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ETSI EN 301 489-34 V1.4.1 (2013-05)

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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Foreword

This Harmonized European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Directive 98/34/EC [i.3] as amended by Directive 98/48/EC [i.8].

The present document together with EN 301 489-1 [1], is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility ("the EMC Directive") (2004/108/EC [i.1] as amended) and Directive 1999/5/EC [i.4] of the European Parliament of th Council 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive").

The present document is part 34 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

National transposition dates	
Date of adoption of this EN:	21 May 2013
Date of latest announcement of this EN (doa):	31 August 2013
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	28 February 2014
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Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive [i.4]. The modular structure is shown in EG 201 399 [i.2].

Interoperability for the product within the scope of the present document is covered by EN 62684 [16] and Safety is covered by EN 60950-1 [i.6]. An EPS not intended to support EN 62684 [16] may meet the EMC requirements of other standards.

The EPS supplied for test (EUT) should be identified by the supplier as intended to support M/455 [i.5] regarding Harmonisation of a Charging Capability for Mobile Phones.

1 Scope

The present document contains the Specific ElectroMagnetic Compatibility (EMC) requirements for the common external power supply (EPS) for use with data-enabled mobile telephones as described in EN 62684 [16] and M/455 [i.5].

Product dependent arrangements necessary to perform the EMC tests on dedicated types of radio communications equipment, and the assessment of test results, are detailed in the appropriate product related parts of EN 301 489 [i.7].

In case of differences (for instance concerning special conditions, definitions and abbreviations) between the present document and EN 301 489-1 [1], the provisions of the present document take precedence.

The environment classification and the emission and immunity requirements used in the present document are as stated in EN 301 489-1 [1], except for any special conditions included in the present document.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 301 489-1 (V1.9.2) (09/2011): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".

From [2] to [7] void.

[8] CENELEC EN 61000-4-6: 2009: "Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields".

From [9] to [15] void.

[16] CENELEC EN 62684: 2010: "Interoperability specifications of common external power supply (EPS) for use with data-enabled mobile telephones".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC Text with EEA relevance.

[i.2] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of Harmonized Standards for application under the R&TTE Directive".

[i.3] Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

[i.4] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[i.5] M/455 EN Annex II Part A of Standardisation mandate to CEN, CENELEC and ETSI on a common Charging Capability for Mobile Telephones 12th, January 2010.

[i.6] CENELEC EN 60950-1:2006: "Information technology equipment - Safety - Part 1: General requirements".

[i.7] ETSI EN 301 489 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services".

[i.8] Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

adaptor: device with a USB Micro-B receptacle/plug connecting to a specific non USB Micro-B connector

NOTE: An Adaptor can also be a cable.

enclosure port: physical boundary of the apparatus through which electromagnetic fields may radiate or impinge

External Power Supply (EPS): Common external Power Supply (EPS)with an AC input which meets the requirements of the specifications given in EN 62684 [16]

port: particular interface, of the specified equipment (apparatus), with the electromagnetic environment

EXAMPLE: Any connection point on an equipment intended for connection of cables to or from that equipment is considered as a port (see figure 1).

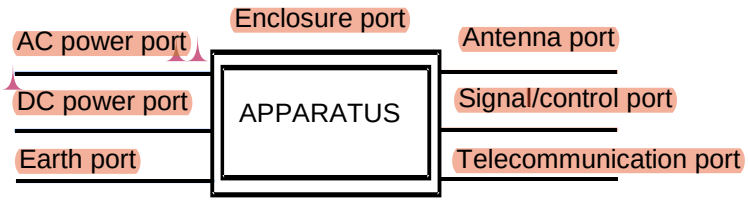

Figure 1: Examples of ports

NOTE: An interface, which uses optical fibre, is not a port for the purposes of testing because it does not interact with the electromagnetic environment within the frequency range, which is applicable for the present document. An optical fibre interface may still be used in the assessment of performance.

representative generic test load: EPS load which fully exercise the EPS and is supplied by the EPS manufacturer

NOTE: E.g. as in clause 4.3.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Alternating Current
AMN	Artificial Mains Network
DC	Direct Current
DCS	Digital Cellular System
EMC	ElectroMagnetic Compatibility
EPS	External Power Supply
ESD	Electro Static Discharge
EUT	Equipment Under Test
PCS	Personal Communications Service
RF	Radio Frequency
rms	root mean square
UE	User Equipment (Mobile station)
UMTS	Universal Mobile Telecommunication System

4 Test conditions

4.1 General

The present document relates to the testing of the EPS, and seeks to ensure that an EPS which is compliant to the provisions of the present document will, when used with a compatible UE which is compliant to the applicable provisions of the EN 301 489 [i.7], comply with the requirements of EN 301 489-1 [1].

The present document describes testing the EPS with a Representative generic test load, which is intended to emulate a UE for the purpose of testing the EPS.

Because the choice of UE may have some impact on the EMC performance of the EPS certain criteria and/or limits have been tightened beyond those applied in the case of testing intended to determine the compliance of a specific EPS - UE combination. Such specific combinations may be tested as described in other parts of the EN 301 489 [i.7], but such testing does not demonstrate compliance to the requirements of an EPS.

The provisions of EN 301 489-1 [1], clause 4.2 shall apply with the following modifications:

- The EPS shall be connected with a Representative generic test load exercising the DC output port.
- Adequate measures shall be taken to avoid the effect of immunity RF test signals on the measuring equipment.
- Measurements shall be taken with the cable supplied with the EPS at the USB Micro-B port. The type and length of cable used shall be recorded in the test report.

4.2 Arrangements for test signals

Adequate measures shall be taken to avoid the effect of immunity test signals on both the measuring equipment and the signal sources for the wanted signals located outside the test environment.

4.3 RF exclusion band of radio communications equipment

Not applicable.

4.4 Narrow band responses of receivers or receivers which are part of transceivers

Not applicable.

4.5 Normal test modulation

Not applicable.

4.6 Representative generic test load

An EPS Representative generic test load which is representative of a UE shall have the following characteristics:

- A USB Micro-B socket connection.
- An input capacitance of 1µF in parallel with the EPS output.
- An input impedance with switchable range of:
  - 10 k Ω (for 0 % rated current).
  - Selection of resistances to obtain the currents and output voltages of the test procedures.

NOTE: Current range 500 mA to 1 500 mA, see EN 62684 [16].

  - A resistance to obtain Maximum rated current.
- A shielded casing/enclosure as given in EN 62684 [16].

5 Performance assessment

EN 301 489-1 [1], clause 5 shall apply with the following modification stated in clause 6.

6 Performance criteria

For the EPS, the performance criteria are based on a UE intended to be used with the EPS. For some specific test cases a different compliance level and/or performance criteria has been defined in order to ensure the compliance at the UE and EPS.

The performance criteria are used to make a decision on whether an EPS passes or fails immunity tests.

For the purpose of the present document two categories of performance criteria apply:

- performance criteria for continuous phenomena applied to EPS;
- performance criteria for transient phenomena applied to EPS.

6.1 Performance criteria for EPS

For an EPS the performance criteria for continuous phenomena shall meet the requirements whilst tested with the representative generic test load as given below.

The EPS shall meet its specification points on voltage ranges as given below, during and after continuous phenomena and after transient phenomena:

- Output Voltage 5 V ±0,25 V from no load to maximum output current measured at the USB Micro-B plug, while connected to the generic test load defined in clause 4.6.

While the parameters above should be monitored at the USB Micro-B plug, the reference for the output voltage is the USB Micro-B plug for an EPS with captive cable and the Standard-A plug for an EPS with detachable cable.

The above criteria shall also be met after exposure to transient phenomena.

The following criteria shall be met after exposure to all immunity phenomena tests:

- Output Voltage Ripple (Under load conditions from idle to full): 80 mVp-p measured at 20 MHz bandwidth using the test method as defined in EN 62684 [16].

7 Applicability overview tables

The applicability overview (tables 1 and 2) give an overview about all EMC tests specified in the present document for EPS equipment.

All tests are port-related EMC tests.

7.1 EMC emission

Table 1: EMC emission measurements for EPS equipment specified in the present document, overview

Phenomenon	Application	Equipment test requirement EPS	Reference clause in the present document
radiated emission	enclosure of EPS equipment	applicable	8.2
conducted emission	DC power output port	applicable	8.3
conducted emission	AC mains input port	applicable	8.4
harmonic current emissions	AC mains input port	applicable	8.5
voltage fluctuations and flicker	AC mains input port	applicable	8.6
conducted emission	telecommunication port	not applicable	8.7

7.2 Immunity

Table 2: Immunity tests for EPS equipment specified in the present document, overview

Phenomenon	Application	Equipment test requirement EPS	Reference clause in the present document
RF electromagnetic field (80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz)	enclosure of EPS equipment	applicable	9.2
electrostatic discharge	enclosure and DC power output port	applicable	9.3
fast transients common mode	DC and AC power ports	applicable	9.4
RF common mode 0,15 MHz to 80 MHz	DC and AC power ports	applicable	9.5
transients and surges	DC power input ports	not applicable	9.6
voltage dips and interruptions	AC mains power input ports	applicable	9.7
surges, line to line and line to ground	AC mains power input ports	applicable	9.8

8 Methods of measurement and limits for EMC emissions

8.1 Test configuration

This clause defines the requirements for test configurations:

- measurements shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications;
- the equipment shall be configured in a manner which is representative for normal/typical operation, where practical;
- ports, which in normal operation are connected, shall be connected to an EPS equipment and to the Representative generic test load, Input/output ports shall be correctly terminated;
- the configuration and mode of operation during the measurements shall be precisely noted in the test report.

8.2 Enclosure of EPS equipment

The EPS shall be configured in order to ascertain the worst case radiated emissions and this shall be recorded. Tests shall then be carried out at the worst case, 10 % and 100 % of the rated output current and when disconnected from the Representative generic test load (no load condition).

This test assesses the ability of EPS equipment to limit their internal noise from being radiated from the enclosure.

8.2.1 Test method

The test method shall be in accordance with EN 301 489-1 [1].

8.2.2 Limits

The EPS equipment under no load condition shall meet the class B limits given in EN 301 489-1 [1].

The EPS equipment under worst case, 10 % and 100 % of the rated output current conditions the measured emissions shall meet the class B limits, given in EN 301 489-1 [1].

8.3 DC power output ports

The EPS shall be configured in order to ascertain the worst level of conducted emissions and this shall be recorded. Tests shall then be carried out at the worst case and at 10 % and 100 % of the rated output current and when disconnected from the Representative generic test load (no load condition).

This test is applicable to EPS equipment that may have DC cables longer than 3 m as declared by the manufacturer.

8.3.1 Definition

This test assesses the ability of the EUT to limit its internal noise from being present on the DC power output ports.

8.3.2 Test method

The test method shall be in accordance with EN 301 489-1 [1]. The Artificial Mains Networks (AMN) as specified in EN 301 489-1 [1] shall be used and be connected to the Representative generic test load.

The measurement frequency range extends from 150 kHz to 30 MHz.

8.3.3 Limits

The equipment shall meet the limits below including the average limit and the quasi-peak limit when using, respectively, an average detector receiver and a quasi-peak detector receiver and measured in accordance with the method described in clause 8.3.2. If the average limit is met when using a quasi-peak detector, the equipment shall be deemed to meet both limits and measurement with the average detector is unnecessary.

The equipment shall meet the class B limits according to EN 301 489-1 [1].

8.4 AC mains power input ports

This test shall be performed on a representative configuration of the EPS.

8.4.1 Definition

This test assesses the ability of the EUT to limit its internal noise from being present on the AC mains power input port.

8.4.2 Test method

The EPS shall be configured as follows:

The EPS shall be tested across the full range of output currents in order to ascertain the worst mode for internal noise and this shall be recorded. Tests shall then be carried out at the worst case, 10 % and 100 % of the rated output current and when disconnected from the Representative generic test load (no load condition).

The test method shall be in accordance with EN 301 489-1 [1] and the Artificial Mains Networks (AMNs) shall be connected to the AC mains power source.

The measurement frequency range extends from 150 kHz to 30 MHz.

8.4.3 Limits

The equipment shall meet the limits below including the average limit and the quasi-peak limit when using, respectively, an average detector receiver and a quasi-peak detector receiver and measured in accordance with the method described in clause 8.4.2. If the average limit is met when using a quasi-peak detector, the equipment shall be deemed to meet both limits and measurement with the average detector is unnecessary.

The equipment shall meet the class B limits given in EN 301 489-1 [1].

8.5 Harmonic current emissions (AC mains input port)

The appropriate requirements of EN 301 489-1 [1] for harmonic current emission apply for equipment covered by the scope of the present document with an input current up to and including 16 A per phase.

8.6 Voltage fluctuations and flicker (AC mains input port)

The appropriate requirements of EN 301 489-1 [1] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document with an input current up to and including 16 A per phase.

8.7 Telecommunication ports

Not applicable.

9 Test methods and levels for immunity tests

9.1 Test configuration

The EPS shall have the following configurations:

- The integral USB cable or the Standard detachable cable assembly, supplied for use with the EPS shall be configured for worst case susceptibility during the immunity tests and this shall be recorded in the test report.
- An EPS shall be tested with the defined Representative generic test load.
- The EPS shall be tested at rated nominal voltage at its full rated load and this shall be recorded.

This clause defines the requirements for test configurations:

- the tests shall be carried out at a point within the specified normal operating environmental range and at the rated supply voltage for the equipment;
- ports, which in normal operation are connected, shall be connected to the Representative generic test load;
- the configuration and mode of operation during the tests shall be precisely noted in the test report.

9.2 Radio frequency electromagnetic field (80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz)

This test shall be performed on a representative configuration the EPS equipment.

An EPS shall be tested with the defined Representative generic test load.

9.2.1 Definition

This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic field disturbance.

9.2.2 Test method

The test method shall be in accordance with EN 301 489-1 [1].

The following requirements and evaluation of test results shall apply:

- the test level shall be 3 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz;
- the test shall be performed over the frequency range 80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz;
- the stepped frequency increments shall be 1 % frequency increment of the momentary used frequency;
- in addition, at the uplink frequencies in table 3 the test level shall be 10 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz.

NOTE: For global bands see informative annex B.

Table 3: Centre uplink test frequencies

Band	Test frequency (MHz)
LTE 13	751,0
GSM 900/UMTS VIII/LTE 8	897,5
LTE 20	847,0
GSM 1800/UMTSIII/LTE 3	1 747,5
UMTS I/LTE I	1 950,0
LTE 7	2 535,0

9.3 Electrostatic discharge

An EPS shall be tested with defined Representative generic test load and no load conditions.

This test shall be performed both on a representative configuration of the EPS with the Representative generic test load and to the shield of the USB Micro-B cable whilst disconnected from the Representative generic test load. In both cases the AC shall be connected.

9.3.1 Definition

This test assesses the ability of the EUT to operate as intended in the event of an electrostatic discharge.

9.3.2 Test method

The test method shall be in accordance with EN 301 489-1 [1].

For EPS equipment the following requirements and evaluation of test results shall apply.

The test severity level for contact discharge shall be 4 kV and for air discharge 8 kV. All other details, including intermediate test levels, are contained within EN 301 489-1 [1].

Electrostatic discharges shall be applied to all exposed surfaces of the EUT except where the user documentation specifically indicates a requirement for appropriate protective measures (see EN 301 489-1 [1]).

9.4 Fast transients, common mode

This test shall be performed on a representative configuration of the EPS with the Representative generic test load.

This test shall be performed on the AC mains power port of the EPS equipment.

This test shall be performed on the DC output port of the EPS equipment if intended to be used with cables longer than 3 m as declared by the manufacturer.

9.4.1 Definition

This test assesses the ability of the EUT to operate as intended in the event of fast transients present on one of the input/output ports.

9.4.2 Test method

The test method shall be in accordance with EN 301 489-1 [1].

The following requirements and evaluation of test results shall apply:

- the test level for DC power output ports shall be 0,5 kV open circuit voltage as given EN 301 489-1 [1] transients shall be applied using a capacitive clamp;
- the test level for AC mains power input ports shall be 1 kV open circuit voltage as given EN 301 489-1 [1] with the EPS AC port connected directly to the test generator.

9.5 Radio frequency, common mode

This test shall be performed on the AC mains power port of the EPS equipment.

This test shall be performed on the DC output port of the EPS equipment if intended to be used with cables longer than 3 m as declared by the manufacturer.

9.5.1 Definition

This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic disturbance on the input/output ports.

9.5.2 Test method

The test method shall be in accordance with EN 301 489-1 [1].

The following requirements and evaluation of test results shall apply:

- the test level shall be severity level 2 as given in EN 61000-4-6 [8] corresponding to 3 V rms unmodulated. The test signal shall then be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz;
- the test shall be performed over the frequency range 150 kHz to 80 MHz;
- a stepped frequency increments shall be 1 % frequency increment of the momentary frequency in the frequency range 150 kHz to 80 MHz;
- the injection method to be used shall be selected according to the basic standard EN 301 489-1 [1];
- the frequencies of the immunity test signal selected and used during the test shall be recorded in the test report.

9.6 Transients and surges in the vehicular environment

Not applicable.

9.7 Voltage dips and interruptions

This test shall be performed on a representative configuration of the EPS with the Representative generic test load.

This test shall be performed on the AC mains power port of the EPS equipment.

9.7.1 Definition

These tests assess the ability of the EUT to operate as intended in the event of voltage dips and interruptions present on the AC mains power input ports.

9.7.2 Test method

The test method of EN 301 489-1 [1], clause 9.7.2 shall apply.

9.8 Surges

This test shall be performed on a representative configuration of the EPS with the Representative generic test load.

This test shall be performed on the AC mains power port of the EPS equipment.

9.8.1 Definition

These tests assess the ability of the EUT to operate as intended in the event of surges present on the AC mains power input port.

9.8.2 Test method

For EPS equipment the pass/failure criteria given in clause 6 (see also EN 62684 [16]) shall apply.

9.8.2.1 Void

9.8.2.2 Void

9.8.2.3 Test method for mains ports

The test level for ac mains power input ports shall be 2 kV line to ground, and 1 kV line to line, with the output impedance of the surge generator as given in EN 301 489-1 [1].

The test generator shall provide the 1,2/50 µs pulse as defined in EN 301 489-1 [1].

Annex A (informative): Rationales considered in drafting EN 301 489-34

Levels for immunity. The mobile phone industry's experience on EMC RF immunity testing indicates that different combinations of phones and accessories might not be in compliance to 3 V/m when used in different combinations. Based on this experience, the compliance level EPS on RF immunity testing with a Representative generic test load, needs to be higher in order to minimize the risk for non-tested combinations of mobile phones and an EPS for UEs. Also different combinations of phones and accessories might not be in compliance to 3 Vrms when used in different combinations. Based on this experience, the compliance level for a standalone EPS on RF immunity testing, needs to be higher in order to minimize the risk for non-compliant combinations of UEs and an EPS for mobile phones.

ESD is to ensure a safe and stable performance of the EPS. Different manufacturers have different protection levels for ESD in their design and product and this may cause potential problems for an EPS that is in compliance with a different product. An ESD testing with a Representative generic test load will provide a reasonable performance level for an EPS since the discharges are likely to affect only the EPS design and not the UE.

Annex B (informative): Global cellular uplink test frequencies

Any optional additional frequencies selected and used during the test specified in clause 9.2.2 should be recorded in the test report.

NOTE: Where the bands overlap they have been grouped appropriately.

Current EU Designation	Frequency Band	Test Frequency (MHz)	Uplink Frequency		
No	GSM-450	467,6	460,6	=	467,6
No	GSM-480		489,0	=	496,0
No	Band 12	Covered by Band 13 in table 3	729,0	=	746,0
No	Band 17		734,0	=	746,0
No (see note)	Band 13		746,0	=	756,0
No	Band 14		758,0	=	768,0
No	GSM-750		777,2	=	792,2
Yes	Band 20		791,0	=	821,0
No	Band 18	Covered by LTE Band 20 and GSM 900 in table 3	860,0	=	875,0
No	Band 5		869,0	=	894,0
No	GSM-850		869,2	=	894,2
No	Band 6		875,0	=	885,0
No	Band 19		875,0	=	890,0
Yes	R-GSM-900	Covered by GSM 900 in table 3	921,0	=	960,0
Yes	E-GSM-900		925,0	=	960,0
Yes	Band 8		925,0	=	960,0
Yes	P-GSM-900		935,0	=	960,0
No	Band 11	1 493,4	1 475,9	=	1 495,9
No	Band 21		1 495,9	=	1 510,9
No	Band 24	1 542,0	1 525,0	=	1 559,0

Current EU Designation	Frequency Band	Test Frequency	Uplink Frequency		
Yes	Band 3	Covered by: GSM 1800/UMTS III/ LTE 3 in table 3	1 805,0	–	1 880,0
Yes	DCS-1 800		1 805,2	–	1 879,8
No	Band 9		1 844,9	–	1 879,9
No	Band 35		1 850,0	–	1 910,0
No	Band 39		1 880,0	–	1 920,0
No	Band 33		1 900,0	–	1 920,0
No	Band 37		1 910,0	–	1 930,0
No	Band 2		1 930,0	–	1 990,0
No	Band 25		1 930,0	–	1 995,0
No	Band 36		1 930,0	–	1 990,0
No	PCS-1 900		1 930,2	–	1 989,8
No	Band 34	2 017,5	2 010,0	–	2 025,0
Yes	Band 1	2 155,0	2 110,0	–	2 170,0
No	Band 4		2 110,0	–	2 155,0
No	Band 10		2 110,0	–	2 170,0
No	Band 23		2 180,0	–	2 200,0
No	Band 40	2 495,0	2 300,0	–	2 400,0
No	Band 41		2 496,0	-	2 690,0
Yes	Band 38		2 570,0	–	2 620,0
Yes	Band 7		2 620,0	–	2 690,0
NOTE: Cellular bands expected to be in operation during 201 x.					

History

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