SRS

Software **R**equirements **S**pecification

Younghwan Jeong

32154231

Intern of SAR team

Sobin Park

32161681

Intern of Mobile EMC/RF team

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1. Introduction

The introduction will be implying information about the purpose, project scope, intended usage, definition, acronyms, and abbreviations.

1.1 Purpose

The purpose of this Software Requirements Specification is to describe the general outline this project, which is for automation services that provide 'frequency and channel information about the Carrier Aggregation (called as CA) combinations that should be measured in real life' among CA combinations provided by the manufacturer. This service is designed and developed by students of the Department of Mobile Systems Engineering, Dankook University as an intern in UL Korea, Ltd. This document will be introducing the overall description, system features, nonfunctional requirements.

1.2 Project Scope

The scope of development of this project is as follows.

Function 1

Enter the 'CA combinations' (i.e. metadata) supplied by the manufacturer into the specific form (called as basic table form).

Function 2

According to *REL. 10LTE SAR TEST GUIDANCE AND KDB INQUIRIES 941225,* establish a CA measurement procedure and analyze and reconstruct the results.

Function 3

Design the program's user-friendly interface according to the measurement procedure we have established.

Our project is not only an automation service that saves time by performing complicated calculations instead, but also aims to increase the efficiency of the overall work by uniformizing the form in which data is written. By using our application, metadata provided by the manufacturer will only be extracted from valuable data according to the user's intention to use.

1.3 Definition & Acronyms and Abbreviations

SRS	Software Requirement Specification
Metadata	Metadata is data about data. - In other words, it's information that's used to describe the data that's contained in something like a web page, document, or file. - - Another way to think of metadata is as a short explanation or summary of what the data is.
SAR	Specific Absorption Rate - SAR refers to the absorption rate of electromagnetic energy absorbed by the human body when the human body is exposed to RF electromagnetic fields. - SAR limit is set to protect users from potential hazards from RF exposure.
Automation	It is the technology by which a process or procedure is performed with minimal human assistance.
CA	Carrier Aggregation - *One of the core technologies of LTE-Advanced* (i.e. LTE-A). - A technique used for wireless communication to increase data rate per user with multiple frequency blocks (component carrier, cc) assigned to the same. - The potential maximum data rate per user increases as more frequency blocks are allocated to users. - PCC: Primary Component Carrier - SCC: Secondary Component Carrier

2. Overall Description

This section provides information about the overall description of our project. It describes product perspectives, functions of our product, operating environment, design and implementation constraints, assumptions and dependencies.

2.1 Product Functions (Functions our Program)

This project performs the following functions step by step.

(1) Enter the metadata supplied by the manufacturer into the specific form.

- The specific form is a '**Basic table'**.
- The user must write the 'Index' columns as '2CC #10'.
- The user must write the 'Restriction' columns as "3CC #1'.
- The user must write the 'Reverse' columns in the form of 'Yes' or 'No'.

(2) Select the above **'basic table' file** in "Basic table" column and select the **'target table form'** in 'Target table' column.

(3) If you followed [step (2)], press the "OK" button to get two files which are 'okbutton1_result1.xlsx' and 'okbutton1_result2.xlsx'.

- [okbutton1_result1.xlsx]
  : A file analyzed for metadata (basic table file).

1. **Eliminate duplicate data between the same cc.**
   - [Reverse] option exception process
   - Color it to mark and distinguish as 'same'.
2. **Eliminate duplicate data between the different cc.**
   - Verification of both sides data for [Reverse] options
   - [Coverage]: Let cc with a higher number take precedence.
   - Color it to mark and distinguish as 'covered' with Index of coverable ca combination

- [okbutton1_result2.xlsx]
  : CA combinations of actual measurements (including reverses).

3. Extract the valuable data and complete it on a specific form.
- The specific form is a **'Target table'**.
- List all CA combinations to be measured substantially considering [Reverse] and [Restriction] options.

(4) The user enters maximum power of the measured power value of the Uplink PCC.

- Also, the user must write information (bandwidth, channel, frequency) of the downlink PCC.

(5) Select the above **'total table' file** in "Total table" column and select the **'result table' file** in 'Result table' column.

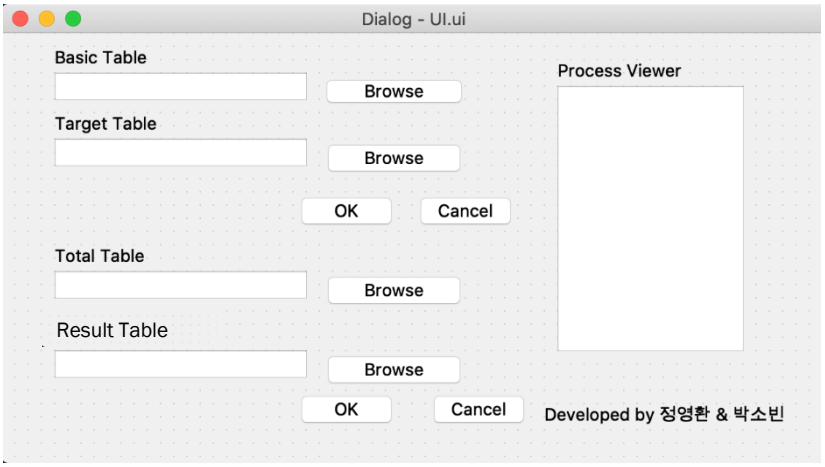
(6) If you followed [step (5)], press the "OK" button to get two files which is a 'okbutton2_result.xlsx'.

- [okbutton2_result.xlsx]
  : A file containing information of downlink ca combination to be measured.

4. The program works according to three cases of CA combinations.
- When component carriers are in different frequency bands,
  we call it 'Inter band'.
  : Enter the middle channel information for the corresponding LTE band.
- When component carriers are contiguous in same frequency bands,
  we call it 'Intra band / contiguous'.
  : Calculate according to the formula of *nominal channel spacing* by classifying whether it is a low channel, a middle channel, or a high channel.

$$\text{Nominal channel spacing} = \left\lfloor \frac{BW_{Channel(1)} + BW_{Channel(2)} - 0.1\left|BW_{Channel(1)} - BW_{Channel(2)}\right|}{0.6} \right\rfloor 0.3 \ \text{[MHz]}$$

- When component carriers are non-contiguous in same frequency bands,
  we call it 'Intra band / non-contiguous'.
  : Display location information as far as possible from other ccs in the same band



[Program UI Design]

2.2 Operating Environment

Application

★ Visual Studio Code

★ Language: Python

2.3 Design and ImplementationConstraints

➢ Restricted computer configuration

Computers in the Chamber where the device is installed have a very limited installation environment. To avoid problems than cannot be installed, we will make a program in one file(.exe), even though the execution speed of this would be take long time about 5 seconds.

➢ Small amount of data due to security constraints

Each company must maintain security for its products. If we don't draw a security agreement, we can't access the raw data. Therefore, we will only get some of the total measurement data and debug it. If not, users who can access the data will check if it works well, and feedback to us.

2.4 Assumptions and Dependencies

➢ Assumptions

We are assuming that program execution works correctly when it works with SAR measurement support devices.

➢ Dependencies

User & Application: when users use an application, they should write the metadata supplied by manufacturer into the specific form. In addition, if users do not use the specified 'base table form' or 'target table form', the program will not run properly.

[basic table form]

Index.0	CC.0	estriction.	Cover.0	Reverse.0	Index.1	CC.1	estriction.	Cover.1	Reverse.1	Index.2	CC.2	estriction.	Cover.2	Reverse.2	Index.3	CC.3	estriction.	Cover.3	Reverse.3
Index	2CC	Restriction	Cover	Reverse	Index	3CC	Restriction	Cover	Reverse	Index	4CC	Restriction	Cover	Reverse	Index	5CC	Restriction	Cover	Reverse
2CC #1	2A-2A			Yes	3CC #1	2A-2A-4A			Yes	4CC #1	2A-2A-5A-30A				5CC #1	2A-2A-46D			
2CC #2	2A-4A			Yes	3CC #2	2A-2A-5A			Yes	4CC #2	2A-2A-5A-66A				5CC #2	2A-5B-30A-66A			
2CC #3	2A-5A			Yes	3CC #3	2A-2A-12A			Yes	4CC #3	2A-2A-12A-66A				5CC #3	2A-5B-66A-66A			
2CC #4	2A-7A			Yes	3CC #4	2A-2A-13A			Yes	4CC #4	2A-2A-13A-66A				5CC #4	2A-46D-66A			

[target table form]

DL CA output power results

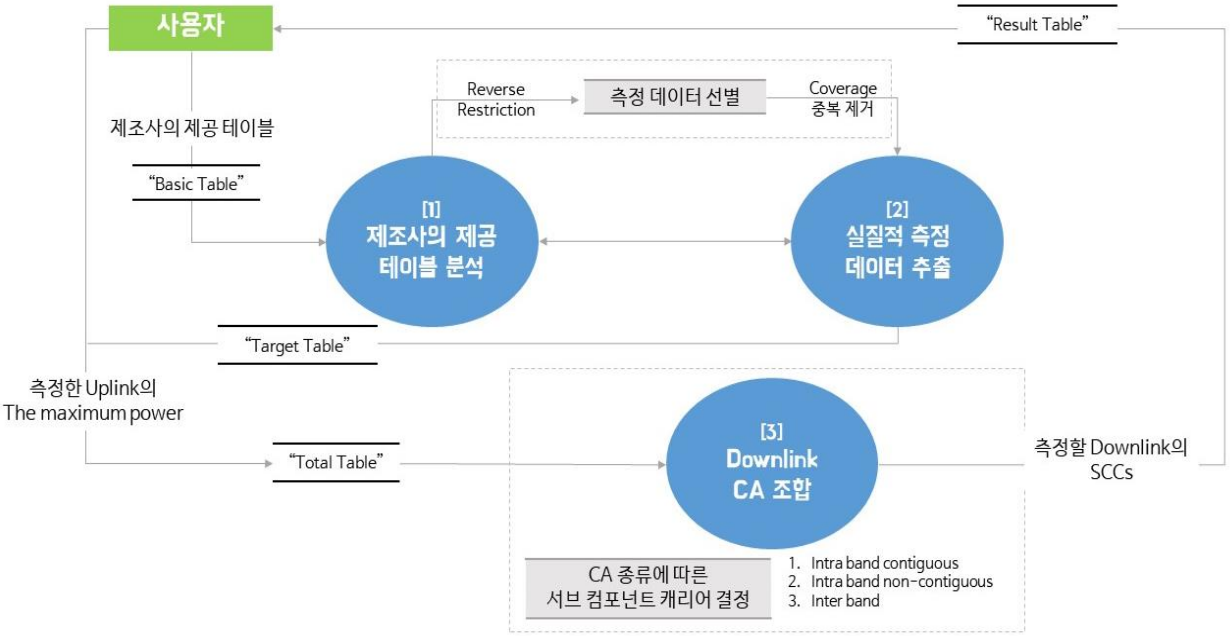
E-UTRA CA congiguration (BCS)	Bands					UL													
	PCC	SCC1	SCC2	SCC3	SCC4	PCC					PCC			SCC1					
	1st	2nd	3rd	4th	5th	Mode	BW (MHz)	Channel	Freq (MHz)	RB/Offset	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)			

2.5 User Characteristics

Users (all employees of the UL Korea SAR team) should know the standard and measuring maximum power value of Uplink PCC. They will be able to sort the CA combinations that needs to be measured. Also, if the measured maximum power value of the uplink PCC and the corresponding downlink PCC information (bandwidth, channel, frequency) are input, SCCs information of the downlink can be obtained.

3. System Features

3.1 User Interface Diagram



표기법	의미
[진행 순서 #] 프로세스 이름	프로세스 처리
자료 이름	자료 흐름
"저장소 이름"	자료 저장소, 데이터 베이스
데이터 처리 과정	데이터 흐름에 따른 작성 코드 내에서 처리되는 과정
단말 이름	자료의 출발과 도착지

3.2 Hardware Interfaces

It depends on the use environment. (i.e. DASY6)

3.3 Software Interfaces

★ Visual Studio Code is our main software interface. This Editor provides various packages. Use develop and upload add-ons (packages), and those who need them can simply download and install them.

4. Functional Requirements

4.1 Normal User

When some staff wants to use our application, the user would need to know *REL. 10 LTE SAR TEST GUIDANCE AND KDB INQUIRIES 941225*.

4.2 Common Functions

➢ Data Management

FR01: The input and output files should be in same directory.

➢ Use Application

FR02: The users must select 2 conditions per 'OK' button. (paths about input and output files)

FR03: After FR02, the users must press "OK" button to get result files.
- First 'OK' button: "okbutton1_result1.xlsx" and "okbutton1_result2.xlsx".
- Second 'OK' button : "okbutton2_result.xlsx"

FR04: The users should not open the output file while sending data to the output path.

FR05: The users can see if the program is finished by the processing figures shown.

5. Non-functional Requirements

5.1 Performance Requirements

NFR01: The application should have an interface with buttons in order to move on.

NFR02: The application should perform all the functions that is required.

NFR03: Before using the application (first 'OK' button), the users must write metadata provided by manufacturer into the specific form. (basic table form)

NFR04: Before using the application (second 'OK' button), the users must write the measured maximum power value of the uplink PCC and the corresponding downlink PCC information into the specific form. (target table form)

5.2 Security Requirements

NFR04: The metadata must be kept confidential within the company.

6. Conclusions

As this SRS report is about writing the outline of the project, we have written an introduction, overall description, system features, functional requirements, non-functional requirements. The goal of our project can be divided into two. One is to link between the device and computer and the other is to significantly reduce working hours compared to the present. As we have never attempted to deal with raw data and devices used in actual work, we are expecting difficulties while finishing this project. Nonetheless, we still plan to provide a successful automation service.