Re: FCC ID:BEJVX3300
Applicant: LG Electronics USA
Correspondence Number: 21573
731 Confirmation Number: TC676202
Date of Original E-Mail: 07/12/2005

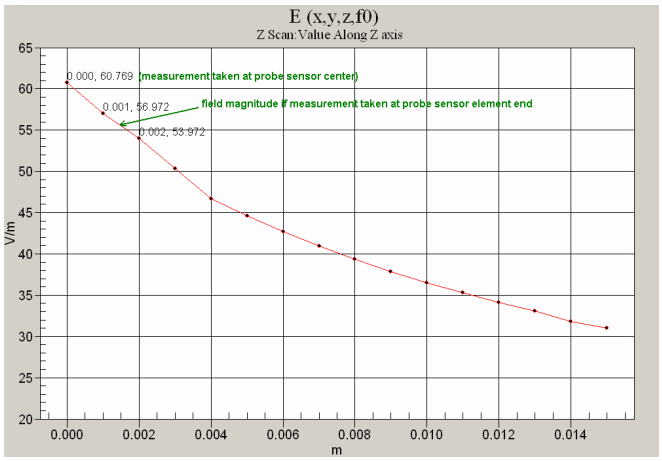
Subject: Request for additional information

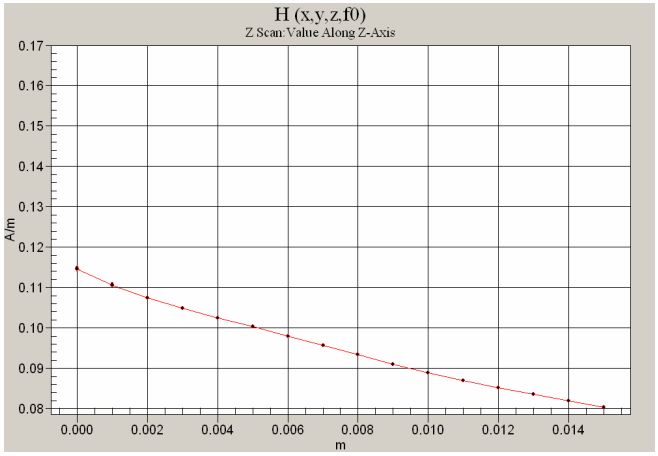
Regarding your answer to question D. Please provide data demonstrating that measurement to probe center is conservative. Suggestions were made at the recent TCB training. Please use the WD in the worst case configuration. Also, please provide more detailed views of the probe tip and sensor. Mechanical drawings would be suitable if photographs cannot show full detail. Details for the H probe are lacking and the third sensor cannot be seen on the E field probe. Please provide critical dimensions as well.

HAC field measurements take place in the close near field with high gradients. Increasing the measuring distance from the source will generally decrease the measured field values (in case of the validation dipole approx. 10% per mm).

Magnetic field sensors are measuring the integral of the H-field across their sensor area surrounded by the loop. They are calibrated in a precise, homogeneous field. When measuring a gradient field, the result will be very close to the field in the center of the loop which is equivalent to the value of a homogeneous field equivalent to the center value. But it will be different from the field at the border of the loop.

Consequently, two sensors with different loop diameters - both calibrated ideally - would give different results when measuring from the edge of the probe sensor elements. The behavior for electrically small E-field sensors is equivalent. See below for distance plots from a WD which show the conservative nature of field readings at the probe element center vs. measurements at the sensor end:

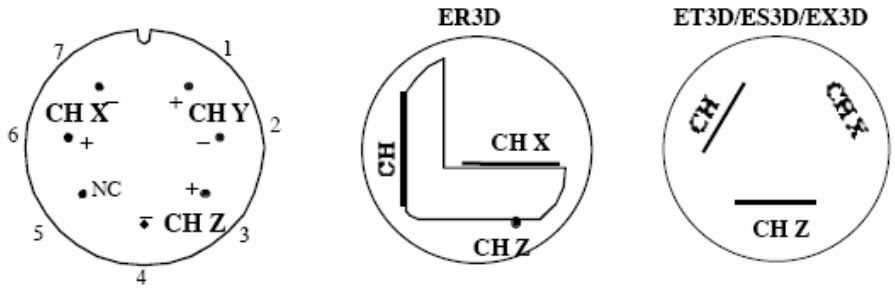




The magnetic field loops of the H3D probes are concentric, with the center 3mm from the tip for H3DV6. Their radius is 1.9mm.

The electric field probes have a more irregular internal geometry because it is physically not possible to have the 3 orthogonal sensors situated with the same center. The effect of the different sensor centers is accounted for in the HAC uncertainty budget ("sensor displacement"). Their geometric center is at 2.5mm from the tip, and the element ends are 1.1mm closer to the tip.

Connector Plan



(seen from back) (seen from front)

The antistatic shielding inside the probe is connected to the probe connector case.

It is recommended to connect the probes with the amplifier using a short and well shielded cable and to connect the cable shielding with the connector case.

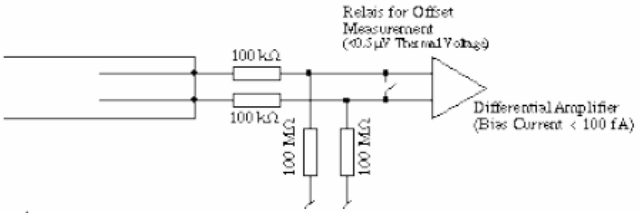
Conversion of Connector Voltage u_i to E-Field E_i

$$E_i = \sqrt{\frac{u_i + (u_i^2 \cdot CF)/(DCP)}{Norm_i \cdot ConvF}}$$

whereby

E_i:	electric field in V/m
u_i:	voltage of channel i at the connector in µV
$Norm_i$:	sensitivity of channel i in µV/(V/m)^2
$ConvF$:	enhancement factor in liquid (ConvF=1 for Air)
DCP:	diode compression point in µV
CF:	signal crest factor (peak power/average power)

Conditions of Calibration



Please note:
- a lower input impedance of the amplifier will result in different sensitivity factors $Norm_i$ and DCP
- larger bias currents will cause higher offset

Regarding your answer to question E please clarify the settings of the analyzer. Generally, a CDMA signal would show a power variation (noise like) in time. Also, there appears to be multiple signals being displayed. Please explain.

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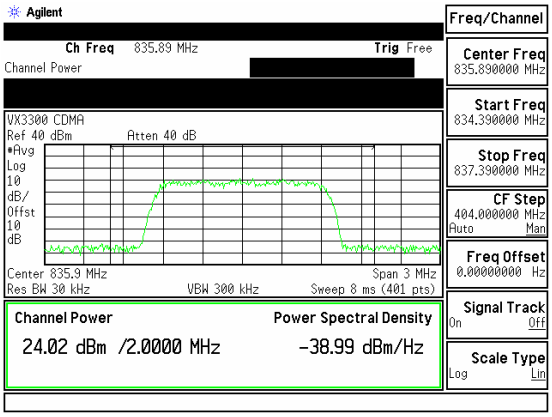
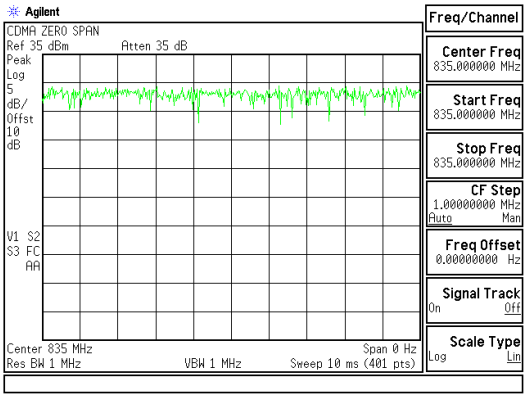
Please find attached replacement wideband and 0 span plots of the WD signal.





Regarding your answer to question I please state expected values for AM and CDMA with justification.

Please find below revised table with appropriate validation:

Frequency (MHz)	Signal Type	Peak Input Power (W)	E-field Result (V/m)	Target Field (A/m)	% Deviation
835	CW	0.100	187.1	**185.1**	**1.1%**
1880	CW	0.100	158.9	**145.8**	**9.0%**

Frequency (MHz)	Signal Type	Peak Input Power (W)	H-field Result (A/m)	Target Field (A/m)	% Deviation
835	CW	0.100	0.471	**0.470**	**0.2%**
1880	CW	0.100	0.466	**0.450**	**3.6%**

Regarding your answer to question L please include a discussion of averaging/ measurement time windows and conversion to final peak.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with	V_i	= compensated signal of channel i	(i = x, y, z)
	U_i	= input signal of channel i	(i = x, y, z)
	cf	= crest factor of exciting field	(DASY parameter)
	dcp_i	= diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E} - \text{fieldprobes}: \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H} - \text{fieldprobes}: \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

with	V_i	= compensated signal of channel i	(i = x, y, z)
	$Norm_i$	= sensor sensitivity of channel i $\mu V/(V/m)^2$ for E-field Probes	(i = x, y, z)
	$ConvF$	= sensitivity enhancement in solution	
	a_{ij}	= sensor sensitivity factors for H-field probes	
	f	= carrier frequency [GHz]	
	E_i	= electric field strength of channel i in V/m	
	H_i	= magnetic field strength of channel i in A/m	

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

The measurement/integration time per point, as specified by the system manufacturer is >500 ms.

The signal response time is evaluated as the time required by the system to reach 90% of the expected final value after an on/off switch of the power source with an integration time of 500 ms and a probe response time of <5 ms. In the current implementation, DASY4 waits longer than 100 ms after having reached the grid point before starting a measurement, i.e., the response time uncertainty is negligible.

If the device under test does not emit a CW signal, the integration time applied to measure the electric field at a specific point may introduce additional uncertainties due to the discretization. The tolerances for the different systems had the worst-case of 2.6%.

The modulation factors obtained were applied to readings taken of the actual wireless device, in order to obtain an accurate peak field reading using the formula:

$$\text{Peak} = 20 \cdot \log(\text{Raw} \cdot \text{PMF})$$

Regarding your answer to question M we understand that you measured HAC ratings for both antennas and only published data for the worst case. If both antennas are still marketed please provide data for both antennas.

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Correspondence Number: 21573
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Date of Original E-Mail: 07/12/2005

Please find attached data for the 2nd antenna:

Mode	Channel	Backlight	Antenna	Conducted Power at BS (dBm)	Time Avg. Field (V/m)	Peak Field (dBV/m)	FCC MARGIN (dB)	RESULT	Excl Blocks per 4.3.1.2.2
E-field Emissions									
CDMA	1013	OFF	2nd	23.7	50.8	34.3	-6.66	M4	1,2,3
CDMA	363	OFF	2nd	23.7	49.8	34.2	-6.83	M4	1,2,3
CDMA	777	OFF	2nd	23.9	51.4	34.4	-6.56	M4	7,8,9
PCS	25	OFF	2nd	23.9	26.1	28.5	-12.49	M4	6,8,9
PCS	600	OFF	2nd	23.8	28.1	29.1	-11.86	M4	6,8,9
PCS	1175	OFF	2nd	24.0	25.9	28.4	-12.57	M4	7,8,9
Mode	**Channel**	**Backlight**	**Antenna**	**Conducted Power at BS (dBm)**	**Time Avg. Field (A/m)**	**Peak Field (dBA/m)**	**FCC MARGIN (dB)**	**RESULT**	**Excl Blocks per 4.3.1.2.2**
H-field Emissions									
CDMA	1013	OFF	2nd	23.7	0.077	-22.2	-12.78	M4	1,4,7
CDMA	363	OFF	2nd	23.7	0.078	-22.1	-12.66	M4	1,4,7
CDMA	777	OFF	2nd	23.9	0.079	-22.0	-12.55	M4	1,4,7
PCS	25	OFF	2nd	23.9	0.044	-27.2	-17.75	M4	4,7,8
PCS	600	OFF	2nd	23.8	0.052	-25.7	-16.30	M4	4,7,8
PCS	1175	OFF	2nd	24.0	0.037	-28.7	-19.26	M4	1,4,7

Regarding your answer to question O please add extra graphics showing the contour plots without the exclusion blocks removed.

Please find attached plots showing the contour plots without the exclusion blocks removed.

Date: 5/13/2005

PCTEST Hearing-Aid Compatability Facility

DUT: LG-VX3300

Type: Tri Mode
Serial: 172
Backlight off
Duty Cycle: 1:1

Communication System: Cellular CDMA; Frequency: 848.31 MHz;

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ER3DV6 - SN2332; Calibrated: 1/31/2005
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn637; Calibrated: 9/22/2004
- Phantom: HAC Phantom; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.5 Build 19;

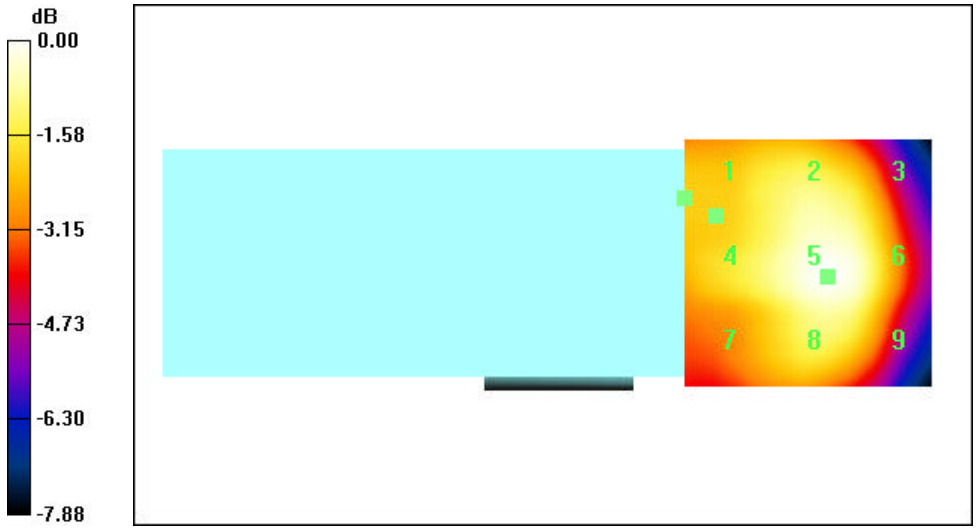
High Channel/Hearing Aid Compatibility Test (261x261x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of Total field (slot averaged) = 60.1 V/m
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

E in V/m (Time averaged)

Grid 1 **51.0**	Grid 2 **56.1**	Grid 3 **53.9**
Grid 4 **53.0**	Grid 5 **60.1**	Grid 6 **59.0**
Grid 7 **48.4**	Grid 8 **56.1**	Grid 9 **55.0**

E in V/m (Slot averaged)

Grid 1 **51.0**	Grid 2 **56.1**	Grid 3 **53.9**
Grid 4 **53.0**	Grid 5 **60.1**	Grid 6 **59.0**
Grid 7 **48.4**	Grid 8 **56.1**	Grid 9 **55.0**



0 dB = 60.1V/m

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Date: 4/11/2005

PCTEST Hearing-Aid Compatability Facility

DUT: LG-VX3300

Type: Tri-Mode Phone
Serial: 172
Backlight off
Duty Cycle: 1:1
Communication System: PCS CDMA; Frequency: 1880 MHz;

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ER3DV6 - SN2332; Calibrated: 1/31/2005
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn637; Calibrated: 9/22/2004
- Phantom: HAC Phantom; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.5 Build 19;

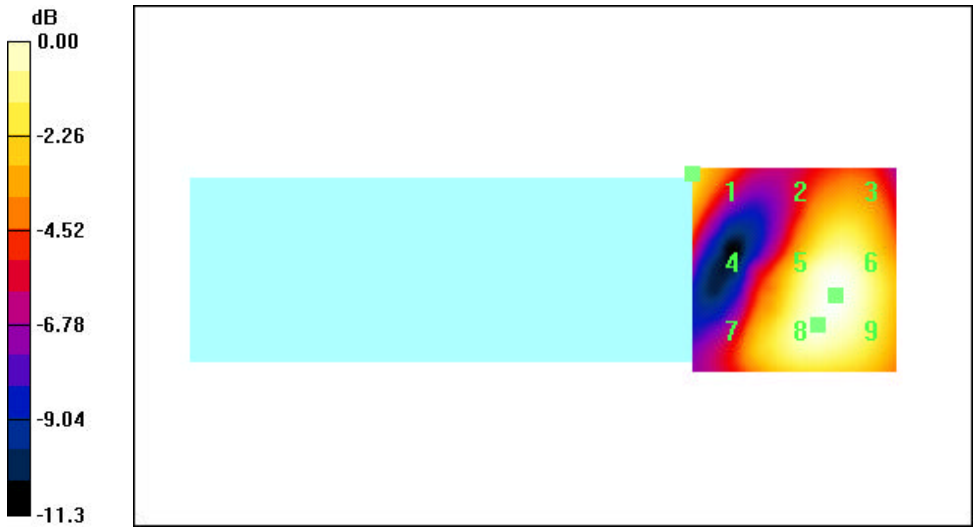
Mid Channel/Hearing Aid Compatibility Test (261x261x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of Total field (slot averaged) = 37.1 V/m
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

E in V/m (Time averaged)

Grid 1 **28.3**	Grid 2 **28.6**	Grid 3 **30.0**
Grid 4 **21.4**	Grid 5 **37.1**	Grid 6 **37.4**
Grid 7 **26.6**	Grid 8 **37.1**	Grid 9 **37.3**

E in V/m (Slot averaged)

Grid 1 **28.3**	Grid 2 **28.6**	Grid 3 **30.0**
Grid 4 **21.4**	Grid 5 **37.1**	Grid 6 **37.4**
Grid 7 **26.6**	Grid 8 **37.1**	Grid 9 **37.3**



0 dB = 37.4V/m

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Date: 4/12/2005

PCTEST Hearing-Aid Compatability Facility

DUT: LG-VX3300

Type: Tri-Mode Phone
Serial: 172
Backlight off
Duty Cycle: 1:1

Communication System: Cellular CDMA; Frequency: 848.31 MHz;

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: H3DV6 - SN6180; Calibrated: 10/6/2004
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn637; Calibrated: 9/22/2004
- Phantom: HAC Phantom; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.5 Build 19;

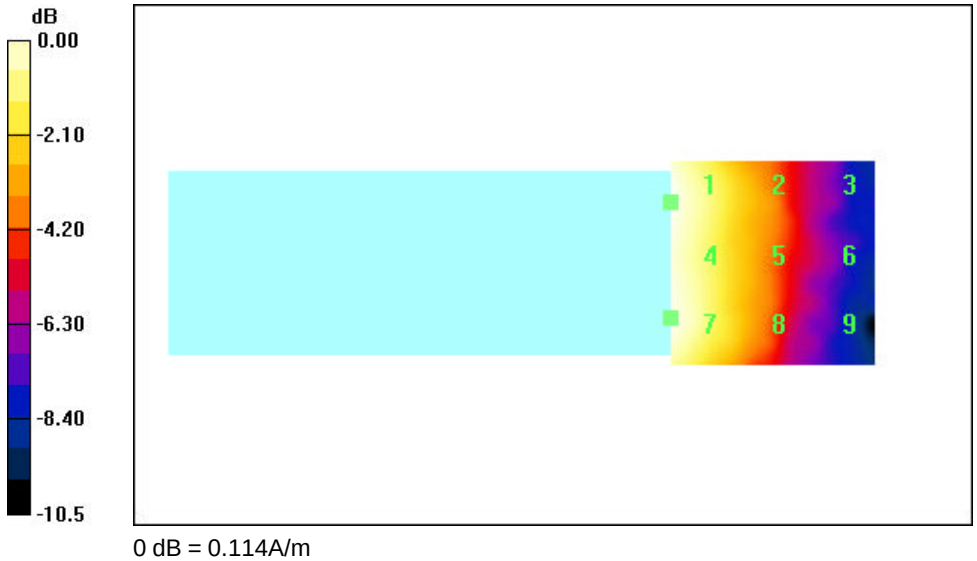
High Channel/Hearing Aid Compatibility Test (261x261x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of Total field (slot averaged) = 0.085 A/m
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

H in A/m (Time averaged)

Grid 1 **0.114**	Grid 2 **0.085**	Grid 3 **0.058**
Grid 4 **0.112**	Grid 5 **0.083**	Grid 6 **0.059**
Grid 7 **0.112**	Grid 8 **0.083**	Grid 9 **0.056**

H in A/m (Slot averaged)

Grid 1 **0.114**	Grid 2 **0.085**	Grid 3 **0.058**
Grid 4 **0.112**	Grid 5 **0.083**	Grid 6 **0.059**
Grid 7 **0.112**	Grid 8 **0.083**	Grid 9 **0.056**



0 dB = 0.114A/m

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Date: 4/12/2005

PCTEST Hearing-Aid Compatability Facility

DUT: LG-VX3300

Type: Tri-Mode Phone
Serial: 172
Backlight off
Duty Cycle: 1:1

Communication System: PCS CDMA; Frequency: 1880 MHz;

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: H3DV6 - SN6180; Calibrated: 10/6/2004
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn637; Calibrated: 9/22/2004
- Phantom: HAC Phantom; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.5 Build 19;

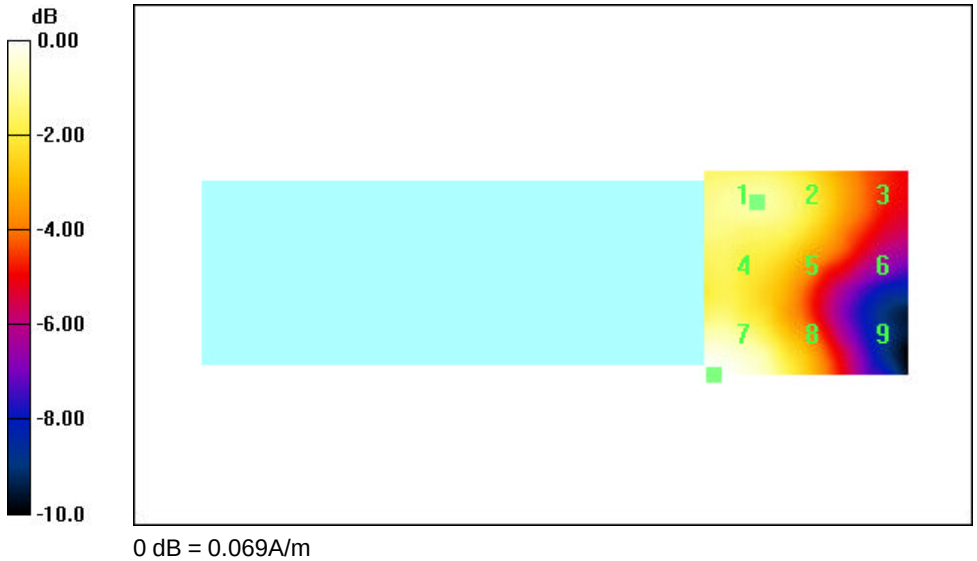
Mid Channel/Hearing Aid Compatibility Test (261x261x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of Total field (slot averaged) = 0.062 A/m
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

H in A/m (Time averaged)

Grid 1 **0.062**	Grid 2 **0.061**	Grid 3 **0.048**
Grid 4 **0.059**	Grid 5 **0.057**	Grid 6 **0.044**
Grid 7 **0.069**	Grid 8 **0.062**	Grid 9 **0.039**

H in A/m (Slot averaged)

Grid 1 **0.062**	Grid 2 **0.061**	Grid 3 **0.048**
Grid 4 **0.059**	Grid 5 **0.057**	Grid 6 **0.044**
Grid 7 **0.069**	Grid 8 **0.062**	Grid 9 **0.039**



0 dB = 0.069A/m

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