SAR Test exclusion documentation
according to FCC KDB 447498

Report identification number: 1-2660/21-02-03 Exclusion (FCC)

Certification numbers and labeling requirements	
FCC ID	QZ9-15WWLC

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

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EUT technologies:

Technologies:	Max. meas. cond. AVG Power*
NFC 13.56 MHz	15.95 dBm

)* according test report R-HF_190-22_01 provided by the manufacturer (Annex A)

SAR test exclusion according to KDB447498 (General RF Exposure Guidance)

Equations from Chapter 4.3.1: Standalone SAR test exclusion considerations page 11 and ff. and tables in Annex C

(c) (2) Standalone SAR test exclusion below 100 MHz < 50mm

$0.5 \times (Threshold_{100MHz}) \times (1+\log(100/f))$

where

$Threshold_{1-g;10-g}$	is 3 for 1-g; 7.5 for 10-g
f	is the RF channel transmit frequency
$Threshold_{100MHz,50mm}$	is $Threshold_{1-g;10-g} \times d / f^{0.5}$; with f = 100MHz and d=50mm

The table below gives the calculated maximal power that could be used for source based time averaged conducted power, adjusted for tune up tolerance. If this is below the calculated value SAR testing is excluded.

frequency [MHz]	Threshold1-g;10-g	Threshold$_{100MHz,50mm}$	Powerlimit [mW]	$P_{max-declared}$		Exclusion
				[dBm]	[mW]	
13.56	3	474.34	442.97	15.95	39.4	yes

Annex A: Test report R-HF_190-22_01:

15W Porsche Koppelbox					
Report no.:	R-HF_190-22/01				
Project no.:	Project name		Project Stage	Report version	No. of page
0901_047	15W Porsche Koppelbox		Certyfication	8	10

0901_047

15W Porsche Koppelbox

NFC Power analysis

Prepared by: Wilk Sławomir   Data: 07.07.2022

1. Introduction

a) Performance of NFC , NFC Output power, Duty cycle

2. Used Equipment

a) FSW27   - Signal & Spectrum Analyzer from R&S

b) RTO2044   - Real Time Osciloscope from Rohde&Schwarz
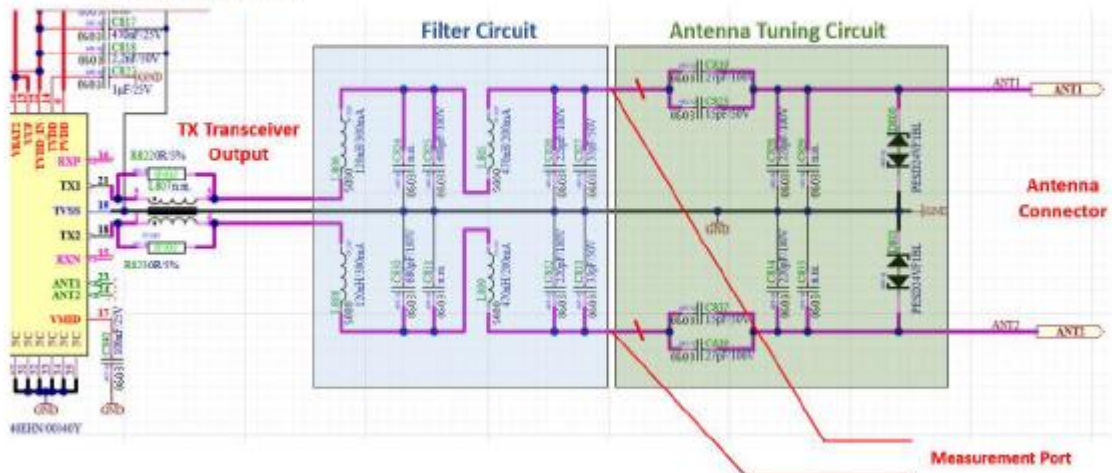
c) PCB Main: BL14810.P07 – from BURY

3. Performed Test

a) Output power without antenna

b) Output power with circuit matching to 50 Ohm
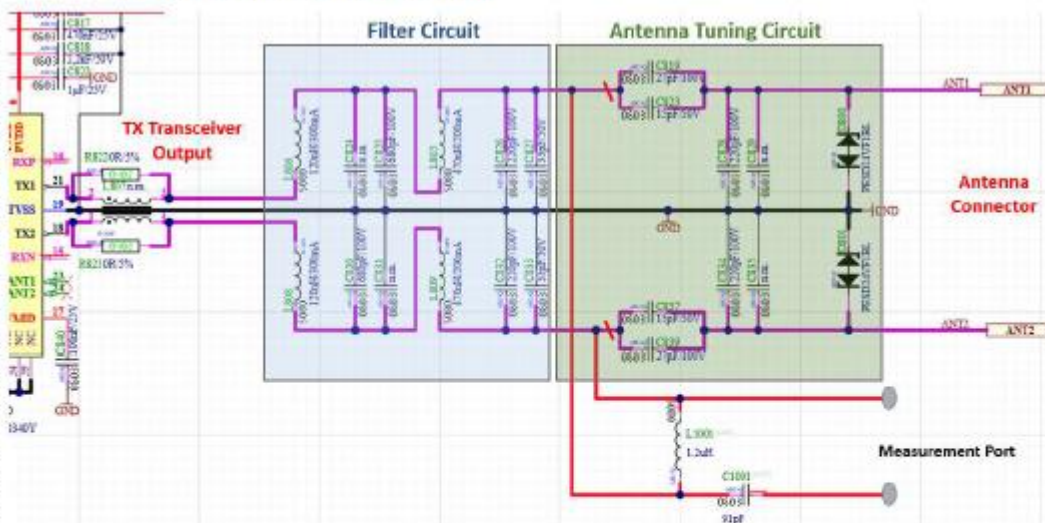
c) Duty cycle

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4. NFC circuit for:

a) Output power

For this case Antenna Tuning Circuit was removed and antenna was disconnected

b) Output power with matching

For this case Antenna Tuning Circuit was removed and antenna was disconnected, additional TX transceiver and Filter circuit was matched to 50 Ohm

c) **Duty cycle was measured by magnetics coupling on oscilloscope**
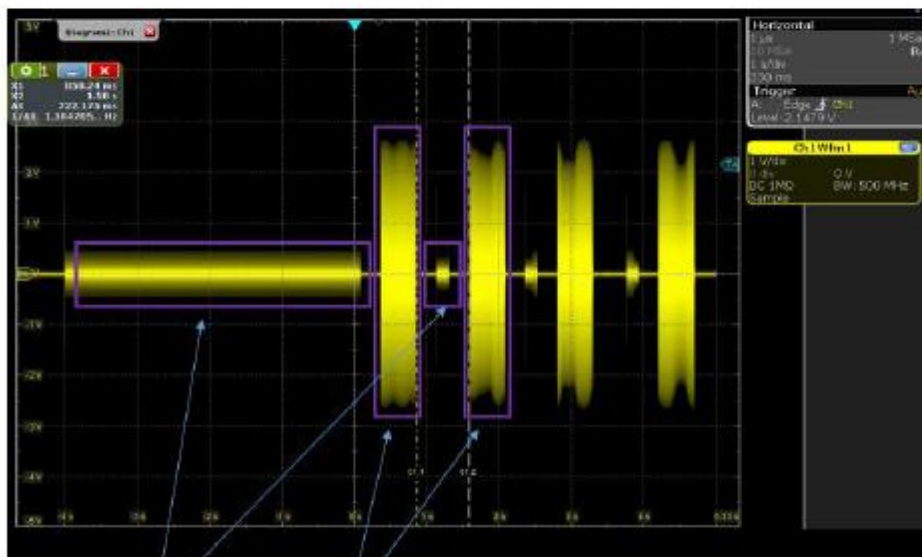
NFC technology works in two modes:

LPOD - Low Power Object Detector (Min Power)

NFC - Normal work

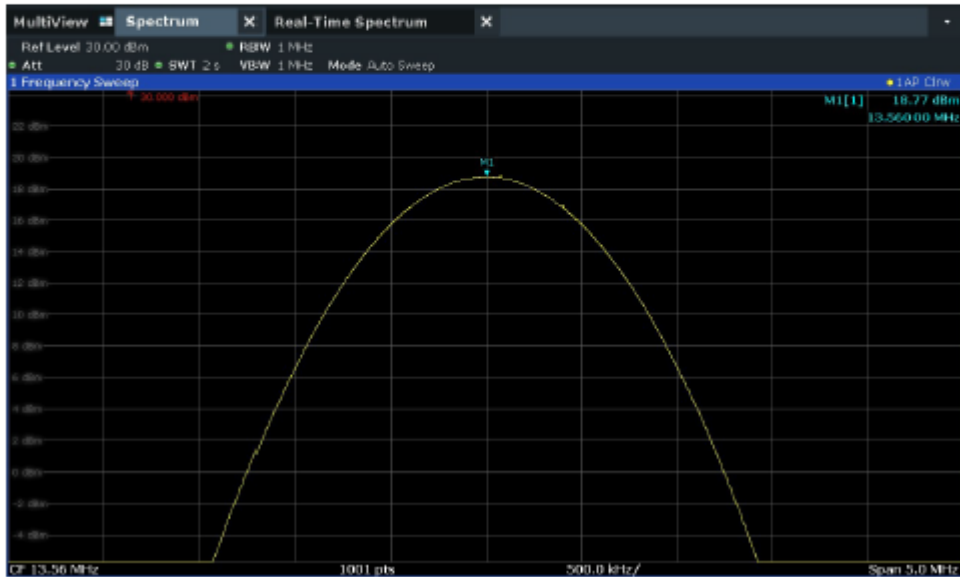   Ping   → Max Power

      Listener   → Tx Off

LPOD   NFC Ping

BURY
TECHNOLOGIES

5. NFC Measurement Result

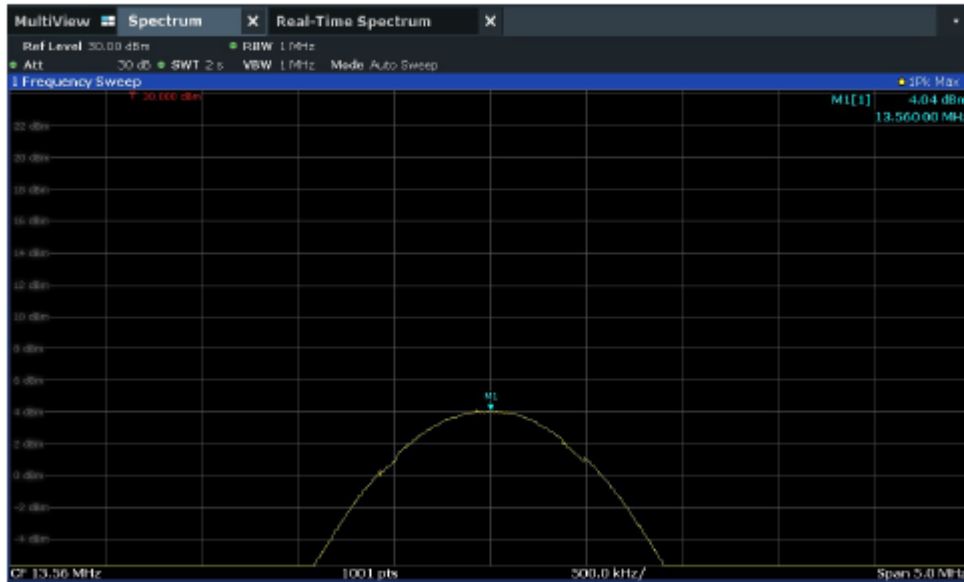### a) Result without matching

Result without matching circuit   = 18,77 dBm = 75.3mW
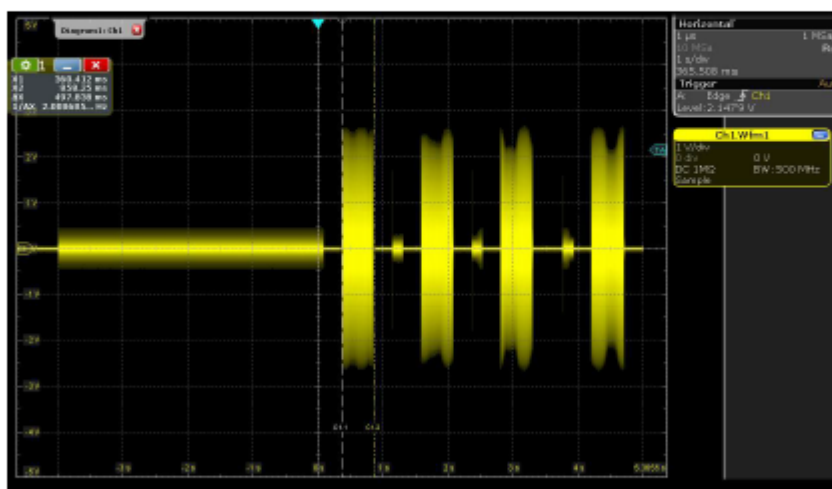
b) Result with matching

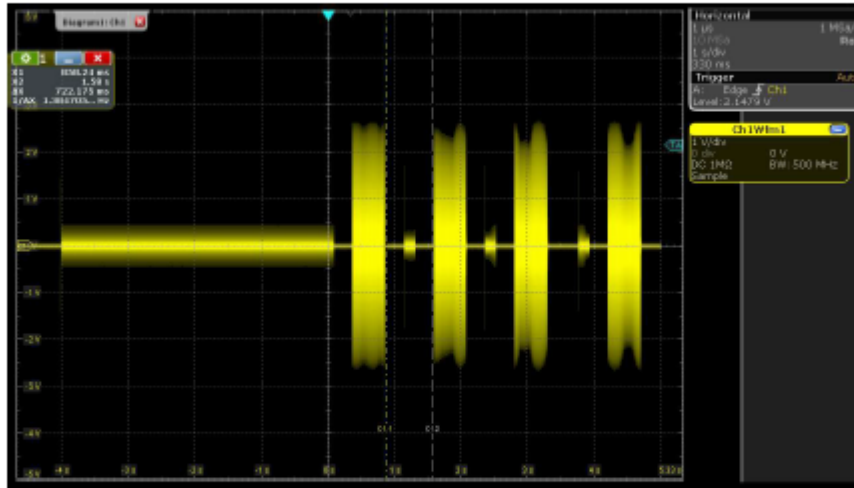**Result with matching circuit   = 19,66 dBm = 92,5mW**

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LPOD Power = 4,04 dBm → 2,535 mW

c) Duty Cycle

Duty Cycle has been defined for the maximum wake-up of the device by moving the object on the surface.

NFC Ping (Max Power) → 498ms

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LPOD $\rightarrow$ 722ms

For the sake of simplicity, we will assume two modes:
LPOD (all time except NCF Ping) and Pmax (NFC Ping)

Duty Cycle

P_{max} $\rightarrow$ 498ms $\rightarrow$ 41%
P_{LPOD} $\rightarrow$ 722ms $\rightarrow$ 59%

Cycles per one minute

$P_{max} + P_{LPOD}$ = 498ms + 722ms = 1220ms

      60000ms / 1220ms = 49,18 cycles

Result per one minute

$$Medium\ Power = \frac{49,18 * 498ms * P_{max} + (60\,000 - 49,18 * 722)ms * P_{LPOD}}{60\,000}$$

$$Medium\ Power = \frac{24492ms * 92,66mW + 35506ms * 2,535mW}{60\,000}$$

$$Medium\ Power = \frac{2359436,43}{60\,000} = 39,324\ mW$$

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6. NFC Result overview

Measurement Port

Correction factor of Matching circuit equals:

$$Correction\ Factor = P_{matching} - P_{nominal}$$

$P_{matching}$ from point 5b → 19,66dBm
$P_{nominal}$ from point 5a → 18,77dBm

$$Correction\ Factor = 19,66 - 18,77 = 0,89\ dB$$

Below attached picture from DUT

Coax Cable connected in measured point with matching circuit.

Duty Cycle measurements using Calibration Coil 1

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7. Summary

For NFC System in 15W Porsche Koppelbox:

Should be used further Value:

P_{max} – Conducted measurement = 92,66 mW

Medium Power from Duty Cycle   – Calculated average power = **39,324 mW**