Electromagnetic Field (EMF) Triaxial Isotropic Antenna

85572A

Introduction

Radio frequency electromagnetic fields (EMF) testing is key to evaluate total RF exposure in any given area due to deployment of various RF/MW networks, such as mobile phones, base stations, Wi-Fi, smart meters, IoT devices, and satellite and radar systems. Exposure levels set by government and regulatory agencies need to be verified in the field for compliance.

FieldFox with EMF measurements (Option 358), connected to the 85572A EMF Triaxial Isotropic Antenna, enables EMF measurements in spectrum analyzer and over-the-air (OTA) 5G NR modes. The total field strength can be measured across the frequency band of interest.

- Enables portable EMF measurements from 400 MHz to 6 GHz (Option 85572A-006) or from 30 MHz to 6 GHz (Option 85572A-007) with Keysight FieldFox analyzers
- Supports spectrum analyzer EMF channel power measurements
- 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 (available for FieldFox B-Series or C-Series)

KEYSIGHT

Key Specifications

FieldFox Analyzer + 85572A Antenna

Require the EMF measurements app (option 358) on the FieldFox

Item	Specifications
System frequency range	400 MHz to 6 GHz (with Option 85572A-006)
	30 MHz to 6 GHz (with Option 85572A-007)
Measurement dynamic range	0.2 mV/m to 200 V/m
Max applicable field strength	300 V/m
Mode	Sweep/FFT
Trace	X-Axis, Y-Axis, Z-Axis, current, isotropic, isotropic accumulated
Limit lines	MSL, ICNIRP
Antenna type	Triaxial isotropic antenna
Antenna factor input methods	Direct to the analyzer, auto download from antenna to SA
Time averaging	1 to 30 min (# of measurement= Measurement time/ (Dwell time x 3)
Units[1]	dBµV/m, dBm/m^2, V/m, W/cm^2, W/m^2, dBµA/m, dBG, dBpT
Result type	ACT, MIN, MAX, AVG, % of limit, spatial averaging

85572A Antenna

Keysight 85572A EMF Triaxial Isotropic Antenna, originally designed and built in the AGOS NIRLab laboratory, contains three passive, independent, orthogonal antennas. If used with the supplied ferrite bead coaxial cable, it allows reliable measurement of radio-frequency electric fields that have an environmental impact in the vast majority of practical cases. The three orthogonal antennas are framed in the spherical radome.

85572A EMF triaxial isotropic antenna (product color is subject to change)

[1] With the antenna connected and “Antenna correction” being set to “On”

Item	Specifications
Frequency range	400 MHz to 6 GHz (with Option 85572A-006)
	30 MHz to 6 GHz (with Option 85572A-007)
Transducer type	Isotropic transducer with three 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	0.2 mV/m to 200 V/m (1 dB compression point)
Sensitivity	< 0.2 mV/m (depending on RBW and noise quality of spectrum analyzer
Max applicable field strength	300 V/m
Probe linearity	< 1.5 dB
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	Ø 77 mm, length 220 mm
Antenna weight	580 g
RF connector	N type Male, 50 Ω
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

Accessories Included

- 1.5 m coaxial cable, ferritized, with calibration certificate of attenuation and return loss (Refer to the following table for the nominal cable loss).

Nominal Cable Loss (Frequency in MHz and Loss in dB)

Frequency	Loss	Frequency	Loss	Frequency	Loss	Frequency	Loss	Frequency	Loss
30	0.08	500	0.58	1,900	1.37	3,300	1.96	4,700	2.50
40	0.11	600	0.64	2,000	1.35	3,400	1.91	4,800	2.30
50	0.14	700	0.72	2,100	1.45	3,500	1.97	4,900	2.42
60	0.16	800	0.77	2,200	1.53	3,600	2.06	5,000	2.51
70	0.18	900	0.83	2,300	1.50	3,700	2.02	5,100	2.46
80	0.19	1,000	0.92	2,400	1.64	3,800	2.06	5,200	2.69
90	0.21	1,100	0.92	2,500	1.59	3,900	2.08	5,300	2.64
100	0.22	1,200	1.01	2,600	1.63	4,000	2.31	5,400	2.87
110	0.23	1,300	1.03	2,700	1.65	4,100	2.22	5,500	2.93
150	0.28	1,400	1.09	2,800	1.68	4,200	2.24	5,600	2.76
200	0.34	1,500	1.14	2,900	1.74	4,300	2.43	5,700	3.00
250	0.40	1,600	1.16	3,000	1.75	4,400	2.29	5,800	2.85
300	0.43	1,700	1.23	3,100	1.82	4,500	2.35	5,900	2.76
400	0.49	1,800	1.26	3,200	1.85	4,600	2.34	6,000	2.87

Accessories Included

- Vertical ¼” thread support
- Non-metallic adapter (UNC, ¼-20 thread (f)) for affixing antenna on compatible tripod

Typical Antenna Factors

Access the original manufacturer’s website at http://www.agos.co.kr for detailed information.

Calibration certificate with antenna factor and return loss of the three antennas.

Examples of isotropic radiaiton patterns

Isotropic radiation pattern/vertical

Isotropic radiation pattern/horizontal

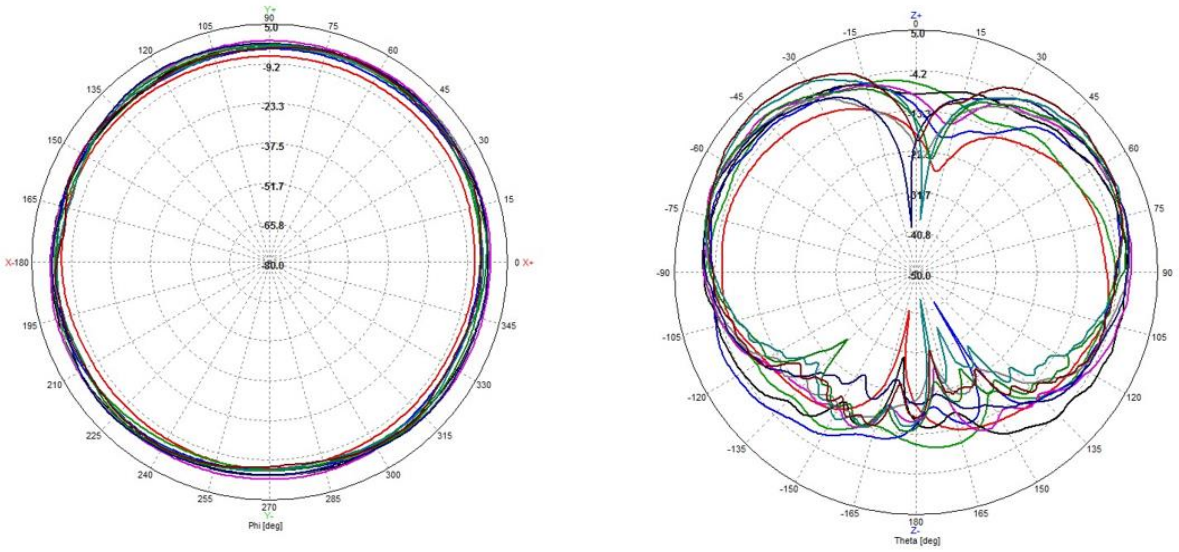

Figure 1. Isotropic radiation patterns for vertical and horizontal orientations

Antenna calibration[2]

The antenna is a passive device that does not contain any parts whose characteristics deteriorate over time; however, the recommended calibration interval depends on either intensity of use or undesired accidental events (falling, crushing, contact with liquids). Generally, the calibration procedure is carried out against the sample in an environment free of an interfering field. A calibration certificate is issued by the original manufacturer's radio-electric laboratory. Calibration certification 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 2), i.e. placing the red mark X (Y, Z) in the upper position. Now the X antenna is ready to be calibrated assuming that a vertical polarization launch is used. Now the other two antenna factors (AFY, AFZ) can be measured in sequence by manually rotating the support through 120° in relation to the base of the support, bringing the three red marks Y, Z in the upper position consecutively.

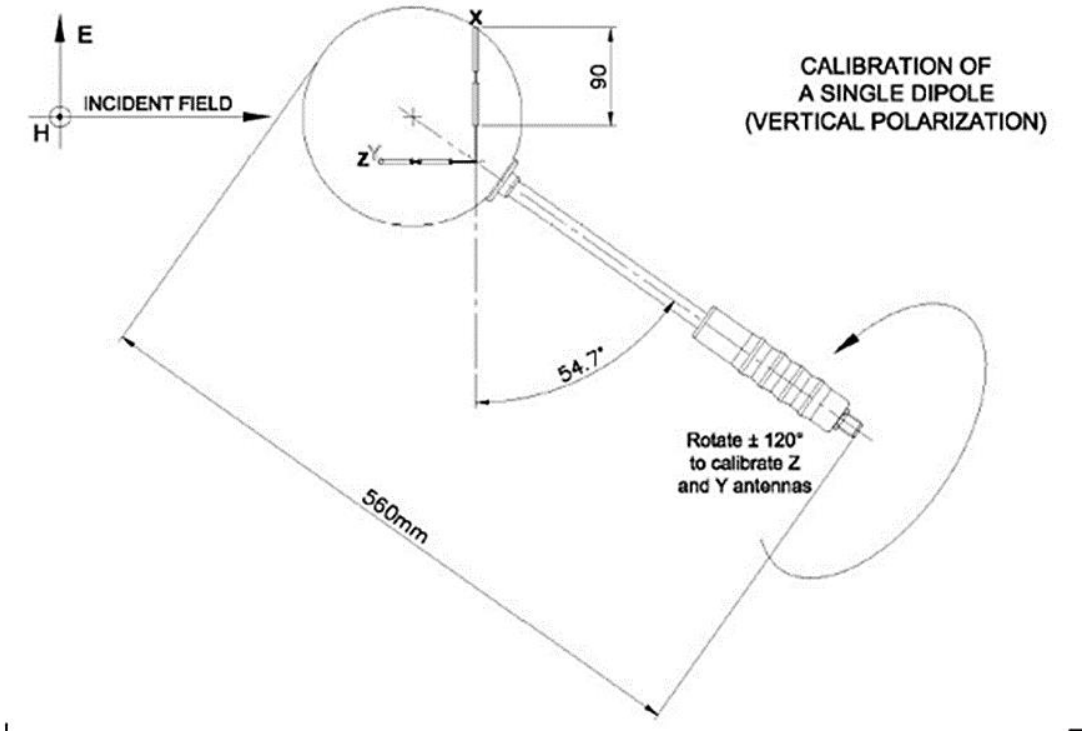

Figure 2. Calibration position and procedure for the 85572A antenna

Connect the axis selection connector of the composite cable to the connector on the antenna pigtail, then fix the N-type male RF connector to the antenna port. Always make sure that both connectors are securely tightened to avoid poor contacts: after measurement is complete, always check that the connectors are still tight.

[2] Antenna calibration is only provided by AGOS, the original manufacturer of the antenna.

Measurement and Results

Connecting the 85572A antenna to the RF input port (Port 2) of a FieldFox handheld analyzer equipped with the EMF measurements option (Opt 358), a user can make the EMF measurements with ease (Figure 3). Figure 4 shows a screenshot on the FieldFox analyzer demonstrating the EMF strength and channel power.

Figure 3. Connect the antenna to the analyzer

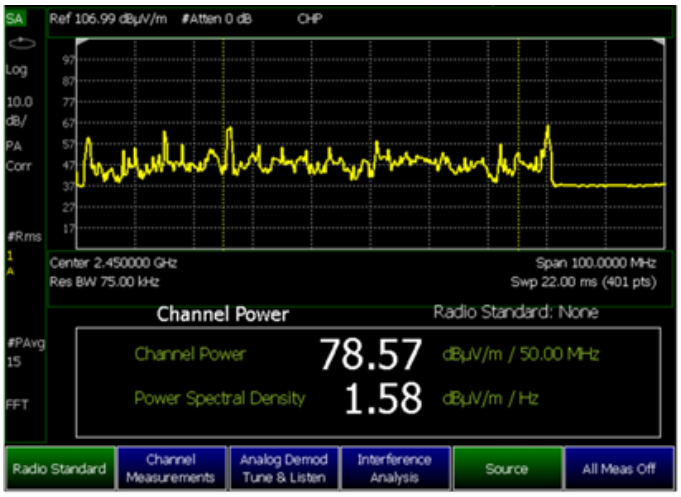

Figure 4. EMF measurement using the FieldFox spectrum analyzer's channel power mode

Carry Precision with You

For further technical and configuration information about the Keysight FieldFox handheld analyzers, either the combination analyzers or signal analyzers, please check the documents listed below.

Related literature	Publication numbers
FieldFox Handheld Analyzers (B- and C-Series), Configuration Guide	5992-3701EN
FieldFox Handheld Analyzers (B-and C-Series), Technical Overview	5992-3703EN
FieldFox Handheld Analyzers (C-Series), Data Sheet	3123-1696.EN
FieldFox Handheld Analyzers (B-Series), Data Sheet	5992-3702EN
FieldFox Handheld Analyzers (A-Series), Configuration Guide	5990-9836EN
FieldFox Handheld Analyzers (A-Series), Technical Overview	5992-0772EN
FieldFox Handheld Analyzers (A-Series), Data Sheet	5990-9783EN

Conclusion

Keysight FieldFox handheld analyzer (with Option 358 for a spectrum/signal analyzer, or with Options 233 and 358 for a combination analyzer) equipped with the Keysight 85572A EMF triaxial isotropic antenna provides customers with an ideal portable solution to accurately quantify RF exposure (between 400 MHz and 6 GHz with Option 85572A-006; or between 30 MHz and 6 GHz with Option 85572A-007) in the field, ensuring compliance with regulatory requirements.