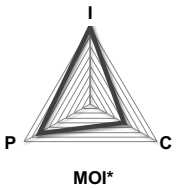
E63 Class, Series B

MPN:

ACB-QCA6391-NI1

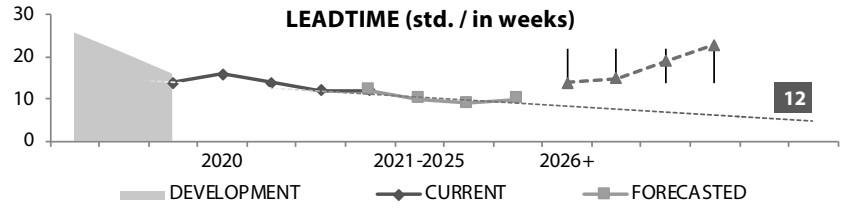
Industrial Grade 1775 Mbps Module, with Dual-Band Simultaneous 802.11ax ac/abgn WLAN via PCIe and Bluetooth 5.2 via HCI UART plus PCM for LE Audio – LGA Embedded SMD Chip-on-Board (CoB) with UFL antenna ports

PCI EXPRESS 63 CLASS



A	A	C	4	4	14 weeks
TECHPOINT	LIFESPOT	VAROD	VERTICALS	DCO	ELT

* Page 2 for key legend. Commercial data refresh: June 2020



based on Qualcomm QCA6391 - Hastings Reference Design

D&B GSA SAM SYSTEM FOR AWARD MANAGEMENT IPC Member ecia ISO 9001 QUALITY ASSURANCE EICC CONFLICT MATERIALS RPT REACH COMPLIANCE RoHS 3 2015/863/EU

PRE-APROVED ANTENNA:

	ANTENNA TYPE	PEAK GAIN	COMPLIANT CUSTOMIZATION
WAPH Series	Internal, PCB Dipole	< 2.5 dBi	Cable length / type / shielding, PCB, labelling, material grade, fine tuning.
WAFH Series	Internal, FPC Dipole	< 3 dBi	Cable length / type / shielding, FPC, labelling, material grade, fine tuning.
WAMF Series	Internal, F-Type PIFA	< 3 dBi	Cable length / type / shielding, PIFA design, labelling, material grade, fine tuning.
WACI Series	Internal, SMT Chip	< 3 dBi	Chip design, identification, material grade, fine tuning.
WAND & WEAD Series	External, PCB Dipole	< 5 dBi	Cable length / type / shielding, PCB, enclosure, identification, material grade, fine tuning.

When indicated: * certified On-Demand † list may vary by domain

Revision History

RELEASES	DATE	NOTES	PREPARED	APPROVED
Version 1.0	2020-02-28	EVT based	A Chen	LTu
Version 1.1	2020-03-27	Cover page and label: visual corrections. Updated ordering information table.	W.O.	LTu
Version 1.2	2020-05-29	Block diagram clarification & enhanced power consumption specifications.	W.O.	LTu
Version 1.3	2020-06-12	Included mechanical placement specifications. Plus, visual adjustments.	W.O.	LTu

* Commercial Key Legend

Indicators that assess the specific product for its position in the technology curve and the supply chain responsiveness it enjoys. They combine an inner-outer view: both from outside factors and from internal corporate and production support.

MOI [Market Orientation Index]	A value calculated from the grading of the factors below. Used as a rule-of-thumb to aid design-in and procurement evaluation. MOI depicts the present product affinity to Innovation (I), Customer Empathy (C) and Price Focus (P).
TECHNOLOGY	High to Low: Advanced (A), Barring (B), Common (C), Dissolving (D)
AGE	Life cycle spot. Early to Late: Agonist (A), Bold (B), Current (C), Distressed (D)
VAROD [Variants On-Demand]	Flexibility in creating variants (Rigid to Flexible): Auxiliary (A), Basic (B), Core (C), Deep (D).
VERTICALS	Applicability in vertical markets: Specialized to a single market (1), to application in multiple verticals (4).
DCO [Design Cost Orientation]	Commodity index related to the cost point for the product's design conception. VALUES: 1 to 4; the higher the number the more cost aware is the core design.
ELT [Effective Lead Time]	Adjusted lead-time in weeks. This is a compound value based on the timeframe for the fulfillment of the 90% of unscheduled orders received accounting also for the industrial lead-time and internal inventory buffering. VALUE: number of ELT weeks.

1. Description

Dual Band Simultaneous 2x2 Wi-Fi 6 CoB: SMD modules that offer a full implementation of the Wi-Fi 6 standard (IEEE 802.11ax). The same wireless processor that is part of the FastConnect 6800 and Networking Pro architectures, the QCA6391 Chipset, is he providing the engineering power of this world leading IC Vendor in a compact solder-down module format.

The E63 Class operates a dual MAC for connections up to 1774.5Mbps data rate (2x2+2x2 11ax DBS). The use of OFDMA and MU-MIMO protocols, both in full UL and DL, effectively doubles the throughput performance and delivers up to 50 percent additional range compared to Wi-Fi 5 devices; even in dense networking environments and with multiple concurrent MU-MIMO links running via a single module.

All the advanced features: empower system design with all the actual advanced features of power-management, Target Wakeup Time (TWT), Multi-BSSID and Multi-TID, Spatial Reuse, 8 Stream Sounding, WPA3 including all optional and additional elements of it, seamless antenna sharing with LTE, LTE-U and 5G, offloading traffic for minimal host utilization also at 11ac/ax speeds, low power PCIe (w/L1 sub-state) interface, integrated close-loop power detector and more. All the wireless modes are supported, also at mixed concurrency (i.e. STA+SAP).

Separate Bluetooth 5.2 on-board: full clock-cycle BT management on an independent antenna chain with all the latest features of BT5.2 and more, like: BLE long range, Enhanced Attributes, LE Audio & Power, Isochronous Channels, dual eSCO and dual A2DP stream-split, ACL support for A2DP true stereo, aptX Adaptive R2 over TWS+, Super Wideband (SWB) Codec, SWB over TWS+, QHS (QC Advanced Channel Coding).

CoB+adaptation, antenna and grade: other than for direct SMT, the E63B Series is available adapted on carriers to form-factors: M.2 E-Key (Series W), M.2 B-Key (Series F) and miniPCIe (Series X). Integration options include choice of antenna connector and operating temperature.

2. Top Features

- True Industrial Grade (-40 ~ +85°C), fully feature Wi-Fi 6 CoB module with flexible antenna configurations.
- A variety of carrier adaptors for easy development or production on different edge connector interfaces.
- Dual Band Simultaneous (DBS) with dual MAC, 2.4Ghz + 5 Ghz wireless connection up to 1775Mbps that supports DL and UL MU-MIMO.
- Separate antenna for fully independent Bluetooth 5.2 on-board, with Enhanced Attributes, LE Audio & Power and Isochronous Channels.
- Full external FEM design with enhanced range, energy and Tx power accuracy; 24dBm aggregate output for WLAN and 19dBm for BT.

3. Specifications

SOLUTION DESIGN	**Chipset**	Qualcomm QCA6391
	Standard	IEEE 802.11ax Wi-Fi 6 plus Bluetooth 5.2 Combo, full backwards compatibility to previous standards
	Industrial Reference	Based on Qualcomm Atheros Hastings reference design
APPEARANCE	**Communications Interface**	LGA-type solder pads: WLAN: via PCI Express Standard 2.1 host I/O BT: via HCI UART and I2S (Virtual-USB mapping at SW level); PCM and I2C are available
	Form Factor	SMD, Chip-on-Board, Soldered, Stamp down, Solder down "SIP type", 2826 (28mm x 26m)
ANTENNA	**Configuration**	WLAN: Two Streams (2 chains), 2x2, 2 Connectors, MU-MIMO BT: One Stream (1 chain), 1x1, 1 Connector
	Type	Three on-board U.FI. connector receptables
WIRELESS PARAMETERS	**Frequency Band**	WLAN: 2.4 GHz ISM Bands 2.412-2.472 GHz, 2.484 GHz 5.15-5.25 GHz (FCC UNII-low band) for US/Canada, Japan and Europe 5.25-5.35 GHz (FCC UNII-middle band) for US/Canada and Europe 5.47-5.725 GHz for Europe 5.725-5.825 GHz (FCC UNII-high band) for US/Canada BT: 2402MHz~2480MHz
	Data Transfer Rates	WLAN: 802.11ax: Up to 1774.5Mbps (dynamic) 802.11ac: Up to 867Mbps (dynamic) 802.11n: Up to 300Mbps (dynamic) 802.11a/g: Up to 54Mbps (dynamic) 802.11b: Up to 11Mbps (dynamic) BT: GFSK at 1Mbp π/4-DQPSK at 2Mpbs 8DPSK at 3Mpbs
	Media Access Control	CSMA/CA with ACK
	Channel	2.4GHz: 1-13 (14 only for Japan) 5GHz: 36-64, 100-165
	Channel Spacing	5MHz, 10MHz, 20 MHz, 40Mhz selectable for 2.4Ghz band. 80Mhz is also available for the 5Ghz band.
	Spreading / Modulation	WLAN: 802.11ax: OFDMA (BPSK, adds 1024-QAM on MCS10 and MCS11) 802.11ac/g/n: OFDM (BPSK, DSSS-OFDM, QPSK,16-QAM,64-QAM, 256-QAM), MRC, STBC, LDPC, ML Demodulation 802.11b: CCK (11, 5.5Mbps), DQPSK (2Mbps), BPSK (1Mbps) BT: GFSK, π/4-DQPSK, 8DPSK

WIRELESS PARAMETERS	**RF Output Power**	802.11b:	22.5 dBm at 11M	±2 dBm	
		802.11g:	20 dBm at 54M	±2 dBm	
		802.11a:	18.5 dBm at 54M	±2 dBm	
		802.11n/ax 2.4G V/HT20	20.5 dBm at MCS0	19 dBm at MCS7	±2dBm
		802.11n/ax 2.4G V/HT40	19 dBm at MCS0	17.5 dBm at MCS7	±2dBm
		802.11ax 2.4G VHT40	17.5 dBm at MCS0	15 dBm at MCS7	±2dBm
		802.11n/ac/ax 5G V/HT20	20.5 dBm at MCS0	19.5 dBm at MCS7	±2dBm
		802.11n/ac/ax 5G V/HT40	19.5 dBm at MCS0	17.5 dBm at MCS7	±2dBm
		802.11ac/ax 5G VHT80	17.5 dBm at MCS0	16.5 dBm at MCS9	±2dBm
		802.11ax 5G VHT80	16.5 dBm at MCS0	15 dBm at MCS11	±2dBm
		• DBm values reflect single RF chain output power performance. Two chain combined output power can be calculated as the single chain output power plus 3dB (2Tx = 1Tx + 3dB). BT: (Class 2 Mode) +2 dBm ≤ Output Power ≤ +6 dBm (Class 1 Mode) +2 dBm ≤ Output Power ≤ +20 dBm			
	RF Receive Sensitivity (Typical, 1x1 chain)	802.11b	11M less than 91 dBm		
		802.11g	54M less than 77 dBm		
		802.11a	54M less than 77 dBm		
		802.11n/ax 2.4G V/HT20	MCS7 less than 77 dBm		95 dBm at MCS0
		802.11n/ax 2.4G V/HT40	MCS7 less than 73.5 dBm		92.5 dBm at MCS0
		802.11ax 2.4G VHT20	MCS9 less than 71.5 dBm, MCS11 less than 64 dBm		94.5 dBm at MCS0
		802.11ax 2.4G VHT40	MCS9 less than 68 dBm, MCS11 less than 62 dBm		92 dBm at MCS0
		802.11n/ac/ax 5G V/HT20	MCS7 less than 77 dBm		95 dBm at MCS0
		802.11n/ac/ax 5G V/HT40	MCS7 less than 74.5 dBm		92.5 dBm at MCS0
		802.11ax 5G V/HT20	MCS9 less than 70 dBm, MCS11 less than 64 dBm		85 dBm at MCS0
		802.11ax 5G V/HT40	MCS9 less than 68 dBm, MCS11 less than 62 dBm		85 dBm at MCS0
		802.11ax 5G V/HT80	MCS9 less than 62 dBm, MCS11 less than 59 dBm		85 dBm at MCS0
		BT: BER < 0.1% (Anritsu 8852B Tx -83Bm)			
	Operating Range	Open Space: ~300 m; Indoor: :~100 m (Coverage vary according to environment, antenna and topography)			
	Wireless Security	WEP 64-bit and 128-bit encryption WPA/WPA2/WPA3 UL/DL (Wi-Fi Protected Access)			
MODALITIES	Infrastructure, AP/STA, Client, Bridge, Mixed-mode, P2P/Ad-hoc				
SAFETY & REGULATORY	Compliant with FCC, CE RED, ISED, Japan TELEC and more. Compliant with RoHS3.				
PROTOCOLS	**IEEE WLAN Network**	802.11ax, 802.11ac, 802.11n, 802.11g, 802.11b, 802.11a, 802.11d, 802.11e, 802.11h, 802.11i, 802.11k, 802.11r, 802.11u, 802.11v and 802.11w.			
	Other Standards				
	Industry Standards				

HOST SYSTEM REQUIREMENTS	**Operating System**	Android/Linux Closed Source, Android/Linux Open Source, Qualcomm Embedded Platform, Windows, MacOS
ENVIRONMENT	**Operating Temperature**	-40° ~ +85° Celsius
	Storage Temperature	-50° ~ +135° Celsius
	Operating Humidity	10%~90% non-condensing
	Storage Humidity	5%~90% non-condensing
ELECTRICAL	**I/O Voltage**	3.3V +/-5%
	Power Consumption	See table below

PROTOCOL	RATE	VOLTAGE	2x2 CTx	2x2 CRx	1x1 CTx	1x1 CRx
802.11b	at 1Mbps	3.3V	667.0 mA	77.5 mA	372.4 mA	60.5 mA
802.11g	at 6Mbps	3.3V	610.0 mA	88.5 mA	340.3 mA	71.4 mA
802.11a	at 6Mbps	3.3V	665.1 mA	94.2 mA	385.5 mA	73.9 mA
802.11n on 2GHz	at HT20, MCS0	3.3V	597.4 mA	87.2 mA	327.1 mA	70.1 mA
802.11n on 5GHz	at HT20, MCS0	3.3V	639.6 mA	119.8 mA	369.8 mA	98.1 mA
802.11ac on 2GHz	at VHT20, MCS7	3.3V	483.0 mA	87.4 mA	274.8 mA	70.4 mA
802.11ac on 5GHz	at VHT40, MCS9	3.3V	611.3 mA	146.1 mA	358.9 mA	118.7 mA
802.11ax on 2GHz	at HE40, MCS11	3.3V	460.5 mA	97.1 mA	286.8 mA	74.6 mA
802.11ax on 5GHz	at HE80, MCS11	3.3V	553.0 mA	164.7 mA	333.1 mA	133.0 mA

- Electronic current values in milliampere. Readings retrieved under stable, typical current and voltage.
- Power consumption ratings are statistical maximums in test system setups which are placed in continuous operating modes.
- Real-life application system power budgets are dependent on traffic mix, environment, topology and domain configuration.

MECHANICAL	**Dimensions**	28mm x 26mm x 2.35mm (with shielding)
	Weight	4.2 g
PACKAGING	**Packing style**	ESD Sleeves in Carton Bulk Package (Optional Tray or Reel Packaging)
	Package Contents	Module only

4. Electrical Characteristics

4.1 Absolute Maximum Ratings

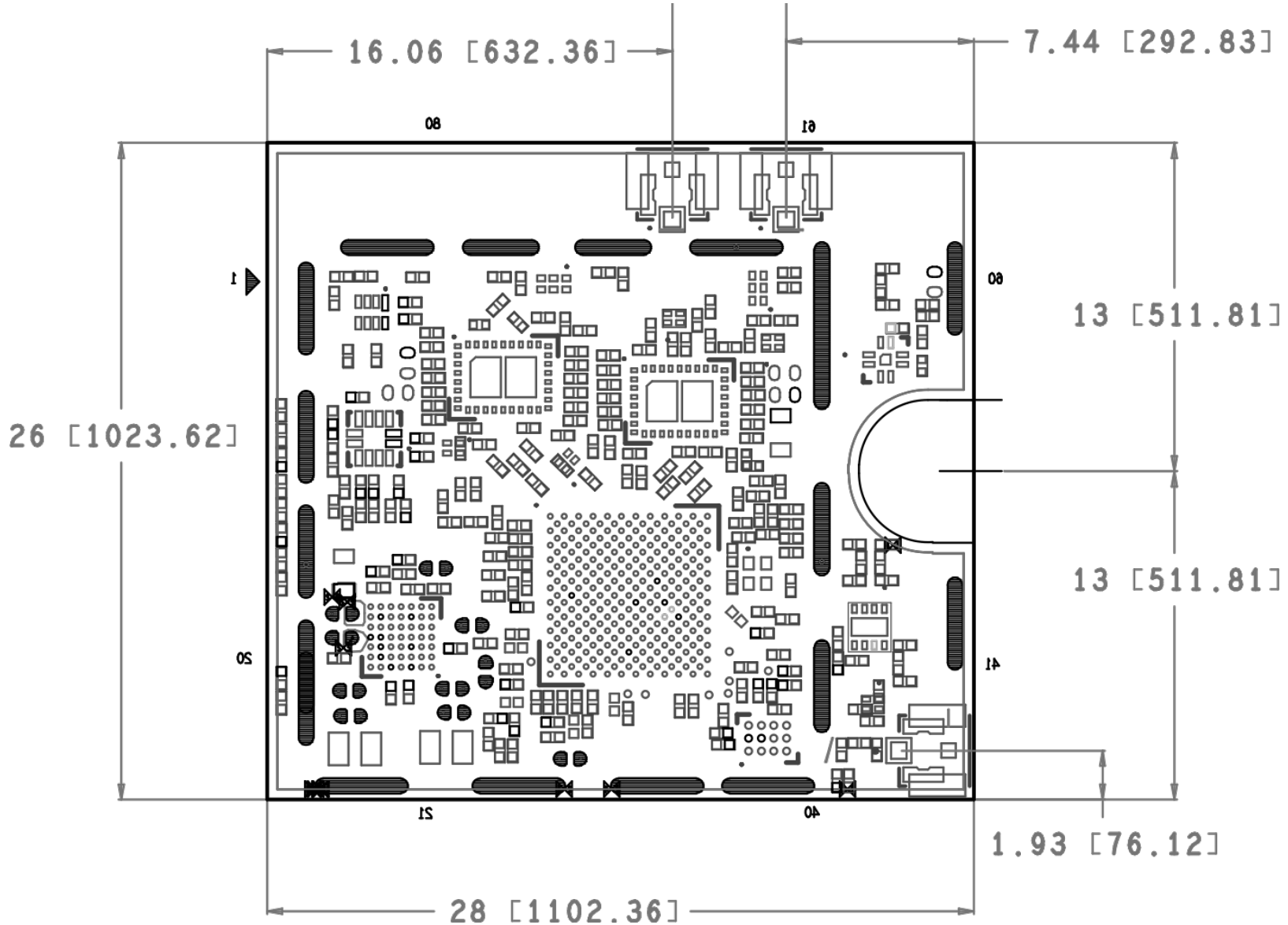
SYMBOL	PARAMETER	MAX. RATING	UNIT
V_{dd33}	Maximum range of I/O supply voltage	3.135~3.465	V
RF_{in}	Maximum RF input (reference to 50 Ω)	+10	dBm
T_{store}	Storage temperature	-50~135	℃

4.2 GPIO Interface Characteristics

See related detailed Pin Mapping and Application Notes documents.

5. Mechanical Drawing

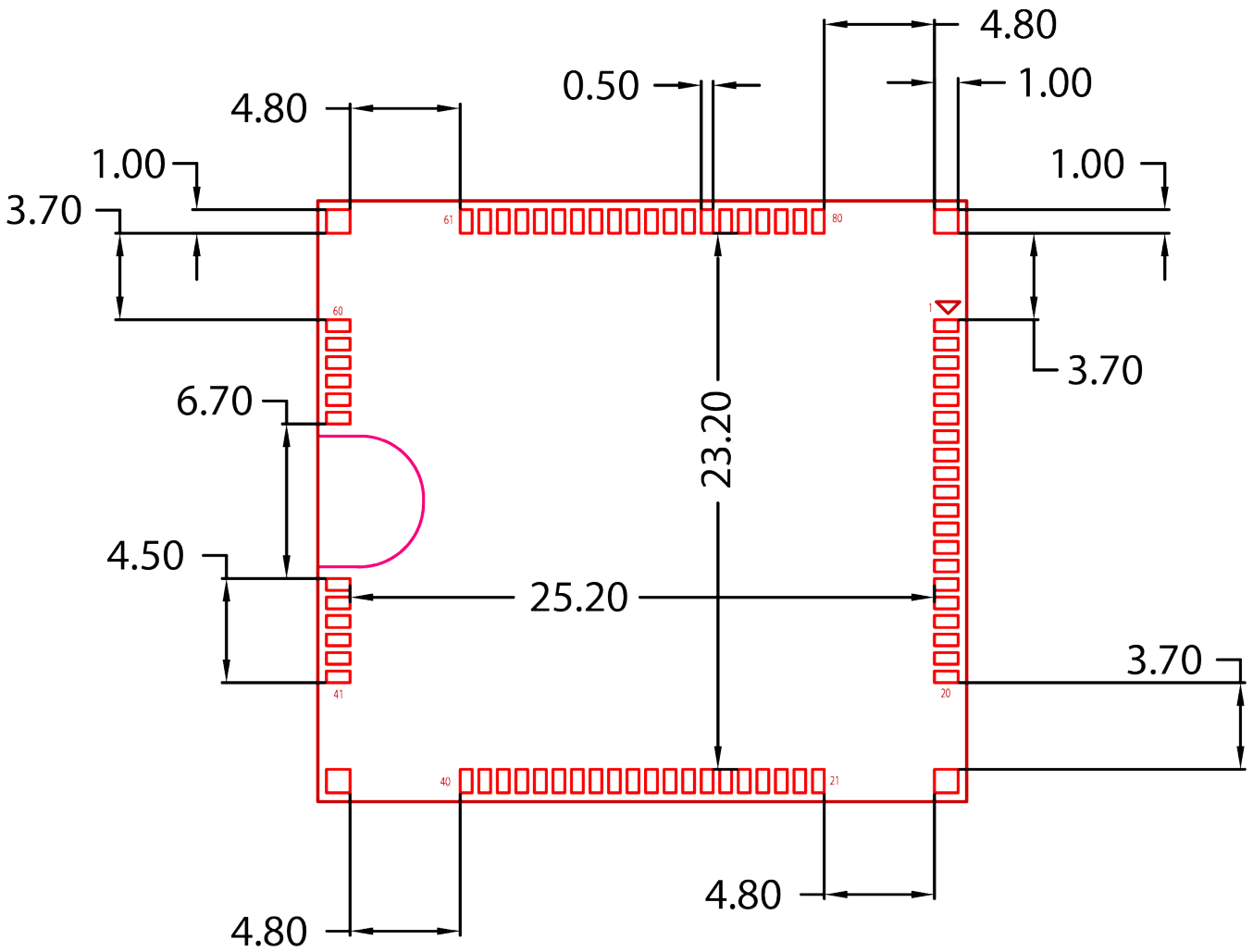
Mechanical drawing in millimetres (mm) and in thousandths of an inch (mil), showing the module's component and shield side (top view):



6. Placement Guidelines

SMD mechanical placement guidelines in millimetres (mm), showing the Land Grid Array (LGA) pads' side (bottom view).

The E63B Series has all its electrical and mechanical connections made through 84 LGA pads, which are positioned in peripheral alignment, including 4 larger electrical ground corner pads.



7. Connector Pin-out definitions

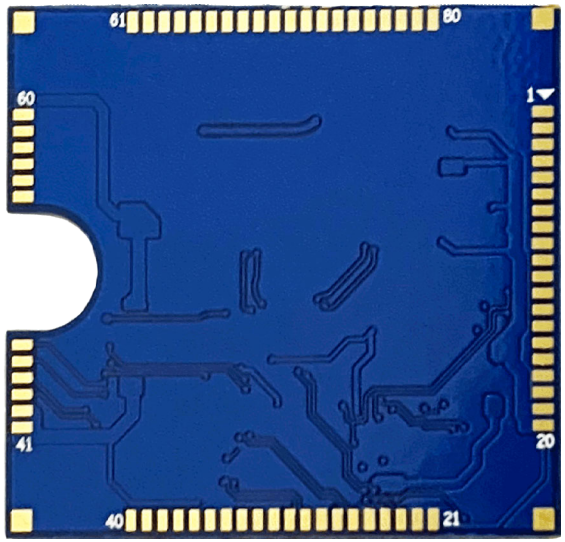
PIN NO.	DEFINITION
PIN 2	PERST0_L
PIN 6	WL_LED_3P3
PIN 7	W_DISABLE1_L
PIN 8	W_DISABLE2_L
PIN 10	BT_LED_3P3
PIN 11	WAKE_BT
PIN 15	WL_DBG_UART_RXD
PIN 16	WL_DBG_UART_TXD
PIN 23	WL_TX_EN
PIN 24	LAA_TX_EN
PIN 26	HST_PCIE_REFCLKN
PIN 27	HST_PCIE_REFCLKP
PIN 29	HST_PCIE_TXN
PIN 30	HST_PCIE_TXP
PIN 32	HST_PCIE_RXN

PIN NO.	DEFINITION
PIN 33	HST_PCIE_RXP
PIN 35	SUSCLK
PIN 36	UART_WAKE_HOST
PIN 37	PEWAKE0_L
PIN 38	CLKREQ0_L
PIN 39	LTE_COEX_RXD
PIN 40	LTE_COEX_TXD
PIN 43	BT_UART_CTS
PIN 44	BT_UART_RTS
PIN 45	BT_UART_RXD
PIN 46	BT_UART_TXD
PIN 56	BT_PCM_SYNC
PIN 57	BT_PCM_IN
PIN 58	BT_PCM_OUT
PIN 59	BT_PCM_CLK

PIN NO.	DEFINITION
1	GND
3	GND
5	GND
9	GND
17	GND
18	GND
19	GND
20	GND
21	GND
22	GND
25	GND
28	GND
31	GND
34	GND
41	GND
42	GND
47	GND
48	GND
49	GND
50	GND
51	GND
52	GND
53	GND
54	GND
55	GND
60-80	GND

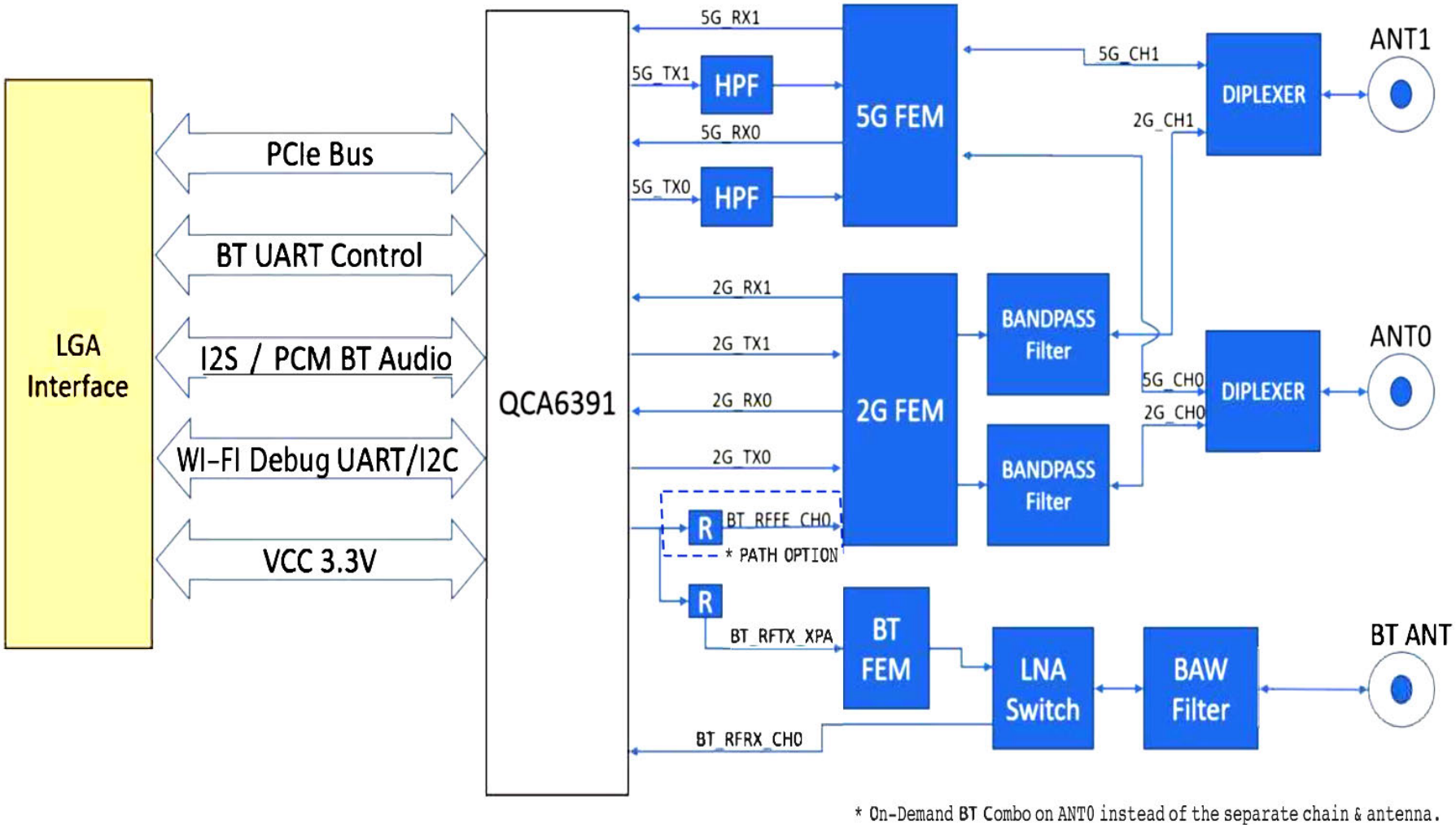
INTERFACE TYPE	BUS SIGNALING	STANDARD
LGA Pads	PCIe	PCIe 2.1
LGA Pads	HCI UART	3.2Mbps
LGA Pads	PCM/I2S/I2C	

*Physical Layer Form-Factor follows standard PCIe definitions. Picture of the bottom side, with pin guidance of the LGA pads, below:



*Pin/Contact Numbers not appearing in the above table are either reserved or unused.

8. Block Diagram



* On-Demand BT Combo on ANT0 instead of the separate chain & antenna.

9. Environmental Performance Qualification

At the time of writing this document, throughput test at controlled thermal conditions are to be scheduled. Any related enquiries can be addressed to your sales / account manager.

10. Standard Domain Code & Identification

The Regulatory Domain pre-programmed as standard is 0x6A [wide open world mode]. Other regulatory domain codes can be pre-programmed on-request at production level. Standard identifiers are based on the Qualcomm reference design:

	VENDOR ID (VID)	SUBSYSTEM VENDOR ID (SVID)	DEVICE ID (DID)	SUBSYSTEM ID (SSID)
STANDARD WLAN	0x17CB	0x17CB	1x01	0x40

11. Product Label

11.1 Front (Shield) Regulatory Label

Standard label is shown here with applicable marking, including some regulatory domain identifiers:

- FCC (USA), ISED (Canada), CE RED (Europe), Japan and EU Safety & Environmental.
- Wireless LAN NIC MAC ID label (human legible and barcode).
- Serial Number label (human legible and barcode) plus Variant Number

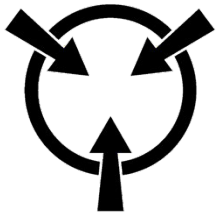
11.2 On-Demand Labelling

Labels and product support materials can be flexibly tailored to OEM/ODM customer's requirements to support practices, target domains and specific markets.

12. ESD Processes

The ACB-QCA6391 constitutes a sensitive electronic device and caution is required when handling it. ESD handling, shipment and storage notices apply. Also see the general Notices Section included in this document.

DO NOT OPEN OR HANDLE EXCEPT AT A STATIC-FREE WORKSTATION



DO NOT SHIP OR STORE NEAR STRONG ELECTROSTATIC, ELECTROMAGNETIC OR RADIOACTIVE FIELDS

13. Packaging, Storage and Handling

ESD Sleeve, Inner Box & Outer Carton level standard packing schematic for retail samples*, follows. Packaging in either matrix tray and tape-and-reel carriers are TBC.

* Packaging modality and artwork can flexibly follow OEM/ODM customer requirements.
** The Packaging modality and the selection of its materials is made with environmental responsibility and commitment to resource preservation. Please reuse and recycle where possible.

	MODULE IN ESD SLEEVE	INNER BOX KIT (K)	MASTER CARTON (M)
CONTENT (UNITS)	1	60	960
INVENTORY SKU	ACB-QCA6391-NI1	ACB-QCA6391-NI1-K	ACB-QCA6391-NI1-M
UPC	812069021595	812069021601	812069021618
OUTER DIMENSIONS	70 x 60 x 3.5 mm	204 x 165 x 65 mm	430 x 350 x 285 mm
GROSS WEIGHT	4.2 gr	310 gr	5.600 gr
PICK & PACK METHOD	Padded envelope or carton box depending on quantity. Padded & separated.	In outer carton packaging.	As-is.
PACKAGING COMPLIANCE **	ANSI/ESD S20.20, IEC 61340-5-1, RoHS3	RoHS3	RoHS3
MOISTURE SENSITIVITY LEVEL (MSL)	IPC/JEDEC J-STD-020: MSL2	IPC/JEDEC J-STD-020: MSL1	IPC/JEDEC J-STD-020: MSL1
HTS CODE (HS)	8517.62	8517.62	8517.62
COUNTRY OF ORIGIN (COO)	158 - Taiwan	158 - Taiwan	158 - Taiwan
NAFTA / ECCN	On request	On request	On request

14. Ordering Information

E63B Series public variant products and related ordering information:

	ORDERING P/N	VARIANT ID	DESCRIPTION	
STANDARD PRODUCT, U.FL CONNECTORS, RETAIL PACK	ACB-QCA6391-NX1	-/A/01	- Standard product - Standard sampling packaging - U.FL / IPEX connectors on-board	
INDUSTRIAL PRODUCT, U.FL CONNECTORS, RETAIL PACK	ACB-QCA6391-NI1	-/B/02	- Standard product - Standard sampling packaging - U.FL / IPEX connectors on-board - Industrial operating temperature	**THIS PRODUCT**
STANDARD PRODUCT, MHF4 CONNECTORS, RETAIL PACK	ACB-QCA6391-NX4	-/C/03	- Standard product - Standard sampling packaging - MHF4 connectors on-board	
INDUSTRIAL PRODUCT, MHF4 CONNECTORS, RETAIL PACK	ACB-QCA6391-NI4	-/D/04	- Standard product - Standard sampling packaging - MHF4 connectors on-board - Industrial operating temperature	

The E63B Series is available adapted on carriers to form-factors: M.2 E-Key (Series W), M.2 B-Key (Series F) and miniPCIe (Series X).

15. Notices

STORAGE: The product shall be stored, and the package shall remain closed according to storage environmental conditions noted within this datasheet. - The product shall be stored in non-corrosive gas (Cl2, NH3, SO2, Nox, etc.). - No excess mechanical shock shall be applied including, but not limited to, sticking the packing materials by sharp object and dropping the product, in order to avoid damaging the packing materials.
SHELVE LIFE: Products left more than two years after reception need to have their specifications confirmed prior to use.
HANDLING: Care in handling or transporting products is required as excessive stress or mechanical shock may break products. – Cracks or damages on products' terminals may lead to changes in their characteristics. Products are not to be touched with bare hands as this may result in electrostatic damage. - Application of static electricity or overvoltage may cause defect in the product or deterioration of its reliability, and caution must be taken against exposure to any static electricity generated by electrified items such as workbenches, soldering irons, tools, carrying containers, etc.
LAND PATTERN & DIMENSIONS: All ground terminals should be connected to the ground patterns. Furthermore, the ground pattern should be provided between IN and OUT terminals. Please refer to the specifications for standard land dimensions.
MECCHANICAL PLACEMENT: When mounting products connected to other components, products may be stressed and broken by uneven forces. To prevent such damages, compliance with specifications for the tools and interfaces being used is required.
CLEANING: As this Product is Moisture Sensitive, no cleaning is permitted.
OPERATIONAL EVNIRONMENTAL CONDITIONS: Products are designed to work as part of electronic compositions under normal environmental conditions (ambient temperature, humidity and pressure). Operation under the following circumstances may damage the products and leakage of electricity and abnormal temperature may occur:
In an atmosphere containing corrosive gasses (Cl2, NH3, SOx, NOx) or combustible / volatile gases - Dusty places – Places of direct sunlight - Water splashing zones - Humid places where water condenses - Freezing places
In the instance of potential operation in such environments, consult with AIRETOS before actual use. Application of static electricity or excessive voltage while assembling and measuring is discouraged as it might be a cause of degradation or destruction.
INPUT POWER CAPACITY: Products shall be used in the input power capacity specified in this datasheet. If components are to be used beyond the documented input power capacity range, prior consultation with VOXMICRO is advised.
LIMITATION OF APPLICATIONS: The product is designed and manufactured for consumer application only and is not available for any application listed below which requires signficanlty high reliability for the prevention of defects that may directly cause damage to the third party's life, body or property.
- Aircraft equipment - Aerospace equipment - Undersea equipment - Power plant control equipment - Medical equipment - Transportation equipment (vehicles, trains, ships, etc.) - Traffic signal equipment - Disaster prevention / crime prevention equipment - Data-processing equipment - Application of similar complexity and/ or reliability requirements to the applications listed in the above.
If the product is to be used in equipment or electric circuit that requires high safety or reliability function / performances, sufficient reliability evaluation check for safety shall be performed prior to commercial shipment and consideration for the installation of a protective circuit at customer's design stage is strongly recommended. Please provide and appropriate fail-safe function on the customer's product to prevent any damages that may be caused by the abnormal function or the failure of our product.
QUALITY CONTROL: Testing and quality control is applied to the extent VOXMICRO deems necessary. Unless mandated by government requirements, VOXMICRO does not necessarily test all parameters of each product.
LIFECYCLE: Please note that VOXMICRO may discontinue the manufacture of products, due to reasons such as end of supply of materials and/or components from our suppliers.
CONFORMITY: Please make sure that your product has been evaluated and confirmed against your specifications when the AIRETOS product is mounted to your product. Please conduct validation and verification of the products in actual condition of mounting and operating environment before commercial shipment of the equipment. All the items and parameters in this product specification have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment agreed upon between you and us. You are requested not to use our product deviating from such agreement. We consider it not appropriate to include other terms and conditions for transaction warranty in product specifications, drawings or other technical documents. Therefore, even if your original part of this product specification includes such terms and conditions as warranty clause, product liability clause, or intellectual property infringement liability clause, we are not able to accept such terms and conditions in this product specification unless they are based on the governmental regulation or what we have agreed otherwise in a separate contact. We would like to suggest that you propose to discuss them under negotiation of contract.

DISCLAIMER: Please note that the only warranty that provides regarding the products is its conformance to the specifications provided herein. Accordingly, VOXMICRO shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification.
VOXMICRO HEREBY DISCLAIMS ALL OTHER WARRANTIES REGARDING THE PRODUCTS, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, THAT THEY ARE DEFECT-FREE, OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. YOU AGREE TO INDEMNIFY AND DEFEND VOXMICRO AND ITS AFFILIATES AGAINST ALL CLAIMS, DAMAGES, COSTS, AND EXPENSES THAT MAY BE INCURRED, INCLUDING WITHOUT LIMITATION, ATTORNEY FEES AND COSTS, DUE TO THE USE OF PRODUCTS.
VOXMICRO's liability under this warranty shall be limited to products that are returned during the warranty period to the address designated by VOXMICRO and that are determined by VOXMICRO not to conform to such warranty. If VOXMICRO elects to repair or replace such products, AIRETOS shall have reasonable time to repair such products or provide replacements. Repaired products shall be warranted for the remainder of the original warranty period. Replaced products shall be warranted for a new full warranty period.
For avoidance of doubt, VOXMICRO shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than VOXMICRO including improper installation or testing, or for any products that have been altered or modified in any way by an entity other than VOXMICRO. Moreover, VOXMICRO shall not be liable for any defects that result from your or third party's design, specifications or instructions for such products.

VOXMICRO PROFILE

Distributed Locations & Customer-Centric Operations

Quality processes at all stages

Sourcing Assurance

Application / Custom / ODM

Materials Management

Supply Chain

FAE

R&D → **DESIGN** → **PRODUCTION** → **DISTRIBUTION** → **TQM**

5%
OF REVENUE
• **INVESTED IN INNOVATION R&D**

10 YEARS
HANDS-ON IN
• **OEM/ODM WIRELESS MODULE MARKET**

DECADES OF
• **CUMMILATIVE ENGINEERING EXPERIENCE**

HUNDREDS OF
• **ROUTINE INDUSTRIAL CUSTOMERS**

THOUSANDS OF
• **TUNING HOURS YEARLY**

MILLIONS OF
• **INTERNAL AND EXTERNAL INVESTMENTS**