



## **Submission to RSM’s “Discussion document: Technical Arrangement of the 3.5GHz Band – June 2019”**

### **Executive summary**

Huawei New Zealand welcomes the opportunity to respond to RSM “*Discussion document: Technical Arrangement of the 3.5GHz Band*” (referred to as the *RSM Discussion Document* in the rest of this document) released in June 2019. This *RSM discussion document* sets out some co-existence rules and technical requirements for operating in the 3.5GHz band. It proposes Time Division Duplex (TDD) mode for 3.5GHz band, a set frame structure to be unanimously adopted by operators, the process of changing the frame structure, and the 3GPP specification based unwanted emission masks being used in creating the management right spectrum.

The overall principles outlined in the *RSM Discussion Document* primarily align with the regulatory frameworks set up by many regions and nations where 3.5GHz has been either allocated or in imminent allocation, although more technical specifications need to be detailed in preparation for the 3.5GHz allocation in New Zealand.

In this submission, Huawei New Zealand responds to a number of questions raised in the RSM Discussion Document. Huawei New Zealand offers the following for RSM consideration,

1. All operators, whether national or regional, being allocated with TDD spectrums in 3.5GHz, need to have their networks synchronized in the same time domain and on the same frame structure to mitigate harmful interference, and
2. Accurate and robust clock source(s) need to be used to allow for continuous time synchronisation amongst networks;
3. The unwanted emission requirements on each management right spectrum to be allocated in 3.5GHz must be specified;
4. Huawei New Zealand would like to draw RSM’s attention to the studies and conclusions drawn by 3GPP and ECC that “*They (EIRP) are not suitable and cannot be applied to 4G and 5G MFCN AAS base stations with integrated antenna arrays*”. Huawei New Zealand agrees with this conclusion, and suggest RSM to consider the following metrics as part of the term and conditions must be met in the spectrum allocation and/or in creating each regulatory management right spectrum in the 3.5GHz band,

- 4.1 For BS Type 1-C, Equivalent Isotropically Radiated Power (EIRP) is used as the metric to measure the Operating band unwanted emissions(OBUE) and spurious emission, and
- 4.2 For BS Type 1-O, Total Radiated Power (TRP) is used as the metric to measure the OBUE and spurious emission;
5. We welcome RSM's adoption of 3GPP specifications in defining the emission masks, and
6. Should RSM intend to set emission requirements more stringent than 3GPP's, we recommend RSM to consider Ofcom(UK)'s relevant requirements as the alternative.

The above summary is addressed to Radio Spectrum Management New Zealand.

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## Responses

*Question 1: Do you agree with the proposed rules of co-existence and the process of change?*

*Question 2: Do you have any additional comments about the process?*

Response:

All operators, whether national or regional, that will be allocated with the TDD mode 3.5GHz spectrums (i.e., 3410~3800MHz) need to deploy their networks synchronized in the same time domain and operate on the same 5G frame structure in order to mitigate mutual uplink-and-downlink interference,.

Continuous time synchronisation is of key importance to reduce the intra-band uplink-and-downlink interferences. Accurate and robust clock source(s) need to be used by all participating operators to allow for rigorous network synchronization in the same time domain. The crystal oscillator used by the clock source should have a resolution equal or better than 0.05ppm (where ppm stands for parts per million), and the time synchronisation should have a deviation equal or better than +/-1.5us.

Huawei New Zealand has no comment on the proposed rules of co-existence and the process of change. Huawei New Zealand recommends the compliance team of RSM to take proper measures to enforce the time synchronization amongst all the participating operators.

Huawei New Zealand is given the impression by this *Discussion Document* that, for each management right licence to be created in the 3.5GHz band an emission mask will be created, assuming the synchronisation solution being deployed on all the networks operating in this band. These emission masks are necessary to prevent excessive inference from a base station transceiver to a terminal receiver operating on adjacent spectrum.

Equipment manufacturers need to make available cellular base station devices that conform to the emission mask requirements, and thus the emission specifications are of the interests to Huawei New Zealand.

RSM may refer to the methodologies adopted by the Electronic Communications Committee (ECC) in its report ECC Report 281 [1] in specifying the emission masks for the management right spectrum licences.

In the ECC Report 281 the emission requirements are specified in the term of block edge mask (BEM) for the synchronised scenario. For the unsynchronized scenario, the process of change proposed in the RSM Discussion Document will suffice.

Huawei New Zealand will response in more details to the calculation methodology for the emission masks later in this document.

Huawei New Zealand raises two concern below and seek for RSM's answers.

In the sub-clause “2. Rules of co-existence and process for change”, it states that “If such harmful interference is proven and...” We would like to understand how such harmful interference is quantified. Does it mean any interference becomes harmful when it exceeds the defined emission mask? If so, it becomes a ‘must’ to define these masks for each spectrum block in the upcoming allocation.

In the same sub-clause it also states, in the second and last paragraph from the bottom of Page 6, “all operators in this band”. Would the ministry clarify whether “all operators” refer exclusively to the national MNOs, or the spectrum occupiers?

*Question 3: Do you agree with the proposed frame structure?*

*Question 4: Do you agree with the proposed arrangement for the special slot?*

*Question 5: Do you agree with the process for defining the start of the TDD frame for the first time?*

*Question 6: Do you agree with the proposed solution for a synchronisation source and timing alignment?*

Response:

The hardware and software products Huawei New Zealand can make available to New Zealand markets are in conformance to the set 5G frame structure.

Huawei New Zealand can also make available hardware and software to allow for the proposed solution for a synchronisation source and clock timing alignment.

*Question 7: Do you agree with the calculation methodology for the unwanted emission mask, particularly the choice of the nominal antenna gain?*

*Question 8: Do you agree with the choice of EIRP over the TRP?*

*Question 9: Do you have any other comments regarding the out-of-band emission mask?*

Response:

By convention an emission mask is specified for each incumbent management right spectrum, for example 3GPP Band 9 (900MHz) and Band 28 (APT700MHz), etc. Thus we presume the emission mask will be specified for each management right spectrum in the upcoming 3.5GHz band allocation.

In Section 4 of the RSM Discussion Document the emission mask calculation methods were tabled for discussion for the 3GPP BS Type 1-H and Type 1-O.

In 3GPP TS38.104 [2] three types of Base Station (BS) are described that may be relevant to 3.5GHz band, i.e., BS Type 1-C, BS Type 1-H and BS Type 1-O. The 5G Type 1-C BS is implemented in the form of Remote Radio Unit (RRU) by Huawei. And Huawei’s commercial 5G Active Antenna Units (AAU) can be best described as BS Type 1-O. The AAUs of Huawei that may be best described as Type 1-H BS is for research and testing purpose in laboratory environment.

Huawei New Zealand suggests RSM to consider the following metrics to be used in the spectrum allocation and/or in creating each regulatory management right spectrum in the 3.5GHz band,

1. For BS Type 1-C, use Equivalent Isotropically Radiated Power (EIRP) as the metric to measure the Operating band unwanted emissions (OBUE) and spurious emission;
2. For BS Type 1-O, use Total Radiated Power (TRP) as the metric to measure the OBUE and spurious emission. The relevant key reasons are discussed below.

3GPP RAN4 investigated extensively the relationship of EIRP and TRP in measuring the unwanted emissions to victim systems. Relevant studies are documented in [1][3]. The investigation results were reviewed and adopted by ECC as per its Report 281 where it is stated that “ECC Report 203 and defined in the ECC/DEC/(11)06 (rev. 2014) are applicable for 3G/4G MFCN and fixed wireless access networks which do not use AAS antennas, but *they are not suitable and cannot be applied to 4G and 5G MFCN AAS base stations with integrated antenna arrays.*” The European Conference of Postal and Telecommunications Administrations (CEPT) in its latest decision EC 235 (2019) [4] uses TRP as the metric in specifying the emission requirements on Active Antenna System (AAS).

Huawei New Zealand is aware that the above two recommendations are aligned with the policies recently made by the UK regulator Ofcom [5], the Korean Regulator MIST [6] and the Deutschland regulator Bundesnetzagentur [7].

The 5G 3.5GHz band RRU and AAU modules that Huawei make available to New Zealand are in conformance to the conducted and radiated requirements specified by 3GPP TS38.104 (v15.5.0). We may also make available to the New Zealand market the radio products in conformance to the Ofcom (UK regulator) emission requirements. Ofcom emission specifications are more stringent than 3GPP’s. We will discuss in more details later in this paper.

Huawei New Zealand makes the assumption that there will be no maximum power set out within in the permitted frequency block of each management right licence. This is consistent with the practice of spectrum allocation by RSM in the past.

*Question 10: Do you agree with the technical compatibility analysis between the amateur operation in 3300-3410 MHz and 5G (or compatible technology) in the 3.5 GHz band?*

*Question 11: Do you agree with the technical compatibility analysis between SRD operation in 2900-3400 MHz and 5G (or compatible technology) in the 3.5 GHz band?*

*Question 12: Do you agree with the arrangement for satellite services in the frequency range 3800-3840 MHz?*

Response:

Huawei New Zealand makes available to the New Zealand market 5G NR AAU modules in full conformance to the relevant emission specifications in 3GPP TS38.104 (v15.5.0).

Huawei New Zealand is aware that the spectrum considered by RSM in the future allocation sits in the range between 3410MHz and 3800MHz. This range coincides with the C-band allocation made by Ofcom UK. Ofcom UK imposes stringent emission requirements, in particular on the spectrum lower than 3410MHz as per Table 5&6 in [5] in prevention of interfering to military radar systems. Ofcom's emission requirements on the range from 3800MHz upwards are close to 3GPP's as per Table 5&6 in [5]. These two tables are shown in Annex A to this response document.

The adoption of Ofcom stringent BEM specifications have many advantages. It prevents the introduction of harmful interference from the 5G cellular base stations to any non-3GPP radio systems or asynchronised 3GPP systems using the spectrum blocks on either side outside the 3410MHz to 3800MHz spectrum. Clear specifications are set out for each BEM, and these values may be adopted straightforwardly. Mainstream vendors are committed to conform to these BEM specifications and create health supporting eco-systems.

Huawei makes available to New Zealand market 5G NR AAU modules of emission properties in conformance to Ofcom UK emission requirements.

*Question 13: Do you agree that operators should be permitted to choose to not follow these technical principles as long as no harmful interference is caused to their adjacent operators?*

*Question 14: Do you agree that the same technical principles should be imposed throughout the 3.5 GHz band?*

Response:

No Comment.

## Reference list

- [1] ECC Report 281, July 2018, <https://www.ecodocdb.dk/document/3360>;
- [2] 3GPP TS38.104, v15.5.0, NR; Base Station (BS) radio transmission and reception, March 2019;
- [3] 3GPP TdocR4-1802154, LS (R4-1801423) on revision of ERC Recommendation 74-01, on unwanted emissions in the spurious domain from CEPT/ECC WG SE;
- [4] CEPT, Commission Implementation Decision (EU) 235, 2019.
- [5] Ofcom “Variation of Spectrum Access licences in the 3400 to 3680 MHz band”, [https://www.ofcom.org.uk/data/assets/pdf\\_file/0025/144880/notice-proposal-vary-3.4-ghz-radio-spectrum-licences.pdf](https://www.ofcom.org.uk/data/assets/pdf_file/0025/144880/notice-proposal-vary-3.4-ghz-radio-spectrum-licences.pdf)
- [6] Korean MIST 5G Frequency Regulation, 전기통신사업용무선설비의기술기준일부개정(안)\_최종본, 25<sup>th</sup> July 2018;
- [7] Bundesnetzagentur, President's Chamber decision of 14 May 2018 on the order for and choice of proceedings for the award of spectrum in the 2 GHz and 3.6 GHz bands for mobile/fixed communication networks (MFCN), May 2018, [https://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/Areas/Telecommunications/Companies/TelecomRegulation/FrequencyManagement/ElectronicCommunicationsServices/FrequencyAward2018/20180613\\_Decision\\_I\\_II.pdf?\\_\\_blob=publicationFile&v=2](https://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/Areas/Telecommunications/Companies/TelecomRegulation/FrequencyManagement/ElectronicCommunicationsServices/FrequencyAward2018/20180613_Decision_I_II.pdf?__blob=publicationFile&v=2)

## Annex A. Ofcom UK Block Edge Mask specifications

The following specifications are cited from Ofcom “Variation of Spectrum Access licences in the 3400 to 3680 MHz band” published on 18<sup>th</sup> April 2019.

For synchronised base stations where the same frame structures are used, the maximum power of base station outside the permitted frequency blocks within the 3400MHz to 3800MHz are specified in Table 3 of the aforementioned Ofcom document, and this table is shown below,

	Non-AAS	AAS
	dBm/5MHz EIRP per antenna	dBm/5MHz TRP per cell
-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	Min (PMax-40, 21)	Min(PMax'-40, 16)
-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	Min (PMax-43, 15)	Min(PMax'-43, 12)
Out of block baseline power limit (BS) Below -10 MHz offset from lower block edge Above 10 MHz offset from upper block edge Within 3400-3800 MHz	Min (PMax-43, 13)	Min(PMax'-43, 1)

The maximum power of base station outside the permitted frequency outside the 3400MHz to 3800MHz range are specified in Table 5&6 of the aforementioned Ofcom document and these two tables are shown below,

	Non-AAS	AAS
	dBm/MHz EIRP per antenna	dBm/MHz TRP per cell
Below 3390MHz	-50	-52

	Non-AAS	AAS
	dBm/5MHz EIRP per antenna	dBm/5MHz TRP per cell
3390-3400MHz	Min(PMax-43, 13)	Min(PMax-43, 1)
3400-3405MHz	Min(PMax-43, 15)	Min(PMax-43, 12)
3405-3410MHz	Min(PMax-40, 21)	Min(PMax-40, 16)
3800-3805MHz	Min(PMax-40, 21)	Min(PMax-40, 16)
3805-3810MHz	Min(PMax-43, 15)	Min(PMax-43, 12)
3810-3840MHz	Min(PMax-43, 13)	Min(PMax-43, 1)
Above 3840MHz	-2	-14

The above out-of-block and out-of-band emissions limits are in line with the harmonised technical conditions in EU Decision.