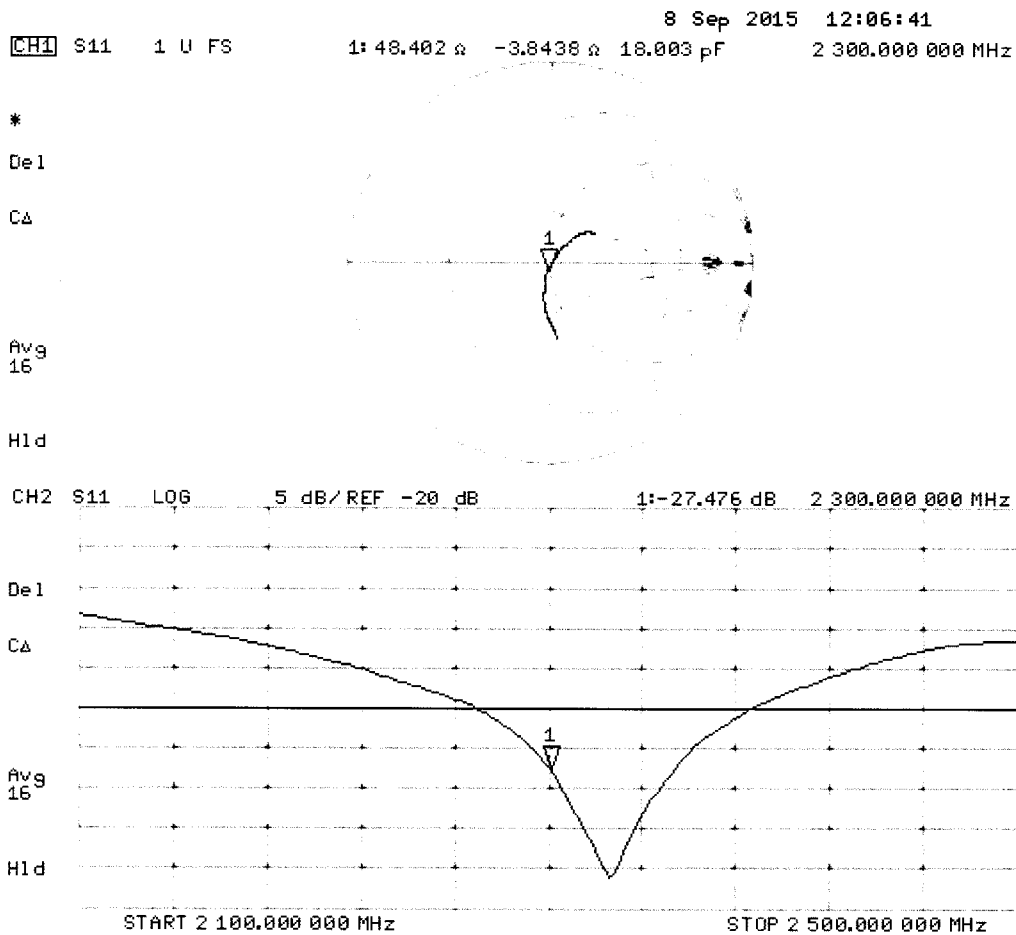
SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.79 W/kg

Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.09.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1060

Communication System: UID 0 - CW; Frequency: 2300 MHz

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.84$ S/m; $\epsilon_r = 53.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.66, 7.66, 7.66); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

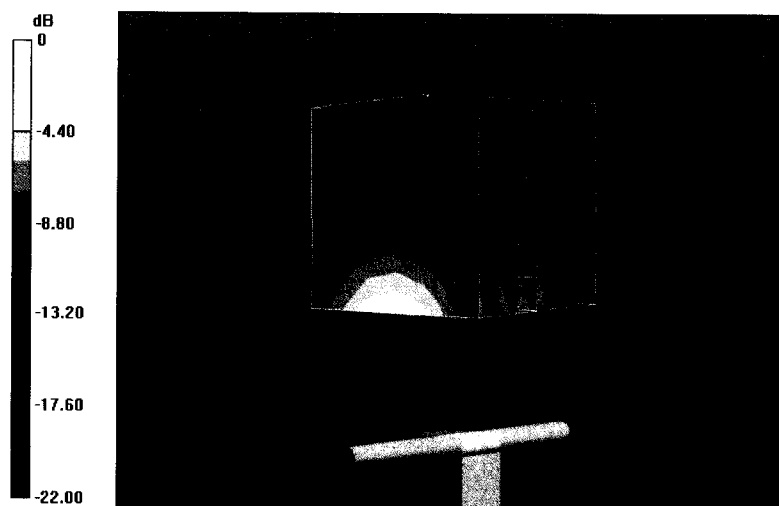
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 106.2 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 23.5 W/kg

SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.83 W/kg

Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Impedance Measurement Plot for Body TSL

17 Sep 2015 13:13:57
 CH1 S11 1 U FS 1: 44.305 Ω -3.0879 Ω 22.409 pF 2 300.000 000 MHz

*

De1

CA

Avg
16

H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-23.270 dB 2 300.000 000 MHz

CA

Avg
16

H1d

START 2 100.000 000 MHz

STOP 2 500.000 000 MHz

gm

**Calibration Laboratory of
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Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

Client **RF Exposure Lab**

Certificate No: **D2550V2-1003_Aug15**

CALIBRATION CERTIFICATE

Object **D2550V2 - SN: 1003**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 10, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Name**
Michael Weber **Function**
Laboratory Technician

Signature

M. Weber

Approved by: **Katja Pokovic** **Technical Manager**

Katja Pokovic

Issued: August 12, 2015

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2550 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.1	1.91 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.8 $\pm$ 6 %	1.97 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	56.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.8 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.6	2.09 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.3 $\pm$ 6 %	2.14 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	54.8 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.38 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	25.2 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.6 Ω - 1.3 j Ω
Return Loss	- 37.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 Ω - 1.2 j Ω
Return Loss	- 29.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.155 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 01, 2010

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D2550V2 SN: 1003 - Head						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/10/2015	-37.2		49.6		-1.3	
8/9/2016	-35.9	-3.5	48.2	-1.4	-1.6	-0.3
8/10/2017	-36.3	-2.4	47.8	-1.8	-1.2	0.1

D2550V2 SN: 1003 - Body						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$	Impedance Imaginary (j Ω)	$\Delta\Omega$
8/10/2015	-29.0		46.8		-1.2	
8/9/2016	-29.1	0.3	45.1	-1.7	-1.8	-0.6
8/10/2017	-28.4	-2.1	45.9	-0.9	-1.5	-0.3

DASY5 Validation Report for Head TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2550 MHz; Type: D2550V2; Serial: D2550V2 - SN: 1003

Communication System: UID 0 - CW; Frequency: 2550 MHz

Medium parameters used: $f = 2550$ MHz; $\sigma = 1.95$ S/m; $\epsilon_r = 40.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

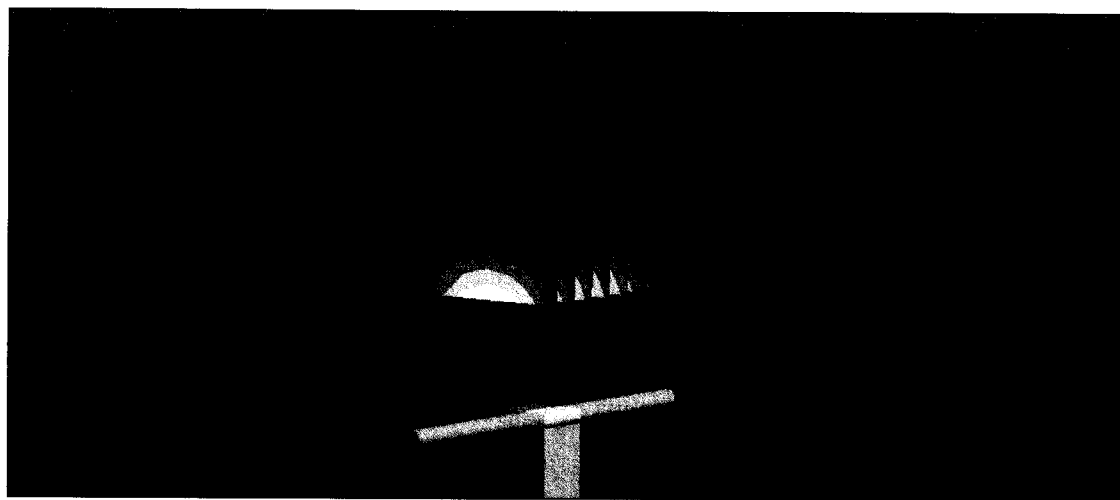
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.1 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 28.8 W/kg

SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.43 W/kg

Maximum value of SAR (measured) = 18.7 W/kg



0 dB = 18.7 W/kg = 12.72 dBW/kg

Impedance Measurement Plot for Head TSL

10 Aug 2015 15:24:48
 CH1 S11 1 U FS 1: 49.619 Ω -1.3164 Ω 47.412 pF 2 550.000 000 MHz

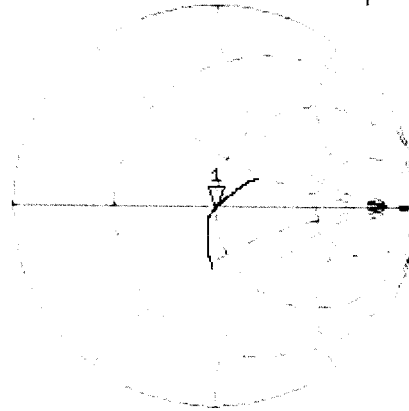
*

De1

CΔ

Avg
16

H1d



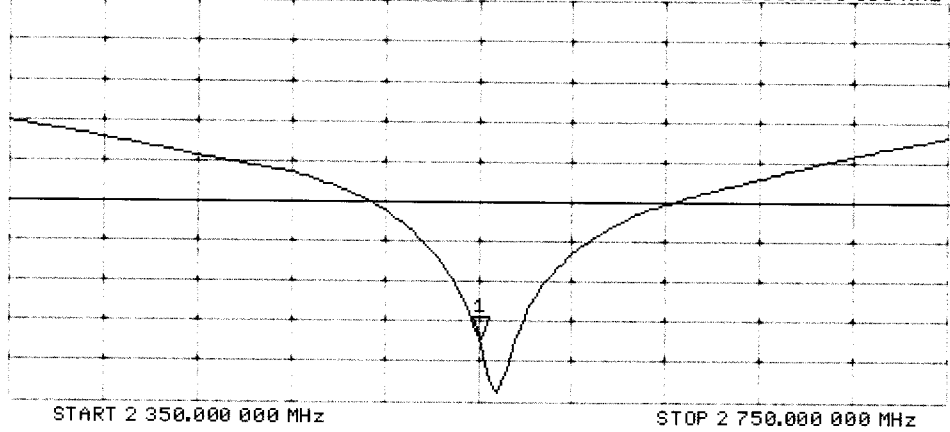
CH2 S11 LOG 5 dB/REF -20 dB 1:-37.239 dB 2 550.000 000 MHz

De1

CΔ

Avg
16

H1d



DASY5 Validation Report for Body TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2550 MHz; Type: D2550V2; Serial: D2550V2 - SN: 1003

Communication System: UID 0 - CW; Frequency: 2550 MHz

Medium parameters used: $f = 2550$ MHz; $\sigma = 2.14$ S/m; $\epsilon_r = 50.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.2, 4.2, 4.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

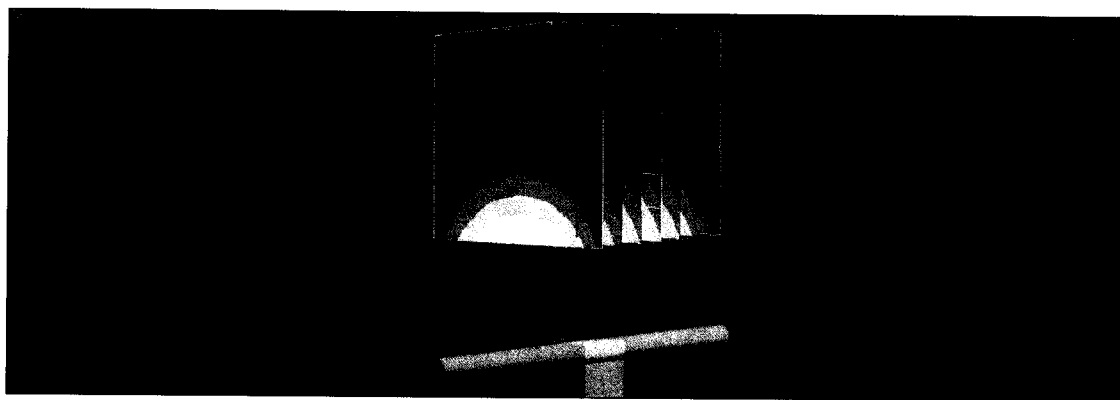
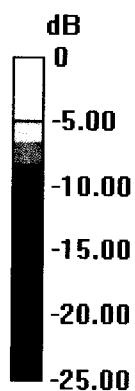
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.70 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 29.1 W/kg

SAR(1 g) = 14 W/kg; SAR(10 g) = 6.38 W/kg

Maximum value of SAR (measured) = 18.5 W/kg



0 dB = 18.5 W/kg = 12.67 dBW/kg

Impedance Measurement Plot for Body TSL

10 Aug 2015 15:24:11
CH1 S11 1 U FS 1: 46.814 Ω -1.2148 Ω 51.376 pF 2 550.000 000 MHz

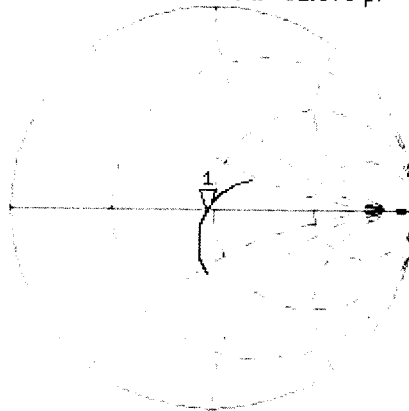
*

De1

Ca

Avg
16

H1d



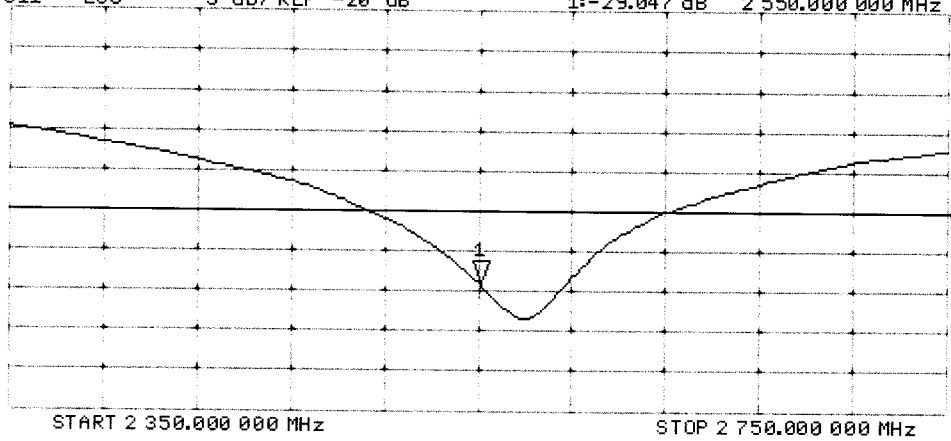
CH2 S11 LOG 5 dB/REF -20 dB 1: -29.047 dB 2 550.000 000 MHz

De1

Ca

Avg
16

H1d



Gm

**Calibration Laboratory of
Schmid & Partner
Engineering AG**
Zeughausstrasse 43, 8004 Zurich, Switzerland



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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Client **RF Exposure Lab**

Certificate No: **D2450V2-881_Aug15**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 881**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 10, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Name** **Michael Weber** **Function** **Laboratory Technician**

Signature

M Weber

Approved by: **Katja Pokovic** **Technical Manager**

Katja Pokovic

Issued: August 12, 2015

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.1 $\pm$ 6 %	1.87 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.5 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.4 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.6 $\pm$ 6 %	2.03 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	52.1 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.27 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.7 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.5 \Omega + 2.4 j\Omega$
Return Loss	- 26.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.9 \Omega + 4.4 j\Omega$
Return Loss	- 27.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 18, 2010

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D2450V2 SN: 881 - Head						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary ($j\Omega$)	$\Delta\Omega$
8/10/2015	-26.2		54.5		2.4	
8/9/2016	-25.4	-3.1	52.8	-1.7	2.9	0.5
8/10/2017	-26.8	2.3	53.4	-1.1	2.6	0.2

D2450V2 SN: 881 - Body						
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance Real (Ω)	$\Delta\Omega$	Impedance Imaginary ($j\Omega$)	$\Delta\Omega$
8/10/2015	-27.0		50.9		4.4	
8/9/2016	-27.5	1.9	51.6	0.7	5.2	0.8
8/10/2017	-26.4	-2.2	50.2	-0.7	4.9	0.5

DASY5 Validation Report for Head TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 881

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.87$ S/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

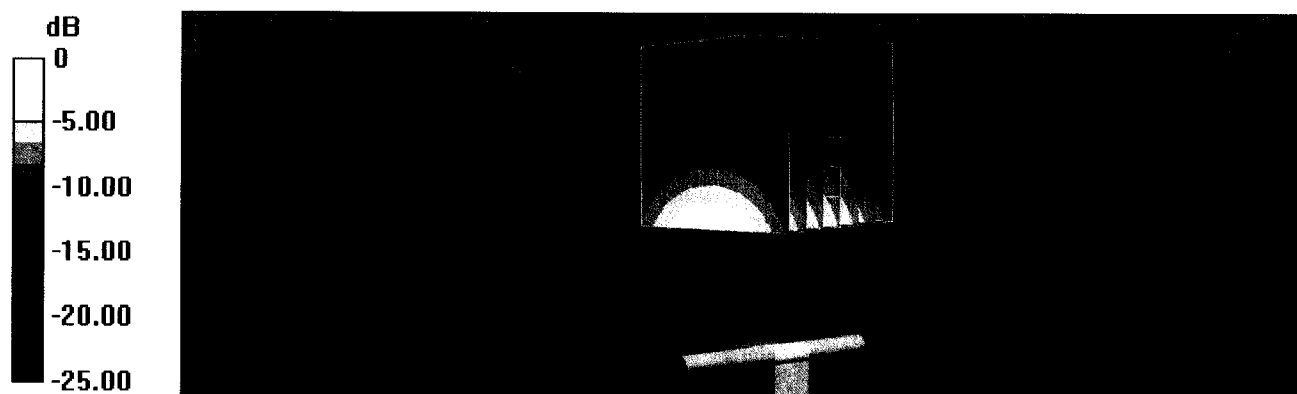
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.8 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 28.0 W/kg

SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.43 W/kg

Maximum value of SAR (measured) = 18.1 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

Impedance Measurement Plot for Head TSL

10 Aug 2015 15:18:07
CH1 S11 1 U FS 1: 54.469 Ω 2.4355 Ω 158.22 μH 2 450.000 000 MHz

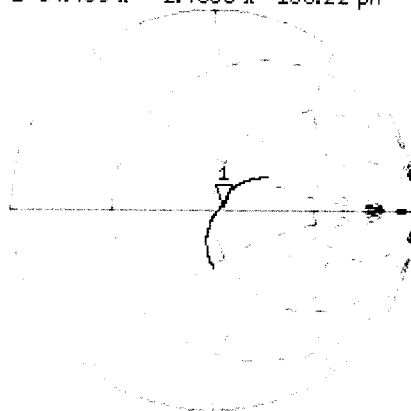
*

De1

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Avg
16

H1d



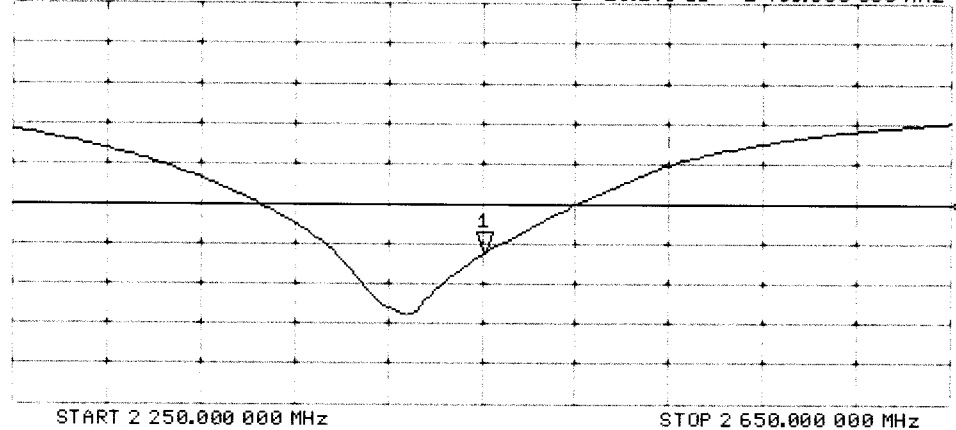
CH2 S11 LOG 5 dB/REF -20 dB 1: -26.248 dB 2 450.000 000 MHz

De1

CA

Avg
16

H1d



DASY5 Validation Report for Body TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 881

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.03$ S/m; $\epsilon_r = 50.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

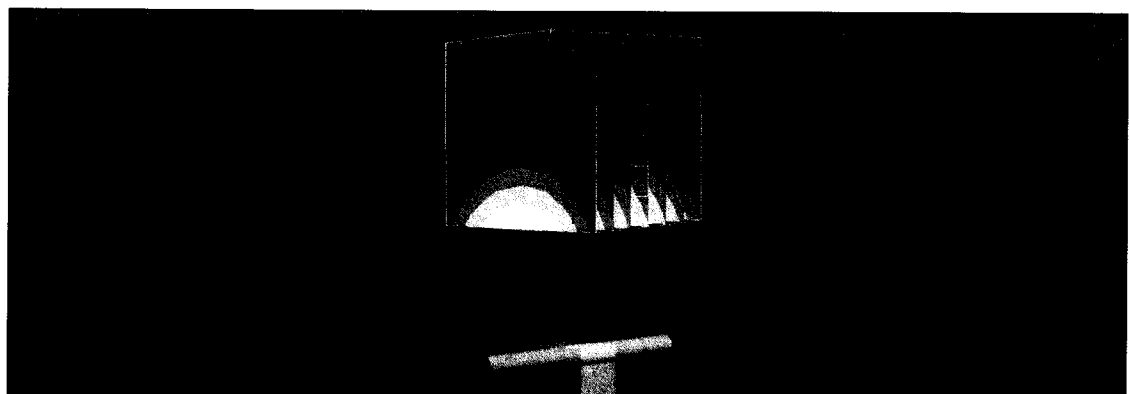
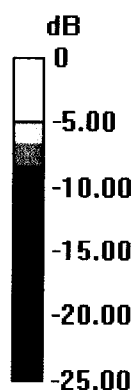
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.26 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 27.7 W/kg

SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.27 W/kg

Maximum value of SAR (measured) = 17.7 W/kg



0 dB = 17.7 W/kg = 12.48 dBW/kg

Impedance Measurement Plot for Body TSL

10 Aug 2015 15:17:39
[CH1] S11 1 U FS 1: 50.879 Ω 4.4199 Ω 287.12 μH 2 450.000 000 MHz

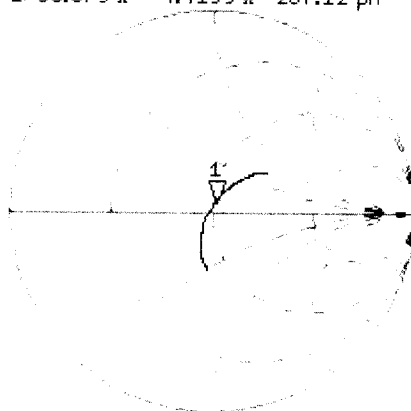
*

De1

CA

Avg
16

H1d



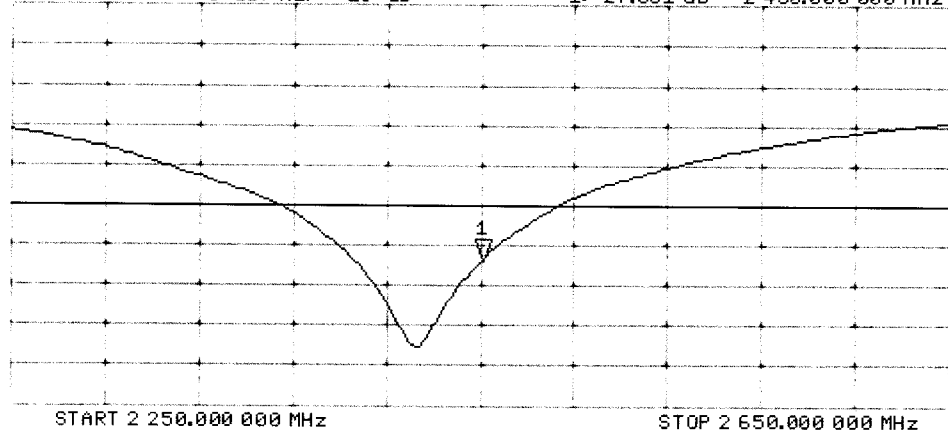
CH2 S11 LOG 5 dB/REF -20 dB 1: -27.001 dB 2 450.000 000 MHz

De1

CA

Avg
16

H1d



gm

**Calibration Laboratory of
Schmid & Partner
Engineering AG**
Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: **SCS 0108**

Client **RF Exposure Lab**

Certificate No: **D5GHzV2-1119_Aug15**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1119**

Calibration procedure(s) **QA CAL-22.v2**
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: **August 11, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 3503	30-Dec-14 (No. EX3-3503_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Israe Elnaouq** Name: **Israe Elnaouq** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Technical Manager

Signature
Israe Elnaouq
Katja Pokovic

Issued: August 11, 2015

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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	4.53 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.63 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.3 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.1 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	4.82 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.1 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.0 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	5.14 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.0 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.9 ± 6 %	5.43 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.77 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	77.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.6 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.7 ± 6 %	5.56 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.79 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	77.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.6 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3 ± 6 %	5.82 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	82.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.9 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.2 ± 6 %	5.95 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	80.7 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.4 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	6.23 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.91 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	78.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.19 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.8 W/kg ± 19.5 % (k=2)

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D5GHzV2 SN: 1119 - Head							
Date of Measurement	Frequency	Return Loss (dB)	Δ%	Impedance (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
8/11/2015	5200 MHz	-21.5		51.6		-8.4	
8/10/2016		-21.3	-0.9	51.2	-0.4	-8.7	-0.3
8/11/2017		-22.1	2.8	50.8	-0.8	-8.1	0.3
8/11/2015	5300 MHz	-27.8		51.4		-3.9	
8/10/2016		-26.4	-5.0	49.8	-1.6	-4.8	-0.9
8/11/2017		-26.9	-3.2	50.2	-1.2	-4.2	-0.3
8/11/2015	5500 MHz	-25.8		54.2		-3.4	
8/10/2016		-24.3	-5.8	52.6	-1.6	-3.9	-0.5
8/11/2017		-25.2	-2.3	53.7	-0.5	-4.4	-1.0
8/11/2015	5600 MHz	-24.3		56.3		-1.5	
8/10/2016		-23.9	-1.6	55.0	-1.3	-2.1	-0.6
8/11/2017		-23.5	-3.3	55.9	-0.4	-1.8	-0.3
8/11/2015	5800 MHz	-23.4		56.6		-2.8	
8/10/2016		-24.3	3.8	54.9	-1.7	-4.1	-1.3
8/11/2017		-24.6	5.1	55.3	-1.3	-3.5	-0.7
D5GHzV2 SN: 1119 - Body							
Date of Measurement	Frequency	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
8/11/2015	5200 MHz	-22.8		51.6		-7.2	
8/10/2016		-21.5	-5.7	51.2	-0.4	-7.9	-0.7
8/11/2017		-22.2	-2.6	50.8	-0.8	-7.5	-0.3
8/11/2015	5300 MHz	-30.8		51.1		-2.7	
8/10/2016		-29.6	-3.9	51.3	0.2	-3.2	-0.5
8/11/2017		-29.3	-4.9	50.2	-0.9	-2.4	0.3
8/11/2015	5500 MHz	-27.4		54.3		-1.3	
8/10/2016		-26.3	-4.0	53.3	-1.0	-2.0	-0.7
8/11/2017		-27.8	1.5	52.5	-1.8	-1.7	-0.4
8/11/2015	5600 MHz	-24.4		56.4		-0.1	
8/10/2016		-23.6	-3.3	55.9	-0.5	-0.9	-0.8
8/11/2017		-24.5	0.4	56.9	0.5	-0.5	-0.4
8/11/2015	5800 MHz	-23.1		57.5		-0.9	
8/10/2016		-23.9	3.5	56.6	-0.9	-1.1	-0.2
8/11/2017		-24.2	4.8	57.6	0.1	-1.2	-0.3

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.6 Ω - 8.4 j Ω
Return Loss	- 21.5 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	51.4 Ω - 3.9 j Ω
Return Loss	- 27.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	54.2 Ω - 3.4 j Ω
Return Loss	- 25.8 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.3 Ω - 1.5 j Ω
Return Loss	- 24.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.6 Ω - 2.8 j Ω
Return Loss	- 23.4 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	51.6 Ω - 7.2 j Ω
Return Loss	- 22.8 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.1 Ω - 2.7 j Ω
Return Loss	- 30.8 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	54.3 Ω - 1.3 j Ω
Return Loss	- 27.4 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	56.4 Ω - 0.1 j Ω
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	57.5 Ω - 0.9 j Ω
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.206 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 08, 2011

DASY5 Validation Report for Head TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1119

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.53$ S/m; $\epsilon_r = 35.5$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 4.63$ S/m; $\epsilon_r = 35.4$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.82$ S/m; $\epsilon_r = 35.1$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 4.93$ S/m; $\epsilon_r = 34.9$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.14$ S/m; $\epsilon_r = 34.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.51, 5.51, 5.51); Calibrated: 30.12.2014, ConvF(5.21, 5.21, 5.21); Calibrated: 30.12.2014, ConvF(5.12, 5.12, 5.12); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.84 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 29.5 W/kg

SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.32 W/kg

Maximum value of SAR (measured) = 18.6 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 67.35 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 32.1 W/kg

SAR(1 g) = 8.46 W/kg; SAR(10 g) = 2.42 W/kg

Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.30 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 33.6 W/kg

SAR(1 g) = 8.5 W/kg; SAR(10 g) = 2.42 W/kg

Maximum value of SAR (measured) = 20.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.73 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 33.5 W/kg

SAR(1 g) = 8.46 W/kg; SAR(10 g) = 2.41 W/kg

Maximum value of SAR (measured) = 20.0 W/kg

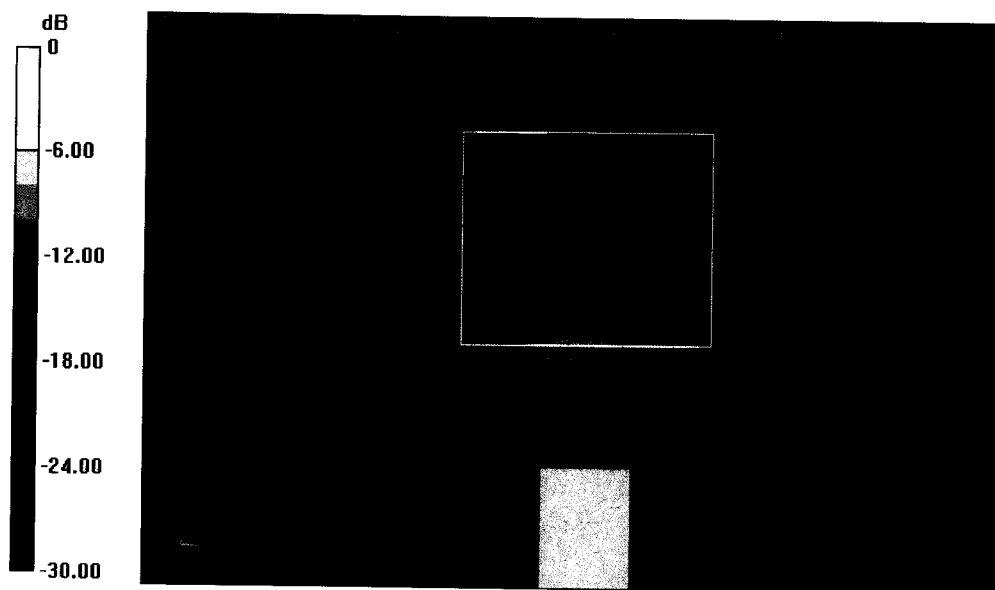
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.40 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 33.5 W/kg

SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.31 W/kg

Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 18.6 W/kg = 12.70 dBW/kg

Impedance Measurement Plot for Head TSL

10 Aug 2015 14:44:08
 CH1 S11 1 U FS 1: 51.607 Ω -8.4160 Ω 3.6367 pF 5 200.000 000 MHz

*

Del

Cor

Avg
16

H1d

CH1 Markers

2: 51.441 Ω
 -3.8533 Ω
 5.30000 GHz
 3: 54.195 Ω
 -3.3574 Ω
 5.50000 GHz
 4: 56.303 Ω
 -1.5313 Ω
 5.60000 GHz
 5: 56.602 Ω
 -2.8145 Ω
 5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -21.510 dB 5 200.000 000 MHz

Del

Cor

Avg
16

H1d

CH2 Markers

2: -27.822 dB
 5.30000 GHz
 3: -25.751 dB
 5.50000 GHz
 4: -24.294 dB
 5.60000 GHz
 5: -23.440 dB
 5.80000 GHz

START 5 000.000 000 MHz

STOP 6 000.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 11.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1119

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.43$ S/m; $\epsilon_r = 47.9$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 5.56$ S/m; $\epsilon_r = 47.7$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 5.82$ S/m; $\epsilon_r = 47.3$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 5.95$ S/m; $\epsilon_r = 47.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 6.23$ S/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.95, 4.95, 4.95); Calibrated: 30.12.2014, ConvF(4.78, 4.78, 4.78); Calibrated: 30.12.2014, ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.11 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 30.4 W/kg

SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.17 W/kg

Maximum value of SAR (measured) = 18.1 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 59.89 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 31.4 W/kg

SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.17 W/kg

Maximum value of SAR (measured) = 18.3 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.26 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 35.5 W/kg

SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.3 W/kg

Maximum value of SAR (measured) = 19.9 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 59.24 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 35.5 W/kg

SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.25 W/kg

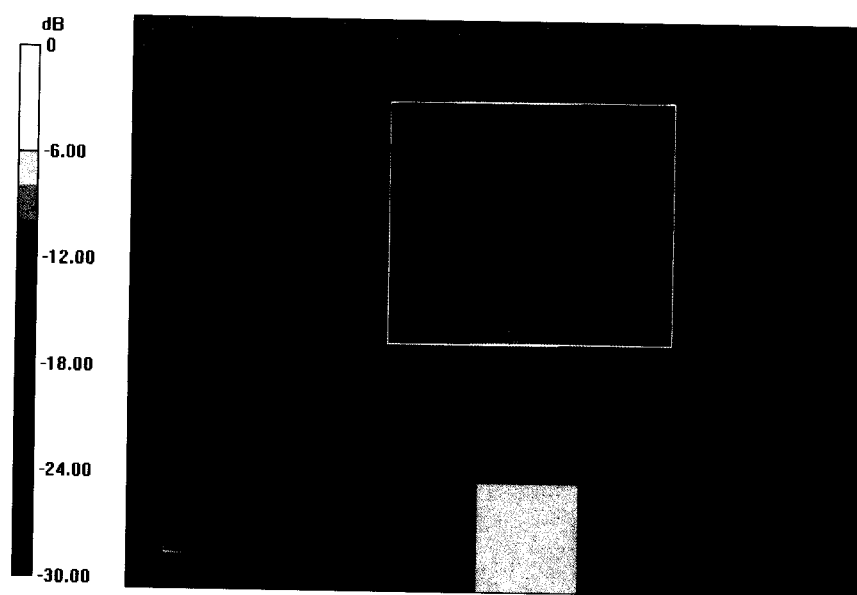
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.15 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 36.5 W/kg

SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.19 W/kg

Maximum value of SAR (measured) = 19.6 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

Impedance Measurement Plot for Body TSL

11 Aug 2015 11:14:37
 CH1 S11 1 U FS 1: 51.588 Ω -7.1816 Ω 4.2618 pF 5 200.000 000 MHz

*

De1

Cor

Avg
16

H1d

CH1 Markers

2: 51.084 Ω
 -2.7031 Ω
 5.30000 GHz
 3: 54.264 Ω
 -1.3027 Ω
 5.50000 GHz
 4: 56.379 Ω
 -140.63 m Ω
 5.60000 GHz
 5: 57.510 Ω
 -906.25 m Ω
 5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -22.827 dB 5 200.000 000 MHz

Cor

Avg
16

H1d

CH2 Markers

2: -30.805 dB
 5.30000 GHz
 3: -27.383 dB
 5.50000 GHz
 4: -24.441 dB
 5.60000 GHz
 5: -23.052 dB
 5.80000 GHz

START 5 000.000 000 MHz

STOP 6 000.000 000 MHz

Appendix F – Phantom Calibration Data Sheets

Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 4.0
Type No	QD OVA 001 B
Series No	1003 and higher
Manufacturer	Untersee Composites Knebelstrasse 8 CH-8268 Mannenbach, Switzerland

Tests

Complete tests were made on the prototype units QD OVA 001 AA 1001, QD OVA 001 AB 1002, pre-series units QD OVA 001 BA 1003-1005 as well as on the series units QD OVA 001 BB, 1006 ff.

Test	Requirement	Details	Units tested
Material thickness	Compliant with the standard requirements	Bottom plate: 2.0mm +/- 0.2mm	all
Material parameters	Dielectric parameters for required frequencies	< 6 GHz: Rel. permittivity = 4 +/-1, Loss tangent ≤ 0.05	Material sample
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions.	DGBE based simulating liquids. Observe Technical Note for material compatibility.	Equivalent phantoms, Material sample
Shape	Thickness of bottom material, Internal dimensions, Sagging compatible with standards from minimum frequency	Bottom elliptical 600 x 400 mm Depth 190 mm, Shape is within tolerance for filling height up to 155 mm, Eventual sagging is reduced or eliminated by support via DUT	Prototypes, Sample testing

Standards

- [1] CENELEC EN 50361-2001, « Basic standard for the measurement of the Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz) », July 2001
- [2] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003
- [3] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005
- [4] IEC 62209 – 2, Draft, "Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices – Human models, Instrumentation and Procedures – Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30 MHz to 6 GHz Handheld and Body-Mounted Devices used in close proximity to the Body.", February 2005
- [5] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition January 2001

Based on the tests above, we certify that this item is in compliance with the standards [1] to [5] if operated according to the specific requirements and considering the thickness. The dimensions are fully compliant with [4] from 30 MHz to 6 GHz. For the other standards, the minimum lower frequency limit is limited due to the dimensional requirements ([1]: 450 MHz, [2]: 300 MHz, [3]: 800 MHz, [5]: 375 MHz) and possibly further by the dimensions of the DUT.

s p e a g

Date 28.4.2008

Signature / Stamp

Schmid & Partner Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland
 Phone +41 44 245 9700, Fax +41 44 245 9779
 info@speag.com, http://www.speag.com

Appendix G – Validation Summary

Per FCC KDB 865664 D02 v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue equivalent media for system validation according to the procedures outlined in FCC KDB 865664 D01 v01r04 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point using the system that normally operates with the probe for routine SAR measurements and according to the required tissue equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Table G-1
SAR System Validation Summary

SAR System #	Freq. (MHz)	Date	Probe S/N	Probe Type	Probe Cal. Point		Cond. (σ)	Perm. (ϵ_r)	CW Validation			Modulation Validation		
									Sens-itivity	Probe Linearity	Probe Isotropy	Modulation Type	Duty Factor	PAR
2	750	9/11/2017	3693	EX3DV4	750	Body	0.98	55.26	Pass	Pass	Pass	QPSK	Pass	Pass
2	835	9/11/2017	3693	EX3DV4	835	Body	0.99	55.04	Pass	Pass	Pass	WCDMA	Pass	Pass
2	835	9/11/2017	3693	EX3DV4	835	Body	0.99	55.04	Pass	Pass	Pass	QPSK	Pass	Pass
2	1750	9/12/2017	3693	EX3DV4	1750	Body	1.51	53.29	Pass	Pass	Pass	WCDMA	Pass	Pass
2	1750	9/12/2017	3693	EX3DV4	1750	Body	1.51	53.29	Pass	Pass	Pass	QPSK	Pass	Pass
2	1900	9/12/2017	3693	EX3DV4	1900	Body	1.53	53.14	Pass	Pass	Pass	WCDMA	Pass	Pass
2	1900	9/12/2017	3693	EX3DV4	1900	Body	1.53	53.14	Pass	Pass	Pass	QPSK	Pass	Pass
2	2300	10/3/2017	3693	EX3DV4	2300	Body	1.82	52.75	Pass	Pass	Pass	QPSK	Pass	Pass
2	2550	10/3/2017	3693	EX3DV4	2600	Body	2.11	52.36	Pass	Pass	Pass	QPSK	Pass	Pass
2	2450	9/06/2017	3693	EX3DV4	2450	Body	1.96	52.64	Pass	Pass	Pass	OFDM/TDD	Pass	Pass
2	5200	9/05/2017	3693	EX3DV4	5200	Body	5.30	48.93	Pass	Pass	Pass	OFDM	N/A	Pass
2	5300	9/05/2017	3693	EX3DV4	5300	Body	5.41	48.88	Pass	Pass	Pass	OFDM	N/A	Pass
2	5500	9/05/2017	3693	EX3DV4	5500	Body	5.62	48.58	Pass	Pass	Pass	OFDM	N/A	Pass
2	5600	9/05/2017	3693	EX3DV4	5600	Body	5.74	48.43	Pass	Pass	Pass	OFDM	N/A	Pass
2	5800	9/05/2017	3693	EX3DV4	5800	Body	5.97	48.13	Pass	Pass	Pass	OFDM	N/A	Pass