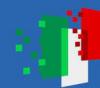




**Allegato 3 – Topic e relativa dimensione del costo progettuale - RESTART SPOKE 3**

N	Topic	<p><b>Costo del progetto (k/€)</b>  <b>N.B.: Il costo del singolo progetto dev'essere compreso tra €570.000 e € 1.500.000</b> In ogni caso, <b>l'agevolazione complessiva per singolo progetto non potrà essere superiore a € 570.000.</b>                      Gli importi sotto sono indicativi</p>
1	<p><b>Sensor and Digital Processing Unit (SDPU) for NCR-MT</b>                      Goal of this call is to have a SDPU that can be used to implement a real-time full stack processor for Network Controlled Repeater using Mobile Terminal (NCR-MT unit) according to the most recent specification of Release 18 of the 3GPP 5G NR standard.                      The targets that SDPU platform must support are listed below:</p> <ul style="list-style-type: none"> <li>• Real time control of NCR (Network Controlled Repeater) using MT-NCR (Mobile Terminal-NCR) based on open source implementation</li> <li>• Be compatible for future research topic in FR3 frequencies (6-20GHz subset)</li> <li>• Address valuable «research-directions» such as:</li> <li>• Support the research on EM Digital Twin</li> <li>• Channel propagation characteristic including motion</li> <li>• Address higher MIMO order</li> <li>• Invest on a flexible high computing hardware platform for next generation SDR</li> <li>• Built a multichannel up/down converter with digitalizers with on-board accurate georeferenced and IMU capabilities</li> <li>• Light and compact design to be mounted on motion platform (ground vehicle or drone) battery powered.</li> </ul> <p>A complete innovative solution is required that overcome the limitation of the current (HPC High Processing Computing) architectures and pave the way to a completely new way for digital processing design. SDPU will enable the innovative NCR-MT Unit, but laying the first milestone to face the challenges of FR3 future telecommunication systems (6G).                      As for the current 3GPP standardization status [Rel. 18], the NCR-Fwd has been already addressed within RESTART 6GWINET Spoke 3 that set these requirements.                      The cooling of SDPU is designed for ambient temperature of 25°C. The assembly should be provided with a light mechanical enclosure. The RF-interfaces are preferred by coaxial connectors (SMA Type).</p> <p>Detailed SDPU functions                      This module is capable to digitalize and synthesize up to 16 RF signals, in the range of 0.4-7.2 GHz. The Analog Front End hosts the fast DAC/ADCs with instantaneous bandwidth up to 500 MHz . There are also 4 fast ADCs that can</p>	280K€



	<p>be used as monitoring of feedback channels for array calibration, intermediate feedbacks, DPD monitoring and so on. It embeds the possibility to vary the gain of the output signals up to 30dB, GPIO signal for fast control real-time and non-real time management channels to a Radio Unit. The FPGA, and the embedded ARM based CPU, is intended to manage all the units and can be programmed with at least two different software:</p> <p>a) A section or the complete stack up of a NCR-MT or the complete stack up of a Standard Radio Node (gNB) over OAI.</p> <p>b) The processing capabilities to digitalize/synthesize up to 16 channels, condition the signals to the required bandwidth and level, process and add time stamp and georeferenced trajectories coherently with the IQ sample that are write/read to different high speed channels like:</p> <p>a. SSD unit up to 2TB, implementing a reliable high speed interface based on M.2 for easy replacement.</p> <p>b. A fast transfer of data to a PC/GPU that hosts the additional processing like hardware accelerators.</p> <p>A very stable timing unit is required and the sensors for positioning. The alarms of the unit are related to the temperature, lock of the synth and RX input power level. Visual (LED) and software messages are automatically generated.</p> <p>On SDPU side, the real-time capabilities of the GPIO shall include the TDD management and the Beam switching capabilities to be compatible when the MT-NCR is interfaced with the NCR-FWD unit.</p>	
2	<p><b>Radio Frequency Unit (RFU) for FR3.</b> Goal is to implement an up to 16T16R transceiver in FR3 SDR for mobile platform with integrated sensors for geo-reference, real-time capabilities to control RF hardware and interface with ARM-based or x86 based PC (Workstation or NUC).</p> <p>The RFU main capability is the up/down conversion of the signals from the SDPU (see other Cascade Call specifications) to the target RF frequency range of FR3 (namely 6-to 20GHz). A high integration of the up/down conversion mixers, filtering and related signal conditioning (gain variation using DSA) is required due to high count of independent RF channels. A single up/down conversion scheme is recommended to guarantee the UWB functionalities across the RF paths independently. Intermediate loopback path are necessary for accurate debugging and characterization of each IF/RF path.</p> <p>The gain of each TX and RX channels can be set independently. In case of TDD mode, fast gain switching (or switch off) shall be provided.</p> <p>The LO (Local Oscillator) signals needed for the mixers are locally generated with the possibility to lock the synthesizers to the high stability reference clock provided by the SDPU. A multichannel synthesizer is necessary to provide enough flexibility in generating different frequencies exploiting advance clocking and PLL schemes.</p> <p>The expected peak output power of each RF path shall exceed 1W (30dBm) at the connector output and in the whole RF Band.</p> <p>The expected maximum total power consumption of the RFU is expected not to exceed 120W. TX or RX chains can be switched off independently when full 16T16R capability is not required to reduce the power consumption.</p> <p>On RX side, is recommended to monitor the RF input power and provide a protection of the RX channels in case the level could damage the Unit.</p>	290k

	<p>On RFU side, different real-time control capabilities can be implemented like, for example, by pre-programming TX/RX/FB channels with 2 sets of gains, switching and DSA control that is guaranteed in real-time (&lt;1µs) from SDPU-GPIO or ON/OFF switching capabilities, or switching capabilities needed by the UWB antenna.</p> <p>The unit can be used as a UWB communication unit either in TDD mode, FDD mode, multi-band or full duplex, or as a radar sensor. TX and RX channels have independent coaxial connectors to the UWB Antenna.</p> <p>A TX-to-TX port and TX-to-RX port isolation better than 30dB and 20dB respectively is recommended.</p> <p>The UWB antenna shall be in the range of 6GHz to 16GHz with acceptable performance of efficiency and gain. The coverage angle up to 120deg considered with 6dB loss of the UWB array gain. The recommended isolation between TX and RX elements should be better than 30dB . UWB array should have independent coaxial connectors for TX and RX.</p> <p>Preferred UWB array should be innovative and non-conventional.</p>	
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Si rimanda inoltre al seguente vincolo richiamato dall'art 2.2 e 3.2 del presente Avviso.

Ai fini dell'ammissibilità della proposta, quest'ultima dovrà prevedere attività riconducibili ai Campi di intervento:

- 022 - *Processi di ricerca e di innovazione, trasferimento di tecnologie e cooperazione tra imprese incentrate sull'economia a basse emissioni di carbonio, sulla resilienza e sull'adattamento ai cambiamenti climatici,*
- 023 - *Processi di ricerca e innovazione, trasferimento di tecnologie e cooperazione tra imprese incentrate sull'economia circolare; e*
- 006 - *Investimenti in beni immateriali in centri di ricerca pubblici e nell'istruzione superiore pubblica direttamente connessi alle attività di ricerca e innovazione*

di cui all'articolo 3 dell'Avviso MUR n. 341 del 15/03/2022.

Nello specifico, come precisato all'art. 7, co. 2, del predetto Avviso (quarto punto elenco), le attività riconducibili ai tre campi d'intervento devono rispettare, per il nostro PE le seguenti percentuali:

- 022: 25%
- 023: 25%
- 006: 50%

È facoltà del soggetto proponente prevedere una diversa distribuzione delle attività del Partenariato esteso tra i diversi campi di intervento previsti dall'Avviso, fermo restando che le % indicate per i campi di intervento 022 e 023 in relazione a ciascuna tematica sono da intendersi minime

Contributo al conseguimento del vincolo climate: Le proposte di progetto dovranno dimostrare di sostenere non meno del 42% dell'allocazione del budget in attività che rispettano il vincolo climate (cd. Tagging climatico), in conformità con l'obiettivo di contribuire alla transizione verde, individuati dall'art.18 par. 4 lettera e) e Allegato VII del Regolamento (UE) 2021/241.<sup>1</sup>

<sup>1</sup> Per l'allegato VI "Metodologia di controllo del clima" si rimanda al seguente link [EUR-Lex](#).