

LTE Downlink Power Allocation

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Emin Bilir

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AGENDA

Why

LTE RE and PRB
Overview

LTE Channel
Type

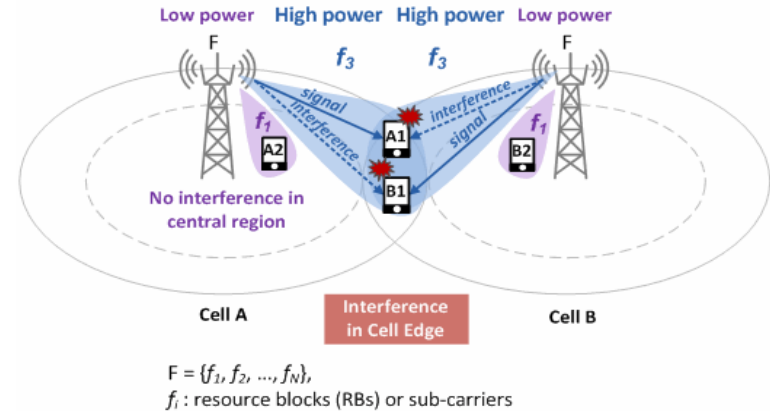
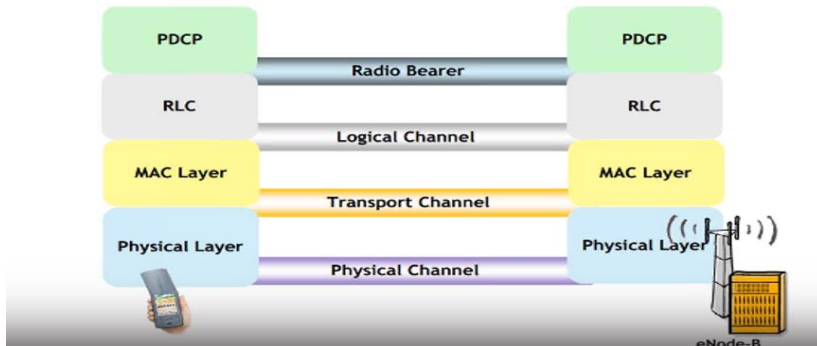
LTE
physical Channels

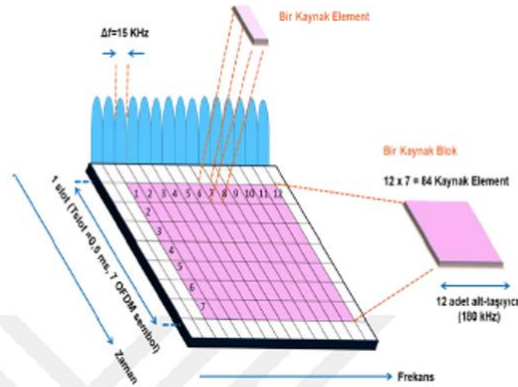
LTE DL Power
Allocation

Implementation

- ❑ We need to understand purpose of LTE channels to be able to understand of LTE protocols and communications.
- ❑ To be familiar with power related to the channels.
- ❑ Taking reactions for troubleshooting consciously
- ❑ Advance knowledge about LTE architecture and overview

P.I.WORKS RADIO CHANNELS

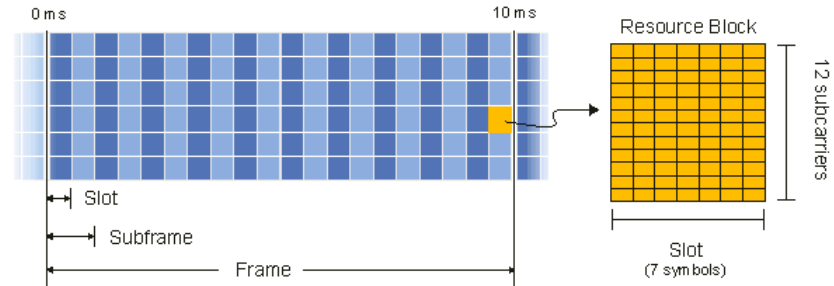




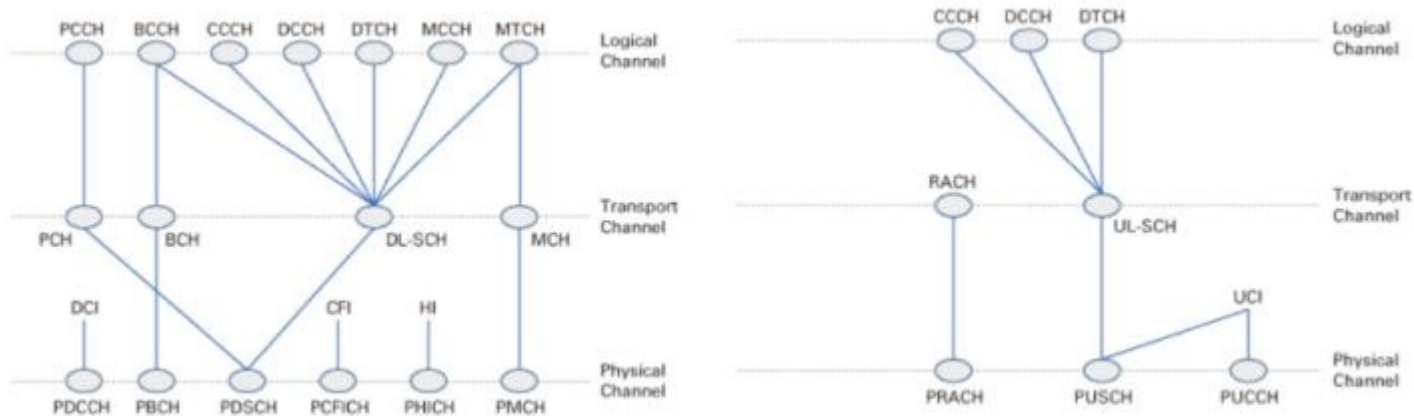
Şekil 2.8. LTE aşağı yönlü kaynak yapısı

Çizelge 2.3. Bant genişliğine göre kaynak blok ve alt taşıyıcılar ile ilgili tanımlamalar

Bant genişliği (MHz)	1.4	3	5	10	15	20
Alt-taşıyıcı bant genişliği (kHz)	15					
Kaynak blok sayısı	6	15	25	50	75	100
Alt-taşıyıcı sayısı	72	180	300	600	900	1200

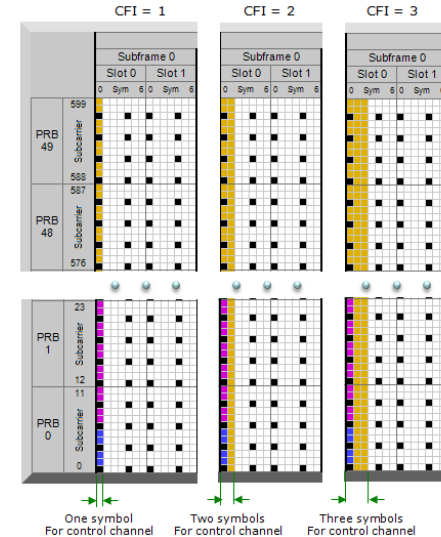
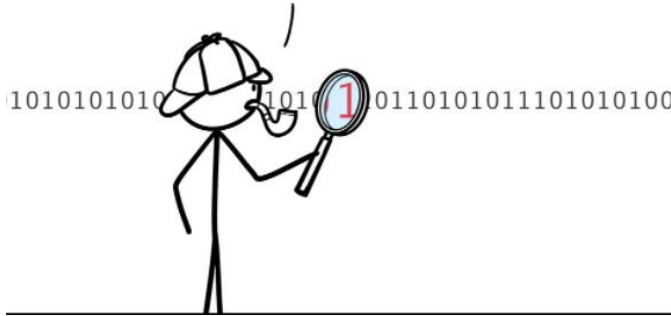


- ❑ Physical channels(**Where** to send this information): These are transmission channels that carry user data and control messages.
- ❑ Logical channels(**What** type of Information): Provide services for the Medium Access Control (MAC) layer within the LTE protocol structure.
- ❑ Transport channels(**How** this information is transported): The physical layer transport channels offer information transfer to Medium Access Control (MAC) and higher layers.

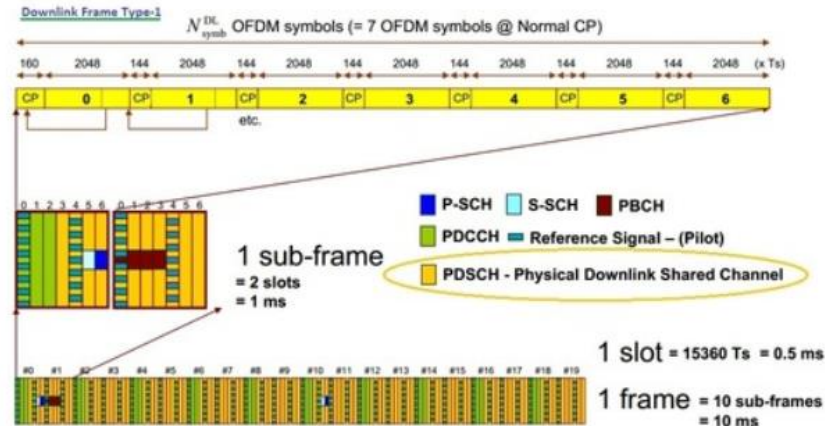


- **Physical Broadcast Channel(PBCH)(QPSK):**This physical channel carries system information for UEs requiring to access the network. It only carries what is termed Master Information Block messages.Always QPSK.(has 14 information bits and 16 CRC bits).
- **Physical Control Format Indicator Channel (PCFICH) :**informs the UE about the format of the signal being received.It indicates the number of OFDM symbols used for the PDCCHs, whether 1, 2, or 3.(Control Format Indicator)

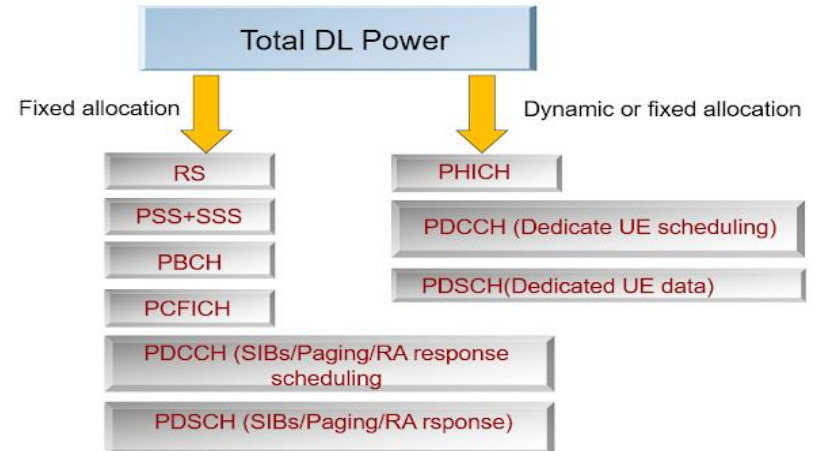
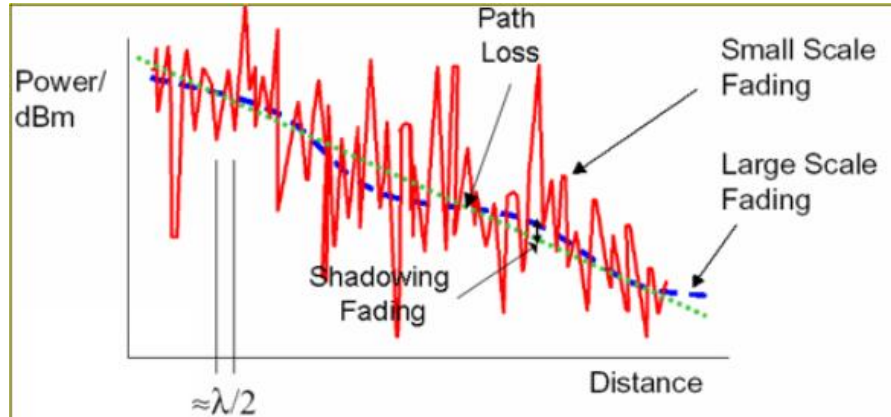
This looks a Bit suspicious!

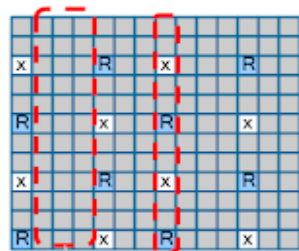
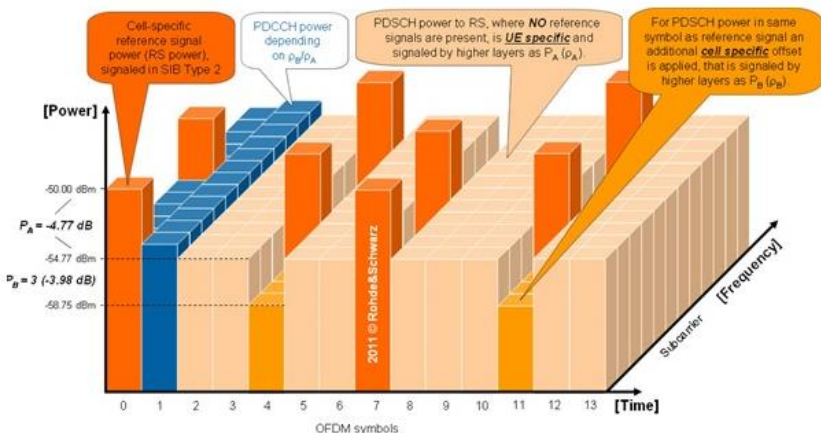


- **Physical Downlink Control Channel (PDCCH)** :if the UE has data in the PDSCH, it needs to know where the data is located. if the UE is unable to decode PDCCH then the UE cannot read the PDSCH in that subframe and consistent decoding failures of PDCCH lead to RLF (Radio Link Failure) due to N310. The main purpose of this physical channel is to carry mainly scheduling information of different types:
 - Downlink resource scheduling
 - Uplink power control instructions
 - Uplink resource grant:UL Grant is a specific physical control channel information from Network (eNodeB) telling a UE "Now you can transmit data" (More accurately saying "You can transmit the data 4 ms after you got this grant").UL Grant is another name of DCI format 0
 - Indication for paging or system information
- **Physical Hybrid ARQ Indicator Channel (PHICH)**: It carries the HARQ ACK/NACK signal indicating whether a transport block has been correctly received. The HARQ indicator is 1 bit long - "0" indicates ACK, and "1" indicates NACK.
- **Physical Downlink Shared Channel (PDSCH)**: The PDSCH can carry DL-SCH or PCH. It carries SIB information, Paging Information and user plan Data.

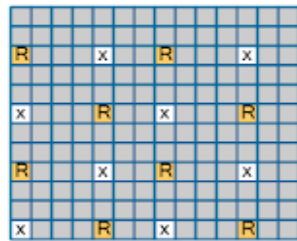


- ❑ Compensate path loss , including shadow fading and multiple path fading
- ❑ Reduce interference on the edge cell





Antenna Port 0



Antenna Port 1

R RS symbol for antenna port 0

R RS symbol for antenna port 1

Type A Symbol: without RS REs

Type B Symbol: RS REs

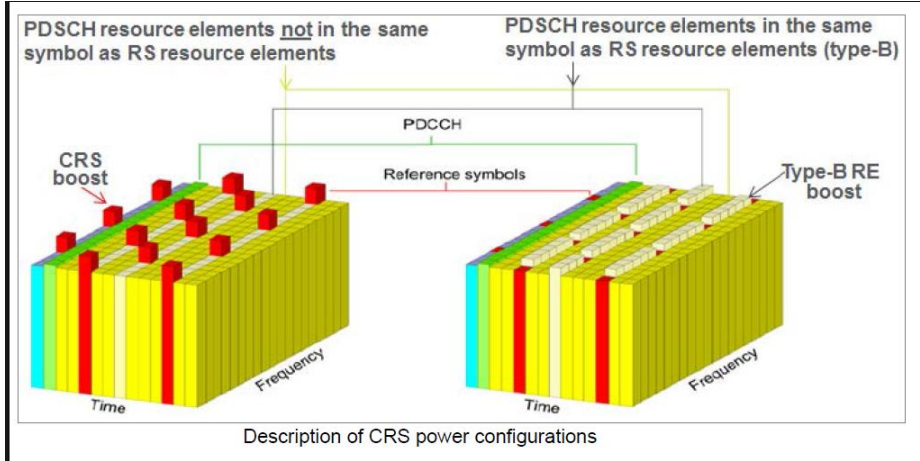
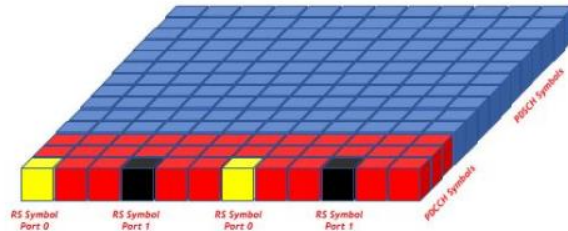
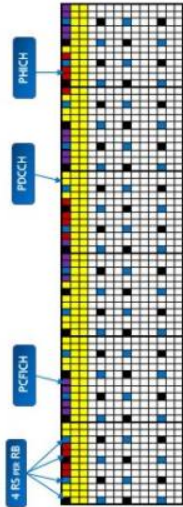
$$RS \text{ Power} = \text{Total power per channel (dBm)} - 10\lg(\text{total subcarrier}) - 10\lg(P_B + 1)$$

Bandwidth	P_B	P_{RS} (dBm)
10M	1	18.2
15M	1	16.4
20M	1	15.2

P_B	Symbol B/ Symbol A	
	1 ANT port	2 or 4 ANT ports
0	1	5/4
1	4/5	1
2	3/5	3/4
3	2/5	1/2

P_B determine the RS occupation of total power, $P_B=1$ indicate the RS power is 9.4% of total power

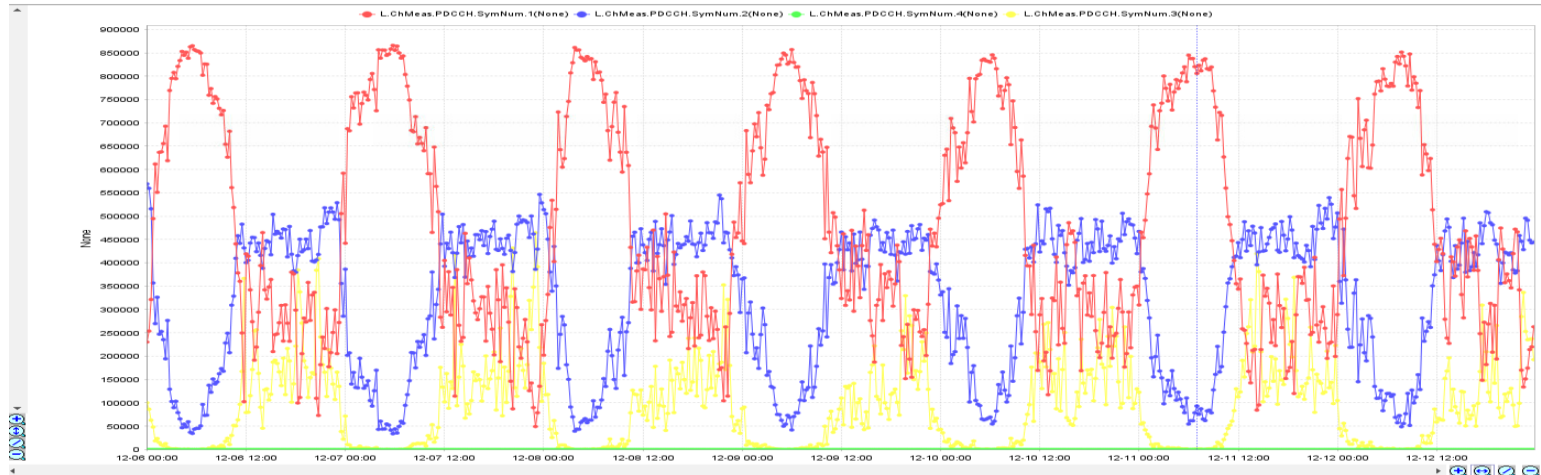
In the frequency domain every 6th subcarrier (= RE) carries an RS. In the time domain, every 4th OFDM symbol carries reference symbols. Due to their importance, reference signals are the highest powered components within the downlink signal. Power boosting is mainly performed on the RS.



Number of OFDM Symbols Occupied by the PDCCH

Counters

Counter ID	Counter Name	Counter Description	Network Element	Applicable Mode	RAN Architecture Option
1526728299	L.ChMeas.PDCCH.SymNum.1	Number of times the PDCCH occupies one symbol in a measurement period	BTS3900, BTS3900 LTE, BTS5900, BTS5900 LTE	L-FDD, L-TDD	N/A
1526728300	L.ChMeas.PDCCH.SymNum.2	Number of times the PDCCH occupies two symbols in a measurement period	BTS3900, BTS3900 LTE, BTS5900, BTS5900 LTE	L-FDD, L-TDD	N/A
1526728301	L.ChMeas.PDCCH.SymNum.3	Number of times the PDCCH occupies three symbols in a measurement period	BTS3900, BTS3900 LTE, BTS5900, BTS5900 LTE	L-FDD, L-TDD	N/A
1526728302	L.ChMeas.PDCCH.SymNum.4	Number of times the PDCCH occupies four symbols in a measurement period	BTS3900, BTS3900 LTE, BTS5900, BTS5900 LTE	L-FDD, L-TDD	N/A



✓ LST PDSCHCFG;
LBR0639

+++ LBR0639 2021-12-15 13:41:28
O&M #006403735
%%/*1906159517*/LST PDSCHCFG;%%
RETCODE = 0 Operation succeeded.

List PDSCH Configuration

Local cell ID	Reference signal power(0.1dBm)	PB	Reference Signal Power Margin(0.1dB)	Offset of Ant0 to Tx Power(0.1dB)	Offset of Ant1 to Tx Power(0.1dB)	Offset of Ant2 to Tx Power(0.1dB)	Off:
11	182	0	0	255	255	255	255
12	182	0	0	255	255	255	255
13	182	0	0	255	255	255	255
21	182	1	0	255	255	255	255
22	182	1	0	255	255	255	255
23	182	1	0	255	255	255	255
41	182	1	0	255	255	255	255
42	182	1	0	255	255	255	255
43	182	1	0	255	255	255	255

(Number of results = 9)

Impact on Radio Network Performance

A smaller value of this parameter leads to higher power for data on the symbols in which there are reference signals. A larger value of this parameter leads to the opposite effect.

✓ LST CELLHPWRCFG;
LBR0817

+++ LBR0817 2021-12-15 13:53:35
O&M #006392443
%%/*1879054385*/LST CELLHPWRCFG;%%
RETCODE = 0 Operation succeeded.

List Cell Channel Power Configuration

Local cell ID	PCFICH power(0.005dB)	PBCH power(0.005dB)	SCH power(0.005dB)	DBCH power(0.005dB)	PCH power(0.005dB)	Rach response power(0.005dB)	Prs power(0.005dB)	Antenna Output Power(W)
11	0	0	-600	0	600	600	600	20
12	0	0	-600	0	600	600	600	20
13	0	0	-600	0	600	600	600	20
21	-600	-600	0	-600	0	0	0	20
22	-600	-600	0	-600	0	0	0	20
23	-600	-600	0	-600	0	0	0	20
41	-600	-600	0	-600	0	0	0	20
42	-600	-600	0	-600	0	0	0	20
43	-600	-600	0	-600	0	0	0	20

(Number of results = 9)

Impact on Radio Network Performance

You are advised to set the parameter to a value that does not deviate from the value of the PA for even power distribution parameter by more than 3 dB. A larger value leads to a larger coverage of the PCFICH but less available power for the PDCCH and PHICH. A smaller value leads to opposite effects.

Thank you!

