Nordic telecom

Nordic Telecom Systems a.s.

RUGGED LTE 410-430 MHz TERMINAL FOR PPDR

REQUEST FOR PROPOSAL

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For avoidance of doubts, the Supplier through its participation in the RFP process thereby acknowledges, undertakes and agrees that he will be obliged to respect the conditions set forth herein. In case that the Supplier requires mutually agreed non-disclosure agreement (hereinafter referred to as "**NDA**") in order to participate in this RFP and eventually submit a proposal, an NDA template is provided by NTS (see **ANNEX 5**).

[1] VAT ID CZ07082835

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MANAGEMENT SUMMARY

Nordic Telecom is a mobile network operator that provides telecommunication and ISP services for more than 100k customers in Czech Republic with its own LTE networks (410-430 MHz, 3.7 GHz, possibly also 700 MHz), full MVNO solution (commercial 2G/3G/LTE bands) and significant ISP infrastructure.

Nordic Telecom employs 350 people and in 2019 recorded a revenue of CZK 550 million / EUR 21,5 million.

The LTE network in the 410-430 MHz band has been launched[2] at the end of 2018, together with technological partner Nokia, as the world's first deployment with firm focus set on critical communication and the network is at the heart of this RFP.

This achievement has been built upon several years of significant efforts of all the involved parties resulting into recent standardization of the radio frequencies within 410-430 MHz band by 3GPP as LTE bands 87/88 and harmonisation by CEPT for implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems. This enabled Nordic Telecom to fully leverage one of its existing assets, 410-430 MHz spectrum licenses, that has been previously used for now discontinued CDMA2000 network.

Our LTE 410-430 MHz network and overall BB-PPDR solution are being deployed from the outset for critical communications, which makes it fundamentally different from commercial LTE networks. In contrast, it offers a high level of security, including end-to-end encryption of all communications, high level of availability and resiliency, focuses on geographical coverage rather than population coverage, provides dedicated capacity, enables user and service prioritization, supports and M2M/IoT use cases, and last but not least, provides support for specific functionalities for public safety (aka PPDR) organisations (e.g. police, fire brigade, emergency medical service) and utilities (e.g. energy, water, transportation).

Such BB-PPDR solution will therefore provide modern and secure communication tools for both mission and business critical communication users on a dedicated, purpose-built LTE 410-430 MHz network for the group of users/organisations with the similar service requirements.

The network is currently in the pilot mode and Nordic Telecom is integrating and validating components and functions of the BB-PPDR solution incl. multimedia group communication (voice, video, data). We are also intensively working with several potential customers from the utilities segment and state organizations on friendly user trials demonstrating the capabilities, features and services. Our main objective for the 2020 is to carry out those trials on our dedicated LTE 410-430 MHz centric BB-PPDR solution.

For the past several years, Nordic Telecom participated in several activities of the Czech Republic's Ministry of the Interior focused on the preparation and fulfilment of the long-term strategy for the mobile communication of the PPDR forces. The most recent one (finished 12/2019) was the preliminary market consultation focused on the use of LTE radio access networks in the 410 - 430 MHz and 450 - 470 MHz (LTE 400 MHz) for the purposes of CZ's PPDR forces and Nordic Telecom was the only subject that provided full scope BB-PPDR solution demonstration in live network incl. our prototype LTE 410-430 MHz hand terminal with mission critical multimedia group communication. Ministry of the Interior then confirmed their interest in the dedicated LTE 400 MHz network in a move that follows the same strategy as in e,g. Germany[3] and Spain[4]. It is our clear objective to bid in the expected future tender from the CZ's Ministry of the Interior for either BB-PPDR services or dedicated LTE 400 MHz network. Based on such tender outcome, we expect to issue a purchase order for commercial deliveries of 10-30k hand terminals in the horizon of 2021/22.

We consider LTE 410-430 and 450-470 MHz as a one LTE 400 MHz market that can be addressed by the same network infrastructure and terminals, with only small SW/HW modifications. While we expect that the LTE 400 MHz technologies will always remain out of commercial mainstream, we are convinced that the LTE 400 MHz networks are best suited for cost effective solutions within both mission and business critical communications. We are certain that the LTE 400 MHz ecosystem will grow significantly in the future and whereas this RFP and overall CZ market potential is only in tens of thousands of terminals, with Germany and other countries one can think about hundreds of thousands.

Key objective of this RFP is to procure operation ready, state-of-the-art, rugged hand terminal with native LTE 410-430 MHz (3GPP band 87) support, specifically designed for push-to-talk/video type of services, with Android OS and in general designed around broadband critical communication needs and requirements of the 21st century.

[2] https://www.nokia.com/about-us/news/releases/2019/04/17/nokia-and-nordic-telecom-launch-the-worlds-first-mission-critical-communication-ready-lte-network-in-the-410-430-mhz-band/
[3] https://www.bdbos.bund.de/DE/Bundesanstalt/Aktuelles_und_Presse/aktuelles_node.html
[4] http://www.uniredasociacion.es/nuevas-tecnologias-digitales-en-redes-de-comunicaciones-criticas/

1. INTRODUCTION

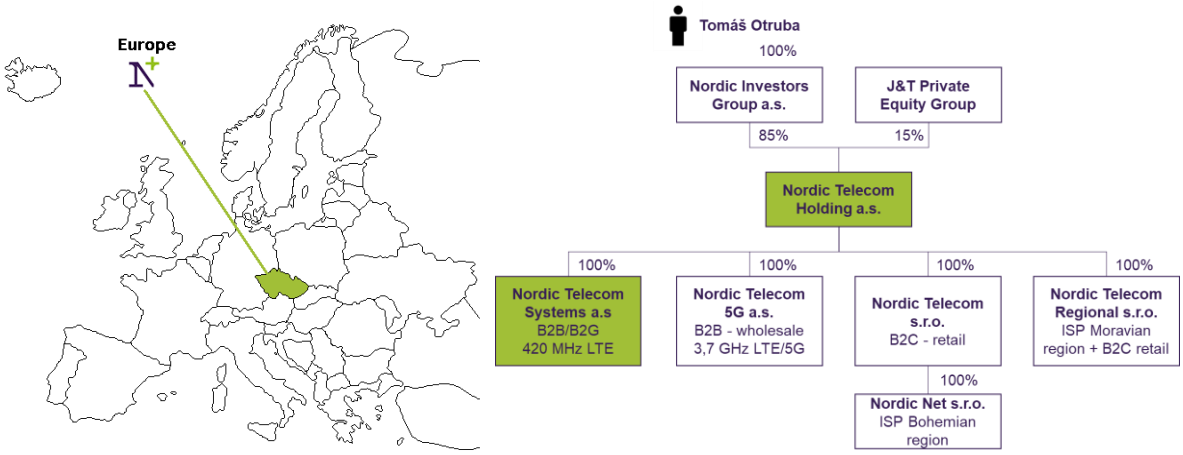
1.1 NORDIC TELECOM SYSTEMS

Nordic Telecom Systems Ltd.[5] (hereinafter referred to as "**NTS**") is a subsidiary of the privately held Nordic Telecom Holding Ltd.[6] (hereinafter commonly referred to as "**Nordic Telecom**"), which has been founded within the Czech Republic's Nordic Investors Group Ltd.[7] as one of its divisions, focused on telecommunications (other divisions are eHealth, distressed assets and real estate).

Nordic Telecom is a mobile network operator that provides telecommunication and ISP services for more than 100k customers in Czech Republic with its own LTE networks, full MVNO solution (commercial 2G/3G/LTE bands) and significant ISP infrastructure. The operator employs 350 people and in 2019 recorded a revenue of CZK 550 million / EUR 21,5 million. Nordic Telecom plans to establish itself as the 4th biggest mobile network operator while also becoming 3rd biggest ISP on the Czech market.

NTS itself focuses on providing specialized professional solutions tailored for mission and business critical communications such as first responders (e.g. police, fire brigade, emergency medical service) and utilities (e.g. energy, water, transportation).

NTS is a member of 450 MHz Alliance[8], 3GPP[9] and recently joined also TCCA[10].

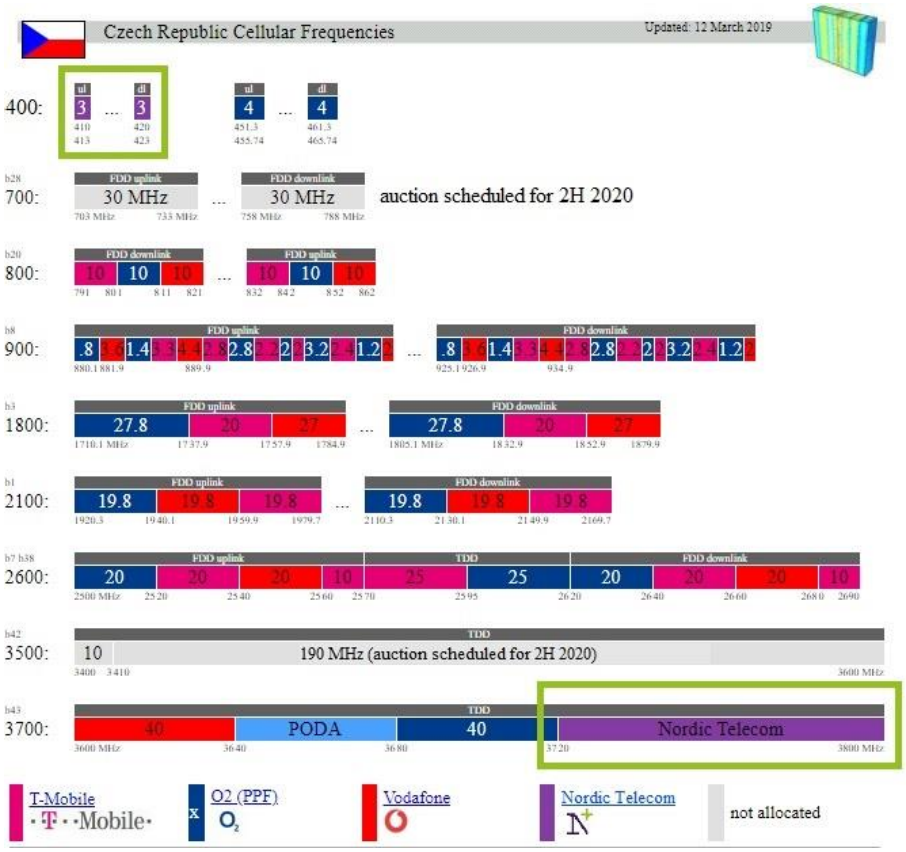


Pic-1: Nordic Telecom Holding Ltd. org. chart

Nordic Telecom currently owns two countrywide rights of use (spectrum licenses) for radio frequencies in the 410-430 MHz (2x4,25 MHz, assigned to NTS) and 3.7 GHz (2x40 MHz, assigned to Nordic Telecom 5G) bands in the Czech Republic and intends to participate in the upcoming 700 MHz spectrum auction planned for 2H 2020[11].

Overall radio frequencies assignment situation in the Czech Republic is thoroughly described in the picture below.

[5] http://www.ntsystems.cz/
[6] https://www.nordictelecom.cz/
[7] https://www.nordic-investors.com/
[8] https://450alliance.org/
[9] https://www.3gpp.org/
[10] https://tcca.info/
[11] https://www.ctu.eu/press-release-ctu-introduced-draft-auction-conditions



Pic-2: Cellular spectrum allocation in Czech Republic[12]

Nordic Telecom's **LTE (5G ready) network utilizing 3.7 GHz spectrum license** (80 MHz block, TDD, 3GPP band 43) is being used for retail and wholesale service offerings of broadband fixed wireless access and as of 03/2020 consists of 700+ sites (eNBs). Support of this network is a complementary requirement of this RFP for the hand terminal.

1.2 LTE 410-430 MHz NETWORK

NTS's **LTE network utilizing 410-430 MHz spectrum licenses** (license for 2x4,25 MHz (extension to 2x5 MHz planned), used bandwidth 2x3 MHz, FDD, 3GPP band 87) has been launched at the end of 2018, together with technological partner Nokia, as the world's first deployment with firm focus set on critical communication.

This achievement has been built upon several years of significant efforts of all the involved parties (NTS, Nokia, 450Alliance and Czech Telecommunication Office), resulting into recent standardization of the radio frequencies within 410-430 MHz band by 3GPP Release-16 as LTE bands 87/88[13] and harmonisation by CEPT[14] for implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems.

This enabled NTS to fully leverage one of its existing assets, 410-430 MHz spectrum licenses, that has been previously used for CDMA2000 1xEV-DO network (in operation from 2007 to 2017) and allowed the migration to 3GPP standard based LTE 410-430 MHz network which is a centrepiece of our intended BB-PPDR solution. NTS thus now follows more than 13 years of experience in providing professional broadband data services within 410-430 MHz band.

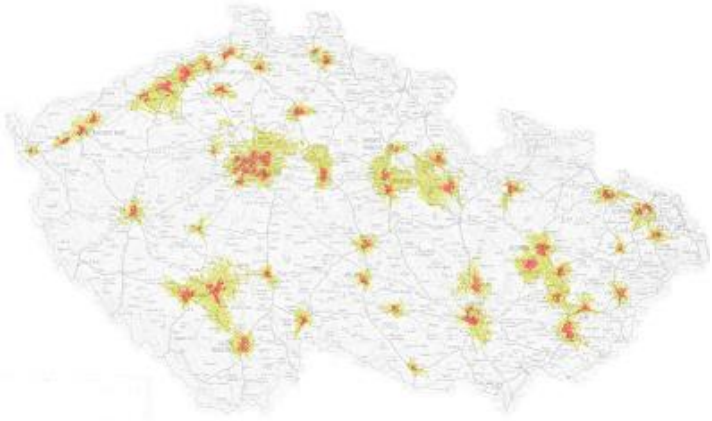
Our LTE 410-430 MHz network and overall BB-PPDR solution are being deployed from the outset for critical communications, which makes it fundamentally different from commercial LTE networks. In contrast, it offers a high level of security, including end-to-end encryption of all communications, high level of availability and resiliency, focuses on geographical coverage rather than population coverage, provides dedicated capacity, enables user and service prioritization, supports and M2M/IoT use cases, and last but not least, provides support for specific functionalities for public safety (aka PPDR) organisations (e.g. police, fire brigade, emergency medical service) and utilities (e.g. energy, water, transportation).

[12] https://www.spectrummonitoring.com/frequencies/#Czech
[13] https://www.3gpp.org/DynaReport/GanttChart-Level-2.htm#bm820078 and http://www.3gpp.org/ftp//Specs/archive/36_series/36.101/36101-g40.zip
[14] https://www.ecodocdb.dk/download/1cadc836-23e4/ECCDEC1602.pdf

Such BB-PPDR solution will therefore provide modern and secure communication tools for both mission and business critical communication users on a dedicated, purpose-built LTE 410-430 MHz network for the group of users/organisations with the similar service requirements.

The network is currently in the pilot mode, without any commercial customers, and NTS is integrating and validating components and functions of the BB-PPDR solution incl. multimedia group communication (voice, video, data).

Radio access network is being gradually deployed and as of 03/2020, there are circa 50 LTE 410-430 MHz eNBs in operation. The plans are to reach 120 eNBs by the end of 2020. NTS together with its partner CETIN[15], the biggest infrastructure supplier in CZ, can rollout circa 400 eNBs within 6 months and reach coverage of circa 95% land coverage within 12-18 months. Such rollout depends on the contract(s) being signed with qualified customer(s).



Pic-3: NTS dedicated LTE 410-430 MHz network - Coverage 2019

NTS is currently intensively working with several potential customers from the utilities segment and state organizations on friendly user trials demonstrating the capabilities, features and services. Our main objective for the 2020 is to carry out those trials on our dedicated LTE 410-430 MHz network centric BB-PPDR solution fulfilling the needs of mission or business critical communication.

1.3 MISSION CRITICAL COMMUNICATION IN CZECH REPUBLIC

Mission critical communications for PPDR forces in Czech Republic is currently provided primarily by now rather obsolete narrowband Tetrapol[16] system called “Pegas”[17], using TDM technology provided by Airbus SLC. Pegas has a country wide coverage (~68% land for hand terminal and ~90% for vehicle terminal, deemed as insufficient by end users) and provides voice centric services for around 35k users and is owned and operated by the Ministry of the Interior (hereinafter referred to as “**MoI**”). Airbus SLC have announced that the Tetrapol TDM technology will reach the end of support milestone at the end of 2020 and the MoI must start the modernization to Tetrapol IP technology in order to provide support.

There are of course several other smaller-scale mission and business critical networks (e.g. TETRA, DMR, P.25, analogue) in Czech Republic which provides services for several tens of thousands of users (e.g. voluntary fire brigade with circa 70k members). One must also not forget that there are dozens of thousands of SIM cards from all commercial mobile network operators providing “best effort” services deemed as unsuitable for both mission and business critical communication.

For the past several years NTS participated in several activities of the Czech Republic’s MoI focused on the preparation and fulfilment of the long-term strategy (initially driven by both end of support for Tetrapol TDM and 700 MHz auction) for the mobile communication of the PPDR forces covering all the above mentioned networks and technologies. The most recent activity (finished 12/2019) was the preliminary market consultation[18] focused on the use of LTE radio access networks in the 410 - 430 MHz and 450 - 470 MHz (hereinafter referred to also as “**LTE 400 MHz**”) for the purposes of CZ’s PPDR forces and the NTS was the only subject that provided demonstration in live network environment and in full scope. NTS demonstrated its dedicated LTE 410-430 MHZ network centric BB-PPDR solution including 3GPP MCX communication (mission critical PTT / video / data) provided by Nokia group communication platform and using our **prototype rugged LTE 410-430 MHz hand terminal with GCT chipset and Android OS**.

[15] https://www.cetin.cz/uvod

[16] https://www.securelandcommunications.com/tetrapol-networks and https://www.tetrapol.com/

[17] https://www.mvcr.cz/clanek/radiokomunikacni-sit-integrovaneho-zachranneho-systemu-pegas.aspx

[18] https://nen.nipez.cz/SeznamZadavacichPostupu/ZakladniInformaceOZadavacimPostupuM-656005907-18361112/ZadavaciDokumentace-656005907-18361112/

As part of the preliminary market consultation evaluation, the MoI confirmed their interest in the dedicated LTE 400 MHz network in a move that follows the same strategy as in e,g. Germany[19] and Spain[20]. The MoI should within 2020 update its long-term strategy for broadband centric mission critical communication potentially resulting into a procurement/tender in 2021/2022.

Due to time constraints and in general difficulties associated with the public procurement processes, it appears[21] that the MoI and Airbus SLC have agreed prolongation of the Tetrapol TDM support beyond EOY 2020 for further 4 years without contracted modernization to Tetrapol IP. Such agreement provides the MoI with sufficient timeframe for qualified strategic decisions, solution(s) procurement and implementation incl. potential migration. **In any case, the position of the MoI and the Government is that the addition of secure mobile broadband data services with high availability are a key requirement/delivery.**

It is our clear objective to bid in such tender from the MoI for either the turnkey BB-PPDR solution or dedicated LTE 400 MHz network and the LTE 410-430 MHz hand terminals are a firm part of any competitive package. Based on such tender outcome, we expect to issue a purchase order for commercial deliveries of 10-30k hand terminals in the horizon of 2021/22.

1.4 LTE 400 MHz MARKET POTENTIAL

Utilization of the LTE 400 MHz broadband spectrum in Europe and worldwide differs country by country. Common trend is migration of legacy CDMA networks (and in some cases also narrowband PMR networks) to LTE technology while preserving co-existence with narrowband PMR networks in adjacent or within the same frequency bands.

National regulators in Europe are aligning their radio spectrum utilisation plans and radio spectrum management strategies with CEPT ECC harmonization activities. This will result into future availability of continuous 2x5 MHz frequency spectrum designated for broadband networks in 410-430 MHz (3GPP bands 87/87) or 450-470 MHz (3GPP bands 72/73, 31 outside Europe) or in both in parallel in most of the European countries, depending on availability and priorities of the national regulator.

In the long-term, network infrastructure manufacturers also predict that the 380-395 MHz band will be standardized by 3GPP as another LTE/5G band.

LTE 450-470 MHz networks are mostly used for broadband coverage of large rural areas (e.g. Brazil, Indonesia, Philippines, Scandinavia) and for utility companies i.e. smart grid distribution networks (e.g. Poland, Germany, Hungary, Austria). Mixed use combining both IoT/M2M, broadband data and mission/business critical voice has been deployed in Russia.

LTE 410-430 MHz networks are currently being deployed in Czech Republic (PPDR), Ireland (Smart Grid) and two other countries (confidential information - middle east, Africa). National regulators in Slovenia, Hungary, Bosnia and Herzegovina, Croatia and Lithuania are considering the use of the spectrum for either wireless broadband or PPDR.

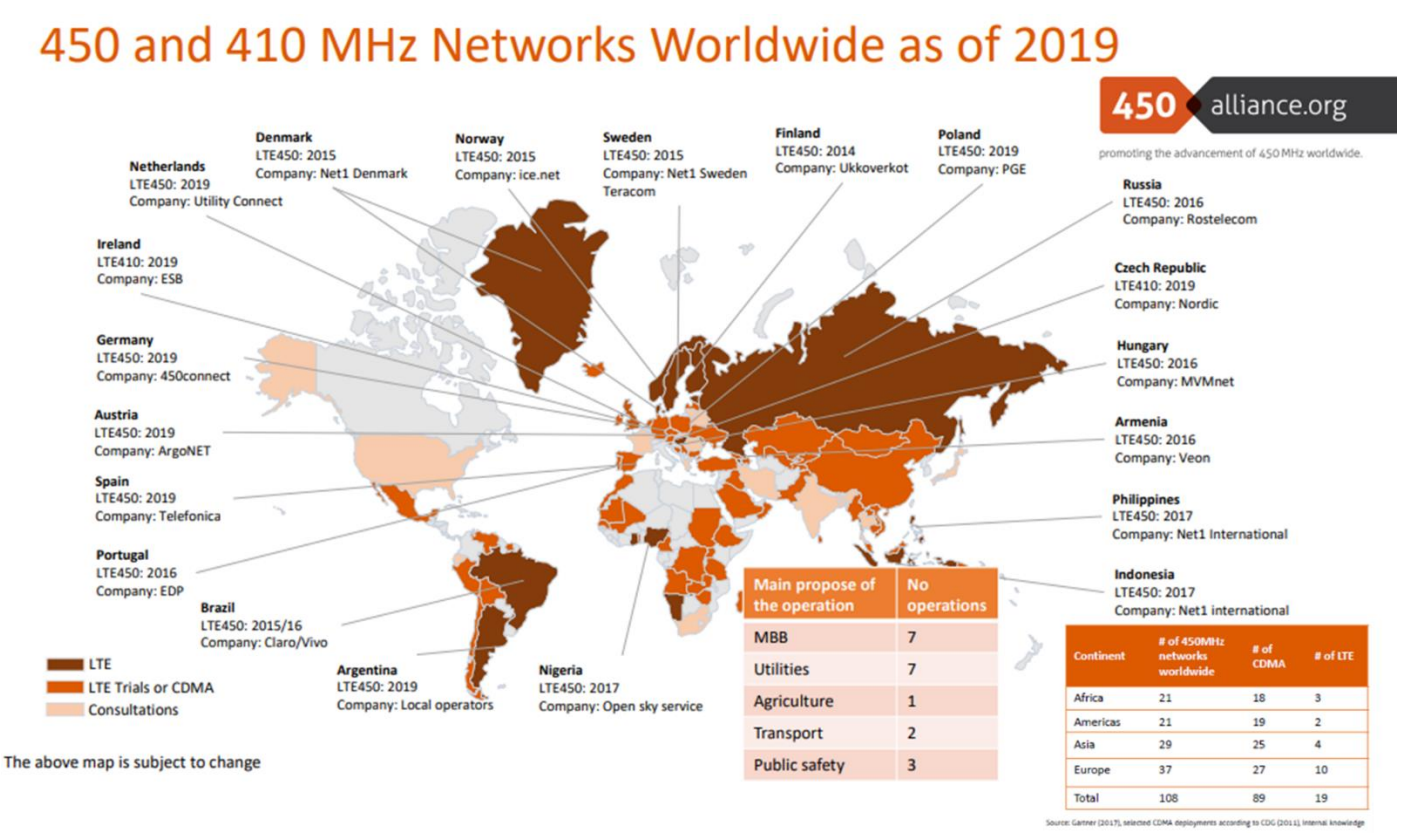
In some countries (e.g. Czech Republic, Germany, Spain, Sweden) the LTE 400 MHz spectrum is now being considered as a spectrum for mission critical communication i.e. public safety/PPDR use, reflecting significant efforts of CEPT ECC within this topic[22]. This is a direct consequence of a clear preference of public safety organisations for dedicated network and the LTE 400 MHz are the only available and cost-efficient option. There's no country in Europe that allocated 2x10 MHz out of 700 MHz core band spectrum as desired by most of the PPDR organisations and followed countries such as the USA, South Korea and Canada. European PPDR organisations typically have access to 700 MHz guard band spectrum, however that is not suitable for country wide coverage and thus the LTE 400 MHz networks preference. BB-PPDR strategies therefore combine dedicated LTE 400 MHz networks with shared and potentially only best effort commercial LTE/5G networks.

Based on feedback from the network infrastructure and terminals manufacturers, NTS considers LTE 410-430 and 450-470 MHz as a one LTE 400 MHz market that can be addressed by the same network infrastructure and terminals, with only small SW/HW modifications necessary. While we expect that the LTE 400 MHz technologies will always remain out of commercial mainstream, we are convinced that the LTE 400 MHz networks are best suited for cost effective solutions within both mission and business critical communications.

Although this RFP is focused on the procurement of the rugged hand terminal for PPDR supporting LTE 410-430 MHz network (3GPP band 87), NTS with the support of 450 MHz Alliance also issued survey within its members in order to assess overall market potential. Preliminary outcomes are summarized in ANNEX 1 of this document.

We are certain that the LTE 400 MHz ecosystem will grow significantly in the future and whereas this RFP and overall CZ market potential is rather low (10-30k terminals required by this RFP, MoI requires network solution for 100-200k users), with Germany and other countries one can think about hundreds of thousands.

[19] https://www.bdbos.bund.de/DE/Bundesanstalt/Aktuelles_und_Presse/aktuelles_node.html
[20] http://www.uniredasociacion.es/nuevas-tecnologias-digitales-en-redes-de-comunicaciones-criticas/
[21] https://www.novinky.cz/domaci/clanek/vnitro-zrusilo-miliardovou-zakazku-na-vysilacky-40313573
[22] https://www.cept.org/ecc/topics/public-protection-and-disaster-relief-ppdr



Pic-4: LTE 400 MHz networks - market potential [Source: 450Alliance]

1.4.1 CHIPSET SUPPLIERS

As mentioned in the previous chapters, NTS's LTE 410-430 MHz network is currently in the pilot mode. As of now, NTS can provide LTE 410-430 MHz broadband data services via commercial grade routers (consumer and professional) and demonstrate its LTE 410-430 MHZ network centric BB-PPDR solution via prototype rugged hand terminal. Both types of equipment (routers and hand terminal) are based on GCT GDM7243ST chipset, while NTS also tested few sample mPCIe modules using Altair FourGee 3800 / 6300 chipset.

LTE 450-470 MHz networks (esp. 3GPP band 31) are already in operation in other countries for several years and as concluded above, the same chipsets can be used to support also LTE 410-430 MHZ networks.

In order to assist any Supplier interested into entering LTE 400 MHz networks market, NTS is providing the list of known (may not be complete or necessarily correct) chipsets that could be able to provide the support:

- Altair FourGee 3800 / 6300 (tested by NTS and in Ireland for LTE 410-430 MHz)
- GCT GDM7243ST (tested and used by NTS for LTE 410-430 MHz)
- HiSilicon Kirin 950
- Leadcore Technlogoy LC1881
- Qualcomm MDM9215 (no longer available)
- Sequans Cassiopeia SQN 3220 / 3242 / 3244
- ZTE WiseFone 7510

1.5 LTE 400 MHz PPDR TERMINAL STRATEGIES

PPDR hand terminal requirements from different countries/operators deploying LTE 400 MHz networks can and will vary based on end user requirements and the initial state such as existing PMR networks and their lifecycle, mid to long-term plans related to migration to BB-PPDR solution, available frequencies, ownership and operation models and many others.

In any case, it would be still beneficial to create a joint demand (i.e. economies of scale) with only small SW/HW modifications necessary to an existing product(s) in order to support specific LTE 400 MHz network similarly to current narrowband PMR terminals (e.g. VHF/UHF, DMR tier II / III, TETRA / TEDS). This would bring a possibility to offer products with the lower cost of customization than separate smaller series developed for each operator/end user.

#	Description	Commercial LTE bands*	Private LTE bands*	PMR

		e.g.: • B1 / B3 / B20 / B28 • May include 2G/3G - see ANNEX 2	e.g.: • LTE 410-430 MHz: B87 / B88 • NATO freq.: 380-395 MHz (no LTE standard yet) • LTE 450-470 MHz: B31 / B72 / B73 *Note: other bands (e.g. B28, B68, B7, B42, B43, B8) can be considered, but out of scope of this RFP*	e.g.: • VHF (136-174 MHz) / UHF (380-470 MHz) • Analogue / digital • PMR technology (TETRA, Tetrapol, DMR tier II / III, P25) • Trunked and / or direct mode operation
1	Private LTE only	-	o	-
2	Private LTE + PMR	-	o	o
3	Commercial and private LTE	o	o	-
4	Commercial and private LTE + PMR	o	o	o

Tab-1: LTE 400 MHz terminal options

**Note: Commercial and private LTE bands are often currently implemented as an independent chipsets and SIM cards, however that's rather a consequence of existing products and chipset capabilities. NTS views this as a temporary state that will be in the future superseded by single chipset solution.*

NTS is convinced that the single product won't fulfil the needs of all the users, however as the LTE 400 MHz market is currently small, compromises would need to be taken. Some countries which are considering LTE 400 MHz prefer LTE only hand terminal (e.g. Germany and Spain, option #3 - combining B72 as private LTE bands and commercial 2G/3G/LTE bands), whereas NTS's prototype rugged hand terminal is LTE+PMR hybrid/multi-mode (option #4 – "private" LTE bands (B28/B43/B87) w/ dedicated chipset and SIM card + commercial 2G/3G/LTE bands on another dedicated chipset and SIM card + DMR tier II in UHF).

Situation in Czech Republic with regards to existing Tetrapol network is evolving and so is the position and the BB-PPDR solution of the NTS. Currently we are leaning towards the option #4 as described in section above, however with VHF instead of UHF for PMR as there's still significant group of potential customers (e.g. fire brigade, emergency medical service) using analogue PMR radios in VHF for both primary and backup communication and direct mode of operation is one of key requirements (it shall be mentioned that the LTE 400 MHz and PMR in VHF should enable NTS to provide active-active configuration of the terminal i.e. listen and communicate on both radio technologies, it is assumed that LTE 400 MHz and PMR in UHF (380-470 MHz) doesn't allow that. On the other hand, there are other potential customers (e.g. municipalities, utilities, road and motorway directorate, commercial security services) where the direct mode isn't an explicit requirement.

This RFP should provide NTS with a view on the market, available products and strategic decisions of the potential Suppliers that would enable to make qualified decisions. Any of the options could be proposed by the potential Supplier.

2. PRODUCT REQUIREMENTS

As mentioned in the introduction chapter, NTS can provide LTE 410-430 MHz broadband data services via commercial grade routers and demonstrate its LTE 410-430 MHZ network centric BB-PPDR solution via prototype rugged hand terminal.

The goal of this RFP is to enable move from prototype rugged hand terminals to commercially orderable and operation ready products enabling NTS to provide its BB-PPDR solution, most importantly 3GPP MCPTT/MCVideo/MCData for group communication of working teams, to its potential customers in Czech Republic.

NTS is well aware that the current LTE 400 MHz market is limited and terminals designed primarily for LTE 410-430 MHz (3GPP band 87) support are not available off-the-shelf as a product at all. In order to assess current state of the LTE 400 MHz market, review approaches of different Suppliers (and their other potential customers) and extend potential group of such Suppliers, **NTS has decided to define set of basic requirements (see chapter 2.1) providing open framework that shall be fulfilled by the Suppliers and their product(s) as proposed within this RFP.** Potential Suppliers are encouraged to provide their own views and accordingly submit their RFP proposals fulfilling the scope and the intent of this RFP.

Chapter 2.2 contains summary of selected lessons learned from the hand terminal prototyping phase that NTS considers important to share with the potential Suppliers.

Chapter 2.3 contains basic security framework enabling to provide and operate mission and business critical communication services in the Czech Republic. Alignment with such framework should be a precondition to any bid in the expected future tender from the CZ's Ministry of the Interior for either BB-PPDR services or dedicated LTE 400 MHz network.

Chapter 2.4 contains "datasheet-like" set of parameters and features allowing NTS to effectively compare various product(s) from different Suppliers as part of the RFP evaluation. Suppliers are kindly requested to provide their inputs accordingly.

Full-blown set of requirements will be potentially provided to shortlisted Suppliers within the later stages of this RFP.

2.1 BASIC REQUIREMENTS

It is desired that the solution proposed by the potential Supplier fulfils following basic requirements:

- Support for LTE 410-430 MHz (3GPP band 87) – refer to ANNEX 3
  - *Note: Suppliers are kindly requested to provide their view on whether the offered product(s) can support other LTE 400 MHz bands and specify the level of customization needed*
- Rugged device optimized for mission critical communication and specifically for push-to-talk/video operation
  - Dedicated HW push-to-talk (PTT) button, not placed opposite to on/off or volume buttons
  - Dedicated HW emergency button with colour differentiation
  - Dedicated HW buttons/knob for volume operation
  - Dedicated on/off button/knob
  - All weather capacitive touchscreen display, gloves compatible, visible in all lighting conditions
  - One hand operation and PTT optimized design
  - Cradle operation compatible (ext. antenna, audio accessories, charging)
  - Compatibility with external accessories (mic, PTT speaker, headset, camera, etc.)
  - Water and dust resistant according to IP67
  - Shock proof according to MIL-STD-810G
  - Standard battery enabling minimum 12hrs of operation, preferably hot-swap replaceable, max 4hrs charging via pins
  - Operation temperature range -20°C to +55°C
- Support for commercial LTE networks (3GPP bands 1/3/20/28) – refer to part of the ANNEX 2
- Android OS
- Documented APIs with SDK for integration 3rd party applications e.g. MCPTT
- Support of multiple parallel APNs/PDN connections (refer to chapter 2.2.3)
- Additional connectivity – WiFi, Bluetooth, NFC
- Memory 64 GB ROM + 4 GB RAM, expandable ROM memory
- CPU with minimum 4 cores (e.g. ARMv8)
- USB-C, SD card slot
- Clear audio features (in/out) and powerful loudspeaker (min. 2W output) for noisy environment
- Front and rear camera, HD resolution as minimum
- In-built GPS/Galileo positioning system
- Various types of sensors
- Multi language menu, CZ localization

2.2 LESSONS LEARNED FROM PROTOTYPE HAND TERMINAL TESTING

As mentioned in the chapter 1.5, commercial and private LTE bands are often currently implemented as an independent chipsets and SIM cards and that's exactly the case of our prototype hand terminal. From our perspective that's a consequence of existing products and chipset capabilities and we see this as a temporary state that will be in the future superseded by single chipset / SIM solution.

Current LTE 410-430 MHz prototype of the rugged hand terminal as used by the NTS fulfils most of the basic requirements as listed in the chapter 2.1 and therefore only key parameters for explanatory purposes are provided herein. It must be noted that the prototypes served well for its intended purposes and certain lack of capabilities is understandable.

- Rugged device optimized for mission critical communication and specifically for push-to-talk/video operation
- Dual SIM single standby design
    - First SIM (Mediatek chipset) for EU standard commercial 2G/3G/LTE bands
    - Second SIM (GCT chipset) for private LTE bands B28/B43/B87
- Support of DMR tier II in UHF for direct mode communication in both analogue and digital mode
- DMR in UHF and LTE 410-430 MHz uses the same antennas and the configuration is "active-standby"
- WiFi supported
- Android OS based

2.2.1 DIRECT MODE OPERATION

Next to the LTE network operation mode (via either commercial or private mobile network), the terminal for PPDR users should be able to provide communication service in direct mode (hereinafter referred to as "**DMO**"). The requirement for DMO is driven by the requirement of PPDR users to communicate "every time & everywhere" incl. out of coverage/service scenarios and tactical reasons.

Due to absence of the 3GPP ProSe feature in LTE devices so far it is not possible to offer DMO regime within LTE technology. And if it was even available, the Tx power of the LTE devices (i.e. 200 mW) and the reach of signal would still have to be evaluated, whether it is efficient for the expected use.

Various solution alternatives are being discussed, however NTS would currently prefer to use PMR module within hybrid / multi-mode hand terminal allowing both analogue and digital communication in direct mode allowing "active-active" configuration for LTE and PMR interworking (i.e. enable scanning and communication in parallel when needed). It is primarily expected, that the DMO regime will be mainly used for direct communication between PPDR users on the defined channel(s). For that purpose, simple implementation of the PMR features would be sufficient. That could be enabled by DMR tier II in VHF spectrum with Tx power scheme 1W / 4W. In such case, two dedicated and programmable PTT buttons shall be provided and the terminal shall provide visual information to the end user on the communication mode (e.g. service availability, groups/channels selected).

DMO can be also potentially used for communication with other users using only PMR radio terminals as their primary solution or it can be used as a relay or gateway function. Such terminal can also provide PMR+LTE convergence i.e. enable seamless communication service using PMR and/or LTE (MCPTT) in parallel. Final solution depends on the potential Supplier's proposal and possibilities the DMO / PMR radio module is capable to offer in coexistence with the mobile network regime within one terminal.

PMR trunked mode is not seen as needed from the perspective of LTE mobile network operator promoting migration to BB-PPDR solution.

Abovementioned shall be taken into consideration if the potential Supplier intends to propose hybrid / multi-mode hand terminal as a response to this RFP. For details on potential requirements for DMR tier II refer to **ANNEX 6**.

2.2.2 DUAL SIM/CHIPSET OPERATION AND PRIORITIZATION OF CONNECTIVITY REGIMES

In case that the proposed product will be dual SIM (private and commercial LTE networks), it is expected that both SIM cards will be in standby regime i.e. DSDS. (dual SIM dual standby). It is assumed that DSDA (dual SIM dual active) is expensive, complex for the implementation and would drastically impact terminal' operation time.

Private LTE 410-430 MHz network shall have the highest priority over commercial 2G / 3G / 4G networks and WiFi and should be primarily used as the major connection to MCPTT server platform. APN "mcptx" should be used in this case. It is expected that due to security reasons, core network configuration of the "mcptx" APN will allow access only to the MCPTT server and other mission critical applications placed in a secure domain and won't provide access to/from to public internet.

Commercial 2G / 3G / 4G networks shall be active in parallel with the private LTE 410-430 MHz network (dual standby regime). The commercial network should be **primarily** used for access to the public internet service for the non-mission critical applications. APN "internet" should be used via SIM card of commercial operator.

Then the commercial networks should be **secondarily** used as a back-up connection for MCPTT communication in case LTE 410-430 MHz network coverage/service isn't available. In ideal state the terminal (possibly with cooperation of MCPTT application, which should be able to select and change the connectivity) should be able to change the connectivity automatically without end user's action. If this

back-up scenario is applied and the terminal will access the MCPTT application server via commercial network, APN “internet” should be used in this case together with VPN secured connection.

It shall be also possible to define in terminal settings menu, whether the WiFi connection (i.e. particular SSIDs) shall be used prior to the commercial 2G / 3G / 4G network for the back-up. VPN secured connection shall be established in the same way as in case of connection via commercial network for back-up scenario and secured access to the MCPTT application server.

User/operator shall be able to configure terminal according to his operational needs – prioritize networks based on various operation and service performance/availability conditions.

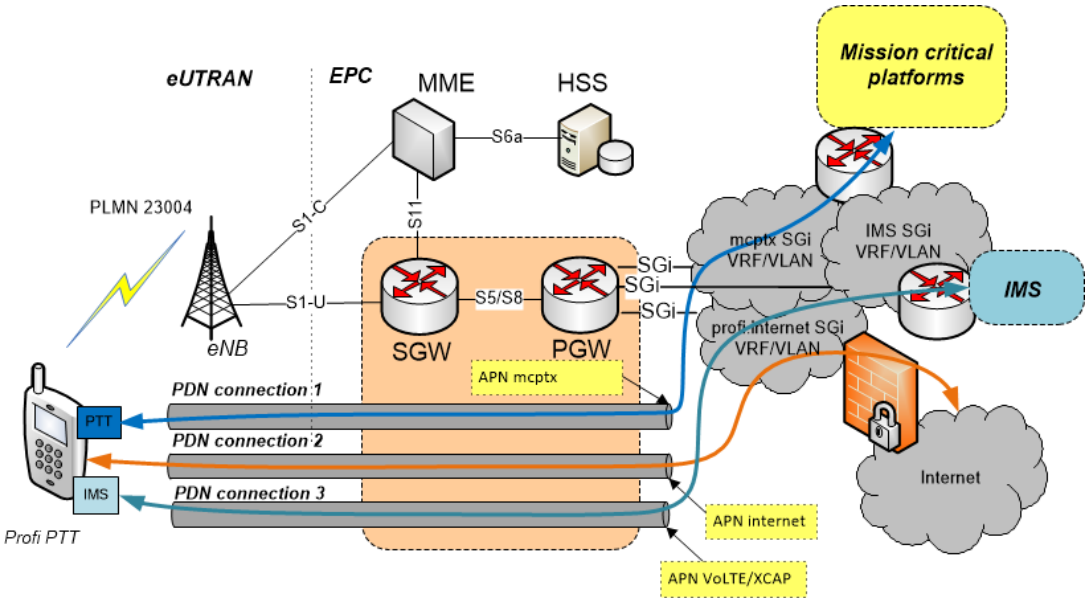
Target solution is to have a single chipset / SIM terminal supporting the whole spectrum of LTE bands from 400-470 MHz range to 3.7 GHz.

Abovementioned (incl. DMO operation (if proposed) as per chapter 2.2.1) shall be taken into consideration if the potential Supplier intends to propose dual SIM hand terminal as a response to this RFP.

2.2.3 SUPPORT OF MULTIPLE APNs, ACTIVE PDN CONNECTIONS SIMULTANEOUSLY

In consideration of the scenarios described in the previous chapter, the terminal should be able to keep multiple data connections simultaneously in order to provide seamless MCPTT service.

According to 3GPP specifications for MCPTT services (i.e. TS 23.179), the MCPTT application should be able to utilize the dedicated APNs for mission critical services. The device must support the connection to several APNs simultaneously i.e. active PDN connections in parallel. There should be the mechanism (i.e. routing table - application specific use of APNs) to decide, which traffic should be routed through which interface. The traffic related to set of MCPTT applications (e.g. “mcptx” APN) should be routed through dedicated MCPTT PDN connections, while the standard data traffic routing is through general purpose "internet" APN and related PDN connection. The routing and related APN settings should be configurable by the device administrator as in case of VoLTE (including remote configuration using XCAP) and must be hidden from ordinary device user. The example of possible configuration is on following picture:



Pic-5: Multi APN concept

2.2.4 COOPERATION WITH THE 3rd PARTY APPLICATION PROVIDERS

For the proper function of the mission critical applications (esp. MCPTT) it is critical that the Supplier closely cooperates with the application provider on integration of the terminal and application features like HW buttons mapping or external accessories integration.

Following are the typical device integration tasks:

- Optimizing application behaviour when terminal is locked, or the screen is off
- Adapting client application to ensure PTT service when the device is in power saving mode
- Integrating device specific keys with the client application (PTT button, emergency button etc.) as well as external accessories
- Use of the client application as Android launcher
- Widget deployment showing e.g. channel ID and activity icons
- Vulnerability testing to identify backdoors and security violations
- Verifying client application together with other customer specific applications and optimization to maximize battery lifetime
- Closing the device at system level for any modifications done by end-users to ensure performance and functional integrity

2.3 SECURITY FRAMEWORK

This chapter intends to define basic security framework enabling to provide and operate mission and business critical communication services in the Czech Republic. Alignment with such framework should be a precondition to any bid in the expected future tender from the CZ's Ministry of the Interior for either BB-PPDR services or dedicated LTE 400 MHz network.

NTS's LTE 410-430 MHz network and overall BB-PPDR solution will become part of Czech Republic's Critical Infrastructure / Critical Information Infrastructure as other commercial mobile networks. The very basic nature of the PPDR communication implies that even stricter regime would be applied for the BB-PPDR solution and all its components incl. end user devices such as hand terminals and their HW and SW equipment.

Generic security framework is in high-level defined by the items below and while it mostly focuses on the network infrastructure, one must understand such framework in full before making any commitments.

- Cybersecurity legislation
  - Refer to https://www.govcert.cz/en/legislation/legislation/, mainly:
    - Act No 181/2014 Coll. on Cyber Security and change of related acts, and
    - Decree No 82/2018 Coll. on Security Measures, Cybersecurity Incidents, Reactive Measures, Cybersecurity Reporting Requirements, and Data Disposal (the Cybersecurity Decree)
  - Also refer to https://www.govcert.cz/en/act/cii-iis/
- Warning against the use of both software and hardware of Huawei Technologies Co., Ltd., and ZTE Corporation
  - Refer to https://www.govcert.cz/en/info/events/2682-software-and-hardware-of-huawei-and-zte-is-a-security-threat/
  - For the avoidance of a doubt:
    - Warning does not ultimately forbid the use of Huawei or ZTE technologies, however appropriate measures must be taken by all involved parties (i.e. Supplier and its suppliers, NTS, potential end customers) in order to reduce or even completely avoid any potential risks
    - Appropriate measures will be discussed on case-by-case basis
- Existing legislation related to current Tetrapol country-wide network "Pegas" that may be applicable for the future BB-PPDR solution
  - Refer to https://www.mvcr.cz/clanek/legislativni-ramec-site-pegas.aspx (CZ only)
- Recommendation on minimum requirements for cryptographic algorithms
  - Refer to https://nukib.cz/download/uredni-deska/Kryptograficke_prostredky_doporuceni_v1.0.pdf (CZ only)
- Security specifications as listed in ANNEX 4, section 1.3
- Cybersecurity standards – ISO/IEC 27001 seen as a basic, other standards compliancy shall be listed by the Supplier

2.4 TERMINAL FEATURES AND PARAMETERS

The table below represents a "datasheet-like" template and non-exhaustive list of parameters and features that the Supplier should use for its description of the product capabilities.

Please, kindly fill in, what is relevant for your product(s) and if relevant, add your own fulfilment.

ID	PARAMETER / FEATURE	COMMENT / DESCRIPTION	YOUR MODEL: SOLUTION OR COMPATIBILITY DESCR.	
1.1	Visualization (picture)			
1.2	Market launch date	*past or planned*		
1.2.1	- Worldwide	*- date and in which markets / countries*		
1.2.2	- CZ	*- date, if applicable*		
1.3	No. of SIM card slots	*Single or dual SIM construction?* *Supplier should indicate also the support of:* *• Standard Mini/Micro/Nano SIM interface/eSIM* *• USIM/ISIM* *• eSIM/eUICC*		
1.4	Chipset(s) solution	*single or dual chipset solution?*		
			Chipset 1	(Chipset 2)
1.4.1	- chipset. model			
1.4.2	- producer			
1.4.3	- CPU clock speed			
1.4.4	- CPU cores number			
1.4.5	- CPU architecture			
1.4.6	- Primary CPU type			
1.4.7	- Secondary CPU type			

1.4.8	- graphics (GPU)			
1.5	Android Operation System	*Which one? (Android 9 and higher is preferably recommended, but not mandatory)*		
1.5.1	- degree of modification	*please, stale whether it is standardized, modified standard or your own proprietary*		
1.6	2G/3G technology & bands			
1.6.1	- GSM	*Highest GERAN (2G) 3GPP release* *Bands: 850 (optional) / 900 / E-GSM / 1800 / 1900* *DTM EDGE/GPRS Support (3GPP TS 43.055)* *A5/1-3-4 support,* *GSM AMR / AMR WB codec*		
1.6.2	- GPRS	*i.e. class 33*		
1.6.3	- EDGE	*i.e. class 33*		
1.6.4	- UMTS	*Highest UTRA (3G) 3GPP release* *WCDMA FDD Band I:* *UL: 1920-1980 MHz, DL: 2110-2170 MHz* *+ List of all supported UMTS bands* *HSDPA Support -Y/N, category* *HSUPA Support - Y/N, category*		
1.7	LTE technology & bands	*We are especially interested in following bands (supported Y/N):* *<u>LTE FDD:</u>* *- LTE commercial 4G bands: most interested in B3 / B20, but the terminal should support all the 4G commercial bands used in CZ (see also ANNEX 2)* *- LTE 410: B87 / B88* *(optional 380-395 MHz – NATO freq.–no LTE standard yet)* *- LTE 450: B31 / B72* *- LTE 700: B28 / B68* *<u>LTE TDD:</u>* *- LTE B43 (TDD 3.7 GHz)*	Chips. 1 / SIM 1	(possibly Chips. 2 / SIM 2)
1.7.1	- LTE Category			
1.7.2	- LTE 3GPP Release No.			
1.7.3	- Public safety QoS support	*Terminal should support the QCIs and the dedicated bearers according to the 3GPP TS 23.203 Rel.12 or newer (QCIs 65, 66, 69, 70)*		
1.8	Direct Mode (DMO) / PMR radio (if applicable)	*Y / N*		
1.8.1	- DMO radio band(s)	*VHF / UHF* - *VHF: 136 – 174 MHz* - *UHF: 400 – 470 MHz* - *Other*		
1.8.2	- DMO standard / method / technology	*Analogue / Digital - DMR II / III, TETRA, P25, TETRAPOL*		
1.8.3	- DMO channel spacing	*12,5 / 25 KHz*		
1.8.4	- DMO Tx power	*1W / 1,8W / 3W / 4W?*		
1.8.5.	- PMR RX Sensitivity	*Analog - 0,250 uV 12 dB SINAD* *Digital - 5% BER: 0.20 µV at 12.5 kHz*		
1.8.6	- Secured DMO	*Encoding (crypto regime) available Y/N?* *Which method / standard?*		
1.9	Antenna	*We are especially interested in antenna solution for private LTE in 410-430 MHz and the antenna for DMO*	Private LTE	DMO
1.9.1	- Type	*directionality*		
1.9.2	- TX/RX antenna gain			
1.9.3	- TX/RX antenna construction	*Detachable? / connectors type*		
1.9.4	- Body Loss			
1.9.5	- Static / dynamic sensitivity			
1.9.6	- Way of integration	*external vs. embedded*		
1.9.7	- External antenna slot Y/N	*whether external antenna slot is available*		

1.10	VoWiFi support Y/N		
1.11	VoLTE support Y/N		
1.12	eMBMS support Y/N	*Terminal should support the MBMS mode-activation/deactivation, voice/data simultaneous receiving according to the 3GPP TS 23.246. Terminal should support RoHC - Robust header compression for the RTP/UDP stream according to the 3GPP TS 36.323 Rel.9 (applies also for VoLTE)*	
1.13	LTE ProSe support Y/N		
1.14	Support of MIMO, SISO etc. For data operations		
1.15	Memory		
1.15.1	- RAM (operational)		
1.15.2	- ROM (internal storage)		
1.15.3	- memory cards support	*which type, up to which memory size*	
1.16	Resistivity – Certificate (IP??, MIL-STD, ATEX)	*Please state, which kind of certificates or declarations about terminal compatibility are you able to issue. Can the resistivity be declared via any of the standards like e.g. IPxx, MIL-STD 810? In which form? We are e.g. interested in the certifications and compatibility about terminal resistivity (e.g. IPxx, MIL-STD 810) or about the certification for the use in special environments like ATEX or similar. If the process of certification or the statement of compatibility is possible, but it is a subject of extra costs, please state these extra costs in the quotation table.*	
1.17	Operation Temperature		
1.18	Operation Humidity		
1.19	Display(s)	*One disp. or multiple displays design*	
1.19.1	- type		
1.19.2	- size		
1.19.3	- resolution		
1.20	Keyboard & Buttons		
1.20.1	- input keyboard type (HW/SW)		
1.20.2	- HW keys Y/N	*Whether standard android phone buttons are HW or SW type (home screen, back, opened apps list)*	
1.21	Special keys Y/N		
1.21.1	- PTT key(s)	*One or two PTT keys?*	
1.21.2	- programmable / media key		
1.21.3	- emergency key		
1.21.4	- turning knob		
1.22	Battery - Main, default		
1.22.1	- type		
1.22.2	- exchangeable Y/N		
1.22.3	- capacity		
1.22.4	- voltage		
1.23	Spare (alternative) Battery - exchangeable – Y/N		
1.23.1	- type		
1.23.2	- capacity		
1.23.3	- voltage		
1.24	Charger - default		
1.24.1	- terminal direct charger – type of connector		
1.24.2	- cradle charger for terminal – availability Y/N		
1.24.3	- external / cradle charger for the terminal main battery (if removable)		

1.24.4	- external / cradle charger for the exchangeable spare battery		
1.25	Camera		
1.25.1	- front c. resolution		
1.25.2	- back c. resolution		
1.25.3	- video recording Y/N		
1.25.4	- flash light params.		
1.26	Audio input/output		
1.26.1	- No. of microphones, microphone params.		
1.26.2	- Speaker parameters, output power		
1.27	Usability		
1.27.1	- gloves operation		
1.27.2	- wet fingers operation		
1.27.3	- display visibility in sunny conditions		
1.27.4	- speaker - noisy environment		
1.27.5	- microphone - noisy environment		
1.27.6	- notification tones		
1.27.7	- LED lights		
1.28	WiFi Y/N and parameters	*Supplier should indicate the support of WLAN client mode for the connectivity over the 3GPP trusted/untrusted 3GPP WiFi access* *WLAN features:* *• WLAN Mode 802.11 a/b/g/n/ac* *◦ Frequency Band 2400,0–2483,5 MHz* *◦ WLAN Channels supported 1-13 (EU standard)* *• WLAN mode 802.11a (5GHz band)* *◦ Frequency Band 51800–5700 MHz* *◦ WLAN Channels supported 36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140 (EU standard)* *• WiFi hotspot* *◦ WPA/WPA2 security* *WLAN interworking should be according to the 3GPP TS 23.234 and 3GPP TS 23.261.*	
1.29	Ports Y/N		
1.29.1	- USB	*Which type? e.g. 2.0, 3.0?*	
1.29.2	- HDMI		
1.29.3	- USB connector with USB Host feature and smart Power Delivery feature		
1.29.4	- audio/video accessory - type of port	*e.g. jack 2,5 / 3,5 mm connector (can't be used for external video camera) or can USB be used?*	
1.30	Bluetooth Y/N	*Supplier should indicate the support of:* *•Bluetooth min. 4.0 HS, EDR Power class2* *•Managed Bluetooth profiles:* *o Headset* *o Hands-free* *o Computer PAN*	
1.31	NFC Y/N	*The NFC reader should be compliant to the ISO/IEC 18000-3, ISO/IEC 18092 / ECMA-340 and ISO/IEC21481 / ECMA-352 standards*	
1.32	FM radio Y/N		
1.33	Position & Localization – which system (GPS, Galileo, GLONAS….)		
1.34	Sensors – which types		
1.35	Security		

1.35.1	- User data encryption? Which type?		
1.35.2	- HW encryption support? (on SD card, on external module, on chip…)	*Supplier should indicate the support of external ciphering module for storing ciphering certificates and running cryptographic algorithms (please describe supported algorithms).* • *Standard MicroSD interface* • *Other format-please describe*	
1.35.3	- "no Google services" variant		
1.36	Parameters (h w d) mm		
1.37	Weight		
1.38	Accessories - availability	*please describe also type of connectors for the accessories*	
1.38.1	-		
1.38.x…			
1.39	Customisation	*Please, state kind and cost of customization available, especially:* • *Branding (NTS brand)* • *Language customization (CZ localisation)* • *Welcome screen / launcher customization* • *Default settings of terminal and operation system* • *Preinstalled applications* • *HW buttons and accessories integration with the applications to be installed (e.g. PTT button, turning knob, external speaker or camera)* • *Other*	
1.40	Certifications		
1.40.1	- EU market compatibility	*It is expected that the Supplier will be responsible for acquiring all the certifications required for launching the hand terminal(s) on EU markets (e.g. CE, EMC, RoHS…) and will be able to declare the EU market compatibility.* *If this process of certification or the statement of compatibility is conditioned by extra costs, please state these extra costs in the quotation table.*	
1.40.2	- GCF	*Supplier should also follow the certification mechanisms defined by Global certification forum, http://www.globalcertificationforum.org/*	
1.4x			

Tab-2: List of parameters and features

3. BUSINESS PROPOSAL

3.1 PRICING MODEL AND DELIVERY TIME

NTS plans to purchase testing samples initially for the in-house testing and then pre-commercial units for potential friendly user pilots with external organisations.

As stated in the chapter 1.3, NTS expects tender from the CZ's MoI in the future for either turnkey BB-PPDR services or dedicated LTE 400 MHz network. Based on such tender outcome, we expect to issue a purchase order for commercial deliveries of 10-30k hand terminals as requested by this RFP in the horizon of 2021/22.

Due to abovementioned, commercial proposal provided by the potential Supplier shall be based rather on the NRE costs model than on the on MOQ requirement. NTS would expect the possibility to deduct NRE payment from the payment for the commercial units delivery in specified volume (MOQ). NTS would be also open to a commercial agreement, associated with one-off NRE expenditure, such as time limited exclusivity for the product(s) with revenue sharing when sold to 3rd parties.

Standard package should contain device, standard battery, antenna, data cable, charging adapter, user manual.

All prices should be quoted in EUR excl. VAT, place and type of delivery according to DDP incoterms 2020, Prague/Czech Republic.

	TESTING SAMPLES	PRE-COMMERCIAL UNITS	COMMERCIAL UNITS
NTS expected volumes	10	100 – 200	3.000 – 5.000 per batch 10.000-30.000 total
Unit price			
MOQ, if required by the Supplier			
NRE cost, if MOQ for commercial units is not applied			
Other*			
Delivery lead time			

Tab-3: Quotation table

**Note: unclassified costs associated with certifications, customizations, specific features, etc.*

3.2 CONTRACTUAL AND BUSINESS CONTINUITY CONDITIONS

Supplier shall state other relevant contractual and business continuity conditions e.g.:

- Company introduction and profile – ownership, revenue, employees, RnD investments, locations, manufactories, suppliers
- Product(s) continuity – additional orders, size of batches, life cycle (e.g. GA, EOLA, LOD, EOL, EOSL)
- Product(s) roadmap – current plans, possibility to influence
- Warranty and out of warranty periods – duration, scope and services
- After-sales support services provided
- Certified support service presence (location)
- Spare parts and accessories – catalogue, pricing, MOQ, duration of availability
- Business continuity assurances – hostile takeover, business plans, legal framework, security assurances and audits
- Other deemed important by the Supplier

3.3 PRODUCT REFERENCES

Supplier shall describe whether the offered hand terminal(s) are based on existing product(s) needing customisations or whether the hand terminal(s) will be newly developed from scratch to fulfil solely NTS's requirements. In the former case, Supplier shall provide technical description of the "base" product that will be customised in order to fulfil the requirements of this RFP, the extent of modifications necessary and reference to commercial use of the "base" product incl. contact information. In the latter case, Supplier shall state other commercial opportunities (i.e. particular customers) that could be opened with the fulfilment of the requirements of this RFP.

Supplier is required to provide the list of reference customers using comparable products or services incl. contact information where possible.

4. RFP PROPOSAL SUBMISSION

Response to this RFP, including all documentation and all additional information, shall be provided in a standard electronic format (i.e. .doc, .xls, .pdf).

Response shall comprise at least:

- High-level product description of the proposed hand terminal(s)
- Detailed technical specification as described in the chapter 2 incl. annexes where relevant
- Filled-in quotation table and answers to the other topics chapter 3
- Generic standards compliancy as per ANNEX 4

The schedule for potential Supplier selection shall be as following:

- Formal confirmation (e-mail) of the Supplier's participation in the RFP till 23. 3. 2020
- Suppliers' questions (free format) to RFP incl. comments on NDA (see ANNEX 5) till 25.3.2020
- NDA (if required by the Supplier) signed by both parties till 30.3.2020
- Answers to Suppliers' questions to RFP till 1.4.2020
- RFP proposals to be submitted till 15.4.2020
- Evaluation of the submitted RFP proposals till 1.5.2020
- From May 2020 onwards, selected Supplier(s) may be asked to present their RFP proposal incl. hand terminal(s) demonstration. Commercial and contract negotiations may commence with shortlisted Supplier(s) afterwards.

Note: End of day and standard Central European Time applies for the dates above, all communication shall be e-mail based unless otherwise agreed

Main contact persons for all questions and for submission of the proposal:

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ANNEX 1

LTE 400 MHz MARKET POTENTIAL

SURVEY RESULTS

1. 450 MHz ALLIANCE MEMBERS SURVEY RESULTS

The survey was conducted at the end of 2019 by NTS under the auspices of the 450 MHz Alliance. Results are continually updated with answers coming later from another participants.

Text of the survey (questionnaire) can be found at https://450alliance.org/rfi-for-handhelds-in-410-and-450-mhz-bands/.

Survey results as of 02/2020:

Country / Operator	**Type of sevices in the network**	**Business segments**	**Type of terminals required**	**Expected quantity** - *Precommercial units* - *First Commercial Order* - *Total Expected Amount*	**Time horizon** - *Precommercial units* - *First Commercial Order* - *Total Expected Amount*
Indonesia / Sampoerna Telekomunikasi Indonesia	- LTE broadband - IoT - Group Commmunications (PTT)	- Business users - Private / Residential users - Government Sectors (PPDR)	- Indoor routers - Industrial routers - Mini routers (MiFi) - Modules (MiniPCIe) - Rugged Android Smartphone (dualSIM: comercial + private) - Rugged Android “Radio type” terminal (Single LTE 410/ 450 – data only)	10 2.000 5.000	Q1/2020 Q1/2020 Q2/2020
Austria / ArgoNET	- IoT - Group Commmunications (PTT)	- Utility - PPDR – Government sectors - Business Users - PMR community	- Industrial routers - Modules (MiniPCIe) - Rugged Android “Radio type” terminal (Single LTE 410/ 450 – data only & (dualSIM: comercial + private)	10 25 2.500	2020 2021 2023
Poland / PGE Group	- IoT - Group Commmunications (PTT)	- Utility	- Indoor routers - Outdoor routers - Industrial routers - Rugged Android Smartphone (Single LTE 410/ 450 – data only) - Rugged Android “Radio type” terminal (Single LTE 410/ 450 – data only)	*(note: stated numbers relevant more to the IoT devices…)* 100-500 5.000 – 20.000 > 1.000.000	2019-2020 Q1 2021 2021-2029
Ireland	- LTE broadband - IoT - Group Commmunications (PTT)	- Utility	- Indoor routers - Outdoor routers - Industrial routers - Rugged Android Smartphone (dualSIM: comercial + private) - Rugged Android “Radio type” terminal (Single LTE 410/ 450 – data only & (dualSIM: comercial + private)	Totally 35.000	By 2022

ANNEX 2

COMMERCIAL 2G / 3G / 4G NETWORKS

TECHNICAL SPECIFICATION

1. GSM / GPRS / EDGE

Feature	Permissible value	Required value	Specification
The highest GERAN (2G) 3GPP Release	i.e.: R99, R7, R8, R9...		
GSM 900 Band		UL: 890-915, DL: 935-960 MHz	
E-GSM UL		880-890, DL: 925-935 MHz	
GSM 1800 Band		UL: 1710 - 1785 MHz, DL: 1805 - 1880 MHz	
GSM 1900 Band		UL: 1850 - 1910 MHz, DL: 1930 - 1990 MHz	
GSM 850 Band		UL: 824 - 849 MHz, DL: 869 - 894 MHz	
GPRS Support	i.e. Class 33		
EDGE Support	i.e. Class 33		
A5/1 Support	Activate/Deactivate	Activate	3GPP 43.020
A5/3 Support	Activate/Deactivate	Activate	3GPP 43.020
GSM AMR Codec			
GSM AMR WB Codec	Activate/Deactivate	Activate	3GPP 26.103

2. UMTS

Feature	Permissible value	Required value	Comment
The highest UTRA (3G) 3GPP Release	i.e.: R8, R9...		
WCDMA FDD Band I		UL: 1920 - 1980 MHz, DL: 2110 - 2170 MHz	Mandatory
WCDMA FDD Band II		UL: 1850 - 1910 MHz, DL: 1930 - 1990 MHz	Optional
WCDMA FDD Band IV		UL: 1710 - 1755 MHz, DL: 2110 - 2155 MHz	Optional
WCDMA FDD Band V		UL: 824 - 849 MHz, DL: 869 - 894 MHz	Optional
WCDMA FDD Band VIII		UL: 880 - 915 MHz, DL: 925 - 960 MHz	Optional
HSDPA Support			category
HSUPA Support			category

3. LTE

Feature	Permissible value	Required value
E-UTRAN 3GPP RRC Release	i.e.: R9, R10...	
LTE ue-Category	i.e. cat 8, cat 9...	
Band 1 LTE FDD		UL: 1920-1980 MHz, DL: 2110-2170 MHz
Band 3 LTE FDD		UL: 1710-1785 MHz, DL: 1805-1880 MHz
Band 7 LTE FDD		UL: 2500-2570 MHz, DL: 2620-2690 MHz
Band 8 LTE FDD		UL: 880-915 MHz, DL: 925-960 MHz
Band 20 LTE FDD		UL: 832-862 MHz, DL: 791-821 MHz
Band 28 LTE FDD – auction in 2H 2020		UL: 703-748 MHz, DL: 758-803

ANNEX 3

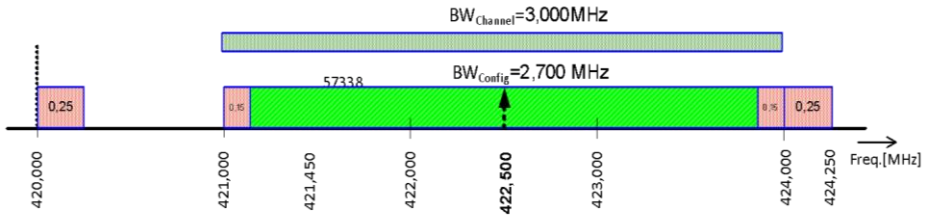
PRIVATE LTE 410-430 MHz NETWORK

TECHNICAL SPECIFICATION

1. NTS FREQUENCY ASSIGNMENT

The frequency assignment of the NTS corresponds to the former CDMA band class5/450, block L with utilization as follows:

- 410.00-414.25 MHz/420.00-424.25 MHz, including 2 guard bands 0.25 MHz on both edges, duplex mode FDD
- The desired LTE network will utilize the single 3 MHz carrier with DL Centre frequency 422,500 MHz at the beginning.



Pic-6: NTS LTE 410-430 MHz frequency assignment

The mid-term intention is to incorporate the remaining frequencies at the interval of 414.25-415 MHz/424.25-425 MHz and widen the band to 3GPP compliant 5 MHz. This will allow to utilize either the LTE 5 MHz carrier, or combination of 3 MHz and 1.4 MHz carriers.

Following information are a 1:1 copy from 3GPP TS 36.101 and related to LTE 410-430 MHz (3GPP band 87).

2. E-UTRA OPERATING BAND NUMBERING

Frequency band specification is described in the following table:

E-UTRA Operating Band	DOWNLINK			UPLINK		
	F_{DL_low} (MHz)	$N_{Offs-DL}$	Range of N_{DL}	F_{UL_low} (MHz)	$N_{Offs-UL}$	Range of N_{UL}
87	420	70546	70546-70595	410	134182	134182-134231

3. MAIN E-UTRA OPERATING BAND

The main operating band corresponds to the E-UTRA band 87 frequency assignment:

Uplink (UL) operating band BS receive UE transmit			Downlink (DL) operating band BS transmit UE receive			Duplex Mode
F_{UL_low} – F_{UL_high}			F_{DL_low} – F_{DL_high}			
410 MHz	–	415 MHz	420 MHz	–	425 MHz	FDD

4. CHANNEL BANDWIDTH

The support of channel bandwidths of the E-UTRA operating band 87 is detailed:

E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
87	Yes	Yes	Yes			

The E-UTRA centre frequency is configurable with step 100kHz

5. RECEIVER PARAMETERS

The user equipment's receiver should fulfil the criteria defined at 3GPP TS 36.101 par.7. The minimum requirements of reference sensitivity power level are the same as for E-UTRA band 31 (3GPP 36.101 par. 7.3.).

Standard LTE REFSENS will be specified to be the same as band 31:

i.e. Reference sensitivity QPSK $P_{REFSENS}$

E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
87	-99.0	-95.7	-93.5				FDD

Uplink configuration for reference sensitivity:

E-UTRA Band	Channel bandwidth / N_{RB}						Duplex Mode
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
87	6	5[4]	5[4]				FDD
NOTE 4: [4] refers to Band 31; in the case of 3 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 9 and in the case of 5 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 10.							

UE category M1 REFSENS will be specified to be the same as band 31 i.e.

Reference sensitivity for FDD and TDD UE category M1 QPSK $P_{REFSENS}$

E-UTRA Band	REFSENS (dBm)	Duplex Mode
87	-96.5	FDD

Reference sensitivity for HD-FDD UE category M1 QPSK $P_{REFSENS}$

E-UTRA Band	REFSENS (dBm)	Duplex Mode
87	-97.3	HD-FDD

FDD and TDD UE category M1 Uplink configuration for reference sensitivity

E-UTRA Band	N_{RB}	Duplex Mode
87	6[1]	FDD and HD-FDD
NOTE 1: [1] refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).		

UE category NB1/NB2 REFSENS will be specified to be the same as band 31 i.e.

Table 7.3.1F.1-1: Reference sensitivity for UE category NB1 and NB2

Operating band	REFSENS [dBm]
87	- 108.2

6. TRANSMITTER PARAMETERS

The output power for any transmission bandwidth within the channel bandwidth is the same as for E-UTRA band 31.

Standard LTE Transmitter output power class is specified as power class 3 with ± 2 dB tolerances.

EUTRA band	Power Class 1 (dBm)	Tolerance (dB)	Power Class 2 (dBm)	Tolerance (dB)	Power Class 3 (dBm)	Tolerance (dB)	Power Class 4 (dBm)	Tolerance (dB)
420 MHz band 87	31	+2/-3			23	±2		

UE category M1 Transmitter output power classes is specified as power classes 3 and 5 with ± 2 dB tolerances.

EUTRA band	Class 3 (dBm)	Tolerance (dB)	Class 5 (dBm)	Tolerance (dB)	Class 6 (dBm)	Tolerance (dB)
420 MHz band 87	23	±2	20	±2	14	±2.5

UE category NB1/NB2 Transmitter output power classes is specified as power classes 3 and 5 with ± 2 dB tolerances and power class 6 with ± 2.5 dB tolerances.

EUTRA band	Class 3 (dBm)	Tolerance (dB)	Class 5 (dBm)	Tolerance (dB)	Class 6 (dBm)	Tolerance (dB)
420 MHz band 87	23	±2	20	±2	14	±2.5

7. UNWANTED EMISSIONS AND THE CO-EXISTENCE OF EXISTING PMR/PAMR AND LTE NETWORKS

The introduction and operation of LTE E-UTRA at NTS's frequency band could have a negative influence on bordering narrowband PMR/PAMR networks in terms of interference. The requirement of interference avoiding is a part of frequency assignment legal notes. Thus, the user equipment should not influence the end devices of narrowband networks in close neighbourhood as well.

The 3GPP recommendation (TS.36.101, par. 6.6.) defines the minimum requirements for user equipment unwanted emissions. Such a requirements may not be enough. The issue and emission requirements are discussed in the CEPT ECC report 240.

Potential Supplier should state its preparedness to fulfil the emission criteria in terms of above.

ANNEX 4

STANDARDS COMPLIANCE

TECHNICAL SPECIFICATION

Supplier should provide the statement of compliance with relevant 3GPP and ETSI standards as listed below, potentially others which the Suppliers considers as relevant.

1. 3GPP STANDARDS

1.1 GENERAL SPECIFICATIONS

- **3GPP TS 23.122**: "Non-Access-Stratum functions related to Mobile Station (MS) in idle mode"
- **3GPP TS 23.401**: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Access Network (E-UTRAN) access"
- **3GPP TS 24.301**: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3"
- **3GPP TS 36.101**: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception"
- **3GPP TS 36.302**: "Evolved Universal Terrestrial Radio Access (E-UTRA); Services provided by the physical layer"
- **3GPP TS 36.304**: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode"
- **3GPP TS 36.306**: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities"

1.2 AIR INTERFACE SPECIFICATIONS

- **3GPP TS 36.201**: “Evolved Universal Terrestrial Radio Access (E-UTRA); LTE physical layer; General description”
- **3GPP TS 36.211**: “Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation”
- **3GPP TS 36.212**: “Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding”
- **3GPP TS 36.213**: “Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures”
- **3GPP TS 36.214**: “Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer – Measurements”
- **3GPP TS 36.321**: “Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification”
- **3GPP TS 36.322**: “Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Link Control (RLC) protocol specification”
- **3GPP TS 36.323**: “Evolved Universal Terrestrial Radio Access (E-UTRA); Packet Data Convergence Protocol (PDCP) Specification”
- **3GPP TS 36.331**: “Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol Specification”

1.3 SECURITY SPECIFICATIONS

- **3GPP TS 33.102**: “3G security; Security architecture”
- **3GPP TS 33.179**: “Security of Mission Critical Push To Talk (MCPTT) over LTE”
- **3GPP TS 33.179**: “Security of Mission Critical Push To Talk (MCPTT) over LTE”
- **3GPP TS 33.180**: “Security of the mission critical service”
- **3GPP TS 33.246**: “3G Security; Security of Multimedia Broadcast/Multicast Service (MBMS)”
- **3GPP TS 33.303**: “Proximity-based Services (ProSe); Security aspects”
- **3GPP TS 33.401**: “3GPP System Architecture Evolution (SAE); Security architecture”
- **3GPP TR 33.879**: “Study on security enhancements for Mission Critical Push To Talk (MCPTT) over LTE”
- **3GPP TR 33.880**: “Study on Mission Critical Security Enhancements”

1.4 SUBSCRIBER IDENTITY MODULE (USIM) SPECIFICATIONS

- **3GPP TS 31.101**: "UICC-terminal interface; Physical and logical characteristics"
- **3GPP TS 31.121**: "UICC-terminal interface; USIM Application Test Specification"
- **ETSI TS 102 230 V7.0.0**: "Smart cards; UICC-Terminal interface; Physical, electrical and logical test specification"
- **ETSI TS 103 383 ETSI TS 103 383**: "Smart Cards; Embedded UICC; Requirements Specification“

1.5 PERFORMANCE AND TEST SPECIFICATIONS

- **3GPP TS 34.108**: "Common Test Environments for User Equipment (UE); Conformance testing"
- **3GPP TS 34.109**: "Terminal logical test interface; Special conformance testing functions"
- **3GPP TS 34.123-1**: "User Equipment (UE) conformance specification; Part 1: Protocol conformance specification"
- **3GPP TS 34.123-2**: "User Equipment (UE) conformance specification; Part 2: Implementation conformance statement (ICS) specification"
- **3GPP TS 34.123-3**: "User Equipment (UE) conformance specification; Part 3: Abstract test suites (ATSs)"
- **3GPP TS 36.508**: “Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Common test environments for User Equipment (UE) conformance testing”
- **3GPP TS 36.509**: “Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Special conformance testing functions for User Equipment (UE)”

- **3GPP TS 36.521-1**: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing"
- **3GPP TS 36.521-2**: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Implementation Conformance Statement (ICS)"
- **3GPP TS 36.521-3**: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Radio Resource Management (RRM) conformance testing"
- **3GPP TS 36.523-1**: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification"
- **3GPP TS 36.523-2**: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 2: Implementation Conformance Statement (ICS) proforma specification"
- **3GPP TS 36.523-3**: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 3: Abstract Test Suites (ATS)"
- **3GPP TS 37.571-1**: "Universal Terrestrial Radio Access (UTRA) and Evolved UTRA (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification for UE positioning; Part 1: Conformance test specification"
- **3GPP TS 37.571-2**: "Universal Terrestrial Radio Access (UTRA) and Evolved UTRA (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification for UE positioning; Part 2: Protocol conformance"
- **3GPP TS 37.571-3**: "Universal Terrestrial Radio Access (UTRA) and Evolved UTRA (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification for UE positioning; Part 3: Implementation Conformance Statement (ICS)"
- **3GPP TS 37.571-4**: "Universal Terrestrial Radio Access (UTRA) and Evolved UTRA (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification for UE positioning; Part 4: Test suites"
- **3GPP TS 37.571-5**: "Universal Terrestrial Radio Access (UTRA) and Evolved UTRA (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification for UE positioning; Part 5: Test scenarios and assistance data"

1.6 GROUP COMMUNICATION SYSTEM ENABLERS SPCIFICATIONS

- **3GPP TS 22.468**: "Group Communication System Enablers for LTE (GCSE_LTE)"
- **3GPP TS 23.468**: "Group Communication System Enablers for LTE (GCSE_LTE); Stage 2"
- **3GPP TS 29.468**: "Group Communication System Enablers for LTE (GCSE_LTE); MB2 Reference Point; Stage 3"

1.7 MISSION CRITICAL COMMUNICATIONS SPECIFICATIONS

Technical specifications:

- **3GPP TS 22.179**: "Mission Critical Push to Talk (MCPTT) over LTE; Stage 1"
- **3GPP TS 22.280**: "Mission Critical Services Common Requirements"
- **3GPP TS 22.281**: "Mission Critical Video over LTE"
- **3GPP TS 22.282**: "Mission Critical Data over LTE"
- **3GPP TS 23.179**: "Functional architecture and information flows to support mission critical communication services; Stage 2"
- **3GPP TS 23.280**: "Common functional architecture to support mission critical services; Stage 2"
- **3GPP TS 23.281**: "Functional architecture and information flows to support Mission Critical Video (MCVideo); Stage 2"
- **3GPP TS 23.282**: "Functional architecture and information flows to support Mission Critical Data (MCData); Stage 2"
- **3GPP TS 23.379**: "Functional architecture and information flows to support Mission Critical Push To Talk (MCPTT); Stage 2"
- **3GPP TS 24.379**: "Mission Critical Push To Talk (MCPTT) call control; Protocol specification"
- **3GPP TS 24.380**: "Mission Critical Push To Talk (MCPTT) media plane control; Protocol specification"
- **3GPP TS 24.381**: "Mission Critical Push To Talk (MCPTT) group management; Protocol specification"
- **3GPP TS 24.382**: "Mission Critical Push To Talk (MCPTT) identity management; Protocol specification"
- **3GPP TS 24.383**: "Mission Critical Push To Talk (MCPTT) Management Object (MO)"
- **3GPP TS 24.384**: "Mission Critical Push To Talk (MCPTT) configuration management; Protocol specification"
- **3GPP TS 26.179**: "Mission Critical Push To Talk (MCPTT); Codecs and media handling"
- **3GPP TS 29.283**: "Diameter Data Management Applications (MCPTT-2 and CSC-13 ref. points)"
- **3GPP TS 33.179**: "Security of Mission Critical Push To Talk (MCPTT) over LTE"

Technical reports:

- **3GPP TR 22.879**: "Feasibility study on mission critical video services over LTE"
- **3GPP TR 22.880**: "Feasibility study on mission critical data communications"
- **3GPP TR 23.779**: "Study on application architecture to support Mission Critical Push To Talk over LTE (MCPTT) services"
- **3GPP TR 23.780**: "Study on Multimedia Broadcast and Multicast Service (MBMS) usage for mission critical communication services"
- **3GPP TR 23.781**: "Study on migration and interconnection for mission critical services"
- **3GPP TR 23.782**: "Study on mission critical communication interworking between LTE and non-LTE systems"
- **3GPP TR 24.980**: "Minimum Requirements for support of MCPTT Service over the Gm reference point"
- **3GPP TR 26.879**: "Study on media, codecs and MBMS enhancements for MCPTT"
- **3GPP TR 26.989**: "Mission Critical Push To Talk (MCPTT); Media, codecs and Multimedia Broadcast/Multicast Service (MBMS) enhancements for MCPTT over LTE"

1.8 MISSION CRITICAL COMMUNICATIONS SUPPORTING SPECIFICATIONS – MBMS, IOPS, ProSe, etc.

- **3GPP TS 22.146**: "Multimedia Broadcast/Multicast Service; Stage 1"
- **3GPP TS 22.246**: "Multimedia Broadcast/Multicast Service (MBMS) user services; Stage 1"
- **3GPP TS 23.246**: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description"
- **3GPP TS 25.346**: "Introduction of Multimedia Broadcast/Multicast Service (MBMS) in the Radio Access Network (RAN); Stage 2"
- **3GPP TS 26.346**: “Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs”
- **3GPP TR 26.946**: "Multimedia Broadcast/Multicast Service (MBMS); User service guidelines"
- **3GPP TS 22.346**: “Isolated Evolved Universal Terrestrial Radio Access Network (E-UTRAN) operation for public safety; Stage 1”
- **3GPP TS 23.303**: “Proximity-based services (ProSe); Stage 2”
- **3GPP TR 22.803**: “Feasibility study for Proximity Services (ProSe)”

2. ETSI STANDARDS FOR DMR

- General System Design - **ETSI TR 102 398 V1.4.1** (2018-11)
- Part 1: DMR Air Interface (AI) protocol - **ETSI TS 102 361-1 V2.5.1** (2017-10)
- Part 2: DMR voice and generic services - **ETSI TS 102 361-2 V2.4.1** (2017-10)
- Part 3: DMR data protocol - **ETSI TS 102 361-3 V1.3.1** (2017-10)
- Part 4: DMR trunking protocol - **ETSI TS 102 361-4 V1.10.1** (2019-08)

ANNEX 5

NON-DISCLOSURE AGREEMENT

TEMPLATE

NON-DISCLOSURE AGREEMENT

……

Registered office
/place of business: …….
Represented by: ……
Company registration number (IČ): ……
Registered in: the Register of Companies administered by the Municipal Court in ……., Section ……, Insert ……..

(hereinafter referred to as the "……")

and

Nordic Telecom Systems a.s.

Registered office: Jihlavská 1558/21, Prague 4 – 140 00
Represented by: Petr Horák, statutory director
Company registration number (IČ): CZ07082835
Registered in: the Register of Companies administered by the Municipal Court in Prague, Section B, Insert 23428

(hereinafter referred to as „NTS")

I.
PURPOSE OF THE AGREEMENT

1. When preparing for a future cooperation and in relation to such cooperation regarding the ……., if it takes place (hereinafter referred to as "Cooperation"), the Parties will be disclosing to each other information which may have the nature of confidential information. The Parties undertake to disclose and handle such information in accordance with this Agreement.
2. The purpose of this Agreement is to ensure confidentiality of disclosed information. For the avoidance of doubt, if the Cooperation between the Parties takes place, this Agreement shall apply to the full extent also to the disclosure of information during such Cooperation, unless otherwise stipulated by the agreement regulating the Cooperation between the Parties.

II.
CONFIDENTIAL INFORMATION

1. The Parties undertake to maintain confidentiality in relation to any facts and information relating to the other Party which they receive during the Cooperation between the Parties, as well as in relation to all other facts and information (particularly of business and technical nature), which were disclosed to the Party by the other Party/Parties and which are not publicly known or available and which may be reasonably considered as information the secrecy of which the disclosing Party may be deemed to be justifiably concerned in (hereinafter referred to as the "Confidential Information").
2. Each Party also undertakes to maintain confidentiality in relation to the facts and information which were expressly designated by the other Party as "*Secret*", "*Confidential*", „*Trade Secret*", or similarly in Czech or English language. Information designated in this manner will also be considered as Confidential Information as per this Agreement. For the avoidance of doubt, Confidential Information does not have to be expressly designated as such, however, in order to avoid any doubt regarding the nature of information, it is advisable to designate the information concerned as Confidential Information, particularly in cases when the nature of the information might not be utterly clear to the other Party.

III.

HANDLING CONFIDENTIAL INFORMATION

1. Each Party undertakes to prevent any leakage, publishing or dissemination of Confidential Information obtained from the other Party/Parties and to protect the secrecy of Confidential Information at least to the extent to which it protects its own trade secrets and always in the manner which is usually used for the protection of trade secret.
2. Each Party undertakes to exercise the best efforts that can be reasonably expected in order to ensure that the secrecy of the other Party's Confidential Information is maintained by its employees or persons designated to fulfill the purpose of the Cooperation. If a Party uses a third party to fulfill the purpose of the Cooperation, such Party is entitled to disclose the Confidential Information obtained from the other Party to such third party only with the other Party's consent and only to the extent necessary for the performance provided by the third party, and it is also obliged to impose on the third party the obligation of confidentiality. The Party which has disclosed the Confidential Information to the third party will be held liable in the case that the third party breaches its obligations.
3. Each Party undertakes to use the Confidential Information obtained from the other Party/Parties exclusively for the purpose for which the Confidential Information was disclosed to it.
4. The Parties agree that based on this Agreement, each of the Parties is entitled to disclose the other Party's Confidential Information to its legal, tax and accounting consultants (hereinafter referred to as the "Consultant"). NTS is entitled to share the Confidential Information based on the purpose of the Cooperation within the Nordic Telecom and Nordic Investors Group, or to its subsidiaries or shareholders (Pursuant to Section 79 et seq. Act No. 90/2012 Coll., On Business Corporations). The Party who disclosed Confidential Information to a third party specified in this article will be held liable for the breach of obligations by such third party.
5. In circumstances where it can be reasonably expected that the confidentiality of the Confidential Information might be jeopardized, the Party on whose part such circumstances exist undertakes to report such a fact to the other Parties. Should any of the Parties reasonably suspect that the other Party is not able to ensure protection of Confidential Information as per this Agreement, any Party may request the other Party to prove that it fulfills its obligations as per this contract. If the other Party satisfies such a request, the reasonable costs related thereto will be borne by the requesting Party.
6. Upon written request of the disclosing Party, the other Parties shall, without undue delay, return to the disclosing Party all media with Confidential Information, particularly any media with PC software, documentation, notes, plans, drafts and their copies.
7. For the avoidance of doubt, all Confidential Information shall remain the property of the disclosing Party and no authorization or other rights related to the information are hereby granted or transferred to the receiving Party/Parties.

IV.
DISCLOSURE OF CONFIDENTIAL INFORMATION

1. The obligations stipulated herein do not apply to Confidential Information which **(i)** is publicly known at the time of its disclosure or becomes publicly known after being disclosed, rightfully and without a breach of any obligation as per this agreement **(ii)** was independently developed or acquired, without a breach of any of the obligations as per this agreement, by the Party who had originally received such information as confidential **(iii)** the recipient is obliged to disclose according to the applicable legal regulations, or based on a decision of the respective public authority, provided that the Party notifies the other Party of this fact immediately after the obligation of disclosure arises (unless it is prevented from doing so by the applicable legal regulations or a decision issued by the respective public authority) and takes any measures necessary in order to protect confidentiality to the maximum possible extent given by the respective legal regulations and the decision of the public authority.
2. Upon request of the Party whose Confidential Information was disclosed as per article IV (1) hereof, the other Party/Parties shall prove the existence of the reason for disclosing the information.

V.
PENALTIES

1. In the event of a breach of any of the obligations defined in Article III (1) to (3) hereof (also taking into account Article V (5) hereof), the breaching Party shall be obliged to pay to the each of the Party whose unjustifiably Confidential information was unjustifiably disclosed a contractual penalty of CZK 300 000 for each breach committed.
2. The Parties have agreed that all contractual penalties hereunder shall be due within 15 days following the delivery of a legitimately-issued statement of contractual penalty to the other Party. The agreement on, and the payment of, any contractual penalty hereunder is without prejudice to the right to claim damages.

VI.
FINAL PROVISIONS

1. This Agreement has been executed in two (2) counterparts, of which each Party shall receive one counterpart. This Agreement shall be governed by the laws of the Czech Republic, without the application of conflict rules.
2. Any and all changes and amendments to this Agreement may only be made in form of written amendments signed by both Parties.
3. Unless otherwise expressly stated by the Parties, this Agreement does not constitute the final offer to contract or an amendment of a contract or acceptance of such offer.
4. This Agreement shall come into force and effect on the date it is signed by both Parties and shall be entered into for a fixed term that shall expire five years following the termination of Parties' Cooperation. Nevertheless, the Parties expressly agree that the obligation to treat Confidential Information of the other Party in compliance with Article III hereof, as well as the entitlement to damages and contractual penalty hereunder shall persist not only during the term hereof but also following the termination of this Agreement until such information becomes generally known in public in a manner other than as a result of a breach of this Agreement.
5. Any and all disputes which the Parties fail to settle amicably by mutual negotiation shall be submitted for final resolution to the competent Czech court having the subject-matter jurisdiction.
6. The Parties confirm that this Agreement represents their complete and exclusive mutual agreement regarding the subject-matter hereof.

Prague, ……..	Prague, ...
.....	.....
NTS	…….

ANNEX 6

DMR FUNCTIONAL REQUIREMNTS

TECHNICAL SPECIFICATION

1. Narrowband PMR functions requirements

- The UE should be capable to operate in band:
  - VHF analog / digital (DMR tier II) - 136-174 MHz
  - UHF analog / digital (DMR tier II) - 400-470 MHz
- Narrowband PMR output power selectable 1W/ 4W
- PMR RX Sensitivity:
  - Analog - 0,250 uV 12 dB SINAD
  - Digital - 5% BER: 0.20 µV at 12.5 kHz
- UE must support DMR tier I and II features in accordance with ETSI TR 102 361 rec family (listed in par.2). Services are as follows (listed at ETSI TR 102 98 par.6 and 7.)

2. DMR services

- Bearer services
- Supplementary services
- Tele-services
- Network procedures
- Features

Table 6.1: DMR tier I and II services overview

Services		Supplementary services
Voice	Individual Call	Late Entry
		OVCM Call
		Talking Party Identification
	Group Call	Late Entry
		Unaddressed Call
		OVCM Call
		Talking Party Identification
	All Call	Late Entry
		Talking Party Identification
	Broadcast Call	Late Entry
		Talking Party Identification
Confirmed PDP	IP over PDP	-
	Short Data over PDP - Status/Pre-coded	-
	Short Data over PDP - Raw Data	-
	Short Data over PDP - Defined Data	-
Unconfirmed PDP	IP over PDP	-
	Short Data over PDP - Raw Data	
	Short Data over PDP - Defined Data	

3. DMR data services

- The Packet Data Protocol contains the following types of data transmissions:
  - unconfirmed data transmission.
  - confirmed data:
    - data transmission;
    - response transmission.
- The PDP supports the following data services:
  - Internet Protocol.
  - Short Data Services:
    - raw data;
    - status/precoded data;
    - ddefined data.

4. Other services

- Any vendor specific features on top of DMR framework should be indicated at vendor's response and documented in detail. Examples:

  - GPS data relay over SMS.
  - Additional information transfer over signalling – device ID, group ID etc.
- DMR tier III (trunking) is optional. If supported, must be in accordance of ETSI TR 102 98 par.8

5. DMR encryption

- UE must support the encryption mechanisms defined by DMR association. The possible methods are:
  - Basic
  - Enhanced - ARC4 40 bits
  - Advanced - AES 128 bits or the AES 256 bits encryption
  - Customised – e.g. proprietary algorithms on SD card
- UE vendor should list these methods at response.