

Annex 1: Measurement diagrams to  
**TEST REPORT**  
No.: 19-1-0192101T01a-C1

According to:

**Title 47**  
**FCC Regulations Subpart 15C**  
§15.231(e)  
**ISED-Regulations**  
RSS-Gen, Issue 5  
RSS-210, Issue 10

for

**PACIFIC Industrial Co., Ltd.**

**Flex-Sens**  
**TPMS transmitter (Universal Sensor)**  
**PMV-E002**

**FCC-ID: PAXPMVE002**  
**ISED: 3729A-PMVE002**

Laboratory Accreditation and Listings



Accredited EMC-Test Laboratory

accredited according to DIN EN ISO/IEC 17025:2018

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## 1. Measurement diagrams

### 1.1. Fundamental field strength (15.231(e))

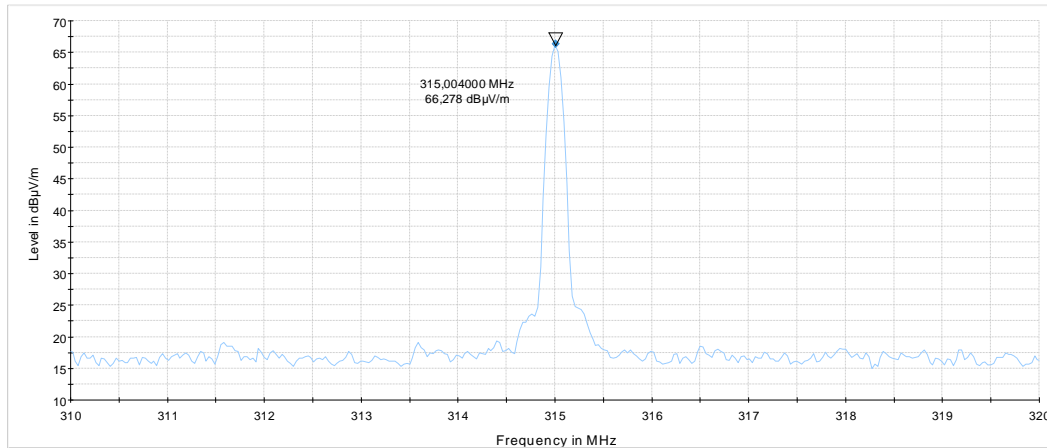


Diagram 3.01: EUT standing position, continuous wave.

PK-Value: 66.28 - 9.82 dB (Averaged timing over 100 ms) = 56.46 dBµV/m@ 3 m

Limit in range 260-470 MHz:

Field strength= $20 \cdot \log_{10}((16.67 \times f_{\text{MHz}}) - 2833.33) = 20 \cdot \log_{10}(2417.78 \mu\text{V/m}) = 67.66 \text{ dB}\mu\text{V/m}$

Margin to limit = 11.19 dB -> pass

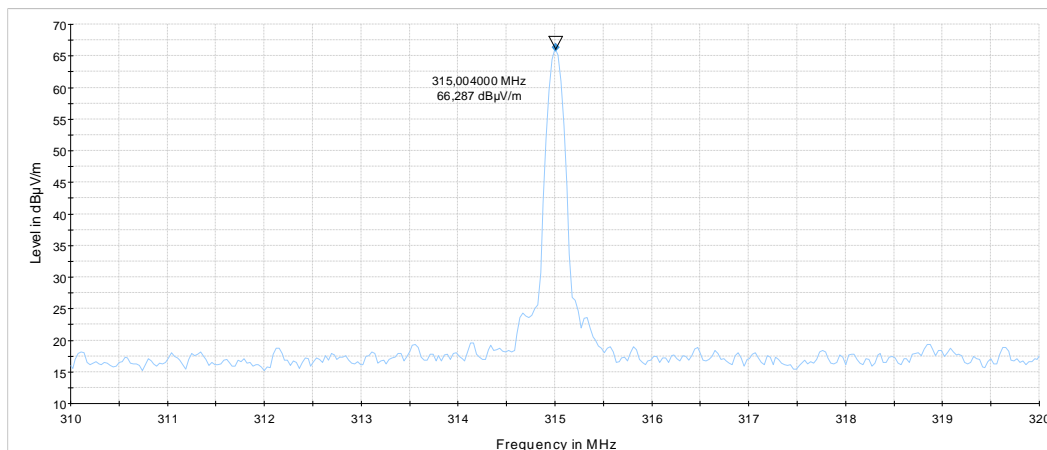


Diagram 3.02, EUT laying position, continuous wave

PK-Value: 66.29 - 9.82 dB (Averaged Timing over 100ms) = 56.47 dBµV/m@ 3 m

Limit: 67.66 dBµV/m

Margin to limit = 11.18 dB -> Pass

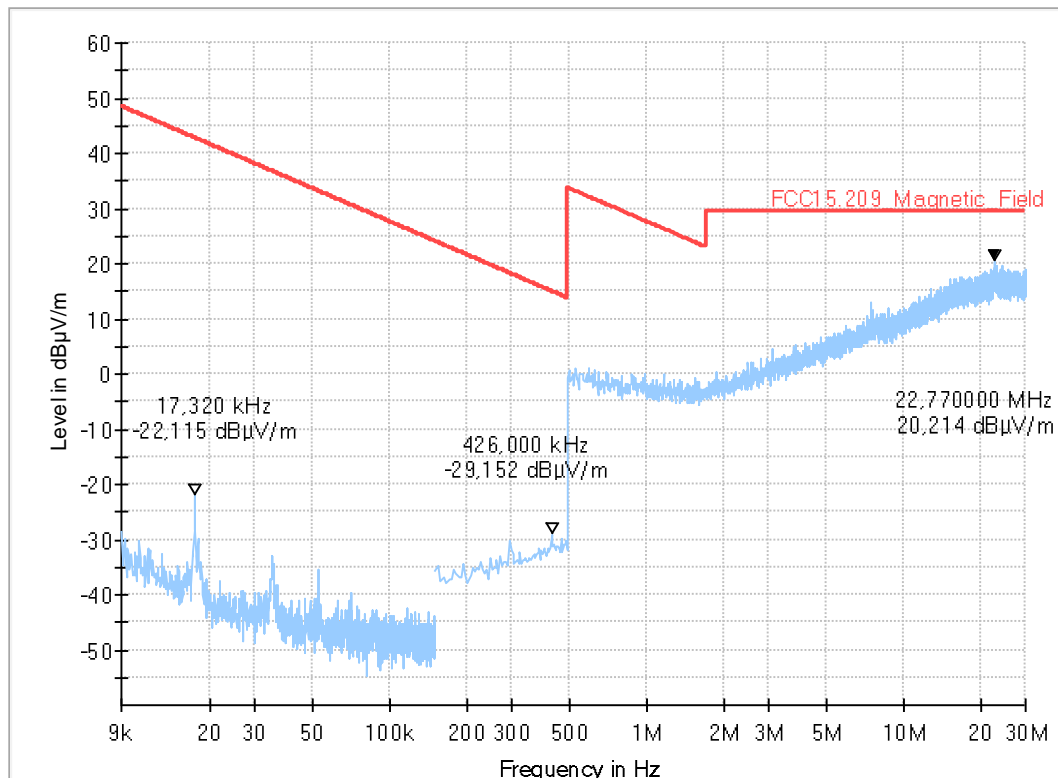
## 1.2. Radiated magnetic field strength measurements (f < 30 MHz)

### 2.01\_RSE\_TX\_standing

#### Common Information

Test Description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-No. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Test software:	EMC32 V10.50.0
Used Filter:	bypass
Test Standard:	FCC 15.205 §15.209; RSS-Gen: Issue 5
Operator:	GHu
Operating Mode:	315 MHz TX CW
Power during tests:	3 V battery
Comment 1:	S11
Environmental Conditions:	Humidity : 34% rH; Temperature: 21 °C
EUT Setup:	standing
Verdict:	Passed
Comment:	-

Full Spectrum

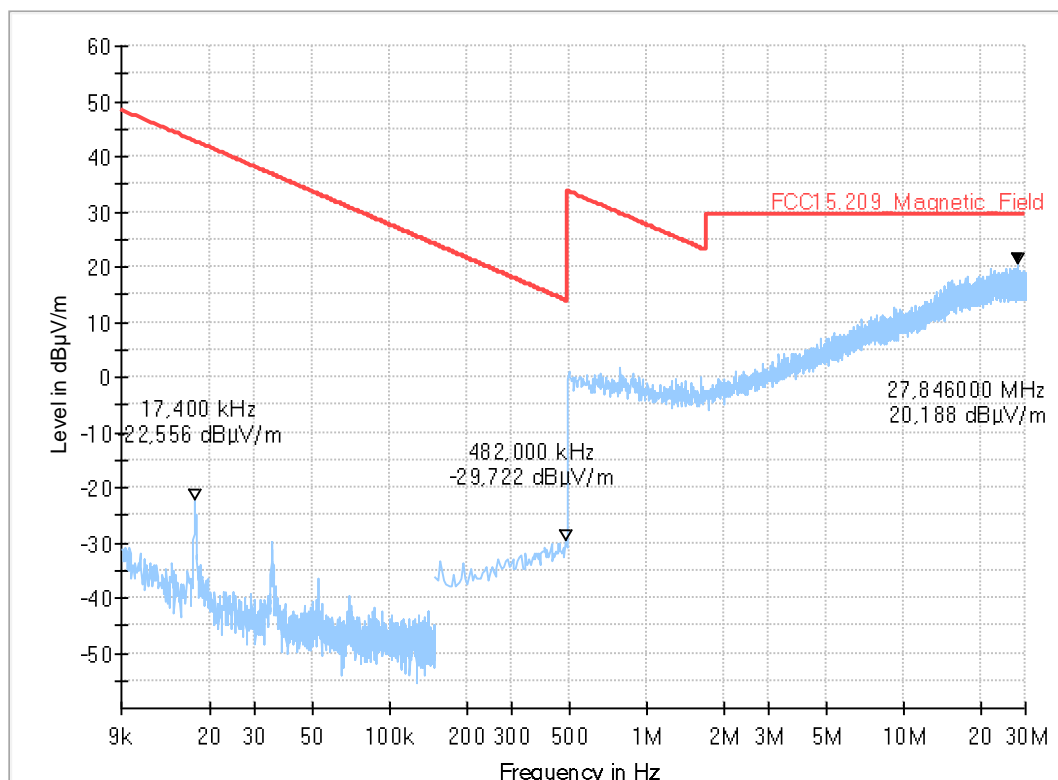


## 2.02\_RSE\_TX\_laying

### Common Information

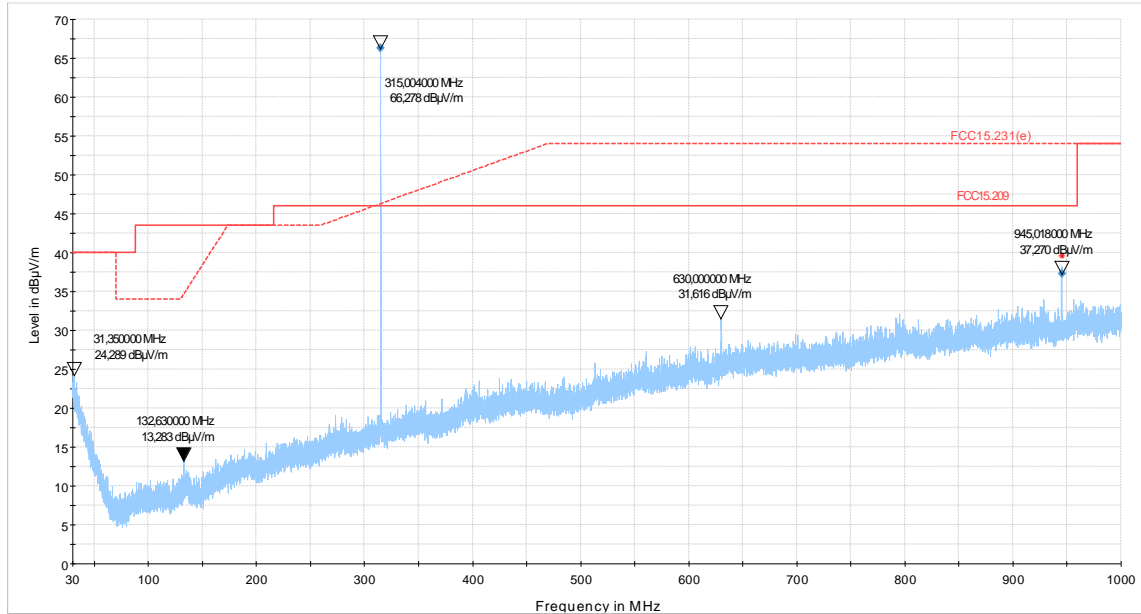
Test Description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-No. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Test-software:	EMC32 V10.50.0
Used Filter:	bypass
Test Standard:	FCC 15.205 §15.209; RSS-Gen: Issue 5
Operator:	GHu
Operating Mode:	315 MHz TX CW
Power during tests:	3 V battery
Comment 1:	S11
Environmental Conditions::	Humidity : 40% rH; Temperature: 21 °C
EUT Setup:	laying
Verdict:	Passed
Comment:	-

Full Spectrum



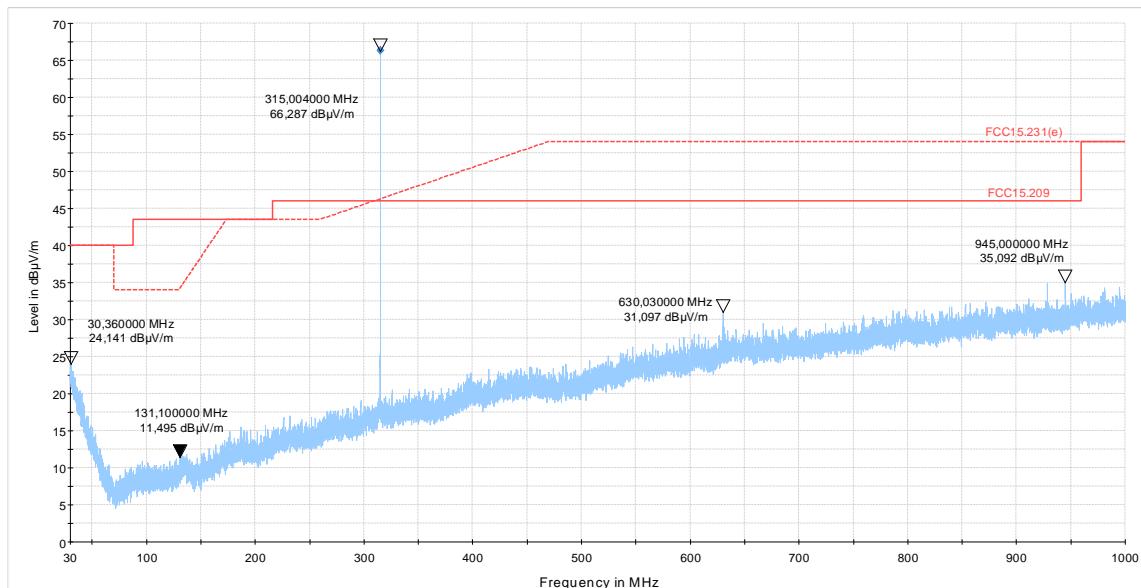
### 1.3. Radiated emissions in the frequency range 30 to 1000 MHz

## 3.11\_RSE\_TX\_standing



**Remark:** wanted TX emission at 315 MHz visible on diagram, not relevant for test decision

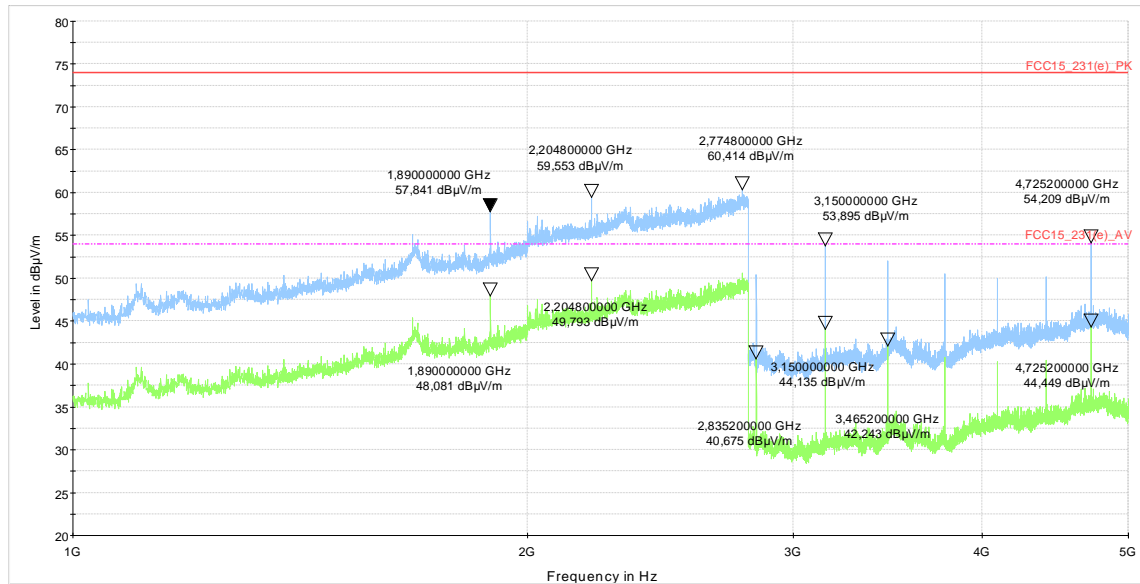
## 3.12\_RSE\_TX\_laying



**Remark:** wanted TX emission at 315 MHz visible on diagram, not relevant for test decision

## 1.4. Radiated emissions in the frequency range above 1000 MHz

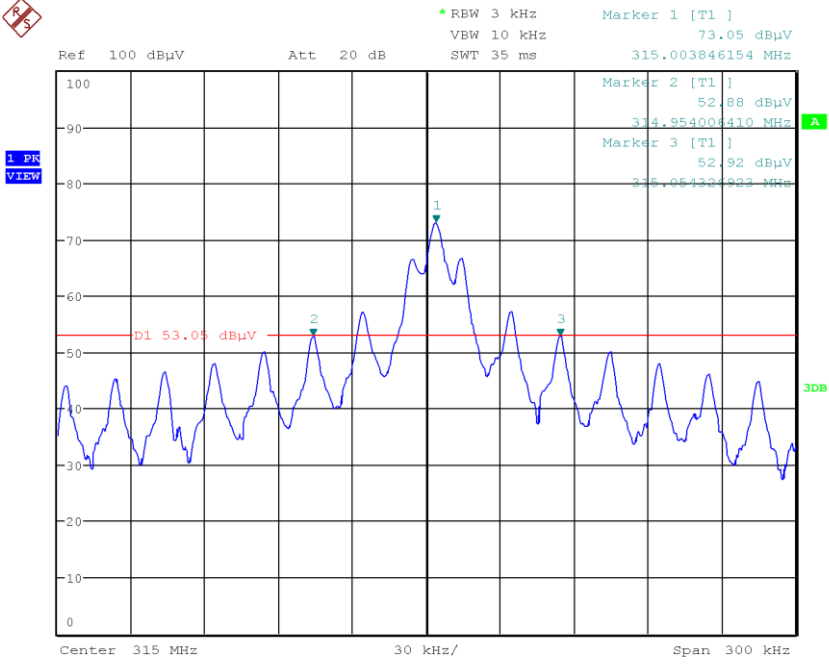
### 4.01\_RSE\_TX



**Remark:** Test mode (CW signal) is applied for this test. Thus the emission level measured by peak detector (blue trace) is corrected according the worst case of duty cycle by -9.82 dB in order to get the emission level related to AVERAGE detector (green trace). See section 1.7. Duty-Cycle correction for determination of worst-case timing and corresponding correction factor calculation.

**1.5. 20 dB bandwidth**

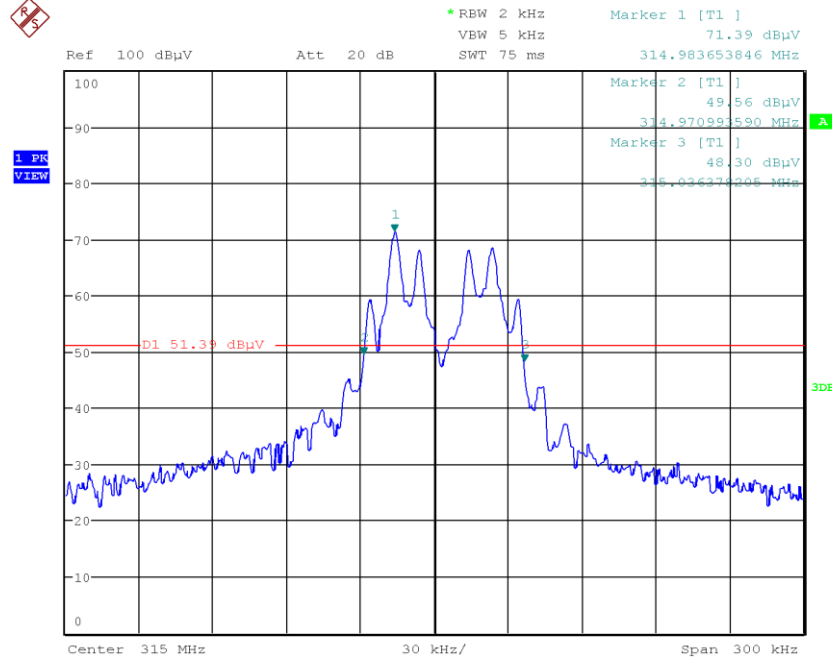
**1.5.1. Operating mode 2, (Trigger command No.28)**



neu  
Date: 16.MAR.2020 10:20:44



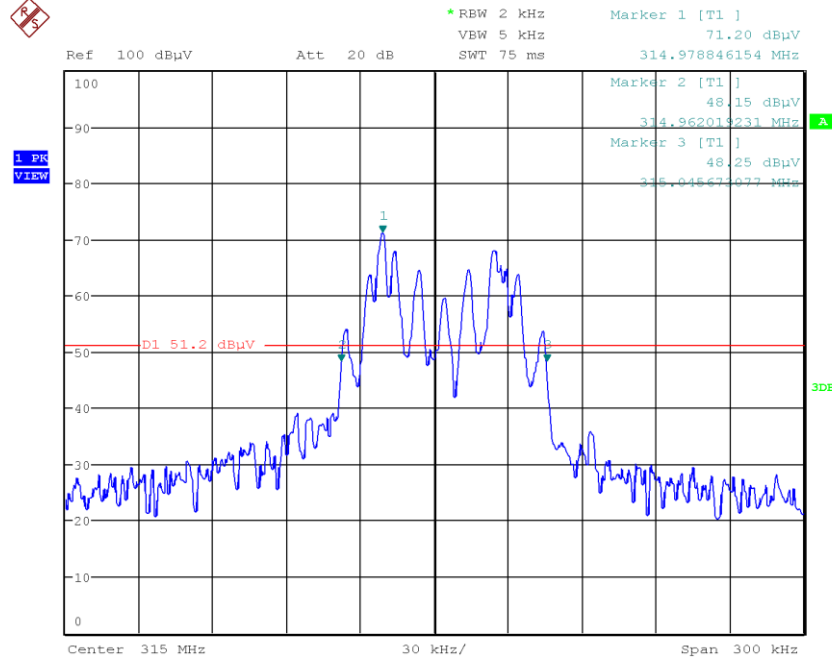
### 1.5.2. Operating mode 3, (Trigger command No.29)



neu

Date: 16.MAR.2020 12:59:33

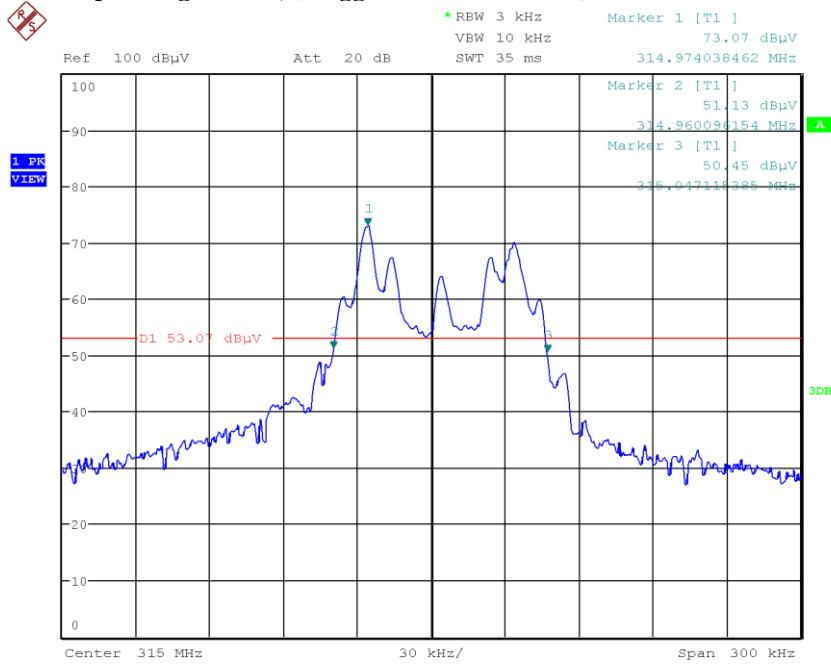
### 1.5.3. Operating mode 4, (Trigger command No.30)



neu

Date: 16.MAR.2020 13:03:11

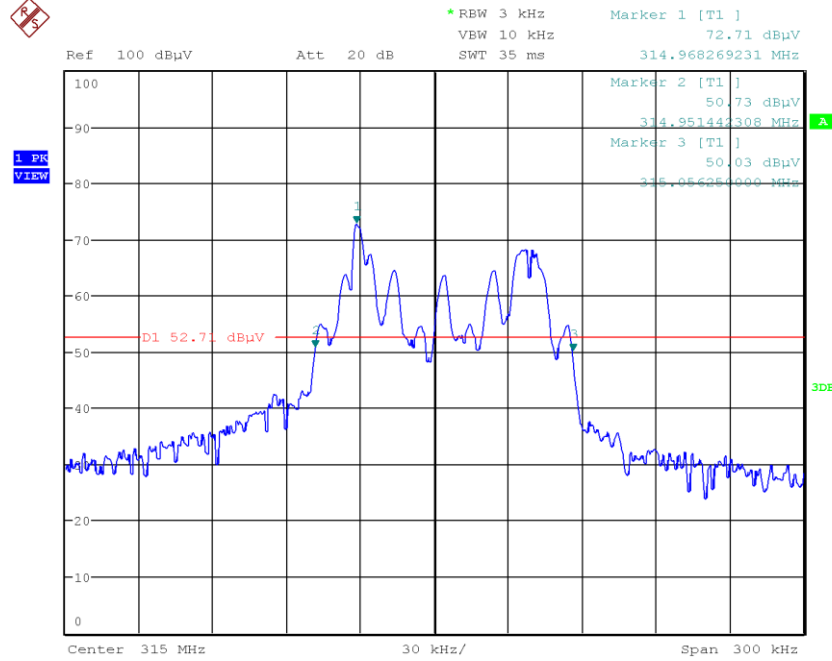
### 1.5.4. Operating mode 5, (Trigger command No.31)



neu

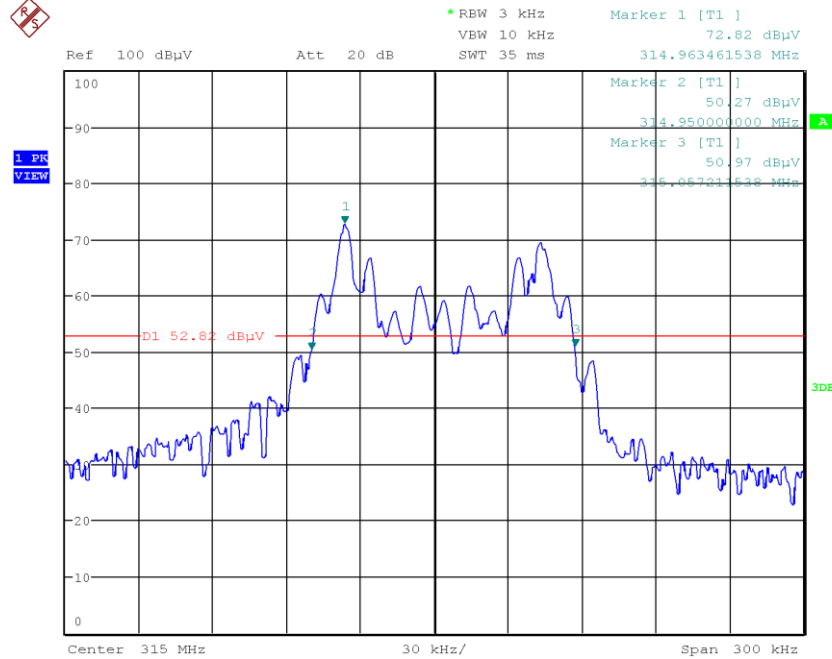
Date: 16.MAR.2020 13:09:18

### 1.5.5. Operating mode 6, (Trigger command No.32)



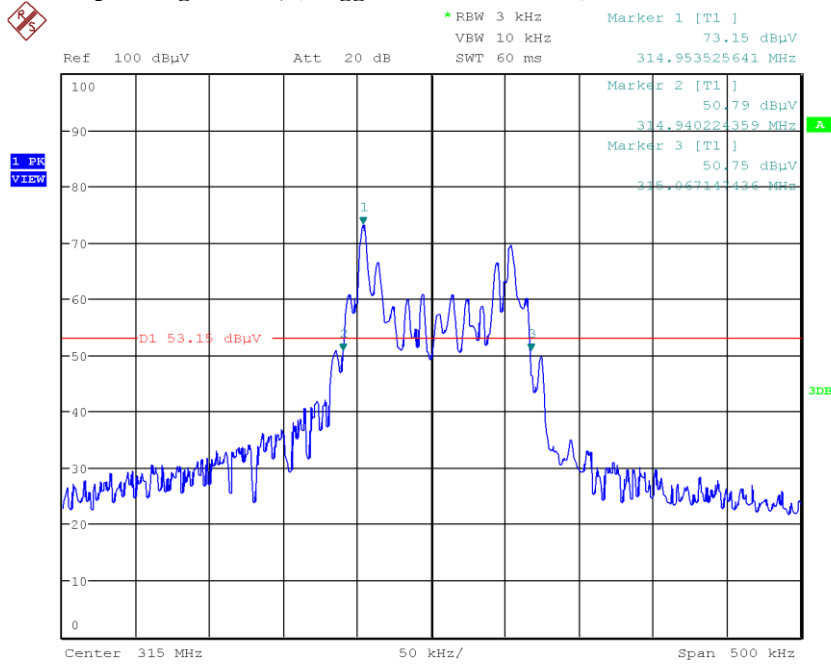
neu  
Date: 16.MAR.2020 13:13:21

### 1.5.6. Operating mode 7, (Trigger command No.33)



neu  
Date: 16.MAR.2020 13:16:38

### 1.5.7. Operating mode 8, (Trigger command No.34)

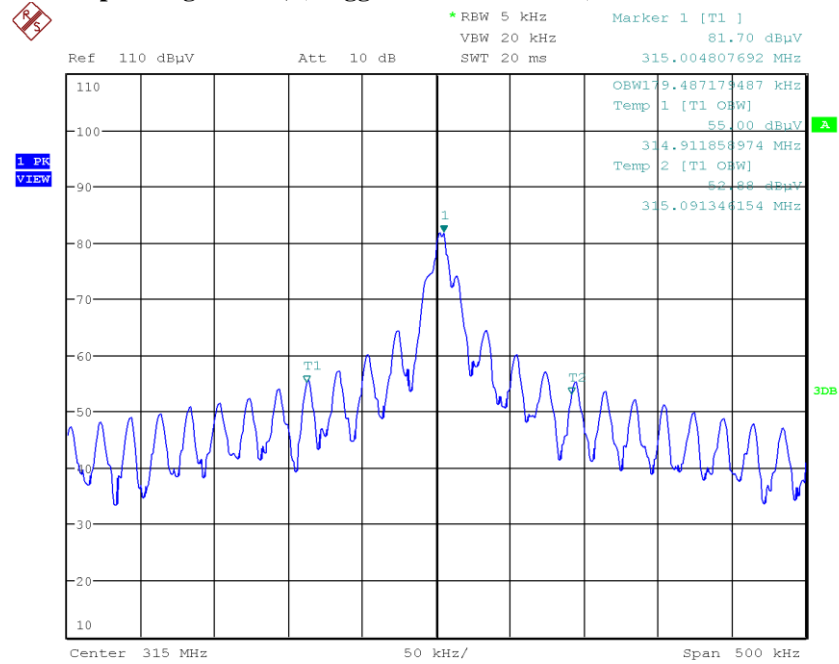


neu

Date: 16.MAR.2020 12:10:12

## 1.6. 99% Occupied bandwidth

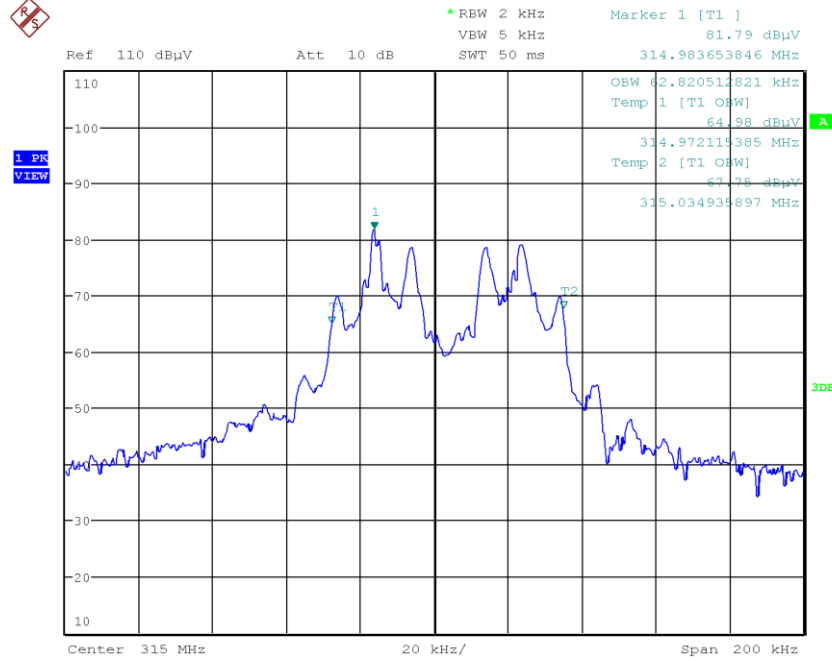
### 1.6.1. Operating mode 2, (Trigger command No.28)



neu

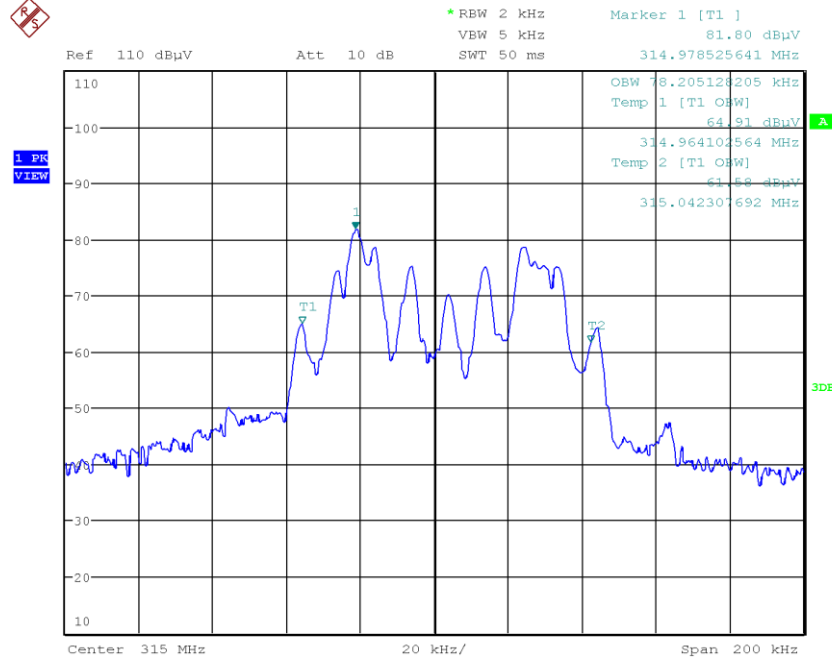
Date: 28.FEB.2020 18:02:15

### 1.6.2. Operating mode 3, (Trigger command No.29)



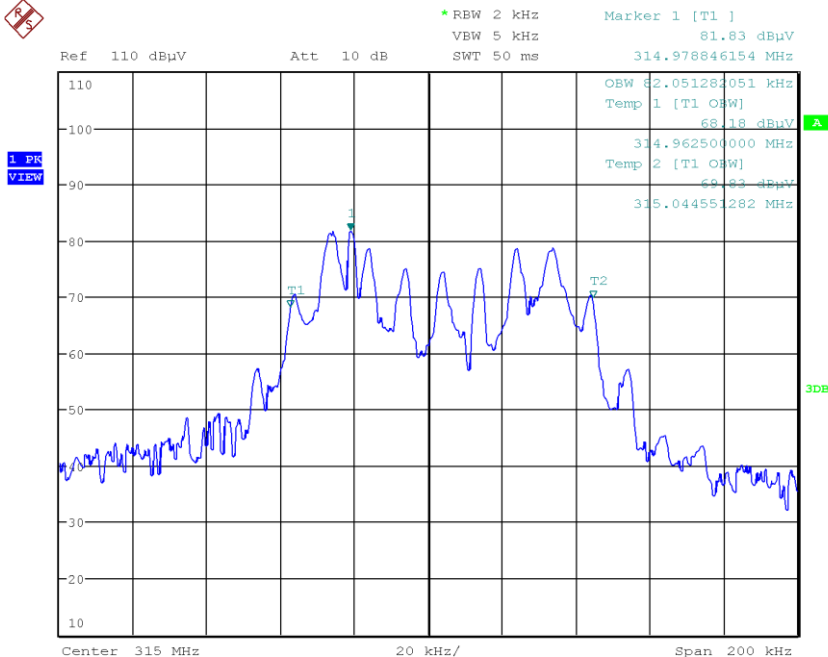
neu  
Date: 28.FEB.2020 18:23:03

### 1.6.3. Operating mode 4, (Trigger command No.30)



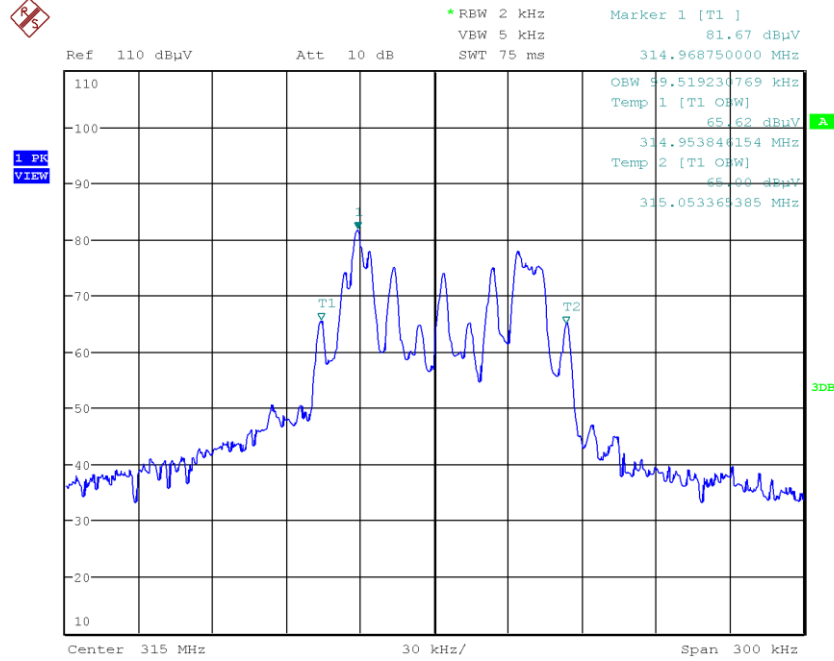
neu  
Date: 28.FEB.2020 18:25:03

1.6.4. Operating mode 5, (Trigger command No.31)



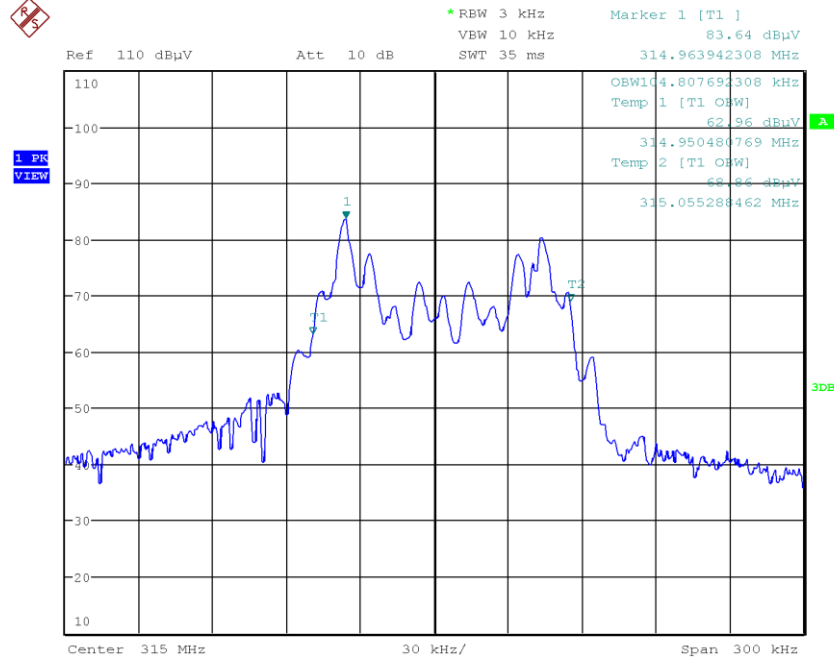
neu  
 Date: 28.FEB.2020 18:27:20

### 1.6.5. Operating mode 6, (Trigger command No.32)



neu  
Date: 28.FEB.2020 18:16:07

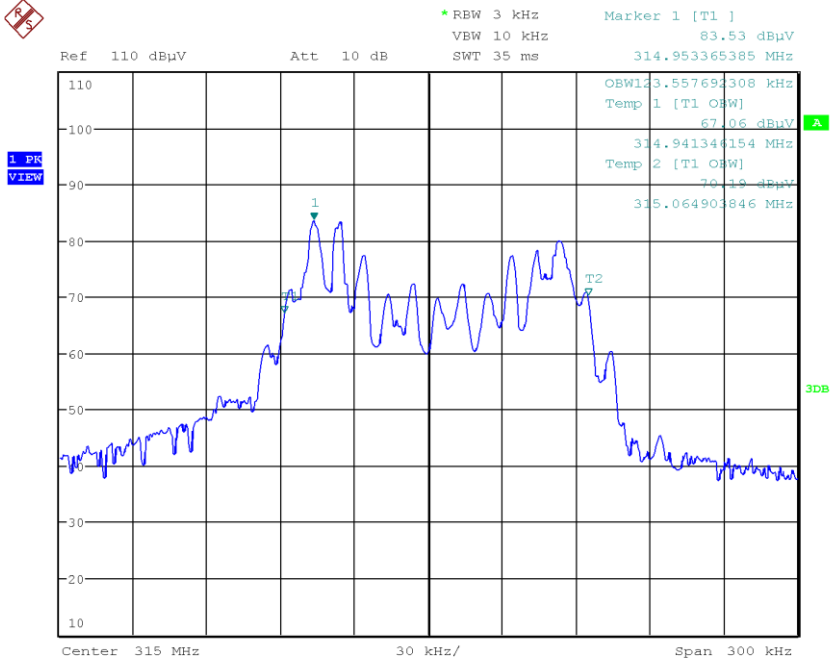
### 1.6.6. Operating mode 7, (Trigger command No.33)



neu  
Date: 28.FEB.2020 18:18:26



**1.6.7. Operating mode 8, (Trigger command No.34)**



neu  
 Date: 28.FEB.2020 18:20:32

## **1.7. Duty-Cycle correction**

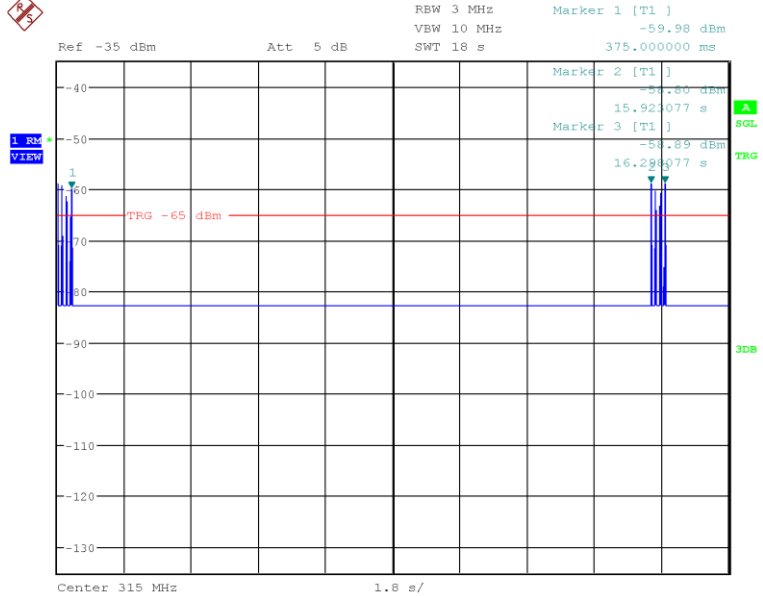
A duty-cycle Peak to AV applies since the transmitter is not 100% on during a 100 ms time unit. Pls. see below diagrams showing the behavior of the pulses and calculations performed

Worst-Case Duty-Cycle correction = -9.82 dB (section 1.8. Transmission characteristics).

**1.8. Transmission characteristics**

**1.8.1. Duty cycle of transmission (§15.231(b)(2))**

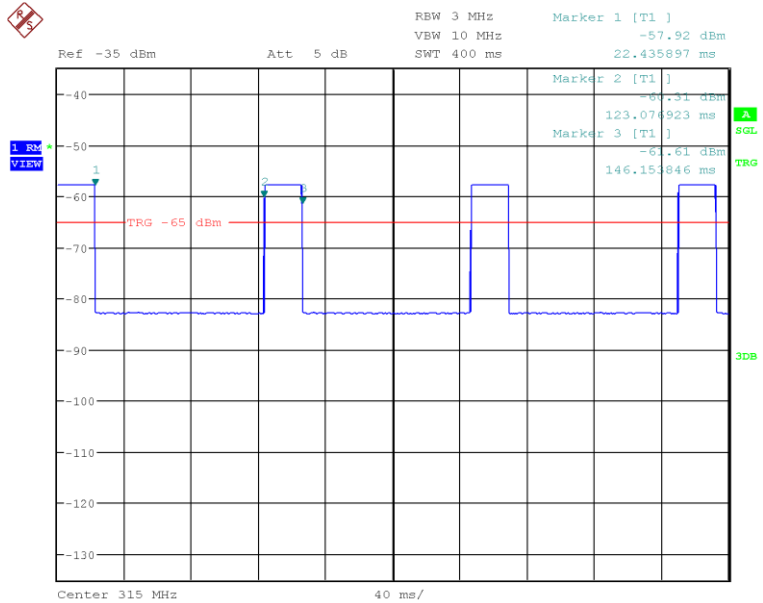
**1.8.1.1. Set. 1 / Op. 9 (Trigger command No.2)**



neu  
Date: 10.MAR.2020 15:40:18

Diagram 40.01a – Sweep time of 18 s

➔ One period of transmission: 375 ms long (including TX-off time + 4 TX-on pulses)



neu  
Date: 10.MAR.2020 15:45:18

Diagram 40.01b – Sweep time of 400 ms

➔ Each pulse takes 22.44 ms in average

**AVERAGE to PEAK correction calculations:**

Cycle Time within 400 ms:  $TX_{ON}\text{-Pulse} + TX_{OFF} = 123.1 \text{ ms}$

Only one Pulse can be observed during a period of 100 ms:

Therefore: Duty-Cycle [dB] related to 100 ms =  $20 \cdot \log_{10}(22.44 \text{ ms} / 100 \text{ ms}) = -12.98 \text{ dB}$

For Peak to AV correction of measured field strength: -12.98 dB apply for averaging the peak emission values.

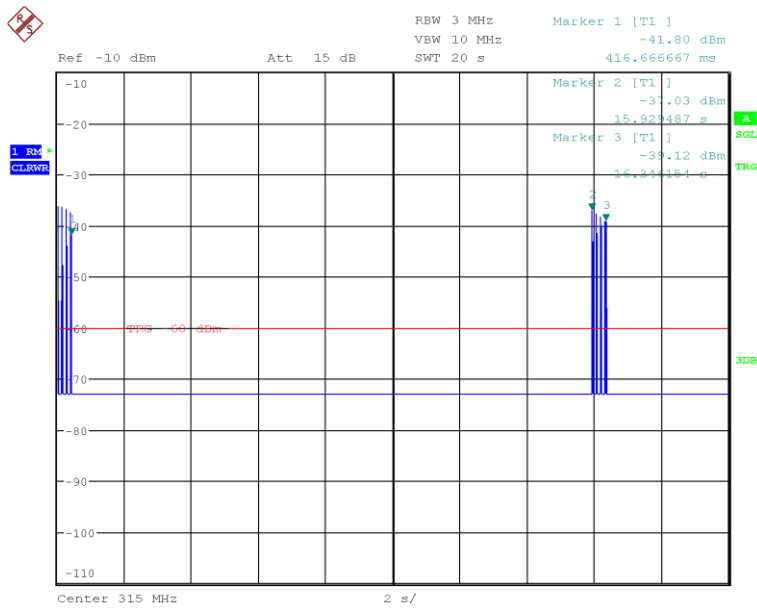
**LIMITS FOR TIMING:**

1. TX-on time:  $375 \text{ ms} < 1 \text{ second}$  (§15.231(e)) ➔ pass
2. Silent period:  $15.923 \text{ s} - 0.375 \text{ s} = 15.548 \text{ s} > 11.25 \text{ s}$  ( $30 \cdot 375 \text{ ms TX-on time}$ )  $> 10 \text{ s}$  ➔ pass
3. Device shall show a means for automatically limiting operation:  
Automatic limiting operation after each train pulse of 375 ms TX-on time ➔ pass

**VERDICT:**

Device under Op. mode 9 (trigger command no. 2) complies with the regulation.

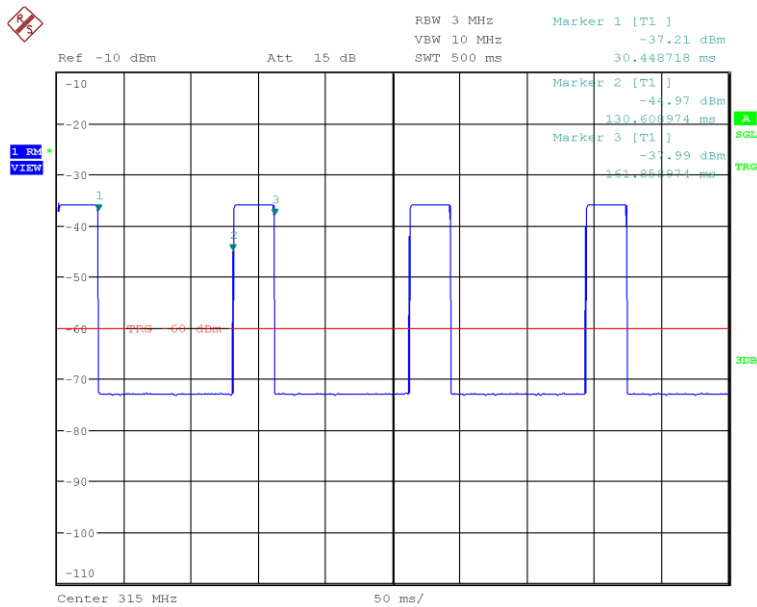
**1.8.1.2. Set. 1 / Op. 10 (Trigger command No.7)**



neu  
 Date: 11.MAR.2020 15:06:21

Diagram 40.02a – Sweep time of 20 s

➔ One period of the transmission: 416.66 ms long (including TX-off time + 4 TX-on pulses)



neu  
 Date: 11.MAR.2020 15:09:26

Diagram 40.01b – Sweep time of 500 ms

➔ Each pulse takes 30.5 ms in average

**AVERAGE to PEAK correction calculations:**

Cycle Time within 500 ms: TX<sub>ON</sub>-Pulse + TX<sub>OFF</sub> = 130.6 ms

Only one Pulse can be observed during a period of 100 ms:

Therefore: Duty-Cycle [dB] related to 100 ms =  $20 \cdot \log_{10}(30.5 \text{ ms} / 100 \text{ ms}) = -10.31 \text{ dB}$

For Peak to AV correction of measured field strength: -10.31 dB apply for averaging the peak emission values.

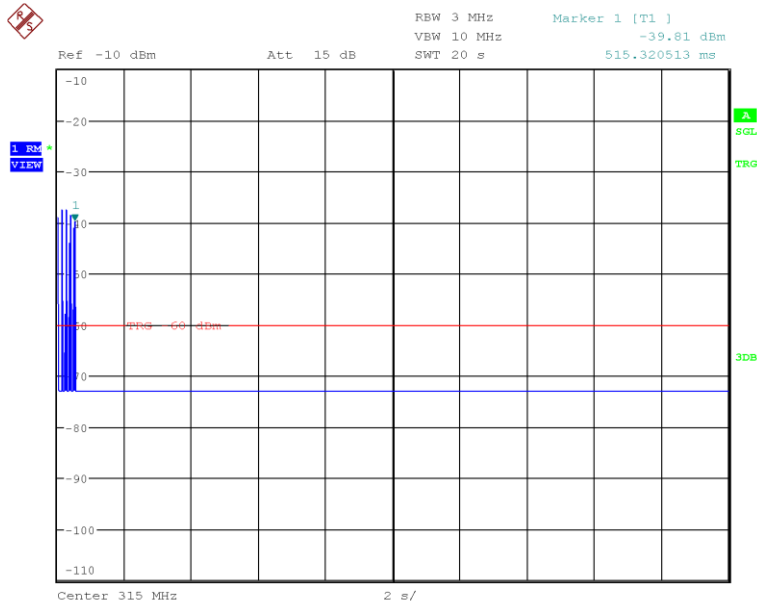
**LIMITS FOR TIMING:**

4. TX-on time: 416.66ms < 1 second (§15.231(e)) → pass
5. Silent period: 15.924 s - 0.41666 s = 15.5127 s > 12.499 s (30 \* 416.66ms TX-on time) > 10 s → pass
6. Device shall show a means for automatically limiting operation:  
Automatic limiting operation after each train pulse of 416.66ms TX-on time → pass

**VERDICT:**

Device under Op. mode 10 (trigger command no.7) complies with the regulation.

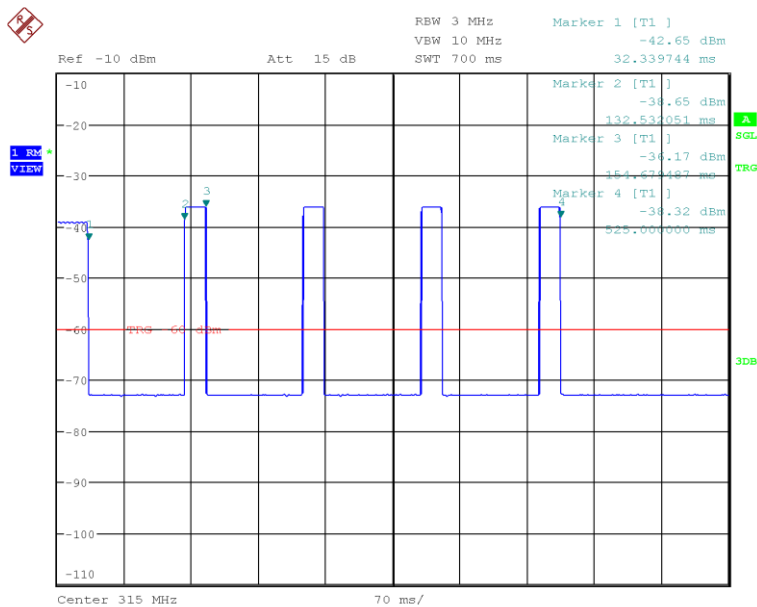
### 1.8.1.3. Set. 3 / Op. 11 (Trigger command No.8)



Date: 21.APR.2020 16:39:17

Diagram 40.03a – Sweep time of 20 s

➔ One non-periodic transmission: 515.32 ms (including TX-off time + 5 TX-on pulses)



Date: 21.APR.2020 16:44:19

Diagram 40.03b – Sweep time of 700 ms

➔ The longest single pulse takes 32.339 ms

Cycle Time within 700 ms: TX<sub>ON</sub>-Pulse + TX<sub>OFF</sub> = 132.5 ms

Only one Pulse can be observed during a period of 100 ms:

Therefore: Duty-Cycle [dB] related to 100 ms =  $20 \cdot \log_{10}(32.339 \text{ ms} / 100 \text{ ms}) = -9.82 \text{ dB}$

For Peak to AV correction of measured field strength: -9.82 dB apply for averaging the peak emission values.

#### **LIMITS FOR TIMING:**

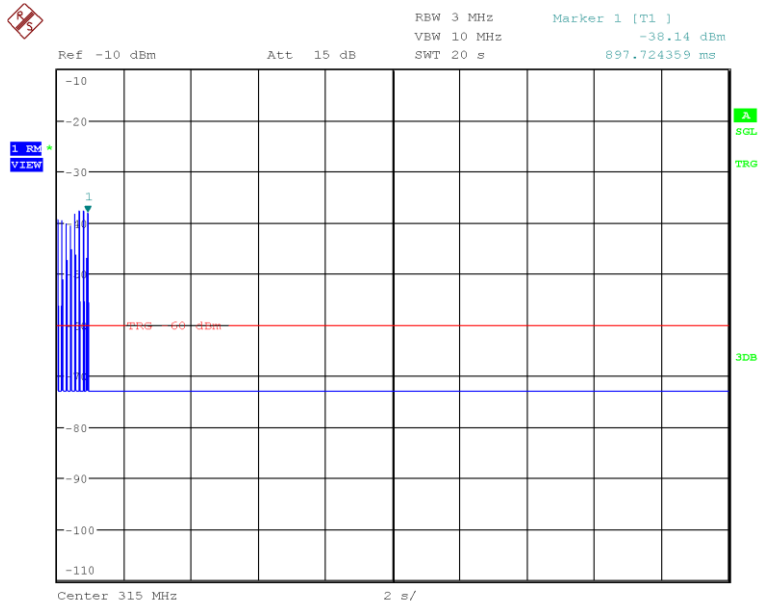
1. TX-on time: 515.32 ms < 1 second (§15.231(e)) → pass
2. Silent period:  $T_s = \infty$  (Non-periodic, non-repetitive) → pass
3. Device shall show a means for automatically limiting operation:  
Automatic limiting operation after each train pulse of 515.32ms TX-on time → pass

#### **VERDICT:**

Device under Op. mode 11 (trigger command no.8) complies with the regulation.



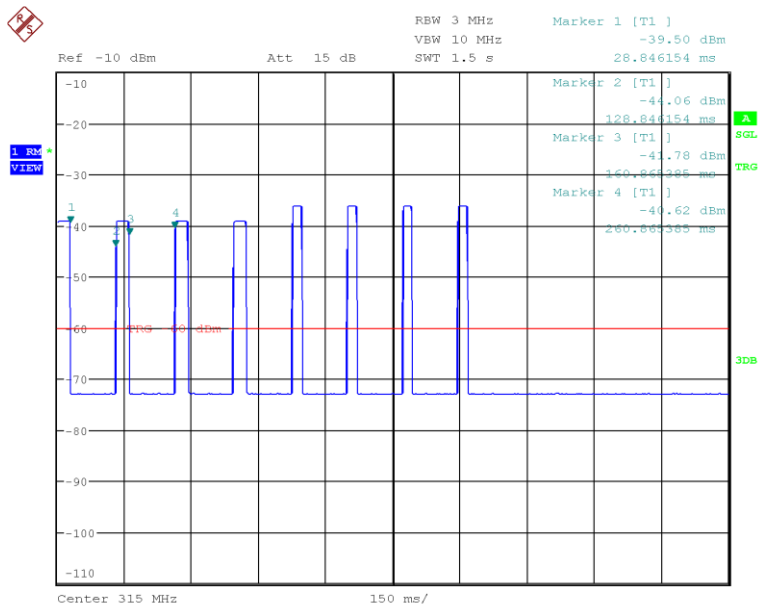
### 1.8.1.4. Set. 3 / Op. 12 (Trigger command No.12)



Date: 21.APR.2020 16:49:01

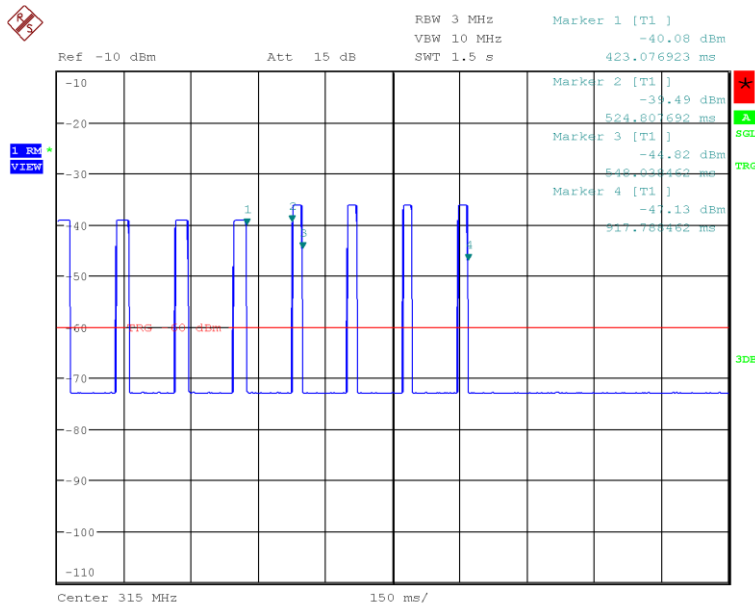
Diagram 40.04a – Sweep time of 20 s

➔ One non-periodic transmission: 897.724 ms, containing 8 pulses (including TX-off time and TX-on time)



Date: 21.APR.2020 16:51:41

Diagram 40.04b – Sweep time of 1.5 s



Date: 21.APR.2020 16:55:36

Diagram 40.04c – Sweep time of 1.5 s (more following markers)

➔ The longest single pulse takes 28.84 ms (ASK-Pulse)

Cycle Time within 1 s:  $TX_{ON}\text{-Pulse} + TX_{OFF} = 128.8 \text{ ms}$

Only one Pulse can be observed during a period of 100 ms:

Therefore: Duty-Cycle [dB] related to 100 ms =  $20 \cdot \log_{10}(28.8 \text{ ms} / 100 \text{ ms}) = -10.81 \text{ dB}$

For Peak to AV correction of measured field strength: -10.81 dB apply for averaging the peak emission values.

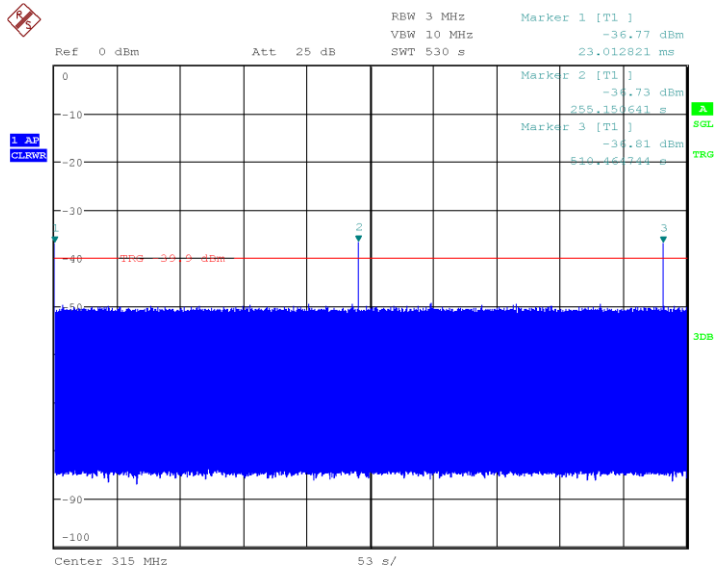
#### LIMITS FOR TIMING:

1. TX-on time: 897.724 ms < 1 second (§15.231(e)) ➔ pass
2. Silent period:  $T_s = \infty$  (Non-periodic, non-repetitive) ➔ pass
3. Device shall show a means for automatically limiting operation:  
Automatic limiting operation after each train pulse of 897.724 ms TX-on time ➔ pass

#### VERDICT:

Device under Op. mode 12 (trigger command no.12) complies with the regulation.

### 1.8.1.5. Set. 4 / Op. 13 (Trigger command No.17)

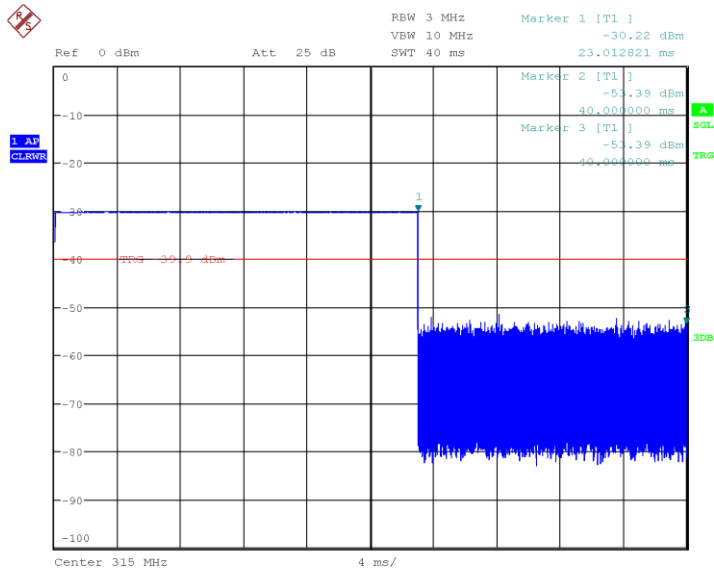


neu

Date: 29.JUL.2020 11:02:31

Diagram 40.05a – Sweep time of 530 s

➔ One periodic transmission each 255.15 s, containing 1 pulse within period



neu

Date: 29.JUL.2020 10:37:20

Diagram 40.05b – Sweep time of 40 ms

➔ One pulse takes 23.01 ms

Only one Pulse can be observed during a period of 100 ms:

Therefore: Duty-Cycle [dB] related to 100 ms =  $20 \cdot \log_{10}(23.01 \text{ ms} / 100 \text{ ms}) = -12.76 \text{ dB}$

For Peak to AV correction of measured field strength: -12.76 dB apply for averaging the peak emission values.

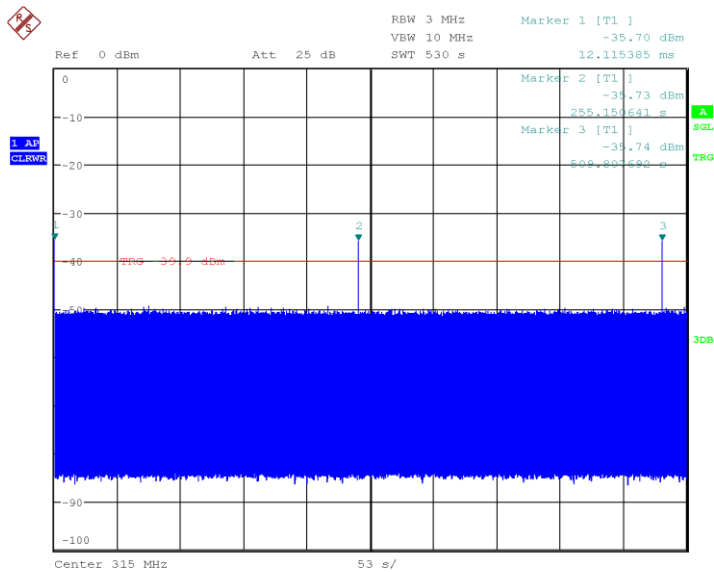
**LIMITS FOR TIMING:**

1. TX-on time: 23.01 ms < 1 second (§15.231(e)) → pass
2. Silent period: 255.15 s - 23.01 ms = 255.127631 s > 10 s > 0.69 s (30 \* 23.01 ms TX-on time) → pass
3. Device shall show a means for automatically limiting operation:  
Automatic limiting operation after each train pulse of 23.01 ms TX-on time → pass

**VERDICT:**

Device under Op. mode 13 (trigger command no.17) complies with the regulation.

### 1.8.1.6. Set. 4 / Op. 14 (Trigger command No.20)

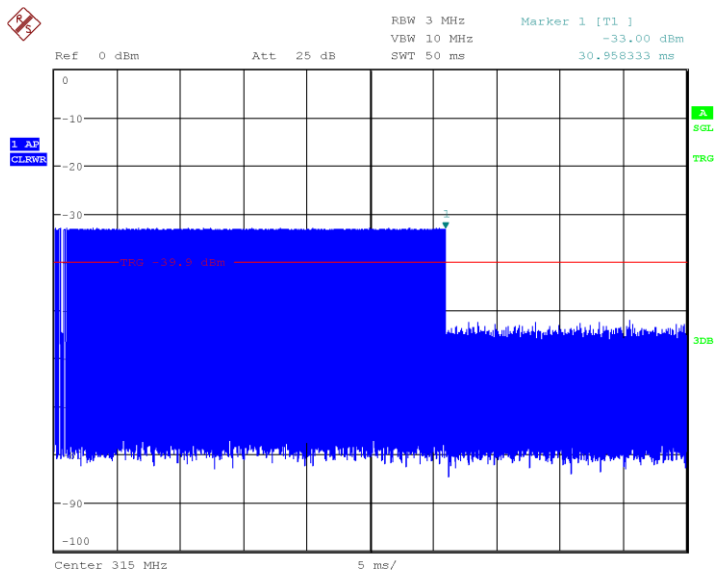


neu

Date: 29.JUL.2020 11:16:10

Diagram 40.06a – Sweep time of 530 s

➔ One periodic transmission each 255.15 s, containing 1 pulse during period



neu

Date: 29.JUL.2020 11:17:54

Diagram 40.06b – Sweep time of 50 ms

➔ One pulse takes 30.96 ms

Only one Pulse can be observed during a period of 100 ms:

Therefore: Duty-Cycle [dB] related to 100 ms =  $20 \cdot \log_{10}(30.96 \text{ ms} / 100 \text{ ms}) = -10.18 \text{ dB}$

For Peak to AV correction of measured field strength: -10.18 dB apply for averaging the peak emission values.

#### **LIMITS FOR TIMING:**

1. TX-on time: 30.96 ms < 1 second (§15.231(e)) → pass
2. Silent period: 255.15 s – 30.96 ms = 255.119681 s > 10 s > 0.9288 s (30\* 30.96 ms TX-on time) → pass
3. Device shall show a means for automatically limiting operation:  
Automatic limiting operation after each train pulse of 30.96 ms TX-on time → pass

#### **VERDICT:**

Device under Op. mode 14 (trigger command no.20) complies with the regulation.

#### **1.8.1.7. Conclusion about duty cycle**

- Worst case of the duty cycle: Operating mode 11 (Trigger command No.8) with the DC-correction factor of -9.82 dB, which is **9.82 dB** in the absolute value and applies to absolute measured peak values of the field strength at 3m distance.

**END OF ANNEX 1**