Handheld EMF Analyzer Band 30MHz-6GHz

KEYSIGHT FieldFox + AGOS Antenna

||AGOS Advanced Technologies

Tri-axial Isotropic measurement from 400MHz to 6GHz (Usable 30MHz to 6GHz)

Spectrum measurement (standard)

EMF measurement (standard)

External EMF software with

- LTE RSRP based Extrapolation (option)
- UMTS (3G) P-CPICH based extrapolation (option)
- GSM extrapolation (option)
- GPS Receiver and Antenna (option)
- 5G NR EMF measurement (SSRP based and in time-domain)(option)

Item	Specifications
System Frequency range	400 MHz ~ 6 GHz (usable down to 30MHz)
Measurement Dynamic Range	0.2mV/m to 200V/m
Max applicable field strength	300V/m
Mode	Sweep / FFT
Trace	X-Axis, Y-Axis, Z-Axis, Current, Isotropic, Isotropic Accumulated
Limit lines	MSL, ICNIRP
Antenna Type	Tri-axial Isotropic antenna
Antenna factor input methods	Direct to the system, To the computer, Auto download from antenna to SA
Time Averaging	1 to 30 min (# of measurement= Measurement Time / (Dwell Time x 3)
Standard Units	dBμV/m, dBmV/m, V/m, A/m, dBm, W/m^2
Extended Units (Option)	dBV/m, W/m^2, dBm/m^2, dBW/m^2, dBA/m, and mW/cm^2., % of the standard
Result Type	ACT, MIN, MAX, AVG, % of limit, Spatial averaging

The ARIA-6000 device, designed and built in AGOS NIRLab laboratory, contains three passive, independent, orthogonal antennas.

If used with the ferrite bead coaxial cable, it allows reliable measurement of radio-frequency electric fields which have an environmental impact in the vast majority of practical cases.

| Item	Specifications
Frequency range	400 MHz ~ 6 GHz (usable down to 30MHz)
Transducer type	isotropic transducer with 3 orthogonal dipole antennas, with RF absorbing boom
Polarization	linear, tri-axial polarization selection by means of internal electronic solid state RF switch
Axis selection	by GPIO interface
Linear dynamic range	0.2mV/m to 200 V/m (1 dB compression point)
Sensitivity	< 0.2 mV/m (depend of RBW and noise quality of spectrum analyzer
Max applicable field strength	300 V/m
Isotropic error on rms total electric field	±1.5 from 30 MHz to 1500 MHz ±2.0 from 1500 MHz to 2000 MHz ±2.5 from 2000 MHz to 3500 MHz ±3.5 from 3500 MHz to 6000 MHz
Dimension	Ø77mm, length 220mm
Antenna Weight	580g
RF connector	N type Male, 50 ohms
Protection class	IP 42
Temperature range	−20°C to +55°C.
Humidity	max 95% at 40°C without condensation
Shock Resistance	1 m drop without degradation of electrical characteristics

Typical Antenna factors

Prequency: MHz
X/Y/Z Axis: dB(1/m)

Frequency	X Axis	Y Axis	Z Axis	Frequency	X Axis	Y Axis	Z Axis	Frequency	X Axis	Y Axis	Z Axis
30	67.9	67.8	67.5	1500	40.1	40.2	41.1	3900	44.9	45.0	45.2
40	66.1	65.8	65.6	1600	40.3	40.1	40.8	4000	46.7	45.9	46.5
50	61.9	61.3	61.3	1700	41.0	40.9	40.1	4100	46.7	46.4	47.1
60	60.6	60.1	60.4	1800	39.8	40.0	39.8	4200	46.0	46.3	46.0
70	60.0	59.5	59.8	1900	39.8	39.6	40.3	4300	45.9	46.2	46.4
80	59.5	59.2	59.6	2000	40.6	40.4	40.4	4400	47.2	46.8	48.9
90	58.9	59.0	59.2	2100	40.0	40.0	39.7	4500	48.2	48.1	50.5
100	58.0	58.2	58.5	2200	40.1	40.0	40.2	4600	47.9	48.1	47.7
110	57.0	57.2	57.5	2300	40.8	40.6	40.8	4700	47.6	47.5	50.1
150	55.4	52.7	54.4	2400	40.2	40.0	40.1	4800	50.4	49.8	53.6
200	52.6	53.3	53.5	2500	40.9	40.8	40.7	4900	50.5	50.5	53.2
250	50.4	51.0	50.7	2600	40.7	40.7	40.5	5000	48.8	49.3	50.4
300	48.7	48.3	47.2	2700	41.0	40.8	41.0	5100	48.8	48.8	53.7
400	51.0	51.1	51.2	2800	41.5	41.2	41.5	5200	50.4	49.8	56.4
500	48.1	48.4	48.9	2900	42.5	42.2	42.1	5300	51.6	48.1	53.7
600	50.1	50.4	49.5	3000	43.0	42.8	42.8	5400	51.0	51.3	50.9
700	45.6	45.8	45.1	3100	42.4	42.3	42.9	5500	49.7	49.6	52.2
800	46.0	45.6	47.4	3200	43.1	42.7	43.2	5600	53.3	51.2	55.0
900	44.1	44.2	44.0	3300	43.4	42.8	43.1	5700	54.1	53.4	54.7
1000	43.2	43.4	42.8	3400	44.5	44.1	43.9	5800	52.2	52.9	52.2
1100	42.6	42.7	43.6	3500	43.5	43.8	44.3	5900	51.8	51.9	54.0
1200	42.3	42.3	43.1	3600	44.3	43.9	44.0	6000	54.1	52.5	56.1
1300	42.5	42.6	42.2	3700	46.1	45.2	45.2				
1400	40.9	41.0	40.4	3800	45.8	45.8	46.1				

ENCLOSED ACCESSORIES

- 1.5 m coaxial cable, ferritized, with calibration certificate of attenuation and return loss (typ. atten. 2,0 dB @ 3GHz, 6,0 dB @ 6 GHz)
- Vertical support for fixing to 1/4" thread
- Calibration certificate with antenna factor and return loss of the three axis
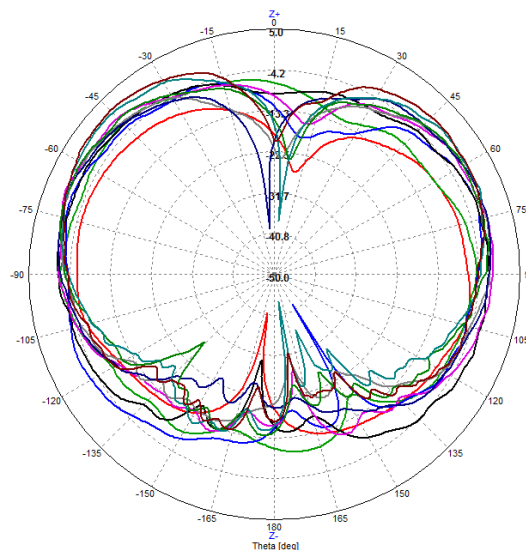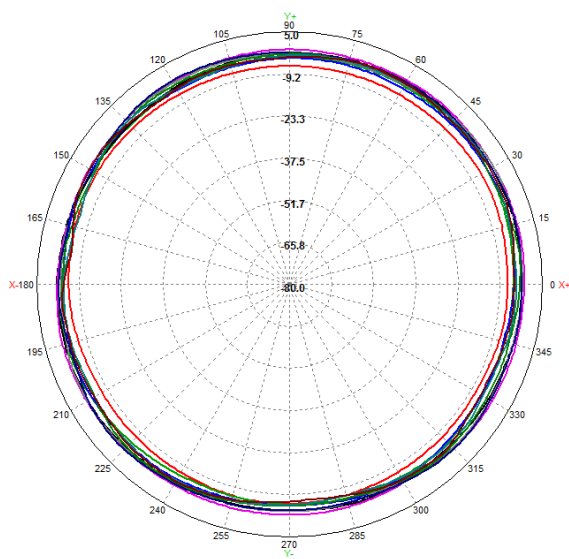
This passive device does not contain any parts whose characteristics deteriorate over time, however the recommended calibration interval depends on intensity of use or on undesired accidental events (falling, crushing, contact with liquids). Generally the calibration procedure is carried out against the sample in an environment free of interfering field. AGOS supplies the antenna complete with a calibration certificate issued by its radio-electric laboratory. This is obtained in a controlled environment (anechoic chamber) by comparison with the laboratory primary samples, calibrated in SIT accredited or equivalent (EA) laboratories.

The correct position is represented in the figure below. Rotate the antenna on its axis until the dipole axis is in a vertical plane (Figure 1), i.e. placing the red mark **X** (Y, Z) in the upper position. Now the **X** antenna is ready to be calibrated supposing that a vertical polarization launch is used. Now the other two antenna factors (AF$_Y$, AF$_Z$) can be measured in sequence by manually rotating the support through 120° in relation to the base of the support, bringing successively the three red marks Y, Z in the upper position.
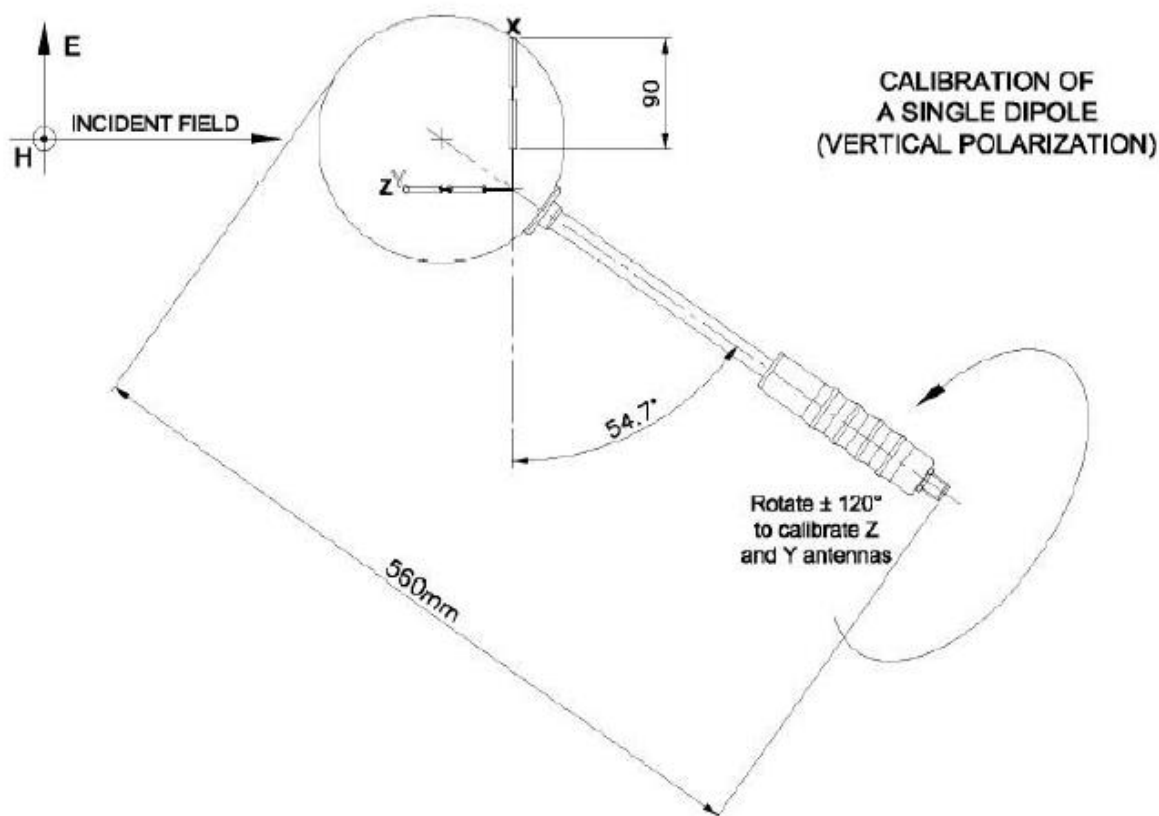
Figure 1: Calibration position and procedure for ARIA 6000 antenna

Connect the axis selection connector of the composite cable to the connector on the antenna pigtail, then fix the N male RF connector to the antenna port. Always make sure that both connectors are well tightened to avoid poor contacts: after measuring has been completed, always check that the connectors are still tight.

EMF measurement and analysis software can control EMF receiver and data gathering from Spectrum analyzer.

- EMF compliance and safety evaluation analysis
- Measurement points with built-in GPS receiver

Safety Evaluation Mode

Safety evaluation mode is settable user frequency table and show the results in common field strength, equivalent power density and % of standard limit (ICNIRP or Unser defined limit).

EMF compliance evaluation Mode

EMF compliance evaluation mode provides EMF measurement functions as radio station installation for Put-into-service. It includes step measurement, spatial averaging and contributed EM sources in near radio tower or investigation domain.
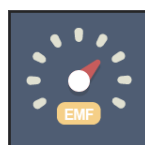
EMF meter Mode

EMF meter mode is based on spectrum display that can analysis "hidden" or "inter-mitten" emitters. And EMF measurement for a single targeted emitter analysis easily.

5G NR EMF Extrapolation Mode (To be released)

EMF Extrapolation mode can provide the maximal EMF exposure estimation with the extrapolation based on reference signal constant radiating. GSM, WCDMA, LTE and 5G NR need to be analysis with these techniques for the worst case. Especially 5G NR needs it due to its air interface architecture.

Safety Evaluation Mode

Safety evaluation mode is based on In-situ measurement of electromagnetic field strength related to human exposure in the vicinity of base stations.
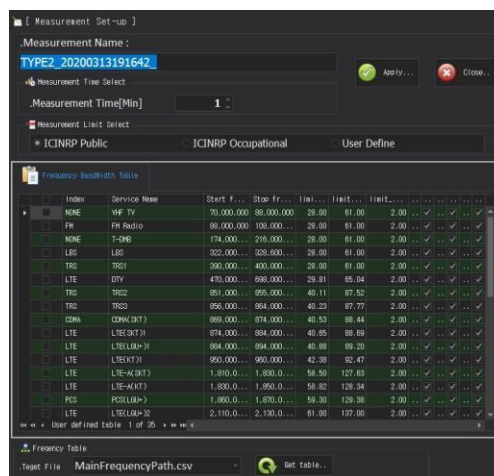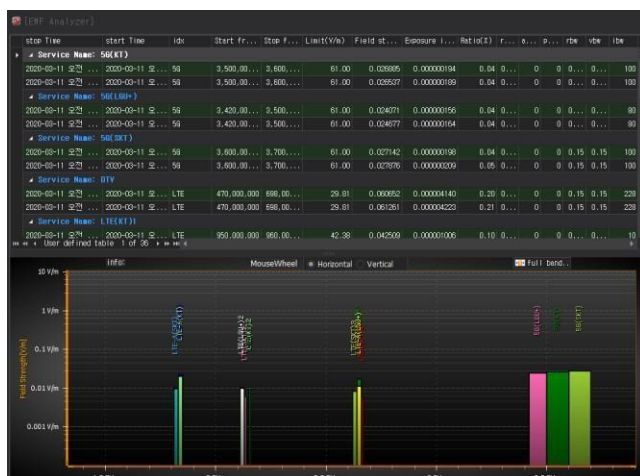

- Multiband frequency table can be configurable and list sweep measurement for each band EMF field strength result compared to ICNIRP limit or User defined limits.
- EMF strength with maximum traffic condition can be delivered using Extrapolation techniques for LTE and 5G NR (To be released)

EMF compliance evaluation Mode

EMF compliance evaluation mode is based on the compliance of fixed equipment for radio transmission from 30MHz to 6GHz intended for use in wireless telecommunication networks with ICNIRP general public and occupational limit or user defined guide line.
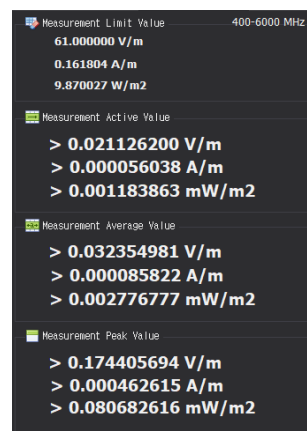
- This mode can be used in EMF filed strength measurement for Put-into- service of radio station.
- Frequency selective measurement for the single service frequency BW for the evaluating of ICNIRP guideline. And measurement other resources in relevant domain.

EMF meter Mode

EMF meter mode can provide electric field strength display along with frequency domain and spectrogram.
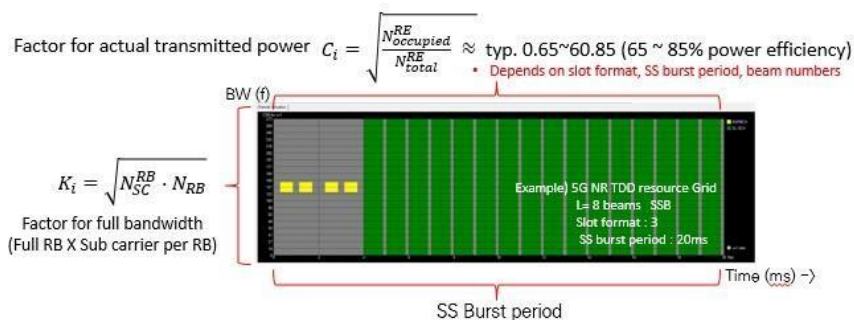It is just simple way to see the value of EMF measurement level.

- This function is useful to check the antenna and instrument status.
- Can be used in maintenance.
- It is easy to find the strongest EMF radiated spot.
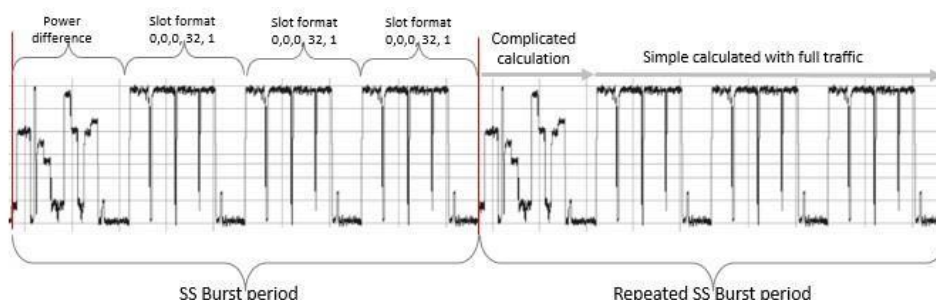
5G NR EMF Extrapolation Mode (To be released)

5G NR TDD is required the SSB (SSRP) with measurement based extrapolation to get the maximal EMF strength in the maximum traffic status for the worst case evaluation.

- EMF strength evaluation with the *channel Power measurement in demodulation* domain.

- *Extrapolation with SSRP measurement*

Factor for actual transmitted power $C_i = \sqrt{\dfrac{N_{occupied}^{RE}}{N_{total}^{RE}}} \approx$ typ. 0.65~60.85 (65 ~ 85% power efficiency)
- Depends on slot format, SS burst period, beam numbers

$K_i = \sqrt{N_{SC}^{RB} \cdot N_{RB}}$

Factor for full bandwidth
(Full RB X Sub carrier per RB)

Example) 5G NR TDD resource Grid
L= 8 beams SSB
Slot format : 3
SS burst period : 20ms

SS Burst period

- *Extrapolation with SSB level in zero span* (Timedomain)

SS Burst period   Repeated SS Burst period
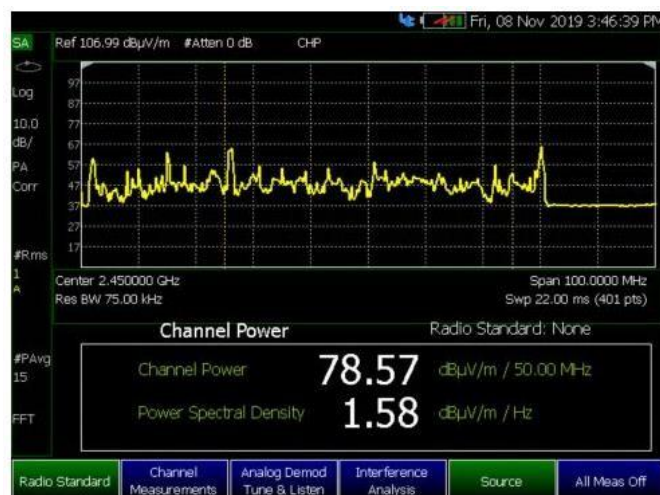
EMF analyzer Software

Standard Included Accessories with the probe ARIA-6000 :

- 1.5 m coaxial cable, ferritized, with calibration certificate of attenuation and return loss

  (typ. atten. 2,0 dB @ 3GHz, 6,0 dB @ 6 GHz)

- Vertical support for fixing to 1/4

- Calibration certificate with antenna factor and return loss of the three axis

Configuration :

- Keysight FieldFox Spectrum Analyzer

- EMF (option -358)
    - Supports connectivity to AGOS Advanced Technologies, Triaxial Isotropic Antenna, model SDIA-6000
    - Spectrum analyzer EMF channel power measurements (Option 233 on combination models)
    - EMF measurements on 5G NR control channels show the impact of the 5G signal over total RF exposure, requires over-the-air (OTA) 5G NR (Option 378 available on B-Series)

- ARIA-6000 : Tri-axial Isotropic Probe
- AFCA15 : Ferrite beard RF cable 1.5m
- AAH : Vertical support for fixing to 1/4
- Berlebach Report 823 Wooden Tripod
- SDEMF-I : EMF analysis Software
    - ✓ Opt 5G : 5G NR EMF extrapolation
- Carrying case : Hard case for probe and accessories

KEYSIGHT   **ES**   **||AGOS**

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