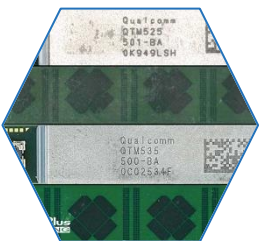
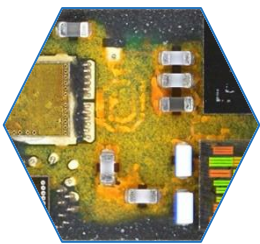
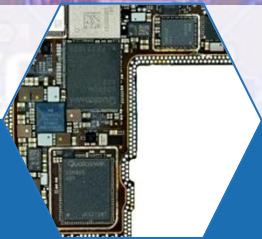


## RF Front-End Module Comparison 2021 – Vol. 2 – Focus on 5G Chipset

*Technical and cost overview of the evolution of radio frequency front-end module technologies integrated in 5G mmWave and Sub-6 GHz Phones in 2020.*



**Title:** RF Front-End Module Comparison 2021 – Vol. 2 – Focus on 5G Chipset

**Pages:** 272

**Date:** April 2021

**Format:** PDF & Excel file

**Price:** EUR 6,490

**Reference:** SPR21530

Last year System Plus Consulting opened hundreds of Front-End Modules (FEMs) and components to provide an overview of the Radio Frequency (RF) FEM market in selected flagship smartphones. We gathered the information into four reports to track the evolution of this technology market.

This year, System Plus Consulting again offers technical and cost comparisons of smartphone RFFEMs. Every comparison report will focus on a specific subject. It can be a player's evolution, a specific technology, or a comparison of flagship devices.

This, the second volume of 2021, provides insights into technology and cost data for FEMs and several components found in 31 smartphones from the latest 5G phones. It provides a ranking of 5G phones and suppliers. It features a comprehensive overview of the RFFEM architectures on the market, comparing available smartphones from these companies. It reveals material substrate trends and main used die functions, along with the different choices in integration of communication technology. We even see millimeter wavelength (mmWave) signal support this year. Also, the report reveals how companies are integrating 5G, from premium to low-end phones.

With teardowns of the smartphones, the main RF modules and components have been extracted and physically analyzed, from the output of the transceiver to the antenna. Packaging, sizes, and technologies are studied to provide a large panel of technical and economic choices and an overview of the market. Every component has been analyzed to understand the manufacturing process cost.

Moreover, the report includes a technical and cost comparison of the modules. It also tries to explain the smartphone makers' choices and supplier tendencies.

### COMPLETE TEARDOWN WITH

- Detailed photos
- Precise measurements
- Module opening
- Die measurements
- Detailed technical and cost analysis of 43 components
- Complete bills-of-materials for the modules
- Comparison between suppliers
- Comparison between oems
- Cost comparisons

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### Physical Comparison

- Area distribution per supplier and function
- Die design win by number and area
- Die distribution per function
- Filter distribution per smartphone: technology and substrate
- PA/LNA/switch distribution per smartphone: technology and substrate
- Material substrate distribution per smartphone

### Cost Comparison

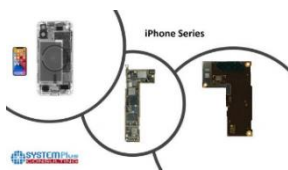
- Chipset cost evolution
- Cost distribution per supplier and function
- RxTx cost evaluation

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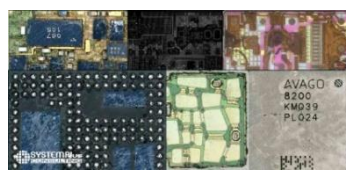
## RELATED REPORTS



### RF Front-End Module Comparison 2021 – Vol. 1 – Focus on Apple

*Technical and cost overview of the evolution of the radio frequency front-end module technologies integrated in the Apple iPhone series from 2016 – 2020.*

March 2021 - EUR 6,490\*



### Broadcom AFEM-8200 PAMiD in the Apple iPhone 12 Series

*Deep dive analysis of the fourth generation of mid/high band front-end module for 4G and 5G from Broadcom.*

February 2021 - EUR 3,990\*

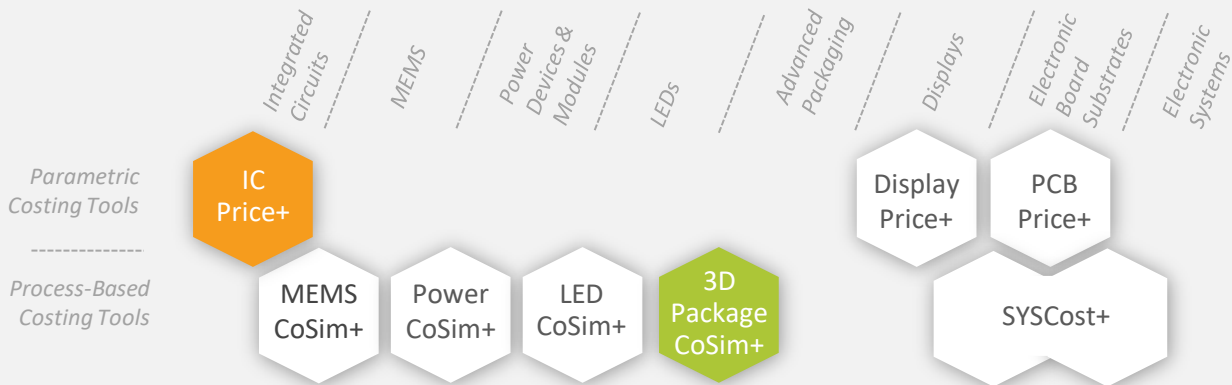


### 5G Packaging Trends for Smartphones 2021

*5G packaging brings innovative technology and 2.6 billion dollar opportunities for SiP business.*

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## COSTING TOOLS



Our analysis is performed with our costing tools IC Price+ and 3D Packaging CoSim+.

System Plus Consulting offers powerful costing tools to evaluate any process or device, the production cost and selling price, from single chip to complex structures. All these tools are on sale under corporate license.

### IC Price+

The tool performs the necessary cost simulation of any Integrated Circuit: ASICs, microcontrollers, DSP, memories, smartpower...

### 3D Packaging CoSim+

Cost simulation tool to evaluate the cost of any Packaging process: Wafer-level packaging, TSV, 3D integration...

## ABOUT SYSTEM PLUS CONSULTING

### WHAT IS A REVERSE COSTING®?

Reverse Costing® is the process of disassembling a device (or a system) in order to identify its technology and calculate its manufacturing cost, using in-house models and tools.



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System Plus Consulting is specialized in the cost analysis of electronics from semiconductor devices to electronic systems. A complete range of services and costing tools to provide in-depth production cost studies and to estimate the objective selling price of a product is available.

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# TERMS AND CONDITIONS OF SALES

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## 1. INTRODUCTION

The present terms and conditions apply to the offers, sales and deliveries of services managed by System Plus Consulting except in the case of a particular written agreement.

Buyer must note that placing an order means an agreement without any restriction with these terms and conditions.

## 2. PRICES

Prices of the purchased services are those which are in force on the date the order is placed. Prices are in Euros and worked out without taxes. Consequently, the taxes and possible added costs agreed when the order is placed will be charged on these initial prices.

System Plus Consulting may change its prices whenever the company thinks it necessary. However, the company commits itself in invoicing at the prices in force on the date the order is placed.

## 3. REBATES and DISCOUNTS

The quoted prices already include the rebates and discounts that System Plus Consulting could have granted according to the number of orders placed by the Buyer, or other specific conditions. No discount is granted in case of early payment.

## 4. TERMS OF PAYMENT

System Plus Consulting delivered services are to be paid within 30 days end of month by bank transfer except in the case of a particular written agreement.

If the payment does not reach System Plus Consulting on the deadline, the Buyer has to pay System Plus Consulting a penalty for late payment the amount of which is three times the legal interest rate. The legal interest rate is the current one on the delivery date. This penalty is worked out on the unpaid invoice amount, starting from the invoice deadline. This penalty is sent without previous notice.

When payment terms are over 30 days end of month, the Buyer has to pay a deposit which amount is 10% of the total invoice amount when placing his order.

## 5. OWNERSHIP

System Plus Consulting remains sole owner of the delivered services until total payment of the invoice.

## 6. DELIVERIES

The delivery schedule on the purchase order is given for information only and cannot be strictly guaranteed. Consequently any reasonable delay in the delivery of services will not allow the buyer to claim for damages or to cancel the order.

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The transport costs and risks are fully born by the Buyer. Should the customer wish to ensure the goods against lost or damage on the base of their real value, he must imperatively point it out to System Plus Consulting when the shipment takes place. Without any specific requirement, insurance terms for the return of goods will be the carrier current ones (reimbursement based on good weight instead of the real value).

## 8. FORCE MAJEURE

System Plus Consulting responsibility will not be involved in non execution or late delivery of one of its duties described in the current terms and conditions if these are the result of a force majeure case. Therefore, the force majeure includes all external event unpredictable and irresistible as defined by the article 1148 of the French Code Civil?

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As a rule, all information handed by customers to system Plus Consulting are considered as strictly confidential.

A non-disclosure agreement can be signed on demand.

## 10. RESPONSABILITY LIMITATION

The Buyer is responsible for the use and interpretations he makes of the reports delivered by System Plus Consulting. Consequently, System Plus Consulting responsibility can in no case be called into question for any direct or indirect damage, financial or otherwise, that may result from the use of the results of our analysis or results obtained using one of our costing tools.

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Any dispute that may arise about the interpretation or execution of the current terms and conditions shall be resolved applying the French law.

If the dispute cannot be settled out-of-court, the competent Court will be the Tribunal de Commerce de Nantes.