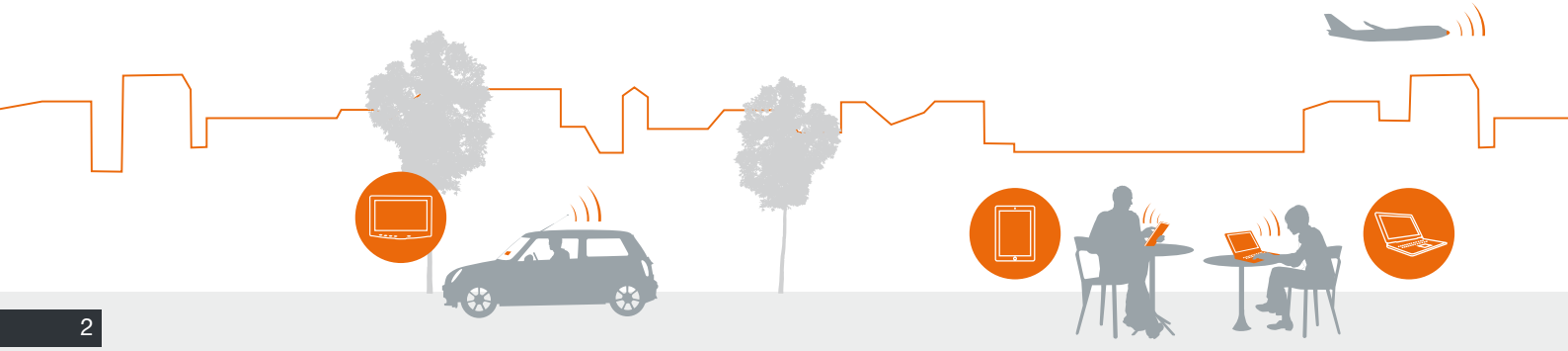
RF SAFETY CATALOG

EMF MEASUREMENT AND MONITORING TOOLS

Microwave Vision Group



The Smart Choice for RF Safety

Since its creation in 1986, Microwave Vision Group (MVG) has developed a unique expertise in the visualization of electromagnetic waves. The Group's mission is to extend this unique technology to all sectors where it will bring strong added value. Year after year, the Group develops a complete range of Radio Frequency (RF) instruments to measure the level of exposure to the electromagnetic field and to address the following needs:

- **To continuously record the electromagnetic field level and alerts the user to potential overexposure**
- **To monitor actual levels and compare them to the regulatory limits**
- **To address public concern through appropriate communication**
- **To simulate EMF radiation in real environments**

Quick Guide of MVG's RF Safety Solutions

Worker safety




System name	EME Guard XS	EME Guard XS 40 GHz	EME Guard XS Radar	EME Guard
Key feature	• Accurate measurement with Tri-axis isotropic sensor • Instant audio and visual alarm • Robust, reliable and user-friendly	• Accurate measurement with Tri-axis isotropic sensor • Instant audio and visual alarm • Robust, reliable and user-friendly • Measurements up to 40 GHz	• Accurate measurement with Tri-axis isotropic sensor • Instant audio and visual alarm • Robust, reliable and user-friendly • Measurements up to 30 GHz • Detects short pulsed signals	• Accurate measurement with triaxial isotropic probe • Customization of alarm thresholds • Vibrating alarm • Data storage software • Robust, all weather design
Utilisation mode	Portable	Portable	Portable	Portable
Selectivity	Broadband	Broadband	Broadband	Broadband
Frequency bands	80 MHz to 6 GHz	80 MHz – 40 GHz	80 MHz – 30 GHz	27 MHz to 40 GHz
Audio alarm	●	●	●	●
Visual alarm	●	●	●	●
Monitoring	●	●	●	●
Data storage				●
Software	NA	NA	NA	EME Guard Analysis
Industries/ Users	• Antenna installer & maintenance companies • Operators (cellular network, broadcast, PMR, …) • Military/Defense • RF laboratory workers • Local and national authorities	• Antenna installer & maintenance companies • Operators (cellular network, broadcast, PMR, …) • Military/Defense • RF laboratory workers • Local and national authorities	• Antenna installer & maintenance companies • Operators (cellular network, broadcast, PMR, radar, …) • Military/Defense • RF laboratory workers • Local and national authorities	• Antenna installer & maintenance companies • Operators (cellular network, broadcast, PMR, radar, …) • Military/Defense • RF laboratory workers
Page	P 10	P 12	P 14	P 16

PUBLIC SAFETY



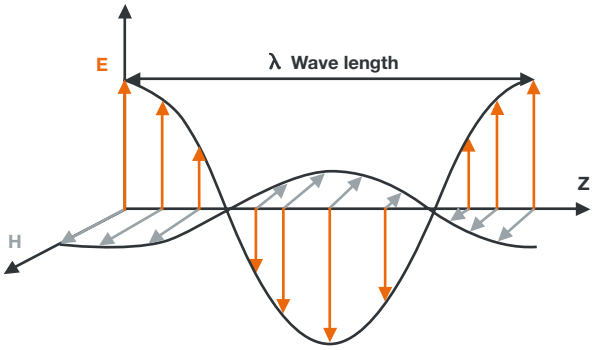


System name	FlashRad	EME Wide	EME Spy Evolution	INSITE Free	EMF Visual
Key feature	• Connected or wire-less communication for data transfer and alarms • Alert users with sound, light, mail or sms • Cover frequencies of all cellular networks including short pulsed signals • Monitor low EMF levels in public areas • Various power supply possibilities	• Real time display of Maximum, RMS or Time/Spatial average of isotropic field value • 0.35 V/m sensitivity • User definable alarm thresholds • Data storage Software	• Measurement choice among a list of 74 standard bands between 80 MHz and 6 GHz • Covering broadcast, cellular, Wi-Fi, & ISM frequency bands • New battery designed for longer measurement cycle	• Frequency selective system for in-situ spot measurement • Compatible with most spectrum analyzers available on the market • Fully automatic measurement process	• Completely redesign interface • GPU-accelerated computing for fast exposure evaluation • Precise and fast creation of 3D environment
Utilisation mode	Stationary	Portable	Portable	Portable	
Selectivity	Broadband	Broadband	Selectivity per services	Selectivity per channel	
Frequency bands	Probe dependent: • 900 MHz to 11 GHz • 700 MHz to 6 GHz • 700 MHz to 3 GHz	100 KHz – 6.5 GHz	Monitoring of up to 20 bands from 80 MHz – 6000 MHz	100 KHz to 6 GHz	
Audio alarm	●	●			
Visual alarm	●				
Monitoring	●	●	●		
Data storage	●	●	●	●	
Software	FlashRad software	EME Wide Analysis	EME Spy Analysis	INSITE Free software	EMF Visual Standard (CPU) or Advanced (GPU)
Industries/ Users	• Military/Defense • Telecom Regulators • RF laboratory • Local and national authorities • Operators (cellular network, broadcast, PMR, radar, …)	• Antenna installer & maintenance companies • Telecom Regulators • RF laboratory • Local and national authorities • Research agencies, R&D labs, universities • Operators (cellular network, broadcast, PMR, radar, …) • Military/Defense	• Local and national authorities • Telecom Regulators • Research agencies, R&D labs, universities • RF laboratory workers • Real estate pre certification	• Certification agencies • Telecom Regulators • Operators (cellular, network, broadcast, PMR, radar, …) • Research agencies, R&D labs, universities • Military/Defense	• Cellular network operators • Installer • Broadcast companies • Regulatory bodies • Municipalities
Page	P 20	P 23	P 26	P 29	P 36

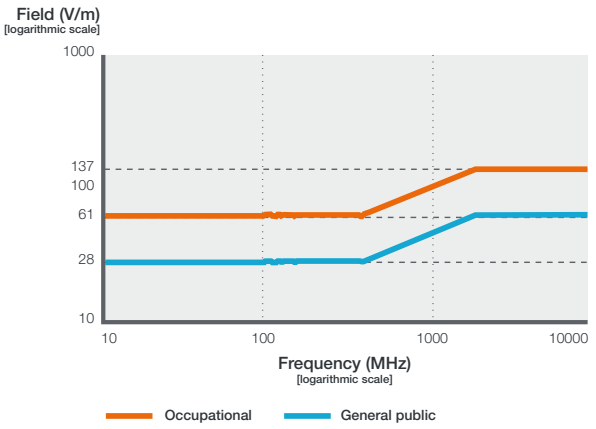
Why do we measure exposure levels?

Electromagnetic fields are increasingly present in our living environment. For this reason they arouse ever more concern and raise questions about the possible harmful effects of these fields on health. As part of its public heath charter and in response to growing concerns, the World Health Organization (WHO) introduced the International Electromagnetic Fields Project in 1996. This Project aims to assess the health and environmental effects caused by static or variable electric and magnetic fields in frequencies from 0 to 300 GHz.

Wherever there is electricity (voltage or current), there is electromagnetic field (EMF). All types of wireless transmissions (radio/TV broadcasting, voice/data wireless communication) use electromagnetic fields. The generated field propagates in the form of waves and is all around us even if we cannot see it or hear it. The electromagnetic field has two components: the Electric E Field and Magnetic H Field, and they are proportional to each other in far field measurement.



ICNIRP - Reference levels for exposure to electric fields



BASIC RESTRICTIONS AND REFERENCE LEVELS

To protect individuals from the potential health effects of radio waves, protection levels known as **basic restrictions** were recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP - http://www.icnirp.org). The ICNIRP is the non-governmental organization officially recognized by the WHO and the International Labor Organization (ILO) in the field of Non-Ionizing Radiation.

These basic restrictions were established based on published biomedical studies and relative to the health effects of electromagnetic waves. In the area of high frequencies, they are expressed in terms of **Specific Absorption Rate (SAR)** and the biological effects appear above 4 Watts per kilogram for the entire body (increase in body temperature of more than one degree) and above 100 watts per kilogram locally.

The basic restrictions are set so as to take into account uncertainties related to personal sensitivity, environmental conditions and diversity in the age and state of health of the populations concerned. The protection levels for workers were established at one tenth of these exposure levels producing an impact, and fifty times lower for the general public. For the general public, the basic restrictions thus require that the power absorbed per kilogram (SAR) be at 0.08 W/kg maximum for the entire body and 2 W/kg maximum for 10 grams of tissue.

Given the complexity of measuring the SAR in situ, the ICNIRP (based on the studies carried out to find the relation between a plane wave power surface density and the power absorbed by an ellipsoid representing a human body) has defined **reference levels** deduced from basic restrictions and **expressed in Volts per meter or Watts per square meter.** Compliance with all the recommended reference levels will ensure that the basic restrictions are observed. If the measured values are higher than the reference levels, this does not necessarily mean that the basic restrictions have been exceeded. In this case, check whether these levels of exposure are lower than the basic restrictions.

REGULATION LINKED TO THE EXPOSURE LEVELS

In Europe, the exposure limits follow the **European Union Council Recommendation 1999/519/CE of July 12th 1999** regarding the **public** exposure to electromagnetic fields. The exposure limit values are revised periodically if needed. The last report from the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), an independent European Commission body, on the health effects of electromagnetic fields, came out in January 2009. The conclusions of this report do not challenge the exposure limit values proposed by the above-mentioned European recommendation.

The great majority of European Union member countries follow this recommendation either by incorporating it into national regulations (Austria, Czech Republic, Estonia, Finland, France, Germany, Hungary, Portugal, Romania, Slovakia, Spain) or in the form of recommendations (Denmark, Ireland, Latvia, Malta, Netherlands, Sweden, United Kingdom).

However, different approaches are applied in certain member states with the introduction of more restrictive limits in "living areas" (Belgium, Bulgaria, Greece, Italy, Lithuania, Luxembourg, Poland, Slovenia). The same goes for Switzerland and Liechtenstein. The values chosen by these States are based on the application of the principle of precaution related to potential health risks related to exposure to electromagnetic fields and the exposure limit values were in most cases set in an arbitrary manner.

Concerning **workers**, as part of the **European directive on exposure of workers to the risks arising from electromagnetic fields** (directive 2013/35/EU of 26 June 2013), all employers must now determine the exposure (levels, duration), assess risks and take the necessary measures to ensure safety and protect the health of workers from the risks arising from professional exposure to these electromagnetic fields. In particular, they must:

- measure and/or calculate the electromagnetic field levels to which workers are exposed, via the appropriate departments at regular intervals
- record the results of this assessment on a reliable medium that can be consulted subsequently

Other information concerning the regulation throughout the world may be found directly on the WHO website: http://www.who.int/docstore/peh-emf/EMFStandards/who-0102/Worldmap5.htm.

MEASUREMENT PROTOCOLS AND STANDARDS

In order to compare the exposure levels measured at the established limits, measuring protocols have been established by the main standardization bodies. Some examples are the ECC/REC/(02)04 recommendation and the EN50383, EN50413, EN50492, EN62311 standards in Europe and the IEEE Std.C95.3 standard in North America.

WHY MEASURE ELECTROMAGNETIC FIELDS?

Measuring the electromagnetic field is essential to check that exposure levels respect the regulatory limits established in each country, and thus ensure the safety of individuals exposed, whether members of the general public or workers.

For individuals who work in proximity to high frequency emmiters, the measurement ensures that the emitter is switched off when the intervention takes place and/or that the electromagnetic fields are well below the recommended levels. It thus reassures these individuals who can then complete their work without worry. The introduction of a Monitoring network on the work site allows this exposure to be constantly monitored. In either case, the measurement allows the employer to check that employees have not been over-exposed during their assignments.

Unlike a simulation or calculation, a measurement is concrete. Communicating the measured exposure levels, which are mostly very low as compared to the reference levels, provides reassurance for the concerned public. If the measurement reveals high levels of exposure, it then allows remedial actions to be implemented. Here again, the measurement can be occasional in time and space: an exposure meter can be lent to an administration official, who for a given period can check the levels to which he/she is exposed in the home or workplace, or it can be performed via a Monitoring network, with each probe sending these measurements over time to a database or eventually to a website, which can then be used by the authorities (municipality for example) to communicate the overall exposure of a city to the public.

The measurement taken by scientists by lending an exposure meter to a representative panel also allows us to find out the average exposure for a given population, and potentially the change in this exposure according to the technology (television broadcast, 2G, 3G, 4G mobile communications, domestic networks).

Finally, the measurements can be used to confirm and/or calibrate a propagation model. An appropriate combination of simulation and measurement allows us to obtain a precise mapping of exposure in a large geographic area, and to monitor changes to this exposure over time, in quasi-real time mode.

HOW TO MEASURE EXPOSURE TO ELECTROMAGNETIC FIELDS

Exposure to electromagnetic fields is generally measured using a probe and a receiver (Volt meter or power meter). An electromagnetic field probe is an "antenna" that has been optimized to measure exposure to electromagnetic fields.

There are two types of probe for measuring exposure to electromagnetic fields: "broadband" probes and "frequency selective" probes.

A broadband probe generally comprises a dipole and a diode connected directly between the two poles of the antenna. Using this type of probe, the voltage proportional to the field level is measured. The quality of this type of probe will therefore depend on its ability to provide the same voltage for the same field and regardless of the frequency (frequency is of course within the usage bandwidth) of the field to be measured. These "broadband" probes provide information on the level of exposure, but do not indicate the frequency of the field to which the user is exposed. They are mostly used in warning products (worker exposure meter) or for a quick measurement of compliance when measured levels remain low. This type of probe is defined by its isotropy, its bandwidth, its sensitivity, its measurement dynamic, its frequency flatness and its linearity.

The second type of probe, depending on the recevier topology used with it, provides information regarding the frequency and the amplitude of the measured field, as well as information on the level. They are incorporated into more refined compliance or information measuring products. They are defined by their isotropy, their bandwidth, and their antenna gain or factor: the dynamic, sensitivity and linearity in this case are dependent on the receiver topology used with a given probe.

Isotropy: The isotropy characterizes the ability of the field measuring probe to always provide the same response to a given field level, regardless of the direction of arrival of this field or its polarizations. It is a parameter required by most of the current measurement standards. There is no single naturally isotropic antenna: for electromagnetic field probes, this isotropy is thus obtained by combining the radiation pattern of three elementary antennae (dipole or monopole) appropriately placed with respect to each other.

Bandwidth: The performances of an electromagnetic field measurement probe vary according to the frequency of the field to be measured. They are thus defined to be used over a limited frequency range, known as the usage bandwidth.

Sensitivity: The sensitivity of an electromagnetic field measurement probe or system is the minimum level of the field that can be measured with this tool.

Dynamic: The dynamic of an electromagnetic field measurement probe or system is the difference between the maximum and minimum field that can be measured with this tool. It is generally expressed in dB.

Frequency flatness: This parameter characterizes the quality of a broadband probe. It represents the variations of the measured E-field at a fixed frequency, when the level of the E-field is varied over the dynamic range of the probe.

Linearity: This parameter characterizes the quality of a broadband probe. It represents the variations in the levels measured, with fixed frequency and making the level of the field measured over the probe's measuring range vary.

Antenna Gain and/or Factor: An antenna gain (respectively of an electromagnetic field measuring probe) characterizes its ability to emit (respectively receive) in a specified direction. It is generally expressed in dBi, taking as a reference an isotropic antenna, meaning a fictitious antenna that radiates uniformly in all directions. The gain of this antenna is thus 1, or 0 dBi (dBi for decibel-isotropic). The role of an electromagnetic field probe is to transform the recieved electromagnetic field level into RF power. The antenna factor is defined as the ratio of the electromagnetic field captured by this antenna to the voltage measured at the antenna terminals.

$$AF = \frac{E}{V_r}$$

The antenna factor (expressed in dB) is linked to its gain by the following equation:

$$AF = 20\,Log(F) - G - 29{,}78$$

In this equation, F is the frequency in MHz, and G is the gain in dBi.
The power received by an antenna capturing an electromagnetic field can easily be found using the following formula:

$$P_r = 20 * Log(E) - AF + 13$$

In this equation, Pr is expressed in dBm, E in V/m and the antenna factor in dB.

WORKER SAFETY

EME Guard XS

- **Accurate measurement with tri-axis sensors**
- **Instant audio and visual alarm**
- **Robust, reliable and user-friendly**

Main features

User profile

- Persons working near antennas including installation and maintenance workers, broadcast, PMR and mobile phone operators or regulatory body employees

Measurement capabilities

- Continuous monitoring of Electromagnetic Field levels with isotropic tri-axis E-field sensors
- EMF Level indicated by a LED color scale
- Audio and visual alarms triggered when EMF exceeds the reference level

Frequency bands

- 80 MHz – 6 GHz

Safety recommendations

- ICNIRP
- FCC 96-326
- Safety Code 6
- 2013/35/UE
  New EU Directive
- Alarm threshold can be adjusted at MVG factory upon request

Product Configuration

Equipment

- ■ EME Guard XS
- ■ MVG Case
- ■ Wirst strap
- ■ Lanyard
- ■ Connecting adapter
- ■ Armband
- ■ 2 x 1.5 V Size N Alkaline batteries
- ■ Instructions for use

Services

- ■ Initial calibration
- □ Additional calibration
- □ Extended warranty

■ Included □ Optional

TECHNICAL CHARACTERISTICS

Probe	Isotropic 3-axes probe
Frequency range	80 MHz - 6 GHz
Lower detection limit	5 V/m
Upper detection limit	350 V/m

MEASUREMENT UNCERTAINTY

Frequency (MHz)	Frequency response	Axial isotropy
80 - 700	-2 / +4 dB	+/- 0.5 dB
700 - 2700	-1 / +5 dB	+/- 0.7 dB
2700 - 6000	+2 / +7 dB	+/- 0.9 dB

ALARM & CONFIGURATION

Reference threshold	Alarm threshold can be adjusted at MVG factory upon request
Visual alarm	7 LEDs
Audio alarm	2 tones (activated from 5 to 350 V/m)
Low battery indicator	Orange flashing LED

MEASUREMENT CONFIGURATION

Measurement period	1 sec

CONDITIONS FOR USE

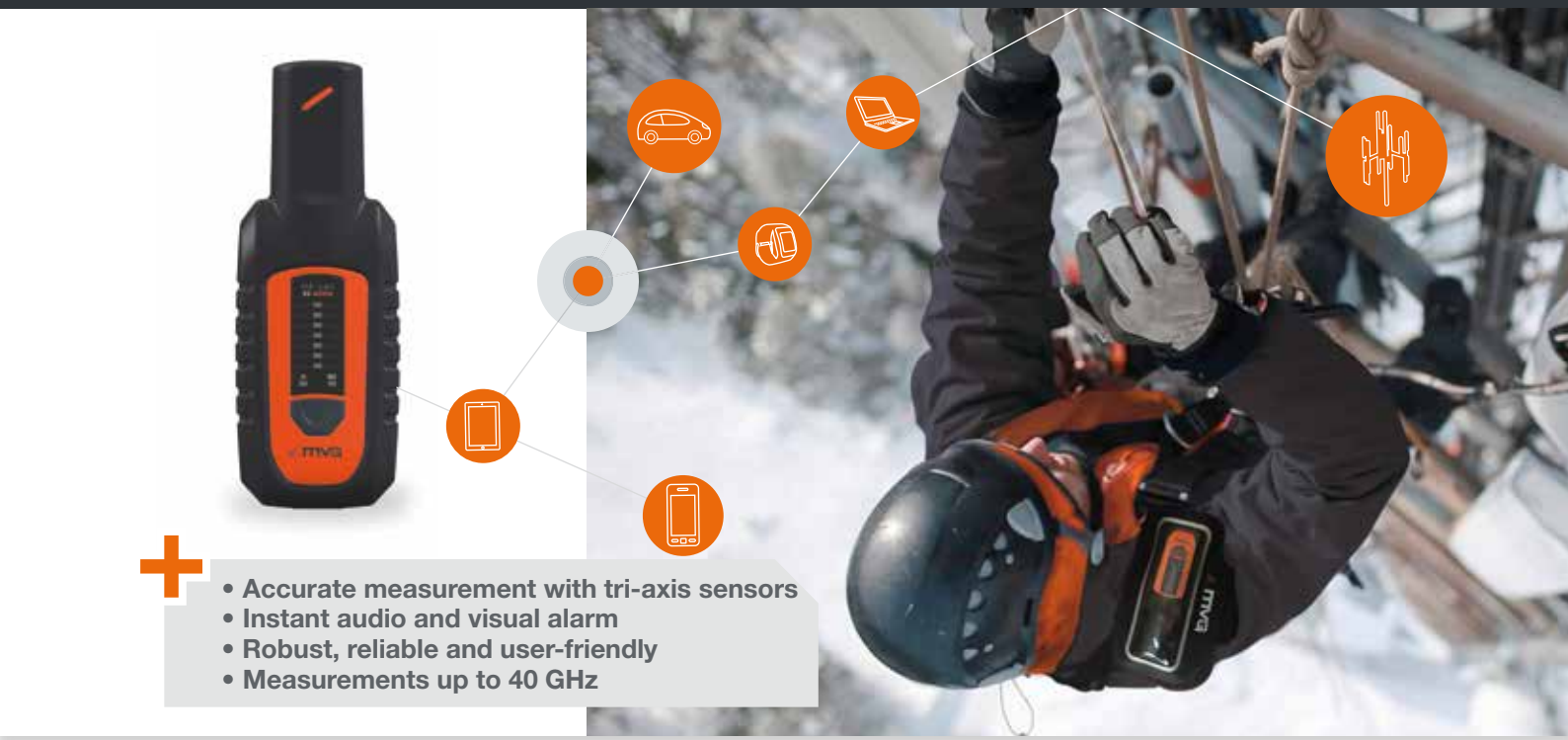
Temperature, humidity	-10°C to 50°C, 85% max humidity
Battery	2 x 1.5 V Size N Alkaline removable batteries
Battery life	> 1000 hours (> 50 days)(1)

MECHANICAL CHARACTERISTICS

Dimensions	132.5 x 48.5 x 28.7 mm (LxWxH) without connecting adapter
Weight	120 g with batteries

(1) If no alarm is triggered

EME Guard XS 40 GHz



- **Accurate measurement with tri-axis sensors**
- **Instant audio and visual alarm**
- **Robust, reliable and user-friendly**
- **Measurements up to 40 GHz**

Main features

User profile

- Persons working near antennas including installation and maintenance workers, broadcast, PMR and mobile phone operators or regulatory body employees

Measurement capabilities

- Continuous monitoring of Electromagnetic Field levels with isotropic tri-axis E-field sensors
- EMF Level indicated by a LED color scale
- Audio and visual alarms triggered when EMF exceeds the reference level

Frequency bands

- 80 MHz – 40 GHz

Safety recommendations

- ICNIRP
- FCC 96-326
- Safety Code 6
- 2013/35/UE
  New EU Directive
- Alarm threshold can be adjusted at MVG factory upon request

Product Configuration

Equipment

- ■ EME Guard XS
- ■ MVG Case
- ■ Wirst strap
- ■ Lanyard
- ■ Connecting adapter
- ■ Armband
- ■ 2 x 1.5 V Size N Alkaline batteries
- ■ Instructions for use

Services

- ■ Initial calibration
- □ Additional calibration
- □ Extended warranty

■ Included □ Optional

TECHNICAL CHARACTERISTICS

Probe	Isotropic 3-axes probe
Frequency range	80 MHz - 40 GHz
Lower detection limit	5 V/m
Upper detection limit	350 V/m

MEASUREMENT UNCERTAINTY

Frequency response	80-200 MHz : -4/-1 dB 200-1000 MHz : -2/+4 dB 1-3.5 GHz : -4/0 dB 3.5-6 GHz : 0/+6 dB 6-15 GHz : +5/+12.5 dB 15-23 GHz : -2/+7.5 dB 23-28 GHz : -6/0 dB 28-40 GHz : -4/+2 dB
Axial isotropy	100 MHz : ± 0.5 dB 2.6 GHz : ± 1 dB 5.5 GHz : ± 1 dB

ALARM & CONFIGURATION

Reference threshold	Alarm threshold can be adjusted at MVG factory upon request
Visual alarm	7 LEDs
Audio alarm	2 tones (activated from 5 to 350 V/m)
Low battery indicator	Orange flashing LED

MEASUREMENT CONFIGURATION

Measurement period	1 sec

CONDITIONS FOR USE

Temperature, humidity	-10°C to 50°C, 85% max humidity
Battery	2 x 1.5 V Size N Alkaline removable batteries
Battery life	> 1000 hours (> 50 days)(1)

MECHANICAL CHARACTERISTICS

Dimensions	132.5 x 48.5 x 28.7 mm (LxWxH) without connecting adapter
Weight	120 g with batteries

(1) If no alarm is triggered

EME Guard XS Radar

- **Accurate measurement with tri-axis sensors**
- **Instant audio and visual alarm**
- **Robust, reliable and user-friendly**
- **Measurements up to 30 GHz**
- **Detects short pulsed signals**

Main features

User profile

- Persons working near radar transmitters or antennas including installation and maintenance workers, broadcast, PMR and mobile phone operators or regulatory body employees

Measurement capabilities

- Continuous monitoring of Electromagnetic Field levels with isotropic tri-axis E-field sensors
- EMF Level indicated by a LED color scale
- Audio and visual alarms triggered when EMF exceeds the reference level
- Short pulsed signal detection

Frequency bands

- 80 MHz – 30 GHz

Safety recommendations

- ICNIRP
- FCC 96-326
- Safety Code 6
- 2013/35/UE
  New EU Directive
- Alarm threshold can be adjusted at MVG factory upon request

Product Configuration

Equipment

- ■ EME Guard XS
- ■ MVG Case
- ■ Wirst strap
- ■ Lanyard
- ■ Connecting adapter
- ■ Armband
- ■ 2 x 1.2 V / 500 mAh NiMH rechargeable batteries Size N
- ■ Batteries charger
- ■ 2 x batteries charge adapter
- ■ Instructions for use

Services

- ■ Initial calibration
- □ Additional calibration
- □ Extended warranty

■ Included □ Optional

TECHNICAL CHARACTERISTICS

Probe	Isotropic 3-axes probe
Frequency range	80 MHz - 30 GHz
Lower detection limit	5 V/m
Upper detection limit	350 V/m

MEASUREMENT UNCERTAINTY

Frequency response	80-700 MHz : -2/+4 dB 0.7-2.7 GHz : -1/5 dB 2.7-6 GHz : +2/+7 dB 6-16 GHz : +4/+13 dB 16-30 GHz : -8/+1 dB
Axial isotropy	100 MHz : ± 0.5 dB 2.6 GHz : ± 0.7 dB 5.5 GHz : ± 0.9 dB

ALARM & CONFIGURATION

Reference threshold	Alarm threshold can be adjusted at MVG factory upon request
Visual alarm	7 LEDs
Audio alarm	2 tones (activated from 5 to 350 V/m)
Low battery indicator	Orange flashing LED
Alarms update period	1 sec

MEASUREMENT CONFIGURATION

Measurement period	20 ms

CONDITIONS FOR USE

Temperature, humidity	-10°C to 50°C, 85% max humidity
Battery	2 x 1.2 V / 500 mAh Size N NiMH rechargeable batteries
Battery life	> 13 hours(1)

MECHANICAL CHARACTERISTICS

Dimensions	132.5 x 48.5 x 28.7 mm (LxWxH) without connecting adapter
Weight	120 g with batteries

(1) If no alarm is triggered

EME Guard

- **Accurate measurement with triaxial isotropic probe**
- **Customization of vibrating alarm thresholds**
- **Data storage software**
- **Robust, all weather design**

Main features

User profile

- Anyone working close to emitting antennas (broadcast, base station, radars …)
- Installation and maintenance staff, broadcast, PMR and mobile phone operators or regulatory bodies employees

Measurement capabilities

- Continuously records the electromagnetic field level and alerts user to potential over-exposure

Frequency bands

- 27 MHz to 40 GHz

Related recommendations

- FCC 96-326
- ICNIRP
- Safety Code 6
- 2013/35/UE

New EU Directive

- Exposure thresholds are user-definable and can be adapted to any recommendation

System Configuration

Software

- ■ EME Guard Analysis

Equipment

- ■ Case
- ■ Belt clip
- ■ USB cable
- ■ Battery charger

Accessories

- □ Holster

Services

- ■ Calibration report
- ■ Initial calibration
- □ Additional calibration
- □ Training
- □ Extended warranty

■ Included □ Optional

A user friendly and flexible instrument

The EME Guard Analysis software defines two user profiles:

❶ Administrator mode, gives additional rights to configure the device to requirements (threshold definition).
❷ User mode, enables download and visualization of measurements recorded in the embedded memory of the device.

The Administrator can customize the device according to the thresholds defined by his own guidelines.
→ Only the Administrator is given right of access to device configuration and customize.

STEP 1: Define the reference threshold that will trigger the visual alarm. The 4 warning lights are activated as soon as exposure level attains 25%, 50%, 75% and 100% of the chosen reference threshold.

STEP 2: Define the thresholds that will trigger the audio and vibrating alarms:
Over a 6 minute mean: the alarm is triggered as soon as the mean calculated over the preceding 6 minutes exceeds the predetermined threshold. This 6 minute calculation is the reference duration which conforms to the ICNIRP recommendations.
Or:
Instantaneous: as soon as a measurement exceeds the threshold, the alarms are triggered.

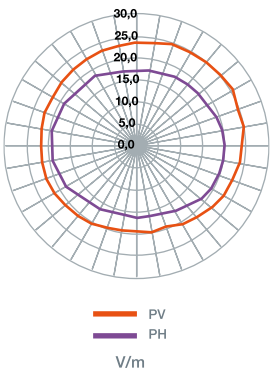
Alarm front view

The measurement files are downloaded on the PC's hard disc as binary files, thus ensuring the safety of historical data.

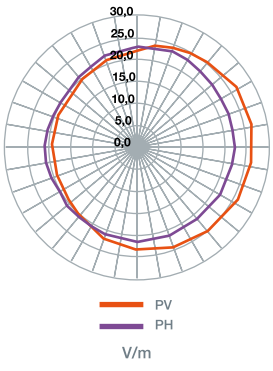
STEP 3: Define the recording period.
STEP 4: Start the device (ON/OFF button) and perform measurements.
STEP 5: Import the measurements in the form of secure files using a USB cable and display the results.

High performance probe for accurate measurements

The EME Guard is equipped with a triaxial probe which guarantees measurement isotropy. Each device comes with a calibration report. The performance of this sensor has been optimized to ensure maximum isotropy.



Isotropy at 1400 MHz



Isotropy at 2100 MHz

A robust product

The device is equipped with an auto-test system which is launched when the device is switched on. This test ensures that the EME Guard is functioning normally and that battery level is sufficient. In any case, if the battery level is too low, an orange warning light alerts the user immediately.

The case is metallic and ensures an IP55 Ingress Protection level, ideal for outdoor use.

TECHNICAL CHARACTERISTICS

Frequency range	27 MHz – 40 GHz
Upper detection limit	200 V/m
Lower detection limit	5 V/m
Damage Level (CW):	> 4000 V/m (> 29 dB above standard)

MEASUREMENT UNCERTAINTY

Axial isotropy	+/- 1 dB at 1400 MHz +/- 2 dB at 2100 MHz
Frequency response	27 MHz - 2.5 GHz: +/- 3 dB 2.5 GHz - 6 GHz: + 6/0 dB 6 GHz - 10 GHz: + 12/+ 6 dB 10 GHz - 20 GHz: + 10/0 dB 20 GHz - 40 GHz: + 8/- 3 dB

ALARM & CONFIGURATION

Reference threshold	Configurable by the user 20, 40, 60, 80, 100 or 140 V/m
Alarm mode	Instantaneous or 6 min. mean
Visual alarm	4 LEDs 25%, 50%, 75% and 100% of the reference threshold
Audio alarm	Activated (from 5 V/m to 137 V/m) or de-activated
Vibrator	Activated (from 5 V/m to 137 V/m) or de-activated
Low battery indicator	Orange LED

MEASUREMENT CONFIGURATION

Update period for display and alarms	1 sec
Measurement recording	Activated or de-activated
Recording capacity	30 000 measurements MAX
Recording period	1-255 sec
Duration of recording	
• min.	1 mn
• max.	Duration in mn = 30 000 points X recording period (sec) / 60

CONDITIONS FOR USE

Temperature, humidity	-10 to 50°C, 85% max. humidity
Power supply of battery charger	110 - 240 VAC, 50 - 60 Hz
Battery	Lithium-Ion
Battery life	> 100 hours
Type of link	USB

MECHANICAL CHARACTERISTICS

Dimensions	172 x 60 x 35 mm (H, L, W) without belt clip
Weight	320 g
Protection	IP 55

HARDWARE REQUIREMENTS

Processor	PC Pentium 500 MHz or equivalent
Cable link	USB
Operating system	XP / WIN7 / WIN8 / WIN10
Memory	256 MB RAM
Free space on hard disk	100 MB

PUBLIC SAFETY

FlashRad

- Connected or wireless communication for data transfer and alarms
- Alert users with sound, light, mail or sms
- Cover frequencies of all cellular networks including short pulsed signals
- Monitor low EMF levels in public areas
- Various power supply possibilities

Main features

User profile

- Companies situated near antennas or radar transmitters, who wish to protect their employees from questionable EMF levels (military bases, airports, etc.)
- Municipalities for measurements in public areas

Measurement capabilities

- Continuous measurement of EMF levels. Each monitor detects signals and then transmits the data to the surveillance PC or FTP server to be processed individually
- Data is collected separately from each monitor in place

Frequency bands

- 700 MHz – 11 GHz; higher or lower frequencies possible

Safety recommendations

- EMF exposure limits can be defined by users and adjusted to any regulation or recommendation

Product Configuration

Software

- ■ FlashRad software

Equipment

- ■ External connectors (mounted on cable or not)
- ■ Ground or wall support
- □ Modem 3G/4G
- □ PoE or autonomous power supply

Accessories

- ■ Case
- □ LEDs box with alarm + USB cable

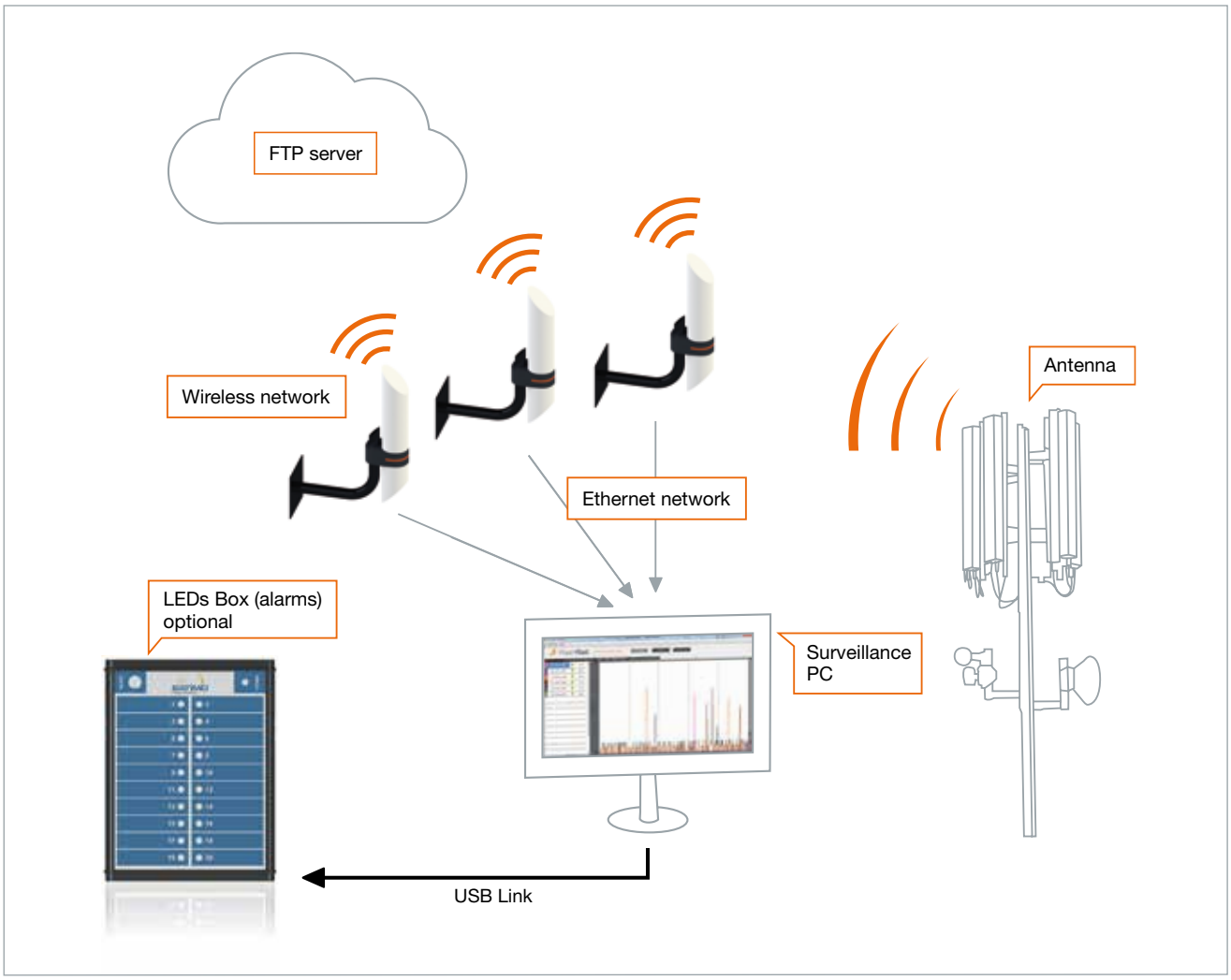
Services

- ■ Initial calibration
- ■ Calibration report
- □ Ground or wall installation
- □ Training
- □ Additional calibration
- □ Extended warranty

■ Included □ Optional

FlashRad is a safety wideband exposure monitoring system that performs continuous measurements of electromagnetic field (EMF) levels. It detects all kinds of pulsed signals, including short pulsed radar, emitted from various sources outside a building. When predetermined EMF levels are exceeded, the FlashRads monitor can sound and flash a warning in its immediate surroundings while sending a signal to the surveillance PC or user (mail, sms) for action.

Overview of FlashRad systems network



FlashRads are connected to a PC or FTP server via Ethernet or Wireless network. Continuous EMF level measurements are sent to the PC or FTP server where the FlashRad monitoring system software collects and displays the incoming data. If the FlashRads detect excessive RF levels, a signal is sent to the PC or user indicating which monitor is detecting the overexposed area. The technician can then take action. Note that each monitor can be stopped or started as necessary.

In Ethernet direct connection, the PC can send a signal to trigger the alarms in the FlashRads when the EMF levels exceed the predetermined levels.

A LED light box is available as an option to allow monitoring in multiple areas. It is connected to the PC by a USB cable of up to 10 meters.

TECHNICAL CHARACTERISTICS

	HIGH LEVEL PULSED SIGNALS (RADAR...)	WORKERS AREA (BTS, TEST...)	PUBLIC AREA
Probe reference	FR100	FR200	FR400
Probe	Isotropic 3-axes probe	Isotropic 3-axes probe	Isotropic 3-axes probe
Frequency range	900 MHz – 11 GHz	700 MHz – 6 GHz	700 MHz – 3 GHz
Lower detection limit	50 V/m	10 V/m	0.05 V/m
Upper detection limit	1000 V/m	200 V/m	100 V/m
Minimum pulse width measurement	≥ 1 µs	≥ 100 µs	≥ 10 µs

MEASUREMENT UNCERTAINTY

Axial isotropy	• 900 MHz – 6 GHz (@150 V/m) : +/-1 dB • 6 GHz – 11 GHz (@150 V/m) : +/-2.2 dB	• 700 MHz – 6 GHz (@50 V/m) : +/-1 dB • 700 MHz – 2,6 GHz (@10 V/m) : +/-2 dB	• 700 MHz – 3 GHz (@10 V/m) : +/-2 dB
Frequency response	• 900 MHz – 1 GHz (@150 V/m) : +3.8/-1.2 dB • 1 GHz – 8 GHz (@150 V/m) : +/-2 dB • 8 GHz – 11 GHz (@150 V/m) : +5/+3 dB	• 700 MHz – 2 GHz (@50 V/m) : +/-3 dB • 2 GHz – 6 GHz (@50 V/m) : +3/+1 dB	• 700 MHz – 3 GHz (@10 V/m) : +/-2.5 dB
Linearity	+/-0.5 dB (200 – 1000 V/m)	+/-1 dB (20 – 200 V/m)	+/-1 dB (1 – 100 V/m)

MEASUREMENT CONFIGURATION

Measurement interval	From 1 à 60 seconds
Measurement records	Yes if user configuration
Storage capacity	> 100 Mb
Data transfer interval	Instantaneous in connected mode From 6 à 1440 minutes in autonomous mode

CONDITIONS FOR USE

Temperature, humidity	-20 to +70°C, 90% max. humidity
Power supply	• 90 - 264 VAC, 47 – 440 Hz • 24 V passive PoE • 12 VDC by solar panel + rechargeable battery (5 days autonomy without sunlight)
Type of network connection	• Ethernet • Modem 3G/4G*

(*) SIM card and subscription not included

ALARM CONFIGURATION

Programmable alarms	Field level, battery level, memory filling, temperature, humidity, communication error
Trigger mode	Instantaneous
Transmission of alarms	By Ethernet or modem (SMS/mail)
Audio and/or Visual alarm	Yes in connected mode if exceeding a field level threshold

MECHANICAL CHARACTERISTICS

Dimensions	Heigth = 648.5 mm Diameter = 100 mm
Weight	4.5 kg
Protection	IP 55
Installation	Ground or wall installation

SOFTWARE REQUIREMENTS

Operating system compatibility	Windows XP, 7, 8, 10

Mechanical installation

Ground Installation

Wall installation

FlashRad

EME Wide

- **Real time display of Maximum, RMS or Time/Spatial average of isotropic field value**
- **0.35 V/m sensitivity**
- **User definable alarm thresholds**
- **Data storage Software**

Main features

User profile

- Workers near antennas, including installers, maintenance workers, broadcasters, and cellular carrier employees: for the control of the compliance of the exposure level with the standards and safety perimeter definition
- Certification laboratory, regulatory body: for control and monitoring of the exposure in public or private locations and site certification

Measurement capabilities

- Continuous EM field level measurements

Frequency bands

- 100 KHz to 6.5 GHz

Related recommendations

- 2013/35/EU Directive
- ICNIRP
- FCC 96-326
- Safety Code 6
- Exposure thresholds are user-definable and can be adapted to any recommendation

Product Configuration

Software

- ■ EME Wide Analysis Software

Equipment

- ■ Case
- ■ Optical cable
- ■ USB adapter
- ■ USB cable
- ■ Battery charger
- ■ USB key for software installation
- ■ User manual
- □ Wood tripod

Services

- ■ Calibration report
- ■ Initial calibration
- □ Additional calibration
- □ Training
- □ Extended warranty

■ Included □ Optional

Key features

Measurements and results

- Isotropic or single axis (X, Y, Z) instantaneous field value
- Maximum, RMS or Time/Spatial average of isotropic field value
- Selectable unit (V/m, A/m, W/m²)
- Alarm function (buzzer) with programmable field threshold
- Measurements stored in a non-volatile memory (up to 20000 points)

Equipment interfaces

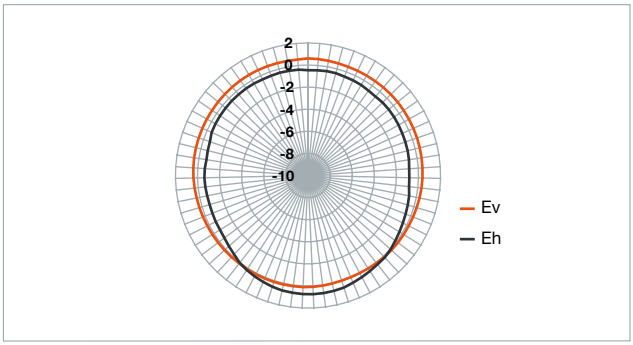
- Easy use from the 5 keys membrane keypad
- 7 cm (2.8") LCD display with led backlight
- Optical link for communication with PC and remote control
- Other information: date & time, temperature, battery charge status

Battery and charge

- AA rechargeable NiMH battery
- External wall charger with set of plugs
- Automatic shutdown for very low battery or during recharge

High performance probe for accurate measurements

The EME Wide is equipped with a triaxial probe which guarantees measurement isotropy. Each device comes with a calibration report. The performance of this sensor has been optimized to ensure excellent isotropy.



A user friendly and flexible software

The EME Wide Analysis software enables two usages:

- **Importation mode** enables download and visualization of measurements recorded in the embedded memory of the device.
- **Real time mode** enables measurement start from the PC, visualization in real time of measurements, and exporting data to a file.

STEP 1: start the device (ON/OFF button) and plug it to the PC.

STEP 2: configure the internal alarm threshold, define measurement unit, clear memory, set window length time for RMS mean calculation, update date and time.

STEP 3: perform measurements. 3 types of measurements exist:

- **Screenshot:** recording from the probe at any time of each information indicated on the main screen of the probe (X, Y, Z, & total E-field, RMS, mean, spatial averaging, maximum value, temperature) into 200 memory cases max.
- **Recording:** start from the probe. Enables to perform 5 time measurements with 5 second period, containing 20 000 points max where X, Y, Z, total E-field, and temperature are saved.
- **Real time:** start from the PC. Enables to perform real time measurements with 1 second period, where X, Y, Z, total E-field, and temperature are saved.

STEP 4: import screenshot and recording measurements in the form of secure files using optical link and display the results.

TECHNICAL CHARACTERISTICS

Frequency range	100 KHz - 6.5 GHz
Upper detection limit	350 V/m
Lower detection limit	0.35 V/m
Damage level (CW)	> 600 V/m

MEASUREMENT UNCERTAINTY

Frequency response @ 10 V/m	± 1 dB (100 MHz – 2.7 GHz) ± 1,5 dB (2.7 GHz – 6.5 GHz)
Axial isotropy @ 60 V/m	± 0.5 dB @ 100 MHz
Linearity [2 V/m – 250 V/m]	± 0.5 dB @ 100 MHz
Temperature sensor	± 2°C

MEASUREMENT CONFIGURATION

Unit	V/m, A/m, W/m²
Measurement mode	Isotropic or single axis (X, Y, Z)
Measurement type	RMS, Maximum, Time/Spatial Average
RMS average	From 1 to 10 minutes
Spatial average	Discrete
Screenshot capacity	200 measurements MAX
Recording capacity	20 000 measurements MAX
Min. measurement period	5 sec for RECORDING mode 1 sec for REAL TIME mode
Alarm function	Single tone buzzer

DISPLAY

Display type	Transflective LCD
Display size	7 cm (2.8''), 128 x 64 dots
Backlight	White leds (Off or permanent)
Refresh rate	200 ms

INTERFACES

Optical interface	Serial, full duplex Optical/USB adapter for PC connection
Probe interface	Plug and play auto detection

CONDITIONS FOR USE

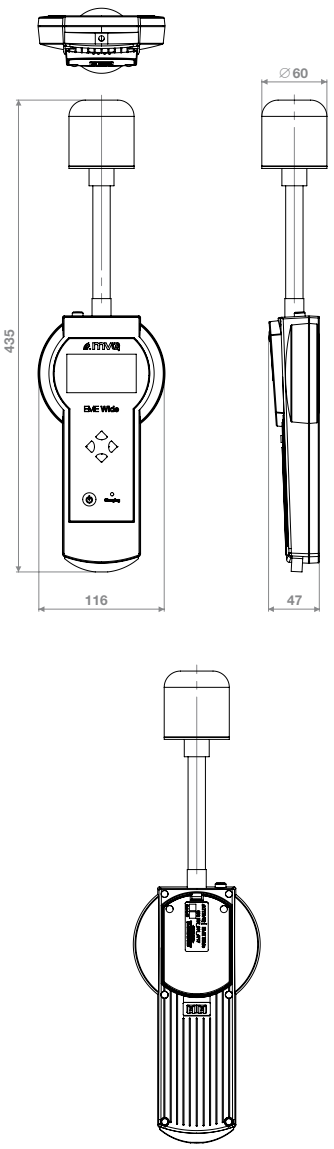
Battery	4 x AA rechargeable NiMH
Battery charger	External wall charger
Operation time	> 48 hours (backlight off)
Charging time	6 hours
Battery level (on display)	5 voltage levels (bar graph)
Operating temperature/humidity	-10°C/+50°C, 5%/95% non condensing
Storage temperature	-20°C/+70°C

MECHANICAL CHARACTERISTICS

Dimensions	435 x 116 x 60 mm (H, L, W)
Weight	600 g
Protection	IP44

PC SOFTWARE

Operating systems compatibility	Windows XP, 7, 8, 10



EME Wide Applications in:

- Telecommunications
- Industry
- Laboratory
- Medical
- Radar equipment
- Worker's safety
- Public safety

EME Spy Evolution

- **Measurement choice among a list of 74 standard bands between 80 MHz and 6 GHz**
- **Covering broadcast, cellular, Wi-Fi, & ISM frequency bands**
- **New battery designed for longer measurement cycle**

Watch a success story of EME Spy 140

Main features

User profile

- Municipalities, governmental agencies, regulatory bodies, research laboratories, universities, broadcasters, PMR, and mobile phone operators

Measurement capabilities

- Continuous monitoring of personal exposure to electromagnetic fields and identification of the contributors.

Frequency bands

- Monitoring of up to 20 bands from 80 MHz – 6000 MHz

Safety recommendations

- Measurements can be compared with the reference levels advised by ICNIRP

Real time visualization kit (optional)

- The field level for each frequency band is displayed as it is measured
- Exports data to the EME Spy Evolution Analysis software for post processing and backup

Product Configuration

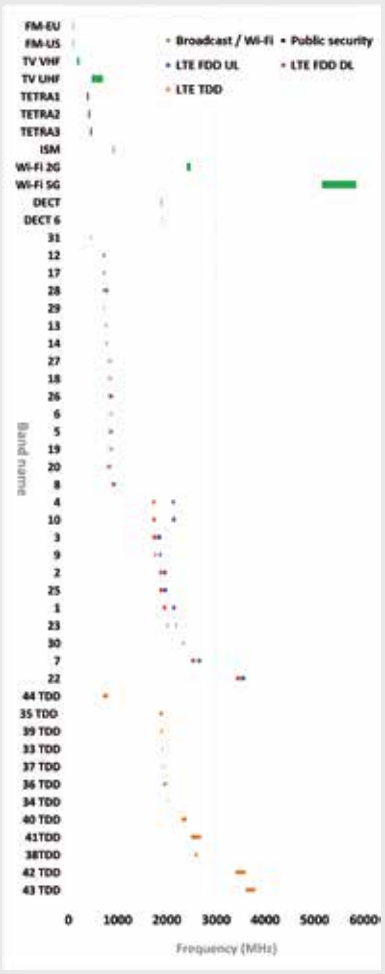
Equipment

- ■ EME Spy Evolution Analysis software
- ■ User manual
- ■ USB cable
- ■ USB power adapter
- ■ Case
- □ Real time visualisation kit

Services

- ■ Initial calibration
- ■ Calibration report
- □ Installation
- □ Training
- □ Additional calibration
- □ Extended warranty

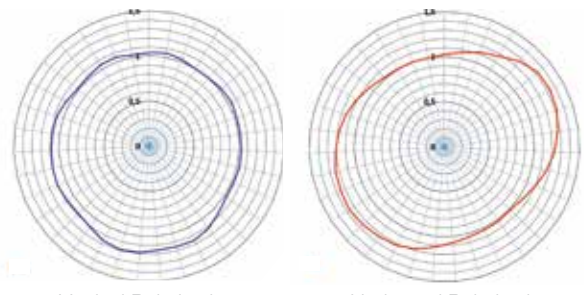
■ Included □ Optional



Frequency table with 74 possible frequency bands for different applications

Differentiating uplink(1) and downlink(2) is not only useful to assess the contribution of each transmitter, but also to avoid discrepancy in the results by phones emitting close to the dosimeter.

(1) Uplink: Sending of information from mobile station to the BTS
(2) Downlink: Sending of information from the BTS to the mobile station



Vertical Polarization Horizontal Polarization

Isotropy measured at 1940 MHz

PROBE CHARACTERISTICS

Probe	Tri-axial E-field probe 80 MHz – 6 GHz
Sensitivity	Down to 0.005 V/m
Dynamic	Up to 61.5 dB
Isotropy	+/- 2.0 dB (1.5 GHz - 4 GHz)
Calibration	Multi point calibration between 80 MHz & 6 GHz

MEASUREMENT CONFIGURATION

Number of data points	80,000 Max (TBC)
Logging intervals	From 2 to 255s (according to desired scenario)

EME Spy Evolution Analysis main window

OPERATING CONDITIONS

Temperature	-20°C to +70°C
Humidity	Up to 85% Max
Battery life*	Test in progress

* Internal battery

MECHANICAL CHARACTERISTICS

Dimensions	168.5 x 72 x 34.3 mm
Weight	520 g
Protection	IP55

PC SOFTWARE

Operating system	Windows XP, 7, 8, 10
Connectivity	Micro USB

INTERFACE

USB	Micro USB slot (charging, communication, external battery)
Power On/Off	Via Push button
Measurement On/Off	Via Push button
Reset device	Via reset button
Visual indicators	LEDs (Measurement action, power ON, default, battery charging)

EME Spy Evolution Real Time Kit

A streamlined and ergonomic screen allows the visualization of only the most useful information in real time on a small laptop PC, tablet or smartphone via a ferrite USB cable (for Windows) or BlueTooth (for Android)

EME Spy Evolution Android Application

http://tinyurl.com/k268zrh

Real-time view of electromagnetic field.

Measurements are transmitted by a Bluetooth link to an Android smartphone to display the exposure levels generated by the main radio services (FM, TV, Cellular Networks, Wi-Fi, etc. ...).

	BASIC MODE	PRO MODE
Real-time display	X	X
Backup + post-processing of measurements for compatibility with the EME Spy Evolution Analysis software		X
Geo-location of the measurements with GPS position		X
Generation of *.kmz files for compatibility with Google Earth		X

The EME Spy Android APP is certified for Smartphones below:
- Galaxy S series (Samsung)
- Xperia Neo (Sony Ericsson)
- Slim Cink (Wiko)
- XT925 (Motorola)

Geolocalized measurements in Paris

* Google Earth installation required. Visit our website for more information.

Real-time Visualization

Google Map View

INSITE Free

- **Compatible with most spectrum analyzers available on the market**
- **Tri-axial probes with excellent isotropic measurement**
- **Additional option for ANFR protocols**

Main features

Measurement capabilities

- Performs in situ spot measurements

User profile

- Regulation agencies, certification offices, municipalities, broadcast, PMR and mobile phone operators, installers, research laboratories, administrative bodies and more

Frequency bands

- 100 KHz to 6 GHz

Related recommendations

- EN50383, EN 50492 and IEC 62232

Compatible with most spectrum analyzers

- AEROFLEX: 3254, 9101, 9102
- ANRITSU: MS2661B, MS2665C, MS2711A, MS2711D, MS2711E, MS2712E, MS2713E, MS2720T, MS2721B, MS2724B, MS2724C, MS2726C, MT8212B, MT8220A, MT8222A, S332D, S362E
- Rohde & Schwarz: FSH3, FSH4, FSH6, FSH8, FSL6, FSL18, FSP, FSV3, FSV7, ZVL3
- Keysight: E7495B, ESA series, 856xEC series, N9912A

System Configuration

Software

- ■ INSITE Free on CD Rom with dongle key
- □ INSITE Free/ANFR on CD Rom with dongle key

Equipment

- ■ 100 KHz to 3 GHz probe
- □ 700 MHz to 6 GHz probe
- ◉ Spectrum analyzer
- ■ Switch box (with battery charger)
- ■ Probe holder
- □ Wooden tripod

Accessories

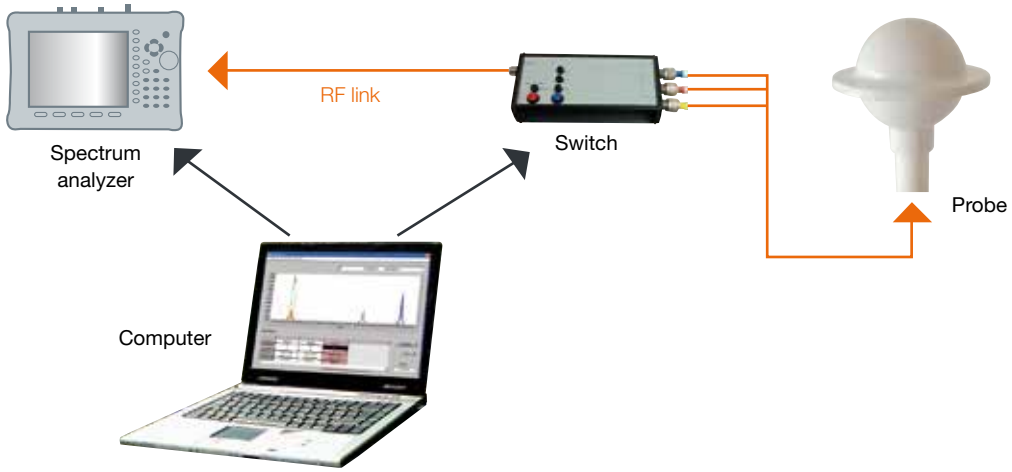
- ■ Cables

Services

- ■ Initial probe and cable calibration
- □ Additional calibration
- □ Training
- □ Extended warranty

■ Included □ Optional ◉ Required

INSITE Free is composed of a probe connected to a switch/amplification box. The system also requires a spectrum analyzer. These elements can be operated either manually or remotely through INSITE Free software. The software enables the user to define measurement scenarios, analyze measurements, review the results graphically and automatically generate reports in Excel format. The switch enables successive selections of the three measurement axes to obtain an isotropic result without changing the position of the probe. Equipped with an amplifier, the switch also improves the sensitivity of the system over the 100 KHz to 30 MHz frequency bands.



Description of the measurement chain with a 6 GHz measurement probe

Measurement scenarios can be defined by the user to fit specific requirements

❶ INSITE Free SW is a flexible tool that can be configured by the user to perform measurements and generate reports according to specific measurement protocols, in particular those recommended by ECC.

❷ In addition, INSITE Free/ANFR SW follows the protocol of the French National Agency of Frequencies (ANFR) step by step.

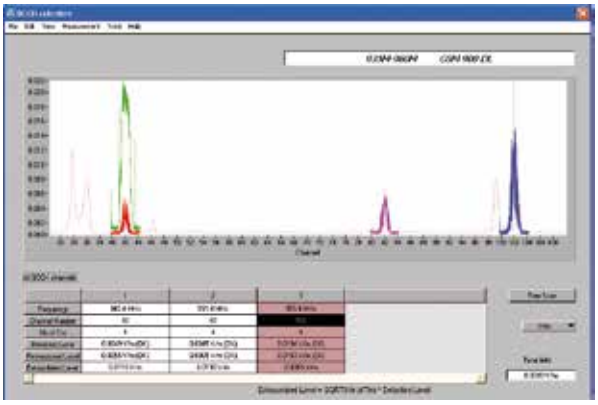
STEP 1: Choose hardware configuration

In this first phase, the user programs the measurement session according to his own hardware configuration: spectrum analyzer, GPS, probe, cable, UMTS scanner and switch. For this purpose, the probes, cable and switch calibration files are selected and loaded.
A selection of several probes is possible.
INSITE Free works with all of the most frequently used spectrum analyzers.

STEP 2: Define measurement scenario

Once the hardware has been configured, the user can program the measurement scenarios:

- Choose frequency bands to be measured from a list or create user-defined bands
- Define the channels or specific carriers
- Define channel width
- Choose attenuation mode
- Choose analysis mode (CW, TDMA, W-CDMA, LTE)
- Choose automatic or manual definition of RBW/VBW



Selection of BCCH for TDMA Analysis

STEP 3: Perform measurement analysis.

The data collected for each band is presented on the main window of the software. Measurements corresponding to each of the three axes can be displayed in order to check the polarisation of the electric field.

Depending on the characteristics of the spectrum analyzer, the user can repeat the following analysis modes:

- CW Analysis: selection of peaks according to predefined threshold
- TDMA analysis: extrapolation of BCCH value
- W-CDMA analysis: UMTS decoding (measurement and extrapolation of the CPICH value)
- LTE analysis : extrapolation of NPBCH value

The user can re-launch measurements using specific detection modes (positive peak, negative peak, sample…) and measurement modes (Max. hold, Min. hold, and average) available with the spectrum analyzer.

TDMA Analysis CW Analysis W-CDMA Analysis

STEP 4: Visualize results

The results can be visualized with the following functions:

- Full scan or per frequency band
- Zoom in with peak identification threshold
- 3 types of scales for a better high and low band visualization
- Quick view of element's properties

Sessions are saved in XML and results can be exported to Excel. The results can be compared to the reference levels given by specific guidelines. Two guidelines are available by default:

- ICNIRP
- Safety Code 6

(Other reference levels can be added upon request).

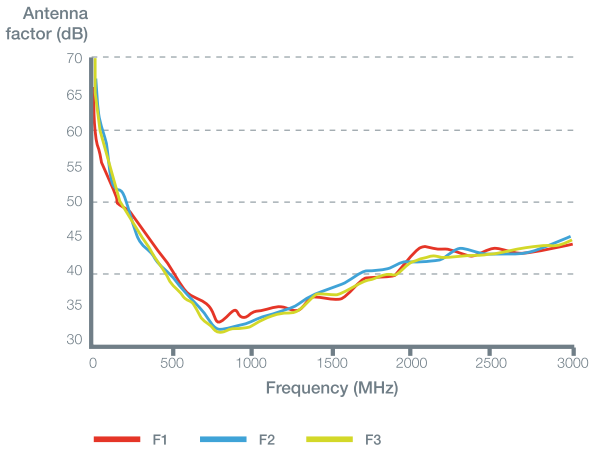
High performance isotropic probes to cover the 100 KHz to 6 GHz frequency ranges

Two probes are available: from 100 KHz to 3 GHz and from 700 MHz to 6 GHz. Both probes are made of three orthogonal monopoles. The patented shape of each monopole optimizes the functioning and isotropy of the probe over the entire frequency range.

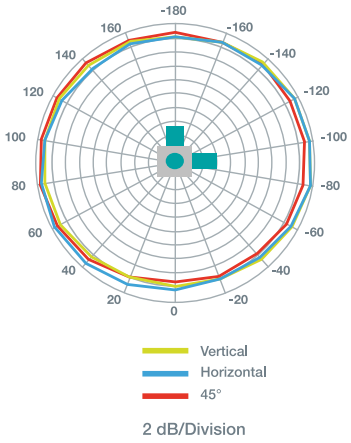
MECHANICAL CHARACTERISTICS / 100 KHz - 3 GHz PROBE	
Dimension (without cable)	406 mm
Weight	980 gr
RF cable length	2 m
Connector	3N
Protection	IP 44
Conditions for use (temperature, humidity)	-10 to 50°c, 85 % humidity

ELECTRICAL CHARACTERISTICS / 100 KHz - 3 GHz PROBE	
Sensitivity at 900 MHz (Given for a spectrum analyzer sensitivity of -90 dBm) (Cable loss taken into account)	1 mV/m
Max. E-field/900 MHz	200 V/m
Isotropy at 900 MHz	± 1 dB
Isotropy at 1800 MHz	± 1,7 dB

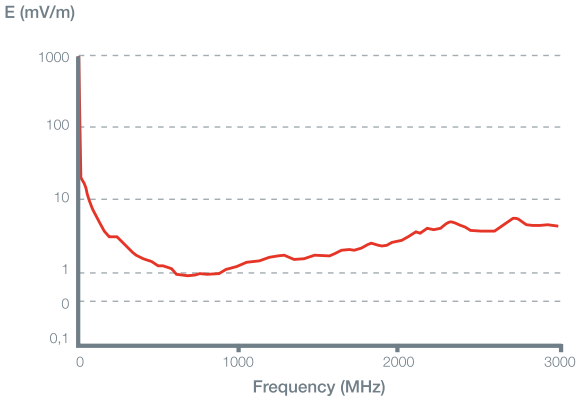
100 KHz - 3 GHz probe antenna factor



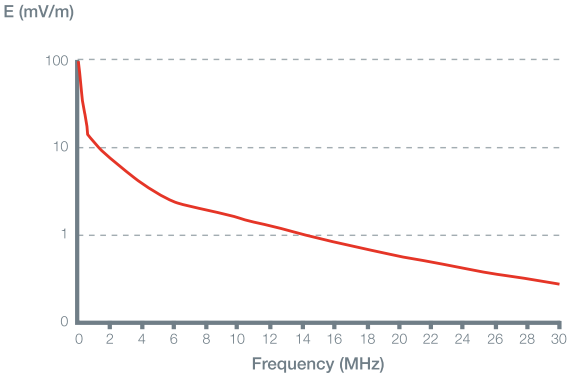
Axial Isotropy at 900 MHz



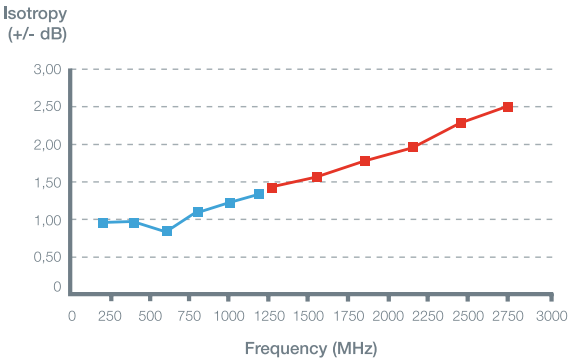
100 KHz - 3 GHz probe sensitivity without amplifier



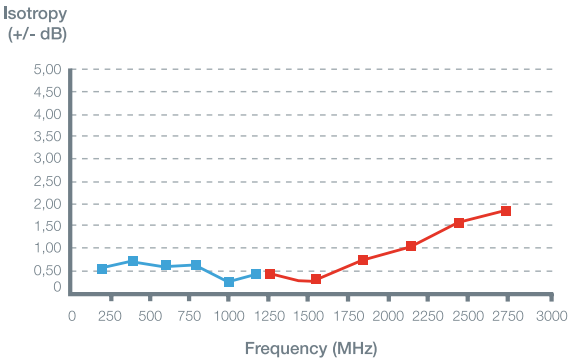
100 KHz - 30 MHz probe sensitivity with amplifier



100 KHz - 3 GHz Axial Isotropy with horizontal polarization



100 KHz - 3 GHz Axial Isotropy with vertical polarization



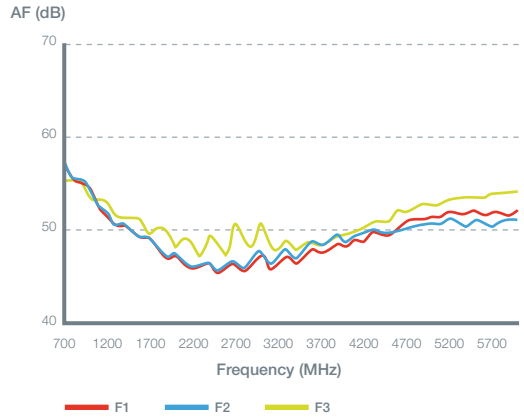
MECHANICAL CHARACTERISTICS / 700 MHz - 6 GHz PROBE

Dimension (without cable)	70 mm
Weight	800 gr
RF cable length	2 m
Connector	3N
Protection	IP 44
Conditions for use (temperature, humidity)	10 to 50°c, 85 % humidity

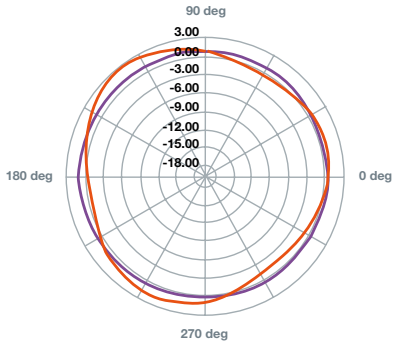
ELECTRICAL CHARACTERISTICS / 700 MHz - 6 GHz PROBE

Sensitivity at 900 MHz (Given for a spectrum analyzer sensitivity of -90 dBm) (Cable loss taken into account)	3,5 mV/m
Max. E-field/900 MHz	200 V/m
Isotropy at 900 MHz	+/- 1,6 dB
Isotropy at 1800 MHz	+/- 2,5 dB

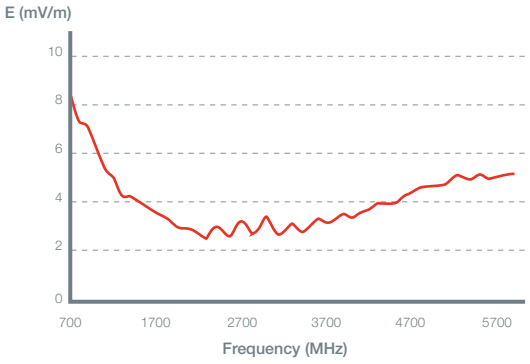
700 MHz - 6 GHz probe antenna factor



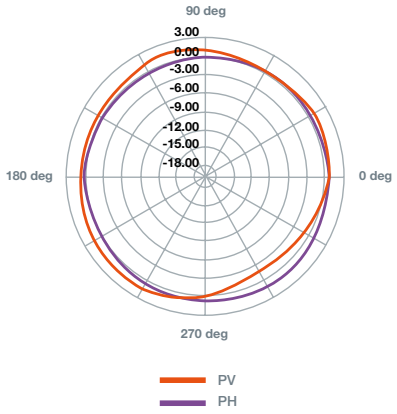
Axial Isotropy 3.6 GHz



700 MHz - 6 GHz probe sensitivity



Axial Isotropy 5.6 GHz



Perform isotropic measurements without changing the position of the probe

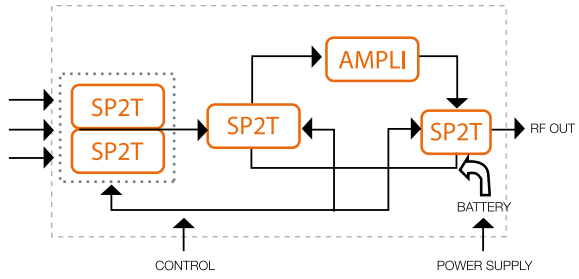
INSITE Free System performs a measurement for each axis and all predefined bands. The power value measured on each axis is then converted into field value.

FOR EACH BAND

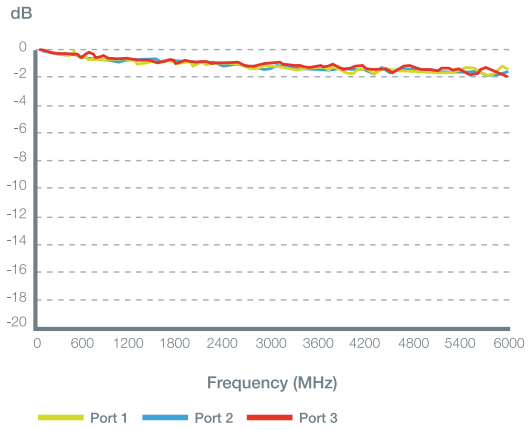
One scan for each axis	X 	Y 	Z 
Conversion in field value	[E] (dB V/m) = Pmes (dBm) – 13 + **Ilossl** + **AF** (dB m-1) **AF:** Antenna Factor **loss:** cable loss, switch loss		
Isotropic value calculation	$[E_{TOT}]$ (V/m) = (**[Ex]² (V/m)** + **[Ey]² (V/m)** + **[Ez]² (V/m)**)$^{1/2}$		

SWITCH BOX CHARACTERISTICS

Dimensions	100 mm x 200 mm x 50 mm	Frequency range	100 KHz – 6 GHz
Battery life	4 hours	Immunity	200 V/m
Protection	IP55	Frequency range amplifier	100 KHz – 30 MHz
N connections	Output: 1 female Input: 3 female	Max power input for amplifier	-30 dBm
Interface	USB	Amplifier gain	32 dB
Working conditions	-10 to 50°C, 85% humidity	Intermodulation	-30 dB @ -50 dBm -40 dB @ -60 dBm

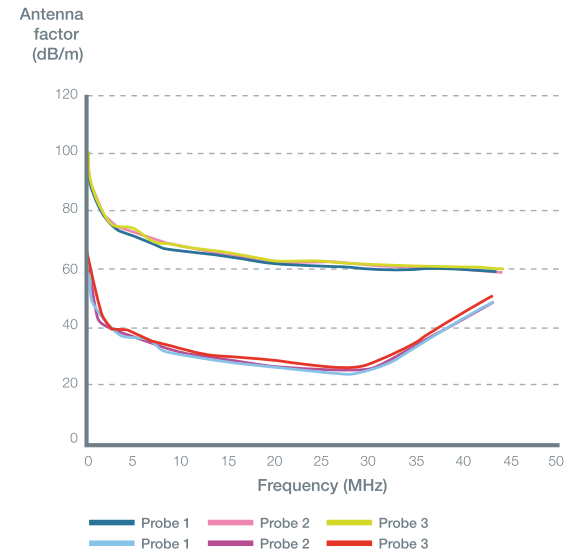


Sketch of the switch

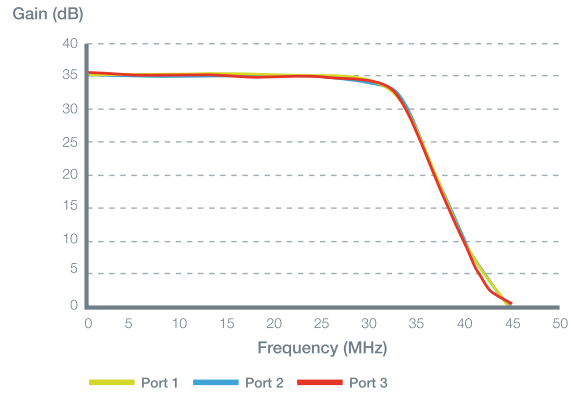


Transmission loss

Antenna factor with or without amplifier



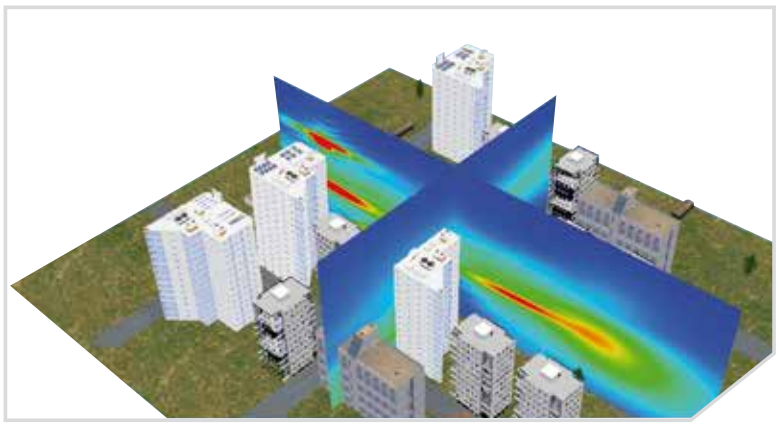
Amplifier gain



HARDWARE REQUIREMENTS

Computer	Processor 2 GHz
Cable link*	3 USB Ports
Operating system	XP / WIN7 / WIN8 / WIN10
Memory	2 GB RAM
Free space	500 MB free space on hard disc

* Serial port, USB, Ethernet or GPIB may be necessary depending on the analyzer



OKTAL-SE
Synthetic Environment

EMF VISUAL

THE REFERENCE SOFTWARE
IN ELECTROMAGNETIC EXPOSURE
SIMULATION

EMF Visual,
electromagnetic exposure simulation software

Worldwide, the telecommunication regulatory bodies are paying more and more attention to human exposure to RF emissions. The authorization for installing new antennas is nowadays dependent upon a proof of compliance with local reference levels.

As a result, an accurate simulation of human exposure to electromagnetic fields is essential. This is the only way to calculate and consider the cumulated level of exposure generated by new antennas in their future installation sites together with all those already in place, used for cellular networks (2G, 3G, 4G, Tetra) or radio services (FM, TV, WLAN, …).

EMF Visual software, reference in the industry, offers reliable and fast calculations. It allows the visualization of electromagnetic fields in a determined zone (near-field/far-field), taking into account the multiple emitters and their interaction with surrounding buildings.

The simulation results can be compared directly with reference levels given by ICNIRP, Safety Code 6, FCC,…etc. thus providing clear and easy-to-understand evaluations of the compliance of a site.

In this new version, EMF Visual is even more powerful thanks to new advanced features. It now uses GPU resources which allow to cover larger areas for exposure evaluation, and enables the use of the GIS database or 3D objects conversion for a direct loading of virtual 3D scenes while interfacing with Sketch Up software.

❶ Completely redesign interface
❷ GPU-accelerated computing for fast exposure evaluation
❸ Precise and fast creation of 3D environment

Main features

Product category
- Electromagnetic exposure simulation software

Simulation capabilities
- EMF Visual is a prediction, analysis and communication tool, which can accurately simulate exposure in both near and far field of the antennas while taking into account its environment

User profile
- Cellular network operators/installer, broadcast companies, regulatory bodies, municipalities.

System Configuration

Software
- ■ EMF Visual Standard (CPU) or Advanced (GPU)
- □ SE-SKP-EMF (plugin for SketchUp[1])
- □ SE-AGETIM-LIGHT-EMF (3D creation)
- □ SE-FFT-EMF (3D Converter)
- □ BSA Synthesis (Custom Antenna creation)

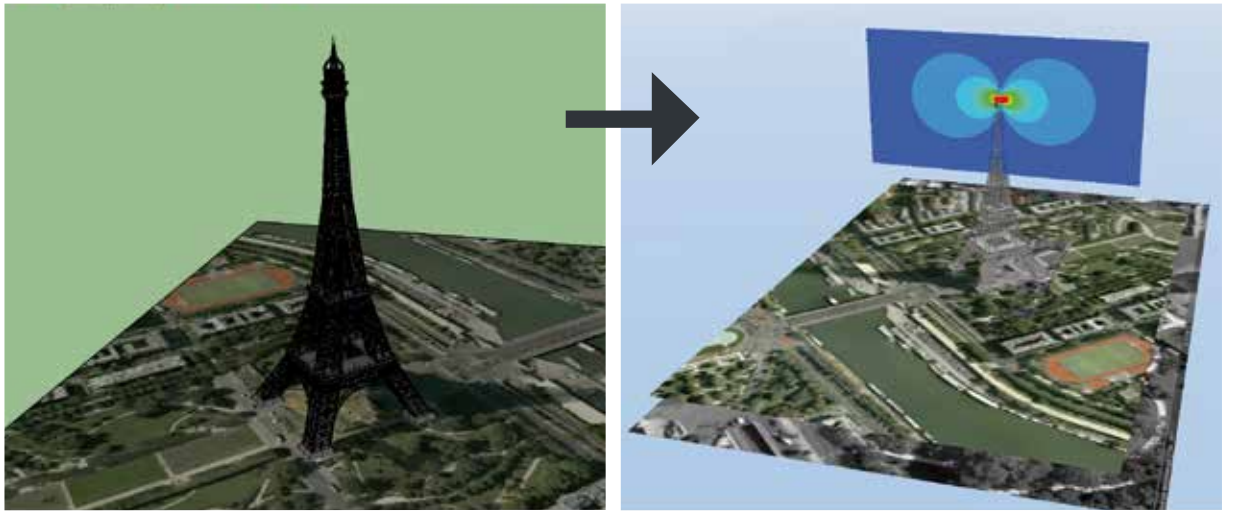
Services
- □ Training
- □ Hotline

■ Included □ Optional

STEP 1: 3D SCENARIO CONSTRUCTION

The creation of 3D scenario for EMF Visual can be done:

- **by importing 3D objects from the EMF Visual generic database.** A wide choice of 3D objects to represent ground, buildings, houses, masts, towers, indoor objects, etc… is available in the generic database.
- **by using the Option SE-SKP-EMF:** plugin for SketchUp[1].

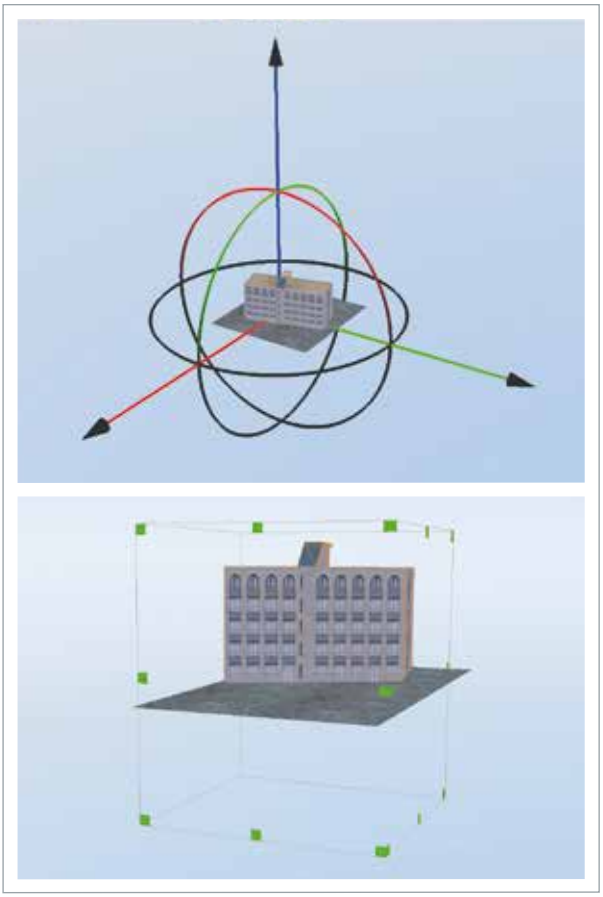


[1]https://www.sketchup.com/ [2]https://3dwarehouse.sketchup.com

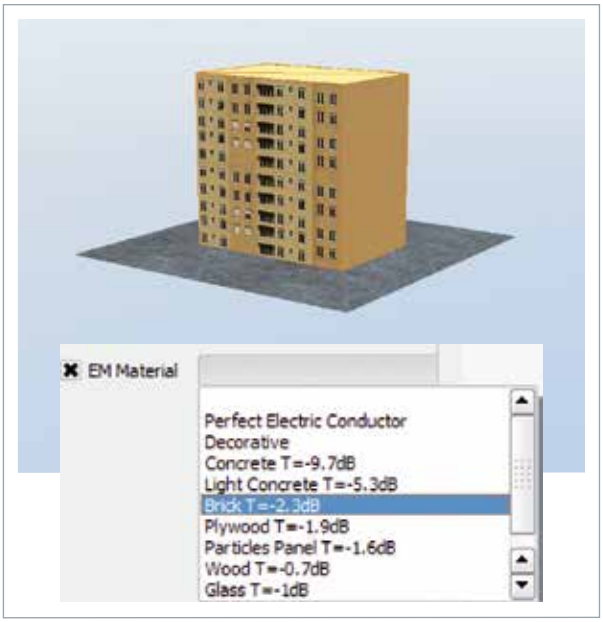
- **By using the Option SE-AGETIM-LIGHT-EMF:** 3D object/scenario creation for EMF Visual from SIG database.

- **By using the Option SE-FFT-EMF (File Format Transfer):** 3D files converter for EMF Visual.

- Graphical tools to adjust the 3D object properties.



- Tools for assignment of the electromagnetic properties.



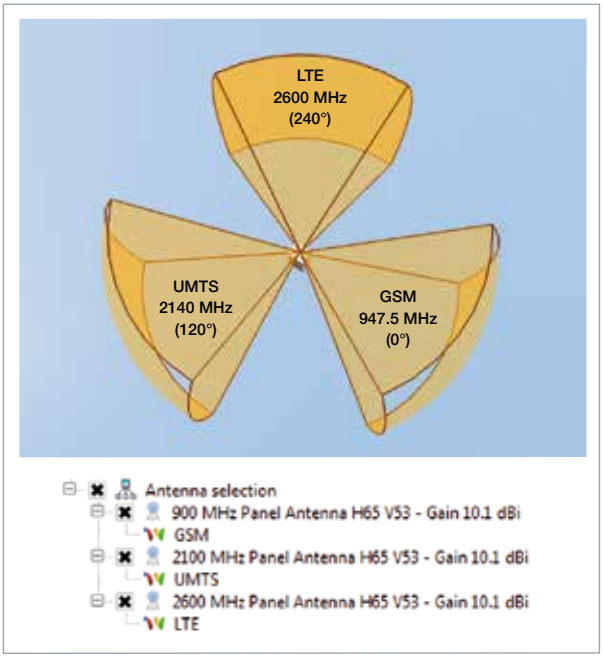
STEP 2: ANTENNA SELECTION AND INSTALLATION

EMF Visual software can use antenna models from the existing database or a custom antennas created by BSA Synthesis Option.

- A complete database of generic models of the most current antennas used in 2G, 3G, 4G cellular networks (700, 800, 900, 1800, 1900, 2100, 2600MHz).
- Over 500 KATHREIN antennas for 2G, 3G, 4G cellular networks.
- An additional database of FM and Wifi antennas.

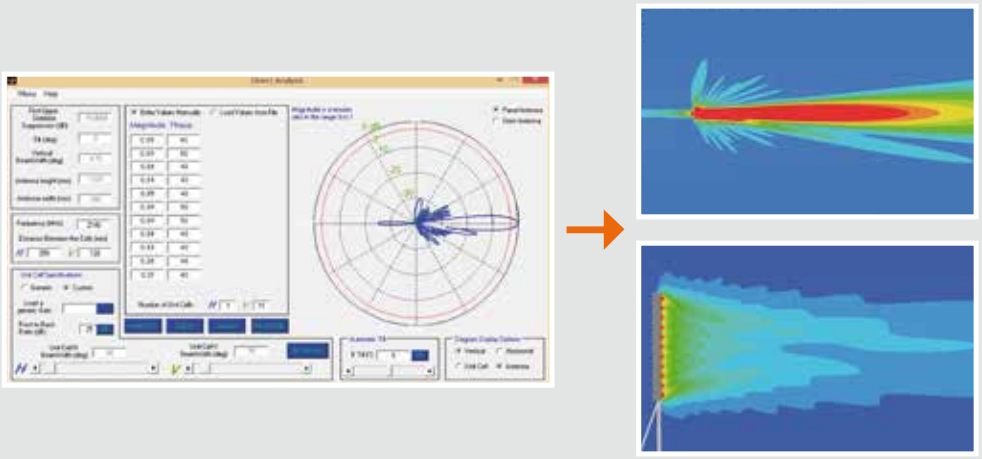
Antenna configuration tools.

- Geometric visualization of the antenna main beam cone in the scene together with graphic tools for adjusting position, tilt, azimuth and power.



BSA SYNTHESIS OPTION: DEFINE ANTENNA CHARACTERISTICS AND CREATE CUSTOMIZED ANTENNAS.

- **BSA Synthesis computes magnitude and phase for each unit cell to generate an antenna model that fits with far field radiation pattern:**
  - **vertical and horizontal -3dB beam width and frequency.**
  - **side lobe suppression.**
  - **number of cell units or antenna length.**
  - **front to back ratio.**
- **Analysis of antenna model from unit cell magnitude and phase data (1D and 2D array antenna).**
- **Exportation of the antenna model to the EMF Visual database.**



STEP 3: COMPUTATION

After defining the computation volume around the area of interest, the electromagnetic field level calculation is launched. The calculation is based on optical geometry (ray tracing). It allows simulation to be performed over a wide area in terms of wavelength and the interactions with the environment of the radiating sources to be taken into account.

- Two computation modes are available according to the chosen option.
- Standard mode: CPU (Central Processing Unit) calculation
- Advanced mode: GPU (Graphics Processing Unit) calculation

Number of reflecting polygons	1800	2400	3000	3600	4200	4800	6000	7200
GPU Simulation duration	1h19min	1h39min	2h04min	1h56min	2h07min	2h04min	2h08min	2h10min
CPU Simulation duration	1h54min	3h49min	5h32min	8h23min	10h32min	12h52min	18h18min	1d49min

Note: the same calculation made without reflecting polygons (free space propagation) is around 30 seconds.

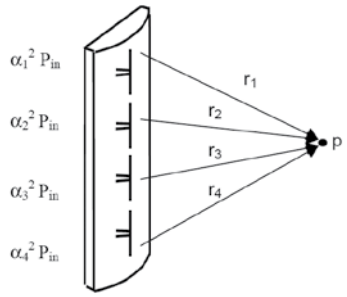
PROPERTIES OF THE VOLUME	
Width/X (m)	14
Depth/Y (m)	14
Height/Z (m)	14
Regular grid	
Near step	0.1 m
Point count	2803221

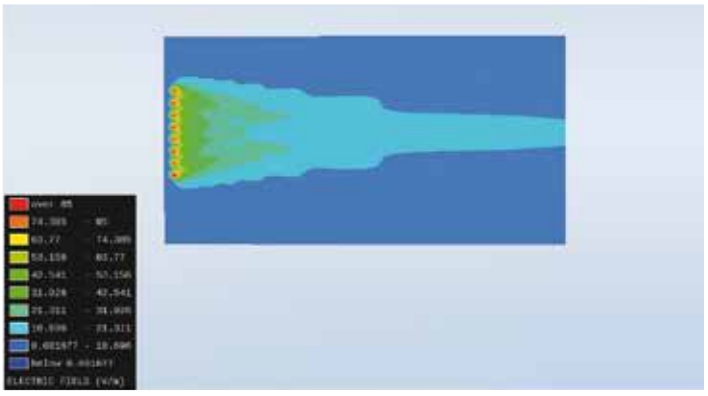
The simulation contains one antenna 900 MHz Omnidirectional V7 Gain 11.3 dBi

MATERIAL PROPERTIES FOR EACH CUBE	
Concrete T	-9.7 db

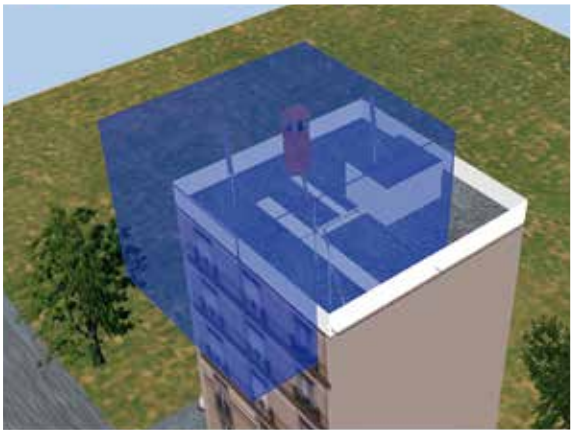
PC CONFIGURATION	
Intel Core i7 CPU	3.20 GHz
RAM	8 Go
NVIDIA GeForce GTX 750 Ti	4 Go

- Accurate representations of the near field by considering the contribution of each sub-cell of the antenna.



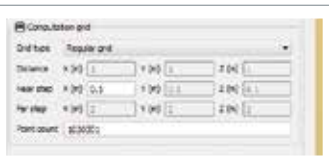


- Definition of a computation volume around the area of interest.



- Selection of the active antenna.

- Adjustment of the mesh step (number of computation points).
- Non-uniform grid to improve resolution around the antennas and to speed up the calculations.

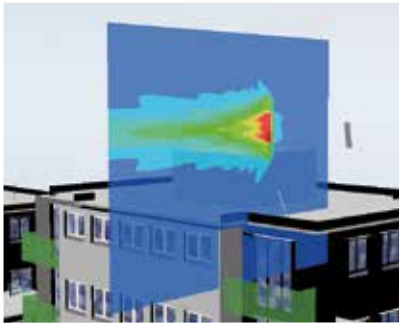


STEP 4: RESULT DISPLAY

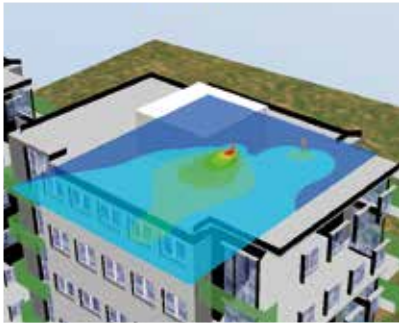
Once the computation is finished, the user can use iso- surface or cut plane tools to display the level of exposure in the vicinity of the 3D environment.

Iso-surface

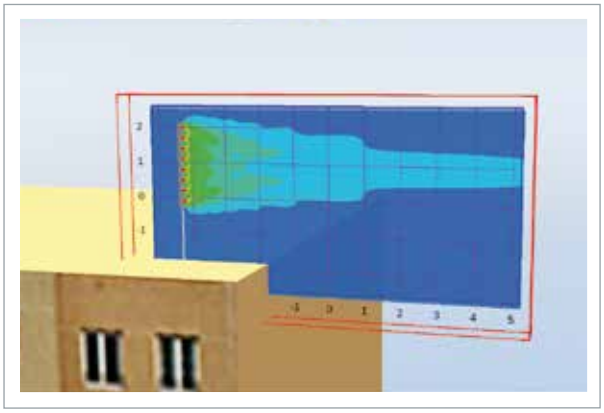
Vertical cut plane



Horizontal cut plane



- Multiple cut plane and multiple distance measuring possibilities for security perimeter definition.



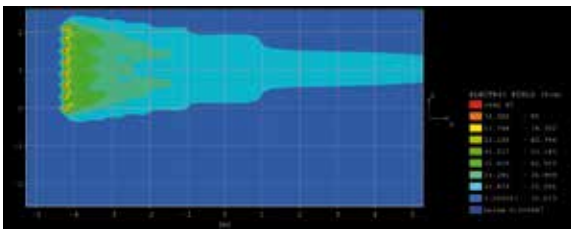
- Evaluates the levels of exposure in terms of E-field (V/m), H-field (A/m), Power Density (W/m²), % of the E-field or % of the Power for multi-frequency sources.
- Determines the safety distances with respect to standards or recommendations (EU recommendation, ICNIRP, and so on …).
- Visual post-processing of the results: choice of colour or transparency.

STEP 5: RESULT EXPORTATION

EMF Visual generates ASCII Txt file (permits result to be loaded in Excel, Matlab…).

For each volume and each band, one ASCII Txt file is created:

- contains the computed E-field value (V/m) is created.
- displays the E-field values for each antenna with the corresponding Cartesian coordinates.
- It is possible to generate a bitmap file, represented the cut plane.



HARDWARE REQUIREMENTS

Processor	PC Pentium > 2 GHz
Graphical Board	NVIDIA using CUDA 5.0 ("Compute Capability" of the card greater than 1.1)
Interface	USB Port
Operating system	WIN7 / WIN8 / WIN10
Memory	> 2 GB RAM
Free space	1 GB free space on hard disc

OPTION - **3D Creation**

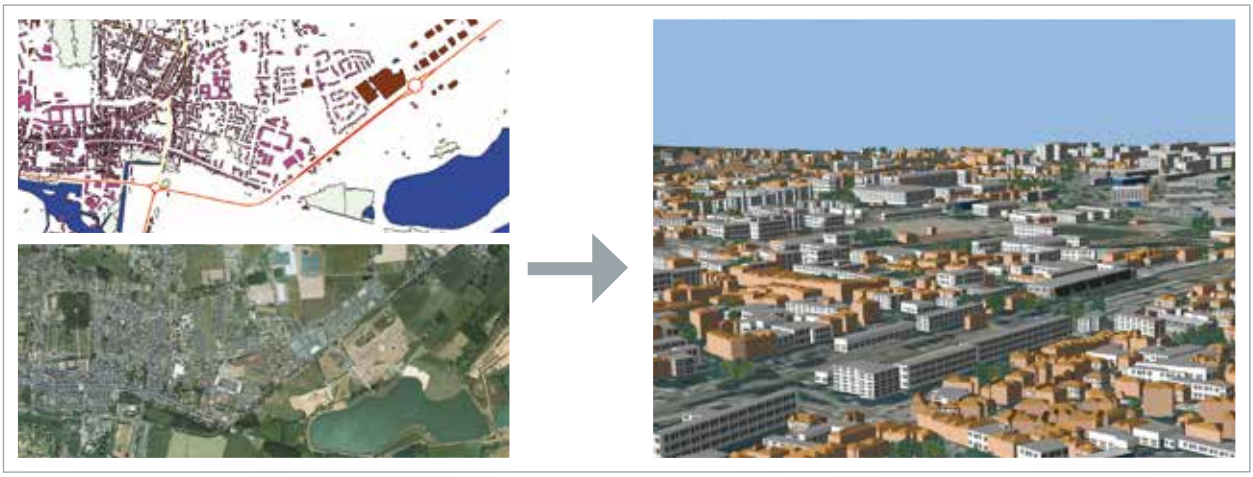
SE-AGETIM-LIGHT-EMF

SE-AGETIM-LIGHT-EMF is a simple terrain generation tool. Any user should be able to generate a virtual 3D scene for EMF-VISUAL. The user can import existing data (planimetry, altimetry, photography), and slightly modify parts of it. The data are automatically treated (corrected, simplified, kept or ignored in the generation process…), and the result is a 3D scene ready to be imported by EMF-VISUAL.

The GIS (Geographical Information System) user interface of SE-AGETIM-LIGHT-EMF also requires the third party GlobalMapper™ software that is included in the SE-AGETIM-LIGHT-EMF software delivery.

The basic features of SE-AGETIM-LIGHT-EMF are the following:

- Source data acquisition via internet (format : shapefile, dted etc…)
- Terrain generation (minimizing GIS operation)
- Priority to the realism and aesthetic of the generated DB
- Robustness with regard to the quality of source data
- Opportunist approach: if the source data is good, it is used, if not ignored.



SE-AGETIM-LIGHT GUI

OPTION - **3D Converter**

SE-FFT-EMF

SE-FFT-EMF (File Format Transfer) product is a 3D geometric data converter, from and to the EMF-VISUAL format (called SDM format). It handles meshed databases (polygons characterized by textures, colors, etc.) used to describe terrains, objects and targets.

SE-FFT-EMF enables the conversion from OpenFlight, OpenInventor, VRML or TDF formats, towards the SDM format and vice versa (except for the TDF format). It also enables the conversion from the SDM format to the BSG format.

SE-FFT-EMF is made of five groups of software:

- SE-FFT-2FLT, that converts database in the SDM format into OpenFlight files, and SE-FFT-FLT, that does the reverse conversion. The resulting SDM files can be imported by EMF-VISUAL. The resulting FLT files can be imported by the OpenFlight utility programs.
- SE-FFT-2IV, that converts database in the SDM format into OpenInventor or VRML files, and SE-FFT-IV that does the reverse conversion (OpenInventor and VRML files). The resulting SDM files can be imported by EMF-VISUAL. The resulting IV files can be imported by the OpenInventor utility programs.
- SE-FFT-TDF, that converts database in the TDF format into SDM files.
- SE-FFT-2BSG, that converts database in the SDM format into BSG files.
- SE-FFT-2SEDRIS, that converts database in the SDM format into SEDRIS STF files, and SE-FFT-SEDRIS that does the reverse conversion. The resulting SDM files can be imported by EMF-VISUAL. The resulting STF files can be imported by the SEDRIS utility programs.

For the OpenFlight module, the versions of the formats supported by the two software components are:

- FLT to SDM: OpenFlight 14.2 to 16.4 and SDM 3.0 for SE-FFT-FLT
- SDM to FLT: SDM 3.0 and 15.8 for SE-FFT-2FLT

For the OpenInventor/VRML module, the versions of the formats supported by the two software components are:

- IV to SDM: OpenInventor, VRML 1.0 and 2.0 and SDM 3.0 for SE-FFT-IV
- SDM to IV: SDM 3.0 and OpenInventor or VRML 2.0 for SE-FFT-2IV

For the TDF module, the TDF format versions handled are the 10.0 and 11.3 and the format SDM 3.0.

For the BSG module, the BSG format version handled is the 1.0 and the format SDM 3.0.

For the SEDRIS module, the versions of the formats supported by the two software components are:

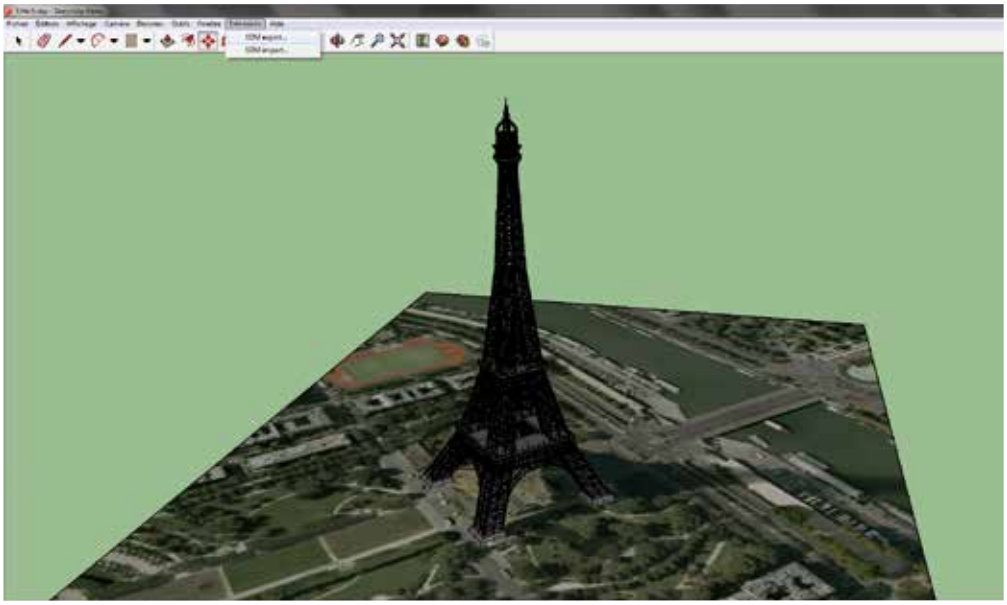
- SEDRIS to SDM: SEDRIS 4.1 and SDM 3.0 for SE-FFT-SEDRIS
- SDM to SEDRIS: SDM 3.0 and SEDRIS 4.1 for SE-FFT-2SEDRIS

OPTION - **Plugin for SketchUp**

SE-SKP-EMF

A plugin for the tool SketchUp[1] is also available as an option. Thanks to this tool, the user can create, from scratch, a model or download it from the Trimble SketchUp library[2] and convert it into the SDM Format.

All the formats compliant with SketchUp interface can be converted into the SDM format.



SketchUp™ plug-in

[1]https://www.sketchup.com/
[2]https://3dwarehouse.sketchup.com

NOTES

About Microwave Vision Group (MVG)

Since its creation in 1986, The Microwave Vision Group (MVG) has developed a unique expertise in the visualization of electromagnetic waves. These waves are at the heart of our daily lives: Smartphones, computers, tablets, cars, trains, planes - none of these devices and vehicles would work without them. Year after year, the Group develops and markets systems that allow for the visualization of these waves, while evaluating the characteristics of antennas, and helping speed up the development of products using microwave frequencies.

The Group's mission is to extend this unique technology to all sectors where it will bring strong added value. Since 2012, MVG is structured around 3 departments: AMS (Antenna Measurement Systems), EMC (Electro-Magnetic Compatibility), EIC (Environmental & Industrial Control).

MVG is present in 10 countries, and generates 90% of sales from exports. The Group has over 350 employees and a loyal customer base of international companies.

Contact your local sales representative for more information

www.mvg-world.com/rfsafety

salesteam@mvg-world.com