



Telecommunications
Standards Advisory
Committee (TSAC)

Technical Specification

Cellular Base Station
and Repeater System

**Draft IMDA TS CBS
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Info-communications Media Development Authority
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Technical Specification for Cellular Base Station and Repeater System

1 Scope

This Specification defines the minimum technical requirements for Cellular Base Station and Repeater System (broadly termed “CBS” in this Specification) to be used in the Public Mobile Radio Communication System and services which employ:

- (a) ITU IMT-2000 radio interface technologies (UTRA FDD and E-UTRA FDD) identified in ITU-R M.1457-12, and transposed from 3GPP Release 8 and 9;
- (b) ITU IMT-Advanced radio interface technologies (LTE-Advanced) identified in ITU-R M.2012-2, and transposed from 3GPP Release 10 and beyond; and
- (c) LTE-Advanced technology series from 3GPP Release 13 onwards, marked with LTE-Advanced Pro.

Note: CBS’ support of the Global System for Mobile Communications (GSM₁) technology is no longer required after 31 March 2017.

2 References

For the technical requirements captured in this Specification, reference has been made to the following standards. Where versions are not indicated, implementation of this Specification shall be based on current and valid versions of these standards published by the respective Standards Development Organisations².

- [1] ETSI EN 301 908-1: IMT cellular networks; Harmonised EN covering essential requirements of Directive 2014/53/EU; Part 1: Introduction and common requirements
- [2] ETSI EN 301 908-3: IMT cellular networks; Harmonised EN covering essential requirements of Directive 2014/53/EU; Part 3: CDMA Direct Spread (UTRA FDD) Base Stations (BS)
- [3] ETSI EN 301 908-11: IMT cellular networks; Harmonised EN covering essential requirements of Directive 2014/53/EU; Part 11: CDMA Direct Spread (UTRA FDD) Repeaters
- [4] ETSI EN 301 908-14: IMT cellular networks; Harmonised EN covering essential requirements of Directive 2014/53/EU; Part 14: Evolved Universal Terrestrial Radio Access (E-UTRA) Base Stations (BS)
- [5] ETSI EN 301 908-15: IMT cellular networks; Harmonised EN covering essential requirements of Directive 2014/53/EU; Part 15: Evolved Universal Terrestrial Radio Access (E-UTRA) FDD Repeaters
- [6] ETSI EN 301 908-18: IMT cellular networks; Harmonised EN covering essential requirements of Directive 2014/53/EU; Part 18: E-UTRA, UTRA and GSM/EDGE Multi-Standard Radio (MSR) Base Station (BS)
- [7] ETSI EN 301 489-1: EMC standard for radio equipment and services; Harmonised Standard covering essential requirements of article 3.1(b) of the Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU; Part 1: Common technical requirements
- [8] ETSI EN 301 489-50: EMC standard for radio equipment and services; Part 50: Specific conditions for Cellular Communication Base Station (BS), repeater and ancillary equipment

¹ Use of the GSM RIT for base stations and repeaters in the GSM900 and GSM1800 bands according to the ETSI EN 301 502 and EN 300 609-4 has ceased after 31 March 2017.

² Implementers of these ETSI standards should check with the ETSI Web Server (<http://ipr.etsi.org>) whether Intellectual Property Rights have been declared to ETSI.

- [9] ITU-R M.1457-12: Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)
- [10] ITU-R M.2012-2: Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-Advanced (IMT-Advanced)
- [11] ITU-T K.116: EMC requirements and test methods for radio telecommunication terminal equipment
- [12] IEC CISPR 32: Electromagnetic compatibility of multimedia equipment – Emission requirements

Note: Validity of the IEC CISPR 22, EMC standard for information technology equipment, has lapsed since 31 March 2017, in sync with IEC's timeline for replacing it with the CISPR 32 standard.
- [13] IEC CISPR 24: Information technology equipment – Immunity characteristics – Limits and methods of measurement
- [14] IEC 60950-1: Information technology equipment – Safety – Part 1: General requirements
- [15] IEC 62368-1: Audio/video, information and communication technology equipment – Part 1: Safety requirements
- [16] IEC 60215: Safety requirements for radio transmitting equipment

3 Abbreviations³

3GPP	3rd Generation Partnership Project
AC	Alternating Current
BS	Base Station
CBS	Cellular Base Station or Repeater
CDMA	Code Division Multiple Access
CISPR	International Special Committee on Radio Interference of the IEC
DC	Direct Current
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMS	Electromagnetic Sustainability
EN	European Standard
ETSI	European Telecommunications Standards Institute
E-UTRA	Evolved Universal Terrestrial Radio Access (also known as LTE)
FDD	Frequency Division Duplex
GSM	Global System for Mobile communications
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	International Electrotechnical Commission
IMT	International Mobile Telecommunications
ITU	International Telecommunication Union
ITU-R	ITU Radiocommunication Sector
ITU-T	ITU Telecommunication Standardization Sector
LTE	Long Term Evolution (also known as E-UTRA)
MSR	Multi Standard Radio
RAT	Radio Access Technology
RF	Radio Frequency
RIT	Radio Interface Technology
SDO	Standards Development Organisation
SELV	Safety Extra-Low Voltage
TDD	Time Division Duplex
UTRA	Universal Terrestrial Radio Access (UTRA FDD also known as WCDMA)
WCDMA	Wideband Code Division Multiple Access

³ 3GPP™ and LTE™ are Trade Marks registered by ETSI for the benefit of its Members and 3GPP Organizational Partners.

4 General Requirements

4.1 Power Supply

The CBS may be AC powered or DC powered. For an AC powered equipment, the Specification shall be complied with when operating from an AC mains supply of voltage, $230V \pm 10\%$ and frequency, $50 \text{ Hz} \pm 2\%$. Where external power supply is used (e.g. AC/DC power converter), it shall not affect the capability of the equipment to meet the requirements of this Specification.

4.2 Radiation Safety Requirements

4.2.1 Use of the CBS shall comply with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).

4.2.2 Compliance with the specified radiation safety standards does not by itself confer immunity from legal obligations and requirements imposed by national health or safety authorities. IMDA may invalidate the equipment registration if so requested by the relevant authority for reasons of safety or hazards that would likely be caused to users.

4.3 Electromagnetic Compatibility (EMC) and Equipment Safety Requirements

4.3.1 EMC assessment

For EMC assessment, the CBS shall be classified as equipment for fixed use. This equipment classification is used to determine the applicability of the EMC (emission and immunity) testing requirements based on §5.5 and §7 of ETSI EN 301 489-1 [7]; or §7.5 and §9 of ITU-T K.116 [11]. The ETSI EN 301 489-1 [7] standard shall be used in conjunction with the ETSI EN 301 489-50 [8] standard for CBS that may be capable of supporting two or more radio transmitters of different technologies, operating simultaneously; or processing two or more carriers in a RF bandwidth, with at least one carrier of a different radio access technology.

4.3.1.1 EMI or emission measurements

The following emissions measurements shall be performed on the CBS, where applicable:

- (a) Radiated emissions from associated ancillary equipment not incorporated in the CBS shall be measured to Class B requirements defined in §4 and Tables A.4 and A.5 of CISPR 32 [12]; or §8.2 of EN 301 489-1 [7];
- (b) Conducted emission at the DC power port of the CBS shall be measured to Class B requirements defined in §4 and Table A10 of CISPR 32 [12]; or §8.3 [7] of EN 301 489-1 [7]; and
- (c) Conducted emission at the AC mains port shall be measured for CBS with dedicated AC/DC power converter to Class B requirements defined in §4 and Table A.10 of CISPR 32 [12]; or §8.4 [7]. Equipment with DC power port which is powered by a dedicated AC/DC power converter is defined as AC mains powered equipment (§3.1.1 [9]).
- (d) Conducted emission at the wired network port⁴ of the CBS shall be measured to Class B requirements defined in Table A.12 of CISPR 32 [12]; or §8.7 of EN 301 489-1 [7].

4.3.1.2 EMS or immunity testing

The following immunity tests may be performed on the CBS to requirements defined in CISPR 24

⁴ Wired network port is used for voice, data and signaling transfers intended for connection to a communication network, e.g. CATV, PSTN, ISDN, ADSL and LAN (§3.1.32 [12]).

[13], §11 of ITU-T K.116 [11] or §9 of EN 301 489-1 [7], where applicable:

- (a) RF electromagnetic field (80 MHz to 1 GHz and 1.4 GHz to 6 GHz) at the enclosure of equipment;
- (b) Electrostatic discharge at the enclosure of equipment;
- (c) Fast transients (common mode) at DC power and AC main power ports that have cables longer than 3 m;
- (d) RF common mode 0.15 MHz to 80 MHz at DC power and AC mains power ports that have cables longer than 3 m;
- (e) Voltage dips and interruptions at AC mains power port of equipment with dedicated AC/DC power converter; and
- (f) Surges, common and differential mode at AC mains power port of equipment with dedicated AC/DC power converter.

4.3.2 Equipment safety testing

4.3.2.1 Equipment safety testing or assessment shall be performed to requirements defined in IEC 60950-1 [14] or IEC 62368-1 [15], based on the following assumptions:

- (a) CBS is powered by a dedicated external power supply or AC/DC power converter; and
- (b) CBS operates with SELV in environments where overvoltage from telecommunication networks may be possible. SELV refers to voltages not exceeding 42.4 V peak or 60 V DC.

4.3.2.2 For CBS safety assessment performed with the hazard-based approach, the processes defined in IEC 62368-1 [15] shall be used:

- (a) Identify energy sources in the CBS;
- (b) Classify energy sources (effect on the body or combustible material, e.g. possibility of injury or ignition);
- (c) Identify safeguards for protection against energy sources; and
- (d) Consider the effectiveness of safeguards with respect to compliance criteria or requirements defined in the standard [15].

4.3.2.3 CBS shall also be assessed for meeting the safety requirements defined in the IEC 60215 [16] for radio transmitting equipment, operating under the responsibility of skilled persons.

5 Technical Requirements

5.1 Operating Frequencies

5.1.1 The CBS shall operate within the frequency bands given in Table 1. Conformance with technical requirements outlined in this Specification is based on the assumption that the operating frequency bands are shared between systems of the IMT family.

Table 1: CBS Operating Frequency Bands

UTRA FDD Band	E-UTRAN Band	Direction of Transmission	Frequency Range
I	1	Transmit	2110 MHz – 2170 MHz
		Receive	1920 MHz – 1980 MHz
III	3	Transmit	1805 MHz – 1880 MHz
		Receive	1710 MHz – 1785 MHz
VII	7	Transmit	2620 MHz – 2690 MHz
		Receive	2500 MHz – 2570 MHz
VIII	8	Transmit	925 MHz – 960 MHz
		Receive	880 MHz – 915 MHz
-	38 ^{Note 1}	Transmit and Receive	2570 MHz – 2615 MHz ^{Note 2}
-	40	Transmit and Receive	2300 MHz – 2340 MHz ^{Note 3}

Note 1: Frequency band may be used for UTRA TDD in multi-RAT capable (MSR) BS (Table C-2 [1] with reference to Part 18 [6]).

Note 2: CBS operating in band 38 shall only transmit and receive within the indicated frequency range.

Note 3: CBS operating in band 40 shall only transmit and receive within the indicated frequency range.

5.1.2 The precise operating frequency range of a CBS shall follow that of the Network Operator from whom the service is provided.

5.2 Radio Interface Requirements

Manufacturers or suppliers shall demonstrate that the CBS (base stations or repeaters) have been tested and certified for operating in the frequency bands stated in clause 5.1.1, and conformity to any or a combination of standards given in Table 2 for Base Stations or Table 3 for Repeaters. The CBS shall comply with the applicable requirements specified in these standards, in addition to the requirements identified in the ETSI EN 301 908-1 [1] for compliance by the base stations and repeaters.

Table 2: IMT RITs in EN 301 908-1 [1] and the Standards Parts for Base Stations

IMT-2000 / IMT-Advanced terrestrial RIT	RAT name in SDO	Reference SDO	EN 301 908 Part
(a) IMT-2000 CDMA Direct Spread	UTRA FDD	ETSI (3GPP)	Part 3 [2]
(b) LTE-Advanced	E-UTRA	ETSI (3GPP)	Part 14 [4]
(c) IMT-2000 CDMA Direct Spread and LTE-Advanced	E-UTRA and UTRA	ETSI (3GPP)	Part 18 [6] covers MSR capable CBS.

Table 3: IMT RITs in EN 301 908-1 [1] and the Standards Parts for Repeaters

IMT-2000 / IMT-Advanced terrestrial RIT	RAT name in SDO	Reference SDO	EN 301 908 Part
(a) IMT-2000 CDMA Direct Spread	UTRA FDD	ETSI (3GPP)	Part 11 [3]
(b) LTE-Advanced	E-UTRA FDD	ETSI (3GPP)	Part 15 [5]

Annex A

CBS Conformance Testing / Verification Checklist

This Checklist is intended for facilitating Supplier's Declaration of Conformity to the requirements defined in the IMDA Technical Specification for Cellular Base Stations and Repeater Equipment ("IMDA TS CBS").

Please note:

"**CR**" indicates that the general or technical requirement set out in a particular section or sub-section ("§") of the IMDA TS CBS is a **Compliance Requirement**.

"**M**" means that it shall be **Mandatory** for the CBS to comply with the requirement set out in the IMDA TS CBS § cited in this Checklist (Table given below).

"**C**" means that compliance with the technical requirement set out in the IMDA TS CBS § cited in this Checklist is **Conditional**. In this case, the need to comply is contingent on the type of CBS (base station or repeater), RIT/RAT and application indicated in the remarks column.

"**V**" means that compliance with the requirement is **Voluntary**.

"**NA**" means that the requirement is **Not Applicable**.

IMDA TS CBS §	Parameter	Reference [n] given in § 2 of IMDA TS CBS	CR	Yes /No/ NA	Remarks
1	IMT-2000 / IMT-Advanced /LTE-Advanced / LTE-Advanced Pro RITs	ITU-R M.1457-12 [9] and M.2012-2 [10]	M		Refer to §5.2 of IMDA TS CBS
4.1	Power supply	§3.1.1 [12]	M		CBS powered by a dedicated AC/DC power converter is defined as AC mains powered equipment.
4.2	Radiation safety requirements	ICNIRP guidelines	M		
4.3	EMC and safety requirements	Heading	-	-	
4.3.1	EMC assessment	§5.5 and §7 [7]; or §9 [11]	M		[7] shall be used in conjunction with [8] for CBS capable of supporting two or more RATs; or processing two or more carriers in a RF bandwidth, with at least one carrier of a different RAT
4.3.1.1 (a)	Radiated emission	Tables A.4 and A.5 [12]; or §8.2 [7]	C		Applicable to ancillary equipment not incorporated in the CBS
4.3.1.1 (b)	Conducted emission: DC power port	Table A.10 [12]; or §8.3 [7]	C		
4.3.1.1 (c)	Conducted emission: AC mains power port	Table A.10 [12]; or §8.4 [7]	C		Applicable to CBS with dedicated AC/DC power converter
4.3.1.2 (a)	RF electromagnetic field (80 MHz to 1 GHz and 1.4 GHz to 6 GHz)	§4.2.3.2 [13]; or §9.2 [7]	V		
4.3.1.2 (b)	Electrostatic discharge	§4.2.1 [13]; or §9.3 [7]	V		
4.3.1.2 (c)	Fast transients common mode	§4.2.2 [13]; or §9.4 [7]	V		Applicable to CBS with dedicated AC/DC power converter; DC power port with cable longer than 3 m
4.3.1.2 (d)	RF common mode 0.15 MHz to 80 MHz	§4.2.3.3 [13]; or §9.5 [7]	V		
4.3.1.2 (e)	Voltage dips and interruptions	§4.2.6 [13]; or §9.7 [7]	V		Applicable to CBS with dedicated AC/DC power converter; wired network ports
4.3.1.2 (f)	Surges, common and differential mode	§4.2.6 [13]; or §9.8 [7]	V		
4.3.2	Equipment safety testing	IEC 60950-1 [14]; or IEC 62368-1 [15]	M		
		IEC 60215 [16]	M		

Annex A

CBS Conformance Testing / Verification Checklist (Cont'd)

IMDA TS CBS §	Parameter	Reference [n] given in § 2 of IMDA TS CBS	CR	Yes /No/ NA	Remarks
5.1	Operating frequencies		M		
5.2	Radio interface requirements	Table C-1 [1], [9] and [10], where applicable	M		State the RITs and the 3GPP Releases supported by the CBS, e.g. 3GPP Release 8, 9, 10 and beyond.
	Radiated emissions	§4.2.2 [1]	M	-	Applicable to base stations and repeaters
5.2 - Table 2 (a)	Spectrum emissions mask	§4.2.2 [2]	C		Base stations that support the UTRA FDD technology, shall be tested to comply with these essential requirements as defined in [2].
	Adjacent channel leakage power ratio (ACLR)	§4.2.3 [2] See Note 1	C		
	Transmitter spurious emissions	§4.2.4 [2]	C		
	Base station maximum output power	§4.2.5 [2]	C		
	Transmitter intermodulation	§4.2.6 [2]	C		
	Receiver spurious emissions	§4.2.7 [2]	C		
	Blocking characteristics	§4.2.8 [2]	C		
	Receiver intermodulation characteristics	§4.2.9 [2]	C		
	Receiver adjacent channel selectivity (ACS)	§4.2.10 [2]	C		
	Home BS output power for adjacent channel protection	§4.2.11 [2]	C		
Reference sensitivity level	§4.2.12 [2] See Note 2	C			
<p>Note 1: For MSR capable BS (defined in [6]), conformance with the UTRA ACLR requirement is demonstrated through the requirement in §4.2.3 [2].</p> <p>Note 2: For MSR capable BS (defined in [6]), conformance with the reference sensitivity level requirement is demonstrated through the requirement in §4.2.12 [2].</p>					
5.2 - Table 2 (b)	Operating band unwanted emissions	§4.2.2 [4]	C		Base stations that support the E-UTRA technology, shall be tested to comply with these essential requirements as defined in [4].
	Adjacent channel leakage power ratio (ACLR)	§4.2.3 [4] See Note 3	C		
	Transmitter spurious emissions	§4.2.4 [4]	C		
	Base station maximum output power	§4.2.5 [4]	C		
	Transmitter intermodulation	§4.2.6 [4]	C		
	Receiver spurious emissions	§4.2.7 [4]	C		
	Blocking characteristics	§4.2.8 [4]	C		
	Receiver intermodulation characteristics	§4.2.9 [4]	C		
	Adjacent channel selectivity (ACS) and narrowband blocking	§4.2.10 [4]	C		
	Home BS output power for adjacent UTRA channel protection	§4.2.11 [4]	C		
Home BS output power for adjacent E-UTRA channel protection	§4.2.12 [4]	C			
Home BS output power for co-channel E-UTRA protection	§4.2.13 [4]	C			
Reference sensitivity level	§4.2.14 [4] See Note 4	C			
<p>Note 3: For MSR capable BS (defined in [6]), conformance with the E-UTRA ACLR requirement is demonstrated through the requirement in §4.2.3 [4].</p> <p>Note 4: For MSR capable BS (defined in [6]), conformance with the reference sensitivity level requirement is demonstrated through the requirement in §4.2.14 [4].</p>					

Annex A

CBS Conformance Testing / Verification Checklist (Cont'd)

IMDA TS CBS §	Parameter	Reference [n] given in § 2 of IMDA TS CBS	CR	Yes /No/ NA	Remarks
5.2 - Table 2 (c)	Operating band unwanted emissions	§4.2.2 [6]	C		MSR capable Base stations that support the E-UTRA and UTRA technologies, shall be tested to comply with these essential requirements as defined in [6].
	Adjacent channel leakage power ratio (ACLR)	§4.2.3 [6]	C		
	Transmitter spurious emissions	§4.2.4 [6]	C		
	Base station maximum output power	§4.2.5 [6]	C		
	Transmitter intermodulation	§4.2.6 [6]	C		
	Receiver spurious emissions	§4.2.7 [6]	C		
	In-band blocking	§4.2.8 [6]	C		
	Out-of-band blocking	§4.2.9 [6]	C		
	Receiver intermodulation characteristics	§4.2.10 [6]	C		
	Narrowband blocking	§4.2.11 [6]	C		
Reference sensitivity level	§4.2.12 [6]	C			
5.2 - Table 3 (a)	Operating band unwanted emissions	§4.2.2 [3]	C		Repeaters that support the UTRA FDD technology, shall be tested to comply with these essential requirements as defined in [3].
	Spurious emissions	§4.2.3 [3]	C		
	Maximum output power	§4.2.4 [3]	C		
	Input intermodulation	§4.2.5 [3]	C		
	Out-of-band gain	§4.2.6 [3]	C		
	Adjacent channel rejection ratio	§4.2.7 [3]	C		
	Output intermodulation	§4.2.8 [3]	C		
5.2 - Table 3 (b)	Operating band unwanted emissions	§4.2.2 [5]	C		Repeaters that support the E-UTRA FDD technology, shall be tested to comply with these essential requirements as defined in [5].
	Spurious emissions	§4.2.3 [5]	C		
	Maximum output power	§4.2.4 [5]	C		
	Input intermodulation	§4.2.5 [5]	C		
	Out-of-band gain	§4.2.6 [5]	C		
	Adjacent channel rejection ratio	§4.2.7 [5]	C		
	Output intermodulation	§4.2.8 [5]	C		

Annex B

Corrigendum / Addendum

Revised TS		Items Changed	Effective Date
Page	Reference		
Changes to IMDA TS CBS Issue 1, Oct 16			
2 and 7	§1 and §5.2 Table 2	The IMDA TS CBS Issue 1 has been replaced by the IMDA TS CBS Issue 1 Rev 1. Changes are intended to provide clarity of requirements for conformity assessment by equipment suppliers, in line with development that has taken place in the IMT systems of the network operators. Main changes include: (a) Support for LTE-Advanced TDD RIT (E-UTRAN RAT)	1 Jul 17
7	§5.1.1 Table 1	(b) Use of E-UTRAN band 38 (2570 MHz – 2615 MHz) and band 40 (2300 MHz – 2340 MHz)	
9	Annex A	(c) Revision of Checklist for clarity in supporting LTE-Advanced TDD RIT (E-UTRAN RAT)	

Revised TS		Items Changed	Date of Issue
Page	Reference		
Changes to IDA TS CBS Issue 1, Jun 11			
2 5 7 8	§1 §4.3 §5.2 Annex A	The IDA TS CBS Issue 1 has been replaced by the IMDA TS CBS Issue 1. Changes are largely editorial to provide clarity of requirements for conformity assessment by equipment suppliers, in line with standards development that has taken place in the SDOs and the IMT systems adopted by network operators. Main changes include: (a) Cessation of support for the GSM RITs by 1 April 2017; (b) Updating of EMC and safety requirements for CBS; (c) Updating of essential requirements for the support of IMT-Advanced / LTE-Advanced RITs; and (d) Addition of a Checklist for facilitating suppliers' declaration of conformity to requirements defined in the Specification.	1 Oct 16

Revised TS		Items Changed	Effective Date
Page	Reference		
Changes to IDA TS GSM-BS Issue 1 Rev 2 and 3G-BS Issue 1 Rev 1, May 11			
3 4	§1.1 §2.2.1	Title of Specification has been renamed as "Technical Specification for Cellular Base Station and Repeater System" (IDA TS CBS Issue 1). The Technical Specification has superseded the following two IDA Technical Specifications: (a) IDA TS GSM-BS Issue 1 Rev 2 (b) IDA TS 3G-BS Issue 1 Rev 1 Changes are mainly editorial in nature, in which the essential technical requirements for compliance formerly defined under the two Specifications (TS GSM-BS and 3G-BS) are now incorporated as one. It also includes the requirements for the Radio Access Technology, E-UTRA.	Jun 11