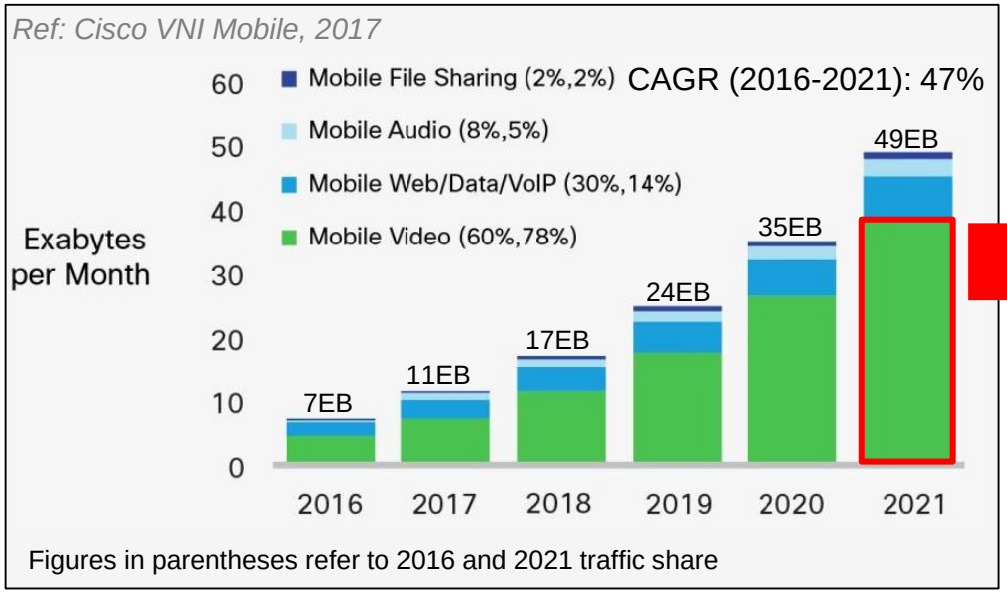
The path to superior voice quality: VoLTE and beyond

Carlos Menendez
Product Marketing MNT

ROHDE&SCHWARZ
Mobile Network Testing

Mobile Data Traffic Growth → driven by video !



More than 75% of the mobile traffic will come from video services!

But bad voice quality is considered key factor to

- Quality of Experience for video and voice services strongly affects the user satisfaction … and the operator's success !

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Definition of Quality

- The word quality identifies the features and characteristics of a product or service
- BUT…
- It is a relative terms and it is measured by a person based on the expectation

Therefore, Quality is the totality of features and characteristics of a product and or service that leads to Customer Satisfaction

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Relativity of Quality

- Quality is not an absolute term
- It depends on the expectations and goals of the user
- Therefore the situation and believes of the user will modify his quality standards
- Without a Benchmark it is not possible to assess the quality levels
- For example: can GSM provide good quality?

Voice Quality of experience

- In order to understand the real perception we deliver algorithms that simulate the human ear
- Our algorithms measure the voice quality as a user would do it and put it in a scale from 1 to 5
- Rohde & Schwarz is the creator (together with other companies) of the current ITU standard P863

POLQA®

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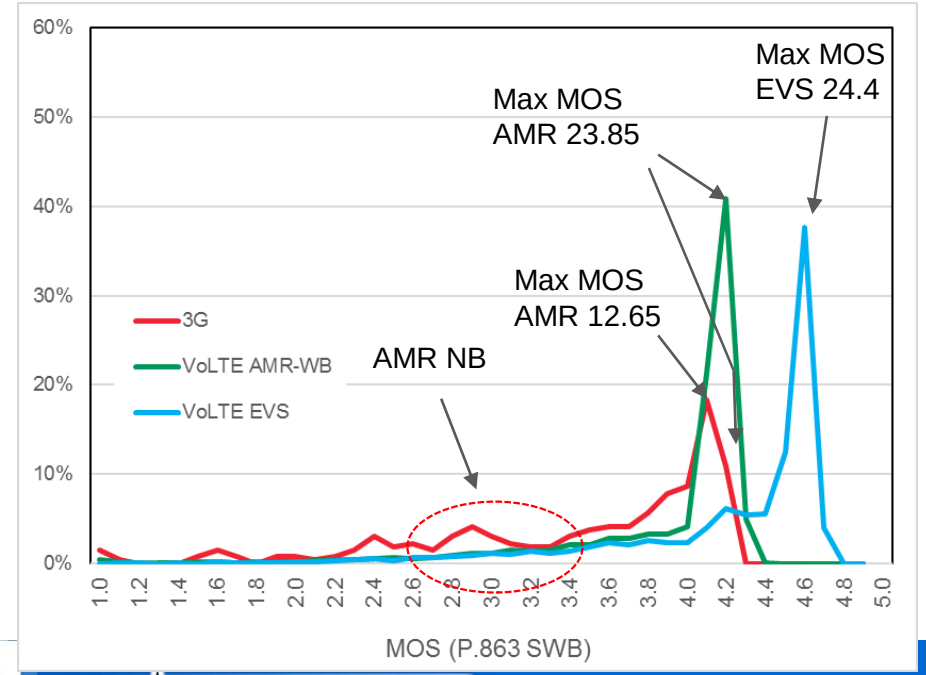
Voice over LTE – Codecs and bitrates

Speech Quality – Introduction by example data

- CS (2G / 3G) — AMR-WB 12.65 kb/s
  - *Some vendors:* — *AMR-WB 23.85 kb/s*
  - *Fallback* — *AMR 12.2 (or lower)*
- VoLTE — AMR-WB 23.85 kb/s
  - *Some MNOs apply* — *AMR-WB 15.85, 12.65*
  - *Some MNOs apply* — *EVS 24.4 kb/s*
- Under perfect network conditions
  - AMR 12.2 — best MOS: **3.20…3.30**
  - AMR-WB 12.65 — best MOS: **3.95…4.00**
  - AMR-WB 23.85 — best MOS: **4.15…4.20**
  - EVS 24.4 — best MOS: **4.55…4.65**



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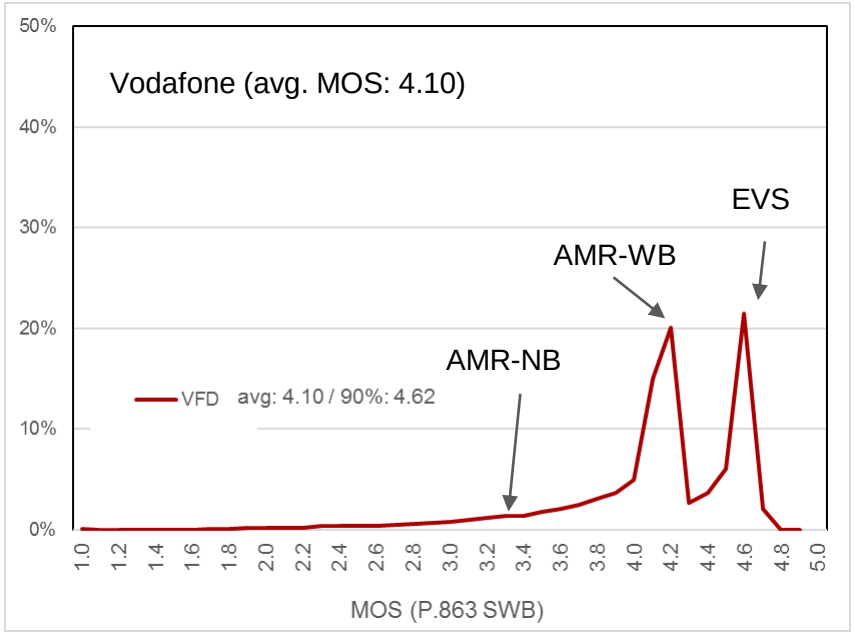
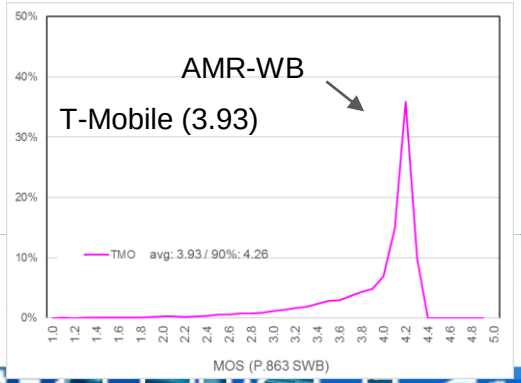
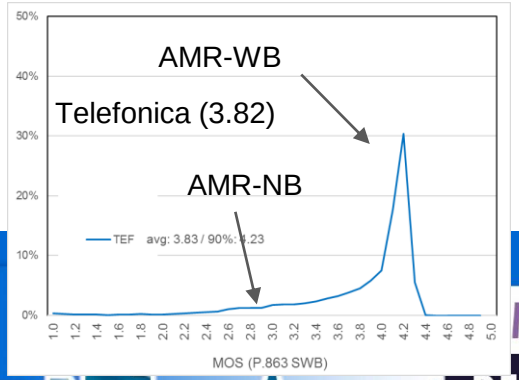
Voice Quality Analysis

- Real field data Germany
- Mobile – to – Mobile
- 17. – 22.05.2017
- ~50% LTE, ~45% 3G, ~5% 2G



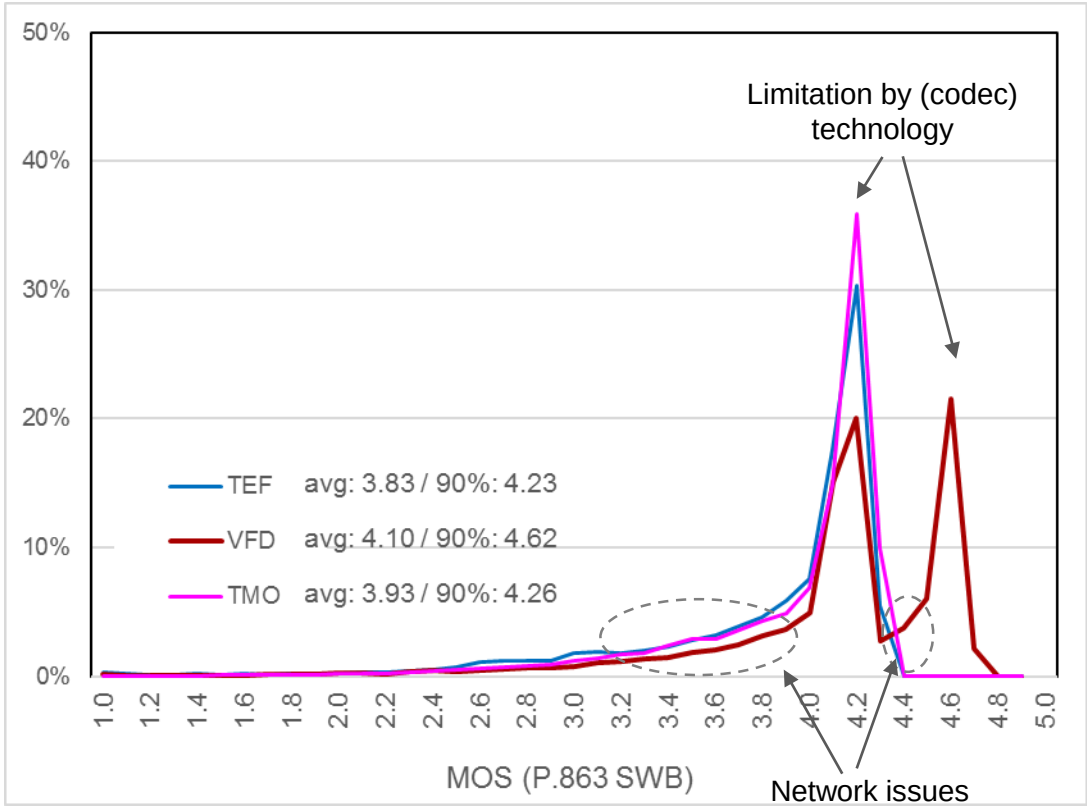




Voice Quality Analysis

- Today VFD has the advantage of EVS (technology profit)
- TEF has still considerable AMR-NB fallbacks
- In general networks are good
  ➔ Technology dominates

VFD avg 12.65	3.92	3G (+ 2G)
VFD avg EVS 24.4	4.28	LTE
TMO avg 12.65	3.82	3G (+2G)
TMO avg 23.85	4.07	LTE
TEF avg 12.65	3.86	3G (+ 2G)
TEF avg 23.85	3.93	LTE



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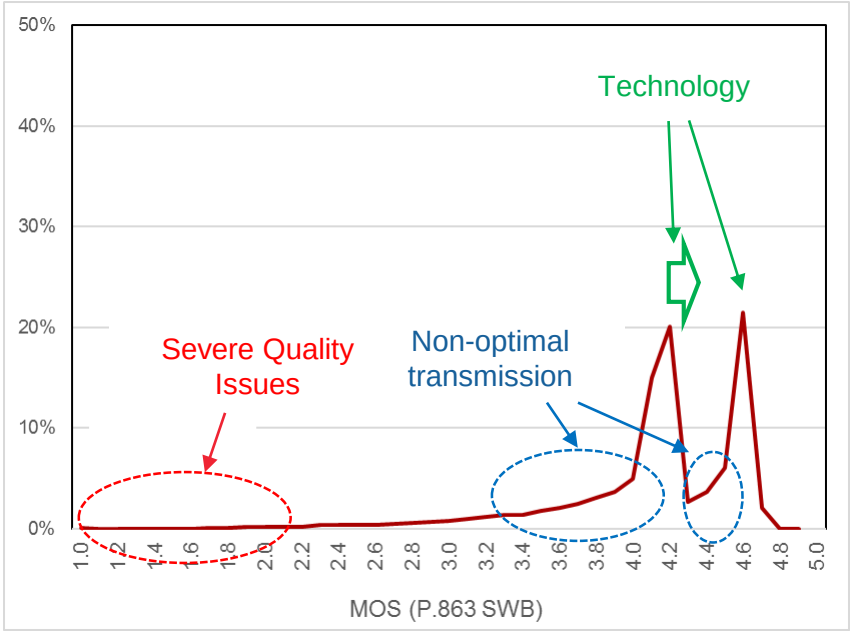
Voice Quality Analysis

How to improve?

- Severe quality issues
  - Inter-RAT and Inter-Freq handovers
  - RTP Loss / Delay in backbone
  - Bad RF condition (of course)
- Non-optimal transmission
  - Uncompensated RTP Jitter (audio distortions)
- Technology improvement
  - Codec / Bitrate
  - Transcoding free operation
  - Use of EVS IO mode



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Voice Quality Analysis

What, if? **What** to improve?

	Average MOS	***Bad Sample Rate*** MOS < 2.0	***GoodOrBetter*** MOS > 3.6
▪ Worst cases, very low MOS scores ➔ Solving all issues of MOS <2.0	*4.10 -> 4.12*	***~1% -> 0%*** *But ~6% of **calls** are covering at least one bad sample (-> 0%)*	*~87%* *No considerable change*
▪ Improving non-optimal transmission ➔ Solving 50% of issues (Max MOS - 2.0)	***4.10 -> 4.22***	*No change*	***~87% -> ~92%***
▪ Technology Improvement ➔ AMR-WB 23.85 in 3G	***4.10 -> 4.17***	*No change*	*~87%* *No change*

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Under perfect network conditions:

- AMR 12.2: best MOS: **3.20…3.30**
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Same data rate, but different MOS, different QoE

- AMR-WB 23.85: best MOS: **4.15…4.20**
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Same data rate, but different MOS, different QoE

Bitrate ≠ Voice quality, but codec type is decisive

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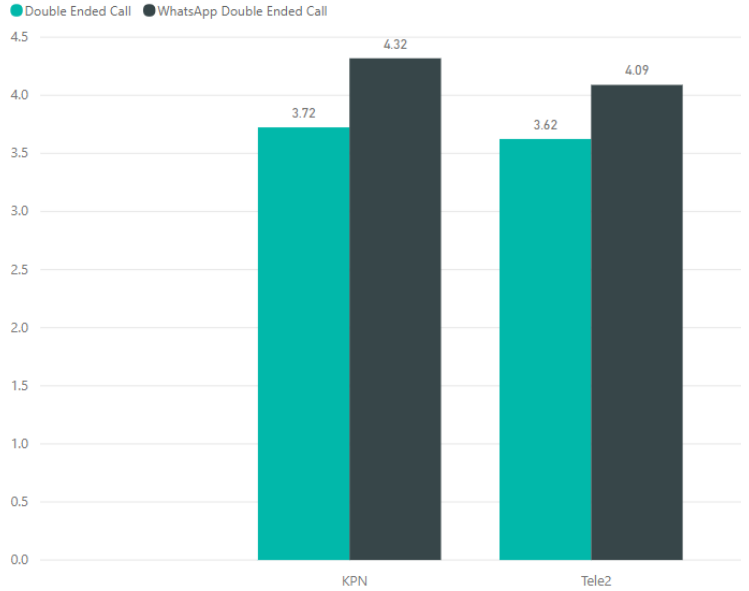
Netherlands Drive test – minimal configuration Freerider

- **QualiPoc-based** light benchmarking system with (optional) scanner(s) and (up to) 6 Android devices
- Usable for both indoor and outdoor measurements (in-building tests, in trains, pedestrian areas, etc.), but with the flexibility to take the system for temporary use into a car or even for a fix vehicle installation

Addition: Real field results Netherlands Oct. 2017

WhatsApp vs. VoLTE – Quality, CST and Reliability

- WOW!
  - Speech Quality Average (good network conditions)
    - VoLTE avg. MOS: 3.65
    - WhatsApp avg. MOS: 4.20
- Although WhatsApp shows reliability issues, it is very close to VoLTE
- The lack of EVS definitely puts VoLTE quality behind most advanced OTT



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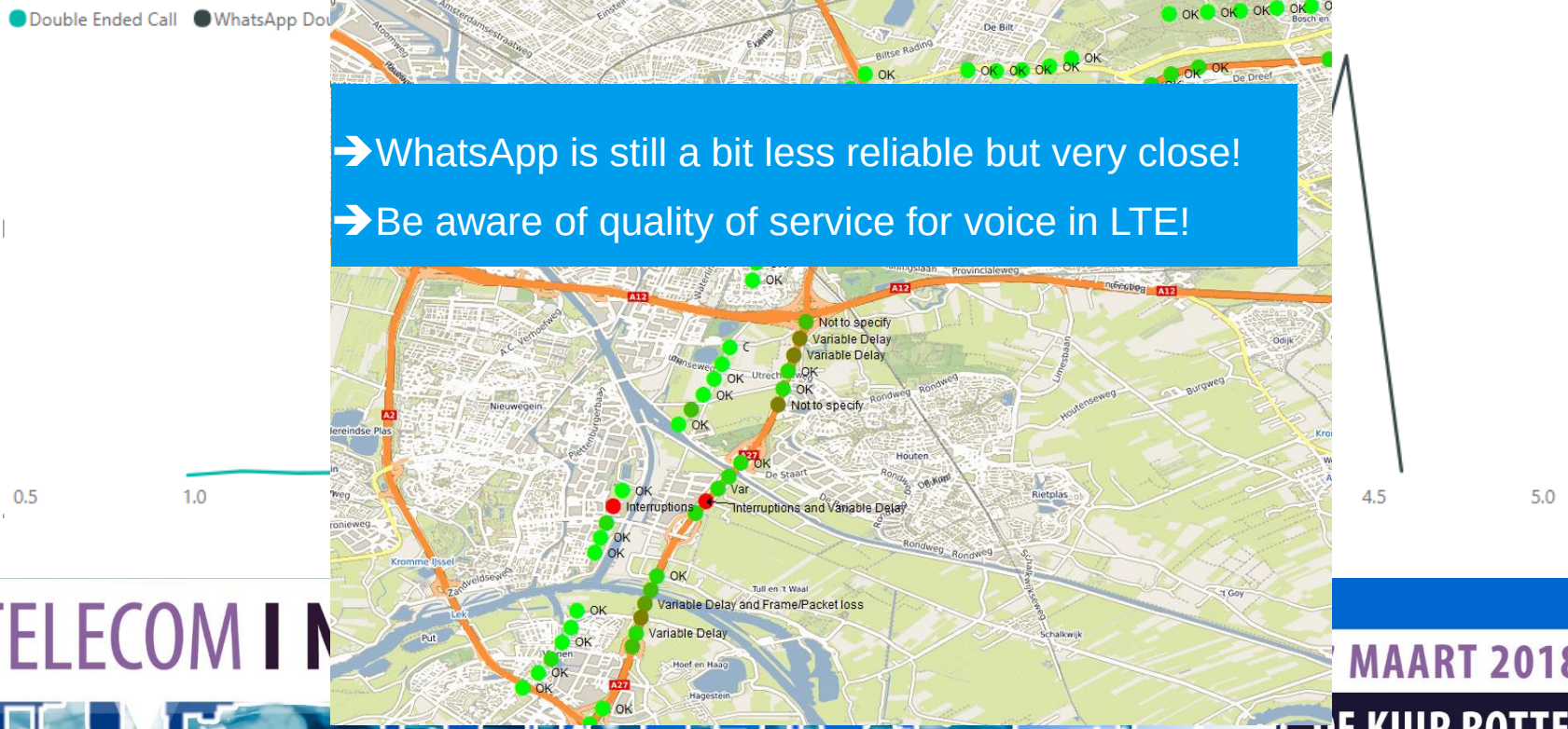
Addition: Real field results Netherlands Oct. 2017

WhatsApp vs. V



➔WhatsApp is still a bit less reliable but very close!

➔Be aware of quality of service for voice in LTE!

From the first lab tests to network insights

Lab Engineering	R&S®ROMES	R&S®TSME	R&S®TSMA		
Spectrum clearance, Interference hunting	R&S®FPH	R&S®FSH	R&S®PR100	R&S®MobileLocator	R&S®ROMES & R&S TSMx
Installation, commissioning, site acceptance	R&S®ZPH & R&S®ZVH	R&S®FSH	PiMPro Tower	R&S Scanners	Qualipoc Android

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From the first lab tests to network insights

Optimization	QualiPoc Android	QualiPoc Probe	QualiPoc Freerider III	R&S®ROMES
Service Quality Monitoring	QualiPoc Probe			
Benchmarking	SmartBenchmarker	QualiPoc Freerider III		
Data management, analysis & reporting	SmartMonitor	R&S®ROMES4NPA	NQDI	

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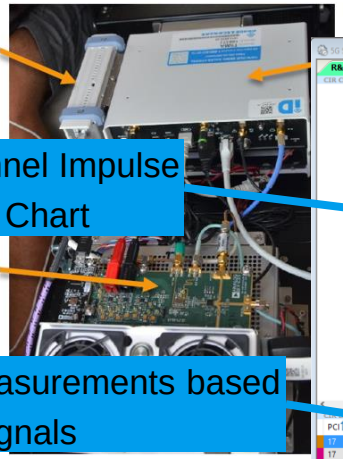
Already actively measuring 5G

28 GHz downconverter prototype



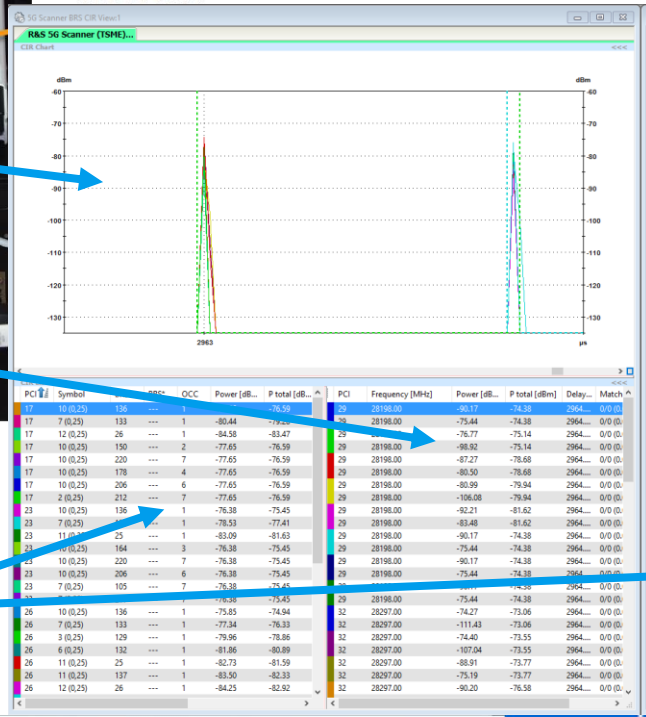
R&S®TSMA

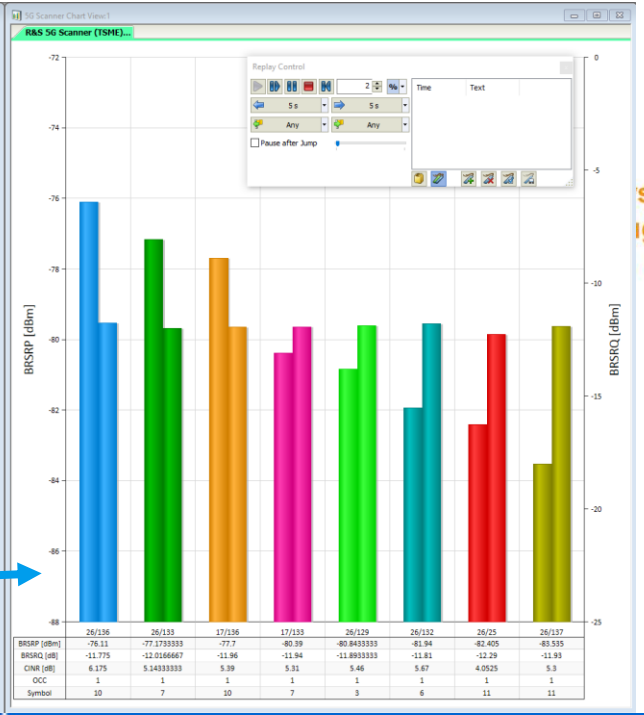
CIR- Channel Impulse Response Chart

VCO+PLL, 100 MHz clock

Power measurements based on sync-signals

Measurements based on BRS





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Thank you! Questions?
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