Hearing Aid Compatibility （HAC）
Test Report

Applicant	:	SeniorTech LLC
Address	:	100 Cherokee Blvd, Suite 216, Chattanooga, TN 37405
Equipment	:	3G senior feature phone
Brand name	:	Snapfon
Model name	:	EZ TWO-B1
FCC ID	:	ZXL-EZTWOB1

Date of Receipt	:	Sep.01.2014
Date of Test	:	Sep.10.2014
Report No.	:	140918001HAC-FCC

The Test Results relate only to the samples tested.
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Test Report Certification

Test Date :10-Sep-14
Report No. :140918001HAC-FCC

Product Name	:	**3G senior feature phone**
Applicant	:	**SeniorTech LLC**
Address	:	**100 Cherokee Blvd, Suite 216, Chattanooga, TN 37405**
Manufacturer	:	**ENJOY GROUP(HK) CO,LIMITED**
Model No.	:	**EZ TWO-B1**
Trade Name	:	**Snapfon**
Measurement Standard	:	**ANSI C63.19-2007 (8 June,2007)**
M category	:	**H-Field Emissions : M3** **E-Field Emissions: M3**
Test Result	:	**Complied**

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Documented By : Jin-Qiang Wang

Tested By : vida gu

Approved By : Jeff Huang

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Description Page

1.GENERAL INFORMATION

1.1. EUT Description

Product Name	**:**	**3G senior feature phone**
Trade Name	**:**	**Snapfon**
Model No.	**:**	**EZ TWO-B1**
TX Frequency	**:**	**GSM 850: 824MHz~849MHz** **GSM 1900: 1850MHz~1910MHz** **WCDMA 850:826.4MHz-846.60MHz** **WCDMA 1900: 1852.4-1907.6MHz**
RX Frequency	**:**	**GSM 850: 869MHz~894MHz** **GSM 1900: 1930MHz~1990MHz** **WCDMA 850: 871.4 - 891.6MHz** **WCDMA 1900: 1932.4 - 1987.6MHz**
Antenna Type	**:**	**PIFA**
Device Category	**:**	**Portable**
Hardware version	**:**	**N/A**
Max. Output Power (Conducted)	**:**	**GSM850: 32.88dBm** **GSM1900:29.42dBm** **WCDMA850:22.80** **WCDMA1900:22.55**

1.2. Test Environment

Ambient conditions in the laboratory:

Items	Required	Actural
Temperature(℃)	15~30	21.4
Humidity(%RH)	30~70	46

2.System components

2.1 ALSAS-10U System Description

ALSAS-10-U is fully compliant with the technical and scientific requirements of IEEE 1528, IEC 62209, CENELEC, ARIB, ACA, and the Federal Communications Commission. The system comprises of a six axes articulated robot which utilizes a dedicated controller.
ALSAS-10U uses the latest methodologies and FDTD order to provide a platform which is repeatable with minimum uncertainty.

2.2 E-Field Probe Specification

Compliant Standards	ANSI C63.19 200x
Construction	3 Dipoles utilizing high impedance lines diode mounted and arranged for X, Y, Z measurements
Frequency Range	700MHz to 3GHz
Sensitivity Air	Better than 0.65 $\mu V/(V/m)^2$
Dynamic Range	2mV to 200mV typical (non amplified)
Isotropic Response Axial	Typically ± 0.1dB
Linearity	±0.2 dB or better
Probe Tip Radius	5 mm
Sensor Offset	1.56 (± 0.02 mm)
Probe Length	290 mm
Connector	6 Pin Bayonet
Material	Ertalyte™

2.3 H-Field Probe Specification

Compliant Standards	ANSI C63.19 200x
Construction	3 Dipoles utilizing high impedance lines diode mounted and arranged for X, Y, Z measurements
Frequency Range	700MHz to 3GHz
Sensitivity Air	$33.0mV/(A/m)^2$
Dynamic Range	5 mA/m to 2 A/m
Linearity	±0.2 dB or better
Probe Tip Radius	User selectable all <7 mm
Sensor Offset	3.5 (± 0.02 mm)
Probe Length	300 mm
Connector	6 Pin Bayonet
Material	Ertalyte™

2.4 Axis Articulated Robot

ALSAS-10U utilizes a six articulated robot, which is controlled using a Pentium based real-time movement controller. The movement kinematics engine utilizes proprietary (Thermo CRS) interpolation and extrapolation algorithms, which allow full freedom of movement for each of the six joints within the working envelop. Utilization of joint 6 allows for full probe rotation with a tolerance better than 0.05mm around the central axis.

Robot/Controller Manufacturer	Thermo CRS
Number of Axis	Six independently controlled axis
Positioning Repeatability	0.05mm
Controller Type	Single phase Pentium based C500C
Robot Reach	710mm
Communication	RS232 and LAN compatible

2.5 Universal Device Positioner

The universal device positioner allows complete freedom of movement of the EUT. Developed to hold a EUT in a free-space scenario any additional loading attributable to the material used in the construction of the positioner has been eliminated. Repeatability has been enhanced through the linear scales which form the design used to indicate positioning for any given test scenario in all major axes.

2.6 Test Equipment List

Instrument	Manufacture	Model No.	Serial No.	Last Calibration
Universal Work Station	Aprel	ALS-UWS	100-00154	NCR
Data Acquisition Package	Aprel	ALS-DAQ-PAQ-3	110-00215	NCR
Probe Mounting Device and Boundary Detection Sensor System	Aprel	ALS-PMDPS-3	120-00265	NCR
E-Field Probe	Aprel	E-020-H	274	Oct.4,2013
H-Field Probe	Aprel	H-030	400-00102	Oct.4,2013
Reference Validation Dipole 900MHz	Aprel	ALS-D-900-S-2-HAC	190-00607	May.28,2014
Reference Validation Dipole 1900MHz	Aprel	ALS-D-1900-S-2-HAC	210-00708	May.28,2014
Dielectric Probe Kit	Aprel	ALS-PR-DIEL	260-00955	NCR
Device Holder 2.0	Aprel	ALS-H-E-SET-2	170-00506	NCR
SAR software	Aprel	ALS-SAR-AL-10	Ver.2.3.8.90	NCR
CRS C500C Controller	Thermo	ALS-C500	RCF0504291	NCR
CRS F3 Robot	Aprel	ALS-F3-SW	N/A	NCR
Power Amplifier	Mini-Circuit	ZHL- 42	040306	Jul.13,2014
Directional Coupler	Agilent	778D-012	N/A	Jul.13,2014
Universal Radio Communication	Agilent	E5515C	104845	Mar.11,2014

Tester				
Spectrum Analyzer	R&S	FSP7	100614	Dec.14,2013
Signal Generator	Agilent	E8257D	N/A	Dec.14,2013
Power Meter	R&S	NRP	N/A	Dec.14,2013

Note: All equipment upon which need to be calibrated are with calibration period of 1 year.

2.7 Measurement Uncertainty

Table 2—Hearing aid immunity measurements

Hearing aid near-field immunity measurement uncertainty estimation						
Contribution	**Data dB**	**Data type**	**Prob. dist.**	**Weight**	**Uncertainty dB**	**Notes/comments**
RF reflections	± 0.8	Spec	Rect	$1/\sqrt{3}$	± 0.46	Reflections < –20 dB
Power meter (forward)	± 0.06	Spec	Rect	$1/\sqrt{3}$	± 0.034	VSWR ≤ 1.08, Γ ≤ 0.04
Power meter (reverse)	± 0.06	Spec	Rect	$1/\sqrt{3}$	± 0.034	VSWR ≤ 1.08, Γ ≤ 0.04
Directional coupler	± 1.0	Spec.	Rect	$1/\sqrt{3}$	± 0.58	VSWR ≤ 1.15, Γ ≤ 0.07
Cable loss	± 1.0	Uncert'y	Norm.	1/2	± 0.5	
Hearing aid loading of ant.	—	—	—	—	—	VSWR ≤ 1.9, Γ ≤ 0.31
Mismatch	± 0.19	Spec.	U-shaped	$1/\sqrt{2}$	± 0.13	$20\text{Log}(1 \pm \Gamma_1\Gamma_2)$
Positioning accuracy	± 1.62	Spec.	Rect.	$1/\sqrt{3}$	± 0.94	E.2.3
Acoustic transmission line	—	—	—	—	—	TBD
Microphone	± 1.0	Spec.	Rect.	$1/\sqrt{3}$	± 0.58	
2 cc coupler	—	—	—	—	—	TBD
Pre-amplifier	± 1.0	Spec.	Rect.	$1/\sqrt{3}$	± 0.58	
Frequency analyzer	± 0.5	Spec.	Rect.	$1/\sqrt{3}$	± 0.29	
System repeatability	± 0.5	Std. Dev.	Norm.	1	± 0.5	
EUT repeatability	—			—	—	TBD
Combined standard uncertainty, $u_c(y)$			Norm.	1	1.65	
Expanded uncertainty, U			Norm.	2	3.29	

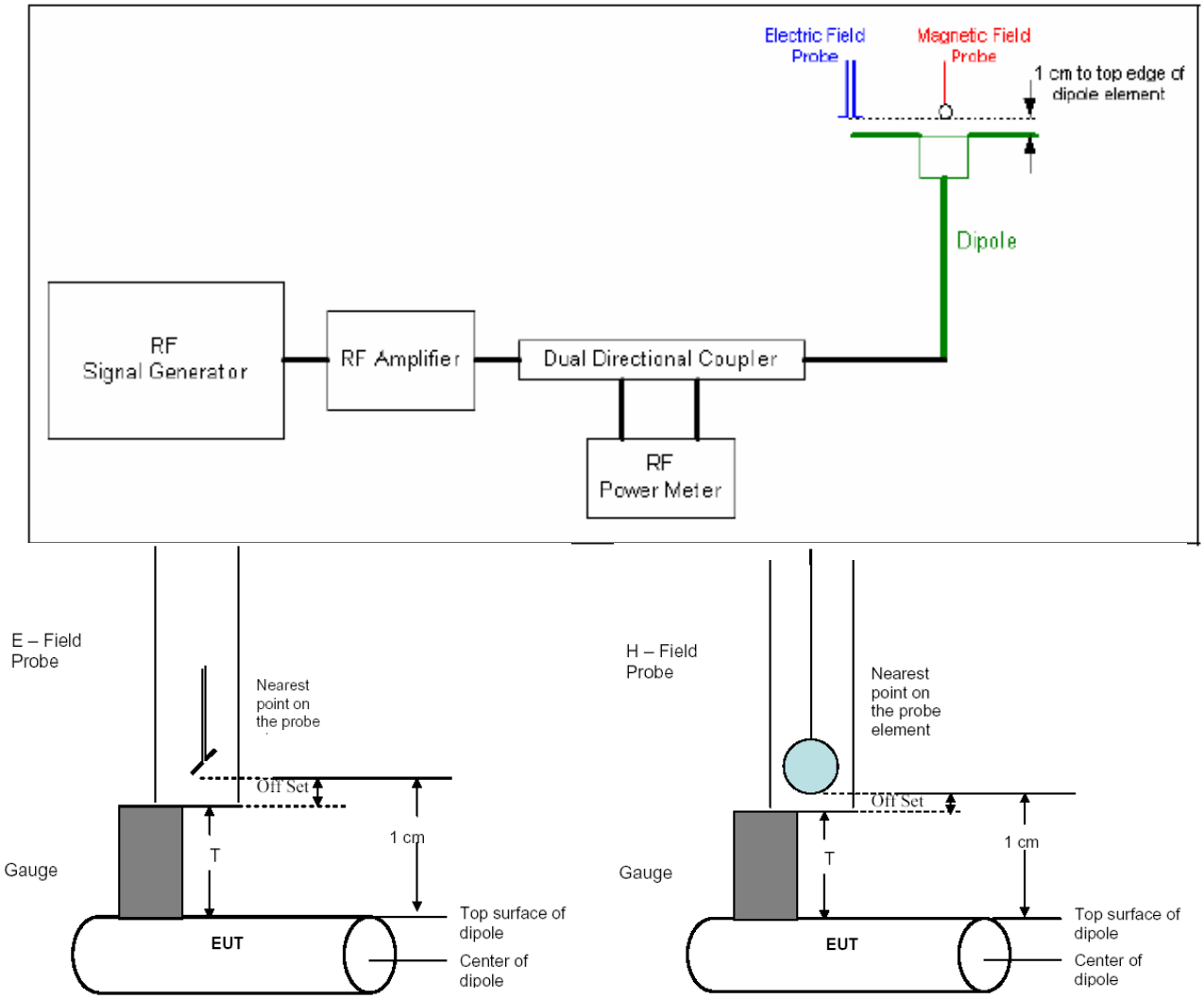
3. HAC RF Emission Measurement Evaluation

3.1 System Check

The test setup should be validated when first configured and verified periodically thereafter to ensure proper function. The procedure consists of two parts: dipole validation and determination of probe modulation factor

3.2 Dipole validation

The HAC validation dipole antenna serves as a known source for an electrical and magnetic RF output. Figure 2 shows the setup used for the dipole validation.
1. The dipole antenna was placed in the position normally occupied by the WD.
2. The dipole was energized with a 20 dBm un-modulated continuous-wave signal.
3. The length of the dipole was scanned with both E-field and H-field probes and the maximum value for each scan was recorded.
4. The readings were compared with the values provided by the probe manufacturer and were found to agree within the allowed tolerance of 10%.Figure 2: Dipole Validation Procedure



The probe is positioned over the illuminated dipole at 10 mm distance from the nearest point on the probe sensor element to the top surface (edge) of the dipole element.

3.3 Probe Modulation Factor

Purpose

The HAC Standard requires measurement of the peak envelope E- and H-fields of the wireless device (WD). Para. 4.1.2.1, and C.3.1 of the standard describes the Probe Modulation Response Factor that shall be applied to convert the probe reading to Peak Envelope Field.

Definitions

The Probe Modulation Factor (PMF) is defined as the ratio of the field readings for a CW and a modulated signal with the equivalent Field Envelope Peak as defined in the Standard (Chapter C.3.1).

Evaluation Procedure for Unknown PMF

The proposed measurement setup corresponds to the procedure as required in the Standard, Chapter C.3.1.

1. Install a calibration dipole for the appropriate frequency band under the Test Arch Phantom and select the proper phantom section according to the probe type installed (E- or H-field). Move the probe to the field reference point. (Do not move the probe between the subsequent CW and modulated measurements.)
2. Install the field probe in the setup.
3. The modulated signal to the dipole must be monitored to record peak amplitude and compared to a CW signal with the same peak envelope level (e.g., with a directional coupler and a spectrum analyzer in zero span mode set to the operating frequency). To determine the peak envelope level of the modulated signal properly, the settings of a spectrum analyzer shall be as follows:
   - Resolution bandwidth >= emission bandwidth
   - Video bandwidth >= 20kHz
   - Center Frequency: nominal center frequency of channel
   - Detection: RMS detection with averaging turned on
   - Trigger: Video or IF trigger, adjusted to give a stable display of the transmission
   - Sweep rate: Sufficiently rapid to permit the transmit pulse to be resolved accurately. The sweep shall be long enough to show a complete transmission. The sweep time may be set to allow a full transmission cycle, displaying the on and off time.
4. Define a DASY4 document and 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.

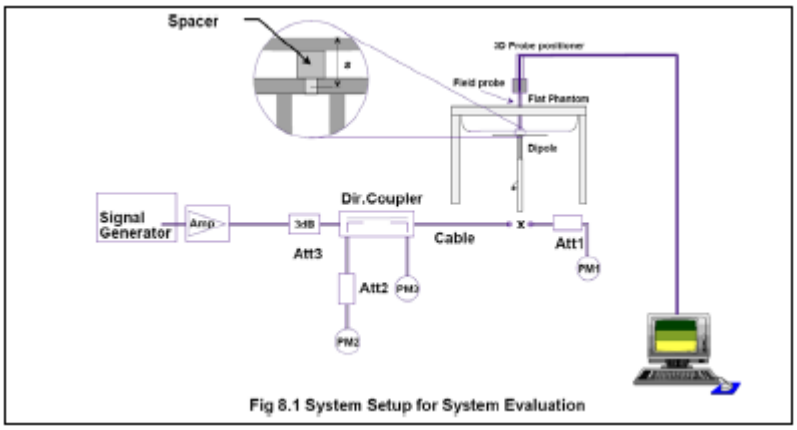


Fig 8.1 System Setup for System Evaluation

3.4 Validation and modulation factor

f(MHz)	Signal Type	Pulse Average Power (dBm)	Measurement E-field (V/m)	Target E-field(V/m)	Deviation (%)	Mod Factor Ration
835.00	CW	20	176.757	184.05	3.96	-
835.00	GSM	20	98.78	-	-	2.57
835.00	WCDMA	20	99.54	-	-	2.68
1880	CW	20	144.484	156.74	7.28	-
1880	GSM	20	93.315	-	-	2.71
1880	WCDMA	20	95.453	-	-	2.85

f(MHz)	Signal Type	Pulse Average Power (dBm)	Measurement H-field (A/m)	Target H-field(A/m)	Deviation (%)	Mod Factor Ration
835.00	CW	20	0.434	0.461	5.86	-
835.00	GSM	20	0.238	-	-	1.82
835.00	WCDMA	20	0.117	-	-	1.71
1880	CW	20	0.430	0.447	3.80	-
1880	GSM	20	0.319	-	-	1.35
1880	WCDMA	20	0.181	-	-	1.37

Note:

1. Modulation Factor =Measured E/H Field (CW)/Measured E/H Field (Modulation)
2. Peak(dB V/m or dB A/m)=20 x log(Reading[time averaging V/m or A/m] x Probe Modulation Factor)

4. HAC Exposure Limits

4.1 ARTICULATION WEIGHTING FACTOR (AWF)

The following AWF factors shall be used for the standard transmission protocols

Standard	Technology	AWF（dB）
TIA/EIA/IS-2000	CDMA	0
TIA/EIA-136	TDMA(50 Hz)	0
J-STD-007	GSM(217)	-5
T1/T1P1/3GPP	UMTS(WCDMA)	0
iDENTM	TDMA(22 and 11Hz)	0

Table: Articulation Weighting Factor (AWF)

4.2 TELEPHONE N-FILED CATEGORY

The following was shows the M-rating for wireless telephone:

Category		Telephone RF parameters < 960 MHz			
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 > 960 MHz			
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: Telephone near-field categories in linear units

NOTE: The WD must be performed in the category M3

5 TEST PROCEDURES

The following illustrate a typical RF emissions test scan over a wireless communications device:

1. Proper operation of the field probe, probe measurement system, other instrumentation, and the positioning system was confirmed.
2. DUT is positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.
3. The DUT 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 DUT 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 test Arch.
6. The measurement system measured the field strength at the reference location.
7. Measurements at 5 mm 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.

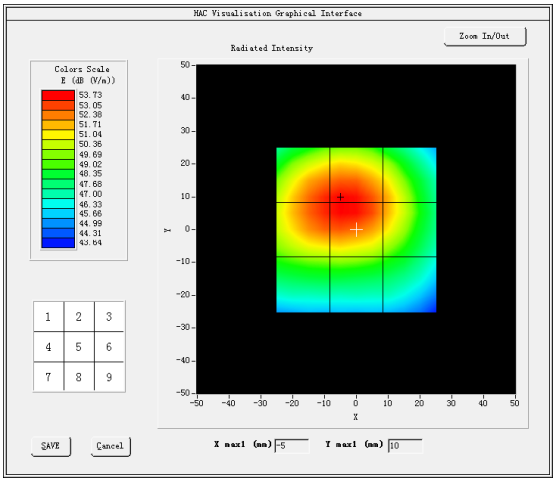
6 HAC RF Emission Test Results

6.1 Conducted Power(Unit:dBm)

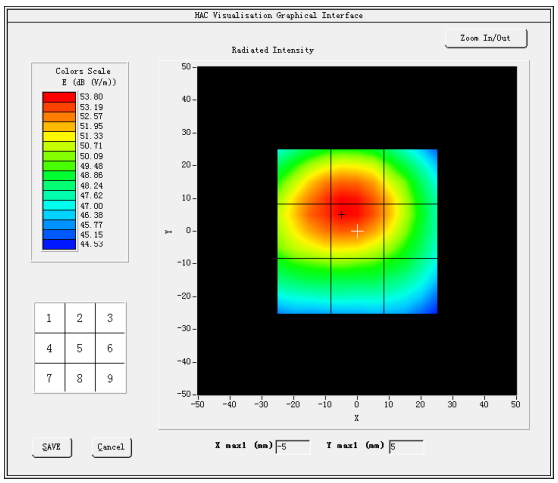
Band	GSM 850			GSM 1900		
Channel	128	190	251	512	661	810
Frequency(MHz)	824.2	836.6	848.8	1850.2	1880.0	1909.8
GSM	32.84	32.85	32.88	29.42	29.37	29.32

Band	WCDMA 850			WCDMA1900		
Channel	128	190	251	512	661	810
Frequency(MHz)	824.2	836.6	848.8	1850.2	1880.0	1909.8
AMR	22.69	22.63	22.75	22.54	22.28	22.40
RMC12.2K	22.66	22.68	22.80	22.55	22.27	22.34

6.2 E-Field Emission

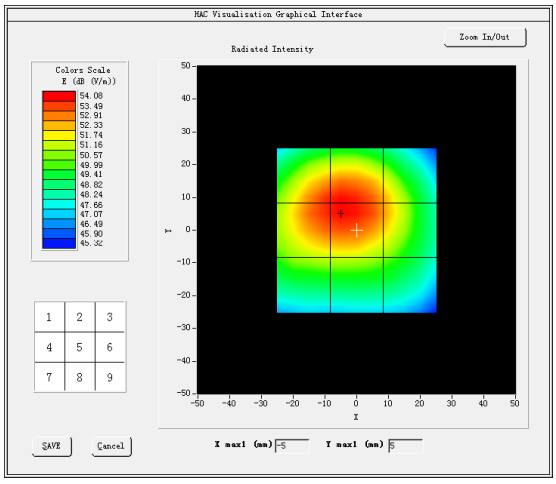
Grid 1: 44.45 **Grid 2: 44.68** Grid 3: 42.71 **Grid 4: 44.56** **Grid 5: 44.80** Grid 6: 42.78 Grid 7: 41.17 Grid 8: 41.24 Grid 9: 40.24	

Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
GSM 850	A	128	824.2	44.80	M3

Grid 1: 44.47 **Grid 2: 44.74** Grid 3: 42.82 **Grid 4: 44.58** **Grid 5: 44.88** Grid 6: 42.97 Grid 7: 41.55 Grid 8: 41.57 Grid 9: 40.63	

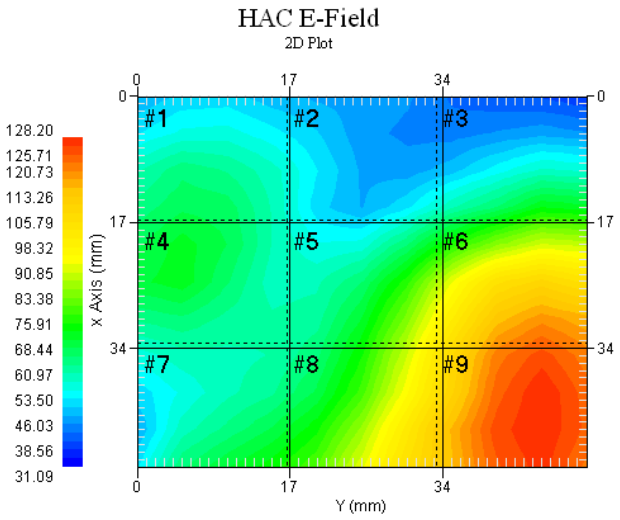
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
GSM 850	A	189	836.4	44.88	M3

Grid 1: 43.77	**Grid 2: 43.93**	Grid 3: 43.04
Grid 4: 43.90	**Grid 5: 44.09**	Grid 6: 43.27
Grid 7: 42.29	Grid 8: 42.30	Grid 9: 41.47



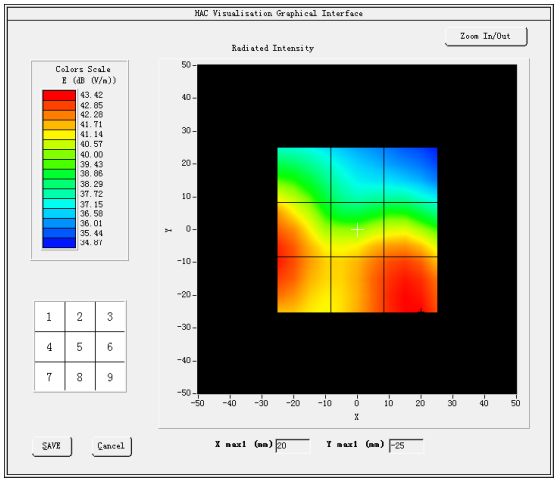
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
GSM 850	**A**	**250**	**848.6**	**44.09**	**M3**

Grid 1: 32.16	Grid 2: 29.68	Grid 3: 29.78
Grid 4: 33.59	**Grid 5: 34.09**	**Grid 6: 34.39**
Grid 7: 33.52	**Grid 8: 34.44**	**Grid 9: 35.05**



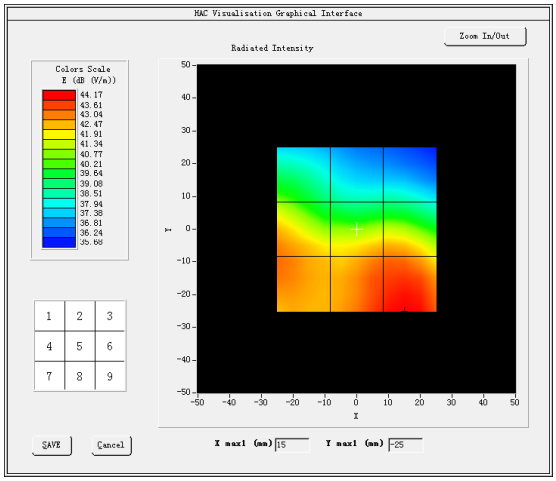
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
GSM 1900	**A**	**513**	**1850.4**	**34.09**	**M4**

Grid 1: 31.92	Grid 2: 29.23	Grid 3: 28.77
Grid 4: 34.15	Grid 5: 33.29	Grid 6: 33.45
Grid 7: 34.19	**Grid 8: 33.98**	**Grid 9: 34.47**

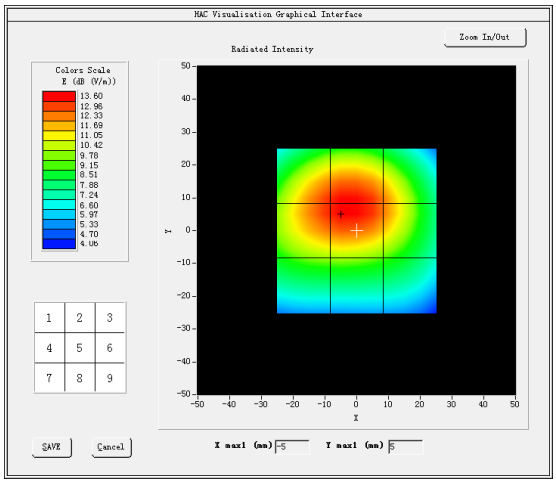


Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
GSM 1900	A	661	1880.0	34.15	M3

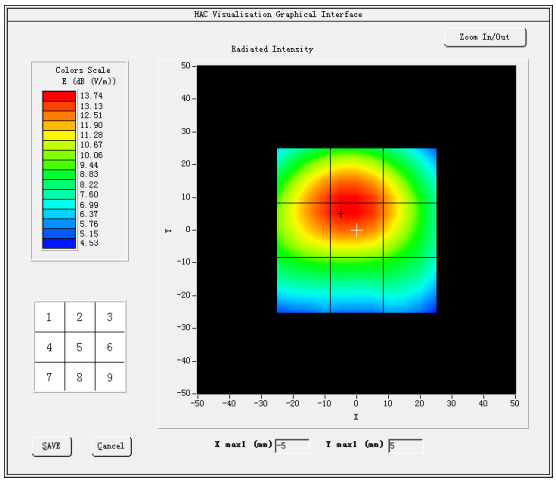
Grid 1: 31.51	Grid 2: 29.56	Grid 3: 29.39
Grid 4: 34.13	Grid 5: 33.89	Grid 6: 33.93
Grid 7: 34.22	**Grid 8: 35.00**	**Grid 9: 35.19**



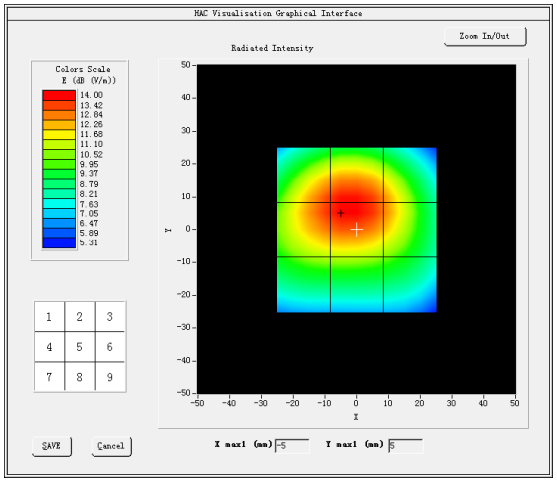
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
GSM 1900	A	810	1909.8	34.13	M4

Grid 1: 44.27 **Grid 2: 44.62** Grid 3: 42.98 **Grid 4: 44.44** **Grid 5: 44.78** Grid 6: 43.11 Grid 7: 41.18 Grid 8: 41.22 Grid 9: 40.45	

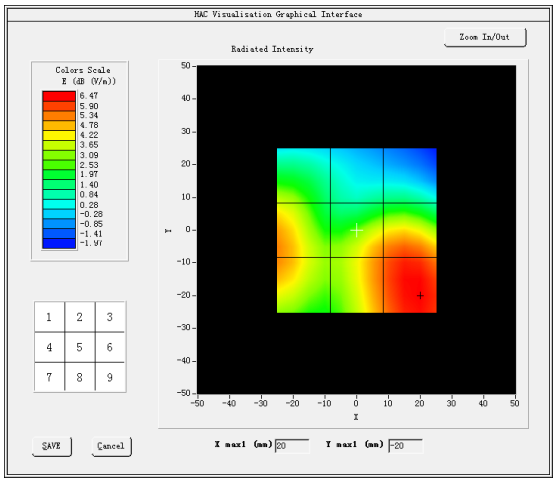
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 850	A	4132	826.000000	44.80	M3

Grid 1: 44.43 **Grid 2: 44.79** Grid 3: 43.13 **Grid 4: 44.59** **Grid 5: 44.94** Grid 6: 43.27 Grid 7: 41.23 Grid 8: 41.26 Grid 9: 40.76	

Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 850	A	4182	836.000000	44.88	M3

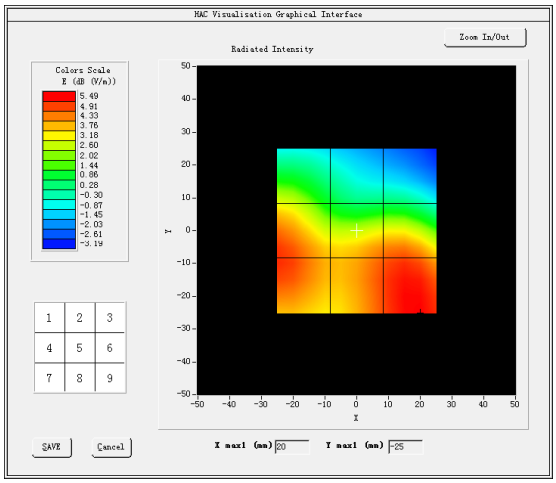
Grid 1: 42.59 **Grid 2: 44.95** Grid 3: 41.43 **Grid 4: 42.79** **Grid 5: 43.15** Grid 6: 41.61 Grid 7: 40.11 Grid 8: 40.15 Grid 9: 39.51	

Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 850	**A**	**4233**	**846.000000**	**43.15**	**M3**

Grid 1: 34.63 Grid 2: 32.23 Grid 3: 32.32 Grid 4: 36.44 **Grid 5: 36.57** **Grid 6: 37.03** Grid 7: 36.43 **Grid 8: 36.85** **Grid 9: 37.63**	

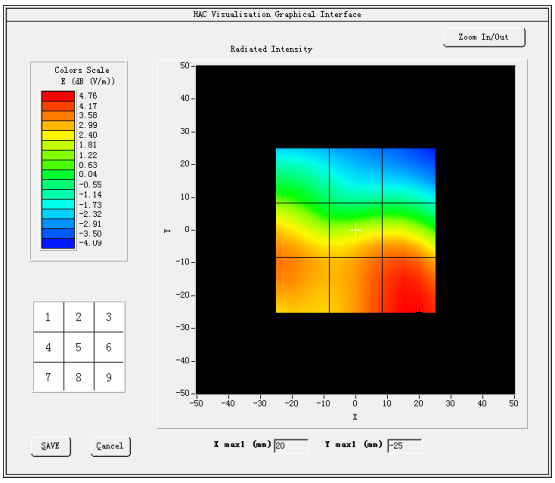
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 1900	**A**	**9262**	**1852.000000**	**36.57**	**M4**

Grid 1: 33.74	Grid 2: 31.68	Grid 3: 31.10
Grid 4: 36.22	Grid 5: 35.64	Grid 6: 35.85
Grid 7: 36.25	**Grid 8: 36.09**	**Grid 9: 36.65**



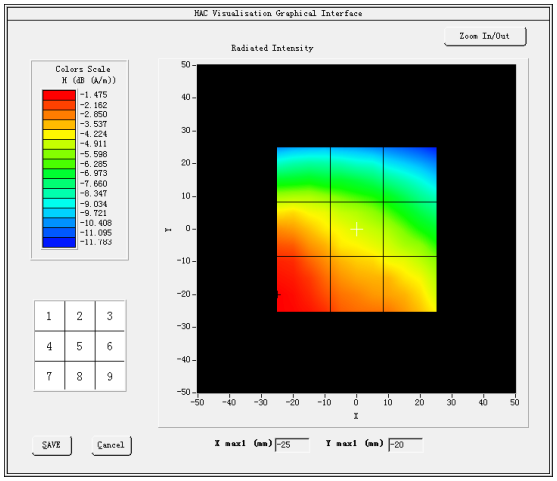
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 1900	A	Channel 9400	1880.000000	36.22	M4

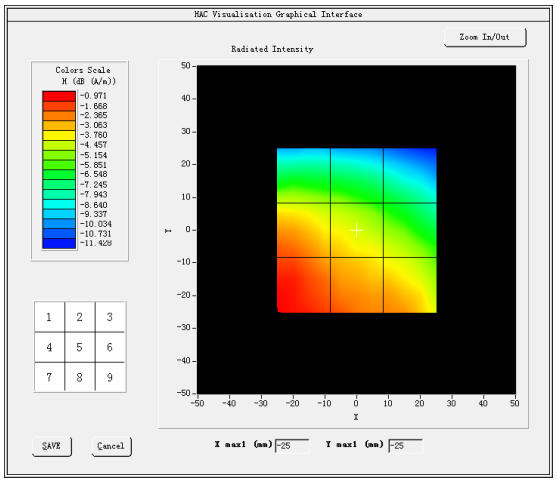
Grid 1: 32.07	Grid 2: 30.35	Grid 3: 30.10
Grid 4: 34.69	Grid 5: 34.75	**Grid 6: 34.85**
Grid 7: 34.80	**Grid 8: 35.41**	**Grid 9: 35.92**

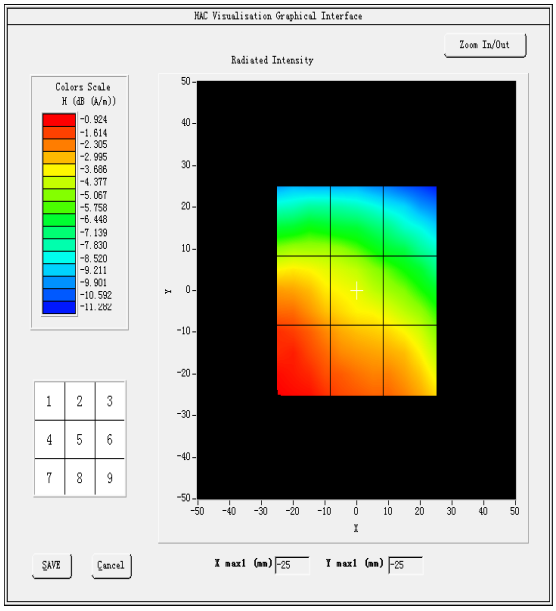


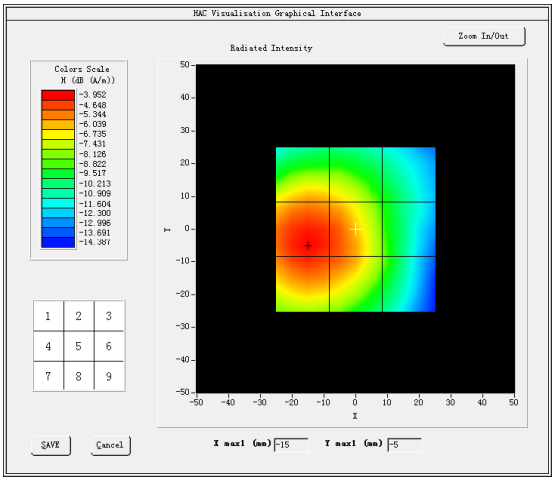
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 1900	A	9538	1907.000000	34.80	M3

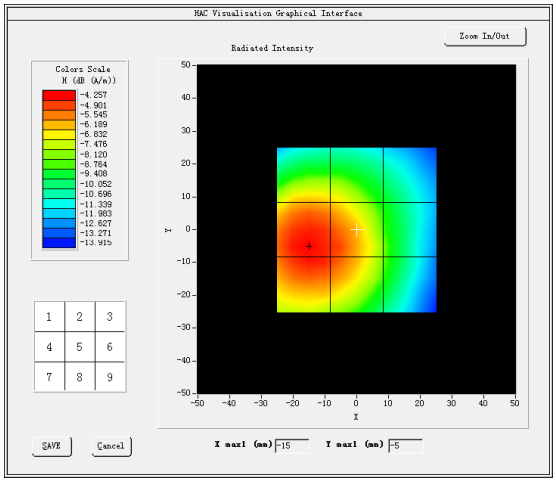
6.3 H-Field Emissions

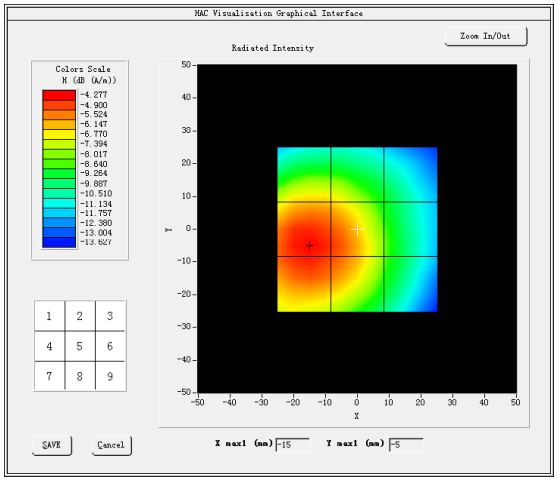
Grid 1: -14.18 Grid 2: -14.68 Grid 3: -15.73 Grid 4: -11.17 Grid 5: -12.71 Grid 6: -13.66 Grid 7: -10.54 Grid 8: -11.36 Grid 9: -11.84					
Operation mode	**Battery**	**Channel**	**f(MHz)**	**Peak(H-field) (A/m)**	**M-Rating**
GSM 850	**A**	**128**	**824.2**	**-14.18**	**M4**

Grid 1: -13.80 Grid 2: -14.31 Grid 3: -15.65 Grid 4: -10.91 Grid 5: -12.25 Grid 6: -13.19 Grid 7: -10.04 Grid 8: -10.89 Grid 9: -11.52					
Operation mode	**Battery**	**Channel**	**f(MHz)**	**Peak(H-field) (A/m)**	**M-Rating**
GSM 850	**A**	**189**	**836.4**	**-13.80**	**M4**

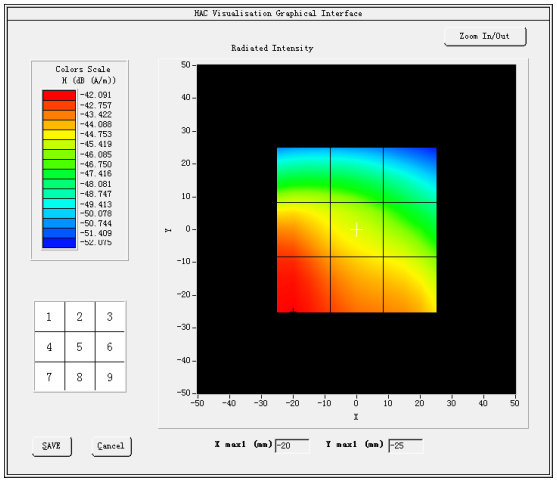
Grid 1: -13.79 Grid 2: -13.93 Grid 3: -15.48 Grid 4: -10.85 Grid 5: -12.11 Grid 6: -12.81 Grid 7: -9.99 Grid 8: -10.69 Grid 9: -11.09					
Operation mode	**Battery**	**Channel**	**f(MHz)**	**Peak(H-field) (A/m)**	**M-Rating**
GSM 850	**A**	**250**	**848.6**	**-13.79**	**M4**

Grid 1: -14.92 Grid 2: -15.43 Grid 3: -18.30 Grid 4: -12.96 Grid 5: -13.60 Grid 6: -17.61 Grid 7: -13.19 Grid 8: -13.76 Grid 9: -17.55					
Operation mode	**Battery**	**Channel**	**f(MHz)**	**Peak(H-field) (A/m)**	**M-Rating**
GSM 1900	**A**	**513**	**1850.4**	**-14.92**	**M4**

Grid 1: -15.53 Grid 2: -15.83 Grid 3: -18.56 Grid 4: -13.26 Grid 5: -13.79 Grid 6: -17.57 Grid 7: -13.33 Grid 8: -13.87 Grid 9: -17.62					
Operation mode	**Battery**	**Channel**	**f(MHz)**	**Peak(H-field) (A/m)**	**M-Rating**
GSM 1900	**A**	**661**	**1880.0**	**-15.53**	**M4**

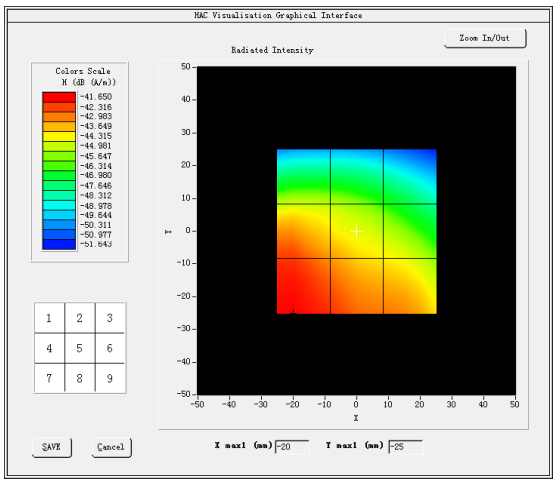
Grid 1: -15.64 Grid 2: -15.85 Grid 3: -18.40 Grid 4: -13.28 Grid 5: -13.86 Grid 6: -17.50 Grid 7: -13.43 Grid 8: -14.02 Grid 9: -17.54					
Operation mode	**Battery**	**Channel**	**f(MHz)**	**Peak(H-field) (A/m)**	**M-Rating**
GSM 1900	**A**	**809**	**1909.6**	**-15.64**	**M4**

Grid 1: -14.57	**Grid 2: -14.91**	**Grid 3: -16.18**
Grid 4: -11.65	Grid 5: -13.11	Grid 6: -13.95
Grid 7: -11.05	Grid 8: -11.80	Grid 9: -12.48

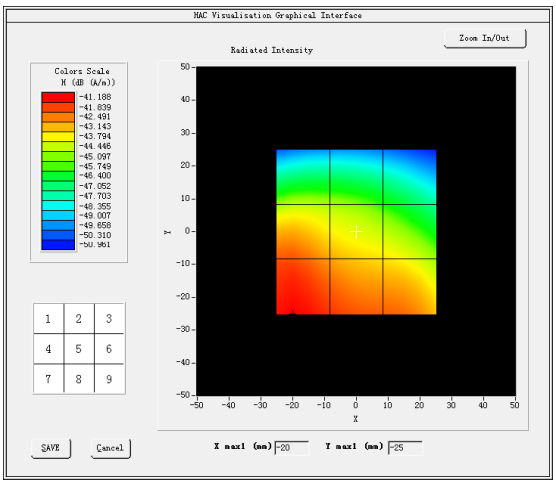


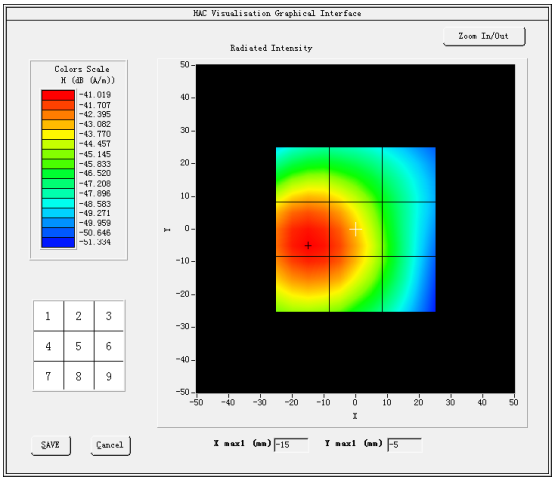
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 850	**A**	**4132**	**826.000000**	**-14.57**	**M4**

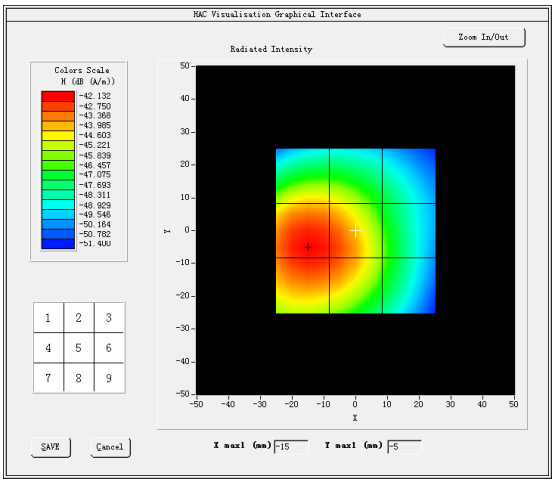
Grid 1: -14.20	**Grid 2: -14.44**	**Grid 3: -15.68**
Grid 4: -11.26	Grid 5: -12.46	Grid 6: -13.38
Grid 7: -10.61	Grid 8: -11.20	Grid 9: -11.88



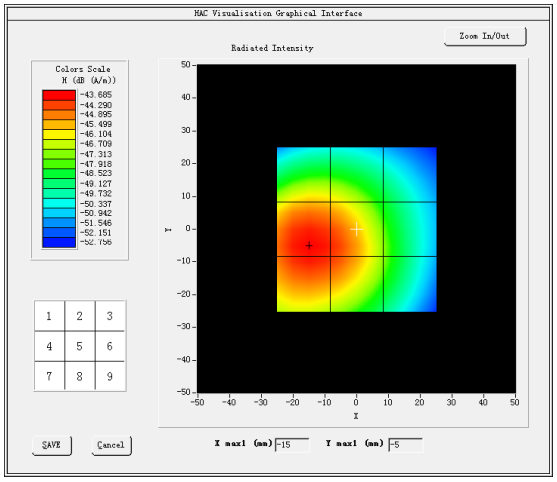
Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 850	**A**	**4182**	**836.000000**	**-14.20**	**M4**

Grid 1: -13.89 Grid 2: -14.06 Grid 3: -15.15 Grid 4: -11.07 Grid 5: -12.13 Grid 6: -12.75 Grid 7: -10.15 Grid 8: -10.73 Grid 9: -11.13					
Operation mode	**Battery**	**Channel**	**f(MHz)**	**Peak(E-field) (V/m)**	**M-Rating**
WCDMA 850	**A**	**4233**	**846.000000**	**-13.89**	**M4**

Grid 1: -11.97 Grid 2: -12.40 Grid 3: -15.46 Grid 4: -9.89 Grid 5: -10.35 Grid 6: -14.57 Grid 7: -10.05 Grid 8: -10.45 Grid 9: -14.59					
Operation mode	**Battery**	**Channel**	**f(MHz)**	**Peak(E-field) (V/m)**	**M-Rating**
WCDMA 1900	**A**	**9262**	**1852.000000**	**-11.97**	**M4**

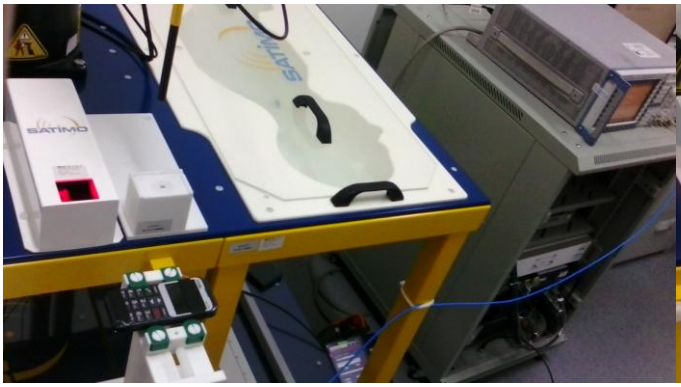
Grid 1: -13.37 **Grid 2: -13.65** **Grid 3: -16.30** Grid 4: -11.01 Grid 5: -11.46 Grid 6: -15.19 Grid 7: -11.12 Grid 8: -11.55 Grid 9: -15.20	

Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 1900	A	Channel 9400	1880.000000	-13.37	M4

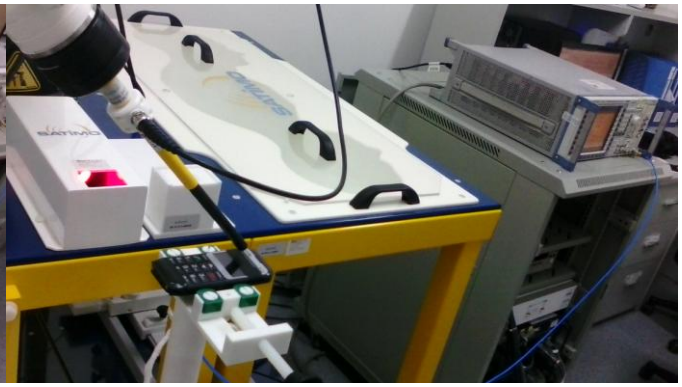
Grid 1: -14.83 **Grid 2: -15.13** **Grid 3: -17.70** Grid 4: -12.56 Grid 5: -12.99 Grid 6: -16.50 Grid 7: -12.64 Grid 8: -13.08 Grid 9: -16.51	

Operation mode	Battery	Channel	f(MHz)	Peak(E-field) (V/m)	M-Rating
WCDMA 1900	A	9538	1907.000000	-14.83	M3

7. HAC Test Photographs

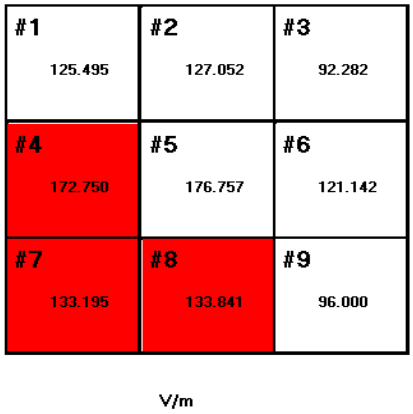
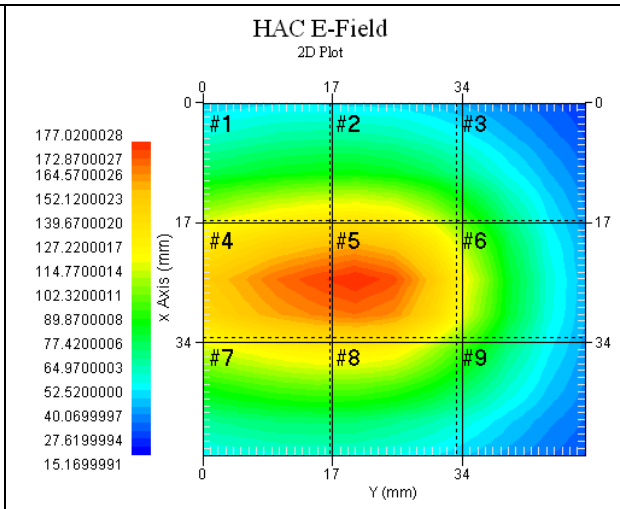


H-field

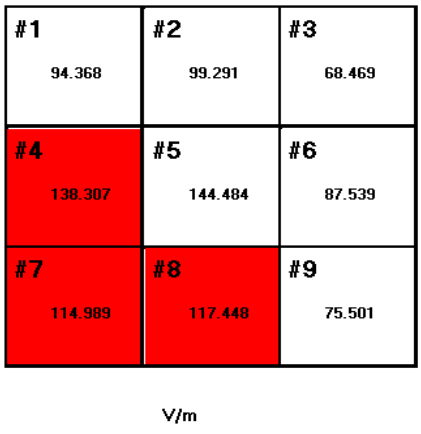
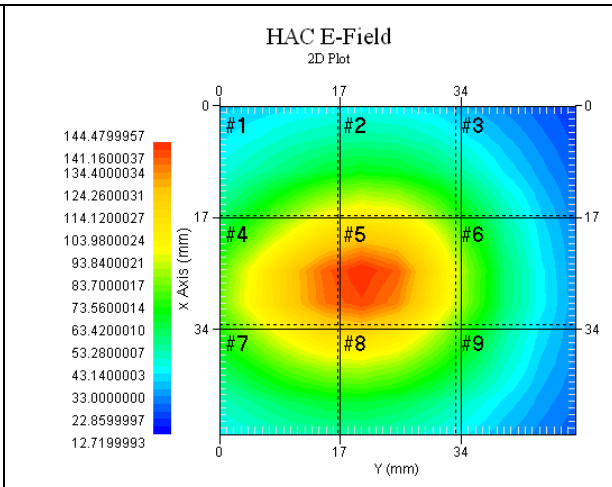


E-field

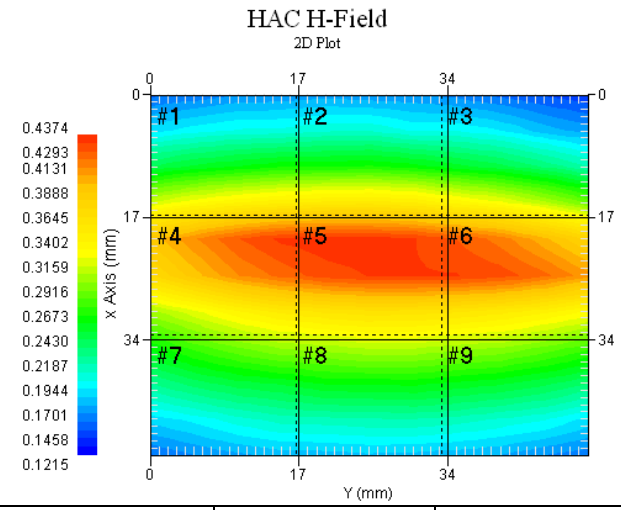
8. System VALIDATION RESULTS

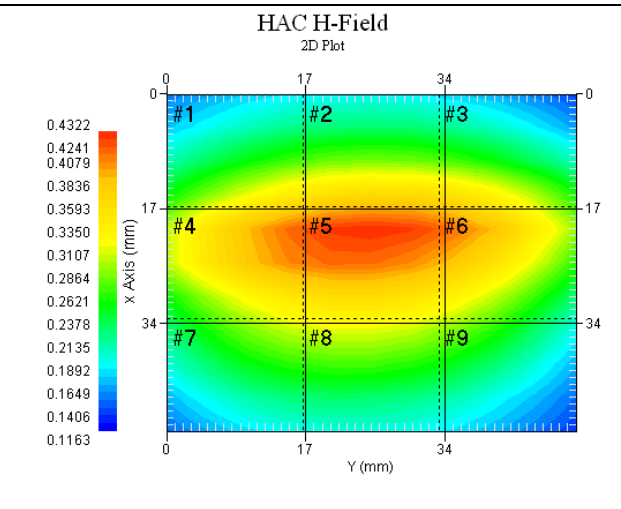
	

Frequency(MHz)	Input power (dBm)	Target Value (V/m)	E-Field(V/m)	Deviation(%)	data
835	20	184.05	176.757	3.96	Oct.17.2011

Frequency(MHz)	Input power (dBm)	Target Value (V/m)	E-Field(V/m)	Deviation(%)	data
1880	20	156.74	144.484	7.82	Oct.17.2011

#1 0.359	#2 0.363	#3 0.351			
#4 0.432	#5 0.434	#6 0.430			
#7 0.304	#8 0.312	#9 0.308			
A/m					
Frequency(MHz)	**Input power (dBm)**	**Target Value (A/m)**	**H-Field(A/m)**	**Deviation(%)**	**data**
835	**20**	**0.461**	**0.434**	**5.86**	**Oct.17.2011**

#1 0.355	#2 0.374	#3 0.363			
#4 0.413	#5 0.430	#6 0.412			
#7 0.309	#8 0.317	#9 0.295			
A/m					
Frequency(MHz)	**Input power (dBm)**	**Target Value (A/m)**	**H-Field(A/m)**	**Deviation(%)**	**data**
1880	**20**	**0.447**	**0.430**	**3.80**	**Oct.17.2011**

Note: Deviation=((E or H-field Result)-(Target field))/(Target field)*100%

9. Probe calibration report

NCL CALIBRATION LABORATORIES

A Division of APREL Inc

Calibration File No.: CP-1360

Client.: IAC

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 835 MHz

Manufacturer: APREL Laboratories
Model No.: E-020-H
Serial No.: 420-00274

E-Field Hearing Aid Compatibility Certification Report

Calibration Procedure: SSI/DRB-TP-D01-038-E
Project No: IAC-HAC e-probe-cal-5623

Calibrated: 4th October 2013
Released on: 6th October 2013

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: _____

NCL CALIBRATION LABORATORIES
303 Terry Fox Drive, Suite 102
Kanata, Ontario
CANADA K2K 3J1
Division of APREL
TEL: (613) 435-8300
FAX: (613) 435-8306

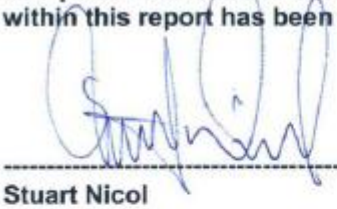
NCL Calibration Laboratories
Division of APREL Laboratories.

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-038-E E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 420-00101.

References

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.



Stuart Nicol

Jesse Hones

NCL Calibration Laboratories
Division of APREL Laboratories.

Calibration Results Summary

Probe Type:	E-Field Probe E-020-H
Serial Number:	420-00274
Frequency:	835 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

Spatial Resolution:

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Sensitivity in Air

Normalized for HAC testing.

Frequency: 835 MHz

Sensitivity Factors

Channel 1: 1.48

Channel 2: 1.48

Channel 3: 1.48

Diode Compression Point: 95 mV

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This page has been reviewed for content and attested to on Page 2 of this document.

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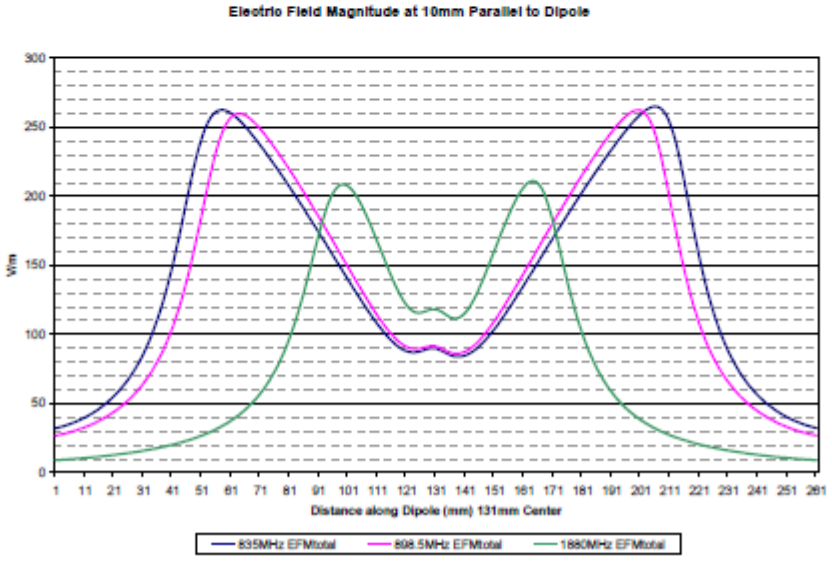
Division of APREL Laboratories.

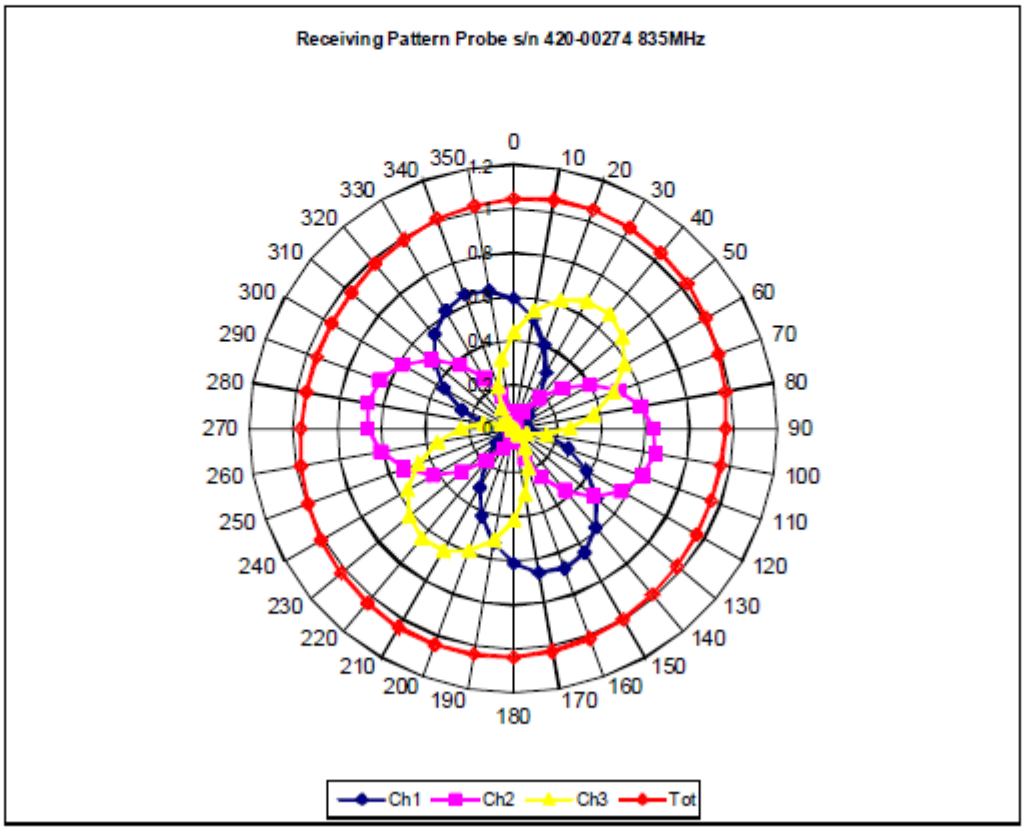
Target E-Field Measured 835 MHz:

The E-Filed measured with probe Serial Number: E-020-H-420-00274 has been normalized to meet the target values to within 10%.

Target E-Field DSY @10mm:	185.90 V/m
Measured E-Field @ 10 mm:	184.05 V/m
Delta E-Field:	1. 85 V/m
Deviation from Target:	< 1%

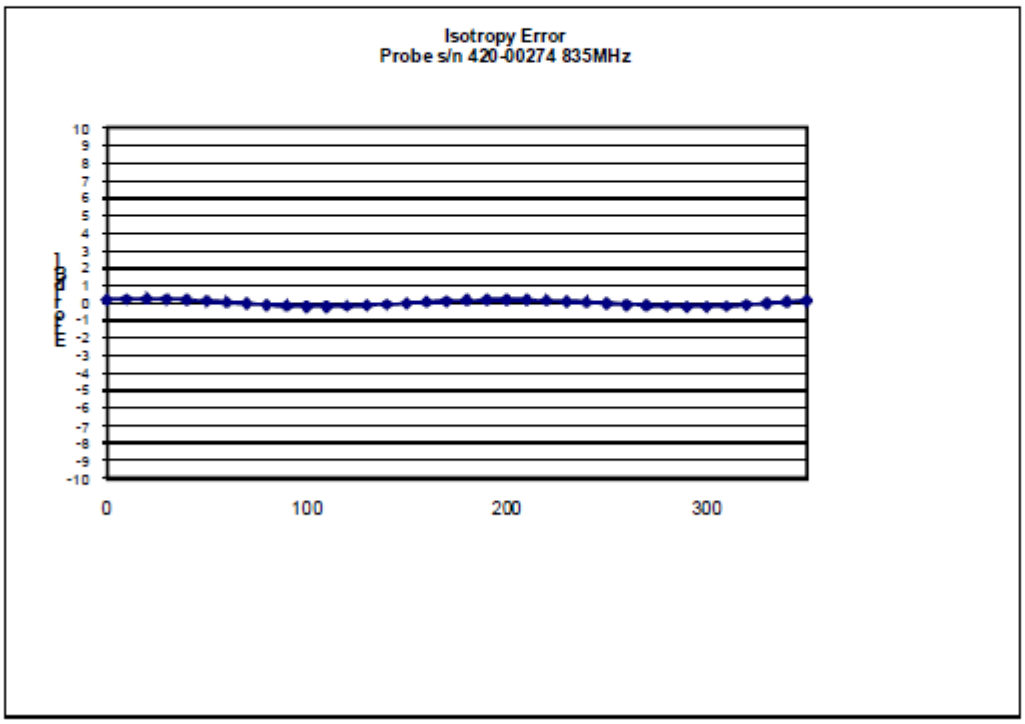


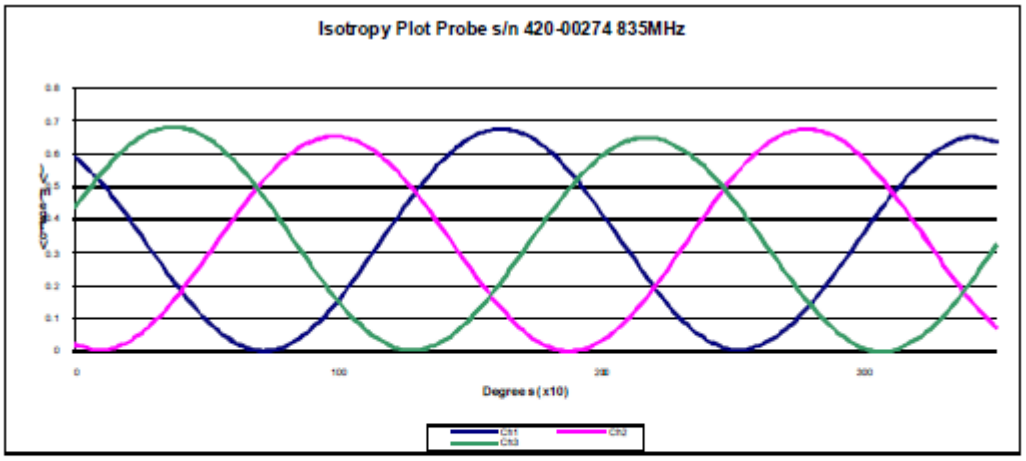
Receiving Pattern 835 MHz (Air)



NCL Calibration Laboratories
Division of APREL Laboratories.

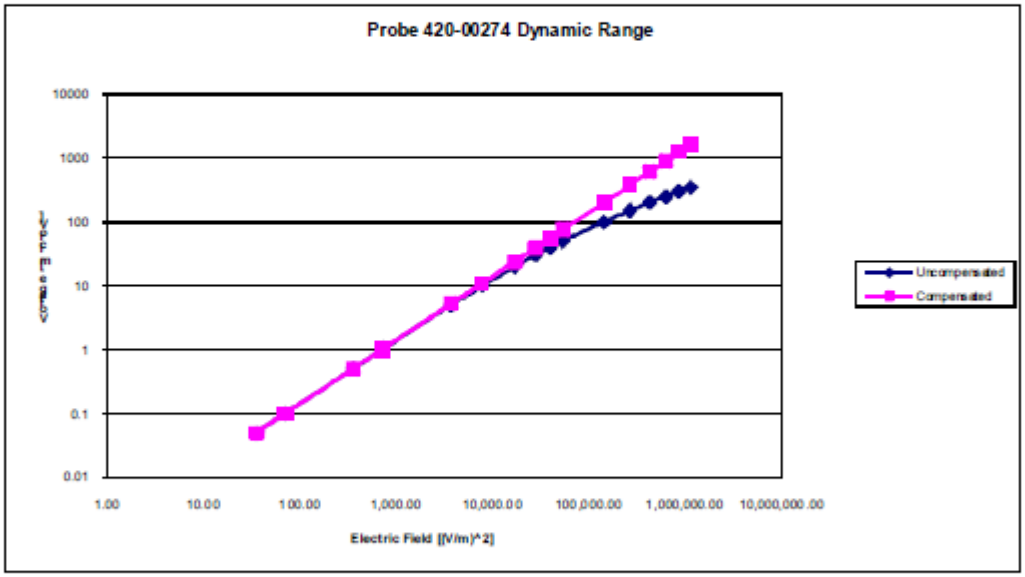
Isotropy Error 835 MHz (Air)



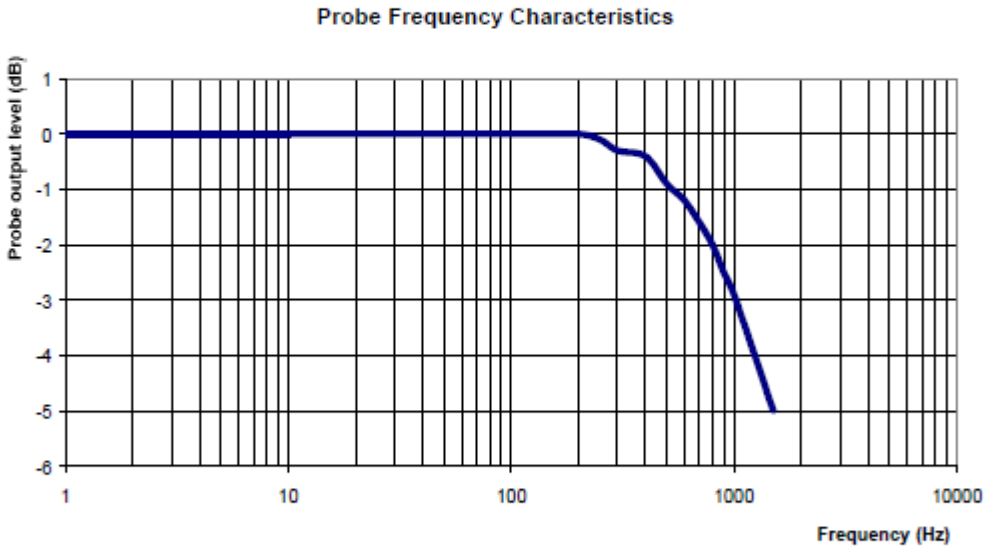


This page has been reviewed for content and attested to on Page 2 of this document.

Dynamic Range



Video Bandwidth



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1.02 KHz: 3 dB

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2011.

NCL CALIBRATION LABORATORIES

A Division of APREL Inc

Calibration File No.: CP-1362

Client.: IAC

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature H-field RF Probe

Manufacturer: APREL Laboratories
Model No.: H-030
Serial No.: 400-00102

Calibration Type.: AIR Calibration

Calibration Frequency.: 835MHz

Calibration Procedure: SSI/DRB-TP-D01-038
Project No: IAC-HAC H-probe-cal-5624

Calibrated: 4th October 2013
Released on: 6th October 2013

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: _____

NCL CALIBRATION LABORATORIES
303 Terry Fox Drive, Suite 102
Kanata, Ontario
CANADA K2K 3J1
Division of APREL
TEL: (613) 435-6300
FAX: (613) 435-6306

NCL Calibration Laboratories
Division of APREL Laboratories.

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-038 H-Field Probe Calibration Procedure. The results contained within this report are for APREL H-Field Probe H-030 400-00102.

References

SSI/DRB-TP-D01-038 H-Field Probe Calibration Procedure
IEEE Std 1309-2005 "Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 kHz to 40GHz".
IEEE Std C63.19-2006 American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids

Conditions

Probe 400-00102 was a re- calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C

Sensor offset

Each probe is comprised of magnetic sensors and positioned at 90 degree to each other. The electric center of the loop is the calibration field point of the probe and the reference for all subsequent sensitivities.

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol

Jesse Hones

Page 2 of 7
This page has been reviewed for content and attested to on Page 2 of this document.

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Mechanical H-Field Probe Properties

Probe Type:	H-Field Probe H-030
Serial Number:	400-00102
Sensor Offset:	3.5 mm
Sensor Diameter:	3.8 mm
Tip Enclosure:	Etralyte
Tip Diameter:	8.5 mm
Total Length:	>300 mm

Sensitivity in Air at 835MHz

All Channels :	128 mV/(A/m)^2
Diode Compression Point:	75 mV

NOTE:

Sensitivity as measured and recorded above has been calculated for each sensor when fully assembled and positioned spatially around the measurement space and has been normalized to reduce measurement uncertainty and enhance probe response for all three measurement locations and perceived vectors.

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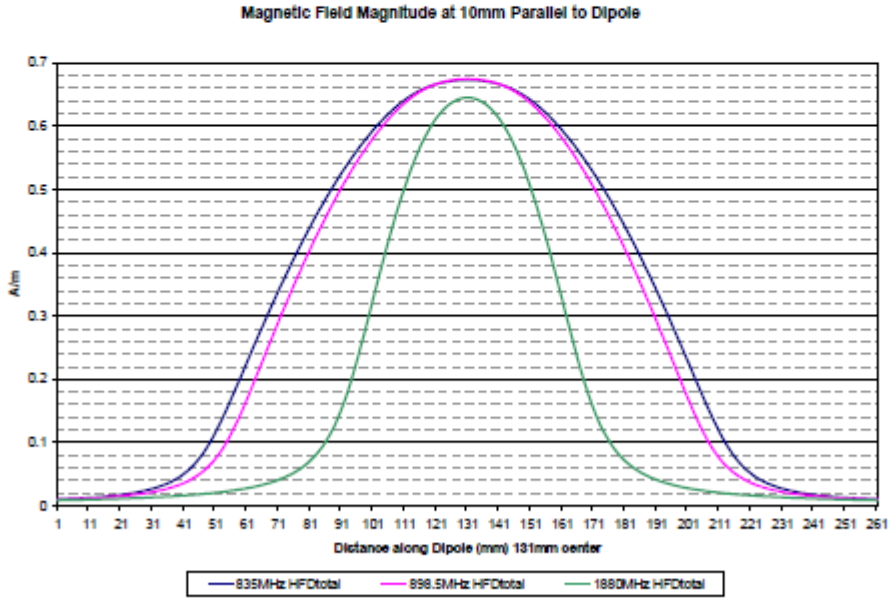
Target H-Field Measured:

The H-Filed measured with probe Serial Number: H-030-400-00102 has been normalized to meet the target values to within 10%.

Target H-Field DSY @ 10 mm:	0.469A/m
Measured H-Field @ 10 mm:	0.461 A/m
Delta H-Field:	0.008 A/m
Deviation from Target:	< 1%



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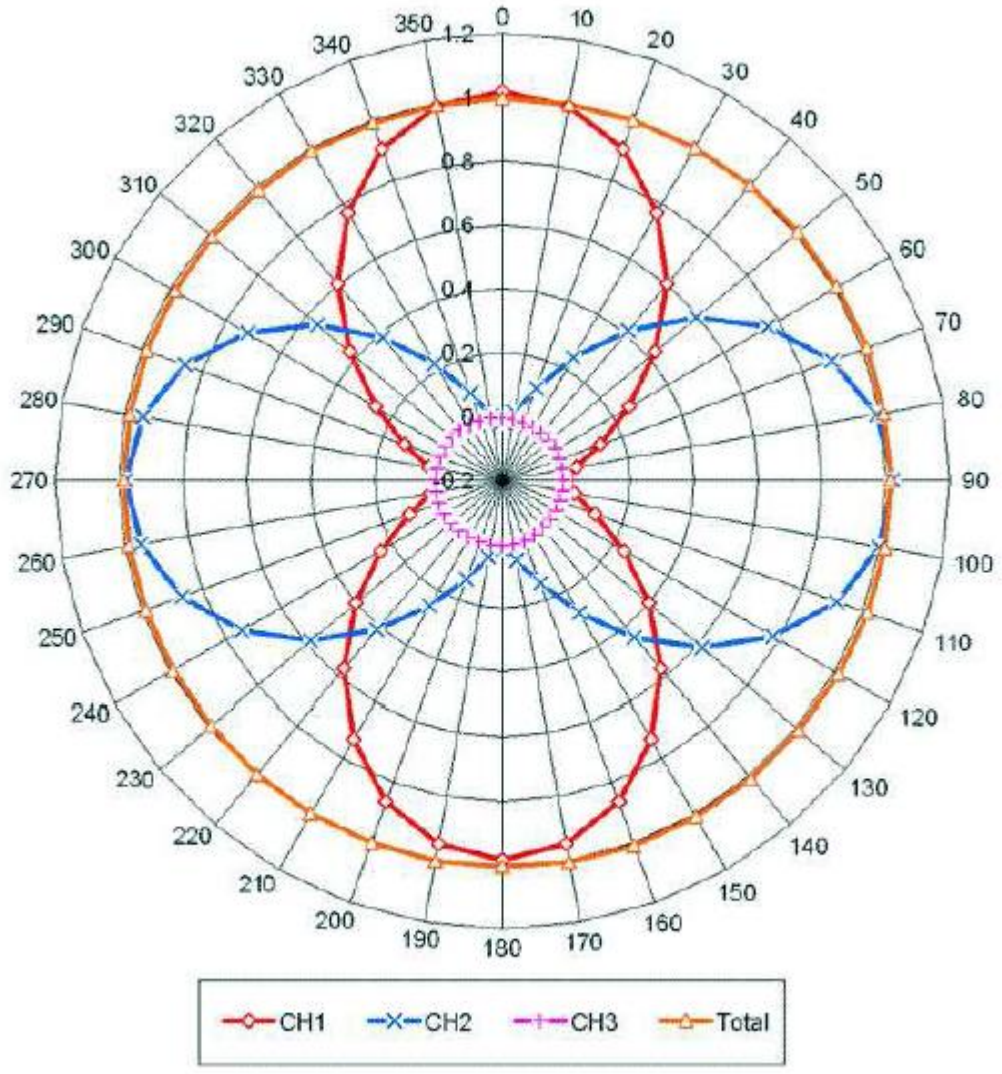
Measured Receiving Pattern at 835MHz

H-030-400-00102



Measured at 90° Θ

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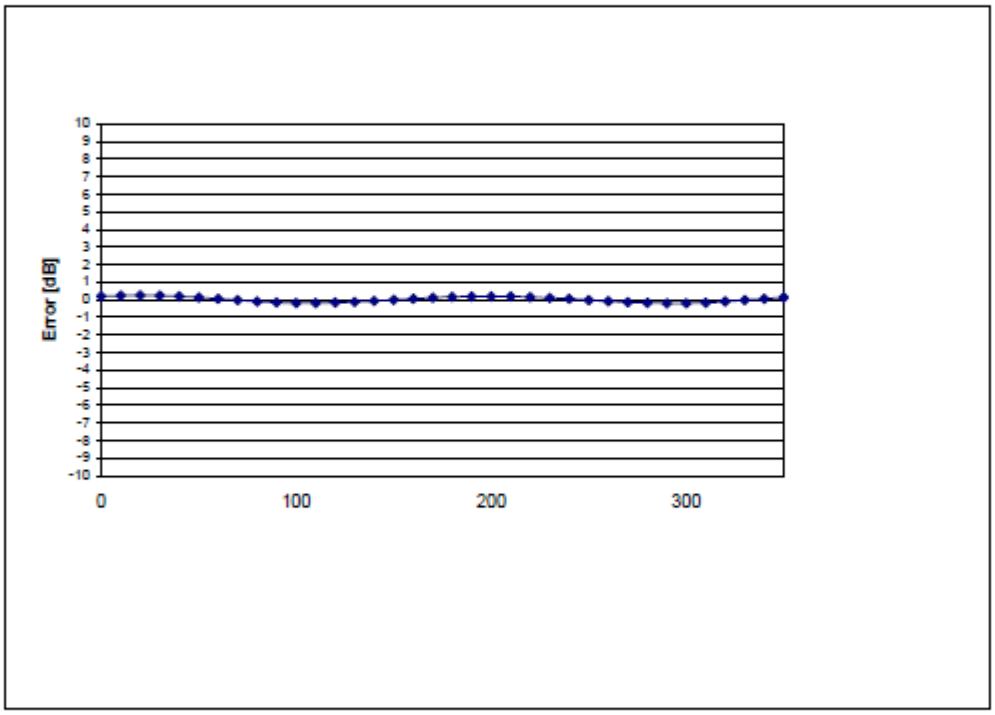
Division of APREL Laboratories.

Loop Isotropy Error Normalized to Reference 835 MHz

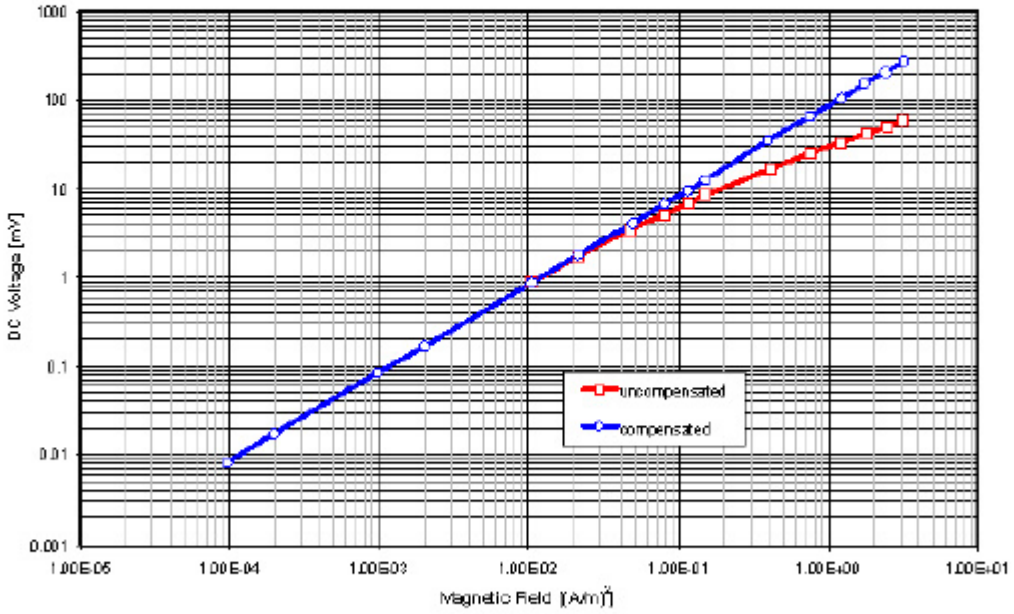


Isotropicity: 0.20 dB

Page 6 of 7
This page has been reviewed for content and attested to on Page 2 of this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Dynamic Range Normalized to Reference



Measured at 90° Φ

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2011.

NCL CALIBRATION LABORATORIES

A Division of APREL Inc

Calibration File No.: CP-1361

Client.: IAC

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 1880 MHz

Manufacturer: APREL Laboratories

Model No.: E-020-H

Serial No.: 420-00274

E-Field Hearing Aid Compatibility Certification Report

Calibration Procedure: SSI/DRB-TP-D01-038-E
Project No: IAC-HAC e-probe-cal-5623

Calibrated: 4th October 2013
Released on: 6th October 2013

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: _____

NCL CALIBRATION LABORATORIES
303 Terry Fox Dr. Suite 102
Ottawa, ONTARIO
CANADA K2K 3J1
Division of APREL Lab.
TEL: (613) 435-8300
FAX: (613) 435-8306

NCL Calibration Laboratories
Division of APREL Laboratories.

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-038-E E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 420-00274.

References

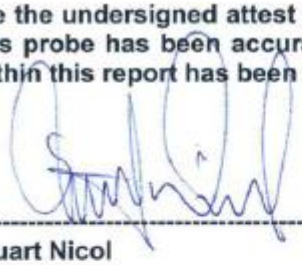
SSI/DRB-TP-D01-038-E E-Field HAC Probe Calibration Procedure
IEEE Std 1309-2006 "Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 kHz to 40GHz".
IEEE Std C63.19-2007 American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids

Conditions

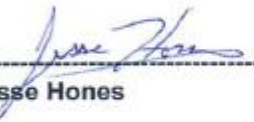
Probe 420-00274 was a re-calibration.

Ambient Temperature of the Laboratory:	22 °C +/- 0.5°C
Temperature of the Tissue:	21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.



Stuart Nicol



Jesse Hones

NCL Calibration Laboratories
Division of APREL Laboratories.

Calibration Results Summary

Probe Type:	E-Field Probe E-020-H
Serial Number:	420-00274
Frequency:	1880 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

Spatial Resolution:

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Sensitivity in Air

Normalized for HAC testing.

Frequency: 1880 MHz

Sensitivity Factors

Channel 1: 1.72

Channel 2: 1.72

Channel 3: 1.72

Diode Compression Point: 95 mV

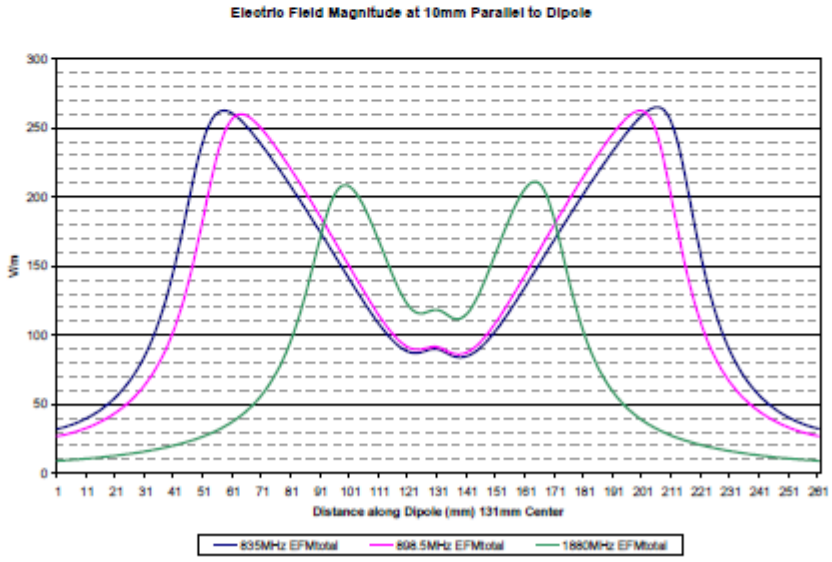
Page 3 of 9
This page has been reviewed for content and attested to on Page 2 of this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

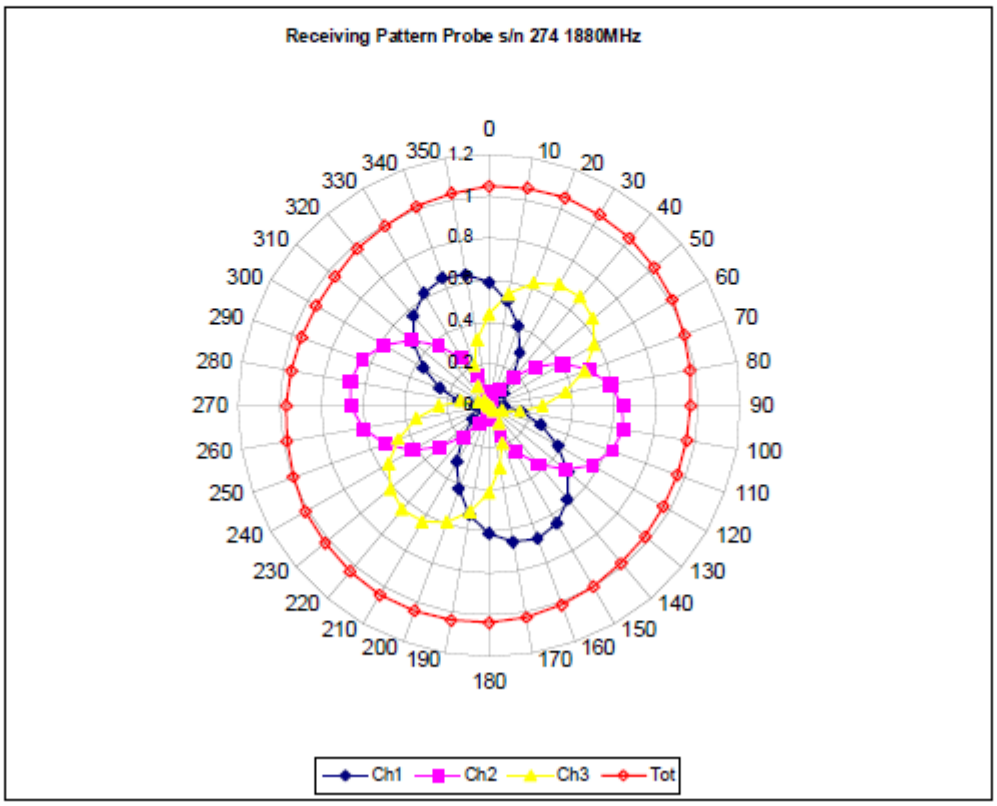
Target E-Field Measured 1880 MHz:

The E-Filed measured with probe Serial Number: E-020-H-420-00274 has been normalized to meet the target values to within 10%.

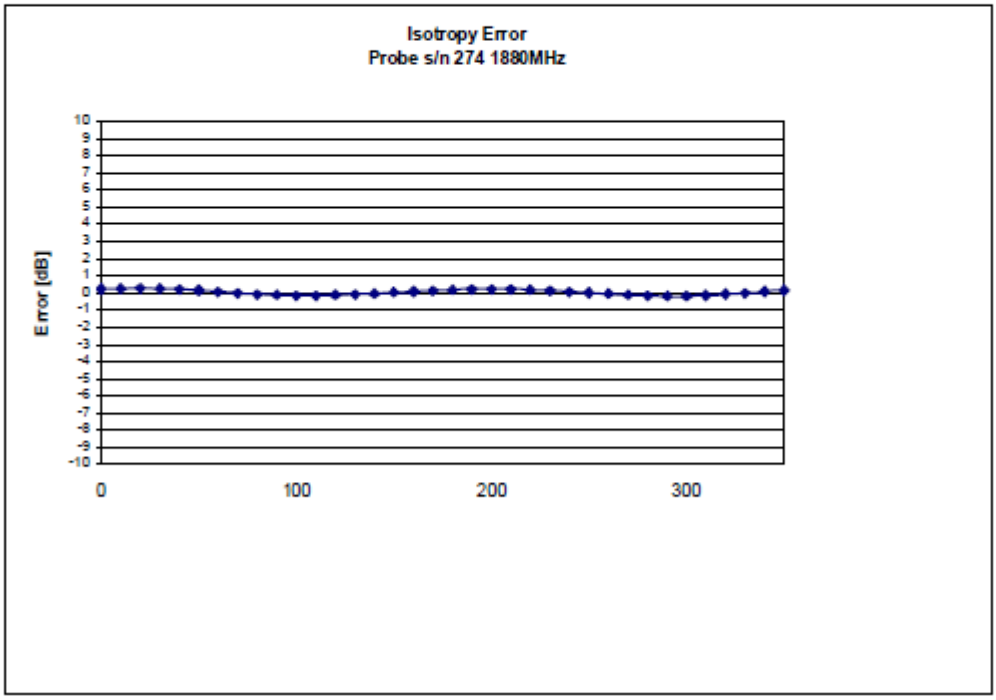
Target E-Field DSY@10mm:	156.0 V/m
Measured E-Field @ 10 mm:	156.74 V/m
Delta E-Field:	0.74 V/m
Deviation from Target:	< 1%

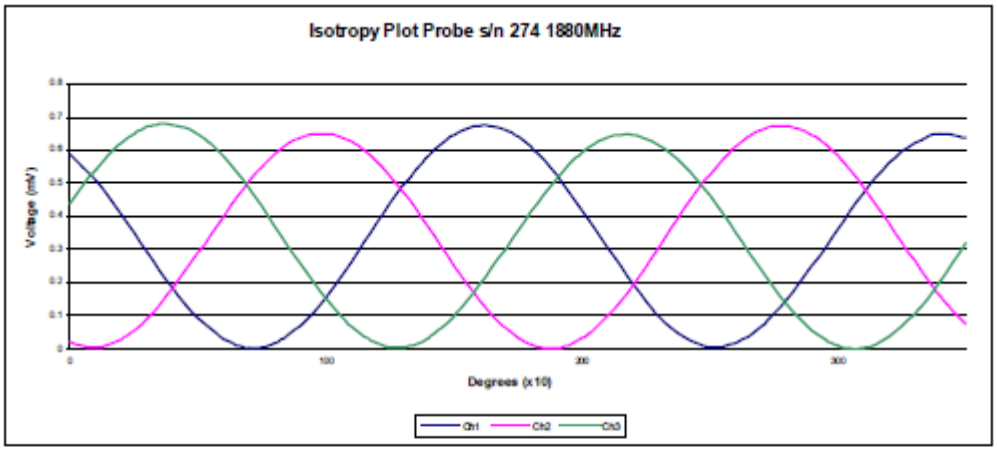


Receiving Pattern 1880 MHz (Air)

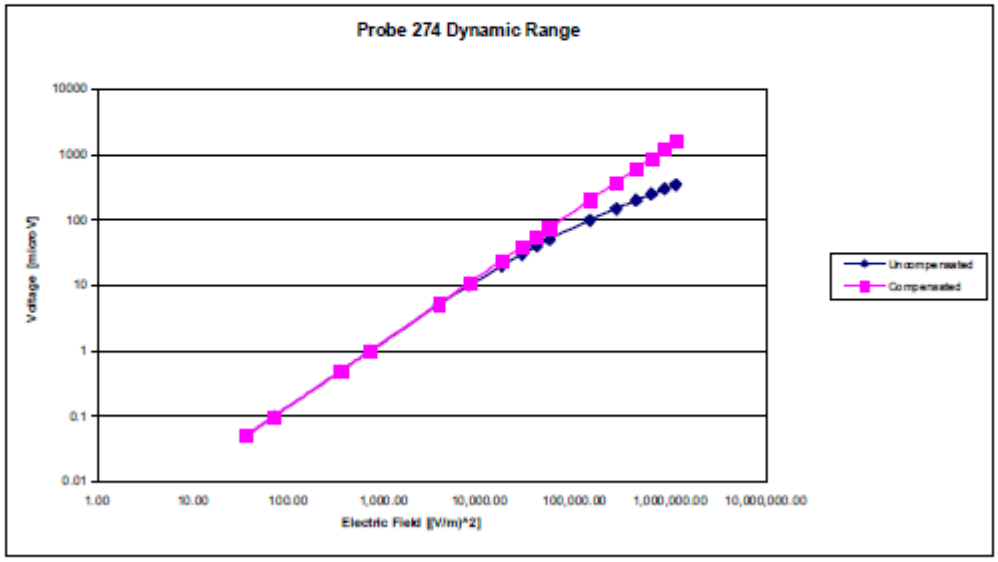


Isotropy Error 1880 MHz (Air)

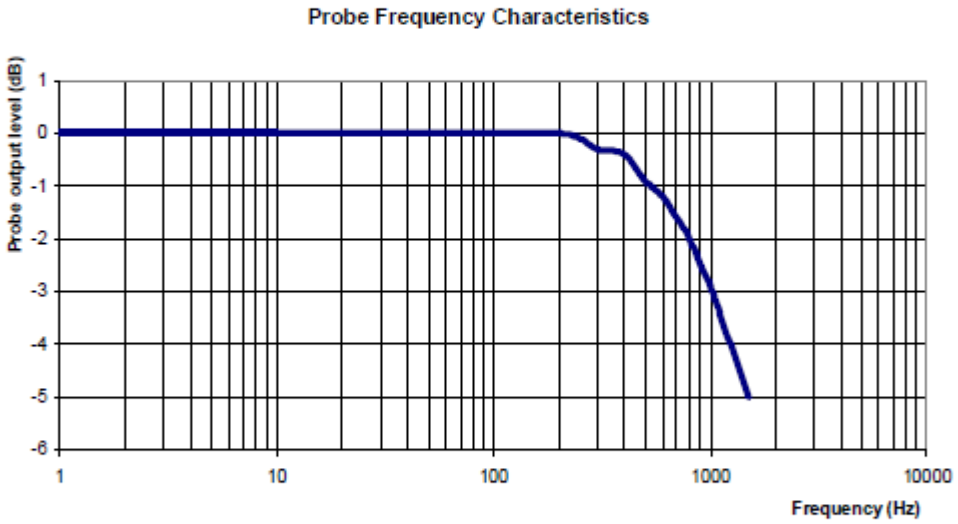




Dynamic Range



Video Bandwidth



Video Bandwidth at 500 Hz	1 dB
Video Bandwidth at 1.02 KHz:	3 dB

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2011.

NCL CALIBRATION LABORATORIES

A Division of APREL Inc

Calibration File No.: CP-1363

Client.: IAC

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature H-field RF Probe

Manufacturer: APREL Laboratories
Model No.: H-030
Serial No.: 400-00102

Calibration Type.: AIR Calibration

Calibration Frequency.: 1880MHz

Calibration Procedure: SSI/DRB-TP-D01-038
Project No: IAC-HAC H-probe-cal-5624

Calibrated: 4th October 2013
Released on: 6th October 2013

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: _____

NCL CALIBRATION LABORATORIES
303 Terry Fox Drive, Suite 102
Kanata, Ontario
CANADA K2K 3J1
Division of APREL
TEL: (613) 435-8300
FAX: (613) 435-8306

NCL Calibration Laboratories

Division of APREL Laboratories.

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-038 H-Field Probe Calibration Procedure. The results contained within this report are for APREL H-Field Probe H-030 400-00102.

References

SSI/DRB-TP-D01-038 H-Field Probe Calibration Procedure
IEEE Std 1309-2005 "Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 kHz to 40GHz".
IEEE Std C63.19-2006 American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids

Conditions

Probe 400-00102 was a re- calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C

Sensor offset

Each probe is comprised of magnetic sensors and positioned at 90 degree to each other. The electric center of the loop is the calibration field point of the probe and the reference for all subsequent sensitivities.

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol

Jesse Hones

NCL Calibration Laboratories
Division of APREL Laboratories.

Mechanical H-Field Probe Properties

Probe Type:	H-Field Probe H-030
Serial Number:	400-00102
Sensor Offset:	3.5 mm
Sensor Diameter:	3.8 mm
Tip Enclosure:	Etralyte
Tip Diameter:	8.5 mm
Total Length:	>300 mm

Sensitivity in Air at 1880MHz

All Channels :	1356 mV/(A/m)^2
Diode Compression Point:	75 mV

NOTE:

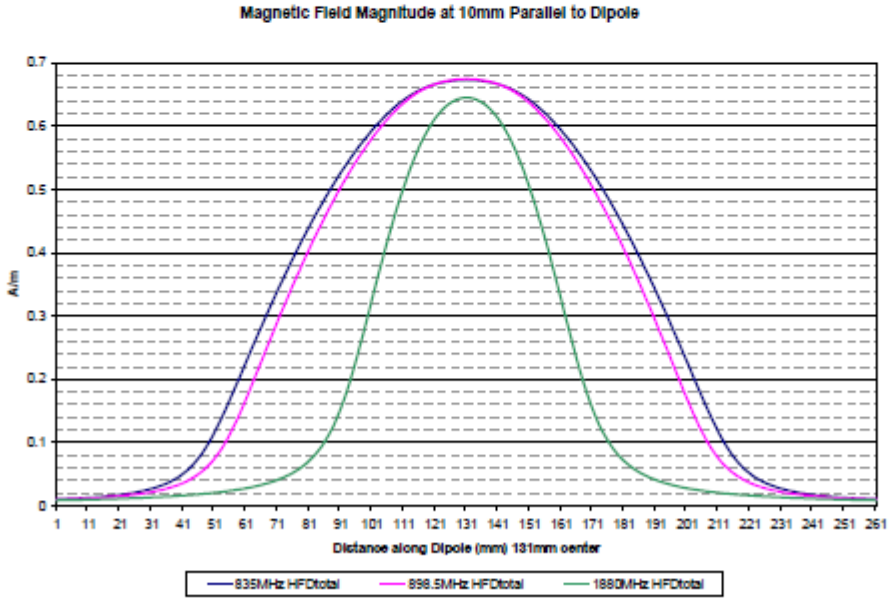
Sensitivity as measured and recorded above has been calculated for each sensor when fully assembled and positioned spatially around the measurement space and has been normalized to reduce measurement uncertainty and enhance probe response for all three measurement locations and perceived vectors.

NCL Calibration Laboratories
Division of APREL Laboratories.

Target H-Field Measured:

The H-Filed measured with probe Serial Number: H-030-400-00102 has been normalized to meet the target values to within 10%.

Target H-Field DSY @ 10 mm:	0.443 A/m
Measured H-Field @ 10 mm:	0.447 A/m
Delta H-Field:	0.004 A/m
Deviation from Target:	< 1%



NCL Calibration Laboratories

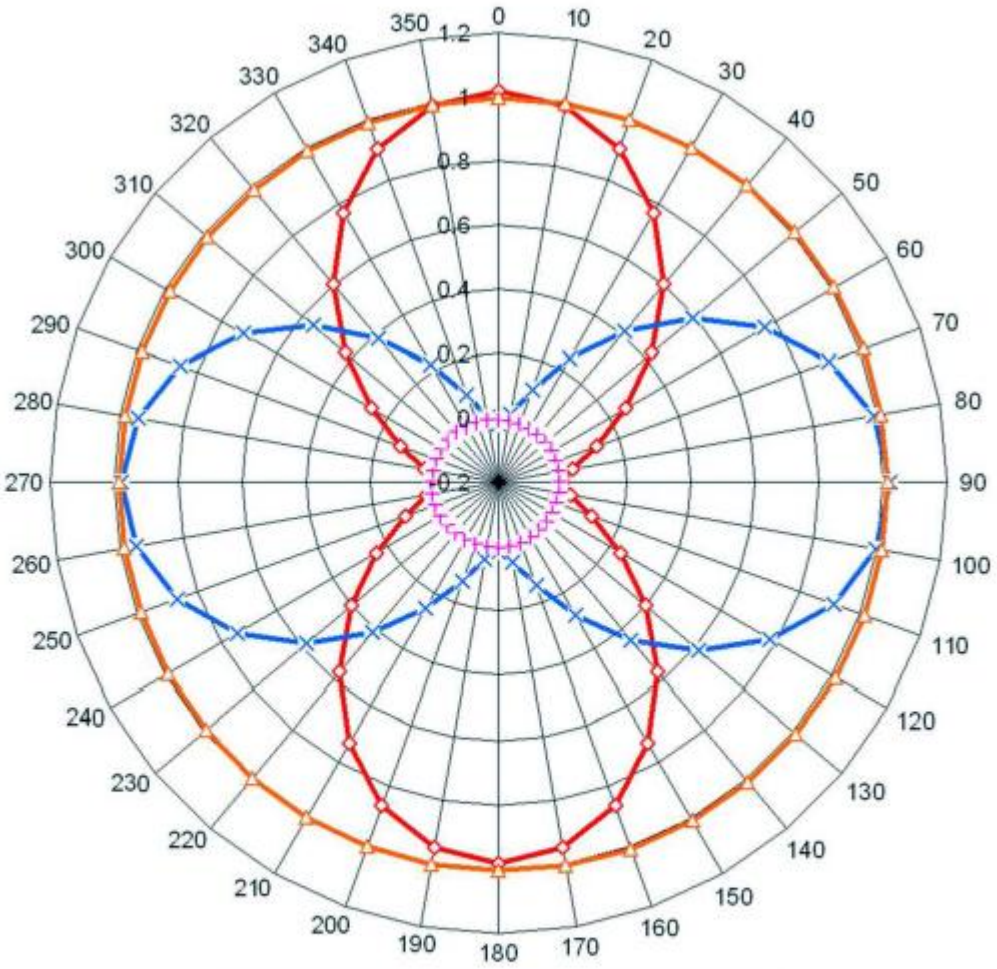
Division of APREL Laboratories.

Spatial Resolution:

The measured probe tip diameter is 8.5 mm (+/- 0.1 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Measured Receiving Pattern at 1880MHz

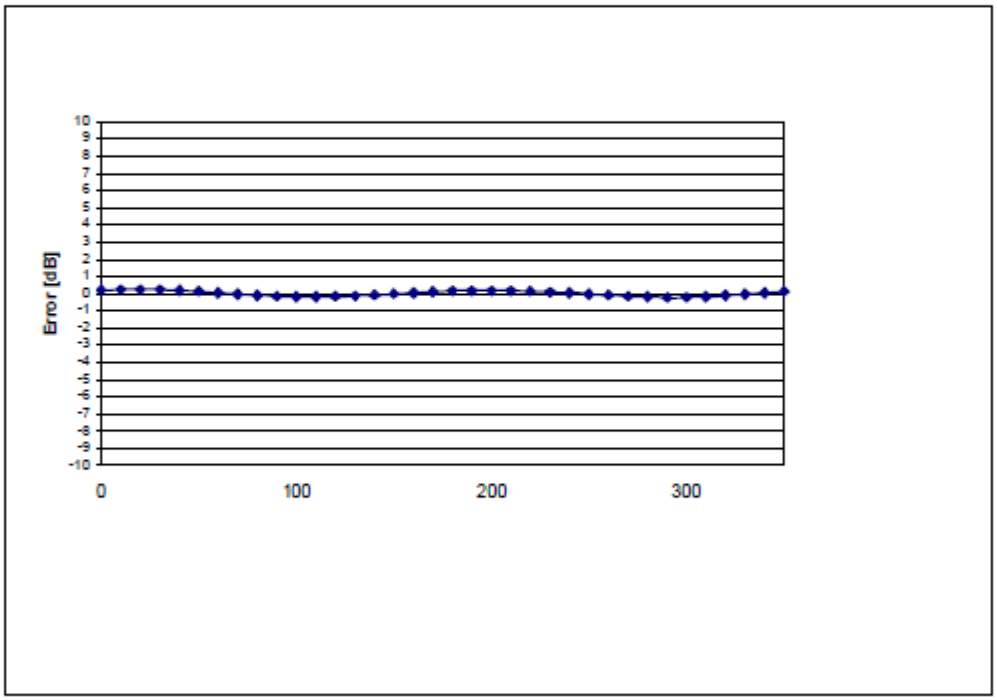
H-030-400-00102



Measured at 90° θ

NCL Calibration Laboratories
Division of APREL Laboratories.

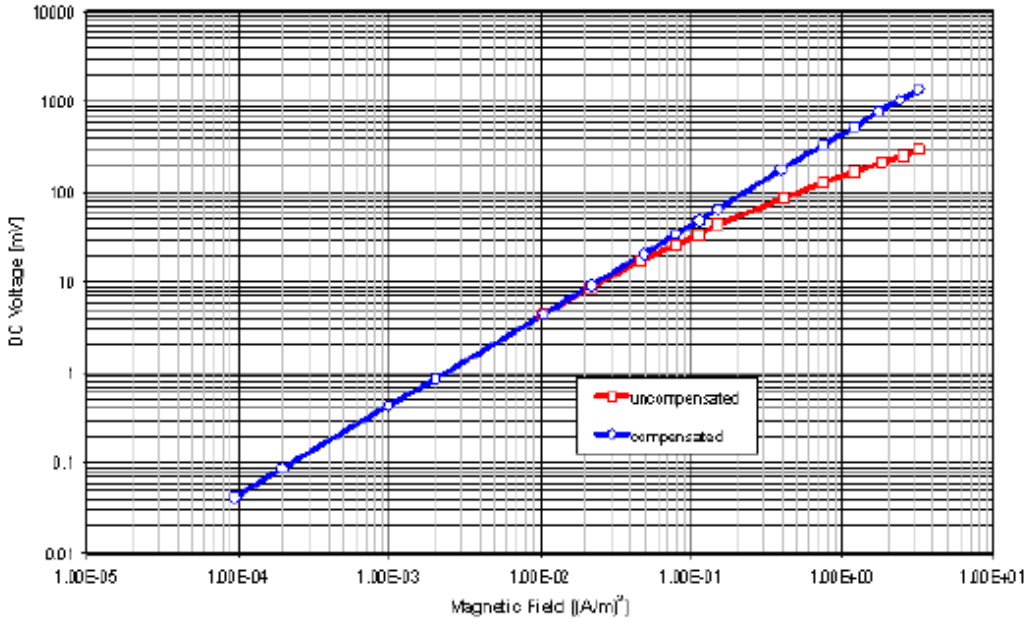
Loop Isotropy Error Normalized to Reference 1880 MHz



Isotropicity: 0.20 dB

NCL Calibration Laboratories
Division of APREL Laboratories.

Dynamic Range Normalized to Reference



Measured at 90° ⊕

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2011.

NCL CALIBRATION LABORATORIES

Calibration File No: HAC-DC-625
Project Number: INKB-D900-cal-5444

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

HAC Validation Dipole

Manufacturer: APREL Laboratories
Part number: ALS-D-900-S-2-HAC
Frequency: 910 MHz
Serial No: 190-00607

Customer: IAC

Calibrated: May 28, 2014
Released on: May 28, 2014

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: _____

NCL CALIBRATION LABORATORIES
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4162

10. Dipole calibration report

NCL Calibration Laboratories
Division of APREL Laboratories.

Conditions

Dipole 190-00607 client calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

Calibration Results Summary

This dipole has been found to comply with the calibration requirements detailed in the "Experimental Investigation into the Frequency Response for the APREL Laboratories IEEE C63.19 Hearing Aid Compatibility Validation Dipole Tuned for Air [2005 version]". When used correctly this dipole has been found to be capable of generating fields as required in the document "ATIS Incubator Solutions Program-4 Hearing Aid Compatibility AISP.4-Hearing Aid Compatibility "Test Plan & Technical Specification for Wireless Phone Compliance Baseline" [2005 Version]" for HAC system validation.

Electrical Results
Frequency: 910MHz

SWR: 1.54 U
Return Loss: -13.097 dB
Impedance: 50.23 Ω

Dipole Complies: 870 to 955MHz

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol

C. Teodorian

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Introduction

The results contained within this calibration report are for HAC Validation Dipole 190-00607. The calibration routine consisted of a two step process. Step 1 involves a mechanical verification and inspection to ensure that the dipole meets the manufacturing tolerances. Step 2 involves a complete electrical calibration of the HAC validation dipole conducted within an ambient controlled environment, where the SWR, Impedance, and Return Loss are fully assessed.

References

Experimental Investigation into the Frequency Response for the APREL Laboratories IEEE C63.19 Hearing Aid Compatibility Validation Dipole Tuned for Air [2005 version]

C63.19 American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids [*draft* 2005 version]

ATIS Incubator Solutions Program-4 Hearing Aid Compatibility
AISP.4-Hearing Aid Compatibility "Test Plan & Technical Specification for Wireless Phone Compliance Baseline" [2005 Version]

Conditions

Dipole 190-00607 was new.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C

3

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Dipole Calibration Results

Electrical Calibration

Test	Result
S11 R/L	-13.097 dB
SWR	1.54 U
Impedance	50.23 Ω

Calibration Summary

This dipole has been found to comply with the calibration requirements detailed in the "Experimental Investigation into the Frequency Response for the APREL Laboratories IEEE C63.19 Hearing Aid Compatibility Validation Dipole Tuned for Air [2005 version]". When used correctly this dipole has been found to be capable of generating fields as required in the document "ATIS Incubator Solutions Program-4 Hearing Aid Compatibility AISP.4-Hearing Aid Compatibility "Test Plan & Technical Specification for Wireless Phone Compliance Baseline" [2005 Version]" for HAC system validation.

4

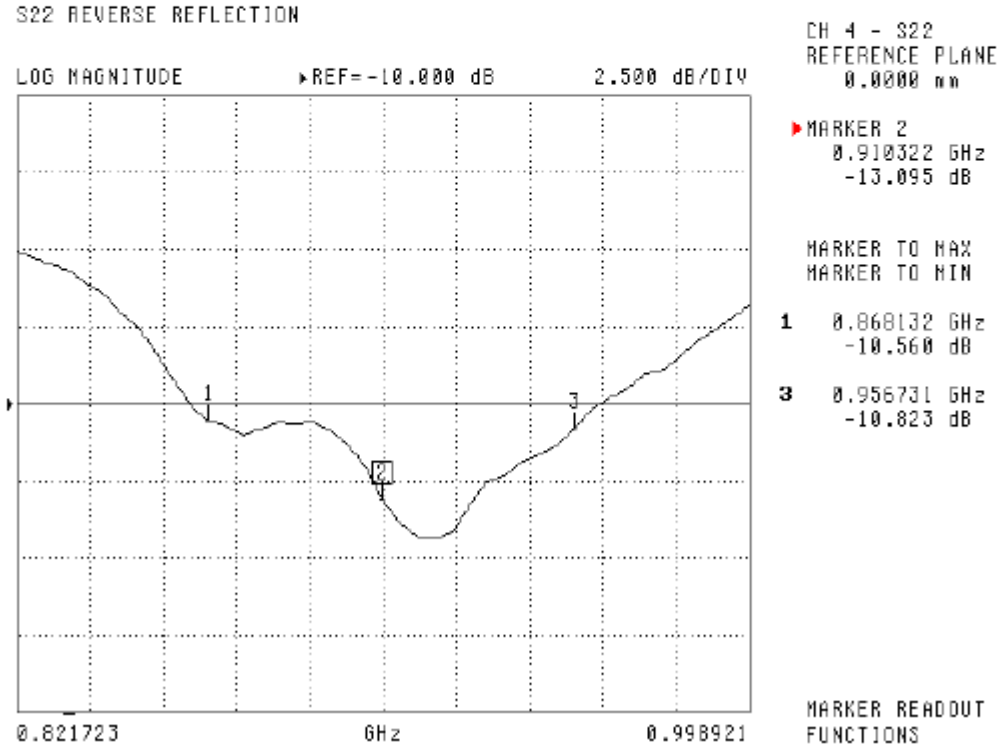
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Results (Graphical Plots)

The following graphs and plots are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss

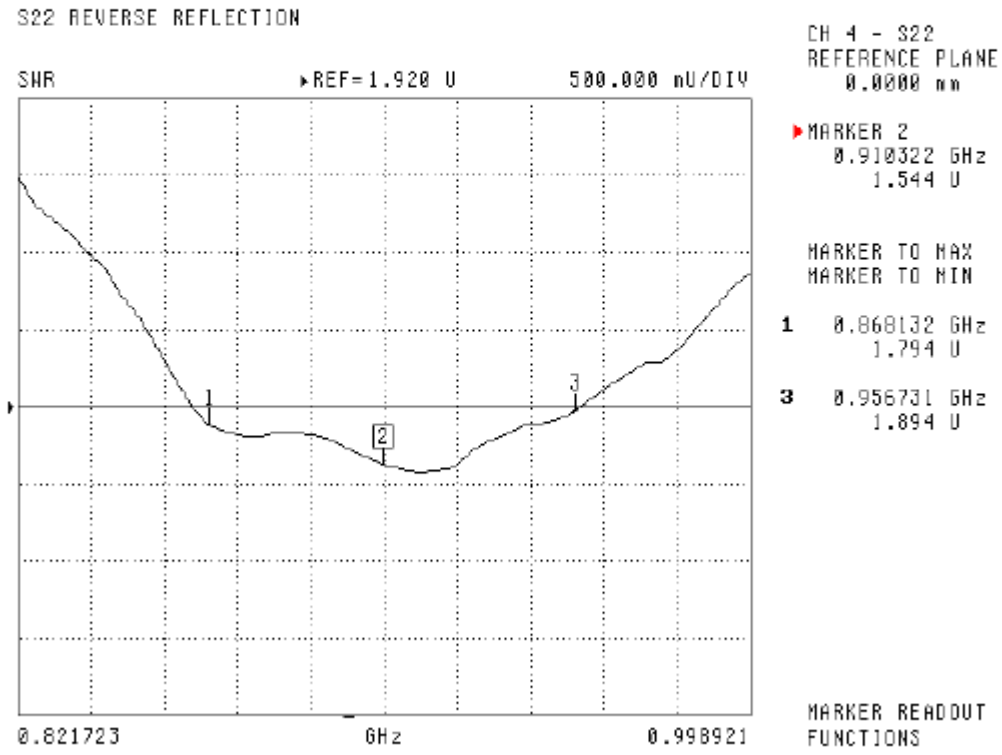


5

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Standing Wave Ratio

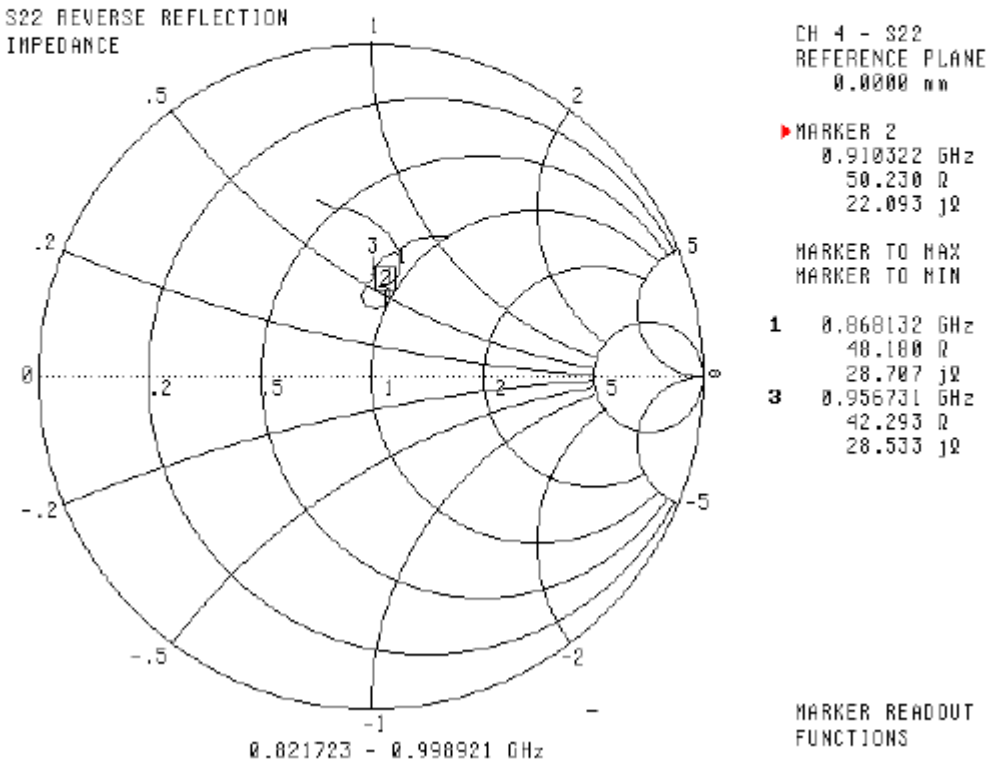


6

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Smith Chart Dipole Impedance



7

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List.

8

This page has been reviewed for content and attested to by signature within this document.

NCL CALIBRATION LABORATORIES

Calibration File No: HAC-DC-626
Project Number: INKB-D1900-cal-5445

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

HAC Validation Dipole

Manufacturer: APREL Laboratories
Part number: ALS-D-1900-S-2-HAC
Frequency: 1855 MHz
Serial No: 210-00708

Customer: IAC

Calibrated: May 28, 2014
Released on: May 28, 2014

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: _____

NCL CALIBRATION LABORATORIES
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4162

NCL Calibration Laboratories
Division of APREL Laboratories.

Conditions

Dipole 210-00708 client calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

Calibration Results Summary

This dipole has been found to comply with the calibration requirements detailed in the "Experimental Investigation into the Frequency Response for the APREL Laboratories IEEE C63.19 Hearing Aid Compatibility Validation Dipole Tuned for Air [2005 version]". When used correctly this dipole has been found to be capable of generating fields as required in the document "ATIS Incubator Solutions Program-4 Hearing Aid Compatibility AISP.4-Hearing Aid Compatibility "Test Plan & Technical Specification for Wireless Phone Compliance Baseline" [2005 Version]" for HAC system validation.

Electrical Results
Frequency: 1855MHz

SWR: 1.39 U
Return Loss: -15.61 dB
Impedance: 37.12 Ω

Dipole Complies: 1745 to 1935MHz

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol

C. Teodorian

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Introduction

The results contained within this calibration report are for HAC Validation Dipole 210-00708. The calibration routine consisted of a two step process. Step 1 involves a mechanical verification and inspection to ensure that the dipole meets the manufacturing tolerances. Step 2 involves a complete electrical calibration of the HAC validation dipole conducted within an ambient controlled environment, where the SWR, Impedance, and Return Loss are fully assessed.

References

Experimental Investigation into the Frequency Response for the APREL Laboratories IEEE C63.19 Hearing Aid Compatibility Validation Dipole Tuned for Air [2005 version]

C63.19 American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids [*draft* 2005 version]

ATIS Incubator Solutions Program-4 Hearing Aid Compatibility
AISP.4-Hearing Aid Compatibility "Test Plan & Technical Specification for Wireless Phone Compliance Baseline" [2005 Version]

Conditions

Dipole 210-00708 was new.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C

3

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Dipole Calibration Results

Electrical Calibration

Test	Result
S11 R/L	-15.61 dB
SWR	1.39 U
Impedance	37.12 Ω

Calibration Summary

This dipole has been found to comply with the calibration requirements detailed in the "Experimental Investigation into the Frequency Response for the APREL Laboratories IEEE C63.19 Hearing Aid Compatibility Validation Dipole Tuned for Air [2005 version]". When used correctly this dipole has been found to be capable of generating fields as required in the document "ATIS Incubator Solutions Program-4 Hearing Aid Compatibility AISP.4-Hearing Aid Compatibility "Test Plan & Technical Specification for Wireless Phone Compliance Baseline" [2005 Version]" for HAC system validation.

4

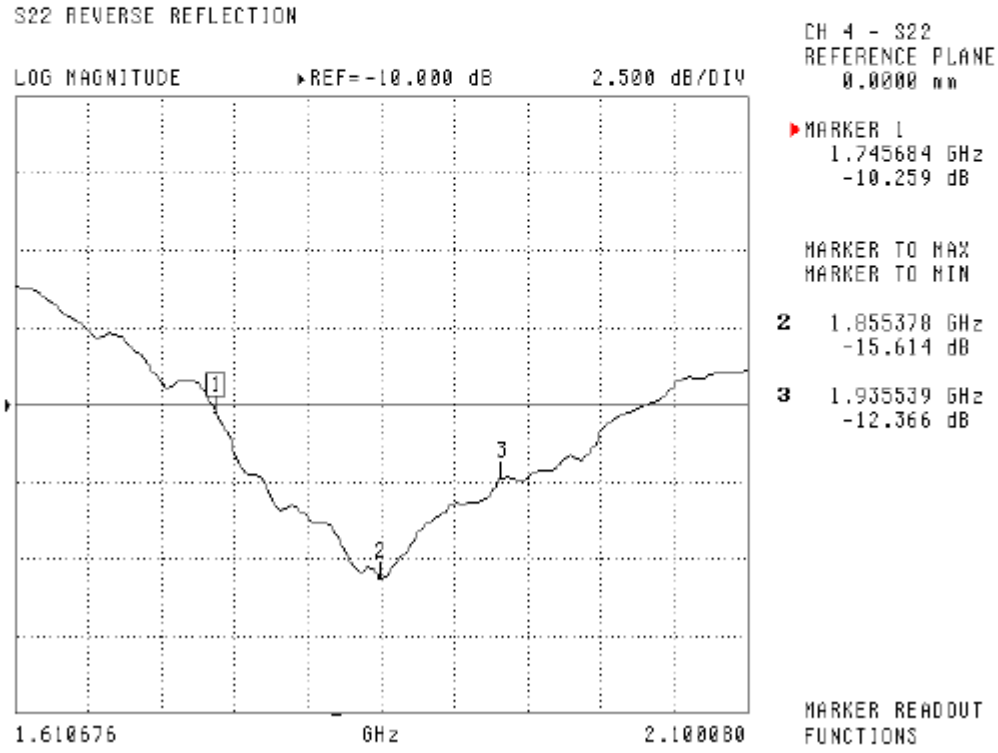
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Results (Graphical Plots)

The following graphs and plots are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss

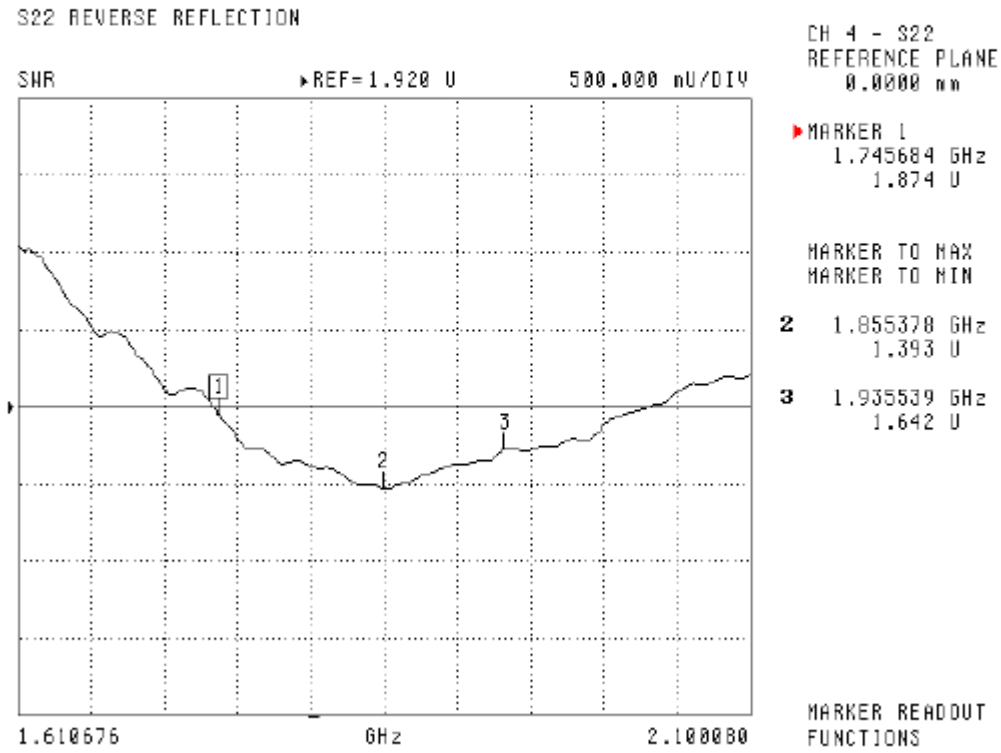


5

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Standing Wave Ratio



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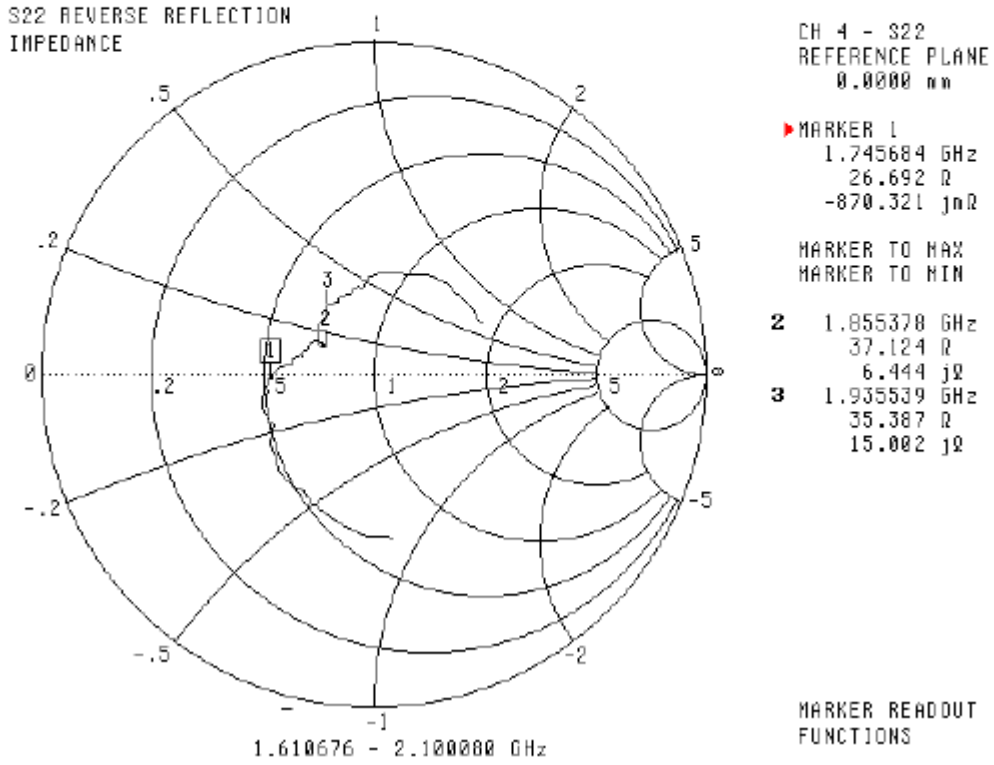
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Smith Chart Dipole Impedance



This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List.

This page has been reviewed for content and attested to by signature within this document.