CEPT ECC
Electronic Communications Committee

# CEPT Report 93

Report from CEPT to the European Commission in response to the Mandate

"to study feasibility of and develop least restrictive harmonised technical conditions for the use of EU-harmonised frequency bands for terrestrial wireless systems providing electronic communications services by satellite systems providing direct-to-device-IMT connectivity"

Report A: operational feasibility, coexistence and compatibility scenarios for the use of the EU-harmonised frequency bands for terrestrial wireless systems capable of providing ECS by satellite systems capable of providing D2D-IMT connectivity.

**Report approved on 30 October 2026 by the ECC**

# 0 EXECUTIVE SUMMARY

This Report is a response to Task 1 of the EC Mandate which calls for studies and assesses operational feasibility, coexistence and compatibility scenarios for the use of the following EU-harmonised frequency bands for terrestrial wireless systems capable of providing ECS (WBB ECS):

- 703-733 MHz/758-788 MHz (‘700 MHz’);
- 791–821 MHz/832-862 MHz (‘800 MHz');
- 880-915 MHz/925-960 MHz (‘900 MHz’);
- 1427-1517 MHz (‘1.5 GHz’);
- 1710 1785 MHz/1805-1880 MHz (‘1 800 MHz’);
- 1920-1980 MHz/2110-2170 MHz (‘paired terrestrial 2 GHz’);
- 2500-2690 MHz (‘2.6 GHz’);
- 3400-3 800 MHz (‘3.6 GHz’);
- 24.25 27.5 GHz (‘26 GHz’);
- and 40.5-43.5 GHz (‘42 GHz’)

by satellite systems capable of providing D2D-IMT connectivity to “standalone” WBB ECS user equipment / terminals (i.e. terminals capable of connecting to both the terrestrial WBB ECS and the satellite without requiring additional components).

Based on the assessment, the following bands will not be considered for further detailed studies of Task 2 of the EC Mandate:

- 26 GHz band;
- 42 GHz band.

The band 2.6 GHz TDD will not be considered for D2D-IMT authorisation but its protection from adjacent D2D-IMT operations in 2.6 GHz FDD bands will be considered for further detailed studies of Task 2.

CEPT cannot yet assess fully the feasibility of D2D-IMT systems in the remaining frequency bands as the studies are still ongoing. Specific challenges have been raised regarding D2D-IMT operation in TDD bands, particularly the 3.6 GHz band. These challenges (e.g. synchronisation capabilities of D2D-IMT systems with terrestrial WBB ECS networks, taking into account challenges such as propagation delay) and the feasibility of this band will be further discussed. CEPT expects to define, for each band where CEPT establishes that D2D-IMT is feasible, the following regulatory limits:

a. Regulatory (Technical and/or operational) limits on D2D-IMT satellite emissions to protect WBB ECS services in co-channel and adjacent blocks;
b. Regulatory (Technical and/or operational) limits on D2D-IMT satellite emissions to protect other services in the bands adjacent to WBB ECS;
c. Regulatory (Technical and/or operational) limits on D2D-IMT satellite emissions to protect other services co-allocated in WBB ECS bands (if any).

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## LIST OF ABBREVIATIONS

| Abbreviation | Explanation |
|---|---|
| **CEPT** | European Conference of Postal and Telecommunications Administrations |
| **D2D-IMT** | Direct-to-Device-IMT |
| **EC** | European Commission |
| **ECC** | Electronic Communications Committee |
| **ECS** | Electronic Communications Services |
| **EEZ** | Exclusive Economic Zones |
| ***e.i.r.p.*** | Effective isotropic radiated power |
| **ETSI** | European Telecommunications Standards Institute |
| **EU** | European Union |
| **FDD** | Frequency Division Duplex |
| **FSS** | Fixed-Satellite Service |
| **IMT** | International Mobile Telecommunications |
| **ITU-R** | International Telecommunication Union, Radiocommunication Sector |
| **OoB** | Out-of-band |
| **PFD** | Power Flux Density |
| **SINR** | Signal to Interference plus Noise Ratio |
| **SNR** | Signal to Noise Ratio |
| **TDD** | Time Division Duplex |
| **UE** | User Equipment |
| **WBB ECS** | Wireless broadband electronic communications services |

# 1 INTRODUCTION

The objective of the EC Mandate is "*to study feasibility and develop harmonised technical conditions for the use of EU-harmonised frequency bands for the terrestrial provision of electronic communications services (ECS) also by satellite systems providing Direct-to-Device-IMT (D2D-IMT) connectivity. Such use should protect the continued use of those bands by terrestrial wireless systems providing ECS, as well as ensure appropriate protection or coexistence with other incumbent services in those bands and in adjacent bands, including across Member States' borders and at the EU's external border. Satellite systems providing D2D-IMT connectivity are intended to complement the coverage of terrestrial wireless systems providing ECS.*"

This Report addresses Task 1 of the EC mandate:

"Study and assess operational feasibility, coexistence and compatibility scenarios for the use of the following EU-harmonised frequency bands for terrestrial wireless systems capable of providing ECS:

- 703-733 MHz/758-788 MHz ('700 MHz'), 791–821 MHz/832-862 MHz ('800 MHz'), 880-915 MHz/925-960 MHz ('900 MHz'), 1427-1517 MHz ('1.5 GHz'), 1710- 1785 MHz/1805-1880 MHz ('1 800 MHz'), 1920-1980 MHz/2110-2170 MHz ('paired terrestrial 2 GHz'), 2500-2690 MHz ('2.6 GHz'), 3400-3 800 MHz ('3.6 GHz'), 24.25- 27.5 GHz ('26 GHz'), and 40.5-43.5 GHz ('42 GHz').

by satellite systems capable of providing D2D-IMT connectivity, which ensure protection of (a) terrestrial wireless systems capable of providing ECS using these bands, and (b) other relevant[1] existing (terrestrial and non-terrestrial) uses in these bands and in adjacent bands and their potential evolution, including across Member States' borders and at the EU's external border. Such satellite systems should further not claim protection by the systems and uses under (a) and (b).

Identify those frequency bands among the above, for which the deployment of satellite D2D-IMT connectivity is feasible."

[1] These relevant users are to be determined by CEPT.

## 2 ASSESSMENT OF FREQUENCY BANDS

CEPT identified varying level of interest and technology maturity in the frequency bands listed in Task 1 of the EC Mandate, as indicated in Table 1.

**Table 1**

| Band | | Stakeholders' Interest for D2D-IMT | Link Budget Proposed (see Annex 1 and Annex 2) | Existing Technology or Future Evolution |
|---|---|---|---|---|
| 700 MHz | | Yes | Yes | Existing Technology |
| 800 MHz | | Yes | Yes | Existing Technology |
| 900 MHz | | Yes | Yes | Existing Technology |
| 1.5 GHz | 1427-1452 MHz | Yes | Yes | Existing Technology/ Future Evolution |
| | 1452-1492 MHz | Yes | Yes | Existing Technology /Future Evolution |
| | 1492-1517 MHz | Yes | Yes | Existing Technology /Future Evolution |
| 1800 MHz | | Yes | Yes | Existing Technology |
| 2 GHz | | Yes | Yes | Existing Technology |
| 2.6 GHz FDD | | Yes | Yes | Existing Technology |
| 2.6 GHz TDD | | No | No | |
| 3.6 GHz | | Yes | Yes | Future Evolution<br>See Note 2 |
| 26 GHz | | See Note 1 | See Note 1 | Future Evolution |
| 42 GHz | | No | No | |

Note 1: A stakeholder (Univity) indicated interest in 26 GHz band and provided link budgets for the band, on the basis of non-"standalone" WBB ECS user equipment / terminals.

Note 2: For the case of TDD bands, synchronisation capabilities of D2D-IMT systems with terrestrial WBB ECS networks, taking into account challenges such as propagation delay, are being investigated. Standardisation activities are expected to be required as well.

Based on the assessment, the following bands will not be considered for further detailed studies of Task 2:

- 26 GHz band;
- 42 GHz band.

The band 2.6 GHz TDD will not be considered for D2D-IMT authorisation but its protection from adjacent D2D-IMT operations in 2.6 GHz FDD bands will be considered for further detailed studies of Task 2.

This assessment does not take into account coexistence and compatibility with other systems.

Some examples of link budgets for D2D-IMT systems are provided in Annex 1 and Annex 2.

## 3 COEXISTENCE AND COMPATIBILITY SCENARIOS

CEPT is currently studying and determining:

a. Regulatory (Technical and/or operational) limits on D2D-IMT satellite emissions to protect WBB ECS services in co-channel and adjacent blocks;

b. Regulatory (Technical and/or operational) limits on D2D-IMT satellite emissions to protect other services in the bands adjacent to WBB ECS;

c. Regulatory (Technical and/or operational) limits on D2D-IMT satellite emissions to protect other services co-allocated in WBB ECS bands (if any).

While these studies are not finalised, CEPT cannot yet assess fully the feasibility of D2D-IMT systems and the studies are still ongoing. The preliminary assessment, including coexistence and compatibility scenarios identified for studies can be found in the draft ECC Report planned for public consultation in November 2026 [1].

ECO Report 03 [2] provides information on the licensing of "Mobile Bands" in CEPT.

Existing WBB ECS uses include the extended coverage area beyond the territorial waters from land based WBB ECS operations and WBB ECS operating at fixed installations within the Exclusive Economic Zones (EEZ).

CEPT administrations consider it necessary to protect their base stations and user equipment in those areas from D2D-IMT downlinks. The need to harmonise such protection will be studied.

# 4 CONCLUSIONS

Based on the assessment, the following bands will not be considered for further detailed studies of Task 2:

- 26 GHz band;
- 42 GHz band.

The band 2.6 GHz TDD will not be considered for D2D-IMT authorisation but its protection from adjacent D2D-IMT operations in 2.6 GHz FDD bands will be considered for further detailed studies of Task 2.

CEPT cannot yet assess fully the feasibility of D2D-IMT systems in the remaining frequency bands as the studies are still ongoing. Specific challenges have been raised regarding D2D-IMT operation in TDD bands, particularly the 3.6 GHz band. These challenges (e.g. synchronisation capabilities of D2D-IMT systems with terrestrial WBB ECS networks, taking into account challenges such as propagation delay) and the feasibility of this band will be further discussed. CEPT expects to define, for each band where CEPT establishes that D2D-IMT is feasible, the following regulatory limits:

a. Regulatory (Technical and/or operational) limits on D2D-IMT satellite emissions to protect WBB ECS services in co-channel and adjacent blocks;
b. Regulatory (Technical and/or operational) limits on D2D-IMT satellite emissions to protect other services in the bands adjacent to WBB ECS;
c. Regulatory (Technical and/or operational) limits on D2D-IMT satellite emissions to protect other services co-allocated in WBB ECS bands (if any).

# ANNEX 1: LINK BUDGET FOR FDD BANDS 700 TO 2600 MHZ (EXAMPLE 1)

## A1.1 SPACE-TO-EARTH

### A1.1.1 Assumptions and target service level

The D2D-IMT system is designed around the following center scenario:

- UE Antenna Gain = -3 dBi;
- UE Noise Factor = 9 dB;
- Terrestrial Loss (to compensate for local propagation losses) = 10 dB;
- Target Signal to Noise Ratio (SNR) = 10 dB.

### A1.1.2 Link budget

Table 2 presents a representative space-to-Earth link budget for a 5 MHz carrier at 700 MHz, based on equation (1),

$$\mathrm{RTrP} = \mathrm{Nth} + \mathrm{UE_{NF}} + \mathrm{TSNR} + \mathrm{UE_{AG}} + \mathrm{TL} + \mathrm{PL} + \mathrm{G_{SAT}} \quad (1)$$

where:

- $\mathrm{RT_rP}$ is the Required Transmit Power (dBm);
- Nth is the thermal noise for the BW considered (dBm);
- $\mathrm{UE_{NF}}$ is the UE Noise Factor (dB);
- TSNR is the Target SNR (dB);
- $\mathrm{UE_{AG}}$ is the antenna gain of the WBB ECS User Equipment (dBi);
- TL is the terrestrial Loss, i.e. a system margin to guarantee QoS (dB);
- PL is the pathloss from the satellite to the ground (dB);
- $\mathrm{G_{SAT}}$ is the antenna gain of the satellite (dBi).

**Table 2: Representative space-to-Earth link budget 700 MHz**

| | | Power (dBm) |
|---|---|---|
| Noise level 4.5 MHz | -107.5 dBm | -107.5 |
| UE Noise factor | 9 dB | -98.5 |
| Target SNR | 10 dB | -88.5 |
| UE Antenna Gain | -3 dBi | -85.5 |
| Terrestrial Loss | 10 dB | -75.5 |
| Pathloss | 147.1 dB | 71.6 |
| Satellite Antenna Directivity | 36.9 dBi | 34.7 |

The link budget is achieved at 700 MHz by transmitting a total power of 34.7 dBm to achieve a minimum received power of -88.5 dBm, requiring a maximum power flux density (PFD) on the ground of -92.8 dB (W/(m$^2$.MHz)) for losses (terrestrial and UE antenna) up to 13 dB.

Table 3 presents a representative space-to-Earth link budget for a 5 MHz carrier at 2600 MHz, based on the same equation as the 700 MHz link budget.

**Table 3: Representative space-to-Earth link budget 2600 MHz**

| | | Power (dBm) |
|---|---|---|
| Noise level 4.5 MHz | -107.5 dBm | -107.5 |
| UE Noise factor | 9 dB | -98.5 |
| Target SNR | 10 dB | -88.5 |
| UE Antenna Gain | -3 dBi | -85.5 |
| Terrestrial Loss | 10 dB | -75.5 |
| Pathloss | 157.8 dB | 82.3 |
| Satellite Antenna Directivity | 48 dBi | 34.3 |

The link budget is achieved at 2600 MHz by transmitting a total power of 34.3 dBm to achieve a minimum received power of -88.5 dBm, requiring a maximum PFD on the ground of -82.1 dB (W/(m$^2$.MHz)) for losses (terrestrial and UE antenna) up to 13 dB.

## A1.2 EARTH-TO-SPACE

### A1.2.1 Assumptions

The D2D-IMT system is designed around the following center scenario:

- Terrestrial Loss (to compensate for local propagation losses) = 10 dB;
- Noise + Interference at satellite receiver = -110 dBm/MHz.

### A1.2.2 Link budget

Table 4 presents a representative Earth-to-space link budget for a 1 MHz bandwidth at 700 MHz, based on equation (2):

$$\mathrm{SINR} = \mathrm{TxRP_{UE}} + \mathrm{TL} + \mathrm{PL} + \mathrm{G_{SAT}} - \mathrm{NI_{SAT}} \quad (2)$$

where:

- $\mathrm{TxRP_{UE}}$ is the Radiated Transmit power of the WBB ECS User Equipment (dBm);
- TL is the terrestrial Loss, i.e. a system margin to guarantee QoS (dB);
- PL is the pathloss from the ground to the satellite (dB);
- $\mathrm{G_{SAT}}$ is the antenna gain of the satellite (dBi);
- $\mathrm{NI_{SAT}}$ is the noise + interference level at the satellite (dBm).

**Table 4: Representative Earth-to-space link budget 700 MHz**

| Parameter | Value |
|---|---|
| UE Tx Power | 23 dBm |
| UE BW | 1 MHz |
| Terrestrial loss | 10 dBm |
| Pathloss | 146.5 dB |

| Parameter | Value |
|---|---|
| Satellite antenna directivity | 36.9 dBi |
| Signal level at satellite receiver | -96.6 dBm |
| Noise + Interference at satellite receiver | -110 dBm |
| Minimum SINR | 13.4 dB |

A UE transmitting at 23 dBm over a 1 MHz BW would achieve a minimum SINR of 13.4 dB at the satellite.

Table 5 presents a representative Earth-to-space link budget for a 1 MHz bandwidth at 2600 MHz.

**Table 5: Representative Earth-to-space link budget 2600 MHz**

| Parameter | Value |
|---|---|
| UE Tx Power | 23 dBm |
| UE BW | 1 MHz |
| Terrestrial loss | 10 dBm |
| Pathloss | 157.4 dB |
| Satellite antenna directivity | 48 dBi |
| Signal level at satellite receiver | -94.4 dBm |
| Noise + Interference at satellite receiver | -110 dBm |
| Minimum SINR | 13.6 dB |

A UE transmitting at 23 dBm over a 1 MHz BW would achieve a minimum SINR of 13.6 dB at the satellite.

# ANNEX 2: LINK BUDGET FOR FDD BANDS FROM 700 TO 2600 MHZ AND 3600 MHZ TDD BAND (EXAMPLE 2)

## A2.1 SPACE-TO-EARTH

### A2.1.1 Assumptions and target service level

The following link budget calculation are considered at nadir and at minimum elevation of 26 degrees and for a 5 MHz carrier (4.5 MHz usable bandwidth). Table 6 summarises the satellite characteristics.

**Table 6: Parameters for link budget**

| Parameter | Unit | Value | | | |
|---|---|---|---|---|---|
| Frequency | MHz | 700 | | | |
| Satellite altitude | km | 500 | | | |
| Maximum antenna gain | dBi | 24.3 | 32.52 | 32.52 | 36 |
| Usable bandwidth | MHz | 4.5 MHz | | | |
| Minimum elevation | ° | 26 | | | |

In addition, the D2D-IMT system is designed around the following assumption:

- UE Antenna Gain = -3 dBi;
- UE Noise Factor = 9 dB;
- Body loss = 4 dB;
- Target SNR @EL 90° (nadir) = 10 dB;
- Target SNR @EL 26° (minimum elevation) = 8 dB.

The target SNR are taken as examples for the sake of the link budget calculations.

### A2.1.2 Link budgets

Table 7 and Table 8 present a representative space-to-Earth link budget for a 5 MHz carrier in the different frequency bands considered at elevation 90° and 26°, respectively. The equation (3) was used:

$$\mathrm{RTrP} = \mathrm{Nth} + \mathrm{UE_{NF}} + \mathrm{TSNR} - \mathrm{G_{UE}} + \mathrm{BL} + \mathrm{FSPL} - \mathrm{G_{SAT}} \quad (3)$$

where:

- $\mathrm{RTrP}$ is the Required Transmit Power (dBm);
- Nth is the thermal noise for the BW considered (dBm);
- $\mathrm{UE_{NF}}$ is the UE Noise Factor (dB);
- TSNR is the Target SNR (dB);
- $\mathrm{G_{UE}}$ is the antenna gain of the WBB ECS User Equipment (dBi);
- BL is the terrestrial Loss, i.e. a system margin to guarantee QoS (dB);
- FSPL is the pathloss from the satellite to the ground (dB);
- $\mathrm{G_{SAT}}$ is the antenna gain of the satellite (dBi).

**Table 7: Representative space-to-eErth link budget @El 90°**

| | | | Power (dBm) @El 90° | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | | | 700 | 1500 | 1750 | 2150 | 2600 | 3600 |
| (1) | UE Noise level 4.5 MHz | 10log(kTB)+NF+30 | -98.4 | -98.4 | -98.4 | -98.4 | -98.4 | -98.4 |
| (2) | Required signal level after UE antenna | (1) + TSNR | -88.4 | -88.4 | -88.4 | -88.4 | -88.4 | -88.4 |
| (3) | Required signal level before UE antenna | (2) - $G_{UE}$ | -85.4 | -85.4 | -85.4 | -85.4 | -85.4 | -85.4 |
| (4) | Required signal level before terrestrial additional losses | (3) + BL | -81.4 | -81.4 | -81.4 | -81.4 | -81.4 | -81.4 |
| (5) | Required *e.i.r.p.* at the satellite | (4) + FSPL | 61.9 | 68.5 | 69.8 | 71.6 | 73.3 | 75.9 |
| (6) | Required satellite conducted power | (5) - $G_{SAT}$ | 37.6 | 36 | 37.3 | 39.1 | 40.8 | 39.9 |

**Table 8: Representative space-to-Earth link budget @El 26°**

| | | | Power (dBm) @El 26° | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | | | 700 | 1500 | 1750 | 2150 | 2600 | 3600 |
| (1) | UE Noise level 4.5 MHz | 10log(kTB)+NF+30 | -98.4 | -98.4 | -98.4 | -98.4 | -98.4 | -98.4 |
| (2) | Required signal level after UE antenna | (1) + TSNR | -90.4 | -90.4 | -90.4 | -90.4 | -90.4 | -90.4 |
| (3) | Required signal level before UE antenna | (2) - G_UE | -87.4 | -87.4 | -87.4 | -87.4 | -87.4 | -87.4 |
| (4) | Required signal level before terrestrial additional losses | (3) + BL | -83.4 | -83.4 | -83.4 | -83.4 | -83.4 | -83.4 |
| (5) | Required *e.i.r.p.* at the satellite | (4) + FSPL | 65.9 | 72.6 | 73.9 | 75.7 | 77.3 | 79.9 |
| (6) | Required satellite conducted power | (5) - $G_{SAT}$ | 41.6 | 40 | 41.4 | 43.2 | 44.8 | 43.9 |

## A2.2 EARTH-TO-SPACE

### A2.2.1 Assumptions

The D2D-IMT system is designed around the following center scenario:

- Body loss = 4 dB;
- Considering a bandwidth of 180 kHz (1 resource block emission from the UE);
- Satellite noise level = 10log(kTB) = -117.6 dBm/180 kHz (with T = 700K and B = 180 kHz).

### A2.2.2 Link budget

Table 9 and Table 10 present a representative Earth-to-space link budget assuming the emission of the UE over 1 resource block (180 kHz) in the different frequency bands considered at elevation 90° and 26°, respectively. The equation (4) was used:

$$\mathrm{SINR} = \mathrm{TxRP_{UE}} + \mathrm{BL} + \mathrm{PL} + \mathrm{G_{SAT}} - \mathrm{N_{SAT}} \quad (4)$$

where:

- $\mathrm{TxRP_{UE}}$ is the Radiated Transmit power of the WBB ECS User Equipment (dBm);
- BL is the terrestrial Loss (dB);
- PL is the pathloss from the ground to the satellite (dB);
- $\mathrm{G_{SAT}}$ is the antenna gain of the satellite (dBi);
- $\mathrm{N_{SAT}}$ Satellite noise level (dBm).

**Table 9: Representative Earth-to-space link budget @El 90°**

| | | | Power (dBm) @El 90° | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | | | 700 | 1500 | 1750 | 2150 | 2600 | 3600 |
| (1) | UE Tx *e.i.r.p.* | | 23 | 23 | 23 | 23 | 23 | 23 |
| (2) | Power after body loss | (1) - BL | 19 | 19 | 19 | 19 | 19 | 19 |
| (3) | Power at the satellite before the antenna | (2) - FSPL | -124.3 | -131.0 | -132.3 | -134.1 | -135.7 | -138.3 |
| (4) | Power after satellite antenna | (3) + $\mathrm{G_{SAT}}$ | -100.0 | -98.4 | -99.8 | -101.6 | -103.2 | -102.3 |
| (5) | SINR | (4) - $\mathrm{N_{SAT}}$ | 17.6 | 19.2 | 17.8 | 16.0 | 14.4 | 15.3 |

**Table 10: Representative Earth-to-space link budget @El 26°**

| | | | Power (dBm) @El 26° | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | | | 700 | 1500 | 1750 | 2150 | 2600 | 3500 |
| (1) | UE Tx *e.i.r.p.* | | 23 | 23 | 23 | 23 | 23 | 23 |
| (2) | Power after body loss | (1) - BL | 19 | 19 | 19 | 19 | 19 | 19 |
| (3) | Power at the satellite before the antenna | (2) - FSPL | -130.4 | -137.0 | -138.4 | -140.1 | -141.8 | -144.4 |
| (4) | Power after satellite antenna | (3) + $\mathrm{G_{SAT}}$ | -106.1 | -104.5 | -105.8 | -107.6 | -109.3 | -108.4 |
| (5) | SINR | (4) - $\mathrm{N_{SAT}}$ | 11.5 | 13.1 | 11.8 | 10.0 | 8.3 | 9.2 |

## ANNEX 3: EC MANDATE

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EUROPEAN COMMISSION
Communications Networks Content & Technology Directorate-General

Digital Decade and Connectivity
**Radio Spectrum Policy**

# MANDATE TO CEPT

**TO STUDY FEASIBILITY OF AND DEVELOP LEAST RESTRICTIVE HARMONISED TECHNICAL CONDITIONS FOR THE USE OF EU-HARMONISED FREQUENCY BANDS FOR TERRESTRIAL WIRELESS SYSTEMS PROVIDING ELECTRONIC COMMUNICATIONS SERVICES BY SATELLITE SYSTEMS PROVIDING DIRECT-TO-DEVICE-IMT[1] CONNECTIVITY**

## 1. PURPOSE

The objective of this Mandate is to study feasibility and develop harmonised technical conditions for the use of EU-harmonised frequency bands for the terrestrial provision of electronic communications services (ECS) also by satellite systems providing Direct-to- Device-IMT (D2D-IMT) connectivity[2]. Such use should protect the continued use of those bands by terrestrial wireless systems providing ECS, as well as ensure appropriate protection or coexistence with other incumbent services in those bands and in adjacent bands, including across Member States' borders and at the EU's external border. Satellite systems providing D2D-IMT connectivity are intended to complement the coverage of terrestrial wireless systems providing ECS.

## 2. BACKGROUND

Satellite connectivity has been rapidly evolving and gaining importance during the current decade based on technological innovation (in particular, the launch of constellations of small-size low-earth orbit (LEO) satellites), cost-efficient satellite production and launch, as well as the growing market demand for ubiquitous broadband and internet services, including in rural and remote areas. While satellite systems providing D2D connectivity have been using dedicated spectrum such as for the Mobile Satellite Service (MSS)[3], the use of radio spectrum harmonised for and authorised to terrestrial wireless systems providing ECS, also by satellite systems providing D2D-IMT connectivity, has become an emerging business model for both, satellite and mobile operators, with the goal to improve coverage for mobile users[4], mainly with

[1] IMT stands for 'International Mobile Telecommunications', including 5G and beyond.

[2] In line with the "RSPG opinion on the EU-level policy approach to satellite Direct-to-Device connectivity and related Single Market issues" (RSPG25-020), satellite D2D-IMT is defined as "services direct to device in bands mostly used for the provision of terrestrial IMT-based services that have been harmonised within the EU for electronic communications services (ECS)". This implies that satellite D2D-IMT connectivity is provided directly to off-the-shelf terminal stations (e.g. end-user devices such as smart phones) used with terrestrial wireless systems providing ECS in EU-harmonised bands for ECS, on the basis of IMT (e.g. 3GPP) standards.

[3] Spectrum allocations for MSS are available in the ITU Radio Regulations.

[4] In particular, providing complementary coverage, wherever terrestrial mobile networks are not available.

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off-the-shelf terminal stations (e.g. smart phones), and optimise network investment cost. The usage of off-the-shelf terminal stations, capable to communicate with both satellite systems providing D2D-IMT connectivity and terrestrial wireless systems providing ECS, has received substantial support in standardisation. Satellite D2D-IMT connectivity is subject to growth of innovative developments.

At present, satellite D2D-IMT deployments are largely driven by non-EU operators and take place outside the EU territory operating under the provisions of Article 4.4 of the ITU Radio Regulations (ITU RR), i.e. on a non-protection and non-interference basis.

Beyond spectrum harmonisation, the introduction of satellite D2D-IMT services in EU-harmonised bands, which are used for the terrestrial provision of ECS, should be subject to national measures ensuring that Member States retain the ability to supervise, maintain or interrupt such services within their national territory, especially in cases of crisis or safeguarding public security.

The World Radiocommunication Conference in 2027 (WRC-27) will consider under its agenda item 1.13[5] regulatory actions, including possible new MSS allocations, for satellite D2D connectivity to off-the-shelf IMT terminal stations. The aim is to complement the coverage of terrestrial IMT networks in certain frequency bands in the range from 694/698 MHz to 2.7 GHz. These include several EU-harmonised frequency bands for terrestrial wireless systems capable of providing (wireless broadband – WBB) ECS by virtue of the Commission implementing decisions (EU) 2016/687 [694-790 MHz / '700 MHz band'], 2010/267/EU [790-862 MHz / '800 MHz band'], (EU) 2022/173 [880-915/925-960 MHz / '900 MHz band', and 1710-1785/1805-1880 MHz / '1800 MHz band'], (EU) 2015/750 [1427-1517 MHz / '1.5 GHz band'], 2012/688/EU [1920-1980 MHz and 2110-2170 MHz / 'paired terrestrial 2 GHz band'], and 2008/477/EC [2.5-2.69 GHz /'2.6 GHz band']. The relevant ITU-R studies will determine the technical, operational and regulatory conditions for the implementation of satellite D2D-IMT connectivity at national borders ensuring the protection of terrestrial wireless systems providing ECS and incumbent services. Moreover, within the scope of this mandate, feasibility of satellite D2D-IMT connectivity should be explored also for other relevant EU-harmonised bands for terrestrial wireless systems providing ECS by virtue of Commission implementing decisions 2008/411/EC [3.4-3.8 GHz / '3.6 GHz band'], (EU) 2019/784 [24.25-27.5 GHz / '26 GHz band'], and (EU) 2024/1983 [40.5-43.5 GHz / '42 GHz band']. Studies for the implementation of D2D-IMT connectivity should address the protection of terrestrial wireless systems providing ECS and other incumbent services within the same band and in adjacent bands, and their potential evolution, including across Member States' borders and at the EU's external borders.

[5] WRC-27 Agenda Item 1.13 reads: "to consider studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage, in accordance with Resolution 253 (WRC-23)"

In this regard, under its Work Programme[6] for 2024 and beyond, the RSPG adopted in June 2025 an Opinion[7] on the EU-level policy approach to satellite D2D connectivity and related single market issues. In that Opinion, the RSPG recommends to the Commission among others:

- to issue a mandate to CEPT to develop harmonised technical conditions for D2D-IMT satellite operations in EU-harmonised bands for ECS which addresses, as appropriate, the protection of networks providing ECS and other radio services from D2D satellite operations; such a mandate should include a follow-up action further to WRC-27, in order to update the technical conditions, if appropriate;
- as a follow-up to the CEPT deliverable to the Commission mandate, to consider proposing an amendment to the relevant Commission implementing decisions, in order to enable the introduction of D2D-IMT under harmonised technical conditions.

The RSPG emphasises that perceived European benefits of satellite D2D-IMT connectivity include providing complementary coverage in rural, remote and maritime areas, as well as enhancing resilience when mobile networks providing ECS are temporarily unavailable (e.g. due to external damage by flooding or earthquakes, or in case of a technical failure).

The RSPG highlights several challenges with the introduction of satellite D2D-IMT services in EU-harmonised bands for terrestrial wireless systems providing ECS, such as interference issues (including across borders) and roaming.

EU policy priorities on the single market, innovation and competitiveness, as well as on technological sovereignty, call for a coordinated approach and an enhanced regulatory framework to promote the proliferation of satellite services across the Union, including harmonised spectrum use. Allowing the use of additional spectrum resources, according to market demand and on the basis of harmonised technical conditions, in EU-harmonised bands already used for terrestrial wireless systems providing ECS also to satellite systems providing D2D-IMT connectivity through extending the designation of those bands to include satellite (D2D-IMT) use, will contribute to achieving the Union's Digital Decade connectivity targets, promoting innovation and level-playing field as well as fostering the development of satellite players originating in the Union. This approach will also foster the convergence of terrestrial and non-terrestrial networks on the path towards 6G, enhance resilience and provide predictability to all relevant spectrum users (terrestrial and non-terrestrial) as regards coexistence, protection of investments and continued development of incumbent services.

In this context, harmonised standards to be developed by the European Telecommunications Standards Institute (ETSI) should be consistent with the harmonised technical conditions established for the future use of EU-harmonised bands by satellite systems providing D2D-IMT connectivity, and also include operational conditions for such satellite systems, in order to ensure their coexistence with incumbent terrestrial wireless systems operating in the same bands and in adjacent bands.

[6] Link: https://radio-spectrum-policy-group.ec.europa.eu/document/download/d4e46670-313b-4bac-8d8d- 760d92f4649b_en?filename=RSPG24-008final-RSPG_WP24_and_beyond_0.pdf

[7] Link: https://radio-spectrum-policy-group.ec.europa.eu/document/download/72e52901-fa1a-474a-9480- a222c5b36545_en?filename=RSPG25-020final-RSPG_Opinion_on_D2D_and_Single_Market_Issues.pdf

## 3. JUSTIFICATION

Pursuant to Article 4(2) of the Radio Spectrum Decision[8], the Commission shall issue mandates to the CEPT for the development of technical implementing measures with a view to ensuring harmonised conditions for the availability and efficient use of radio spectrum necessary for the functioning of the internal market. Such mandates shall set the tasks to be performed and their timetable.

Pursuant to Article 6(1) of the Radio Spectrum Policy Programme (RSPP)[9], Member States shall, in cooperation with the Commission, ensure the availability of sufficient spectrum for coverage and capacity purposes within the Union, in order to enable the Union to have the fastest broadband speeds in the world, thereby making it possible for wireless applications and European leadership in new services to contribute effectively to economic growth.

The Digital Decade Policy Programme 2030[10] (DDPP) sets out digital connectivity targets for 2030, including for the deployment of networks with gigabit speeds and highlights the importance of connectivity infrastructure. All end users at a fixed location should be covered by a gigabit network up to the network termination point and all populated areas should be covered by a next-generation wireless high-speed network with performance at least equivalent to that of 5G. In the context of technology neutrality, which is a guiding principle for digital connectivity infrastructure of the highest performance, resilience, security and sustainability, different types of communications technologies can contribute to the achievement of gigabit connectivity. These include the current and upcoming generations of fibre, satellite, electronic communications networks, WAS/RLAN or other systems to be developed in the future, whereby such technologies should be treated equally and without prior constraints regarding their deployment and performance characteristics.

Spectrum co-usage between both terrestrial and satellite systems should ensure efficient use of spectrum, prevent harmful interference to terrestrial wireless systems providing ECS, and adequately protect other relevant incumbent wireless services and applications. It will therefore be necessary to carry out the relevant technical studies and define appropriate compatibility and coexistence conditions. Those conditions should support the use of EU-harmonised bands also by satellite systems providing D2D-IMT connectivity and, at the same time, safeguard the unconstrained continuity of the current operation and the future evolution and development of all relevant radio services and applications currently using these bands and adjacent bands.

The CEPT should work in cooperation with the ETSI, taking into account the need for consistency between future harmonised standards and the harmonised technical conditions resulting from this Mandate.

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[8] Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision) (OJ L 108, 24.4.2002, p. 1).

[9] Decision No 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy programme (OJ L 81, 21.3.2012, p. 7).

[10] Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030(OJ L 323, 19.12.2022, p. 4)

## 4. TASK ORDER AND SCHEDULE

This Mandate addresses operational feasibility, coexistence and compatibility studies for the use of relevant EU-harmonised bands for terrestrial wireless systems providing ECS by satellite systems providing D2D-IMT connectivity, which ensure protection of existing uses, also for their evolution and development, in those bands and in the adjacent bands, including across Member States' borders and at the EU's external border. It further addresses the development of EU-harmonised technical conditions.

The CEPT is thereby mandated to carry out the following tasks:

**Task 1**

Study and assess operational feasibility, coexistence and compatibility scenarios for the use of the following EU-harmonised frequency bands for terrestrial wireless systems capable of providing ECS:

- 703-733 MHz/758-788 MHz ('700 MHz'), 791–821 MHz/832-862 MHz ('800 MHz'), 880-915 MHz/925-960 MHz ('900 MHz'), 1427-1517 MHz ('1.5 GHz'), 1710- 1785 MHz/1805-1880 MHz ('1 800 MHz'), 1920-1980 MHz/2110-2170 MHz ('paired terrestrial 2 GHz'), 2500-2690 MHz ('2.6 GHz'), 3400-3 800 MHz ('3.6 GHz'), 24.25- 27.5 GHz ('26 GHz'), and 40.5-43.5 GHz ('42 GHz'),

by satellite systems capable of providing D2D-IMT connectivity, which ensure protection of (a) terrestrial wireless systems capable of providing ECS using these bands, and (b) other relevant[11] existing (terrestrial and non-terrestrial) uses in these bands and in adjacent bands and their potential evolution, including across Member States' borders and at the EU's external border. Such satellite systems should further not claim protection by the systems and uses under (a) and (b).

Identify those frequency bands among the above, for which the deployment of satellite D2D-IMT connectivity is feasible.

**Task 2**

Pursuant to the outcome of Task 1,

a) Study technical and operational conditions for the EU-harmonised bands for which the deployment of satellite systems capable of providing D2D-IMT connectivity is deemed feasible, in order to protect terrestrial wireless systems capable of providing ECS and other relevant existing radio services and applications, without constraining those, within and adjacent to the identified frequency bands, including across Member States' borders and at the EU's external border.

b) Based on the outcome of sub-task 2a), develop the least restrictive harmonised technical and operational conditions, to be implemented in the EU's regulatory framework, for the wireless communications between satellite systems capable of providing D2D-IMT

[11] These relevant users are to be determined by CEPT.

connectivity and terminal stations used with terrestrial wireless systems capable of providing ECS.

These conditions must be consistent with the existing EU regulatory framework applicable to the frequency bands under consideration. They must ensure interference mitigation, protection of or appropriate co-existence with terrestrial wireless systems capable of providing ECS and other relevant existing radio services/applications in the same band and in adjacent bands as well as facilitate cross-border frequency coordination.

**Task 3**

The CEPT must take into account relevant conclusions at the international level within the scope of this Mandate, such as from technical studies performed within the ITU-R and the outcome of WRC-27, so as to review and, if necessary, to revise the results under Tasks 1 and 2 after WRC-27.

The CEPT is also requested to collaborate actively with all concerned stakeholders as well as ETSI, which develops relevant harmonised standards for the presumption of conformity under Directive 2014/53/EU[12]. Based on the harmonised technical and operational conditions pursuant to Task 2 (and possibly Task 3), the CEPT may further recommend to ETSI to consider the results of this study when developing relevant harmonised standards.

CEPT should provide deliverables according to the following schedule:

| **Delivery date** | **Deliverable** | **Subject** |
|---|---|---|
| July 2026 | Draft Report A[13] from the CEPT to the Commission. | Draft results under Task (1) of this Mandate. |
| November 2026 | Final Report A from the CEPT to the Commission taking into account the outcome of the public | Draft results under Task (1) of this Mandate |
| March 2027 | Draft Report B[15] from the CEPT to the Commission | Draft results under Task (2) of this Mandate. |
| July 2027 | Final Report B from CEPT to the Commission taking into account the outcome of the public consultation | Final results under task (2) of this Mandate |

[12] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC (OJ L 153, 22.5.2014, p. 62).

[13] Subject to a public consultation.

| Delivery date | Deliverable | Subject |
|---|---|---|
| July 2028 | Draft Report C[15] from the CEPT to the Commission | Draft results under Task (3) of this Mandate. |
| November 2028 | Final Report C from the CEPT to the Commission taking into account the outcome of the public consultation | Final results under Task (3) of this Mandate. |

In addition, CEPT is requested to report on the progress of its work pursuant to this Mandate to all meetings of the Radio Spectrum Committee taking place during the course of the Mandate.

The Commission, with the assistance of the Radio Spectrum Committee and pursuant to the Radio Spectrum Decision, may consider applying the results of this mandate in the EU, pursuant to Article 4 of the Radio Spectrum Decision.

Electronically signed on 27/10/2017 09:56 (UTC+01) in accordance with article 11 of Commission Decision (EU) 2021/2121

## ANNEX 4: LIST OF REFERENCES

[1] Draft ECC Report: “Feasibility, coexistence and compatibility scenarios for the use MFCN frequency bands by satellite systems providing direct-to-device-IMT connectivity”, latest draft from October 2026 available online: https://cept.org/documents/se-40/98040/se40-26-106a03_draft-ecc-report-on-d2d-imt

[2] ECO Report 03: “The Licensing of "Mobile Bands" in CEPT”, latest amended August 2026