**3GPP TSG-RAN WG4 Meeting # 104-e R4-22XXXXX**

**Electronic Meeting, 15– 26 August 2022**

**Agenda item:** 12.4.5

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Email discussion summary for [104-e][128] LTE\_terr\_bcast\_bands\_UERF

**Document for:** Information

# Introduction

This document summarizes the email discussion for the following agenda items

* + 1. General and work plan [LTE\_terr\_bcast\_bands\_part2-Core]
		2. Band definition and system parameters [LTE\_terr\_bcast\_bands\_part2-Core]
		3. UE RF requirement maintenance [LTE\_terr\_bcast\_bands\_part2-Core]

for the Rel-18 work item on 5G Broadcast (RP-220518). Discussion of basestation Tx requirements is treated in thread 316 including Proposal 3 in documents R4-2211555, R4-2211981, R4-2211982, and R4-2212099 and Proposal 3 in R4-2211585. This document is organized by the following topics: system parameters, band definition, and UE RF requirements.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Qualcomm Incorporated | Gene Fong | gfong@qti.qualcomm.com |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2211555**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211555.zip) | SWR | Proposal 1:RAN4 to define a new band type for independent downlink-only transmissions.Proposal 2:RAN4 to define a band for LTE based 5G Terrestrial Broadcast covering the spectrum range 470 – 698 MHz to be used in terms of 6, 7 or 8 MHz carrier bandwidth.Proposal 3 is treated in thread 316.  |
| [**R4-2211585**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211585.zip) | ROHDE & SCHWARZ | Proposal 1: Define the band 5B0 (470 – 698 MHz) for LTE based 5G Terrestrial Broadcast with bandwidths possibilities of 6, 7 and 8 MHz in respect to ITU recommendations as well as regional and local regulations within different ITU regions.Proposal 2: Define a new band type Supplementary Downlink Only (SDO) to be used for LTE based 5G Terrestrial Broadcast.Proposal 3 is treated in thread 316. |
| [**R4-2211981**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211981.zip) | Cellnex | Proposal 1:RAN4 to define a new band type for independent downlink-only transmissions.Proposal 2:RAN4 to define a band for LTE based 5G Terrestrial Broadcast covering the spectrum range 470 – 698 MHz to be used in terms of 6, 7 or 8 MHz carrier bandwidth.Proposal 3 is treated in thread 316.  |
| [**R4-2211982**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211982.zip) | BNE | Proposal 1:RAN4 to define a new band type for independent downlink-only transmissions.Proposal 2:RAN4 to define a band for LTE based 5G Terrestrial Broadcast covering the spectrum range 470 – 698 MHz to be used in terms of 6, 7 or 8 MHz carrier bandwidth.Proposal 3 is treated in thread 316.  |
| **[R4-2212071](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212071.zip%22%20%5Ct%20%22_parent)** | Nokia, Nokia Shanghai Bell | Observation 1: Reference standards and regulations for this work item are for DTT transmission, which is different from the ones for cellular systems.Observation 2: Although the coexistence study is not in the scope of this work item, at least the network deployment assumption needs to be studied w.r.t. whether the existing general UE and BS RF requirements for legacy bands can be reused for this new band or not. |
| [**R4-2212072**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212072.zip) | Nokia, Nokia Shanghai Bell | Proposal 1: It is proposed to specify a new band(s) clearly distinguished from other conventional cellular bands in RAN4 specifications.Proposal 2: It is further discussed whether RAN4 can specify a harmonized band for all the regions.Proposal 3: It is further discussed where and how to define operating bands in the existing specifications.Observation 1: FDD duplex mode can be used for this new band used only for a MBMS dedicated cell.Proposal 4: Spectrum utilization 90% is specified in TS 36.101 and TS 36.104.Observation 2: There is no specific requirement for channel spacing.Proposal 5: 100 kHz channel raster is proposed for LTE based 5G broadcast band(s). It is FFS if only valid channel location is explicitly clarified in the specifications for each channel bandwidth.Proposal 6: Once we agree how many bands are specified, operating band number(s) next to the one for NR\_600MHz\_APT is(are) reserved for LTE based 5G broadcast band(s).Observation 3: E-ARFCN after 70655 is available for LTE\_TDD\_1670\_1675MHz and LTE based 5G broadcast band(s), which need to be coordinated among the WIs. |
| [**R4-2212073**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212073.zip) | Nokia, Nokia Shanghai Bell | Observation 1: The band is downlink only and is used for MBMS dedicated cell.Observation: UE receiver RF requirement needs to be specified without the help of uplink or other simultaneous 3GPP bands.Observation 2: UE receiver requirements, such as maximum input level, adjacent channel selectivity (ACS) and blocking characteristics (in-band, out-of-band) need to be evaluated for the DTT deployment scenarios.Proposal 1: It is further discussed how to specify UE RF requirement for MBMS dedicated band considering the test aspects.Proposal 2: The impact of mismatched channel bandwidth and channel filter bandwidth shall be further studied w.r.t. the impact of ACI if it can provide sufficient ACS. |
| [**R4-2212099**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212099.zip) | TDF | Proposal 1:RAN4 to define a new band type for independent downlink-only transmissions.Proposal 2:RAN4 to define a band for LTE based 5G Terrestrial Broadcast covering the spectrum range 470 – 698 MHz to be used in terms of 6, 7 or 8 MHz carrier bandwidth.Proposal 3 is treated in thread 316.  |
| [**R4-2213698**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213698.zip) | ZTE Corporation | Proposal 1: to further discuss the highest frequency of LTE based broadcast with regional regulators. Proposal 2: to define the lowest frequency of LTE based broadcast as 470MHz;Proposal 3: the band number for LTE based broadcast could be 105 or 106 which depends on the ongoing discussion in Rel-18.Proposal 4: to define the duplex mode of LTE based broadcast band as DL only.Proposal 5: to follow the Rel-17 agreement for transmission bandwidth configuration for 6/7/8MHz.Proposal 6: to follow the existing channel spacing for LTE base broadcast or not to define channel spacing for LTE based broadcast.Proposal 7: use the carrier based approach to define the channel raster for LTE based broadcast with its granularity as 100kHz. |
| [**R4-2214002**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2214002.zip) | Qualcomm Incorporated | Observation 1: 5G terrestrial broadcast may need new broadcast dedicated RF requirementsObservation 2: 5G terrestrial broadcast system does not have uplink but receiver performance can still be tested with the aid of application layer. Mapping of BLER metric to core RF requirements on throughput needs further discussion. Observation 3: New FRC’s are needed for Rel-18 5G terrestrial broadcast RF performance requirements. Observation 4: Regulatory documents indicated in the WID should be reviewed for possible inclusion into the 3GPP specifications. Not all of the documents are freely available within the public domain.Proposal 1: How to handle 6, 7 and 8 MHz bandwidth in the specifications should be coordinated between UE and BS specifications. Proposal 2: Two options are blocker placement shall be considered. The first is according to 10 MHz LTE channelization and the second is specific blocker placement according to 6, 7, and 8 MHz broadcast channelization. The power levels are still to be studied, but should take into consideration the assumption of coordination between nearby broadcast transmitters.Proposal 3: Discuss whether the same reference sensitivity as LTE 10 MHz can apply for bandwidths of 6, 7, and 7 MHz in broadcast bands, whether it can be scaled to bandwidth, or whether more detailed study is warranted. |

# Topic #1: System parameters

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Open issues summary

The following open issues have been identified and presented in company contributions

Sub-topic 1-1 Coexistence

Sub-topic 1-2 New band type

Sub-topic 1-3 Channel bandwidths

Sub-topic 1-4 Channel spacing and channel raster

Sub-topic 1-5 Spectrum utilization

### Sub-topic 1-1 Coexistence

Aspects related to system parameters was discussed in a number of papers. It was recognized by all companies that the WID indicates coordination between systems operating in the same geography is expected

The operation and planning of transmitters in these bands is different from cellular. In most cases, coordination mechanisms are in place so that when a new transmitter is proposed to be deployed in a given region, appropriate measures are taken (e.g. in terms of specific requirements for that transmitter, or usage of guard channels) to ensure coexistence with other systems in the same geography.

Nonetheless, Nokia in R4-2212071 proposes that the HPHT deployment was not the scenario studied in 3GPP when the general coexistence parameters were derived and when MBMS was specified. Therefore, before applying the general coexistence parameters (ACLR, ACS, etc), some study should first be conducted. On the other hand, ZTE in R4-2213699 (treated in thread 316) agrees that currently TN BS is not applicable for HPHT scenario. However, for how to protect the DTT service, there were some discussions in the past e.g., Band 20 or Band n71 (9 MHz guard band) and its coexistence requirement were also captured in BS spec. ZTE suggest to follow the legacy regulatory requirement instead of further do the evaluation study again.

**Issue 1-1: Coexistence**

* Is a coexistence study for HPHT deployment needed?
	+ Option 1: Yes
	+ Option 2: No
* Recommended WF
	+ Discuss in the first round.

### Sub-topic 1-2 New band type

It was recognized that the existing band types FDD, TDD, SDL are not well suited for the 5G broadcast band(s) and that a new type should be created. It was also suggested that a new suffix could be used to capture the specific requirements related to these downlink-only bands.

If there is a new band type created, is there any impact to other specifications in other working groups?

**Issue 1-2: New band type**

* Is a new band type needed?
	+ Option 1: Yes
	+ Option 2: No
* Recommended WF
	+ If the answer is Yes, then please also comment whether there is impact to other WG’s
	+ If the answer is No, then please comment on how existing band types could be used

### Sub-topic 1-3 Channel bandwidths

The bandwidths allocated for broadcast in the UHF band are 6, 7, and 8 MHz depending on the region. However, LTE specifications only define bandwidths of 1.4, 3, 5, 10, 15, and 20 MHz. One option is to explicitly define new 6, 7, and 8 MHz channels (recognizing on the UE side that new filters should not necessarily be assumed). The other option is to reuse the existing bandwidths, perhaps taking into account some of the ideas explored in the NR study item on efficient use of non-standard bandwidths.

**Issue 1-3: Channel bandwidths**

* How should the channel bandwidths be handled?
	+ Option 1: New channel bandwidths 6, 7, and 8 MHz are defined in both BS and UE specifications, applicable only to the 5G broadcast bands. It is recognized that the UE will not necessarily incorporate a new filter, rather only the existing 10 MHz filter should be assumed.
	+ Option 2: The existing LTE bandwidths are used to cover the 5G broadcast channels.
	+ Option 3: Other solutions?
* Recommended WF
	+ Based on the contributions submitted, companies seem to recommend option 1 but all options can be discussed in the first round.

### Sub-topic 1-4 Channel spacing and channel raster

The conventional channel raster resolution for LTE is 100 kHz. However, the broadcast channelization for the UHF band is fixed for 6, 7, or 8 MHz channels.

**Issue 1-4: Channel spacing and channel raster**

* How should the channel spacing and channel raster be handled?
	+ Option 1: Maintain the 100 kHz channel raster for generality. Some channel raster points may not be used.
	+ Option 2: Downsample the channel raster to 3 sets of possibilities, for 6, 7, and 8 MHz channelizations.
* Recommended WF
	+ Decide between the two options for channelization stating the reason for your preference

### Sub-topic 1-5 Spectrum utilization

Table 2.3.1-1: Maximum transmission bandwidth configurations for MBMS

|  |  |  |  |
| --- | --- | --- | --- |
| Bandwidth | 6 MHz | 7 MHz | 8 MHz |
| NRB | 30 | 35 | 40 |

**Issue 1-5: Spectrum utilization**

* + Any concerns with the above? Any other aspect that needs consideration?

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1 Coexistence

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2 New band type

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-3 Channel bandwidths

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-4 Channel spacing and channel raster

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-5 Spectrum utilization

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1-1 Coexistence** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #1-2 New band type** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #1-3 Channel bandwidths** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #1-4 Channel spacing and channel raster** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #1-5 Spectrum utilization** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

## Discussion on 2nd round (if applicable)

# Topic #2: Band definition

## Open issues summary

One of the objectives of the WID RP-220518 is to specify band(s) within the UHF spectrum allocated to broadcast systems (~470 - ~694/698 MHz, depending on the region). A number of contributions provided suggestions on the number of bands, the lower edge, and the upper edge of such bands.

Some options to consider include

1. Single global band from 470 – XXX MHz defined for 6, 7, and 8 MHz bandwidths
2. Three bands from 470 – XXX MHz with one band for 6 MHz bandwidth, one band for 7 MHz bandwidth, and one band for 8 MHz bandwidth. Each of these bands would be intended for deployment in regions compatible with the defined channel bandwidth.

The advantage of a single band is a single common ecosystem and global roaming. The disadvantage of a single band is the filter implementation would be expected to cover the entire superset band, therefore not able to provide any rejection in countries where only a portion of the band (i.e., only up to 694 MHz) is available. The advantage of three separate bands is the filter can be tailored to 694, 698, or 702 MHz for example. But the ecosystem is fragmented regionally since it is unlikely that a single device will implement all three bands with three distinct filters.

Another consideration is the current state-of-the-art filter technology may not support a single wideband filter across the entire UHF frequency range. Hence, split filters may be required. Technical data is welcomed.

Some companies proposed Band 105 or 106 for this band and EARFCN range, but the moderator proposes that such details can be resolved in later meetings after the number of bands and basic system parameters have been agreed.

### Sub-topic 2-1 Number of bands

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 2-1: Number of bands**

* Proposals
	+ Option 1: Single global band from 470 – XXX MHz defined for 6, 7, and 8 MHz bandwidths
	+ Option 2: Three bands from 470 – XXX MHz with one band for 6 MHz bandwidth, one band for 7 MHz bandwidth, and one band for 8 MHz bandwidth. Each of these bands would be intended for deployment in regions compatible with the defined channel bandwidth.
	+ Option 3: Other
* Recommended WF
	+ Discuss options in the first round

### Sub-topic 2-2 Frequency range

**Issue 2-2: Frequency range**

* Proposals
	+ Option 1: Lower edge is 470 MHz, upper edge is TBD
	+ Option 2: Lower edge is TBD, upper edge is TBD
* Recommended WF
	+ Discuss options in the first round, though there may be a dependency on the number of bands Issue 2-1.

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1 Number of bands

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 2-2 Frequency range

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#2-1 Number of bands** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #2-2 Frequency range** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #3: UE RF requirements

## Open issues summary

Two papers from Nokia R4-2212073 and Qualcomm R4-2214002 were submitted to the sub-agenda on UE RF requirements. It was recognized in both papers that the 5G broadcast is expected to operate in a standalone downlink-only configuration. Thus, UE Tx requirements are not applicable but moreover, UE uplink in this band or any other band is not available to verify UE Rx requirements. Both Nokia and Qualcomm stated that current LTE MBMS only specifies performance requirements and there may be a need to map performance requirements to core RF requirements. However, details are not provided. The two papers also indicate that additional requirements for 5G broadcast such as maximum input level, ACS, blocking should be evaluated in the context of HPHT deployment scenarios. Lastly, both papers also describe the need to assess the impact of a UE 10 MHz Rx filter for channels that are fundamentally spaced by 6, 7, and 8 MHz. Qualcomm discusses reference sensitivity and presents options to reuse the same reference sensitivity as Band 71, to scale with bandwidth, or to further analyze the expected front-end losses and noise.

### Sub-topic 3-1 Core requirement verification

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 3-1: Core requirement verification**

* Proposals
	+ Option 1: In the absence of uplink, core requirements can be indirectly verified by performance (BLER) tests, but the mapping is TBD.
	+ Option 2: New requirements or methods should be developed to verify the RF core requirements.
	+ Option 3: Other
* Recommended WF
	+ Discuss the options. Although details are scant at this time, comments and suggestions are welcomed.

### Sub-topic 3-2 ACS and blocker placement

**Issue 3-2: ACS and blocker placement**

* Proposals
	+ Option 1: Specify ACS and blocking by the conventional LTE blocker placement for a 10 MHz channel.
	+ Option 2: Specify ACS and blocking according to 6, 7, and 8 MHz channelization, but UE filter is assumed to be 10 MHz wide.
	+ Option 3: Other
* Recommended WF
	+ TBA

### Sub-topic 3-2 Reference sensitivity

**Issue 3-3: Reference sensitivity**

* Proposals
	+ Option 1: Same as Band 71 10 MHz refsens
	+ Option 2: Band 71 10 MHz refsens scaled to 6, 7, and 8 MHz
	+ Option 3: More study is needed including expected FE losses and noise
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 3-1 Core requirement verification

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 3-2 ACS and blocker placement

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

 Sub topic 3-3 Reference sensitivity

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#3-1 Core requirement verification** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #3-2 ACS and blocker placement** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #3-3 Reference sensitivity** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-2211555 |  | BS requirements for 5G terrestrial broadcast | SWR |  |  |
| R4-2211585 |  | Discussion on Introduction of new bands and bandwidth allocation for LTE based 5G terrestrial broadcast | ROHDE & SCHWARZ |  |  |
| R4-2211981 |  | BS requirements for 5G terrestrial broadcast | Cellnex |  |  |
| R4-2211982 |  | BS requirements for 5G terrestrial broadcast | BNE |  |  |
| R4-2212071 |  | New bands and bandwidth allocation for LTE based 5G broadcast; general scope of the work item | Nokia, Nokia Shanghai Bell |  |  |
| R4-2212072 |  | LTE based 5G broadcast; general approach, specification impacts, band definition and system parameters | Nokia, Nokia Shanghai Bell |  |  |
| R4-2212073 |  | LTE based 5G broadcast; general approach for UE RF | Nokia, Nokia Shanghai Bell |  |  |
| R4-2212099 |  | BS requirements for 5G terrestrial broadcast  | TDF |  |  |
| R4-2213698 |  | Discussion on system parameters for LTE based broadcast | ZTE Corporation |  |  |
| R4-2214002 |  | UE requirements for 5G terrestrial broadcast | Qualcomm Incorporated |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents