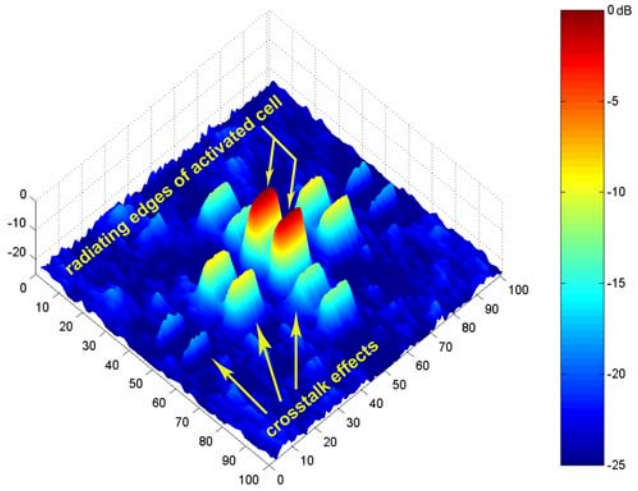
OPTEOS CUSTOMIZED MEASUREMENT SERVICES

A New Generation of RF characterization

OPTEOS' innovative Electro-Optic (EO) field imaging technique opens a new era of RF test and measurement. Instead of using traditional electrical-to-electrical, port-to-port measurement schemes, our customized RF characterization services are performed based on a cutting-edge, electrical-to-optical process that allows us to detect internal signals from your RF structures under actual operating conditions. By using OPTEOS' electro-optic technologies, we can provide, for your circuits, antennas, or antenna arrays, internal measurements that you may not have imagined would ever be possible. No longer do you need to wonder exactly what is really happening inside your RF structures – we can take you inside them through the window of OPTEOS' EO measurement so you can see for yourself.

Antenna/Array Measurements

Have you ever wondered what the actual field distributions of your radiating structures are at the aperture level? Now, you can see all orthogonal vector electric field components that radiate from your antennas or arrays as they are operating. The validation of new antenna designs cannot be easier – fabricate your design, and we will show you the exact field distributions of your antenna.



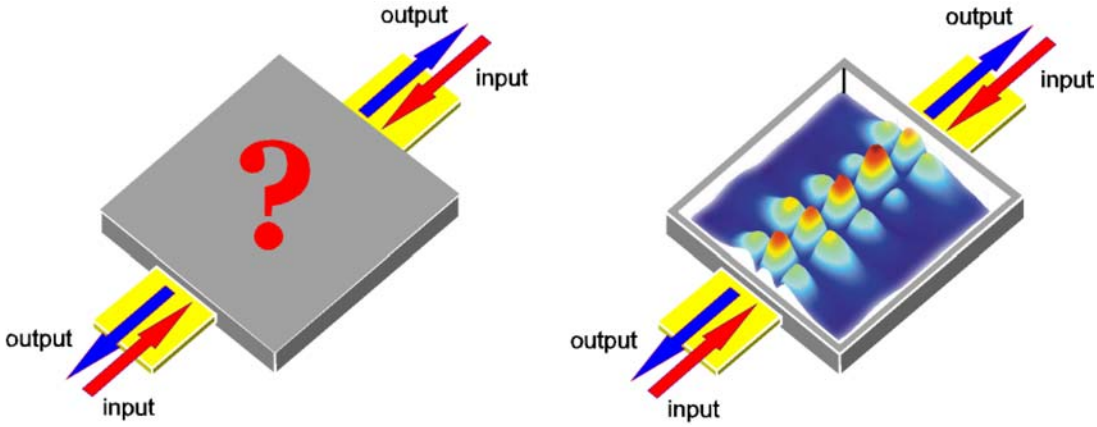
Single cell activation – cross-talk measurement

Are you concerned with the operating uniformity of your complicated active arrays? You may want to know the accuracy of the phase distribution of your phased array. Look no further. We can provide the most fundamental information – field amplitude and phase distribution – right at the aperture. Validate your array designs, identify malfunctioning cells, and explore crosstalk and other local field effects. Of course, all necessary far-field information can then be extracted from the near-field data with great ease. Give OPTEOS the opportunity to provide you with the most enlightening experience possible in the evaluation of your antennas and arrays.

Integrated Circuit Measurements

Do conventional port-based measurements fail to provide sufficient information to analyze your complicated RF circuits? Would it be helpful to directly observe the distribution of signals being combined from multiple transistors in an amplifier? Do you want to know signal amplitude and phase at circuit internal nodes rather than only at the input and output ports? OPTEOS has the right solution. We

can transport you into your own creation, so you may observe signals propagating inside of your ICs under actual operating condition.



By using OPTEOS' internal-node Electro-Optic measurements, you can directly evaluate the performance of every individual component forming your complex ICs, whether they are passive or active elements. It is even possible to measure fields from circuits within enclosures and packages, providing unique opportunities to investigate interference and isolation. Don't evaluate from outside the package – move your observation point right into your IC, where it can provide unique benefits.
Please visit us at **www.opteos.us** or e-mail **info@opteos.us** for more information.

Key Measurement Parameters	
Parameter	**Value**
BANDWIDTH	DC ~ > 100 GHz
DYNAMIC RANGE	> 70 dB
MINIMUM RF POWER	< - 15 dBm *
DISTINCTION BETWEEN FIELD COMPONENTS	> 30 dB **
SPATIAL RESOLUTION	< 8 µm
SCANNING AREA	User defined
MEASUREMENT DISTANCE	User defined, down to < 100 µm ***

* Value measured at 25 µm from the top of X-band microstrip. The value depends on operating frequency, DUT geometry, and probe position.
** Capability of EO system to separate orthogonal vector components of E-field.
*** Distance from the top of device or antenna under test.

Conventional vs EO RF Test and Measurement

Antenna / Antenna Arrays

Parameters	Conventional	OPTEOS
SIGNAL EXTRACTION	Electrical – to – Electrical	Electrical – to – Optical
MEASUREMENT POINT	Near-field (several λ away from AUT) ~ far-field	At the aperture of AUT (less than 100 μm) ~ Near-field
BANDWIDTH	Limited by system config.	DC to >100 GHz, without any system reconfiguration
INFORMATION	Limited near-field and far-field information	Detailed amplitude/phase distribution at the aperture; far field info (via numerical transformation)
RESULTS and APPLICATIONS	• Overall evaluation of antennas, arrays • Limited info. for detailed design evaluation • Limited info. for complete operating evaluation/diagnostics	• Overall evaluation of antennas, arrays • Precise design, operating, & diagnostic evaluation (high resolution, separate x-y-z field-component measurements) • Comprehensive far-field analysis based on field transformation

Integrated Circuit

Parameters	Conventional	OPTEOS
SIGNAL EXTRACTION	Electrical – to – Electrical	Electrical – to – Optical
MEASUREMENT POINT	At the ports of circuit	Internal nodes of circuit (or inside of package)
BANDWIDTH	Limited by system configuration (Different system conf. may be needed for different BW)	DC to >100 GHz, without any system reconfiguration
INFORMATION	Input / Output information at the ports	Internal amplitude and phase variations + In/Output info.
RESULTS and APPLICATIONS	• Overall evaluation of circuit • Limited info. for detailed fault isolation • Limited info. for internal operating evaluation	• Overall evaluation of circuit • Precise fault isolation • Comprehensive internal info. (Gain/stg, phase variation, delay, crosstalk, etc) • Applicable for RF MEMS

Innovative RF Characterization Service by OPTEOS, INC.

How it works:

I. Identify your needs	
• Identify your RF structures to be tested • Specify operating conditions • Identify specific characteristics you want to see from your RF structures • Your propriety information will be protected by Non-Disclosure Agreement (NDA)	
You will receive	Opteos needs
1. Device identification form 2. Objective identification form 3. NDA form	1. Completed device identification form 2. Completed objective identification from 3. Completed NDA from OPTEOS or your own NDA to be accepted by OPTEOS

II. Planning	
• Establish detailed measurement plan • Finalize measurement schedule • Estimate cost for the service	
You will receive	Opteos needs
1. Detailed measurement plan 2. Measurement scheduling 3. Quotation for the service	1. Your opinion on the plan and schedule 2. Your final approval for the plan and schedule 3. Your purchase order

** **STEP I and II is fee-free process.***

III. Measurement	
• Receipt of DUT or AUT from customer • Perform Electro-Optic measurements based on the approved plan and schedule by customer • Organize raw data obtained from the measurements • Prepare measurement service report	
You will receive	Opteos needs
1. Progress update (if the task takes longer that 1 week) 2. Request for discussion to refine the measurement process (if necessary)	1. Teleconference to discuss refining the measurement process (if necessary)

IV. Result Delivery

- Deliver raw measurement data (soft copy)
- Deliver report documents (soft and hard copy)
- Other customer defined data and information
- Soft copies of data and report will be password protected. Password will be separately delivered to customer

You will receive	Opteos needs
1. Notification of the completion of measurement service and password for soft copies 2. Soft and hard copies of results 3. Additional task request form for further measurement service or post analysis 4. Your DUTs or AUTs ** 5. Invoice	1. Your approval for the completion of service or 2. Additional measurement service/post analysis request 3. Payment for the completion of measurement service

** ***Opteos may keep your DUTs or AUTs for prompt additional measurements or analysis. However, if customer decides to complete the measurement service, the DUTs or AUTs will be immediately returned to customer.***

V. Post Analysis and Consultant (part of Premium Service)

- Extensive additional measurements and in-depth data analysis by designated team(s) of Opteos engineers
- Conventional measurements or numerical analysis available upon customer's request***
- Consulting to solve problems or improve performance of your DUTs or AUTs
- Customer can request Premium Service during the planning stage (STEP I or II)
- Also, customer can request PPC at the delivery of initial measurement results (STEP IV)

You will receive	Opteos needs
1. New service plan (if necessary) 2. Interim progress update (if the task takes longer that 1 week) 3. Notification of the completion of measurement service and password for soft copies 4. Soft and hard copies of results including complete set of raw data, post analysis, and consulting/suggestion 5. Your DUTs or AUTs 6. Invoice	1. Teleconference to discuss refinement of the service process (if necessary) 2. For successful service, Opteos may need to contact to you to discuss interim progress 3. Your review of final deliverable 4. Payment for the completion of service

*** ***Please contact Opteos to confirm if the conventional RF measurements or numerical simulations you need are available.***

For additional information on the Measurement Service, please contact Opteos, Inc. at
E-mail: info@opteos.us / Phone: (734) 973-6600 × 13 / Fax: (734) 973-7220