



Technical Specification

Ka-Band Transceiver for an Intersatellite Link with Heinrich Hertz / H2Sat

Tender No.: OV-140-26

Contracting Authority:
Technische Universität Berlin, represented by the President
Straße des 17. Juni 135
10623 Berlin

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1 BRIEF DESCRIPTION OF THE SERVICE

Technische Universität Berlin (TU Berlin, hereinafter the contracting authority - AG) intends to procure two (2) space-qualified Ka-band transceiver systems for the implementation of a bidirectional intersatellite link between a CubeSat LEO satellite constellation and the geostationary Heinrich Hertz satellite (H2Sat). The service includes the transceiver system, the required electrical, mechanical, thermal and software interfaces, verification, documentation, optional support for integration, testing and commissioning, and an optional ground-station modem for end-to-end data transmission. Space suitability must be demonstrated by heritage and AIT/AIVT evidence.

2 STATEMENT OF WORK

The following sections describe the minimum criteria (MK), including the required components and parameters of the services to be procured, and provide detailed information on the scope of work to be fulfilled with the offer. The offer shall clearly distinguish between the base scope and options.

Requirements that are not met will result in exclusion of the respective offer.

2.1 OPERATIONAL SCENARIO AND BOUNDARY CONDITIONS

- Orbit: LEO, approx. 500 km, SSO
- Satellite platform: 16U; available satellite peak power: 50-100 W
- Bidirectional LEO-GEO intersatellite link in Ka-band as a relay via Heinrich Hertz / H2Sat
- The main language used for the project is German.

2.2 MILESTONES

The mission foresees the following milestones:

- Q4 2026 CDR
- Q2 2027 Integration
- Q2/Q3 2027 AIVT
- Q4 2027 / Q1 2028 launch / LEOP

2.3 PROJECT KICK-OFF MEETING

The contractor (AN) shall hold an initial coordination meeting / project kick-off (approx. 2 hours) for the contracting authority (AG) in German within no more than 2 weeks after award. The AN shall provide qualified personnel responsible for the project. The meeting shall be scheduled remotely by the AN. The offer shall be briefly presented and the further procedure shall be defined. The meeting minutes serve as evidence of performance.

2.4 SCOPE OF DELIVERY

The minimum requirements for the AN's scope of delivery are specified below:

- 2 x Ka-band transceiver hardware units for use on small satellites.
- 1 x firmware, configuration and operations software, including commanding, telemetry and diagnostic functions.
- Interface documentation for connection to OBC/PDH, power supply, thermal control and antenna system.
- Optional services: EGSE, engineering support, ground-station modem for end-to-end data transmission

2.5 MINIMUM REQUIREMENTS FOR THE BIDDER

- Mandatory preparation of complete technical documentation, including ICD, test procedures, test reports and configuration data.
- Relevant RF, environmental, EMC and functional tests must already have been performed for the offered hardware or demonstrably equivalent hardware. The corresponding test evidence or test reports shall be provided with the offer. A technical project manager and a contact person for quality/verification, including respective deputies, shall be named.
- Presentation of the supply chain, including critical components and export-control status.
- Demonstrable experience with RF/Ka-band communication systems for space, flight or comparable high-reliability applications is desirable and shall be shown by presenting relevant previous projects of the bidder.

2.6 TECHNICAL REQUIREMENTS

Note: All requirements are function-/performance-based. Offers may propose equivalent solutions; equivalence shall be demonstrated (compliance matrix + evidence).

2.6.1 General Requirements

ID	Priority	Requirement	Evidence
KA-ALL-001	Must	All interfaces required for integration must be openly documented. Proprietary interfaces are permissible if they are fully described and usable in satellite operations without manufacturer tools.	ICD, manual
KA-ALL-002	Must	The solution must be based on existing hardware, qualified assemblies or space-adjacent designs and must not require a complete new development. The offered solution or a demonstrably equivalent predecessor design must meet the minimum requirement: TRL ≥ 8 and flight heritage or suitable environmental qualification (see KA-ALL-003). (see Section 7.2 Quality Criteria)	Heritage evidence,
KA-ALL-003	Must	The system must be suitable for use in a LEO space environment. The bidder must provide evidence of the environmental tests performed: TVAC, radiation, vibration and EMC.	Qualification matrix, test

ID	Priority	Requirement	Evidence
KA-ALL-004	Must	The bidder must clearly identify all assumptions, deviations and required contributions from the contracting authority.	Deviation list

2.6.2 RF and Link Requirements

ID	Priority	Requirement	Evidence
KA-RF-001	Must	The frequencies must be configurable within 26 ± 0.4 GHz in the transmit path and 23 ± 0.4 GHz in the receive path.	Data sheet, technical description/ICD/manual
KA-RF-002	Must	Full-duplex operation must be supported.	ICD, operating description
KA-RF-003	Must	The RF output power must be adjustable, at least up to 1000 mW.	Data sheet
KA-RF-004	Must	The data rate must be at least 1 MSymb/s, with the option to configure lower data rates. Higher data rates will be evaluated positively (see Section 7.2 Quality Criteria).	Data sheet, test report, link budget
KA-RF-005	Must	The system must be capable of compensating Doppler and frequency offsets of a LEO-GEO link. At minimum, the supported frequency offset, the maximum offset rate and the acquisition procedure shall be specified.	Test report, analysis
KA-RF-006	Optional	Optional delivery (not mandatory to offer): compatible ground-station modem for demodulation and decoding of the signal transmitted by the space-segment TX/RX for an end-to-end connection.	The bidder shall attach a separate document for this and state the costs in the price sheet. As part of the award decision, it will be decided whether the optional delivery will also be commissioned by the AG.

2.6.3 Transceiver

ID	Priority	Requirement	Evidence
KA-TXRX-001	Must	The bidder must fully describe the supported modulation types, coding methods, symbol rates, data rates, interleaving and framing options.	Data sheet, ICD/manual
KA-TXRX-002	Should	CCSDS-compatible framing, channel-coding or packetization options should be supported. (see Section 7.2 Quality Criteria)	Data sheet

ID	Priority	Requirement	Evidence
KA-TXRX-003	Must	Housekeeping telemetry must be available.	TM/TC ICD

2.6.4 Data, Command and Software Interfaces

ID	Priority	Requirement	Evidence
KA-IF-001	Must	The TX/RX must provide a digital payload-data interface to the OBC/PDH. A full-duplex RS-422 interface with 115200 bps shall be offered as the interface.	ICD
KA-IF-002	Should	Gigabit Ethernet with IP-based configuration and data transmission should be supported. (see Section 7.2 Quality Criteria)	ICD, data sheet
KA-IF-003	Must	Firmware/software versions, configurations and parameters of the transceiver unit must be clearly identifiable and restorable.	ICD/manual

2.6.5 SWaP/Mechanical

ID	Priority	Requirement	Evidence
KA-EMT-001	Must	The system must be compatible with the satellite power supply (provision of 3.3 V, 5 V or 15 V). Supported supply voltages, inrush currents, operating power, peak power and protection functions shall be specified.	ICD, data sheet
KA-EMT-002	Must	Power consumption must be suitable for LEO small satellites. Maximum power consumption target value: 25 W; lower values will be evaluated positively (see Section 7.2 Quality Criteria).	Data sheet
KA-EMT-003	Must	Mass, dimensions, mounting points, center of gravity, connectors and required installation volumes must be fully documented.	ICD
KA-EMT-004	Must	The solution must be integrable into a small satellite. SWaP for the transceiver unit: max. 0.5 kg and compact form factor max. 0.5 U (96 x 96 x 50 mm (L x W x H)). Lower values will be evaluated positively (see Section 7.2 Quality Criteria).	Data sheet, CAD model
KA-EMT-005	Must	Operating and non-operating temperature ranges must be specified.	ICD

2.6.6 Export Control

ID	Priority	Requirement	Evidence
KA-LEG-001	Must	The bidder must disclose the export-control status of all relevant hardware, software, firmware, documentation and technical support.	Export-control declaration

3 PAYMENT SCHEDULE

Payments shall be made as follows:

Performance share:

- (1) 50% of the total amount after completion of the initial coordination meeting / project kick-off
- (2) 50% of the total amount after performance: FM hardware delivery

All remuneration is understood as net remuneration plus the applicable statutory VAT.

A performance share is deemed completed when:

- The performance has been fully rendered and accepted by the AG

4 PLACE OF PERFORMANCE

All development work shall take place on the AN's own premises. The AG does not provide workplaces.

All physical items in the scope of delivery shall be delivered to the following address:

Technische Universität Berlin

Marchstr. 12-14

10587 Berlin

Germany

The integration laboratory and Mission Control Center (MCC) are located at TU Berlin, Marchstraße 12-14, 10587 Berlin.

5 DATES / EXECUTION PERIODS

Start of execution: Execution may begin on the day of contract award (expected 19 October 2026).

End of execution: The flight hardware must be delivered no later than the end of May 2027.

EM/EGSE delivery (optional) shall be made as soon as possible, at least 4 months (expected 31 December 2026) before the FM models.

The technical documentation shall be provided immediately after contract award, but no later than within 4 weeks.

If bidders deviate from the binding deadlines stated above, justified alternative binding delivery times/deadlines must be included in the offer. As part of the examination and evaluation, the AG reserves the right to decide whether the respective offer is admitted to further evaluation.

6 DOCUMENTS TO BE SUBMITTED

In addition to the required self-declarations (see tender documents), the following items shall be presented in writing in the offer. If the following items are not presented in writing, the offer will be excluded.

- TUB - Bidder's offer letter: Please submit this document completed with the offer.
- TUB - Price sheet (ZK): Please submit this document completed with the offer.
- TUB - EU declarations to be submitted by the company (EK): Please submit this document completed with the offer.

TUB - Compliance matrix (EK): The bidder shall provide a completed compliance matrix for all requirements listed above.

TUB - Specification documents (EK): The bidder shall submit the following descriptions and evidence:

- technical description of the offered Ka-band transceiver,
- available technical documentation (e.g. data sheet, user manual, RF/electrical/mechanical/thermal/software ICD, TM/TC list, configuration description).
- evidence of flight heritage and environmental qualification, minimum 1 page

Note: Individual information under this item will be evaluated as an award criterion for quality and may not be requested subsequently by the AG.

- TUB - Quality criterion (ZK): The bidder shall state in a clear overview whether and to what qualitative extent the additional aspects are fulfilled. The AG will verify the information against the submitted evidence if necessary.

Note: Fulfillment and indication of the additional criteria under section 7.2 are included in the evaluation and are not mandatory for the bidder. If no or insufficient information is provided, the bidder receives 0 points. Subsequent requests are not permitted.

7 AWARD CRITERIA AND WEIGHTING

Taking all circumstances into account, the contract will be awarded to the most economically advantageous offer. The evaluation is based on the submitted

offer. It is therefore in the bidder's interest to provide all requested information as detailed and accurately as possible.

The award criteria are weighted as follows:

- Total net offer price: 38 %
- Quality: 62 %

7.1 TOTAL NET OFFER PRICE

The lowest offer price is determined from the set of evaluable offers, i.e. all offers that have not been excluded for formal reasons, for lack of company suitability, or because of a price that is unreasonable in relation to the service.

The offer with the lowest total price (excluding VAT) receives the maximum percentage of 38 %. If the total price of an offer is, for example, 100 % higher than the offer with the lowest total price, this offer receives 0 %. Zero percent is the lower limit; no negative percentages are awarded. The percentages in between are calculated linearly using the following equation:

Formula:

$$Percent_{price} = \left(2 - \frac{Price}{Price_{min}} \right) * 38$$

7.2 QUALITY

The aspects described below constitute an improved performance. Fulfillment of these aspects is not mandatory for the bidder but will be considered in the offer evaluation.

A maximum total of 62 percent is awarded for fulfillment of the aspects; partial points are not awarded. Each offer that fully fulfills the specified aspect receives the indicated score. If no or insufficient information is provided, the bidder receives 0 points. Fulfillment of the additional aspect shall be clearly identified in the offer.

Weighting of the Quality Criteria

No.	Evaluation criterion	Weighting
1	Technical performance of the transceiver	20 %
2	Integrability into the satellite platform	30 %
3	Heritage	10 %
4	Should criteria under sections 2.6.3 and 2.6.4	2 %
	Total	62 %

For qualitative criteria 1-4, a point scale is used and broken down for the respective criteria. Only values exceeding the minimum requirement are evaluated positively.

The percentages achieved for the respective subcriteria are multiplied by the respective weighting:

$$Criterion_{Quality\ No.\ 1} = \left(\frac{achieved\ Percent}{100} \right) * 20$$

7.2.1 Technical Performance of the Transceiver - Subcriterion 1

The data rate in the receive and transmit paths of the offered transceiver for the planned LEO mission is evaluated.

No.	Subcriterion						Weighting
A	Data rate Tx min. 1 MBaud						50 %
B	Data rate Rx min. 1 MBaud						50 %
	Total A-B						100 %
Subcriterion	0 points (minimum requirement)	1 point	2 points	3 points	4 points	5 points	
A Data rate Tx min. 1 MBaud	= 1 MBaud	> 1 MBaud <= 1.50 MBaud	> 1.5 MBaud <= 2 MBaud	> 2 MBaud <= 2.50 MBaud	> 2.5 MBaud <= 3 MBaud	> 3 MBaud	
B Data rate Rx min. 1 MBaud	= 1 MBaud	> 1 MBaud <= 1.50 MBaud	> 1.5 MBaud <= 2 MBaud	> 2 MBaud <= 2.50 MBaud	> 2.5 MBaud <= 3 MBaud	> 3 MBaud	

Calculation example:

The points achieved are calculated with the respective weighting using the rule of three as follows:

$$Subcriterion_A = \left(\frac{achieved\ points}{5} \right) * 50$$

The percentages for subcriteria A-B are then added as the overall evaluation criterion Technical Performance of the Transceiver No. 1.

7.2.2 Integrability into the Satellite Platform - Subcriterion 2

The evaluation assesses how well the offered transceiver can be mechanically and electrically integrated into the intended satellite platform.

No.	Subcriterion	Weighting
C	Undercutting the mass requirement of 500 g	30 %
D	Undercutting the envelope requirement 96 x 96 x 50 mm (L x W x H) The volume reduction is calculated on the basis of the maximum permissible envelope volume of 96 x 96 x 50 mm (L x W x H). Calculation example for volume reduction: The maximum permissible envelope volume is 96 x 96 x 50 mm = 460,800 mm³. If the offered envelope volume is, for example, 80 x 80 x 50 mm = 320,000 mm³, the following volume reduction results: Volume reduction = (460,800 mm³ - 320,000 mm³) / 460,800	30 %

		mm³ x 100 = 30.56 %				
		The offer therefore reaches the evaluation level "20 to < 35 % volume reduction".				
E		Low power consumption compared with 25 W maximum			40%	
		Total C-E			100 %	
Subcriterion	0 points (minimum requirement)	1 point	2 points	3 points	4 points	5 points
C Mass	= 500 g	< 500 g and ≥ 425 g	< 425 g and ≥ 350 g	< 350 g and ≥ 275 g	< 275 g and ≥ 200 g	< 200 g
D Envelope	= 96 x 96 x 50 mm	= 5 to < 20 % volume below minimum requirement.	= 20 to < 35 % volume below minimum requirement	= 35 to < 50 % volume below minimum requirement	= 50 to < 65 % volume below minimum requirement	≥ 65 % volume below minimum requirement
E maximum power consumption	= 25 W	< 25 W and ≥ 24 W	< 24 W and ≥ 23 W	< 23 W and ≥ 22 W	< 22 W and ≥ 21 W	< 21 W

Calculation example:

The points achieved are calculated with the respective weighting using the rule of three as follows:

$$Subcriterion_D = \left(\frac{achieved\ points}{5} \right) * 30$$

The percentages for subcriteria C-E are then added as the overall evaluation criterion Integrability into the Satellite Platform No. 2.

7.2.3 Qualification, Heritage and Project Risk - Subcriterion 3

The technical maturity of the offered design and the risk for deployment, integration and operation are evaluated.

No.	Subcriterion	Weighting
F	Flight heritage of the offered design or a demonstrably equivalent predecessor design	100 %
	Total F	100 %
Points	Evaluation scale	
0	Minimum requirement: TRL ≥ 8 and flight heritage or suitable environmental qualification is available.	
1	1 to 5 missions with identical or demonstrably equivalent design.	
2	6 to 10 missions with identical or demonstrably equivalent design.	
3	> 10 missions or multi-year on-orbit use without significant anomalies.	
4	> 50 missions or very broad on-orbit use with documented performance.	
5	> 100 missions or very high series/mission heritage with robust on-orbit performance data.	

Calculation example:

The points achieved are calculated with the respective weighting using the rule of three as follows:

$$Subcriterion_H = \left(\frac{achieved\ points}{5} \right) * 100$$

Further weighting is applied under evaluation criterion Qualification, Heritage and Project Risk No. 3.

7.2.4 Should Criteria under Sections 2.6.3 and 2.6.4 - Subcriterion 4

No.	Subcriterion	Weighting
G	KA-TXRX-002 - CCSDS-compatible framing, channel-coding or packetization options are supported.	1 %
H	KA-IF-002 - Gigabit Ethernet with IP-based configuration and data transmission is supported.	1 %
	Total G + H	2 %

In the event of a tie in the overall evaluation of price and quality, the offer with the higher score in the quality award criterion will be awarded the contract. If a tie also remains in this respect, the decision will be made by drawing lots.