SingleRAN
SRAN13.1

CloudAIR Feature Description

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1 Multi-mode Evolution

1.1 GL Spectrum Sharing

1.1.1 MRFD-130201 GSM and LTE Spectrum Concurrency (GSM)

Availability

This feature is available from SRAN13.0.

Summary

With the increasing popularity of data services and the ever-roaring penetration rate of smart terminals, network performance is facing unprecedented challenges. However, some operators are confronted with such challenges as insufficient spectrum resources and long-term persistence of massive number of GSM users. Consequently, they cannot evolve GSM networks into LTE networks, which provide better data service experience.

This feature enables GSM and LTE to be deployed on the same spectrum band, and determines the usage of this band based on the service volume. The co-deployment of GSM and LTE on one spectrum band fully improves spectral efficiency and addresses the issue that one spectrum band can be allocated to only one RAT in refarming technologies. The BSC and eNodeB implement joint allocation and scheduling of the shared spectrum band. When GSM does not occupy the shared spectrum band, LTE can use the shared spectrum band to meet its large bandwidth requirements. This feature applies to the frequency bands supported by both GSM and LTE, that is, 850 MHz, 900 MHz, 1800 MHz, and 1900 MHz frequency bands.

Benefits

This feature provides the following benefits:

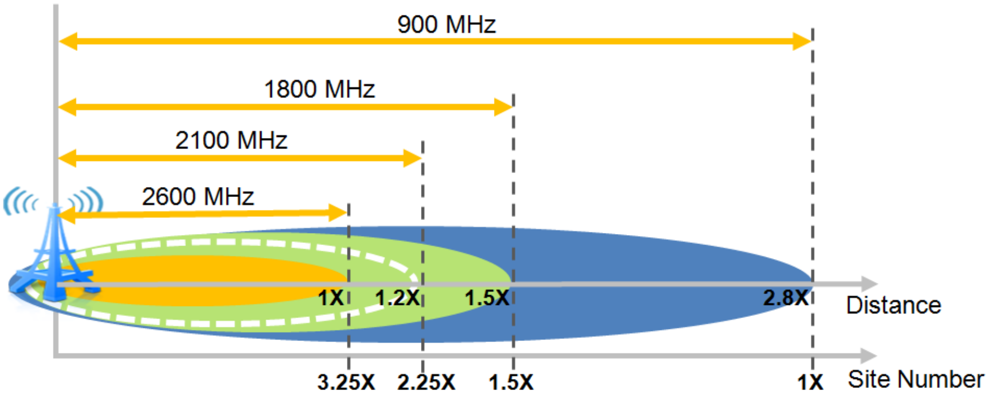
- Solves the long-tail challenge of legacy GSM terminals

  Although GSM spectral efficiency is low, for GSM to exit requires a significant amount of time, and may involve years for completion. This is because legacy GSM terminals generally have a long-tail issue and will not exit the network within a specific short period of time. Spectrum resources occupied by GSM cannot be released and reallocated to newer radio access technologies (RATs) that can provide higher spectral efficiency. This feature enables LTE deployment on the same spectrum band originally allocated to GSM while keeping legacy GSM networks.

- Solves the early phase issue of insufficient LTE coverage, facilitating user acceptance

  Low frequency bands 900 MHz and 850 MHz are characterized by low propagation loss and wide coverage, in comparison to high frequency bands 1800 MHz, 1900 MHz, and 2600 MHz. 900 MHz and 850 MHz are considered as gold frequency bands in mobile networks which only have a small bandwidth. Only 56% of operators have a bandwidth of 5–10 MHz on these frequency bands. Without this feature, these operators cannot deploy LTE on 900 MHz and 850 MHz frequency bands. They can only deploy LTE on high frequency bands with relatively abundant frequency resources.

  With this feature, operators can deploy LTE on 900 MHz and 850 MHz frequency bands, allowing LTE to quickly achieve full coverage on low frequency bands. LTE can scale up and down based on the user penetration rate.



- Addresses the pain point that one spectrum band can only be allocated to one RAT in refarming technologies

  This feature enables GSM and LTE concurrency on the same spectrum band. These two RATs use spectrum resources as required. When the GSM traffic is heavy, spectrum resources are allocated to GSM. When the GSM traffic is light, spectrum resources are allocated to LTE. This improves spectral efficiency.

- Supports CA of LTE carriers on 850, 900, 1800, and 1900 MHz frequency bands

  After LTE is deployed on the 850, 900, 1800, or 1900 MHz frequency band, the LTE carriers on different frequency bands can be aggregated to fully utilize the remaining resources of these frequency bands to improve user experience.

- Supports legacy GSM terminals
- Comprehensively ensures the best performance of GSM and LTE networks

  This feature optimally improves LTE network capacity without sacrificing GSM network KPIs.

Description

This feature is applicable to either band of a dual-band network, and to the primary or secondary frequency band of a co-BCCH cell. This feature causes interference between GSM and LTE, and can only be enabled on a single frequency band in an area to minimize the impact on network performance. A proprietary interface is introduced between the BSC and eNodeB for the exchange of information between GSM and LTE to support this feature. The BSC performs a real-time calculation to determine the timeslots on which LTE cells can multiplex the shared spectrum based on LTE configurations, GSM channel configurations, channel occupation, and MS measurement information. Based on the calculation results, GSM frequencies, transmit power, and co-coverage attributes of GSM frequencies, the eNodeB determines the low- and high-quality frequency resources, as well as the frequency resources that cannot be scheduled. The eNodeB then schedules the resources accordingly. If no communication link is configured between the BSC and eNodeB, GSM solely uses the shared spectrum resources.

Enhancement

None

Dependency

- Base station controller
  - Huawei BSC6900 or BSC6910 running SRAN13.0 or later versions must be used on the radio access network. The BSC6900/BSC6910 service processing boards (XPUa/XPUb/XPUc/EGPUa/EGPUb) support this feature. If the average CPU load of the service processing boards on the live network exceeds 50% before this feature is deployed, new service processing boards must be added.
  - When this feature is implemented on multiple BSCs, an Iur-g interface must be configured between these BSCs.
  - The GL interference coordination information is exchanged between the BSC and eNodeB over the Abis interface, which supports IP over E1/T1, IP over Ethernet, and TDM transmission modes. The Abis interface boards can be used for the information exchange.
- Base station

  Huawei base stations running SRAN13.0 or later versions must be used on the radio access network. The base station must be a GL co-MPT or a GL separate-MPT multimode base station. When GSM and LTE are deployed on different BBUs, these BBUs must be interconnected. Other hardware requirements are described in the table below.

Hardware	Requirement
Main control boards	• UMPT • UMDU/MDUC • GTMUb/GTMUc These boards do not support this feature in SingleOM scenarios.
RF modules (RRUs/RFUs/AAUs)	All RF modules that support GSM or LTE and the 850 MHz, 900 MHz, 1800 MHz, or 1900 MHz frequency band, excluding the GRFU V1, GRFU V2, GRFU V2a, MRFU V1, MRFU V2, MRFU V2a, RRU3008 V1, RRU3008 V2, RRU3908 V1, RRU3908 V2, AAU3902, and AAU5972

NOTE
The UMDU/MDUC is a built-in board of the BBU3910A/BBU3910C.

- UE

  None
- Core network

  None

- Other NEs

  Huawei U2000 and CME running SRAN13.0 or later versions must be used.
- Other features
  - Prerequisite features (requiring any of the following features)

    GBFD-510401 BTS GPS Synchronization

    GBFD-118620 Clock over IP support 1588V2

    GBFD-118201 Soft-Synchronized Network

    GBFD-201201 BTS Supporting 1588v2 ATR
  - Mutually exclusive features

    MRFD-090201 GSM and LTE FDD Dynamic Spectrum Sharing(GSM)

    MRFD-111401 GSM and LTE Zero Bufferzone

    GBFD-113901 Satellite Transmission over Abis Interface

    GBFD-510104 Multi-site Cell
- Others

  This feature must be simultaneously used with MRFD-130221 GSM and LTE Spectrum Concurrency (LTE FDD).

1.1.2 MRFD-130221 GSM and LTE Spectrum Concurrency (LTE FDD)

Availability

This feature is available from SRAN13.0.

Summary

With the increasing popularity of data services and the ever-roaring penetration rate of smart terminals, network performance is facing unprecedented challenges. However, some operators are confronted with such challenges as insufficient spectrum resources and long-term persistence of massive number of GSM users. Consequently, they cannot evolve GSM networks into LTE networks, which provide better data service experience.

This feature enables GSM and LTE to be deployed on the same spectrum band, and determines the usage of this band based on the service volume. The co-deployment of GSM and LTE on one spectrum band fully improves spectral efficiency and addresses the issue that one spectrum band can be allocated to only one RAT in refarming technologies. The BSC and eNodeB implement joint allocation and scheduling of the shared spectrum band. When GSM does not occupy the shared spectrum band, LTE can use the shared spectrum band to meet its large bandwidth requirements. This feature applies to the frequency bands supported by both GSM and LTE, that is, 850 MHz, 900 MHz, 1800 MHz, and 1900 MHz frequency bands.

Benefits

This feature provides the following benefits:

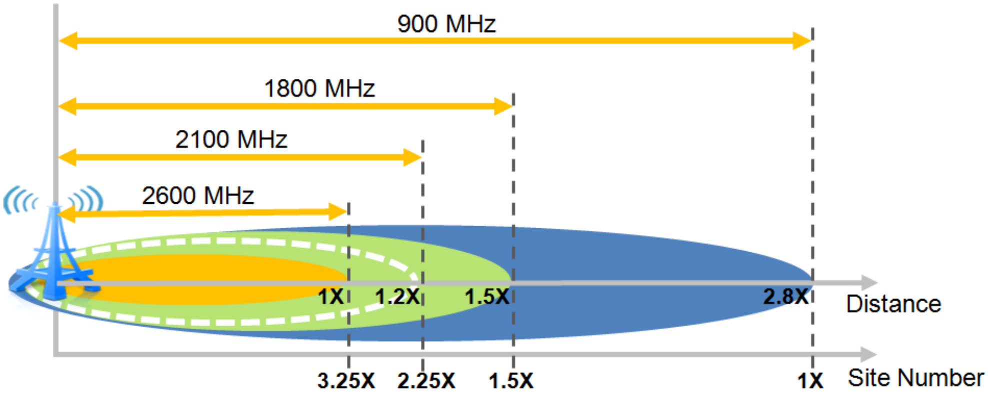
- Solves the long-tail challenge of legacy GSM terminals

  Although GSM spectral efficiency is low, for GSM to exit requires a significant amount of time, and may involve years for completion. This is because legacy GSM terminals generally have a long-tail issue and will not exit the network within a specific short period of time. Spectrum resources occupied by GSM cannot be released and reallocated to newer radio access technologies (RATs) that can provide higher spectral efficiency. This feature enables LTE deployment on the same spectrum band originally allocated to GSM while keeping legacy GSM networks.

- Solves the early phase issue of insufficient LTE coverage, facilitating user acceptance

  Low frequency bands 900 MHz and 850 MHz are characterized by low propagation loss and wide coverage, in comparison to high frequency bands 1800 MHz, 1900 MHz, and 2600 MHz. 900 MHz and 850 MHz are considered as gold frequency bands in mobile networks which only have a small bandwidth. Only 56% of operators have a bandwidth of 5–10 MHz on these frequency bands. Without this feature, these operators cannot deploy LTE on 900 MHz and 850 MHz frequency bands. They can only deploy LTE on high frequency bands with relatively abundant frequency resources.

  With this feature, operators can deploy LTE on 900 MHz and 850 MHz frequency bands, allowing LTE to quickly achieve full coverage on low frequency bands. LTE can scale up and down based on the user penetration rate.



- Addresses the pain point that one spectrum band can only be allocated to one RAT in refarming technologies

  This feature enables GSM and LTE concurrency on the same spectrum band. These two RATs use spectrum resources as required. When the GSM traffic is heavy, spectrum resources are allocated to GSM. When the GSM traffic is light, spectrum resources are allocated to LTE. This improves spectral efficiency.

- Supports CA of LTE carriers on 850, 900, 1800, and 1900 MHz frequency bands

  After LTE is deployed on the 850, 900, 1800, or 1900 MHz frequency band, the LTE carriers on different frequency bands can be aggregated to fully utilize the remaining resources of these frequency bands to improve user experience.

- Supports legacy GSM terminals
- Comprehensively ensures the best performance of GSM and LTE networks

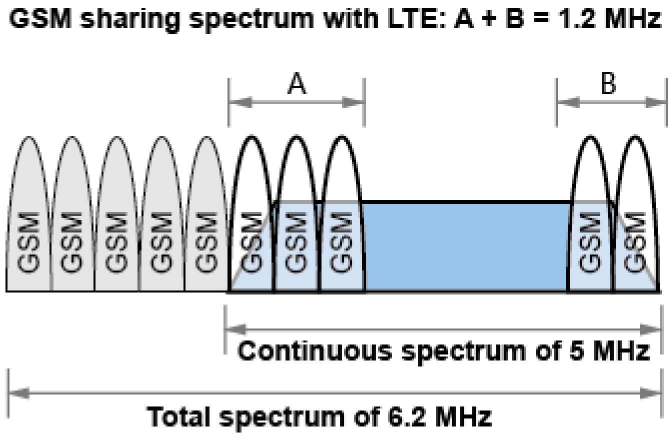
  This feature optimally improves LTE network capacity without sacrificing GSM network KPIs.

Description

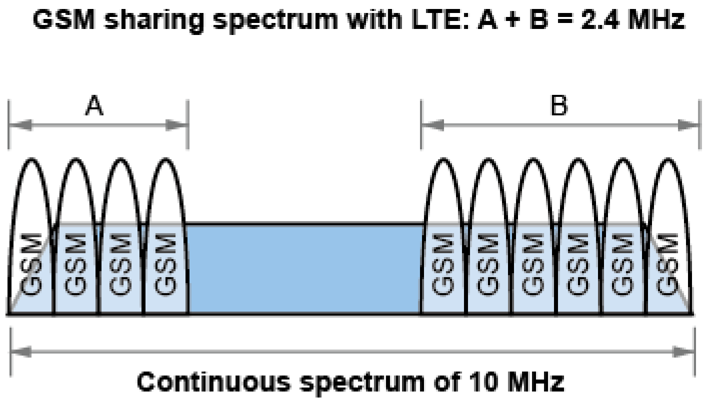
This feature allows GSM and LTE spectrum concurrency on a part of spectrum. A proprietary interface is introduced between the BSC and eNodeB to exchange information between GSM and LTE to support this feature. If a connection is not established between the BSC and eNodeB, the spectrum that can be used for GSM and LTE concurrency can only be allocated to GSM. The BSC determines whether the interference from LTE to GSM is acceptable based on the GSM and LTE level difference threshold for timeslot multiplexing as well as the measurement information reported by MSs. LTE can multiplex the shared GSM time-frequency resources only if the interference level is acceptable. If the interference level is unacceptable, LTE cannot multiplex the shared GSM time-frequency resources. The BSC sends the transmit power and multiplexing status of shared frequencies to the eNodeB over the proprietary interface. The eNodeB uses the information received from the BSC to calculate the amount of available time-frequency resources on the shared spectrum, and allocates and schedules the resources accordingly. If no communication link is configured between the BSC and eNodeB, GSM solely uses the shared spectrum resources.

This feature supports only LTE FDD 5 MHz, 10 MHz, 15 MHz, and 20 MHz bandwidths, and the uplink and downlink bandwidths must be the same. The continuous bandwidth and shared bandwidth in each LTE FDD bandwidth are as follows:

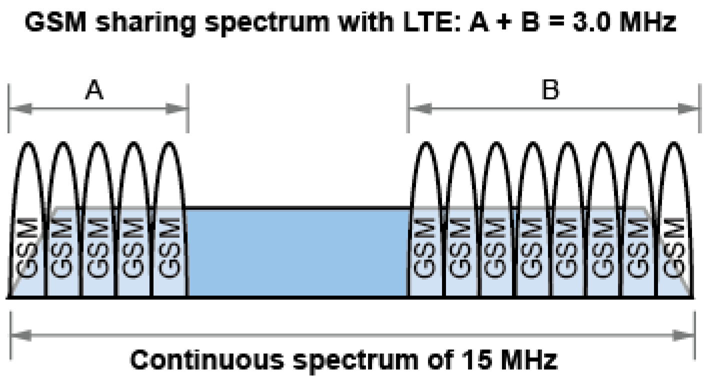
- LTE FDD 5 MHz bandwidth: A total of 6.2 MHz bandwidth is required, the continuous bandwidth must be at least 5 MHz, and GSM can share up to 1.2 MHz bandwidth with LTE. The following figure illustrates feature application when these requirements are met.



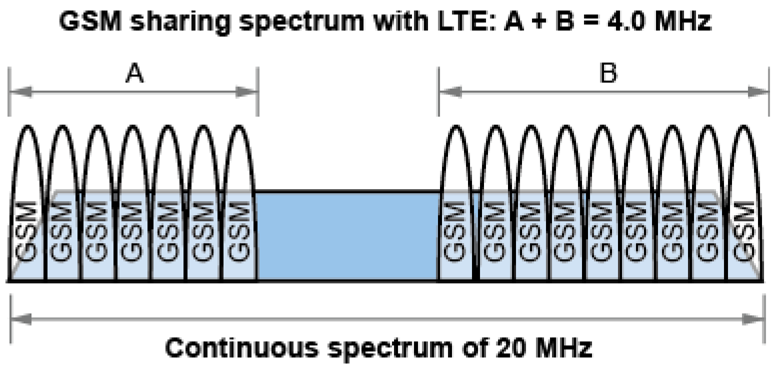
- LTE FDD 10 MHz bandwidth: A continuous 10 MHz bandwidth is required, and GSM can share up to 2.4 MHz bandwidth with LTE. The following figure illustrates feature application when these requirements are met.



- LTE FDD 15 MHz bandwidth: A continuous 15 MHz bandwidth is required, and GSM can share up to 3 MHz bandwidth with LTE. The following figure illustrates feature application when these requirements are met.



- LTE FDD 20 MHz bandwidth: A continuous 20 MHz bandwidth is required, and GSM can share up to 4 MHz bandwidth with LTE. The following figure illustrates feature application when these requirements are met.



Enhancement

None

Dependency

- Base station controller
  - Huawei BSC6900 or BSC6910 running SRAN13.0 or later versions must be used on the radio access network. The BSC6900/BSC6910 service processing boards (XPUa/XPUb/XPUc/EGPUa/EGPUb) support this feature. If the average CPU load of the service processing boards on the live network exceeds 50% before this feature is deployed, new service processing boards must be added.
  - When this feature is implemented on multiple BSCs, an Iur-g interface must be configured between these BSCs.
  - The GL interference coordination information is exchanged between the BSC and eNodeB over the Abis interface, which supports IP over E1/T1, IP over Ethernet, and TDM transmission modes. The Abis interface boards can be used for the information exchange.
- Base station

  Huawei macro base stations running SRAN13.0 or later versions must be used on the radio access network. The base station must be a GL co-MPT or a GL separate-MPT multimode base station. When GSM and LTE are deployed on different BBUs, these BBUs must be interconnected. Other hardware requirements are described in the table below.

Hardware	Requirement

Hardware	Requirement
Main control boards	• UMPT • UMDU • LMPT • GTMUb/GTMUc These boards do not support this feature in SingleOM scenarios.
Baseband boards	• UBBPd: UBBPd1 to UBBPd6 • UBBPe: UBBPe1 to UBBPe4, UBBPei, UBBPep, and UBBPex • UMDU
RF modules (RRUs/RFUs/AAUs)	All RF modules that support GSM or LTE and the 850 MHz, 900 MHz, 1800 MHz, or 1900 MHz frequency band, excluding the GRFU V1, GRFU V2, GRFU V2a, MRFU V1, MRFU V2, MRFU V2a, RRU3008 V1, RRU3008 V2, RRU3908 V1, RRU3908 V2, AAU3902, and AAU5972
Antenna specifications	1T1R, 2T2R, 2T4R, and 4T4R
Base station types	Macro base stations (configured with the BBU3900, BBU3910, BBU3910A, or BBU5900)

NOTE

The UMDU is a built-in board of the BBU3910A.

- UE

  None
- Core network

  None
- Other NEs

  Huawei U2000 and CME running SRAN13.0 or later versions must be used.
- Other features
  - Prerequisite features

    None
  - Mutually exclusive features

    MRFD-090202 GSM and LTE FDD Dynamic Spectrum Sharing(LTE FDD)

    MRFD-111401 GSM and LTE Zero Bufferzone

    MRFD-231808 GSM and LTE Buffer Zone Optimization(LTE)

    MRFD-101221 UL Refarming Zero Bufferzone

    LOFD-111205 CDMA and LTE Zero Bufferzone (LTE FDD)

    LOFD-001051 Compact Bandwidth

    LEOFD-111302 Flexible Bandwidth based on Overlap Carriers

DDB function of LEOFD-121204 3D Beamforming

LOFD-060201 Adaptive Inter-Cell Interference Coordination

LOFD-070220 eMBMS Phase 1 based on Centralized MCE Architecture

LOFD-081208 Inter-eNodeB SFN Based on Coordinated eNodeB

LAOFD-110203 ePDCCH (Trial)

- Others

  This feature must be simultaneously used with MRFD-130201 GSM and LTE Spectrum Concurrency (GSM).

1.1.3 MRFD-131201 GSM and LTE Spectrum Concurrency Phase 2 (GSM)

Availability

This feature is available from SRAN13.1.

Summary

With the increasing popularity of data services and the ever-roaring penetration rate of smart terminals, network performance is facing unprecedented challenges. However, some operators are confronted with such challenges as insufficient spectrum resources and long-term persistence of massive number of GSM users. Consequently, they cannot evolve GSM networks into LTE networks, which provide better data service experience.

This feature enables GSM and LTE to be deployed on the same spectrum band, and determines the usage of this band based on the service volume. The co-deployment of GSM and LTE on one spectrum band fully improves spectral efficiency and addresses the issue that one spectrum band can be allocated to only one RAT in refarming technologies. The BSC and eNodeB implement joint allocation and scheduling of the shared spectrum band. When GSM does not occupy the shared spectrum band, LTE can use the shared spectrum band to meet its large bandwidth requirements. This feature applies to the frequency bands supported by both GSM and LTE, that is, 850 MHz, 900 MHz, 1800 MHz, and 1900 MHz frequency bands.

Benefits

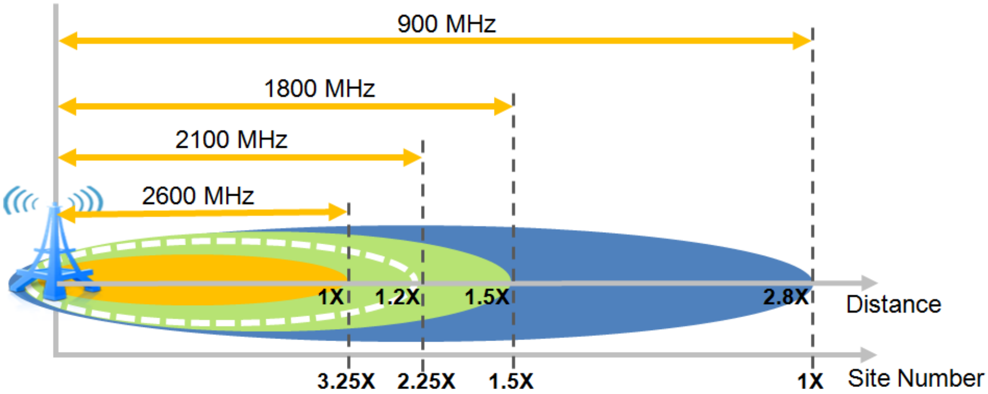
This feature provides the following benefits:

- Solves the long-tail challenge of legacy GSM terminals

  Although GSM spectral efficiency is low, for GSM to exit requires a significant amount of time, and may involve years for completion. This is because legacy GSM terminals generally have a long-tail issue and will not exit the network within a specific short period of time. Spectrum resources occupied by GSM cannot be released and reallocated to newer radio access technologies (RATs) that can provide higher spectral efficiency. This feature enables LTE deployment on the same spectrum band originally allocated to GSM while keeping legacy GSM networks.
- Solves the early phase issue of insufficient LTE coverage, facilitating user acceptance

  Low frequency bands 900 MHz and 850 MHz are characterized by low propagation loss and wide coverage, in comparison to high frequency bands 1800 MHz, 1900 MHz, and 2600 MHz. 900 MHz and 850 MHz are considered as gold frequency bands in mobile networks which only have a small bandwidth. Only 56% of operators have a bandwidth of 5–10 MHz on these frequency bands. Without this feature, these operators cannot deploy LTE on 900 MHz and 850 MHz frequency bands. They can only deploy LTE on high frequency bands with relatively abundant frequency resources.

With this feature, operators can deploy LTE on 900 MHz and 850 MHz frequency bands, allowing LTE to quickly achieve full coverage on low frequency bands. LTE can scale up and down based on the user penetration rate.



- Addresses the pain point that one spectrum band can only be allocated to one RAT in refarming technologies

  This feature enables GSM and LTE concurrency on the same spectrum band. These two RATs use spectrum resources as required. When the GSM traffic is heavy, spectrum resources are allocated to GSM. When the GSM traffic is light, spectrum resources are allocated to LTE. This improves spectral efficiency.

- Supports CA of LTE carriers on 850, 900, 1800, and 1900 MHz frequency bands

  After LTE is deployed on the 850, 900, 1800, or 1900 MHz frequency band, the LTE carriers on different frequency bands can be aggregated to fully utilize the remaining resources of these frequency bands to improve user experience.

- Supports legacy GSM terminals
- Comprehensively ensures the best performance of GSM and LTE networks

  This feature optimally improves LTE network capacity without sacrificing GSM network KPIs.

Description

This feature is applicable to either band of a dual-band network, and to the primary or secondary frequency band of a co-BCCH cell. This feature causes interference between GSM and LTE, and can only be enabled on a single frequency band in an area to minimize the impact on network performance. A proprietary interface is introduced between the BSC and eNodeB for the exchange of information between GSM and LTE to support this feature. The BSC performs a real-time calculation to determine the timeslots on which LTE cells can multiplex the shared spectrum based on LTE configurations, GSM channel configurations, channel occupation, and MS measurement information. Based on the calculation results, GSM frequencies, transmit power, and co-coverage attributes of GSM frequencies, the eNodeB determines the low- and high-quality frequency resources, as well as the frequency resources that cannot be scheduled. The eNodeB then schedules the resources accordingly. If no communication link is configured between the BSC and eNodeB, GSM solely uses the shared spectrum resources. This feature allows a larger maximum shared bandwidth than the GSM and LTE Spectrum Concurrency feature. In LTE FDD 10 MHz, 15 MHz, and 20 MHz scenarios, GSM can share up to 4.4 MHz, 5 MHz, and 5 MHz bandwidth with LTE, respectively. Previously, LTE cells in the area where this feature is to be enabled must be configured with different bandwidths due to varying degree of GSM traffic. A buffer zone must be planned between LTE sites with different bandwidths. After an increase in the maximum bandwidth that GSM can share with LTE, LTE cells in the area where this feature is to be enabled can then be configured with the same bandwidth, eliminating the configuration of the buffer zone.

Enhancement

None

Dependency

- Base station controller
  - Huawei BSC6900 or BSC6910 running SRAN13.1 or later versions must be used on the radio access network. The BSC6900/BSC6910 service processing boards (XPUa/XPUb/XPUc/EGPUa/EGPUb) support this feature. New service processing boards must be added if either of the following conditions is met before feature deployment:
    - The ratio of LTE shared bandwidth to the LTE standard bandwidth is less than or equal to 24%, but the average CPU load of service processing boards on the live network exceeds 50%.
    - The ratio of LTE shared bandwidth to the LTE standard bandwidth exceeds 24%, and the average CPU load of service processing boards on the live network exceeds 42%.
  - When this feature is implemented on multiple BSCs, an Iur-g interface must be configured between these BSCs.
  - The GL interference coordination information is exchanged between the BSC and eNodeB over the Abis interface, which supports IP over E1/T1, IP over Ethernet, and TDM transmission modes. The Abis interface boards can be used for the information exchange.
- Base station

  Huawei base stations running SRAN13.1 or later versions must be used on the radio access network. The base station must be a GL co-MPT or a GL separate-MPT multimode base station. When GSM and LTE are deployed on different BBUs, these BBUs must be interconnected. Other hardware requirements are described in the table below.

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NOTE

The UMDU/MDUC is a built-in board of the BBU3910A/BBU3910C.

- UE

  None
- Core network

  None
- Other NEs

  Huawei U2000 and CME running SRAN13.1 or later versions must be used.
- Other features
  - Prerequisite features

    MRFD-130201 GSM and LTE Spectrum Concurrency (GSM)
  - Mutually exclusive features

    None
- Others

  This feature must be simultaneously used with MRFD-131221 GSM and LTE Spectrum Concurrency Phase 2 (LTE FDD).

1.1.4 MRFD-131221 GSM and LTE Spectrum Concurrency Phase 2 (LTE FDD)

Availability

This feature is available from SRAN13.1.

Summary

With the increasing popularity of data services and the ever-roaring penetration rate of smart terminals, network performance is facing unprecedented challenges. However, some operators are confronted with such challenges as insufficient spectrum resources and long-term persistence of massive number of GSM users. Consequently, they cannot evolve GSM networks into LTE networks, which provide better data service experience.

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This feature provides the following benefits:

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  Although GSM spectral efficiency is low, for GSM to exit requires a significant amount of time, and may involve years for completion. This is because legacy GSM terminals generally have a long-tail issue and will not exit the network within a specific short period of time. Spectrum resources occupied by GSM cannot be released and reallocated to newer radio access technologies (RATs) that can provide higher spectral efficiency. This feature enables LTE deployment on the same spectrum band originally allocated to GSM while keeping legacy GSM networks.

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  Low frequency bands 900 MHz and 850 MHz are characterized by low propagation loss and wide coverage, in comparison to high frequency bands 1800 MHz, 1900 MHz, and 2600 MHz. 900 MHz and 850 MHz are considered as gold frequency bands in mobile networks which only have a small bandwidth. Only 56% of operators have a bandwidth of 5–10 MHz on these frequency bands. Without this feature, these operators cannot deploy LTE on 900 MHz and 850 MHz frequency bands. They can only deploy LTE on high frequency bands with relatively abundant frequency resources.

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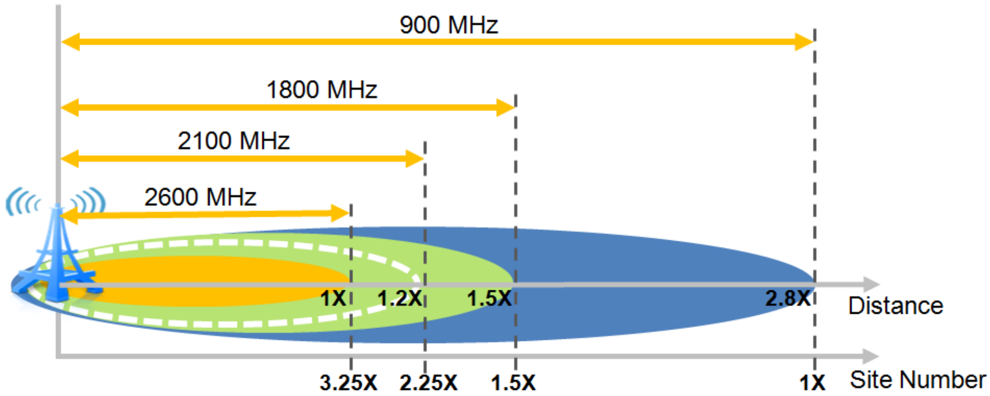


- Addresses the pain point that one spectrum band can only be allocated to one RAT in refarming technologies

  This feature enables GSM and LTE concurrency on the same spectrum band. These two RATs use spectrum resources as required. When the GSM traffic is heavy, spectrum resources are allocated to GSM. When the GSM traffic is light, spectrum resources are allocated to LTE. This improves spectral efficiency.

- Supports CA of LTE carriers on 850, 900, 1800, and 1900 MHz frequency bands

  After LTE is deployed on the 850, 900, 1800, or 1900 MHz frequency band, the LTE carriers on different frequency bands can be aggregated to fully utilize the remaining resources of these frequency bands to improve user experience.

- Supports legacy GSM terminals
- Comprehensively ensures the best performance of GSM and LTE networks

  This feature optimally improves LTE network capacity without sacrificing GSM network KPIs.

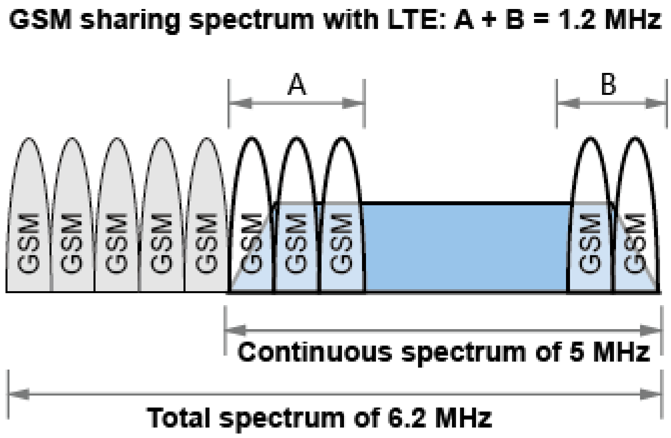
- This feature allows a larger maximum shared bandwidth than the GSM and LTE Spectrum Concurrency feature. In LTE FDD 10 MHz, 15 MHz, and 20 MHz scenarios, GSM can share up to 4.4 MHz, 5 MHz, and 5 MHz bandwidth with LTE, respectively. Previously, LTE cells in the area where this feature is to be enabled must be configured with different bandwidths due to varying degree of GSM traffic. A buffer zone must be planned between LTE sites with different bandwidths. After an increase in the maximum bandwidth that GSM can share with LTE, LTE cells in the area where this feature is to be enabled can then be configured with the same bandwidth, eliminating the configuration of the buffer zone.

Description

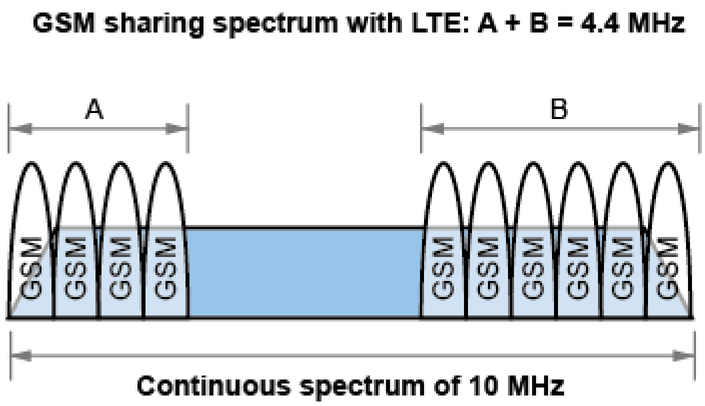
This feature allows GSM and LTE spectrum concurrency on a part of spectrum. A proprietary interface is introduced between the BSC and eNodeB to exchange information between GSM and LTE to support this feature. If a connection is not established between the BSC and eNodeB, the spectrum that can be used for GSM and LTE concurrency can only be allocated to GSM. The BSC determines whether the interference from LTE to GSM is acceptable based on the GSM and LTE level difference threshold for timeslot multiplexing as well as the measurement information reported by MSs. LTE can multiplex the shared GSM time-frequency resources only if the interference level is acceptable. If the interference level is unacceptable, LTE cannot multiplex the shared GSM time-frequency resources. The BSC sends the transmit power and multiplexing status of shared frequencies to the eNodeB over the proprietary interface. The eNodeB uses the information received from the BSC to calculate the amount of available time-frequency resources on the shared spectrum, and allocates and schedules the resources accordingly. If no communication link is configured between the BSC and eNodeB, GSM solely uses the shared spectrum resources.

This feature supports only LTE FDD 5 MHz, 10 MHz, 15 MHz, and 20 MHz bandwidths, and the uplink and downlink bandwidths must be the same. The continuous bandwidth and shared bandwidth in each LTE FDD bandwidth are as follows:

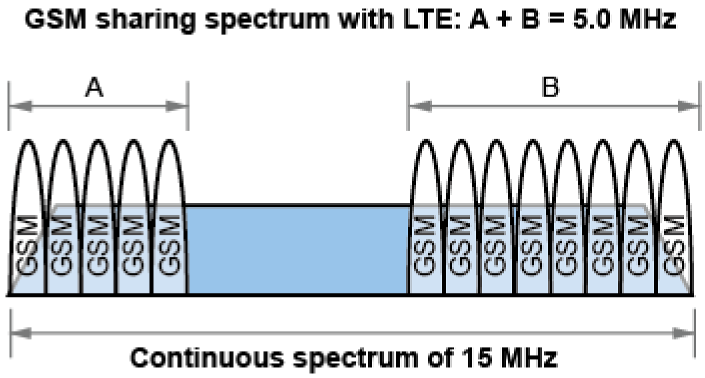
- LTE FDD 5 MHz bandwidth: A total of 6.2 MHz bandwidth is required, the continuous bandwidth must be at least 5 MHz, and GSM can share up to 1.2 MHz bandwidth with LTE. The following figure illustrates feature application when these requirements are met.



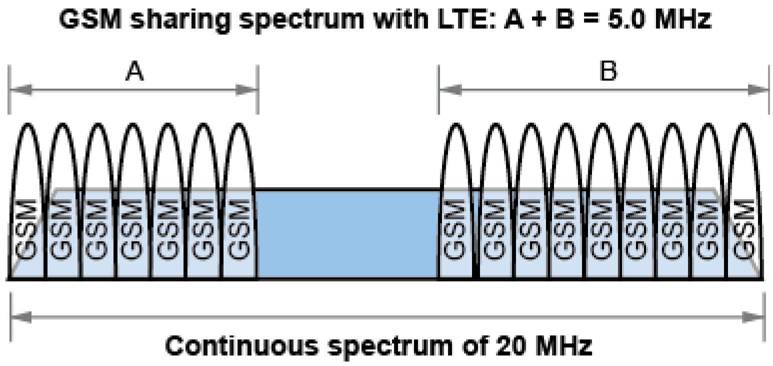
- LTE FDD 10 MHz bandwidth: A continuous 10 MHz bandwidth is required, and GSM can share up to 4.4 MHz bandwidth with LTE. The following figure illustrates feature application when these requirements are met.



- LTE FDD 15 MHz bandwidth: A continuous 15 MHz bandwidth is required, and GSM can share up to 5 MHz bandwidth with LTE. The following figure illustrates feature application when these requirements are met.



- LTE FDD 20 MHz bandwidth: A continuous 20 MHz bandwidth is required, and GSM can share up to 5 MHz bandwidth with LTE. The following figure illustrates feature application when these requirements are met.



Enhancement

None

Dependency

- Base station controller
  - Huawei BSC6900 or BSC6910 running SRAN13.1 or later versions must be used on the radio access network. The BSC6900/BSC6910 service processing boards (XPUa/XPUb/XPUc/EGPUa/EGPUb) support this feature. New service processing boards must be added if either of the following conditions is met before feature deployment:
    - The ratio of LTE shared bandwidth to the LTE standard bandwidth is less than or equal to 24%, but the average CPU load of service processing boards on the live network exceeds 50%.
    - The ratio of LTE shared bandwidth to the LTE standard bandwidth exceeds 24%, and the average CPU load of service processing boards on the live network exceeds 42%.
  - When this feature is implemented on multiple BSCs, an Iur-g interface must be configured between these BSCs.
  - The GL interference coordination information is exchanged between the BSC and eNodeB over the Abis interface, which supports IP over E1/T1, IP over Ethernet,

and TDM transmission modes. The Abis interface boards can be used for the information exchange.

- Base station

  Huawei macro base stations running SRAN13.1 or later versions must be used on the radio access network. The base station must be a GL co-MPT or a GL separate-MPT multimode base station. When GSM and LTE are deployed on different BBUs, these BBUs must be interconnected. Other hardware requirements are described in the table below.

Hardware	Requirement
Main control boards	• UMPT • UMDU • LMPT • GTMUb/GTMUc These boards do not support this feature in SingleOM scenarios.
Baseband boards	• UBBPd: UBBPd1 to UBBPd6 • UBBPe: UBBPe1 to UBBPe4, UBBPei, UBBPep, and UBBPex • UMDU
RF modules (RRUs/RFUs/AAUs)	All RF modules that support GSM or LTE and the 850 MHz, 900 MHz, 1800 MHz, or 1900 MHz frequency band, excluding the GRFU V1, GRFU V2, GRFU V2a, MRFU V1, MRFU V2, MRFU V2a, RRU3008 V1, RRU3008 V2, RRU3908 V1, RRU3908 V2, AAU3902, and AAU5972
Antenna specifications	1T1R, 2T2R, 2T4R, and 4T4R
Base station types	Macro base stations (configured with the BBU3900, BBU3910, BBU3910A, or BBU5900)

NOTE

The UMDU is a built-in board of the BBU3910A.

- UE

  None

- Core network

  None

- Other NEs

  Huawei U2000 and CME running SRAN13.1 or later versions must be used.

- Other features
  - Prerequisite features

    MRFD-130221 GSM and LTE Spectrum Concurrency (LTE FDD)
  - Mutually exclusive features

None

- Others

  This feature must be simultaneously used with MRFD-131201 GSM and LTE Spectrum Concurrency Phase 2 (GSM).

1.2 UL Spectrum Sharing

1.2.1 MRFD-130212 UMTS and LTE Spectrum Sharing (UMTS)

Availability

This feature is available from SRAN13.1.

NOTE

LT1SRFSPCS00 and LT1S5000RFSS are the hardware licenses for this feature, which must be purchased based on the types of RF units used on the live network.

Summary

Operators have growing demands for faster deployment or more capacity for LTE networks because data services are growing more popular and the penetration rate of smart terminals is increasing. However, available spectrum is scattered and therefore unsuitable for current LTE standard bandwidth requirements (even after integration or refarming). Operators possessing UMTS and LTE networks have not introduced any new changes. This will eventually waste spectrum resources. Operators possessing only a UMTS network are confronted with similar problems when attempting to deploy LTE networks. Operators possessing multiple UMTS carriers are confronted with similar problems when attempting to perform UL refarming whereas the refarming cannot be performed in units of 5 MHz.

This feature allows UMTS and LTE networks to be co-deployed on a minimum of 8.4 MHz spectrum, achieving full utilization of operators' spectrum resources.

Benefits

This feature reduces the minimum spectrum required for the co-deployment of continuous UMTS and LTE networks to 8.4 MHz, improving both spectrum utilization and user experience.

Description

This feature can be used independently or together with the Flexible frequency bandwidth of UMTS carrier feature.

- When this feature is used alone, spectrum sharing is implemented between one UMTS carrier and one LTE carrier.

  On the UMTS side, this feature uses uplink and downlink asymmetric band-pass filters to enable UMTS to work on a compact bandwidth. The saved bandwidth is then shared with LTE. The uplink asymmetric band-pass filter helps filter out any interference from UMTS uplink receive signals, ensuring the normal operation of UTMS cells. The downlink asymmetric band-pass filter attenuates signals outside the compact bandwidth, reducing the interference caused by UMTS downlink signals to LTE. On the LTE side, this feature punctures available RBs in LTE cells using a standard bandwidth. This helps to reduce the LTE effective bandwidth, and any performance loss caused by RB puncturing is offset by physical channel resource management. In this way, LTE cells can work properly using a smaller non-standard bandwidth, and the saved bandwidth is available to share with UMTS.

The following figure illustrates how this feature works using 15 MHz of bandwidth, where the maximum overlapped spectrum between UMTS and LTE in the uplink and downlink are both 5 MHz. With this feature, there is enough bandwidth to deploy both a 5 MHz UMTS cell, and a 15 MHz LTE cell. Without this feature, after deploying a 5 MHz UMTS cell, there would only be enough left over to deploy a 10 MHz LTE cell.

Figure 1-1 UMTS and LTE spectrum sharing

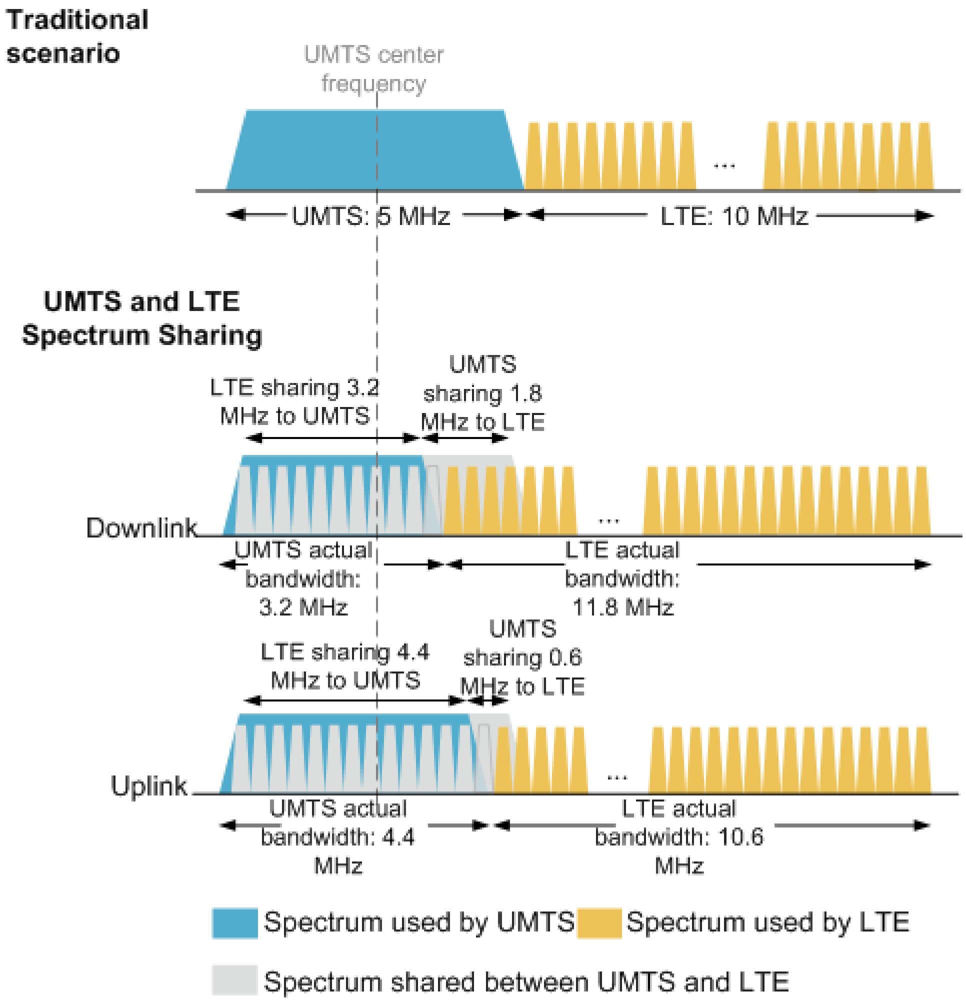


Table 1-1 describes the maximum sharable bandwidths between UMTS and LTE.

Table 1-1 Maximum sharable bandwidths between UMTS and LTE

LTE Standard Bandwidth	Maximum Sharable LTE Spectrum in the Uplink and Downlink	UMTS Standard Bandwidth	Maximum Sharable UMTS Spectrum in the Downlink	Maximum Sharable UMTS Spectrum in the Uplink	Maximum Overlapped Spectrum Between UMTS and LTE in the Uplink and Downlink
5 MHz	1 MHz	5 MHz	1.8 MHz	0.6 MHz	1.6 MHz
10 MHz	3.4 MHz				4 MHz
15 MHz	4.6 MHz				5 MHz
20 MHz	4.6 MHz				5 MHz

Table 1-2 describes how much LTE cell downlink capacity is improved in different application scenarios compared with an LTE network using the adjacent lower bandwidth.

Table 1-2 LTE cell downlink capacity gains

LTE Standard Bandwidth	Actual Available LTE Bandwidth	LTE Downlink Capacity Gain
5 MHz	4 MHz–5 MHz	+20%–58% more than with 3 MHz of LTE bandwidth
10 MHz	6.6 MHz–10 MHz	+22%–90% more than with 5 MHz of LTE bandwidth
15 MHz	11.4 MHz–15 MHz	+10%–43% more than with 10 MHz of LTE bandwidth
20 MHz	16.6 MHz–20 MHz	+8%–27% more than with 15 MHz of LTE bandwidth

- When this feature is used together with the Flexible frequency bandwidth of UMTS carrier feature, spectrum sharing is implemented between multiple UMTS carriers and an LTE carrier.

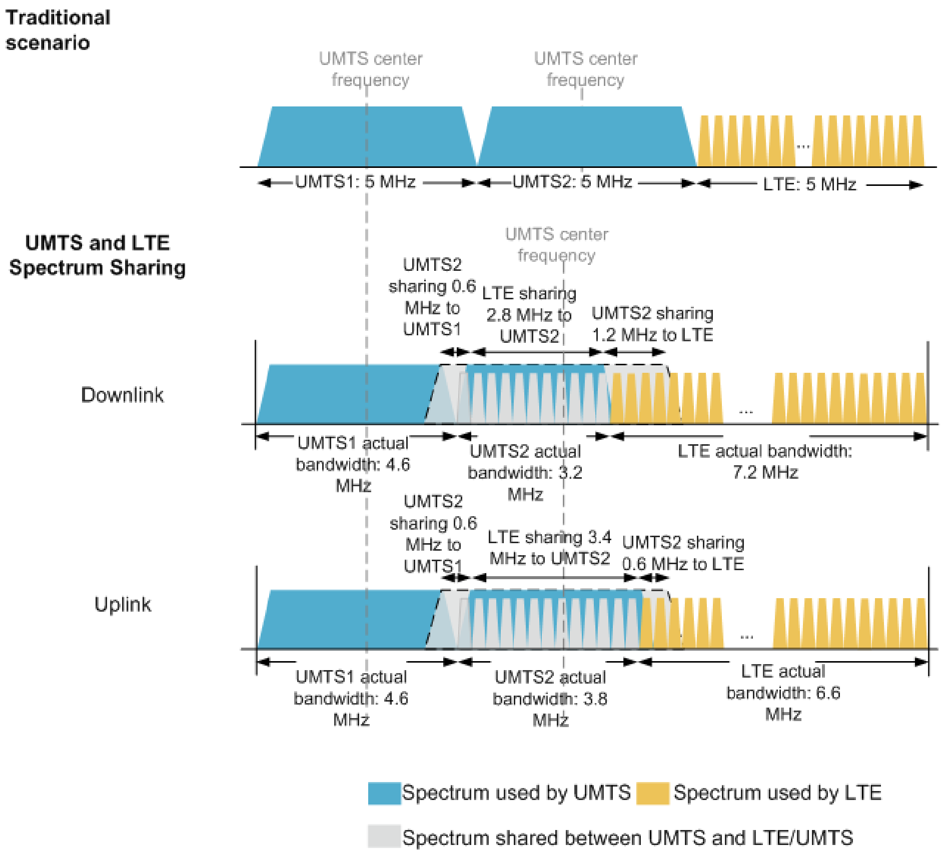
  Specifically, both ends of the UMTS spectrum are shared. One end is shared to the LTE network, and the other end is shared to another UMTS network.
  - The amount of the UMTS spectrum shared to the LTE network and technical details on UMTS and LTE spectrum sharing are described in the sections above.
  - At the end of the UMTS spectrum shared to another UMTS network, the maximum amount of overlapped spectrum in the uplink and downlink are 0.6 MHz. In addition, the UMTS carrier that shares spectrum with the LTE carrier must have at least 3.2 MHz of exclusive spectrum.

NOTE

For details about WRFD-021001 Flexible frequency bandwidth of UMTS carrier, see *GU 900 MHz Non-standard Frequency Spacing* in *RAN Feature Documentation*.

Figure 1-2 illustrates how the UMTS and LTE Spectrum Sharing feature and the Flexible frequency bandwidth of UMTS carrier feature work using 15 MHz of total bandwidth. With these two features, there is enough bandwidth to deploy two 5 MHz UMTS cells, and a 10 MHz LTE cell. Without these two functions, after deploying two 5 MHz UMTS cells, there would only be enough left over to deploy a 5 MHz LTE cell.

Figure 1-2 Simultaneous use of these two features



The following table lists the minimum bandwidth requirements in different configuration scenarios.

Configuration	LTE Configuration Bandwidth	Minimum Required Bandwidth	Actual Bandwidth Occupied by UMTS	Actual Bandwidth Occupied by LTE
1U1L	5 MHz	8.4 MHz	U1: 3.4 MHz	5 MHz
	10 MHz	11 MHz	U1: 3.2 MHz	7.8 MHz
	15 MHz	15 MHz	U1: 3.2 MHz	11.8 MHz
	20 MHz	20 MHz	U1: 3.2 MHz	16.8 MHz

2U1L	5 MHz	12.4 MHz	U1: 4.6 MHz; U2: 3.2 MHz	4.6 MHz
	10 MHz	15 MHz	U1: 4.6 MHz; U2: 3.2 MHz	7.2 MHz
	15 MHz	18.8 MHz	U1: 4.6 MHz; U2: 3.2 MHz	11 MHz
	20 MHz	23.8 MHz	U1: 4.6 MHz; U2: 3.2 MHz	16 MHz
3U1L	5 MHz	16.6 MHz	U1: 4.6 MHz; U2: 4.2 MHz; U3: 3.2 MHz	4.6 MHz
	10 MHz	19.2 MHz	U1: 4.6 MHz; U2: 4.2 MHz; U3: 3.2 MHz	7.2 MHz
	15 MHz	23 MHz	U1: 4.6 MHz; U2: 4.2 MHz; U3: 3.2 MHz	11 MHz
	20 MHz	28 MHz	U1: 4.6 MHz; U2: 4.2 MHz; U3: 3.2 MHz	16 MHz

Enhancement

None

Dependency

- Base station controller

  None

- Base station

  UL co-MPT or separate-MPT macro base stations must be used on the radio access network (RAN). The base stations must meet the following hardware requirements:

  - Boards
    - The main control board must be a UMPT. The baseband processing board must be a UBBP.
    - A UBBP board supporting UMTS must be configured to provide CPRI ports.
    - The UBBP board does not support this feature when any of the following conditions are met:
      - The UBBP board is configured to work in GSM&UMTS&LTE mode.
      - The UBBPd1, UBBPd2, UBBPd3, or UBBPd4 board is configured to work in GSM&UMTS mode.
      - The BBU3910A1 (UMDU) is configured to work in GSM&UMTS or UMTS&LTE mode.
    - There is only half as many UL spectrum sharing cells supported by a baseband processing board as there are normal UMTS cells. For example, if a baseband processing board supports up to six normal UMTS cells, this board can serve no more than three UL spectrum sharing cells and three normal UMTS cells. In addition, when an uplink resource group serves 1–3 UL spectrum sharing

cells, the number of available channel elements (CEs) decreases by 128. When an uplink resource group serves 4–6 UL spectrum sharing cells, the number of available CEs decreases by 256.

- When an uplink resource group serves more than nine cells, enabling this feature triggers reallocation of the baseband resources in the resource group. The reallocation then possibly causes re-establishment of cells not enabled with this function in the resource group.
- This feature and the GU@5 MHz Phase 2 feature joint occupy the access resources of interface boards. When these two features are used together, the number of cells that can be enabled with this feature on a base station decreases. The maximum number of cells that can be enabled with this feature equals (24 – Number of cells enabled with the GU@5 MHz Phase 2 feature).

NOTE

The UMDU is a built-in board of the BBU3910A. For details on the UMDU, see *BBU Hardware Description* in *3900 Series Base Station Product Documentation* or *BBU5900 Hardware Description* in *5900 Series Base Station Product Documentation*.

- RF modules
  - RFUs/RRUs: all RFUs or RRUs supporting LTE or UMTS, excluding the LRFU, MRFU V1, MRFU V2, MRFU V2a, RRU3203, RRU3801C, RRU3801E, RRU3804, RRU3805, RRU3806, RRU3808, RRU3908 V1, RRU3908 V2, and WRFU
  - AAUs: AAU3910, AAU3911, AAU3920, AAU3940, AAU3961, and AAU5940
- Antenna specifications

  UMTS: 1T1R and 1T2R

NOTE

If UMTS cells need to work in 2T2R mode, WRFD-030011 MIMO Prime must be enabled.

- UE

  None
- Core network

  None
- Other NEs

  None
- Other features
  - Prerequisite features

    None
  - Mutually exclusive features
    - WRFD-141202 Independent Demodulation of Signals from Multiple Small Cell RRUs in One Cell
    - WRFD-021308 Extended Cell Coverage up to 200km
    - WRFD-010209 4-Antenna Receive Diversity
    - WRFD-010203 Transmit Diversity
    - WRFD-021350 Independent Demodulation of Signals from Multiple RRUs in One Cell
    - WRFD-010205 Cell Digital Combination and Split
    - WRFD-191202 Intelligent 2T VAM

- WRFD-201203 UMTS 4T Beam Optimization
- WRFD-201204 UMTS MassiveBeam 8T8R
- WRFD-151210 Inter-Dependence of BBU Uplink Resource
- WRFD-010692 HSUPA FDE
- WRFD-170108 Hitless Cell Rehoming
- WRFD-191212 Dual Carriers over Narrowband

- Others

  This feature must be simultaneously used with MRFD-130222 UMTS and LTE Spectrum Sharing (LTE FDD).

  When spectrum sharing needs to be implemented between multiple UMTS carriers and an LTE carrier, the WRFD-021001 Flexible frequency bandwidth of UMTS carrier feature must be activated.

1.2.2 MRFD-130222 UMTS and LTE Spectrum Sharing (LTE FDD)

Availability

This feature is available from SRAN13.1.

Summary

Operators have growing demands for faster deployment or more capacity for LTE networks because data services are growing more popular and the penetration rate of smart terminals is increasing. However, available spectrum is scattered and therefore unsuitable for current LTE standard bandwidth requirements (even after integration or refarming). Operators possessing UMTS and LTE networks have not introduced any new changes. This will eventually waste spectrum resources. Operators possessing only a UMTS network are confronted with similar problems when attempting to deploy LTE networks. Operators possessing multiple UMTS carriers are confronted with similar problems when attempting to perform UL refarming whereas the refarming cannot be performed in units of 5 MHz.

This feature allows UMTS and LTE networks to be co-deployed on a minimum of 8.4 MHz spectrum, achieving full utilization of operators' spectrum resources.

Benefits

This feature reduces the minimum spectrum required for the co-deployment of continuous UMTS and LTE networks to 8.4 MHz, improving both spectrum utilization and user experience.

Description

This feature can be used independently or together with the Flexible frequency bandwidth of UMTS carrier feature.

- When this feature is used alone, spectrum sharing is implemented between one UMTS carrier and one LTE carrier.

  On the UMTS side, this feature uses uplink and downlink asymmetric band-pass filters to enable UMTS to work on a compact bandwidth. The saved bandwidth is then shared with LTE. The uplink asymmetric band-pass filter helps filter out any interference from UMTS uplink receive signals, ensuring the normal operation of UTMS cells. The downlink asymmetric band-pass filter attenuates signals outside the compact bandwidth, reducing the interference caused by UMTS downlink signals to LTE. On the LTE side, this feature punctures available RBs in LTE cells using a standard bandwidth. This helps to reduce the LTE effective bandwidth, and any performance loss caused by RB puncturing is offset by physical channel resource management. In this way, LTE cells can work properly using a smaller non-standard bandwidth, and the saved bandwidth is available to share with UMTS.

The following figure illustrates how this feature works using 15 MHz of bandwidth, where the maximum overlapped spectrum between UMTS and LTE in the uplink and downlink are both 5 MHz. With this feature, there is enough bandwidth to deploy both a 5 MHz UMTS cell, and a 15 MHz LTE cell. Without this feature, after deploying a 5 MHz UMTS cell, there would only be enough left over to deploy a 10 MHz LTE cell.

Figure 1-3 UMTS and LTE spectrum sharing

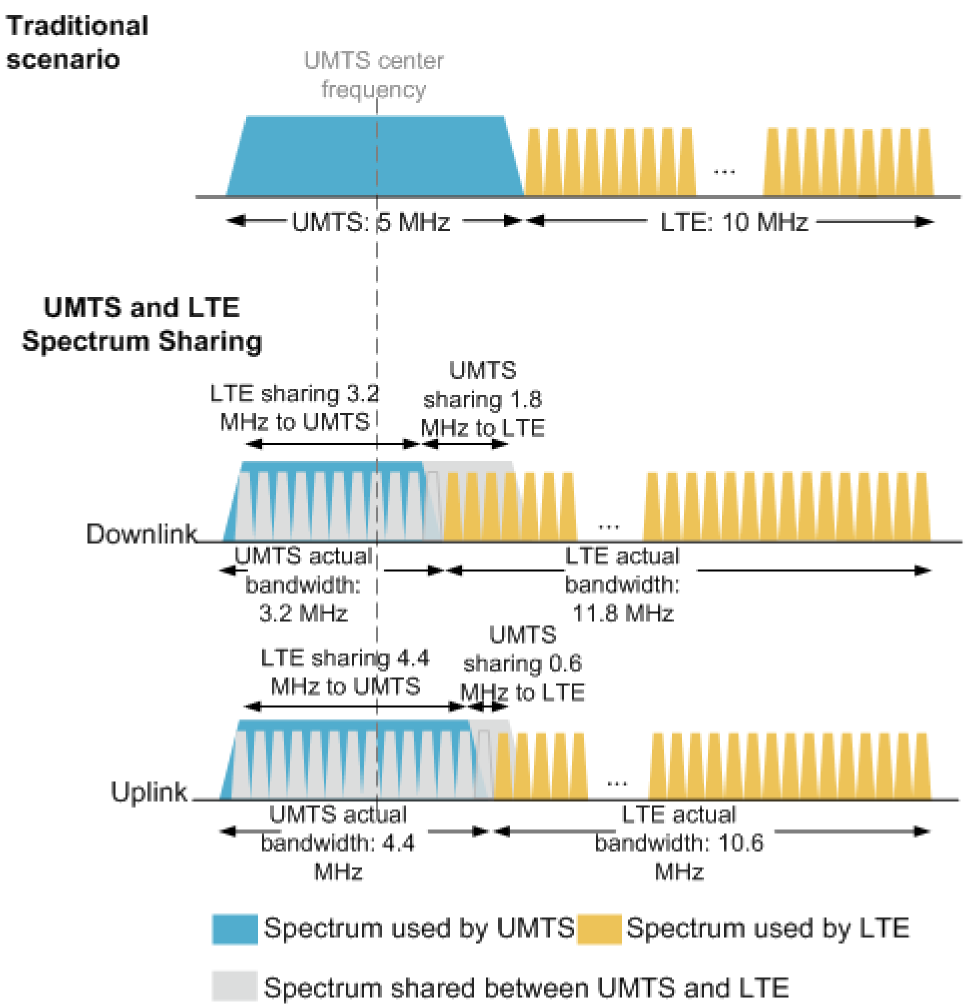


Table 1-3 describes the maximum sharable bandwidths between UMTS and LTE.

Table 1-3 Maximum sharable bandwidths between UMTS and LTE

LTE Standard Bandwidth	Maximum Sharable LTE Spectrum in the Uplink and Downlink	UMTS Standard Bandwidth	Maximum Sharable UMTS Spectrum in the Downlink	Maximum Sharable UMTS Spectrum in the Uplink	Maximum Overlapped Spectrum Between UMTS and LTE in the Uplink and Downlink
5 MHz	1 MHz	5 MHz	1.8 MHz	0.6 MHz	1.6 MHz
10 MHz	3.4 MHz				4 MHz
15 MHz	4.6 MHz				5 MHz
20 MHz	4.6 MHz				5 MHz

Table 1-4 describes how much LTE cell downlink capacity is improved in different application scenarios compared with an LTE network using the adjacent lower bandwidth.

Table 1-4 LTE cell downlink capacity gains

LTE Standard Bandwidth	Actual Available LTE Bandwidth	LTE Downlink Capacity Gain
5 MHz	4 MHz–5 MHz	+20%–58% more than with 3 MHz of LTE bandwidth
10 MHz	6.6 MHz–10 MHz	+22%–90% more than with 5 MHz of LTE bandwidth
15 MHz	11.4 MHz–15 MHz	+10%–43% more than with 10 MHz of LTE bandwidth
20 MHz	16.6 MHz–20 MHz	+8%–27% more than with 15 MHz of LTE bandwidth

- When this feature is used together with the Flexible frequency bandwidth of UMTS carrier feature, spectrum sharing is implemented between multiple UMTS carriers and an LTE carrier.

  Specifically, both ends of the UMTS spectrum are shared. One end is shared to the LTE network, and the other end is shared to another UMTS network.

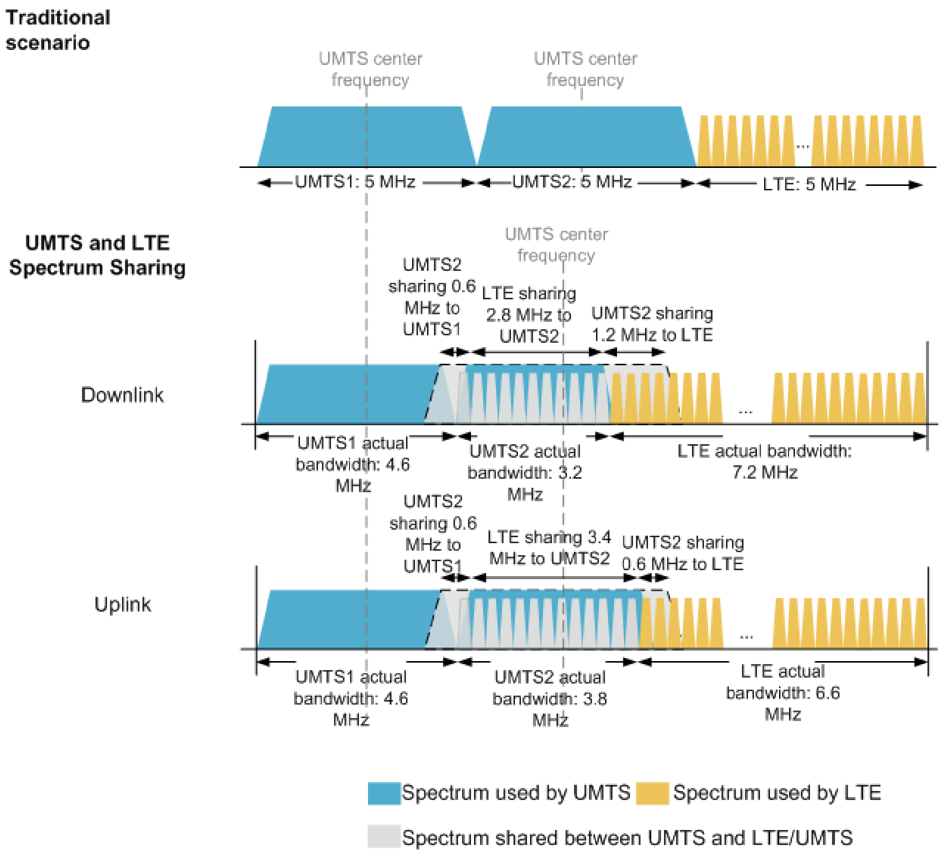
  - The amount of the UMTS spectrum shared to the LTE network and technical details on UMTS and LTE spectrum sharing are described in the sections above.
  - At the end of the UMTS spectrum shared to another UMTS network, the maximum amount of overlapped spectrum in the uplink and downlink are 0.6 MHz. In addition, the UMTS carrier that shares spectrum with the LTE carrier must have at least 3.2 MHz of exclusive spectrum.

NOTE

For details about WRFD-021001 Flexible frequency bandwidth of UMTS carrier, see *GU 900 MHz Non-standard Frequency Spacing* in *RAN Feature Documentation*.

Figure 1-4 illustrates how the UMTS and LTE Spectrum Sharing feature and the Flexible frequency bandwidth of UMTS carrier feature work using 15 MHz of total bandwidth. With these two features, there is enough bandwidth to deploy two 5 MHz UMTS cells, and a 10 MHz LTE cell. Without these two functions, after deploying two 5 MHz UMTS cells, there would only be enough left over to deploy a 5 MHz LTE cell.

Figure 1-4 Simultaneous use of these two features



The following table lists the minimum bandwidth requirements in different configuration scenarios.

Configuration	LTE Configuration Bandwidth	Minimum Required Bandwidth	Actual Bandwidth Occupied by UMTS	Actual Bandwidth Occupied by LTE
1U1L	5 MHz	8.4 MHz	U1: 3.4 MHz	5 MHz
	10 MHz	11 MHz	U1: 3.2 MHz	7.8 MHz
	15 MHz	15 MHz	U1: 3.2 MHz	11.8 MHz
	20 MHz	20 MHz	U1: 3.2 MHz	16.8 MHz

2U1L	5 MHz	12.4 MHz	U1: 4.6 MHz; U2: 3.2 MHz	4.6 MHz
	10 MHz	15 MHz	U1: 4.6 MHz; U2: 3.2 MHz	7.2 MHz
	15 MHz	18.8 MHz	U1: 4.6 MHz; U2: 3.2 MHz	11 MHz
	20 MHz	23.8 MHz	U1: 4.6 MHz; U2: 3.2 MHz	16 MHz
3U1L	5 MHz	16.6 MHz	U1: 4.6 MHz; U2: 4.2 MHz; U3: 3.2 MHz	4.6 MHz
	10 MHz	19.2 MHz	U1: 4.6 MHz; U2: 4.2 MHz; U3: 3.2 MHz	7.2 MHz
	15 MHz	23 MHz	U1: 4.6 MHz; U2: 4.2 MHz; U3: 3.2 MHz	11 MHz
	20 MHz	28 MHz	U1: 4.6 MHz; U2: 4.2 MHz; U3: 3.2 MHz	16 MHz

Enhancement

None

Dependency

- Base station controller

  None

- Base station

  UL co-MPT or separate-MPT macro base stations running SRAN13.1 or later versions must be used on the RAN. The base stations must meet the following hardware requirements:

  – Boards
    - UMPT
    - LMPT
    - UMDU
    - UBBP

NOTE

- The UMDU is a built-in board of the BBU3910A. For details on the UMDU, see *BBU Hardware Description* in *3900 Series Base Station Product Documentation* or *BBU5900 Hardware Description* in *5900 Series Base Station Product Documentation*.
- To prevent cell activation failures due to lack of baseband resources, cells enabled with this feature must be bound to baseband boards supporting this feature. If cells are not bound to such baseband boards, cell activation may fail because the baseband boards supporting this feature are fully occupied and other baseband boards do not support this feature.

  – RF modules
    - RFUs/RRUs

All RFUs or RRUs supporting LTE or UMTS, except LRFU, MRFU V1, MRFU V2, MRFU V2a, RRU3203, RRU3801C, RRU3801E, RRU3804, RRU3805, RRU3806, RRU3808, RRU3908 V1, RRU3908 V2, and WRFU

        - AAUs

          AAU3910, AAU3911, AAU3920, AAU3940, AAU3961, and AAU5940

    - Antenna specifications

      1T1R, 2T2R, 2T4R, and 4T4R

- UE

  None

- Core network

  None

- Other NEs

  None

- Other features
    - Prerequisite features

      None

    - Mutually exclusive features
        - MRFD-231808 GSM and LTE Buffer Zone Optimization(LTE)
        - MRFD-111401 GSM and LTE Zero Bufferzone
        - MRFD-090202 GSM and LTE FDD Dynamic Spectrum Sharing(LTE FDD)
        - MRFD-130221 GSM and LTE Spectrum Concurrency (LTE FDD)
        - MRFD-101221 UL Refarming Zero Bufferzone (Trial)
        - LOFD-111205 CDMA and LTE Zero Bufferzone (LTE FDD)
        - LOFD-001051 Compact Bandwidth
        - LEOFD-111302 Flexible Bandwidth based on Overlap Carriers
        - LAOFD-110203 ePDCCH (Trial)

- Others

  This feature must be simultaneously used with MRFD-130212 UMTS and LTE Spectrum Sharing (UMTS).

  When spectrum sharing needs to be implemented between multiple UMTS carriers and an LTE carrier, the WRFD-021001 Flexible frequency bandwidth of UMTS carrier feature must be activated.

1.3 Power Sharing

1.3.1 MRFD-131212 UMTS and LTE Dynamic Power Sharing (UMTS)

Availability

This feature is available from SRAN13.1.

Summary

This feature enables the idle power of one radio access technology (RAT) to be temporarily allocated to another RAT for an improvement in user experience. This occurs as a result of an imbalance in the distribution of UMTS and LTE traffic or when the peak hours of UMTS and LTE spike fall in different periods of a single day.

During UMTS off-peak hours, UMTS shares its idle power with LTE. U2L power sharing improves the throughput of LTE UEs using the quadrature phase shift keying (QPSK) modulation scheme.

During LTE off-peak hours, LTE shares its idle power with UMTS. L2U power sharing improves the average throughput of a UMTS cell.

Benefits

This feature provides the following benefits:

- U2L power sharing improves the throughput of UEs using the QPSK modulation scheme in LTE cells, since these UEs are allocated the idle power of UMTS.
- L2U power sharing improves the throughput of HSDPA UEs, since the shared idle power of LTE is allocated to HSDPA UEs.

Description

This feature consists of U2L and L2U power sharing.

When UMTS and LTE share the same RF module, UMTS and LTE cells calculate their own power usage based on which peak and off-peak hours of UMTS and LTE cells can be determined.

- U2L power sharing

  During UMTS off-peak hours, UMTS limits the amount of power available to HSDPA services, and shares its idle power with LTE. The pilot power of LTE cells remains the same before and after U2L power sharing. After U2L power sharing, the throughput of LTE UEs using the QPSK modulation scheme improves, which may cause interference to adjacent cells.

  The actual gains provided by U2L power sharing on the live network are closely related to the traffic model. U2L power sharing can provide a large gain when UMTS traffic is low and LTE traffic is high.
- L2U power sharing

  During LTE off-peak hours, LTE limits the number of available RBs, and shares its idle power with UMTS. The pilot power of UMTS cells remains the same before and after L2U power sharing. After L2U power sharing, the throughput of HSDPA UEs improves, which may cause interference to adjacent cells.

  The actual gains provided by L2U power sharing on the live network are closely related to the traffic model. L2U power sharing can provide a large gain when LTE traffic is low and UMTS traffic is high.

This feature is applicable to the following scenarios:

- LTE and UMTS carriers share a power amplifier (PA) and are configured on each RRU channel. RRUs are not combined.
- LTE carriers do not use a 1.4 MHz or 3 MHz bandwidth.

- No NB-IoT carrier is configured on RRU channels.

Enhancement

None

Dependency

- Base station controller

  None
- Base station
  - Only the UMPT series main control boards, UMDU, and WMPT support this feature.
  - Only the UBBPd, UBBPe, and WBBPf series baseband processing boards support this feature.
  - Only the RRU3962 and RRU5507 support this feature.
  - This feature is not applicable to combined RRUs.
  - This feature is not applicable to LTE carriers operating on a 1.4 MHz or 3 MHz bandwidth.
  - This feature supports 5 MHz, 10 MHz, 15 MHz, and 20 MHz LTE cells. In 5 MHz and 10 MHz LTE cells, LTE cannot share power to UMTS and can only use UMTS shared power.
- UE

  None
- Core network

  None
- Other NEs

  None
- Other features
  - Prerequisite features
    - WRFD-010610 HSDPA Introduction Package
    - WRFD-160251 HSDPA Inter-Cell Power Sharing

      When two or more UMTS carriers participate in power sharing on a single RF channel, this feature must be enabled.
  - Mutually exclusive features
    - WRFD-010205 Cell Digital Combination and Split
    - WRFD-010684 2×2 MIMO
    - WRFD-021350 Independent Demodulation of Signals from Multiple RRUs in One Cell
    - WRFD-151208 Macro-Micro Multi RRUs in One Cell
    - WRFD-190205 VAM Power Saving
    - MRFD-221801 Multi-mode Dynamic Power Sharing(UMTS)
    - WRFD-201203 UMTS 4T Beam Optimization
    - WRFD-201208 UMTS Massive Beam 8T8R
- Others

This feature must be simultaneously used with MRFD-131222 UMTS and LTE Dynamic Power Sharing (LTE FDD).

1.3.2 MRFD-131222 UMTS and LTE Dynamic Power Sharing (LTE FDD)

Availability

This feature is available from SRAN13.1.

Summary

This feature enables the idle power of one radio access technology (RAT) to be temporarily allocated to another RAT for an improvement in user experience. This occurs as a result of an imbalance in the distribution of UMTS and LTE traffic or when the peak hours of UMTS and LTE spike fall in different periods of a single day.

During UMTS off-peak hours, UMTS shares its idle power with LTE. U2L power sharing improves the throughput of LTE UEs using the quadrature phase shift keying (QPSK) modulation scheme.

During LTE off-peak hours, LTE shares its idle power with UMTS. L2U power sharing improves the average throughput of a UMTS cell.

Benefits

This feature provides the following benefits:

- U2L power sharing improves the throughput of UEs using the QPSK modulation scheme in LTE cells, since these UEs are allocated the idle power of UMTS.
- L2U power sharing improves the throughput of HSDPA UEs, since the shared idle power of LTE is allocated to HSDPA UEs.

Description

This feature consists of U2L and L2U power sharing.

When UMTS and LTE share the same RF module, UMTS and LTE cells calculate their own power usage based on which peak and off-peak hours of UMTS and LTE cells can be determined.

- U2L power sharing

  During UMTS off-peak hours, UMTS limits the amount of power available to HSDPA services, and shares its idle power with LTE. The pilot power of LTE cells remains the same before and after U2L power sharing. After U2L power sharing, the throughput of LTE UEs using the QPSK modulation scheme improves, which may cause interference to adjacent cells.

  The actual gains provided by U2L power sharing on the live network are closely related to the traffic model. U2L power sharing can provide a large gain when UMTS traffic is low and LTE traffic is high.
- L2U power sharing

  During LTE off-peak hours, LTE limits the number of available RBs, and shares its idle power with UMTS. The pilot power of UMTS cells remains the same before and after

L2U power sharing. After L2U power sharing, the throughput of HSDPA UEs improves, which may cause interference to adjacent cells.

The actual gains provided by L2U power sharing on the live network are closely related to the traffic model. L2U power sharing can provide a large gain when LTE traffic is low and UMTS traffic is high.

This feature is applicable to the following scenarios:

- LTE and UMTS carriers share a power amplifier (PA) and are configured on each RRU channel. RRUs are not combined.
- LTE carriers do not use a 1.4 MHz or 3 MHz bandwidth.
- No NB-IoT carrier is configured on RRU channels.

Enhancement

None

Dependency

- Base station controller

  None
- Base station
  - Only the UMPT series main control boards support this feature.
  - Only the UBBPd series and UBBPe series baseband processing boards support this feature.
  - Only the RRU3962 and RRU5507 support this feature.
  - This feature is not applicable to combined RRUs.
  - This feature is not applicable to LTE carriers operating on a 1.4 MHz or 3 MHz bandwidth.
  - This feature supports 5 MHz, 10 MHz, 15 MHz, and 20 MHz LTE cells. In 5 MHz and 10 MHz LTE cells, LTE cannot share power to UMTS and can only use UMTS shared power.
- UE

  None
- Core network

  None
- Other NEs

  None
- Other features
  - Prerequisite features

    LCOFD-131311 Cross LTE Carriers Dynamic Power Sharing
  - Mutually exclusive features
    - LBFD-002022 Static Inter-Cell Interference Coordination
    - LBFD-00202201 Downlink Static Inter-Cell Interference Coordination
    - LOFD-001003 DL 4x2 MIMO
    - LOFD-001060 DL 4x4 MIMO
    - LOFD-060201 Adaptive Inter-Cell Interference Coordination

- LOFD-070208 Coordinated Scheduling based Power Control
- LOFD-081208 Inter-eNodeB SFN Based on Coordinated eNodeB
- LOFD-081209 Inter-eNodeB Adaptive SFN/SDMA Based on Coordinated eNodeB
- LOFD-081221 Super Combined Cell
- LOFD-001007 High Speed Mobility
- LOFD-001008 Ultra High Speed Mobility
- MRFD-231806 GSM and LTE Dynamic Power Sharing(LTE)
- MLBFD-120001 NB-IoT Network Deployment

- Others

  This feature must be simultaneously used with MRFD-131212 UMTS and LTE Dynamic Power Sharing (UMTS).

1.3.3 LCOFD-131311 Cross LTE Carriers Dynamic Power Sharing (LTE FDD)

Availability

This feature is:

- Available in macro eNodeBs as of eRAN13.1.
- Not available in micro eNodeBs.
- Not available in LampSite eNodeBs.

Summary

This feature enables TTI-level power sharing between LTE cells that share the same power amplifier (PA) channels of one RF module.

Benefits

This feature enables eNodeBs to determine the power usage of LTE cells sharing the same PA channels of one RF module in each TTI. If further data scheduling is required in a cell where all its bandwidth has been occupied, this cell can instantaneously share the power of idle cells, so that the transmit power of that cell exceeds its static power configuration. This is based on the fact that different cells do not have their bandwidths fully occupied at the same time. This feature improves power efficiency, increases cell edge user–perceived throughput, and mitigates instantaneous inter-cell load imbalance.

Description

LTE cells instantaneously have all their bandwidth occupied or change to idle mode. Different cells may not have their bandwidths fully occupied at the same time.

This feature enables instantaneous power coordination for multiple cells sharing the same PA channels of one RF module in each TTI, based on the preceding fact. If data transmission is required in a cell where no remaining power is available, this cell can instantaneously use the power of idle cells, so that the transmit power of that cell exceeds its static power configuration.

This feature does not increase the PA channel capability of the RF module. It increases user-perceived throughput by using power resources of idle cells for busy cells. Therefore, the sum of maximum transmit power of multiple power-sharing cells does not exceed the sum of their static power configurations.

This feature applies to cells with insufficient instantaneous power due to their limited static power configurations. In these cells, further data transmission is required after scheduling. This feature enables a carrier with heavy instantaneous traffic to use the remaining power of other carriers. This is based on the fact that the instantaneous power usage is imbalanced among LTE carriers with different services. This feature increases both the average cell throughput and downlink edge-user-perceived throughput.

Enhancement

None

Dependency

- Base station controller
  None
- eNodeB
  - MPT: The UMPT or later board is required.
  - BBP: The UBBPd, UBBPe, or later board is required.
  - RF module: RRU5507, RRU3962, and RRU5501
- UE
  None
- Core network
  None
- Other NEs
  None
- Other features
  - Prerequisite features: None
  - Mutually exclusive features:
    - LOFD-060201 Adaptive Inter-Cell Interference Coordination
    - LOFD-070208 Coordinated Scheduling based Power Control
    - LOFD-081208 Inter-eNodeB SFN Based on Coordinated eNodeB
    - LOFD-081209 Inter-eNodeB Adaptive SFN/SDMA Based on Coordinated eNodeB
    - LOFD-001007 High Speed Mobility
    - LOFD-001008 Ultra High Speed Mobility
    - LOFD-081221 Super Combined Cell
    - MRFD-231806 GSM and LTE Dynamic Power Sharing(LTE)

1.3.4 TDLCOFD-131311 Cross LTE Carriers Dynamic Power Sharing (LTE TDD)

Availability

This feature is:

- Available in macro eNodeBs as of LTE TDD eRAN13.1.
- Not available in micro eNodeBs.
- Not available in LampSite eNodeBs.

Summary

Dynamic Power Sharing Between Carriers enables TTI-level power sharing between LTE cells that share the same power amplifier (PA) channels of one RF module.

Benefits

This feature enables eNodeBs to determine the power usage of LTE cells sharing the same PA channels of one RF module in each TTI. If further data scheduling is required in a cell where all its bandwidth has been occupied, this cell can instantaneously share the power of idle cells, so that the transmit power of that cell exceeds its static power configuration. This is based on the fact that different cells do not have their bandwidths fully occupied at the same time. This feature improves power efficiency, increases user-perceived throughput, and mitigates inter-cell imbalance in instantaneous loads.

Description

LTE cells instantaneously have all their bandwidth occupied or change to idle mode. In addition, different cells do not have their bandwidths fully occupied at the same time.

This feature enables instantaneous power coordination for multiple cells sharing the same PA channels of one RF module in each TTI, based on the preceding fact. If data transmission is required in a cell where no remaining power is available, this cell can instantaneously use the power of idle cells, so that the transmit power of that cell exceeds its static power configuration.

Power sharing does not increase the PA channel capability of the RF module. It increases user-perceived throughput by using power resources of idle cells for busy cells. Therefore, the sum of maximum transmit power of multiple power-sharing cells is equal to the sum of their static power configurations.

This feature applies to cells with insufficient instantaneous power due to their limited static power configurations. That is, further data transmission is required in the cells after scheduling. This feature enables the carrier with heavy instantaneous traffic to use the remaining power of other carriers. This is based on the fact that the instantaneous power usage is imbalanced among LTE carriers with different services. Therefore, both the network throughput and user-perceived throughput are increased.

Enhancement

None

Dependency

- eNodeB
  The UBBP is required. The RF module must be an RRU3257 or RRU3279.
- UE
  The UE complies with 3GPP Release 8 or later.
- Transport network
  None
- Core network
  None
- OSS
  None
- Other features
  This feature does not require other features.
- Mutually exclusive features
  This feature does not work with the following features:
  - TDLBFD-00202201 Downlink Static Inter-Cell Interference Coordination
  - TDLOFD-060201 Adaptive Inter-Cell Interference Coordination
  - TDLOFD-080203 Coordinated Scheduling based Power Control
  - TDLOFD-001080 Inter-eNodeB SFN Based on Coordinated eNodeB
  - TDLOFD-001082 Inter-eNodeB Adaptive SFN/SDMA Based on Coordinated eNodeB
  - TDLOFD-001007 High Speed Mobility
  - TDLBFD-110103 Soft Split Resource Duplex
  - TDLEOFD-130501 Inter-Cell DL D-MIMO
- Others
  None

1.4 LTE High and Low Band Coordination

1.4.1 LCOFD-131312 LTE Spectrum Coordination (LTE FDD)

Availability

This feature is:

- Available in macro eNodeBs as of eRAN13.1.
- Available in micro eNodeBs (BTS3911E and BTS3912E) as of eRAN13.1.
- Available in LampSite eNodeBs as of eRAN13.1.

Summary

For a CA UE located a medium or long distance from the cell center, its downlink data rate may not reach the expected value because of radio interface limitation in the uplink on the high-frequency component carrier (CC) of the UE. This feature changes the PCC of the CA UE from the high-frequency carrier to a low-frequency one based on uplink channel quality, so that the downlink channels on the high-frequency carrier can continue to be used for the UE. This maintains the downlink data rate of the UE and improves user experience.

Benefits

On a multi-band LTE network, this feature takes effect on CA UEs located at the uplink coverage edge of high LTE frequencies, which usually encounter uplink usage limitation while downlink is still available. It increases the downlink usage of high frequencies for these CA UEs and the downlink data rates of them.

Description

When an eNodeB finds that the uplink SINR on the PCC of a CA UE is poor, the eNodeB evaluates whether any SCC of the UE can provide better uplink performance. If an SCC can provide better uplink performance, the eNodeB hands over the UE from the PCC to the SCC, configures the original SCC as a new PCC, and configures the original PCC as a new SCC.

Enhancement

None

Dependency

- eNodeB
  - BBP: LBBPc is incompatible with this feature.
- eCoordinator
  None
- UE
  CA must be supported.
- Core network
  None
- Other NEs
  None
- Prerequisite features
  LAOFD-001001 LTE-A Introduction
- Mutually exclusive features
  None
- Others
  None

1.4.2 TDLCOFD-131312 LTE Spectrum Coordination (LTE TDD)

Availability

This feature is:

- Available in macro eNodeBs as of LTE TDD eRAN13.1.

- Available in LampSite eNodeBs as of LTE TDD eRAN13.1.
- Available in micro eNodeBs as of LTE TDD eRAN13.1.

Summary

In LTE networks with both high and low frequency bands, this feature exchanges the high-frequency primary component carrier (PCC) and a low-frequency secondary component carrier (SCC) for a carrier aggregation (CA) UE to increase downlink RB usage of the original PCC. This feature takes effect on CA UEs located at the uplink coverage edge of high LTE frequencies, which usually encounter uplink usage limitation while downlink is still available. This limitation may even affect the deployment of high frequencies.

Benefits

This feature offers the following benefits to the LTE networks deployed with both high and low frequency bands:

- Increases the uplink and downlink RB usage of cells.
- Increases the uplink and downlink data rates of cell-edge CA UEs.

Description

When an eNodeB finds that the uplink SINR on the PCC of a CA UE is poor, the eNodeB evaluates whether any SCC of the UE can provide better uplink performance. If an SCC can provide better uplink performance, the eNodeB hands over the UE from the PCC to the SCC so that the original SCC acts as a new PCC, and then the eNodeB configures the original PCC as a new SCC.

Enhancement

None

Dependency

- eNodeB
  None
- UE
  CA is supported.
- Transport network
  None
- Core network
  None
- OSS
  None
- Other features
  This feature requires TDLAOFD-001001 LTE-A Introduction to be activated.
- Mutually exclusive features
  None
- Others

None

2 Acronyms and Abbreviations

Acronyms and Abbreviations	Expansion
E	Enhanced feature
M	Maintenance (No change)
N	New added feature
3G	3 rd Generation Mobile Communication System
3GPP	3rd Generation Partnership Project
AMR	Adaptive Multi-Rate
Abis	Abis Interface
BBU	Baseband Control Unit
BSC	Base Station Controller
CME	Control Management Entity
CN	Core Network
FE	Fast Ethernet
GE	Gigabit Ethernet
GERAN	GSM/EDGE Radio Access Network
GSM	Global System For Mobile Communication
HCS	Hierarchical Cell Structure
LDR	Load Reshuffling
LMPT	LTE Main Processing Transmission unit
Iub	Iub Interface
LTE	Long Term Evolution
MIMO	Multi-Input Multi-Output

Acronyms and Abbreviations	Expansion
NACC	Network Assisted Cell Change
PHB	Per-Hop-Behavior
QoS	Quality of Service
RAB	Radio Access Bearer
RAN	Radio Access Network
RIM	Radio Information Manager
RNC	WCDMA Radio Network Controller
RRC	Radio Resource Connection
SGSN	Serving GPRS Support Node
SRAN	Single Radio Access Network
TDM	Time Division Multiple Access
UMTS	Universal Mobile Telecommunications System
UE	User Equipment
WCDMA	Wideband CDMA
WMPT	WCDMA Main Processing Transmission unit