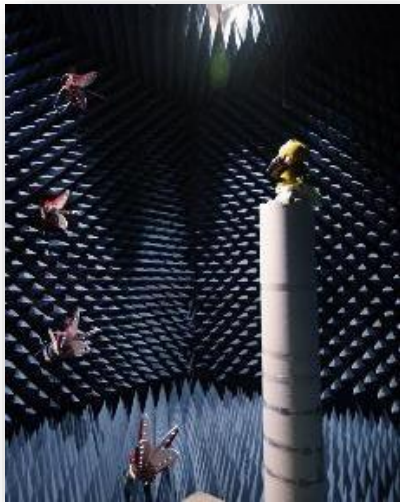




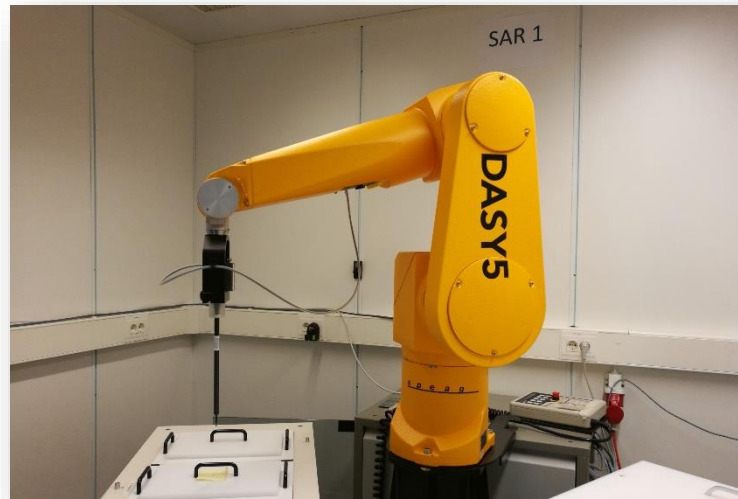
Test Right. Design Right.

State of Art Laboratories Ready to Serve You

3 x certified OTA
test chambers
= capacity of
19 000h / year



2 x certified SAR test
systems = capacity of
19 000h / year



The world's most advanced
MIMO OTA test chamber
for emulating realistic field
radio conditions anywhere in
the world



Testing Capabilities

Cellular GCF&PTCRB certification

Antenna efficiency
GSM TRP + TRS
GSM + E-GPRS TRP + TRS (singlepoint)
GSM ICD
GSM Sensitivity Response
WCDMA TRP + TRS
WCDMA ICD
WCDMA Sensitivity Response
LTE TRP + TRS
LTE Intermediate Channel Sensitivity
LTE Sensitivity Response
LTE Carrier Aggregation TRP + TRS, ICD
CDMA TRP + TIS

Operator Cellular RF OTA tests

According operator specifications
LTE Envelope Correlation Coefficient (ECC)

Additional cellular tests

LTE MIMO OTA
E-GPRS/HSPA/LTE DL&UL Throughput

Wi-Fi PTCRB certification

TRP + TRS
Conducted Tx Power and Rx Sensitivity
Wi-Fi desense
Cellular desense

Additional Wi-Fi tests

Standalone* TRP
MIMO OTA

LTE MIMO OTA

According to the CTIA 1.1 and 3GPP specifications
4x2 MIMO OTA
4x4 MIMO OTA

BT and BLE

TRP + TRS
Standalone* TRP

Antenna tests

3D antenna patterns (active & passive)

* Equipment is not connected to a tester. Transmission is forced ON and TRP is measured

A-GPS certification

(Over GSM,WCDMA, LTE FDD/TDD)
TIS/TRS
UHS
PIGS (UE-Assisted / -Based)
ICD

GNSS tests

GPS Air Performance Test
ETSI EN-3033413
Adjacent frequency band selectivity

Additional GNSS tests

Antenna efficiency
Standalone GPS

SAR testing

LTE, WCDMA, GSM, CDMA, WLAN, Bluetooth, TETRA, VHF, UHF

We Are True Professionals in RF OTA

CTIA and 3GPP OTA Test Specifications

- Verkotan employees have been the key contributors into the CTIA and 3GPP Test Specifications since kick off meetings in 1999
- Many of the test methods have been validated in Verkotan test lab (ex-Nokia labs)

Mega operators have specific OTA requirements, additional specific test cases, and variation in test methods

- Verkotan employees know Operators specs to the tiniest details
- Personal contacts to operators employees responsible for OTA approval
- Verkotan test results and reports are approved by all the major operators: Deutsche Telecom, AT&T, Telecom Italy, H3G... Also for the operators requiring special laboratory audit like Vodafone and Orange

We help you through RF OTA requirements and testing



Example of Fast Accredited OTA Testing

Verkotan has 4 anechoic OTA test chambers – one of them dedicated to MIMO/3D OTA + the fastest test system for OTA testing
=> We can ensure your product hits the market faster !

Example product A

**Cellular PTCRB and AT&T OTA + A-GPS&Glonass
for a Smartphone (<72mm) to US market:**

4 GSM bands

WCDMA I, II, IV, V, VIII

LTE 1,2,3,4,5,7,12,13,17,20,29,30,40,41

LTE 2CA 13 combinations

LTE 3CA 6 combinations

WLAN a,b,g,n

A-GPS, A-Glonass

Test throughput time : 15 work days

Example product B

**Cellular GCF, VF, Orange, DTAG OTA
for Smartphone (<72mm) EU & APAC market:**

4 GSM bands

WCDMA I, II, IV, V, VIII

LTE 1,2,3,4,5,7,12,13,17,20,28,

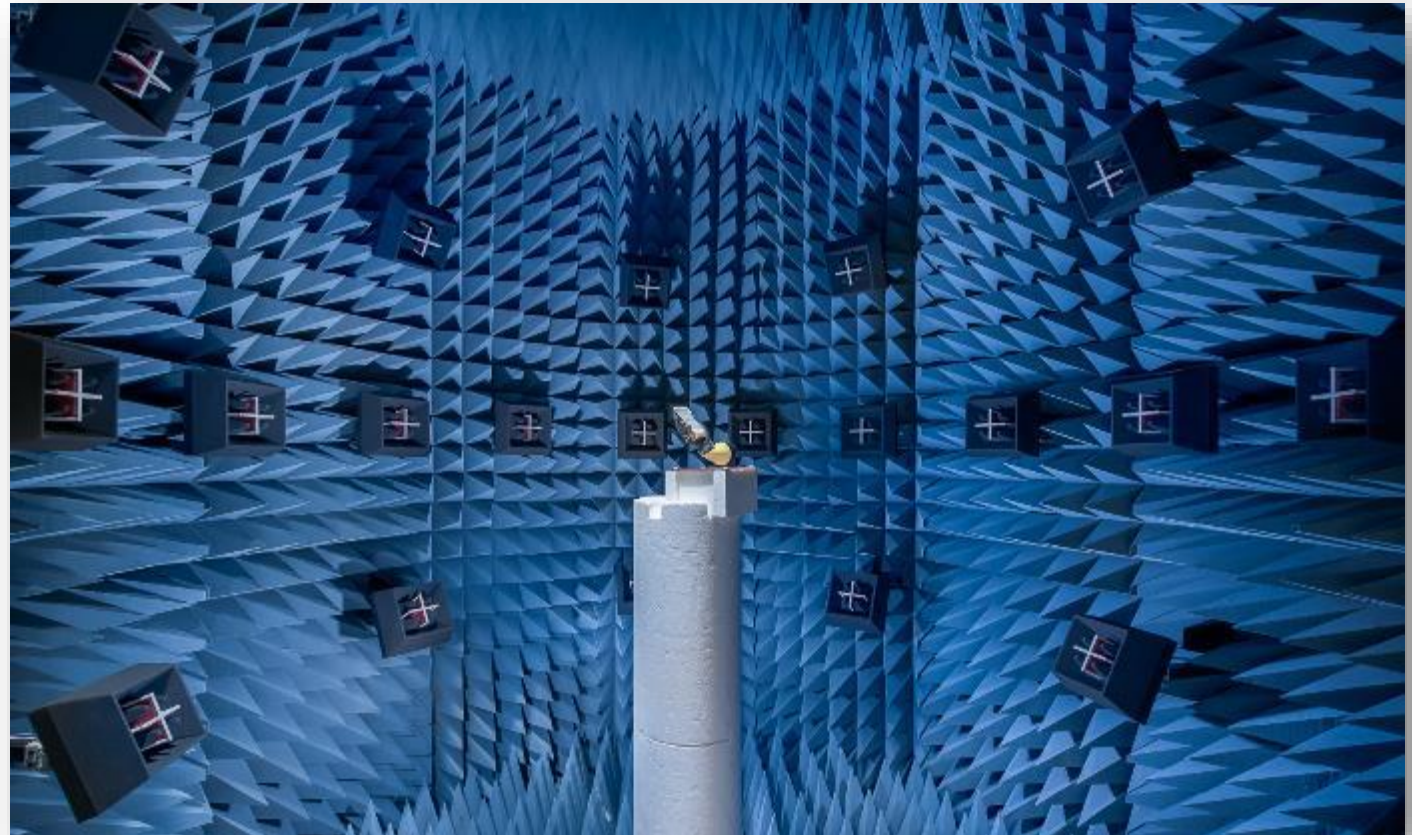
LTE 2CA 9 combinations

Test throughput time : 7 work days

Next Generation MIMO 3D OTA Chamber

- **Technical Specifications**
- Dimensions:
- Diameter: 6.0m
- Height: 5.8m
- Measurement Distance 2.2m
- Measurement Antennas:
- 38 dual polarized
- Frequency Range:
- 600MHz - 6GHz

This chamber allows you to recreate the radio environment of e.g. Time's Square or Grand Canyon and test your device in repeatable and reliable way.



Three High Quality OTA Chambers

Wireless Systems

Performance testing:

- GSM Bands
- UMTS Bands
- LTE Bands
- CDMA bands
- TD-SCDMA Bands
- A-GPS
- Passive Antenna Testing
- Glonass
- Beidou
- FM Radio
- Wlan
- Bluetooth

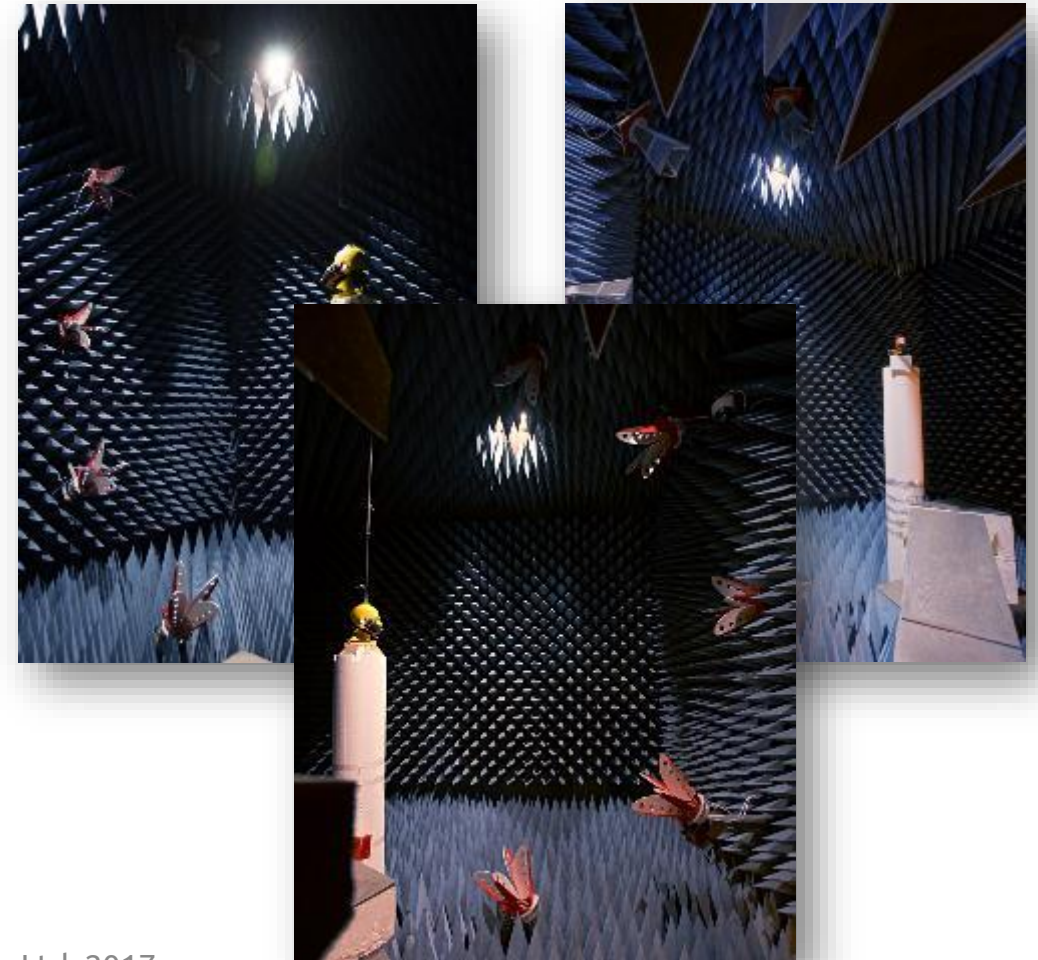
Technical Specifications

Dimensions:

- Width: 7.3m
- Length: 6.2m
- Height: 6.8m
- Measurement Distance: 3.4m

Frequency Range:

- 400MHz - 20GHz
- OTA Measurement uncertainties:
- TRS: 0.69dB
 - TPR: 0.81dB
 - CTIA ripple test: 0.29dB

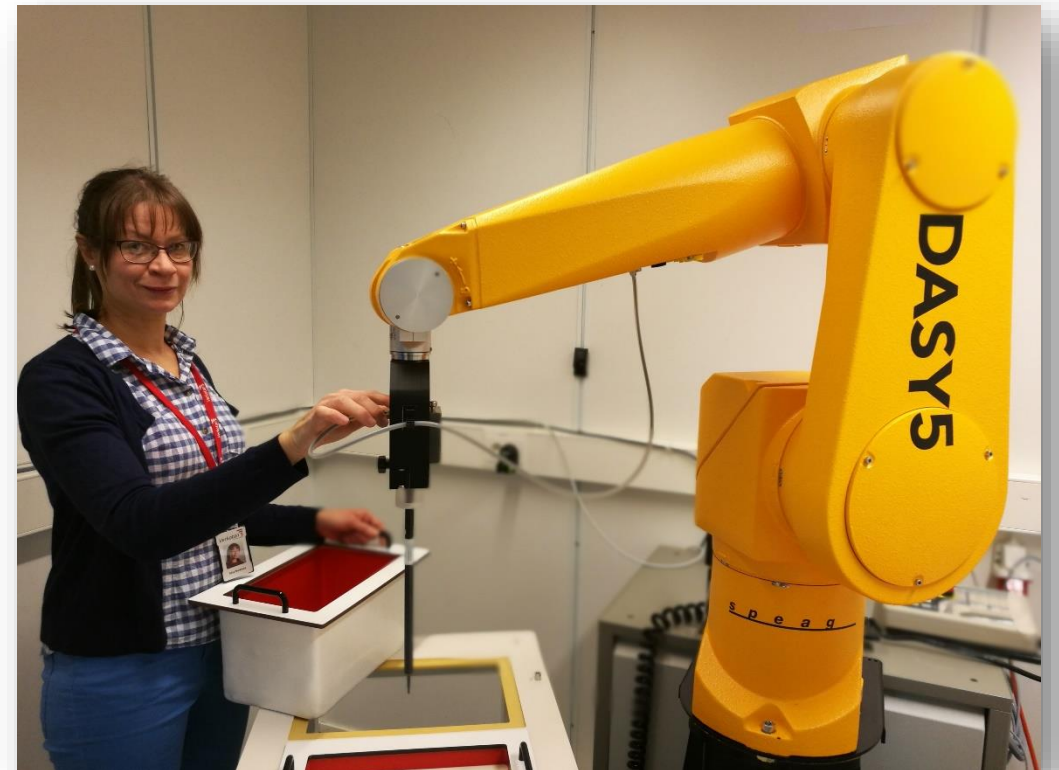


SAR Testing for CE, FCC and ISED certification

- 2 DASY5 systems in RF shielded rooms.
- 3 pcs twin SAM phantoms
- 1 Eli (oval shaped) phantom
- Base Station Phantom (BSTP-A)
- Head, body and whole body capability
- Measurable frequency range: 30-6000MHz
- Testing in non-signaling and signaling modes
- Dielectric parameter validation

We have done SAR testing for:

- Cellular, Satellite, TETRA, BLE, WLAN, military radio, VHF and UHV devices
- Cellular Base Station antennas



Scope of Accreditations

OTA Testing

- CTIA Test Plan For Wireless Device Over-the-Air Performance
- 3GPP TS34.114
- 3GPP TR 37.902
- 3GPP TR 25.914
- CTIA/Wi-Fi Alliance Test Plan for RF Performance Evaluation of Wi-Fi Mobile Converged Devices



SAR Testing

- ICNIRP (1998)
- 1999/519/EC
- IEEE 1528-2013
- EN 50566-2013
- EN 50360 (2001) + A1 (2012)
- IEC 62209-1 (2005) EN 62209-1 (2006) YD/T 1644.1
- IEC 62209-2 (2010) EN 62209-2 (2010)
- IEC/EN 62479 (2010)
- ANSI/IEEE C95.1-2005
- ANSI/IEEE C95.3-2002
- IEC 62311 (2007) EN 62311 (2008)
- RSS-102, Issue 5

SAR Testing

- Australian Communications and Media Authority (ACMA) (2014)
- 47CFR §2.1093
- FCC Published RF Exposure KDB Procedures
- ARIB STD-T56

History of Our Laboratories

- 1996 Nokia established the OTA labs
- 1999 CTIA established and specification work started. Strong participation from Nokia OTA team
- 2003 3GPP/GCF OTA standardization work started. Nokia OTA team being the key initiator
- 2003 The new lab facilities opened
- 2012 MIMO test specification initiated by Nokia
- 2014 Labs moved to Microsoft ownership
- 2015 OTA labs purchased by Verkotan Oy

We will help you to deliver leading radio
performance.

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