TSG-RAN meeting #19 RP-030194
Birmingham, Great Britain, 11th -14th March, 2003

Agenda Item: **9.10**

Source: **Motorola**

Title: **Status of supporting low level output powers for FDD base stations within the 3GPP RAN specifications today**

Document for: **Approval**

Introduction

The purpose of this document is to state Motorola's current understanding of how the 3GPP R99 specifications support a low level output power from an FDD base station.

Discussion

What power is low level?

RP-030147 suggests that a base station with a rated output power in the range of –10 to 0 dBm would useful for some operators and manufactures of auxiliary equipment. It requests that a study item would be required to add this to our current specifications. This document considers the case of a base station with a rated output power of –10 dBm and determines if changes would be needed.

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4.2 Base station classes

The requirements in this specification apply to base station intended for general-purpose applications.

The base station with the low output power would be a general purpose base station.

6 Transmitter characteristics

6.1 General

Unless otherwise stated, the transmitter characteristics are specified at the BS antenna connector (test port A) with a full complement of transceivers for the configuration in normal operating conditions. If any external apparatus such as a TX amplifier, a diplexer, a filter or the combination of such devices is used, requirements apply at the far end antenna connector (port B).

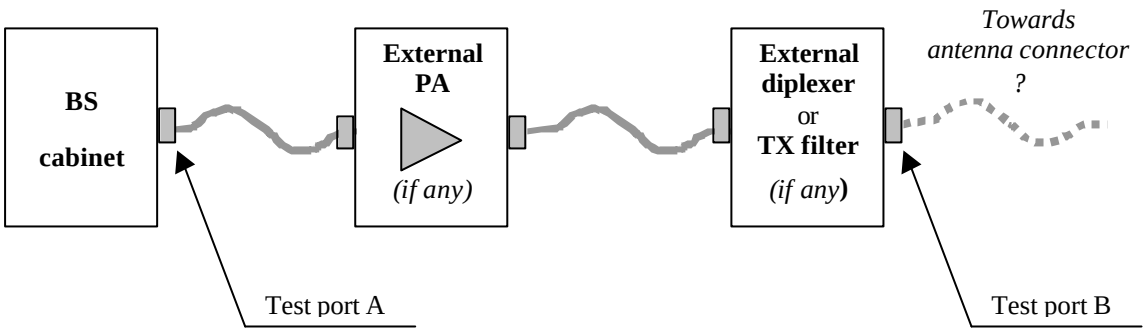

Figure 6.1: Transmitter test ports

For this study Motorola have assume the port of concern is test port A

6.2 Base station output power

Output power, Pout, of the base station is the mean power of one carrier delivered to a load with resistance equal to the nominal load impedance of the transmitter.

Rated output power, PRAT, of the base station is the mean power level per carrier that the manufacturer has declared to be available at the antenna connector.

6.2.1 Base station maximum output power

Maximum output power, Pmax, of the base station is the mean power level per carrier measured at the antenna connector in specified reference condition.

6.2.1.1 Minimum requirement

In normal conditions, the Base station maximum output power shall remain within +2 dB and -2dB of the manufacturer's rated output power.

In extreme conditions, the Base station maximum output power shall remain within +2.5 dB and -2.5 dB of the manufacturer's rated output power.

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

The rated output power, PRAT, would be –10 dBm. This is in-line with the output power specifications within 25.104.

6.4.2 Power control dynamic range

The power control dynamic range is the difference between the maximum and the minimum code domain power of a code channel for a specified reference condition.

6.4.2.1 Minimum requirements

Down link (DL) power control dynamic range:

Maximum code domain power: BS maximum output power - 3 dB or greater

Minimum code domain power: BS maximum output power - 28 dB or less

In this case the max code power would be –13 dBm, and the minimum –38 dBm. Although the lower limit is probably not useful, it could be met, therefore a change is not essential.

6.4.3 Total power dynamic range

The total power dynamic range is the difference between the maximum and the minimum output power for a specified reference condition.

NOTE: The upper limit of the dynamic range is the BS maximum output power. The lower limit of the dynamic range is the lowest minimum power from the BS when no traffic channels are activated.

6.4.3.1 Minimum requirement

The downlink (DL) total power dynamic range shall be 18 dB or greater.

In this case the minimum output power would be –28 dBm.

6.4.4 Primary CPICH power

Primary CPICH power is the code domain power of the Common Pilot Channel averaged over one frame. Primary CPICH power is indicated on the BCH.

6.4.4.1 Requirement

Primary CPICH code domain power shall be within ? 2.1dB of the Primary CPICH code domain power indicated on the BCH.

From 25.331, the RRC specification the primary CPICH power indicated on the BCH can have the range –10 to +50 dBm. This is the first area work would be required, since in realistic scenarios a range of –3 to –15 dB would be useful. Hence a CR to 25.331 increasing the FDD CPICH power range to –25 dBm to +50 dBm. A search of 25.331 did not reveal any other absolute values, hence this is the only change.

6.6.2 Out of band emission

Table 6.6: Spectrum emission mask values, BS maximum output power P < 31 dBm

Frequency offset of measurement filter -3dB point, ? f	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth
2.5 ? ?f < 2.7 MHz	2.515MHz ? f_offset < 2.715MHz	-22 dBm	30 kHz
2.7 ? ?f < 3.5 MHz	2.715MHz ? f_offset < 3.515MHz	-22 dBm - 15?(f_offset - 2.715) dB	30 kHz
(see note)	3.515MHz ? f_offset < 4.0MHz	-34 dBm	30 kHz
3.5 ? ?f < 7.5 MHz	4.0MHz ? f_offset < 8.0MHz	-21 dBm	1 MHz
7.5 ? ?f MHz	8.0MHz ? f_offset < f_offset_{max}	-25 dBm	1 MHz

Spectrum emissions are fully specified for an output power of –10dBm.

All other transmitter requirements are fully specified for an output power of – 10 dBm.

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All tests within 25.141 can be performed with an output power of –10 dBm, tested at port A.

Furthermore guidance is provided for the testing of base stations with separate power amplifiers.

4.6.4 Ancillary RF amplifiers

The requirements of the present document shall be met with the ancillary RF amplifier fitted. At tests according to clauses 6 and 7 for TX and RX respectively, the ancillary amplifier is connected to the BS by a connecting network (including any cable(s), attenuator(s), etc.) with applicable loss to make sure the appropriate operating conditions of the ancillary amplifier and the BS. The applicable connecting network loss range is declared by the manufacturer. Other characteristics and the temperature dependence of the attenuation of the connecting network are neglected. The actual attenuation value of the connecting network is chosen for each test as one of the applicable extreme values. The lowest value is used unless otherwise stated.

Sufficient tests should be repeated with the ancillary amplifier fitted and, if it is optional, without the ancillary RF amplifier to verify that the BS meets the requirements of the present document in both cases.

When testing, the following tests should be repeated with the optional ancillary amplifier fitted according to the table below, where x denotes that the test is applicable:

Table 4.3

	Subclause	TX amplifier only	RX amplifier only	TX/RX amplifiers combined (Note)
Receiver Tests	7.2		X	X
	7.5		X	X
	7.6		X	X
	7.7		X	
Transmitter Tests	6.2	X		X
	6.5.1	X		X
	6.5.2.2	X		X
	6.5.3	X		X
	6.6	X		X

NOTE: Combining can be by duplex filters or any other network. The amplifiers can either be in RX or TX branch or in both. Either one of these amplifiers could be a passive network.

In test according to subclauses 6.2 and 7.2 highest applicable attenuation value is applied.

As covered above, the minimum primary CPICH power for testing is –10 dB. For this case this would be –20 dBm. Hence a change may be required to the RRC spec. However this is referenced at the antenna port, port B, hence has to take the gain of the auxiliary equipment into account.

6.1.1.1 Test Model 1

This model shall be used for tests on:

- spectrum emission mask;
- ACLR;
- spurious emissions;
- transmit intermodulation;
- base station maximum output power.
- total power dynamic range (at Pmax)

64 DPCHs at 30 ksps (SF=128) distributed randomly across the code space, at random power levels and random timing offsets are defined so as to simulate a realistic traffic scenario which may have high PAR (Peak to Average Ratio).

Considering that not every base station implementation will support 64 DPCH, variants of this test model containing 32 and 16 DPCH are also specified. The conformance test shall be performed using the largest of these three options that can be supported by the equipment under test.

"Fraction of power" is relative to the maximum output power on the TX antenna interface under test.

Table 6.1: Test Model 1 Active Channels

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset ($x256T_{chip}$)
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
S-CCPCH containing PCH (SF=256)	1	1.6	-18	3	0
DPCH (SF=128)	16/32/64	76.8 in total	see table 6.2	see table 6.2	see table 6.2

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9.2.5.3 Transmitted code power measurement report mapping

The reporting range for *Transmitted code power* is from -10 ... 46 dBm.

In table 9.46 the mapping of measured quantity is defined. The range in the signalling may be larger than the guaranteed accuracy range.

For a –10 dBm output power this range is not in line with the max code power of –13 dBm, and the minimum –38 dBm within 25.104. Therefore a CR would be required increasing the range in the NBAP specification, and possibly in 25.133 for the accuracy.

There are no other changes required to 25.133.

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9.2.1.46A Minimum DL Power Capability

This parameter indicates the minimum DL power capability for a local cell within the Node B. The reference point is the antenna connector.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Minimum DL Power Capability			INTEGER (0..800)	Unit: dBm, Range: -30 .. +50 dBm Step: 0.1 dB

9.2.1.39 Maximum DL Power Capability

This parameter indicates the maximum DL power capability for a local cell within the Node B. The reference point is the antenna connector.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Maximum DL Power Capability			INTEGER (0..500)	Unit: dBm Range: 0..50 dBm Step: 0.1 dB

9.2.1.40 Maximum Transmission Power

The Maximum Transmission Power is the maximum power for all downlink channels added together, that is allowed to be used simultaneously in a cell. The reference point is the antenna connector.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Maximum Transmission Power			INTEGER (0..500)	Unit: dBm Range: 0..50 dBm Step: 0.1 dB

Clearly the range would have to be increase to –10 to 50dBm

9.2.2.33 Primary CPICH Power

The Primary CPICH power is the power that shall be used for transmitting the P-CPICH in a cell. The reference point is the antenna connector.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Primary CPICH Power			INTEGER (-100..500)	Value = Primary CPICH Power/10 Unit: dBm Range: -10.0 .. +50.0 dBm Step: 0.1 dB

9.2.3.9 PCCPCH Power

The Primary CCPCH power is the power that shall be used for transmitting the PCCPCH in a cell. The PCCPCH power is the reference power in a TDD-cell. The reference point is the antenna connector.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
PCCPCH Power			INTEGER (-15..+40,…)	Unit: dBm Range: -15 ..+40 dBm Step: 0.1 dB

In order to meet the test model requirements within 25.141 the range of the CPICH and PCCPCH has to be able to go down to –10dB, a additional margin of 5 dB would be useful. Hence the lower limit of both parameters should be decreased to –25 dBm.

No other changes could be identified in 25.433.

Conclusions

To support an output power of 0 dBm one change may be required to the 25.133 specification.

To support an output power of –10 dBm several changes would be required to the RAN specifications. Most of the changes are to RAN 3 specifications (NBAP), 1 change to a RAN 4 specification, 25.133, and 1 change to a RAN 2 specification, 25.331.

If RAN agree that output powers of –10 dBm would be useful Motorola fully support either a study item or work item to make the changes. We would recommend that RAN 3 be the lead group.