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**TECHNOLOGY ASPECTS**

**Director, Radiocommunication Bureau<sup>1,2</sup>**

FINAL EVALUATION REPORT FROM THE 5G INFRASTRUCTURE ASSOCIATION ON  
IMT-2020 PROPOSAL IMT-2020/ 17

This contribution contains in Attachment 1 the Final Evaluation Report from the Independent Evaluation Group 5G Infrastructure Association (<http://www.itu.int/oth/R0A0600006E/en>). The report contains a subset of detailed analysis of the analytical, inspection and simulation characteristics defined in ITU-R Reports M.2410-0, M.2411-0 and M.2412-0 [1] – [3] using a methodology described in Report ITU-R M.2412-0 [3].

The final report contains analytical, simulation and inspection evaluation results.

The evaluation targets the DECT of component RIT proposal contained in IMT-2020/17 (Rev.1)-E [4] (DECT RIT).

The attached evaluation report consists of 3 Parts:

- **Part I:** Administrative Aspects of 5G Infrastructure Association
- **Part II:** Technical Aspects of the work in 5G Infrastructure Association
- **Part III:** Conclusion

The report is structured according to the proposed structure in [5].

**Attachment:** 1

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<sup>1</sup> Submitted on behalf of the Independent Evaluation Group 5G Infrastructure Association.

<sup>2</sup> This contribution is based on work underway within the research in 5G PPP and 5G Infrastructure Association, see <https://5g-ppp.eu/>. The views expressed in this contribution do not necessarily represent the 5G PPP.

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## PART I

### Administrative aspects of 5G Infrastructure Association

#### I.1 Name of the Independent Evaluation Group

The Independent Evaluation Group is called *5G Infrastructure Association*.

#### I.2 Introduction and background of 5G Infrastructure Association

The 5G Infrastructure Association Independent Evaluation Group was launched by the 5G Infrastructure Association as part of 5G Public Private Partnership (5G PPP) in October 2016 by registration at ITU-R.

The 5G Public Private Partnership (5G PPP) is a sub-research program in Horizon 2020 of the European Commission. 5G Infrastructure Association is representing the private side in 5G PPP and the EU Commission the public side. The Association was founded end of 2013. The Contractual Arrangement on 5G PPP was signed by the EU Commission and representatives of 5G Infrastructure Association in December 2013. 5G PPP is structured in three program phases.

- In Phase 1 from July 1, 2015 to 2017 19 projects researched the basic concepts of 5G systems in all relevant areas and contributed to international standardization (<https://5g-ppp.eu/5g-ppp-phase-1-projects/>).
- Phase 2 started on June 1, 2017 with 23 projects (<https://5g-ppp.eu/5g-ppp-phase-2-projects/>). The focus of Phase 2 is on the optimization of the system and the preparation of trials.
- The Phase 3 is implemented with 14 projects (<https://5g-ppp.eu/5g-ppp-phase-3-projects/>)
  - Part 1: 3 Infrastructure Projects,
  - Part 2: 3 Automotive Projects, and
  - Part 3: 8 Advanced 5G validation trials across multiple vertical industries. This phase is addressing the development of trial platforms especially with vertical industries, large scale trials, cooperative, connected and automated mobility, 5G long term evolution as well as international cooperation.

In each phase around 200 organizations are cooperating in the established projects.

The main key challenges of the 5G PPP Program are to deliver solutions, architectures, technologies and standards for the ubiquitous 5G communication infrastructures of the next decade:

- Providing 1000 times higher wireless area capacity and more varied service capabilities compared to 2010.
- Saving up to 90 % of energy per service provided. The main focus will be in mobile communication networks where the dominating energy consumption comes from the radio access network.
- Reducing the average service creation time cycle from 90 hours to 90 minutes.
- Creating a secure, reliable and dependable Internet with a “zero perceived” downtime for services provision.
- Facilitating very dense deployments of wireless communication links to connect over 7 trillion wireless devices serving over 7 billion people.
- Enabling advanced User controlled privacy.

The Independent Evaluation Group is currently supported by the following 5G PPP Phase 2 projects:

- 5G Essence,
- 5G MoNArch,
- 5G Xcast,
- One 5G and
- To-Euro-5G CSA

and the 5G PPP Phase 3 projects

- 5G Genesis,
- 5G Solutions,
- 5G Tours,
- 5G VINNI,
- Clear5G,
- Full5G CSA,
- Global5G.org CSA

and the 5G Infrastructure Association members

- Huawei,
- Intel,
- Nokia,
- Telenor,
- Turkcell and
- ZTE Wistron Telecom AB

This Evaluation Group is evaluating some of all 16 evaluation characteristics according to Table 2 by means of analytical, inspection and simulation activities in order to perform a full evaluation.

### **I.3 Method of work**

The 5G Infrastructure Association Evaluation Group is organized as Working Group in 5G PPP under the umbrella of the 5G Infrastructure Association. Evaluation activities are executed according to a commonly agreed plan and conducted work through e.g.:

- Physical meetings and frequent telephone conferences where the activities are planned and where action items are given and followed up.
- Frequent email and telephone discussions among partners on detailed issues on an ad-hoc basis.
- File sharing on the web.

Participation in the ITU-R Correspondence Group dedicated to the IMT-2020 evaluation topics. In addition, the Evaluation Group participated in a workshop organized by 3GPP on October 24 and 25, 2018 in Brussels and the ITU-R WP5D Evaluation Workshop on December 10 and 11, 2019 in Geneva at the 33<sup>rd</sup> meeting of Working Party 5D. In that workshop the Evaluation Group presented the work method, work plan, channel model calibration status, baseline system calibration assumptions, and available evaluation results.

At and after the ITU-R workshop the Evaluation Group communicated with other Evaluation Groups as well regarding calibration and is making material openly available.

Open issues in the system description were discussed and clarified with DECT.

The assessment of the proponent submission and self-evaluation has been made by analytical, inspection and simulation methods as required in Reports ITU-R M.2410-0 [1], M.2411-0 [2] and M.2412-0 [3], see Table 2 in M.2412-0 [3].

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## **I.6 Structure of this Report**

This Report consists of 3 Parts:

- Part I: Administrative Aspects of 5G Infrastructure Association
- Part II: Technical Aspects of the work in 5G Infrastructure Association
- Part III: Conclusion

The report is structured according to the proposed structure in [5].

## PART II

### Technical aspects of the work in 5G Infrastructure Association

#### II.A What candidate technologies or portions of the candidate technologies this IEG is or might anticipate evaluating?

In this report, final results are presented for the RIT proposals in [4] with a focus on the DECT component RIT submission to ITU-R by means of simulation evaluation. The complete simulation evaluations will be provided in the final evaluation report. Table 1 shows the evaluated proposals.

TABLE 1

Evaluated technology proposals

3GPP		China	Korea	ETSI TC DECT DECT Forum		Nufront	TSDSI
SRIT	RIT			3GPP NR component RIT	DECT2020 component RIT		
-	-	-	-	-	✓	-	

Table 2 is summarizing the different evaluation characteristics.

TABLE 2

Summary of evaluation methodologies

Characteristic for evaluation	High-level assessment method	Evaluation methodology in ITU-R Report M.2412-0	Related section of Reports ITU-R M.2410-0 and ITU-R M.2411-0
Peak data rate	Analytical	§ 7.2.2	Report ITU-R M.2410-0, § 4.1
Peak spectral efficiency	Analytical	§ 7.2.1	Report ITU-R M.2410-0, § 4.2
User experienced data rate	Analytical for single band and single layer; Simulation for multi-layer	§ 7.2.3	Report ITU-R M.2410-0, § 4.3
5 <sup>th</sup> percentile user spectral efficiency	Simulation	§ 7.1.2	Report ITU-R M.2410-0, § 4.4
Average spectral efficiency	Simulation	§ 7.1.1	Report ITU-R M.2410-0, § 4.5
Area traffic capacity	Analytical	§ 7.2.4	Report ITU-R M.2410-0, § 4.6
User plane latency	Analytical	§ 7.2.6	Report ITU-R M.2410-0, § 4.7.1
Control plane latency	Analytical	§ 7.2.5	Report ITU-R M.2410-0, § 4.7.2
Connection density	Simulation	§ 7.1.3	Report ITU-R M.2410-0, § 4.8
Energy efficiency	Inspection	§ 7.3.2	Report ITU-R M.2410-0, § 4.9
Reliability	Simulation	§ 7.1.5	Report ITU-R M.2410-0, § 4.10
Mobility	Simulation	§ 7.1.4	Report ITU-R M.2410-0, § 4.11
Mobility interruption time	Analytical	§ 7.2.7	Report ITU-R M.2410-0, § 4.12



<b>Characteristic for evaluation</b>	<b>High-level assessment method</b>	<b>Evaluation methodology in ITU-R Report M.2412-0</b>	<b>Related section of Reports ITU-R M.2410-0 and ITU-R M.2411-0</b>
Bandwidth	Inspection	§ 7.3.1	Report ITU-R M.2410-0, § 4.13
Support of wide range of services	Inspection	§ 7.3.3	Report ITU-R M.2411-0, § 3.1
Supported spectrum band(s)/range(s)	Inspection	§ 7.3.4	Report ITU-R M.2411-0, § 3.2

## **II.B Confirmation of utilization of the ITU-R evaluation guidelines in Report ITU-R M.2412**

5G Infrastructure Association confirms that the evaluation guidelines provided in Report ITU-R M.2412-0 [3] have been utilized.

## **II.C Documentation of any additional evaluation methodologies that are or might be developed by the Independent Evaluation Group to complement the evaluation guidelines**

The following additional evaluation methodologies have been applied by this Evaluation Group:

- Updating of already available link-level and system-level simulators according to the submitted RITs as well as to ITU-R requirements
- These link-level and system-level simulators have been calibrated with respect to externally available results.

## **II.D Verification as per Report ITU-R M.2411 of the compliance templates and the self-evaluation for each candidate technology as indicated in A)**

The evaluation template in the Final Evaluation Report is completed in Section III-2. These results have a gap with the self-evaluation report for the DECT component RIT.

### **II.D.1 Identify gaps/deficiencies in submitted material and/or self-evaluation**

There were obvious gaps and deficiencies identified in the technology submission of ETSI/DECT.

## **II.E Assessment as per Reports ITU-R M.2410, ITU-R M.2411 and ITU-R M.2412 for each candidate technology as indicated in A)**

In the following Sections details are provided on

- Detailed analysis/assessment and evaluation by the IEGs of the compliance templates submitted by the proponents per the Report ITU-R M.2411 section 5.2.4;
- Provide any additional comments in the templates along with supporting documentation for such comments;
- Analysis of the proponent's self-evaluation by the IEG.

## **Analytical, inspection evaluation and simulation-based evaluation**

## **II.E.1 Reliability**

The ITU-R minimum requirements on reliability are given in [1]. The following requirements and remarks are extracted from [1]:

*Reliability relates to the capability of transmitting a given amount of traffic within a predetermined time duration with high success probability.*

*Reliability is the success probability of transmitting a layer 2/3 packet within a required maximum time, which is the time it takes to deliver a small data packet from the radio protocol layer 2/3 SDU ingress point to the radio protocol layer 2/3 SDU egress point of the radio interface at a certain channel quality.*

*This requirement is defined for the purpose of evaluation in the URLLC usage scenario.*

*The minimum requirement for the reliability is  $1-10^{-5}$  success probability of transmitting a layer 2 PDU (protocol data unit) of 32 bytes within 1 ms in channel quality of coverage edge for the Urban Macro-URLLC test environment, assuming small application data (e.g. 20 bytes application data + protocol overhead).*

*Proponents are encouraged to consider larger packet sizes, e.g. layer 2 PDU size of up to 100 bytes.*

### **II-E.1.1 Evaluation methodology and KPIs**

The ITU-R minimum requirements on reliability are given in [1]. Specifically, reliability relates to the capability of transmitting a given amount of traffic within a predetermined time duration with high success probability. Reliability is the success probability of transmitting a layer 2/3 packet within a required maximum time, which is the time it takes to deliver a small data packet from the radio protocol layer 2/3 SDU ingress point to the radio protocol layer 2/3 SDU egress point of the radio interface at a certain channel quality. This requirement is defined for the purpose of evaluation in the URLLC usage scenario.

The reliability evaluation uses system-level simulations followed by link-level simulations. The detailed evaluation method can be found in [3].

The minimum requirement for the reliability is  $1-10^{-5}$  success probability of transmitting a layer 2 PDU (protocol data unit) of 32 bytes within 1 ms in channel quality of coverage edge for the Urban Macro-URLLC test environment, assuming small application data (e.g. 20 bytes application data + protocol overhead).

### **II.E.1.2 Evaluation results for DECT**

Reliability for DECT is evaluated under Urban Macro – URLLC test environment. The evaluation configuration B (carrier frequency = 700 MHz) and channel model A defined in Report ITU-R M.2412 [3] are evaluated for downlink and uplink. The detailed evaluation assumptions for system level and link level simulation can be found in Appendix C.

#### **II-E.1.2.1 Downlink reliability**

In the DECT evaluation, frequency reuse schemes are exploited to mitigate interference and improve the reliability. The following three configurations for frequency reuse factor 1, 3, and 7 are evaluated based on ITU-R WP 5D/1299.

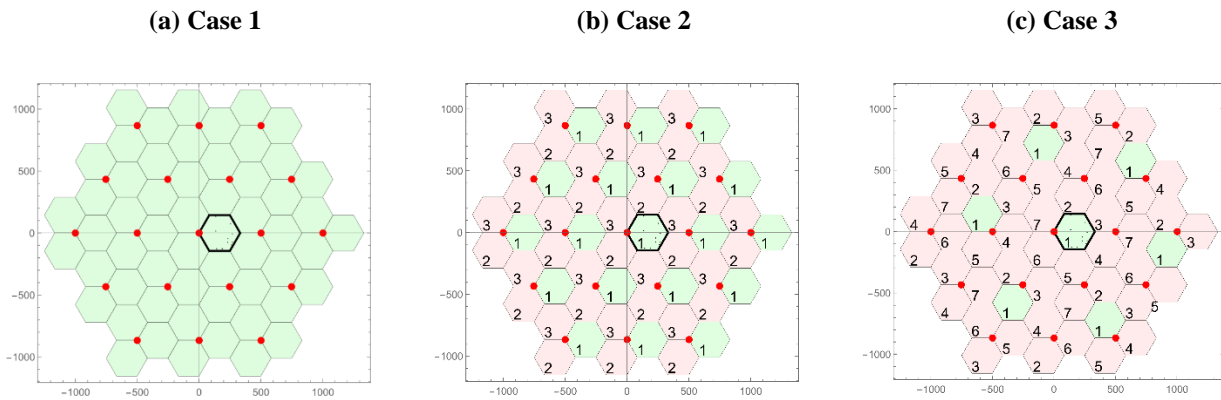
- Case 1: The frequency reuse factor is set to 1. A single DECT-2020 channel with 1.728 MHz bandwidth is applied for URLLC service in each cell, i.e. the system can be considered as a single frequency network.

- Case 2: The frequency reuse factor is set to 3. 3 DECT-2020 channels are applied for URLLC service and the neighboring three BSs use different channels.
- Case 3: The frequency reuse factor is set to 7. 7 DECT-2020 channels are applied for URLLC service and the neighboring seven BSs use different channels.

The network layouts for different frequency reuse factors are provided in Figure 1 extracted from Report ITU-R WP 5D/1299. In Figure 1, the interference cell from the wrap-around layout are not marked.

FIGURE 1

Network layout for frequency reuse factors 1, 3, and 7. Green color indicates interfering cell. Number indicates the used channel in a given configuration.



In the system-level simulation, the SINR distributions for different frequency reuse factors provided in Figure 2 and the 5%-tile SINR are illustrated in Table 3. Pre-processing SINR is used for reliability evaluation, which is defined on an Rx antenna port with respect to a Tx antenna port.

FIGURE 2

Downlink SINR distribution obtained from system level simulation  
(BS antenna array: 15x4, BS Tx power: 49 dBm)

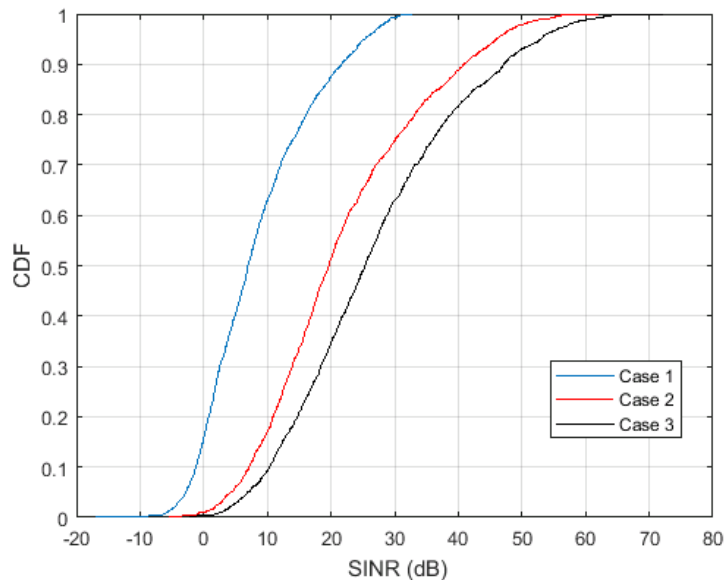


TABLE 3

**5%-tile SINR obtained from system-level simulation for downlink**

Configuration	Case 1	Case 2	Case 3
5%-tile SINR (BS Tx power: 49 dBm BS antenna array: 15x4)	-2.8 dB	4.4 dB	6.9 dB

In the link-level simulation, the packet with the size of 37 bytes is carried in one slot over 4 available data filed symbols. And the second level MCS (i.e. QPSK modulation and 3/4 code rate) is used in the evaluation. NLOS channel state is considered. The SNR-BLER curve is illustrated in Figure 3.

FIGURE 3

**SNR-BLER curve for data channel evaluation (BS antenna array: 15x4, BS Tx power: 49 dBm)**

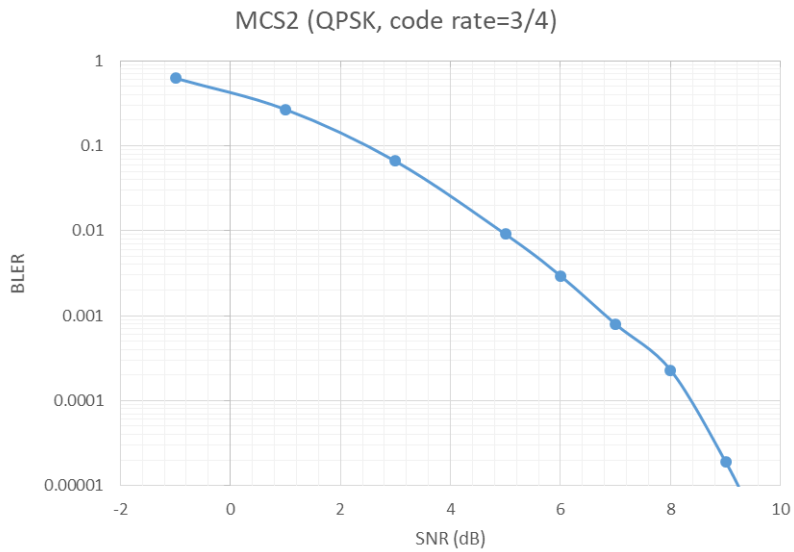


TABLE 4

**Evaluation results of downlink reliability**

Scheme and antenna configuration	Sub-carrier spacing [kHz]	Channel condition	Frequency reuse scheme	5%-tile SINR [dB]	ITU Requirement	Reliability
SU-MIMO (BS antenna array: 15x4)	27	NLOS	Case 1	-2.8	99.999%	10.9213%
SU-MIMO (BS antenna array: 15x4)	27	NLOS	Case 2	4.4	99.999%	98.3007%
SU-MIMO (BS antenna array: 15x4)	27	NLOS	Case 3	6.9	99.999%	99.9215%

Based on the results from Figure 2 and Figure 3, the downlink reliability is obtained in Table 4. It is observed that DECT cannot fulfil the reliability requirement in downlink using the maximum antenna array 15x4.

### II-E.1.2.2 Uplink reliability

For uplink reliability evaluation, the frequency reuse schemes are the same as that of downlink. In the system-level simulation, the SINR distributions for different frequency reuse factors are provided in Figure 4 and the 5%-tile SINR is illustrated in Table 5.

FIGURE 4

**Uplink SINR distribution obtained from system level simulation  
(BS antenna array: 15x4, UE Tx power: 23 dBm)**

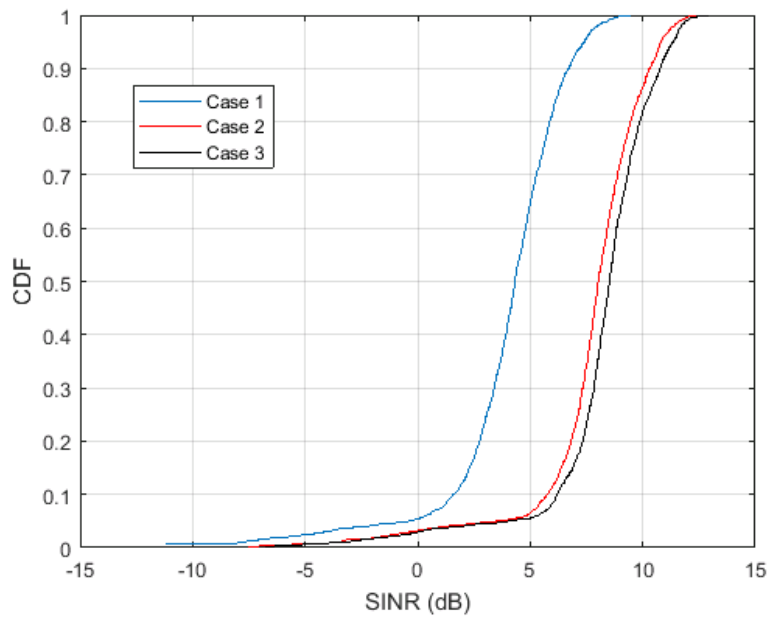


TABLE 5

**5%-tile SINR obtained from system-level simulation for uplink**

Configuration	Case 1	Case 2	Case 3
5%-tile SINR ( UE Tx power: 23 dBm BS antenna array: 15x4)	-0.4 dB	3.7 dB	4.1 dB

In the link-level simulation, the evaluation assumptions including packet size, MCS level, and channel state are the same as that of downlink. The SNR-BLER curve for uplink data channel is also provided in Figure 3.

TABLE 6

**Evaluation results of uplink reliability**

<b>Scheme and antenna configuration</b>	<b>Sub-carrier spacing [kHz]</b>	<b>Channel condition</b>	<b>Frequency reuse scheme</b>	<b>5%-tile SINR [dB]</b>	<b>ITU Requirement</b>	<b>Reliability</b>
SU-MIMO (BS antenna array: 15x4)	27	NLOS	Case 1	-0.4	99.999%	48.5944%
SU-MIMO (BS antenna array: 15x4)	27	NLOS	Case 2	3.7	99.999%	96.3088%
SU-MIMO (BS antenna array: 15x4)	27	NLOS	Case 3	4.1	99.999%	97.4825%

Based on the results from Figure 4 and the 5%-tile SINR in Table 5, the uplink reliability is obtained in Table 6. It is observed that DECT cannot fulfil the reliability requirement in uplink using the maximum antenna array 15x4.

Since the DECT cannot fulfil the reliability requirement with the maximum antenna array 15x4, the DECT also cannot fulfil the reliability requirement with the antenna array 5x4.

## **II.F Questions and feedback to WP 5D and/or the proponents or other IEGs**

Currently, there is no further question.

## Part III

### Conclusion

#### III-1 Completeness of submission

5G Infrastructure Association finds that the submission in [4] is ‘complete’ according to [2]. 5G Infrastructure Association completed evaluations on the submissions in document IMT-2020/17 (i.e. “DECT technology”) and provides assessment and evaluation results. It is identified that the DECT of component RIT in ETSI (TC DECT) and DECT Forum SRIT cannot meet the minimum requirements in URLLC test environment.

#### III-2 Compliance with requirements

These are the main conclusions on the 5G Infrastructure Association evaluation of the evaluated proposal. In Table 7 below, it is shown whether or not 5G Infrastructure Association has confirmed the proponent’s claims relating to IMT-2020 requirements.

The phrase ‘Requirements fulfilled’ in the tables below indicates that 5G Infrastructure Association Evaluation Group assessment confirms the associated claim from the proponent that the requirement is fulfilled.

In Section III-2.1 the detailed compliance templates are summarized.

##### III-2.1 Overall compliance

TABLE 7

5G Infrastructure Association assessment of compliance with requirements

Characteristic for evaluation	DECT component RIT: 5G IA assessment	Section
Connection density	Not provided	
Reliability	DECT cannot meet the requirement	Part II-E.1.2.

It should be noted that the analysis behind the analytical and inspection results is not limited by properties of the test environment; hence all these conclusions are valid for all test environments.

##### III-2.2 Detailed compliance templates

###### III-2.2.1 Compliance template for services<sup>3</sup>

	Service capability requirements	Evaluator’s comments
5.2.4.1.1	<b>Support for wide range of services</b> Is the proposal able to support a range of services across different usage scenarios (eMBB, URLLC, and mMTC)?: <input type="checkbox"/> YES / <input checked="" type="checkbox"/> NO Specify which usage scenarios (eMBB, URLLC, and mMTC) the candidate RIT or candidate SRIT can support. <sup>(1)</sup>	The proposal of DECT component RIT does not support URLLC, so a range of services across different usage scenarios cannot be support by this DECT component RIT.

<sup>(1)</sup> Refer to the process requirements in IMT-2020/2.

<sup>3</sup> If a proponent determines that a specific question does not apply, the proponent should indicate that this is the case and provide a rationale for why it does not apply.

### III-2.2.2 Compliance template for spectrum<sup>3</sup>

	Spectrum capability requirements	Evaluator's comments
5.2.4.2.1	<p><b>Frequency bands identified for IMT</b></p> <p>Is the proposal able to utilize at least one frequency band identified for IMT in the ITU Radio Regulations? YES / <input type="checkbox"/> NO</p> <p>Specify in which band(s) the candidate RIT or candidate SRIT can be deployed.</p>	Not provided
5.2.4.2.2	<p><b>Higher Frequency range/band(s)</b></p> <p>Is the proposal able to utilize the higher frequency range/band(s) above 24.25 GHz? YES / <input type="checkbox"/> NO</p> <p>Specify in which band(s) the candidate RIT or candidate SRIT can be deployed.</p> <p>Details are provided in Section II-E.16.</p> <p>NOTE 1 – In the case of the candidate SRIT, at least one of the component RITs need to fulfil this requirement.</p>	Not provided

### III-2.2.3 Compliance template for technical performance<sup>3</sup>

Minimum technical performance requirements item (5.2.4.3.x), units, and Report ITU-R M.2410-0 section reference <sup>(1)</sup>	Category			Required value	Value <sup>(2)</sup>	Requirement met?	Evaluator's Comments <sup>(3)</sup>
	Usage scenario	Test environment	Downlink or uplink				
5.2.4.3.11 Reliability (4.10)	URLLC	Urban Macro – URLLC	Downlink	1-10 <sup>-5</sup> success probability of transmitting a layer 2 PDU (protocol data unit) of size 32 bytes within 1 ms in channel quality of coverage edge	10.9213%~99.9215%	No	For evaluation configuration B (Carrier frequency = 700 MHz).
			Uplink		48.5944%~97.4825%	No	For evaluation configuration B (Carrier frequency = 700 MHz).

<sup>(1)</sup> As defined in Report ITU-R M.2410-0.

<sup>(2)</sup> According to the evaluation methodology specified in Report ITU-R M.2412-0.

<sup>(3)</sup> Proponents should report their selected evaluation methodology of the Connection density, the channel model variant used, and evaluation configuration(s) with their exact values (e.g. antenna element number, bandwidth, etc.) per test environment, and could provide other relevant information as well. For details, refer to Report ITU-R M.2412-0, in particular, § 7.1.3 for the evaluation methodologies, § 8.4 for the evaluation configurations per each test environment, and Annex 1 on the channel model variants.

<sup>(4)</sup> Refer to § 7.3.1 of Report ITU-R M.2412-0.

### III-3 Number of test environments meeting all IMT-2020 requirements

Based on our independent evaluation report, at least, 1 test environment cannot meet all IMT-2020 requirements, namely Urban Macro-URLLC test environment.



## ANNEX A

### Detailed evaluation assumptions for reliability

The detailed system-level for downlink and uplink reliability are illustrated in Table A-1 and Table A-2, respectively.

TABLE A-1

#### System-level evaluation assumptions for downlink reliability

Parameters	Urban Macro–URLLC
Inter-site distance	500 m
Number of antenna elements per TRxP	Results provided with 60, (15x4) antenna elements.
UE antennas	4
Device deployment	20% indoor, 80% outdoor
UE mobility model	Fixed and identical speed $ v $ of all UEs, randomly and uniformly distributed direction
UE speeds of interest	3 km/h for indoor and 30 km/h for outdoor
Inter-site interference modelling	Explicitly modelled
BS noise figure	5 dB
UE noise figure	7 dB
BS antenna element gain	8 dBi
UE antenna element gain	0 dBi
Thermal noise level	-174 dBm/Hz
Traffic model	Full buffer
Simulation bandwidth	20 MHz
UE density	10 UEs per TRxP
UE antenna height	1.5 m
Numerology	27 kHz SCS
Scheduling	PF
Receiver	MMSE-IRC
Channel estimation	Non-ideal
Carrier frequency	700 MHz
TRxP number per site	3
Wrapping around method	Geographical distance based wrapping
Criteria for selection for serving TRxP	RSRP based

NOTE – Other system configuration parameters align with Report ITU-R M.2412.

TABLE A-2

**System-level evaluation assumptions for uplink reliability**

<b>Parameters</b>	<b>Urban Macro–URLLC</b>
Inter-site distance	500m
Number of antenna elements per TRxP	Results provided with 60, (15x4) antenna elements.
UE antennas	4
Device deployment	20% indoor, 80% outdoor
UE mobility model	Fixed and identical speed $ v $ of all UEs, randomly and uniformly distributed direction
UE speeds of interest	3 km/h for indoor and 30 km/h for outdoor
Inter-site interference modelling	Explicitly modelled
BS noise figure	5 dB
UE noise figure	7 dB
BS antenna element gain	8 dBi
UE antenna element gain	0 dBi
Thermal noise level	-174 dBm/Hz
Traffic model	Full buffer
Simulation bandwidth	20 MHz
UE density	10 UEs per TRxP
UE antenna height	1.5 m
Numerology	27 kHz SCS
Simulation bandwidth	20 MHz
Scheduling	PF
Receiver	MMSE-IRC
Channel estimation	Non-ideal
Carrier frequency	700 MHz
TRxP number per site	3
Wrapping around method	Geographical distance based wrapping
Criteria for selection for serving TRxP	RSRP based

NOTE – Other system configuration parameters align with Report ITU-R M.2412.

The detailed link-level evaluation assumptions for downlink and uplink reliability are illustrated in Table A-3.

TABLE A-3  
**Link-level evaluation assumptions for downlink/uplink reliability**

Parameters	Urban Macro–URLLC
Evaluated service profiles	Full buffer best effort
Simulation bandwidth	1.728 MHz
Number of users in simulation	1
Packet size	37 bytes at Layer 2 PDU
Link-level Channel model	TDL-iii
Delay spread scaling parameter	363 ns
Carrier frequency for evaluation	700 MHz
Numerology	27 kHz SCS
Number of antenna elements per TRxP	Results provided with 60, (15x4) antenna elements.
UE antennas	4
Packet format	Long preamble packet
Channel estimation	Non-ideal
Number of symbol for control information	2
Number of symbol for data	4
Control information modulation and coding	TBCC with code rate = 1/2, QPSK 2 repetitions
Data modulation and coding	Turbo with code rate = 3/4, QPSK

NOTE – Other system configuration parameters align with Report ITU-R M.2412.

## References

- [1] ITU-R: *Minimum requirements related to technical performance for IMT-2020 radio interface(s)*. Report ITU-R M.2410-0, (11/2017).
- [2] ITU-R: *Requirements, evaluation criteria and submission templates for the development of IMT-2020*. Report ITU-R M.2411-0, (11/2017).
- [3] ITU-R: *Guidelines for evaluation of radio interface technologies for IMT-2020*. Report ITU-R M.2412-0, (10/2017).
- [4] ITU-R WP5D: *Acknowledgement of candidate SRIT submission from ETSI (TC DECT) and DECT Forum under Step 3 of the IMT-2020 process*. Document IMT-2020/17-(Rev.1)E, 23 December 2019.
- [5] ITU-R WP 5D: *Information of the evaluation for the terrestrial components of the radio interface(s) for IMT-2020. Liaison statement to registered Independent Evaluation Groups*. Document 5D/TEMP/769(Rev 1), 16 July 2019.