CARBON BASED SMART SYSTEM FOR WIRELESS APPLICATION

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UPDATED CONTINGENCY PLAN

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1 UPDATED RISK AND CONTINGENCY PLAN FOR CARBON NANOTUBES DEMONSTRATOR

1.1 DEMONSTRATOR DESCRIPTION, CRITICAL PARTS.

The CNTs based demonstrator is a T/R module operating in the range of 2-80GHz. The main components to obtain such a system will be: a) Antenna b) Low noise amplifier c) Switch d) Filter. All these components are based on CNTs technology.

The following critical parts are to be developed in order to successfully obtain a functional CNT based demonstrator:

1. CNT based antenna
2. CNT FET
3. CNT switch.
4. CNT filter
5.

Each of these parts will be addressed below

1.2 CNT BASED ANTENNA

In case the CNTs antenna fails to perform as necessary, for example the CNT module will not receive microwaves signals, a patch antenna on the Si/SiO2 substrate will be used. Another alternative solution is to use commercial monopole for the CNT antenna replacement.

1.3 CNT FET

Currently, CNT FET are already manufactured and measured in the consortium.
In case the CNTs amplifier fails to perform as necessary, for example the CNT module will not amplify the antenna signals, the solution is to replace the CNT FET with a MMMIC amplifier.

1.4 CNT SWITCH

At this point, the consortium has already developed and fabricated an CNT based RF Switch
In case the CNTs switch fails to perform as necessary, for example the module is not able to switch between T/R modes, a commercial switch or a MEMS switch will replace the CNT switch.

1.5 CNT FILTER

In case the CNTs filter fails to perform as necessary, for example the RF signal will be not filtered, a commercial filter will replace it.

All failed component will be re-designated and re-fabricated.

2 UPDATED RISK AND CONTINGENCY PLAN FOR GRAPHENE DEMONSTRATOR

2.1 DEMONSTRATOR DESCRIPTION, CRITICAL PARTS.

The graphene based demonstrator is a receiver module operating in the range of 2-20GHz. The main components to obtain such a system will be: a) Antenna b) Low noise amplifier c) Frequency mixer d) detection circuit all based on graphene technology.
Following the specifications work performed in WP1, the operating frequency of the demonstrator was fixed at 10GHz.
The following critical parts are to be developed in order to successfully obtain a functional graphene based demonstrator:

1. Graphene based antenna
2. Graphene FET
    1. Graphene Mixer
    2. Graphene Low noise amplifier
3. Graphene based detector.

Each of these parts will be addressed below

2.2 GRAPHENE BASED ANTENNA

Up to now the graphene based antenna has been simulated in WP1 and realistic parameters have been identified to proceed to prototype fabrication.
In case the graphene antenna fails to perform as necessary, there are two options to replace this part so that the graphene based demonstrator will not be compromised.

2.2.1.1 Replacement with a CNT based antenna

Assuming that the graphene antenna fails to perform but the CNT based antenna developed within the consortium does perform as requested; the graphene based antenna will be replaced with a CNT based one. This will keep the all carbon approach originally designed.

2.2.1.2 Replacement with a metallic antenna

In case both CNT and graphene antennae fail to perform as requested, a conventional metallic dipole antenna will be used to replace the graphene antenna. At 10 GHz such antenna are known to perform without issues although their size will be larger compared to their CNT/graphene counterparts. At the cost of larger size, the metallic antenna will still provide detection for the demonstrator to operate.

2.3 GRAPHENE FET DEVICES

At this point graphene devices have already been successfully fabricated within the consortium. Current control has been shown at low frequency.
The remaining risks regarding the GFET device fabrication are the following:

- Insufficient frequency response
- low gain / high noise

The above issues can have a direct impact on the fabrication of the LNA and the mixer circuits.
If the GFET device fails to meet the required specifications the following alternatives are available:

2.3.1.1 Replacement with CNT based FETs

CNT FETs are developed in parallel with the graphene modules. The first alternative assuming the graphene FET based modules (LNA and Mixer) fail to meet the required specifications they will be replaced with their CNT based counterparts.

2.3.1.2 Replacement of LNA

In case the GFET devices fail to perform with adequately low noise figures to successfully realize a low noise amplifier as described in the demonstrator specifications, and assuming the CNT based LNA also fails to meet required specifications, a commercially available LNA will be used to complete the graphene based module. Package level integration will be used to combine the LNA with the rest of the modules to reach a functional demonstrator.

2.3.1.3 Replacement of mixer

In the case the GFET fails to perform as required in order to realize a mixing circuit, A schottky diode mixer will be realized instead. The GFET's will be used to realize the rest of the graphene based circuits and modules and they will be adapted to work with a diode based mixer instead. Although such a system is suboptimal it will still enable us to prove the concept of NANORF using even partially carbon based technology.

2.4 GRAPHENE RF DETECTOR

At this point, the consortium has already developed two different types of graphene based RF detectors.

One based on asymmetric ohmic contact and one based on ballistic transport. The prototypes are already meeting the required specifications as put forward in the DoW at 10GHz which is the demonstrator frequency.

Thus there is no need to develop a contingency plan for the graphene detector.