



CTSU vs CTSU2 comparative

A Degree Thesis

Submitted to the Faculty of the

Escola Tècnica d'Enginyeria de Telecomunicació de Barcelona

Universitat Politècnica de Catalunya

by

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In partial fulfilment of the requirements for the degree in Telecommunications Technologies and Services Engineering

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Barcelona, January 2022



<u>Abstract</u>

The project consists of a comparative of two Capacitive Touch Sensing Units using a touch user interface.

The first one (CTSU) is applied to an existing Renesas Xtreme Family (RX) microcontroller board.

A new software has been implemented for the second one (CTSU2), which is applied to Renesas Advanced Family (RA) microcontroller board.

Tests in its basic configuration, when configuring multi-frequency and configuring parallel scan have been run and compared for both boards.

Based on those test results, two final touch control configurations are selected and ElectroMagnetic Compatibility tests have been executed.

Gathering all the results, it can be seen that, when using parallel scan on a RA microcontroller, the measurement time decreases significantly and Signal to Noise Ratio (SNR) results are acceptable, although they are worse than on other configurations. Using multifrequency configuration EMC tests have passed successfully. In conclusion, the results obtained from CTSU2 exceed those from CTSU.



<u>Resum</u>

El projecte consisteix en una comparativa de dues Capacitive Touch Sensing Units utilitzant una interfície d'usuari tàctil.

La primera (CTSU) s'aplica a una placa existent de microcontroladors Renesas Xtreme Family (RX).

S'ha implementat un nou programari per a la segona (CTSU2), que s'aplica a una placa de microcontrolador Renesas Advanced Family (RA).

S'han realitzat tests en la seva configuració bàsica, configurant multifreqüència i escaneig paral·lel, i s'han comparat per a ambdues plaques.

A partir d'aquests resultats, s'han seleccionat dues configuracions finals de control tàctil i s'han realitzat proves de Compatibilitat ElectroMagnètica.

Recollint tots els resultats, es pot observar que, quan s'utilitza l'escaneig paral·lel en un microcontrolador RA, el temps de mesura disminueix significativament i els resultats de relació senyal/soroll (SNR) són acceptables, tot i que pitjors que en altres configuracions. Utilitzant la configuració de multifreqüència, les proves d'EMC s'han superat correctament. En conclusió, els resultats obtinguts de CTSU2 superen els de CTSU.



<u>Resumen</u>

El proyecto consiste en una comparativa de dos Capacitive Touch Sensing Units utilizando una interfaz de usuario táctil.

La primera (CTSU) se aplica a una placa existente de microcontroladores Renesas Xtreme Family (RX).

Se ha implementado un nuevo software para la segunda (CTSU2), que se aplica a una placa de microcontrolador Renesas Advanced Family (RA).

Se han realizado tests en su configuración básica, configurando multifrecuencia y escaneo paralelo, y se han comparado para ambas placas.

A partir de estos resultados, se han seleccionado dos configuraciones finales de control táctil y se han realizado pruebas de Compatibilidad ElectroMagnética.

Recogiendo todos los resultados, puede observarse que, cuando se utiliza el escaneo paralelo en un microcontrolador RA, el tiempo de medida disminuye significativamente y los resultados de relación señal/ruido (SNR) son aceptables, aunque peores que en otras configuraciones. Utilizando la configuración de multifrecuencia, las pruebas de EMC se han superado correctamente. En conclusión, los resultados obtenidos de CTSU2 superan a los de CTSU.



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Revision history and approval record

Revision	Date	Purpose
0	07/10/2021	Document creation
1	21/01/2022	Document revision

DOCUMENT DISTRIBUTION LIST

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1. Introduction

1.1. <u>Statement of purpose</u>

The project scope is to evaluate new technology improvements, based on the Capacitive Touch Sensing Unit (CTSU) technology from Renesas.

It will be taken as reference the CTSU2 applied to the Renesas Advanced Family (RA) microcontrollers, in respect to former CTSU in a real application environment using the Renesas Xtreme Family (RX) microcontroller.

The project is carried out at the company E.G.O. Appliance Controls S.L.U, a company dedicated to the development, production and sale of electronic circuits for different types of applications. So, for doing the comparative, an EGO's existing touch user interface named T4, applied to a washer, will be taken as a reference.



Figure 1. T4 touch user interface

The project main goals are:

- 1. To implement software to the new board according to the RA and CTSU2 specification.
- 2. Get basic functionality for a board sample with RA microcontroller (touch control routines).
- 3. Run a set of tests for RA CTSU technology board including:
 - a. Tests in former CTSU configuration.
 - b. Tests configuring multi-frequency scan.
 - c. Tests configuring parallel scanning function.
- 4. EMC tests. Based on those test results, a final touch control configuration for the RA CTSU technology board will be selected. With this configuration a set of EMC tests will be run.



1.2. <u>Background</u>

Until now CTSU has been the reference technology for EGO on current existing UI products. Even if it's an improved technology in respect to first touch control generation, there are some aspects to consider that can lead to quality issues:

- Scan rate / sensitivity: As more touch channels are required, it's important to increase the readability rate per channel.
- In some environments, coupled Cp's (parasitic capacitance) often mask the touch reading leading to loss of sensitivity.
- Coupled noise coming from signal lines and/or electronic radiated emitters in the proximity lead to unstable reading systems.

As a consequence, the problems reported above impact the final performance of the touch control system, both in normal operation and during EMC assessment.

CTSU2 offers several improvements that help increase performance and reduce these potential problems.

- Improved noise immunity
 - Improved HW IP
 - Multiple frequency scan
 - Shield electrode support
- Improved sensitivity
 - Improved ICO to manage temperature drift
 - Internal Temperature Drift correction
- New features
 - Parallel scan to support multiple touch via frequency converter
 - Safety function included

1.3. <u>Requirements and specifications</u>

Here is a list of software and tools used in the project:

- e² studio version 2021-07 (21.7.0): Eclipse-based Renesas integrated development environment (IDE).
- Renesas FSP Smart Configurator Core (8.5.0.v20210624-1718): Enhanced software package designed to provide easy-to-use, scalable, high-quality software for embedded system designs using Renesas RA Family of Arm Microcontrollers.
- QE for Capacitive Touch (1.2.0.v20201223-0532): Development assistance tool for Capacitive Touch Sensors.
- CS+ (V6.01.00): Formerly CubeSuite+, an integrated development environment.
- Workbench6 Software (1.07.00.00): The IDE used with Renesas RX 32-bit microcontrollers for capacitive touch applications.





• TouchAPI version 2018/01/22-0A.

The project consists of verifying different tests, so there are no specific margins or values to be reached in order to evaluate it.

1.4. <u>Methods and procedures</u>

As mentioned before, the project aims to compare the technology used on a current product of the company, so it will be performed in the framework of its development project.

There exists the T4 touch user interface and there is a current existing board based on RX130 microcontroller and CTSU touch technology.

For RA, the development environment and library are different. The target is to develop the firmware needed to configure the test setups and make the measurements, so there is a reference, but the adaptation will be done from scratch as well as the tests, as they will have to be adapted for making the same measurements and have conclusive results.

1.5. Work plan with tasks, milestones and a Gantt diagram

a) Work Packages

Project: Microcontroler family and tools knowledge acquisition WP ref: (WP1)		
Major constituent: SW	Sheet 1 of 3	
Short description:	Planned start date: 04/10/2027 Planned end date: 26/12/2021	
Knowledge to be acquired in different fields (specified in internal tasks)	Start event: 04/10/2021 End event: 26/12/2021	
Internal task T1: Microcontroler family knowledge Internal task T2: SW Life cycle development tools. JIRA/Git Internal task T3: Use of Renesas e2studio IDE platform for the development/configuration of the software Internal task T4: Use of Renesas QE for Capacitive touch, the development assistance tool for capacitive touch sensors Internal task T5: Use of On chip debugger (Renesas E2 Lite) in the process of development/debugging Internal task T6: Use of an oscilloscope for electronic inspection during development Internal task T7: Use of EMC specific equipment for analysing system response in hazardous environments Internal task T8: Test Report elaboration	Deliverables:	Dates:





Project: RA software development	WP ref: (WP2)	
Major constituent: SW	Sheet 1 of 3	
Short description:	Planned start date: 11/10/2021 Planned end date: 15/12/2021	
To adapt the software to the new board according to the RA and CTSU2 specification, get basic functionality for a board sample.	Start event: 11/10/2021 End event: 15/12/2021	
Internal task T1: Self touch buttons configuration Internal task T2: Self tests SW adaptation Internal task T3: Mutual touch buttons configuration Internal task T4: Mutual tests SW adaptation Internal task T5: Multi-frequency SW adaptation Internal task T6: Parallel scanning SW adaptation Internal task T7: Board configuration	Deliverables: RA software	Dates: 15/12/2021

Project: RX software adaptation WP ref: (WP3)		
Major constituent: SW Sheet 2 of 3		
Short description:	Planned start date: 01/11/2021 Planned end date: 15/12/2021	
To adapt current software for testing SW	Start event: 15/10/2021 End event: 02/11/2021	
Internal task T1: Current SW understanding Internal task T2: Self tests SW adaptation Internal task T3: Mutual tests SW adaptation	Deliverables: RX software	Dates: 02/11/2021

Project: Tests in former CTSU configuration	WP ref: (WP4)	
Major constituent: simulation	Sheet 2 of 3	
Short description:	Planned start date: 15/11/2021 Planned end date: 28/11/2021	
Injected currents and fast transients.	Start event: 15/11/2021 End event: 28/11/2021	
Internal task T1: Self measurement parameters for RX Internal task T2: Mutual measurement parameters for RX Internal task T3: Self measurement parameters for RA Internal task T4: Mutual measurement parameters for RA	Deliverables: Former CTSU tests	Dates: 28/11/2021



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Project: Tests configuring multi-frequency scan	WP ref: (WP5)	
Major constituent: simulation Sheet 2 of 3		
Short description:	Planned start date: 29/11/2021 Planned end date: 12/12/2021	
Comparative test with and without multi-frequency	Start event: 29/11/2021 End event: 12/12/2021	
Internal task T1: Tests setup Internal task T2: Run test Internal task T3: Test analysis and parameterization Internal task T4: Gathering tests results	Deliverables: Multi frequency scan tests	Dates: 12/12/2021

Project: Tests configuring parallel scanning function	WP ref: (WP6)	
Major constituent: simulation	Sheet 3 of 3	
Short description:	Planned start date: 13/12/2021 Planned end date: 26/12/2021	
Comparative test with and without parallel scanning	Start event: 13/12/2021 End event: 26/12/2021	
Internal task T1: Tests setup Internal task T2: Run test Internal task T3: Test analysis and parameterization Internal task T4: Gathering tests results	Deliverables: Parallel scan tests	Dates: 26/12/2021

Project: Tests configuring EMC immunity level	WP ref: (WP7)	
Major constituent: simulation	Sheet 3 of 3	
Short description:	Planned start date: 27/12/2021 Planned end date: 09/01/2022	
Apply EMC test and verify immunity levels according IEC standards	Start event: 27/12/2021 End event: 09/01/2022	
Internal task T1: Tests setup Internal task T2: Run test Internal task T3: Test analysis and parameterization Internal task T4: Gathering tests results	Deliverables: EMC tests	Dates: 09/01/2022





Project: Final conclusion	WP ref: (WP8)					
Major constituent: documentation	Sheet 3 of 3					
Short description:	Planned start date: 10/01/2022 Planned end date: 21/01/2022					
Set the benefits and drawbacks of using the new technology and the future possibilities based on the run tests and conclusions.	Start event: 10/01/2022 End event: 21/01/2022					
Internal task T1: Tests comparison Internal task T2: Reach conclusion Internal task T3: Conclusion documentation	Deliverables: Final conclusion	Dates: 21/01/2022				

Table 1. Work packages

b) Milestones

Here is a list of the different checkpoints followed during the project:

WP#	Task#	Short title	Milestone / deliverable	Date (week)
2	7	RA software	Software	15/12/2021
3	5	RX software	Software	02/11/2021
4	4	Former CTSU tests	Tests results	28/11/2021
5	4	Multi frequency scan tests	Tests results	12/12/2021
6	4	Parallel scan tests	Tests results	26/12/2021
7	4	EMC tests	Tests results	09/01/2022
8	3	Final conclusion	Final conclusion	21/01/2022

Table 2. Milestones





c) Time Plan (Gantt diagram)



Figure 2. Gantt diagram



1.6. Initial plan deviations

The project had to be done with a specific board using a RA2E1 microcontroller (gathering the hardware of the touch screen that will be used on the washing machine) which was already requested by the company.

However, the specific board took longer than expected to arrive, so I started to make the software based on RA2L1 (quite similar to RA2E1) and this work could later be added to the final software. I also could focus on RX software adaptation ending earlier than expected.

Once the board arrived I started testing it, but I found problems with the connection.

There was a design mistake in the PCB and the person in charge of it was off work, making it longer for me to find the error.

I corrected the hardware connections and changed them to fit the project.

A redistribution of WP2 tasks had to be done, starting with buttons configuration and software adaptation and ending with board configuration (which originally was the first task).





2. <u>State of the art of the technology used or applied in this</u> thesis

2.1. Capacitive Touch Switch

The capacitive touch switch detects the status of the switch (ON or OFF) by measuring a small capacitive (1pF or less) change which exists between the electrodes and the human body. For the capacitive touch detection method which Renesas has developed, it adopts the switched capacitor filter in order to achieve high sensitivity and noise immunity, and judges the status of switch by converting the capacitance to current, amplifying and digitalization. (Figure 3)



Figure 3. Flow of capacitance touch switch detection [2]

2.2. <u>Self-capacitance Method</u>

The mechanism of existing electrostatic capacity is shown in Figure 4. Parasitic capacity (Cp) exists between an electrode on the space and the conductive materials (ground pattern or metal frame, etc.) of its surroundings. At this time, finger capacity (Cf) is newly generated between the human body and electrode if the human body approaches, and it is grounded to the ground through the sole capacity (Cs) which is generated between the sole of feet and the ground through the human body as a conductor (the red line in the figure).



Figure 4. Generation of electrostatic capacity (self-capacitance method) [2]



Total capacity that is occurring on the electrode is shown in the following equation:

$$Total Capacity = Cp + Cf$$

The capacitive touch switch judges the status of the switch by detecting the increase of *Cf* of capacitance by the human body and measures the capacitance on the electrode by cyclic measurement. By setting a threshold for the amount of increase in *Cf*, you can determine whether the touch button is ON or OFF.

The CTSU outputs a digital count value proportional to capacitance C of the connected electrode, and determines whether the touch button is ON or OFF by software. When the electrode is connected to the CTSU, it performs as a switched capacitor controlled by the sensor drive pulse and estimates capacitance from the charge/discharge current to *C*. The CTSU measurement block has a current-frequency conversion function which inputs a current equivalent to the charge/discharge current and outputs a frequency proportional to the amount of current.





2.3. <u>Mutual-capacitance Method</u>

There is a mutual capacity method with a pair of electrodes in contrast with the self-capacity method with a single electrode. The example of the mutual capacity method is shown in Figure 6. The mutual capacity method is configured by receiving electrode, transmitting electrode, and pulse generators. When AC pulse is inputted to the transmitting electrode, Field Coupling is generated between the receiving electrodes. If a human body approaches in this state, the part of the electric field moves to the human body and the electric field between electrodes decreases.



Figure 6. Mutual capacity method [2]

By setting a threshold for the amount of increase in Cf, you can determine whether the touch button is ON or OFF.

The CTSU outputs a digital count that is negatively proportional to the mutual capacitance of Rx and Tx connected to the electrode, and determines whether the touch button is ON or OFF by software.

In order to measure the capacitance Cm existing on the two connected electrodes, the CTSU obtains Cm by inverting the phase relationship between the pulse output and the switched capacitor, measuring the self capacitance twice, then calculating the difference of the two values by software.









2.4. Capacitance-Current Conversion

Switched capacitor filter (SCF) is structured by a capacitor, a power supply, two switches and the control signal to toggle the two switches in ON or OFF mode alternatively.



Figure 8. SCF configuration and Charge and discharge operation of capacitor [2]

When SW1 turns ON, SW2 turns OFF and the capacitor is charged as described in Figure 8 (left). After switching SW1 to OFF, SW2 is switched to ON, and the capacitor is discharged as described in Figure 8 (right).



Figure 9. Status of SW1 and SW2 and the relationship of electric current i [2]

The electric charge of the capacitor is 0 at the moment SW1 turns ON. As the charge of the capacitor progresses, the amperage decreases, and the current stops at full charge. After that, the electric charge of the capacitor flows into the ground when SW2 turns ON. This current (Figure 9 dashed line) does not appear on the power supply side because SW1 is turned OFF. When cyclically repeats this operation, a certain amount of current flows intermittently synchronised with turning ON and OFF.

Amperage changes when changing the capacity of the capacitor or the ON/OFF cycle of the switches:



Figure 10. Double external capacitor capacity [2]







From these relationships, the following equation holds by writing the circuit current as i, the switch frequency as f, capacitor capacity as c, and circuit voltage as v.

$$i = fcv$$

The conversion ratio of capacitance and amperage can be changed by adjusting *f* and *v*.

Figure 12 shows an image of a CTSU measurement. When one cycle of the sensor drive pulse frequency is shorter than the C charge/discharge time and the charge/discharge is insufficient, not enough current flows to C and the count value is smaller than the ideal value. When parasitic capacitance is large, it may be possible to take a measurement by lowering the sensor drive pulse frequency. When the sensor drive pulse frequency is lowered, the CTSU can measure a maximum of 50pF. Note that when the sensor drive pulse frequency is decreased, the number of measurements per unit time by the current-frequency conversion function also declines. The sensitivity of the electrode is likely to decrease as well. The unit time can be increased by adjusting the register setting value in the CTSU, but the amount of time required to complete the measurement will also increase. When designing a capacitive electrode circuit, conditions for button sensitivity, measurement time and noise immunity must be met.



Figure 12. Image of CTSU Measurement [1]

2.5. Digitalization of Current

The capacity of the capacitor, which is converted to amperage, is digitalized by means of the circuit that changes oscillating frequency in accordance with amperage and the counter that counts pulse outputting from the circuit.

The flow of digitalization is shown in Figure 13. The electric current from SCF flows alternatively because the capacitor with SCF charges and discharges continually. This alternative current is smoothed by the power supply circuit connected to SCF. The current is sent to the current oscillator that varies oscillation frequency in proportion to amperage, and converted to oscillation frequency. This pulse is sent to the counter, and the counter holds it by measuring the number of pulses for a certain time. The graph in the figure shows the example when the frequency of SCF is fixed and the capacitor capacity is doubled, then the amperage and the frequency of the current oscillator become double. Eventually, the count value measured by the counter also doubles.







Figure 13. Flow of current digitalization [2]

Measurement of the capacitance is carried out at a regular interval as the measured timing shown in the figure. Count value obtained by measurement (blue line in figure 14) increases with the increase of capacitance when finger is approached, and decreases and becomes to a certain value when the finger is away again. At this time, set the count value when the finger is away as a standard value (green dashed line) and the value that added a certain value from the standard value as threshold value. Then, it will be possible to switch ON/OFF as a capacitive touch switch by switching ON when the measured count value exceeds the threshold value and switching OFF when the value is under the threshold value.



Figure 14. ON/OFF switch judgement [2]

The sensitivity adjustment of the capacitive touch switch can be done by changing the threshold value. Also, chattering suppression of the switch and the reaction rate can be adjusted by changing the cycle of measurement timing and averaging the multiple times of count value.





2.6. <u>Mutual-capacitance parallel scan mode</u>

This mode provides fast measurement time by parallel scanning the Rx lines with a CFC circuit. Operation is otherwise identical to normal CTSU mutual scanning.

- Scan Order
 - The hardware scans all Rx pins simultaneously for each Tx pin.
 - For example, if sensors TS10, TS11, and TS03 are specified as Rx sensors, and sensors TS02, TS07, and TS04 are specified as Tx sensors, the hardware will scan them in the following sensor-pair order: TS02-(TS03, TS10, TS11), TS04-(TS03, TS10, TS11), TS07-(TS03, TS10, TS11)
- Element
 - An element refers to the index of a sensor-pair within the scan order. Using the previous example, TS07-TS10 is element 7.
- Scan Time
 - Because the Rx lines are scanned in parallel, CFC mutual-capacitance scan is the same amount of times faster than a basic mutual matrix scan as the number of Rx lines. In other words, on a matrix with N receive lines, CFC mutual scanning is N times faster than basic mutual scanning.

2.7. <u>Multi-frequency Measurements</u>

The CTSU2 peripheral takes measurements at three different frequencies to avoid synchronous noise. After standardising the results obtained at the three frequencies in accordance with the first frequency reference value, the measured value is determined based on majority in a process referred to as "normalisation."

The three values standardised to the first frequency reference value are called correction data.



Figure 15. Multi-frequency Measurements [6]

2.8. <u>Debounce</u>

When pressing a button the voltage may fluctuate between states several times during the transition period. Debounce is used to remove that small ripple of current that makes a series of short contacts, by waiting a specified amount of time between sampling periods.



2.9. EMC (Electromagnetic compatibility)

2.9.1. Electrical fast transient/burst immunity test

Its objective is to evaluate the immunity of electrical and electronic equipment when subjected to electrical fast transient/bursts (sequence of a limited number of distinct pulses or an oscillation of limited duration) on supply, signal, control and earth ports.





2.9.2. Immunity to conducted disturbances, induced by radio-frequency fields

Its objective is to evaluate the functional immunity of electrical and electronic equipment to electromagnetic disturbances coming from intended radio-frequency (RF) transmitters in the frequency range 150 kHz up to 80 MHz.

The open circuit test levels (e.m.f.) of the unmodulated disturbing signal, expressed in r.m.s., are given in Table 3.

Frequency range 150 kHz to 80 MHz										
	Voltage level (e.m.f.)									
Level	Uo V	Uo dB (µV)								
1	1	120								
2	3	129,5								
3	10	140								
Xª	Spe	ecial								
^a "X" can be any level, above, below or in between the others. The level has to be specified in the dedicated equipment specification.										







The test levels are set at the EUT port of the coupling devices. For testing of the equipment, this signal is 80 % amplitude modulated with a 1 kHz sine wave to simulate actual threats. The effective amplitude modulation is shown in Figure 17.





2.10. FINE Interface

FINE is used to communicate with the serial programmer in boot mode (FINE Interface).

Figure 18 shows an Example of Pin Connections in Boot Mode (FINE Interface).



Figure 18. Example of Pin Connections in Boot Mode (FINE Interface)





2.11. SWD Interface

SWD Interface Connection Figure 19 shows a recommended circuit for connection through the SWD interfaces.



Figure 19. Example of Connection through the SWD Interfaces

Notes:

- 1. For DLM control, the MD pin must be connected to the emulator. When DLM control is not required, the MD pin can operate even if it is not connected to the emulator. When the MD pin is not connected to the emulator, a special circuit for the pin must be configured on the user system. For details on handling of the MD pin, refer to section2.5,Notes on Connection.
- 2. If a 10-pin connector is mounted on the user system, pins 11 to 20 are not used.
- **3.** E2 Lite emulator does not support outputting trace data in Emulator Debugger. On the other hand, E2 emulator only handles outputting trace data from SWO pin.





3. <u>Methodology / project development</u>

The initial part of the project gathers some knowledge acquisition as well as some software/hardware tests in order to understand the state of the art of the technology used with practical results. For this purpose, RA2L1 microcontroller has been used on Capacitive Touch Evaluation System with Self-capacitance Button/Wheel/Slider Electrode Board and Mutual-capacitance Button/Proximity Sensor Board.





Figure 20. CAP Touch CPU Board + Self-capacitance Button/Wheel/Slider Electrode Board

Figure 21. Mutual-capacitance Button/Proximity Sensor Board

The first test was to achieve a basic configuration of some self buttons. The next figure shows the monitoring of one of the three configured buttons. Measurement count (red), threshold (green) and reference (blue) values can be identified as well as the "pressed button" state (red bar).



Figure 22. Self button monitoring

When monitoring different channels at the same time different calibrations of them can be seen, setting each of them in a different offset. The sequence of pressed buttons on the next image is the button TS_B3 (yellow), TS_B2 (green) and TS_B1 (red), keeping the last one pressed.



Figure 23. Self button sequence monitoring





The next step is to compare self buttons' behaviour with mutual buttons. In order to see the effect of Rx and Tx sensor pins the configuration will be a square of four buttons. The next figure shows the configuration of the channels, where TS00 and TS08 are Tx and TS23 and TS32 are Rx.



Figure 24. Mutual 2x2 configuration

As expected, in figure 25 it can be seen that the button count is negatively proportional to the mutual capacitance of Rx and Tx. So, when using mutual buttons, the "pressed" status will be when the count value crosses the threshold negatively.



Figure 25. Mutual button monitoring

The effect on the other channels when pressing one of them is shown in figure 26. The sequence of touch of the next image is the button K0 (red), K5 (yellow), K1 (green) and K6 (orange), keeping the last one pressed. It can be noticed that the sensor count value increases on the non-touched channels because of the proximity of each to the other.



Figure 26. Mutual button sequence monitoring

Some measurements can be done with the QR tool. Nevertheless, to gather the same kind of measurements, the comparative SNR will be calculated with a specifically developed software, as the two projects use different frameworks and we can not use this tool on both of them.



For calculating measurement times, a pin toggle has been used, and this toggle has been visualised with the oscilloscope (yellow measurement). There is also the touch sensor pin representation (blue signal) where we can see three different measures, as this configuration uses only one self channel with multifrequency (three different frequencies).

This blue representation is an invasive method, as it is being taken from the touch pin itself, but it allows us to see a nearly representation of the signal and a conceptual view.



Figure 27. One button with multifrequency configuration measurement time

When measuring a mutual button on a configuration of four mutual buttons square (figure 28), it can be seen that two buttons share the Tx pin, so we can observe two different measures of it (with three measurements on each because of multifrequency). In the case of the Rx pins (figure 29), all measures in the same Rx are together.



Figure 28. Four buttons with multifrequency configuration measurement time (Tx pin)

lek Run	Trig'd				Noise Filter Off
	v		8	6	
			<u>-</u>		🗧 2.43ms 🔰 15.2 V
					6 4.81ms 0.00 V
<u> </u>					⇔2.38ms ⇔15.2
				. [<mark>.]</mark>	
		1. 1. 1. <u>1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1</u>			
	· · · · · · · · · · · · · · · · · · ·	<u> </u>	<u> </u>		
				· · · · · · ·	
	: i	1.00ms	3.05216ms	(1) J 2.80 V	27.2626 Hz
1 5.00 V	2 10	0.0 V ICTO+W	lidth 4.810ms	?	10:26:36

Figure 29. Four buttons with multifrequency configuration measurement time (Rx pin)





In the case of parallel scan, Tx has just one measurement for each pin (apart from multifrequency), as we measure together all Rx pins for each Tx pin.

Tek Run Trig'd	li 👬]	Noise Filter Off
i 🗸 🗸 🗸 🖓 👘 🖓			
			. 🗧 1.23ms 60.0mV
			8 2.42ms 20.0mV
		. <u>.</u>	
	na ang mang sa		
2			
		· · · · · · · · · · · · · · · · · · ·	
	i (400,us	5.400 % (1) / 800m	/ 29.0405 Hz
(1) 5.00 V (2)	1.00 V 1+Width	2.435ms ?	10:07:19

Figure 30. Four buttons with multifrequency and parallel scan configuration measurement time (Tx pin)

Te.	k	R	un			T	rig)'d							1	1	ŀ					ľ			ł]				N	ois	e Fi	lte	r C	lff				
					5	6																-										Ì	_	-	ď	7.0				97'	lead	
												-										Web									-				4 2, 42	41) 2.36	jus ms Sm	s	2	924 924	4m) 4m) 400	/ / IV
																															1											
2																																										
																						-					_		-		Ļ											
										:				-		40	10,	: JS			1.	60	48	0m	15	1)	7	3.2	20 \	,			29),O4	192	H		: : : .	l,		
1		5,	00	۷					2	\mathbf{P}	2	00	m١			1		+Y	lid	th		2	.43	34r	ns		?											1	0:10):5()	

Figure 31. Four buttons with multifrequency and parallel scan configuration measurement time (Rx pin)

A table of different measurement times for the different button configurations has been made:

Button number	1	2 (1x2)	3 (1x3)	3 (3x1)	4 (2x2)	5 (1x5)	9 (3x3)
Self	650us	1.24ms	1.84ms	-	-	-	-
Mutual	1.24ms	2.43ms	3.62ms	3.62ms	4.81ms	6ms	10.75ms
Mutual + parallel scan	1.25ms	2.43ms	3.62ms	1.25ms	2.43ms	6ms	3.64ms

Table 4. RA measurement times comparative

Note: button number (Rx x Tx)

It can be noticed that for mutual buttons the time is doubled in respect of on self buttons, because two pins (Rx and Tx) are being scanned for each channel. When using parallel scan the time is reduced if there are multiple Rx pins for the same Tx pin, and this reduction is in order of how many of these Rx are.



3.1. Board configuration for measurements

The first thing to look at on the RA2E1 microcontroller board was the connection, as it was not communicating with the debugger. RA2E1 was expected to support FINE connection but it does not, so another debugging interface had to be used. For implementing SWD Interface Connection some of the pins had to be changed (see section 1 of appendices for resulting schematic).

The next thing to look at were the used ports for its configuration on the code (see section 2 of appendices to see the resulting touch foil of both boards).

For SNR and time tests, of all the channels on the board, only 2 self buttons and 3 mutual buttons will be used. This configuration allows us to compare SNR results between buttons and also allows us to compare times. Mutual buttons must be parallel in reception in order to compare parallel scan from the configuration without parallel scan, as parallel scan works scanning several reception ports within scanning the same transmission port.

So the figure 32 represents the configuration for the project with RX130 microcontroller, where S49 (TS01) and S48 (TS25) are self buttons, TS22 is a transmitter pin and TS10, TS09 and TS08 are receiver pins, resulting on the mutual buttons S2, S10 and S18.



Figure 32. Two self, three mutual configuration for RX

Then, to have an equivalent configuration while using RA2E1 it would result like the following figures:



Without parallel scan:

With parallel scan:

Figure 33. Two self, three mutual without parallel scan configuration for RA

Figure 34. Two self, three mutual with parallel scan configuration for RA





In figures 33 and 34, self channel S49 is the TS21 pin and S48 is TS22. On mutual channels the transmitter pin is TS30 and the receiver pins are TS26, TS15 and TS14. On parallel scan configuration we can see that CFC configuration is activated.

This configuration should be compared with and without multifrequency and parallel scan. With the equivalent scan time that we have on RX130 configuration, the measurement exceeds its maximum size when using multifrequency because, as we have seen in section 2.7, two detection values are added resulting in a high measurement value. This, added to having a higher value because of the scan time, results in overflow. With this being said, a new comparison must be done decreasing the scan time. When

With this being said, a new comparison must be done decreasing the scan time. When decreasing the scan time, it will decrease the sensitivity because it compresses the integration period.

All this brings us to this different configurations to be compared:

- RX
- RA with RX scan time
- RA with lower scan time
- RA with multifrequency scan
- RA with parallel scan
- RA with multifrequency and parallel scan

As the project consists of a comparison between an existing board and a new version of it with a different microcontroller, the next step is to understand the original configuration and extract the information needed to implement an equivalence in the new board.

Config.	RX	/ RA S high	ingle scan	freq. v time	with	R/	A Sing M	gle fre ultifre	əq. / F əq.	RA	RA Single freq. + parallel / RA Multifreq. + parallel						
Channel	S49	S48	S18	S10	S2	S49	S48	S18	S10	S2	S49	S48	S18	S10	S2		
DPF	4	4	1	1	1	4	4	1	1	1	4	4	0.25	0.25	0.25		
ScT	576	576	1152	1152	1152	128	128	256	256	256	128	128	256	256	256		

Table 5. Parameters comparative for each configuration

Notes: DPF: Drive Pulse Frequency (MHz) ScT: Scan Time (us)

3.2. <u>Sensibility measurements</u>

The following function has been used for SNR calculation:

 $SNR = \frac{max touch - reference}{noise}$ where noise = max no touch - min no touch

The sensor value has been extracted from the code. Several measurements have been made and the extracted sensor value has been compared to obtain the maximum and minimum value. From these values, noise can be obtained.

This noise will be calculated while the sensor is not in touch. Once we have saved these values, touch measurements need to be done in order to find *max touch* value and *reference* value. With these results we can obtain SNR using the previous function (see section 3 of appendices for the code example).



3.3. <u>Time measurements</u>

The same method as the one followed to obtain figure 27 is used to get the time measurements. A toggle is programmed and measured using an oscilloscope. In this case the pin itself is not measured, but all the channels *scan time* is measured (see section 3 of appendices for the code example).

For RX, the pin toggle is set up by implementing a *state change* right before the measurement starts, and another *state change* when the interrupt jumps (at the end of the measurement).

For RA, the first *state change* is implemented right before the measurement starts. Once this measurement ends, it results in a flag change and the other *state change* comes after it. In the end, it is not needed to check the end of the measure like it was with the RX.

3.4. <u>Memory usage measurement</u>

There is an option on both used frameworks (CS+ and e2 studio) which allows extracting the Memory Usage. This has been done for each of the different configurations in order to compare it.

3.5. EMC tests

On the next table are the two RA configurations chosen to do the EMC tests:

Configurations	All channels scan time (seconds)
RX	62,49
RA single frequency + parallel scan	4,95
RA multifrequency + parallel scan	12,89

Table 6. Measurement time for all channels on EMC chosen configurations

In order to compare both boards, debounce and threshold changes may be done by approximating the measurement time to 65 seconds. In this time, one measurement can be done with RX configuration, 13 measurements with RA single frequency + parallel scan configuration, and 5 measurements with RA multifrequency + parallel scan configuration, so the initial debounce parameters are set based on these values. Threshold is set to 60%.

The drift frequency is used to recalculate the reference value during the execution of the program, and refers to the number of samples between the reference value's recalculations. On the RA multifrequency with parallel scan configuration, this value is set to 150, as RA makes 5 times more samples than RX, which has a drift frequency of 30.

Electrical fast transient/burst immunity tests are configured to a voltage peak level of 4kV, a 100kHz repetition frequency and 60s steps.

Immunity to conducted disturbances, induced by radio-frequency fields tests, are set to a voltage level of 6V and a frequency range of 1MHz up to 10MHz.

The EMC immunity level results are considered passed if it does not detect any fake touch.





4. <u>Results</u>

After all the measurements, some tables are made in order to gather the information into a conclusive result.

Results can be summarised in SNR results (with and without leds activation), time results, memory results and EMC immunity level results.

As it has been said before, the evaluation is based in different configurations: in the first one the board is using the current microcontroller used by the company, RX130, while the other tests are using RA2E1 microcontroller, first using the equivalent values to the RX configuration, later reducing the scan time in order to balance the next results and, finally, applying multi frequency and parallel scan.

SNR results without leds 20 8 6 SNR (dB) 4 2 1 S49 S48 **S18** S10 **S**2 📕 RX 🛛 📕 RA, RX equivalent config. 📕 RA 1 freq. 🛛 🗧 RA 1 freq. + parallel RA multifreq. RA multifreq. + parallel

As leds add some noise, SNR results need to be found with and without the leds.

Figure 35. SNR results without leds

In the case of not using leds, we can see better results on self buttons than on mutual buttons. We can also see better SNR on RA2E1 than on RX130 when using the same scan time. When reducing the scan time we can see better SNR results when there is no parallel scan and when using multifrequency scan.

For SNR with leds comparison, we will only compare RA results, due to the different configurations of the leds with respect to RX.




SNR results with leds



Figure 36. SNR results with leds

We can clearly see a decrease of the SNR value when using leds. The differences mentioned before between configurations are still the same but, in this case, are less noticeable because the SNR levels are closer now.



Figure 37. Time results

We can see that, with equivalent configurations, RX130 and RA2E1 use almost the same time for the measurements. When using multifrequency, the time is three times the time of one frequency measurement (because we are using three frequencies). When using parallel scan, the mutual measurement time is the third part of it when it is not using parallel scan, because we have three mutual buttons in parallel on reception and it scans all of them at the same time.

We can see that with an equivalent configuration, RA has better SNR than RX, using almost the same measurement time. When using additional configurations as





multifrequency scan, SNR results increase. And when using parallel scan, it makes the measurement much faster, although SNR decreases.



Figure 38. Memory usage results

It can be seen that memory usage does not change too much from one to the other configuration, when adding multifrequency and parallel scan the memory usage increases a little, but it will not be a decisive factor for the results of our comparison.

With the configurations set as specified in section 3.5, EMC immunity level results have been run for RA CTSU technology board.

This results, compared to RX CTSU technology board EMC tests results, are gathered on the next table:

EMC immunity level results	RX	RA Single frequency	RA Multifrequency	
Electrical fast transient/burst	Dassad	Dassad	Dassad	
immunity test	Passed	Passeu	Passeu	
Immunity to conducted				
disturbances, induced by	Passed	Failed	Passed	
radio-frequency fields				

 Table 7. EMC immunity level results

With the single frequency with parallel scan configuration we have reduced the measurement time to an 8% in respect to RX, and SNR has decreased an average of 26% while passing burst EMC test, but not passing injected EMC tests.

With the multifrequency with parallel scan configuration we have reduced the measurement time to a 21% in respect to RX, and SNR has decreased an average of 20% while passing burst and injected EMC tests.

In the end, for the purpose of this board, the optimal configuration is to use multifrequency with parallel scan.



5. <u>Budget</u>

This project consists of a software development of a hardware board, so the budget will consist of software, hardware and engineering costs.

It is usual for some softwares to be free until some memory usage is exceeded. In this case, CS+ and Workbench were free, while e2studio had a cost of 1700€/year.

Software	Price	Utilization (months)	Amortization (years)	Cost
e2studio,1 user, PROFESSIONAL FLOATING LICENCE	1.700,00€	4	1	566,67 €
CubeSuite+	0,00€	-	-	-
WWB6 - Wireless Workbench® 6	0,00€	-	-	-
			Total	566,67 €

 Table 8. Software costs

The hardware part is divided in components and tools lists.

As the T4 (RX) board is already in production, several units are bought, resulting in a low price in comparison to the T4 (RA) board.

Components list	Cost
RA2L1 CAP Touch CPU Board + Self-capacitance Button/Wheel/Slider Electrode Board (RTK0EG0022S01001BJ)	140,00€
Mutual-capacitance Button/Proximity Sensor Board - Touch Sensor Development Tools RX130 Capacitive Evaluation Kit (RTK0EG0003S02001BJ)	197,00€
Renesas E1 emulator (R0E000010KCE00)	149,00 €
T4 board	15,00 €
Renesas E2 Lite (RTE0T0002LKCE00000R)	72,70€
T4 (RA) board	200,00€
Total	773,70€

Table 9. Component costs

Tools	Price	Utilization (months)	Amortization (years)	Cost
PC	700,00€	4	5	46,67 €
Oscilloscope	200,00€	4	15	4,44 €
			Total	51,11 €

Table 10. Tools costs





Different engineering tasks have been implemented for the project, the table 11 summarises each part. It includes the Social Security costs that the company must assume.

Engineering	Hours	Salary	Total
Junior Software Development	405	9€	3.645€
Support for Software Development	20	57€	1.140 €
Layout (PCB routing support)	35	30 €	1.050 €
Hardware Development	22	30 €	660 €
		Net total	6.495€
		Social Security (33%)	2.143€
		Total	8.638€

Table 11. Engineering costs

This different parts result on the next amount for the final cost of the project:

Description	Cost
Software	566,67 €
Hardware	824,81 €
Engineering	8.638€
Total	10.029,83 €

Table 12. Project total cost



6. <u>Conclusions and future development</u>

Creating a new software for the new T4 board using RA2E1 microcontroller has been accomplished. It is a functional board which can be implemented and used in future products of the company.

It has been demonstrated that we get a lot of advantages from using CTSU2 instead of CTSU. For the purpose of this board, the optimal configuration is to use multifrequency with parallel scan.

For further developments some more comparatives and improvements can be done. As an example, as CTSU2 includes shield electrode support, shield and safety function analysis could be done.

Some radiated and conducted emissions EMC tests could also be run. This kind of tests consist of measuring the electromagnetic field strength of the emissions that are unintentionally generated by the board in order to assure that it complies with the emissions limits.

As we have seen that the single frequency configuration measurement time is much lower than the one on multifrequency configuration, the debounce parameter could be incremented from 5 to 15 samples, resulting in an increment of the stability of the system. It can be the case that this would be preferred, so some improvements should be studied in order that this configuration passes EMC injected tests.

Finally, it is possible to configure non-touch signs detections (if the immunity to radiated emissions is confirmed previously), as CTSU2 is able to detect the movement of the finger to one or two dimensional directions with better results than CTSU, due to the sensibility improvements resulting from the better time results.





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Appendices



1. T4 using RX130 vs T4 using RA2E1 schematics





2. Resulting touch foils for RX and RA

Touch foil with RX130:



Touch foil with RA2E1:







3. <u>Code used for measurement extractions</u>

For tracking code changes Git software has been used.

SNR measurement code for RX

Set minimum value to maximum for later comparison:

```
for (loop = 0; loop < SELF_KEY_NUM; loop++)
{
    ss_valminSelf[loop]=0xFFFF;
}
for (loop = 0; loop < MUTUAL0_KEY_NUM; loop++)
{
    ss_valminMut[loop]=0xFFFF;
}</pre>
```

Sensor value extraction:

```
if (_0_SELF_MODE == g_key_info[method].mode)
ł
     if (0 != g key info[method].key num)
     {
         for (loop = 0; loop < MAX TS; loop++)
         ł
              if (KEY ENABLE == touch key function check( method, loop))
              ł
                  sensor_val = R_Get_Cap_Touch_Sensor_Data(method, _0_BUTTON, loop);
                  if (loop==1)
                  £
                       ss valSelf[0]=sensor val;
                  }
                  else
                   ł
                       ss valSelf[1]=sensor val;
                  3
                  touch_key_decode(method, sensor_val, loop);
              }
         }
else
ł
   if (0 != g_key_info[method].key_num)
       for (loop = 0; loop < g_key_info[method].ena_num; loop++)</pre>
           sensor_val = R_Get_Cap_Touch_Sensor_Data(method, _1_MATRIX, loop);
           ss valMut[loop]=sensor_val;
           touch_key_decode(method, sensor_val, loop);
       }
       for (loop = 0; loop < g key info[method].key max group; loop++)</pre>
       ł
           g_touch_all_result[method].matrix[loop] = *(g_key_info[method].touch_result + loop);
           status = 0 SUCCESS;
       }
   }
g_ctsu_status[method].flag.data_update = _0_NON_UPDATE;
```





Noise and touch values measurement:

```
if(count > 100)
{
    if (method==0)
    Ł
        for (button_id = 0; button_id < SELF_KEY_NUM; button_id++)</pre>
        ł
            if (ss_valSelf[button_id]>ss_valmaxSelf[button_id])
                 ss valmaxSelf[button id]=ss valSelf[button id];
             3
            if (ss_valSelf[button_id]<ss_valminSelf[button_id])</pre>
             ł
                 ss valminSelf[button id]=ss valSelf[button id];
             }
            ss valtouchSelf[button id]=ss valmaxSelf[button id]-*(g key info[0].ref+button id);
            ss_valnoiseSelf[button_id]=ss_valmaxSelf[button_id]-ss_valminSelf[button_id];
        }
    3
    if (method==1)
    ł
        for (button id = 0; button id < MUTUAL0 KEY NUM; button id++)</pre>
        {
            if (ss valMut[button id]>ss valmaxMut[button id])
             £
                 ss valmaxMut[button id]=ss valMut[button id];
             }
            if (ss valMut[button id]<ss valminMut[button id])</pre>
             ł
                 ss valminMut[button id]=ss valMut[button id];
             3
            ss_valtouchMut[button_id] =* (g key info[1].ref+button_id) -ss_valminMut[button_id];
            ss_valnoiseMut[button_id]=ss_valmaxMut[button_id]-ss_valminMut[button_id];
        3
    }
3
count++:
```

SNR measurement code for RA

Set minimum value to maximum for later comparison:

Sensor value extraction:

```
* Function Name: touch_button_self_decode[]
void touch_button_self_decode (touch_button_info_t * p_binfo, uint16_t value, uint8_t button_id)
{
    uint32_t threshold;
    uint16_t threshold_sub_hys;
    ss_valSelf[button_id]=value;
```





* * Function Name: touch_button_mutual_decode[]
void touch_button_mutual_decode (touch_button_info_t * p_binfo, uint16_t value, uint8_t button_id)
{
 uint16_t threshold;
 uint32_t threshold_add_hys;
 ss_valMut[button_id]=value;

Noise and touch values measurement:



Toggle code for RX

Change before measurement:

```
g_touch_system.flag.timing = 0;
R_Set_Cap_Touch_Measurement_Start( method );
PORT3.PDR.BYTE |= 0x40U;
PORT3.PODR.BYTE |= 0x40U;
if (_00_GET_OK == R_Get_Cap_Touch_Data_Check( method ))
ł
    if (_1_FINISH == R_Get_Cap_Touch_Initial_Status())
    Ł
        if (_0_SUCCESS == R_Set_Cap_Touch_Result_Create( method ))
        ł
            g_ts_result = R_Get_Cap_Touch_Result( method );
            if (0 != (g_ts_result.button[0] & 0x0001))
            Ł
                /* Touch feedback
                                                   */
                                   Led etc...
                /* Touch feedback Led etc...
                                                   */
            }
        }
    }
    else
    ł
        R_Set_Cap_Touch_Initial_Tuning( method );
    3
}
method = R_Set_Cap_Touch_Next_Method_Change( method );
```

PrepareReplayMessage(); /* Make the replay message of the serial command from Workbench */





Change when interrupt jumps:

void	CTSUInterrupt(void)		
	uint8_t err_status; PORT3.PODR.BYTE &= (uint8_t) (~0x40U);		
	<pre>if (0 != CTSUGetTscapVoltageError()) {</pre>		
	<pre>if (_1_CORRECTION == g_correction_mode) {</pre>		
	<pre>g_correction_status.flag.icomp_error = 1; }</pre>	/* TSCAP voltage error	*/

Toggle code for RA

```
⊖ void qe_touch_main(void)
  {
      fsp_err_t err;
           /* for [CONFIG01] configuration */
           pin_high(BSP_IO_PORT_04_PIN_07);
           err = RM_TOUCH_ScanStart(g_qe_touch_instance_config01.p_ctrl);
           if (FSP_SUCCESS != err)
Θ
           {
               while (true) {}
           }
          while (0 == g_qe_touch_flag) {}
pin_low(BSP_IO_PORT_04_PIN_07);
g_qe_touch_flag = 0;
           err = RM_TOUCH_DataGet(g_qe_touch_instance_config01.p_ctrl, &button_status, NULL, NULL);
           if (FSP_SUCCESS == err)
Θ
           {
Θ
               if(previous_button_status != button_status)
               {
                   previous_button_status = button_status;
Θ
                   if ( button_status != 0)
                   {
                        uiTouchCounterDetected++;
                   }
               }
           }
           /* for [CONFIG02] configuration */
           pin_high(BSP_IO_PORT_04_PIN_07);
           err = RM_TOUCH_ScanStart(g_qe_touch_instance_config02.p_ctrl);
Θ
           if (FSP_SUCCESS != err)
           {
               while (true) {}
          while (0 == g_qe_touch_flag) {}
pin_low(BSP_IO_PORT_04_PIN_07);
           g_qe_touch_flag = 0;
           err = RM_TOUCH_DataGet(g_qe_touch_instance_config02.p_ctrl, &button_status_2, NULL, NULL);
Θ
           if (FSP_SUCCESS == err)
           {
Θ
               if(previous_button_status_2 != button_status_2)
                {
                    previous_button_status_2 = button_status_2;
Θ
                    if ( button_status_2 != 0)
                    {
                        uiTouchCounterDetected++;
                    }
                }
                ucEnableTouchProcess = 0;
           }
 }
```





Code changes for RA EMC tests

Threshold change to be adjusted to 60%.

```
    Touch Related Information for [CONFIG02] configuration...

  #define QE_TOUCH_CONFIG02_NUM_BUTTONS (54)
#define QE_TOUCH_CONFIG02_NUM_SLIDERS (0)
#define QE_TOUCH_CONFIG02_NUM_SLIDERS (0)
  #define QE_TOUCH_CONFIG02_NUM_WHEELS (0)
  #define QE_TOUCH_CONFIG02_NUM_TOUCH_PADS (0)
  #define THR_MUTUAL 60/100
  /* Button configurations */
#if (QE_TOUCH_CONFIG02_NUM_BUTTONS != 0)
  const touch_button_cfg_t g_qe_touch_button_cfg_config02[] =
  {
       /* s47 */
       {
           .elem_index = 0,
           .threshold = 394*THR MUTUAL,
           .hysteresis = 19,
      },
/* s40 */
       {
           .elem index = 1,
           .threshold = 343*THR_MUTUAL,
           .hysteresis = 17,
       },
```

For debounce changes, ucCnt stands for enabling touch process time

```
ucCnt64ms++;
if (ucCnt64ms >= (65/5))
{
    ucCnt64ms=0;
    ucEnableTouchProcess = 1;
}
```

on_freq is the debounce parameter.

```
/* Touch configurations */
 const touch_cfg_t g_qe_touch_cfg_config02 =
 {
      .p_buttons = g_qe_touch_button_cfg_config02,
      .p_sliders = NULL,
       p_wheels
                   = NULL,
⊕ #if (TOUCH_CFG_PAD_ENABLE != 0)
      .p pad
                   = NULL,
 #endif
     .num_buttons = QE_TOUCH_CONFIG02_NUM_BUTTONS,
.num_sliders = QE_TOUCH_CONFIG02_NUM_SLIDERS,
      .num_wheels = QE_TOUCH_CONFIG02_NUM_WHEELS,
                     = 1,
      .number
⊖ #if ((TOUCH_CFG_UART_MONITOR_SUPPORT == 1) || (TOUCH_CFG_UART_TUNING_SUPPORT == 1))
      .p_uart_instance = &g_uart_qe,
⊖#else
     .p_uart_instance = NULL,
 #endif
      .on_freq
                   = 5.
     .off_freq
                  = 3.
      .drift_freq = 255,
      .cancel_freq = 0,
      .p_ctsu_instance = &g_qe_ctsu_instance_config02,
 };
 touch_instance_ctrl_t g_qe_touch_ctrl_config02;
```





4. Tests executions

Jira Software is the leading agile project management tool used by the company. Test results have been reported and exported from Jira:

SNR, memory and time test execution results:

Te	st Cycle											
K	ey	SP00014-	-C1	Name			RX tests					
D	escription	RX tests v Memory	with and withou usage using a r	ut leds to find n eference finger	neasure for T4	ement tin RX	e, maximum measured s	signal, SNR and				
PI	anned	2021-11-	01, 00:00	Planned er	nd date		2022-01-15, 00:00	Iteration	-			
St	art date	DONE		Version								
51	atus	DONE		version			-					
Te	st Execution	ıs										
Ke	₽y		SP00014-T13	Status	PASS	Name	RX tests in former CTS leds (all channels)	U configuration w	/ith			
0	bjective		To find measu reference fing	d measurement time, maximum measured signal, SNR and Memory usage using a ence finger for T4 RX								
Pr	econdition		Config: all cha	nnels								
Co	overage (iss	ues)	SP00014-10									
Co	overage (co	nfluence										
pa	ages)											
C	overage (w	eb links)					0					
			2022-01-13,	Estimated	00.00	Actual	00.00					
A	ctual end d	ate	08:57	Time	00:00	time	00:00					
A	ssigned to		Nira Tubert	Environment	CS+	Туре	Manual execution					
E>	ecuted by		Nira Tubert									
Is	sues		-	1								
-					oct Cor							
	Cantura		DACC		est scr	ιρτ						
	Datalla		Check			ما بنيم من أخار	aut tauching					
	Details		Check	max, min, and i	incelf	alues with						
	Test Data		ss_vain ss_vain	ss_valmaxSelf, ss_valminSelf, ss_valnoiseSelf ss_valmaxMut, ss_valminMut, ss_valnoiseMut								
	Expected I	Result	Max, n	x, min and noise values								
1	Actual Res	ult		[0] [1] [1] [2] [3] [3] [3] [3] [46] [3] [3] [46] [3] [3] [46] [3] [3] [46] [46]	15573 15573 14812 14667 904 9563 4563 6952 3645 3755 6107 918. 790. 845.	unt16_t unt16_t	(2) [2](4] [2](4] (2) [2](4] (2) [2](4] (2) [46](96) (2) [48](96) (2) [48](96) (2) [48](96) 2) 2) 2)					
	Statue		PASS									
	Details		Check	touch value /m	ax-refe	rence diff	erence while touching)					
	Test Data		ss valt	ouchSelf ss val	touch	Aut	erence while todening)					
	Expected	Result	Maxim	um measured a	ignal							
2	Actual Res	ult	\$49: \$48: \$18: \$10: \$2:	(0) (1) (31) (39)		3060 uin 4272 uin 913 uin 887 uin	t = t(2) t = t(2) t = t(2) t = t(2) t = t(2) t = t(2)					
	Issues		12.0	. [20]		100 m uin	LIU_L(Z)					





Status	PASS	PASS						
Details	Calculate S	Calculate SNR (touch/noise value)						
Test Data								
Expected Result	SNR							
	RX all channels	Max NT	Min NT	Noise	Max T	SNR		
	Self but							
	S49	15973	14812	1161	3060	2,64		
	S48	15571	14667	904	4272	4,73		
Actual Result	Mutual but							
	S18	4563	3645	918	913	0,99		
	S10	4545	3755	790	887	1,12		
	S2	6952	6107	845	1087	1,29		
Issues	-							

Кеу	SP00014-T3	Status	PASS	Name	RX tests in former CTSU configuration without leds (all channels)
Objective	To find measure fing	urement time, n ger for T4 RX	naximui	n measur	red signal, SNR and Memory usage using a
Precondition	Config: all ch	annels			
Coverage (issues)	SP00014-10				
Coverage (confluence pages)					
Coverage (web links)	-				
Actual end date	2022-01-13, 08:56	Estimated Time	00:00	Actual time	00:00
Assigned to	Nira Tubert	Environment	CS+	Туре	Manual execution
Executed by	Nira Tubert				
Issues	1 				

		Test Script					
Status	PASS						
Details	Check max, min, and	noise values without touching					
	ss valmaxSelf, ss valu	minSelf. ss. valnoiseSelf					
Test Data	ss valmaxMut ss val	ss_valmaxset, ss_valminset, ss_valmoisesett					
Exported Pecult	Max min and poice a	values					
Expected Result							
	Watch	Value Type (Byte Size)					
	∃ Ss_valmaxSelf	$- uint16_t [2] (4)$					
	- [0]	10905 mint16 ± (2)					
	E ss valminSelf	- uint16 t (2)(4)					
	• [0]	10083 uint16 t(2)					
	• [1]	10846_ uint16 t(2)					
	E 😜 ss_valnoiseSe	- uint16_t [2](4)					
	e [0]	59 uint16_t(2)					
	€ [1]	60 uint16_t(2)					
	🗄 👽 ss_valmaxMut	- uint16_t [48]					
	🖌 [31]	8343 uint16_t(2)					
Actual Result	🧉 [39]	8818 uint16_t(2)					
	€ [46]	14014 uint16_t(2)					
	🗄 🗣 ss_valminMut	- uint16_t [48]					
	e [31]	8269_ uint16_t(2)					
	e [39]	8766 uint16_t(2)					
	€ [46]	13938. uint16_t(2)					
	🗄 💊 ss_valnoiseMut	- uint16_t [48]					
	• [31]	75 uint16_t(2)					
	0 [39]	52 uint16_t(2)					
	€ [46]	76 uint16_t(2)					
Issues	(=)						
Status	PASS						
Details	Check touch value (n	nax-reference difference while touching)					
Test Data	ss_valtouchSelf, ss_va	altouchMut					
Expected Result	Maximum measured	signal					
Actual Result							
	S49.						
	😜 [0]	450 uint16_t(2)					
	101	540 mint16 t(7)					
	€ [0]	540 uint16_t(2)					
	548						
	♥ [1]	811 uint16_t(2)					
	S18						
	♀ [31]	1046 uint16 t(2)					
	S10	An version general of 172 Anthon general the constraint of					
	🥥 [39]	1063uint16 t(2)					
1							





	\$2: • [46] 1285uint16_t(2)						
Issues							
Status	PASS						
Details	Calculate S	SNR (touch	/noise valu	e)			
Test Data							
Expected Result	SNR	2.0				75 5.0	
	RX all channels	Max NT	Min NT	Noise	Max T	SNR	
	Self but						
	S49	10142	10083	59	540	9,15	
A start Downla	S48	10906	10846	60	811	13,52	
Actual Result	Mutual but						
	S18	8343	8269	75	1046	13,95	
	S10	8818	8766	52	1063	20,44	
	S2	14014	13938	76	1285	16,91	
Issues	1.00						

Key	SP00014-T1	Status	PASS	Name	RX tests in former CTSU configuration without leds
Objective	To find measu reference fing	irement time, ma er for T4 RX	ximum	measured	d signal, SNR and Memory usage using a
Precondition	Config: 2 self	buttons, 3 mutua	l butto	ns (1 TX, 3	3 RX)
Coverage (issues)	SP00014-10				
Coverage (confluence pages)					
Coverage (web links)					
Actual end date	2022-01-13, 08:53	Estimated Time	00:00	Actual time	00:00
Assigned to	Nira Tubert	Environment	CS+	Туре	Manual execution
Executed by	Nira Tubert				
Issues	-				

	Test Script	
Status	PASS	
Details	Check max, min, and noise values	without touching
Test Data	ss_valmaxSelf, ss_valminSelf, ss_va	InoiseSelf
Test Data	ss_valmaxMut, ss_valminMut, ss_va	alnoiseMut
Expected Result	Max, min and noise values	
Actual Result	$ \begin{array}{ c c c c c } Factor & Fac$	Norman France Analisation of the decoder of the de
Issues		
Status	PASS	
Details	Check touch value (max-reference	difference while touching)
Test Data	ss_valtouchSelf, ss_valtouchMut	
Expected Result	Maximum measured signal	
Actual Result	S49 9437 10x00463 xinst€_s(2) S48 9(1) 4032 (0x0762) xinst€_s(2) S18 9(2) 748 (0x0246) xinst€_s(2) S10 9(1) 733 (0x0246) xinst€_s(2) S2 S2 S2 S30	0x80006556 9x80006552 9x00005523
	(2) 754 (Bw02f2) wint16_t(2)	0x0000526
Issues	17.5	
Status	PASS	





. 8	Exported Dearth	CNID						
ļ	Expected Result	SINK	and the second second			Constanting of the second s	1	
ļ		RX	Max NT	Min NT	Noise	Max T	SNR	
		Self but					-	
		S49	16870	16733	137	3437	25,09	
		S48	15457	15323	134	4092	30,54	
	Actual Result	Mutual						
		but						
		S18	4708	4644	64	748	11.69	
		\$10	4771	4718	52	5/10	10.36	
		510	7620	7566	64	754	11 79	
	·	32	1050	1300	04	154	11,70	
	issues	-						
	Status	PASS	0.1444					
	Details	Check me	asurement	time				
	Test Data	1.0						
	Expected Result	Measurem	ent time					
	Actual Kesult	1 2.00 V			s 40.1200m	3 3 3 1 2 480mV 480mV 3 3 480mV 48	438,313 Hg [1:23:34 Nose Filter Off 9 36.5ms 4.7.7 0 37.7ms 40.0 -1.11ms -4.8 438,393 Hg [1:24:15 Nose Filter Off 9 37.7ms 4.7.7 0 41.1ms -0.0 -3.41ms -4.7	
		1 2.00 V						
		Tek PreVu Constraints Constra	nent time ()1.00n 9 [1.00n [1.00n ms)	s 40.1400m ns 40.1200m 1,111 3,41 4,52 4,58	3 (1) / 480mV	433.032 Hz [11:25:50 Noise Filter Off	
	Issues	Tek PreVu Tek PreVu	nent time ()1.00n 9 1 1.00n (1.00n ms)	s 40.1400m s 40.1200m 1,11 3,41 4,52 4,58	3 1 7 480mV	433.032 Hz [11:25:50 Noise Filter Off	
	lssues Status	Tek PreVu Tek PreVu	ment time ()1.00n 9 1 1 1.00n 1.00n ms)	s 40.1480m s 40.1280m 1,11 3,41 4,52 4,58	s (1) / 480mV	433.032 Hz [11.25.50 Noise Filter Off	





Test Data Expected Result		Mem	ory us	age											
ł	- Ap - Colour			Profil	ed memo	- 9° ory mapping	list	Bu	ild options about the	selected memory	mapping				
				B P	rofile(Co	ollect)		TT		, servere a memory	mapping				
5					ronie(ci	onect) a	86 ~		301	2					
					Latest re	suit of profi	ling>	[[[5	etting state o	of common opt	lons]				
	Actual Re	sult		Deta	ils of the	selected m	emory ma	oping							
				1 1	Ippe ∇+P Size [Bytes] ∇+P Size [%] ∇+P NOPM 20221 31.01										
					ROM		20	321	31,01						
					RAM		3	835	37,45						
	Issues														
es	t Cvcle														
Ke	w	SPO	0014-C2		N	ame			RA tests						
	.y	Rat	ests with a	nd witho	ut leds	(using)	difforor	t configu	rations) to find	measuremen	t time mavimu	m			
De	escription	mea	ests with a		nd Me	mon		ng a refe	rence finger fo	r TA RA	it unie, maximu	un			
DI.		mea	isureu sign			mory us	aye us	ng a reie	Tence iniger io						
- 10	anneu art data	202	1-11-01, 00	0:00	00 Planned end			e	2022-01-15,	00:00	Iteration	-			
	artuate														
Test Executions		DO	NE		Ve	ersion			87.0						
		ns													
, .	-	0	SP00014-	G		-		RA test	s in former CTS	SU configurati	ion (0.128ms fo	r se			
Key			T5	Status		PASS	Name	scan tin	ne, 0.256ms for	r mutual scan	time, without I	eds)			
			To find me	easureme	ent tim	e, maxin	num m	easured si	gnal, SNR and	Memory usad	ge using a refer	renc			
DF	ojective		finger for	anna measurement time, maximum measured signal, SNR and Memory usage using a reference nger for T4 RA											
Precondition Coverage		n	Config: 2	iger for T4 RA											
			30mg. 2 :	Sh Sutt			20013		.,						
ir	sues)		SP00014-	10											
	Juesj														
-0	verage														
C	onfluence	1													
Da	ges)	102102													
Co	overage (w	veb													
in	ıks)														
۸.	tual and c	late	2021-12-	Estimat	ed	00.00	Actua	00:00							
	tuai enu t	Jace	27, 11:43	Time		00.00	time	00.00							
	6 90		Nira			t ^{e2} T	time Type								
					12			1.4	S 29						
As	signed to	2	Tubert	Enviror	nment	ez studio	Туре	Manual	execution						
As	signed to	5 	Tubert Nira	Enviror	nment	ez studio	Туре	Manual	execution						
As Ex	ecuted by		Tubert Nira Tubert	Enviror	nment	studio	Туре	Manua	execution						
Ex	ecuted by		Tubert Nira Tubert	Enviror	nment	ez studio	Туре	Manual	execution						
As Ex	ecuted by		Tubert Nira Tubert -	Enviror	nment	ez studio	Туре	Manual	execution						
As Ex Iss	ecuted by		Tubert Nira Tubert -	Enviror	nment	studio	Type Test S	Manual	execution						
As Ex Iss	ecuted by ues Status		Tubert Nira Tubert -	Enviror	nment	ez studio	Type Test S	Manual	execution						
As Ex Iss	ecuted by sues Status Details		Tubert Nira Tubert -	PASS Chec	iment	ez studio min, an	Type Test S d noise	Manual cript values wi	execution]					
As Ex Iss	ecuted by sues Status Details		Tubert Nira Tubert -	PASS Chec ss_va	k max, ImaxSe	min, and	Type Test S d noise IminSe	Manual cript values wi	execution thout touching]					
As Ex Iss	ecuted by sues Status Details Test Data		Tubert Nira Tubert -	PASS Chec ss_va ss va	k max, ImaxSe	ez studio min, and elf, ss_va	Type Test S d noise IminSe alminM	Manual cript values wi lf, ss_valn ut, ss valr	execution thout touching oiseSelf oiseMut]					
Ex Iss	ecuted by sues Status Details Test Data	Resu	Tubert Nira Tubert -	PASS Chec ss_va ss_va Max	k max, ImaxSe ImaxM	min, and elf, ss_va ut, ss_va	Type Test S d noise IminSe alminM values	Manual cript values wi lf, ss_valn ut, ss_valn	execution thout touching oiseSelf noiseMut]					
As Ex Iss	ecuted by sues Status Details Test Data Expected	Resu	Tubert Nira Tubert -	PASS Chec Ss_Va Ss_Va Max,	k max, ImaxSe ImaxM min ar	min, and min, savel, ss_valut, ss_va	Type Test S d noise IminSe alminM values	Manual	execution thout touching oiseSelf noiseMut]					
As Ex Iss	ecuted by sues Status Details Test Data Expected Actual Re	Resu	Tubert Nira Tubert -	PASS Chec Ss_Va Ss_Va Max,	k max, ImaxSe ImaxM min ar	min, and elf, ss_va lut, ss_va	Type Test S d noise IminSe alminM values	Manual cript values wi lf, ss_valn ut, ss_valr	execution thout touching oiseSelf noiseMut]					
As Ex Iss	ecuted by sues Status Details Test Data Expected Actual Re	Resu	Tubert Nira Tubert -	PASS Chec Ss_va Max,	k max, ImaxSe ImaxM min ar	min, and elf, ss_va lut, ss_va	Type Test S d noise lminSe alminM values	Cript values wi If, ss_valn ut, ss_valr	execution thout touching oiseSelf noiseMut]					
As Ex Iss	signed to ecuted by sues Status Details Test Data Expected Actual Re	Resusult	Tubert Nira Tubert -	PASS Chec SS_Va Max, Exp	k max, lmaxSe ImaxM min ar	min, and elf, ss_valut, ss_valut, ss_val	Type Test S d noise IminSe alminM values	Cript values wi If, ss_valn ut, ss_valr	execution thout touching biseSelf noiseMut Value	Address					
Ex SS	signed to ecuted by sues Status Details Test Data Expected Actual Re	Resu	Tubert Nira Tubert -	PASS Chec Ss_va Ss_va Max,	k max, ImaxSe ImaxM min ar	min, and elf, ss_va lut, ss_va nd noise	Type Test S d noise IminSe alminM values	values wi f, ss_valn ut, ss_valr ype int16_t [2]	thout touching oiseSelf oiseMut Value 0x2004654	Address 0x2004654					
As Ex SS	signed to ecuted by sues Status Details Test Data Expected Actual Re	Resussult	Tubert Nira Tubert -	PASS Chec ss_va Max,	k max, ImaxSe ImaxM min ar ression \$ ss_va (%= ss	ez studio min, an- elf, ss_va lut, ss_va nd noise	Type Test S d noise IminSe alminM values	values wi if, ss_valn ut, ss_valn int16_t [2]	thout touching oiseSelf oiseMut Value 0x20004654 7661	Address 0x20004654 0x20004654					
As Ex SS	signed to ecuted by sues Status Details Test Data Expected Actual Re	Resu	Tubert Nira Tubert -	PASS Chec ss_va Max,	k max, ImaxSe ImaxM min ar ss_va (0)= ss (0)= ss	ez studio min, and elf, ss_va lut, ss_va nd noise	Type Test S d noise lminSe alminM values	values wi tf, ss_valnut, ss_valnut, ss_valnut, ss_valnut, int16_t [2] int16_t int16_t	thout touching piseSelf noiseMut Value 0x20004654 7661 7707 0x20004654	Address 0x20004654 0x20004654 0x20004654					
As Ex SS	signed to ecuted by sues Status Details Test Data Expected Actual Re	Resu	Tubert Nira Tubert -	Enviror Chec Ss_va Ss_va Max,	k max, lmaxSe lmaxM min ar ol= ss_va (ol= ss (ol= ss	ez studio min, and elf, ss_va lut, ss_va nd noise slSelf _valSelf[0] _valSelf[1] ilmaxSelf	Type Test S d noise lminSe alminM values	values wi f, ss_valn ut, ss_valn ut, ss_valn int16_t [2] int16_t int16_t [2] int16_t	execution thout touching oiseSelf noiseMut Value 0x20004654 7661 7707 0x20004694 7664	Address 0x20004654 0x20004654 0x20004656 0x20004694					
As Ex SS	signed to ecuted by sues Status Details Test Data Expected Actual Re	Resu	Tubert Nira Tubert -	PASS Chec ss_va Max, Exp * s	k max, k max, lmaxSe lmaxM min ar cession \$ ss_va (v)= ss (v)= ss (v)= ss (v)= ss	ez studio min, an- elf, ss_va lut, ss_va ad noise slSelf _valSelf[0] _valSelf[1] slmaxSelf _valmaxSelf	Type Test S d noise lminSe lminSe lminM values	values wi f, ss_valn ut, ss_valn ut, ss_valn ut16_t [2] int16_t int16_t int16_t int16_t	execution thout touching oiseSelf noiseMut Value 0x20004654 7661 7707 0x20004694 7694 7749	Address 0x20004654 0x20004656 0x20004656 0x20004694 0x20004694 0x20004694					
Ex SS	signed to ecuted by sues Status Details Test Data Expected Actual Re	Resu	Tubert Nira Tubert -	PASS Chec ss_va Max,	k max, k max, lmaxSe lmaxM min ar cression (0= ss (0= ss (0= ss (0= ss (0= ss) (0= ss)	ez studio min, an- elf, ss_va lut, ss_va nd noise s_valSelf[0] _valSelf[1] limaxSelf _valmaxSi _valmaxSi	Type Test S d noise lminSe alminM values	values wi f, ss_valn ut, ss_valn ut, ss_valn ut, ss_valn int16_t [2] int16_t int16_t int16_t int16_t int16_t	execution thout touching oiseSelf toiseMut Value 0x20004654 7766 7707 0x20004694 7694 7749 0x20004670	Address 0x20004654 0x20004654 0x20004656 0x20004656 0x20004694 0x20004694 0x20004694					
I I	signed to ecuted by sues Status Details Test Data Expected Actual Re	Resu	Tubert Nira Tubert -	Enviror PASS Chec ss_va Max, Exp • • •	k max, ImaxSe ImaxM min ar cossion cossis co	ez studio min, an- elf, ss_va lut, ss_va lut	Type Test S d noises alminMvalues	values wi f, ss_valn ut, ss_valn int16_t [2] int16_t int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t	execution thout touching biseSelf biseMut Value 0x20004654 7661 7707 0x20004694 7694 7749 0x20004670 7619	Address 0x20004654 0x20004654 0x20004654 0x20004694 0x20004694 0x20004696 0x20004696 0x20004670					
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Ass Ex	signed to ecuted by sues Status Details Test Data Expected Actual Re	Result	Tubert Nira Tubert -	Enviror Chec ss_va ss_va Max, Exp * s * s	k max, k max, ImaxSummark ImaxSumark	ez studio min, an- elf, ss_va lut, ss_va lut, ss_va d noise s_valSelf[0] _valSelf[1] limaxSelf _valmaxSelf _valmaxSelf _valminSelf _valmaxNut[0]	Type Test S d noise alminSe alminSe alminM values it it <td>Values wi f, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [3] int16_t [3] int16_t [3]</td> <td>execution thout touching oiseSelf noiseMut Value 0x20004654 7661 7707 0x20004654 7664 7749 0x20004670 7619 7665 0x20004670 7619 7665 0x20004670 75 84 0x20004670 1360 1382 2218 0x20004680 1384 1401 2232 0x2004658 1384</td> <td>Address 0x20004654 0x20004654 0x20004654 0x20004654 0x20004694 0x20004694 0x20004694 0x20004670 0x20004670 0x20004670 0x20004670 0x20004690 0x20004690 0x20004690 0x20004690 0x20004690 0x20004690 0x20004692 0x20004692 0x20004693 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698</td> <td></td> <td></td>	Values wi f, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- ut, ss_valu- int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [2] int16_t int16_t [3] int16_t [3] int16_t [3]	execution thout touching oiseSelf noiseMut Value 0x20004654 7661 7707 0x20004654 7664 7749 0x20004670 7619 7665 0x20004670 7619 7665 0x20004670 75 84 0x20004670 1360 1382 2218 0x20004680 1384 1401 2232 0x2004658 1384	Address 0x20004654 0x20004654 0x20004654 0x20004654 0x20004694 0x20004694 0x20004694 0x20004670 0x20004670 0x20004670 0x20004670 0x20004690 0x20004690 0x20004690 0x20004690 0x20004690 0x20004690 0x20004692 0x20004692 0x20004693 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698					
Ex Iss	signed to ecuted by sues Status Details Test Data Expected Actual Re	Result	Tubert Nira Tubert -	Enviror PASS Chec ss_va ss_va Max, Exp ~ s ~ s ~ s ~ s ~ s ~ s ~ s ~ s	k max, k max, ImaxSu ImaxSu min ar \$\$ \$\$_va \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$	ez studio min, an- elf, ss_va lut, ss_va lut	Type Test S d noise alminSe alminSe alminM values i i i	values wi if, ss_valu ut, ss_v	execution execution thout touching biseSelf bioiseMut Value 0x20004654 7661 7707 0x20004654 7694 7749 0x20004670 7619 7665 0x20004670 75 84 0x20004670 35 40 0x20004680 1360 1382 2218 0x20004680 1384 1401 2232 0x20004658 1350	Address 0x20004654 0x20004654 0x20004654 0x20004654 0x20004694 0x20004694 0x20004690 0x20004670 0x20004670 0x20004670 0x20004664 0x20004660 0x20004690 0x20004690 0x20004690 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698					
Ex Iss	signed to ecuted by ues Status Details Test Data Expected Actual Re	Resu	Tubert Nira Tubert 	Enviror PASS Chec ss_va Max, Chec v o v o v o v o v o v o	k max, k max, k max, min ar k min ar k max, min ar k max, k min ar k min ar <td>ez studio min, an- elf, ss_va lut, ss_va ut, ss_va dut, ss_va ut, ss_va dut, ss_va ut, ss_va dut, ss_va ut, ss_va dut, ss</td> <td>Type Test S d noise alminSe alminSe alminM values i i i</td> <td>Values wi reript values wi f, ss_valn ut, ss_valn int16_t [2] int16_t</td> <td>execution thout touching oiseSelf ooiseMut Value 0x20004654 7661 7707 0x20004694 7694 7749 0x20004694 769 7665 0x20004694 75 84 0x20004690 35 40 0x20004690 35 1360 1382 2218 0x20004680 1384 1401 2232 0x20004658 1350 1367</td> <td>Address 0x20004654 0x20004654 0x20004654 0x20004654 0x20004694 0x20004694 0x20004694 0x20004694 0x20004670 0x20004670 0x20004666 0x20004660 0x20004680 0x20004690 0x20004690 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698</td> <td></td> <td></td>	ez studio min, an- elf, ss_va lut, ss_va ut, ss_va dut, ss_va ut, ss_va dut, ss_va ut, ss_va dut, ss_va ut, ss_va dut, ss	Type Test S d noise alminSe alminSe alminM values i i i	Values wi reript values wi f, ss_valn ut, ss_valn int16_t [2] int16_t	execution thout touching oiseSelf ooiseMut Value 0x20004654 7661 7707 0x20004694 7694 7749 0x20004694 769 7665 0x20004694 75 84 0x20004690 35 40 0x20004690 35 1360 1382 2218 0x20004680 1384 1401 2232 0x20004658 1350 1367	Address 0x20004654 0x20004654 0x20004654 0x20004654 0x20004694 0x20004694 0x20004694 0x20004694 0x20004670 0x20004670 0x20004666 0x20004660 0x20004680 0x20004690 0x20004690 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004680 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698					
Ex Iss	signed to ecuted by ues Status Details Test Data Expected Actual Re	Resussult	Tubert Nira Tubert - 	Enviror Chec ss_va ss_va Max, Exp * 6 * 6 * 6 * 6	k max, k max, min arx k max, min arx (0= ss (0= ss (0= ss	ez studio min, an- elf, ss_va lut, ss_va lut, ss_va lut, ss_va lut, ss_va lut, ss_va lut, ss_va lut, ss_va limaxSelf[1] _valSelf[1] _valSelf[1] _valself[1] _valself[1] _valself[1] _valself[1] _valself[1] _valmaxSelf _valmoself _val	Type Test S IminSe IminSe alminM ulastic c <	values wi f, ss_value ut, ss_valu ut, ss_valu ut, ss_valu ut, ss_valu ut, ss_valu ut, ss_valu ut, ss_valu ut, ss_valu ut, st_valu ut, st_v	execution execution thout touching oiseSelf oiseMut Value value valu	Address 0x20004654 0x20004654 0x20004654 0x20004654 0x20004694 0x20004694 0x20004690 0x20004670 0x20004670 0x20004670 0x20004670 0x20004664 0x20004664 0x20004664 0x20004664 0x20004690 0x20004690 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004692 0x20004693 0x20004693 0x20004653 0x20004653					
Iss Iss	signed to ecuted by sues Status Details Test Data Expected Actual Re	Result	Tubert Nira Tubert - - - -	Enviror Chec ss_va ss_va Max, Exp ~ s ~ s ~ s	k max, k max, ImaxSt Im	ez studio min, an- elf, ss_va lut, ss_va nd noise slSelf _valSelf[0] _valSelf[0] _valSelf[0] _valSelf[0] _valSelf[0] _valSelf _valself _va	Type Test S d noise alminSe alminM values i	Manual Manual cript values wi if, ss_valn- ut, ss_valn ut, ss_valr ut, ss_valr int16_t [2] int16_t int16_t [2] int16_t [2] int16_t [2] int16_t [2] int16_t [2] int16_t [2] int16_t [3] int16_t [3]	execution	Address 0x20004654 0x20004654 0x20004654 0x20004654 0x20004694 0x20004694 0x20004694 0x20004670 0x20004670 0x20004670 0x20004664 0x20004664 0x20004664 0x20004664 0x20004692 0x20004692 0x20004692 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698 0x20004698					





		(x)= 5	s valnoiseMu	t[1] uint16 t	34	0	2000468a	
		(x)= s	s_valnoiseMu	t[2] uint16_t	33	0	2000468c	
		× 🍰 55_1	altouchMut	uint16_t	[3] 0x20	004668 0>	20004668	
			s_valtouchMu	ut[0] uint16_t	15	0	20004668	
			s_valtouchMu	ut[2] uint16_t	18	0	2000466c	
	Issues	-		-fal amrio_t		0		
	Status	PASS						
	Details	Check tou	ch value (m	ax-reference	e differen	ce while to	uchina)	
	Test Data	ss valtouc	hSelf, ss va	ltouchMut				
	Expected Result	Maximum	measured s	signal				
2	Actual Result	849 09: 55,241 548 09: 55,241 518 318 318 318 310 310 310 310 310	touchSelf(0) uint16 touchSelf(1) uint16 touchMut(0) uint16 touchMut(1) uint16	5_t 1237 5_t 1728 5_t 209 5_t 208	0x2000469 0x2000469 0x2000466 0x2000466	0 2 8 a		
		S2	touchMut[2] uint16	5_t 215	0x2000466	c		
	Issues							
1	Status	PASS						
	Details	Calculate S	SNR (touch,	/noise value	2)			
l	Test Data							
	Expected Result	SNR						
		RA 1 freq	Max NT	Min NT	Noise	Max T	SNR	
		Self but						
		S49	7694	7619	75	1237	16,49	
		S48	7749	7665	84	1728	20,57	
	Actual Result	Mutual but						
		S18	1384	1350	34	209	6,15	
		S10	1401	1367	34	208	6,12	
		S2	2232	2199	33	215	6,52	
1	Issues	-						
+	Statuc	PASS	1					
		Charlenso	asurement	time				
	Details	Check me						
•	Details Test Data	-	22					
	Details Test Data Expected Result	- Measurem	ient time					
	Details Test Data Expected Result Actual Result	- Measurem	ient time					
1	Details Test Data Expected Result Actual Result	- Measurem	ient time		*		Noise Filter Off	
•	Details Test Data Expected Result Actual Result	- Measurem	ent time		¥.		Noise Filter Off	
•	Details Test Data Expected Result Actual Result	Tek Stop	nent time		V		Noise Filter Off	
•	Details Test Data Expected Result Actual Result	- Measurem	nent time				Noise Filter Off	
	Details Test Data Expected Result Actual Result	Measurem	eent time				Noise Filter Off	
•	Details Test Data Expected Result Actual Result	Tels stop	nent time				Noise Filter Off	
	Details Test Data Expected Result Actual Result	Tels Stop	nent time				Noise Filter Off	
•	Details Test Data Expected Result Actual Result	Measurem	nent time				Noise Filter Off	
	Details Test Data Expected Result Actual Result	Measurem	eent time				Noise Filter Off	
	Details Test Data Expected Result Actual Result	Measurem	eent time				Noise Filter Off	
	Details Test Data Expected Result Actual Result	Check measurem Measurem	eent time		0.00000		Noise Filter Off	6:15
	Details Test Data Expected Result Actual Result	Tek Stop	eent time	F 	**************************************		Noise Filter Off 1.13900Htb[080 Noise Filter Off	16:15
	Details Test Data Expected Result Actual Result	Check measurem Measurem	eent time	E	0.00000	3	Noise Filter Off 1.15900Htl [08: Noise Filter Off 0 -1.76ms	6:15
	Details Test Data Expected Result Actual Result	Check measurem Measurem	eent time	E	8.00000		Noise Filter Off 1.15900Htb[0:s: Noise Filter Off 0 -1.76ms 0 -1.34ms	16:15 80.01 3.44
	Details Test Data Expected Result Actual Result	- Measurem	eent time	[1.44V	Noise Fifter Off 1.13900Hrd (ps: Noise Fifter Off @ -1.76ms @ -1.34ms 422.us	16:15 80.0 3.44 43.3
1	Details Test Data Expected Result Actual Result	Check mer Measurem	eent time	[] 400,⊮ 		71.44	Noise Filter Off 1.13900Htb[(05: Noise Filter Off ◎ -1.76ms ○ -1.34ms △ 422,ys	16:15 80.0 3.44 ~3.3
1	Details Test Data Expected Result Actual Result	Check mer	eent time	[Noise Filter Off 1.139004tb(062 Noise Filter Off @ −1.76ms © −1.34ms 42238	16:15 3.44 ~3.3
1	Details Test Data Expected Result Actual Result	Tels Stop	eent time	(=) €00,0 = =	0.00000	3 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Noise Filter Off 1.135004t2(68 Noise Filter Off ◎ −1.76ms ◎ −1.34ms △ 422.05	80.00 3.44 4.3.3
	Details Test Data Expected Result Actual Result	Measurem	eent time	(0.00000	3 	Noise Filter Off 1.13500Ht2[08: Noise Filter Off 0 - 1.76ms 0 - 1.34ms - 422JJS	80.0r 3.44
	Details Test Data Expected Result Actual Result	Tels Stop	eent time	[0.00000	3)(1) /1.44V	Noise Filter Off 1.13500Ht2[08: Noise Filter Off 0 - 1.34ms - 4.22.05	16:15 80.0r 3.44 ≏3.3





		Tek St	op 🖉		1 V		Noise Filter	Off
			8		0 9		€ -1.29r	ns 160mV
							6 -81.3, o1.21	us 3.36 V ms ⇔3.20 V
					a de la competencia de la comp	1 1 1 1 1 1 1 1 1		
							ii	
		1 2.0 TR 5 St	0 V	400	JUS 0.0	0000 s (1) / 1	.44 V 1.13915ki Noise Filter	Hz 08:46:35
					e V			
							© -1.84r -81.3	ns 3.36 V us 3.36 V
								ms0.00 V
			· · · · · · · · · · · · · · · · · · ·		1 I			
		1	- a pane para					
		1 20	0 V	400	us 0.0	0000 3 (1) /1	.44 V 1.13875ki	HZ[08:46:41
				4				
		Measu	urement time (m:	s)				
		Self			0,42			
		Mutua	al		1,21			
		Total			1,63			
		Globa			1,76			
	Issues							
	Status	PASS						
	Details	Check	memory usage					
	Test Data							
	Expected Result	Memo	ry usage					
5		C) Problems C) Consie 🗟 Scattoniar 😳 Scattilanus 🔒	Mercey Dage 18 D D	etug 🛷 Seenti	Marriery Region Monge 1	Deuton Ministry Wooge	· · · · · · · · · · · · · · · · · · ·
	Actual Desult	Fogue Consta Vetario	n l na l nd Data		30792 kyteis s kyteis 68 kyteis	• 04:0000000 9-000-0000	andran arsum	87 tyleid (57.74%)
	Actual Result	Data Stack	foed Detail		2368 kyteol 36 kyteol 1628 kyteol	9-3041FFF	um 14 Ap. 8100	
		E Others			156 kyoniq	9-2006000	and an and an and an and an	6 Intelai (22,17%)
	Issues	100						
	220X		a conservation of the			RA tes	ts configuring	multi-frequency
K	₽ y	SP00014-T10	Status	PASS	Name	scan w	ith leds	
0	bjective	To find meas	urement time, m	aximum	measure	ed signal, S	NR and Memo	ory usage using a
		reference find	er for T4 RA					
Pr	econdition	Config: 2 self	buttons 3 mutu	al hutto	ns (1 TX	3 RX)		
	verage (issues)	SP00014-11	battons/ b mata	arbutto	115 (111)	5100		
~	verage (confluence	51 000 14 11						
22	nes)							
~	verage (web links)							
		2021-12-27	Estimated		Actual	and a second second		
40	tual end date	11:43	Time	00:00	time	00:00		
	wr 10000			e2			22 1010	
As	signed to	Nira Tubert	Environment	studio	Туре	Manua	l execution	
y	ecuted by	Nira Tubert		1				
S	sues	2						
_								
			les	st Script				
	Status	PASS					20	
		Check	max, min, and no	oise valu	es witho	ut touching	9	
	Details	and the second sec	haxself ss valmir	nSelt, ss_	valnoise	Self		
	Test Data	ss_valn	and the second s		and the second second			
	Test Data	ss_valn ss_valn	naxMut, ss_valmi	nMut, ss	_valnois	eiviut		
	Test Data Expected Result	ss_valn ss_valn Max, m	naxMut, ss_valmi nin and noise valu	nMut, ss ues	_valnois	eiviut		
	Test Data Expected Result	ss_valn ss_valn Max, m Expres	naxMut, ss_valmi nin and noise valu sion	nMut, ss ues Type	s_valnois	alue	Address	8
	Test Data Expected Result	ss_valn ss_valn Max, m Expres	naxMut, ss_valmi nin and noise valu sion ss_valSelf	nMut, ss ues Type uint16_1	t [2]	alue x200047e4	Address 0x200047e4	23 24
	Test Data Expected Result	ss_valn ss_valn Max, m Expres	naxMut, ss_valmi nin and noise valu sion ss_valSelf x)= ss_valSelf[0] x)= ss_valSelf[1]	nMut, ss ues Type uint16_ uint16_	x_valnois v t [2] 0 t 1 t 1	alue x200047e4 5388 5222	Address 0x200047e4 0x200047e4 0x200047e6	5
	Test Data Expected Result	ss_valn ss_valn Max, rr Expres	naxMut, ss_valmi nin and noise valu sion ss_valSelf x)= ss_valSelf[0] x)= ss_valSelf[1] ss_valmaxSelf	nMut, ss ues Type uint16_ uint16_ uint16_ uint16	xulnois v t [2] 0 t 1 t 1 t 1 t 2] 0	alue x200047e4 5388 5222 x20004824	Address 0x200047e4 0x200047e4 0x200047e6 0x20004824	
	Test Data Expected Result	ss_valn ss_valn Max, rr Expres	naxMut, ss_valmi in and noise valu sion ss_valSelf %= ss_valSelf[0] %= ss_valSelf[1] ss_valmaxSelf %= ss_valmaxSelf	nMut, ss ues Type uint16_1 uint16_1 uint16_1 uint16_1 uint16_1	xulnois (2) (2) (2) (2) (3) (4) (4) (4) (5) (5) (5) (6) (7) (7) (7) (7) (7) (7) (7) (7	alue x200047e4 5388 5222 x20004824 5517	Address 0x200047e4 0x200047e4 0x200047e6 0x20004824 0x20004824	





	🗸 🏤 ss_valminSelf	uint16_t [2]	0x20004800	0x20004800
	(x)= ss_valminSelf[0]	uint16_t	15253	0x20004800
	(x)= ss_valminSelf[1]	uint16_t	15145	0x20004802
	✓ iss_valnoiseSelf	uint16_t [2]	0x200047f4	0x200047f4
	(×)= ss_valnoiseSelf[0]	uint16_t	264	0x200047f4
	(×)= ss_valnoiseSelf[1]	uint16_t	294	0x200047f6
	✓ A ss_valtouchSelf	uint16_t [2]	0x20004820	0x20004820
	(x)= ss_valtouchSelf[0]	uint16_t	129	0x20004820
	(x)= ss_valtouchSelf[1]	uint16_t	173	0x20004822
	✓ Image: Ss_valMut	uint16_t [3]	0x20004810	0x20004810
Actual Result	(x)= ss_valMut[0]	uint16_t	2638	0x20004810
	(x)= ss_valMut[1]	uint16_t	2638	0x20004812
	(x)= ss_valMut[2]	uint16_t	4300	0x20004814
	✓ I ss_valmaxMut	uint16_t [3]	0x20004828	0x20004828
	(x)= ss_valmaxMut[0]	uint16_t	2794	0x20004828
	(x)= ss_valmaxMut[1]	uint16_t	2776	0x2000482a
	(×)= ss_valmaxMut[2]	uint16_t	4497	0x2000482c
	✓ iss_valminMut	uint16_t [3]	0x200047e8	0x200047e8
	(x)= ss_valminMut[0]	uint16_t	2551	0x200047e8
	(x)= ss_valminMut[1]	uint16_t	2581	0x200047ea
	(x)= ss_valminMut[2]	uint16_t	4142	0x200047ec
	✓ Iss_valnoiseMut	uint16_t [3]	0x20004818	0x20004818
	(x)= ss_valnoiseMut[0]	uint16_t	243	0x20004818
	(x)= ss_valnoiseMut[1]	uint16_t	195	0x2000481a
	(x)= ss_valnoiseMut[2]	uint16_t	355	0x2000481c
	✓ Iss_valtouchMut	uint16_t [3]	0x200047f8	0x200047f8
	(x)= ss_valtouchMut[0]	uint16_t	107	0x200047f8
	(x)= ss_valtouchMut[1]	uint16_t	94	0x200047fa
	(x)= ss_valtouchMut[2]	uint16_t	144	0x200047fc
Issues				
Status	PASS			
Details	Check touch value (max-	reference c	lifference while	touching)
		LAA .	interence write	touching)
lest Data	ss_valtouchSelf, ss_valtou	JchMut		
Expected Result	Maximum measured sigr	nal		
	S49			
	00: ss_valtouchSelf[0] uint16_t	2342	0x20004820	
	S48:			
	(X)= ss_valtouchSelt[1]_uint16_t	3005	0x20004822	
	518			
Actual Result	(x)= ss_valtouchMut[0] uint16_t	513	0x200047f8	
1	S10			
	the second secon	463	0x200047fa	
	(X)* s5_vartouchMut[1] uncto_t			
	(x)* ss_varcouchivid(1) uincio_t			
	S2	648	0x 2000476e	
	S2 60= ss_valtouchMut(2) uint16_t	648	0x200047fc	
Issues	S2 S2 ss_valouchMut[2] uint16_t -	648	0x200047fe	

Details	Calculate	SNR (touch	/noise valu	e)		
Test Data						
Expected Result	SNR					
	RA	Max NT	Min NT	Noise	Max T	SNR
	Self but					
	S49	15517	15253	264	2342	8,87
	S48	15439	15145	294	3606	12,27
Actual Result	Mutual but					
	S18	2794	2551	243	513	2,11
	S10	2776	2581	195	463	2,37
	S2	4497	4142	355	648	1,83
Issues	2-02					

Key	SP00014- T12	Status	PASS	Name	RA tests configuring multi-frequency scan with parallel scanning function with leds
Objective	To find me reference f	asurement tim inger for T4 R4	e, maxim A	um meas	ured signal, SNR and Memory usage using a
Precondition	Config: 2 s	elf buttons, 3 r	nutual bu	ittons (1	TX, 3 RX)
Coverage (issues)	SP00014-1	1			
Coverage (confluence pages)					
Coverage (web links)		<i>60</i>		70	
Actual end date	2021-12- 27, 11:44	Estimated Time	00:00	Actual time	00:00





•	cianad to	Nira Tubort	Environm	ant	e2	Tuna	Man	ual ovo cuti	on.		
A:	ssigned to	Nira Tubert	studio studio								
Ð	ecuted by	Nira Tubert	rt								
ls	sues	-									
_			Test Script								
1	Status	1	PASS								
1	Details		Check max, min, and noise values without touching								
	Details		ss_valmaxSelf, ss_valminSelf, ss_valnoiseSelf								
	Test Data	3	ss_vaimaxzen, ss_vaiminzen, ss_vainoiseSen ss_valmaxMut, ss_valminMut, ss_valnoiseMut								
	Frank and Parallel		ss_vaimaxivi	ut, ss	vaimin	liviut, ss_	vainoi	seiviut			
	Expected Result		wax, min an	a noi	se valu	es					
	Actual Result										
	1	1	F			T		Mal.		. I	
			Expression			lype		value	Add	ress	
			V SS_val	Self	[0]	uint16_t	[2]	0x20004850.	0x20	004850	
			(x)= ss	valSelf	[1]	uint16 t		15279	0x20	004852	
			v 🏤 ss_valı	maxSe	lf	uint16_t	[2]	0x20004890.	0x20	0004890	
			(x)= ss_	valmax	Self[0]	uint16_t		15515	0x20	0004890	
			(×)= 55_1	valmax	Self[1]	uint16_t		15490	0x20	004892	
			🗸 🎲 ss_valı	minSel	f	uint16_t	[2]	0x2000486c.	0x20	100486c	
			(x)= ss_	valmin	Self[0]	uint16_t		15151	0x20)00486c	
			(X)= 55_1	vaimin	sen[1]	uint16_t	[2]	0x20004960	0x20	1004860	
			(x)= cc	valnois	eSelf[0]	uint16 +	[4]	364	0x20	004860	
			(x)= 55	valnois	eSelf[1]	uint16_t		379	0x20	0004862	
			v 🍰 ss_valt	touchS	elf	uint16_t	[2]	0x2000488c.	0x20)00488c	
			(×)= 55_1	valtou	chSelf[0]	uint16_t		186	0x20	100488c	
			(x)= ss_1	valtou	chSelf[1]	uint16_t		196	0x20	00488e	
			∽ 🎲 ss_vall	Mut	101	uint16_t	[3]	0x2000487c.	0x20	00487c	
			(×)= SS_1	valMu	(U) H(1)	uint16_t		2072	0x20	100487c	
			(x)= 55_1 (x)= 55_1	valMrd	121	uint16 +		4723	0x20	004878	
			v 🍰 ss vali	maxM	ut	uint16 t	[3]	0x20004894.	0x20	0004894	
			(×)= 55_	valmax	Mut[0]	uint16_t	1	2658	0x20	0004894	
			(x)= 55_1	valmax	Mut[1]	uint16_t		2978	0x20	1004896	
			(×)= 55_	valmax	Mut[2]	uint16_t		4831	0x20	004898	
			V 🎲 ss_valı	minMu	it .	uint16_t	[3]	0x20004854.	0x20	1004854	
			(x)= 55_1	valmin	Mu+[1]	uint16_t		2519	0x20	1004854	
			(x)= 55_1	valmin	Mut[7]	uint16_t		2848 4665	0x20	1004850	
			v s val	noisel	lut	uint16 t	[3]	4005 0x20004884	0x20	004884	
			(×)= 55_	valnois	eMut[0]	uint16_t		139	0x20	0004884	
			(×)= ss_	valnois	eMut[1]	uint16_t		130	0x20	0004886	
			(x)= ss_1	s_valnoiseMut[2]		uint16_t		166	0x20004888	004888	
			🗸 🖓 ss_valt	touch	Aut	uint16_t	[3]	0x20004864.	0x20	004864	
			(x)= ss_1	valtou	chMut[0] uint16_t		75	0x20	004864	
			(x)= 55_ (x)= cc	valtou	chMut[2	1 uint16 t		76	0x20	1004868	
	lequer		VV- 32_	rancou	cinviacia] differio_e		10	UNE		
-	Status		PASS								
	Status		PASS Check touch value (may-reference difference while touching)								
	Details Test Data		Check touch value (max-reference difference while touching)								
	lest Data		ss_valtouchSelf, ss_valtouchMut								
	Expected Result		Maximum m	neasu	red sig	nal					
			S49		a horaster i t		1.2	2000.107			
			¢9• ss_valtou	conseif[0]	unt16_t	2434	Cx	20004680			
		3	S48								
2			60: ss_valtou	uchSelf[1]	uint16_t	3101	0x	2000488e			
1	13. at	2	S18								
	Actual Result		(4. ss_valtou	chMut 0	uint16_t	443	Ūx	20004864			
			S10			107		2000 1055			
			ee ss_valtou	- noviue ()	_uniclo_t	+8/	UX	20000000			
		5	S2								
			60 ss_valtou	chMut(2	uint16_t	599	Ox	20004868			
	Issues		-0								
T	Status		PASS								
	Details		Calculate SN	NR (to	uch/nc	oise value	e)				
	Test Data		-				1				
	Expected Pecult		SNR								
	Expected Result						-				1
			NA Darellat	Max I	NT N	∕lin NT	Nois	e Ma	хΤ	SNR	
			parallel				-				
			Self but					1 1 <u>20</u> 00			
3			549	1551	5 1	5151	364	243	4	6,69	
	Actual Result		548	15490	J 1	5111	379	310	1	8,18	
			Mutual								
			but								





Issues	1-11						
	S2	4831	4665	166	499	3,01	
	S10	2978	2848	130	487	3,75	
	S18	2658	2519	139	443	3,19	

Issues

Key	SP00014- T11	Status	PASS	Name	RA tests configuring multi-frequency scan with parallel scanning function without leds
Objective	To find me	asurement time,	, maxim	um meas	sured signal, SNR and Memory usage using a
	reference f	inger for T4 RA			
Precondition	Config: 2 s	elf buttons, 3 mi	utual bu	ttons (1	TX, 3 RX)
Coverage (issues)	SP00014-1	1		A.4	
Coverage (confluence pages)					
Coverage (web links)					
Actual end date	2021-12- 27, 11:44	Estimated Time	00:00	Actual time	00:00
Assigned to	Nira Tubert	Environment	e2 studio	Туре	Manual execution
Executed by	Nira Tubert				
Issues	843				

	Tes	t Script							
Status	PASS								
Details	Check max, min, and noise values without touching ss_valmaxSelf, ss_valminSelf, ss_valnoiseSelf								
T D									
lest Data	ss_valmaxMut, ss_valmin	ss valmaxMut, ss valminMut, ss valnoiseMut							
Expected Result	Max, min and noise values								
	Everencien	Tree	Value	Address					
	Expression	iype	value	Address					
	v 🖓 ss_valSelf	uint16_t [2]	0x20004748	0x20004748					
	(x)= ss_valSelf[0]	uint lo_t	10307	0x20004748					
	(x)= ss_valSelf[1]	uint16_t	15341	0x2000474a					
	ss_vaimaxSelf	uint lo_t [2]	0x20004788	0x20004788					
	(x)= ss_valmaxSelf[0]	uint lo_t	15454	0x20004788					
	(x)= ss_valmaxSelf[1]	uint lo_t	0.20004764	0x20004788					
	ss_vaiminseir	untio_t[2]	15202	0x20004764					
	(x)= ss_valminSell[0]	uncio_c	15205	0x20004764					
	(x)= ss_vaiminseit[1]	uint lo_t	10270	0x20004760					
	ss_vainoiseSelf	uint16_t[2]	0x20004758	0x20004758					
	(x)= ss_valnoiseSelf[0]	uintio_t	101	0x20004758					
	(x)= ss_valnoiseSelf[1]	uint lo_t	120	0x2000475a					
	ss_valtouchSelf	uint 16_t [2]	0x20004784	0x20004784					
	(x)= ss_valtouchSelf[0]	untio_t	64 52	0x20004704					
	(x)= ss_valtouchSelf[1]	uintio_t	32	0x20004780					
	v cs ss_valivite	untio_t[5]	0x20004774	0x20004774					
Actual Result		uint lo_t	2003	0x20004774					
	(x)= ss_valiviut[1]	uint lo_t	2992	0x20004770					
	(x)= ss_valiviut[2]	uint lo_t	4844	0x20004778					
	ss_valmaxMut	uint16_t[3]	0x2000478c	0x2000478c					
	(x)= ss_valmaxMut[0]	uint16_t	2705	0x2000478c					
	(x)= ss_valmaxiviut[1]	uint lo_t	3027	0x2000478e					
	(k)= ss_valmaxiviut[2]	uint lo_t	4915	0x20004790					
	ss_vaiminiviut	uint lo_t [3]	0x2000474C	0x2000474c					
	(x)= ss_valminiviut[U]	uint lo_t	2010	0x2000474c					
	(q)= ss_valminiviut[1]	uint lo_t	2937	0x2000474e					
	(x)= ss_valminiviut[2]	uint lo_t	4824	0x20004750					
	ss_vainoiseiviut	uint lo_t [3]	0x2000477C	0x20004776					
	(x)= ss_valnoiselviut[0]	uint lo_t	89	0x2000477c					
	(x)= ss_valnoiselviut[1]	uint lo_t	70	0x2000477e					
	(x)= ss_valhoiseiviut[2]	uint lo_t	91	0x20004780					
	ss_valtouchiviut	uint lo_t [3]	0x2000475C	0x2000475c					
	ss_valtouchivit[0]	untio_t	30	0x2000475c					
	ss_valtouchiviut[1]	uint lo_t	34	0x2000475e					
	ss_valtouchiviut[2]	untro_t	44	0x20004700					
lssues	17.6								
Status	PASS								
Details	Check touch value (max-	reference d	ifference while	touching)					
Test Data	ss_valtouchSelf, ss_valto	uchMut		0000					
Expected Result	Maximum measured sig	nal							
Actual Result	S49								
	(4- ss_valtouchSelf[0] uint16_t	2392	0×20004784						
	048 04- ss_valnoiseSelf[1] uint16_t	3833	0x2000475a						





	S18	touchMut[0] uint	16 + 346	0,200047	S.		
	de ss_va	ittouchMut[U] uint	10_t 540	0x200047	36		
	S10	ltouchMut[1] uint1	6_t 514	0x2000475	ie		
	S2			10/00/04			
I	ss_va	ItouchMut[2] uint1	6_t 55/	0x2000478	50		
Issues							
Status	PASS						
Details	Calculate	SNR (touch	/noise valu	e)			
Test Data	(=)						
Expected Result	SNR						
	RA	NA NT				C110	
	parallel	Max NI	Min NI	Noise	Max I	SNR	
	Self but						
	S49	15434	15283	151	2392	15,84	
	\$48	15401	15275	126	3833	30.42	
Actual Result	Mutual	13401	13213	120	5055	50,42	
	hutual	1					
	but	2705	2010	00	246	2.00	
	518	2705	2616	89	346	3,89	
	S10	3027	2957	70	514	7,34	
	S2	4915	4824	91	557	6,12	
Issues	-						
Status	PASS						
Details	Check me	asurement	time				
Test Data	-						
Expected Result	Measurem	nent time					
Actual Decult	Tek Stop	.sine unite		Ť.		Noise Filter Off	
Actual Result				Ŭ.	والمتقاوم وتتنا		
	5 200V		Vino	× 0,0000	250 (144V	799 745 Living	.ee.eq
	1 2.00 V Tek Stop		(400,u	s 0.0000	s (1 / 1.44V	733.745 Hz[08 Noise Filter Off	:55:53
	(1) 2.00V Tek Stop	•	<u>400,</u> ,	s 0.00000	s) <mark>(1)</mark> / 1.44 V	733.745 Hz[0e Noise Filter Off	:55:59 160mV
	(1) 2.00 V Tel: Step	8](400,u	s 0.00000	3) (1) / 1.44 V	733.745 H2[08 Noise Filter Off @ −1.31ms @ −97.3.us	:55:59 160mV 3.44 V
	Tiek Stop)400.u	s 0.00000	s <mark>(1</mark> /144V	733.745 H2j0e Noise Filter Off © −1.31ms © −97.3.us ⇔1.21ms	155:53 160mV 3.44 V △3.28 V
	Tiek Stop)400.u E - 1	s 0.00000	s)(1) 71,44V	733.745 Hgjog Noise Filter Off @ -1.31ms @ -97.3 <i>us</i> 121ms	:55:59 160mV 3.44 V △3.28 V
	1 200V Tiek Step		(400) E	s 0.00000	s] 1 /1.44 V	733.745 H±00 Noise Filter Off ● -1.31ms ● -97.3.us =1.21ms	:55:53 160mV 3.44 V 3.28 V
	1 200V Tek Stop)400 .0 E - 1	s 0.00000	s) 1 /1.44V	733.745 HJ(00 Nose Filter Off © −1.31ms ⊕ −37.3.95 ⇔1.21ms	160mV 3.44 V ∞3.28 V
	1 200V Tek Stop)(400.u c - 1	s 0.00000	3/11.27.44V	733.745 HJ(00 Noise Filter Off 2) −1.31ms 0) −97.3.µs 	160mV 3.44 V 4.3.28 V
	1 200V Tek Stop		1400.x	s 0.00000	3 67 /1.44V	735.745 Hjor Noise Filter Off © −1.31ms ○ −97.3us ⇔1.21ms	160mV 3.44 V △3.28 V
	1 200V Tek Stop		400,	s 0.00000	3 	733.745 H2[00 Noise Filter Off © -1.31ms © -97.3.us =1.21ms	160mV 3.44 V ≏3.28 V
	1 200V Tek Stop)400,u	s 0.00000	3	733.745 H2[00 Noise Filter Off ◎ −1.31ms ◎ −57.3µs △1.21ms	:55:53 160mV 3.44∨ ≏3.28 V
	1 200V		<u>]</u> 400.0 E→+	s 0.00000	s] 7 / 1.44 V	733.745 H2[00 Nose Filter Off ● -1.31ms ● -77.3us ● 1.21ms ■ 1.21ms	:55:53 160mV 3.44∨ △3.28 ∨ ↓
	1 2.00 V Tek Stop)400. E	s 0.00000	s] 1 /1.44 V	733.745 H±00 Noise Filter Off ● −1.31ms ● −97.3.us −1.21ms −1.21ms −7.3.308 H±008 Noise Filter Off	160mV 3.44 V
	1 200V Tek Stop		}400,0 ► + + 400,0	s 0.00000 6 9 5 0.00000	3) 1 /1.44 V	733.745 H200 Noise Filter Off ● -1.31ms ● -97.3.us ● 1.21ms ● 1.21ms	150mW 3.44 V
	1 2004 Tek Stop]400.0 ⊏ □ 400.0 400.0 (400.0	s 0,0000 6 V s 0,00000	s) 7 7 1.44 V	733.745 Hz]00 Noise Filter Off ● -1.31ms ● -97.3.us -1.21ms 733.908 Hz]00 Noise Filter Off ● 1.10.us ● 1.10.us ● 1.10.us	55:53 160mV 3.44 V -3.28 V 4 55:12 3.28 V 3.44 V
	1 200V Tak Stop		400,µ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	s 0,00000	3) 11 /1.44V	733.745 H2[00 Noise Filter Off ● -1.31ms ● -97.3us	55553 160mV 3.44V
	1 200V Telk \$top 1 2000 1 2000 1 2000 1 2000 1 2000 1 2000 1 2000 1 2000 1 2000 1 2000] 400,0 	s 0.00000	3 71.44 V 3 71.44 V 1 1 1 1 1 4 1 4 1 1 4 4 4 4 4 4 4 4 4 4 4 4 4	733.745 H2[00 Noise Filter Off ● -1.31ms ● -57.3µs ● 1.21ms ■ 1.21ms 733.908 H2[00 Noise Filter Off ● 1.10µs ● 1.21ms ■ 1.21ms	160mV 3.44 ¥ 4 4 4558:12 3.28 ¥ 4 4 4
	1 200V Tek Stop		<u> </u> 400,, = 400,, = =	s 0.00000	3 - 71.44 V - 71.44 V - 71.44 V	733.745 H2[00 Noise Filter Off ○ -1.31ms ○ -97.3.us △ 1.21ms ○ 3.3.006 H2[00 Noise Filter Off ○ 1.21ms △ 1.21ms △ 1.21ms △ 1.21ms	55:53 160mV 3:44 V ⇒3:28 V 4 56:12 3:28 V 3:28 V 3:28 V 3:44 V 4
	1 2.00 V Tek, Stop]400 ⊢ → 400	s 0.00000	s] (1 / 1.44 V	733.745 H2[00 NoseFilter Off □ -1.31ms □ -7.3.us □ -1.31ms □ -1.31ms □ -1.31ms □ -1.31ms □ -1.31ms □ -1.31ms □ 1.21ms □ 1.21ms □ 1.21ms	160mV 3.44 V ⇒3.28 V € 55612 3.28 V 3.28 V 3.28 V 3.28 V 3.28 V 3.28 V 4.45 55612
	1 200V Tek Stop Tek Stop]400. F → †	s 0.00000	s) (1 /1.44V 3	733.745 H2[00 Noise Filter Off ○ -1.31ms ○ -97.3.us △ 1.21ms ○ 1.21ms 733.908 H2[08 Noise Filter Off ○ 1.10,us ○ 1.21ms △ 1.21ms	160mV 3.44V ⇔3.28V € 556:12 3.26V 3.44V 3.44V 3.44V 4
	1 2004 Tek Stop)400 E	s 0.00000	3) 1 /1.44V	733.745 H200 Noise Filter Off © −1.31ms 0 −97.3.us −1.21ms −1.21ms −1.21ms −1.21ms −1.21ms −1.21ms −1.21ms −1.21ms −1.21ms −1.21ms −1.21ms	160mV
	1 200V Tek Stop		400,µ 400,µ 400,µ	s 0.00000	3 71.44 V	733.745 H2[00 Noise Filter Off □ -1.31ms □ -97.3µs □ 1.21ms 733.908 H2[00 Noise Filter Off □ 1.10µs □ 1.21ms □ 1.21ms □ 1.21ms	150rw 3.44 ¥ ∞3.28 ¥ 4 4 556:12 3.28 ¥ ∞150m¥ 4
	1 200V Tak Stop 1 200V Tak Stop		400,0	s 0.00000	3 7.44V	733.745 H2[00 Noise Filter Off	180mW 3.44 ¥ ⇒3.28 ¥ 4 \$56:12 \$3.26 ¥ \$3.26 ¥
	1 200V Tak Stop 1 200V Tak Stop			s 0,00000	3) 71.44 V	733.745 H2[00 Noise Filter Off ○ -1.31ms ○ -97.3.us △ 1.21ms ○ -1.32ms △ 1.21ms ○ 1.21ms ○ 1.21ms ○ 1.21ms ○ 1.21ms ○ 1.21ms	150mV 3.44 ∨ -3.28 ∨ -3.48 ∨ -3.28 ∨
	1 2.00 V Tek, Stop 1 2.00 V Tek, Stop 1 2.00 V Tek, Stop 1 2.00 V Tek, Stop		400,	s 0.00000 C S 0.00000 S 0.00000 S 0.00000 S 0.00000 S S 0.00000 S S 0.00000 S S 0.00000 S S S 0.00000 S S S S S S S S S S S S S	3 3 3 3 7 1.44 V 1 3 7 1.44 V 1 3 1 7 1.44 V 1 1 1 1 1 1 1 1 1 1 1 1 1	733.745 H2[00 Noise Filter Off □ -1.31ms □ -97.3.us □ -1.21ms □ -1.21ms	55:53 160m¥ 3.44¥ -3.28¥ -3.28¥ -3.28¥ -3.28¥ -3.28¥ -4. -56:12 -3.28¥ -4. -4. -4. -4. -4. -4. -5. -5. -2. -5. -2. -5. -2. -5. -5. -5. -5. -5. -5. -5. -5
	1 200V Tek Stop Tek Stop			s 0.00000	s) 71.44 V 3 3) 71.44 V 4 3) 71.44 V 3) 71.44 V	733.745 H200 NoseFited Off □ -1.31ms □ -7.3.us □ -1.21ms □ -1.21ms □ -1.21ms □ -1.21ms □ -1.21ms □ -1.21ms □ -1.21ms □ -1.21ms □ -1.21ms	55:53 160mV 3.44 V ⇒3.28 V 4 55:12 3.28 V 3.28 V 4 55:12 3.28 V 4 55:12 3.28 V 4 55:12 3.28 V 4 55:12 3.28 V 4 55:12 3.28 V 4 55:12 3.28 V 4 55:12 5
	1 200V Tek Stop Teik Stop]400 F → ↓ [400 E → ↓	s 0.00000 C S 0.00000 S 0.000000 S 0.000000 S 0.000000 S 0.00000000 S 0.00000000000000000000000000000000000	s) 71.44 V	733.745 H2[00 Noise Filter Off ○ -1.31ms ○ -97.3.us △ 1.21ms ○ -97.3.us △ 1.21ms ○ -97.3.us ○ -1.51ms ○ -1.21ms ○ -1.21ms ○ -1.21ms	160mV →328 V →328 V + + + + + + + + + + + + +
	1 2004 Tek Stop		400,0 400,0 400,0 E	s 0.00000 0 0 1 1 0 1	3) - 71.44V - 71.44V - 71.44V - 71.44V	733.745 H2[00 Noise Filter Off	150mW 3.44 ¥ 3.28 ¥ 4 4 556:12 3.26 ¥ 4 4 4 4 4 3.26 ¥ 4 3.26 ¥ 4 3.26 ¥ 4 3.26 ¥ 3.44 ¥ 4 3.26 ¥ 3.44 ¥ 4 3.26 ¥ 4 3.26 ¥ 4 4 3.26 ¥ 4 4 3.26 ¥ 4 4 4 4 4 4 4 4 4 4 4 5 5 6 12 8 12 8 12 8 12 8 12 8 12 8 12 8 12
	1 200V Tek Stop			s 0.00000	3 3 7 7 1.44 V 3 7 7 1.44 V 1 3 7 7 1.44 V 1 3 7 7 1.44 V 1 7 1.44 V 1 7 1.44 V 1 7 1.44 V 1 7 1.44 V 1 7 1 1 1 1 1 1 1 1 1 1 1 1 1	733.745 H2[00 Noise Filter Off □ -1.31ms □ -57.3.us □ -57.3.us □ -1.21ms □ -1.21ms	55:53 180mW 3.44 y -3.28 y 4 556:12 556:12 3.26 y 4 4 556:23 3.36 y -3.26 y 4 -3.26 y -3.26 y -3.26 y -3.26 y -3.26 y -3.28 y
	1 2004 Task Stop 2004 1 2004			s 0,00000	3 3 7 7 1.44 V 3 7 7 1.44 V 3 7 7 1.44 V 1 3 1 7 1.44 V 1 3 1 7 1.44 V 1 1 1 1 1 1 1 1 1 1 1 1 1	733.745 H2 (00 Noise Filter Off ◎ -1.31ms ○ -57.3.us a.1.21ms 0 -57.3.us a.1.21ms 0 -1.10us ○ 1.21ms 0 -1.21ms 0 -1.21ms	180mW 3.44 ¥ -3.28 ¥ -556:12 3.28 ¥ -556:12 3.28 ¥ -556:23 3.36 ¥ -280.0m¥ -280.0m¥
	1 200V Task Stop 1 200V 1 200V 1 200V 1 200V			s 0.00000	3 3 7 7 1.44 3 7 7 1.44 7 1.44 7 7 1.44 7 7 1.44 7 7 1.44 7 7 1.44 7 7 1.44 7 7 7 1.44 7 7 7 7 7 7 7 7 7 7 7 7 7	733.745 H2[00 Noise Filter Off ○ -1.31ms ○ -97.3.us -1.21ms ○ 1.21ms ○ 1.10.us ○ 1.21ms ○ 1.21ms ○ 1.21ms ○ 1.21ms ○ 1.21ms ○ 1.21ms ○ 1.21ms ○ 2.21ms	 55:53 160mV 3:44 ∨ -3:28 ∨
	1 2.00 V Tek, Stop 3.00 V 1 2.00 V Tek, Stop 3.00 V]400, ← 400, ← 400, ←	s 0.00000 C S 0.00000 S 0.00000 S 0.00000 S 0.00000 S 0.00000 S 0.00000 S S 0.00000 S S 0.00000 S S 0 0 0 0 0 0 0 0 0 0 0 0 0	3 3 7 1.44 V 3 7 1.44 V 3 7 1.44 V 1.44 V 1	733.745 H200 Noise Filter Off ○ -1.31ms ○ -97.3.us □ 1.21ms □ 2.73ms	 55:53 160mV 3.44 V →3.28 V 4 4 4 55:23 3.56 V 4 4
	1 2004 Tek, Stop Tek, Stop Tek, Stop		400, ← 400, 400, 	s 0.00000 C 0 S 0.00000 S 0 S 0 S 0 S 0 S 0 S 0 S 0	s) ~ 1.44 V	733.745 H200 Nose Filter Off □ -1.31ms □ -7.3.us □ -1.31ms □ -1.21ms □	55:53 160mV 3.44 V ⇒3.28 V 4 556:12 3.28 V 4 556:12 3.28 V 4 556:23 3.36 V 3.36 V 3.34 V 4 4 4 556:23 3.36 V 4 4 556:23 3.36 V 4 556:23 3.36 V 4 556:23 3.36 V 4 556:23 3.36 V 4 556:23 3.36 V 4 556:23 3.36 V 4 556:23 3.36 V 4 556:23 3.36 V 4 556:23 3.36 V 556:23 3.36 V 556:24 556:24 556:24 556:25
	1 2004 Tek, Stop Tek, Stop Tek, Stop Tek, Stop Tek, Stop]400 F → 1 [400] F → 1 [400]	s 0.00000	3) 1 /1.44 V 3) 1 /1.44 V 4 - 3 3) 1 /1.44 V 4 - 3	733.745 H200 Nose Filter Off ● -1.31ms ● -97.3.us = 1.21ms = 1.21ms	55553 160mW 3.44 ¥ -328 ¥





	Measurement time (ms)						
1	Self	1,21					
	Mutual	1,21					
	Total	2,42					
	Global	2,73					
Issues							
Status	PASS						
Details	Check memory usage	Check memory usage					
Test Data							
Expected Result	Memory usage						
Actual Result	Prome Const & Section 2 Sections Prome Pro	3- Ditugi ≠ Seevi 2018 Interno 8 Interno 36 Interno 37 Interno	Briel 21 21 25 45 44 Browner Browner Browner Browner				
Issues							

ĸ	ey	SP00014-T9	Status	PASS	Name	RA tests	configuring m	ulti-frequency scar		
		To find measurement time, maximum measured signal, SNR and Memory usage using a								
0	bjective	reference fing	ger for T4 RA	aximum	measure	u signal, s	INK and Memor	y usage using a		
P	recondition	Config: 2 self	buttons, 3 mutu	al butto	ons (1 TX,	3 RX)				
C	overage (issues)	SP00014-11								
C	overage (confluence									
n	ages)									
0	yer, weraa (web links)									
-	overage (web links)	2024 42 27	-			1				
A	ctual end date	2021-12-27,	Estimated	00:00	Actual	00:00				
		11:44	Time		time	1000000000				
A	ssigned to	Nira Tubert	Environment	e2 studio	Туре	Manual	execution			
E	recuted by	Nira Tubert		ordano		100				
1.0			Tester Non							
13	sues	-								
			Te	st Scrip	ot					
1	Status	PASS								
	Details	Check	max, min, and n	oise val	ues witho	ut touchin	a			
		ss valn	navSelf ss valmi	nSelf s	valnoise	Self	5			
	Test Data	ss_valn	navMut ss_valm	inMut a	s valnoise	oMut				
	Francisco de Decembro	SS_Vdii		innviut, :	s_vanois	eiviut				
	Expected Result	Max, n	nin and noise va	lues						
	Actual Result									
		Expres	sion	Type	Va	alue	Address			
		Lipic.	er unlCalf	uint16	+ [2] 0.	20004644	0-2000/644			
		- (1)	ss_valSelf[0]	uint16	+ 15	220004000	0x200040dc			
			A)- ss_valSelf[1]	uint16	+ 15	420	0x2000400C			
		×	ss valmavSelf	uint16	+[2] 0v	2000471c	0x20004042			
		- 50	ble ss valmaxSelf[0]	uint16	t 15	392	0x2000471c			
		(x)= ss_valmaxSelf[1]	uint16	t 15	494	0x2000471e			
		~ A	ss valminSelf	uint16	t[2] 0x	200046f8	0x200046f8			
		(x)= ss_valminSelf[0]	uint16	t 15	267	0x200046f8			
		(x)= ss_valminSelf[1]	uint16	t 15	364	0x200046fa			
		~ 🏤	ss_valnoiseSelf	uint16	_t [2] 0x	200046ec	0x200046ec			
			x)= ss_valnoiseSelf[0] uint16	t 12	15	0x200046ec			
		(x)= ss_valnoiseSelf[1] uint16	_t 13	0	0x200046ee			
		~ 🗳	ss_valtouchSelf	uint16	_t [2] 0x	20004718	0x20004718			
			x)= ss_valtouchSelf[()] uint16	_t 62	1	0x20004718			
			x)= ss_valtouchSelf[] uint16	_t 59		0x2000471a			
		× 🐝	ss_valMut	uint16	_t[3] 0x	20004708	0x20004708			
			x)= ss_valMut[0]	uint16	_t 27	21	0x20004708			
			wess_valMut[1]	uint16	_t 27	00	0x2000470a			
			x)= ss_valMut[2]	uint16	_t 44	2000 4720	0x2000470c			
		× 3	ss_valmaxiviut	uint16	_t[5] 0x	20004720	0x20004720			
			<pre>>>_vaimaxivlut(0)>>>_vaimaxivlut(1)</pre>	uint10	+ 27	49	0x20004720			
			x)= ss_valmavMut[1	uint16	+ AA	152	0x20004724			
		~ . Q	ss valminMut	uint16	t [3] 0v	200046e0	0x200046e0			
			x)= ss valminMutf01	uint16	t 26	98	0x200046e0			
			x)= ss_valminMut[1]	uint16	t 27	34	0x200046e2			
			x)= ss valminMut[2]	uint16	t 43	86	0x200046e4			
		× 2	ss_valnoiseMut	uint16	t [3] 0x	20004710	0x20004710			
			x)= ss_valnoiseMut[() uint16	t 51		0x20004710			
			x)= ss valnoiseMut[11 uint16	+ 51		0x20004712			
			a salutationscillar	J unitro	J I		UX20004112			





		V 2 55 V	altouchMut	uint16 t [3	1 0x200	046f0	0x200046f0			
		(×)= 5	s_valtouchMut[0] uint16_t	27		0x200046f0			
		(×)= 5	s_valtouchMut[1] uint16_t	26		0x200046f2			
		(×)= s	s_valtouchMut[2] uint16_t	37		0x200046f4			
	Issues	17-11								
	Status	PASS								
	Details	Check tou	ch value (ma	x-reference	differen	ce while	touching)			
	Test Data	ss_valtouc	hSelf, ss_valte	ouchMut			12203			
	Expected Result	Maximum	measured sig	gnal						
		S49								
		00: ss_val S48:	couchSelf[0] uint16_t	2429	0x2000471	18				
2			opendentif amere-	334	01200047					
	Actual Result	S18 60+ ss_val S10 64- ss_val	touchMut[0] uint16_t touchMut[1] uint16_t	332 425	0x200046f 0x200046f	f0 f2				
		S2 (9- ss valtouchMut/2) uint16 t 492 0x2003464								
	Issues									
Í	Status	PASS								
	Details	Calculate :	SNR (touch/n	oise value)	0					
	Test Data	-		-/						
	Expected Result	SNR								
		RA	Max NT	Min NT	Noise	Max 1	SNR			
		Self but								
		549	15392	15267	125	2429	19.43			
3		\$49	15494	15364	130	35/2	27.25			
	Actual Pocult	340 Martinel	13454	13304	150	5542	21,23			
	Actual Result	IVIUTUAI								
		fut	2740	2600	54	222	0.54			
		518	2749	2098	51	332	6,51			
		510	2785	2734	51	425	8,33	_		
		S2	4452	4386	66	492	7,45			
10.0	Issues									
4	lssues Status	- PASS								
4	lssues Status Details	- PASS Check me	asurement tir	ne						
4	Issues Status Details Test Data	- PASS Check me	asurement tir	ne						
4	Issues Status Details Test Data Expected Result	- PASS Check me - Measurem	asurement tir nent time	ne						
4	Issues Status Details Test Data Expected Result Actual Result	- PASS Check me - Measurem	asurement tir Ient time	ne						
4	Issues Status Details Test Data Expected Result Actual Result	- PASS Check me - Measurem	asurement tir	ne	V		- Noise Fi	Iter Off		
4	Issues Status Details Test Data Expected Result Actual Result	PASS Check me - Measuren	asurement tir	ne	V	00ms 1	-] Noise Fi	Iter Off		
4	Issues Status Details Test Data Expected Result Actual Result	PASS Check me - Measuren	asurement time	ne	0ms 3.800	00ms 1	-] Noise Fil	Iter Off 60 Hb (08:52:57 Iter Off		
4	Issues Status Details Test Data Expected Result Actual Result	PASS Check me - Measurem	asurement time		9 *	00ms 1	-] Noise Fil	tter Off 60 H3[06:52:57 Tter Off 74Jus 3.36 V 22ms 160mV 22ms 160mV		
4	Issues Status Details Test Data Expected Result Actual Result	PASS Check me - Measurem	asurement tir		0ms 3.500	00ms 1	→ Noise FI /1.44V 597.7 → Noise FI 0 2: 0 1. -1	tter Off 60 Ha 06852:57 Tter Off 74us 3.36 V 22ms 160mV .21ms a.320 V		
4	Issues Status Details Test Data Expected Result Actual Result	PASS Check me - Measurem	asurement time	ne	0ms 3.800		-] Noise Fi	tter Off 60 Hb[0e52:57 tter Off 74,us 3.36 V .21ms = 3.20 V		
4	Issues Status Details Test Data Expected Result Actual Result	PASS Check me - Measuren	asurement time	ne	0ms 3.800		-] Noise Fi	tter Off 60 Hb (08:52:57 tter Off 74.us, 3.36 V .21ms = 3.20 V		





Image: status Image: status<		Tek Stop			Noise Filter Off
Image: status Image: status<					● 1.30ms 3.36 V ● 4.90ms 160mV △3.59ms △3.20 V
Issues - Status PASS Details Check memory usage Test Data - Expected Result Memory usage Actual Result Image Presult					
200V 1.00ms 35000mm 1.44V 397.752.H (0.655.27) 11bk, 3tep 0 -177.05 3.84V -5.07ms -3.20V 1 0 -177.05 3.84V -5.07ms -3.20V 1 0 -177.05 3.84V -5.07ms -3.20V 2 0.00V 1.00ms 2.6000mm -1.44V 296.173 H (0.653.20) 1 2.60V 1.00ms 2.6000mm -1.44V 296.173 H (0.653.20) 1 6.60 1.21 Mutual 3,59 -5.07 -5.07 1 5.61 1.21 Mutual 3,59 -5.07 -5.07 1 5.01 4.80 Global 5.07 -5.07 -5.07 1 5.025 - - - - - 5 5 5 - - - - 5 5 5 - - - - - 5 5 5 5 - - - - - -<					
Issues - Status PASS Details Check memory usage Test Data - Expected Result Memory usage Actual Result Image and im		1 2.00 V Tek Stop	(1.00ms 3.	50000ms 1 / 1.44 V	397.752 Hz Noise Filter Off
Issues - Status PASS Details Check memory usage Test Data - Expected Result Memory usage Actual Result Memory usage Test Data - Expected Result Memory usage Test Data - Test Data - <th></th> <th></th> <th></th> <th>8</th> <th> ■ -177.µs 3.36 V ■ 4.90ms 160mV △5.07ms △3.20 V </th>				8	 ■ -177.µs 3.36 V ■ 4.90ms 160mV △5.07ms △3.20 V
Image: second					
Measurement time (ms) Self 1,21 Mutual 3,59 Total 4,80 Global 5,07 Issues - Status PASS Details Check memory usage Test Data - Expected Result Memory usage Actual Result Image Superson		1 2.00 V	(1.00ms 3.	50000ms) <mark>(1)</mark> / 1.44 V	396.173 Hz[08:53:28
Self 1,21 Mutual 3,59 Total 4,80 Global 5,07		Measurement time (ms)			
Mutual 3,59 Total 4,80 Global 5,07 Issues - Status PASS Details Check memory usage Test Data - Expected Result Memory usage Actual Result		- 1C	52 M (200 G)		
Intel 4,80 Global 5,07 Issues - Status PASS Details Check memory usage Test Data - Expected Result Memory usage Actual Result Image: Check Result in the state of the sta		Self	1,21		
Issues - Status PASS Details Check memory usage Test Data - Expected Result Memory usage Actual Result Status		Self Mutual	1,21 3,59		
Status PASS Details Check memory usage Test Data - Expected Result Memory usage Actual Result Image: Comparison of		Self Mutual Total Global	1,21 3,59 4,80 5,07		
Details Check memory usage Test Data - Expected Result Memory usage Actual Result Image: Comparison of the state	Issues	Self Mutual Total Global	1,21 3,59 4,80 5,07		
Test Data - Expected Result Memory usage Actual Result Result Image State Image State Image State <td< td=""><th>lssues Status</th><td>Self Mutual Total Global - PASS</td><td>1,21 3,59 4,80 5,07</td><td></td><td></td></td<>	lssues Status	Self Mutual Total Global - PASS	1,21 3,59 4,80 5,07		
Expected Result Memory usage Actual Result Channel &	lssues Status Details	Self Mutual Total Global - PASS Check memory usage	1,21 3,59 4,80 5,07		
Actual Result	lssues Status Details Test Data	Self Mutual Total Global - PASS Check memory usage -	1,21 3,59 4,80 5,07		
500000 (1091)	lssues Status Details Test Data Expected Result	Self Mutual Total Global - PASS Check memory usage - Memory usage	1,21 3,59 4,80 5,07		
	Issues Status Details Test Data Expected Result Actual Result	Self Mutual Total Global - PASS Check memory usage - Memory usage - Memory usage - Memory usage -	1,21 3,59 4,80 5,07 5,07	Annual State	B \$\ \$\ \$\ \$\ \$

Key	SP00014-T8	Status	PASS	Name	RA tests configuring one frequency with parallel scan with leds
Objective	To find meas reference fin	urement tim ger for T4 R/	e, maximui A	m measur	red signal, SNR and Memory usage using a
Precondition	Config: 2 self	buttons, 3 r	nutual but	tons (1 TX	(, 3 RX)
Coverage (issues)	SP00014-11			-94	
Coverage (confluence pages)					

(actimation pages)						
Coverage (web links)						
Actual end date	2021-12-27, 11:44	Estimated Time	00:00	Actual time	00:00	
Assigned to	Nira Tubert	Environment	e2 studio	Туре	Manual execution	
Executed by	Nira Tubert		0			
Issues	12					

Issues -					
	Tes	t Script			
Status	PASS				
Details	Check max, min, and no	ise values wi	thout touching	9	
Test Data	ss_valmaxSelf, ss_valmin ss_valmaxMut, ss_valmin	Self, ss_valno Mut, ss_valr	oiseSelf 10iseMut		
Expected Result	Max, min and noise valu	ies			
	Expression v 🏤 ss_valSelf	Type uint16_t [2]	Value 0x200047c8	Address 0x200047c8	
	(x)= ss_valSelf[0]	uint16_t	7670	0x200047c8	
	(x)= ss_valSelf[1]	uint16_t	7889	0x200047ca	
	🗸 🎲 ss_valmaxSelf	uint16_t [2]	0x20004808	0x20004808	
	(x)= ss_valmaxSelf[0]	uint16_t	7708	0x20004808	
	(x)= ss_valmaxSelf[1]	uint16_t	7925	0x2000480a	





1	4			
	✓ ⅔ ss_valminSelf	uint16_t [2]	0x200047e4	0x200047e4
	(x)= ss_valminSelf[0]	uint16_t	7408	0x200047e4
	(x)= ss_valminSelf[1]	uint16_t	7609	0x200047e6
	v 😪 ss_valnoiseSelf	uint16_t [2]	0x200047d8	0x200047d8
	(x)= ss_valnoiseSelf[0]	uint16_t	300	0x200047d8
	(x)= ss_valnoiseSelf[1]	uint16_t	316	0x200047da
	v 🎲 ss_valtouchSelf	uint16_t [2]	0x20004804	0x20004804
	(x)= ss_valtouchSelf[0]	uint16_t	143	0x20004804
	(x)= ss_valtouchSelf[1]	uint16_t	113	0x20004806
	🗸 🍪 ss_valMut	uint16_t [3]	0x200047f4	0x200047f4
Actual Result	(x)= ss_valMut[0]	uint16_t	1269	0x200047f4
	(x)= ss_valMut[1]	uint16_t	1422	0x200047f6
	(x)= ss_valMut[2]	uint16_t	2340	0x200047f8
	✓ iss_valmaxMut	uint16_t [3]	0x2000480c	0x2000480c
	(x)= ss_valmaxMut[0]	uint16_t	1332	0x2000480c
	(x)= ss_valmaxMut[1]	uint16_t	1493	0x2000480e
	(x)= ss_valmaxMut[2]	uint16_t	2421	0x20004810
	🗸 🎲 ss_valminMut	uint16_t [3]	0x200047cc	0x200047cc
	(x)= ss_valminMut[0]	uint16_t	1249	0x200047cc
	(×)= ss_valminMut[1]	uint16_t	1401	0x200047ce
	(x)= ss_valminMut[2]	uint16_t	2310	0x200047d0
	✓ Iss_valnoiseMut	uint16_t [3]	0x200047fc	0x200047fc
	(x)= ss_valnoiseMut[0]	uint16_t	83	0x200047fc
	(x)= ss_valnoiseMut[1]	uint16_t	92	0x200047fe
	(x)= ss_valnoiseMut[2]	uint16_t	111	0x20004800
	✓ iss_valtouchMut	uint16_t [3]	0x200047dc	0x200047dc
	(x)= ss_valtouchMut[0]	uint16_t	26	0x200047dc
	(x)= ss_valtouchMut[1]	uint16_t	31	0x200047de
	(x)= ss_valtouchMut[2]	uint16_t	28	0x200047e0
lssues	(74)			
Status	PASS			
Details	Check touch value (max-	reference d	lifference while	touchina)
Test Data	ss valtouch Self, ss valtou	uchMut		,
Expected Result	Maximum measured sign	nal		
	242			
	S49	1411	0.00017-0	
	S49 00= ss_valnoiseSelf[0] uint16_t	1411	0x200047d8	
	S49 (0)= ss_valnoiseSelf[0] uint16_t S48	1411	0x200047d8	
	S49 (0= ss_valnoiseSelf[0] uint16_t S48 (0- ss valnoiseSelf[1] uint16 t	1411	0x200047d8 0x200047da	
	S49 00= ss_valnoiseSelf[0] uint16_t S48 00= ss_valnoiseSelf[1] uint16_t	1411	0x200047d8 0x200047da	
Actual Pacule	S49 09= sc_valnoiseSelf[0] uint16_t S48 69- ss_valnoiseSelf[1] uint16_t S18 518 518	1411	0x200047d8 0x200047da	
Actual Result	S49 09: ss_valnoiseSelf[0] uint16_t S48 09: ss_valnoiseSelf[1] uint16_t 09: ss_valnoiseSelf[1] uint16_t 1 S18 09: ss_valnoiseSelf[1] uint16_t	1411 1852 176	0x200047d8 0x200047da 0x200047dc	
Actual Result	S49 00= ss_valnoiseSelf(0) uint16_t S48 60- ss_valnoiseSelf(1) uint16_t S18 00- ss_valnoiseSelf(1) uint16_t S0+ ss_valnoiseSelf(1) uint16_t 00- ss_valnoiseSelf(1)	1411 1852 176	0x200047d8 0x200047da 0x200047dc	
Actual Result	S49 00+ st_valnoiseSelf[0] uint16_t S48 00+ st_valnoiseSelf[1] uint16_t S18 00+ st_valnoiseSelf[1] uint16_t S18 00+ st_valnoiseSelf[1] uint16_t	1411 1852 176	0x200047d8 0x200047da 0x200047dc	
Actual Result	S49 09: ss_valnoiseSelf[0] uint16_t S48 09: ss_valnoiseSelf[1] uint16_t S18 09: ss_valtouchMut[0] uint16_t S10 09: ss_valtouchMut[1] uint16_t	1411 1852 176 221	0x200047d8 0x200047da 0x200047de 0x200047de	
Actual Result	S49 00- ss_valnoiseSelf(0)_uint16_t S48 00- ss_valnoiseSelf(1)_uint16_t S18 00- ss_valnoiseSelf(1)_uint16_t S10 00- ss_valnoiseSelf(1)_uint16_t S2 S2	1411 1852 176 221	0x200047d8 0x200047da 0x200047de 0x200047de	
Actual Result	S49 00+ ss_valnoiseSelf(0) S48 00+ ss_valnoiseSelf(1) unit16_t S18 00+ ss_valnouchMut(0) unit16_t S10 00+ ss_valnouchMut(1) 00+ ss_valnouchMut(1) 00+ ss_valnouchMut(2) 00+ ss_valnouchMut(2)	1411 1852 176 221 252	0x200047d8 0x200047da 0x200047dc 0x200047dc	
Actual Result	S49 00= ss_valnoiseSelf(0) uint16_t S48 00= ss_valnoiseSelf(1) uint16_t S18 00= ss_valnoiseSelf(1) uint16_t S10 00= ss_valnouchMut[0] uint16_t S2 00= ss_valnouchMut[1] uint16_t	1411 1852 176 221 252	0+20004768 0+20004768 0+20004766 0+20004766 0+20004766	

Status	PASS						
Details	Calculate S	NR (touch	/noise valu	e)			
Test Data	100	10		1FX			
Expected Result	SNR						
	RA 1 freq	Max NT	Min NT	Noise	Max T	SNR	
	Self but						
	S49	7708	7408	300	1411	4,70	
	S48	7925	7609	316	1852	5,86	
Actual Result	Mutual but						
	S18	1332	1249	83	176	2,12	
	S10	1493	1401	92	221	2,40	
	S2	2421	2310	111	252	2,27	
Issues							

Кеу	SP00014-T7	Status	PASS	Name	RA tests configuring one frequency with parallel scan without leds
Objective	To find meas reference fin	urement time, ger for T4 RA	, maximu	m measu	red signal, SNR and Memory usage using a
Precondition	Config: 2 sel	f buttons, 3 m	utual but	tons (1 T)	(, 3 RX)
Coverage (issues)	SP00014-11				
Coverage (confluence pages)					
Coverage (web links)					
Actual end date	2021-12-27, 11:44	Estimated Time	00:00	Actual time	00:00
		-		-	





				studic	., ., .,					
×	ecuted by	Nira Tubert								
ss	sues	-								
				Test S	cript					
I	Status	PAS	PASS							
İ	Details	Che	Check max, min, and noise values without touching							
ł		ss v	s_valmaxSelf, ss_valminSelf, ss_valnoiseSelf							
	lest Data	ss v	almaxMut, ss va	alminM	ut, ss va	lnoiseMut				
ł	Expected Result	Max	, min and noise	values						
ŀ	Actual Result									
1										
1		Ev.	pression	т	/De	Value	Address			
		EX.			int16 + [2]	0x200046-0	0x200046c0			
		- · ·	(X)= ss valSelf[0]	u u	int16 t	7713	0x200046c0			
			(x)= ss_valSelf[1]	u	int16_t	7640	0x200046c2			
		*	ss_valmaxSelf	u	int16_t [2]	0x20004700.	0x20004700			
			(x)= ss_valmaxSe	lf[0] u	int16_t	7762	0x20004700			
			(x)= ss_valmaxSe	lf[1] u	int16_t	7687	0x20004702			
		~.	ss_valminSelf	U	int16_t [2]	0x200046dc	0x200046dc			
			(x)= ss_valminSel	r[U] u	int16_t	76/5	0x200046dc			
			ss_valminSel	n[1] U	int16 + (2)	0x20004640	0x200046de			
			ss_valnoiseself (x)= ss_valnoise	elf[0]	int16 t	87	0x200046d0			
			(x)= ss_valnoiseS	elf[1] u	int16 t	84	0x200046d2			
		~.	ss_valtouchSelf	u	int16_t [2]	0x200046fc	0x200046fc			
			(x)= ss_valtouchS	elf[0] u	int16_t	57	0x200046fc			
			(x)= ss_valtouchS	Gelf[1] u	int16_t	52	0x200046fe			
		~	윩 ss_valMut	u	int16_t [3]	0x200046ec.	0x200046ec			
			(x)= ss_valMut[0]	u	int16_t	1316	0x200046ec			
			(x)= ss_valMut[1]	u	int16_t	1489	0x200046ee			
			ss valmavMut[2]	u u	int16 + [3]	0x20004704	0x20004010			
		-	(x)= ss_valmaxM	ut[0] u	int16 t	1342	0x20004704			
			(x)= ss_valmaxM	ut[1] u	int16_t	1513	0x20004706			
			(×)= ss_valmaxM	ut[2] u	int16_t	2436	0x20004708			
		~	😵 ss_valminMut	u	int16_t [3]	0x200046c4.	0x200046c4			
			(x)= ss_valminMu	ut[0] u	int16_t	1298	0x200046c4			
			(×)= ss_valminMu	ut[1] u	int16_t	1461	0x200046c6			
ļ			(×)= ss_valminMu	ut[2] u	int16_t	2387	0x200046c8			
ļ		~	ss_vainoiseMut	ution	int16 +	0x200046t4	0x200040t4			
ļ			(x)= ss valnoiselv	lut[1]	int16 t	52	0x200046f6			
			(x)= ss_valnoiseN	1ut[2] u	int16_t	49	0x200046f8			
		×.	ss_valtouchMut	t u	int16_t [3]	0x200046d4	0x200046d4			
ļ			🚓 ss_valtouchN	Mut[0] u	int16_t	20	0x200046d4			
			😵 ss_valtouch	Mut[1] u	int16_t	26	0x200046d6			
ļ			ss_valtouchN	Mut[2] u	int16_t	22	0x200046d8			
ļ	lssues	-								
ļ	Status	PAS	5							
I	Details	Che	ck touch value (max-re	ference	difference whi	le touching)			
ľ	Test Data	ss_v	altouch Self, ss_v	altouc	hMut		1990): 			
ŀ	Expected Result	Max	imum measured	d signa	1					
- 4		\$40		j						
		549	(x)= ss_valnoiseSelf[0] uii	nt16_t	1224	0x200046dD				
					- Weiter					
			S-48 [04-ss_valnoiseSelf11] uint16_t 1904 0x20046d2							
		S48								
		S48	(x)= ss_valnoiseSelf[1] uii	nt16_t	1904	0x200046d2				
	Antonia Distancia	S48	00- ss_valnoiseSelf[1] uii	nti6_t	1904	0x200046d2				
	Actual Result	S48	00• ss_valnoiseSelf[1] uii	nti6_t nti6_t	1904	0x200046d2 0x200046d4				
•	Actual Result	S48	09- ss_valnoiseSelf[1] uii	nti6_t nti6_t	1904	0x200046d2 0x200046d4				
	Actual Result	S48 S18 S10	09- ss_valnoiseSelf[1] uii	nt16_t nt16_t nt16_t	1904 198 241	0x200046d2 0x200046d4				
	Actual Result	S48 S18 S10	09- ss_valnoiseSelf[1] uii	nt16_t nt16_t nt16_t	1904 198 241	0x200046d2 0x200046d4 0x200046d6				
	Actual Result	\$48 518 \$10 \$2	00- ss_valhouseSelf[1] uii	nt16_t nt16_t nt16_t	1904 198 241	0x200046d2 Dx200046d4 Dx200046d6				
	Actual Result	\$48 518 510 52	00- sz_valnoiseSelf[1] uli	nt16_t nt16_t nt16_t	1904 198 241 272	0x200046d2 0x200046d4 0x200046d6 0x200046d8				
	Actual Result	\$48 \$18 \$10 \$2	00- ss_valhouseSelf[1] uii	nt16_t nt16_t nt16_t	1904 198 241 272	Dx:200046d2 Dx:200046d4 Dx:200046d6 Dx:200046d8				
	Actual Result Issues Status	548 518 510 52 -	00-ss_valnoiseSelf[1] uii @ ss_valtouchMut[0] uir @ ss_veltouchMut[1] uir @ ss_valtouchMut[2] uir	nt16_t nt16_t nt16_t	1904 198 241 272	Dx200046d2 Dx200046d4 0x200046d6 Dx200046d6 Dx200046d8				
	Actual Result Issues Status Details	548 518 510 52 - PAS Calc	00- ss_valnoiseSelf(1) ui ss_valtouchMut(0) uir ss_valtouchMut(1) uir ss_valtouchMut(2) uir ulate SNR (four	nt16_t nt16_t nt16_t h/nois	1904 198 241 272 272	Dr.20004642 Dr.20004664 Dr.20004666 Dr.20004668				
	Actual Result Issues Status Details Teet Data	548 518 510 52 - PAS Calc	00- sz_valnoiseSelf[1] uli 20- sz_valtouchMut[0] uli 20- sz_valtouchMut[1] uli 20- sz_valtouchMut[2] uli 20- sz_valtouchMut[2] uli 20- sz_valtouchMut[2] uli 20- sz_valtouchMut[2] uli 20- sz_valtouchMut[2] uli 20- sz_valtouchMut[2] uli	nt16_t nt16_t nt16_t nt16_t :h/noise	1904 198 241 272 e value)	Dx20004642 Dx20004664 Dx20004666 Dx20004666				
	Actual Result Issues Status Details Test Data	548 518 510 52 - PAS Calc -	00- sz_valnoiseSelf[1] uli sz_valtouchMut[0] uli sz_valtouchMut[1] uli sz_valtouchMut[2] uli uliate SNR (touc	nt16_t nt16_t nt16_t nt16_t :h/noisi	1904 198 241 272 e value)	Dx200046d2 Dx20004664 Dx20004666 Dx20004666				
2	Actual Result Issues Status Details Test Data Expected Result	S48 S18 S10 S2 - - PAS Calc - - SNR	00- sz_valnoiseSelf[1] uli 25 sz_valtouchMut[0] uli 25 sz_valtouchMut[1] uli 26 sz_valtouchMut[2] uli 20 20 20 20 20 20 20 20 20 20	nt16_t nt16_t nt16_t .h/noise	1904 198 241 272 e value)	Dx200046d2 Dx20004664 Dx20004666 Dx20004668				
	Actual Result Issues Status Details Test Data Expected Result	S48 S18 S10 S2 Calc - SNR RA	00- sz_valnoiseSelf[1] uli sz_valtouchMut[0] uli sz_valtouchMut[1] uli sz_valtouchMut[2] uli ulate SNR (touc 1 freq Max NT	nt16_t nt16_t nt16_t :h/noise	1904 198 241 272 e value)	0x200046d2 0x20004664 0x20004668 0x20004668	x T SNR			
2	Actual Result Issues Status Details Test Data Expected Result	S48 S18 S10 S2 Calc Calc Calc SNR RA Selt	00-ss_valnoiseSelf[1] ui ss_valtouchMut[0] uir ss_valtouchMut[1] uir ss_valtouchMut[2] uir ss_ualtouchMut[2] u	nt16_t nt16_t nt16_t :h/noise :Mir	1904 198 241 272 e value)	0x200046d2 0x200046d4 0x200046d6 0x200046d8 0x200046d8	x T SNR			
2	Actual Result Issues Status Details Test Data Expected Result	S48 S18 S10 S2 Calc Calc Calc Calc SNR RA Selt S45	00- sz_valnoiseSelf(1) ui sz_valtouchMut(0) ui sz_valtouchMut(1) uir sz_valtouchMut(2) u	nt16_t nt16_t nt16_t :h/noise : Mir 767	1994 198 241 272 e value) n NT I 75 8	0:2004642 0:2004664 0:2004666 0:2004668 0:2004668 Noise Ma 37 122	x T SNR 24 14,07			
	Actual Result Issues Status Details Test Data Expected Result	S48 S18 S10 S2 Calc Calc Calc Calc SNR RA Selt S45 S45 S45	00- ss_valnoiseSelf(1) ui ss_valhouchMut(0) uir ss_valhouchMut(1) uir ss_valhouchMut(2) uir ulate SNR (touc 1 freq Max NT 5 but 0 7762 3 7687	nt16_t nt16_t nt16_t :h/noise :h/noise 767 760	1994 198 241 272 272 e value) 10 NT 1 55 8 8 33 8	0:2004642 0:2004664 0:2004666 0:2004668 0:2004668 Noise Ma 37 122 34 190	x T SNR 24 14,07 14 22,67			
2	Actual Result Issues Status Details Test Data Expected Result Actual Result	S48 S18 S10 S2 Calc - - SNR RA S45 S48 S48 S48 S48 S48 S48 S48 S48 S48 S48	ee-ss_valnoiseSelf(1) ui ss_valtouchMut(0) uir ss_valtouchMut(1) uir ss_valtouchMut(2) uir ulate SNR (touc 1 freq Max NT but 0 7762 3 7687 tual	nt16_t nt16_t ht16_t ht16_t Mir 767 760	1994 198 241 272 e value) 1 NT 1 275 8 03 8	0:2004642 D:2004664 0:2004666 D:2004668 D:2004668 D:2004668 D:2004668 D:2004668 D:2004668 D:2004668 D:2004668 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004664 D:2004666 D:2004664 D:2004666 D:200466 D:2	x T SNR 24 14,07 04 22,67			
2	Actual Result Issues Status Details Test Data Expected Result Actual Result	548 518 510 52 - - - - - - - - - - - - - - - - - -	ee- sz_valnoiseSelf(1) ui sz_valtouchMut(0) uir sz_valtouchMut(1) uir sz_valtouchMut(2) uir ulate SNR (touc 1 freq Max NT 5 but 0 7762 8 7687 tual	nti6,t nti6,t nti6,t : : : : : : : : : : : : : : : : : : :	1994 198 241 272 e value) 55 8 33 8	0:2004642 D:2004664 0:2004668 D:2004668 D:2004668 Noise Ma 37 122 34 190	x T SNR 24 14,07 24 22,67			
2	Actual Result Issues Status Details Test Data Expected Result Actual Result	548 518 510 52 - Calc - Calc - SNR RA Sel: 548 S48 S48 S48 S48 S48 S48 S48 S48 S48 S	00- sz_valnoiseSelf[1] ui 2 sz_valtouchMut[0] uir 2 sz_valtouchMut[1] uir 2 sz_valtouchMut[2] uir 3 ulate SNR (touc ulate SNR (touc 1 freq Max NT 9 7762 3 3 ulate 7687 1342	nti6_t nti6_t nti6_t 	1994 198 241 272 e value) 75 8 33 8 93 8	0x20004642 0x20004664 0x20004666 0x20004668 0x2004668 0x2004668 0x2004668 0x2004688	x T SNR 24 14,07 24 22,67 33 4,50			





		S2	2436	2387	49	272	5,55		
	Issues	-	26				2		
4	Status	PASS							
	Details	Check mea	asurement t	time					
	Test Data	576							
	Expected Result	Measurement time							
	Actual Result								
	Issues Status	Telk Stop 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2	nent time (r	200.us 200.us 200.us 200.us 200.us 200.us	0.00000 s 0.00000 s 0.000000 s 0.0000000000		Noise Filter Off 1.97597/Htb]00 Noise Filter Off ● -483,US ● -427,US ■	2449;22 160mW ⇒0.000 V ⇒0.000 V ⇒0.000 V ⇒0.000 V ⇒0.000 V ⇒0.000 V ⇒0.000 V ⇒0.000 V ⇒0.000 V	
	Details	Check mer	mory usage						
	Test Data	-	y usaye	2					
	Evnected Result	Memory	sade						
-	εχρέςτεα κέςμιτ	Memory us	sage	Wires light D to Dray	af Seath		-1.00	** 28 G 4 = 0	
5	Actual Result	See Program Constant: Heisisker Date Data Sind- Constant		do taxed	2014 bytest 3 bytest 60 bytest 2015 bytest 10 bytest 14 bytest 15 bytes	ery Pargien Usage "Device Memory (R Sci 4000000 Sci 400000 Sci 40000 Sci 400000 Sci 40000 Sci 400000 Sci 400000 Sci 400000 Sci 40000 Sci 400000 Sci 40000 Sci 400000 Sci 40000 Sci 40000000 Sci 4000000000 Sci 40000	994 2000 A 1993 7 April 10 1779 1993 5 April 10	(42%)	
	lssues	-							
		1623							





Key	SP00014- T6	Status	PASS	Name	RA tests in former CTSU configuration (0.128ms for self scan time, 0.256ms for mutual scan time, with leds)							
Objective	To find measurement time, maximum measured signal, SNR and Memory usage using a reference											
	finger for T4 RA											
Precondition	Config: 2	self buttons, 3 n	nutual b	uttons (1 TX, 3 RX)							
Coverage (issues)	SP00014-1	2014-10										
Coverage (confluence pages)												
Coverage (web links)												
Actual end date	2021-12- 27, 11:45	Estimated Time	00:00	Actual time	00:00							
Assigned to	Nira Tubert	Environment	e2 studio	Туре	Manual execution							
Executed by	Nira Tubert											
Issues	-											

i I Result	Check max, min, and noi ss_valmaxSelf, ss_valmin ss_valmaxMut, ss_valmin Max, min and noise value	se values wi Self, ss_valno Mut, ss_valn	thout touching oiseSelf 10iseMut	3							
ı I Result	ss_valmaxSelf, ss_valmins ss_valmaxMut, ss_valmin Max, min and noise value	Self, ss_valno Mut, ss_valn	oiseSelf 10iseMut								
l Result	ss_valmaxMut, ss_valmin Max, min and noise value	Mut, ss_valn	noiseMut								
l Result	Max, min and noise value	wiut, ss_vair	IOISEIVIUL								
Result	Max, min and noise value	Max, min and noise values									
		25	150.050	INCOMENT.							
	Expression	Туре	Value	Address							
	V 🎲 ss_valSelf	uint16_t [2]	0x2000475c	0x2000475c							
	(×)= ss_valSelf[0]	uint16_t	7681	0x2000475c							
	(x)= ss_valSelf[1]	uint16_t	7751	0x2000475e							
	✓ iss_valmaxSelf	uint16_t [2]	0x2000479c	0x2000479c							
	(x)= ss_valmaxSelf[0]	uint16_t	7778	0x2000479c							
	(x)= ss_valmaxSelf[1]	uint16_t	7823	0x2000479e							
	v 🎲 ss_valminSelf	uint16_t [2]	0x20004778	0x20004778							
	(x)= ss_valminSelf[0]	uint16_t	7573	0x20004778							
	(x)= ss_valminSelf[1]	uint16_t	7583	0x2000477a							
	✓ ⅔ ss_valnoiseSelf	uint16_t [2]	0x2000476c	0x2000476c							
	(x)= ss_valnoiseSelf[0]	uint16_t	205	0x2000476c							
	(x)= ss_valnoiseSelf[1]	uint16_t	240	0x2000476e							
	ss_valtouchSelf	uint16_t[2]	0x20004798	0x20004798							
	(x)= ss_valtouchSelf[0]	uint10_t	100	0x20004798							
	(x)= ss_valtouchSelf[1]	uint10_t	76 0x20004789	0x20004798							
	SS_Valiviut	uint16 +	1292	0x20004788							
esult	(x)= ss_vall/ut[0]	uint16 t	1262	0x20004785							
	(A) St valMat(2)	uint16 +	2178	0x2000478-							
	w s valmavMut	uint16 + [2]	0x200047a0	0x200047a0							
	(x): ss valmaxMut[0]	uint16 t	1402	0x200047a0							
	(x)= ss_valmaxMut[1]	uint16 t	1431	0x200047a2							
	60 ss valmavMut[2]	uint16 t	2257	0x200047a4							
	ss valminMut	uint16 t [3]	0x20004760	0x20004760							
	(x)= ss valminMutf01	uint16 t	1220	0x20004760							
	(x)= ss valminMut[1]	uint16 t	1300	0x20004762							
	(x)= ss_valminMut[2]	uint16_t	2091	0x20004764							
	✓	uint16_t [3]	0x20004790	0x20004790							
	(x)= ss_valnoiseMut[0]	uint16_t	182	0x20004790							
	(x)= ss_valnoiseMut[1]	uint16_t	131	0x20004792							
	(x)= ss_valnoiseMut[2]	uint16_t	166	0x20004794							
	✓ 4 ss_valtouchMut	uint16_t [3]	0x20004770	0x20004770							
	(x)= ss_valtouchMut[0]	uint16_t	166	0x20004770							
	(x)= ss_valtouchMut[1]	uint16_t	52	0x20004772							
	(x)= ss_valtouchMut[2]	uint16_t	86	0x20004774							
	1.00										
	PASS										
	Check touch value (may	reference di	ifference while	touching)							
	check touch value (max-	include di	incrence while	(ouching)							
1	ss_valtouchSelt, ss_valtou	ICNMUT									
Result	Maximum measured sigr	nal									
esult											
	esult A Result esult	esult	 	 							





	S10										
	60- ss_valb	ouchMut[1] uint1	5_t 237	0x200047	72						
	S2 60: ss_valt	ouchMut[2] uint1	5_t 301	0x200047	74						
Issues	1201										
Status	PASS	PASS									
Details	Calculate S	Calculate SNR (touch/noise value)									
Test Data	1213										
Expected Result	SNR	SNR									
	RA 1 freq	Max NT	Min NT	Noise	Max T	SNR					
	Self but										
	S49	7778	7573	205	1356	6,61					
	S48	7823	7583	240	1883	7,85					
Actual Result	Mutual but										
	S18	1402	1220	182	227	1,25					
	S10	1431	1300	131	237	1,81					
	S2	2257	2091	166	301	1,81					
Iccuec	-	1	10								

Key	SP00014- T4	Status	PASS	Name	RA tests in former CTSU configuration (0.576ms for self scan time, 1.152ms for mutual scan time, with leds)						
Objective	To find me finger for	asurement time T4 RA	e, maxin	num mea	asured signal, SNR and Memory usage using a reference						
Precondition	Config: 2 s	elf buttons, 3 n	nutual b	uttons (1 TX, 3 RX)						
Coverage (issues)	SP00014-1	0014-10									
Coverage (confluence pages)											
Coverage (web links)											
Actual end date	2021-12- 27, 11:45	Estimated Time	00:00	Actual time	00:00						
Assigned to	Nira Tubert	Environment	e2 studio	Туре	Manual execution						
Executed by	Nira Tubert										
Issues	-										

		Tes	t Script							
	Status	PASS								
	Details	Check max, min, and noise values without touching								
	Test Data	oiseSelf noiseMut								
	Expected Result									
Ī	Actual Result									
		Expression	Type uint16 t [2]	Value 0x2000475c	Address 0x2000475c					
l		(x)= ss valSelf[0]	uint16 t	34583	0x2000475c					
l		(x)= ss_valSelf[1]	uint16 t	34400	0x2000475e					
L		✓ A ss_valmaxSelf	uint16_t [2]	0x2000479c	0x2000479c					
L		(x)= ss_valmaxSelf[0]	uint16_t	34746	0x2000479c					
L		(x)= ss_valmaxSelf[1]	uint16_t	34669	0x2000479e					
L		✓ 🍰 ss_valminSelf	uint16_t [2]	0x20004778	0x20004778					
L		(x)= ss_valminSelf[0]	uint16_t	34409	0x20004778					
L		(x)= ss_valminSelf[1]	uint16_t	34364	0x2000477a					
L		🗸 🍪 ss_valnoiseSelf	uint16_t [2]	0x2000476c	0x2000476c					
L		(x)= ss_valnoiseSelf[0]	uint16_t	337	0x2000476c					
L		(x)= ss_valnoiseSelf[1]	uint16_t	305	0x2000476e					
l		✓ 🍰 ss_valtouchSelf	uint16_t [2]	0x20004798	0x20004798					
l		(x)= ss_valtouchSelf[0]	uint16_t	169	0x20004798					
		(x)= ss_valtouchSelf[1]	uint16_t	155	0x2000479a					
L		✓ A ss_valMut	uint16_t [3]	0x20004788	0x20004788					
l		(x)= ss_valMut[0]	uint16_t	6028	0x20004788					
L		(x)= ss_valMut[1]	uint16_t	6097	0x2000478a					
I		(v)= ss_valMut[2]	uint16_t	9726	0x2000478c					
		A								

v @ ss_valmaxMut uint16_t [3]
(v)= ss_valmaxMut[0] uint16_t
(v)= ss_valmaxMut[1] uint16_t

 (0)= ss_valmaxMut[1]
 uint16_t

 (v)= ss_valmaxMut[2]
 uint16_t

 (v)= ss_valminMut
 uint16_t[3]

 (0)= ss_valminMut[0]
 uint16_t

 (v)= ss_valminMut[1]
 uint16_t

 (v)= ss_valminMut[2]
 uint16_t

6228

9976

9653

0x200047a0 ... 6166

0x20004760 ... 5903 5987

0x200047a0 0x200047a0

0x200047a2

0x200047a4

0x20004760 0x20004760 0x20004762

0x20004764





	1	✓ SS_V8	InoiseMut	uint16_t [3] 0x20004	4790 0x	20004790						
		(x)= ss	_valnoiseMut[0] uint16_t	263	Ox	20004790						
		(×)= ss	_valnoiseMut[1] uint16_t	241	Ox	20004792						
		(×)= ss	_valnoiseMut[2] uint16_t	323	Ox	20004794						
		V 🚓 ss_va	altouchMut	uint16_t [3] 0x20004	4770 0x	20004770						
		(×)= 55	_valtouchMut[0] uint16_t	103	Ox	20004770						
		(×)= \$5	_valtouchMut[1] uint16_t	102	0x	20004772						
		(×)= 55	_valtouchMut[2] uint16_t	9/	0x	20004774						
L	Issues		-										
	Status	PASS	PASS										
	Details	Check touc	Check touch value (max-reference difference while touching)										
	Test Data	ss_valtouch	ss_valtouchSelf, ss_valtouchMut										
	Expected Result	Maximum	Maximum measured signal										
	- head	S49:	S49:										
	Main as validouchSelff01 uint16 t 4655 0x20004738												
		\$49.	1.00	11	3								
		64= ss veltouchSelf[1] unt16 t 8778 0x2000479a											
2		(x)= ss_valte	ouchSelf[1]_uint16_t	8778	0x20004798								
	Actual Result	S18:											
		(K)= ss_valto	ouchMut[0] uint16_t	942	0x20004770								
		S10:											
		04- ss_valtouchMut[1] uint16_t 898 0x20004772											
		S2:											
		04: ss valtour/hMut[2] uint16 t 1153 0r/20004774											
		warss_varioucranut(z) uintito_t 1135 UK200047/4											
	Issues	-											
	Status	PASS											
	Details	Calculate S	NR (touch/n	oise value)								
	Test Data	(=))											
	Expected Result	SNR											
		RA 1 freq	Max NT	Min NT	Noise	Max T	SNR						
		Self but						1					
		\$49	34746	34409	337	4655	13.81	-					
3		\$18	34669	34364	305	8778	28.78	-					
	A start Downly	348	34009	34304	303	0//0	20,70	-					
	Actual Result	Mutual											
		but											
		S18	6166	5903	263	942	3,58						
		S10	6228	5987	241	898	3,73						
		S2	9976	9653	323	1153	3,57	1					
	Issues	123	Entropy Lowerskiel Distribution of Destroyal Statistics of the Statistics of th										

Key	SP00014- T2	Status	PASS	Name	RA tests in former CTSU configuration (0.576ms for self scan time, 1.152ms for mutual scan time, without leds)					
Objective	To find me finger for	easurement tim T4 RA	e, maxir	num me	asured signal, SNR and Memory usage using a reference					
Precondition	Config: 2 s	elf buttons, 3 n	nutual b	outtons (1 TX, 3 RX)					
Coverage (issues)	SP00014-	200014-10								
Coverage (confluence pages)										
Coverage (web links)										
Actual end date	2021-12- 27, 11:45	Estimated Time	00:00	Actual time	00:00					
Assigned to	Nira Tubert	Environment	e2 studio	Туре	Manual execution					
Executed by	Nira Tubert									
Issues	(*)									

	Tes	t Script						
Status	PASS							
Details	Check max, min, and no	Check max, min, and noise values without touching						
Test Data	ss_valmaxSelf, ss_valminSelf, ss_valnoiseSelf ss_valmaxMut, ss_valminMut, ss_valnoiseMut							
Expected Result	Max, min and noise values							
	Expression	Type uint16_t [2]	Value 0x20004640	Address 0x20004640				
Status Details Test Data Expected Result	(x)= ss_valSelf[0]	uint16_t	34493	0x20004640				
	(x)= ss_valSelf[1]	uint16_t	34433	0x20004642				
	🗸 🎲 ss_valmaxSelf	uint16_t [2]	0x2000467a	0x2000467a				
	(x)= ss_valmaxSelf[0]	uint16_t	34583	0x2000467a				
	(x)= ss_valmaxSelf[1]	uint16_t	34563	0x2000467c				





	✓ A ss_valminSelf	uint16_t [2]	0x2000465a	0x2000465a				
	(x)= ss_valminSelf[0]	uint16_t	34366	0x2000465a				
	(x)= ss_valminSelf[1]	uint16_t	34360	0x2000465c				
	✓ 🍰 ss_valnoiseSelf	uint16_t [2]	0x20004650	0x20004650				
	(x)= ss_valnoiseSelf[0]	uint16_t	217	0x20004650				
	(x)= ss_valnoiseSelf[1]	uint16_t	203	0x20004652				
	✓ 🍰 ss_valtouchSelf	uint16_t [2]	0x20004676	0x20004676				
	(x)= ss_valtouchSelf[0]	uint16_t	97	0x20004676				
	(x)= ss_valtouchSelf[1]	uint16_t	89	0x20004678				
	✓ 🍰 ss_valMut	uint16_t [3]	0x20004668	0x20004668				
Actual Result	(v)= ss_valMut[0]	uint16_t	6171	0x20004668				
Actual Result	(x)= ss_valMut[1]	uint16_t	6237	0x2000466a				
	(x)= ss_valMut[2]	uint16_t	9994	0x2000466c				
	✓ Iss_valmaxMut	uint16_t [3]	0x2000467e	0x2000467e				
	(x)= ss_valmaxMut[0]	uint16_t	6186	0x2000467e				
	(x)= ss_valmaxMut[1]	uint16_t	6271	0x20004680				
	(x)= ss_valmaxMut[2]	uint16_t	10017	0x20004682				
	🗸 鐌 ss_valminMut	uint16_t [3]	0x20004644	0x20004644				
	(x)= ss_valminMut[0] uint16_t 6124 0x20004644							
	(x)= ss_valminMut[1]	uint16_t	6213	0x20004646				
	(x)= ss_valminMut[2]	uint16_t	9949	0x20004648				
	✓ Iss_valnoiseMut	uint16_t [3]	0x20004670	0x20004670				
	(x)= ss_valnoiseMut[0]	uint16_t	62	0x20004670				
	(x)= ss_valnoiseMut[1]	uint16_t	58	0x20004672				
	(x)= ss_valnoiseMut[2]	uint16_t	68	0x20004674				
	✓ Iss_valtouchMut	uint16_t [3]	0x20004654	0x20004654				
	(x)= ss_valtouchMut[0]	uint16_t	32	0x20004654				
	(x)= ss_valtouchMut[1]	uint16_t	33	0x20004656				
	(x)= ss_valtouchMut[2]	uint16_t	38	0x20004658				
lssues								
Status	PASS							
Details	Check touch value (max-	reference c	lifference while	touching)				
Test Data	ss valtouchSelf ss valtou	ichMut						
	ss_valtouchisen, ss_valtou							
Expected Result	Maximum measured sign	าลเ						
Actual Result	S49							
	(K)= ss_valtouchSelf[0] uint16_t	5715	0x20004676					
	240							
	040.	73.65	0x 2000/678					
	00= ss_valtouchSelf[1] uint16_t 7365 0x20004678							
	S18							
	eg= ss_valtouchMut[0] uint16_t	972	0x20004654					
	the measured and an are an an an and an							
	S10							
	510							
	S10 (A)- ss_valtouchMut[1] uint16_t	925	0x20004656					
	S10 (k)- ss_valtouchMut[1] uint16_t S2	925	0x20004656					
	Actual Result Issues Status Details Test Data Expected Result Actual Result	Actual Result 	Actual Result 	Actual Result 				

	Issues -										
	Status	PASS									
	Details	Calculate S	NR (touch	/noise valu	e)						
Test Data -											
	Expected Result	SNR									
		RA 1 freq	Max NT	Min NT	Noise	Max T	SNR				
		Self but									
	Actual Result	S49	34583	34366	217	5715	26,34				
3		S48	34563	34360	203	7365	36,28				
		Mutual but									
		S18	6186	6124	62	972	15,68				
		S10	6271	6213	58	925	15,95				
		S2	10017	9949	68	1091	16,04				
	Issues	453									
4	Status	PASS									
	Details	Check measurement time									
	Test Data										
	Expected Result	Measurem	ent time								
	Actual Result	1ek Stop					Noise Filter Off				





	1 2.00 V Telk Stop	1.00ms 2.68000ms 1 / 1.44 V	375.718 Hz 08:42:51 Noise Filter Off					
			8 -1.36ms 3.36 V					
			a1.31ms a3.20 V					
	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -							
	(1) 2.00 ∀	1.00ms 2.68000ms 1 / 1.44 V	374.150 Hz 08:43:02					
	Tels Stop	Tels Stop						
			0. 274 v 200 V					
			2.74,05 5.26 V 6 3.90ms 3.36 V 3.89ms 480.0mV					
		der er kranste kranste kranste						
	1 Anno Paris an Anno Anno Anno Anno Anno Anno Anno A	dendendend <mark>e</mark> nd	an a r fran a fran a s					
			e e e e dista e e en en					
	(1) 2.00 V Tiek Stop	1.00ms 2.68000ms 1 71.44 V	375.678 Hz 08:43:15 Noise Filter Off					
			8 -1 44mc 160mV					
			 B 3.90ms B 3.36 V △5.33ms △3.20 V 					
	1	darahan bard <mark>e</mark> rad						
	2.00 V	1.00ms 2.68000ms 1 / 1.44 V	375.762 Hz]08:44:00					
	Measurement time (ms	5)						
	Self	1,31						
	TI contractor to the	1. Constant	1					
	Mutual	3,89						
	Global	5,20						
	Giobai	5,55						
sues								
atus	PASS							
etails	Check memory usage	Check memory usage						
est Data								
xpected Result	Memory usage	Memory usage						
	Star Star Property Prop	E Pasters E Concle & Searthour D'Searthour M Searthour & Dolog of Searth B Sea Theory Taylor Day (Searthour Decoupling)						
Actual Result	Constant Data	0 (yeta) E0 (yeta) 2300 (yeta) 2300 (yeta)	20112/02271 byteo((27, N%)					
	2004 - 2005 - 20	04 Kyteli 1354 Kyteli 136 Kyteli 136 Kyteli						
		0.2108000	3852/1838 by6e()(22,17%)					
sues	5733							



telecos BCN

EMC test execution results:

Te	st Cycle									
Key SP0001		I4-C3 Name		EMO	EMC tests					
Description Apply 8		MC test and verify immunity levels accord		cording I	ding IEC standards					
Planned start date 2021-1		2-27, 00:00	Planned end date	202	2-01-09, 00:00	Iteration -				
St	atus	DONE	1	Version	-					
	at Executions									
le	st Executions									
Key		SP00014-T14	Status	PASS	Name	Burst Test				
Objective		Check that no fake touches are detected during the Burst test				t				
Precondition		Burst Test at 4kV @ 100 kHz.								
Coverage (issues)			•							
Coverage (confluence pages)			•							
Coverage (web links)		•								
Actual end date		2022-01-19, 10:53 Estimated Time 00:00 Actual time 00:00								
Assigned to		Narcis Oriol	Environment	-	Type	Manual execution				
Everyted by		Nira Tubert		1.000	manual excession					
Executed by										
15	sues			•						
L				Test Script						
Γ	Status		PASS							
			heck that no fake detetections are encountered during the Burst test with the one							
	Details		frequency + parallel RA configuration							
			Burst test configuration:							
		- I ⁻	enar versteringunderen.							
1 Test Data			• 4kV							
			 100 kHz 							
			30s step							
1 lest Data	rest bata	P	Project configuration:							
			 mutual threshold 60% 							
			on freq 15							
			touch enable freq 65/15							
			wouch enable freq bay to							
	Expected Result No		No fake detections encountered							
	Actual Result No 1		No fake detections encountered							
L	Issues	isues -								
	Status		PASS							
	Details		Check that no fake detetections are encountered during the Burst test with the one							
			frequency + parallel RA configuration							
			Burst test configuration:							
			- 4147							
			• 4kV							
			• 100 kHz							
2 Test Data			60s step							
		F	Project configuration:							
			 mutual threshold 60% 							
	Expected Result		on freq 15							
			 touch enable freg 65/15 							
			No fake detections encountered							
	Actual Result	-	No fake detections encountered							
	Accuar Nesarc		to take detections	encountered						
H	Chature									
	Status	ļ	heck that no false	detetections are one	ounter	during the Pro	et tect with the ere			
	Details		check that no take detections are encountered during the Burst test with the one frequency + parallel PA configuration							
			Rust test configuration							
	Test Data P		Burst test configuration:							
			• 4kV							
			 100 kHz 							
			60s step							
3			Project configuration:							
			reject contrigutation.							
			 mutual threshold 60% 							
			on_freq 1							
			touch enable freq 65/15							
	Expected Result N		No fake detections encountered							
	Actual Result D		Detections encountered							
	Issues .									
	Status		FAIL							
17										




	Details	Check that no fake detetections are encountered during the Burst test with the one	
		frequency + parallel RA configuration	
	Test Data	Burst test configuration: 4kV 100 kHz 60s step Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/15	
	Expected Result	No fake detections encountered	
	Actual Result	Detections encountered	
Ц	Issues		
	Status	FAIL	
	Details Check that no fake detections are encountered during the Burst test with Multifrequency + parallel RA configuration		
5	Test Data Expected Result	Wirst test configuration: 4kV 100 kHz 60s step Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 No fake detections encountered	
	Actual Result	Detections encountered	
	Issues	•	
	Status	PASS	
	Details	Check that no fake detetections are encountered during the Burst test with the Multifrequency + parallel RA configuration	
6	Test Data	Burst test configuration: • 4kV • 100 kHz • 60s step Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5	
	Expected Result	No fake detections encountered	
	Actual Result	No fake detections encountered	
	Issues	•	
_			

Key	SP00014-T15	Status	PASS	Name	Injected Test
Objective	Check that no Fake detections are encountered during the Injected test				
Precondition	•				
Coverage (issues)	rage (issues) - rage (confluence pages) -				
Coverage (confluence pages)					
Coverage (web links)	•				
Actual end date	2022-01-21, 11:45	Estimated Time	00:00	Actual time	00:00
Assigned to	Narcis Oriol	Environment	-	Туре	Manual execution
Executed by	Nira Tubert				
Issues	•				

	Test Script			
1	Status	FAIL		
	Details	Check that no fake detetections are encountered during the Injected test with the one frequency + parallel RA configuration		
	Test Data	Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 60% • on_freq 15 • touch enable freq 65/15		





		drift_freq 150
	Expected Result	No fake detections encountered
	Actual Result	Detections encountered
	Issues	-
	Status	FAIL
1		Check that no fake detetections are encountered during the Injected test with the
	Details	Multifrequency + parallel RA configuration
		Injected test configuration:
		• 10V
	Test Data	 1MHz - 10MHz
		Project configuration:
2		 mutual threshold 60%
		on freq 5
		 touch enable freq 65/5
		 drift_freq 150
	Expected Result	No fake detections encountered
	Actual Result	Detections encountered
	Issues	
	Status	FAIL
1	Details	Check that no fake detetections are encountered during the Injected test with the
1	Decalis	Multifrequency + parallel RA configuration
1		Injected test configuration:
1		• 10V
		 1MHz - 10MHz
,	Test Data	Project configuration:
ľ	lest Data	 mutual threshold 60%
		on_freq 5
		 touch enable freq 65/5
		 drift_freq 60
	Expected Result	No fake detections encountered
	Actual Result	Detections encountered
⊢	Issues	-
Г		
	Status	FALL
	Details	Check that no fake detetections are encountered during the Injected test with the Writing upon a particular of configuration
	Details	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration
	Details	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration:
	Details	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz
	Details	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration:
4	Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration:
4	Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • or free 5
4	Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable free 65/5
4	Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 10V 10W 10Hz - 10MHz Project configuration: mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 150
4	Test Data Expected Result	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered
4	Test Data Expected Result Actual Result	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered
4	Test Data Expected Result Actual Result Issues	Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered -
4	Test Data Expected Result Actual Result Issues Status	Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered -
4	Test Data Expected Result Actual Result Issues Status Details	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - ML Check that no fake detetections are encountered during the Injected test with the
4	Test Data Expected Result Actual Result Issues Status Details	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration
4	Test Data Expected Result Actual Result Issues Status Details	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration:
4	Test Data Test Data Expected Result Actual Result Issues Status Details	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V
4	Test Data Test Data Expected Result Actual Result Issues Status Details	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10W • 1MHz - 10MHz
4	Test Data Expected Result Actual Result Issues Status Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration:
4	Test Data Expected Result Actual Result Issues Status Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - FALE Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 80%
4	Test Data Expected Result Actual Result Issues Status Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5
4	Test Data Expected Result Actual Result Issues Status Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • touch enable freq 65/5
4	Details Test Data Expected Result Actual Result Issues Status Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - FALE Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 30
4	Test Data Expected Result Actual Result Issues Status Details Test Data Expected Result	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - FALL Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 30 No fake detections encountered
4	Test Data Expected Result Actual Result Issues Status Details Test Data Expected Result Actual Result	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 10V 1MHz - 10MHz Project configuration: mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered Detections encountered - MU Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 10V 1MHz - 10MHz Project configuration: mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 30 No fake detections encountered Detections encountered
5	Test Data Expected Result Actual Result Issues Status Details Test Data Expected Result Contemporate Expected Result Contemporate Co	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - FALL Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 10Hz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 30 No fake detections encountered
5	Status Details Test Data Expected Result Actual Result Issues Status Details Test Data Expected Result Actual Result Issues Status Expected Result Actual Result Issues Status Status	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - FALE Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 30 No fake detections encountered - FALE Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 30 No fake detections encountered - FALE Check that ne fake detetections encountered
5	Status Details Test Data Expected Result Actual Result Issues Status Details Test Data Expected Result Actual Result Issues Status Details Expected Result Actual Result Issues Status Details	Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered Detections encountered - FAL Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 10V • 1MHz - 10MHz Project configuration: • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 30 No fake detections encountered - FAL Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration • mutual threshold 80% • on_freq 5 • touch enable freq 65/5 • drift_freq 30 No fake detections encountered - FAL Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration
5	Status Details Test Data Expected Result Actual Result Issues Status Details Test Data Expected Result Actual Result Issues Status Details Expected Result Issues Status Details Test Data	Check that no fake deteetctions are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 10V 1MHz - 10MHz Project configuration: mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered Detections encountered - FXE Check that no fake deteetctions are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 30 No fake detections encountered Project configuration: mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 30 No fake detections encountered Detections encountered - FXE Check that no fake detectctions are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 30 No fake detections encountered Detections encountered - FXE Check that no fake detectctions are encountered during the Injected test with the Multifrequency + parallel RA configuration Linected test configuration: Linected test configur
5	Status Details Details Expected Result Actual Result Issues Status Details Expected Result Expected Result Status Details Expected Result Issues Status Details Test Data Details Test Data	Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 10V 11MHz - 10MHz Project configuration: mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered Detections encountered Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 10V 11MHz - 10MHz Project configuration: mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 30 No fake detections encountered Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: Mutual threshold 80% on_freq 5 touch enable freq 65/5 drift_freq 30 No fake detections encountered Detections encountered Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: Mutual threshold 80% Mutual threshold 80% M





		 1MHz - 10MHz
		Project configuration:
		 mutual threshold 80%
		on_freq 15
		 touch enable freq 65/5
		 drift_freq 30
	Expected Result	No fake detections encountered
	Actual Result	Detections encountered
	Issues	-
	Status	FAIL
		Check that no fake detetections are encountered during the Injected test with the
	Details	one frequency + parallel PA configuration
		Injected test configuration:
		• 6V
		- 1MUz - 5MUz
		Project configuration:
7	Test Data	Project conliguration.
		 mutual threshold 60%
		on_freq 5
		 touch enable freq 65/15
		 drift_freq 150
	Expected Result	No fake detections encountered
	Actual Result	Detections encountered
	Issues	-
	Status	FAIL
		Check that no fake detetections are encountered during the injected test with the
	Details	one frequency + parallel RA configuration
		Injected test configuration
		- 6/
		- OV
		INITZ - DMITZ Design configuration:
8	Test Data	Project conliguration.
[*		 mutual threshold 60%
		on_freq 15
		 touch enable freq 65/15
		 drift_freq 150
	Expected Result	No fake detections encountered
	Actual Result	Detections encountered
	Issues	•
	Status	PASS
		Check that no fake detetections are encountered during the Injected test with the
	Details	
		Multifrequency + parallel RA configuration
1		Multifrequency + parallel RA configuration
		Multifrequency + parallel RA configuration Injected test configuration: 6V
		Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz
		Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration:
9	Test Data	Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration:
9	Test Data	Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration: • mutual threshold 60%
9	Test Data	Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration: • mutual threshold 60% • on_freq 5
9	Test Data	Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration: • mutual threshold 60% • on_freq 5 • touch enable freq 65/5
9	Test Data	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150
9	Test Data Expected Result	Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration: • mutual threshold 60% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered
9	Test Data Expected Result Actual Result	Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration: • mutual threshold 60% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered No fake detections encountered
9	Test Data Expected Result Actual Result Issues	Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration: • mutual threshold 60% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered No fake detections encountered -
9	Test Data Expected Result Actual Result Issues Status	Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration: • mutual threshold 60% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered No fake detections encountered -
9	Test Data Expected Result Actual Result Issues Status Datails	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered No fake detections encountered - #MSS Check that no fake detections are encountered during the Injected test with the
9	Test Data Expected Result Actual Result Issues Status Details	Multifrequency + parallel RA configuration Injected test configuration:
9	Test Data Expected Result Actual Result Issues Status Details	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: • mutual threshold 60% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered No fake detections encountered - FASS Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration:
9	Test Data Expected Result Actual Result Issues Status Details	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered No fake detections encountered Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 6V
9	Test Data Expected Result Actual Result Issues Status Details	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered No fake detections encountered - Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 10MHz
9	Test Data Expected Result Actual Result Issues Status Details	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered No fake detections encountered - Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 10MHz Project configuration:
9	Test Data Expected Result Actual Result Issues Status Details Test Data	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered No fake detections encountered Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 10MHz Project configuration: mutual threshold 60%
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9	Test Data Expected Result Actual Result Issues Status Details Test Data	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered No fake detections encountered fess Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 10MHz Project configuration: mutual threshold 60% on_freq 5 mutual threshold 60% on_freq 5 touch analyle for 65 (5
9	Test Data Expected Result Actual Result Issues Status Details Test Data	Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 5MHz Project configuration: • mutual threshold 60% • on_freq 5 • touch enable freq 65/5 • drift_freq 150 No fake detections encountered No fake detections encountered • FASS Check that no fake detetections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration: • 6V • 1MHz - 10MHz Project configuration: • mutual threshold 60% • on_freq 5 • touch enable freq 65/5 • drift free 150
9	Test Data Expected Result Actual Result Issues Status Details Test Data	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered No fake detections encountered Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration:
9	Test Data Expected Result Actual Result Issues Status Details Test Data Expected Result	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 5MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered No fake detections encountered Check that no fake detections are encountered during the Injected test with the Multifrequency + parallel RA configuration Injected test configuration:
9	Test Data Expected Result Actual Result Issues Status Details Test Data Expected Result Actual Result	Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - SMHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered No fake detections encountered - Multifrequency + parallel RA configuration Injected test configuration: 6V 1MHz - 10MHz Project configuration: mutual threshold 60% on_freq 5 touch enable freq 65/5 drift_freq 150 No fake detections encountered





<u>Glossary</u>

API	Application Programming Interface
CFC	Current to Frequency Converter
CSTU	Capacitive Touch Sensing Unit Driver
EMC	Electromagnetic compatibility
EUT	Equipment Under Test
FSP	Flexible Software Package
HMI	Human-Machine Interface
IDE	Integrated Development Environment
РСВ	Printed Circuit Board
QE	Quick and Effective Tool Solutions
RA2L1, RA2E	1
	RA: Renesas Advanced Family
	2: Renesas RA2 Series
	L: Ultra-Low power
	E: entry line
RX130	Renesas Xtreme 130 Product Group
SWD	Serial Wire Debug
SNR	Signal to Noise Ratio
TSn	Sensor pins for the CTSU (touch sensor)
Rx	Receiver TS
Тх	Transmitter TS