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Source: **Motorola**
Title: **Listing of key Radio transmission and reception parameter for ETSI and ARIB**

1. Introduction

The intention of this paper is to help the procedure of generating one common 3GPP R4 specfication document by reviewing the following source documents:

- ARIB Volume 4 “Specification of Mobile Station for 3G Mobile Systems”
- ARIB Volume 5 “Specification of Base Station for 3G Mobile Systems”
- ETSI UMTS XX06v4.1.0 UTRA; FDD Radio transmission and reception.
- ETSI UMTS XX12v0.1.0 UTRA; TDD Radio transmission and reception.

A lot of effort has been made in developing the above source documents, and for that reason we should utilise their above contents in a such a way that a common output document can be developed.

The attached document has been developed to further this process by listing the key radio transmission and reception parameters from some of the above source documents. This list is not comprehensive and the may not include all recent changes in the above source documents. however this may be a useful starting point to further the work programme.

SPECIFICATIONS		ETSI-SMG2-LI	ARIB	COMMENT
1Description		XX06.0.4.1 UTRA FDD XX12.0.1.0 UTRA TDD <This is the current release of the ETSI LI document>	MS specification ver 1.0-0.0 30th September 1988 + further contributions Only the sections, which relate to radio Tx and Rx parameters, are detailed.	
Frequency band and channel arrangement				
1	Chip rate	4096/ …. / Mcps	The chip rate shall be chosen from the following chip rates [ ] / [ ] / [ ] Mcps	
2	Frequency band	• 1920 – 1980: UL TX FDD • 2110 – 2170: DL TX FDD • 1900 – 1920: UL/DL TDD • 2010 – 2025: UL/DL TDD	• 1920 – 1980: UL TX FDD • 2110 – 2170: DL TX FDD • • 2010 – 2025: UL/DL TDD	
3	TX – RX frequency separation.	1. Minimum Tx –Rx separation is 135 MHz 2. Variable duplexer is FFS	The minimum carrier spacing between the forward link and the reverse link for the FDD system shall be[ ] MHz	
4	Channel spacing	The nominal channel spacing is 5 MHz but this can be adjusted to optimise performance in a particular deployment scenario.	The minimum carrier spacing is [ ] MHz	
5	Channel raster	200 kHz	200 kHz	
6	Channel number	The carrier frequency is designated by the UTRA absolute radio frequency channel number (UARFCN)	The MS is assigned in terms of raster number and associated channel frequency.	
7	MS interface requirements	Not specified. This are treated in other ETSI groups	MS shall have the following; Air , User UIM and Adapter interface	
8	Environmental Temp	Not specified so far	Temp requirement are specified	
9	Environmental Voltage	Not specified so far	Voltage requirement are specified	
10	Environmental Vibration	Not specified so far	Vibration requirement are specified	
11	Environmental humidity	Not specified so far	Humidity requirement are specified	
12	EMC	Not specified so far, but will be treated in other ETSI groups. Separate requirement for Base Station and Mobile Station	EMC requirement	
13	RF safety	Normally not specified in the requirement for radio transmission & reception.. However the point is noted ❑ All MS power classes shall met the applicable RF emission specification(s). The means for meeting such as limiting the long term average power and associated control are for further study.	SAR requirement specified.	
Transmitter performance				
14	General (Transmitter)	Unless detailed the transmitter characteristics are specified at the antenna connector of the equipment. For equipment with integral antenna only, a reference antenna with a gain of 0 dBi is assumed.		
15	MS power class (dBm)	The max output power is the measure of power when average over the transmit timeslot at the max power control setting • FDD: 0, 10, 21, 24, 27 and 33 dBm • Working assumption 21 dBm • Tolerance not defined in ETSI For multi-code operation, the maximum output power will be reduced by the difference of peak to average ratio between single and multi-code	The max RF output power is defined as the maximum power measured at the MS antenna connector. • FDD: 0/10/21/24/27/33 dBm • +1/-3 dB tolerance The max mean power is reduced in the multi-code transmission by the difference of peak to average ratio between the single and multi-code case.	

16	BS station output power.	The base station output power profile can be used to cater for different system scenario. The following examples of base station classes can be considered for the various system scenarios ❑ BS class 1 Macro ❑ BS class 2 Micro ❑ BS class 3 Pico ❑ BS class 4 (residential mode TDD)	Total power is the mean power when the BS is transmitting a signal modulated with a combination of Perch channel, common physical channel and DCH. The total power shall remain within + [ ] dB and – [ ] dB of the manufacturers rated power	
17	MS Frequency stability	The UE carrier frequency shall be accurate to within ±[0.1] PPM compared to signal received from the BS (these signals will have an apparent error due to BS frequency error and Doppler shift). In the later case, signals from the BS must be averaged over sufficient time that errors due to noise or interference are allowed for within the above ± [0.1] PPM figure.	Frequency stability is the ability of a MS transmitter to transmit at an assigned carrier frequency with AFC ON The MS output carrier frequency shall be within the limits specified of any assigned channel frequency with AFC is within ± 0.1 PPM.	
18	BS frequency stability	The frequency stability of the BS shall be accurate to within ± [0.05] PPM for RF frequency generation. For some BS classes the frequency stability of the BS shall be accurate to within ± [] PPM for RF frequency generation.		
19 Open look power control	Power control	Open loop power control is the ability of the UE transmitter to sets it's output power to a specified value An example of open loop power control is when the received signal at the UE is used as an initial reference. If it's too low the UE is assumed to be far from the base station and transmits with a high power. If it's too high the UE it is assumed to be close in and transmits at low power. This procedure can be used during normal operation as well as for sending access requests.	Open loop power control is the ability of the MS to set its output power to a specified value. 1. The MS shall have the capability of setting open loop power with a step of 1 dB. 2. The open loop power control error shall be less than +/- 9 dB	
20 Closed loop power control	Power control	Closed loop power control is the ability of the UE / BS transmitter to adjust its output power in response to the UL/DL received signal .	Closed loop power control is the ability of the MS transmitter to adjust its output power in accordance with the TPC symbols in the forward link 1. Step size of 1 dB 2. The average rate of change is specified. 3. The time/ramp up template is specified.	
21	Tx Power control steps	The power control step is the minimum step change in the UL/DL transmitter output power in response to a TPC message. 1. UL Variable 0.25- 1.5 dB 2. DL Variable 0.25- 1.5 dB	Covered above	
22	Tx Power control cycles per second	The maximum rate of change for the UL/DL transmitter power control step. • Up link (UL) 1.6 kHz • Down link (DL) 1.6 kHz	Not specified as implicit.	

23	Tx Dynamic range	The power control dynamic range is difference between the maximum average power and the minimum transmit power for a specified reference condition 1. Up link (UL) 80 dB 2. Down link (DL) 30 dB	The power control dynamic range is the range of output power capable to set and output from a MS: 1. The dynamic range is terminal power class dependent.	
24	Tx Minimum transmit power	The minimum controlled output power of the UE/BS is when the power control setting is set to a minimum value. This is when both the closed loop and open loop power control indicates a minimum transmit output power is required. a) UL -50 dBm b) DL -[ ] dBm	This is not specified since it follows that the min. power can be obtained by consideration the max. power and the dynamic range.	
25	Tx ON/OFF ratio	Transmit ON/OFF ratio is defined as the ratio of the maximum average transmit power within the channel bandwidth with the transmitter ON and OFF.	The transmit ON/OFF ratio is defined as the ratio of the average transmit power within the channel bandwidth to that of the transmitting power off. 1. The dynamic range is terminal power class dependant	
26	Tx DTX	Not specified – this is an omission	DTX is a function with the object of minimising interference of MS against other MS. It can minimise transmitting power from MS when voice information, user information or control information is not occurred. • Power ver time template is provided	
27	Tx Occupied bandwidth	Occupied bandwidth is a measure of the bandwidth containing 99% of the total integrated power for transmitted spectrum and is centred on the assigned channel frequency. The occupied channel bandwidth is less than 5 MHz based on a chip rate of 4.096 Mcps.	This is covered in ARIB under spurious emissions	
28	Tx Out of band emissions	Out of band emissions are unwanted emissions immediately outside the [channel] bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission limit can be specified in terms of a spectrum emission mask or adjacent channel power ratio for the transmitter.	This is covered in ARIB under spurious emissions	
29	Tx spectrum emission mask	The emission mask will be different for the type of UE(s) and BS(s) and may depend on the power class, single / multi-code allocation slotted mode, etc and is an item for further study.	This is covered in ARIB under spurious emissions	

30 Tx Adjacent channel Power Continuous modulation		Adjacent channel power ratio (ACPR) is the ratio of the transmitted power within a reference bandwidth of [4.096 MHz) to the power measured within a reference bandwidth of [4.096 MHz] centred on the adjacent(s) channel(s). Note for MS 1. In order to ensure that switching transients due to slotted or DTX mode does not degrade the ACPR value the reference measurement conditions are an item for further study. 2. The possibility is being considered of dynamically relaxing the ACP requirements for User Equipment(s) under conditions when this would not lead to significant interference (with respect to other system scenario or UMTS operators). This would be carried out under network control, primarily to facilitate reduction in UE power consumption. • The ACP1 is [ ] dBc • The ACP2 is [ ] dBc	Adjacent channel leakage power This is specified in terms of spectrum leakage power due to continuous modulation and due to switching transients. 1. Continuous modulation spectrum power: The adjacent channel interference power due to continuous modulation shall be defined as the power that is radiated within a bandwidth of (4.096) of which centre frequency is separated by delta freq. (5 MHz) from the subjective carrier frequency is modulated with the reference coded test signal. 2. Performance requirements • MS ACP 1: -35 dBc • MS ACP 2: -45 dBc	
31 Tx Adjacent channel Power Switching transients		This is not specified as a separate item in xx06	The adjacent Switching transients shall be defined as the power that is radiated within a BW of 4.096 MHz of which the centre frequency is separated by delta f [5] MHz from the subjective carrier frequency is modulated with the ref. Coded test signal The adjacent channel interference power against the mean output power of the MS in the transmission band shall not exceed the limits required by the system.	
32 Tx Spurious emissions		Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions. The frequency boundary and the detailed transitions of the limits between the requirement for out band emissions and spectrum emissions is an item for further study. Guidance can be taken from the applicable tables from ITU-R Recommendations SM.329 and from the ERC Recommendations that are currently under progress	Spurious emissions are emissions at frequencies that are outside the assigned channels, measured at the MS antenna connector. This test measures the spurious emissions during continuous transmissions. 1. 9 kHz to 30 MHz less than –36 dBm (BW is 1 kHz for freq. 9-150 kHz and 10 kHz for frequency 150 kHz to 30 MHz) 2. 30 to 1 GHz less than –36 dBm (BW is 100 kHz) 3. 1 GHz to (Fc-Nb*14.5) MHz less than –30 dBm (BW is 1MHz) • Nb is necessary bandwidth • Fc is centre frequency of carrier • The min requirement of –40 dBm applies to 1893.5 MHz to 1919.6 MHz <PHS band>	

33	MS Tx intermodulation	The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna. User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or BS receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the output power of the wanted signal to the output power of the intermodulation product when an interfering signal is added at a level below the wanted signal. For a UE transmitter operating at the nominal power defined by its class, the intermodulation attenuation shall be at least [ ] dB for an intermodulation component when an interfering CW signal shall be applied at a frequency offset of [ ] MHz and with a power level of [ ] dB below the power level of the wanted signal.	The transmit intermodulation is defined by the ratio of the output power of subject transmitted signal to the output power of intermodulation product when an interfering signal (that differs from the frequency of subject signal) is added at a level 30 dB lower than that of subject signal 1. MS transmit max power modulated. The frequency of the offset interferer is TBD. 2. The requirement of transmitting intermodulation for carrier spacing 5 MHz is ❑ Interfering signal offset 5 MHz and 10 MHz ❑ Interfering signal level is –- 40 dBc ❑ Requirement is –35 dBc at 5 MHz offset and –45 dBc at 10 MHz offset.	
34	BS Tx intermodulation	In a BS intermodulation may be caused by combining several RF channels to feed a single antenna, or when BS(s) are operated in close vicinity of each other. In this case the BS(s) can produce intermodulation products, which can fall into the UE/BS receiver band. The BS intermodulation attenuation is defined by the ratio of the output power of the wanted signal to the output power of the intermodulation product when an interfering signal is added at a level below the wanted signal.		
35	Tx Modulation accuracy	Modulation accuracy is the ability of the transmitter to generate the ideal signal. The difference between the measured and theoretical modulated waveform is the modulation accuracy < Current proposal from HP >	The modulation accuracy is defined by the rms value of errors in signalling points, i.e. the square root of the values, which is obtained by dividing the sum of squared errors over slots by the number of symbols. As well , the modulation accuracy is defined by the waveform quality factor p 1. MS is transmitting max power 2. Modulation accuracy is measured by modulation analyser 3. The waveform quality factor p shall be greater than 0.9444 and the rms value of vector error shall be 12.5% rms or less. The origin offset is at least [-20] dBc or less.	

Receiver performance				
36	**General (Receiver)**	Unless detailed the receiver characteristic are specified at the antenna connector of the UE. For UE with an integral antenna only, a reference antenna with a gain of 0 dBi is assumed. UE with an integral antenna may be taken into account by converting these power levels into field strength requirements, assuming a 0-dBi-gain antenna.		
37	Rx diversity characteristics	Three forms of diversity are mentioned 1. Time (channel coding and interleaving) 2. Multi-path (rake or other suitable receiver structure…) 3. Space diversity (Antenna diversity….)	This text is not included.	
38	Rx sensitivity	The reference sensitivity is the minimum receiver input power measured at the antenna port at which the [FER/BER] does not exceed the specific value indicated in section 7.3.1 and 7.3.2 1. MS: Table of Data rate / ref. Sen / FER/BER 2. BS: Table of Data rate / ref. Sen / FER/BER 3. No values have been proposed in ETSI	MS: The RF sensitivity of the MS is the minimum received power , measured at the MS antenna connector, at which the FER does not exceed a specific value 1. Loop-back mode with 8 Kbps 2. Count the number of frames transmitted and the number of good frames received at the MS 3. The FER shall not exceed 0.01 with a 95% confidence	
39	Rx Dynamic range	The receiver dynamic range is the input power range at the [UE/BS] antenna port over which the [FER/BER} does not exceed a specific rate. The static [BER/FER] reference performance as specified in clause 7.3.1 and 7.3.2 should be met over a receiver input range of [ ] dB above the specified reference sensitivity level.	MS: The Rx dynamic range is the input power range at the MS antenna connector over which the FER does not exceed a specific value. 1. Loop back with 8 Kbps 2. Count the number good frames transmitted and the number of good frames received at the MS 3. The FER shall not exceed 0.01 with a 95% confidence	
40	Rx MS Adjacent channel selectivity	MS Adjacent channel selectivity (ACS) is a measure of the receiver ability to receive a wanted signal at is assigned channel frequency in the presence of a modulated signal in the adjacent channel The static reference performance as specified in clause 7.3.1 and 7.3.2 should be met when the following signals are applied to the receiver; ❑ A wanted signal at the assigned channel frequency, 3 dB above the static reference level. ❑ A modulated interfering adjacent channel signal with a level of [ ] dBm.	Adjacent channel selectivity is a measure of the receiver's ability to receive a W-CDMA signal at its assigned frequency in the presence of adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. Receiver selectivity performance is measured by the frame error rate (FER) 1. Loop back with 8 Kbps 2. The adjacent channel interfer power and frequency offset is not specified. 3. Count at the BS the number good frames transmitted and the number of good frames received at the MS 4. The FER shall not exceed 0.01 with a 95% confidence	

41 Base Station	Rx Intermodulation characteristics	Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver to receiver a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal. The static reference performance as specified in clause 7.3.1 and 7.3.2 should be met when the following signals are applied to the receiver; ❑ A wanted signal at the assigned channel frequency, 3 dB above the static reference level. ❑ An interfering signal at frequency [f1] and frequency [f2] with a level of [ ] dBm.		
42	Rx blocking	The blocking characteristics is a measure of the receiver ability to receive a wanted signal at is assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels; without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occur. The static reference performance as specified in clause 7.3.1 and 7.3.2 should be met when the following signals are applied to the receiver; ❑ A wanted signal at the assigned channel frequency, 3 dB above the static reference level. ❑ An interfering signal at [frequency(s)] offset from the nominal assigned channel below a level of [ ] dBm. ❑ < Editor The frequency range (in band/out of band) and level of the interfering signal is an item for further study>	The spurious response and blocking are measures of receiver ability to receive a CDMA signal on its assigned channel frequency in the presence of a single interfering CW tones 1. Loop back with 8 Kbps 2. The level of the CW tone is not specified. Also not specified is the wanted signal level. 3. Count at the BS the number good frames transmitted and the number of good frames received at the MS 4. The FER shall not exceed 0.01 with a 95% confidence	

43	Rx Spurious response	Spurious response is a measure of the receiver's ability to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the blocking limit is not met. The static reference performance as specified in clause 7.3.1 and 7.3.2 should be met when the following signals are applied to the receiver; ❑ A wanted signal at the assigned channel frequency, 3 dB above the static reference level. ❑ A CW interfering signal below a level of [ ] dBm. ❑ The number of allowed spurious responses is an item for further study.	This is treated in ARIB under one clause number	
44	SIR/RSSI performance	Not specified	The RSSI is a measure of the signal level received over a receiver bandwidth indicated at the MS station. The MS station shall be capable of measuring RSSI within the detection range and accuracy specified …	
45	Rx SIR	Not specified	Received SIR shall be used for the reference of a SIR based fast closed loop transmitter power control. SIR is defined as the ratio between the desired signal level and interfering signal level at the MS receiver input. MS should be capable of measuring SIR within the specified accuracy over the specified detection range.	
46	Spurious emission		The spurious emission power generated or amplified in a receiver that appears at the mobile station antenna connector. 1. Less than –xx dBm in a 1 MHz bandwidth for frequencies in the mobile station receive band 2. Less than –xx dBm in a 1 MHz bandwidth for frequencies in the mobile station TX band 3. Less than –xx dBm in a 50 kHz bandwidth for all over frequencies	
47	**General (Receiver)**	The current XX06 document specifies receiver performance in terms of reference sensitivity and dynamic reference sensitivity The reference is a direct connection to the Rx (no AWGN channel) and the dynamic sensitivity is for a number of test environments and channel conditions.	ARIB specify two method of performance requirement • Performance in a static (AWGN no fading or multi path) channel • Performance in a multipath fading channel	

48 Rx Performance in a Static channel Single link performance	The current xx06 document is undefined and does not specify an AWGN channel test as a standalone Single link performance is specified as part of the reference sensitivity tests.	Single link performance is determined with 1 only active BS. The reception characteristics of different channels in the static environment are determined by the average BER or by the average FER at specified Eb/No values. BER/FER is calculated for each of the possible individual data rates. 1. The required Eb/No is [ ] for the following services • Speech (10-3 BER) @ 8 Kbps • Long constrained delay data (10-6 BER) @ 64, 2048 • Unconstrained delay data @ 64, 2048	
49 RX Performance in Multi-path fading channel Single link performance	The minimum required dynamic reference sensitivity performance is specified according to the traffic rate and the propagation conditions in terms of UE and BS sensitivity performance. Only header are provide with no text. Channel conditions are specified as a normative Annex called Propagation conditions. There is no details provided in this annex	Modified ITU models (as per IMT submission) are used for the performance measurement in multipath fading channels. Delay power spectrums of the modified multipath channels are presented in table The reception characteristics of the different channels in the multipath-fading environment are determined by the average BER/FER at the specified Eb/No values. The required Eb/No for 10E-3 and 10E-6 are for • Speech (10-3) • LCD (10-6) • UDD (10-6) with the following channel model • Indoor (A) • Pedestrian (A) • Vehicular (A)	