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**IRIS411 LICENSE AGREEMENT**

**BETWEEN**

**ACP ADVANCED CIRCUIT PURSUIT AG**

**AND**

**LEADCORE TECHNOLOGY CO., LTD.**

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LICENSE AGREEMENT

This IRIS411 License Agreement (“License”)is made and entered into by and between ACP

Advanced Circuit Pursuit AG，a Swiss corporation, with offices at Zwischenweg 2, CH-8702 Zollikon, Switzerland (“ACP”)，and Leadcore Technology Co” Ltd., a China corporation, with offices at No. 1258，MingYue Road, PuDong New District Shanghai，201206, P. R. China (’’Leadcore11)，and shall be *deemed* effective as of May 20th, 2015 (“Effective Date”). ACP and Leadcore hereinafter are also individually referred to as “Party” and collectively as “Parties”.

WHEREAS, ACP is a company specialized in the development and marketing of radio frequency integrated circuits **(“RF”** or **6fiRFIC5)** for cellular communications of most common wireless standards;

WHEREAS, Leadcore is a company specialized in the development and marketing of baseband integrated circuits (“BBIC”)and application processors for wireless communications as part of one or more of Leadcore’s baseband solutions as defined more particularly below;

WHEREAS, Leadcore and ACP have signed a Definitive Agreement with an effective date of December 1, 2012 (“Definitive Agreement”)，regarding certain enumerated items therein including, pursuant to the terms agreed to as specified therein, the conclusion of development by ACP of its proprietary IRIS411 product and agreement thereafter to negotiate on fair and reasonable business terms a non-exclusive license for the IRIS411 to Leadcore for Leadcore5 s integration of the IRIS411 into a Leadcore LTE platform;

WHEREAS，each Party hereto is agreeable to entering into an agreement further expanding upon the Definitive Agreement for the IRIS411 on the terms and conditions as set out in this License; and

WHEREAS, in furtherance of the Definitive Agreement, the Parties now desire to conclude a License for the ACP proprietary IRIS411 product, in accordance with terms set forth herein;

NOW THEREFORE, THE PARTIES HERETO AGREE AS FOLLOWS:

Article 1 — Definitions

Whenever capitalized in this License:

1. “ACP Logo” shall mean the ACP company name as well as any and all ACP registered and common law trademarks, brands, logos and letterheads on product documentation and promotional materials.
2. “ACP Product” shall mean the ACP proprietary RF CMOS transceiver product currently referenced as the “IRIS411”，developed by and proprietary to ACP, for use in 2G, 3G and 4G technologies GSM, GPRS，EDGE，TD-SCDMA，WCDMA and LTE.

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1. **“Claim”** has the meaning set forth in Article 5.2 of this License.
2. **“Definitive Agreement”** shall mean those legally binding documents executed by both Parties each with an effective date of December 1，2012.
3. **“Disclosing Party”** shall have the meaning set forth in Article 3.1 of this License.
4. **“Effective Date”** shall have the meaning set forth in the first paragraph of this License.
5. **“Fatal Event”** shall have the meaning set forth in Article 2.5.3 of this License.
6. **“Force Majeure”** shall be understood to mean and include damage or delay caused by acts or regulations or decrees of any Government (de facto or de jure)，natural phenomena such as earthquakes and floods，fires，riots, wars, shipwrecks, freight embargoes or other causes, whether similar or dissimilar to those enumerated above, unforeseeable and beyond the reasonable control of the Parties and which prevent the total or partial carrying out of any obligation under this License.
7. **“Intellectual Property Rights”** and **“IPR”** shall mean patents (including issued patents, patent applications, reissues, divisions, continuations and extensions thereof), utility models， design rights, pattern generation and other database rights，copyrights, rights in computer programs, trade secrets and any other form of intellectual property right protection afforded by law to inventions, derivations, translations, adaptations, representations, technical information, and applications thereof for the entire world and for the duration of time these rights are protected,
8. **“ERIS411** Licensed Product” shall mean the ACP Product currently referenced as the IRIS411, which Leadcore has had manufactured，packaged and tested by the ACP designated Manufacturer and which is offered for sale in combination with one or more Leadcore LTE Platforms under the license grant pursuant to Article 2.1.
9. **“IRIS411 Minimums Amount”** shall have the meaning set forth in Article 2.4 of this License.
10. **“IRIS411 Minimums Period”** shall have the meaning set forth in Article 2.4 of this License.
11. **“Leadcore LTE** Platform(s)^ shall mean one or more mobile platforms supporting second generation (2G) cellular communication standards GSM, GPRS and EDGE, third generation (3G) cellular communication standards TD-SCDMA/HSPA or WCDMA/HSPA, and fourth generation (4G) cellular communication standards TDD LTE and FDD LTE and which consists primarily of one or more Leadcore proprietary Baseband Integrated Circuits (BBICs) and necessary system and driver software, and may include one or more Power Management Integrated Circuits (PMICs). An initial list of Leadcore LTE Platforms is attached as Appendix 1，to which future additional Leadcore LTE Platforms maybe added over time.

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1. **“Leadcore(HK)”** shall mean the wholly owned subsidiary of Leadcore known as Leadcore Technology (Hong Kong) Co. Ltd.，with offices at Room 1404，14/F” World Commerce Centre，Harbour City，7-11 Canton Road，Tsimshatsui，Kowloon, Hong Kong.
2. “License” shall have the meaning set forth in the first paragraph of this License Agreement.
3. **“Licensed Product”** shall mean the IRIS411 Licensed Product
4. **“Manufacturer”** shall mean either individually or collectively，those third party entities designated by ACP from time to time which Leadcore shall use in the manufacturing of the ACP Products pursuant to Article 2.1 (License Grant) and Article 4 (Confidentiality) and shall include without limitation the ACP designated (a) foundry, (b) assembly and packaging company, and (c) company performing final testing of the packaged ACP Product,
5. **“Party”** or **“Parties”** shall have the meaning set forth in the first paragraph of this License.
6. “Recipient” shall have the meaning set forth in Article 4.1 of this License.
7. **“RF”** or **“RFIC”** shall have the meaning set forth in the second paragraph of this License.

Article 2 - **License** Grant and Obligations

1. License Grant. Subject to the terms of this License and during the term hereof，and further based on the cooperation between the Parties and in consideration of Leadcore having issued binding purchase orders to ACP for a total aggregate quantity of 5,000,000 units of IRIS411 under the conditions set forth in Article 8.2.2 of the Definitive Agreement for the grant of the license hereunder，and in consideration of Leadcore completing its payment obligations pursuant to those issued binding purchase orders as more fully set forth in Article 2.2 below， ACP hereby grants Leadcore a non-exclusive worldwide right and license, to have manufactured (by the ACP designated Manufacturer), market, have marketed, sell，have sold, distribute and have distributed the ACP Product but only under the ACP Logo and only in combination, each，with a Leadcore LTE Platform. The Parties each acknowledge and understand that Leadcore may use Leadcore(HK) for certain rights granted and obligations required under the license granted in this Article 2.1. For the avoidance of doubt, ACP and Leadcore each agree that Leadcore may use Leadcore(HK) for certain marketing, selling, and distribution activities hereunder，*provided, however,* that Leadcore remain primarily responsible for all actions and inactions on the part of Leadcore(HK) under this License including, without limitation，the handling of ACP Confidential Information and all payment and reporting requirements.
2. The right to have manufactured the ACP Product under Article 2 **J** shall be conditional upon the timely payment by Leadcore of any and all outstanding invoices for issued binding IRIS411 purchase orders placed (pursuant to the Definitive Agreement) between January 1, 2015 and the Effective Date (the “Outstanding Invoices”). Leadcore understands and agrees that upon execution of this License, ACP will be advancing current Leadcore business opportunities even though the payment for each of those individual Outstanding Invoices may

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not yet have been paid in full by the Effective Date because under individual Outstanding Invoices，the payment might not yet be due\* By executing this License，Leadcore acknowledges and agrees that Leadcore is obligated to and shall timely pay when due each Outstanding Invoice in order to meet the minimum IRIS411 purchase requirement under the Definitive Agreement, which is a pre-condition for the Article 2,1 (License Grant) herein. The Parties therefore agree that in addition to any and all rights and remedies given to ACP under Article 8 herein, ACP shall have the unilateral right to immediately terminate this License including, without limitation, Article 2.1 (License Grant), in the event Leadcore does not timely and fully meet its payment obligations under the Outstanding Invoices.

1. Royalties, Leadcore shall pay a royalty to ACP for each Licensed Product sold by Leadcore per the schedules immediately below. The Parties understand and agree that the amount of royalty otherwise owing on any returns of those Licensed Product for which royalties have accrued but have not yet been paid shall be deducted from the royalty payable for the applicable reporting period. The amount of royalty on returns，if any，for those Licensed Product for which royalties have already been paid by Leadcore to ACP under this License shall be credited against future royalty payment for the subsequent reporting period. Any deductions and/or credits shall be fully documented in the reports provided to ACP pursuant to Article 2.6 below.

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| Over 1 up to 5,000,000 | 0.18 |
| 5,000,001 and above | 0.15 |

1. IRIS411 Minimums. Leadcore agrees that within one (1) year of the Effective Date of the License (hereafter，the “IRIS411 Minimums Period’’)，Leadcore shall pay ACP a minimum royalty equal to USS 1,000,000 for the aggregate sales of the IRIS411 Licensed Product (hereafter, respectively, the **“IRIS411 Minimums Amount”).** In case of a failure by Leadcore to meet the IRIS411 Minimums Amount within the IRIS411 Minimums Period, Leadcore shall pay ACP a penalty charge equal to the amount in US dollars not met for minimums which were otherwise required as set forth in this Article 2.4, or ACP shall have the unilateral right, in its sole discretion, to increase the royalty rate for aJl ACP products either licensed to Leadcore pursuant to Article 2.1 (to wit，the IRIS411)，or otherwise purchased or licensed by Leadcore, by as much as US$ 0,05 per unit for outstanding and subsequent units sold until such time as the full outstanding value of the IRIS411 Minimums Amount owed to ACP has been paid in full. Orders placed after the IRIS411 Minimums Period ends may be subject to the higher charge until such time as the IRIS411 Minimums Amount (e.g., US$ 1,000,000) is paid in full. For avoidance of doubt, IRIS411 units sold by Leadcore(HK) shall be included in the tally of IRIS411 units sold by Leadcore for purposes of calculating whether the IRIS411 Minimums Amount has been met.

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1. pbligation to Use JCP Designated Manufacturer and to Pay for Mask Set.
2. Subject to the terms and conditions set forth in this License, Leadcore’s right to have manufactured the ACP Product under Article 2.1 shall be subject to Leadcore using the ACP designated Manufacturer and paying directly to ACP USS 300,000 for the right to use, non-exclusively, the production mask set designated as Product ID 6391 (PID 6391), ACP shall retain ownership of any and all rights in and to the PID 6391 mask set, including the right to make copies thereof Leadcore agrees, by signing this License，to abide by all such terms stated herein, including ownership of PID 6391 mask set by ACP and all underlying intellectual property, as more fully set forth in Article 4.
3. The Parties each agree that as between the Parties, Leadcore shall have the responsibility to negotiate production capacity with the ACP designated Manufacturer. In furtherance hereof and as part of Article 2.1 (License Grant), ACP shall set up，at no additional cost，three testers at the ACP designated Manufacturer for final production testing of IRIS41L For each additional tester (that is，in addition, to the original three) setup by or on behalf of ACP pursuant to this License，Leadcore shall pay directly to ACP US$ 50,000 each time for setting up each additional tester as part of any capacity expansion which Leadcore may negotiate with the ACP designated Manufacturer during the term of this License.
4. Subject to the foregoing Article 2.5.1，as well as to the terms and conditions set forth in this License，in the event ACP were to suffer or permit the appointment of a receiver for its business assets or avail itself or become subject to any proceedings under bankruptcy laws or any other laws relating to insolvency or protection of the rights of creditors，or become subject to an order of dissolution, ACP agrees that as of the effective date of such an event (a “Fatal Event”)，Leadcore would thereafter have the right to use the PID 6391 mask set for the express and limited purpose of continuing the manufacture of Licensed Product by the ACP designated Manufacturer, *but only to the extent* that Leadcore remains in full compliance with each and every term of each of the executed agreements between Leadcore and ACP including, without limitation，the Definitive Agreement (including the agreements referenced therein) and this License, and specifically including, without limitation, those provisions herein requiring full compliance with any and all obligations concerning timely payment of royalties，respecting ownership of the ACP intellectual property and no reverse engineering of any ACP products, including the ACP Product.
5. Reporting and Payments. Within fifteen (15) days of the end of each calendar month (e.g.s within 15 days of January 31，and so forth) during the term of this License and once within fifteen (15) days of termination pursuant to Article 8.2, Leadcore shall provide to ACP each of the following:
6. a written report for the said calendar month stating the following:
7. number of wafer starts,

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1. number of fab-outs，wafer and final test yields,
2. the number of IRJS411 Licensed Products shipped by Leadcore,
3. the number of IRIS411 Licensed Products, returned by customers, if any，and
4. a three-month rolling sales forecast for the IRIS411 Licensed Product,
5. a written statement itemizing all royalties required hereunder for Licensed Product(s) identified in the foregoing report, and
6. payment for all royalties due along with a copy of bank remittance of the actual payment for the said royalties. For the avoidance of doubt, Leadcore shall bear all banking cfiarges associated with remitting the payment，including the charges levied by the beneficiary’s bank.

The said report, royalty statement and bank remittance copy (electronic scan) shall be dispatched by electronic mail delivery to an electronic address to be designated in writing by ACP from time to time. The said royalties due shall be remitted by international bank transfer to an account of ACP to be designated in writing by ACP from time to time. For the purpose of this License the date of the report in this Article *2.6* is that on the sender’s time-stamp of the said electronic mail and the date of royalty payment is the date on the said copy of bank remittance. Further, for the purpose of this License, the date of Licensed Product(s) being shipped or sold is the date of the pickup notice by the express or other dispatch services from the (production) final test facilities of the ACP designated Manufacturer therefor.

Without prejudicing either Party's right to seek remedies from the other Party under other clauses of this License, the Parties expressly agree that the only conditions governing royalty payment are those defined in Article 2.3 herein and this Article 2.6, which are strictly separate from any other claims including without limitation those over indemnity，product maturity and/or reliability, dissatisfaction of support, customer returns，breach of confidentiality, nonconformance of performance specifications or outcome of Leadcore characterization of Licensed Product(s) as well as from any demands for performance improvement beyond those described in the performance specifications or data sheets from Leadcore or its customers. Leadcore hereby expressly agrees that shipment of Licensed Product(s) from the Manufacturer (for purposes of clarity, from the ACP designated *company for final testing)* is the only condition triggering royalty payment and it shall not withhold either reporting of or payment for the said shipment(s) by alleging breach of either the spirit or the letters of the other clauses of this License.

Leadcore shall pay ACP penalties for delays in reporting and payment according to the schedule below, wherein any delays of a fraction of a month shall be deemed as a full month under “each month farther”：

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| Delay in fulfilling one or more of the following obligations under Article 2.6 (a): (iii), (iv), (v)，  Article 2.6 (b) and Article 2.6 (c) | Penalty payable |

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| Up to 1 month | 5000 US$ |
| Each month further | 5000US$ |

1. Taxes. Leadcore agrees to the following practice and procedure regarding responsibility for and payment of taxes under this License:
2. All charges hereunder are gross amounts but exclusive of any value added tax (VAT) or analogous tax only,
3. If the transactions as described in this License are subject to any applicable VAT or analogous tax, ACP shall provide Leadcore with a valid invoice that complies with local tax regulations and which specifically states this tax. Provided ACP has stated the VAT or analogous tax (as identified above) on the applicable invoice，Leadcore will pay to ACP the VAT or analogous tax properly chargeable in respect of that payment. Leadcore reserves the right to withhold payment of any VAT or analogous tax to ACP until ACP has provided Leadcore with a valid invoice which states such tax. Where Leadcore believes that any of its royalty payment or any other payment to ACP should be free of VAT obligations, Leadcore shall so notify ACP before making the corresponding product shipment, and provide justifications therefor under applicable tax rules. In case of doubt it is incumbent upon Leadcore to seek clarification from the relevant tax authorities. If ACP has incorrectly determined the amount of VAT chargeable to Leadcore despite such notification and contrary to the clarification and guidance from the tax authorities, then the invoice shall be corrected and (i) where Leadcore has overpaid any amount，ACP will repay this amount plus interest to Leadcore and (ii) where Leadcore has paid less than the correct amount, Leadcore shall pay the outstanding amount to ACP upon receipt of a valid invoice.
4. Leadcore shall not deduct withholding income tax from its royalty payments to ACP on behalf of the Chinese tax authorities, *unless and until* Leadcore first provides ACP with the following:
5. objective written proof, in the form of an official government “tax bill” from the Chinese government specifying the amount owed by ACP to the Chinese government referencing at minimum both:
6. the applicable Chinese tax regulations and/or laws on which such tax bill is based， and
7. the reason under applicable Chinese law why the amount is owed principally by ACP and not Leadcore itself，and
8. objective written proof，in the form of an official government “receipt of tax paid” from the Chinese government specifying the amount paid by Leadcore on behalf of ACP to the Chinese government for the tax allegedly owed by ACP.

Thereafter, ACP shall have thirty (30) days to provide written objection to Leadcore regarding Leadcore’s intent to deduct withholding income tax from the current royalty payment owed to ACP. Upon receipt of written objection, Leadcore shall not deduct such withholding income tax from the royalty payment unless and until the matter is resolved between the Parties. Under all circumstances，Leadcore shall timely pay ACP each royalty payment when due. If no written objection is made, Leadcore may deduct the exact amount as specified on

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both the ^ax bill” and “receipt of tax paid” from the current royalty payment owed to ACP. Leadcore shall also provide annually a year-end receipt and report from the applicable Chinese tax authorities of all withholding tax deducted under this Article 2.7(c) for the applicable calendar year on or before January 31st of the following calendar year.

1. Audits. Leadcore agrees to the following practice and procedure regarding audits under this License:
2. ACP shall have the right，during normal business hours and upon at least ten (10) days prior written notice，to appoint a Firm of certified public accountants，subject to confidentiality obligations, to inspect the particular Leadcore，Leadcore(HK)? or subcontractor facilities and audit the specific Leadcore records, including without limitation computer databases，relating to Leadcore’s calculation and payment of the royalties due to ACP under Articles 2.3 and 2.6 in order to verify that Leadcore has paid to ACP the correct royalty amounts owed under this License. Only the findings of the auditor as laid down in a written audit report will be provided to ACP with copy to Leadcore. The audit will be conducted at ACP?s expense, unless the audit reveals that Leadcore has underpaid the amounts owed to ACP by two percent (2%) or more in any calendar month, in which case Leadcore will reimburse ACP for all reasonable costs and expenses incurred by ACP in connection with such audit. Leadcore will promptly pay to ACP any amounts shown by any such audit to be owing plus interest; provided，however, that Leadcore retains its legal right to later bring a legal or equitable action disputing the results of such audits.
3. Such audits will be conducted no more than once in any period of twelve consecutive months if previous audits uncovered no underpayments\*
4. Each time an underpayment is reported, ACP shall be entitled，but not obliged, to conduct two audits in the subsequent twelve (12) months at Leadcore5 s cost,
5. Press Release. ACP and Leadcore agree to issue a joint press release announcing Leadcore’s inclusion of the ACP Product into mobile platforms based on the Leadcore LIE Platforms. The timing and content of this press release is to be agreed upon by both Leadcore and ACP, but not later than ten (10) calendar days after the signing of this License，and shall not contradict the Shanghai Stock Exchange requirements for public announcements of “Listed Companies” (publicly traded) in the People’s Republic of China.
6. Branding. Leadcore agrees that the ACP Product will be offered for sale and sold only as incorporated onto one or more of the Leadcore LTE Platforms identified on Appendix 1 hereto. Each ACP Product as sold by Leadcore will be branded with the ACP Logo. Leadcore agrees not to alter the ACP Logo, including ACP letter heads in technical documentation and promotional materials. All use by Leadcore of the ACP Logo and all goodwill associated with such ACP Logo shall inure solely to ACP,
7. Leadcore will use reasonable commercial efforts to promote and sell the Licensed Product

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Article 3 — Confidentiality

1. “Confidential Information” shall mean proprietary and confidential information of a Party, whether in tangible or intangible form, that is disclosed by such Party (the “Disclosing Party”)to the other party (“Recipient”)pursuant to this License\* The Parties each agree that information disclosed by the Disclosing Party need not be marked “eonfidentiai” to be considered Confidential Information, but that any information specifically marked as “confidential” shall be treated as Confidential Information. By way of example, Confidential Information includes, without limitation, any information，technical data, or know-how

' considered proprietary by the Disclosing Party including, but not limited to, the Disclosing Party’s research，products, product roadmaps, wafers, samples，microchips, pattern generation database，substrate design and database，PCB (Printed Circuit Board) design and database， test specifications，formulae, software, evaluation platform and control software thereof, evaluation boards and control software thereof，reference design and control software thereof, manual and/or automated procedures for device or product testing, services, development, inventions, processes, specifications, data sheets, designs, drawings, diagrams, engineering, marketing, techniques, documentation, customer information, pricing information, procedures，data, concepts, financial, marketing, sales，manufacturing, operational, strategic planning, budgeting and other information disclosed by the Disclosing Party to Recipient, as well as information and material generated by the Recipient that contains, reflects or is derived from Confidential Information of the Disclosing Party, including but not limited to mask works produced from ACP’s design and pattern generation database(s), measurement results of manufactured integrated circuits in wafer, chip or other form from the said mask works and analyses and assessments thereof，evaluation, reference，and support/control printed circuit boards produced or reproduced based on Disclosing Party’s source information, as well as evaluation platforms incorporating the said boards and control software thereof. The disclosure maybe directly or indirectly in writing, orally, by inspection or by access.

1. Each Party covenants and agrees that it will use the Confidential Information that it receives from the other Party only as provided herein，and shall not disclose such Confidential Information to any person or persons who do not need to have knowledge of such Confidential Information in the course of their employment with it, or in the case of contractors，in the course of performance of their contract with it, without the prior written consent of the Disclosing Party. Each Party shall use the same degree of care to protect such Confidential Information as it employs with respect to its own confidential and proprietary information of like nature, and at a minimum to exercise at all times a reasonable degree of care. The obligations of confidentiality and restrictions on use of Confidential Information based on or related to the ACP Product under this Article 3 shall remain in force perpetually.
2. Exceptions. Confidential Information shall not include any information that:
3. is already in the public domain at the time it was disclosed or subsequently enters the public domain through no fault of the Recipient;
4. is known to Recipient or in its possession (as shown by tangible evidence) prior to receipt;

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1. is independently developed by Recipient; or
2. is received by Recipient, on a non-confidential basis，from a third party，without breach of this License (or any other fully executed agreement between the Parties) by Recipient
3. Nothing in this License shall prevent the Recipient from disclosing Confidential Information to the extent the Recipient is legally compelled to do so by any governmental investigative agency or judicial body pursuant to proceedings over which such agency or body has jurisdiction; provided，however, that prior to any such disclosure, the Recipient shall (a) assert the confidential nature of the Confidential Information to the agency; (b) promptly nottfy the Disclosing Party in writing of the agency5 s order or request to disclose; and (c) reasonably cooperate with the Disclosing Party in protecting against any such disclosure and/or obtaining a protective order narrowing the scope of the compelled disclosure and protecting its confidentiality\*
4. Leadcore shall furthermore have the right to disclose, on a strict need-to-know basis, such Confidential Information to its subcontractors, customers and partners as is required to execute Leadcore’s rights under Article *2A* but without prejudice to the protection afforded to ACP Confidential Information under this License. Leadcore agrees not to disclose ACP Confidential Information to any third parties, except those third parties who need to know the Confidential Information expressly and solely in furtherance of Leadcore5s rights under Article 2.1 and who have signed a confidentiality agreement with Leadcore in a form acceptable to ACP and at a minimum containing provisions similar to this Article 3 before any disclosure of Confidential Information is made by Leadcore to such third party. Leadcore shall be fully liable to ACP for any action or inaction on the part of any such third party that receives ACP Confidential Information pursuant to the provisions of this Article 3.5.
5. Upon request of the Disclosing Party, the Recipient shall，save for such number of copies as reasonably necessary for archiving and customer support purposes, return all data, documents，samples, information, equipment, printed circuit boards, evaluation platforms and control software thereof obtained directly or indirectly from the Disclosing Party.
6. Mo Reverse Engineering，Under no circumstances will either Party directly or indirectly reverse engineer, dissemble, or decompile the Confidential Information of the other Party， nor will any Party to this License (or any third party subcontractor agreement) attempt to examine or copy, in whole or in part, any of the underlying circuits or algorithms of the said Confidential Information including, without limitation, the ACP Product, without the express written consent of the Party owning or controlling said Confidential Information.

Article 4 - Intellectual Property Rights (TPR)

1. The Parties shall retain exclusive worldwide right，title and interest in and to their respective IPR. Nothing in this License is intended to give Leadcore, or any third party, any right of ownership with respect to the Intellectual Property Rights in or to the ACP Product，the ACP Logos or the production mask set for the ACP Product

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1. Except as expressly provided in this License，no license under any patents，copyrights， trademarks, trade secrets or any other IPRs，express or implied，is granted by ACP to Leadcore hereunder.

Article 5 - Indemnity

1. ACP warrants and represents that the ACP Products will not infringe any third party issued patent in the People’s Republic of China.
2. ACP shall defend Leadcore，at its expense against any claim，suit or proceedings alleging that the ACP Products or any portion thereof infringe any third party issued patent in the People’s Republic of China (hereinafter, a **“Claim”).**
3. ACP will hold harmless Leadcore，and ACP shall pay all costs and damages (including reasonable attorney fees) arising out of or, resulting from any Claim, but only to the extent damages are awarded in any such suit or any settlement is reached with respect thereto, and then only up to the amount set forth in Article 5.4 below and further provided that ACP is notified by Leadcore promptly in writing of the Claim，and at ACFs request is given control of the defense and any settlement of any Claim, and is given all requested reasonable assistance for defense of same by Leadcore. Leadcore shall pay for any attorney fees Leadcore incurs after ACP assumes the defense.
4. Notwithstanding any other provision of this License, the foregoing provisions of this Article 5 constitute the *exclusive* obligation and liability of both Parties arising out of any actual or alleged infringement pursuant to Article 5，1. No other indemnities are expressly or implicitly granted. In no event shall either Party’s aggregate costs for the defense and indemnity liability under this Article 5 exceed five-hundred thousand US dollars (USS 500,000).

Article 6 — Limitation of Liability

1. **EXCEPT FOR LIABILITY ARISING UNDER ARTICLES 3 OR 5, NEITHER PARTY SHALL HAVE ANY LIABILITY FOR INCIDENTAL, CONSEQUENTIAL, INDIRECT, SPECIAL OR PUNITIVE DAMAGES OR LIABILITIES OF ANY KIND OR FOR LOSS OF REVENUE, LOSS OF BUSINESS OR OTHER FINANCIAL LOSS ARISING OUT OF ORIN CONNECTION WITH THIS AGREEMENT, REGARD­LESS OF THE FORM OF THE ACTION, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT PRODUCT LIABILITY OR OTHERWISE, EVEN IF ANY REPRESENTATIVE OF A PARTY HERETO HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE PARTIES AGREE THAT THESE LIMITATIONS SHALL APPLY EVEN IF ANY LIMITED REMEDY SPE­CIFIED HEREIN IS FOUND TO HAVE FAILED OF ITS ESSENTIAL PURPOSE.**
2. **EXCEPT AS EXPRESSLY PROVIDED IN THIS AGREEMENT, ACP MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY FOR MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

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Article 7 - Warranty

1. ACP will use reasonable efforts to achieve generally the performance targeted for the ACP Product as set forth in Appendix 2 hereto. Because such performance may be significantly affected by the PCB layout and the choice and quality of the requisite external components when mounted on an evaluation board and/or inserted in a socket and/ or otherwise incorporated in a customer product, the targeted performance specifications are substantially based on the ACP Product in its original package and measured when mounted on ACP evaluation boards with requisite external components using ACP recommended settings or programming sequences.
2. Both Parties shall use reasonable efforts to optimize the combined settings and driver software of both the ACP Product and corresponding Leadcore LTE Platform so that each of the resulting Licensed Products achieves certification by the Chinese MIIT for use in at least one Chinese cellular wireless network.

Article 8 - Duration/Termination

1. This License will continue for a period of four (4) years from the Effective Date and shall thereafter automatically be renewed and extended indefinitely for additional periods of one (1) year each, unless either Party gives the other Party at least twelve (12) months prior written notice of its intention not to have the License so renewed.
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|  |  |
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| Signature: |  |
| Date: | no人i 7mv |
| Name: | )~  Dr. Oiuting Huang |
| Function: | CEO |
| Signature: |  |
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Name: Dr. Qian Guoliang

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LIST OF APPENDICES

1. Leadcore LTE Platform⑻
2. IRIS411 Performance Specifications - ACP CONFIDENTIAL

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Appendix 1: Leadcore LTE Platforms

LC17XX Series

LC18XX Series

LC19XX Series

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**Appendix *2:*** IRIS411 Performance Specifications - ACP CONFIDENTIAL

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IRIS411 Specifications

*Appendix 2 to IRIS411 License Agreement Between ACP and Leadcore Technologies*

RELEASE DATE CONFIDENTIALITY RELEASE NOTES

**April 20, 2015**

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Contains target specifications. Data are subject to change.

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IRIS411 - LTE-Enabled Multi Mode RF Transceiver

Provisional Specifications

***IRIS411***

*LTE^VCDMA/TD-SCDMA/HSPA/EDGE/GPRS/GSM RF Transceiver for User Equipment*

***Features***

* Single-chip RF transceiver for LTE***I*** E- UTRA FDD and TDD with 17 RF inputs and 8 RF outputs
* Support for WCDMA/HSPA co-banded in FDD bands, HSDPA up to 64-QAM and HSUPA up to 16-QAM and beyond
* Support for TD-SCDMA/TD-HSPA co­banded in TDD bands, TD-HSDPA up to 64-QAM and TD-HSUPA up to 16- QAM and beyond
* S叩port for quad-band GSM, GRPS, f and EDGE
* No interstage SAW filters required for LTE FDD / WCDMA Rx and Tx paths
* No SAW filters required for LTE TDD / TD-SCDMA Rx and Tx paths
* No SAW filters required for GSM/GPRS/EDGE Tx path
* Support for GPRS/EDGE up to class 39 and GGE PA ramping
* Fully integrated frequency synthesis, complete with loop filter
* On-chip 26MHz DCXO
* Support for AFC of 19.2, 26, 38.4, or 52MHz off-chip TCXO by AFCDAC
* Includes two Rx ADCs, Tx DAC, digital front-ends, and auxiliary ADC
* Integrated LDO linear regulators
* MIPI RFFE control interface, 12 GPOs
* Serial peripheral control interface
* DigRF v1.12 interface for GGE
* DigRF v4 control and data interface (LS, HS1x, two Rx lanes)

***Applications***

User equipment such as mobile phones and data modems for 4G (E-UTRA), 3G (UTRA) and 2G (GGE) in E-UTRA bands 1-14,17-21, 23-25,33-41.

***General Description***

IR1S411 is a single-chip RF transceiver for LTE/E-UTRA FDDZTDD applications (4G). It also provides WCDMA/TD-SCDMA (3G) and GSM/GPRS/EDGE (2G) legacy support.

In the 4G and 3G modes, high sensitivity, low EVM, and high linearity are among the receivers salient features that secure best-in­class performance for QPSK, 16-QAM as well as 64-QAM, lending itself well to higher data throughput that is in growing demand by smart phones and data modems. For 4G/3G TDD, it enables a unique SAW-less configu­ration to remove both the cost and sensitivity loss of Rx SAW filters. For 4G/3G FDD, IRIS411 requires no interstage SAW filters in the receive paths, altogether enabling an unprecedented integration level and low complexity for the 4G/3G RF subsystem.

The transmitter offers low EVM to support 16-QAM for high throughput, and keeps spurious emissions low to relieve the RF sub system equally of the SAW filters commonly found in 4G/3G transmitters. In GSM/EDGE mode, the receiver excels in low noise figure and high linearity. The transmitter offers high spectral purity that again enables tough spurious emission requirements to be met without interstage SAW filters.

IRIS411 caters favorably to advanced multi-mode multi-band RF subsystems by offering a total of 17 RF inputs and 8 RF outputs. Putting IRIS411 at the center of a sophisticated RF subsystem enables a very compact PCB footprint as it comes fully integrated with synthesizers, Rx ADCs, a Tx DAG, a DCXO, LDO regulators, a MIPI RFFE control interface, and a high-speed DigRF v4 control and data interface.

*Ordering Information*

|  |  |
| --- | --- |
| TYPE NUMBER PACKAGE | |
| NAME | DESCRIPTION |
| IRIS411 VFBGA | Very thin-proftle Fine-pitch Ball Grid Array, 169 balls, 7x7x1 mm |
| *Zwischenweg 2, 8702 Zollikonr Switzerland, Tel ^41 44 390* 36 *14, Fax +41 44 390* 36 *34* | |

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Provisional Specifications

***Contents***

1. TD-SCDMAZHSDPA Receive Mode 7
2. WCDMA/HSPA Receive Mode 8

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Ir^insnAit l^flode\*«\*，▼>\*¥■\*■¥«■囑■■\*«■，《\*■，■■，■■■■»，■»■■■■■■<■■<■鼉■■■鼉■龜《暑«\*4>\*衊《«\*■«■■&\*■\*■■■ •■«\*\*»■»■»

* 1. WCDMA/HSUPA Transmit Mode 10
  2. TDD/FDD LTE Transmit Mode 11

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Provisional Specifications

***1. Block Diagram***

TXLOWGSM

Figure 1: IRIS411 block diagram (Supply Pins Omitted)

**RXAHI1**

**RXAHI2**

**RXAHJ3**

**RXAH14**

**RXAHI5**

KALOW1

**XAL0W2**

**XALOW3**

**XALOW4**

**RXAHI6**

**RXAHI7**

RESETN

SPl

DIGRFEN

RXDATA1P

RXDATA1N

RX0ATA2P

RXDATA2N

TXDATAP

TXDATAN

RXIXOATA

RXTXEN

GPO

SCLK

SDATA

AUXCLKOUT

XIN

VCTRL

SYSCLKEN

SYSCLKOUT

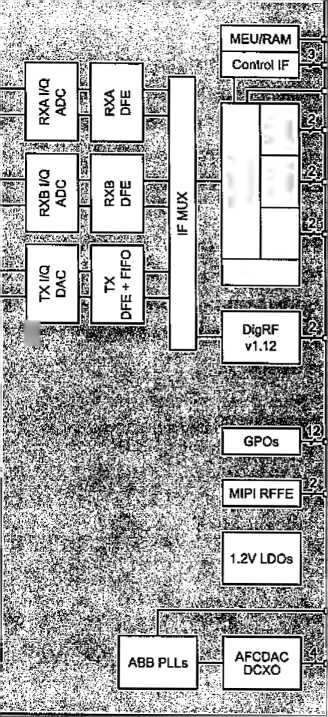
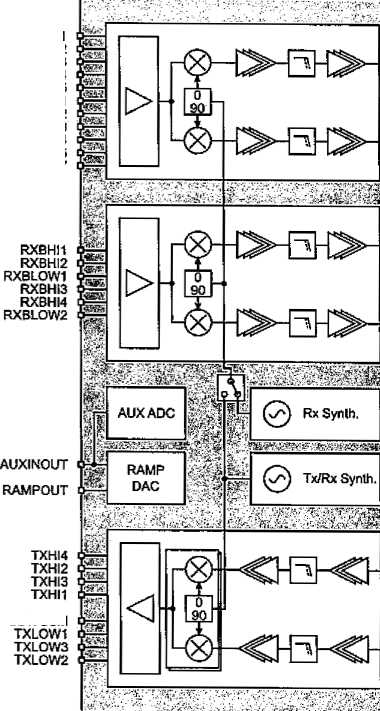
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| --- | --- |
| **DigRF v4**  **Protocol** | **M.TX**  **Uanel** |
| **M-TX**  **Lane 2** |
| 1 |
| **V4PLL** | |

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***2. Pin Assignment***

I

NAME PIN DESCRIPTION

NAME PIN DESCRIPTION

|  |  |
| --- | --- |
| RXBL0W1 | A1 |
| RXBHI2 | A2 |
| RXBHI1 | *A3* |

RXAHI7

RXAHI6

RXAL0W4

RXAL0W3

RXAL0W2

RXALOW1

RXAHI5

RXAHI4

RXAHI3

RXAHI2

RXBHI3

RXAH11

RXBHI4

NC

RAMPOUT

VDD3RS

0 12 3 3 50 1 A4A5A6A7A8A9A1A1A1A1B1B1C1C3C1C1

|  |  |
| --- | --- |
| RXBL0W2 | D1 |
| NC | D3 |
| LDORSIN | D11 |
| TXHI4 | D13 |
| NC | E3 |
| VIO | E11 |
| TXHI2 | E13 |
| SPIDIO | F1 |
| NC | F2 |
| NC | F3 |
| SDATA | F11 |
| TXHI3 | F13 |
| NC | G1 |
| NC | G2 |
| NC | G3 |
| SCLK | G11 |
| TXHI1 | G13 |
| NC | H1 |
| NC | H2 |
| NC | H3 |
| RXTXEN | H11 |
| TXLOWGSM | H13 |
| VDD3INTF | *J1* |
| SPICLK | J2 |
| NC | J3 |
| AUXINOUT | J11 |
| TXL0W1 |  |

Rx input low band Rx input high band FDD/TDD Rx input high band FDD/TDD

Rx i叩ut high band TDD Rx input high band TDD Rx input low band Rx input low band Rx input low band Rx input low band Rx input high band FDD Rx i叩ut high band FDD Rx i叩ut high band FDD Rx input high band FDD Rx input high band FDD/TDD

Rx input high band FDD

Rx input high band

FDD/TDD

Not connected

GSM PA ramp signal from

Ramp DAC

2.85V supply for Rx

synthesizer

Rx input low band

Not connected

Rx synthesizer LDO input

(1.6V)

Tx output (>2.3GHz)

Not connected MIPI RFFE supply (s叩plied from internally or externally) Tx output high band SPI data signal {DigRF v1.12 protocol)

Not connected

Not connected

MIPt RFFE data

Tx output high band

Not connected

Not connected

Not connected

MIPI RFFE clock

Tx output high band

Not connected

Not connected

Not connected

DigRF v1.12 enable signal

Tx output low band GSM

2.85V supply

SPI clock signal (DigRF

vl.12 protocol)

Not connected Input to Aux ADC / auxiliary output from Ramp DAC Tx output low band

LDODIGIN

NC

NC

NC

TXLOW3

VCTRL

AUXCLKOUT

K1K2K3K1K1L1L2

GPO[11]

GPO[10]

GPO[8]

GPO[6]

GPO[4]

GPQP]

GPO[0]

SPIEN

RESETN

TXLOW2

XIN

SYSCLKOUT

RXTXDATA

NC

GPO[9]

GPO[7]

GPO[5]

GPO[3]

GPO[1]

SYSCLKEN

VDD3TS

VDDD

VDDIO

RXDATA2P

RXDATA2N

RXDATA1P

RXDATA1N

TXDATAP

IXDATAN

NC

DIGRFEN

LDOTSIN

LDOMAININ

LDOTXIN

L3L4L5L6L7L8L9L1L1L1M

234567891 MMM M MMM M M

MN

2

*N*

N3

N5N6

N7

8

N

o 1 2 3 9 11 41 1 N N N NN

2.85V supply for digital LDO and MIPI RFFE LDO Not connected Not connected Not connected Tx output low band Control voltage for VCTCXO

Auxiliary clock output (19.2MHz, 26MHz,

38.4MHz, 52MHz, 30.72MHz)

GPO data GPO data GPO data GPO data- GPO data GPO data GPO data

SPI enable signal (DigRF v!.12 protocol)

Global reset (active-low)

Tx output tow band Crystal input or system dock input System clock output DigRF v1.12 data Not connected GPO data GPO data GPO data GPO data GPO data

Enable the system clock output SYSCLKOUT 2.85V supply for Tx synthesizer

Digital core 1.2V supply (supplied from internally) Digital I/O 1.2V-1.8V supply (supplied from externally) DigRF v4 Rx2 interface positive node DigRF v4 Rx2 interface negative node DtgRF v4 Rx1 interface positive node DigRF v4 Rx1 interface negative node DigRF v4 Tx interface positive node DigRF v4Tx interface negative node Not connected DigRF v4 enable signal Tx synthesizer LDO input (1.6V)

Main LDO input (1.6V)

Tx LDO input (16V)

All other pins: Global ground or dedicated ground

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***2*** 3

**5 6**

**6 9 10 11 12 13**

RXBLOW1 RXBKI2 RXBHI1 RXAHI7 RXAH16 RXALOW4 RXALOW3 RXALOW2 RXALOW1 RXAHIS RXAHI4 RXAHI3

•曇響馨馨

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RXBHI3 GND

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GND NC

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GND NC

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GND GKD NC

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SPJDIO NC NC

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NC NC NC

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RXAHI2

RXBHI3 GND GND GND GND GND GND GND GND GND GND GND

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GND RAMPOUT VDD3RS GND

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GND GND VIO GND

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GND GND SDATA GND

0 0 3 0

GND GND SLK GND

0 0 3 0

RXBHI4 GND NC GND GND GND GND GND GND RAMPOUT VDD3RS GND GND

RXBLOW2 GND NC GND GND GND GND GND GND GND LDORSIN GND

GND GND NC GND GND GND GND GND GND GND VIO GND

SHDIO NC NC GNDIO GND GND GND GND GND GND SDATA GND

NC NC NC GND GND GND GND GND GND GND SLK GND

o

GND

o

NC NC NC GNDtO GND GND GND GND GND

TXHI4

TXHI2

TXHI3

TXHI1

GND RXTXEN GND TXLOWGSM

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VDD3INTF SPICLK NC GND GND GND GND GND GND GND AUXINOUT GND TXLOW1

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| • | **o** | o | o | O | O | O | o | O | o | • | o | e |
| LDODIGIN | NC | NC | GNDD | GNDIO | GND | GND | GNDIO | GND | GND | NC | GND | TXL0W3 |
| • | o | o | o | o | o | o | o | o | o | o | o | 馨 |
| VCTRL | AUXCLK  QLJJ | GP0[1l] GPO[10] | | GP0[81 | GPO问 | GP0[4] | GP0[2] | GPO[0] | SPIEN | RESETN | GND | TXL0W2 |
| o | C) | **o** | **3** | **o** | **o** | **o** | **3** | **3** | **3** | **o** | o | 壽 |
| XIN | SYSCLK  oin | RXTXDATA | NC | GP0[9] | GP0|7] | GP015] | G 尸 Op] | GP0[1] | SYSCLKEN | WD3TS | GND | GND |
| o |  | **o** | o | **3** | **o** | **o** | **3** | **o** | o | • | o | o |
| VDDD | VDDIO | RXDATA2P RXDATA2N RXDATA1P RXDATA1N TXDATAP | | | | | ™atan | NC | DIGRFEN LDOTSIN LDOMAININ LOOTXIN | | | |
| • | • | **o** | **3** | **O** | **3** |  | **3** | o | **□** | 參 | • | • |

S叩plies and LDO LR inputs Reference clock

Ground and not connected Digital

RF

Analog

Figure 2: Pin configuration (top view).

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***3. AC ElecMcal Characteristics***

*Receiver*

General condition, unless otherwise noted: 1.5V < Vlooin 3.0V, 2.7V 5 Vdds^ 3.0V, 1.14V < Vddio 彡 2.0V, -3O"C Tamb 彡 85'C. Typical values are at Vldoin = 1.6V, Vdd3 = 2.85V, Vddio = 1.8V, Tamb = 25°C. Minimum and maximum numbers apply to all frequency channels and include variations over process, voltage and temperature. AH

parameters are referred to the input of the Rx matching network, and apply to one Rx output (RXA/RXB).

1. ***GSM/GPRS/EDGE Receive Mode***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PARAMETER | SYM. | CONDITION | MIN. | TYP, | MAX, | UNIT |
| 1, Overall Characteristics | | | | | | |
| Receive frequency range |  | GSM-850 | 869 |  | 894 | MHz |
|  |  | GSM-900 | 925 |  | 960 |  |
|  |  | DCS 1800 | 1805 |  | '1880 |  |
|  |  | PCS WOO | 1930 |  | 1990 |  |
| Noise Figure | NF | Tamb = +25deg |  | 3 |  | dB |
| Error vector magnitude | EVMo, | GMSK rms phase error |  | 2 |  | deg |

8-PSK rms EVM 2.5

2. Gain and PGC Characteristics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Max. voltage gain | GRrx叩ax | Tami> ==-+25，，C | 94 | dB |
| Min. voltage gain | Grx.min | 丁amb =•十25 C | 5 | dB |
| 3. Baseband Characteristics | | | | |
| Channel selectivity of adjacent | BBse| | of 0.2MHz offset GMSK signal | 1 | dB |
| signals |  | of 0.4MHz offset GMSK signal | 38 |  |
|  |  | of 0.6MHz offset GMSK signal | 50 |  |
|  |  | of 0.6MHz offset CW signal | 60 |  |
| 4. Rx Synthesizer Characteristics | | | | |
| Synthesizer switching time | Tsyn.rx |  | 100 | ys |

1. ***TD-SCDMA/HSDPA Receive Mode***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PARAMETER | SYM. | CONDITION | MIN. | TYP. | MAX. | UNIT |
| 1. Overall Characteristics | | | | | | |
| Receive frequency range | frx | Bands 34(F), 39(A) and 40(E) | 1880 |  | 2400 | MHz |
| Noise figure | NF | Tamt. = +25\*C <Band A/E/F) |  | 3.8 |  | dB |
| Error vector magnitude | EVMrx | QPSK signal at Pin = -60dBm |  | 4 |  | % |
| ***2,*** Gain and PGC Characteristics | | | | | | |
| Max. voltage gain | Grxfmax | to one IZQ output, Tamb =+25°C |  | 94 |  | dB |
| Min. voltage gain | G(x；min | to one l/Q output, Tamb =+25°C |  | 5 |  | dB |
| 3. Rx Synthesizer Characteristics | | | | | | |
| Synthesizer switching time | Tsyn.rx |  |  | 100 |  | US |
|  | | | | | | |

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Provisional Spec珩cations

1. ***WCDMA/HSPA Receive Mode***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PARAMETER | SYM. | CONDITION | MIN. | TYP. | MAX. | UNIT |
| •L Overall Characteristics | | | | | | |
| Receive frequency range | fee | band 1 (high band) | 2112.4 |  | 2167.6 | MHz |
| (center frequency) |  | band 2 (high band) | 1932.4 |  | 1987.6 |  |
|  |  | band 3 (high band) | 1807.4 |  | 1877.6 |  |
|  |  | band 4 (high band) | 2112.4 |  | 2152.6 |  |
|  |  | band 5 (low band) | 871‘4 |  | 891.6 |  |
|  |  | band 6 (low band) | 877.4 |  | 882.6 |  |
|  |  | band 8 (low band) | 927.4 |  | 957.6 |  |
|  |  | band 9 (high band) | 1847.4 |  | 1877.4 |  |
|  |  | band 10 {high band) | 2112.4 |  | 2167.6 |  |
|  |  | support of further bands is not precluded |  |  |  |  |
| Noise figure | NF | Tamb ~ +25° C |  | 3.5 |  | dB |
| Error vector magnitude | EVMW | QPSK signal at Pin = -60dBm |  | 4 |  | % |

2. Gain and PGC Characteristics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Max. voltage gain | G ,x,max | to one l/Q output, Tamb =+25\*C | 94 | dB |
| Min, voltage gain | Grx.min | to one l/Q output, Tam& =+25°C | 5 | dB |
| 3. Rx Synthesizer Characteristics | | | | |
| Synthesizer switching time | Tsyn.rx |  | 100 | ps |

|  |  |
| --- | --- |
| ***3.4 LTE FDD/TDD Receive Mode*** | |
| PARAMETER SYM. CONDITION | MIN. TYP. MAX. UNIT |

1. Overall Characteristics

|  |  |  |  |
| --- | --- | --- | --- |
| Receive frequency range frx  (band limits according to 3GPP definitions in TS 36.101) | high bands >2.3GHz:  FDD: 7  TDD: 38, 40, 41 | 2300 | 2690 MHz |
|  | high bands <2.2GHz:  FDD： 1,2, 3, 4, 9, 10,11,21,  23, 24, 25  TDD: 33, 34, 35, 36, 37, 39 | 1805 | 2200 |
|  | low bands:  FDD; 5, 6, 8,12, 13,14,17,  18, 19, 20  TDD: not applicable | 728 | 960 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Noise figure | NF | Tamb = +25flC | 3.9 | dB |
| Error vector magnitude | EVMrx | QPSK signal at Pin = -60dBm | 4 | % |
| 2. Gain and PGC Characteristics | | | | |
| Max. voltage gain | Grx,max | to one 1/Q output, Tamb =+25°C | 94 | dB |
| Min. voltage gain | Gwtmin | to one l/Q output, Tamb =+25°C | 5 | dB |
| 3. Rx Synthesizer Characteristics | | | | |
| Synthesizer switching time | T syn,rx |  | 100 | PS |
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*Transmitter*

General condition, unless otherwise noted: 1.5V < Vldoin 3.0V, 2.7V < Vdd3^ 3.0V, 1.14V Vddio^ 2.0V, -30BC 彡丁amb 彡 85°C, Typical values are at Vldoin = 1.6V, Vdo3 = 2.85V, Vddio = 1 -SV, Tamb = 25°C. Minimum and maximum numbers apply to all frequency channels and include variations over process, voltage and temperature.

* 1. ***GSM/GPRS/EDGE Transmit Mode***

PARAMETER SYM. CONDITION ' MIN. TYP. MAX. UNIT

1. General Characteristics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Transmit frequency range | ftx | low band, GSM850 | 824 | 849 MHz |
|  |  | low band, GSM900 | 880 | 915 |
|  |  | high band, DCS | 1710 | 1785 |
|  |  | high band, PCS | 1850 | 1910 |

2. GMSK Mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GMSK mode output power | PoutGMSK | | 2 | dBm |
| Modulation spectrum | ModSp | at 200kHz, in 30kHz BW | -35 | dBc |
| measurement in 30 kHz resolution BW around the carrier frequency |  | at 250kHz, in 30kHz BW | -40 |  |
|  | at 400kHz, in 30kHz BW | -62 |  |
|  | 600kHz-1.8MHz, in 30kHz BW | -65 |  |
| Modulation accuracy | ModAcc | phase error rms | 2,5 | - |
|  |  | phase error peak | 10 |  |
| 3. PSK Mode | | | | |
| Maximum output power | PoutMax |  | 0 | dBm |
| Modulation spectrum measurement in 30 kHz resolution BW around the carrier frequency | ModSp | at 200kHz, in 30kHz  at 250kHz, in 30kHz | -35  -40 | dBc |
|  | at 400kHz, in 30kHz | -60 |  |
|  |  | 600kHz-1.8MHz, in 30kHz | -63 |  |
| Modulation accuracy | EVMrms | RMSEVM | 3.5 | % |
| 4. Tx Synthesizer Characteristics | | | | |
| Sythesizer settling time | TsynTx | arbitrary frequency step | 100 | ps |

* 1. ***TDSCDMA Transmit Mode***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PARAMETER | SYM, | CONDITION | MIN. | TYP. | MAX. | UNIT |
| 1. Overall Characteristics | | | | | | |
| Transmit frequency range | ftx | Bands 34(F), 39(A) and 40(E) | 1880 |  | 2400 | MHz |
| Maximum output power | P 賦 max |  |  | 0,5 |  | dBm |
| Adjacent channel leakage ratio | ACLR | Pout =-40dBm..0.5dBm |  | -43 |  | dBc |
| at ±1.6MHz |  | Pout <-40dBm |  | -80 |  | dBm |
| Alternate channel leakage ratio at ± 3.2MHz offeet | AltCLR | Pout = -30dBm .. 0.5dBm |  | -60 |  | dBc |
|  | Pout< -30dBm |  | -80 |  | dBm |
| Error vector magnitude | EVMtx | Pout = -37dBm .. Pout,max |  | 4 |  | % |
| ***2.*** Gain and PGC Characteristics | | | | | | |
| Programmable gain range | GRtx |  |  | 85 |  | dB |

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|  |  |  |  |
| --- | --- | --- | --- |
| Programmable gain step resolution | GStx | 0.125 | dB |
| 3. Baseband Characteristics | | | |
| BB filter passband edge | fc | 1,33 | MHz |
| BB filter stop-band attenuation | fin = 5.12MHz | 25 | dB |
| 4. Tx Synthesizer Characteristics | | | |
| Synthesizer switching time | Tayn,tx | 100 |  |

* 1. ***WCDMA/HSUPA Transmit Mode***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PARAMETER | SYM. | CONDITION | MIN. | TYP. | MAX. | UNIT |
| 1. Overall Characteristics | | | | | | |
| Transmit frequency range | ftx | band 1 | 1922.4 |  | 1977.6 | MHz |
| (center frequency) |  | band 2 | 1852.4 |  | 1907.6 |  |
|  |  | band 3 | 1712.4 |  | 1782.6 |  |
|  |  | band 4 | 1712.4 |  | 1752.6 |  |
|  |  | band 5 | 826.4 |  | 846.6 |  |
|  |  | band 6 | 832.4 |  | 837.6 |  |
|  |  | band 8 | 882.4 |  | 912.6 |  |
|  |  | band 9 | 1752.4 |  | 1782.4 |  |
|  |  | band 10 ! | 1712.4 |  | 1767.6 |  |
| Maximum output power | P out,max |  |  | 0.5 |  | dBm |
| Adjacent channel leakage ratio | ACLR | Pout =-40dBm„0.5dBm |  | -43 |  | dBc |
| at +5MHz |  | Pout <-40dBm |  | -80 |  | dBm |
| Alternate channel leakage ratio at± 10MHz offset | AltCLR | Pout = -40dBm .. 0.5dBm |  | -60 |  | dBc |
|  | Pout < -40dBm |  | -80 |  | dBm |
| Error vector magnitude | EVMtx | Pout = -37dBm .. Pout,max |  | 4 |  | % |
| ***2.*** Gain and PGC Characteristics | | | | | | |
| Programmable gain range | GRtx |  |  | 85 |  | dB |
| Programmable gain step | GStx |  |  | 0.125 |  | dB |

resolution

3. Baseband Characteristics

|  |  |  |
| --- | --- | --- |
| BB filter passband edge fc | 2.5 | MHz |
| BB filter stop-band attenuation fin = 20MHz | 50 | dB |
| 4. Tx Synthesizer Characteristics | | |
| Synthesizer switching time Tsyn，tx | 100 | ps |

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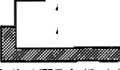
* 1. ***TDD/FDD LTE Transmit Mode***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PARAMETER | SYM. | CONDITION | MIN. | TYP. | MAX, | UNIT |
| 1. Overall Characteristics | | | | | | |
| Transmit frequency range {band limits according to 3GPP definitions in TS 36.101) | fix | high bands >2,3GHz:  FDD: 7  TDD: 38, 40, 41 | 2300 |  | 2690 | MHz |
|  |  | high bands <2.2GHz:  FDD: 1,2, 3, 4, 9, 10, 11,21,  23, 24, 25  TDD: 33, 34, 35, 36, 37, 39 | 1710 |  | 2025 |  |
|  |  | low bands:  FDD: 5, 6, 8,12, 13,14,17,  18, 19,20 | 699 |  | 915 |  |
| Maximum output power | P 賦 max |  |  | 0.5 |  | dBm |
| Adjacent channel leakage ratio at ±20MHz | ACLR | Pout =-40dBm..0.5dBnn  Pout <-40dBm |  | -80 |  | dBc  dBm |
| Alternate channel leakage ratio | AltCLR | Pout = -35dBm .. 0.5dBm |  | -45 |  | dBc |
| at 土 40MHz offset |  | Pout < -35dBm |  | -80 |  | dBm |
| Error vector magnitude | EVMu | Pout = -37dBm .. Pout,max |  | 4 |  | % |

2. Gain and PGC Characteristics

|  |  |  |  |
| --- | --- | --- | --- |
| Programmable gain range | GRtx | 85 | dB |
| Programmable gain step resolution | GStx | .0.125 | dB |
| 3. Bstseband Characteristics | | | |
| BB fitter passband edge | fc | 12,5 | MHz |
| BB filter stop—band attenuation | fin = 25MHz | 25 | dB |
| 4. Tx Synthesizer Characteristics | | | |
| Synthesizer switching time | Tsyn.lx | 100 | ps |

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***4. Package Outline***

SEATING PLANE

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1 2 3 4 5 6 7 8 9 10 11 12 13

BOTTOM VIEW

Figure 3: VFBGA169, Very thin-profile Fine-pitch Ball Grid Array, 169 balls, 7x7x1 mm

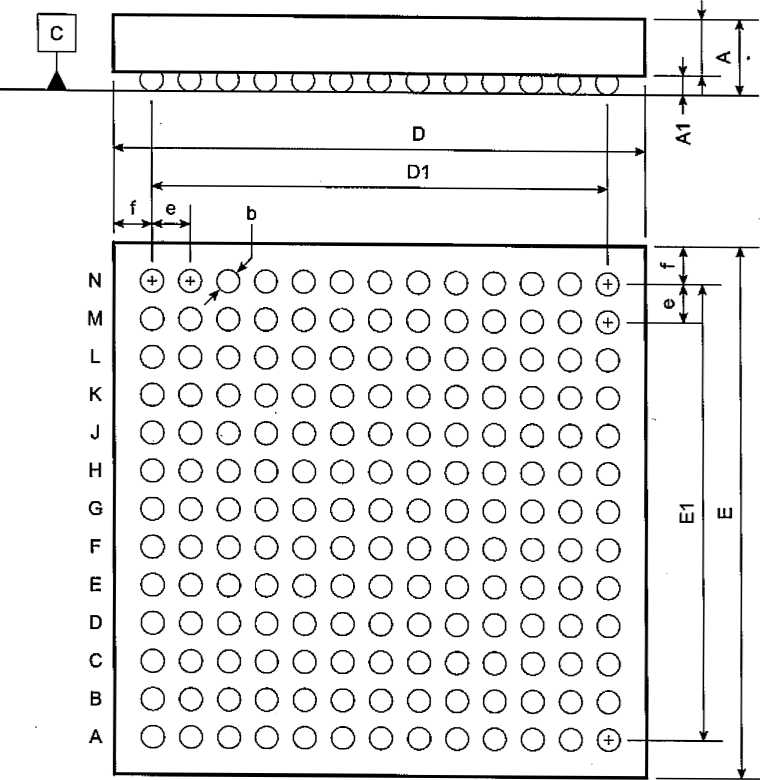
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| REF. | MIN. | TYP. | MAX, | UNIT |
| A | 0.83 | 0.93 | 1.03 | mm |
| A1 |  | 0.22 |  | mm |
| A2 |  | 0.71 |  | mm |
| e |  | 0.50 |  | mm |
| f |  | 0.50 |  | mm |

Table 1: Package dimensions, references to Figure 3.

|  |  |  |  |
| --- | --- | --- | --- |
| REF. | MIN. | TYP. | MAX. UNIT |
| D |  | 7.0 | mm |
| D1 |  | 6,0 | mm |
| E |  | 7.0 | mm |
| El |  | 6.0 | mm |
| b |  | 0,30 | mm |

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5. Definitions

5,1 List of Abbreviations

|  |  |  |  |
| --- | --- | --- | --- |
| ABB | Analog baseband | MPR | Maximum power reduction |
| ACLR | Adjacent channel leakage ratio | na | not applicable / not available |
| AFC | Automatic frequency control | n. c. | not connected |
| ASM | Antenna switch module | PA | Power amplifier |
| BB | Baseband | PMU | Power management unit |
| BW | Bandwidth | RBW | Resolution bandwidth |
| ch. | Channel | PGC | Programmable gain control |
| CW | Continuous wave, single-tone sine | RF | Radio-frequency |
| DBB | Digital baseband | RFFE | RF front-end |
| DFE | Digital front-end | RMS | Root-mean-square |
| DL | Downlink | Rx | Receiver |
| E-UTRA | Evolved UTRA (LTE) | sig. | Signal |
| FDD | Frequency division duplex | SPI | Serial peripheral interface |
| HS | High speed | TCXO | Temp.-compensated crystal oscillator |
| HS1P | High speed 1 primary | TDD | Time division duplex |
| HS2S | High speed 2 secondary | VFBGA | Very thin-profi!e fine-pitch ball grid |
| tc | Integrated circuit |  | array |
| LS | Low speed | Tx | Transmi 廿 er |
| LSB | Least significant bit | UL | Uplink |
| MIP1 | Mobile industry processor interface | UTRA | Universal Terrestrial Radio Access |
| MSB | Most significant bit |  |  |

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