## Annex A: Probe sensitivity and reference signal measurement plots

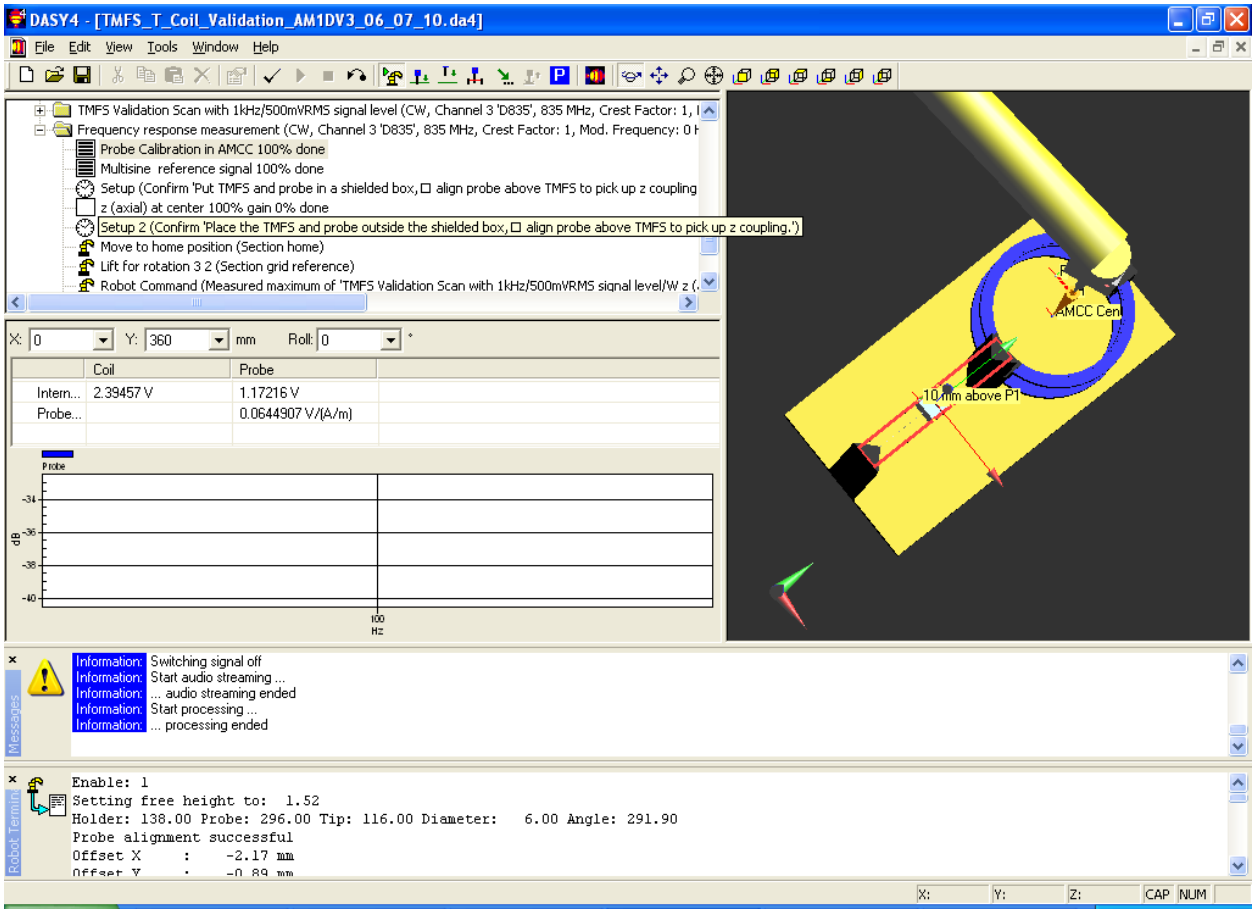



**Figure A1: Probe calibration data for coil and probe**

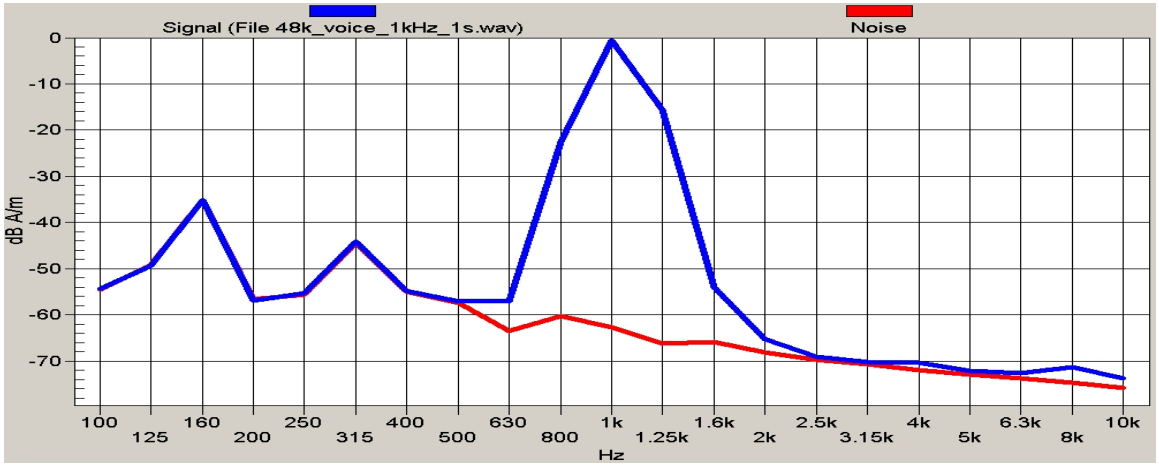



**Figure A2: Reference voice 1 kHz signal and noise**

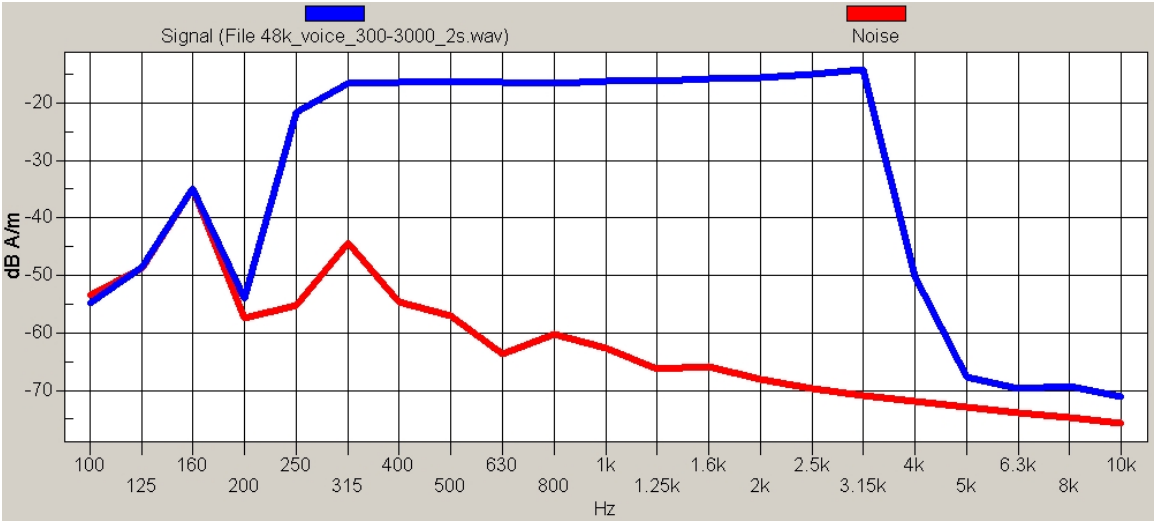



**Figure A3: Reference voice simulated signal and noise**

## Annex B: Ambient noise and TMFS system validation data/plots

Date/Time: 6/7/2010 2:47:03 PM

Test Laboratory: RIM Testing Services

TMFS_T_Coil_Validation_AM1DV3_06_07_10

## DUT: TMFS; Type: Sample

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: TCoil Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## Background Noise 10 mm above Grid Reference/z (axial) noise/ABM Noise(x,y,z) (1x1x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Off

Output Gain: 100

Measure Window Start: 2000ms

Measure Window Length: 5000ms

Device Reference Point: 0.000, 0.000, -6.30 mm

## Background Noise 10 mm above Grid Reference/z (axial) noise/ABM Noise Spectrum(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Off
Output Gain: 100
Measure Window Start: 2000ms
Measure Window Length: 5000ms
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM = -59.3 dB A/m
Location: 0, 0, 13 mm

## Background Noise 10 mm above Grid Reference/x (longitudinal) noise/ABM Noise Spectrum(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Off
Output Gain: 100
Measure Window Start: 2000ms
Measure Window Length: 5000ms
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM = -59.3 dB A/m
Location: 0, 0, 13 mm

## Background Noise 10 mm above Grid Reference/y (transversal) noise/ABM Noise Spectrum(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Off
Output Gain: 100
Measure Window Start: 2000ms
Measure Window Length: 5000ms
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM = -59.3 dB A/m
Location: 0, 0, 13 mm

## TMFS Validation Scan with 1kHz/500mVRMS signal level/W z (axial) 8 x 8 step 2/ABM Signal(x,y,z) (5x5x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: 1 kHz Sine
Output Gain: 35.7
Measure Window Start: 0ms
Measure Window Length: 1000ms
BWC applied: 0.000868546 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1 comp = -20.3 dB A/m
BWC Factor = 0.000868546 dB
Location: 0, 2, 3 mm

## TMFS Validation Scan with 1kHz/500mVRMS signal level/W x (longitudinal) 52 x 16 step 4/ABM Signal(x,y,z) (14x5x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: 1 kHz Sine
Output Gain: 35.7
Measure Window Start: 0ms
Measure Window Length: 1000ms
BWC applied: 0.000868546 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

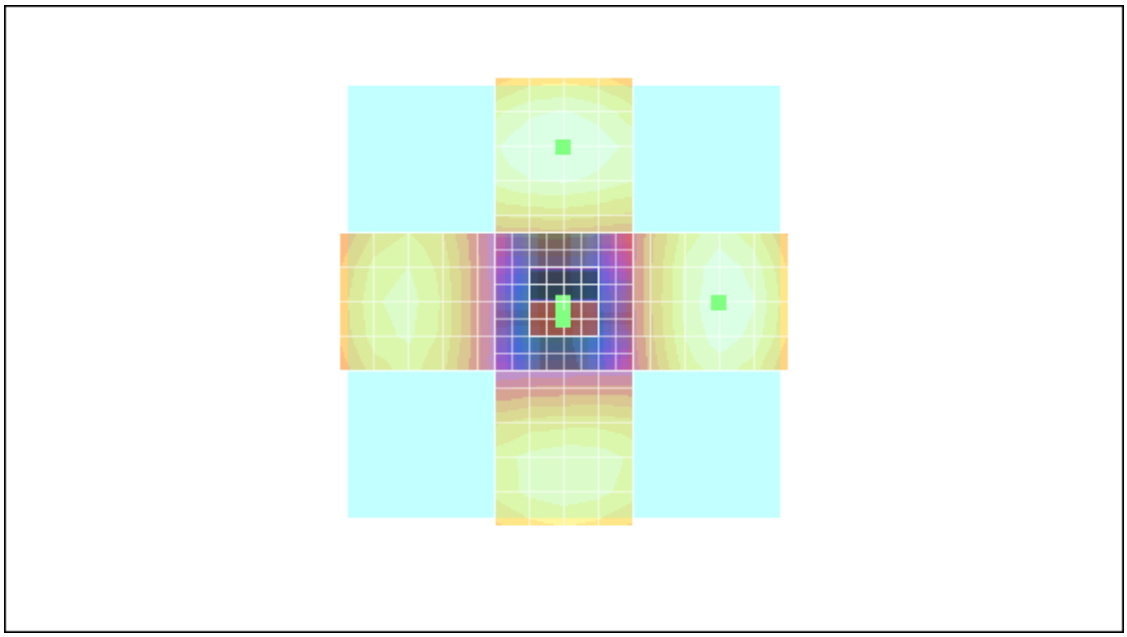
ABM1 comp = -25.0 dB A/m
BWC Factor = 0.000868546 dB
Location: -18, 0, 3 mm

## TMFS Validation Scan with 1kHz/500mVRMS signal level/W y (transversal) 16 x 52 step 4/ABM Signal(x,y,z) (5x14x1):

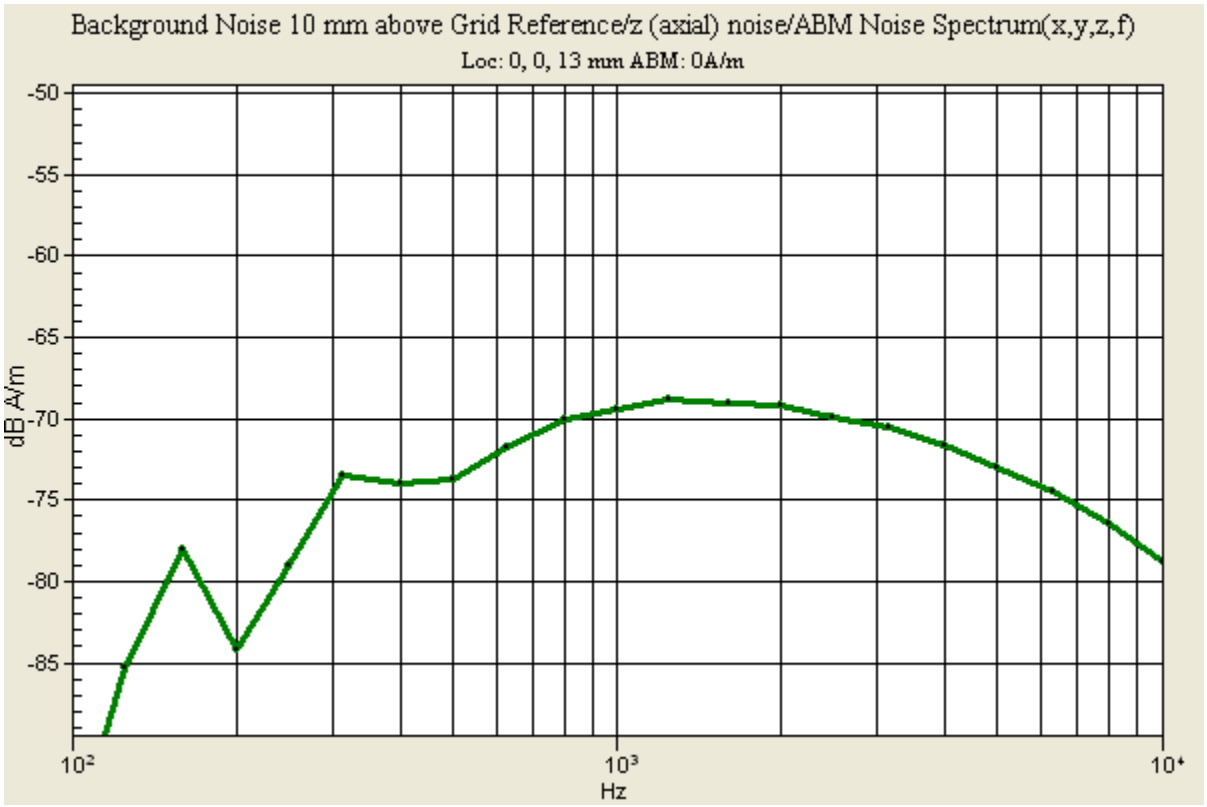
Measurement grid: dx=10mm, dy=10mm
Signal Type: 1 kHz Sine
Output Gain: 35.7
Measure Window Start: 0ms
Measure Window Length: 1000ms
BWC applied: 0.000868546 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

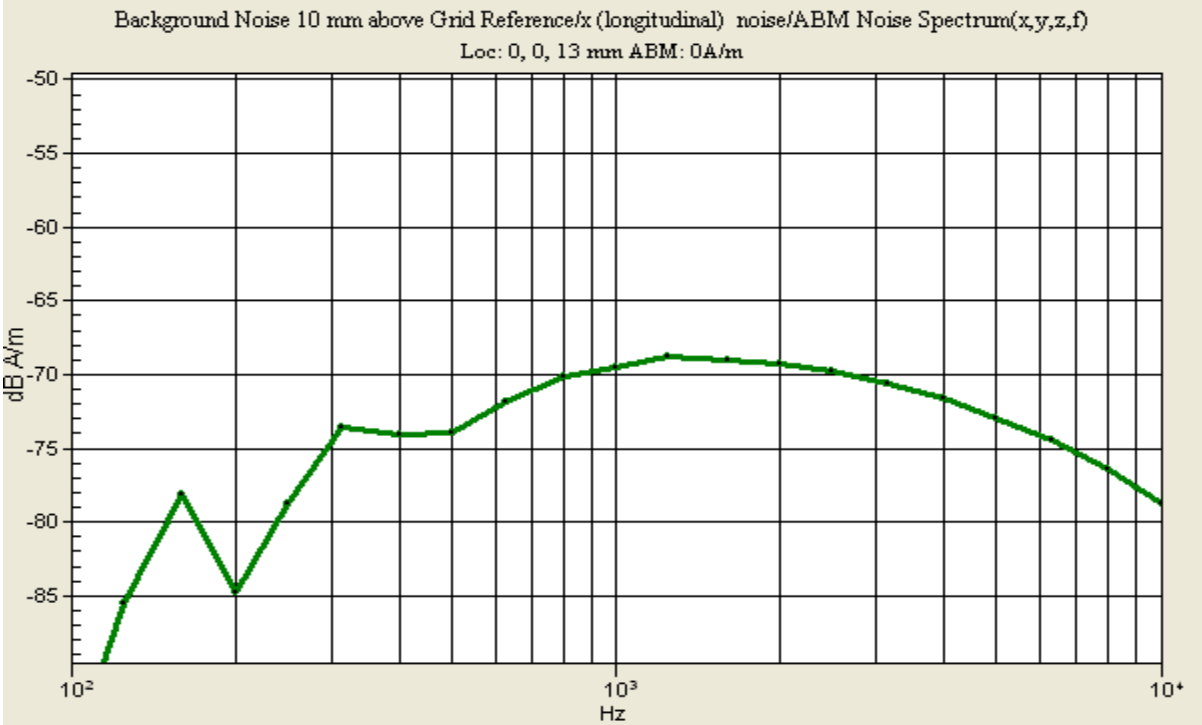
**Cursor:**

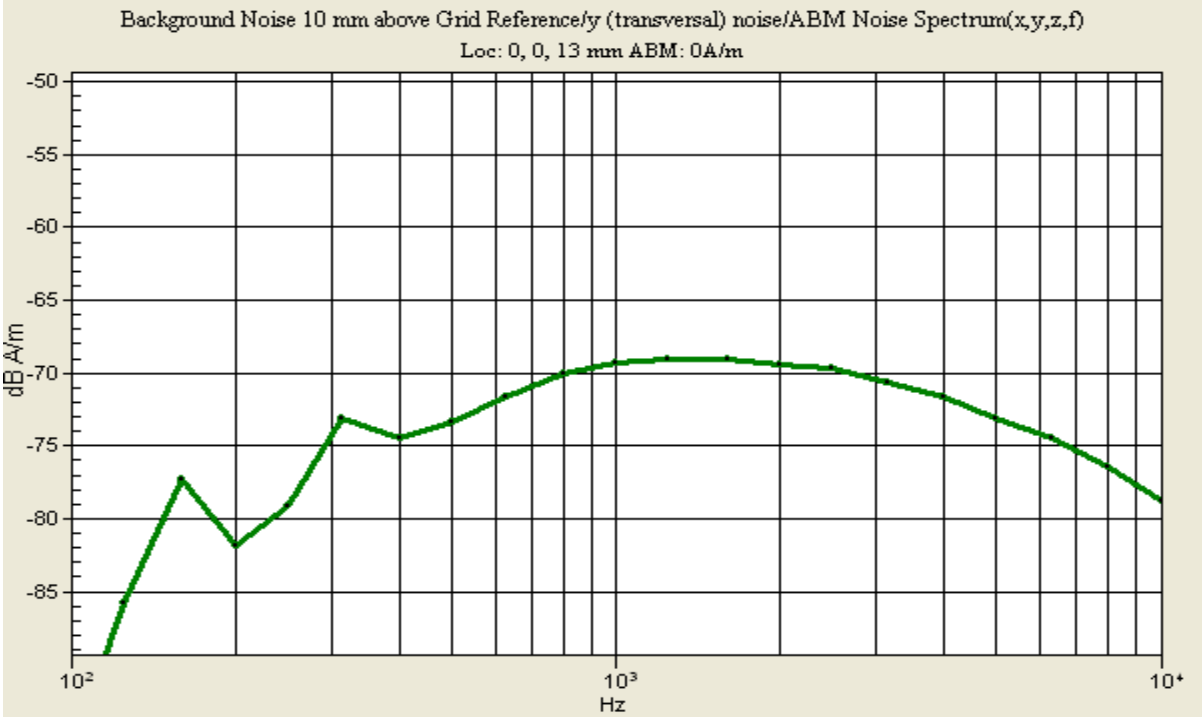
ABM1 comp = -26.3 dB A/m
BWC Factor = 0.000868546 dB
Location: 0, -18, 3 mm

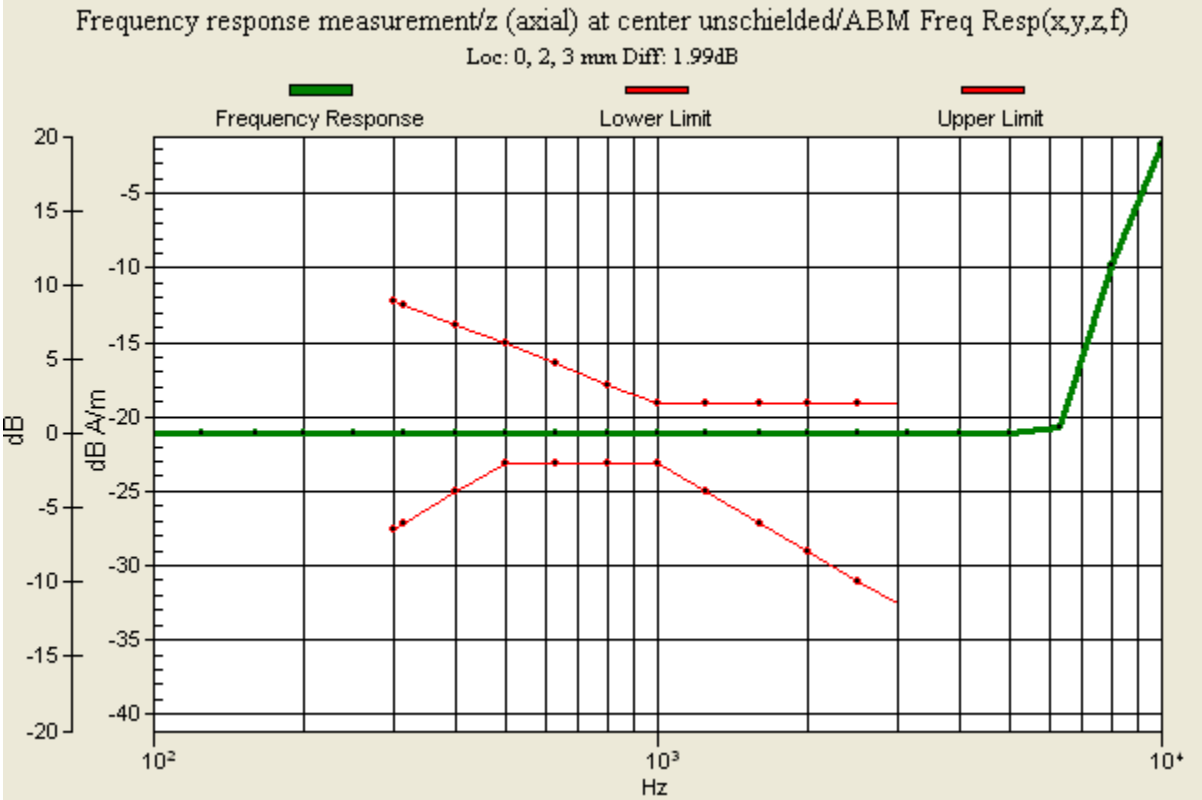


0 dB = 1.00A/m







## Annex C: Audio Band Magnetic measurement data and plots

Date/Time: 6/8/2010 8:41:48 PM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA800_low_chan_Axial

DUT: BlackBerry Smartphone;

Communication System: CDMA 800; Frequency: 824.7 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/z (axial) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155041 dB

Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Low Chan/z (axial) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

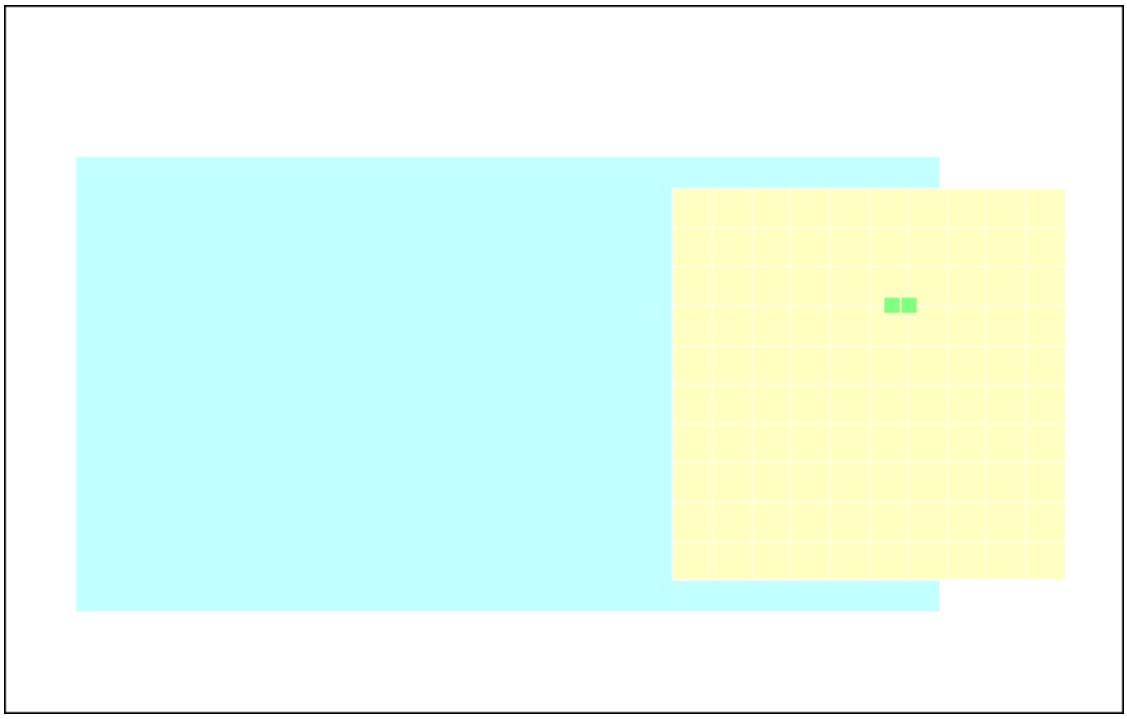
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155041 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

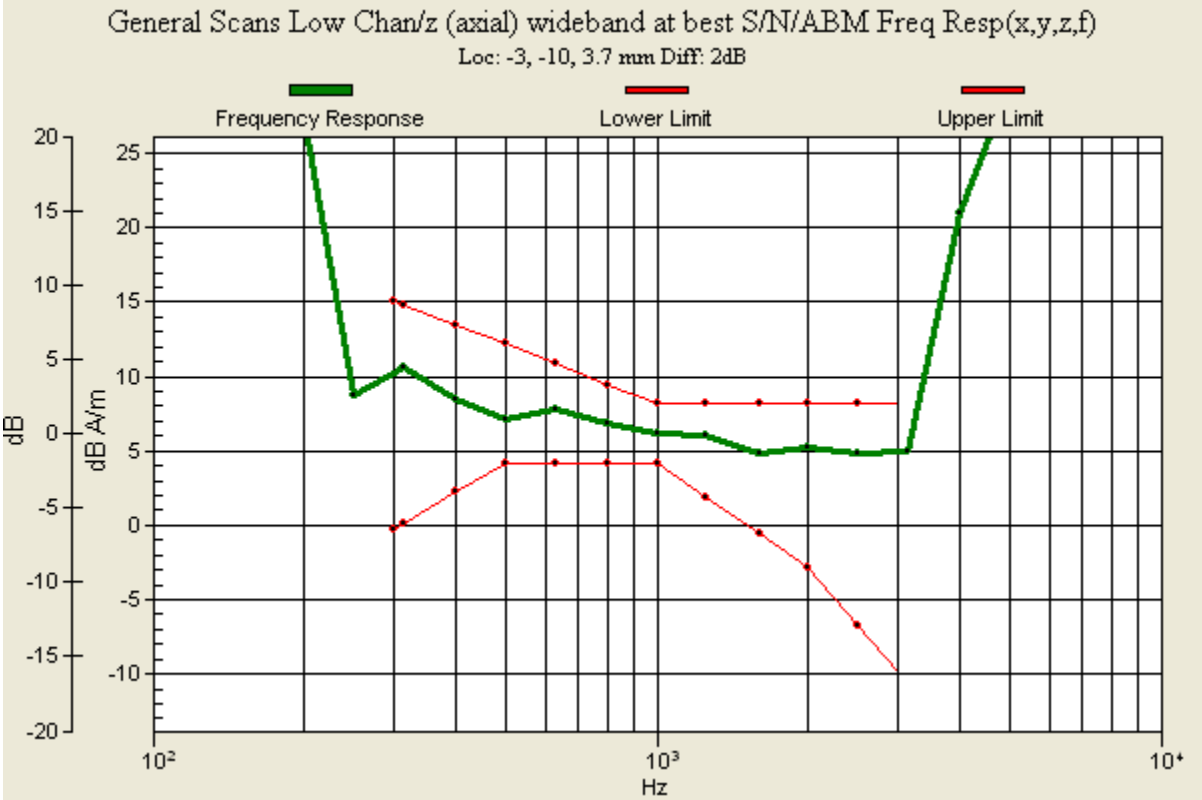
ABM1/ABM2 = 51.9 dB
ABM1 comp = 4.86 dB A/m
BWC Factor = 0.155041 dB
Location: -3, -10, 3.7 mm

## General Scans Low Chan/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 54.9
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, -6.30 mm



0 dB = 1.00



Date/Time: 6/8/2010 8:52:01 PM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA800_low_chan_Radial_L

DUT: BlackBerry Smartphone;

Communication System: CDMA 800; Frequency: 824.7 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/x (longitudinal) 5.0mm 50 x 50/ABM

## SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155041 dB

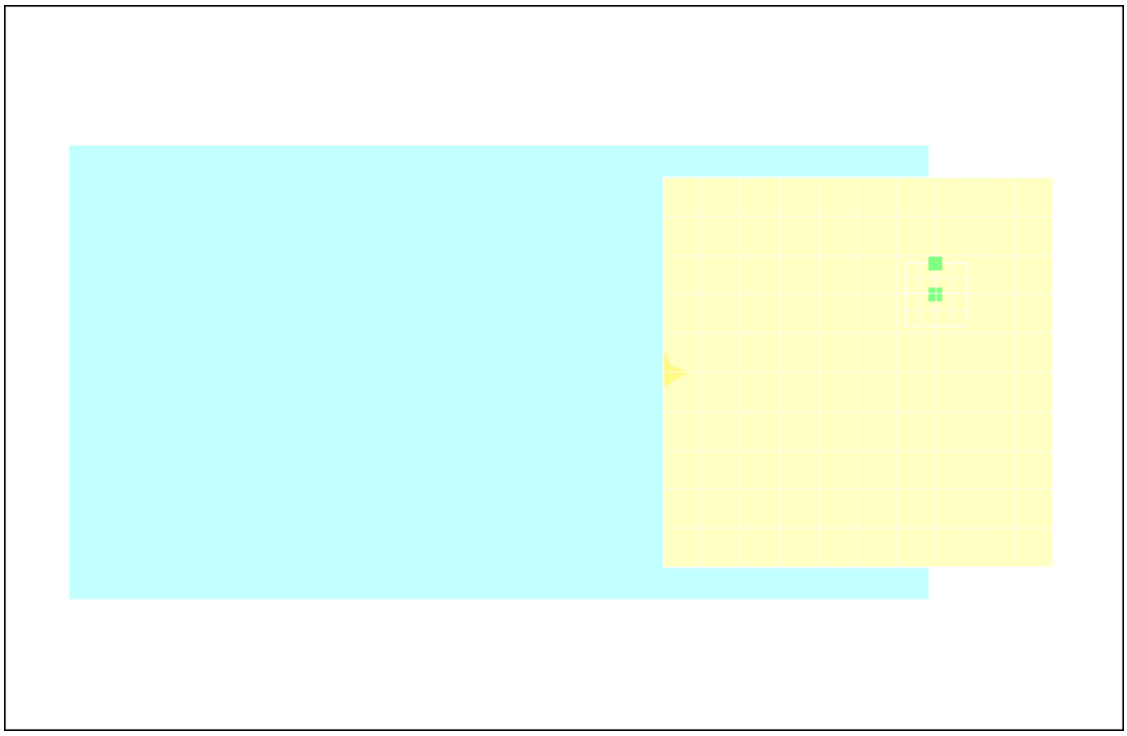
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Low Chan/x (longitudinal) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155041 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 45.7 dB
ABM1 comp = -3.65 dB A/m
BWC Factor = 0.155041 dB
Location: -10, -14, 3.7 mm



0 dB = 1.00

Date/Time: 6/8/2010 9:02:35 PM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA800_low_chan_Radial_T

**DUT: BlackBerry Smartphone;**

Communication System: CDMA 800; Frequency: 824.7 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/y (transversal) 5.0mm 50 x 50/ABM

## SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155041 dB

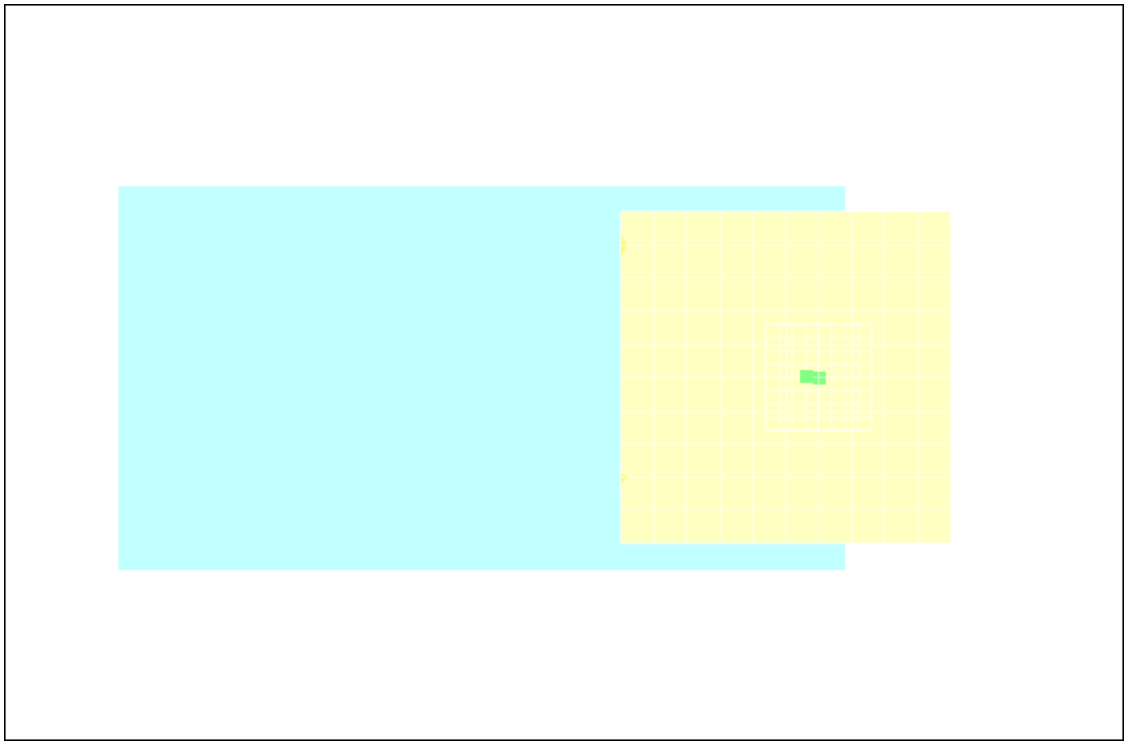
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Low Chan/y (transversal) fine 2mm 8 x 8/ABM SNR(x,y,z) (9x9x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155041 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 54.6 dB
ABM1 comp = -1.73 dB A/m
BWC Factor = 0.155041 dB
Location: -3, 0, 3.7 mm



0 dB = 1.00

Date/Time: 6/8/2010 8:52:01 PM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA800_mid_chan_Axial

DUT: BlackBerry Smartphone;

Communication System: CDMA 800; Frequency: 824.7 MHzFrequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/x (longitudinal) 5.0mm 50 x 50/ABM

## SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155041 dB

Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Mid Chan/z (axial) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

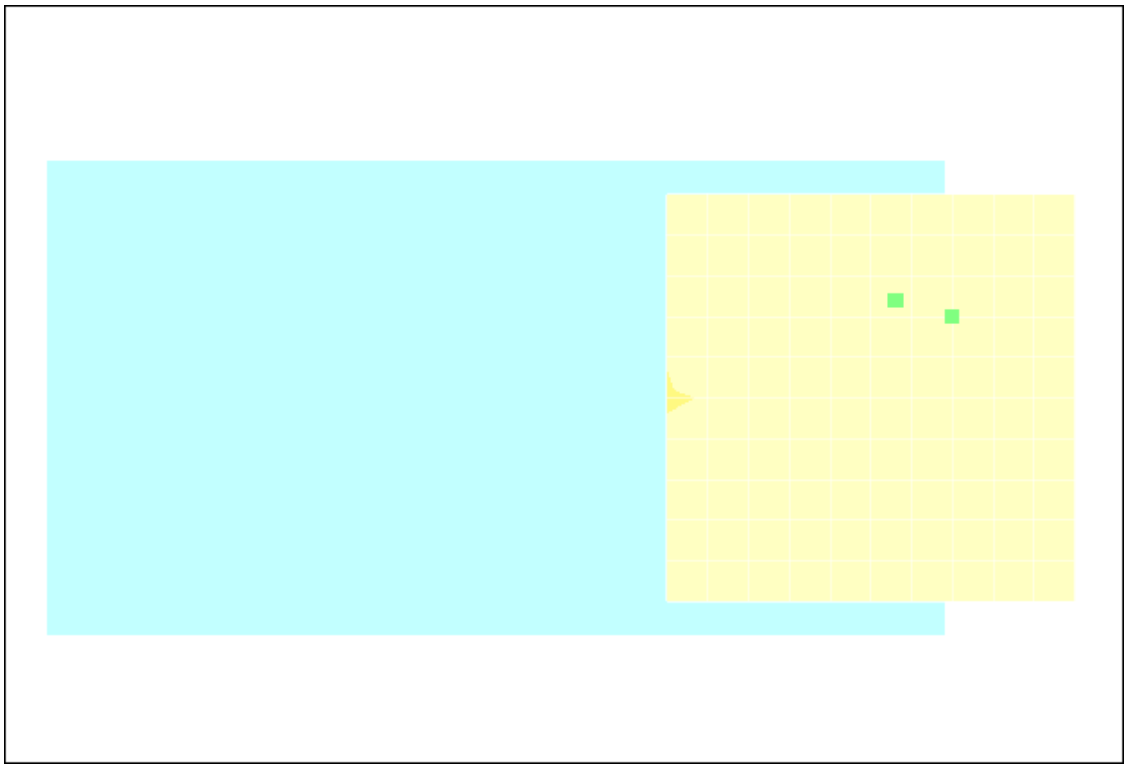
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155979 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

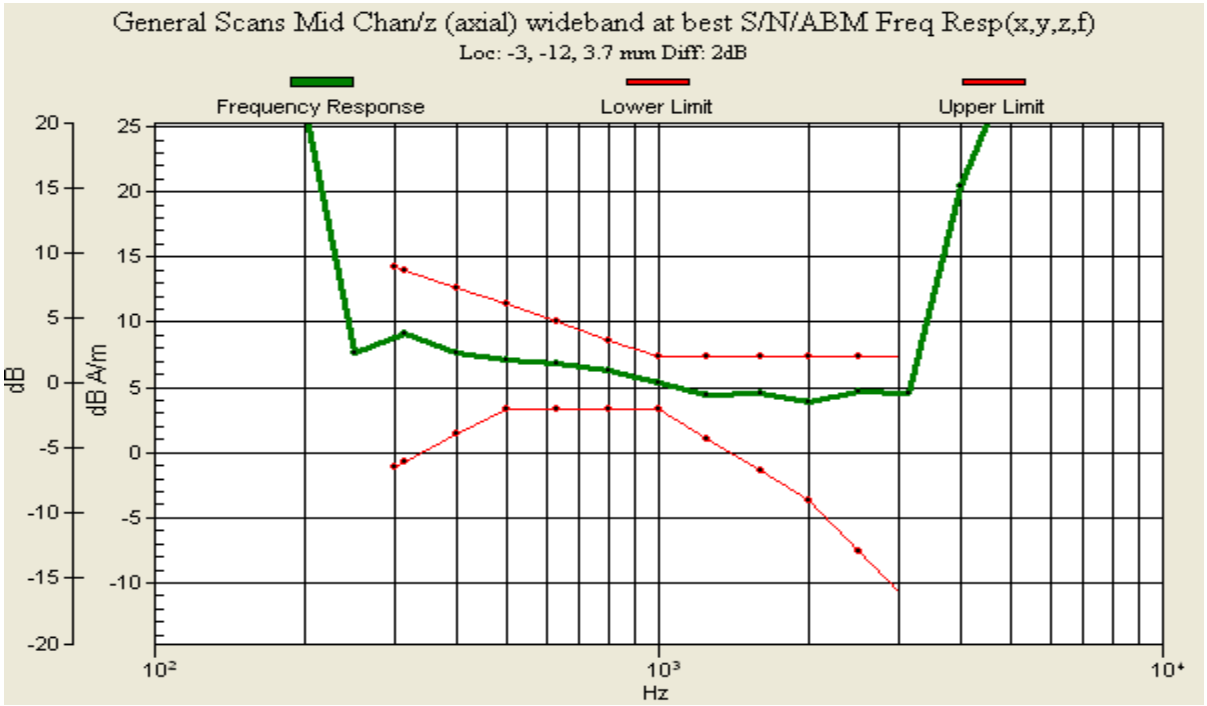
ABM1/ABM2 = 52.0 dB
ABM1 comp = 3.91 dB A/m
BWC Factor = 0.155979 dB
Location: -3, -12, 3.7 mm

## General Scans Mid Chan/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 54.9
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, -6.30 mm



0 dB = 1.00



Date/Time: 6/8/2010 8:52:01 PM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA800_mid_chan_Radial_L

**DUT: BlackBerry Smartphone;**

Communication System: CDMA 800; Frequency: 824.7 MHzFrequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/x (longitudinal) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155041 dB

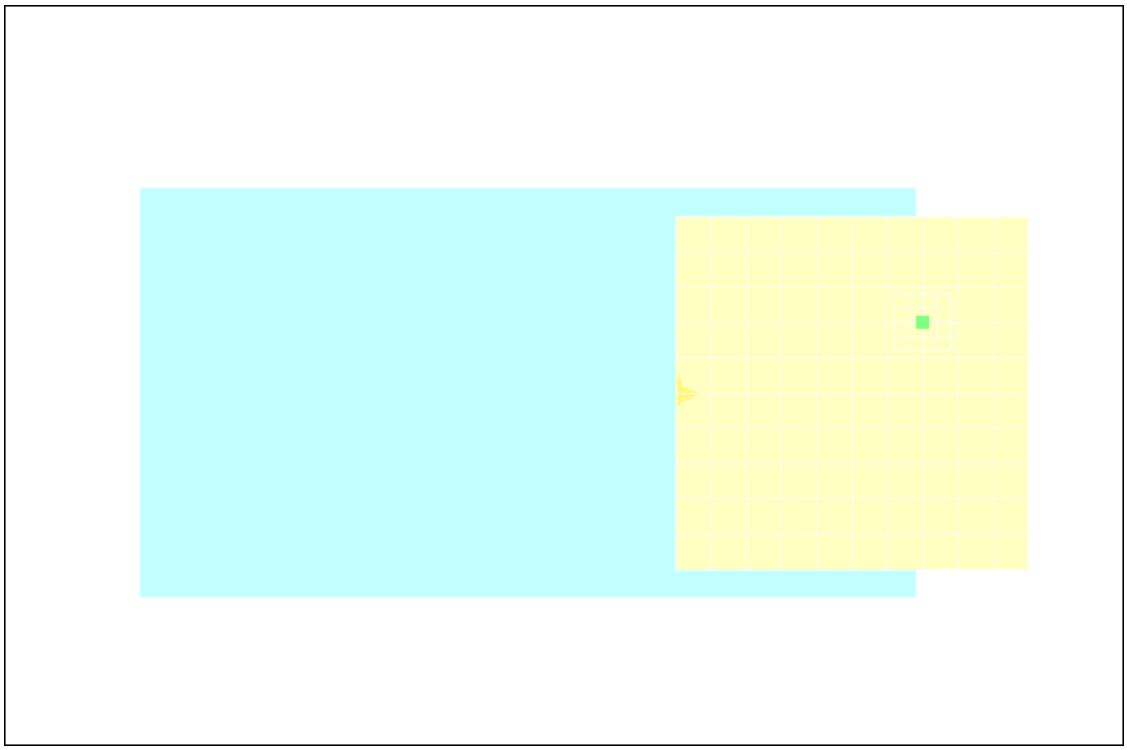
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Mid Chan/x (longitudinal) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155979 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 45.9 dB
ABM1 comp = -2.10 dB A/m
BWC Factor = 0.155979 dB
Location: -10, -10, 3.7 mm



0 dB = 1.00

Date/Time: 6/8/2010 9:02:35 PM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA800_mid_chan_Radial_T

**DUT: BlackBerry Smartphone;**

Communication System: CDMA 800; Frequency: 824.7 MHzFrequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/y (transversal) 5.0mm 50 x 50/ABM

## SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155041 dB

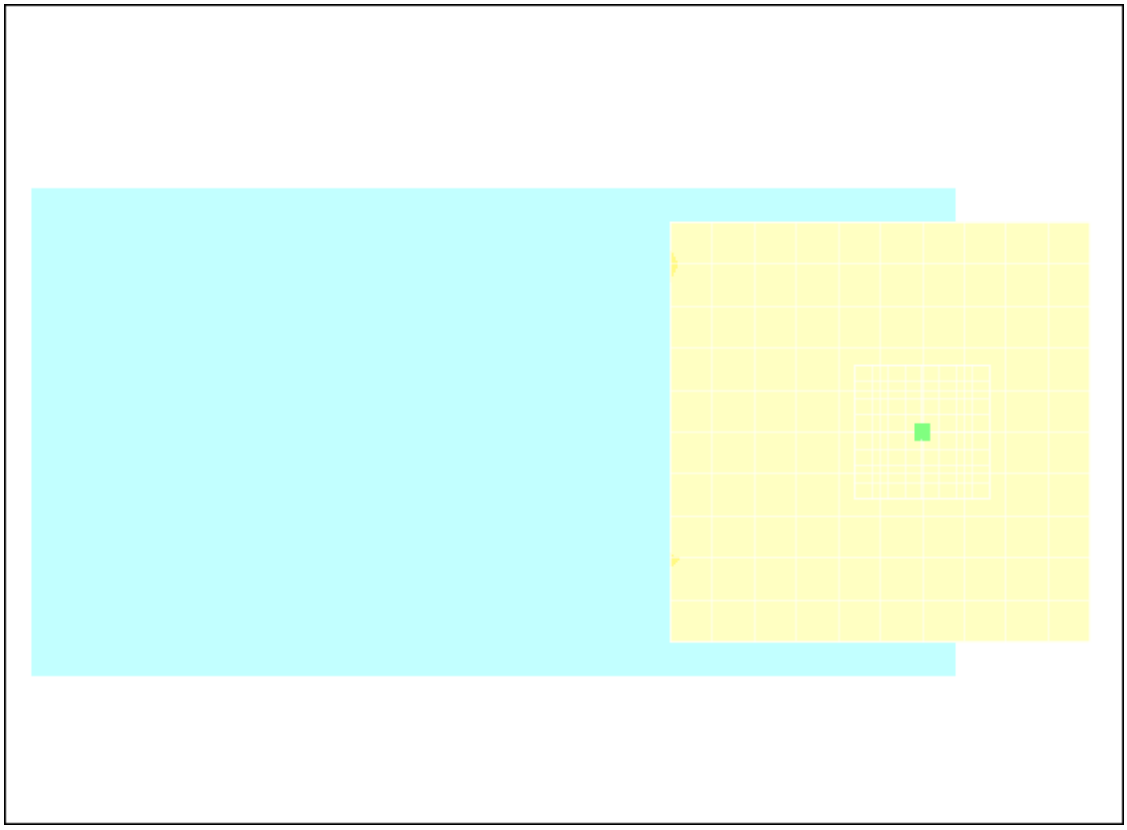
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Mid Chan/y (transversal) fine 2mm 8 x 8/ABM SNR(x,y,z) (9x9x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155979 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 54.8 dB
ABM1 comp = -2.46 dB A/m
BWC Factor = 0.155979 dB
Location: -5, 0, 3.7 mm



0 dB = 1.00

Date/Time: 6/8/2010 8:41:48 PM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA800_high_chan_Axial

DUT: BlackBerry Smartphone;

Communication System: CDMA 800; Frequency: 824.7 MHzFrequency: 848.52 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/z (axial) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155041 dB

Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans High Chan/z (axial) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

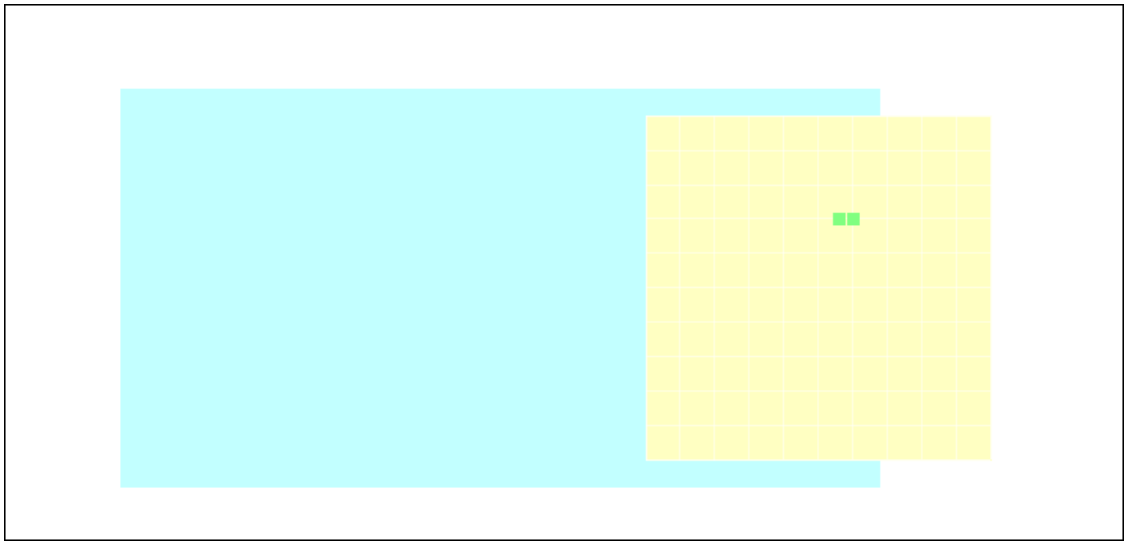
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155041 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

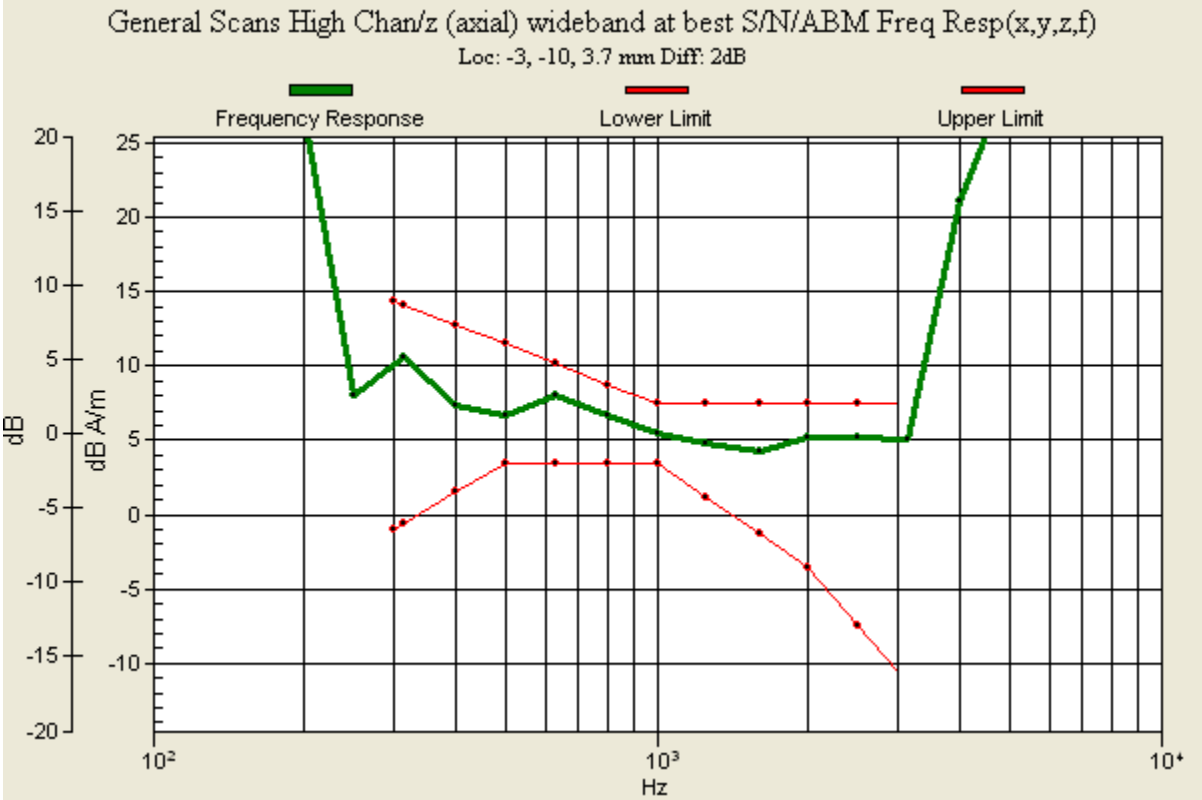
ABM1/ABM2 = 52.3 dB
ABM1 comp = 4.68 dB A/m
BWC Factor = 0.155041 dB
Location: -3, -10, 3.7 mm

## General Scans High Chan/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 54.9
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, -6.30 mm



0 dB = 1.00



Date/Time: 6/8/2010 8:52:01 PM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA800_high_chan_Radial_L

**DUT: BlackBerry Smartphone;**

Communication System: CDMA 800; Frequency: 824.7 MHzFrequency: 848.52 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/x (longitudinal) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155041 dB

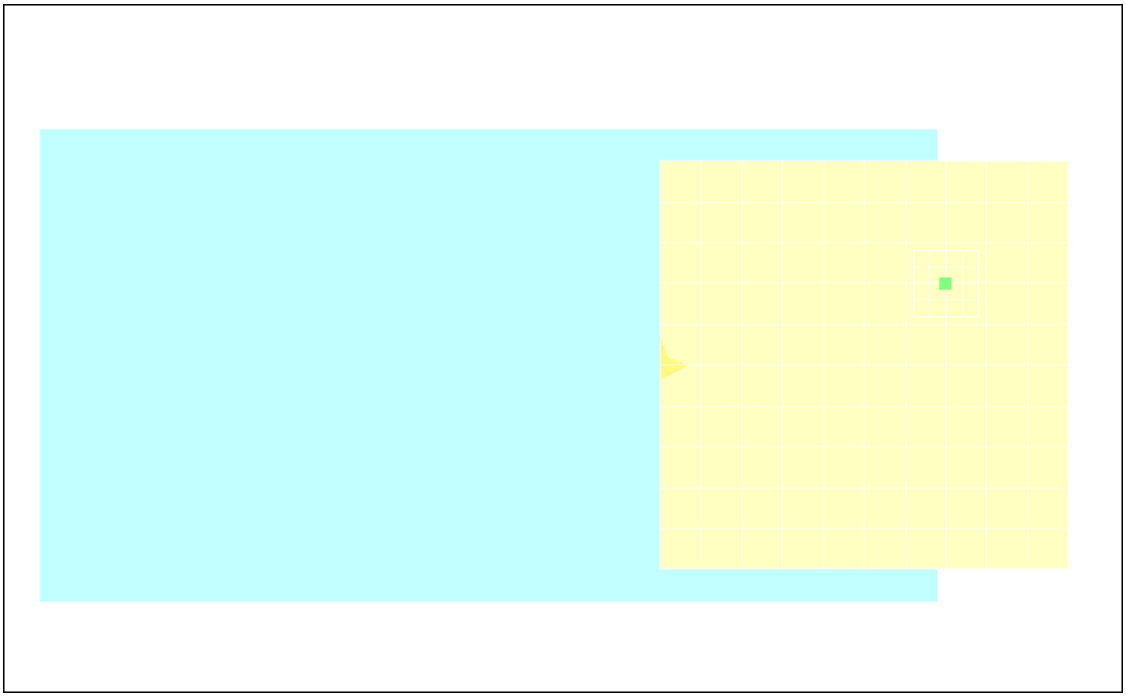
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans High Chan/x (longitudinal) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155041 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 45.7 dB
ABM1 comp = -2.78 dB A/m
BWC Factor = 0.155041 dB
Location: -10, -10, 3.7 mm



0 dB = 1.00

Date/Time: 6/8/2010 9:02:35 PM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA800_high_chan_Radial_T

DUT: BlackBerry Smartphone;

Communication System: CDMA 800; Frequency: 824.7 MHzFrequency: 848.52 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/y (transversal) 5.0mm 50 x 50/ABM

## SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155041 dB

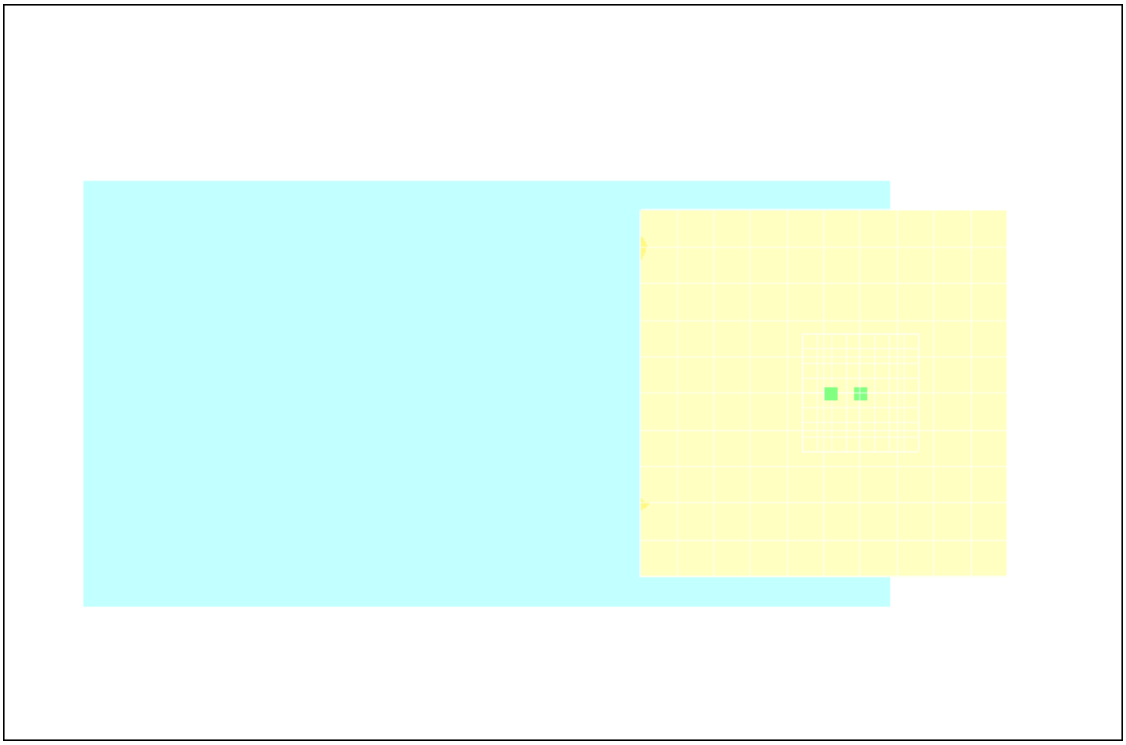
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans High Chan/y (transversal) fine 2mm 8 x 8/ABM SNR(x,y,z) (9x9x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155041 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 54.1 dB
ABM1 comp = -1.12 dB A/m
BWC Factor = 0.155041 dB
Location: -1, 0, 3.7 mm



0 dB = 1.00

Date/Time: 6/9/2010 12:00:29 AM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA1900_low_chan_Axial

DUT: BlackBerry Smartphone;

Communication System: CDMA 1900; Frequency: 1851.25 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/z (axial) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155979 dB

Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Low Chan/z (axial) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

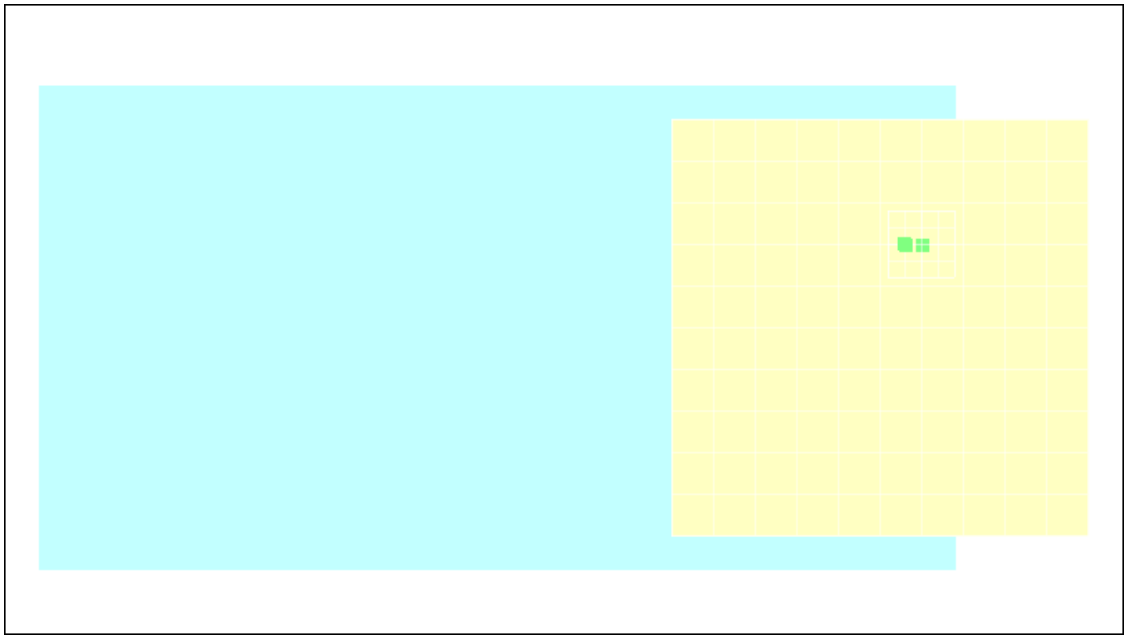
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155979 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

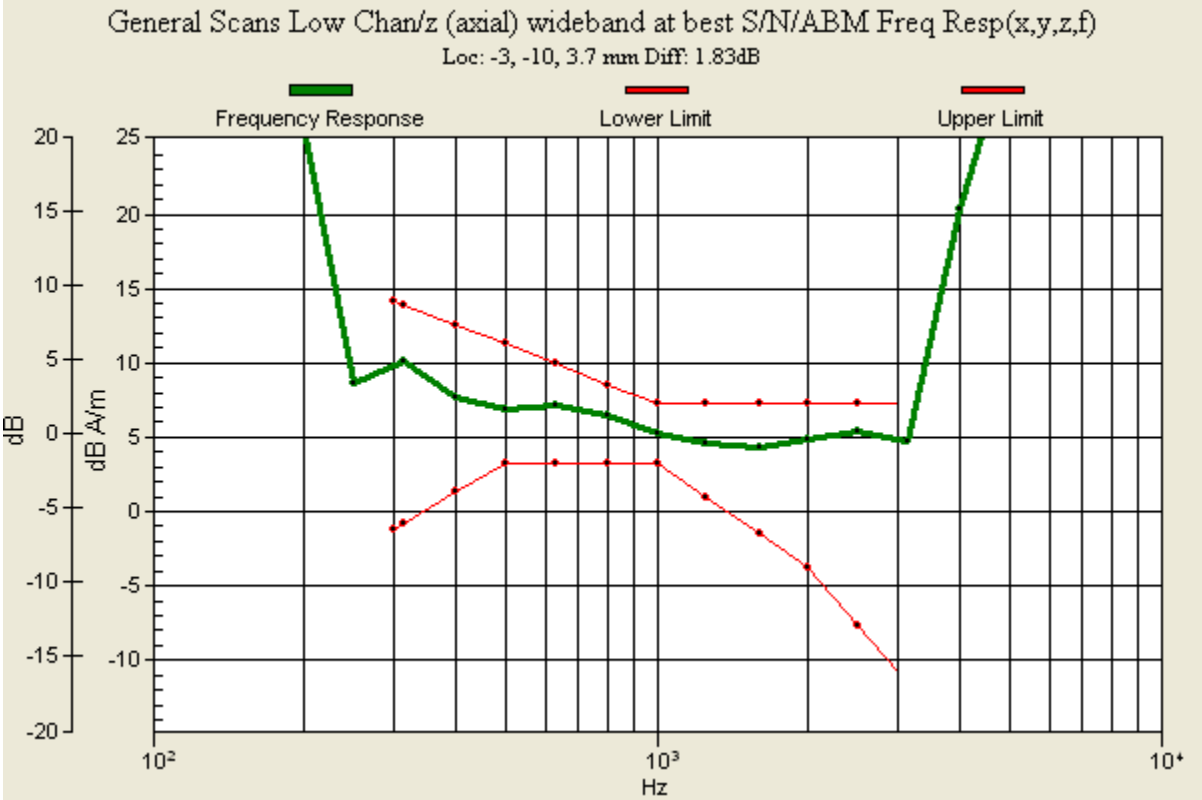
ABM1/ABM2 = 51.4 dB
ABM1 comp = 3.70 dB A/m
BWC Factor = 0.155979 dB
Location: -3, -10, 3.7 mm

## General Scans Low Chan/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 54.9
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, -6.30 mm



0 dB = 1.00



Date/Time: 6/9/2010 12:10:45 AM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA1900_low_chan_Radial_L

**DUT: BlackBerry Smartphone;**

Communication System: CDMA 1900; Frequency: 1851.25 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/x (longitudinal) 5.0mm 50 x 50/ABM

## SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155979 dB

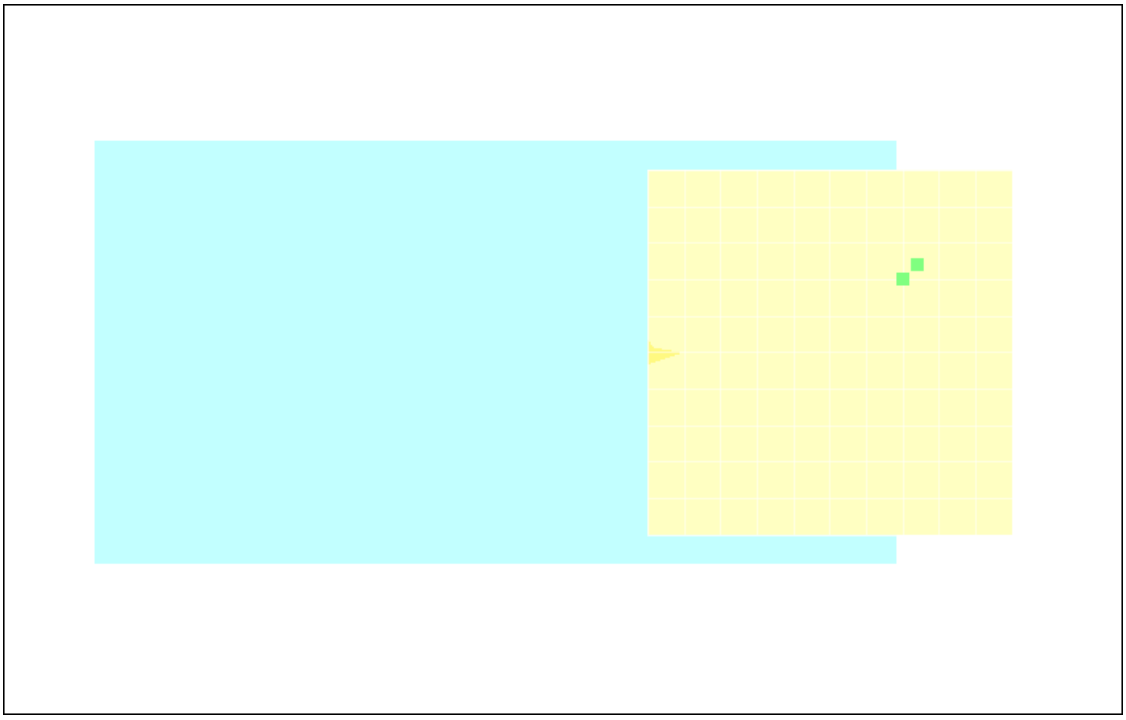
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Low Chan/x (longitudinal) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155979 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 45.3 dB
ABM1 comp = -4.87 dB A/m
BWC Factor = 0.155979 dB
Location: -12, -12, 3.7 mm



0 dB = 1.00

Date/Time: 6/9/2010 12:21:19 AM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA1900_low_chan_Radial_T

**DUT: BlackBerry Smartphone;**

Communication System: CDMA 1900; Frequency: 1851.25 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/y (transversal) 5.0mm 50 x 50/ABM

## SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155979 dB

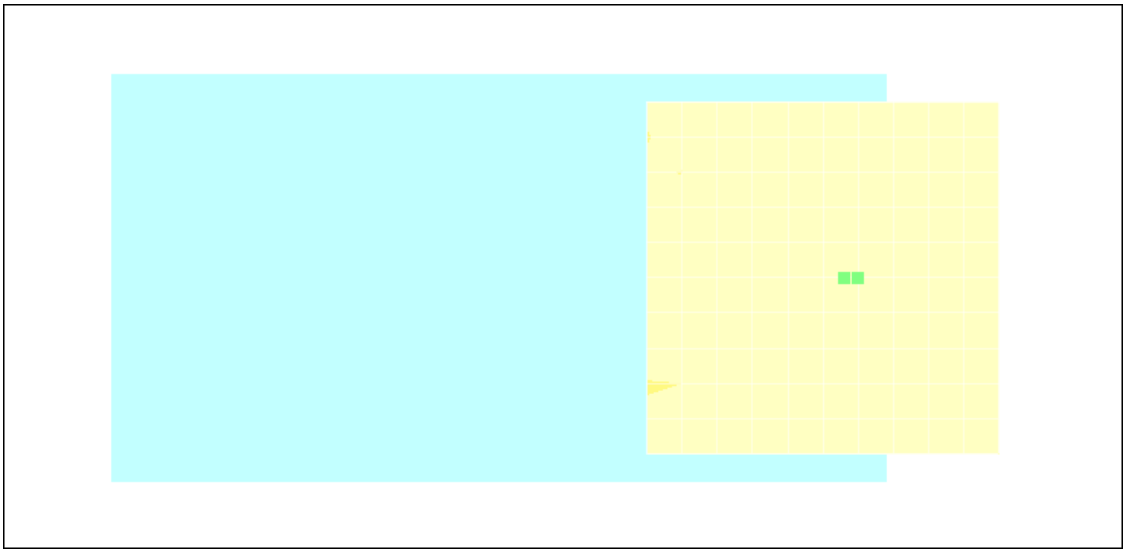
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Low Chan/y (transversal) fine 2mm 8 x 8/ABM SNR(x,y,z) (9x9x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155979 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 54.2 dB
ABM1 comp = -2.12 dB A/m
BWC Factor = 0.155979 dB
Location: -3, 0, 3.7 mm



0 dB = 1.00

Date/Time: 6/9/2010 12:00:29 AM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA1900_mid_chan_Axial

DUT: BlackBerry Smartphone;

Communication System: CDMA 1900; Frequency: 1851.25 MHzFrequency: 1880 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/z (axial) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155979 dB

Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Mid Chan/z (axial) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

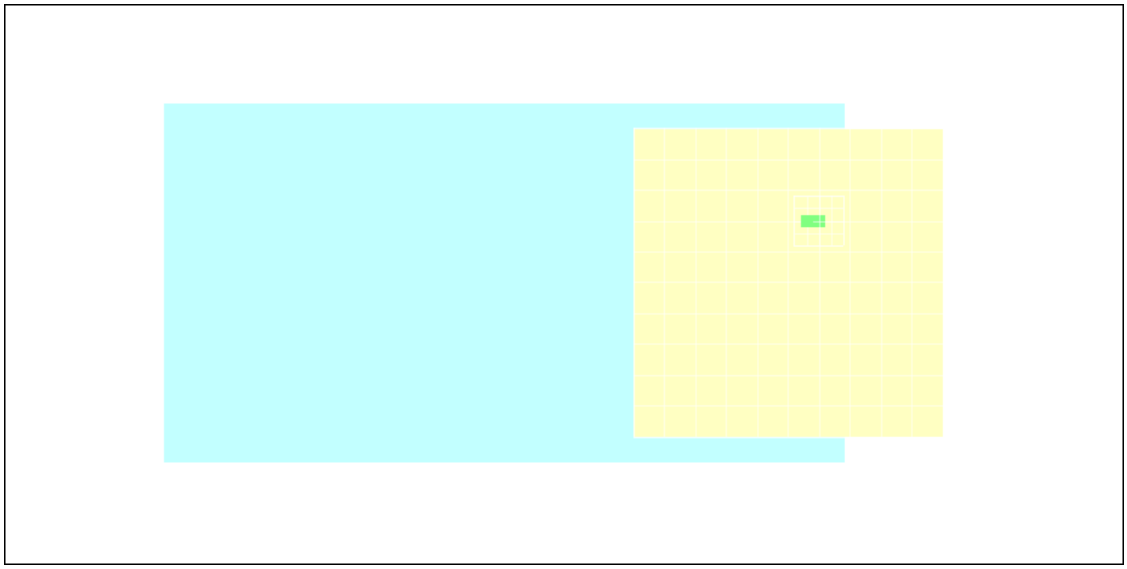
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155041 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

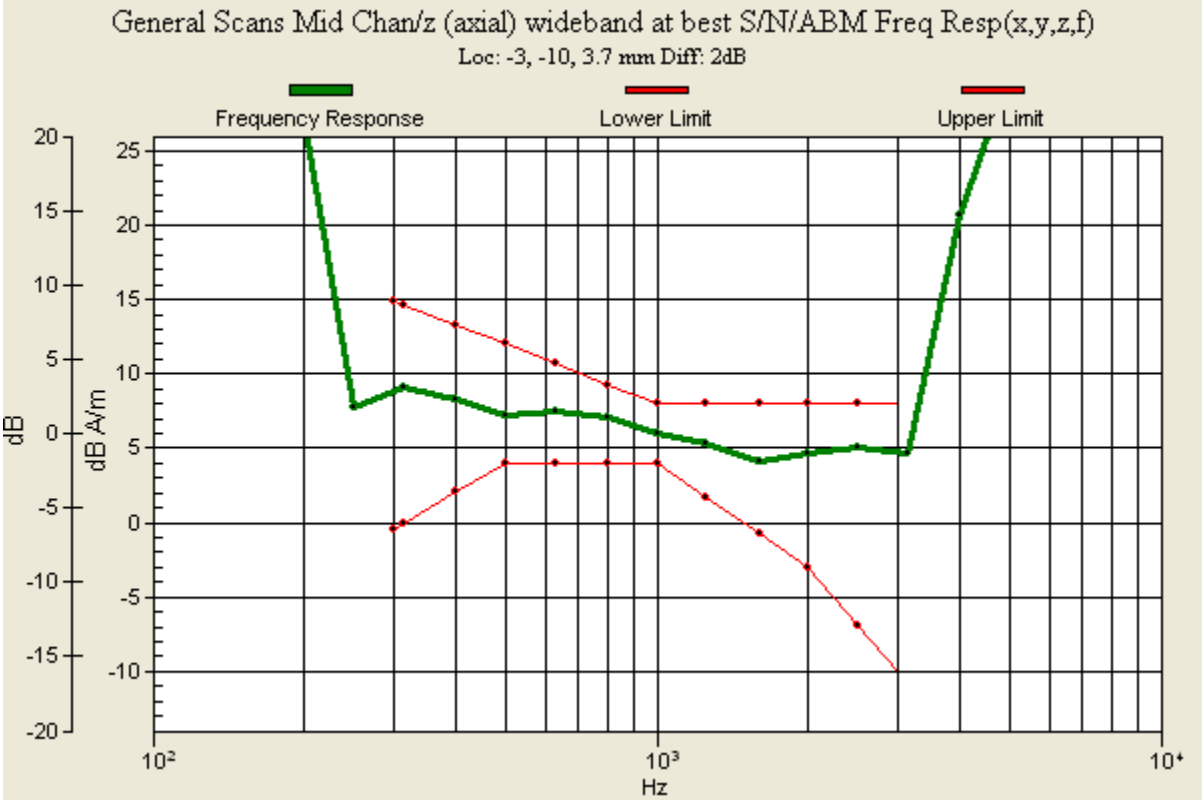
ABM1/ABM2 = 52.2 dB
ABM1 comp = 4.97 dB A/m
BWC Factor = 0.155041 dB
Location: -3, -10, 3.7 mm

## General Scans Mid Chan/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 54.9
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, -6.30 mm



0 dB = 1.00



Date/Time: 6/9/2010 12:10:45 AM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA1900_mid_chan_Radial_L

**DUT: BlackBerry Smartphone;**

Communication System: CDMA 1900; Frequency: 1851.25 MHzFrequency: 1880 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/x (longitudinal) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155979 dB

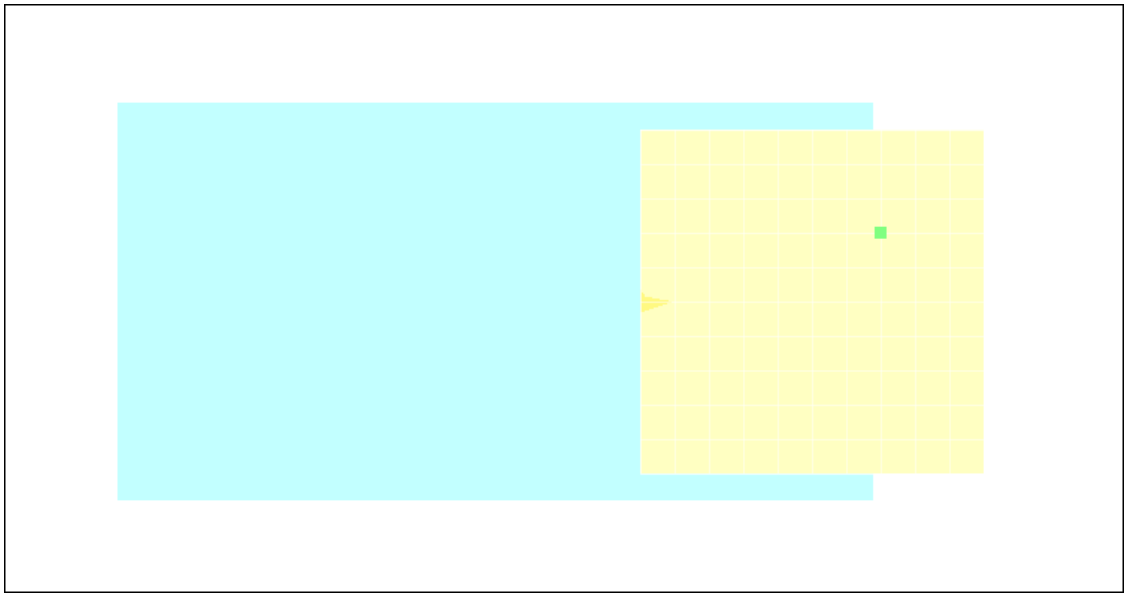
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Mid Chan/x (longitudinal) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155041 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 45.9 dB
ABM1 comp = -2.96 dB A/m
BWC Factor = 0.155041 dB
Location: -10, -10, 3.7 mm



0 dB = 1.00

Date/Time: 6/9/2010 12:21:19 AM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA1900_mid_chan_Radial_T

DUT: BlackBerry Smartphone;

Communication System: CDMA 1900; Frequency: 1851.25 MHzFrequency: 1880 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/y (transversal) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155979 dB

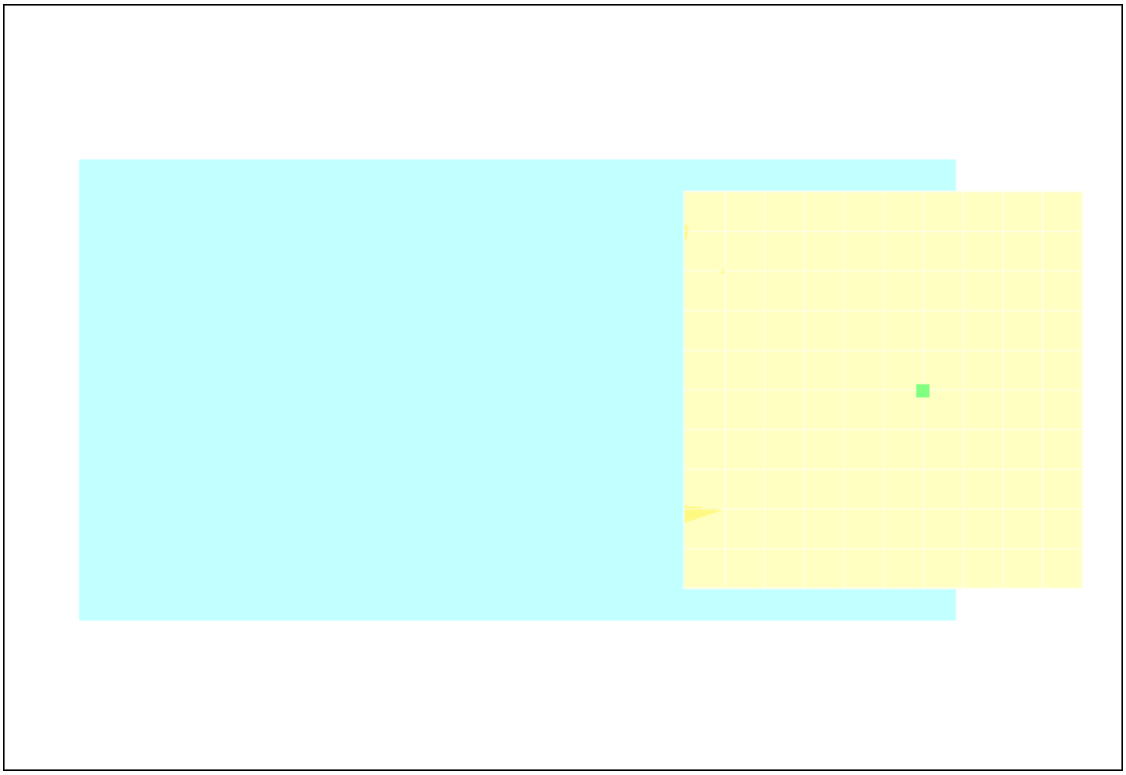
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans Mid Chan/y (transversal) fine 2mm 8 x 8/ABM SNR(x,y,z) (9x9x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155041 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 54.8 dB
ABM1 comp = -2.60 dB A/m
BWC Factor = 0.155041 dB
Location: -5, 0, 3.7 mm



0 dB = 1.00

Date/Time: 6/9/2010 12:00:29 AM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA1900_high_chan_Axial

**DUT: BlackBerry Smartphone;**

Communication System: CDMA 1900; Frequency: 1851.25 MHzFrequency: 1908.5 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/z (axial) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155979 dB

Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans High Chan/z (axial) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

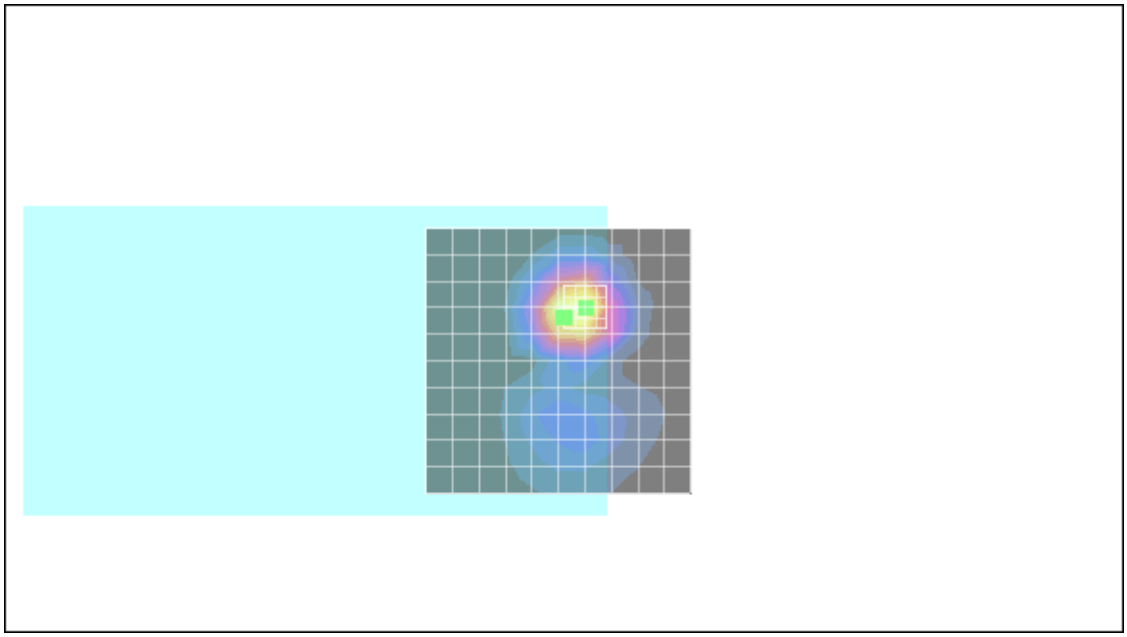
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155979 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

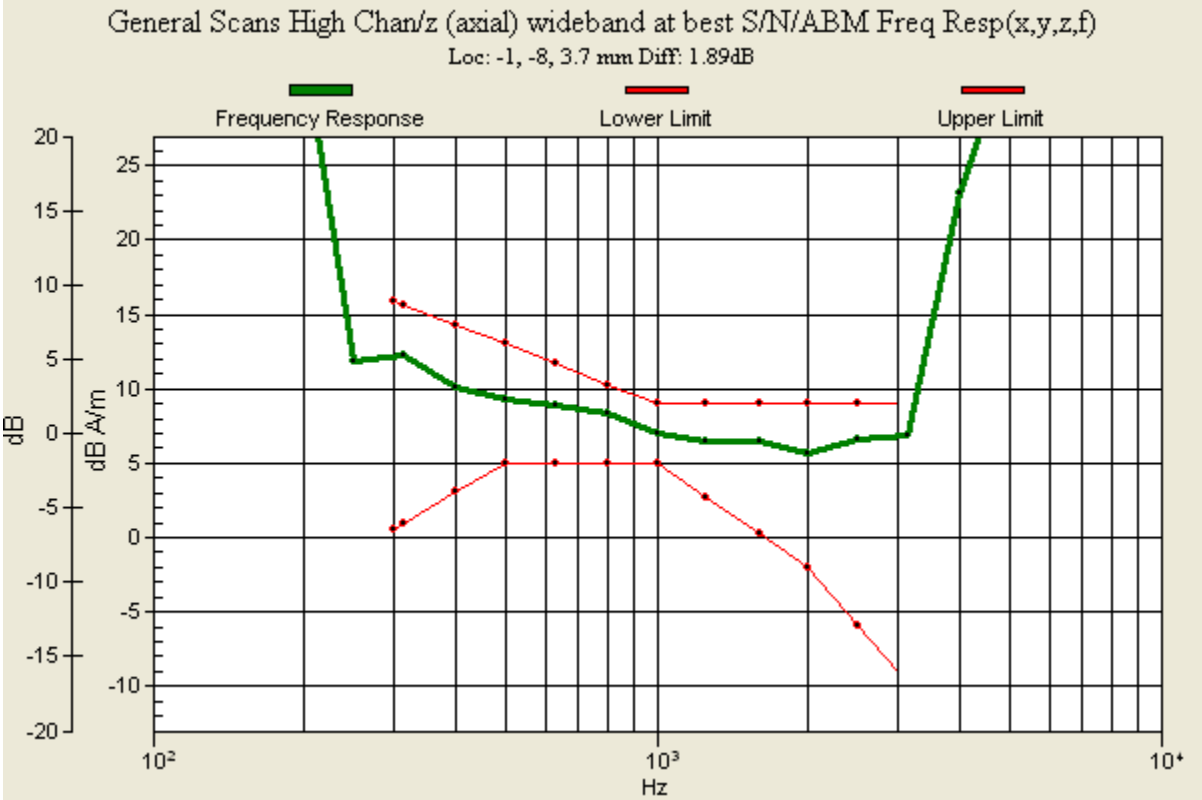
**Cursor:**

ABM1/ABM2 = 50.4 dB
ABM1 comp = 6.15 dB A/m
BWC Factor = 0.155979 dB
Location: -1, -8, 3.7 mm

## General Scans High Chan/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 54.9
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, -6.30 mm





Date/Time: 6/9/2010 12:10:45 AM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA1900_high_chan_Radial L

## DUT: BlackBerry Smartphone;

Communication System: CDMA 1900; Frequency: 1851.25 MHzFrequency: 1908.5 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/m$^3$

Phantom section: TCoil Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/x (longitudinal) 5.0mm 50 x 50/ABM SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155979 dB

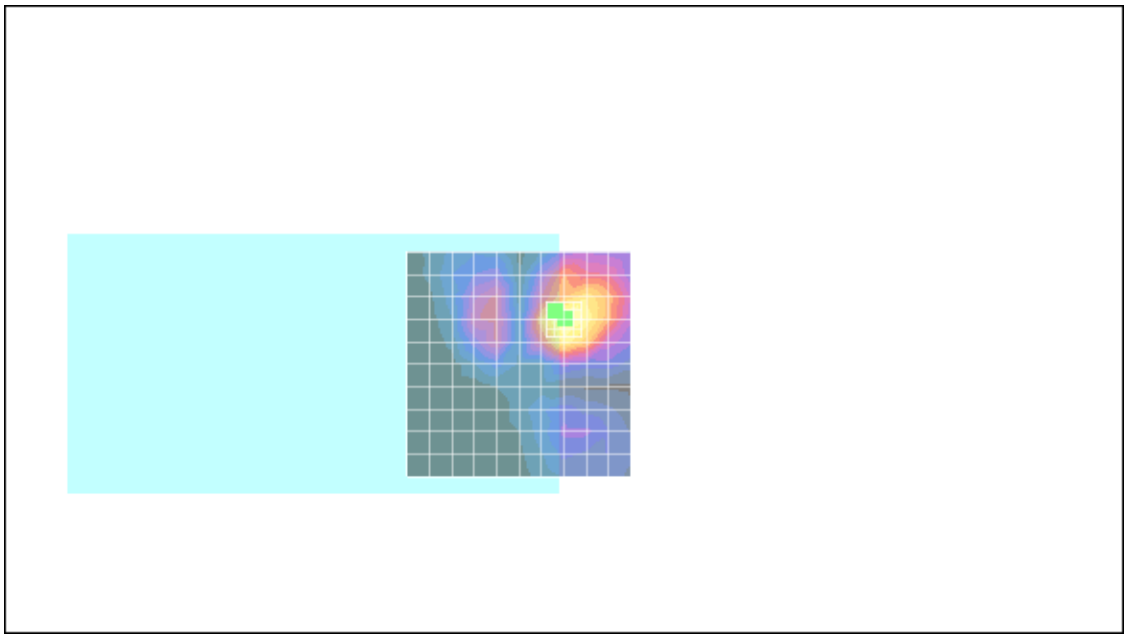
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans High Chan/x (longitudinal) fine 2mm 8 x 8/ABM SNR(x,y,z) (5x5x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155979 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 40.6 dB
ABM1 comp = -2.26 dB A/m
BWC Factor = 0.155979 dB
Location: -8, -12, 3.7 mm



Date/Time: 6/9/2010 12:21:19 AM

Test Laboratory: RIM Testing Services

HAC_TCoil_CDMA1900_high_chan_Radial T

## DUT: BlackBerry Smartphone;

Communication System: CDMA 1900; Frequency: 1851.25 MHzFrequency: 1908.5 MHz;Duty Cycle: 1:1

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$

Phantom section: TCoil Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: AM1DV2 - 1016; ; Calibrated: 3/17/2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn473; Calibrated: 1/4/2010
- Phantom: HAC RF Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

## General Scans Low Chan/y (transversal) 5.0mm 50 x 50/ABM

## SNR(x,y,z) (11x11x1):

Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 28

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.155979 dB

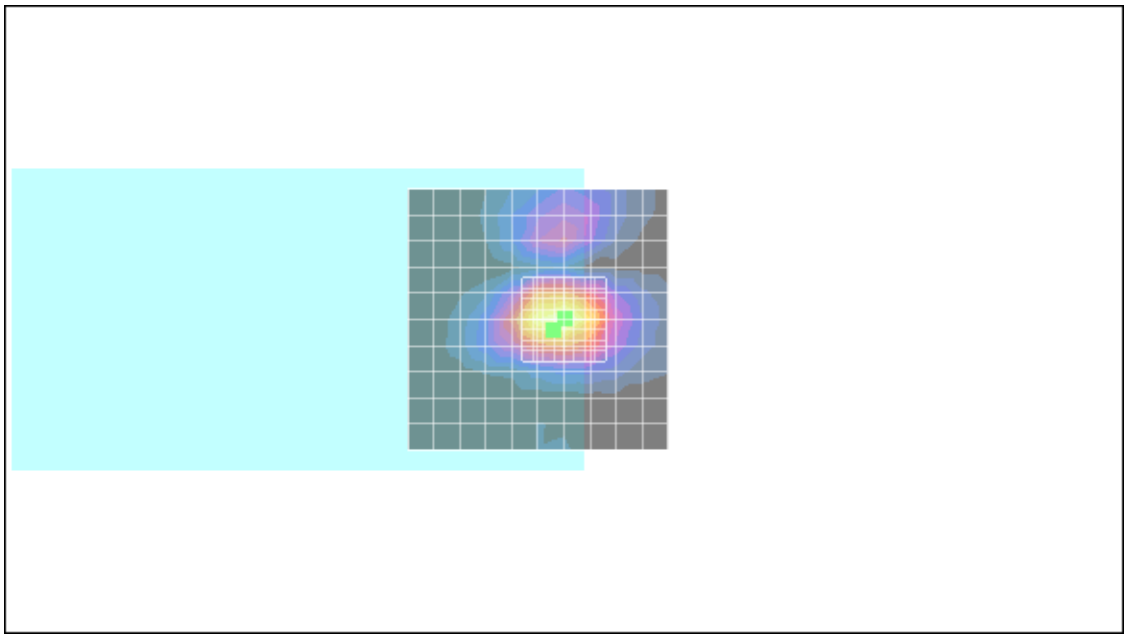
Device Reference Point: 0.000, 0.000, -6.30 mm

## General Scans High Chan/y (transversal) fine 2mm 8 x 8/ABM SNR(x,y,z) (9x9x1):

Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 28
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 0.155979 dB
Device Reference Point: 0.000, 0.000, -6.30 mm

**Cursor:**

ABM1/ABM2 = 49.3 dB
ABM1 comp = -1.67 dB A/m
BWC Factor = 0.155979 dB
Location: -3, 2, 3.7 mm



## Annex D: Probe/TMFS calibration certificate and specification

**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

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: RIM

Certificate No: AM1DV2-1016_Mar10

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | AM1DV2 - SN: 1016 |
| Calibration procedure(s) | QA CAL-24.v2<br>Calibration procedure for AM1D magnetic field probes and TMFS in the audio range |
| Calibration date: | March 17, 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 |
|---|---|---|---|
| Keithley Multimeter Type 2001 | SN: 0810278 | 1-Oct-09 (No: 9055) | Oct-10 |
| Reference Probe AM1DV2 | SN: 1008 | 21-Jan-10 (No. AM1D-1008_Jan10) | Jan-11 |
| DAE4 | SN: 781 | 22-Jan-10 (No. DAE4-781_Jan10) | Jan-11 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| AMCC | 1050 | 15-Oct-09 (in house check Oct-09) | Oct-10 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Mike Meili | Laboratory Technician | |
| Approved by: | Fin Bomholt | R&D Director | |

Issued: March 18, 2010

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

**References**

[1] ANSI C63.19-2007
American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.
[2] DASY4 manual, Chapter: Hearing Aid Compatibility (HAC) T-Coil Extension

**Description of the AM1D probe**

The AM1D Audio Magnetic Field Probe is a fully shielded magnetic field probe for the frequency range from 100 Hz to 20 kHz. The pickup coil is compliant with the dimensional requirements of [1]. The probe includes a symmetric low noise amplifier for the signal available at the shielded 3 pin connector at the side. Power is supplied via the same connector (phantom power supply) and monitored via the LED near the connector. The 7 pin connector at the end of the probe does not carry any signals, but determines the angle of the sensor when mounted on the DAE. The probe supports mechanical detection of the surface.
The single sensor in the probe is arranged in a tilt angle allowing measurement of 3 orthogonal field components when rotating the probe by 120° around its axis. It is aligned with the perpendicular component of the field, if the probe axis is tilted nominally 35.3° above the measurement plane, using the connector rotation and sensor angle stated below.
The probe is fully RF shielded when operated with the matching signal cable (shielded) and allows measurement of audio magnetic fields in the close vicinity of RF emitting wireless devices according to [1] without additional shielding.

**Handling of the Item**

The probe is manufactured from stainless steel. In order to maintain the performance and calibration of the probe, it must not be opened. The probe is designed for operation in air and shall not be exposed to humidity or liquids. For proper operation of the surface detection and emergency stop functions in a DASY system, the probe must be operated with the special probe cup provided (larger diameter).

**Methods Applied and Interpretation of Parameters**

- *Coordinate System:* The AM1D probe is mounted in the DASY system for operation with a HAC Test Arch phantom with AMCC Helmholtz calibration coil according to [2], with the tip pointing to "southwest" orientation.
- *Functional Test:* The functional test preceding calibration includes test of
  Noise level
  RF immunity (1kHz AM modulated signal). The shield of the probe cable must be well connected.
  Frequency response verification from 100 Hz to 10 kHz.
- *Connector Rotation:* The connector at the end of the probe does not carry any signals and is used for fixation to the DAE only. The probe is operated in the center of the AMCC Helmholtz coil using a 1 kHz magnetic field signal. Its angle is determined from the two minima at nominally +120° and –120° rotation, so the sensor in the tip of the probe is aligned to the vertical plane in z-direction, corresponding to the field maximum in the AMCC Helmholtz calibration coil.
- *Sensor Angle:* The sensor tilting in the vertical plane from the ideal vertical direction is determined from the two minima at nominally +120° and –120°. DASY system uses this angle to align the sensor for radial measurements to the x and y axis in the horizontal plane.
- *Sensitivity:* With the probe sensor aligned to the z-field in the AMCC, the output of the probe is compared to the magnetic field in the AMCC at 1 kHz. The field in the AMCC Helmholtz coil is given by the geometry and the current through the coil, which is monitored on the precision shunt resistor of the coil.

**AM1D probe identification and configuration data**

| | |
|---|---|
| Item | **AM1DV2** Audio Magnetic 1D Field Probe |
| Type No | SP AM1 001 AC |
| Serial No | **1016** |

| | |
|---|---|
| Overall length | 296 mm |
| Tip diameter | 6.0 mm (at the tip) |
| Sensor offset | 3.0 mm (centre of sensor from tip) |
| Internal Amplifier | 40 dB |

| | |
|---|---|
| Manufacturer / Origin | Schmid & Partner Engineering AG, Zurich, Switzerland |
| Manufacturing date | Apr-2006 |
| Last calibration date | April 23, 2009 |

**Calibration data**

| | | | |
|---|---|---|---|
| Connector rotation angle | (in DASY system) | **253.9** ° | +/- 3.6 ° (k=2) |
| Sensor angle | (in DASY system) | **3.94** ° | +/- 0.5 ° (k=2) |
| Sensitivity at 1 kHz | (in DASY system) | **0.0652 V / (A/m)** | +/- 2.2 % (k=2) |

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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** RTS (RIM Testing Services) **Certificate No: TMFS_1003_Jan10**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object / Identification | TMFS-1 – SN: 1003 |
| Calibration procedure(s) | QA CAL-24 v2<br>Calibration procedure for AM1D magnetic field probes and TMFS in the audio range |
| Calibration date | January 22, 2010 |
| Condition of the calibrated item | In Tolerance |

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The calibrations have been conducted in the R&D laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Keithley Multimeter Type 2001 | SN: 0810278 | 1-Oct-09 (No: 9055) | Oct-10 |
| **Secondary Standards** | **ID #** | **Cal / Check Date** | **Scheduled Calibration Check** |
| AMCC | 1050 | 15-Oct-09 (in house check Oct-09) | Oct-11 |
| Reference Probe AM1DV2 | SN: 1008 | 21-Jan-10 (No. AM1D-1008_Jan10) | Jan-11 |
| AMMI Audio Measuring Instrument | 1062 | 14-Jul-09 (in house check Jul-09) | Jul-11 |
| Agilent WF Generator 33120A | MY40005266 | 13-Oct-09 (in house check Oct-09) | Oct-11 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Mike Meili | Laboratory Technician | |
| Approved by: | Fin Bomholt | R&D Director | |

Issued: January 25, 2010

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

**References**

[1] ANSI-PC63.19-2007
American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.
[2] DASY4 manual, Chapter 29: Hearing Aid Compatibility (HAC) T-Coil Extension (April 2008)

**Methods Applied and Interpretation of Parameters**

- *Coordinate System:* The TMFS is mounted underneath the HAC Test Arch touching equivalently to a wireless device according to [2] 29.2.2.: In "North" orientation, the TMFS signal connector is directed to the north, with x and y axes of TMFS and Test arch coinciding (see fig. 1). The rotational symmetry axis of the TMFS is aligned to the center of the HAC test Arch. For East, South and West configuration, the TMFS has been rotated clockwise in steps of 90°, so the connector looks into the specified direction. The evaluation of the radial direction is referenced to the device orientation (x equivalent to South direction).

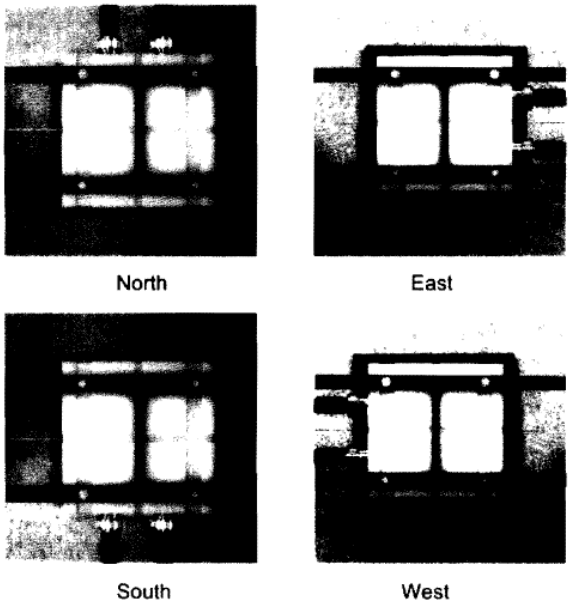


Fig. 1 TMFS scanning measurement configurations

- *Measurement Plane:* In coincidence with standard [1], the measurement plane (probe sensor center) is selected to be at a distance of 10 mm above the the surface of the TMFS touching the frame. The 50 x 50 mm scan area is aligned to the center of the unit. The scanning plane is verified to be parallel to the phantom frame before the measurements using the predefined "Geometry and signal check" procedure according to the predefined procedures described in [2].

- *Measurement Conditions:* Calibration of AM1D probe and AMMI are according to [2]. The 1 kHz sine signal for the level measurement is supplied from an external, independent generator via a BNC cable to TMFS IN and monitored at TMFS OUT with an independent RMS voltmeter or Audio Analyzer. The level is set to 0.5 Vrms and monitored during the scans.

- For the *frequency response*, a higher suppression of the background ambient magnetic field over the full frequency range was achieved by placing the TMFS in a magnetically shielded box. The AM1D probe was fixed without robot positioner near the axial maximum for this measurement. The background noise suppression was typ. 30 dB at 100 Hz (minimum) and 42 dB at 1 kHz. The predefined multisine signal (48k_multisine_50-10000_10s.wav) was used and evaluated in the third-octave bands from 100 Hz to 10000 Hz.

## 1 Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY5 | V5.2 B162 |
| **DASY PP Version** | SEMCAD | V14.0 B59 |
| **Phantom** | HAC Test Arch | SD HAC P01 BA, #1002 |
| **Distance TMFS Top - Probe Centre** | 10 mm | |
| **Scan resolution** | dx, dy = 5 mm | area = 50 x 50 mm |
| **Frequency** | for field scans | 1 kHz |
| **Signal level to TMFS** | for field scans | 500 mV RMS |
| **Signal** | for frequency response | multisine signal 50-10000 Hz, each third-octave band |

Table 1: System configuration

## 2 Axial Maximum Field

| Configuration | East | South | West | North | Subset Average | Average |
|---|---|---|---|---|---|---|
| | | | | | | |
| **Axial Max** | -20.17 | -20.17 | -20.16 | -20.17 | | **-20.17** |
| | | | | | | |
| TMFS Y Axis 1st Max | -25.74 | -25.74 | -25.70 | -25.70 | | |
| TMFS Y Axis 2nd Max | -25.92 | -25.66 | -26.02 | -25.7 | | |
| **Longitudinal Max Avg** | **-25.83** | **-25.70** | **-25.86** | **-25.70** | **-25.77** | |
| | | | | | | |
| TMFS X Axis 1st Max | -25.73 | -25.71 | -25.73 | -25.67 | | |
| TMFS X Axis 2nd Max | -25.68 | -25.91 | -25.67 | -25.96 | | |
| **Transversal Max Avg** | **-25.71** | **-25.81** | **-25.70** | **-25.82** | **-25.76** | |
| | | | | | | |
| **Radial Max** | | | | | | **-25.77** |

Table 2: Axial and radial field maxima measured with probe center at 10mm distance in dB A/m

The maximum was calculated as the average from the values measured in the 4 orientations listed in table 2.

**Axial Maximum** **-20.17 dB A/m** (+/- 0.33dB, k=2)

## 3 Radial Maximum Field

In addition, the average from the 16 maxima of the radial field listed in table 2 (measured at 10mm) was calculated:

Radial Maximum **-25.77 dB A/m**

## 4 Appendix

### 4.1 Frequency response

Max. deviation measured, relative to 1 kHz: **min. –0.03, max. +0.02 dB**

| Frequency [Hz] | Response [dB] |
|---|---|
| 100 | 0.02 |
| 125 | 0.00 |
| 160 | -0.01 |
| 200 | 0.00 |
| 250 | 0.02 |
| 315 | -0.01 |
| 400 | 0.00 |
| 500 | 0.00 |
| 630 | 0.00 |
| 800 | 0.00 |
| **1000** | **0.00** |
| 1250 | -0.01 |
| 1600 | -0.01 |
| 2000 | -0.01 |
| 2500 | -0.01 |
| 3150 | -0.01 |
| 4000 | -0.02 |
| 5000 | -0.02 |
| 6300 | -0.03 |
| 8000 | -0.03 |
| 10000 | -0.03 |

Table 3: Frequency response

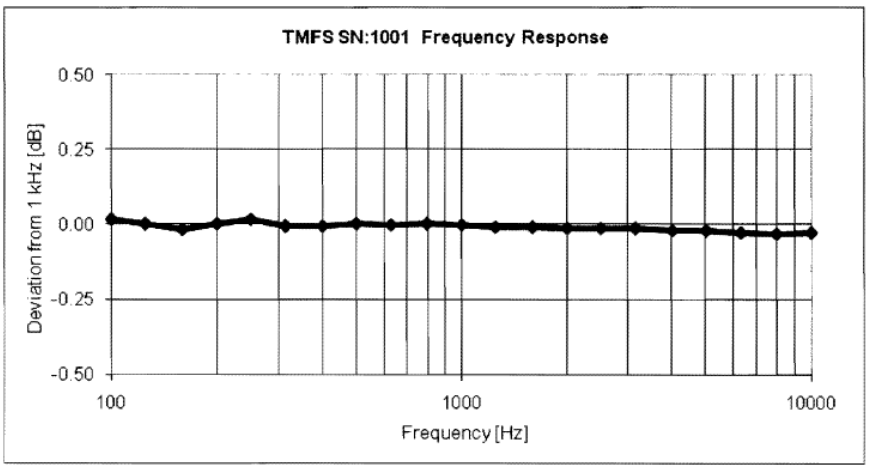


Fig. 2 Frequency response 100 to 10'000 Hz

### 4.2 Field plots

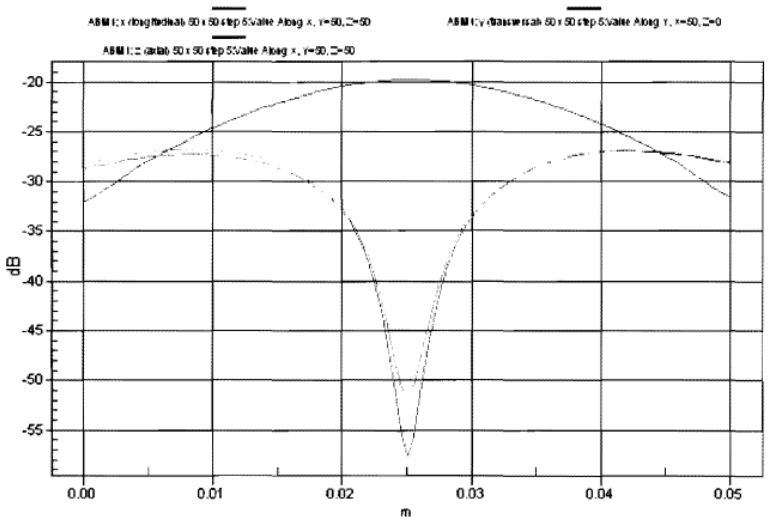


Fig. 3: Typical 2D field plots for x (red), y (green) and z (blue) components

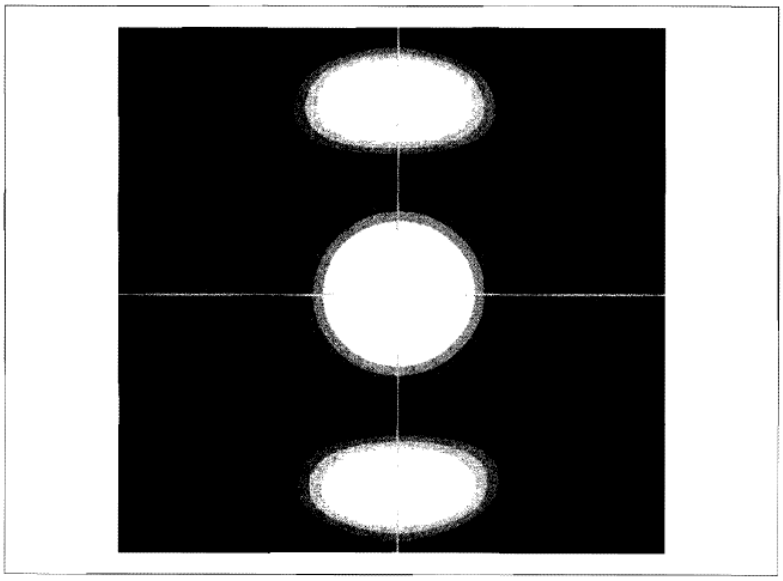

Fig. 4: Superponed field plots of z (axial), x and y radial magnetic field, 50 x 50 mm, individual scaling: white = max. field level, black = -4dB below max. The lines show the position of the 2D field plot of figure 3.

Schmid & Partner Engineering AG

s p e a g

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Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

## Certificate of conformity

| | |
|---|---|
| Item | Audio Magnetic Calibration Coil<br>AMCC |
| Type No | **SD HAC P02 A** |
| Series No | 1001 ff. |
| Manufacturer / Origin | Schmid & Partner Engineering AG<br>Zurich, Switzerland |

**Description of the item**
The Audio Magnetic Calibration coil (AMCC) is a Helmholtz Coil designed according to standard [1], section D.9 for calibration of the AM1D probe. Two horizontal coils are positioned above a non-metallic base plate and generate a homogeneous magnetic field in the z direction (normal to it).

**Configuration**
The AMCC consists of two parallel coils of 20 turns with radius 143 mm connected in parallel in a distance of 143 mm. With this design, a current of 10 mA produces a field of 1 A/m.
The DC input resistance at the input BNC socket is adjusted by a series resistor to a DC resistance of approximately 50 Ohm. The voltage required to produce a field of 1 A/m is consequently approx. 500 mV.
To current through the coil is monitored via a shunt resistor of 10 Ohm +/- 1%. The voltage is available on a BNO socket with 100 mV corresponding to 1 A/m.

**Handling of the item**
The coil shall be positioned in a non-metallic environment to avoid distortion of the magnetic field.

**Tests**

| Test | Requirement | Details | Units tested |
|---|---|---|---|
| Number of turns | N = 20 per coil | Resistance measurment | all |
| Orientation of coils | parallel coils with same direction of windings | Magnetic field variation in the AMCC axis | all |
| Coil radius | r = 143 mm | mechanical dimension | First article |
| Coil distance | d = 143 mm<br>distance between coil centers | mechanical dimension | First article |
| Input resistance | 51.7 +/- 2 Ohm | DC resistance at BNC input connector | all |
| Shunt resistance | R = 10.0 Ohm +/- 1 % | DC resistance at BNO output connector | all |
| Shunt sensitivity | Hc = 1 A/m per 100 mV<br>according to formula<br>Hc = (U / R) * N / r / (1.25^1.5) | Field measurement compared with Narda ELT400 + BN2300/90.10 | First article |

**Standards**
[1] ANSI PC63.19-2006 Draft 3.12

**Conformity**
Based on the tests above, we certify that this item is in compliance with the requirements of [1].

**Date** 22.5.2006

**Stamp / Signature**

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## Specifications

### Audio Magnetic Field Probe AM1D

The AM1D probe is an active probe with a single sensor according to [1] section D.8. It is fully RF shielded and has a rounded tip of 6 mm diameter incorporating a pickup coil with its center offset 3mm from the tip and the sides.

SPEAG, the manufacturer of the T-Coil system tested the probe frequency response and its dynamic range. The compliance is stated in the Certificate of conformity document 880-SPAM1001A-A. Also the probe frequency has been verified and the response deviation from the ideal differentiator was within +0.05 and - 0.46 dB in the range 100 Hz to 10 kHz on the center frequencies of the third-octave bands. Note that it includes the probe preamplifier and also with the AMMI internal preamplifiers, filters and processing.

**Dynamic range:**
maximum + 21 dB A/m @ 1 kHz
Noise level typically -70 dB A/m @ 1 kHz
ABM2 typically -60 dB A/m

**Linearity**
Within < 0.1 dB from 5 dB
below limitation to 16 dB above noise level

**Sensitivity**
Typically -24 dBV / A/m @ 1 kHz probe output

**Audio Magnetic Measurement Instrument (AMMI)**
sampling rate 48 kHz / 24 bit
dynamic range 85 dB
test signal generation user selectable and predefined (via PC)
calibration auto-calibration / full system calibration using AMCC
with monitor output
dimensions 482 x 65 x 270 mm

**Helmholtz Calibration Coil (AMCC)**
dimensions 370 x 370 x 196 mm, according to ANSI-PC63.19
The Audio Magnetic Calibration coil is a Helmholtz Coil designed according to [1], section D.9 for calibration of the AM1D probe. The two horizontal coils generate a homogeneous magnetic field in the z direction.

Shunt sensitivity Hc = 1 A/m per 100mV according to formula:

Hc = (U / R) * N / r / (1.25 ^ 1.5)

Number of turns N = 20 per coil
Coil radius r = 143 mm
Shunt resistance R = 10.00 Ohm