

## Smlouva č. CTU/2020\_072

uzavřená podle § 2079 a násl. s využitím § 2358 násl. zákona č. 89/2012 Sb., občanský zákoník, ve znění pozdějších předpisů (dále jen „smlouva“), mezi těmito smluvními stranami:

### 1. Česká republika – Český telekomunikační úřad

Se sídlem: Sokolovská 58/219, Praha 9 - Vysočany  
Adresa pro doručování: poštovní přihrádka 02, 225 02 Praha 025  
Bankovní spojení: ČNB Praha  
Číslo účtu: xxxxxxxxxxxxxxxx  
IČO: 701 06 975  
DIČ: CZ70106975 (osoba identifikovaná k dani)  
Její jménem jedná: Ing. Jan Ševčík  
ředitel Sekce kontroly a ochrany spotřebitele

(dále jen „kupující“) na straně jedné

a

### 2. ROHDE & SCHWARZ - Praha, s.r.o.

Se sídlem: Hadovka Office Park, Evropská 2590/33c, 160 00 Praha 6  
Zastoupená: Ing. Pavlem Šalandou, jednatelem  
IČO: 629 06 127  
DIČ: CZ62906127  
Bankovní spojení: UniCredit Bank Czech Republic and Slovakia, a.s.  
Číslo účtu: xxxxxxxxxxxxxxxx  
Zapsaná v Obchodním rejstříku vedeném u Městského soudu v Praze, oddíl C, vložka č. 34376

(dále jen „prodávající“) na straně druhé

## I.

### Účel a předmět smlouvy

1. Účelem této smlouvy je stanovení obsahových požadavků, postupů, obchodních podmínek a dalších smluvních ujednání, na jejichž základě dojde k realizaci dodávky měřicího přístroje pro analýzu mobilních sítí na základě výsledků výběrového řízení v rámci veřejné zakázky malého rozsahu na dodávky s názvem „Nákup analyzátoru mobilních sítí využívajícího bezdrátové rozhraní“.
2. Předmětem této smlouvy je na straně jedné závazek prodávajícího dodat za podmínek stanovených touto smlouvou kupujícímu měřicí přístroj pro analýzu mobilních sítí a poskytnout související plnění v rozsahu a za podmínek podle této smlouvy včetně její přílohy č. 1, a na straně druhé závazek kupujícího za řádně a včas poskytnuté plnění zaplatit prodávajícímu sjednanou cenu podle čl. VII této smlouvy.

## **II.**

### **Místo plnění**

Místem plnění je pracoviště kupujícího na adrese Jurkovičova 1, 638 00 Brno (viz příloha č. 1 této smlouvy), nebude-li dohodnuto jinak.

## **III.**

### **Termín plnění**

Prodávající se zavazuje dodat měřicí přístroj pro analýzu mobilních sítí a poskytnout související plnění nejpozději do 6 týdnů ode dne nabytí účinnosti této smlouvy.

## **IV.**

### **Předání a převzetí**

1. Plnění se považuje za řádně poskytnuté po předání všech produktů, včetně základního popisu a základní uživatelské příručky, při současném zaškolení vybraných zaměstnanců kupujícího v místě plnění a po akceptaci plnění podepsáním akceptačního protokolu.
2. V rámci procesu předání bude pořízen písemný předávací protokol, ve kterém pověřený zástupce prodávajícího (viz čl. XIII odst. 3 této smlouvy) výslovně prohlásí, že plnění je předáváno bez vad, a zástupce kupujícího prohlásí, že dodávku přebírá ke kontrole kvality (výstupem bude protokol o shodě) a akceptačnímu řízení (výstupem bude akceptační protokol). Předání a převzetí se uskuteční na místě uvedeném v čl. II této smlouvy a na písemnou výzvu prodávajícího doručenou pověřenému zástupci kupujícího min. dva pracovní dny před plánovaným předáním.
3. Výsledkem kontroly kvality může být „Schváleno bez výhrad“ (tj. shoda se specifikací provedení - při kontrole kvality nebyly shledány nedostatky bránící akceptaci výstupu), a „Neschváleno - vráceno k přepracování“ (tj. neshoda se specifikací provedení - při kontrole kvality byly shledány vady a nedodělky bránící akceptaci výstupu; prodávající odstraní všechny nalezené vady a nedodělky v termínu stanoveném kupujícím; odstranění zjištěných vad a nedodělků bude ověřeno opětovnou kontrolou kvality a výsledek bude zaznamenán formou dodatku k protokolu o shodě). Akceptační řízení následuje po schválení bez výhrad v protokolu o shodě a je ukončeno podepsáním akceptačního protokolu.

## **V.**

### **Záruka za jakost**

1. Prodávající poskytuje na plnění záruku za jakost po dobu minimálně 24 měsíců. Záruční doba počíná běžet dnem podpisu akceptačního protokolu podle čl. IV odst. 2 této smlouvy.
2. Smluvní strany sjednávají, že v případě zjištění vady se kupující zavazuje vadu oznámit prodávajícímu prokazatelným způsobem.
3. Prodávající se zavazuje vadu odstranit v místě plnění nejpozději do 30 dnů ode dne jejího oznámení a předání vadného výrobku zástupci prodávajícího.

## **VI.**

### **Povinnosti smluvních stran**

1. Prodávající se zavazuje:
  - a) provést předmět smlouvy na odborné úrovni řádně a včas v termínu dle čl. III této smlouvy,
  - b) bez zbytečného odkladu informovat kupujícího o ohrožení splnění této smlouvy (zejména splnění předmětu smlouvy).

2. Kupující se zavazuje:

- a) poskytnout prodávajícímu součinnost nezbytně nutnou pro splnění této smlouvy,
- b) průběžně informovat o svých návrzích a doporučeních. Tyto návrhy a doporučení budou poskytnuty objektivním a profesionálním způsobem.

## VII.

### Cena a platební podmínky

1. Cena za plnění podle této smlouvy činí 1.473.605 Kč bez DPH. Celková cena za dodávku včetně DPH ve výši 21 % činí 1.783.062,05 Kč.
2. Celková cena je stanovena jako konečná, pevná a nepřekročitelná, přičemž zahrnuje veškeré náklady související s plněním předmětu smlouvy. Cena může být změněna pouze v případě změny sazby daně z přidané hodnoty.
3. Nárok na úhradu ceny za plnění vzniká prodávajícímu okamžikem podpisu akceptačního protokolu podle čl. IV odst. 2 této smlouvy.
4. Celková cena bude uhrazena bezhotovostním převodem na účet prodávajícího, a to na základě daňového dokladu – faktury (dále jen „faktura“) vystavené prodávajícím se splatností nejméně 30 dnů ode dne jejího doručení kupujícímu, avšak faktura doručená kupujícímu mezi 15. prosincem a 10. lednem je splatná nejdříve následujícího 1. února.
5. Faktura musí obsahovat náležitosti daňového a účetního dokladu podle zákona č. 563/1991 Sb., o účetnictví, ve znění pozdějších předpisů, § 29 zákona č. 235/2004 Sb., o dani z přidané hodnoty, ve znění pozdějších předpisů (jedná se především o označení faktury a její číslo, jméno, sídlo a IČO prodávajícího, bankovní spojení, fakturovanou částku bez/včetně DPH, sazbu DPH), § 435 občanského zákoníku a současně evidenční číslo této smlouvy. Nedílnou součástí faktury bude tvořit kopie akceptačního protokolu.
6. V případě, že faktura nebude obsahovat některou z předepsaných náležitostí či bude obsahovat chyby v psaní či počtech, je kupující oprávněn vrátit takovou fakturu prodávajícímu k doplnění či opravě. Lhůta splatnosti se v takovém případě přerušuje a počíná znovu běžet od vystavení opravené či doplněné faktury.
7. Platební povinnosti kupujícího plynoucí z této smlouvy jsou splněny dnem odepsání částky z účtu kupujícího ve prospěch účtu prodávajícího.

## VIII.

### Povinnost mlčenlivosti Důvěrnost informací

1. Prodávající a kupující se zavazují, že obchodní, technické, jakož i netechnické informace, které mají nebo by mohly mít potenciální hodnotu, a které jim byly svěřeny smluvním partnerem, nezpřístupní třetím osobám bez předchozího písemného souhlasu druhé smluvní strany a nepoužijí tyto informace ani pro jiné účely než pro plnění svých závazků dle podmínek této smlouvy. Za důvěrnou informaci se pokládá vždy taková informace, která je takto kteroukoliv smluvní stranou kdykoliv označena. To však neplatí v případě, že by se stala tato informace, k níž se zavazují k povinnosti mlčenlivosti či k povinnosti zachovat důvěrnost informace, dle tohoto ustanovení smlouvy, obecně známou či dostupnou.
2. Prodávající se výslovně zavazuje, že informace, získané v souvislosti s plněním předmětu smlouvy nezneužije k jinému účelu než výlučně k plnění této smlouvy.
3. Prodávající se zavazuje, že všechny povinnosti stanovené mu v tomto článku ve stejné podobě uplatní vůči svým zaměstnancům, resp. tyto povinnosti přeneše v rámci svých smluvních vztahů na případné poddodavatele.

## **IX. Vyšší moc**

1. Smluvní strany nebudou odpovědné za částečné nebo úplné neplnění smluvních závazků následkem okolností vylučujících odpovědnost v případech tzv. vyšší moci. Výraz vyšší moc znamená a zahrnuje zejména: přírodní katastrofu, požár, záplavy, zemětřesení a dále povstání, stávky, pracovní boje jakéhokoliv druhu nebo terorismus, které mají přímou souvislost a brání plnění povinností ze smlouvy a plnění povinností nelze zajistit jinak nebo je nahradit, nehody, pád letadla včetně nehod, kterým se nedalo vyhnout v souvislosti s plněním této smlouvy včetně přijetí zákona nebo mimořádného rozhodnutí přísl. úřadu v souvislosti se zásahem vyšší moci, pokud příčiny a události mají vliv na plnění povinností stran ze smlouvy a plnění povinností vyplývajících ze smlouvy nelze zajistit jinak.
2. Vyskytne-li se působení překážky v důsledku vyšší moci, s níž jsou spojeny účinky vylučující odpovědnost, lhůty ke splnění smluvních závazků se prodlouží o dobu trvání takové překážky. Smluvní strana, která je postižena takovou překážkou, je však povinna okamžitě, písemně, uvědomit druhou smluvní stranu o této skutečnosti, o začátku trvání této překážky a předpokládané době jejího trvání.

## **X. Salvátorské ustanovení**

Obě smluvní strany prohlašují, že pokud se kterékoliv ustanovení této smlouvy nebo s ní související ujednání ukáže být neplatným nebo se neplatným stane, že tato skutečnost neovlivní platnost smlouvy jako celku. V takovém případě se obě smluvní strany zavazují nahradit neprodleně neplatné ustanovení ustanovením platným; obdobně se zavazují postupovat v případě ostatních nedostatků smlouvy či souvisejících ujednání.

## **XI. Ukončení smlouvy**

1. Tato smlouva může být ukončena písemnou dohodou obou smluvních stran.
2. Kterákoliv ze smluvních stran může odstoupit od smlouvy, v případě, že druhá smluvní strana poruší podstatným způsobem své povinnosti vyplývající z této smlouvy a dále též z důvodů upravených občanským zákoníkem, kdy se za podstatné porušení smlouvy považuje takové porušení povinností, o němž strana porušující smlouvu již při uzavření smlouvy věděla nebo musela vědět, že by druhá strana smlouvu neuzavřela, pokud by toto porušení předvídala a jestliže nezjedná nápravu do 10 dnů od doručení písemného oznámení druhé smluvní strany, které bude obsahovat popis porušení závazku a požadavek na nápravu.
3. Za podstatné porušení smlouvy prodávajícím se podle této smlouvy dále považuje zejména:
  - a) nedodržení stanoveného termínu plnění smlouvy,
  - b) nedodržení povinnosti mlčenlivosti či zachování důvěrných informací,
  - c) neodstranění vad ve sjednané lhůtě.
4. Odstoupení od smlouvy musí být provedeno písemně a doručeno druhé smluvní straně. Právní účinky nastávají dnem doručení o odstoupení od smlouvy druhé smluvní straně.
5. V případě, že tato smlouva zanikne odstoupením, má prodávající právo na poměrnou úhradu za již dodanou část dodávky podle této smlouvy. Toto ustanovení neplatí v případě, že dojde k odstoupení od smlouvy z důvodu na straně prodávajícího.

## XII.

### Smluvní pokuty, odpovědnost za škody

1. V případě prodlení prodávajícího s termínem plnění podle čl. III této smlouvy uhradí kupující prodávajícímu smluvní pokutu ve výši 0,1 % z celkové ceny dodávky včetně DPH za každý i započatý den prodlení až do řádného předání dodávky, maximálně však do 5 % z celkové ceny dodávky včetně DPH.
2. V případě prodlení prodávajícího s odstraněním oznámených vad je prodávající povinen uhradit kupujícímu smluvní pokutu ve výši 0,1 % z celkové ceny dodávky za každou vadu a započatý den prodlení, maximálně však do 5 % z celkové ceny dodávky včetně DPH.
3. V případě prodlení kupujícího s uhrazením faktury má prodávající právo na úrok z prodlení v zákonné výši z dlužné částky za každý den prodlení.
4. Za porušení jiné povinnosti stanovené smlouvou uhradí prodávající kupujícímu částku 500 Kč za každý jednotlivý případ porušení této povinnosti.
5. Smluvní pokuta a úrok z prodlení jsou splatné ve lhůtě 10 kalendářních dnů ode dne doručení písemné výzvy k jejich úhradě.
6. Uplatněním nároku na smluvní pokutu ani jejím skutečným uhrazením nezaniká povinnost zavázané strany splnit povinnost, jejíž plnění bylo zajištěno smluvní pokutou.
7. Zaplacením smluvní pokuty podle této smlouvy není dotčeno právo smluvní strany na náhradu škody vzniklé porušením smluvní povinnosti. Smluvní strany se dohodly, že celková odpovědnost každé smluvní strany za jakékoliv takové újmy (škodu) - pokud by nešlo o případ úmyslu či hrubé nedbalosti – je smluvně omezena, a to na náhradu částky, která bude v součtu činit maximálně 50 % z celkové ceny dodávky vč. DPH. Přitom se současně vylučuje odpovědnost za nepřímé/následné škody (včetně např. ušlého zisku, ztráty provozního využití, náhradního/krycího nákupu; dále ztráty dat, informací a programů následkem softwarové chyby). Povinnost k náhradě majetkové újmy (škody) je rovněž vyloučena v případech nutné obrany, krajní nouze a vyšší moci. Nelze uplatňovat náhradu majetkové újmy (škody) za to, co mohlo být uspokojeno v rámci nároků z odpovědnosti za vady.

## XIII.

### Závěrečná ustanovení

1. Jestliže bude mít kupující jakékoli výhrady ať již ve vztahu k poskytovanému plnění předmětu této smlouvy nebo k osobám podílejících se na straně prodávajícího na plnění dodávky, sdělí je důvěrným způsobem kontaktní osobě prodávajícího uvedené v odstavci 3 tohoto článku. Jestliže se bude domnívat, že tyto výhrady nejsou adekvátně řešeny nebo že jejich charakter či vážnost to vyžadují, bude výslovně kontaktovat odpovědnou osobu uvedenou v záhlaví této smlouvy.
2. Jestliže výhrada podle odstavci 1 tohoto článku nebude vyřešena způsobem uspokojivým pro obě smluvní strany, jmenují obě smluvní strany po jednom vedoucím zaměstnanci, který bude oprávněn vyvolat jednání a s vynaložením veškeré dobré vůle vyřešit spornou záležitost. Schůzka se musí uskutečnit v přiměřeně krátké době po písemném vyzvání jedné ze smluvních stran. Pokud nedojde k dohodě, je kupující oprávněn odstoupit od smlouvy v souladu s čl. XI odst. 2 této smlouvy.
3. Jednáním o věcném plnění předmětu smlouvy, postupech prací, účasti na pracovních poradách, konzultacích v průběhu trvání smlouvy, kontrolou plnění smlouvy a předkládáním návrhů na úpravu nebo doplnění smlouvy jsou pověřeni:
  - za kupujícího: xxxxxxxxxxxxxxxx  
telefon: + 420 xxx xxx xxx, e-mail: xxxxxxxxxxxxxx

- za prodávajícího: xxxxxxxxxxxxxxxx  
telefon: xxx xxx xxx, e-mail: xxxxxxxxxxxxxx

4. Tato smlouva je vyhotovena ve třech stejnopisech s platností originálu, z nichž kupující obdrží dvě a prodávající jedno vyhotovení. Nedílnou součástí této smlouvy je příloha č. 1 – Technická specifikace předmětu plnění.
5. Tato smlouva a práva a povinnosti z ní vyplývající se řídí českým právem. Práva a povinnosti smluvních stran, pokud nejsou upraveny touto smlouvou, se řídí občanským zákoníkem a předpisy souvisejícími.
6. Smluvní strany bezvýhradně souhlasí se zveřejněním smlouvy, případných dodatků uzavřených k této smlouvě, jakož i se zveřejněním dalších aspektů tohoto smluvního vztahu v souladu se zákonem č. 340/2015 Sb., o zvláštních podmínkách účinnosti některých smluv, uveřejňování těchto smluv a o registru smluv (zákon o registru smluv), ve znění pozdějších předpisů. Uveřejnění smlouvy zajistí kupující.
7. Veškeré změny či doplňky této smlouvy mohou být provedeny pouze písemně, a to formou písemných, vzestupně číslovaných dodatků k této smlouvě potvrzenými oběma smluvními stranami, a to osobami oprávněnými jednat za smluvní strany ve věcech smluvních.
8. Jakékoli oznámení ve smyslu této smlouvy od druhé smluvní strany musí být písemné.
9. Tato smlouva se vztahuje i na právní nástupce smluvních stran.
10. Tato smlouva nabývá platnosti dnem podpisu oprávněnými zástupci obou smluvních stran a účinnosti dnem zveřejnění smlouvy podle zákona o registru smluv.
11. Obě smluvní strany prohlašují, že se s textem této smlouvy seznámily, obsahu porozuměly, souhlasí s ním a na důkaz toho připojují své vlastnoruční podpisy.

V Praze dne 26. listopadu 2020

V Praze dne 30. listopadu 2020

Za prodávajícího:

Za kupujícího:

.....  
Ing. Pavel Šalanda  
jednatel

.....  
Ing. Jan Ševčík  
ředitel

Sekce kontroly a ochrany spotřebitele

## Technická specifikace předmětu dodávky

### 1. Požadavky na měřicí vybavení

#### 1.1. Analyzátor mobilních sítí – 1 kus

- Frekvenční rozsah minimálně 400 MHz až 6 GHz.
- Měření pokrytí mobilním signálem pro technologie GSM, LTE, 5G.
- Kompatibilita a možnost spolupráce se skenery TSME/6.
- Kompatibilita a možnost spolupráce se zařízeními s aplikací QualiPoc.
- Možnost záložního (bateriového) napájení.
- Kompatibilní s aplikacemi NESTOR a SmartONE (ROMES)
- Podpora operačního systému Windows 10 (64bitová verze) a možnost propojení se zařízeními s operačním systémem Android.
- Příjem GNSS.
- Sítové rozhraní 1 Gbit/s.
- Podpora bezdrátového rozhraní (WLAN/Bluetooth).
- Rozhraní pro připojení ext. zařízení: USB-C, USB 3.0, HDMI

#### 1.2. Příslušenství

- Napájecí adaptér pro střídavé (230 V) i stejnosměrné (12 V) napětí.
- Kabeláž pro připojení analyzátorů TSME/6 (data i napájení).
- Ochranný obal určený k přenosu a brašna (batoh) pro možnost měření při chůzi.
- Tablet s operačním systémem Android s možností propojení a vzdáleného ovládání analyzátoru mobilních sítí.

### 2. Instalace a školení

- 2.1. Prodávající zajistí jako součást plnění instalaci potřebných aplikací vlastněných kupujícím – NESTOR a SmartONE (ROMES) na dodaném měřicím vybavení včetně potřebných aplikací pro dodané příslušenství (tablet).
- 2.2. Implementace musí zahrnovat veškerou aplikační konfiguraci pro bezchybný provoz se stávajícími zařízeními kupujícího. Jedná se o stávající analyzátor mobilních sítí TSME a TSME6 a mobilní telefony s měřicí aplikací QualiPoc.
- 2.3. Zaškolení obsluhy musí zahrnovat školení pro minimálně 2 pracovníky kupujícího v délce alespoň 12 hodin a technickou podporu v rozsahu 50 hodin. Technická podpora může být podle požadavku kupujícího čerpána buď jako telefonická podpora, nebo osobní konzultace v prostorách kupujícího, a to kdykoliv po dobu 12 měsíců od data akceptace plnění.

### 3. Technická specifikace dodávaných zařízení R&S TSMA6 a R&S FR4-CORE

- Brožura R&S TSMA6 a brožura R&S FR4-CORE

# R&S® TSMA6 AUTONOMOUS MOBILE NETWORK SCANNER



Drive and walk testing with maximum flexibility



Product Brochure  
Version 09.00

**ROHDE & SCHWARZ**

Make ideas real





# AT A GLANCE

**The compact R&S®TSM A6 autonomous mobile network scanner is an integrated solution for efficient drive and walk testing. It offers maximum performance, autonomy and connectivity with an integrated high-performance PC and a mobile network scanner to comply with the latest requirements for state-of-the-art mobile network testing.**

In-building and urban hot spot traffic is growing tremendously, and with it mobile network testing requirements. A typical measurement setup no longer consists of a network scanner and a mobile phone. It is now a high-performance setup of scanners and smartphones/devices processing a huge amount of measurement data to obtain deep real-time network insights and analyze user experience. Accurate scanner based RF measurements and device based user experience analysis complement each other, creating a perfectly aligned ecosystem.

The R&S®TSM A6 combines the technology of the R&S®TSM E6 multitechnology network scanner with a high-performance Intel CPU based PC. The system can run Windows PC based drive test software, which supports multiple external devices such as smartphones connected via USB.

With its ultrabroadband frontend, the integrated scanner measures all supported technologies from 350 MHz to 6 GHz simultaneously. The future-proof architecture and in-field upgradeability for both hardware and software allow up to 4x4 MIMO measurements and pave the way for 5G.

Weighing only 1360 g and with a sophisticated design and optional hot-swappable batteries, the test and measurement equipment can be stowed in a carrying bag, making it the ideal companion for remote or unattended operation during drive and walk test campaigns.



R&S®TSM A6 with R&S®TSM A6-BP battery pack.

# KEY FACTS

- ▶ No limitations in 3GPP (e.g. 5G NR, LTE, WCDMA, GSM, NB-IoT) frequency bands up to 6 GHz, including a multi-GNSS receiver for uninterrupted location tracking
- ▶ More than ten technologies simultaneously in one scanner
- ▶ Supports R&S®TSME30DC and R&S®TSME44DC downconverters for mmWave measurements
- ▶ Compact and lightweight design with customized mechanical concept for cascading multiple scanners
- ▶ Maximum connectivity, with support for additional scanner hardware, Windows based PCs, Android based UEs and tablets using wireless and wired connections
- ▶ Integrated high-performance Intel i7 CPU based PC

## BENEFITS

### High-performance, multifunctional platform

- ▶ Simultaneous measurements with no limitations in 3GPP frequency bands and technologies with SIB/L3 decoding support
- ▶ Cascading and upward/downward compatibility for a maximum degree of freedom
- ▶ Proof of upgradeability: 5G NR measurements on the R&S®TSMA6
- ▶ Maximum connectivity for challenging measurement campaigns
- ▶ Portable solution to simplify measurement campaigns
- ▶ [page 4](#)

### Advanced measurements for deep network insights during measurement campaigns

- ▶ Power spectrum measurement up to 6 GHz for spectrum clearance
- ▶ NB-IoT/Cat NB1 measurements
- ▶ LTE-M measurements
- ▶ Reduced setup time to increase efficiency of drive and walk tests
- ▶ LTE subband measurements
- ▶ Position estimation of base stations
- ▶ [page 10](#)

### Wide range of applications in the mobile network testing landscape

- ▶ Controlling and monitoring measurements with smartphones and tablets
- ▶ Running Windows based measurement software on the high-performance integrated PC
- ▶ Open interface and use as OEM
- ▶ [page 12](#)

# HIGH-PERFORMANCE, MULTIFUNCTIONAL PLATFORM

## Simultaneous measurements with no limitations in 3GPP frequency bands and technologies with SIB/L3 decoding support

The core of the R&S®TSMA6 consists of very fast signal processing with proven algorithms on a high-performance PC and a receiver frontend that seamlessly supports the frequency range from 350 MHz to 6 GHz. Decades of Rohde&Schwarz RF experience allows both to be combined in an extremely compact autonomous scanner. Fully user-configurable and simultaneous measurement tasks cover all major wireless communications standards and offer deep RF and network insights with SIB/layer 3 (SIB/L3) decoding support and advanced measurements in LTE such as allocation analysis. With well-established LTE-Advanced network features such as carrier aggregation, it is designed for high measurement speeds – even in a multicarrier, multitechnology configuration.

Multitechnology measurements are mandatory for 5G NR non-standalone networks. Since information necessary to access the 5G NR carrier is transmitted on LTE, the R&S®TSMA6 is able to decode the latest Rel. 15 SIB messages for LTE-5G NR dual connectivity and to perform these measurements simultaneously with high speed.

The R&S®TSMA6 not only supports measurements based on specific channels and signals, it also decodes L3/MIB-SIB broadcast information from base stations. This feature makes it possible to determine the configuration of the wireless communications network in detail and to easily detect errors. L3/MIB-SIB broadcast information is supported for all major 3GPP technologies.

## Examples of simultaneous use of multiple frequencies in different bands for each technology

	North America					Europe		
<b>GSM</b>	850 MHz	1900 MHz				900 MHz	1800 MHz	–
<b>WCDMA</b>	850 MHz	1900 MHz	2100 MHz/ AWS			900 MHz	2100 MHz	–
<b>LTE-FDD, LTE-M</b>	700 MHz	850 MHz	1900 MHz	2100 MHz/ AWS	LTE-LAA: 5300 MHz	800 MHz	1800 MHz	2600 MHz
<b>LTE-TDD</b>	2500 MHz	3400 MHz				2500 MHz	3400 MHz	–
<b>NB-IoT/Cat NB1</b>	700/800/900/1800/1900/2100 MHz					700/800/900/1800/1900/2100 MHz		
<b>Spectrum</b>	UL and DL frequencies					UL and DL frequencies		
<b>5G NR</b>	sub 6 GHz/FR1 (native) mmWave/FR2, 24 GHz to 30 GHz (requires R&S®TSME30DC) or 24 GHz to 44 GHz (requires R&S®TSME44DC)							

## Technology support at a glance

	Technologies supported	MIB, SIB decoding
GSM	•	•
WCDMA	•	•
CDMA2000®	•	•
1xEV-DO (Rel. 0/Rev. A/Rev. B)	•	•
WiMAX™ IEEE 802.16e	•	•
TD-LTE	•	•
LTE-FDD	•	•
LTE-M	•	•
NB-IoT/Cat NB1	•	•
TETRA, TETRA DMO	•	•
TD-SCDMA	•	•
RF power scan	•	–
CW channel power RSSI scan	•	–
5G NR (FR1, FR2)	•	MIB, SIB1, OSI (SIB2 to SIB9 if broadcasted)

### Cascading and upward/downward compatibility for a maximum degree of freedom

Each investment in measurement tools should be long-term, ensuring maximum investment protection. The R&S®TSMA6 achieves this by offering upward and downward compatibility for hardware and software. The synchronization interface has been designed to interact with a predecessor R&S®TSME, with an R&S®TSME6 for MIMO measurements or to control the R&S®TSME30DC/TSME44DC downconverter for measuring above 6 GHz for 5G NR applications. The result is a future-proof product that offers users maximum degree of freedom. For details, see the R&S®TSME30DC/R&S®TSME44DC product brochure (PD 3607.9608.12).

A simple software upgrade allows the R&S®TSMA6 to perform 5G NR measurements and achieve upward compatibility. Software options for existing technologies, for example TETRA, GSM, WCDMA, LTE, LTE-M and NB-IoT, ensure downward compatibility.

Multiple units can be conveniently cascaded thanks to a customized mechanical concept. A click-in mechanism creates a vibration-proof stack of seamlessly and mechanically connected R&S®TSMA6 scanners.

R&S®TSMA6 with battery pack, R&S®TSME6 and R&S®TSME30DC/TSME44DC on top.



## Proof of upgradeability: 5G NR measurements on the R&S®TSMAG

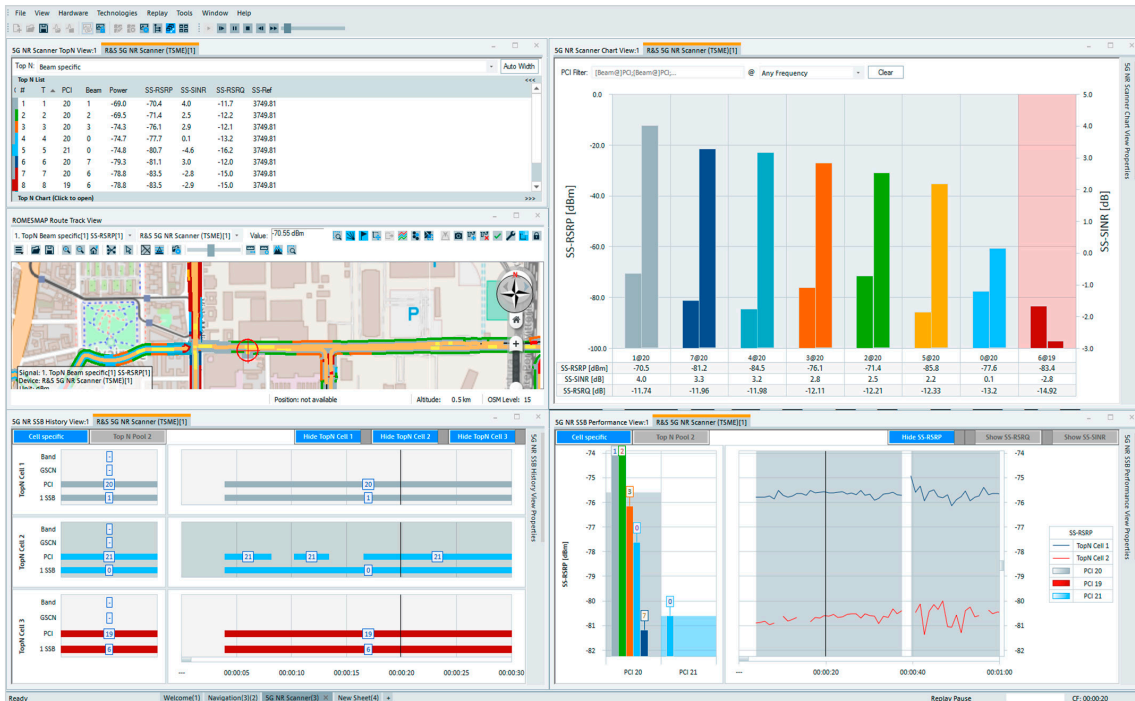
5G NR is expected to become the leading radio access technology in mobile networks in the next years. New use cases such as ultra high speed internet access, massive numbers of connected devices and low latency connections require a completely new radio interface compared to LTE. This leads to a very flexible physical layer that can be adapted to different use cases to enhance network availability and maximize quality of service – from low latency to ultra high data rate applications. One example for flexibility is the position of synchronization signal blocks (SSB). SSBs do not necessarily have to be in the center of the 5G NR carrier. It is almost impossible to detect them manually without having detailed information about the network configuration. The automatic channel detection (ACD) feature finds the frequency and transmission case of 5G NR SSBs without any user input except the frequency range where the algorithm should search for 5G NR SSBs.

A special network configuration in the frequency domain is called dynamic spectrum sharing between 5G NR and LTE. It helps operators rapidly deploy 5G NR and use their spectrum even more efficiently. This puts additional requirements on receivers. The R&S®TSMAG is ready to identify and accurately measure such carriers.

Another essential building block of the 5G NR physical layer is the use of beamforming technology. It is the key to overcoming the issue of higher path loss due to operating at higher frequencies. Beamforming is even used for synchronization signals that UEs traditionally use to synchronize with the network. In 5G NR, synchronization signals are also used for channel quality estimations, which are the basis for establishing effective data transmissions.

The R&S®TSMAG-K50 option enables the R&S®TSMAG to measure 5G NR synchronization signal blocks on both sub 6 GHz and mmWave spectra with an R&S®TSMAG30DC (24 GHz to 30 GHz) or R&S®TSMAG44DC (24 GHz to 44 GHz) downconverter. 5G NR SSB measurements help verify 5G NR coverage and the effect of beamforming, which is a very complex technology involving several components. Each SSB can be transmitted on different beams (depending on the network configuration), which can be measured by the scanner. The scanner is also able to read the MIB content of each SSB and SIB1 to SIB9, if broadcasted by the network. With different SSBs and beams, the scanner results become three dimensional – power and signal-to-noise and interference measurements for each PCI and SSB/beam index deliver a complete set of data to verify the transmission of each SSB/beam. 5G NR SSB measurements are supported for all SSB subcarrier spacings and transmission cases defined for sub 6 GHz bands. R&S®SmartONE expert mode (R&S®ROMES4) provides new views and signals, giving a clear overview of different PCIs and SSBs for all evaluation tasks during measurement and replay.

R&S®SmartONE expert mode (R&S®ROMES4) drive test software supports the R&S®TSMAG.

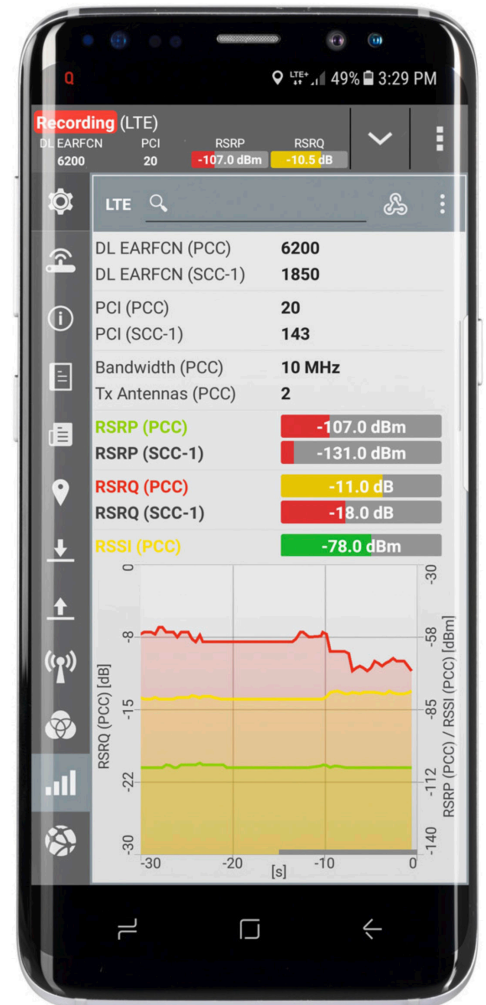


## Advanced 5G NR measurements

Network synchronization in the time domain becomes even more important with the introduction of 5G NR in TDD mode. Perfectly synchronized networks in the time domain show better performance because they do not suffer from overlapping uplink and downlink time slots. The R&S®TSMA6 is able to measure the time of arrival offset between the PPS pulse (or the internal receiver clock) and the received 5G NR and LTE synchronization signal blocks (SSB) to determine the quality of network synchronization.

While the time of arrival offset between the PPS pulse and the SSB is a relative value, some measurements require the absolute time of arrival of the 5G NR SSB. Absolute times of arrival are mandatory to measure the time alignment error of a specific site. The entire signal chain including the baseband, signal processing, cables, and antenna elements with phase shifters and filters can add significant time delays until the signal is broadcasted over the air. The receiver can provide absolute and calibrated time of arrival values (UTC time), allowing these delays to be detected and optimized. Time alignment error measurements require an extremely precise time base and stationary measurements to avoid multipath propagation and Doppler shift. Any deviation of a network's time base will lead to a frequency drift. The precise SSB center frequency is therefore measured to detect drifting cells in the frequency domain.

Electromagnetic field strength (EMF) measurements are the basis to prove that the electromagnetic radiation is below the thresholds defined by the regulator. With the usage of new frequency bands and technical features such as beamforming in 5G NR, EMF measurements become even more important. The R&S®TSMA6 controlled by an QualiPoc Android device is able to perform EMF measurements on 5G NR synchronization blocks for further country-specific extrapolation and total EMF calculation.



The Android based QualiPoc application running on a smartphone controls the R&S®TSMA6.

## Maximum connectivity for challenging measurement campaigns

Data collection in current measurement campaigns is not limited to a single data source. Multitechnology, multi-scanner measurements (MIMO) and user equipment based measurement data complement each other, yielding a full set of data for deep RF insights and KPIs for user experience measurements such as video quality. Seven USB ports (4 × USB 3.0, 1 × USB-C, 2 × USB 2.0) enable the connection of additional data sources such as smartphones, IoT chipsets and additional frontends, for example for 4x4 MIMO measurements. The R&S®TSMA6 can accept all other wired connections from a PC, such as HDMI™ or an Ethernet port for network access. The scanner also has a dedicated LAN port for a second scanner frontend (R&S®TSME6).

Wireless connections such as Wi-Fi and Bluetooth® allow portable devices to set up, control and run measurement campaigns on the R&S®TSMA6 via remote desktop with access to Windows based software running on the R&S®TSMA6 and the Android based QualiPoc application running on a smartphone. Controlling the R&S®TSMA6 from a mobile device offers maximum efficiency and convenience for the user and the measurement process.

R&S®TSMA6 rear view with connectors.



### Portable solution to simplify measurement campaigns

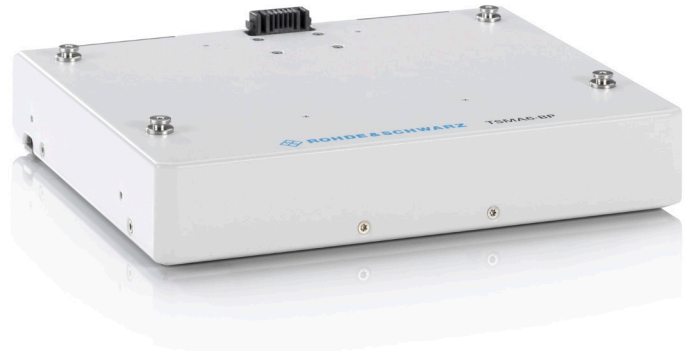
Getting the equipment ready and handling the equipment during the measurement has a considerable impact on the length of the measurement campaign. The goal is to seamlessly collect all data as quickly as possible.

For precise and uninterrupted location tracking even in critical and dense urban and in-vehicle environments, the R&S®TSMA6 includes a multi-GNSS receiver with exceptionally high sensitivity for position fixing and position tracking that supports all major satellite navigation systems. Using up to three satellite systems in parallel for precise location tracking, the multi-GNSS chip uses the results from the integrated gyro/acceleration sensor to bridge gaps in satellite based data, for example when going through road tunnels in a vehicle (requires a specific mounting solution).

The R&S®TSMA6 can optionally be equipped with the R&S®TSMA6-BP battery pack to allow mobile operation. The battery pack is attached to the scanner's housing via a vibration-proof mechanical connection and has two easily accessible, rechargeable and hot-swappable batteries. The R&S®TSMA6 is always ready for operation and no separate charger is required since the batteries can be charged directly in the instrument. Charging takes place automatically when the R&S®TSMA6 is connected to a power supply, e.g. in a vehicle or an external power supply.

The optional R&S®TSMA6-ZCB2 carrying bag offers convenience when performing measurements. The bag has room for the R&S®TSMA6 with a battery pack, two spare batteries, a mobile phone or tablet, a one-port (R&S®TSME-Z10) or two-port antenna (R&S®TSME-Z11) and a R&S®TSME6 for 2x2 MIMO measurements or a R&S®TSME30DC/TSME44DC and an mmWave antenna mounting kit. The battery pack is easily accessible so its charge level can be checked at any time and batteries can be quickly replaced during operation.

R&S®TSMA6-BP battery pack.



R&S®TSMA6-ZCB2 carrying bag shown here with an R&S®TSMA6, a battery pack and a tablet.



# ADVANCED MEASUREMENTS FOR DEEP NETWORK INSIGHTS DURING MEASUREMENT CAMPAIGNS

## Power spectrum measurement up to 6 GHz for spectrum clearance

To overcome capacity problems in mobile networks, additional spectra will be acquired. According to the latest frequency plans, the spectrum from 3.2 GHz to 6 GHz will be used for additional LTE carriers as well as for the fifth generation of mobile networks, which is ready to become the main technology and is expected to grow significantly during the next few years. To ensure the best quality of services after a commercial network rollout, spectrum measurements during the early engineering phase must ensure that the new spectrum is free of interference. Especially when it comes to overlapping spectra with Wi-Fi, which is heavily occupied by Wi-Fi access points, a general picture of the spectrum occupancy is needed in order to detect the noise floor and identify critical areas for network rollout regarding the signal to interference and noise ratio (SINR).

## NB-IoT/Cat NB1 measurements

The R&S®TSMA6-K34 option enables the R&S®TSMA6 to measure in NB-IoT/Cat NB1 networks. NB-IoT/Cat NB1 is a 3GPP standard for connecting a huge number of devices, such as smart meters, to the internet of things (IoT). While traditional LTE standards mainly enhance throughput and network capacity, NB-IoT/Cat NB1 focuses on low power consumption for IoT devices and maximum availability of the connection, especially indoors.

Indoor measurements require lightweight and ultracompact scanners with low power consumption. For coverage validation, troubleshooting and optimization, the R&S®TSMA6 measures signal power and quality and the power to interference and noise ratio on each available physical cell ID based on synchronization and reference signals.

To efficiently integrate the NB-IoT carrier into the available spectrum, the standard provides three operating modes. The R&S®TSMA6 supports all three modes. The most spectrum-efficient mode is the LTE in-band operating mode, where the NB-IoT carrier uses the spectrum of one LTE physical resource block (PRB). The guard band and standalone operating modes allow NB-IoT deployments independent of the LTE spectrum.

NB-IoT measurements can be run simultaneously with measurements on other technologies such as GSM, LTE and (W)CDMA (with the appropriate R&S®TSMA6 options). For optimization or when troubleshooting, the impact of NB-IoT spectrum on the adjacent GSM/LTE/(W)CDMA spectrum and vice versa can be validated.

## LTE-M measurements

LTE-M is another 3GPP standard for connecting things to the internet. LTE-M addresses different use cases than NB-IoT, for instance voice (VoLTE) and mobility. It also provides higher data rates. LTE-M is based on legacy LTE and reuses some of the cell-specific signals. Like NB-IoT, LTE-M uses smart mechanisms to enlarge the link budget. One of these mechanisms is frequency hopping to overcome fading and areas of bad SINR (resulting from LTE traffic and other interference) across the LTE spectrum. This is achieved by dividing the LTE carrier into several LTE-M narrowbands that can handle LTE-M traffic in a manner that suits the RF environment. The R&S®TSMA6 supports LTE-M measurements that deliver RF parameters (SINR, RSRP, RSRQ and RSSI) on each of these LTE-M narrowbands via a PCI interface to identify, for example, the best narrowband for LTE-M data transmission. In R&S®SmartONE expert mode (R&S®ROMES4), it is also possible to compare all narrowbands at a glance to evaluate the RF environment in the surrounding narrowbands. With fading and interference from LTE traffic and other pilot signals, the RF parameter differences between the narrowbands can be quite remarkable. It is also possible to compare scanner based and module based results to verify if the LTE-M module uses the best narrowband for data transmission.

### Reduced setup time to increase efficiency of drive and walk tests

Setting up the measurement campaign is the most time-consuming process that has to be accomplished before capturing valuable field data during drive and walk tests. To reduce costs and setup time, the R&S®TSMA6 provides a helpful channel configuration feature for major 3GPP standards such as 5G NR, NB-IoT, LTE, LTE-M, WCDMA, GSM and CDMA2000®/1xEV-DO. In combination with the R&S®ROMES4ACD or R&S®TSMA6-K40 automatic channel detection option, the R&S®TSMA6 automatically detects active channels in a specified 3GPP band or frequency range. The results obtained during the automatic channel detection process can be directly added to the workspace, even during the measurement campaign. In shared spectrum networks, technologies, frequency bands and carrier bandwidths are no longer static. For example, LTE can be deployed in a spectrum traditionally used for GSM or WCDMA. During drive and walk tests in such networks, frequent bandwidth and channel changes can regularly occur in urban or rural environments depending on the rollout strategy. To speed up the detection process or release signal processing capacity for other parallel measurement tasks, users can enhance the automatic channel detection feature with an optional spectrum scan.

Without the R&S®ROMES4ACD option, automatic channel detection is provided by the R&S®TSMA6-K40 option via the open Windows API virtual communications (ViCom) interface, which currently supports 5G NR, NB-IoT, LTE, WCDMA and CDMA2000®/1xEV-DO.

### LTE subband measurements

Passive scanner measurements are no longer limited to measuring on specific signals or channels or decoding SIB/layer 3 information. Using intelligent and optimized signal processing algorithms, the R&S®TSMA6 is able to offer deep network insights that go beyond pure RF parameters.

Dedicated measurements on reference signals of each LTE resource block give the complete picture of broadband carriers. They also provide insights into fading effects, wideband and narrowband interference and in-band operation of advanced IoT technologies. These technologies occupy LTE resource blocks such as LTE-M or NB-IoT/Cat NB1 and might affect neighboring subbands. To estimate the upper limit of data throughput based on the current RF conditions for each resource block, the scanner delivers an estimated throughput value, which is visualized by R&S®SmartONE expert mode (R&S®ROMES4) for each data layer in MIMO measurement setups.

### Position estimation of base stations

During a drive test, R&S®SmartONE expert mode (R&S®ROMES4) can use the measurement and location data delivered by the R&S®TSMA6 to estimate the geographic position of the base stations. This calculation is fast and accurate. 5G NR, GSM, WCDMA, LTE, NB-IoT, CDMA2000®/1xEVDO and TETRA networks are supported in parallel. This unique feature enables users to quickly generate a base station list for export or graphic display.

# WIDE RANGE OF APPLICATIONS IN THE MOBILE NETWORK TESTING LANDSCAPE

## Controlling and monitoring measurements with smartphones and tablets

During a measurement campaign, the R&S®TSMA6 records the current RF environment while the Android based QualiPoc application carries out extensive service tests on smartphones, including evaluation of voice and video quality. QualiPoc Android clearly displays the measurement values recorded by the scanner on a monitor. Coupled with the R&S®TSMA6, QualiPoc delivers all the required measurement data. User-friendly operation enables complicated tasks such as optimization in multi-story buildings to be performed precisely and efficiently.

## Running Windows based measurement software on the high-performance integrated PC

The R&S®TSMA6 features a fully functional computer running Windows 10 IoT Enterprise. Any drive test software that supports the R&S®TSME6 can be installed, e.g. R&S®SmartONE. External storage media containing software to be installed can be connected via USB.

No cables or accessories are required for mobile use. The software running on the scanner can be controlled via WLAN from a tablet with any Windows Remote Desktop application. The app is available for iPad, Android and Windows tablets.

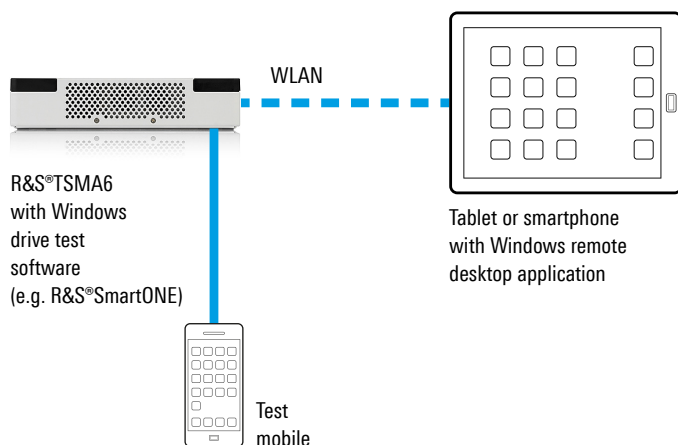
Test phones can also be connected for voice and data tests since the drive test software runs on the R&S®TSMA6 computer. This makes the R&S®TSMA6 scanner a compact, fully functional mobile measuring system. In addition to mobile operation, the R&S®TSMA6 can be used as a fixed probe in this configuration. Remote access is provided via an IP network. Multiple devices can be integrated into such a system.

## Open interface and use as OEM

Many manufacturers have firmly integrated Rohde&Schwarz scanners into their drive test toolchain. The outstanding signal processing capabilities and the user-friendly Windows API virtual communications (ViCom) interface with sample code make it very easy for users to get the most out of every Rohde&Schwarz drive test scanner.

The API delivers all the data that the scanner can measure. It measures cell performance and quality parameters at high speed and collects the GSM, WCDMA, LTE (FDD/TDD), LTE-M, 5G NR, NB-IoT, TD-SCDMA, CDMA2000®, 1xEV-DO and WiMAX™ system information transmitted via the air interface. TETRA networks are exclusively measured using R&S®SmartONE expert mode (R&S®ROMES4). In addition to cell measurements, in-depth spectrum analysis can be performed simultaneously in all bands. GPS information and scanner status are also transmitted via the interface.

## Measurement software runs under Windows on the R&S®TSMA6



# SPECIFICATIONS

Specifications		
<b>RF characteristics</b>		
Frequency range		350 MHz to 6 GHz
Level measurement uncertainty	350 MHz to 3 GHz	< 1 dB
	3 GHz to 6 GHz	< 1.5 dB
Maximum operating measurement range input level		-10 dBm (nom.)
Maximum extended measurement range input level	in extended range mode: not 100% compliant with measured values	+10 dBm (nom.)
Maximum safe permissible input level		+20 dBm/10 V DC
Noise figure	900 MHz	5 dB (meas.)
	2100 MHz	5 dB (meas.)
	3500 MHz	6 dB (meas.)
	5100 MHz	7 dB (meas.)
Intermodulation-free dynamic range	900 MHz	-2 dB (meas.)
	2100 MHz	-2 dBm (meas.)
	3500 MHz	-9 dBm (meas.)
	5100 MHz	-14 dBm (meas.)
RF receive paths		1
VSWR (preselection on/off)	$350 \text{ MHz} \leq f \leq 1.6 \text{ GHz}$	< 2.7/2.0 (meas.)
	$1.6 \text{ GHz} \leq f \leq 2.45 \text{ GHz}$	< 2.6/1.7 (meas.)
	$2.45 \text{ GHz} \leq f \leq 3.6 \text{ GHz}$	< 3.0/2.3 (meas.)
	$3.6 \text{ GHz} \leq f \leq 6.0 \text{ GHz}$	< 3.4/2.6 (meas.)
<b>LTE/LTE-M characteristics</b>		
Frequency bands supported		no restrictions
Measurement modes	automatic detection of carrier bandwidth	LTE-FDD, LTE-TDD, LTE-M
Measurement speed (LTE/LTE-M)	automatic detection of all 504 physical cell IDs with SIB decoding active/two adjacent channels	max. 330 Hz/25 Hz (meas.)
Physical decoding accuracy		
Sensitivity for initial physical cell ID decoding	SYNC signal power (LTE)	-128 dBm (meas.)
	RSRP (LTE/LTE-M)	-147 dBm/-132 dBm (meas.)
Sensitivity after successful physical cell ID decoding	SYNC signal power (LTE)	-130 dBm (meas.)
	RSRP (LTE/LTE-M)	-149 dBm/-132 dBm (meas.)
WB RS SINR dynamic range		-20 dB to +42 dB (meas.)
SYNC SINR dynamic range		-20 dB to +42 dB (meas.)
PCI false detection (ghost code)		< 10 <sup>-8</sup>
<b>NB-IoT/Cat NB1 characteristics</b>		
Frequency bands supported		no restrictions
NB-IoT/Cat NB1 measurement modes		<ul style="list-style-type: none"> <li>▶ standalone</li> <li>▶ guard band</li> <li>▶ in-band</li> </ul>
Sensitivity for physical cell ID decoding (initial decoding)	SYNC signal power (NSSS power)	-132 dBm (meas.)
	reference signal power (NRSRP)	-143 dBm (meas.)
Sensitivity for physical cell ID decoding (after successful decoding)	SYNC signal power (NSSS power)	-135 dBm (meas.)
	reference signal power (NRSRP)	-146 dBm (meas.)
SYNC CINR dynamic range	SYNC signals (NSSS CINR)	-15 dB to +30 dB (meas.)
	reference signals (NRS CINR)	-15 dB to +30 dB (meas.)
Demodulation threshold	sync signal power (NSSS power)	-120 dBm (meas.)
Measurement speed		5 Hz (single channel) (meas.)
PCI false detection (ghost code)		< 10 <sup>-8</sup>

## Specifications

### 5G NR characteristics

Frequency bands supported		FR1, sub 6 GHz, FR2 (24 GHz to 30 GHz)
SSB subcarrier spacings supported		15 kHz, 30 kHz, 120 kHz, 240 kHz
SSB periodicities supported		5 ms, 10 ms, 20 ms, 40 ms, 80 ms, 160 ms
SSB sensitivity (single PCI)	SS-RSRP (10 ms periodicity, 30 kHz subcarrier spacing)	-150 dBm (meas.)
	SS-RSRP (40 ms periodicity, 30 kHz subcarrier spacing)	-142.5 dBm (meas.)
	SS-RSRP (5 ms periodicity, 15 kHz subcarrier spacing)	-156 dBm (meas.)
	SS-RSRP (20 ms periodicity, 15 kHz subcarrier spacing)	-149 dBm (meas.)
SSB index detection threshold (single PCI)	SS-RSRP (10 ms periodicity, 30 kHz subcarrier spacing)	-145 dBm (meas.)
	SS-RSRP (40 ms periodicity, 30 kHz subcarrier spacing)	-140 dBm (meas.)
	SS-RSRP (5 ms periodicity, 15 kHz subcarrier spacing)	-153 dBm (meas.)
	SS-RSRP (20 ms periodicity, 15 kHz subcarrier spacing)	-146 dBm (meas.)
	SS-RSRP (20 ms periodicity, 120 kHz subcarrier spacing)	-136 dBm (meas.)
	SS-RSRP (20 ms periodicity, 240 kHz subcarrier spacing)	-130 dBm (meas.)
SINR dynamic range	20 ms periodicity, 30 kHz subcarrier spacing	-19 dB to +40 dB
	20 ms periodicity, 240 kHz subcarrier spacing	-15 dB to +40 dB
Measurement speed (single PCI)	20 ms periodicity, 30 kHz subcarrier spacing	49 Hz (meas.)
	40 ms periodicity, 30 kHz subcarrier spacing	26 Hz (meas.)
	20 ms periodicity, 120 kHz subcarrier spacing	49 Hz (meas.)
	80 ms periodicity, 120 kHz subcarrier spacing	14 Hz (meas.)
Minimum MIB demodulation threshold	SS-RSRP	-144 dBm
	SS-SINR	-21 dB (meas.)
Minimum SIB demodulation threshold	SS-RSRP	-123 dBm
	SS-SINR	-5 dB (meas. relative to AWGN)
Time base accuracy (for time alignment measurements)	depending on quality of GNSS signal	5 ns to 30 ns (typ.)

### WCDMA characteristics

Frequency bands supported		no restrictions
Number of RF carrier frequencies		max. 32
Measurement speed	high speed/high dynamic mode, automatic detection of all 512 scrambling codes	300 Hz/80 Hz with BCH demodulation (meas.)
Scrambling code detection sensitivity		
Sensitivity for initial SC detection	high speed/high dynamic mode	-119 dBm/-127 dBm (meas.)
Sensitivity after successful SC detection	high speed/high dynamic mode	-124 dBm/-132 dBm (meas.)
Scrambling code false detection (ghost code)		$< 10^{-9}$
Dynamic range $E_c/I_0$ for initial detection	high speed/high dynamic mode	-20 dB/-26 dB (meas.)
Dynamic range $E_c/I_0$ after successful detection	high speed/high dynamic mode	-23 dB/-31 dB (meas.)
Min. BCH demodulation threshold $E_c/I_0$	high speed/high dynamic mode	$> -14$ dB/-20 dB (meas.)

### GSM characteristics

Frequency bands supported		no restrictions
Measurement modes	in parallel	DB/TCH/SCH code power, TCH total in-band power, timeslot power, GSM spectrum, BCH demodulation for all system information types
Measurement speed	with SI decoding active	720 channels/s (meas.)
Sensitivity	detection/BSIC decoding/BCH decoding	-124 dBm/-122 dBm/-117 dBm (meas.)
BSIC decoding dynamic range		
Sensitivity for initial BSIC detection		$C/I > -2$ dB (meas.)
Sensitivity after successful BSIC detection		$C/I > -24$ dB (meas.)
BCCH decoding dynamic range		$C/I > 0$ dB (meas.)

## Specifications

### CDMA2000® characteristics

Frequency bands supported		no restrictions
Number of RF carrier frequencies		max. 32
Measurement speed	automatic detection of all 512 PN codes	max. 70 Hz, with BCH demodulation (meas.)
PN detection sensitivity (initial decoding)	RSCP without/with demodulation	-130 dBm/-125 dBm (meas.)

### 1xEV-DO characteristics (Rel. 0/Rev. A/Rev. B)

Frequency bands supported		no restrictions
Number of RF carrier frequencies		max. 32
Measurement speed		max. 20 Hz, with BCH demodulation (meas.)
PN detection sensitivity (initial decoding)	RSCP with demodulation	-122 dBm (meas.)

### TD-SCDMA characteristics

Frequency bands supported		no restrictions
Number of RF carrier frequencies		max. 32
Measurement speed	high speed	40 Hz, with BCH demodulation (meas.)
	high sensitivity	15 Hz, with BCH demodulation (meas.)
Automatic detection		all 128 scrambling codes
Scrambling code detection sensitivity		
Sensitivity for initial BTS detection (DwPTS)	high speed/high sensitivity	-119 dBm/-118 dBm RSCP (meas.)
Sensitivity for initial SC detection (midamble)	high speed/high sensitivity	-119 dBm/-119 dBm RSCP (meas.)
Sensitivity after successful BTS detection	high speed/high sensitivity	-120 dBm/-121 dBm (meas.)

### TETRA characteristics

Measurement type		RF parameters, constellation diagram/EVM measurements
TETRA bands supported		350 MHz to 6 GHz
Number of RF carrier frequencies	within a 10 MHz downlink band	max. 400
Channel resolution		25 kHz (QPSK)
Measurement speed		max. 8000 channels/s, 20/s for a 10 MHz block (meas.)
Sensitivity (RSSI)	RSSI measurements	-128 dBm (meas.)
	TETRA BSCH decoding (BSCH decoding for channels with SNR > 8 dB)	-121 dBm (meas.)
	BER measurements	-121 dBm (meas.)

### WiMAX™ characteristics

Frequency bands supported		no restrictions
Measurement speed	automatic detection of all 114 preamble indices	9 channels/s (meas.)
Preamble decoding accuracy	frame duration: 5 ms, FFT size: 1024, bandwidth: 10 MHz/2.657 GHz	±1 dB (-20 dBm to -110 dBm) (meas.)
Sensitivity for initial preamble decoding	RSSI	-105 dBm (meas.)
Sensitivity after successful preamble decoding	RSSI	-129 dBm (meas.)
SINR dynamic range		-22 dB to +26 dB (meas.)

### RF power scan

Frequency range		350 MHz to 6 GHz
Frequency resolution		140 Hz to 1.438 MHz
Sensitivity	22.46 kHz (RMS) frequency resolution, at 900 MHz	-126 dBm (meas.)
	140 Hz RBW, RMS, at 900 MHz	-147 dBm (meas.)
Scan speed	180 kHz resolution, 100 MHz span, 20 MHz bandwidth, FFT size: 128	312 Hz (meas.)
	11.23 kHz resolution, 10 MHz span, 10 MHz bandwidth, FFT size: 1024	950 Hz (meas.)
	140 Hz resolution, 1 MHz span, 1 MHz bandwidth, FFT size: 8192	130 Hz (meas.)
RSSI scan speed	20 MHz span, 20 MHz bandwidth, FFT size: 1024	99 GSM channels: max. 950 Hz (94 050 channels/s) (meas.)
	20 MHz span, 20 MHz bandwidth, FFT size: 256	4 WCDMA channels: max. 950 Hz (3800 channels/s) (meas.)
	20 MHz span, 20 MHz bandwidth, FFT size: 256	1 LTE channel (100 RB): max. 950 Hz (950 channels/s) (meas.)

<b>Specifications</b>		
Maximum number of frequency ranges		20
Detectors		max., min., RMS, auto
<b>CW scanning</b>		
Sensitivity channel power RSSI scan	200 kHz channel (GSM)	-119 dBm (meas.)
	5 MHz channel (UMTS)	-104 dBm (meas.)
	20 MHz channel (LTE)	-98 dBm (meas.)
Scan rate	200 kHz channel (GSM)	2450 Hz (254 000 channels/s) (meas.)
	5 MHz channel (UMTS)	13 100 Hz (52 400 channels/s) (meas.)
	20 MHz channel (LTE)	12 995 Hz (12 995 channels/s) (meas.)
<b>Integrated PC</b>		
Processor		Intel® Core™ i7-7567U, dual core, 3.5 GHz (Turbo Boost: 4.0 GHz), 4 Mbyte cache
Memory	standard hardware configuration R&S®TSMAG-BST	8 Gbyte DDR4 RAM
	extended hardware configuration R&S®TSMAG-B1T	16 Gbyte DDR4 RAM
Graphics		Intel® Iris™ Plus Graphics 650
Hard disk	standard hardware configuration R&S®TSMAG-BST	256 Gbyte (M.2, form factor 2280)
	extended hardware configuration R&S®TSMAG-B1T	1 Tbyte (M.2, form factor 2280)
Operating system		Windows 10 IoT Enterprise x64
<b>Connectivity</b>		
Scanner link		integrated (1 × Gigabit Ethernet)
LAN		2 × Gigabit Ethernet
USB		1 × USB-C 3.1 (multiport, Thunderbolt, display port, standard USB-C 3.1), 4 × USB 3.0, 2 × USB 2.0
WLAN		IEEE802.11b, g, n, IEEE802.11ac (access point limited to 2.4 GHz)
Bluetooth®		Bluetooth® 4.1
Video		1 × HDMI™ 2.0, 1 × USB-C 3.1
GPS	antenna supply	active 3 V, max. 25 mA, SMA female
RF		SMA female
User interface		WebGUI (via LAN or integrated Wi-Fi hotspot); LEDs: 2 × scanner, 1 × firmware based/from microcontroller (power-on, error, warning), 1 × controlled by measurement software
<b>GPS/GLONASS receiver</b>		
Type	max. three in parallel, combinations depend on software implementation	multi-GNSS: GPS, GLONASS, BeiDou, Galileo
Sensitivity (GPS, Galileo, GLONASS)	cold start	-148 dBm
	tracking/reacquisition	-160 dBm
Acquisition (GPS, Galileo, GLONASS)	cold start/hot start	26 s/< 1 s
Channels		50
<b>General data</b>		
<b>Environmental conditions</b>		
Temperature range	operating	0°C to +50°C
	permissible in R&S®TSMAG-ZCB2 carrying bag	-10°C to +55°C (system boot 0°C to +55°C)
		+5°C to +40°C
	storage	-25°C to +70°C
Damp heat		+25°C/+55°C, 95% rel. humidity, noncondensing, cyclic, in line with EN 60068-2-30

## Specifications

Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
	random	10 Hz to 300 Hz, acceleration 1.9 g (RMS), 300 Hz to 500 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4, procedure I
Power rating		
Supply voltage	DC	11 V to 18 V – 0%/+ 10%
Maximum input current		7 A
Rated power	no external interface devices (USB, HDMI™)	45 W
Product conformity		
Electromagnetic compatibility	EU: in line with Radio Equipment Directive 2014/53/EU	applied harmonized standards: ETSI EN 300489-1, ETSI EN 300489-17, ETSI EN 300489-22, ETSI EN 300328, ETSI EN 301893, ETSI EN 300440, EN 55032, EN 300339, EN 50498
	international	CISPR 32, UN ECE R 10
Electrical safety	EU: in line with Radio Equipment Directive 2014/53/EU	applied harmonized standard: EN 61010-1
	international	IEC 61010-1
Restriction of the use of hazardous substances	EU: in line with 2011/65/EU (RoHS)	applied harmonized standard: EN 50581
International approvals	Korea	KC mark
Calibration interval		24 months
Dimensions and weight		
Dimensions	W × H × D	204 mm × 45 mm × 171 mm (8.15 in × 1.81 in × 6.22 in)
Weight		1360 g (3.0 lb)

## R&S®T SMA6-Z1 AC power supply

Power rating		
Input voltage	at +25°C (1.6 A charge/1.6 A discharge)	100 V to 264 V AC
Input frequency		47 Hz to 63 Hz
Input current	230 V AC	0.7 A
Inrush current		70 A
Efficiency		CEC VI
Standby power		0.15 W
Output voltage		15 V DC
Output current	> 100 V AC	7 A
Load regulation		max. ±5%
Standard output connector		7-pin ODU, snap-in male
Standard output cable length		120 cm (3.9 ft)
Temperature range	operating	–10°C to +70°C
	derating 230 V AC	derated linearly from +45°C at 100% load to +70°C at 50% load
	derating 110 V AC	derated linearly from +40°C at 100% load to +60°C at 50% load
	storage	–40°C to +85°C
Product conformity		
Electromagnetic compatibility	EU: in line with Radio Equipment Directive 2014/53/EU	applied harmonized standards: ETSI EN 300489-1, ETSI EN 300489-17, ETSI EN 300489-22, ETSI EN 300328, ETSI EN 301893, ETSI EN 300440, EN 55032, EN 300339, EN 50498
	international	CISPR 32, UN ECE R 10



**R&S®TSMA6-Z1 AC power supply**

Electrical safety	EU: in line with Radio Equipment Directive 2014/53/EU international	applied harmonized standard: EN 61010-1 IEC 61010-1
Restriction of the use of hazardous substances	EU: in line with 2011/65/EU (RoHS)	applied harmonized standard: EN 50581
Dimensions	W × H × D	67 mm × 35 mm × 167 mm (2.64 in × 1.38 in × 6.57 in)
Weight		583 g (1.29 lb)

**R&S®TSMA6-BP battery pack unit**

Autonomous power path switching	DC IN path/battery path	yes
Number of battery bays	form factor: battery type	2
Type of supported batteries		R&S®MNT-BP89WH only
Hot-swap support	battery replacement without DC OUT voltage interruption (one battery has to be in bay)	yes
Charging/discharging mode	battery bay 1/bay 2	simultaneous charging, simultaneous discharging
SMB interface to host (R&S®TSMA6)		yes
Charging time for two batteries in parallel	R&S®TSMA6 switched off	typ. 4.0 h
Autonomy	two fully charged batteries in bay, typical CPU load, no external USB devices	typ. 3.5 h
User interface	in combination with the R&S®TSMA6 (one dual color LED per bay)	charging state indicator LED, acoustic battery low charge alarm
	standalone or R&S®TSMA6 switched off (one LED per bay)	charging state indicator LED

**General data**

Power rating		
Supply voltage		11 V to 28 V DC – 0%/+ 10%
Maximum input current		9 A
Input power	R&S®TSMA6 connected, two batteries charging	110 W
	R&S®TSMA6 powered off, two batteries charging	60 W
Standby power	R&S®TSMA6 powered off, no batteries charging	1 W
Output voltage; output power		
	docking connector (R&S®TSMA6)	
	DC IN powered	18.5 V at 65 W
	battery powered	nom. 15 V at 65 W
	Aux 1/2 connector	
	DC IN powered	18.5 V at 30 W
	battery powered	nom. 15 V at 30 W
	overall output power (R&S®TSMA6 + Aux 1 + Aux 2)	105 W
Efficiency		> 85%
Connectors		DC IN (ODU 7-pin, female), DC OUT (6-pin docking connector), DC Aux (ODU 6-pin, female)
Environmental conditions		
Temperature range	operating	–10°C to +55°C
	charging	0°C to +35°C
	in R&S®TSMA6-ZCB2 carrying bag	0°C to +25°C
	storage <sup>1)</sup>	–20°C to +60°C
Damp heat		+25°C/+55°C, 95% rel. humidity, noncondensing, cyclic, in line with EN 60068-2-30

<sup>1)</sup> Note: extended exposure to temperatures above +45°C could degrade battery performance and life.

**R&S®TSMA6-BP battery pack unit**

Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
	random	10 Hz to 500 Hz, acceleration 1.9 g RMS
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4, procedure I
Product conformity		
Electromagnetic compatibility	EU: in line with Radio Equipment Directive 2014/53/EU	applied harmonized standards: ETSI EN300489-1, ETSI EN300489-17, ETSI EN300489-22, ETSI EN300328, ETSI EN301893, ETSI EN300440, EN55032, EN300339, EN50498
	international	CISPR 32, UN ECE R 10
Electrical safety	EU: in line with Radio Equipment Directive 2014/53/EU	applied harmonized standard: EN 61010-1
	international	IEC 61010-1
	UN transportation testing for lithium batteries	UN DOT 38.3
Restriction of the use of hazardous substances	EU: in line with 2011/65/EU (RoHS)	applied harmonized standard: EN 50581
Dimensions (W × H × D)	R&S®TSMA6-BP	204 mm × 45 mm × 171 mm (8.15 in × 1.69 in × 6.22 in)
	R&S®TSMA6-BP plus R&S®TSMA6 stacked	204 mm × 81 mm × 171 mm (8.15 in × 3.19 in × 6.22 in)
Weight	R&S®TSMA6-BP without batteries	824 g (1.82 lb)
	R&S®TSMA6-BP plus two batteries in bay	1720 g (3.79 lb)

**R&S®MNT-BP89WH battery**

Life expectancy	at +25°C (3.0 A charge/1.2 A discharge)	> 300 cycles, with min. 80% of initial capacity
Charging options		inside the R&S®TSMA6-BP or with separate R&S®TSMA6-BC4 charger
Electrical characteristics		
Nominal voltage		14.4 V
Initial capacity		> 5510 mAh
Maximum charge current	allowed ambient temperature: 0°C to +45°C	3 A
Maximum charge voltage		16.8 V ± 50 mV
Peak discharge current		20 A
Continuous discharge current	+10°C to +65°C	8.25 A
	-10°C to +10°C	linear degradation (0 A to 8.25 A)
Temperature range	operating	0°C to +40°C (charging), -10°C to +55°C (discharging)
	storage <sup>1)</sup>	-20°C to +50°C
Product conformity		in line with CE, UL2054, UL1642, FCC, IEC 62133, RoHS, UN38.3
Dimensions	W × H × D	77.4 mm × 22.5 mm × 150.4 mm (3.05 in × 0.89 in × 5.92 in)
Weight		446 g (0.98 lb)

## R&S®TSMA6B-BP battery pack unit

Autonomous power path switching	DC IN path/battery path	yes
Number of battery bays	form factor: battery type	2
Type of supported batteries		R&S®MNT-BP99WH only
Hot-swap support	battery replacement without DC OUT voltage interruption (one battery has to be in bay)	yes
Charging/discharging mode	battery bay 1/bay 2	simultaneous charging, simultaneous discharging
SMB interface to host (R&S®TSMA6)		yes
Charging time for two batteries in parallel	R&S®TSMA6 switched off	typ. 4.0 h
Autonomy	two fully charged batteries in bay, typical CPU load, no external USB devices	typ. 3.5 h
User interface	in combination with the R&S®TSMA6 (one dual color LED per bay)	charging state indicator LED, acoustic battery low charge alarm
	standalone or R&S®TSMA6 switched off (one LED per bay)	charging state indicator LED

### General data

Power rating		
Supply voltage		11 V to 28 V DC – 0%/+ 10%
Maximum input current		9 A
Input power	R&S®TSMA6 connected, two batteries charging	110 W
	R&S®TSMA6 powered off, two batteries charging	60 W
Standby power	R&S®TSMA6 powered off, no batteries charging	1 W
Output voltage; output power		
	docking connector (R&S®TSMA6)	
	DC IN powered	18.5 V at 65 W
	battery powered	15 V at 65 W (nom.)
	Aux 1/2 connector	
	DC IN powered	18.5 V at 30 W
	battery powered	15 V at 30 W (nom.)
	overall output power (R&S®TSMA6 + Aux 1 + Aux 2)	105 W
Efficiency		> 85%
Connectors		DC IN (ODU 7-pin, female), DC OUT (6-pin docking connector), DC Aux (ODU 6-pin, female)
Environmental conditions		
Temperature range	operating	–10°C to +55°C
	charging	0°C to +35°C
	in R&S®TSMA6-ZCB2 carrying bag	0°C to +25°C
	storage <sup>1)</sup>	–20°C to +60°C
Damp heat		+25°C/+55°C, 95% rel. humidity, noncondensing, cyclic, in line with EN 60068-2-30
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
	random	10 Hz to 500 Hz, acceleration 1.9 g RMS
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4, procedure I

<sup>1)</sup> Note: extended exposure to temperatures above 45°C could degrade battery performance and life.

## R&S®TSM6B-BP battery pack unit

Product conformity		
Electromagnetic compatibility	EU: in line with Radio Equipment Directive 2014/53/EU	applied harmonized standards: ETSI EN300489-1, ETSI EN300489-17, ETSI EN300489-22, ETSI EN300328, ETSI EN301893, ETSI EN300440, EN55032, EN300339, EN50498
	international	CISPR 32, UN ECE R 10
Electrical safety	EU: in line with Radio Equipment Directive 2014/53/EU	applied harmonized standard: EN61010-1
	international	IEC61010-1
	UN transportation testing for lithium batteries	UN DOT 38.3
Restriction of the use of hazardous substances	EU: in line with 2011/65/EU (RoHS)	applied harmonized standard: EN50581
Dimensions (W × H × D)	R&S®TSM6B-BP	204 mm × 45 mm × 171 mm (8.15 in × 1.69 in × 6.22 in)
	R&S®TSM6B-BP plus R&S®TSM6 stacked	204 mm × 81 mm × 171 mm (8.15 in × 3.19 in × 6.22 in)
Weight	R&S®TSM6B-BP without batteries	674 g (1.49 lb)
	R&S®TSM6B-BP plus two batteries in bay	1570 g (3.46 lb)

## R&S®MNT-BP99WH battery

Life expectancy	at +25°C (3.0 A charge/1.2 A discharge)	> 300 cycles, with min. 63% of initial capacity
Charging options		inside the R&S®TSM6x-BP or with separate R&S®TSM6-BC2 or R&S®TSM6-BC4 charger
Electrical characteristics		
Nominal voltage		14.4 V
Initial capacity		> 6900 mAh
Maximum charge current	allowed ambient temperature: 0°C to +45°C	4.8 A
Maximum charge voltage		16.8 V ± 50 mV
Maximum discharge current		10 A
Peak discharge current		20 A
Continuous discharge current	-20°C to +25°C	8.5 A
	-10°C to +10°C	linear degradation (0 A to 8.25 A)
Temperature range	operating	0°C to +40°C (charging), -10°C to +55°C (discharging)
	storage <sup>1)</sup>	-20°C to +50°C
Product conformity		in line with CE, UL2054, FCC, PSE, KC, Gost, EAC, CQC, RCM, IEC62133, UN38.3, RoHS, Reach, BIS, BSMI
Dimensions	W × H × D	77.4 mm × 22.5 mm × 150.4 mm (3.05 in × 0.89 in × 5.92 in)
Weight		430 g (0.95 lb)

### Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

### Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

# ORDERING INFORMATION

Designation	Type	Order No.
<b>Base unit (includes accessories such as power cable, manual)</b>		
Autonomous mobile network scanner, standard hardware configuration	R&S®TSM A6-BST	4901.0514.02
Scope of delivery: R&S®TSM A6, Ethernet patch cable, R&S®TSM E-Z7 multiband antenna, 4 collar screws, 12 V DC power cable (cigarette lighter plug), active GPS antenna, quick start guide, hinged ferrite		
<b>Hardware options (built-in hardware)</b>		
Battery pack, includes two batteries (R&S®MNT-BP89WH)	R&S®TSM A6-BP	4900.9001.02
Battery pack, includes two batteries (R&S®MNT-BP99WH)	R&S®TSM A6B-BP	4900.9001.20
Hardware upgrade for integrated PC: 1 Tbyte SDD and 16 Gbyte RAM	R&S®TSM A6-B1T	4901.0520.02
<b>Software options (firmware)</b>		
WCDMA scanning	R&S®TSM A6-K21	4901.0789.02
CDMA2000® scanning	R&S®TSM A6-K22	4901.0766.02
GSM scanning	R&S®TSM A6-K23	4901.0795.02
1xEV-DO scanning	R&S®TSM A6-K24	4901.0750.02
CW scanning	R&S®TSM A6-K25	4901.0814.02
TETRA scanning	R&S®TSM A6-K26	4901.0743.02
RF power scan	R&S®TSM A6-K27	4901.0720.02
WiMAX™ scanning	R&S®TSM A6-K28	4901.0737.02
LTE scanning	R&S®TSM A6-K29	4901.0772.02
LTE-MIMO scanning	R&S®TSM A6-K30	4901.0714.02
LTE eMBMS scanning	R&S®TSM A6-K32	4901.0643.02
NB-IoT/Cat NB1 scanning	R&S®TSM A6-K34	4901.0808.02
LTE-M scanning	R&S®TSM A6-K35	4901.0208.02
5G NR scanning	R&S®TSM A6-K50	4901.0966.02
5G NR scanning add-ons	R&S®TSM A6-K51	4901.0250.02
Automatic channel detection	R&S®TSM A6-K40	4901.0614.02
QualiPoc support	R&S®TSM A6-K61	4901.0820.02
Block I/Q data	R&S®TSM A6-K10	Please contact your local Rohde & Schwarz sales office.
Simultaneous measurement in 1 band	R&S®TSM A6-K1B	4901.0695.02
Simultaneous measurement in 2 bands	R&S®TSM A6-K2B	4901.0689.02
Simultaneous measurement in 3 bands	R&S®TSM A6-K3B	4901.0672.02
Simultaneous measurement in 4 bands	R&S®TSM A6-K4B	4901.0666.02
Simultaneous measurement in 5 bands	R&S®TSM A6-K5B	4901.0650.02
Simultaneous measurement in all bands	R&S®TSM A6-KAB	4901.0708.02
Upgrade by one additional band (in field)	R&S®TSM A6-KUB	4901.0950.02
<b>Additional software</b>		
R&S®SmartONE expert mode (R&S®ROMES4) drive test software	R&S®ROMES4	1117.6885.04
R&S®TSM E6 driver for R&S®SmartONE expert mode drive test software	R&S®ROMES4T1E	1117.6885.82
R&S®ROMES4 option, base station position estimation	R&S®ROMES4LOC	1117.6885.32
R&S®ROMES4 driver, automatic channel detection	R&S®ROMES4ACD	1506.9869.03
ViCom R&S®TSMx scanner interface/API	R&S®VICOM	4900.7309.02
<b>Accessories</b>		
Downconverter (24 GHz to 30 GHz)	R&S®TSM E30DC	4901.1004.02
Downconverter (24 GHz to 44 GHz)	R&S®TSM E44DC	4901.2600.02
Carrying bag	R&S®TSM A6-ZCB2	3630.7695.02
Carrying box	R&S®TSM A6-Z5	3630.7689.02
19" rack adapter for up to two R&S®TSM A6	R&S®TSM A6-Z2	4900.8940.02
AC power supply	R&S®TSM A6-Z1	4901.0550.02
4-bay charger for R&S®TSM A6-BP batteries	R&S®TSM A6-BC4	3630.7708.02
Power cable for R&S®TSM A6 battery pack	R&S®TSM A6-BPPT	4900.1730.02
Dual power cable for R&S®TSM A6 battery pack	R&S®TSM A6-BP2T	4901.0566.02
Additional lithium-ion battery pack	R&S®MNT-BP89WH	1321.3772.00
Additional lithium-ion battery pack	R&S®MNT-BP99WH	3660.9109.02

Designation	Type	Order No.
Synchronization cable for one R&S®TSM A6 and one R&S®TSM E6	R&S®TSM E6-ZC2	4900.1800.02
Synchronization cable for one R&S®TSM A6 and up to three R&S®TSM E6	R&S®TSM E6-ZC4	4900.1817.02
Synchronization port to BNC port cable	R&S®TSM E6-ZCS	4901.1540.02
<b>Antennas</b>		
Antenna mount, magnetic	R&S®TSM E-ZA1	1506.9817.02
Antenna mount, fixed	R&S®TSM E-ZA2	1506.9823.02
Antenna mount, fixed, with integrated GPS antenna	R&S®TSM E-ZA4	1506.9846.02
Antenna emitter, 406 MHz to 440 MHz (requires antenna mount)	R&S®TSM W-ZE2	1117.8165.00
Antenna emitter, 380 MHz to 430 MHz (requires antenna mount)	R&S®TSM W-ZE7	1519.5709.02
Antenna emitter, 698 MHz to 2700 MHz (requires antenna mount)	R&S®TSM W-ZE8	1506.9852.02
Antenna emitter, 430 MHz to 470 MHz	R&S®TSM W-ZE9	1519.5709.03
Antenna emitter, 600 MHz to 6000 MHz	R&S®TSM E-ZE17	3666.1574.02
Ultrawideband antenna, 350 MHz to 6000 MHz	R&S®TSM E-Z9	3590.8039.02
Single-port ultrawideband antenna, 698 MHz to 6000 MHz	R&S®TSM E-Z10	4900.1917.02
3-port antenna, 698 MHz to 2690 MHz (MIMO) + GPS	R&S®TSM E-Z11	4900.1923.02
2-port MIMO reference antenna, 698 MHz to 2700 MHz	R&S®TSM E-Z12	4900.1930.02
3-port MIMO antenna, 698 MHz to 3800 MHz (MIMO) + GPS/GNSS for drive testing	R&S®TSM E-Z13	4900.1946.02
4-port MIMO antenna, 698 MHz to 3500 MHz (2x2 MIMO) + 5150 MHz to 5850 MHz (2x2 MIMO) for drive testing	R&S®TSM E-Z14	4900.1952.02
Single-port ultrawideband antenna, 698 MHz to 3800 MHz, with magnetic mount	R&S®TSM E-Z15	3652.7281.02
2-port antenna, 698 MHz to 3800 MHz, with magnetic mount	R&S®TSM E-Z15P2	3657.5770.02
Ultrawideband antenna, 615 MHz to 6000 MHz (for walk testing)	R&S®TSM E-Z17	4900.1969.02
Basic handheld directional antenna	R&S®HE400BC	4104.6000.04
Log-periodic antenna module, 450 MHz to 8 GHz	R&S®HE400LP	4104.8402.02
N (m) to SMA (m) adapter	R&S®TSM A6-ZHE4	4900.9660.02
<b>PC accessories</b>		
USB 3.0 to Gbit LAN adapter	R&S®TSPC-U2L	3593.8430.02
USB-C to dual Gbit LAN adapter	R&S®TSPC-U2L2	4900.8970.02
5-port USB or AC-powered LAN switch	R&S®TSPC-LS	3624.8364.02
External DVD drive	R&S®TSPC-DVDD	3592.4053.02
10" portable monitor, HDMI™	R&S®TSPC-MMON	3592.4047.02
Compact keyboard, US, with trackball, USB	R&S®TSPC-KEYB	1508.1607.02
Surface Pro 4, remote tablet	R&S®TSPC-SF4P	3623.3981.02

<b>Warranty</b>		
Base unit		3 years
All other items <sup>1)</sup>		1 year
<b>Options</b>		
Extended warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	

<sup>1)</sup> For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1-year warranty.

Your local Rohde & Schwarz expert will help you determine the optimum solution for your requirements. To find your nearest Rohde & Schwarz representative, visit [www.rohde-schwarz.com](http://www.rohde-schwarz.com)

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## Service that adds value

- ▶ Worldwide
- ▶ Local und personalized
- ▶ Customized and flexible
- ▶ Uncompromising quality
- ▶ Long-term dependability

## Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

[www.rohde-schwarz.com](http://www.rohde-schwarz.com)

## Mobile network testing

The company's broad and diverse product portfolio for mobile network testing addresses every test scenario in the network lifecycle – from base station installation to network acceptance and network benchmarking, from optimization and troubleshooting to interference hunting and spectrum analysis, from IP application awareness to QoS and QoE of voice, data, video and app based services.

[www.rohde-schwarz.com/mnt](http://www.rohde-schwarz.com/mnt)

## Rohde & Schwarz customer support

[www.rohde-schwarz.com/support](http://www.rohde-schwarz.com/support)



# R&S®FR4

## Freerider 4

### Backpack System

#### Walk testing with maximum flexibility





# R&S®FR4 Freerider 4 Backpack System

## At a glance

The R&S®FR4 Freerider 4 backpack system is a compact, lightweight solution for walk test and drive test campaigns. Supporting up to 12 test mobile phones and high-performance scanner measurements (including 5G millimeterwave and LTE 4x4 MIMO), it is ideal for network optimization, benchmarking and cellular network analysis.

To ensure maximum autonomy, the R&S®FR4 Freerider 4 backpack system is equipped with an intelligent voltage supply with one to eight batteries that can be hot swapped. The integrated Ethernet switch and optional USB hub allow R&S®TSMx6 scanners and QualiPoc mobile phones to be connected and charged. A light, yet water-resistant coating with air passages and silent fans allows the backpack to be used in a wide range of climates. The carrying straps can be individually adjusted to offer the best wearing comfort. An external tablet or laptop can be used to wirelessly control the measurement application running on an R&S®TSMx6 autonomous mobile network scanner or R&S®NCM2 compact integrated PC.

### Key facts

- Modular and future-proof for network optimization, benchmarking and cellular network analysis
- Supports up to 12 test mobile phones
- Supports 5G NR, including millimeterwave
- Compact and lightweight
- Designed for all environmental conditions

## Benefits and key features

### Flexible solution

- Ideal backpack solution for your application
  - Supports all Rohde&Schwarz drive test applications
- ▷ [page 3](#)

### Wide range of supported measurements

- Extensive test mobile phone support
  - Unrivalled scanner support
- ▷ [page 4](#)

### Professional platform for everyday use

- Designed for usability and reliability
  - Designed for the toughest environmental conditions
- ▷ [page 5](#)

# Flexible solution

## Ideal backpack solution for your application

Mobile traffic data is exploding. Globally, it has doubled in recent years, especially in indoor locations such as shopping malls, stadiums, event halls, pedestrian zones, airports and trains. For network operators, such indoor or confined venues are extremely challenging because they require a denser network of endpoints and a higher number of base stations. The R&S®FR4 Freerider 4 backpack system is the ideal solution to easily and comfortably test such demanding locations.

It is not always possible to deploy dedicated drive test vehicles. With the R&S®FR4 Freerider 4 backpack system, a complete and compact drive test system can be temporarily installed in a rental car, significantly reducing the setup time for measurement campaigns. The sturdy construction is shock and vibration proof in line with automotive standards and can be used in any vehicle type.

## Supports all Rohde & Schwarz drive test applications

- ▮ R&S®ROMES4 drive test software for in-field optimization
- ▮ SmartBenchmarker for benchmarking tests
- ▮ R&S®NESTOR cellular network analysis software

The future-proof R&S®FR4 Freerider 4 backpack system supports the latest 5G networks as well as legacy technologies such as GSM, UMTS and LTE. Devices such as scanners and test mobile phones can be added or upgraded in the field.



R&S®FR4-CORE inside the R&S®FR-BP backpack, with external tablet

# Wide range of supported measurements

## Extensive test mobile phone support

The R&S®FR4 Freerider 4 backpack system supports up to 12 test mobile phones, which can be charged via the optional, integrated USB hub. A specially designed mount with quick-release function makes it easy to detach the mobile phones, for example to exchange SIM cards. Depending on the number of test mobile phones, the position of the phones can easily be changed to meet campaign requirements.

## Unrivalled scanner support

Full support of the R&S®TSMx scanner family:

- R&S®TSMA6 autonomous mobile network scanner
- R&S®TSME6 ultracompact drive test scanner
- R&S®TSME30DC ultracompact downconverter

The R&S®FR4 fully supports GSM, WCDMA, CDMA2000®, 1xEV-DO, WiMAX™, LTE, NB-IoT, LTE-M, PowerScan RF, CW channel power scan and 5G NR. For 5G NR millimeterwave, it offers a measurement bandwidth of up to 100 MHz. LTE MIMO measurements support up to 4x4 MIMO configurations. Scanner antennas are integrated into the backpack design with neat cable guides and optimized antenna positions, for example with dedicated antenna rods for millimeterwave measurements above the user's head.



R&S®FR4-CORE with eight QualiPoc mobile phones

# Professional platform for everyday use

## Designed for usability and reliability

To ensure maximum autonomy, the R&S®FR4 Freerider 4 backpack system is equipped with an intelligent voltage supply with one to eight batteries that can be hot swapped. With four batteries, a measurement duration of more than four hours is possible (equipped with one R&S®TSM6 and four test mobile phones). The batteries can be charged inside the backpack and do not have to be removed for charging. Alternatively, the system can be operated from the AC power supply (included in scope of delivery) or in a car with the optional DC/DC converter. The entire system can be started or shut down with a central power button.

The backpack can be operated from a tablet or laptop via Wi-Fi to control the measurement application running on a built-in PC (R&S®NCM2) or an R&S®TSM6 scanner. A cabled LAN or USB connection is also possible via the integrated LAN switch or optional USB hub.

Since measurement days can be long, the R&S®FR4 Freerider 4 backpack system has been designed with user ergonomics and weight reduction in mind. The carrying straps and hip belt can be individually adjusted to offer the best wearing comfort. The compact design allows free movement even in crowded or narrow locations. A typical measurement configuration (one R&S®TSM6 and four test mobile phones) weighs less than 7.9 kg.

## Designed for the toughest environmental conditions

The system has been designed for indoor and outdoor use. Active ventilation with silent fans allows operation in hot climates. The coating protects the backpack against splash water ingress in rainy conditions, and the light color of the coating minimizes the impact of solar radiation.



View of inside with QualiPoc, R&S®NCM2 compact integrated PC and R&S®TSM6 ultracompact drive test scanner

# Specifications in brief

Specifications in brief		
<b>Environmental conditions</b>		
Temperature	operating temperature range	0 °C to +50 °C
	permissible temperature range	-10 °C to +55 °C <sup>1)</sup>
	storage temperature range	-40 °C to +55 °C
Damp heat		+25 °C/+55 °C, < 95% relative humidity, cyclic, noncondensing, in line with EN 60068-2-14
<b>Connectors</b>		
		power in 5 × LAN, 16 × USB (optional)
<b>Power rating</b>		
Supply voltage	DC	16 V to 19 V
Power consumption during operation	equipped with R&S®NCM2, 2 × R&S®TSME6, 8 × UEs performing a real measuring task	typ. 90 W
Maximum inrush current		11 A at 19 V
<b>Product conformity</b>		
Electromagnetic compatibility	EU: in line with EMC directive 2004/108/EC	applied harmonized standards: EN 55032/EN 61326-1 (home location, class B), EN 55024, EN 61000-6-2/EN 61326 (industrial location, class B)
Electrical safety	EU: in line with directive 2014/35/EC	EN 61010-1
	USA	UL 61010-1
<b>Dimensions and weight</b>		
Dimensions	R&S®FR4-CORE	485 mm × 356 mm × 146 mm (19.1 in × 14.0 × 5.8 in)
	R&S®FR4-CORE and R&S®FR4-EXTEND	485 mm × 356 mm × 191 mm (19.1 in × 14.0 × 7.5 in)
Weight	depends on installed devices	
	R&S®FR4-CORE (without devices and batteries)	approx. 3.2 kg (7.1 lb)
	R&S®FR4-CORE and R&S®FR4-EXTEND (without devices and batteries)	approx. 4.0 kg (8.8 lb)
	1 × R&S®TSMA6 and 4 × test mobile phones	approx. 7.9 kg (17.4 lb)
<b>Software</b>		
	only one can be installed	optimized for the software applications: ■ R&S®ROMES ■ SmartBenchmarker ■ R&S®NESTOR

<sup>1)</sup> The maximum operating temperature may be lowered by the maximum stable operating temperature of the installed UEs and devices.

# Ordering information

Designation	Type	Order No.
<b>Base unit (including accessories supplied such as power cable, manual)</b>		
Backpack core	R&S®FR4-CORE	1900.6403.10
Scope of delivery: battery management and power distribution, LAN switch, fans, internal case, AC power supply		
<b>Hardware options</b>		
Extension kit	R&S®FR4-EXTEND	1900.6403.11
Mounting kit for UE	R&S®FR4-MK-UE	1900.6403.14
Mounting kit for UE9-12	R&S®FR4-MK-912	1900.6403.15
UPC4 USB hub	R&S®FR4-MK-HUB	1900.6403.18
Mounting kit for R&S®NCM2	R&S®FR4-MK-N2	1900.6403.12
Mounting kit for R&S®TSMA6	R&S®FR4-MK-A6	1900.6403.13
Mounting kit for R&S®TSME6	R&S®FR4-MK-E6	1900.6403.16
Backpack for R&S®FR4-CORE	R&S®FR4-BP	1900.6403.20
Backpack for R&S®FR4-CORE and R&S®FR4-EXTEND	R&S®R4-BP-EXT	1900.6403.21
Lithium-ion battery pack	R&S®MNT-BP89W	1321.3772.00
<b>External accessories (e.g. antenna, cables)</b>		
ISOFIX car mounting kit	R&S®FR4-ISOFIX	1900.6403.27
Transportation case	R&S®FR4-TRCASE	1900.6403.28
Synchronization cable, for two R&S®TSME6	R&S®FR4-SC-2FD	1900.6403.24
Synchronization cable, for four R&S®TSME6	R&S®FR4-SC-4FD	1900.6403.25
Synchronization cable, for five R&S®TSME6 and one R&S®TSME30DC	R&S®FR4-SC-6FD	1900.6403.26
Panorama dipole antenna, 700 MHz to 2700 MHz	R&S®TSME-Z7	3591.2870.02
Single-port ultrawideband antenna, 698 MHz to 6000 MHz	R&S®TSME-Z10	4900.1917.02
Antenna holder, for R&S®TSME-Z10	R&S®FR4-MK-Z10	1900.6403.22
Three-port antenna, 698 MHz to 2690 MHz (MIMO) + GPS	R&S®TSME-Z11	4900.1923.02
Antenna holder, for R&S®TSME-Z11	R&S®FR4-MK-Z11	1900.6403.23
Antenna for 5G, 20 GHz to 40 GHz	R&S®FR4-5G-ANT	1900.6403.19
Vehicle power supply (16 V DC, 120 W)	R&S®FR3-VPS	1900.5794.08

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## Sustainable product design

- | Environmental compatibility and eco-footprint
- | Energy efficiency and low emissions
- | Longevity and optimized total cost of ownership

Certified Quality Management

**ISO 9001**

Certified Environmental Management

**ISO 14001**

## Rohde & Schwarz training

[www.training.rohde-schwarz.com](http://www.training.rohde-schwarz.com)

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R&S®FR4 Freerider 4 Backpack System

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