



Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-04

## TEST REPORT

Test Report No.: 1-4018/22-01-02-A



Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-05

### Testing Laboratory

#### CTC advanced GmbH

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#### Accredited Test Laboratory:

The testing laboratory (FCC part 15 D) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS). The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-04 / -05

### Applicant

#### HBC-radiomatic GmbH

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74564, Crailsheim  
Germany  
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Contact: Timo Becker  
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### Manufacturer

#### HBC-radiomatic GmbH

Haller Str. 45-53  
74564, Crailsheim  
Germany

### Test Standard/s

FCC Part 15, subpart D: 2016      Isochronous UPCS Device 1920 – 1930 MHz  
Industry Canada RSS-213, Issue 3: 2 GHz Licence-exempt Personal Communication Service Devices (LE-PCS) 2015

### Test Item

|                            |                                               |
|----------------------------|-----------------------------------------------|
| <b>Kind of product:</b>    | <b>DECT ULE Radio Module</b>                  |
| <b>Product name:</b>       | <b>TC190</b>                                  |
| <b>HVIN:</b>               | TC190                                         |
| <b>PMN:</b>                | TC190                                         |
| <b>FVIN:</b>               | /                                             |
| <b>HMN:</b>                | /                                             |
| <b>FCC ID:</b>             | NO9TC190                                      |
| <b>IC:</b>                 | 2977A-TC190                                   |
| <b>S/N serial number:</b>  | Radiated: /<br>Conducted: /                   |
| <b>HW hardware status:</b> | TC190                                         |
| <b>SW software status:</b> | SC010203, SC210100, SC010105, SC110100        |
| <b>Frequency [MHz]:</b>    | 1920 -1930                                    |
| <b>Type of Modulation:</b> | Digital (Gaussian Frequency Shift Keying)     |
| <b>Number of channels:</b> | 5 RF Channels, 5x12 = 60 TDMA Duplex Channels |
| <b>Antenna:</b>            | onboard inverted F antenna, MMCX connector    |
| <b>Power Supply:</b>       | 3.7 V DC                                      |
| <b>Temperature Range:</b>  | -30°C to 80°C                                 |

**Test Report authorised:**

**Test performed:**

2023-05-09 Luckenbill, Andreas  
Head of Radio and SAR Services

2023-05-09 Wolf, Joachim  
Head of New Services

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## 2 General information

### 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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In no case this test report can be considered as a Letter of Approval.

This test report replaces test report 1-4018/22-01-02 from 2023-03-16, which is no longer valid.

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

### 2.2 Application details

|                                    |            |
|------------------------------------|------------|
| Date of receipt of order:          | 2022-03-22 |
| Date of receipt of test item:      | 2022-07-20 |
| Start of test:                     | 2022-07-20 |
| End of test:                       | 2023-05-09 |
| Person(s) present during the test: |            |

## 3 Test standard/s:

| Test Standard                    | Version | Test Standard Description                                                                                                                                               |
|----------------------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC Part 15, subpart D           | 2016-06 | Isochronous UPCS Device 1920 – 1930 MHz                                                                                                                                 |
| Industry Canada RSS-213, Issue 3 | 2015-03 | 2 GHz Licence-exempt Personal Communication Service Devices (LE-PCS)                                                                                                    |
| ANSI C63.17                      | 2013-08 | American National Standard for Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communication Services (UPCS) Devices |
| ANSI C63.4                       | 2014-06 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz     |

## 4 Test Environment

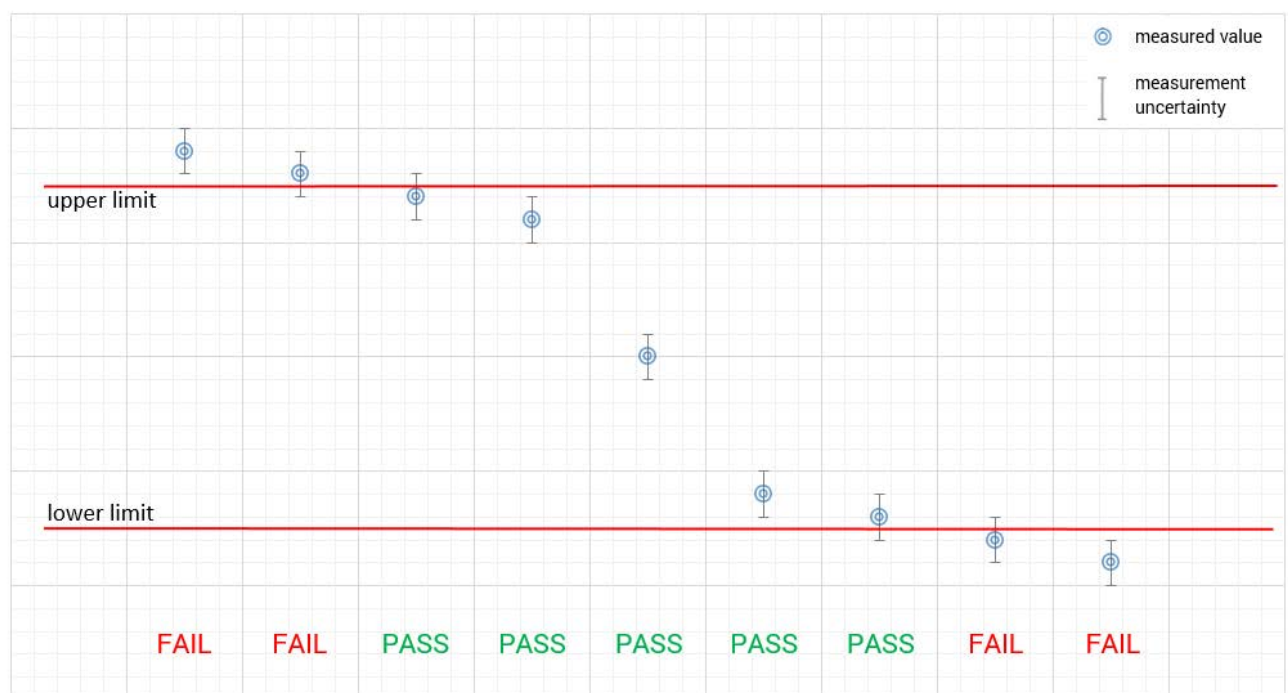
|                            |                                                                                                                      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|
| Temperature:               | + 22 °C during room temperature tests<br>+ 80 °C during high temperature test<br>- 30 °C during low temperature test |
| Relative humidity content: | 38 %                                                                                                                 |
| Air pressure:              | not relevant for this kind of testing                                                                                |

## 5 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.

The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."

### measured value, measurement uncertainty, verdict



## 6 Measurement uncertainty

| Measurement uncertainty                                  |                        |               |
|----------------------------------------------------------|------------------------|---------------|
| Test case                                                | Uncertainty            |               |
| Frequency and Timing                                     | $\pm 1 \times 10^{-7}$ |               |
| Antenna Gain                                             | $\pm 3$ dB             |               |
| Conducted Level Measurement                              | > 10 MHz               | $\pm 0.28$ dB |
|                                                          | > 3.6 GHz              | $\pm 0.39$ dB |
|                                                          | > 7.0 GHz              | $\pm 1.00$ dB |
|                                                          | > 13.6 GHz             | $\pm 1.32$ dB |
| Spurious emissions radiated below 30 MHz                 | $\pm 3$ dB             |               |
| Spurious emissions radiated 30 MHz to 1 GHz              | $\pm 3$ dB             |               |
| Spurious emissions radiated 1 GHz to 12.75 GHz           | $\pm 3.7$ dB           |               |
| Spurious emissions radiated above 12.75 GHz              | $\pm 4.5$ dB           |               |
| Spurious emissions conducted below 30 MHz (AC conducted) | $\pm 2.6$ dB           |               |

## 7 Summary of Measurement Results

|                                     |                                                                     |
|-------------------------------------|---------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | No deviations from the technical specifications were ascertained    |
| <input type="checkbox"/>            | There were deviations from the technical specifications ascertained |

### CFR 47 Part 15 UPCS

| Name of test                                                     | FCC CFR 47 Paragraph                  | IC RSS-213 Paragraph   | Verdict          |
|------------------------------------------------------------------|---------------------------------------|------------------------|------------------|
| Digital Modulation Techniques                                    | 15.319(b)                             | 6.1                    | N/P <sup>5</sup> |
| Labeling requirements                                            | 15.19(a)(3)                           | RSS-GEN 5.2            | N/P <sup>5</sup> |
| Antenna requirements                                             | 15.317, 15.203                        | 4.1(e)                 | N/P <sup>5</sup> |
| Power Line Conducted Emission                                    | 15.107(a),<br>15.207(a)               | 6.3<br>RSS GEN 7.2.2   | N/P <sup>5</sup> |
| Emission Bandwidth                                               | 15.323(a)                             | 6.4                    | N/P <sup>5</sup> |
| In-band Emission                                                 | 15.323(d)                             | 6.7.2                  | N/P <sup>5</sup> |
| Out-of-band Emissions                                            | 15.323(d)                             | 6.7.1                  | Complies         |
| Peak Transmit Power                                              | 15.319(c)(e),<br>15.31(e)             | 6.5                    | Complies         |
| Power Spectral Density                                           | 15.319(d)                             | 4.3.2.1                | N/P <sup>5</sup> |
| Automatic discontinuation of transmission                        | 15.319(f)                             | 4.3.4(a)               | N/P <sup>5</sup> |
| Carrier frequency stability                                      | 15.323(f)                             | 6.2                    | Complies         |
| Frame repetition stability                                       | 15.323(e)                             | 4.3.4(c)               | N/P <sup>5</sup> |
| Frame period and jitter                                          | 15.323(e)                             | 4.3.4(c)               | N/P <sup>5</sup> |
| Monitoring threshold, Least interfered channel                   | 15.323(c)(2);(5);<br>(9)              | 4.3.4(b)               | N/P <sup>5</sup> |
| Monitoring of intended transmit window and maximum reaction time | 15.323(c)(1)                          | 4.3.4                  | N/P <sup>5</sup> |
| Threshold monitoring bandwidth                                   | 15.323(c)(7)                          | 4.3.4                  | N/A              |
| Reaction time and monitoring interval                            | 15.323(c)(1);(5);<br>(7)              | 4.3.4                  | N/P <sup>5</sup> |
| Access criteria test interval                                    | 15.323(c)(4);(6)                      | 4.3.4                  | N/P <sup>5</sup> |
| Access criteria functional test                                  | 15.323(c)(4);(6)                      | 4.3.4                  | N/P <sup>5</sup> |
| Acknowledgments                                                  | 15.323(c)(4)                          | 4.3.4                  | N/P <sup>5</sup> |
| Transmission duration                                            | 15.323(c)(3)                          | 4.3.4                  | N/P <sup>5</sup> |
| Dual access criteria                                             | 15.323(c)(10)                         | 4.3.4                  | N/P <sup>5</sup> |
| Alternative monitoring interval                                  | 15.323(c)(10);(11)                    | 4.3.4                  | N/A <sup>2</sup> |
| Spurious Emissions (Antenna Conducted)                           | 15.323(d)                             | 6.7.1                  | N/P <sup>5</sup> |
| Spurious Emissions (Radiated)                                    | 15.319(g),<br>15.109(a),<br>15.209(a) | 4.3.3<br>RSS-GEN 7.2.3 | N/P <sup>5</sup> |
| Receiver Spurious Emissions                                      | N/A                                   | 6.8                    | N/P <sup>5</sup> |

<sup>1</sup> Only applicable for EUT that can initiate a communication link

<sup>2</sup> The client declares that the tested equipment does not implement this provision

<sup>3</sup> The tested equipment has integrated antennas only

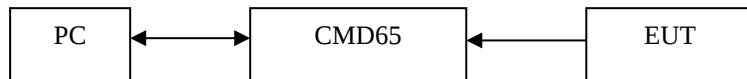
<sup>4</sup> Only requirement FCC 15.109 for unintentional radiators was tested radiated

<sup>5</sup> not performed

## 8 Test Set-up

### 8.1 Frequency Measurements

#### Test Set-up 1:



This setup is used for measuring Carrier Frequency Stability at nominal and extreme temperatures.

For long term Frequency Stability, the EUT was in loopback-mode and was controlled with the CMD65, the modulation pattern was set to 01010101....

### 8.2 Timing Measurements

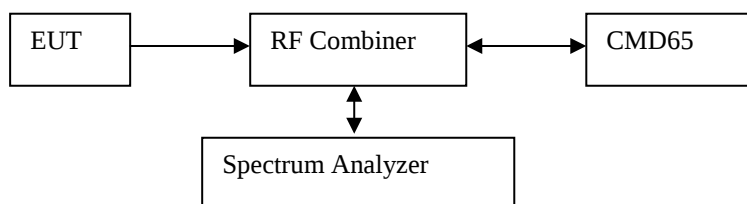
#### Test Set-up 2:



This setup is used for measuring Frame Repetition Stability, Frame Period and Jitter.

### 8.3 Conducted Emission Test

#### Test Set-up 3:



This setup is used for all conducted emission tests.

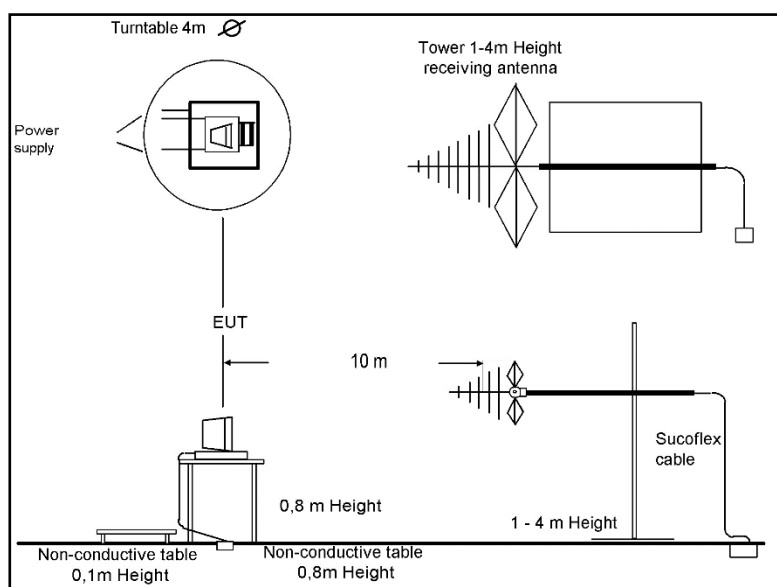
The EUT was in loopback-mode and was controlled with the CMD65, the modulation pattern was set to Pseudo-Random bit sequence to simulate normal speech.

### 30 MHz – 1GHz:

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a non conducting table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position  $\pm 45^\circ$  and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.



**1GHz – 10 GHz:****Test Set-up 5:**

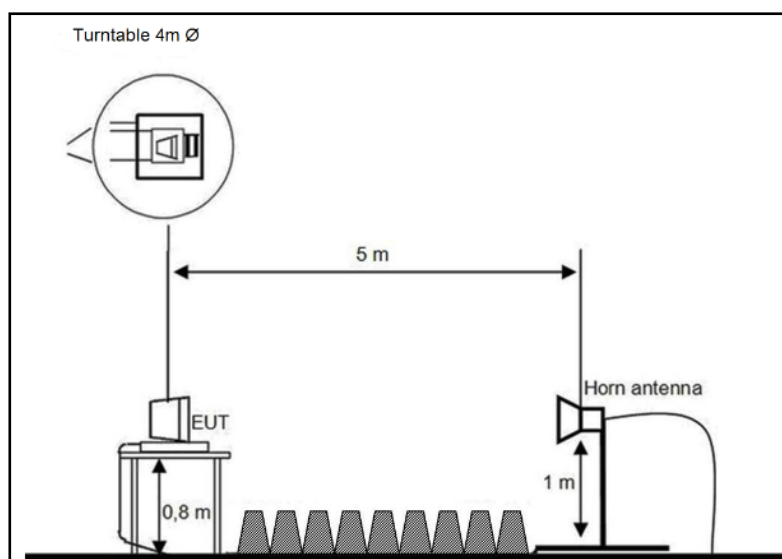
- The Equipment was setup to simulate a typical usage like described in the user manual / or described by manufacturer.
- If the EUT is a tabletop system, a non conducting table with 0,8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is: (see ANSI C 63.4)
  - < 18 GHz = 3 m
  - 18-26 GHz = 1,5 m
  - 26-40 GHz = 0,75 m
- The EUT was set into operation.

**Premeasurement**

- The turntable rotates continuous from 0° to 360°
- The antenna is polarized vertical and horizontal.
- In accordance to the antenna beam and the size of the EUT the antenna height changes in 30 cm steps, start at 1 meter. If it is not possible to tilt the emissions will be checked with a manually tilted antenna from top side.
- The analyzer scans quickly to find the maximum emissions of the EUT

**Final measurement**

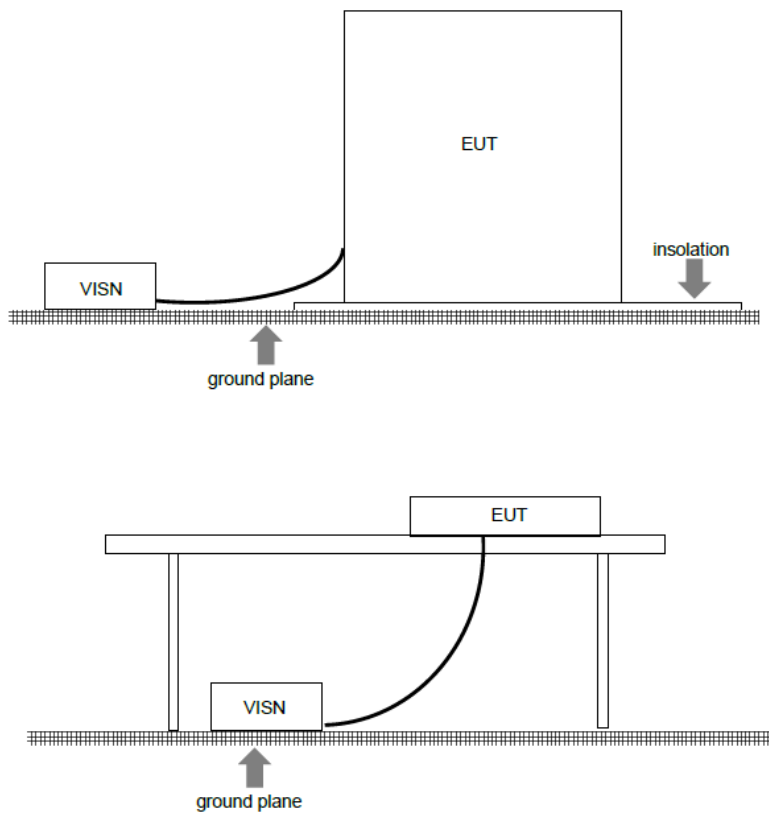
- The final measurement will be performed with minimum the six highest peaks (depends on emissions and number of measured points below 1 GHz)
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter.
- The final measurement will be done with AV (Average / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit, and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.



## 8.5 Power Line Conducted Emissions Test

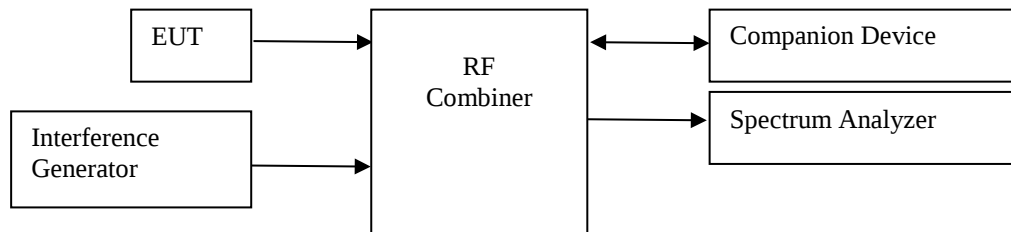
### Test Set-up 6:

According to EMC basic standard **ANSI C 63.4**



## 8.6 Monitoring Tests

### Test Set-up 6:

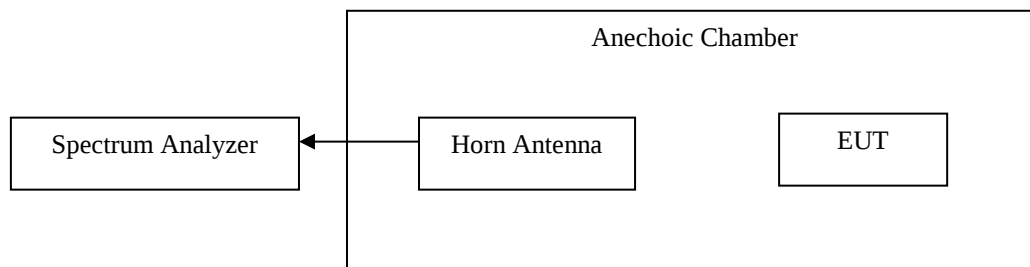


This test setup is used for all Monitoring and Time and Spectrum Access Procedure tests. The path loss from the signal generator to the EUT is measured with a power meter before the testing is started.

A clock signal is used to synchronize the Interference Generator to the start of the DECT frame, this signal always comes from the base station. If the EUT is a DECT Portable Part (i.e. a handset) the clock signal will come from the Companion Device.

## 8.7 Radiated Output Power Test

### Test Set-up 7:



This setup is used for measuring the radiated output power in a fully anechoic chamber with a measurement distance of 1m.

## 9 Detailed Test Results

### 9.1 Power Line Conducted Emissions

#### Measurement Procedure:

ANSI C63.4-2014 using 50 $\mu$ H/50 ohms LISN.

**Test Result:** not performed

**Measurement Data:** /

**Requirement:** FCC 15.207 (a)

## 9.2 Digital Modulation Techniques

The tested equipment is based on DECT technology, the only difference is that the channel allocation is modified to operate in the 1920-1930 MHz band.

The EUT use Multi Carrier / Time Division Multiple Access / Time division duplex and Digital GFSK modulation.

For further details see the operational description provided by the applicant.

### Requirement: FCC 15.319(b)

All transmissions must use only digital modulation techniques.

## 9.3 Labeling Requirements

See separate documents showing the label design and the placement of the label on the EUT.

### Requirement: FCC 15.19

The FCC identifier shall be displayed on the label, and the device(s) shall bear the following statement in a conspicuous location on the device or in the user manual if the device is too small:

*This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.*

The label itself shall be of a permanent type, not a paper label, and shall last the lifetime of the equipment.

## 9.4 Antenna Requirements

Does the EUT have detachable antenna(s)?

☐ Yes

☐ No

If detachable, is the antenna connector(s) non-standard?

☐ Yes

☐ No

The tested equipment has only integral antennas. The conducted tests were performed on a sample with a temporary antenna connector.

**Requirements: FCC 15.203, 14.204. 15.317**

## 9.5 Channel Frequencies

| UPCS CHANNEL    | FREQUENCY (MHz) |
|-----------------|-----------------|
| Upper Band Edge | 1930.000        |
| 0 (Highest)     | 1928.448        |
| 1               | 1926.720        |
| 2               | 1924.992        |
| 3               | 1923.264        |
| 4 (Lowest)      | 1921.536        |
| Lower Band Edge | 1920.000        |

**Requirement: FCC 15.301**

Within 1920-1930 MHz band for isochronous devices.

## 9.6 Automatic Discontinuation of Transmission

|                                                          |                                            |                                            |
|----------------------------------------------------------|--------------------------------------------|--------------------------------------------|
| Does the EUT transmit control and Signaling Information? | <input type="checkbox"/> Yes               | <input type="checkbox"/> No                |
| Type of EUT:                                             | <input type="checkbox"/> Initiating device | <input type="checkbox"/> Responding device |

The following tests simulate the reaction of the EUT in case of either absence of information to transmit or operational failure after a connection with the companion device is established.

| Number | Test                                | EUT Reaction | Verdict |
|--------|-------------------------------------|--------------|---------|
| 1      | Power removed from EUT              |              | N/P     |
| 2      | EUT switched Off                    |              | N/P     |
| 3      | Hook-On by companion device         |              | N/P     |
| 4      | Hook-On by EUT                      |              | N/P     |
| 5      | Power removed from companion device |              | N/P     |
| 6      | Companion device switched Off       |              | N/P     |

- A – Connection breakdown, Cease of all transmissions  
 B – Connection breakdown, EUT transmits control and signaling information  
 C – Connection breakdown, companion device transmits control and signaling information  
 N/A – Not applicable (the EUT does not have an on/off switch and can not perform Hook-On)

### Requirement: FCC 15.319(f)

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. This provision is not intended to preclude transmission of control and signaling information or use of repetitive code used by certain digital modulation technologies to complete frame or burst intervals.

## 9.7 Peak Power Output

### Measurement Procedure:

ANSI C63.17, clause 6.1.2.

### Test Results: Pass

### Measurement Data:

#### Maximum Conducted Output Power Internal Antenna

| Channel No. | Frequency (MHz) | Maximum Conducted Output Power (dBm) | Maximum Radiated Output Power (dBm) | Maximum Antenna Gain (dBi) |
|-------------|-----------------|--------------------------------------|-------------------------------------|----------------------------|
| 4           | 1921.536        | 20.12                                | 18.15                               | -1.97                      |
| 2           | 1924.992        | 20.15                                | 17.75                               | -2.40                      |
| 0           | 1928.448        | 20.12                                | 18.02                               | -2.01                      |

#### Maximum Conducted Output Power MMCX Connector

| Channel No. | Frequency (MHz) | Maximum Conducted Output Power (dBm) |
|-------------|-----------------|--------------------------------------|
| 4           | 1921.536        | 19.80                                |
| 2           | 1924.992        | 19.81                                |
| 0           | 1928.448        | 19.76                                |

For this test it was also checked that the input voltage variation of 85 and 115% of nominal value did not have any effect on the measured output power, neither radiated nor conducted.

### Limit:

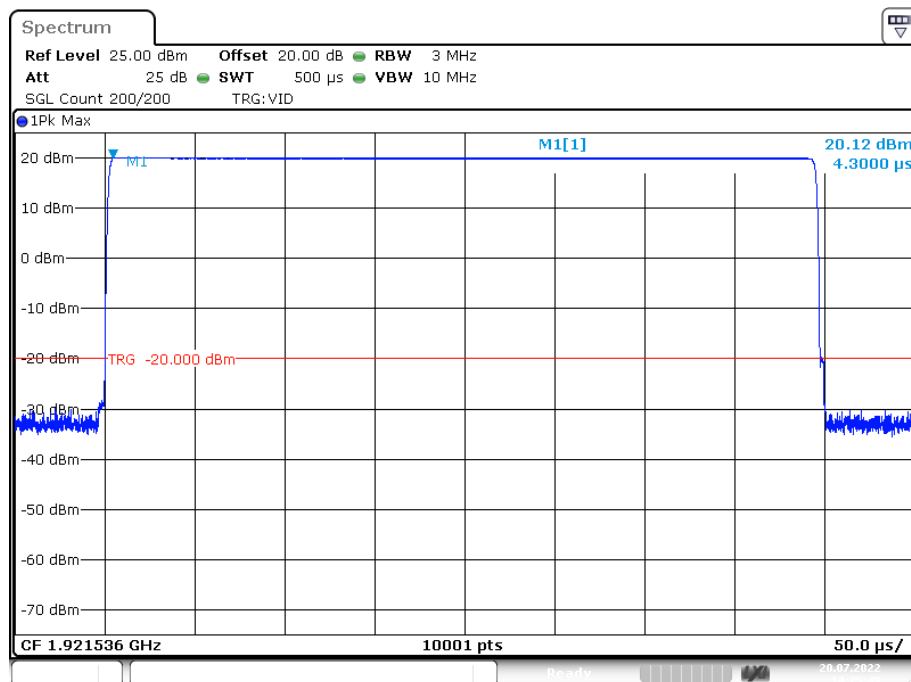
Conducted:  $100 \mu\text{W} \times \text{SQRT}(B)$  where B is the measured Emission Bandwidth in Hz  
 FCC 15.319(c)(e): 20.8 dBm (120 mW)  
 RSS-213, Issue 2: 20.6 dBm (114 mW)  
 The antenna gain is below 3 dBi.

### Requirements: FCC 15.319(c)(e). RSS-213, Issue 2

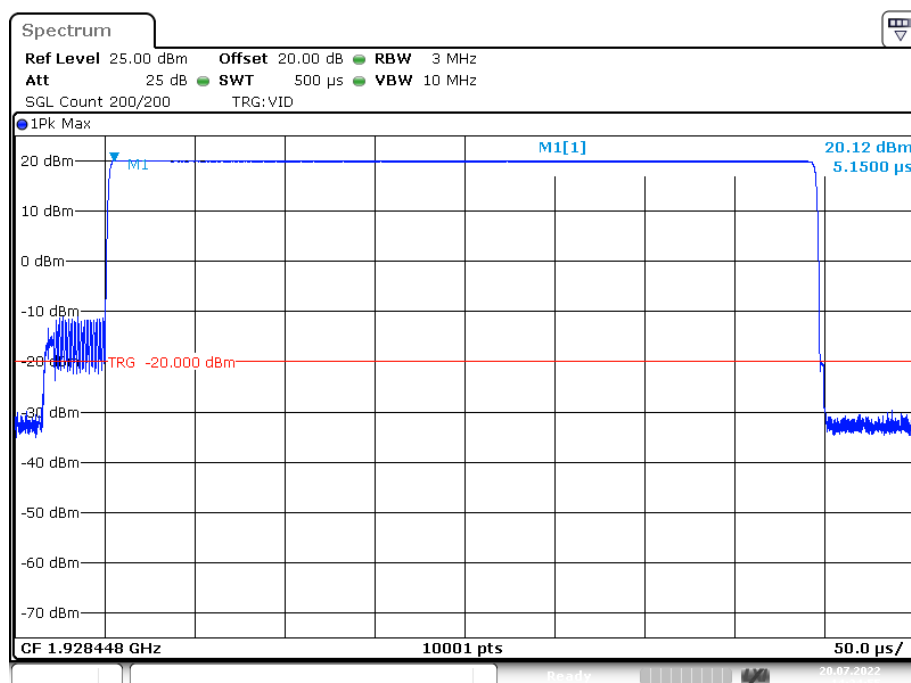
Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in Hertz.

The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

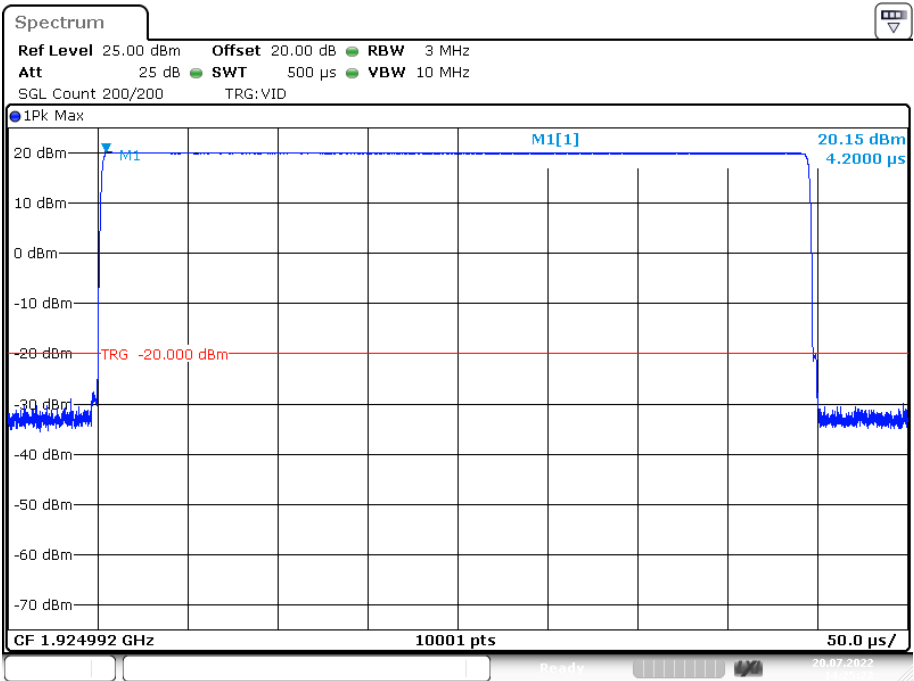
## Conducted Peak Output Power Internal Antenna



## Lower Channel

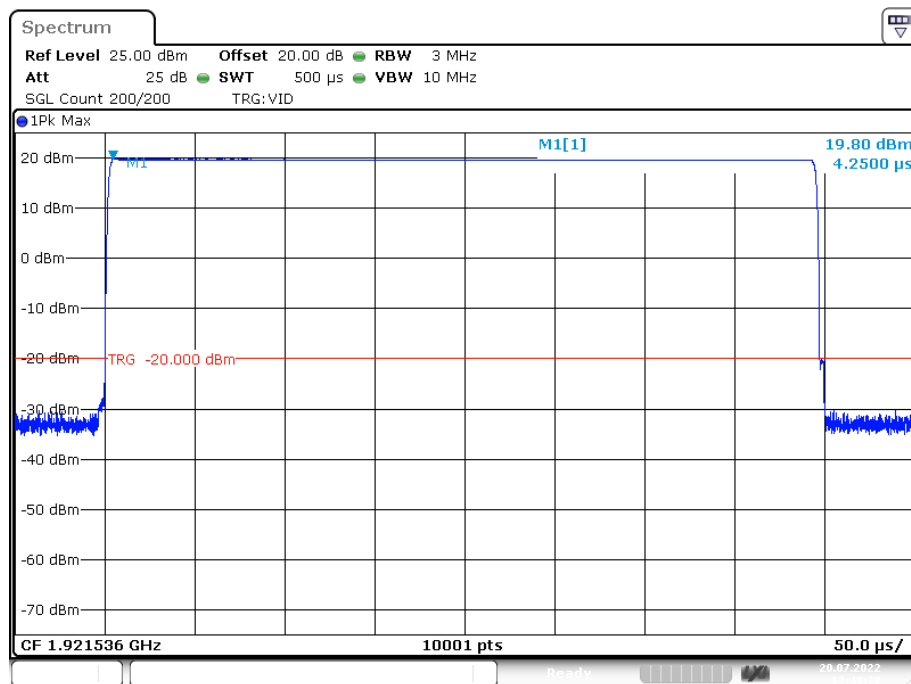


## Upper Channel

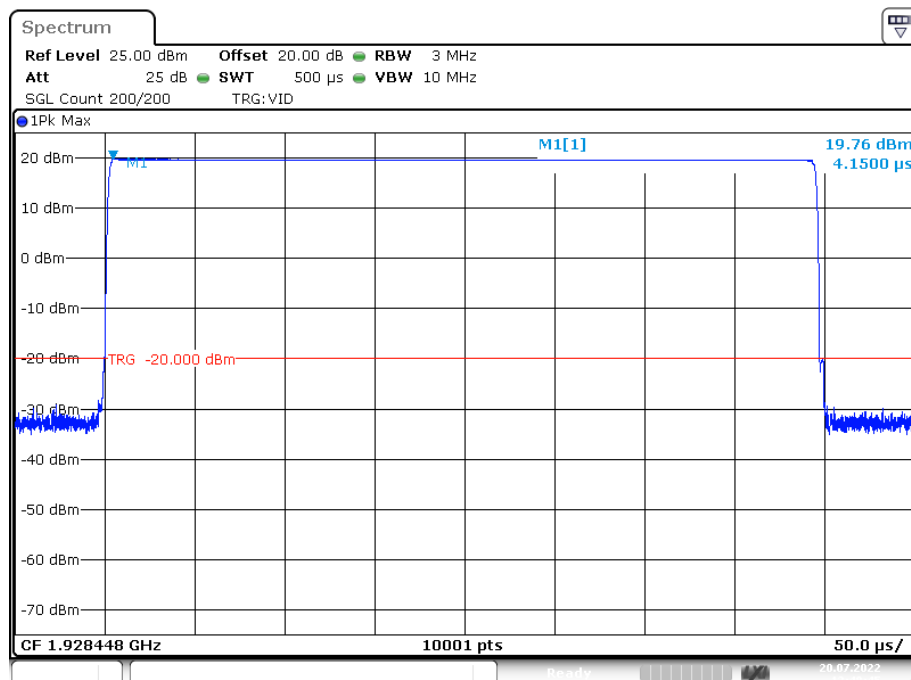


Middle Channel

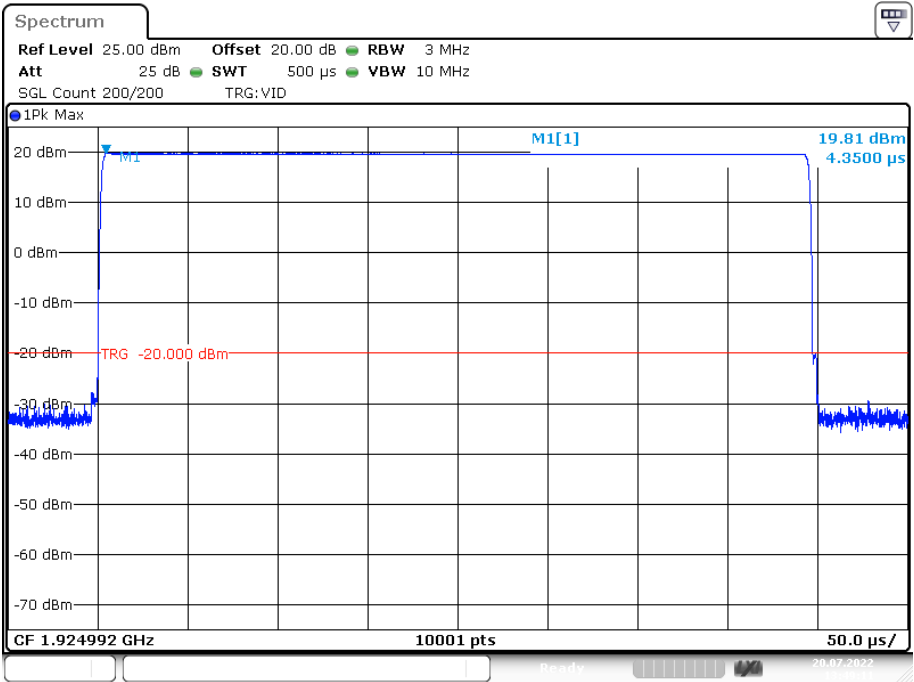
## Conducted Peak Output Power MMCX Connector



### Lower Channel

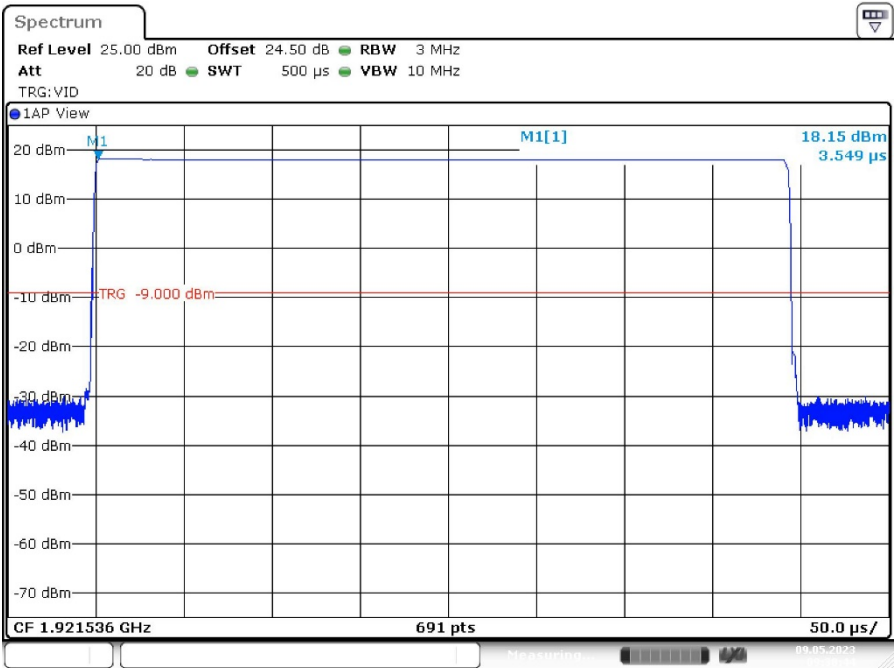


### Upper Channel

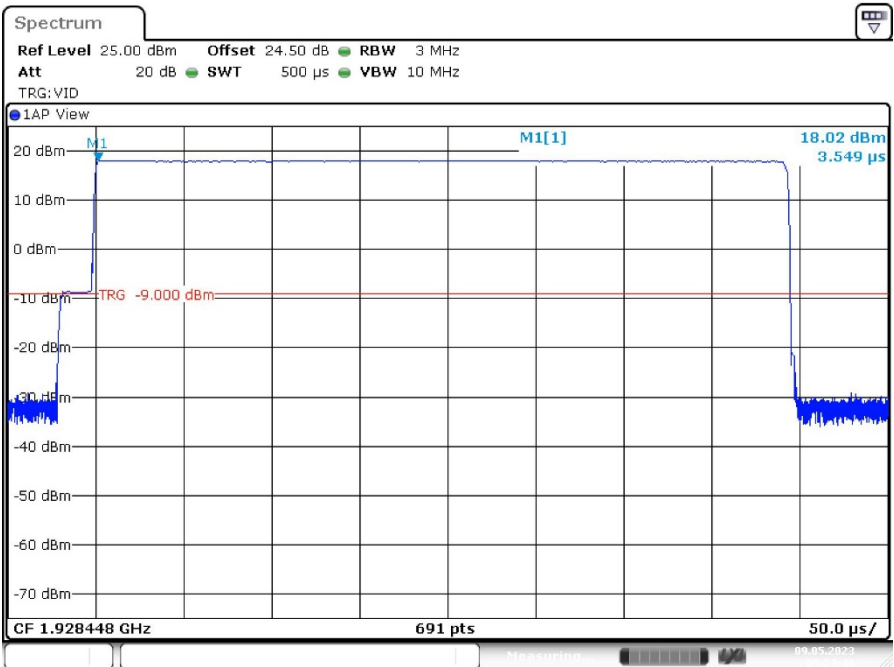


Middle Channel

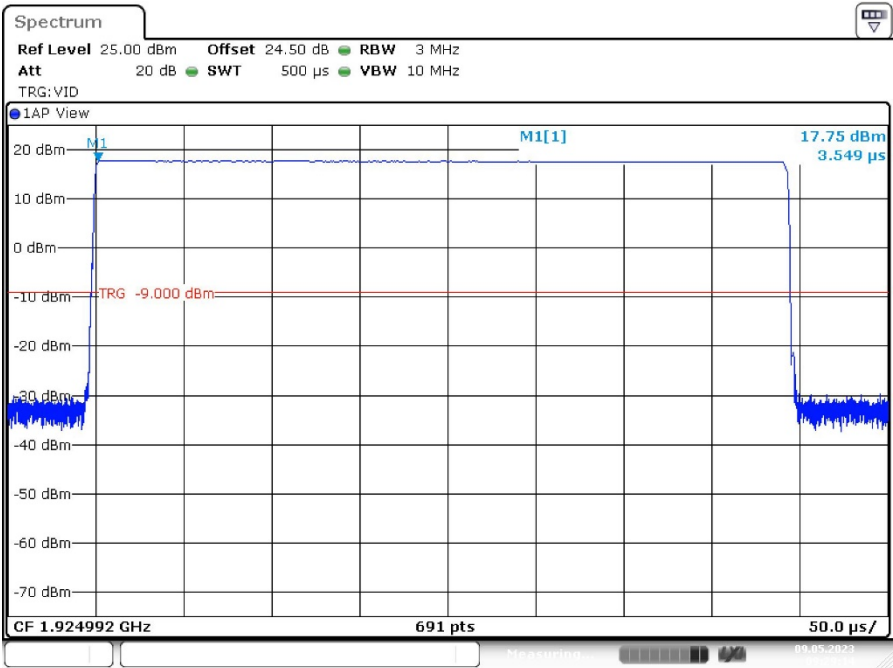
Radiated Peak Output Power Internal Antenna



Lower Channel



Upper Channel



Middle Channel

## 9.8 Emission Bandwidth B

### Measurement Procedure:

ANSI C63.17, clause 6.1.3.

**Test Results: not performed**

### Measurement Data:

| Channel No. | Frequency (MHz) | 26 dB Bandwidth B (kHz) |
|-------------|-----------------|-------------------------|
| 4           | 1921.536        | N/P                     |
| 0           | 1928.448        | N/P                     |

| Channel No. | Frequency (MHz) | 20 dB Bandwidth B (kHz) |
|-------------|-----------------|-------------------------|
| 2           | 1924.992        | N/P                     |

| Channel No. | Frequency (MHz) | 6 dB Bandwidth B (kHz)  |
|-------------|-----------------|-------------------------|
| 4           | 1921.536        | N/A                     |
| 0           | 1928.448        | N/A                     |
| Channel No. | Frequency (MHz) | 12 dB Bandwidth B (kHz) |
| 4           | 1921.536        | N/A                     |
| 0           | 1928.448        | N/A                     |

### Requirement: FCC 15.323(a)

The 26 dB Bandwidth B shall be larger than 50 kHz and less than 2.5 MHz.

### Requirement: RSS-213 Issue 2, clause 6.4

The 20 dB Bandwidth B shall be larger than 50 kHz and less than 2.5 MHz.

No requirement for 6 dB and 12 dB Bandwidth. These values are only used for testing Monitoring Bandwidth if the Simple Compliance test fails (ANSI C63.17, clause 7.4).

## 9.9 Power Spectral Density

### Measurement Procedure:

ANSI C63.17, clause 6.1.5.

**Test Results: not performed**

**Measurement Data: /**

| Channel No. | Frequency (MHz) | Power Spectral Density (dBm/3kHz) |
|-------------|-----------------|-----------------------------------|
| 4           |                 |                                   |
| 0           |                 |                                   |

Averaged over 100 sweeps.

### Requirement: FCC 15.319(d)

The Power Spectral Density shall be less than 3 mW/3kHz (4.77 dBm) when averaged over at least 100 sweeps.

## 9.10 In-Band Unwanted Emissions, Conducted

### Measurement Procedure:

ANSI C63.17, clause 6.1.6.1.

**Test Results: not performed**

**Measurement Data: /**

**Requirement: FCC 15.323(d)**

|                           |                                                                   |
|---------------------------|-------------------------------------------------------------------|
| B < f2 ≤ 2B:              | less than or equal to 30 dB below max. permitted peak power level |
| 2B < f2 ≤ 3B:             | less than or equal to 50 dB below max. permitted peak power level |
| 3B < f2 ≤ UPCS Band Edge: | less than or equal to 60 dB below max. permitted peak power level |

## 9.11 Out-of-Band Emissions, Conducted

### Measurement Procedure:

ANSI C63.17, clause 6.1.6.2.

### Test Results: Pass

### Measurement Data:

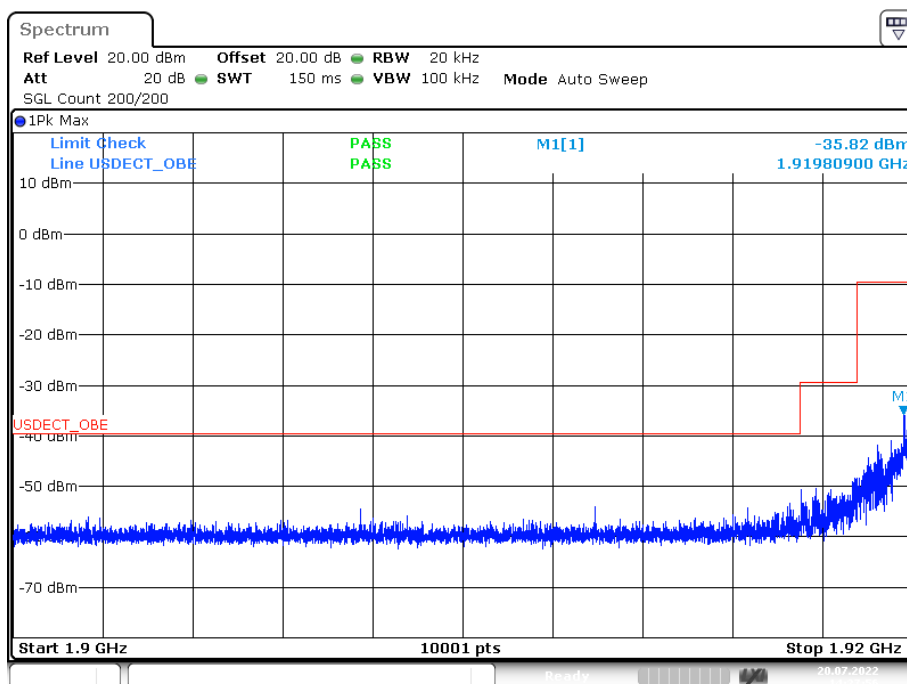
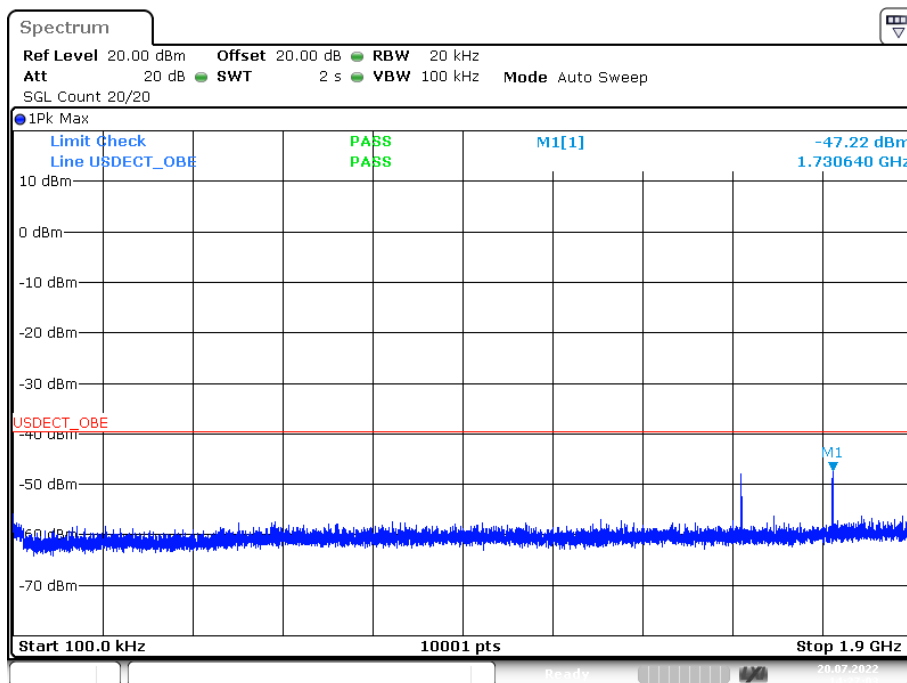
See plots.

### Requirement: FCC 15.323(d)

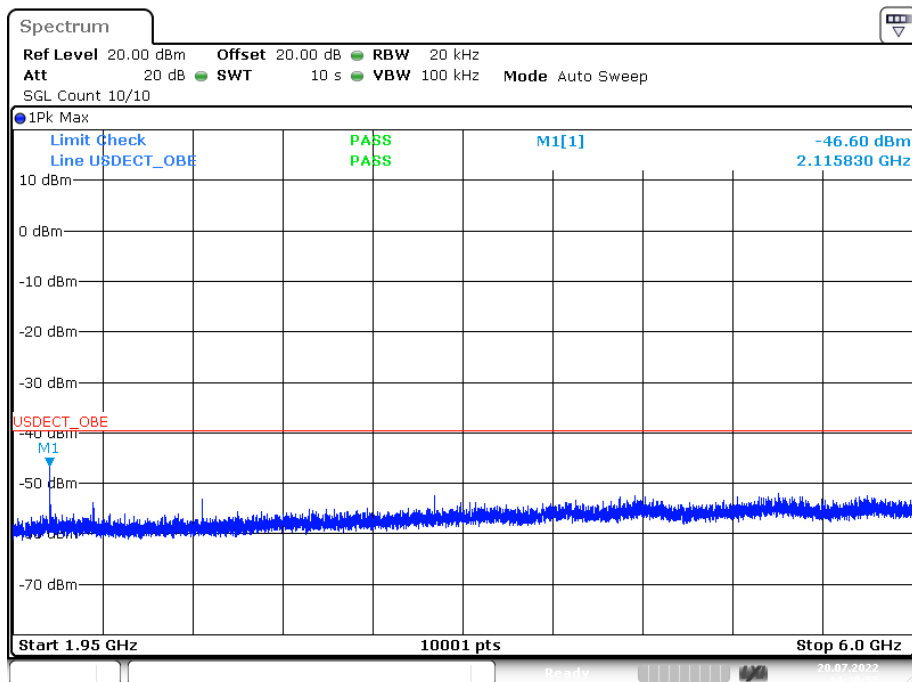
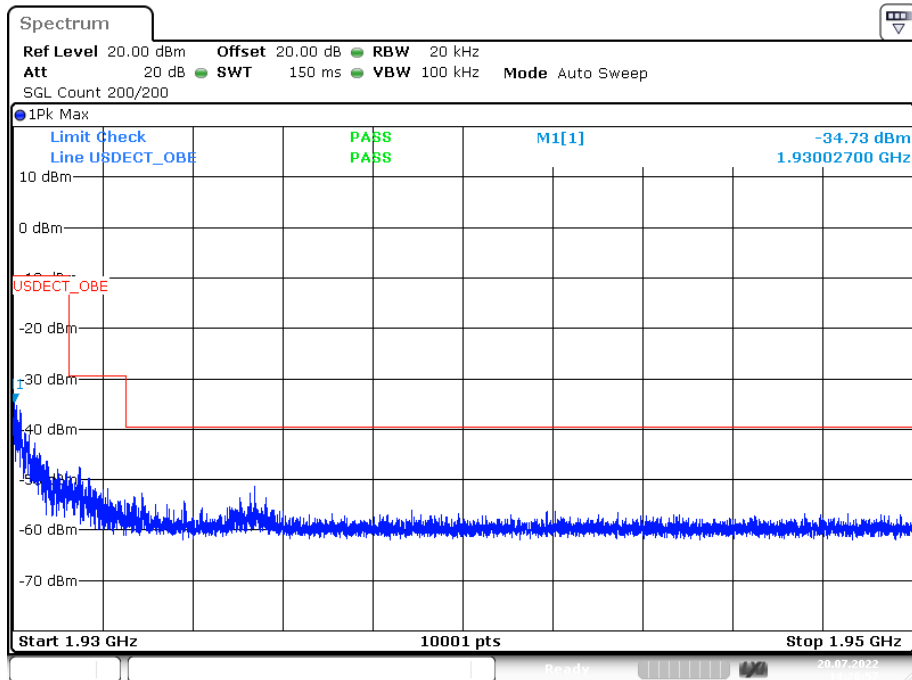
|                                                           |                  |
|-----------------------------------------------------------|------------------|
| $f \leq 1.25$ MHz outside UPCS band:                      | $\leq -9.5$ dBm  |
| $1.25 \text{ MHz} \leq f \leq 2.5$ MHz outside UPCS band: | $\leq -29.5$ dBm |
| $f \geq 2.5$ MHz outside UPCS band:                       | $\leq -39.5$ dBm |

## Out-of-Band Unwanted Emissions, Conducted, Internal Antenna

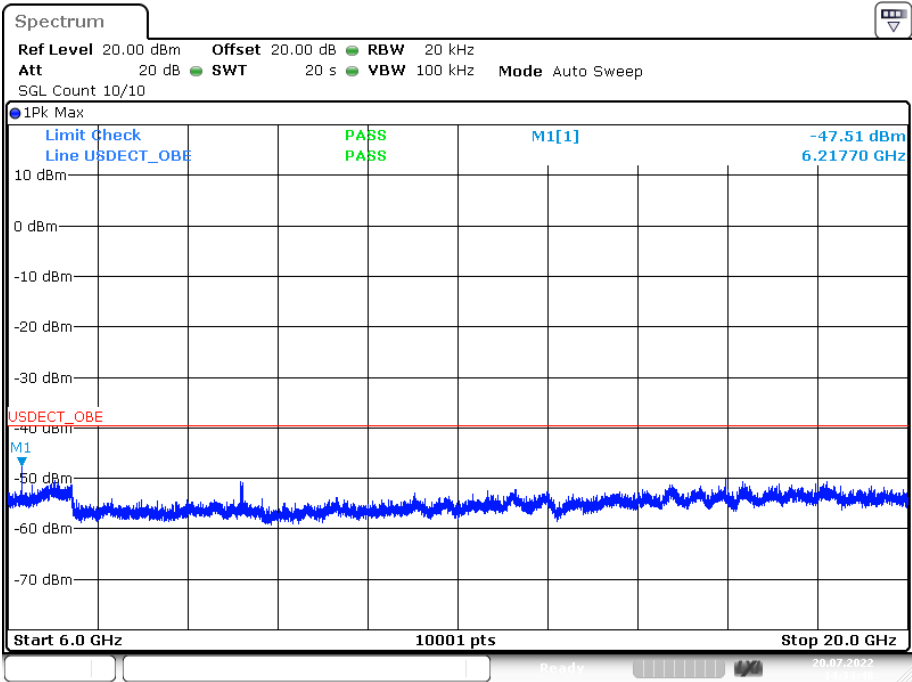
Upper and Lower Channel:



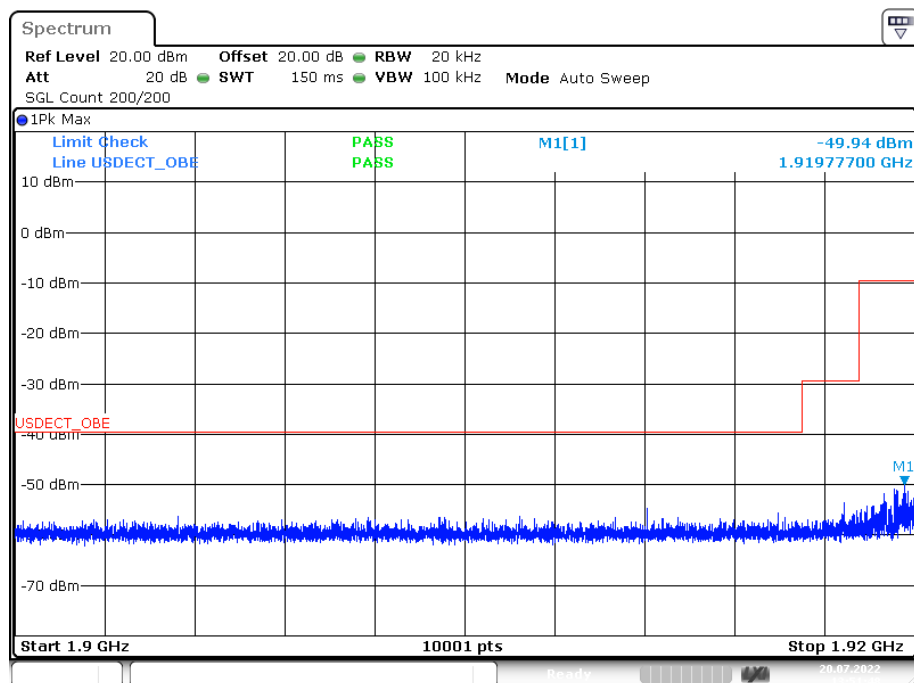
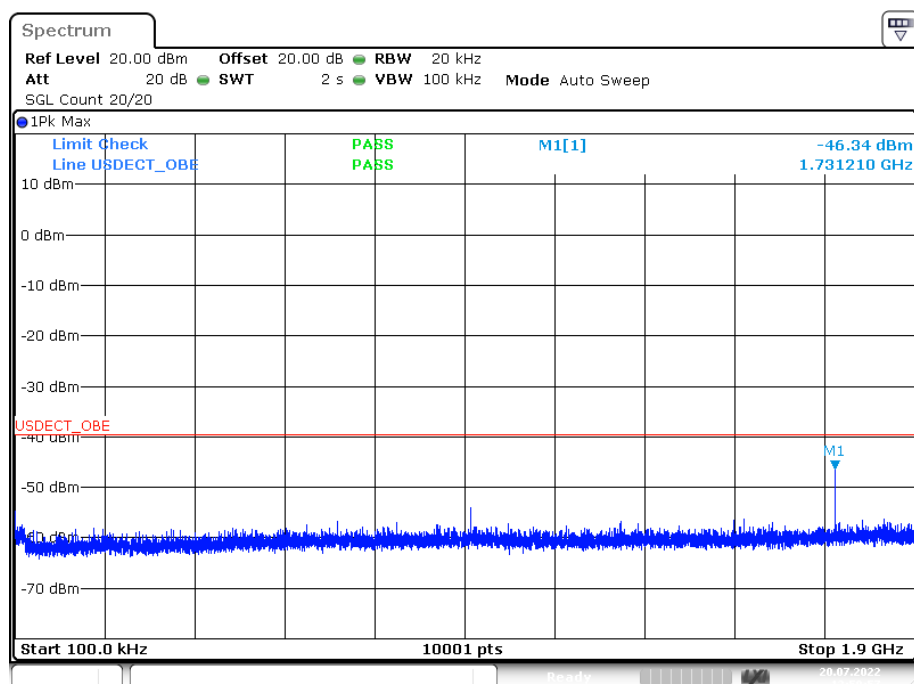
## Out-of-Band Unwanted Emissions, Conducted, Internal Antenna



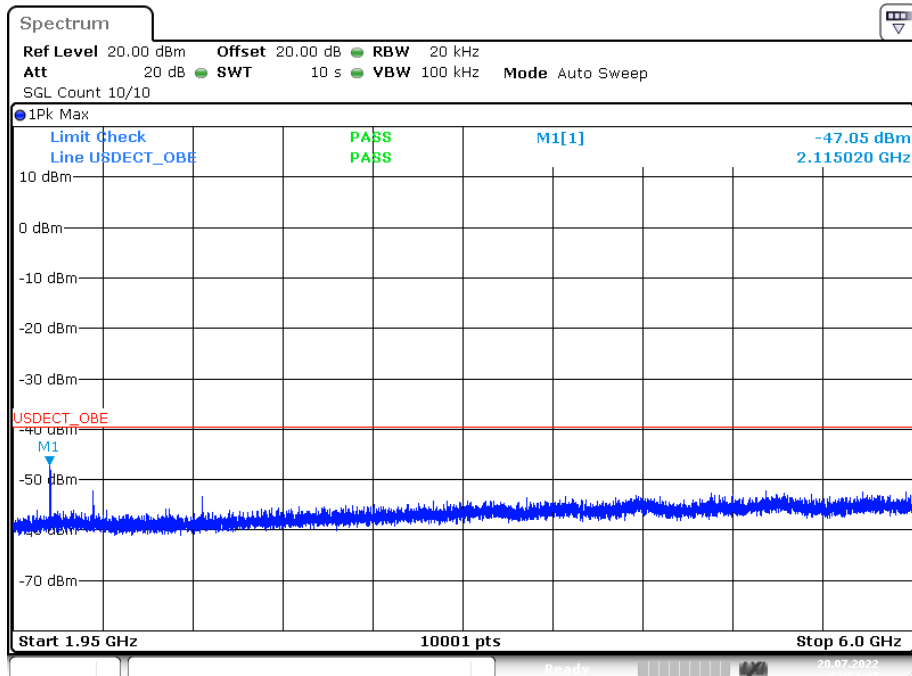
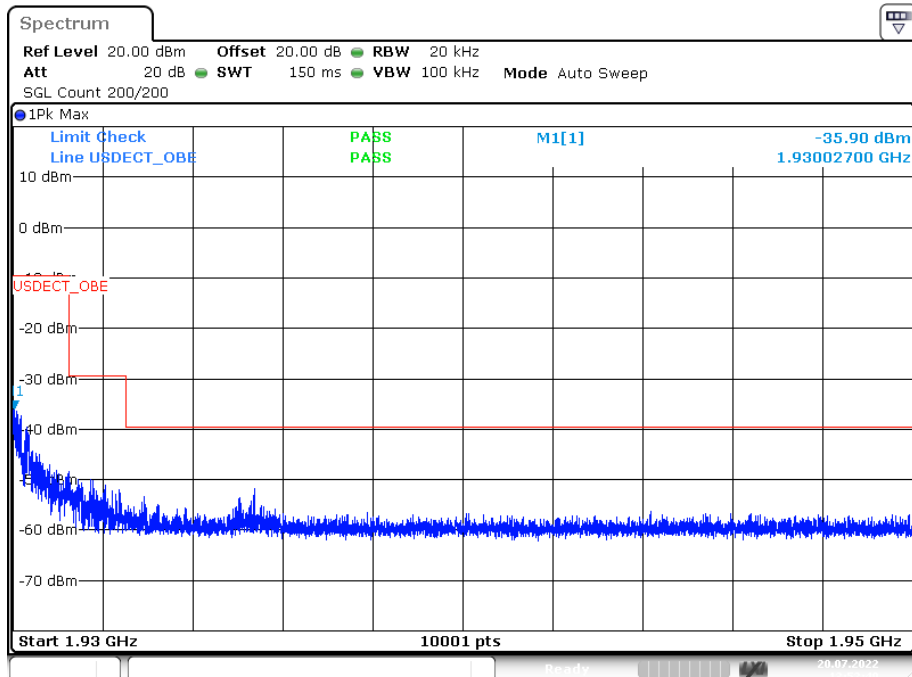
Out-of-Band Unwanted Emissions, Conducted, Internal Antenna



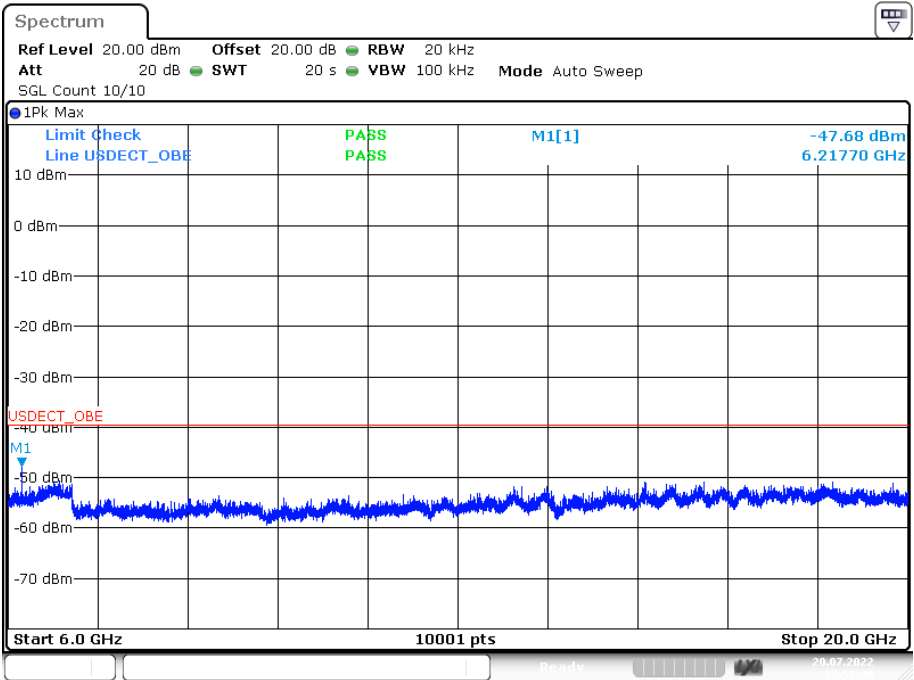
## Out-of-Band Unwanted Emissions, Conducted, MMCX Connector



## Out-of-Band Unwanted Emissions, Conducted, MMCX Connector



## Out-of-Band Unwanted Emissions, Conducted, MMCX Connector



The BS spurious out-of-band transmission level is below the indicated limit.

## 9.12 Carrier Frequency Stability

### Measurement Procedure:

ANSI C63.17, clause 6.2.1.

**Requirement: FCC 15.323(f)**

**Test Results: Pass**

### Measurement Data:

The Frequency Stability is measured with the CMD65. The CMD65 was logged by a computer programmed to get the new readings as fast as possible (about 3 readings per second) over the noted time period or number of readings. The peak-to-peak difference was recorded and the mean value and deviation in ppm was calculated.

The Carrier Frequency Stability over power Supply Voltage and over Temperature is measured also with the CMD65.

#### Carrier Frequency Stability over Time at Nominal Temperature

| Average Mean Carrier Frequency (MHz) | Max. Diff. (kHz) | Min. Diff. (kHz) | Max Dev. (ppm) | Limit (ppm) |
|--------------------------------------|------------------|------------------|----------------|-------------|
| 1924.989                             | 3.43             | -18.3            | 8.0            | ±10         |

Deviation ppm = ((Max.Diff. – Mean.Diff.) / Mean Carrier Freq.) x 10<sup>6</sup>

Deviation (ppm) is calculated from 3000 readings with the CMD65.

#### Carrier Frequency Stability over Power Supply at Nominal Temperature

| Voltage   | Measured Carrier Frequency (MHz) | Difference (kHz) | Deviation (ppm) | Limit (ppm) |
|-----------|----------------------------------|------------------|-----------------|-------------|
| 5.00 V DC |                                  |                  |                 | ±10         |
| 5.75 V DC |                                  |                  |                 |             |
| 4.25 V DC |                                  |                  |                 |             |

Deviation ppm = ((Mean – Measured frequency) / Mean) x 10<sup>6</sup>

#### Carrier Frequency Stability over Temperature

| Temperature | Measured Carrier Frequency (MHz) | Difference (kHz) | Deviation (ppm) | Limit (ppm) |
|-------------|----------------------------------|------------------|-----------------|-------------|
| T = +20°C   | 1924.989                         | Ref              | Ref             | ±10         |
| T = -30°C   | 1924.989                         | 0.0              | 0.0             |             |
| T = +80°C   | 1925.007                         | 18 kHz           | 9.4             |             |

Deviation ppm = ((Mean – Measured frequency) / Mean) x 10<sup>6</sup>

### 9.13 Frame Repetition Stability

**Measurement Procedure:**

ANSI C63.17, clause 6.2.2.

**Test Results: not performed**

**Measurement Data:**

The Frame Repetition Stability is measured with the CMD65. The Frame Repetition Stability is 3 times the standard deviation.

| Carrier Frequency (MHz) | Mean (Hz) | Standard Deviation (ppm) | Frame Repetition Stability (ppm) |
|-------------------------|-----------|--------------------------|----------------------------------|
| 1924.992                |           |                          |                                  |

**Limit:**

|                            |                |
|----------------------------|----------------|
| Frame Repetition Stability | ±10 ppm (TDMA) |
|----------------------------|----------------|

Ref. FCC 15.323(e). ANSI C63.17, clause 6.2.2.

### 9.14 Frame Period and Jitter

**Measurement Procedure:**

ANSI C63.17, clause 6.2.3.

**Test Results: not performed**

**Measurement Data:**

The Frame Repetition Stability is measured with the CMD65

| Carrier Frequency (MHz) | Frame Period (ms) | Max Jitter (µs) | 3xStandard Deviation of Jitter (µs) |
|-------------------------|-------------------|-----------------|-------------------------------------|
| 1924.992                | 10.000            |                 |                                     |

Max Jitter =  $(1/(\text{Frame Period} + \text{Pk-Pk})/2) - (1/\text{Frame Period})$ , when Pk-Pk and Frame Period are in Hz.  
 $3x\text{St.Dev. Jitter } 3x(1/(\text{Frame Period} + \text{St.Dev})) - (1/\text{St.Dev}) \times 10^6$

**Limit:**

|                           |             |
|---------------------------|-------------|
| Frame Period              | 20 or 10 ms |
| Max Jitter                | 25 µs       |
| 3 times St.Dev. of Jitter | 12.5 µs     |

Ref. FCC 15.323(e). ANSI C63.17, clause 6.2.3.

## 9.15 Monitoring Threshold, Least Interfered Channel

### Measurement Procedure:

ANSI C63.17, clause 7.3.2

### Monitoring Threshold limits:

Lower Threshold:

$$T_L = 15 \log B - 184 + 30 - P_{EUT} \text{ (dBm)}$$

B is measured Emission Bandwidth in Hz

$P_{EUT}$  is measured Transmitter Power in dBm

### Calculated value:

|                 |  |
|-----------------|--|
| Lower Threshold |  |
|-----------------|--|

### Least Interfered Channel (LIC) Procedure Test, FCC 15.323(c)(2) and (c)(5)

| ANSI C63.17 clause 7.3.2 ref.                           | Observation | Verdict    |
|---------------------------------------------------------|-------------|------------|
| b) $f_1 T_L + 13 \text{ dB}$ , $f_2 T_L + 6 \text{ dB}$ |             | <b>N/P</b> |
| c) $f_1 T_L + 6 \text{ dB}$ , $f_2 T_L + 13 \text{ dB}$ |             | <b>N/P</b> |
| d) $f_1 T_L + 7 \text{ dB}$ , $f_2 T_L$                 |             | <b>N/P</b> |
| e) $f_1 T_L$ , $f_2$ at $T_L + 7 \text{ dB}$            |             | <b>N/P</b> |

**Measurement Procedure:**

ANSI C63.17, clause 7.3.3

**Selected Channel Confirmation, FCC 15.323(c)(1) and (5)**

| ANSI C63.17 clause 7.3.3              | Observation | Verdict    |
|---------------------------------------|-------------|------------|
| b) Shall <b>not</b> transmit on $f_1$ |             | <b>N/P</b> |
| d) Shall <b>not</b> transmit on $f_2$ |             | <b>N/P</b> |

Comment: This test is only applicable for EUTs that can be an initiating device.

## 9.16 Threshold Monitoring Bandwidth

This test is only required if a dedicated monitoring receiver is used. If the test is not carried out the manufacturer shall declare and provide evidence that the monitoring is made through the radio receiver used for communication.

### Measurement Procedure:

Simple Compliance Test, ANSI C63.17, clause 7.4.1

More Detailed Test, ANSI C63.17, clause 7.4.2

The test is passed if **either** the Simple Compliance Test or the More Detailed Test is passed.

During this test the spectrum analyzer is observed visually to see if the EUT transmits or not.

### Test Results:

| Test performed                             | Observation | Verdict |
|--------------------------------------------|-------------|---------|
| Simple Compliance Test, at $\pm 30\%$ of B | N/A         | N/A     |
| More Detailed Test, at -6 dB points        | N/A         | N/A     |
| More Detailed Test, at -12 dB points       | N/A         | N/A     |

The More Detailed Test must be pass at both the -6dB and -12 dB points if the Simple Compliance Test fails.

**Comment:** The tested EUT uses the same receiver for monitoring and communication, this test is therefore not required.

### Limits: FCC 15.323(c)(7):

The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission.

## 9.17 Reaction Time and Monitoring Interval

### Measurement Procedure:

ANSI C63.17, clause 7.5

### Test Results:

By administrative commands and out-of-operating region interference, the EUT is restricted to operate on carrier frequencies  $f_1$  and  $f_2$ .

Time-synchronized pulsed interference was then applied on  $f_1$  at pulsed levels TL + UM to check that the EUT does not transmit. The level was raised 6 dB for part d) with 35  $\mu$ s pulses. Additionally a CW signal was applied on  $f_2$  with a level of TL.

The pulses are synchronized with the EUT timeslots and applied cantered within all timeslots.

| Pulse Width, ref. to ANSI C63.17 clause 7.5                                                               | Observation | Verdict |
|-----------------------------------------------------------------------------------------------------------|-------------|---------|
| c) > largest of 50 $\mu$ s and $50 \times \text{SQRT}(1.25/B)$                                            |             | N/P     |
| d) > largest of 35 $\mu$ s and $35 \times \text{SQRT}(1.25/B)$<br>and with interference level raised 6 dB |             | N/P     |

**Comment:** Since B is larger than 1.25 MHz, the test was performed with pulse lengths of 50  $\mu$ s and 35  $\mu$ s.

### Limits: FCC 15.323(c)(1), (5) and (7)

The maximum reaction time must be less than  $50 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$  microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds.

If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be  $35 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$  microseconds but shall not be required to be less than 35 microseconds.

## 9.18 Time and Spectrum Window Access Procedure

This requirement is only for EUTs which transmit unacknowledged control and signaling information

### Measurement Procedure:

Timing for EUTs using control and signaling channel type transmissions: ANSI C63.17, clause 8.1

Test results:

| Access Criteria, ref. to ANSI C63.17 clause 8.1.1                                                                                                                                            | Observation | Verdict |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|
| b) Check that the EUT transmits on the interference free time slot                                                                                                                           |             | N/P     |
| b) The EUT must terminate or pause in its repetitive transmission of the control and signaling channel on the open channel to repeat the access criteria not less frequently than every 30 s |             | N/P     |

If FCC 15.323(c)(6) option Random Waiting Interval is NOT implemented

| Access Criteria, ref. to ANSI C63.17 clause 8.1.2                                                                    | Observation | Verdict |
|----------------------------------------------------------------------------------------------------------------------|-------------|---------|
| b) Check that the EUT changes to interference free time slot when interference is introduced on the time slot in use |             | N/P     |

If FCC 15.323(c)(6) option Random Waiting Interval is implemented

| Access Criteria, ref. to ANSI C63.17 clause 8.1.3                                                              | Observation | Verdict |
|----------------------------------------------------------------------------------------------------------------|-------------|---------|
| b-d) Check that the EUT uses random waiting interval before continuing transmission on an interfered time slot |             | N/P     |

Comment: The tested EUT does not support the Random Waiting Interval option.

### Limits:

#### FCC 15.323(c)(4):

Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgments must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signaling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which the time access criteria must be repeated.

#### FCC 15.323(c)(6):

If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available.

## 9.19 Acknowledgments and Transmission duration

### Measurement Procedure:

Acknowledgments: ANSI C63.17, clause 8.2.1

Transmission Duration: ANSI C63.17, clause 8.2.2

During the test **Initial transmission without acknowledgments** the signal from the EUT to the companion device is blocked by circulators in addition to the tunable attenuator.

The test **Transmission time after loss of acknowledgments** is performed by cutting-off the signal from the companion device by a RF switch the time until the EUT stops transmitting.

The **Transmission Duration** test is performed by monitoring the slot in use and measuring the time until the EUT changes to a different slot.

### Test Results:

#### Acknowledgments

| Test ref. to ANSI C63.17 clause 8.2.1              | Observation | Verdict |
|----------------------------------------------------|-------------|---------|
| a) Initial transmission without acknowledgments    |             | N/P     |
| c) Transmission time after loss of acknowledgments |             | N/P     |

#### Transmission Duration

| Test ref. to ANSI C63.17 clause 8.2.2                      | Observation | Verdict |
|------------------------------------------------------------|-------------|---------|
| b) Transmission duration on same time and frequency window |             | N/P     |

Comment: /

### Limits: FCC 15.323(c)(3) and (4)

Occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

Once access to specific combined time and spectrum windows is obtained an acknowledgment from a system participant must be received by the initiating transmitter within one second or transmission must cease.

Periodic acknowledgments must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signaling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which the time access criteria must be repeated.

## 9.20 Dual Access Criteria Check

### Measurement Procedure:

EUTs that do not implement the Upper Threshold: ANSI C62.17, clause 8.3.1

EUTs that implement the Upper Threshold: ANSI C62.17, clause 8.3.2

This test is required for equipment that uses the access criteria in FCC 15.323(c)(10).

### Test Results:

#### EUTs that do NOT implement the LIC algorithm:

| Test ref. to ANSI C63.17 clause 8.3.1                                                                                         | Observation | Verdict |
|-------------------------------------------------------------------------------------------------------------------------------|-------------|---------|
| b) EUT is restricted to a single carrier $f_1$ for TDMA systems. The test is pass if the EUT can set up a communication link. |             | N/P     |
| c) d) No transmission on interference-free <b>receive</b> time/spectrum window. All transmit slots blocked                    |             | N/P     |
| e) f) No transmission on interference-free <b>transmit</b> time/spectrum window. All transmit slots blocked                   |             | N/P     |

#### EUTs that implement the LIC algorithm:

| Test ref. to ANSI C63.17 clause 8.3.2                                                                                         | Observation | Verdict |
|-------------------------------------------------------------------------------------------------------------------------------|-------------|---------|
| b) EUT is restricted to a single carrier $f_1$ for TDMA systems. The test is pass if the EUT can set up a communication link. |             | N/P     |
| c) d) Transmission on interference-free <b>receive</b> time/spectrum window.                                                  |             | N/P     |
| e) f) Transmission on interference-free <b>transmit</b> time/spectrum window.                                                 |             | N/P     |

Comment: This test is only applicable for EUTs that can be an initiating device of a duplex connection.

### Limits: FCC 15.323(c)(10)

An initiating device may attempt to establish a duplex connection by monitoring both, its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.

## 9.21 Alternative monitoring interval

Test procedure described in ANSI C63.17, clause 8.4.

This test is required if the EUT implements the provision of FCC 15.323(c)(11).

### Test Result:

Not tested. The tested EUT does not implement this provision. See manufacturer's declaration.

## 9.22 Spurious Emissions (Radiated)

### Measurement Procedure:

FCC 15.209, FCC 15.109

**Test Result: not performed**

### Measurement Data: /

### Requirement: FCC 15.109(b)

|                 |                     |
|-----------------|---------------------|
| 30 – 88 MHz:    | 90 $\mu\text{V/m}$  |
| 88 – 216 MHz:   | 150 $\mu\text{V/m}$ |
| 216 – 960 MHz:  | 210 $\mu\text{V/m}$ |
| 960 – 1000 MHz: | 300 $\mu\text{V/m}$ |

## 9.23 Receiver Spurious Emissions

### Measurement Procedure:

Industry Canada RSS-213 paragraph 6.8 and RSS-GEN paragraphs 4.8 and 6.

### Test results:

| Frequency MHz | Carrier No. | Measured Value Conducted dBm | Conducted Limit dBm | Margin dB |
|---------------|-------------|------------------------------|---------------------|-----------|
| 30 - 1000     | all         |                              | -57                 |           |
| > 1000        | all         |                              | -53                 |           |

### Requirements: RSS-GEN Issue 2, clause 6

The measurement can be performed either radiated or conducted.

**When measured conducted:** No spurious signals appearing at the antenna terminals shall exceed 2 nW per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nW above 1 GHz.

**When measured radiated:** See table 1 in RSS-GEN Issue2, clause 6.

## 10 Test equipment and ancillaries used for tests

To simplify the identification of the test equipment and/or ancillaries which were used, the reporting of the relevant test cases only refer to the test item number as specified in the table below.

| No.              | Equipment         | Manufacturer | Type     | Serial No. | Inv. No.  | Kind of Calib. | Last Calib. | Next Calib. |
|------------------|-------------------|--------------|----------|------------|-----------|----------------|-------------|-------------|
| <b>Conducted</b> |                   |              |          |            |           |                |             |             |
| L-1              | Spectrum Analyzer | R&S          | FSV30    | 100763     | 300003950 | k              | 12/2022     | 12/2023     |
| L-2              | Signal Generator  | R&S          | SMBV100A | 257858     | 300004529 | vlk!           | 12/2020     | 12/2023     |
| L-3              | Signaling Unit    | R&S          | CMD 65   | 825486     | 300003611 | vlk!           | 03/2021     | 03/2023     |
| L-4              | Power Meter       | R&S          | NRP      | 100212     | 300003780 | vlk!           | 12/2022     | 12/2024     |
| L-5              | Power Sensor      | R&S          | NRP-Z22  | 100031     | 400000188 | vlk!           | 12/2021     | 12/2023     |

| No.                                  | Equipment    | Manufacturer | Type     | Serial No. | Inv. No.   | Kind of Calib. | Last Calib. | Next Calib. |
|--------------------------------------|--------------|--------------|----------|------------|------------|----------------|-------------|-------------|
| <b>Power Line Conducted Emission</b> |              |              |          |            |            |                |             |             |
| G-1                                  | EMI Receiver | R&S          | ESCI 3   | 100083     | 3000003312 | k              | 12/2022     | 12/2023     |
| G-2                                  | VISN         | R&S          | ESH 3-Z5 | 893045/004 | 300000584  | vlk!           | 12/2022     | 12/2024     |

| No.                      | Equipment         | Manufacturer | Type      | Serial No. | Inv. No.  | Kind of Calib. | Last Calib. | Next Calib. |
|--------------------------|-------------------|--------------|-----------|------------|-----------|----------------|-------------|-------------|
| <b>Radiated Emission</b> |                   |              |           |            |           |                |             |             |
| F-1                      | EMI Receiver      | R&S          | ESR3      | 102587     | 300005771 | k              | 12/2022     | 12/2023     |
| F-2                      | Spectrum Analyzer | R&S          | FSU26     | 200809     | 300003874 | k              | 12/2022     | 12/2023     |
| F-3                      | Trilog Antenna    | Schwarzbeck  | VULB9163  | 371        | 300003854 | vlk!           | 11/2020     | 11/2023     |
| F-4                      | Horn antenna      | Schwarzbeck  | BBHA9120B | 188        | 300003896 | vlk!           | 04/2022     | 04/2024     |

### **Agenda:** Kind of Calibration

k calibration / calibrated  
 ne not required (k, ev, izw, zw not required)  
 ev periodic self verification  
 Ve long-term stability recognized  
 vlk! Attention: extended calibration interval  
 NK! Attention: not calibrated

EK limited calibration  
 zw cyclical maintenance (external cyclical maintenance)  
 izw internal cyclical maintenance  
 g blocked for accredited testing

\*) next calibration ordered / currently in progress

## **11 Observations**

No observations exceeding those reported with the single test cases have been made.

### **Annex A: Photographs of the Test Set-up**

See additional PDF document Annex A-C.

### **Annex B: External Photographs of the EUT**

See additional PDF document Annex A-C.

### **Annex C: Internal Photographs of the EUT**

See additional PDF document Annex A-C.

**Annex D: Document History**

| Version | Applied Changes            | Date of Release |
|---------|----------------------------|-----------------|
| -A      | Correction of antenna gain | 2023-05-09      |
|         |                            |                 |

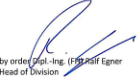
## Annex E: Further Information

### Glossary

|          |   |                                  |
|----------|---|----------------------------------|
| DUT      | - | Device under Test                |
| EMC      | - | Electromagnetic Compatibility    |
| EUT      | - | Equipment under Test             |
| FCC      | - | Federal Communication Commission |
| FCC ID   | - | Company Identifier at FCC        |
| HW       | - | Hardware                         |
| IC       | - | Industry Canada                  |
| Inv. No. | - | Inventory number                 |
| N/A      | - | not applicable                   |
| S/N      | - | Serial Number                    |
| SW       | - | Software                         |

## Annex F: Accreditation Certificate

| first page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | last page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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|  <p>Deutsche Akkreditierungsstelle GmbH</p> <p>Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV<br/>Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition</p> <p><b>Accreditation</b> </p> <p>The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory</p> <p><b>CTC advanced GmbH</b><br/>Untertürkheimer Straße 6-10, 66117 Saarbrücken</p> <p>is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields:</p> <p><b>Telecommunication (FCC Requirements)</b></p> <p>The accreditation certificate shall only apply in connection with the notice of accreditation of 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 05 pages.</p> <p>Registration number of the certificate: <b>D-PL-12076-01-05</b></p> <p>Frankfurt am Main, 09.06.2020</p> <p>by order: <br/>Dipl.-Ing. (FH) Ralf Eigner<br/>Head of Division</p> <p><small>The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH.<br/><a href="https://www.dakks.de/en/content/accredited-bodies-dakks">https://www.dakks.de/en/content/accredited-bodies-dakks</a><br/>See notes overleaf.</small></p> | <p>Deutsche Akkreditierungsstelle GmbH</p> <p>Office Berlin<br/>Spittelmarkt 10<br/>10117 Berlin</p> <p>Office Frankfurt am Main<br/>Europa-Allee 52<br/>60327 Frankfurt am Main</p> <p>Office Braunschweig<br/>Bundesallee 100<br/>38116 Braunschweig</p> <p>The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAKKS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.</p> <p>No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAKKS.</p> <p>The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAKKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.</p> <p>The up-to-date state of membership can be retrieved from the following websites:<br/>EA: <a href="http://www.european-accreditation.org">www.european-accreditation.org</a><br/>ILAC: <a href="http://www.ilac.org">www.ilac.org</a><br/>IAF: <a href="http://www.iaf.nu">www.iaf.nu</a></p> |

| first page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | last page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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**Note:**

The current certificate including annex can be received on request.