SAMSUNG ELECTRONICS Co., Ltd.,
Regulatory Compliance Group
IT R&D Center

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Yeongtong-gu, Suwon-si,
Gyeonggi-do, Korea 443-742

TEST REPORT ON HAC

Model Tested:	**SCH-R250**
FCC ID (Requested) :	**A3LSCHR250A**
Job No :	**AH-068**
Report No :	**AH-068-M1**
Date issued :	**Sep. 3, 2010**
Result Summary :	**M4-2007 (RF EMISSION Category)**

- Abstract –

This document reports on HAC Tests carried out in accordance with ANSI C63.19(2007), FCC Rule Part(s) FCC 47 CFR §20.19, §6.3, §7.3

Prepared By

YB KIM – Test Engineer

Authorized By

JD JANG – Technical Manager

Contents

1. GENERAL INFORMATION

Test Sample :	Dual-Band CDMA Phone with Bluetooth
Model Number :	SCH-R250
Serial Number :	Identical prototype (S/N : # FH-182-A)
Manufacturer :	SAMSUNG ELECTRONICS Co., Ltd.
Contact :	YB KIM
Phone :	+82-31-301-1551
Fax :	+82-31-279-7629
Test Standard :	ANSI C 63.19 (2007), FCC 47 CFR § 20.19, §6.3, §7.3
FCC Classification	Licensed Portable Transmitter Held to Ear (PCE)
Test Dates :	Aug.26 ,2010 ~ Aug.27 ,2010
Tested for :	FCC/TCB Certification

2. DESCRIPTION OF DEVICE

Tx Freq. Range :	824.70 ~ 848.31 MHz(CDMA) 1851.25 ~ 1908.76 MHz(PCS)
Rx Freq. Range :	869.70 ~ 893.31 MHz(CDMA) 1931.25 ~ 1988.76 MHz(PCS)
Antenna Configuration :	AISCHR250PA
Antenna Manufacturer :	PARTRON
Antenna Dmimensions :	40 X 14 X 7.6 (mm)

3. DESCRIPTION OF TEST EQUIPMENT

3.1 HAC Measurement Setup

Robotic System

Measurements are performed using the DASY4(or DASY5) automated dosimetric assessment system. Which
is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Stäubli), robot controller, measurement server, Samsung computer, near-field probe, probe alignment sensor, and the SAM twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 3.1).

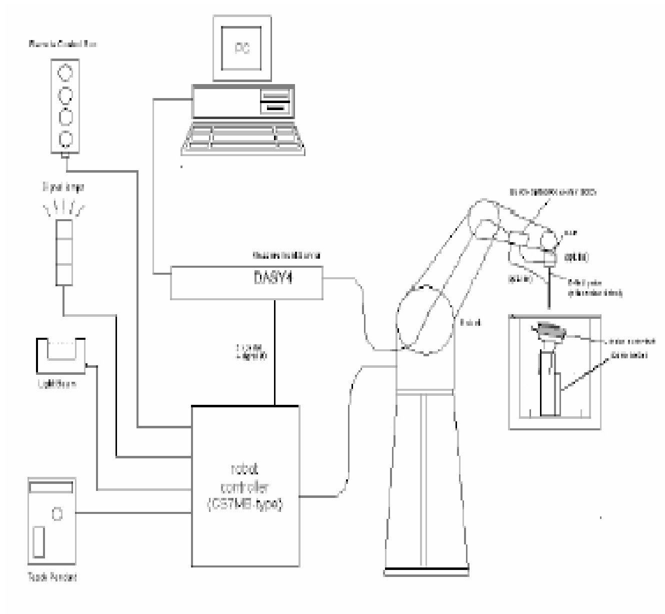


Figure 3.1 HAC Measurement System Setup

System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control is used to drive the robot motors. The PC consists of the Samsung computer with Windows XP system and HAC Measurement Software DASY4(or DASY5), LCD monitor, mouse and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the measurement server

System Electronics

The DAE4(or DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

3.2 Probe Description

ER3DV6 E-Field Probe Description

Construction: One dipole parallel, two dipoles normal to probe axis
Built-in shielding against static charges

Calibration: In air from 100 MHz to 3.0 GHz
(absolute accuracy ±6.0%, k=2)

Frequency: 100 MHz to > 6 GHz;
Linearity: ± 0.2 dB (100 MHz to 3 GHz)

Figure 3.2 E-field Probe

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

Dynamic Range 2V/m to 1000V/m
(M3 or better device readings fall well below diode compression point)

Linearity : ±0.2dB

Dimensions Overall length: 330 mm (Tip: 16 mm)
Tip diameter: 8 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 2.5 mm

H3DV6 H-Field Probe Description

Construction: Three concentric loop sensors with 3.8 mm loop diameters Resistively loaded detector diodes for linear response Built-in shielding against static charges

Frequency: 200 MHz to 3 GHz (absolute accuracy ± 6.0%, k=2); Output linearized

Directivity: ± 0.25 dB (spherical isotropy error)

Dynamic Range: 10mA/mto2A/mat1 GHz
(M3 or better device readings fall well below diode compression point)

Dimensions: Overall length: 330 mm (Tip: 40 mm)
Tip diameter: 6 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 3 mm

E-Field Interference < 10% at 3 GHz (for plane wave)

Figure 3.3 H-field Probe

3.3 Test Arch Phantom

Enables easy and well defined positioning of the phone and calibration dipoles as well as simple teaching of the robot (See Figure 3.4)

Dimensions: 370 x 370 x 370 mm

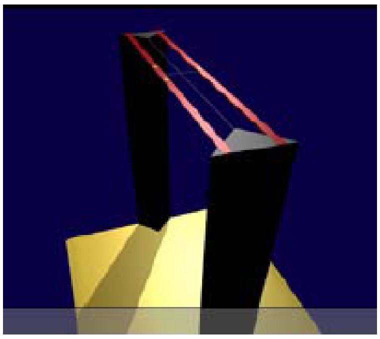


Figure 3.4 Test Arch Phantom

3.4 Validation Dipole

The reference dipole should have a return loss better than –20 dB (measured in the setup) at the resonant frequency to reduce the uncertainty in the power measurement.

Application	- Free space antenna - Hearing Aid susceptibility measurements according to ANSI C 63.19 - Validaation of Hearing Aid RF setup for wireless device emission measurement according to ANSI C63.19
Frequency	835 MHz, 1880 MHz
Return Loss	< -20 dB at specified validation position
Dimensions	835 MHz : 166 x 330 mm 1880MHz : 80.8 x 330 mm

3.5 Equipment Calibration

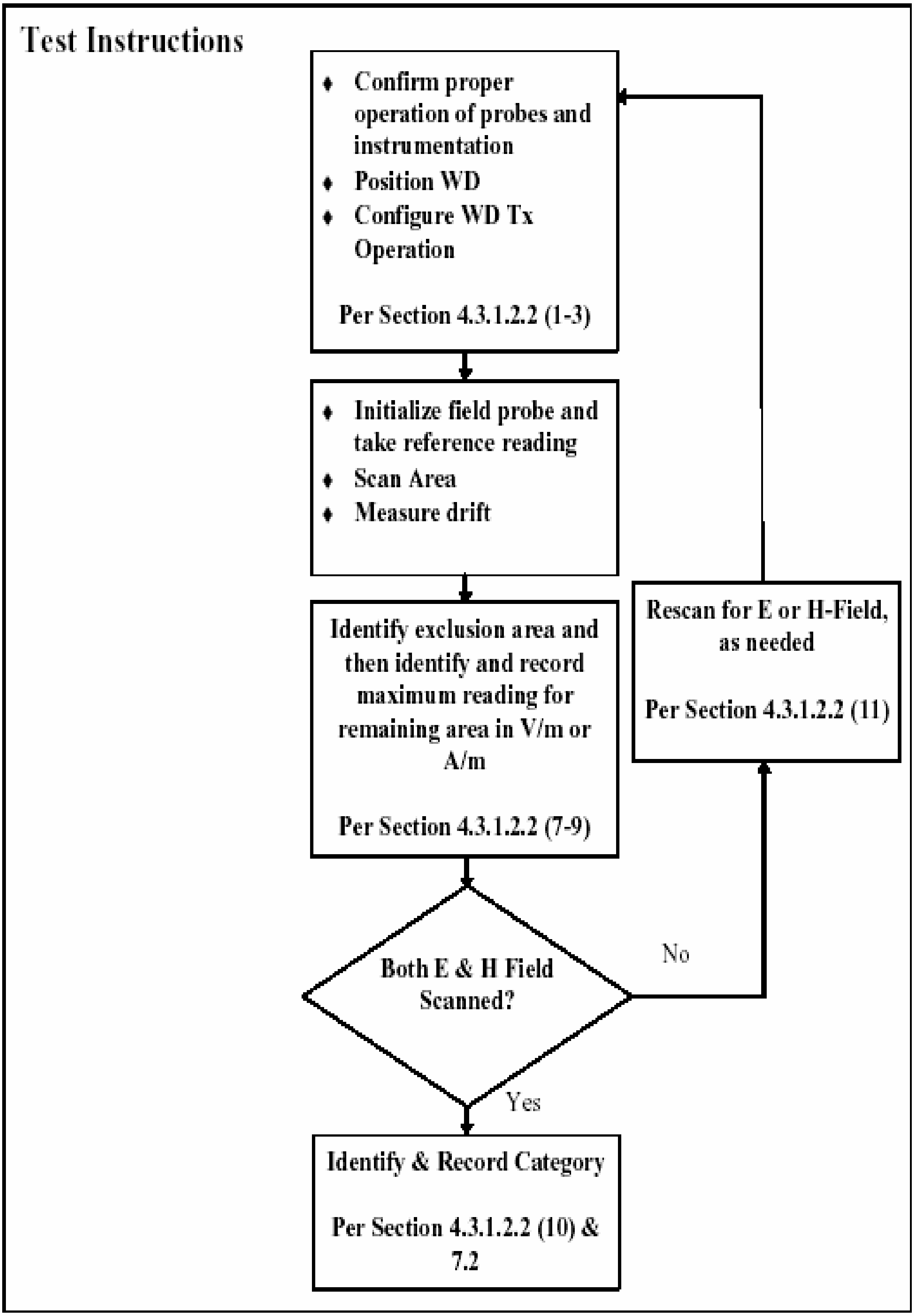
Table 3.2 Test Equipment Calibration

Type	Calibration Due Date	Serial No.
Stäubli Robot RX90BL	Not Required	F05/51G6A1/A/01
HAC Phantom	Not Required	1018
SPEAG DAE4	2011.03.18	670
SPEAG E-Field Probe ER3DV6	2011.03.16	2370
SPEAG H-Field Probe H3DV6	2011.01.22	6200
SPEAG Validation Dipole CD835 V3	2011.02.11	1105
SPEAG Validation Dipole CD1880 V3	2011.03.10	1016
E4438C Signal Generator	2011.04.14	MY47271094
BBS3Q7ECK Power Amp	2010.10.20	1007D/C0035
P-Series Power Meter	2011.03.24	MY45100306
Widenand Power Sensor	2011.03.24	MY45240464
Widenand Power Sensor	2011.03.24	MY45240463
DASY4 S/W (ver 4.7)	Not Required	-
Directional Coupler	2011.05.28	18862
Spectrum Analyzer	2011.03.08	MY45304704
Base Station Simulator	2010.12.21	GB46490113

NOTE:

The E-field and H-field probe was calibrated by SPEAG,

4. HAC MEASUREMENT PROCEDURE



The evaluation was performed using the following procedure.

1. Confirm proper operation of the field probe, probe measurement system, and other instrumentation.

2. WD is positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.

3. The WD operation for maximum rated RF output power was configured and confirmed with the base station simulator, at the test channel and other normal operating parameters as intended for the test. The battery was ensured to be fully charged before each test.

4. The center sub-grid was centered over the center of the acoustic output (also audio band magnetic output, if applicable). The WD audio output was positioned tangent (as physically possible) to the measurement plane.

5. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the HAC Phantom.

6. The measurement system measured the field strength at the reference location.

7. Measurements at 2mm increments in the 5 x 5 cm region were performed and recorded. A 360° rotation about the azimuth axis at the maximum interpolated position was measured. For the worst-case condition, the peak reading from this rotation was used in re-evaluating the HAC category.

8. The system performed a drift evaluation by measuring the field at the reference location.

9. Steps 1-8 were done for both the E and H-Field measurements.

10. The HAC measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5% occurred, the tests were repeated.

5. DESCRIPTION OF TEST POSITION

5.1 Measurement reference and plane

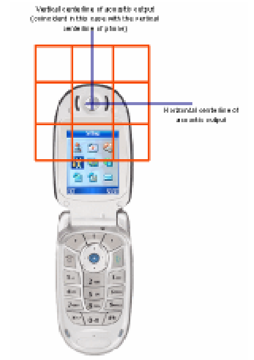


Figure 5.1 Wireless Device and Measurement Plane

1. The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.

2. The grid is centered on the audio frequency output transducer of the WD (speaker or T- coil).

3. The grid is in a reference plane, which is defined as the planar area that contains the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver area of the phone and is defined by the points of the receiver-end of the WD handset, which, in normal handset use,

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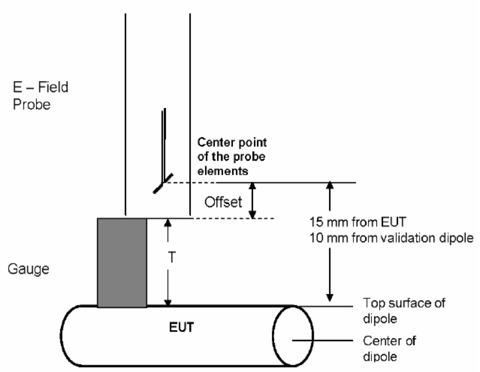


Figure 5.2 Gauge block with E-field probe

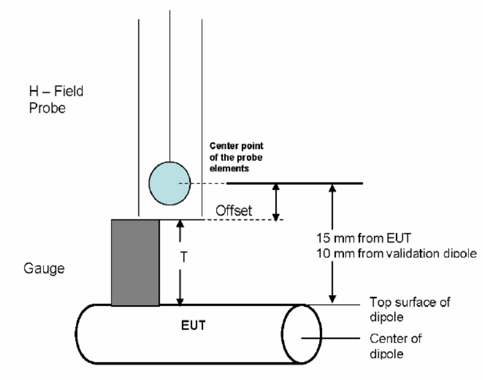


Figure 5.3 Gauge block with H-field probe

6.Measurement Uncertainty

Source of Uncertainty		Value	probability distribution	Divisor	c_i E	c_i H	Standard uncertainty E	Standard uncertainty H	vi or veff E	vi or veff H
Measurement System										
Probe Calibration		5.05	normal	1.000	1	1	5.05	2.55	0	0
Axial Isotropy		4.70	rectangular	1.732	1	1	2.71	2.71	∞	∞
Sensor Displacement		16.50	rectangular	1.732	1	0.145	9.53	1.38	∞	∞
Boundary Effects		2.40	rectangular	1.732	1	1	1.39	1.39	∞	∞
Linearity		4.70	rectangular	1.732	1	1	2.71	2.71	∞	∞
Scaling to Peak Envelop Power		2.00	rectangular	1.732	1	1	1.15	1.15	∞	∞
System Detection Limit		1.00	rectangular	1.732	1	1	0.58	0.58	∞	∞
Readout Electronics		0.30	normal	1.000	1	1	0.30	0.30	∞	∞
Response Time		0.80	rectangular	1.732	1	1	0.46	0.46	∞	∞
Integration time		2.60	rectangular	1.732	1	1	1.50	1.50	∞	∞
RF Ambient condition		3.00	rectangular	1.732	1	1	1.73	1.73	∞	∞
RF Reflections		3.92	normal	1.000	1	1	3.92	3.92	2	2
Probe Positioner		1.20	rectangular	1.732	1	0.67	0.69	0.46	∞	∞
Probe Positioning		4.70	rectangular	1.732	1	0.67	2.71	1.82	∞	∞
Variability between 2mm & 5mm		3.85	normal	1.000	1	1	3.85	3.85	4	4
Extrap. And Interpolation		1.00	rectangular	1.732	1	1	0.58	0.58	∞	∞
Test Sample Related										
Device Positioning		0.57	normal	1.000	1	0.67	0.57	0.38	24	24
Device Holder and Phantom		2.40	rectangular	1.732	1	1	1.39	1.39	∞	∞
Power Drift		5.00	rectangular	1.732	1	1	2.89	2.89	∞	∞
Phantom and Setup Related										
Phantom Thickness		2.40	rectangular	1.732	1	0.7	1.39	0.93	∞	∞
$u_c(F_S)$	**Combined Standard Uncertainty**		**normal**				**13.82**	**9.83**	211	54
$U(F_S)$	**Expanded Uncertainty**		**normal k=**	**2.0**			**27.09**	**19.26**		

7. SYSTEM VERIFICATION

7.1 Test System Validation

Prior to assessment, the system is verified to the ±10% of the specification at 835MHz, 1880MHz, by using the system validation kit(s). (see Appendix C, Graphic Plot Attached)

Table 7.2 System Validation Results

Frequency	Targeted E-field (V/m)	Measured E-field (V/m)	Deviation (%)	Targeted H-field (A/m)	Measured H-field (A/m)	Deviation (%)	Date
835 MHz	159.2	155.9	-2.07	0.448	0.46	2.68	Aug.26.2010
1880 MHz	138.8	132	-4.90	0.471	0.45	-4.46	Aug.27.2010

*Validation was measured with input power 100 mW

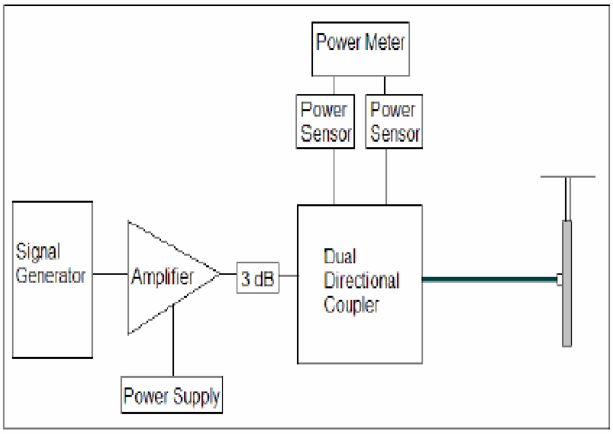


Figure 7.1 Dipole Validation Test Setup

Validations of the DASY4(or DASY5) test system were performed using the measurement equipment listed in Section 3.2. All validations occur in free space using the DASY4(or DASY5) test arch. Note that the 10mm probe to dipole separation is measured from the top edge of the dipole to the calibration reference point of the probe. SPEAG uses the center point of the probe sensor(s) as the reference point when establishing targets for their dipoles. Therefore, because SPEAG's dipoles and targets are used, it is appropriate to measure the 10mm separation distance to the center of the sensors as they do. This reference point was used for validation only. Validations were performed at 835 MHz and/or 1880 MHz. These frequencies are within each operating band and are within 2MHz of the mid-band frequency of the test device. The obtained results from the validations are displayed in the table 7.2.

8. MODULATION FACTOR

After every probe calibration, the response of the probe to each applicable modulated signal (CDMA, GSM, etc) must be assessed at both 835 MHz and 1880 MHz. The response of the probe system to a CW field at the frequency(s) of interest is compared to its response to a modulated signal with equal peak amplitude. For each PMF assessment, a Signal Generator was used to replace the original CW signal with the desired modulated signal. The PMF results are shown in Tables 5.
RF Field Probe Modulation Response was measured with the field probe and associated measurement equipment. The proposed setup corresponds to the procedure as required in the Standard.

1. Install a validation dipole for the appropriate frequency band under the Test Arch Phantom Move the probe to the field reference point. Do not move the probe between the corresponding CW and modulated measurements.

2. Install the field probe in the setup.

3. The signal to the dipole must be monitored to record peak amplitude. Set a CW signal to the same level (refer to Appendix B)

4. Set the procedure properties (frequency, modulation frequency and crest factor) according to the measured signal. Define a multimeter job for the field reading.

5. Define a second procedure for the evaluation of the CW signal (frequency set as above, modulation frequency = 0, crest factor = 1) and a multimeter job.

6. The ratio of the CW reading to modulated signal reading is the probe modulation factor(PMF) for the modulation and field probe combination. This was repeated for 80% AM.

7. Steps 1-6 were repeated at all frequency bands and for both E and H field probes.

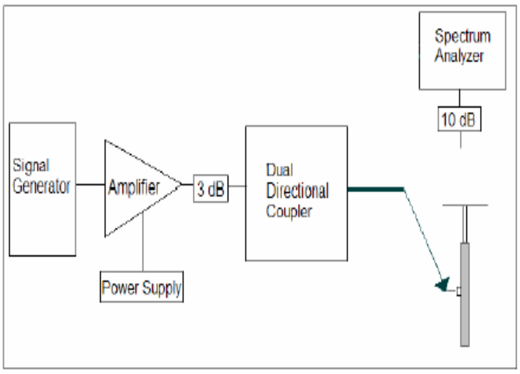


Figure 8.1 Setup to Dipole

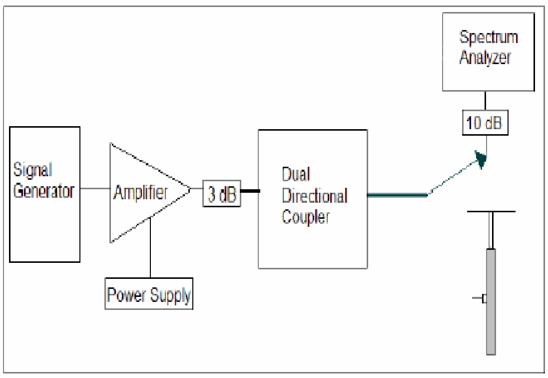


Figure 8.2 Setup to Peak Power using Spectrum Analyzer

8.1 Modulation Factors

Frequency	Protocol	E-field (V/m)	H-field (A/m)	E-Field PMF	H-Field PMF
835 MHz	AM	48.1	0.111	1.57	1.56
835 MHz	CDMA	75.9	0.178	1.00	0.98
835 MHz	CW	75.7	0.174	-	-
1880 MHz	AM	22.7	0.073	1.54	1.53
1880 MHz	CDMA	35.2	0.112	0.99	0.99
1880 MHz	CW	34.8	0.111	-	-
1880 MHz	CW	34.8	-	-	-
1880 MHz	RC1/SO3	12.4	-	2.77	-

Table 8.1 Modulation Factors

8.2 CW and Modulated Signal Zero-span plots:

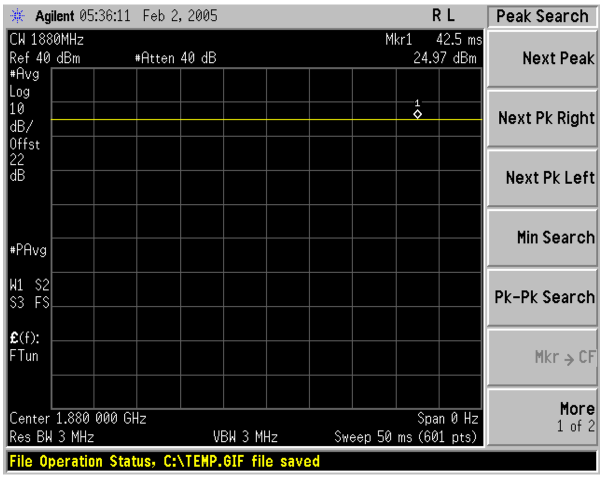


Figure 8.3 CW Signal

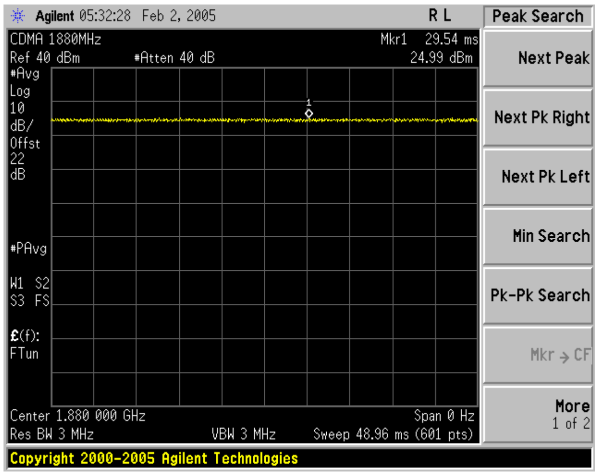


Figure 8.4 CDMA Signal

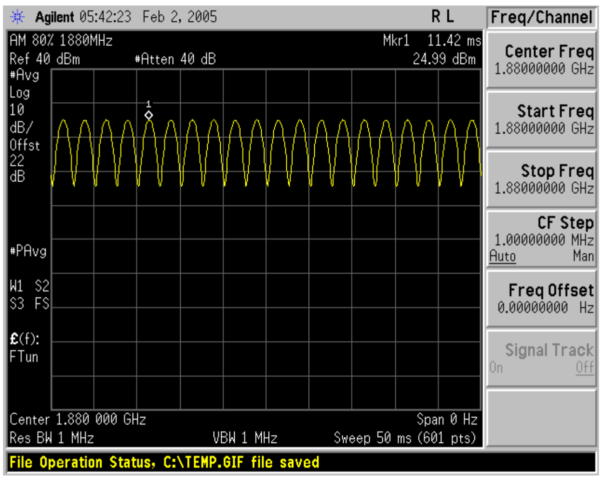


Figure 8.5 AM 80% Signal

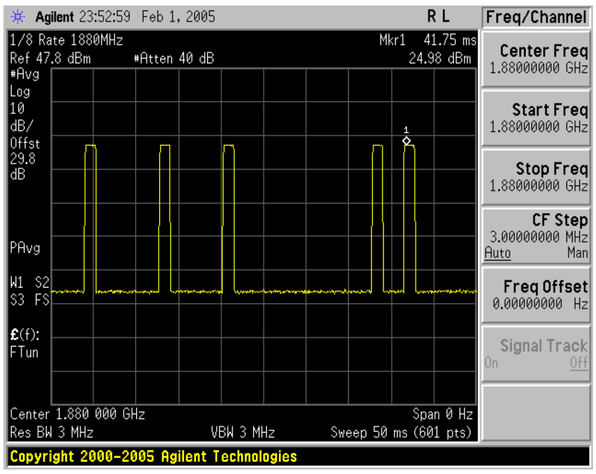


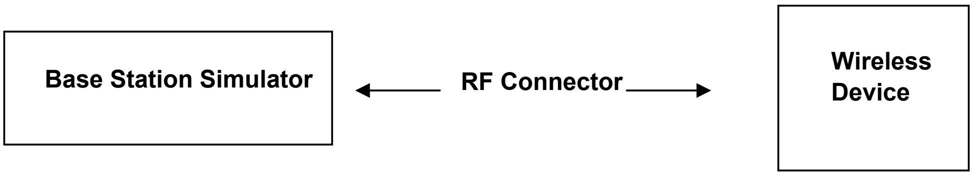
Figure 8.6 1/8 rate Signal

9. FCC 3G MEASUREMENTS – MAY/JUNE 2006

Sample pre-testing of the various modes were performed at the worst case probe location as part of subset testing justification. See below for measured conducted power for applicable device modes.

9.1 Handset Capabilities*

* See Device Capabilities attachment for applicable device modes and powers



9.2 Worst-Case Probe Location Measurements

Below are RC/SO mode investigation results of the device at the worst-case(maximum) field point location with multimeter function of DASY4

Mode	Channel	Back light	RC/SO	Battery	Antenna	Conducted Power at BS(dBm)	Time Avg. Field [V/m]	Peak Field [V/m]	Peak Field [dBV/m]	Category	FCC limit [dBV/m]	FCC Margin [dB]
E-field Emissions												
PCS	600	off	RC3/SO55	Standard	Intenna	25.0	29.8	29.51	29.40	M4	41.0	-11.60
PCS	600	on	RC3/SO55	Standard	Intenna	25.0	29.5	29.21	29.31	M4	41.0	-11.69
PCS	600	off	RC1/SO2	Standard	Intenna	24.8	29.2	28.91	29.22	M4	41.0	-11.78
PCS	600	off	RC3/SO2	Standard	Intenna	25.0	28.8	28.51	29.10	M4	41.0	-11.90
PCS	600	off	RC1/SO55	Standard	Intenna	24.8	28.2	27.96	28.93	M4	41.0	-12.07
PCS	600	off	RC2/SO9	Standard	Intenna	24.9	28.6	28.35	29.05	M4	41.0	-11.95
PCS	600	off	RC1/SO3	Standard	Intenna	24.8	10.5	29.04	29.26	M4	41.0	-11.74
PCS	600	off	RC3/SO3	Standard	Intenna	24.8	27.0	26.73	28.54	M4	41.0	-12.46
PCS	600	off	RC2/SO17	Standard	Intenna	25.0	10.4	28.77	29.18	M4	41.0	-11.82

Table 9-1 Handset 3G mode variation on RF Emission

10. Test Results

10.1 Measurement Results(E-field)

E-FIELD EMISSIONS:

Mode	Channel	Back light	RC/SO	Battery	Antenna	Conducted Power at BS(dBm)	Time Avg. Field [V/m]	Peak Field [V/m]	Peak Field [dBV/m]	Category	FCC limit [dBV/m]	FCC Margin [dB]	Excl Blocks Per 4.3.1.2.2
E-field Emissions													
CDMA	1013	off	RC3/SO55	Standard	Intenna	24.8	48.3	48.3	33.68	M4	51.0	-17.32	None
CDMA	384	off	RC3/SO55	Standard	Intenna	24.8	50.8	50.8	34.12	M4	51.0	-16.88	None
CDMA	777	off	RC3/SO55	Standard	Intenna	25.0	55.6	55.6	34.90	M4	51.0	-16.10	None
PCS	25	off	RC3/SO55	Standard	Intenna	24.8	28.5	28.2	29.00	M4	41.0	-12.00	None
PCS	600	off	RC3/SO55	Standard	Intenna	24.9	29.6	29.3	29.34	M4	41.0	-11.66	None
PCS	1175	off	RC3/SO55	Standard	Intenna	24.8	27.5	27.2	28.69	M4	41.0	-12.31	None
T-Coil Location	600	off	RC3/SO55	Standard	Intenna	24.9	29.6	29.30	28.00	M4	41.0	-12.06	None

NOTES:

1. The test data reported are the worst-case HAC value with the test position set in a typical configuration. Test procedures used are according to ANSI C 63.19 (2007).
2. All modes of operation were investigated, and the worst-case results are reported.
3. Battery is fully charged for all readings.
4. Power Measured ☑ Conducted
5. Battery Option ☑ Standard ☐ Extended ☐ Slim
6. Bluetooth deactivated (According to customer's request)
7. "T-Coil Location" is the result of RF-Emission that was measured at T-Coil center.

Note: Worst-case measurement evaluated for worst-case 1/8 rate gating condition in RC1/SO3; Mute=Yes

10.2 Measurement Results(H-field)

H-FIELD EMISSIONS:

Mode	Channel	Back light	RC/SO	Battery	Antenna	Conducted Power at BS(dBm)	Time Avg. Field [A/m]	Peak Field [A/m]	Peak Field [dBA/m]	Category	FCC limit [dBA/m]	FCC Margin [dB]	Excl Blocks Per 4.3.1.2.2
H-field Emissions													
CDMA	1013	off	RC3/SO55	Standard	Intenna	24.8	0.108	0.106	-19.49	M4	0.6	-20.09	None
CDMA	384	off	RC3/SO55	Standard	Intenna	24.8	0.112	0.110	-19.17	M4	0.6	-19.77	None
CDMA	777	off	RC3/SO55	Standard	Intenna	25.0	0.126	0.123	-18.20	M4	0.6	-18.80	None
PCS	25	off	RC3/SO55	Standard	Intenna	24.8	0.082	0.081	-21.83	M4	-9.4	-12.43	None
PCS	600	off	RC3/SO55	Standard	Intenna	24.9	0.086	0.085	-21.41	M4	-9.4	-12.01	None
PCS	1175	off	RC3/SO55	Standard	Intenna	24.7	0.990	0.084	21.52	M4	-9.4	-12.11	None

NOTES:

1. The test data reported are the worst-case HAC value with the test position set in a typical configuration. Test procedures used are according to ANSI C 63.19 (2007).
2. All modes of operation were investigated, and the worst-case results are reported.
3. Battery is fully charged for all readings.
4. *Power Measured ☑ Conducted
5. Battery Option ☑ Standard ☐ Extended ☐ Slim
6. Bluetooth deactivated (According to customer's request)

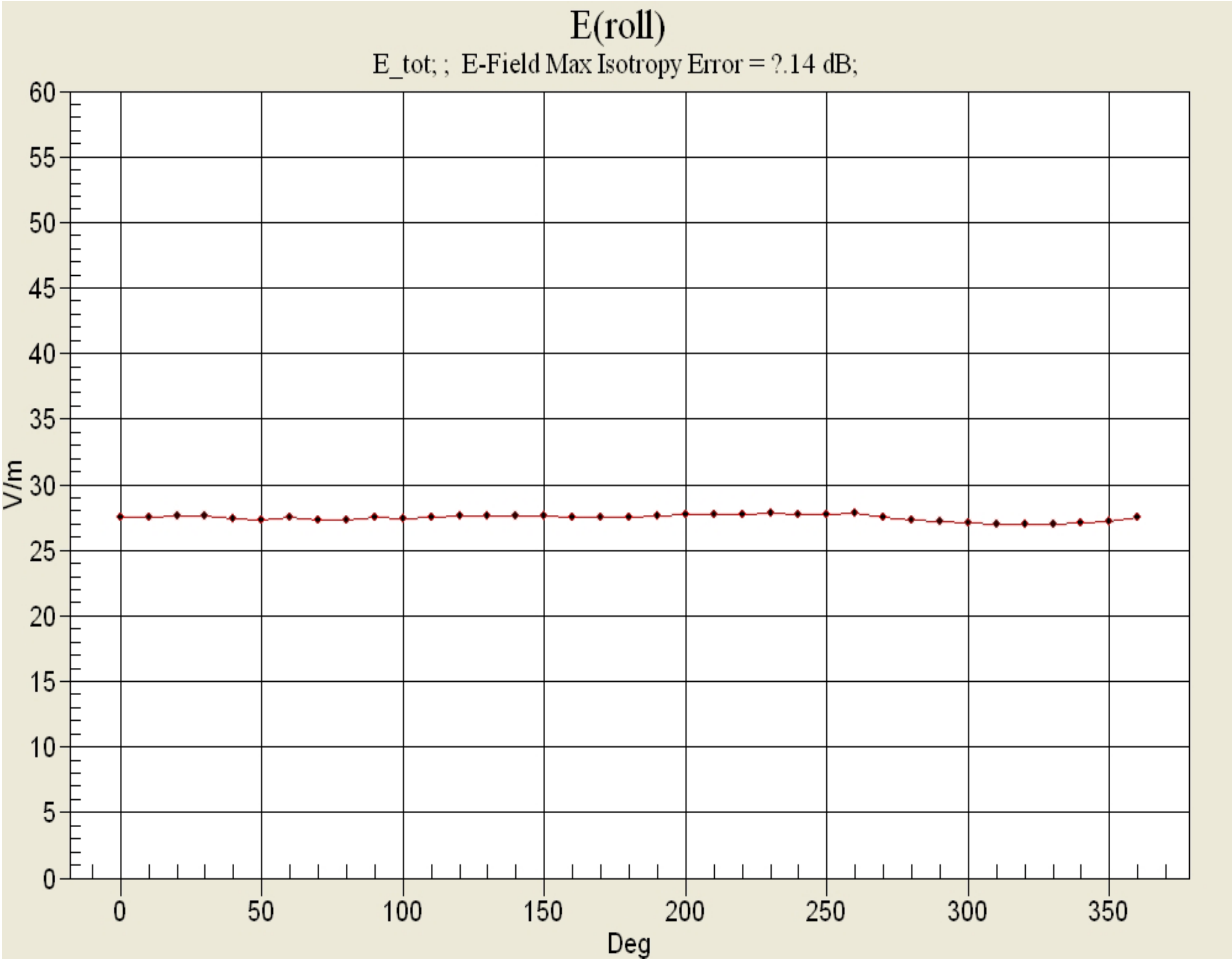
Note: Worst-case measurement evaluated for worst-case 1/8 rate gating condition in RC1/SO3; Mute=Yes

10.3 Worst-case Configuration Evaluation

PCS E-Field Emission

Mode	Channel	Back light	RC/SO	Battery	Antenna	Conducted Power at BS(dBm)	Time Avg. Field [V/m]	Peak Field [V/m]	Peak Field [dBV/m]	Category	FCC limit [dBV/m]	FCC Margin [dB]
E-field Emissions												
PCS	660	Off	RC3/SO55	Standard	Intenna	25.0	27.8	27.50	28.79	M4	41.0	-12.21

Peak Reading 360 degree Probe Rotation at Azimuth axis



Worst-Case Probe Rotation about Azimuth axis

Note: Location of probe rotation is shown in APPENDIX E

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APPENDIX A

Probe Modulation Factor

Measurement procedure

1. Modulated signal measurement: Connect the modulated signal with the correct frequency via the cable to the dipole.
2. Run the multimeter in the procedure with the corresponding modulation setting in continuous mode.
3. Adjust the signal amplitude to acheive the same field level display in the multimeter as during the WD field scan. Read the multimeter display and note it together with the probe ID,modulation type and frequency.
4. Read the peak envelope on the monitor in order to adjust the CW signal later to the same level.
5. Switch the signal source off and verify that the ambient and instrumentation noise level is at least 10dB lower.
6. CW measurement: Change the signal to CW at the same center frequency, without touching or moving the dipole or probe in the setup.
7. Adjust the CW signal amplitude to the same peak level on the monitor.
8. Run the multimeter in the CW procedure in continuous mode.
9. Read the multimeter display and note it together with the probe ID, modulation type and frequency.
10. Calculate the Probe Modulation Factor as the ratio between the CW multimeter field reading and the r for the applicable modulation.
11. Perform the above setup and procedure for E-field and H-field probes.

Spectrum Analyzer setting.

1. Frequency Setting

ex) 835 MHz, 1880MHz, 2450 MHz

2. RBW/VBW/SPAN/Detector Setting.

	CW	GSM	CDMA	WCDMA	AM80%
RBW	Same setting with modulated signal respectively.	1MHz	3MHz	5MHz	1MHz
VBW		1MHz	3MHz	5MHz	1MHz
SPAN		0MHz	0MHz	0MHz	0MHz
DETECTOR		Peak	Average	Average	Peak

3. Trigger: Video or IF trigger, adjusted to give a stable display of the transmission
4. Sweep rate: Sufficiently rapid to permit the transmit pulse to be resolved accurately.

APPENDIX B

ANSI C63.19 (2007)- Telephone near-field categories.

Category	Telephone RF Parameters <960MHz				
Near Field	AWF	E-Field Emissions		H-Field Emissions	
Category M1/T1	0	631.0 to 1122.0	V/m	1.91 to 3.39	A/m
	-5	473.2 to 841.4	V/m	1.43 to 2.54	A/m
Category M2/T2	0	354.8 to 631.0	V/m	1.07 to 1.91	A/m
	-5	266.1 to 473.2	V/m	0.80 to 1.43	A/m
Category M3/T3	0	199.5 to 354.8	V/m	0.60 to 1.07	A/m
	-5	149.6 to 266.1	V/m	0.45 to 0.80	A/m
Category M4/T4	0	< 199.5	V/m	< 0.60	A/m
	-5	< 149.6	V/m	< 0.45	A/m
Category	Telephone RF Parameters >960MHz				
Near Field	AWF	E-Field Emissions		H-Field Emissions	
Category M1/T1	0	199.5 to 354.8	V/m	0.60 to 1.07	A/m
	-5	149.6 to 266.1	V/m	0.45 to 0.80	A/m
Category M2/T2	0	112.2 to 199.5	V/m	0.34 to 0.60	A/m
	-5	84.1 to 149.6	V/m	0.25 to 0.45	A/m
Category M3/T3	0	63.1 to 112.2	V/m	0.19 to 0.34	A/m
	-5	47.3 to 84.1	V/m	0.14 to 0.25	A/m
Category M4/T4	0	<63.1	V/m	<0.19	A/m
	-5	<47.3	V/m	<0.14	A/m

Table B.1 Telephone near-field categories in linear units.

Category	Telephone RF Parameters <960MHz				
Near Field	AWF	E-Field Emissions		H-Field Emissions	
Category M1/T1	0	56 to 61	dB (V/m)	+5.6 to +10.6	dB (A/m)
	-5	53.5 to 58.5	dB (V/m)	+3.1 to +8.1	dB (A/m)
Category M2/T2	0	51 to 56	dB (V/m)	+0.6 to +5.6	dB (A/m)
	-5	48.5 to 53.5	dB (V/m)	-1.9 to +3.1	dB (A/m)
Category M3/T3	0	46 to 51	dB (V/m)	-4.4 to +0.6	dB (A/m)
	-5	43.5 to 48.5	dB (V/m)	-6.9 to -1.9	dB (A/m)
Category M4/T4	0	<46	dB (V/m)	< -4.4	dB (A/m)
	-5	< 43.5	dB (V/m)	< -6.9	dB (A/m)
Category	**Telephone RF Parameters >960MHz**				
Near Field	**AWF**	**E-Field Emissions**		**H-Field Emissions**	
Category M1/T1	0	46 to 51	dB (V/m)	-4.4 to 0.6	dB (A/m)
	-5	43.5 to 48.5	dB (V/m)	-6.9 to -1.9	dB (A/m)
Category M2/T2	0	41 to 46	dB (V/m)	-9.4 to -4.4	dB (A/m)
	-5	38.5 to 43.5	dB (V/m)	-11.9 to -6.9	dB (A/m)
Category M3/T3	0	36 to 41	dB (V/m)	-14.4 to -9.4	dB (A/m)
	-5	33.5 to 38.5	dB (V/m)	-16.9 to -11.9	dB (A/m)
Category M4/T4	0	<36	dB (V/m)	<-14.4	dB (A/m)
	-5	<33.5	dB (V/m)	<-16.9	dB (A/m)

Table B.2 Telephone near-field categories in logarithmic units.

APPENDIX C

The Validation Measurements

DUT: Dipole 835 MHz; Serial: CD835V3 - SN:1105
Program Name: HAC 835MHz E-field Validation, Date: 2010/08/26
Procedure Name: E Scan 10mm above Dipole

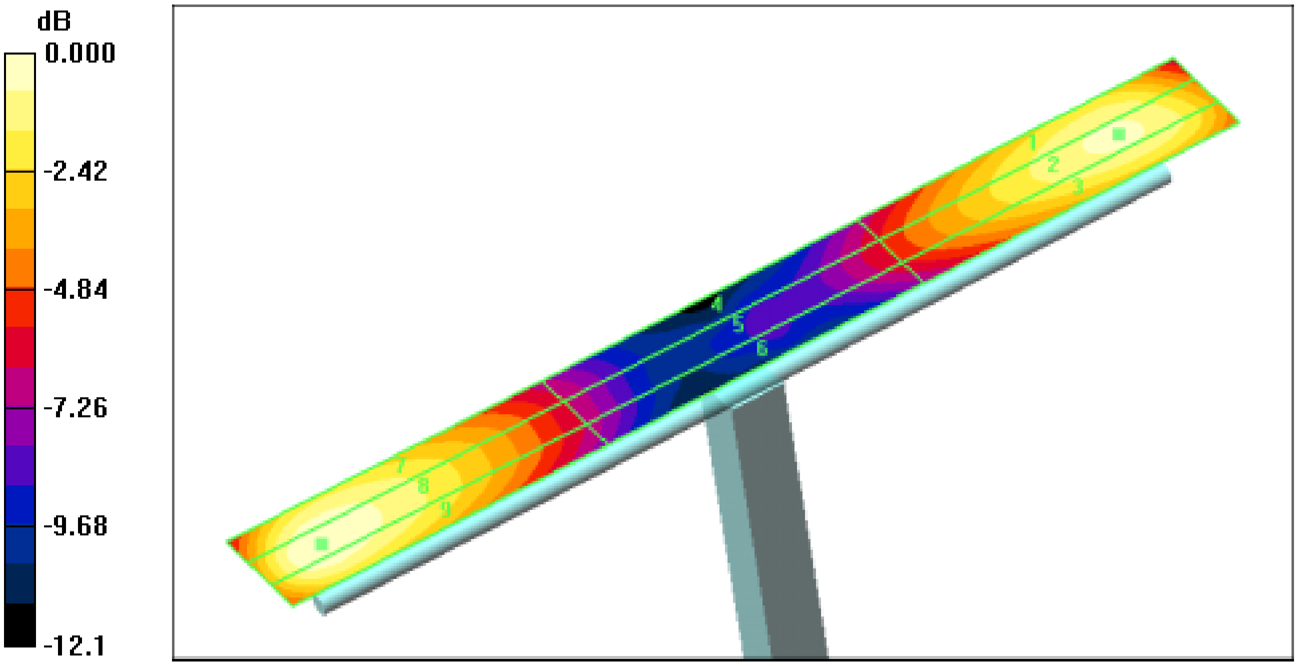
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: E Dipole Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2370; ConvF(1, 1, 1); Calibrated: 2010-03-16
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn670; Calibrated: 2010-03-18
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

E Scan 10mm above Dipole/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 161.3 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 109.1 V/m; Power Drift = -0.016 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **147.7 M4**	Grid 2 **150.5 M4**	Grid 3 **146.8 M4**
Grid 4 **83.8 M4**	Grid 5 **85.7 M4**	Grid 6 **82.8 M4**
Grid 7 **155.0 M4**	Grid 8 **161.3 M4**	Grid 9 **157.6 M4**



0 dB = 161.3V/m

DUT: Dipole 835 MHz; Serial: CD835V3 - SN:1105
Program Name: HAC 835MHz H-field Validation, Date: 2010/08/26
Procedure Name: H Scan 10mm above Dipole

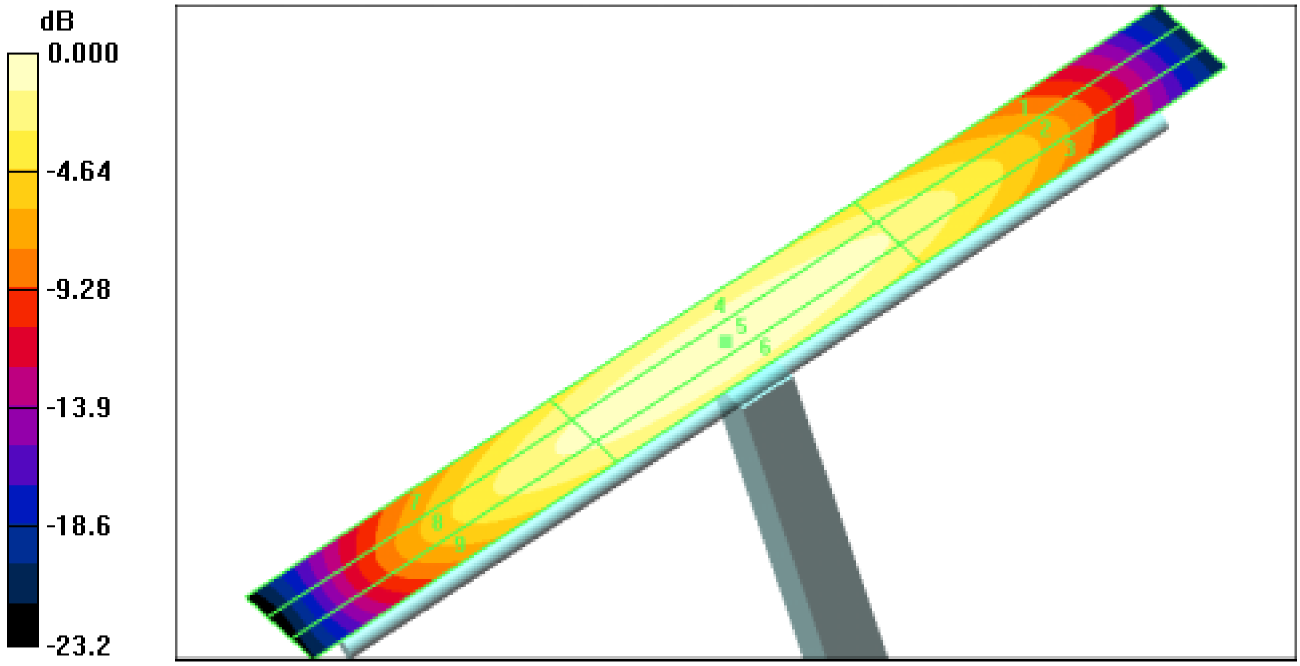
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section

DASY4 Configuration:
- Probe: H3DV6 - SN6200; ; Calibrated: 2010-01-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn670; Calibrated: 2010-03-18
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

H Scan 10mm above Dipole/Hearing Aid Compatibility Test (41x361x1): Measurement grid:
dx=5mm, dy=5mm
Maximum value of peak Total field = 0.460 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.487 A/m; Power Drift = 0.053 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.360 M4**	Grid 2 **0.383 M4**	Grid 3 **0.370 M4**
Grid 4 **0.427 M4**	Grid 5 **0.460 M4**	Grid 6 **0.445 M4**
Grid 7 **0.380 M4**	Grid 8 **0.410 M4**	Grid 9 **0.398 M4**



0 dB = 0.460A/m

DUT: HAC Dipole 1880 MHz; Serial: SN:1016
Program Name: HAC 1880MHz E-field Validation, Date: 2010/08/27
Procedure Name: E Scan 10mm above Dipole

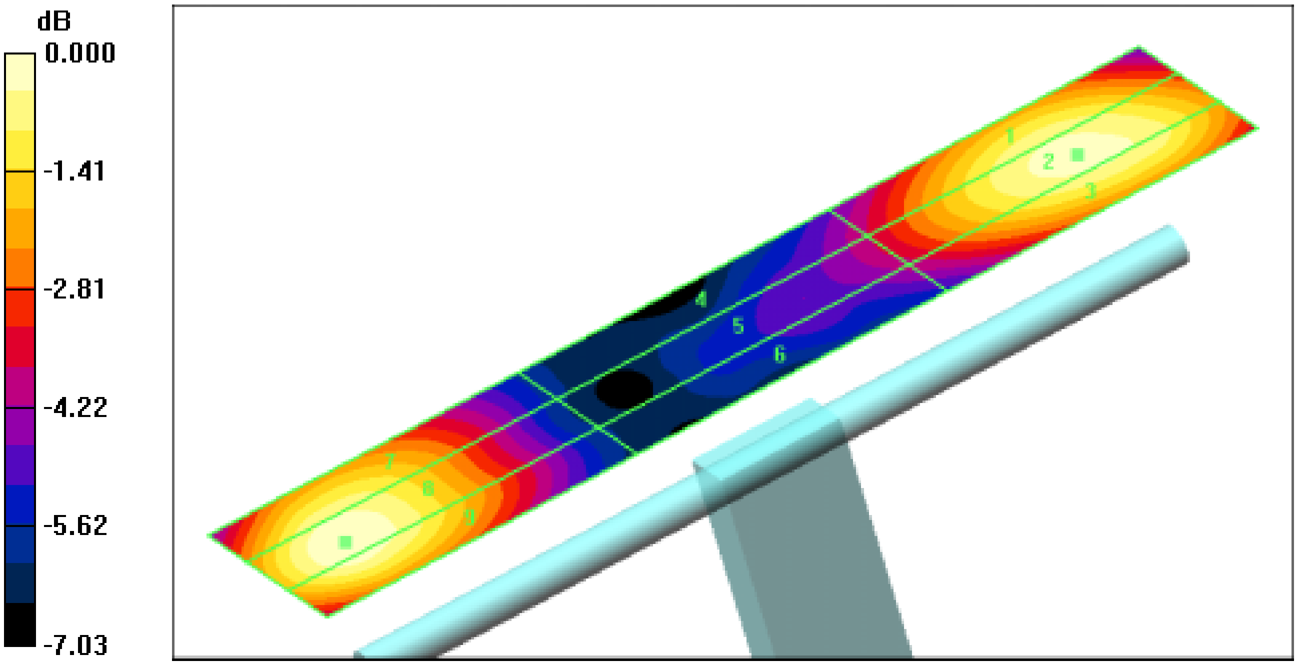
Communication System: CW; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: E Dipole Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2370; ConvF(1, 1, 1); Calibrated: 2010-03-16
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn670; Calibrated: 2010-03-18
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

E Scan 10mm above Dipole/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 134.4 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 150.3 V/m; Power Drift = 0.012 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **127.0 M2**	Grid 2 **130.3 M2**	Grid 3 **128.3 M2**
Grid 4 **87.1 M3**	Grid 5 **88.6 M3**	Grid 6 **85.1 M3**
Grid 7 **127.1 M2**	Grid 8 **134.4 M2**	Grid 9 **132.1 M2**



0 dB = 134.4V/m

DUT: HAC Dipole 1880 MHz; Serial: SN:1016
Program Name: HAC 1880MHz H-field Validation, Date: 2010/08/27
Procedure Name: H Scan 10mm above Dipole

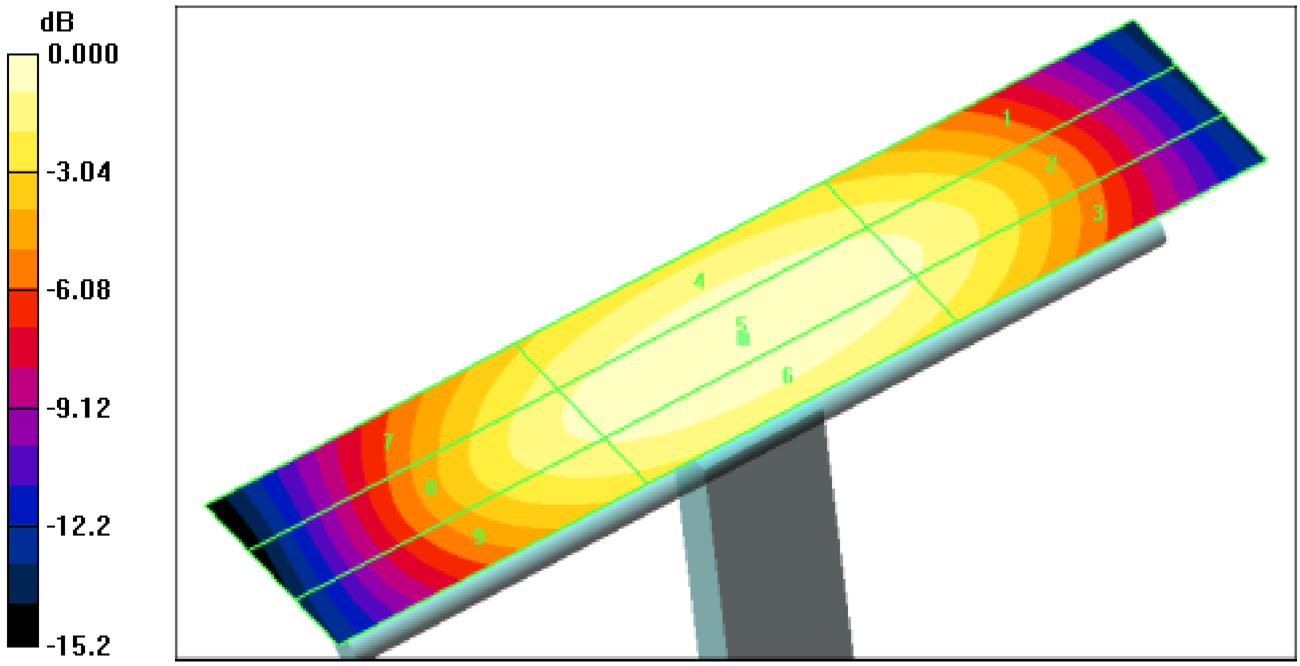
Communication System: CW; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section

DASY4 Configuration:
- Probe: H3DV6 - SN6200; ; Calibrated: 2010-01-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn670; Calibrated: 2010-03-18
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

H Scan 10mm above Dipole/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.450 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.474 A/m; Power Drift = 0.010 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.389 M2**	Grid 2 **0.415 M2**	Grid 3 **0.404 M2**
Grid 4 **0.422 M2**	Grid 5 **0.450 M2**	Grid 6 **0.439 M2**
Grid 7 **0.384 M2**	Grid 8 **0.414 M2**	Grid 9 **0.404 M2**



0 dB = 0.450A/m

APPENDIX D

Plots of The HAC Measurements

DUT: SCH-R250; Serial: FH-182-A
Program Name: SCH-R250(E-Field), Date: 2010/08/26
Procedure Name: Ch.0777, Ant, Intenna, Bat. Standard(RC3/SO55)

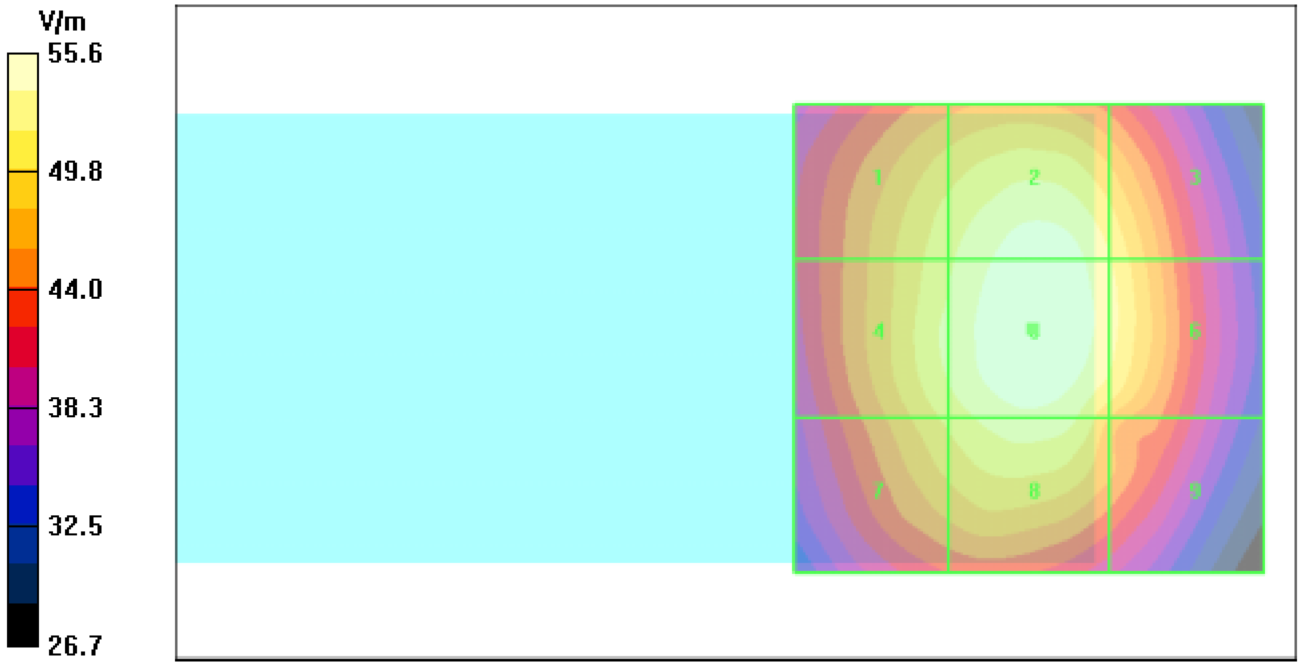
Communication System: CDMA&PCS; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2370; ConvF(1, 1, 1); Calibrated: 2010-03-16
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn670; Calibrated: 2010-03-18
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch.0777, Ant, Intenna, Bat. Standard(RC3/SO55)/Hearing Aid Compatibility Test (101x101x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 55.6 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 75.8 V/m; Power Drift = -0.028 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **51.4 M4**	Grid 2 **54.8 M4**	Grid 3 **51.9 M4**
Grid 4 **52.4 M4**	Grid 5 **55.6 M4**	Grid 6 **52.6 M4**
Grid 7 **50.4 M4**	Grid 8 **53.1 M4**	Grid 9 **47.9 M4**



DUT: SCH-R250; Serial: FH-182-A
Program Name: SCH-R250(E-Field), Date: 2010/08/27
Procedure Name: Ch.600, Ant, Intenna, Bat. Standard(RC3/SO55)

Communication System: CDMA&PCS; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

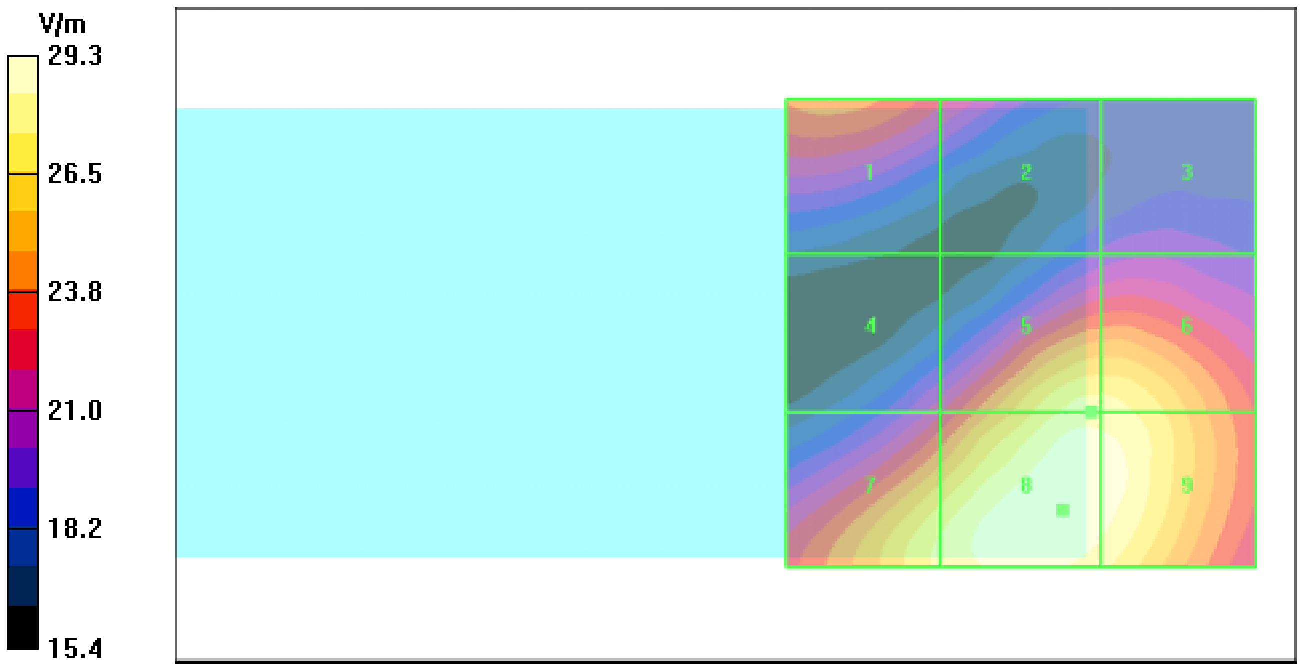
DASY4 Configuration:
- Probe: ER3DV6 - SN2370; ConvF(1, 1, 1); Calibrated: 2010-03-16
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn670; Calibrated: 2010-03-18
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch.600, Ant, Intenna, Bat. Standard(RC3/SO55)/Hearing Aid Compatibility Test (101x101x1):

Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 29.3 V/m
Probe Modulation Factor = 0.990
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 27.4 V/m; Power Drift = -0.105 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **24.2 M4**	Grid 2 **22.2 M4**	Grid 3 **19.9 M4**
Grid 4 **21.8 M4**	Grid 5 **28.0 M4**	Grid 6 **28.0 M4**
Grid 7 **27.8 M4**	Grid 8 **29.3 M4**	Grid 9 **29.0 M4**



DUT: SCH-R250; Serial: FH-182-A
Program Name: SCH-R250 (H-Field), Date:2010/08/26
Procedure Name: Ch.777, Ant, Intenna, Bat. Standard(RC3/SO55)

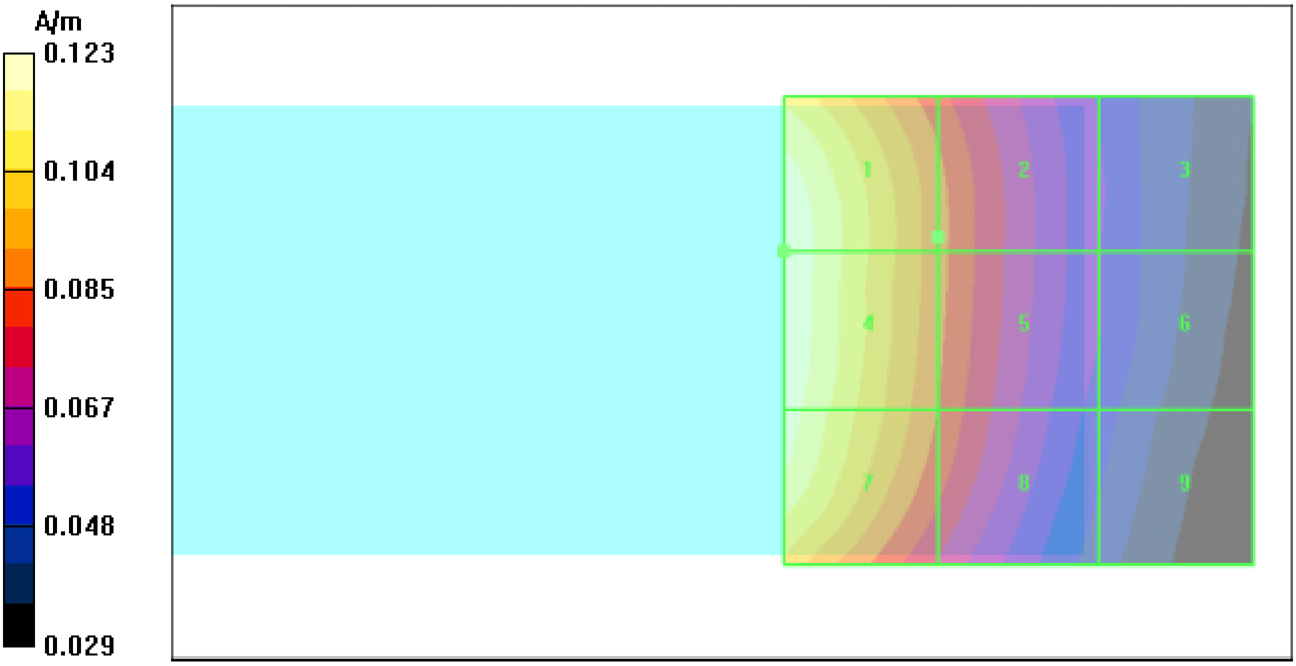
Communication System: CDMA&PCS; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6200; ; Calibrated: 2010-01-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn670; Calibrated: 2010-03-18
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch.777, Ant, Intenna, Bat. Standard(RC3/SO55)/Hearing Aid Compatibility Test (101x101x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.123 A/m
Probe Modulation Factor = 0.980
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.074 A/m; Power Drift = 0.038 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.123 M4**	Grid 2 **0.088 M4**	Grid 3 **0.055 M4**
Grid 4 **0.123 M4**	Grid 5 **0.088 M4**	Grid 6 **0.055 M4**
Grid 7 **0.120 M4**	Grid 8 **0.085 M4**	Grid 9 **0.052 M4**



DUT: SCH-R250; Serial: FH-182-A
Program Name: SCH-R250 (H-Field), Date:2010/08/27
Procedure Name: Ch.0600, Ant. Intenna, Bat. Standard(RC3/SO55)

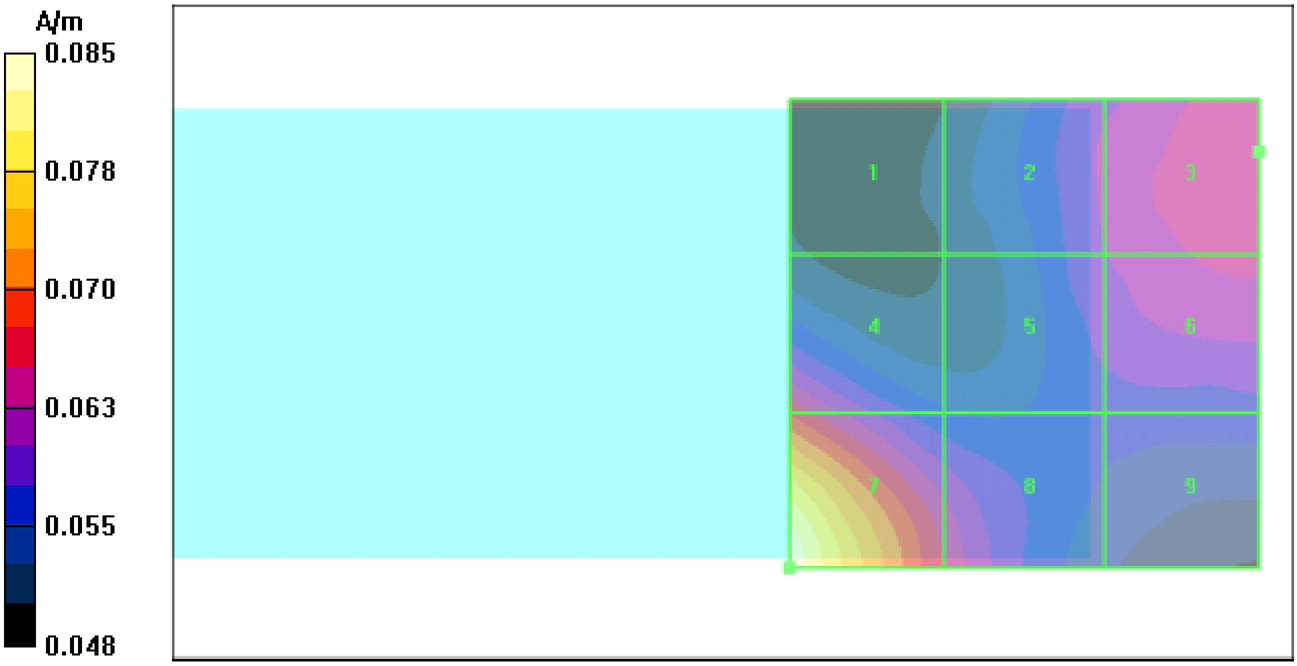
Communication System: CDMA&PCS; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, $\varepsilon_r = 1$; ρ = 1 kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6200; ; Calibrated: 2010-01-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn670; Calibrated: 2010-03-18
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch.0600, Ant. Intenna, Bat. Standard(RC3/SO55)/Hearing Aid Compatibility Test (101x101x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.085 A/m
Probe Modulation Factor = 0.990
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.058 A/m; Power Drift = -0.012 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.052 M4**	Grid 2 **0.061 M4**	Grid 3 **0.065 M4**
Grid 4 **0.068 M4**	Grid 5 **0.060 M4**	Grid 6 **0.064 M4**
Grid 7 **0.085 M4**	Grid 8 **0.065 M4**	Grid 9 **0.057 M4**



APPENDIX E

Probe Calibration(E-field)

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Samsung (Dymstec)**

Certificate No: ER3-2370_Mar10

CALIBRATION CERTIFICATE

Object	ER3DV6 - SN:2370
Calibration procedure(s)	QA CAL-02.v5 and QA CAL-25.v2 Calibration procedure for E-field probes optimized for close near field evaluations in air
Calibration date:	March 16, 2010

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 E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ER3DV6	SN: 2328	3-Oct-09 (No. ER3-2328_Oct09)	Oct-10
DAE4	SN: 789	23-Dec-09 (No. DAE4-789_Dec09)	Dec-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

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

Issued: March 19, 2010

O.k to use

2010.4.9

Glossary:

NORMx,y,z	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	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., ϑ = 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:

a) IEEE Std 1309-2005, " IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005.

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 for XY sensors and ϑ = 90 for Z sensor (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart).
- *DCPx,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.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* 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.
- *Spherical isotropy (3D deviation from isotropy)*: in a locally homogeneous field realized using an open waveguide setup.
- *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 *NORMx* (no uncertainty required).

Probe ER3DV6

SN:2370

Manufactured:	October 12, 2005
Last calibrated:	March 10, 2009
Recalibrated:	March 16, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ER3DV6 SN:2370

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)	1.74	1.64	2.01	± 10.1%
DCP (mV)[A]	98.2	94.3	96.7	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300	± 1.5 %
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

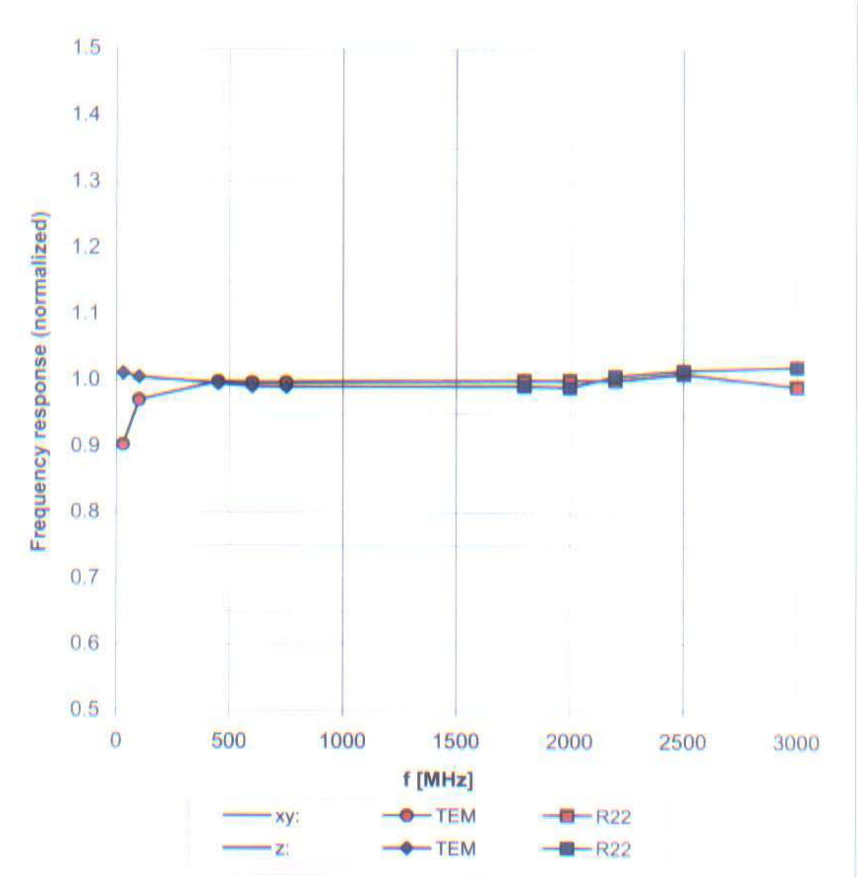
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] numerical linearization parameter: uncertainty not required

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

Frequency Response of E-Field

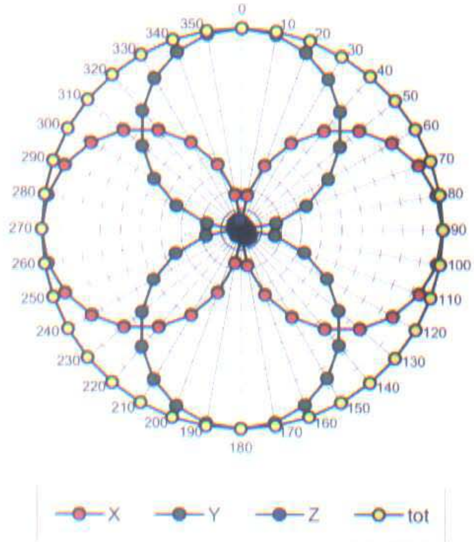
(TEM-Cell:ifi110 EXX, Waveguide R22)



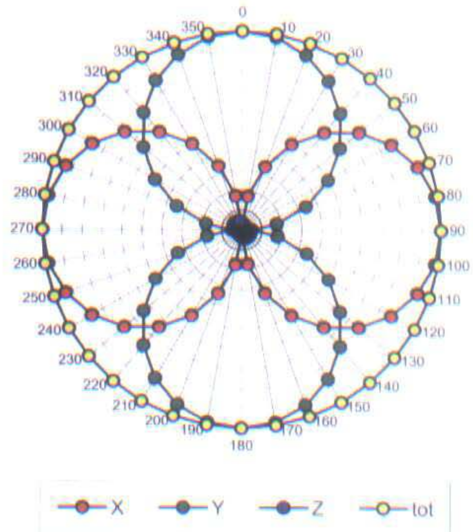
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$

f = 600 MHz, TEM ifi110EXX

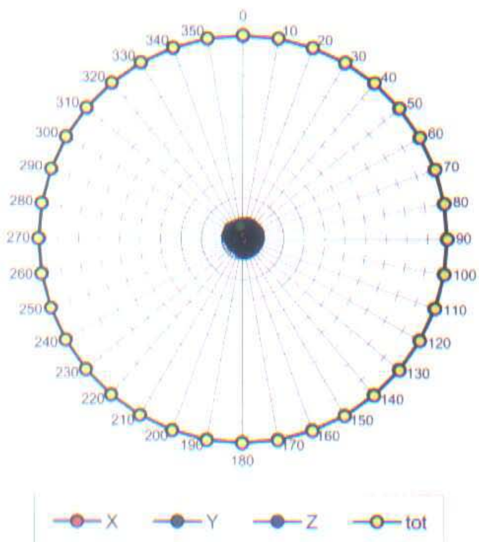


f = 2500 MHz, WG R22

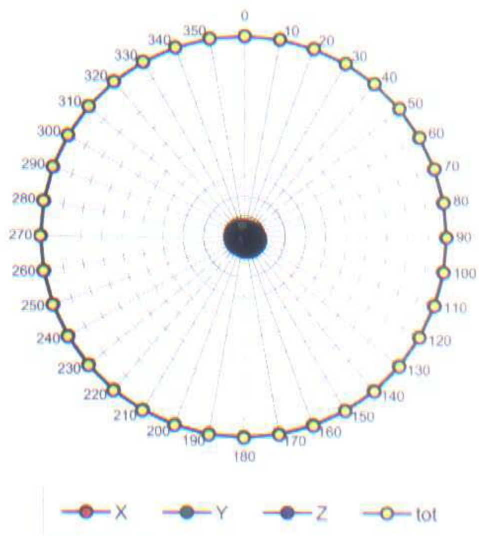


Receiving Pattern (ϕ), $\vartheta = 90°$

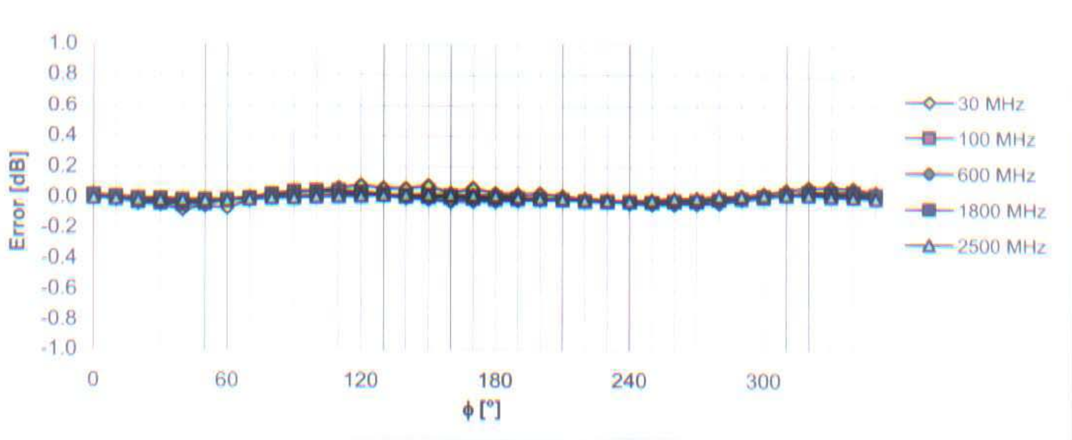
f = 600 MHz, TEM ifi110EXX



f = 2500 MHz, WG R22

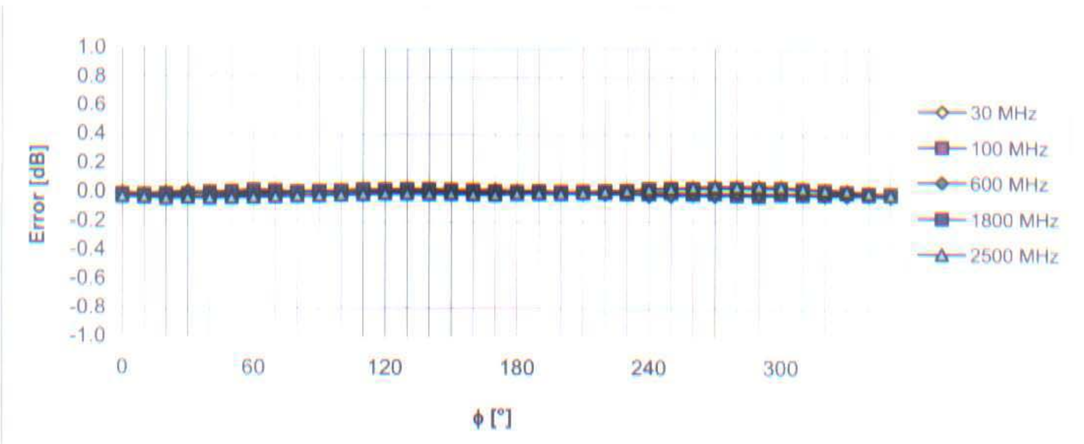


Receiving Pattern (ϕ), ϑ = 0°



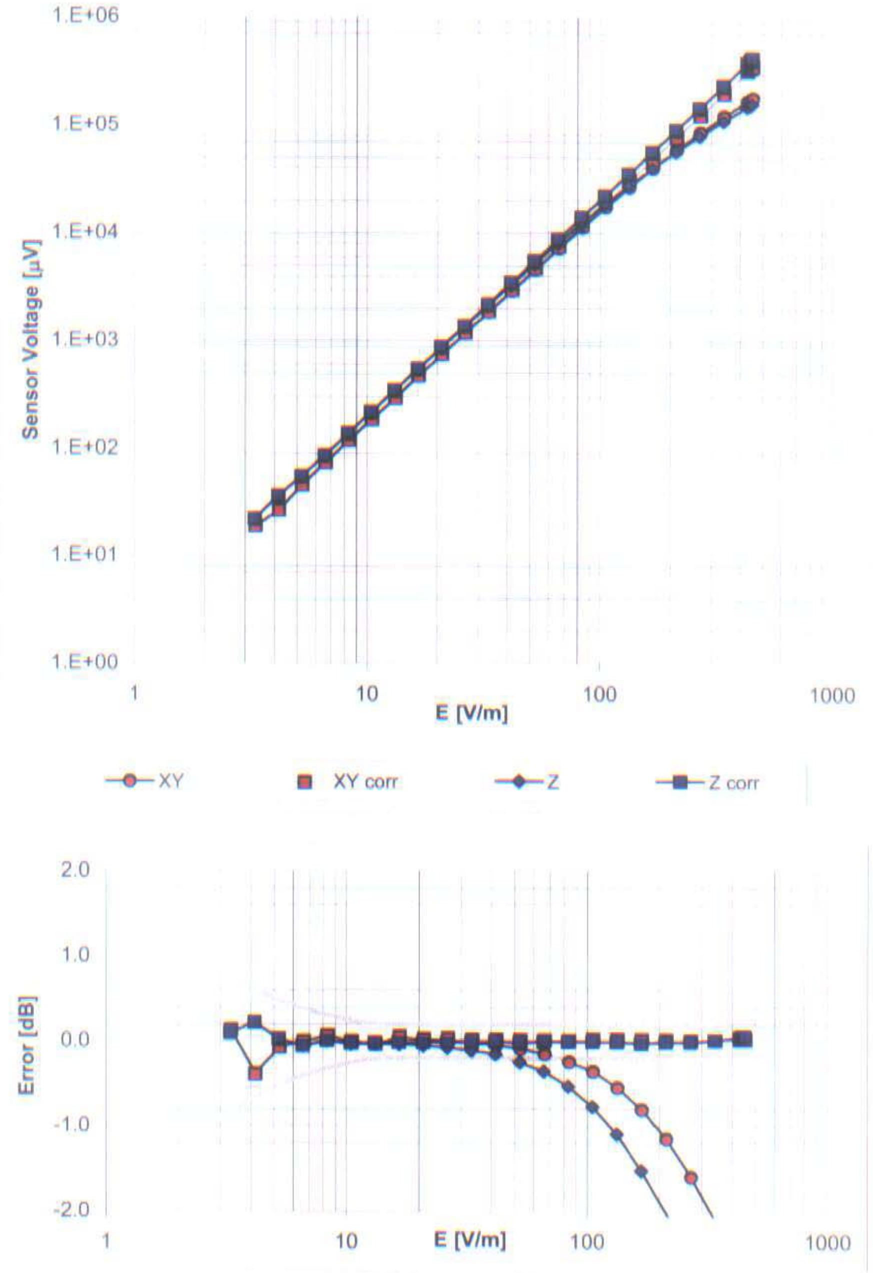
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Receiving Pattern (ϕ), ϑ = 90°



Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

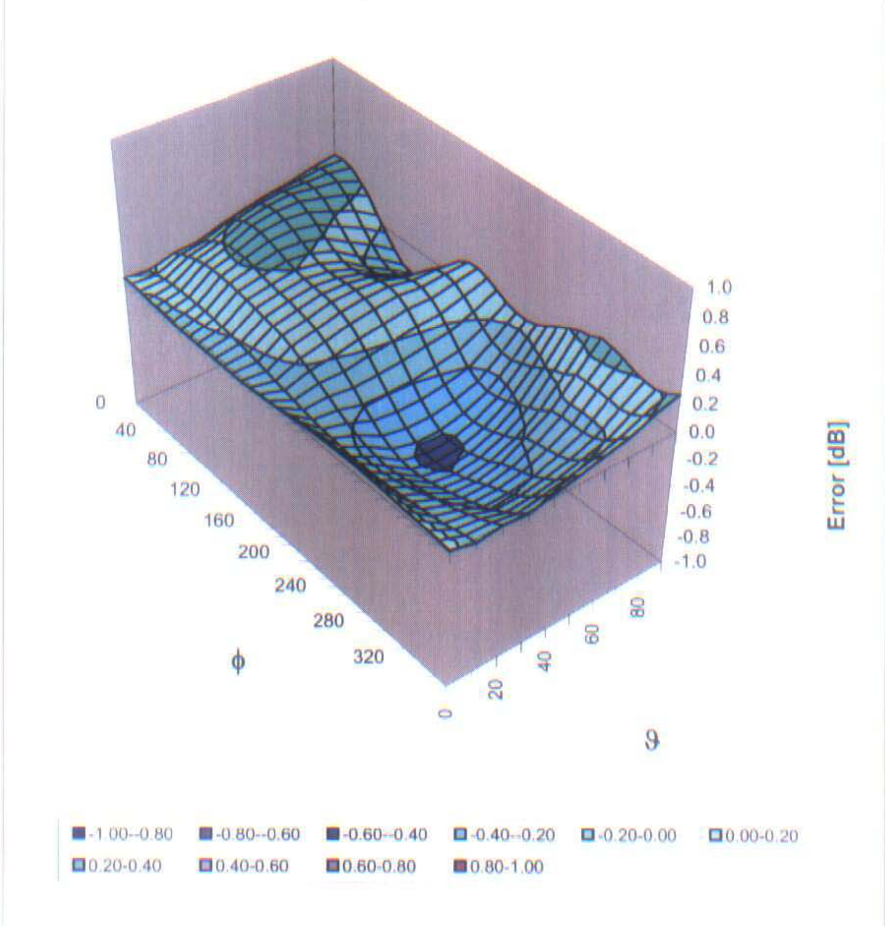
Dynamic Range f(E-field)
(Waveguide R22, f = 1800 MHz)



Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Deviation from Isotropy in Air

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Other Probe Parameters

Sensor Arrangement	Rectangular
Connector Angle (°)	-227.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	8.0 mm
Probe Tip to Sensor X Calibration Point	2.5 mm
Probe Tip to Sensor Y Calibration Point	2.5 mm
Probe Tip to Sensor Z Calibration Point	2.5 mm

Probe Calibration(H-field)

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Samsung (Dymstec)**

Certificate No: **H3-6200_Jan10**

CALIBRATION CERTIFICATE

Object	H3DV6 - SN:6200
Calibration procedure(s)	QA CAL-03.v5 and QA CAL-25.v2 Calibration procedure for H-field probes optimized for close near field evaluations in air
Calibration date:	January 22, 2010

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 E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe H3DV6	SN: 6182	3-Oct-09 (No. H3-6182_Oct09)	Oct-10
DAE4	SN: 789	23-Dec-09 (No. DAE4-789_Dec09)	Dec-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 25, 2010

O.K to use

2010. 2. 8

Glossary:

NORMx,y,z	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	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:

a) IEEE Std 1309-2005, " IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005.

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ for XY sensors and $\vartheta = 90$ for Z sensor (f $\leq$ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).
- *X,Y,Z(f)_a0a1a2= X,Y,Z_a0a1a2* frequency_response* (see Frequency Response Chart).
- *DCPx,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.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* 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.
- *Spherical isotropy (3D deviation from isotropy)*: in a locally homogeneous field realized using an open waveguide setup.
- *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 *X_a0a1a2* (no uncertainty required).

Probe H3DV6

SN:6200

Manufactured:	July 12, 2006
Last calibrated:	January 19, 2009
Recalibrated:	January 22, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: H3DV6 SN:6200

Basic Calibration Parameters

		Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (A/m / √(μV))	a0	2.40E-3	2.37E-3	2.67E-3	± 5.1%
Norm (A/m / √(μV))	a1	1.86E-4	1.44E-4	2.01E-4	± 5.1%
Norm (A/m / √(μV))	a2	9.98E-5	9.71E-5	8.45E-5	± 5.1%
DCP (mV)[A]		90.7	85.9	84.8	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300	± 1.5 %
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

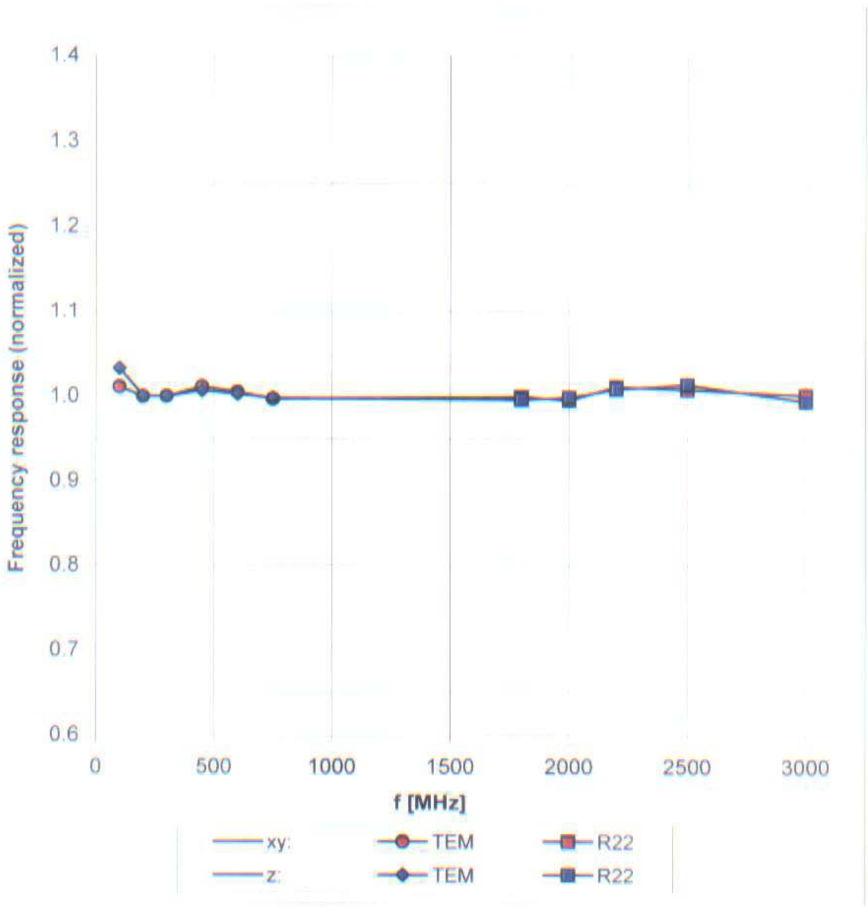
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] numerical linearization parameter: uncertainty not required

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

Frequency Response of H-Field

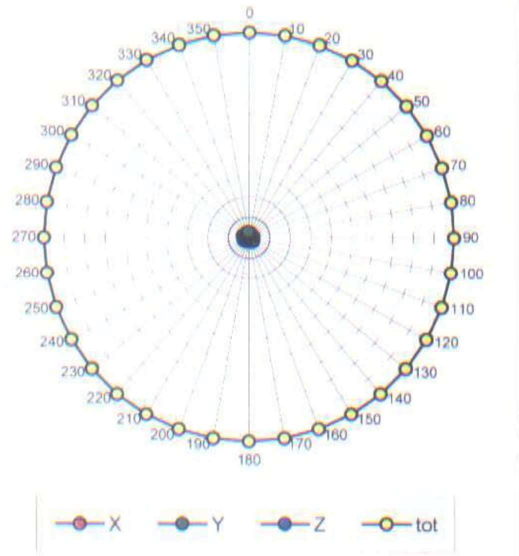
(TEM-Cell:ifi110 EXX, Waveguide R22)



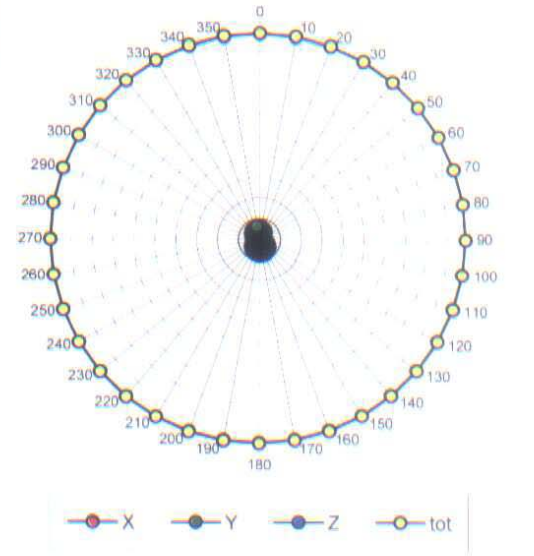
Uncertainty of Frequency Response of H-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 90°

f = 600 MHz, TEM ifi110EXX

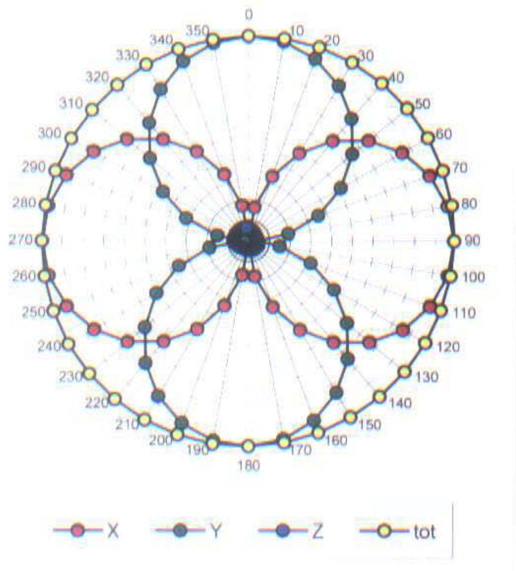


f = 2500 MHz, WG R22

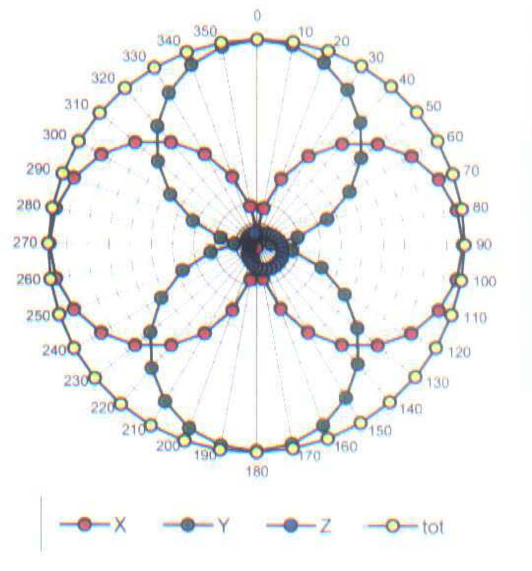


Receiving Pattern (ϕ), ϑ = 0°

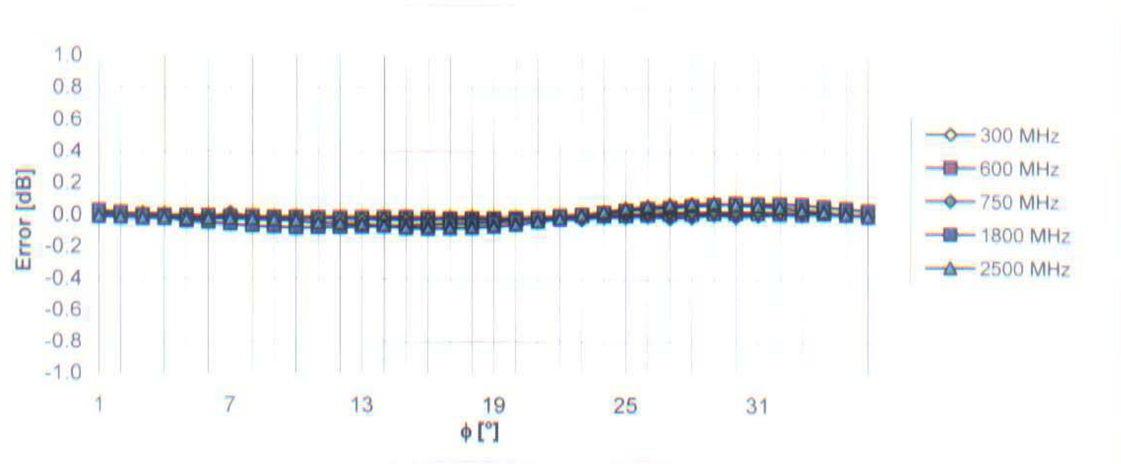
f = 600 MHz, TEM ifi110EXX



f = 2500 MHz, WG R22

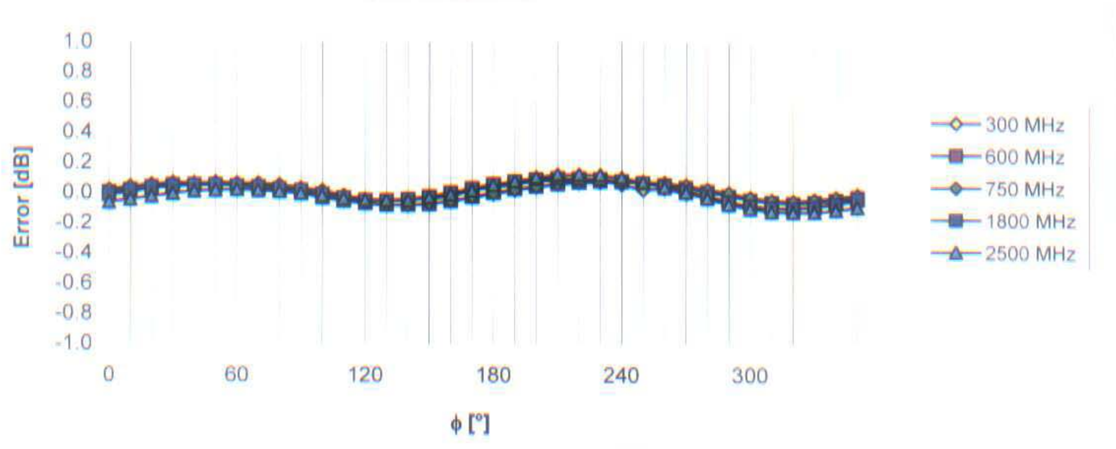


Receiving Pattern (ϕ), ϑ = 90°



Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

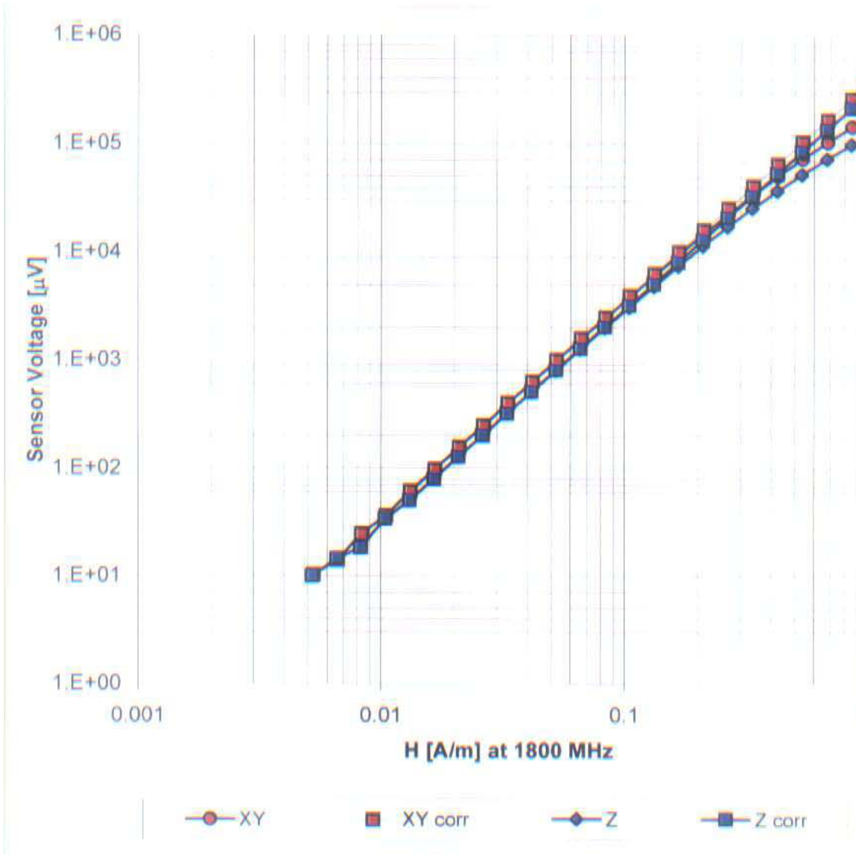
Receiving Pattern (ϕ), ϑ = 0°

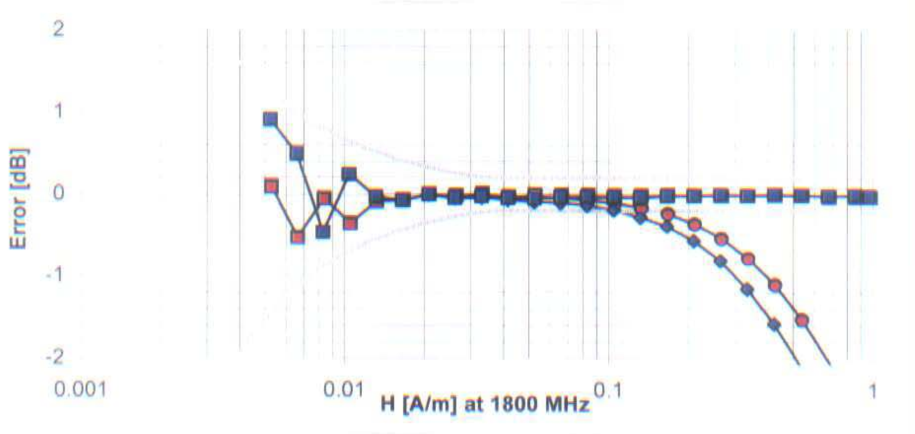


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(H-field)

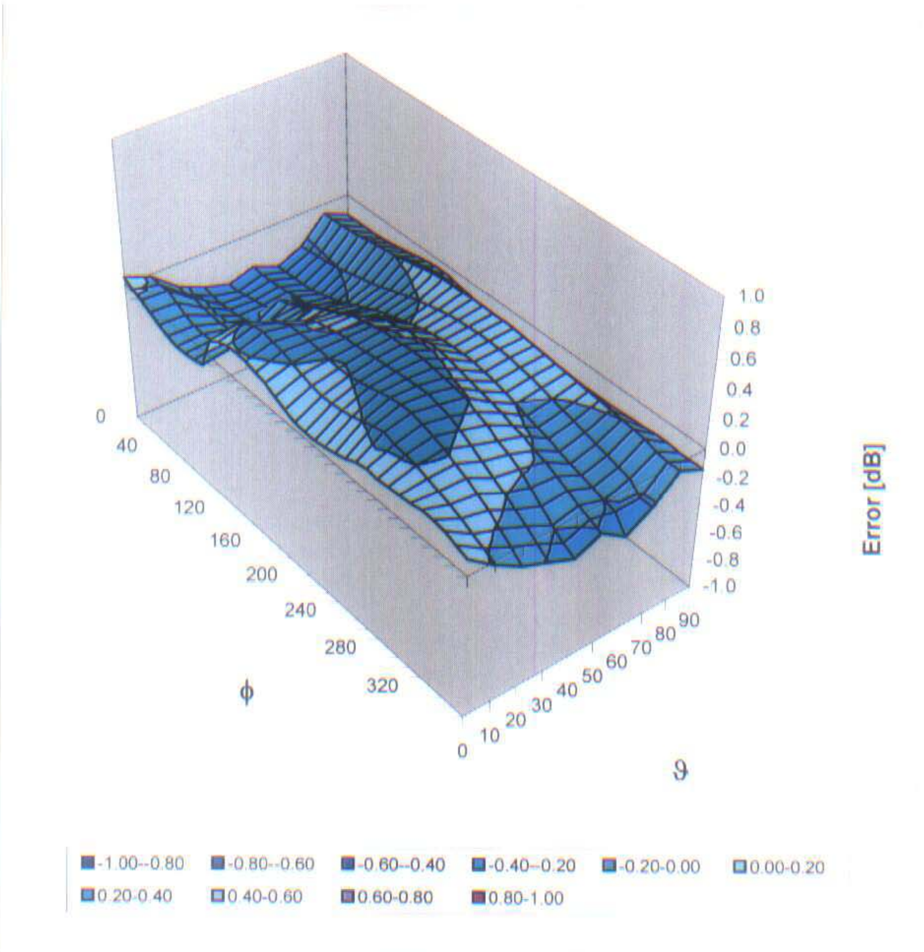
(Waveguide R22, f = 1800 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Deviation from Isotropy in Air
Error (ϕ, ϑ) , f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Other Probe Parameters

Sensor Arrangement	Rectangular
Connector Angle (°)	-150.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	20 mm
Tip Diameter	6.0 mm
Probe Tip to Sensor X Calibration Point	3 mm
Probe Tip to Sensor Y Calibration Point	3 mm
Probe Tip to Sensor Z Calibration Point	3 mm