SRM-3006
5G NR Code Selective Measurement

- **Measurement concept**
  Measuring principle of code-selective measurement at 5G.
- **SRM based implementation**
  Details of the measurement implementation based on the SRM.

Measurement concept

Measurement

The measurement method is based on the determination of the radiated field produced by the Secondary Synchronization Signal (SSS) of the downlink of the Physical Broadcast Channel (PBCH).

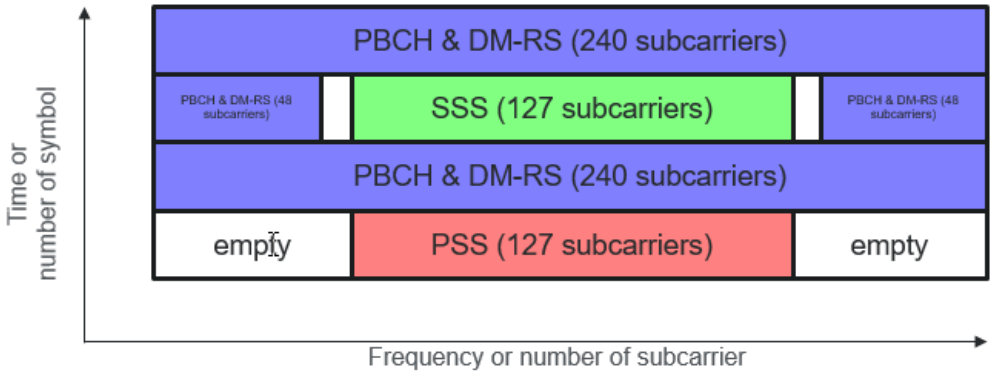
Advantages of the code selective measurement:

- It is independent of traffic situation
- It also works with beamforming
- It can distinguish between different cells
- It does not react on signals emitted by mobile phone (important in TDD systems, 5G NR will be mainly used in TDD mode)

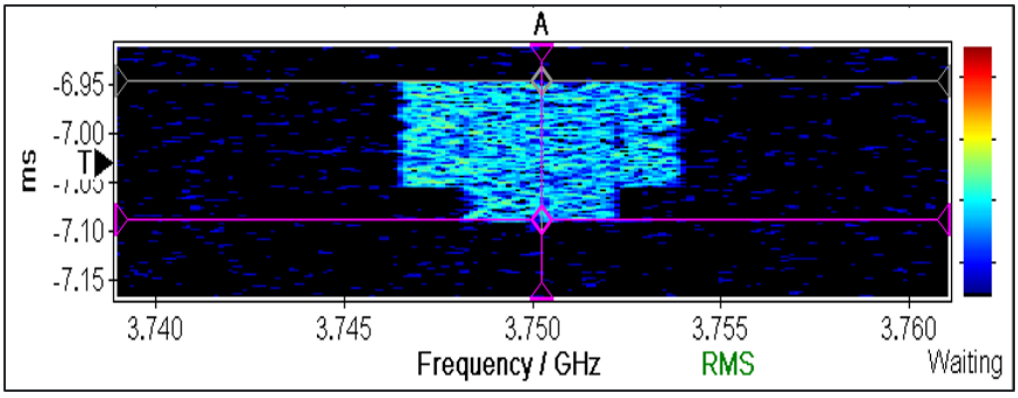
Structure of SS/PBCH block

PSS (red) and SSS (green) are signals inside the physical broadcast channel (**SS/PBCH**) block

- The entire block is 240 subcarriers broad and 4 symbols long
- PSS and SSS are 127 subcarriers broad and 1 symbol long



Schematic diagram



SS/PBCH Block measured using IDA-2 I/Q recorder

Measurement Bandwidths

The bandwidth of the SS/PBCH block and the SSS/PSS signal are defined as follows:

- SS/PBCH block has a bandwidth of 240 x Δf
- The SSS/PSS signal bandwidth is 127x Δf

The subcarrier spacing of the PBCH block "Δf" can have the following values for carrier frequencies ≤ 6 GHz:

- 15 kHz, 30 kHz

This results in the following bandwidths:

Δf	0,015 MHz	0,030 MHz
SS/PBCH	3,600 MHz	7,200 MHz
SSS	1,905 MHz	3,810 MHz
PSS	1,905 MHz	3,810 MHz

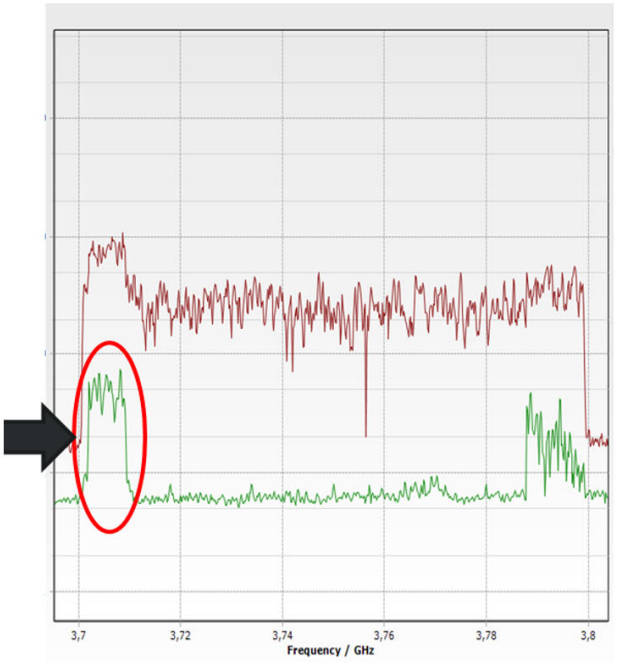
Note:

5G signals above 6 GHz require significantly larger measurement bandwidths. This SRM can only perform frequency-selective measurements in these higher frequency bands.

SS/PBCH Frequency

In contrast to 4G, 5G synchronization SS/PBCH can be shifted individually by the operator inside the frequency band. If frequency of the synchronization is unknown, it has to be located by a spectrum measurement.

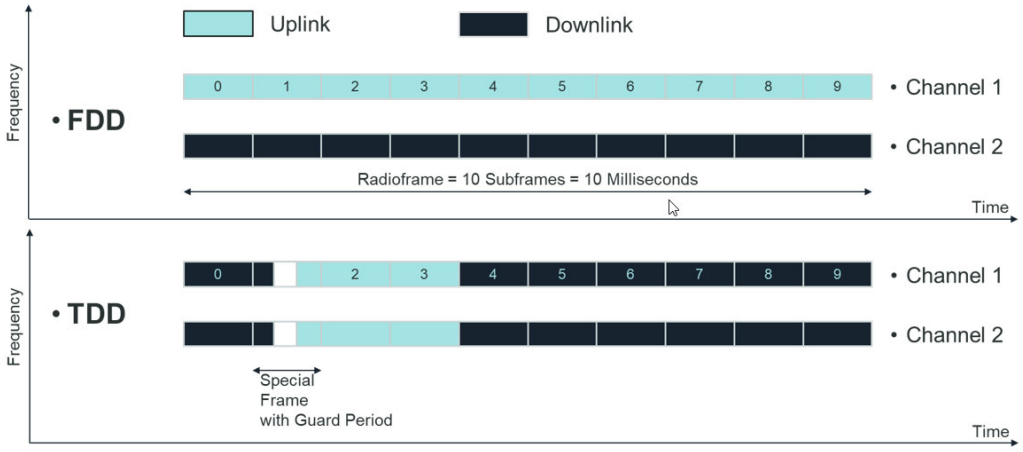
E.g.: 100 MHz bandwidth system with synchronization at lower edge of spectrum



TDD vs. FDD

Most base stations are expected to use TDD, in which uplink and downlink are multiplexed over time slots.

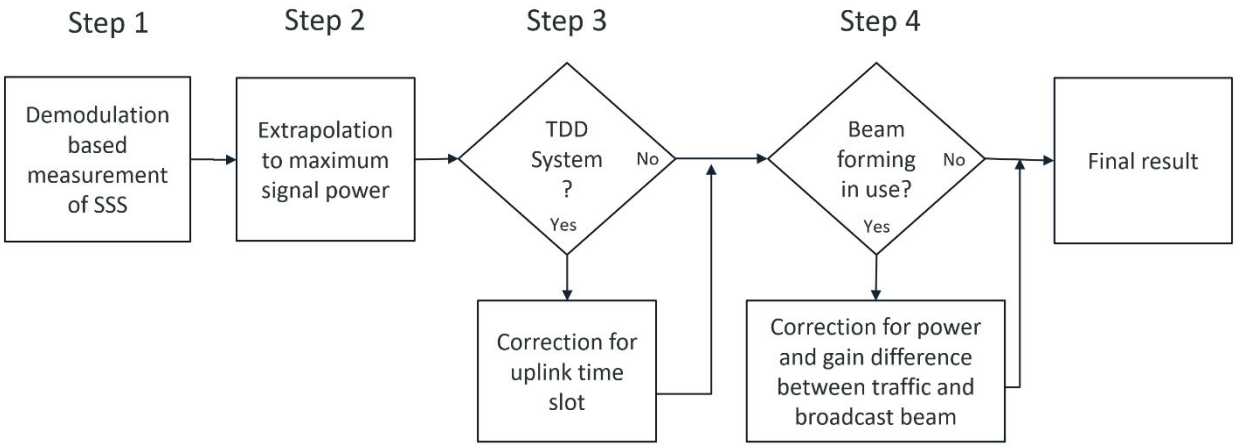
- This improves the utilization of the available frequency spectrum.
- Since often more data is required for the downlink than for the uplink, TDD allows additionally the data rate to be adjusted accordingly via the number of timeslots.



Extrapolation

For the extrapolation of 5G signals several parameters have to be considered due to the use of TDD and beam forming.

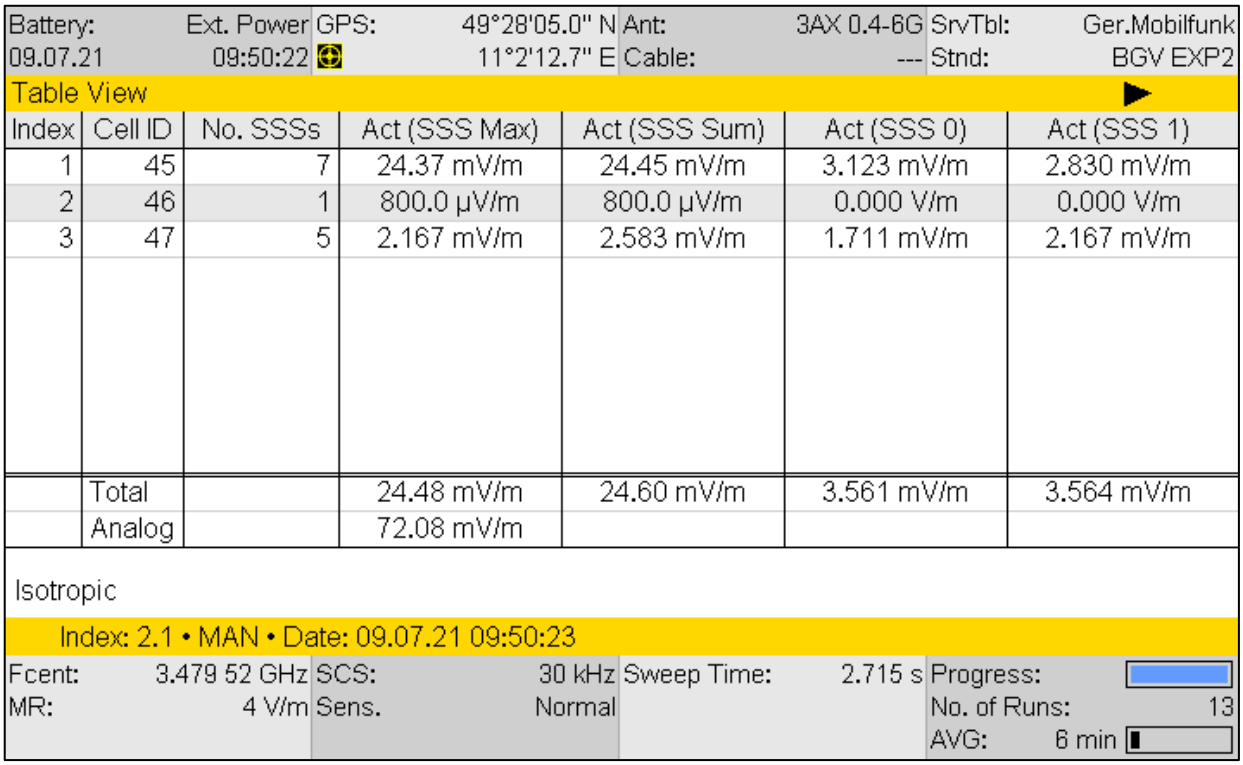
Even though there will be different extrapolation methods depending on the country, which differ slightly from each other, the basic principle can be described as follows:



SRM based implementation

SRM 5G Measurement Mode

The measurement mode can be accessed via the "More" button.



Battery: Ext. Power	GPS: 49°28'05.0" N	Ant: 3AX 0.4-6G	SrvTbl: Ger.Mobilfunk
09.07.21 09:50:22	11°2'12.7" E	Cable: ---	Stnd: BGV EXP2

Table View

Index	Cell ID	No. SSSs	Act (SSS Max)	Act (SSS Sum)	Act (SSS 0)	Act (SSS 1)
1	45	7	24.37 mV/m	24.45 mV/m	3.123 mV/m	2.830 mV/m
2	46	1	800.0 µV/m	800.0 µV/m	0.000 V/m	0.000 V/m
3	47	5	2.167 mV/m	2.583 mV/m	1.711 mV/m	2.167 mV/m
	Total		24.48 mV/m	24.60 mV/m	3.561 mV/m	3.564 mV/m
	Analog		72.08 mV/m			

Isotropic

Index: 2.1 • MAN • Date: 09.07.21 09:50:23

Fcent: 3.479 52 GHz	SCS: 30 kHz	Sweep Time: 2.715 s	Progress:
MR: 4 V/m	Sens. Normal		No. of Runs: 13
			AVG: 6 min

Measurement of a 5G NR base station with beamforming antennas

SRM 5G Code Selective Measurement - Firmware Option

Article-Nr.:	3701/08
Description:	Option, 5G NR
Compatibility	All SRM-3006

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