



## TEST REPORT

Test Report No.: 1-9102/19-01-07



### Testing Laboratory

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#### Accredited Test Laboratory:

The testing laboratory (FCC part 15 D) is accredited according to DIN EN ISO/IEC 17025 (2018) 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

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### Manufacturer

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 9400, Noerresundby  
 Denmark

### 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>Wireless microphone system, Microphone unit</b>
<b>Product name:</b>	<b>RM-WOM, RM-WDR, RM-WGS, RM-WGL</b>
<b>HVIN:</b>	<b>RM-WOM, RM-WDR, RM-WGS, RM-WGL</b>
<b>PMN:</b>	<b>RM-WOM, RM-WDR, RM-WGS, RM-WGL</b>
<b>FVIN:</b>	<b>-/-</b>
<b>HMN:</b>	<b>-/-</b>
<b>FCC ID:</b>	<b>A6RRMWMIC</b>
<b>IC:</b>	<b>740B-RMWMIC</b>
<b>S/N serial number:</b>	Radiated: / Conducted: /
<b>HW hardware status:</b>	V2
<b>SW software status:</b>	V0012
<b>Frequency [MHz]:</b>	1920 -1930
<b>Type of Modulation:</b>	$\pi/2$ -DBPSK, $\pi/4$ -DQPSK
<b>Number of channels:</b>	5 RF Channels, 5x12 = 60 TDMA Duplex Channels
<b>Antenna:</b>	Two integrated antennas
<b>Power Supply:</b>	Li-Ion battery, 3.6 V DC
<b>Temperature Range:</b>	-20°C to 50°C

**Test Report authorised:**

**Test performed:**

**2020-09-17**      Lenjoint, Marco  
 Lab Manager RCE

**2020-09-17**      Wolf, Joachim  
 Head of Department EPNS

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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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**RM-WOM was used for testing. As declared by the customer, the three variants (RM-WDR, RM-WGS and RM-WGL) use the same PCB, but with minor population differences. The reduced user interface on the RM-WDR, RM-WGS and RM-WGL variants means, that some parts are not mounted, e.g. colour LED's and capacitive touch points.**

**The gooseneck variants are identical except for the difference in gooseneck length.**

**These hardware differences have no impact on the radio performance of the different microphones.**

### 2.2 Application details

Date of receipt of order:	2020-07-07
Date of receipt of test item:	2020-08-31
Start of test:	2020-09-03
End of test:	2020-09-17
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 + 50 °C during high temperature test - 20 °C during low temperature test
Relative humidity content:	38 %
Air pressure:	not relevant for this kind of testing

## 5 Summary of Measurement Results

<input checked="" type="checkbox"/>	<b>No deviations from the technical specifications were ascertained</b>
<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	Complies
Labeling requirements	15.19(a)(3)	RSS-GEN 5.2	Complies
Antenna requirements	15.317, 15.203	4.1(e)	Complies
Power Line Conducted Emission	15.107(a), 15.207(a)	5.4 RSS_GEN 7.2 RSS_GEN 8.8	Complies
Emission Bandwidth	15.323(a)	6.4	Complies
In-band Emission	15.323(d)	6.7.2	Complies
Out-of-band Emissions	15.323(d)	6.7.1	Complies
Peak Transmit Power	15.319(c)(e), 15.31(e)	6.5	Complies
Power Spectral Density	15.319(d)	4.3.2.1	Complies
Automatic discontinuation of transmission	15.319(f)	4.3.4(a)	Complies
Carrier frequency stability	15.323(f)	6.2	Complies
Frame repetition stability	15.323(e)	4.3.4(c)	Complies
Frame period and jitter	15.323(e)	4.3.4(c)	Complies
Monitoring threshold, Least interfered channel	15.323(c)(2);(5); (9)	4.3.4(b)	Complies
Monitoring of intended transmit window and maximum reaction time	15.323(c)(1)	4.3.4	Complies
Threshold monitoring bandwidth	15.323(c)(7)	4.3.4	N/A
Reaction time and monitoring interval	15.323(c)(1);(5); (7)	4.3.4	Complies
Access criteria test interval	15.323(c)(4);(6)	4.3.4	Complies
Access criteria functional test	15.323(c)(4);(6)	4.3.4	Complies
Acknowledgments	15.323(c)(4)	4.3.4	Complies
Transmission duration	15.323(c)(3)	4.3.4	Complies
Dual access criteria	15.323(c)(10)	4.3.4	Complies
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	Complies <sup>3</sup>
Spurious Emissions (Radiated)	15.319(g), 15.109(a), 15.209(a)	4.3.3 RSS-GEN 7.2.3	Complies <sup>4</sup>
Receiver Spurious Emissions	N/A	6.8	Complies

<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

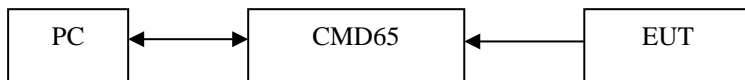
<sup>3</sup> The tested equipment has integrated antennas only

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

## 6 Test Set-up

### 6.1 Frequency Measurements

#### Test Set-up 1:

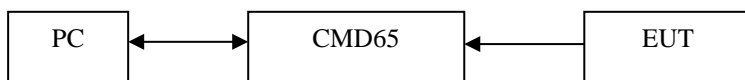


This setup is used for measuring Carrier Frequency Stability at nominal and extreme temperatures.

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

### 6.2 Timing Measurements

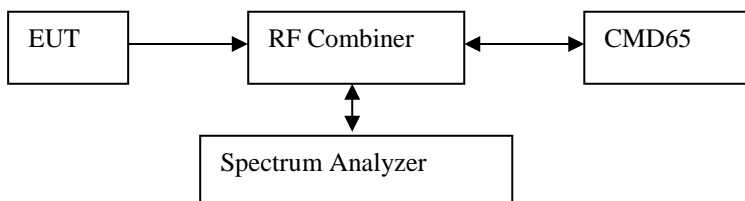
#### Test Set-up 2:



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

### 6.3 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.

## 6.4 Radiated Emission Test

30 MHz – 1GHz:

### Test Set-up 4:

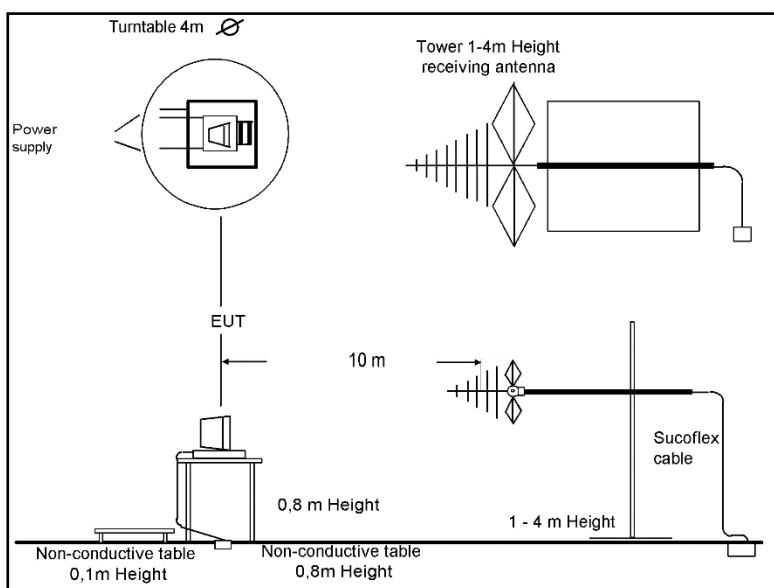
- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a non-conducting table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on 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.

### Premeasurement

- 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.

### Final measurement

- 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 maximizes 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:**

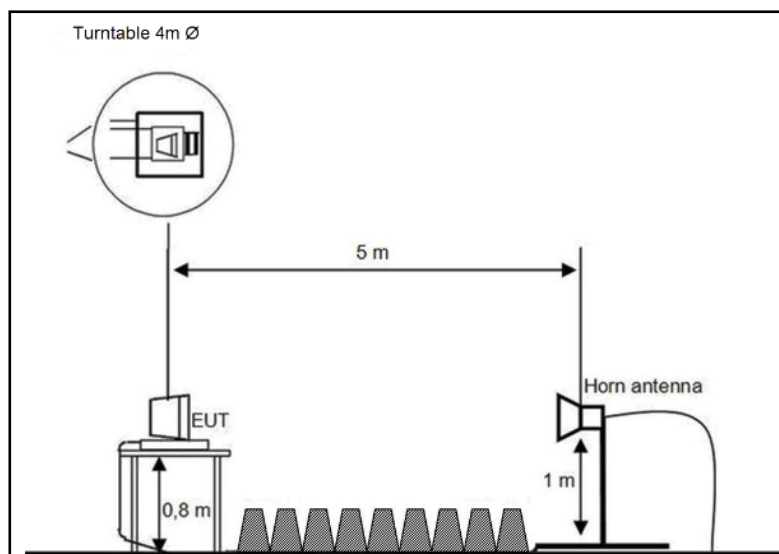
- The Equipment was setup to simulate a typical usage like described in the user manual / or described by manufacturer.
- If the EUT is a tabletop system, a non conducting table with 0,8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the 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.

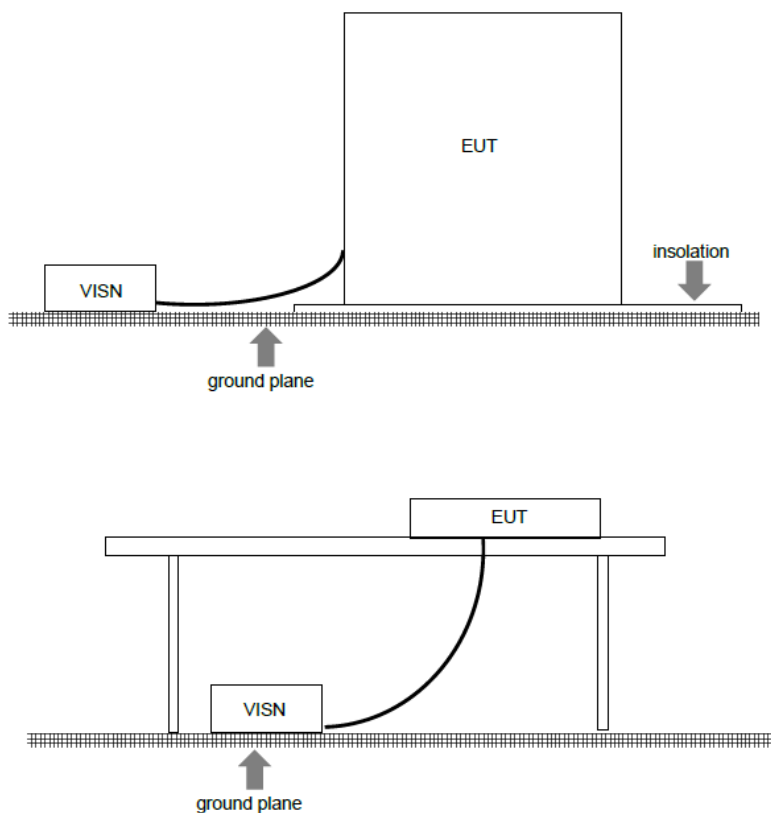




## 6.5 Power Line Conducted Emissions Test

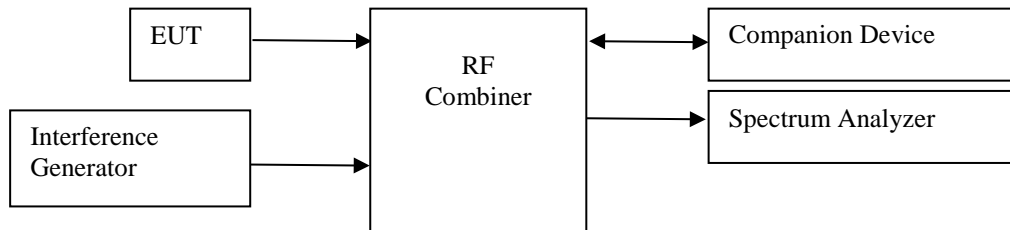
### Test Set-up 6:

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



## 6.6 Monitoring Tests

### Test Set-up 6:

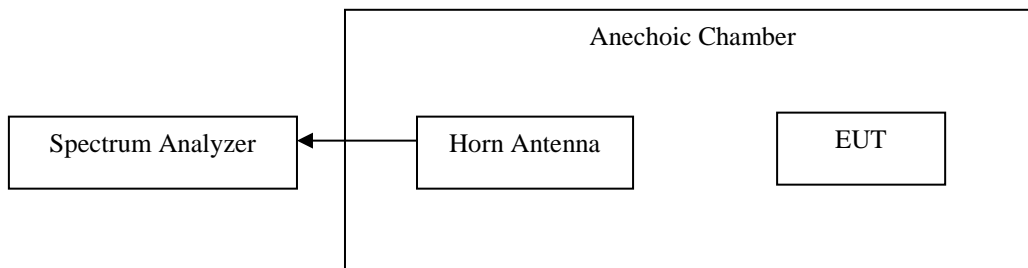


This test setup is used for all Monitoring and Time and Spectrum Access Procedure tests. The path loss from the signal generator to the EUT is measured with a power meter before the testing is started.

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.

## 6.7 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.

## 7 Detailed Test Results

### 7.1 Power Line Conducted Emissions

**Measurement Procedure:**

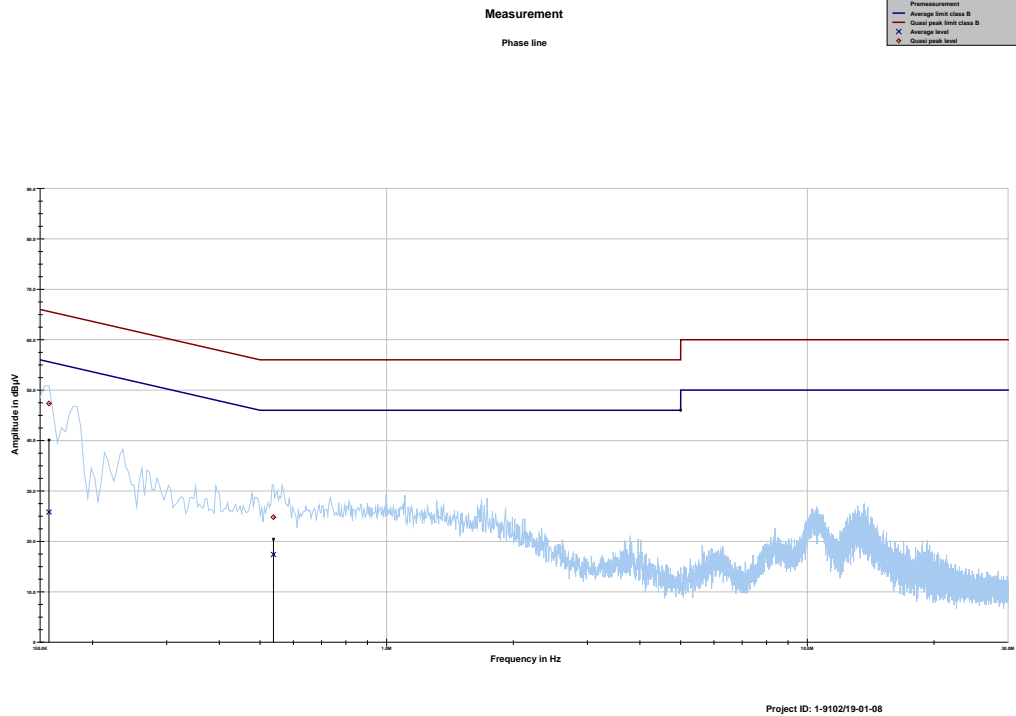
ANSI C63.4-2014 using 50 $\mu$ H/50 ohms LISN.

**Test Result:** Pass

**Measurement Data:** See attached plots and tables

**Requirement:** FCC 15.107 (a), FCC 15.207 (a)

**Phase Line**



Phase line tbl

Project ID: 1-9102/19-01-08

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.157463	47.35	18.25	65.597	25.82	29.97	55.787
0.538050	24.80	31.20	56.000	17.39	28.61	46.000

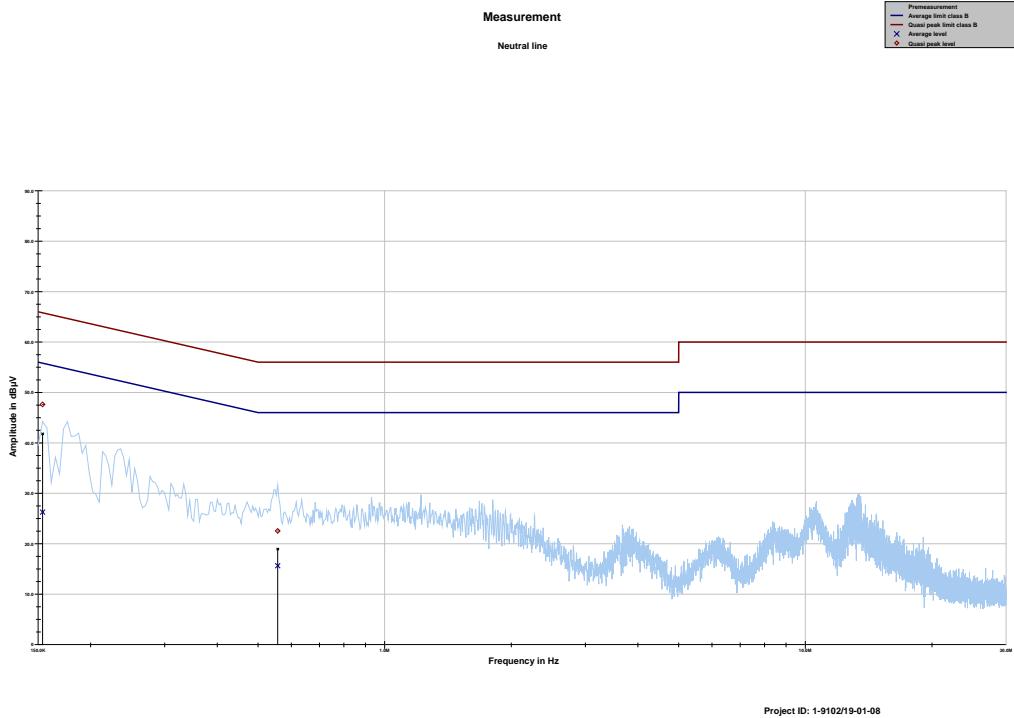
Project ID - 1-9102/19-01-08

EUT - RM-WCH-8 + RM-WOM + RM-WDR + RM-WGS + RM-WGL + PA-300C

Serial Number - Z6R000041 + Z6L000132 + Z6M000144 + Z6P000039 + Z6N000069 + JIID03P1SSY

Operating mode - charging 4 microphones

**Neutral Line**



Neutral line tbl

Project ID: 1-9102/19-01-08

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.153731	47.62	18.18	65.796	26.25	29.64	55.893
0.556706	22.53	33.47	56.000	15.63	30.37	46.000

Project ID - 1-9102/19-01-08

EUT - RM-WCH-8 + RM-WOM + RM-WDR + RM-WGS + RM-WGL + PA-300C

Serial Number - Z6R000041 + Z6L000132 + Z6M000144 + Z6P000039 + Z6N000069 + JIID03P1SSY

Operating mode - charging 4 microphones

## 7.2 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.

## 7.3 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.

## 7.4 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**

## 7.5 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.

**7.6 Automatic Discontinuation of Transmission**

Does the EUT transmit control and Signaling Information?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Type of EUT:	<input checked="" 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	C	Pass
2	EUT switched Off	C	Pass
3	Hook-On by companion device	N/A	N/A
4	Hook-On by EUT	N/A	N/A
5	Power removed from companion device	A	Pass
6	Companion device switched Off	N/A	N/A

- 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 or repetitive code used by certain digital modulation technologies to complete frame or burst intervals.



## 7.7 Peak Power Output

### Measurement Procedure:

ANSI C63.17, clause 6.1.2.

### Test Results: Pass

### Measurement Data:

#### Maximum Conducted Output Power

Channel No.	Frequency (MHz)	Maximum Conducted Output Power (dBm) DBPSK	Maximum Radiated Output Power (dBm) DBPSK	Maximum Antenna Gain (dBi) DBPSK
4	1921.536	18.8	19.6	0.8
2	1924.992	18.7	20.1	1.4
0	1928.448	18.6	19.8	1.2

Channel No.	Frequency (MHz)	Maximum Conducted Output Power (dBm) DQPSK
4	1921.536	18.8
2	1924.992	18.7
0	1928.448	18.6

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:

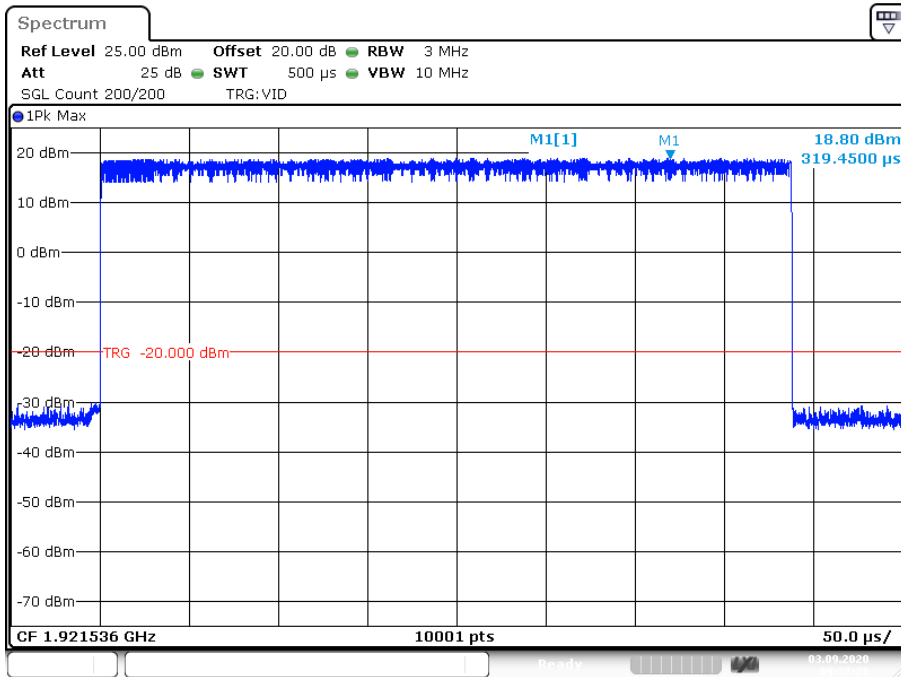
Conducted:  $100 \mu\text{W} \times \text{SQRT}(B)$  where B is the measured Emission Bandwidth in Hz  
 FCC 15.319(c)(e): 21.2 dBm (131 mW)  
 RSS-213, Issue 2: 21.2 dBm (131 mW)  
 The antenna gain is below 3 dBi.

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

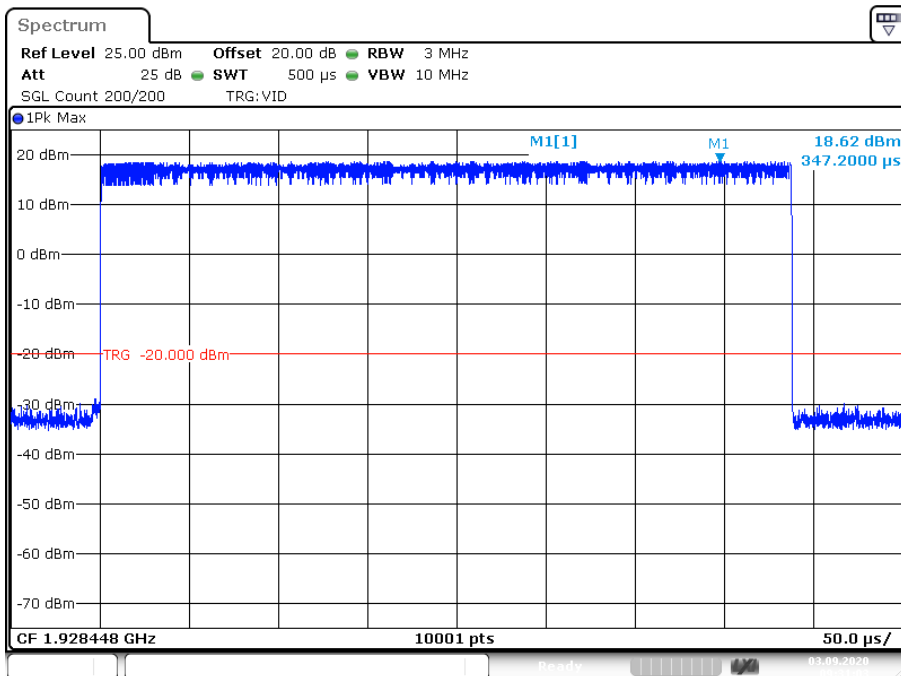
Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in Hertz.

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

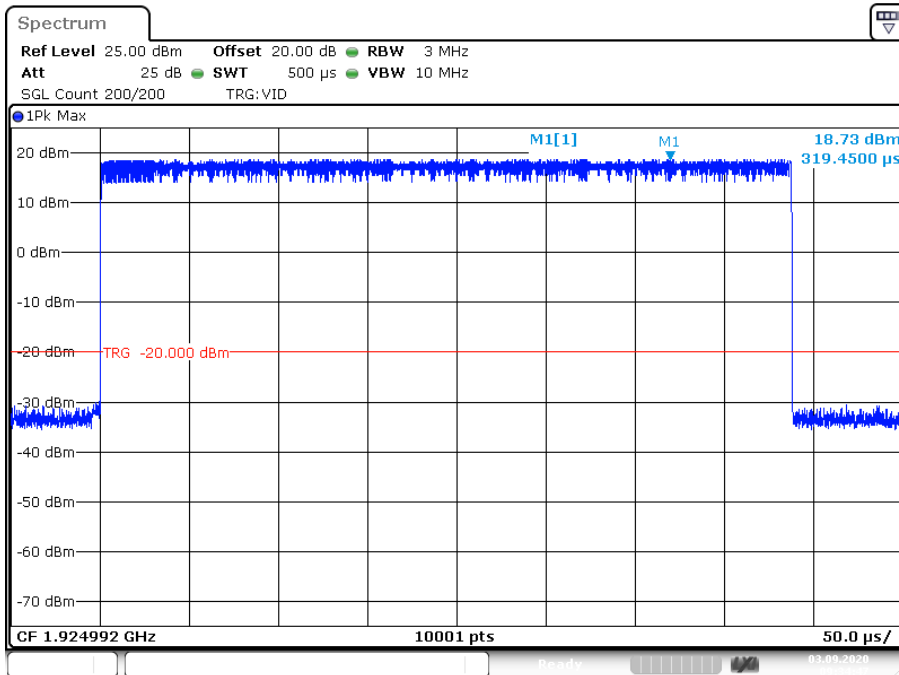
### Conducted Peak Output Power, DBPSK



### Lower Channel

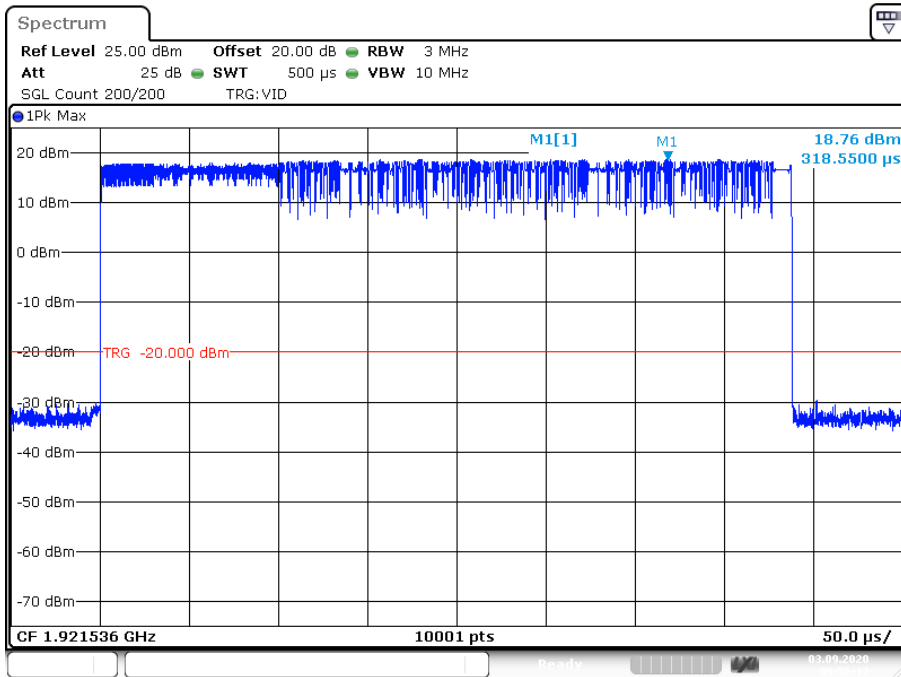


### Upper Channel

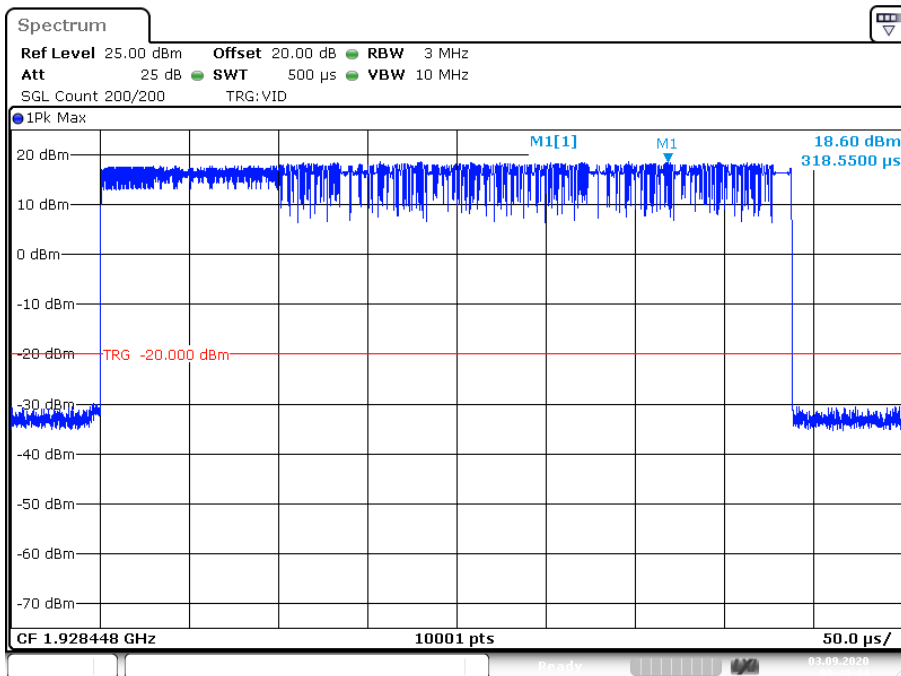


**Middle Channel**

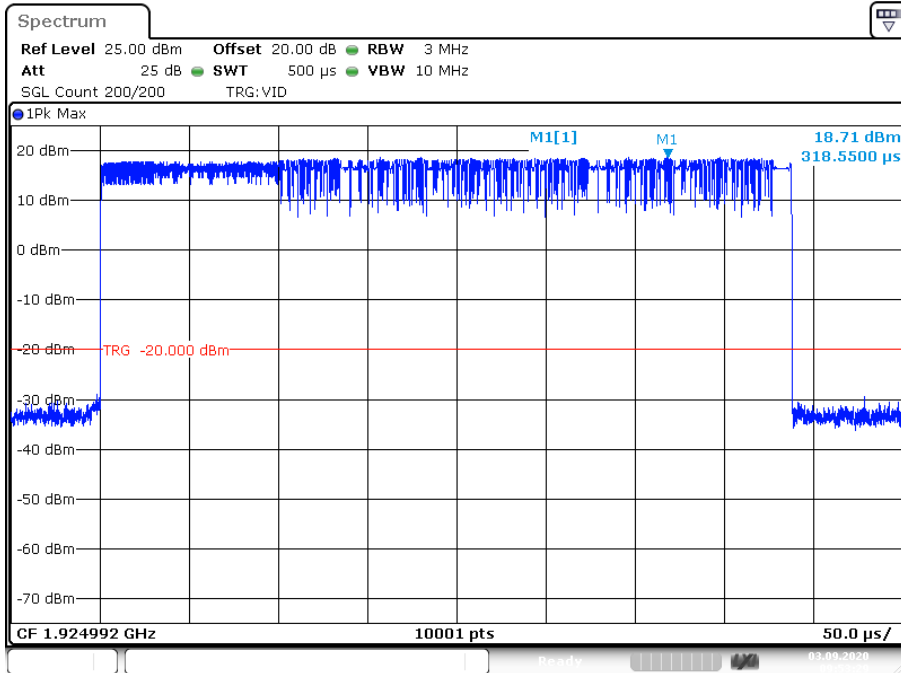
### Conducted Peak Output Power, DQPSK



### Lower Channel

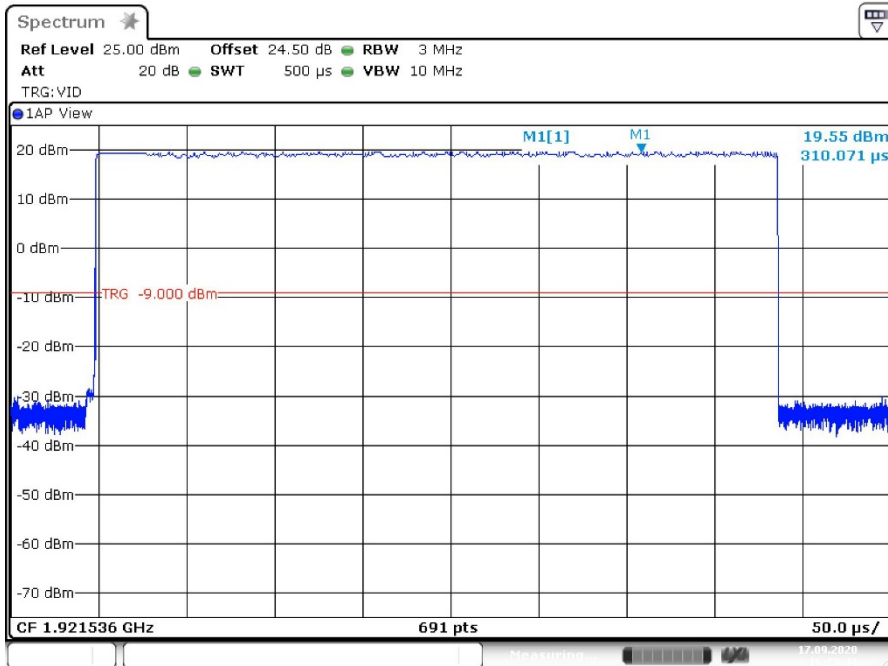


### Upper Channel

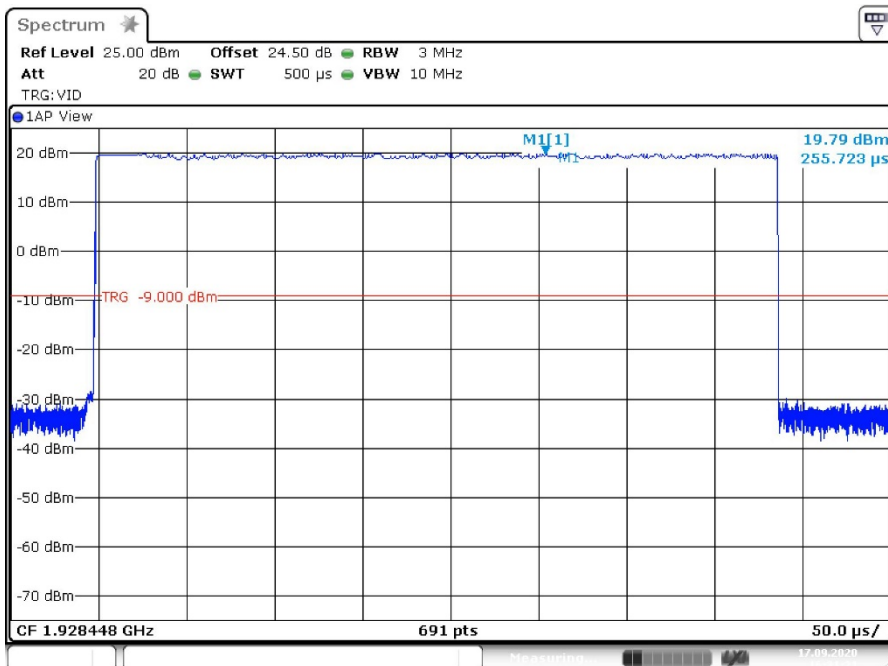


**Middle Channel**

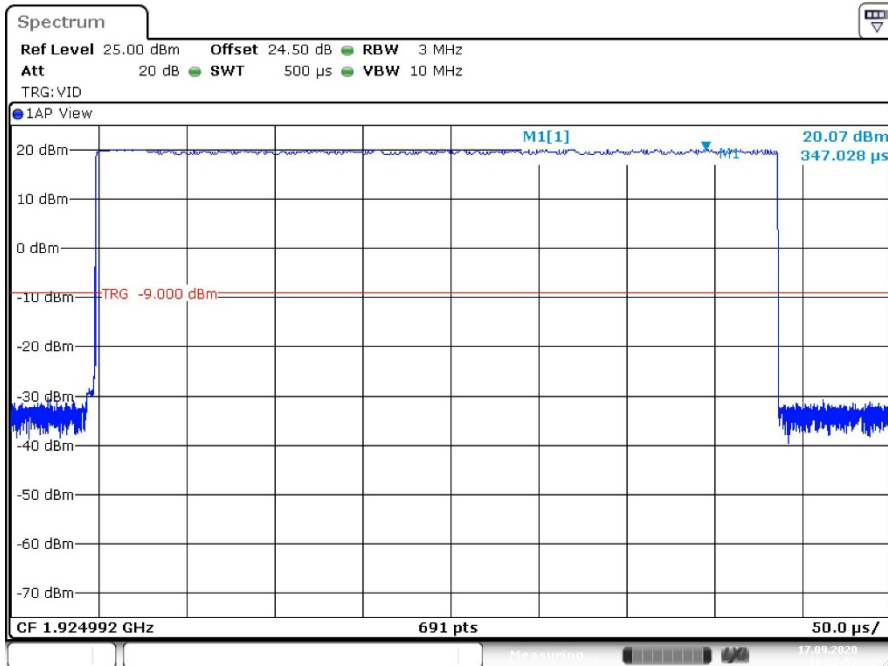
### Radiated Peak Output Power DBPSK



### Lower Channel



### Upper Channel



**Middle Channel**

## 7.8 Emission Bandwidth B

### Measurement Procedure:

ANSI C63.17, clause 6.1.3.

### Test Results: Pass

### Measurement Data:

Channel No. DBPSK	Frequency (MHz)	26 dB Bandwidth B (kHz)
4	1921.536	1686
0	1928.448	1689

Channel No. DQPSK	Frequency (MHz)	26 dB Bandwidth B (kHz)
4	1921.536	1722
0	1928.448	1724

Channel No. DBPSK	Frequency (MHz)	99% Bandwidth B (kHz)
2	1924.992	1686

Channel No. DQPSK	Frequency (MHz)	99% Bandwidth B (kHz)
2	1924.992	1722

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.

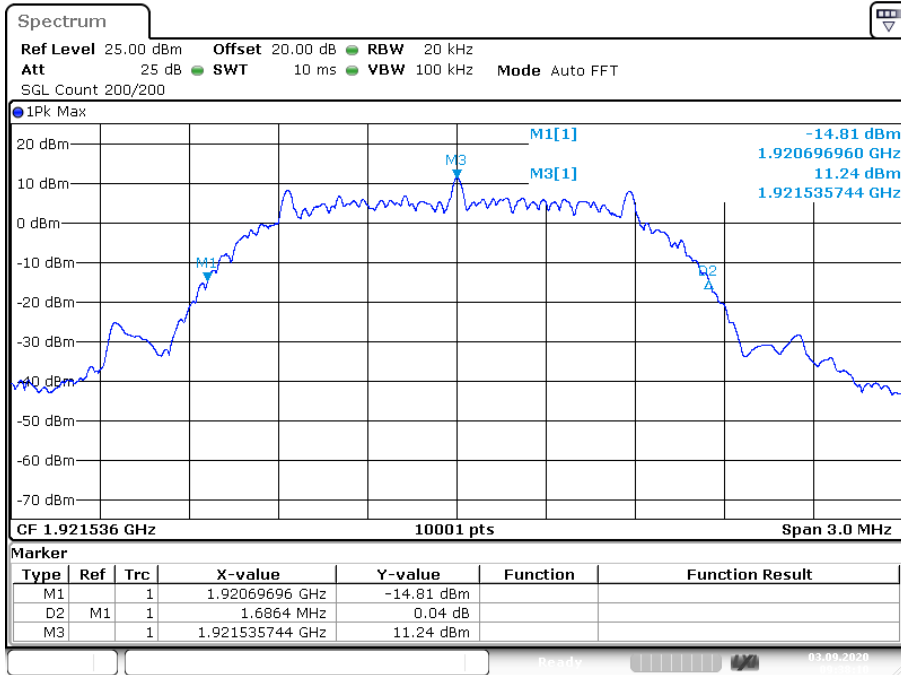
### Requirement: RSS-213 Issue 2, clause 6.4

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

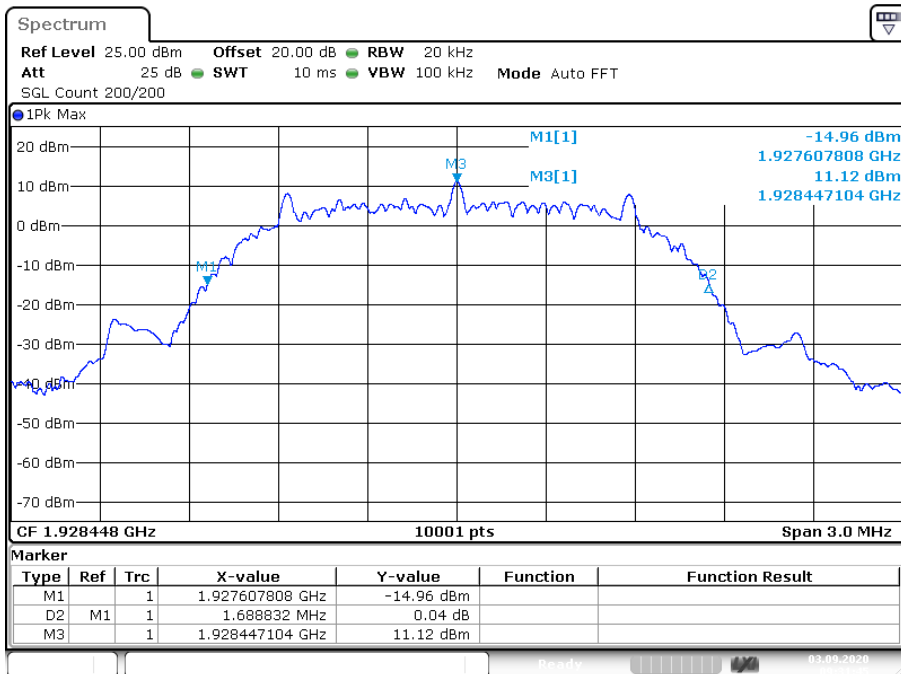
No requirement for 6 dB and 12 dB Bandwidth. These values are only used for testing Monitoring Bandwidth if the Simple Compliance test fails (ANSI C63.17, clause 7.4).



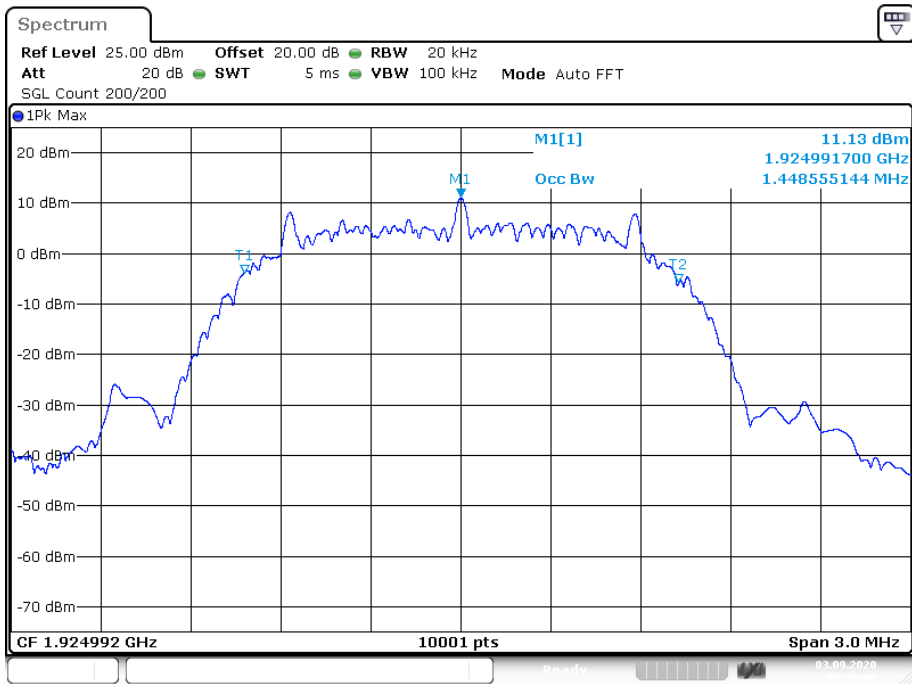
**Modulation: DBPSK**



**26 dB Emission Bandwidth B, Lower Channel**

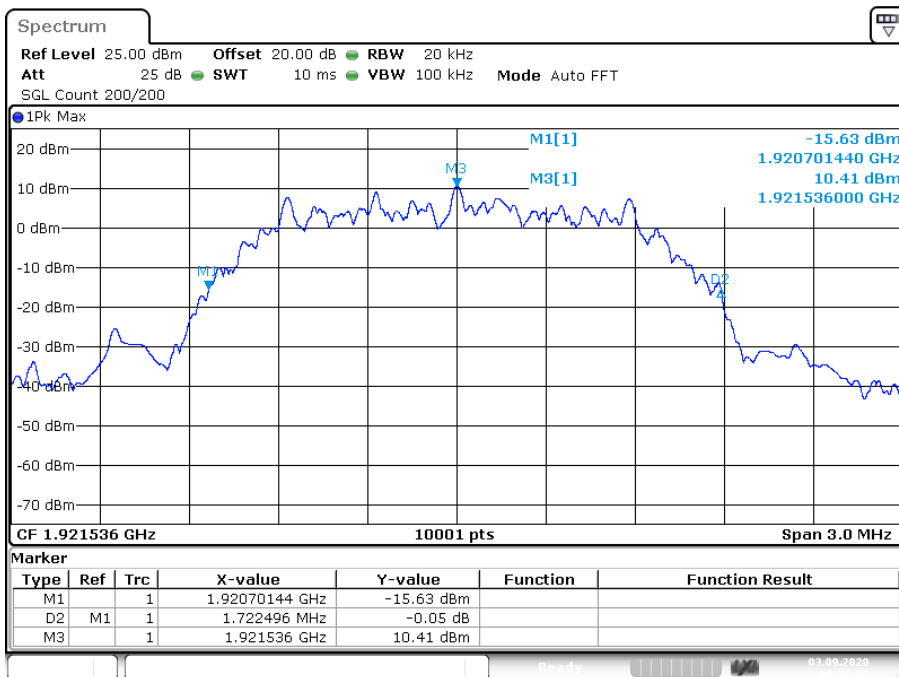


**26 dB Emission Bandwidth B, Upper Channel**

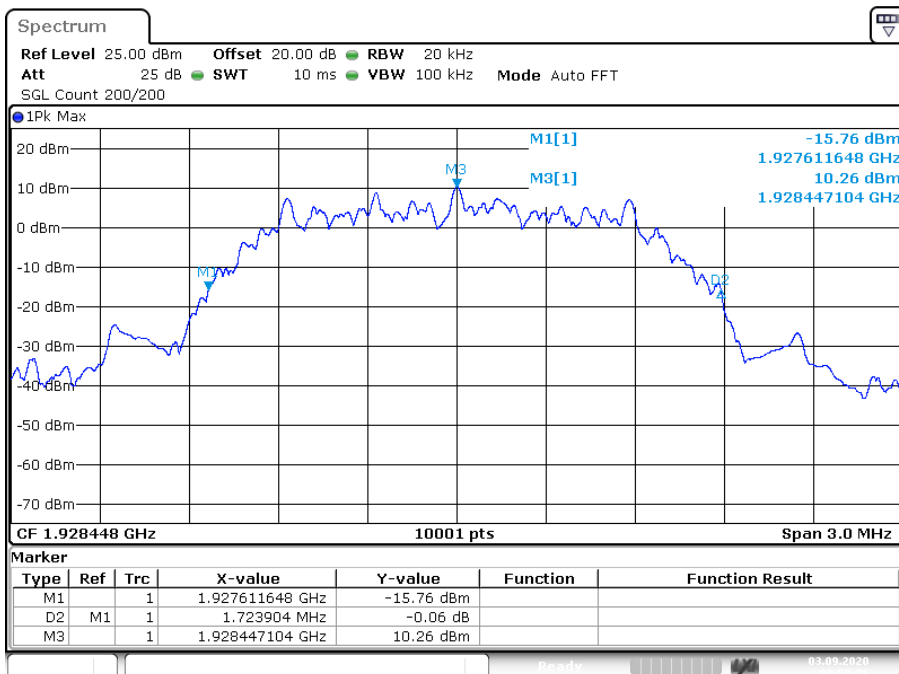


**99% Emission Bandwidth B, Middle Channel**

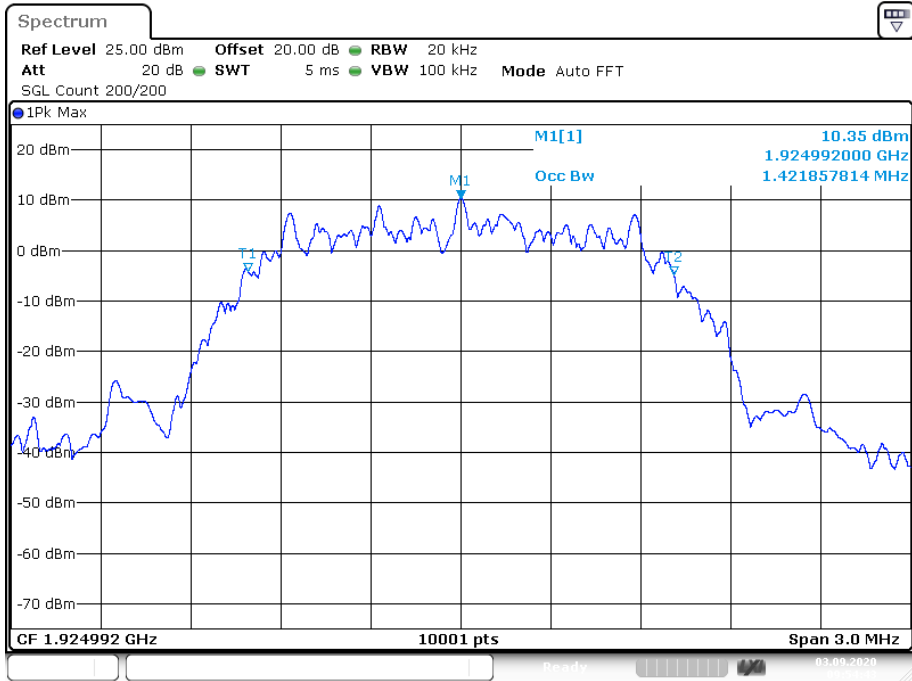
**Modulation: DQPSK**



**26 dB Emission Bandwidth B, Lower Channel**



**26 dB Emission Bandwidth B, Upper Channel**



**99% Emission Bandwidth B, Middle Channel**

## 7.9 Power Spectral Density

### Measurement Procedure:

ANSI C63.17, clause 6.1.5.

**Test Results: Pass**

### Measurement Data:

Channel No. DBPSK	Frequency (MHz)	Power Spectral Density (dBm/3kHz)
4	1921.535744	-3.40
0	1928.447104	-3.26

Channel No. DQPSK	Frequency (MHz)	Power Spectral Density (dBm/3kHz)
4	1921.536000	-1.99
0	1928.447104	-2.32

Averaged over 100 sweeps.

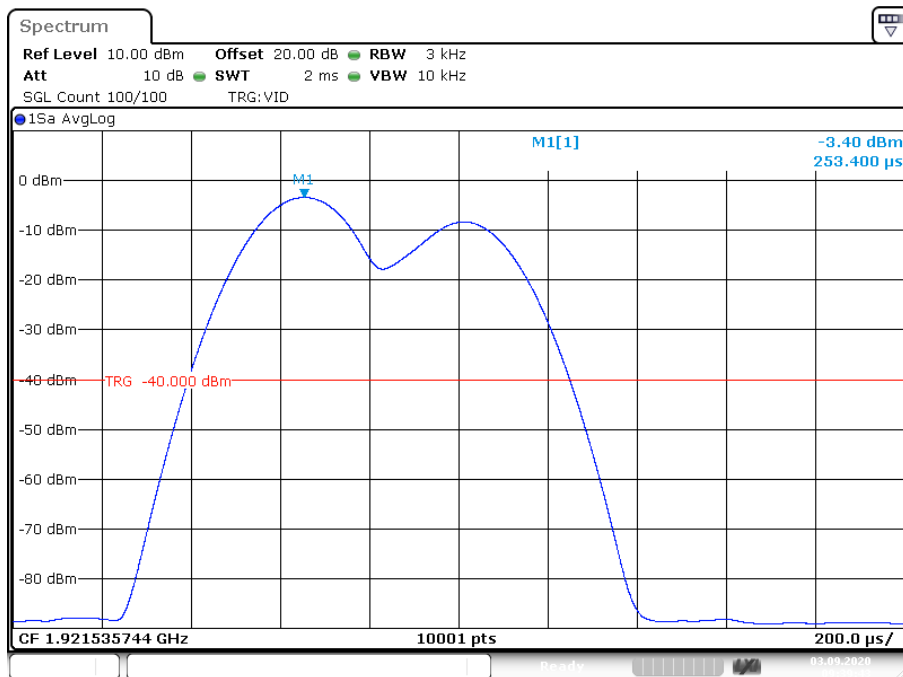
### Requirement: FCC 15.319(d)

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

## Power Spectral Density, DBPSK

Lower Channel:

Frequency of the maximum level was recorded under chapter 5.9.

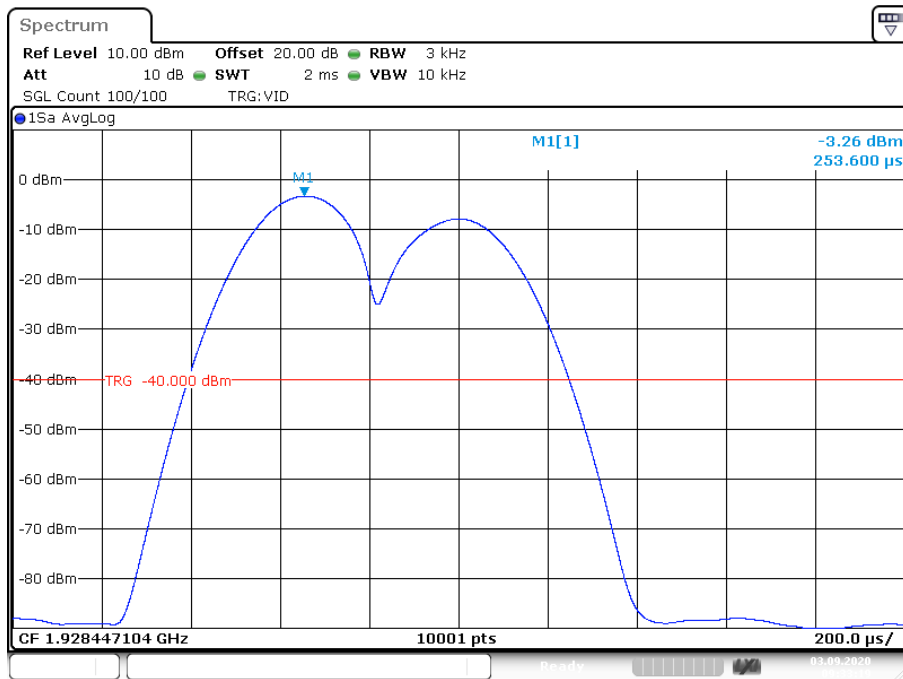


Averaged, 100 Sweeps

Pulse power [dBm]	-3.40
Pulse power [mW]	0.46

**Upper Channel:**

Frequency of the maximum level was recorded under chapter 5.9.



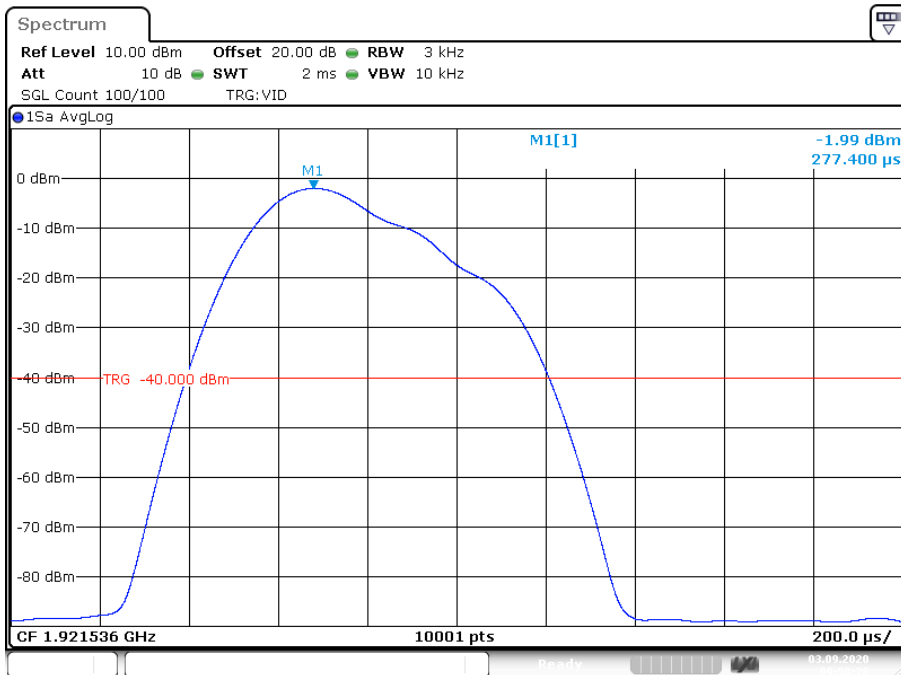
**Averaged, 100 Sweeps**

<b>Pulse power [dBm]</b>	-3.26
<b>Pulse power [mW]</b>	0.47

## Power Spectral Density, DQPSK

Lower Channel:

Frequency of the maximum level was recorded under chapter 5.9.



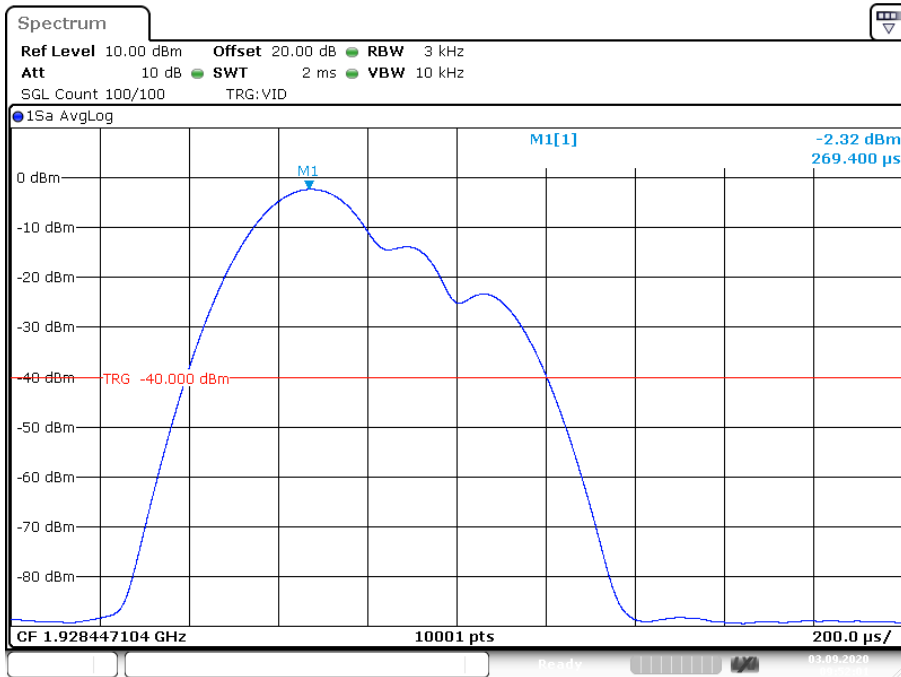
Averaged, 100 Sweeps

Pulse power [dBm]	-1.99
Pulse power [mW]	0.63



**Upper Channel:**

Frequency of the maximum level was recorded under chapter 5.9.



**Averaged, 100 Sweeps**

Pulse power [dBm]	-2.32
Pulse power [mW]	0.59

## 7.10 In-Band Unwanted Emissions, Conducted

### Measurement Procedure:

ANSI C63.17, clause 6.1.6.1.

### Test Results: Pass

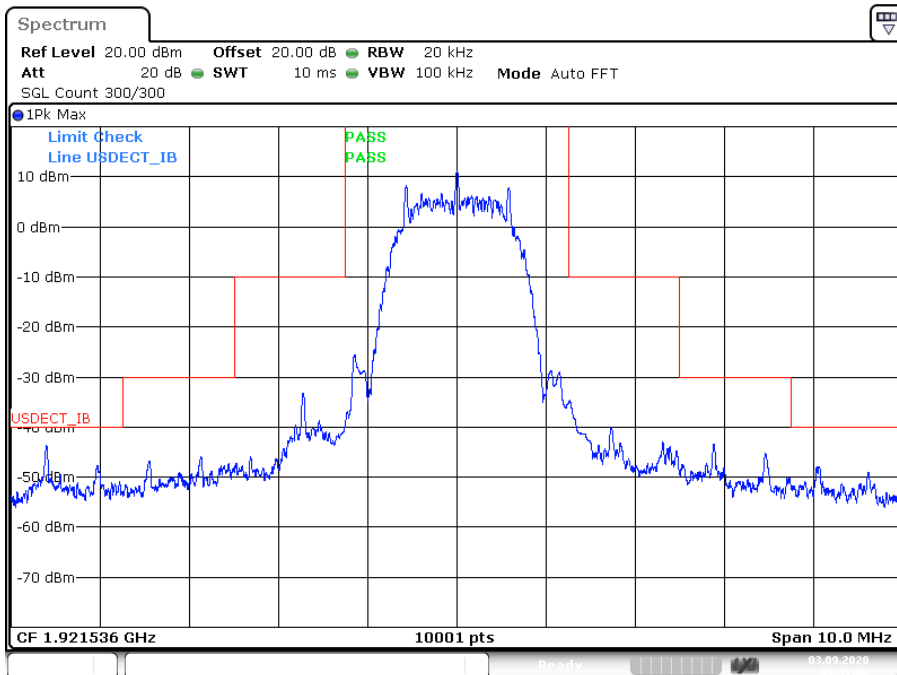
### Measurement Data:

See plots.

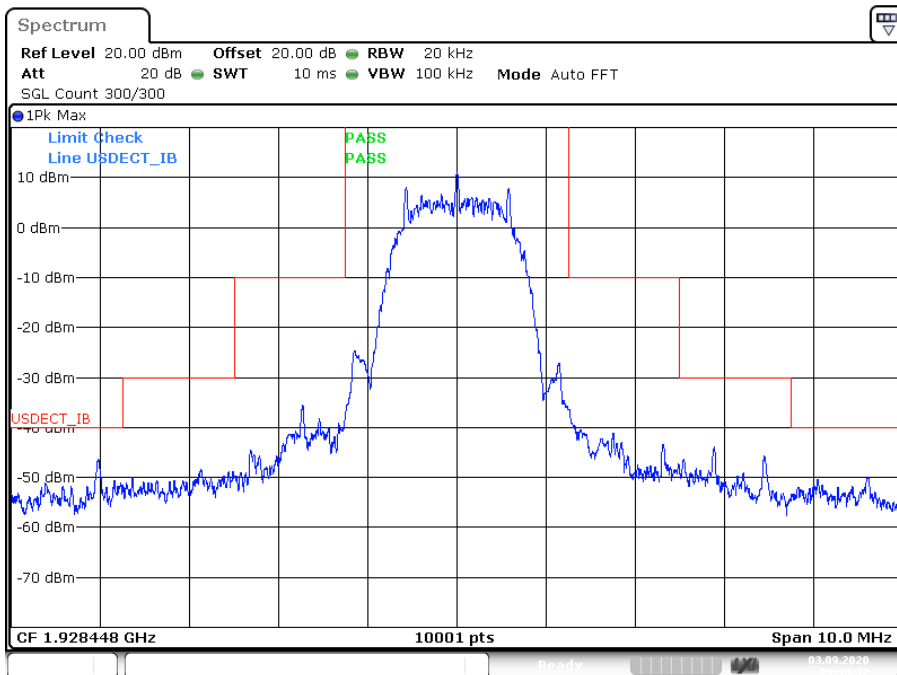
### Requirement: FCC 15.323(d)

$B < f_2 \leq 2B$ :	less than or equal to 30 dB below max. permitted peak power level
$2B < f_2 \leq 3B$ :	less than or equal to 50 dB below max. permitted peak power level
$3B < f_2 \leq \text{UPCS Band Edge}$ :	less than or equal to 60 dB below max. permitted peak power level

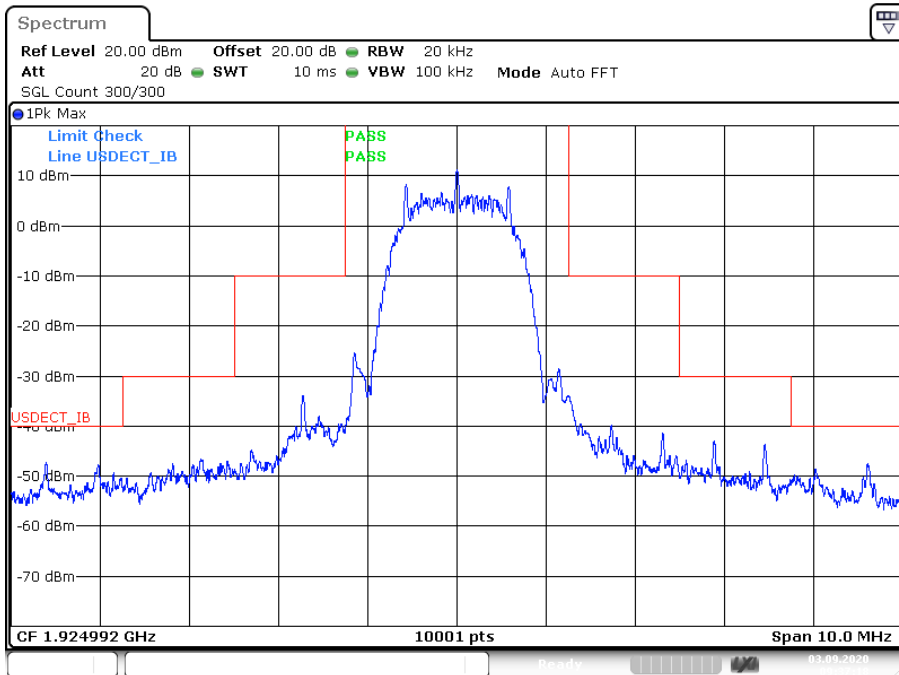
### In-Band Unwanted Emissions, Conducted, DBPSK



### Lower Channel

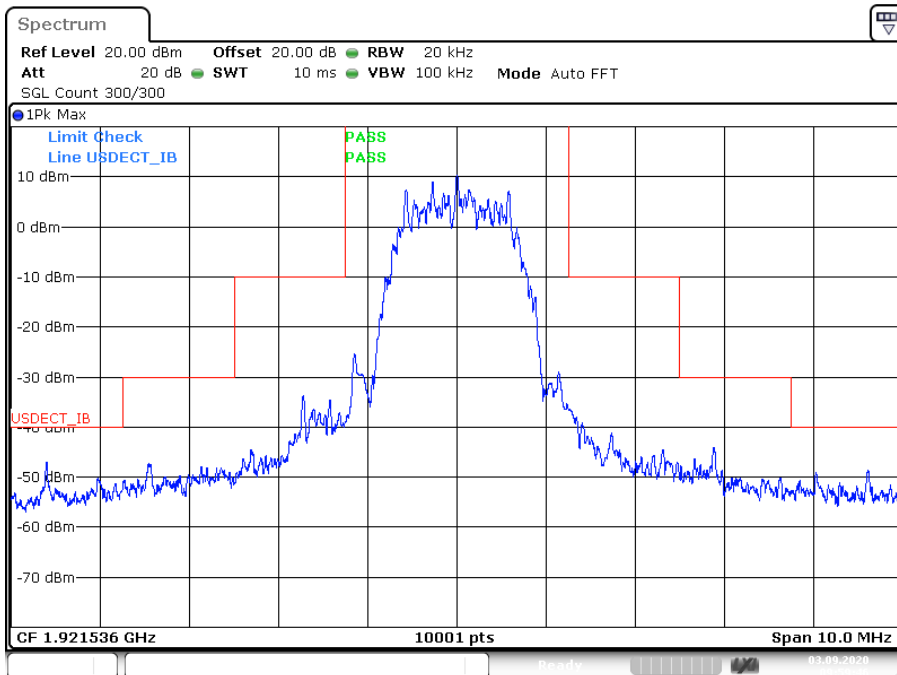


### Upper Channel

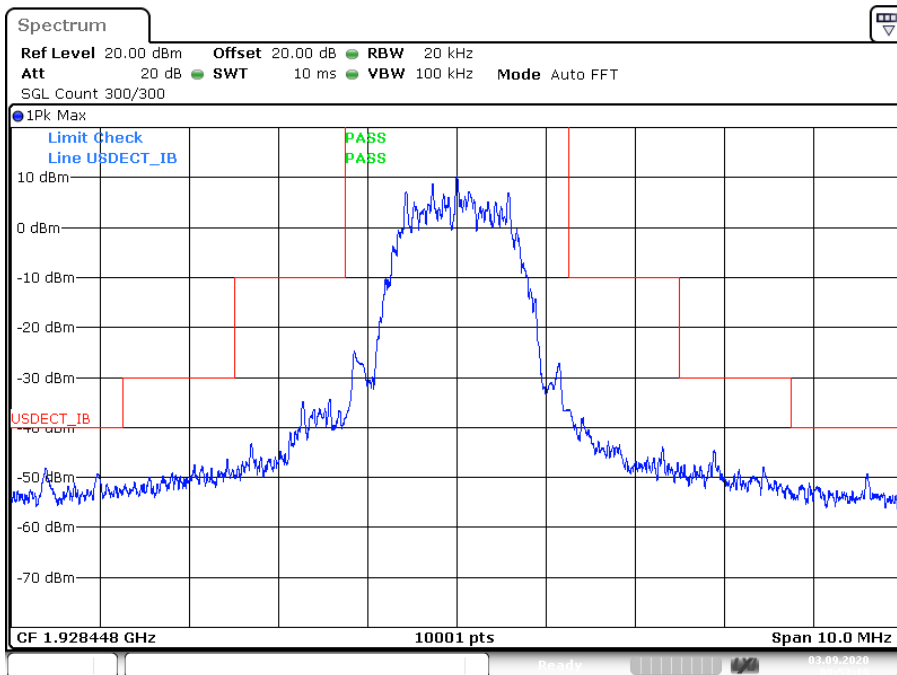


**Middle Channel**

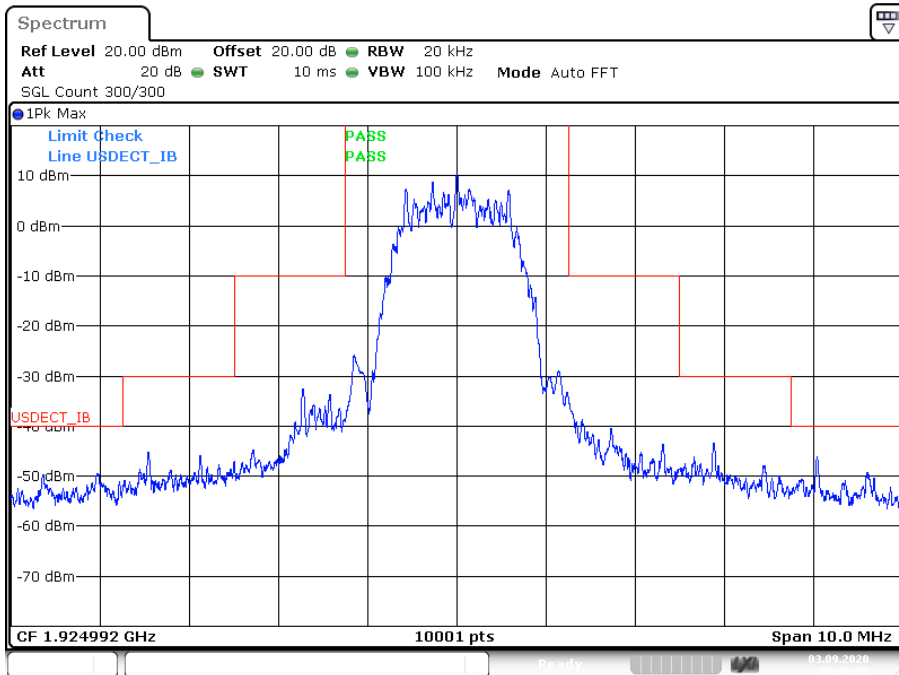
### In-Band Unwanted Emissions, Conducted, DQPSK



### Lower Channel



### Upper Channel



### Middle Channel

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

## 7.11 Out-of-Band Emissions, Conducted

### Measurement Procedure:

ANSI C63.17, clause 6.1.6.2.

### Test Results: Pass

### Measurement Data:

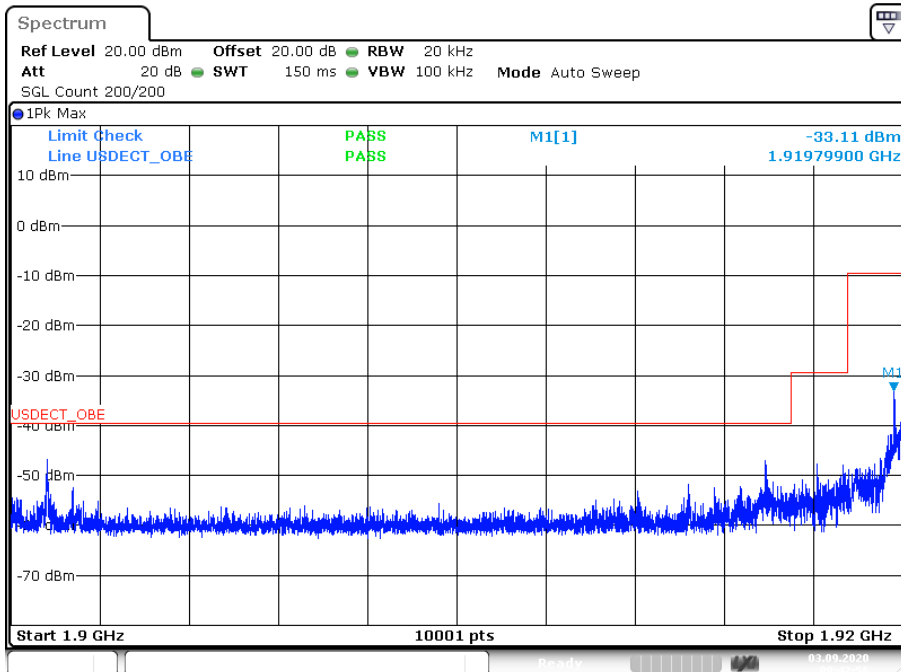
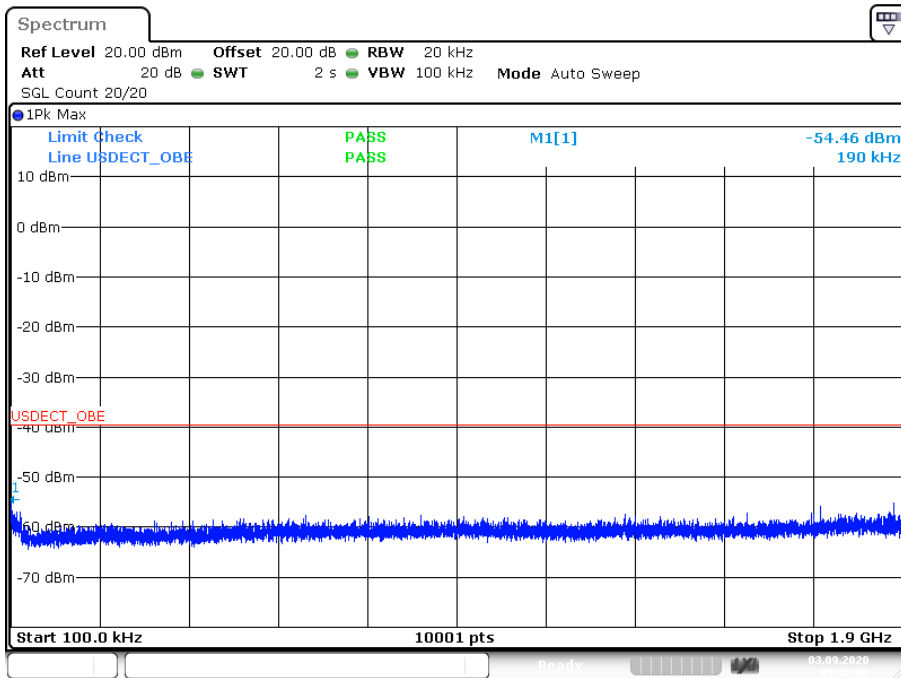
See plots.

### Requirement: FCC 15.323(d)

$f \leq 1.25$ MHz outside UPCS band:	$\leq -9.5$ dBm
$1.25$ 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

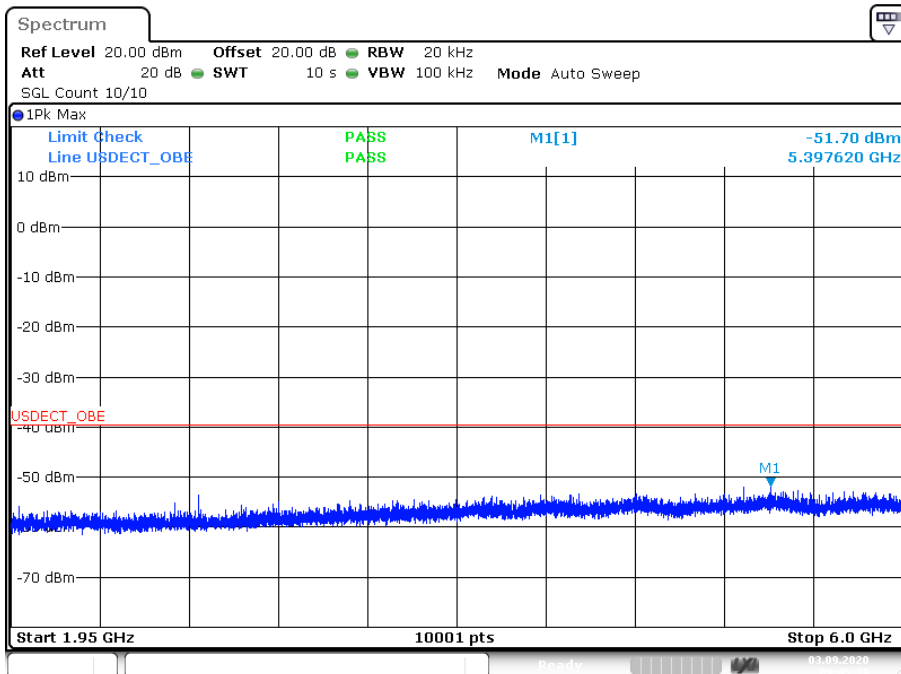
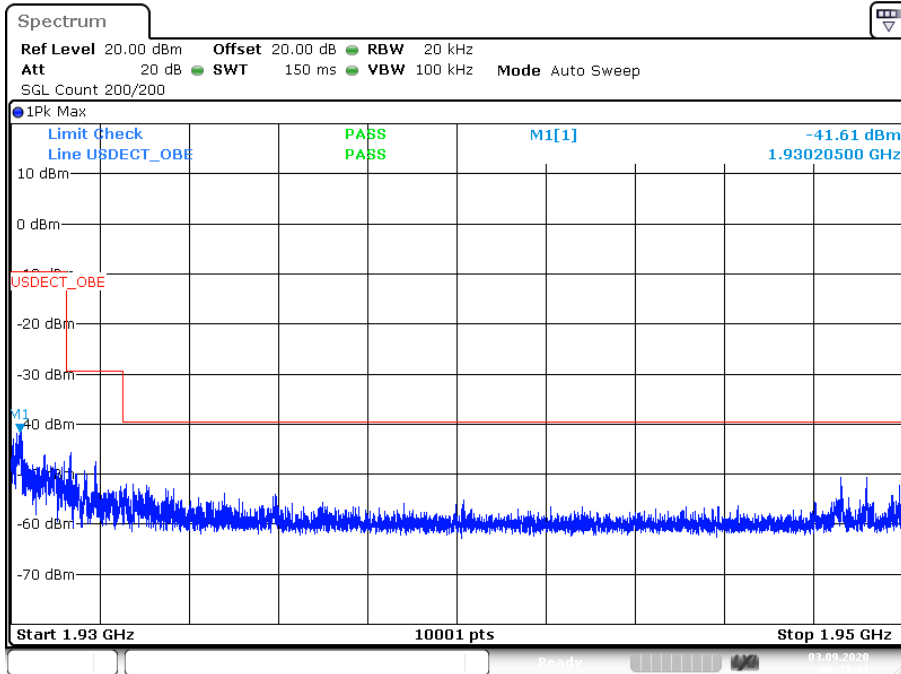
### Out-of-Band Unwanted Emissions, Conducted, DBPSK

Upper and Lower Channel:

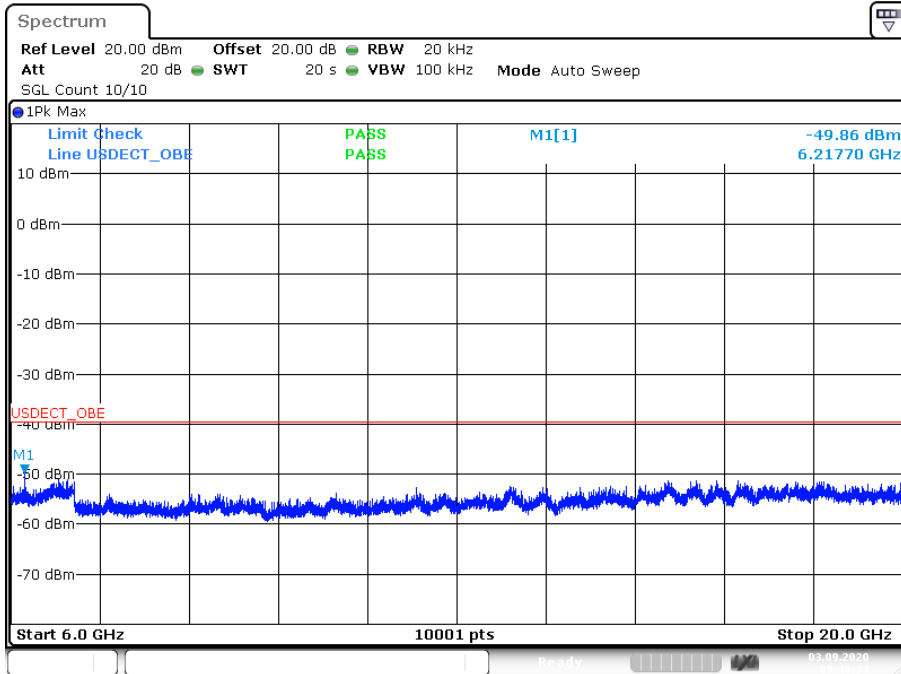




### Out-of-Band Unwanted Emissions, Conducted, DBPSK



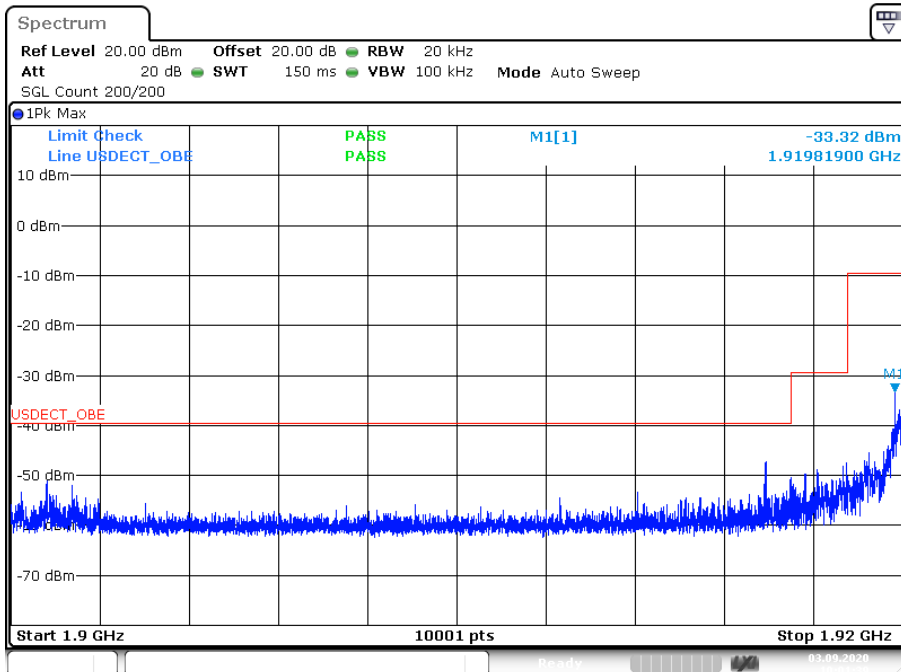
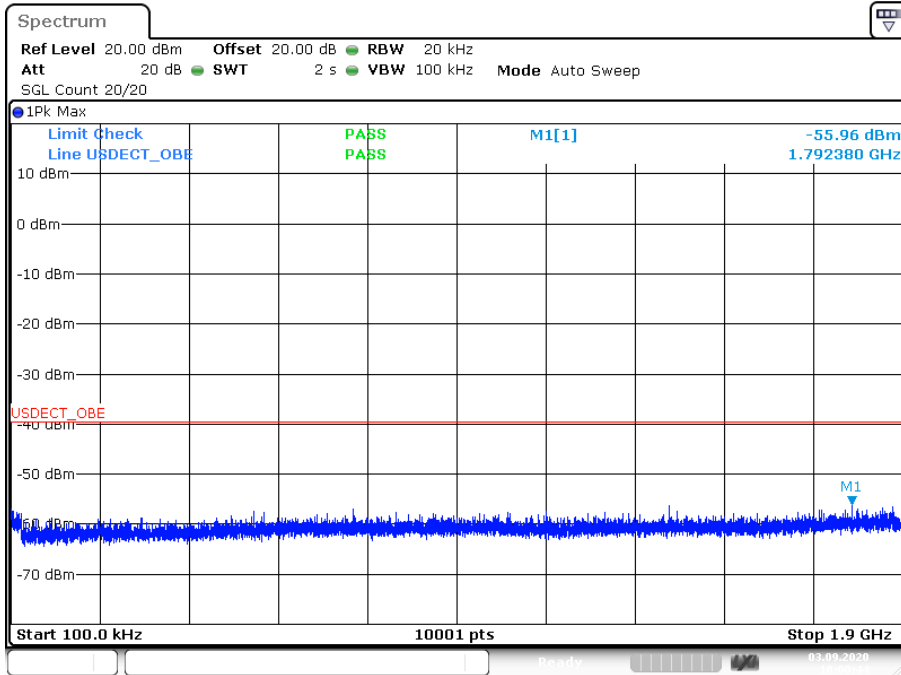
### Out-of-Band Unwanted Emissions, Conducted, DBPSK



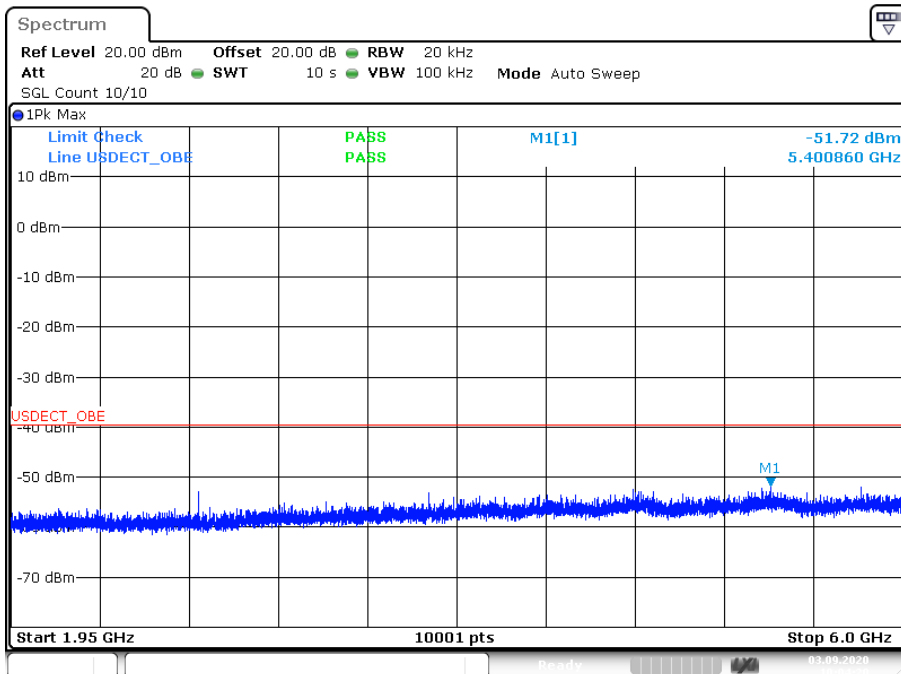
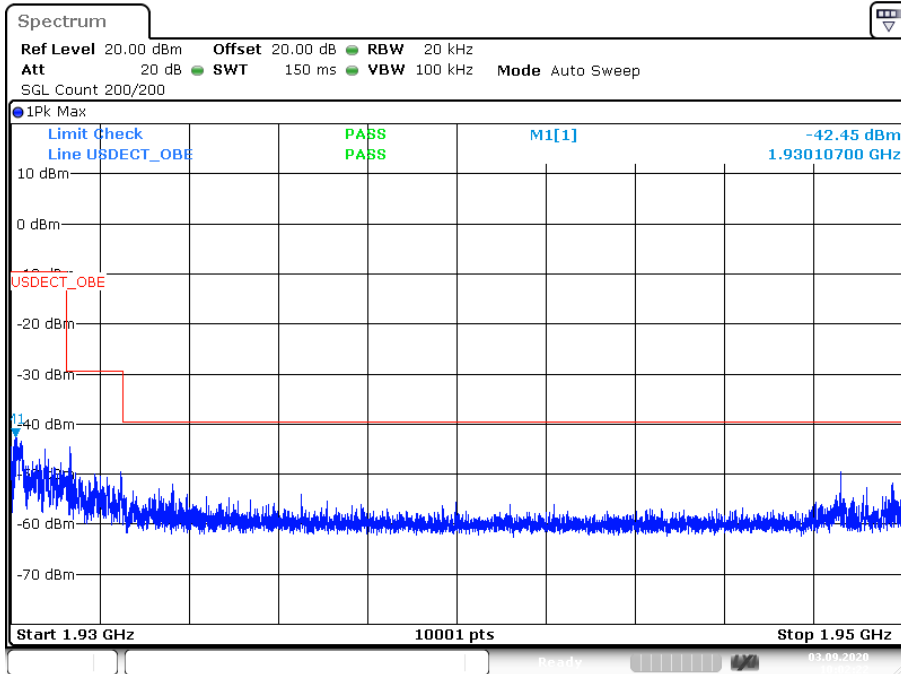
The BS spurious out-of-band transmission level is below the indicated limit.

### Out-of-Band Unwanted Emissions, Conducted, DQPSK

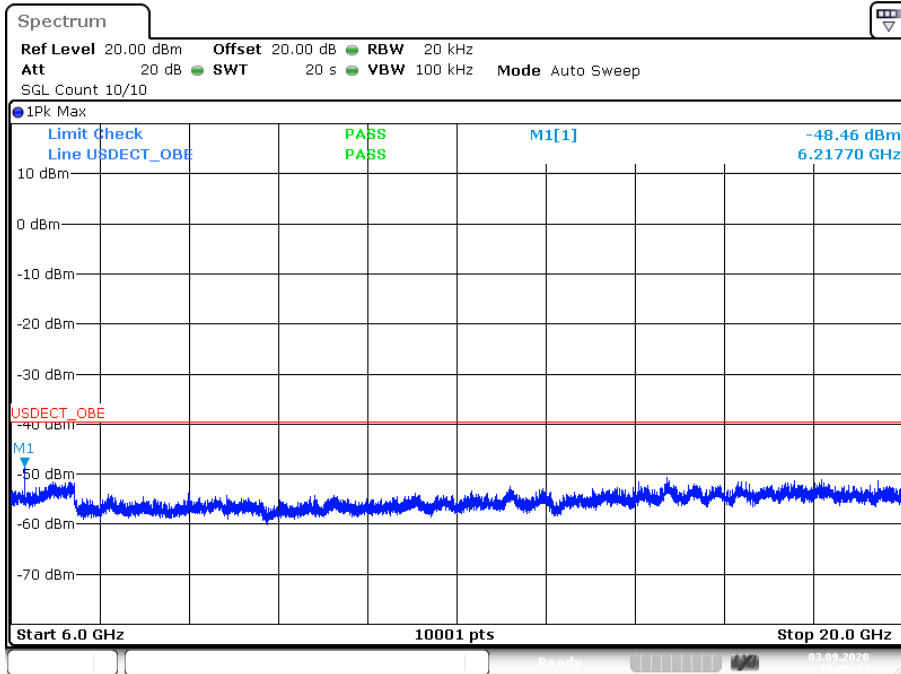
Upper and Lower Channel:



### Out-of-Band Unwanted Emissions, Conducted, DQPSK



### Out-of-Band Unwanted Emissions, Conducted, DQPSK



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

## 7.12 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)
1924.987882	-1.59	-4.59	1.312	±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)
3.6 V DC	1924.990	Ref.	Ref.	±10
4.2 V DC	1924.990	0.0	0.0	
3.3 V DC	1924.990	0.0	0.0	

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	1924.990	Ref.	Ref.	±10
T = -20°C	1924.990	0.0	0.0	
T = +50°C	1924.990	0.0	0.0	

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

### 7.13 Frame Repetition Stability

**Measurement Procedure:**

ANSI C63.17, clause 6.2.2.

**Test Results: Pass**

**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	100.0000000000	0.055	0.165

**Limit:**

<b>Frame Repetition Stability</b>	±10 ppm (TDMA)
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Ref. FCC 15.323(e). ANSI C63.17, clause 6.2.2.

### 7.14 Frame Period and Jitter

**Measurement Procedure:**

ANSI C63.17, clause 6.2.3.

**Test Results: Pass**

**Measurement Data:**

The Frame Repetition Stability is measured with the CMD65

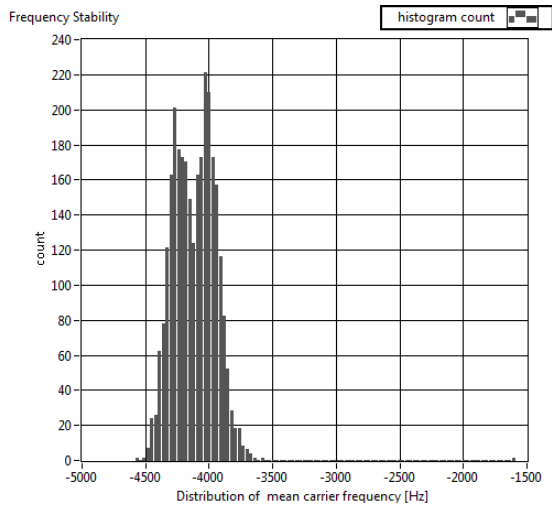
Carrier Frequency (MHz)	Frame Period (ms)	Max Jitter (µs)	3xStandard Deviation of Jitter (µs)
1924.992	10.000	0.003	0.002

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

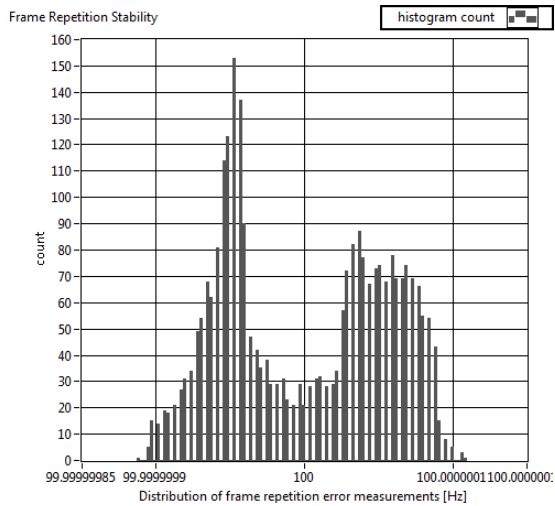
**Limit:**

<b>Frame Period</b>	20 or 10 ms
<b>Max Jitter</b>	25 µs
<b>3 times St.Dev. of Jitter</b>	12.5 µs

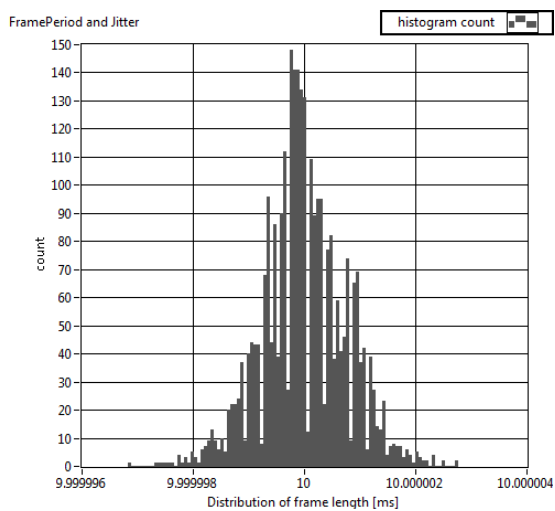
Ref. FCC 15.323(e). ANSI C63.17, clause 6.2.3.



**Histogram of Carrier Frequency Stability**



**Histogram of Frame Repetition Stability**



**Histogram of Frame Period and Jitter**



## 7.15 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	-79.7 dBm
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### 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) $f_1 T_L + 13 \text{ dB}$ , $f_2 T_L + 6 \text{ dB}$	Transmission always on $f_2$	<b>Pass</b>
c) $f_1 T_L + 6 \text{ dB}$ , $f_2 T_L + 13 \text{ dB}$	Transmission always on $f_1$	<b>Pass</b>
d) $f_1 T_L + 7 \text{ dB}$ , $f_2 T_L$	Transmission always on $f_2$	<b>Pass</b>
e) $f_1 T_L$ , $f_2$ at $T_L + 7 \text{ dB}$	Transmission always on $f_1$	<b>Pass</b>

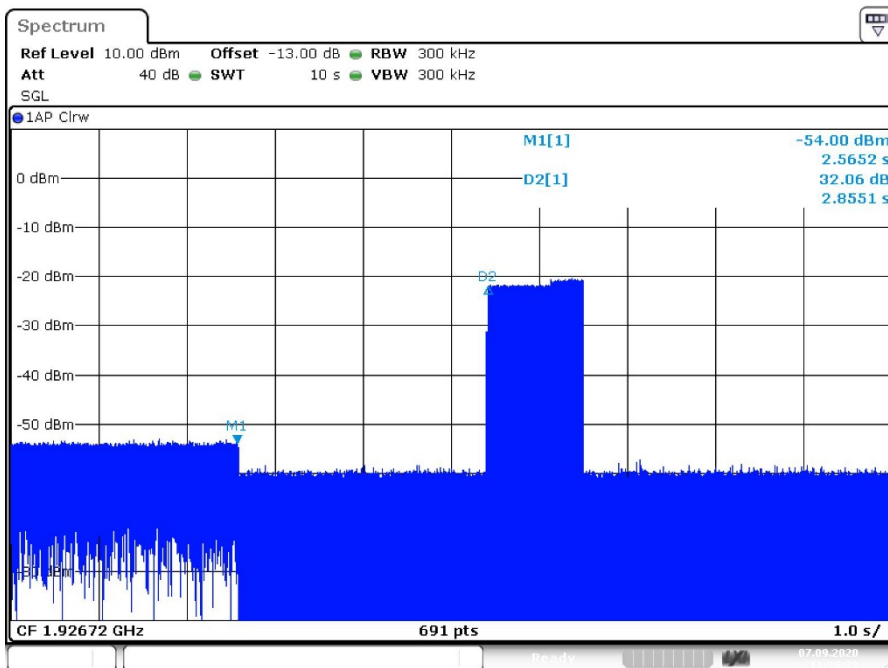
**Measurement Procedure:**

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 $f_1$	EUT transmits on $f_2$	<b>Pass</b>
d) Shall <b>not</b> transmit on $f_2$	EUT transmits on $f_1$	<b>Pass</b>

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



**7.3.3 Selected Channel Confirmation, connection 2.9 s after interferer removed**

## 7.16 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.

## 7.17 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 centered within all timeslots.

Pulse Width, ref. to ANSI C63.17 clause 7.5	Observation	Verdict
c) > largest of 50 $\mu$ s and $50 \cdot \text{SQRT}(1.25/B)$	Transmission on $f_2$	<b>Pass</b>
d) > largest of 35 $\mu$ s and $35 \cdot \text{SQRT}(1.25/B)$ and with interference level raised 6 dB	Transmission on $f_2$	<b>Pass</b>

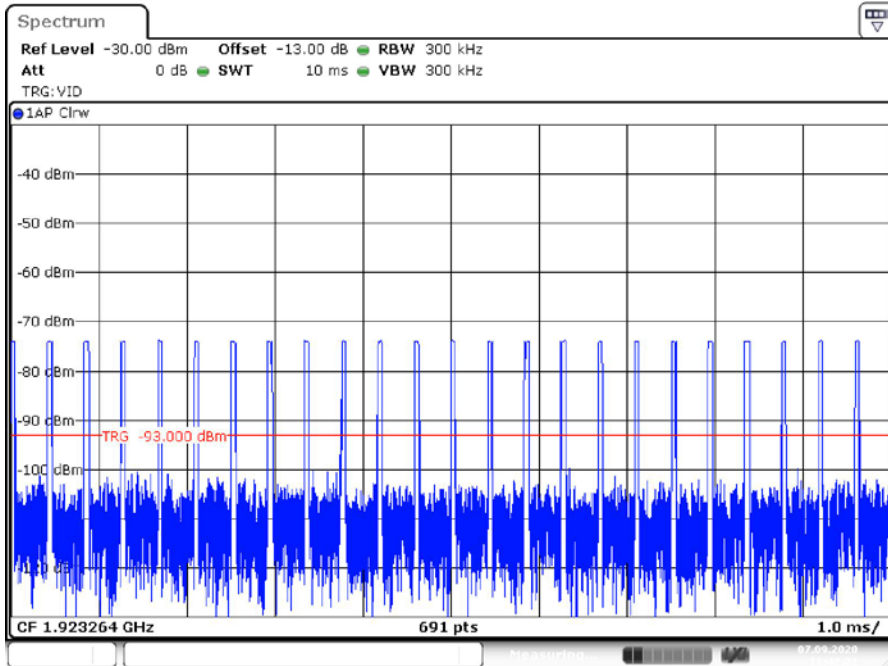
**Comment:** Since B is larger than 1.25 MHz, the test was performed with pulse lengths of 50  $\mu$ s and 35  $\mu$ s.

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

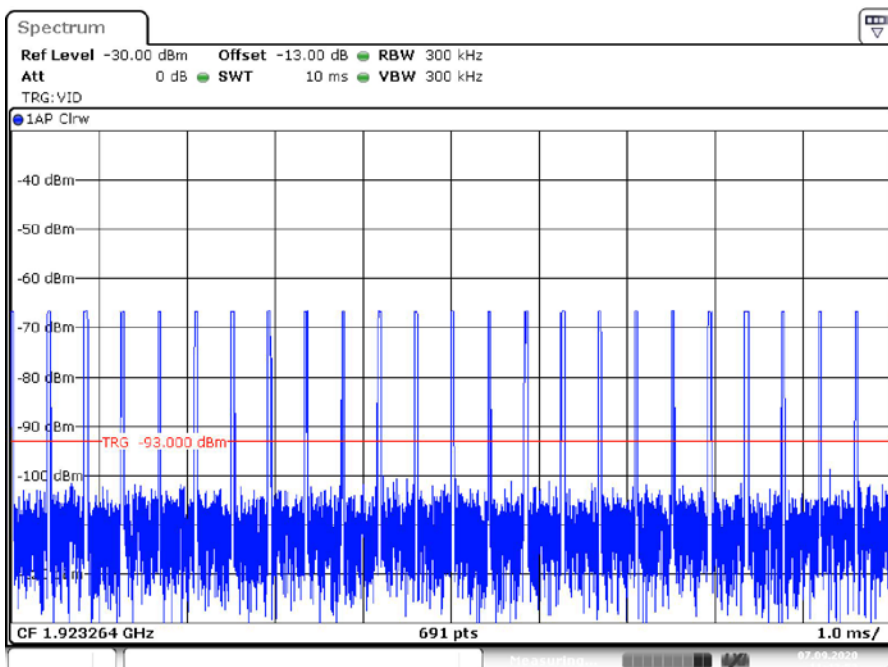
The maximum reaction time must be less than  $50 \cdot \text{SQRT}(1.25/\text{emission bandwidth in MHz})$  microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds.

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

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



**50 µs Pulses**



**35 µs Pulses**

## 7.18 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/A	N/A
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/A	N/A

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/A	N/A

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/A	N/A

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.

## 7.19 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	0.4 ms	Pass
c) Transmission time after loss of acknowledgments	6.1 s	Pass

#### Transmission Duration

Test ref. to ANSI C63.17 clause 8.2.2	Observation	Verdict
b) Transmission duration on same time and frequency window	5 s	Pass

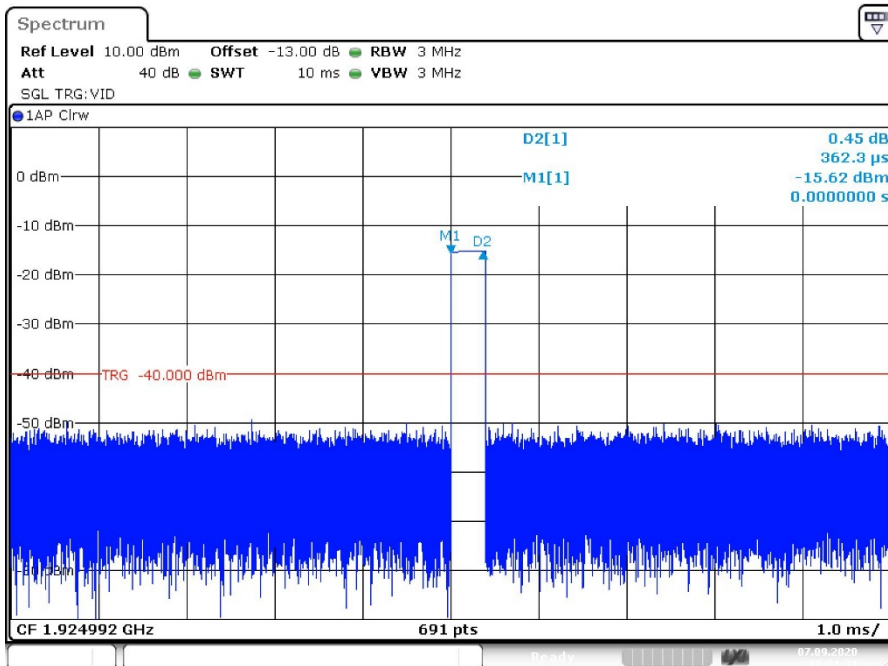
Comment: /

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

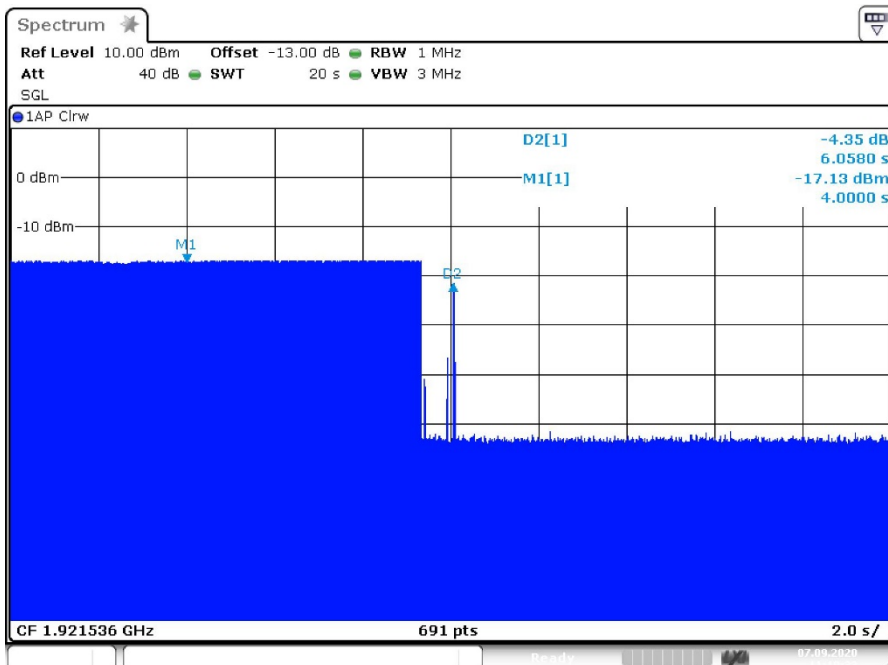
Occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

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.



8.2.1a) Initial Transmission Time without Acknowledgments



8.2.1c) Transmission Time after Loss of Acknowledgments



## 7.20 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/A	N/A
c) d) No transmission on interference-free <b>receive</b> time/spectrum window. All transmit slots blocked	N/A	N/A
e) f) No transmission on interference-free <b>transmit</b> time/spectrum window. All transmit slots blocked	N/A	N/A

#### 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/A	N/A
c) d) Transmission on interference-free <b>receive</b> time/spectrum window.	N/A	N/A
e) f) Transmission on interference-free <b>transmit</b> time/spectrum window.	N/A	N/A

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.

## 7.21 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.

## 7.22 Spurious Emissions (Radiated)

### Measurement Procedure:

FCC 15.209, FCC 15.109

### Test Result: Pass

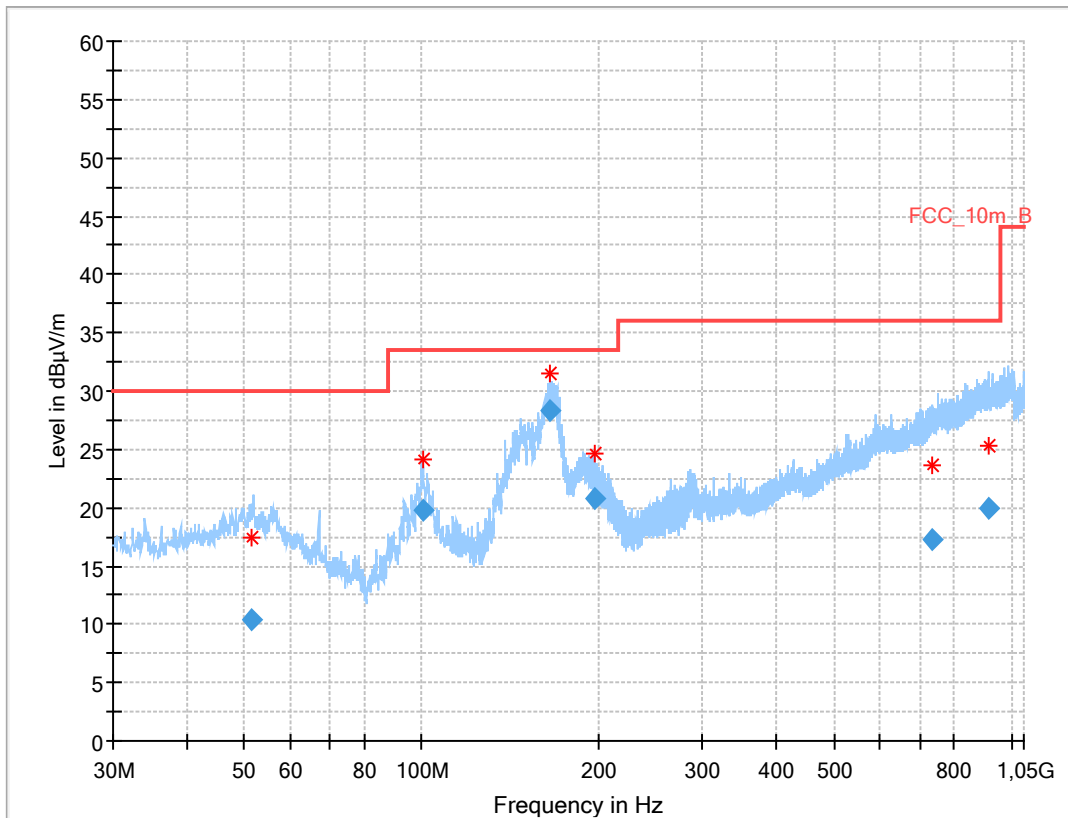
Measurement Data: See plots.

### Requirement: FCC 15.109(b)

30 – 88 MHz:	90 $\mu$ V/m
88 – 216 MHz:	150 $\mu$ V/m
216 – 960 MHz:	210 $\mu$ V/m
960 – 1000 MHz:	300 $\mu$ V/m

### Common Information

EUT: RM-WCH-8 + RM-WOM + RM-WDR + RM-WGS + RM-WGL + PA-300C  
 Serial number: Z6R000041 + Z6L000132 + Z6M000144 + Z6P000039 + Z6N000069 + JIID03P1SSY  
 Test description: FCC part 15 class B @ 10 m  
 Operating condition: charging four microphones  
 Operator name: Hennemann  
 Comment: AC: 115 V / 60 Hz

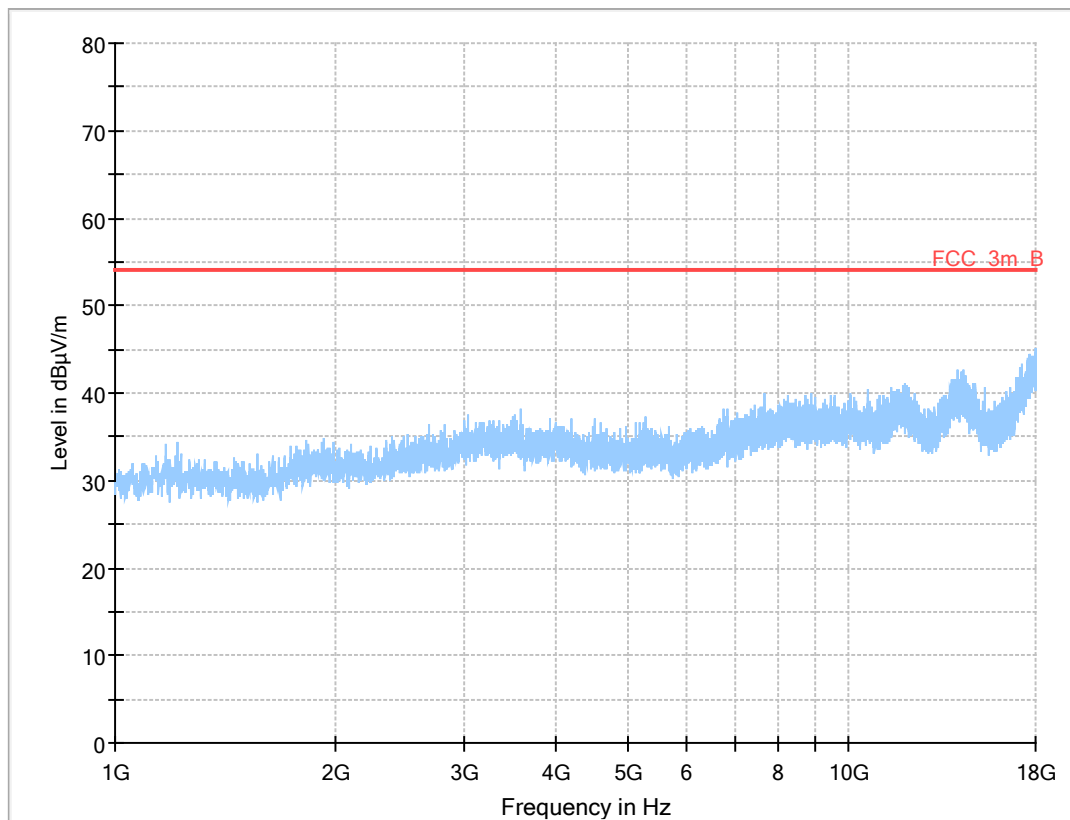


### Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
51.647	10.40	30.0	19.6	1000	120.0	127.0	V	180	14
100.577	19.86	33.5	13.6	1000	120.0	100.0	V	90	13
165.588	28.33	33.5	5.2	1000	120.0	100.0	V	354	10
196.667	20.77	33.5	12.7	1000	120.0	392.0	H	9	12
734.175	17.34	36.0	18.7	1000	120.0	209.0	V	15	22
912.805	19.94	36.0	16.1	1000	120.0	200.0	H	126	24

## Common Information

EUT:	RM-WCH-8 + RM-WOM + RM-WDR + RM-WGS + RM-WGL + PA-300C
Serial number:	Z6R000041 + Z6L000132 + Z6M000144 + Z6P000039 + Z6N000069 + JIID03P1SSY
Test description:	FCC part 15 class B
Operating condition:	charging four microphones
Operator name:	Hennemann
Comment:	AC: 115 V / 60 Hz



**The radiated spurious emission of the unintentional radiator is below the indicated limit.**

## 7.23 Receiver Spurious Emissions

### Measurement Procedure:

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

### Test results:

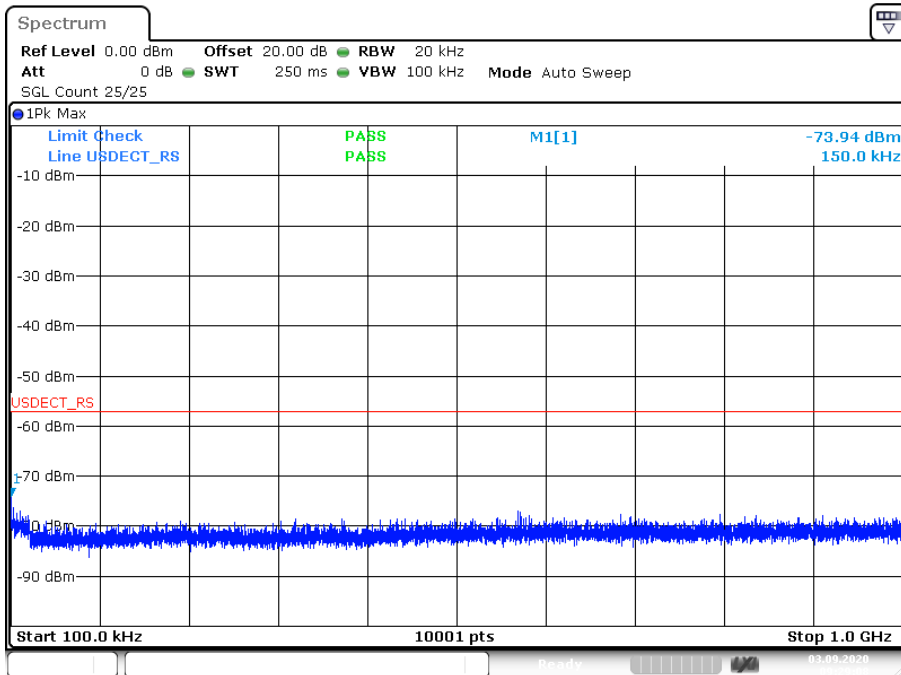
Frequency MHz	Carrier No.	Measured Value Conducted dBm	Conducted Limit dBm	Margin dB
30 - 1000	all	-73.9	-57	16.9
> 1000	all	-70.7	-53	17.7

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

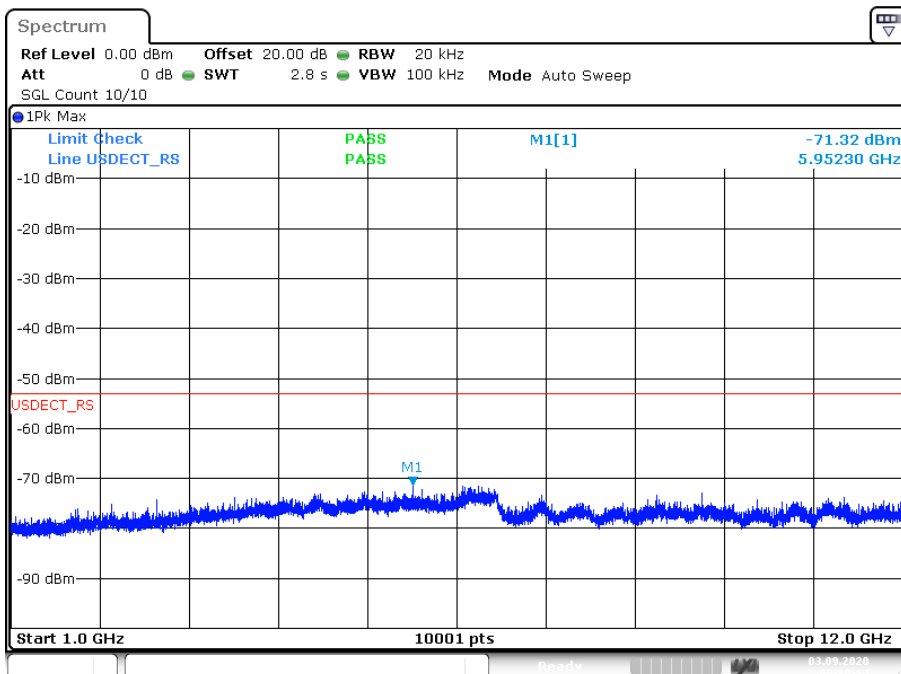
The measurement can be performed either radiated or conducted.

**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.

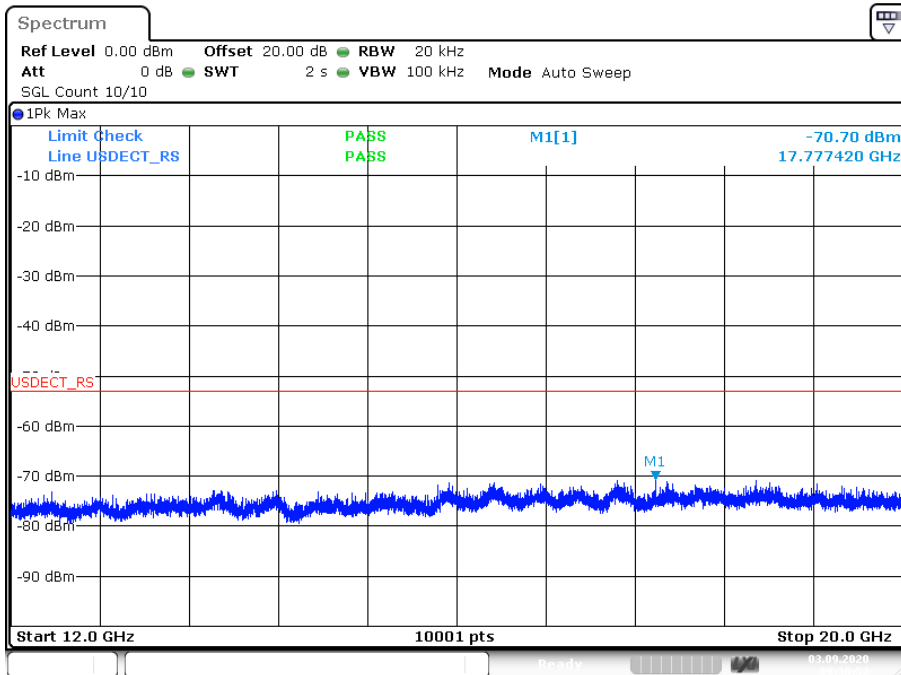
**When measured radiated:** See table 1 in RSS-GEN Issue2, clause 6.



**Receiver Spurious Emissions, Conducted, 100 kHz – 1 GHz**



**Receiver Spurious Emissions, Conducted, 1 GHz – 12 GHz**



**Receiver Spurious Emissions, Conducted, 12 GHz – 20 GHz**

## 8 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	12/2019	12/2020
L-2	Signal Generator	R&S	SMBV100A	257858	300004529	vlk!	12/2017	12/2020
L-3	Signaling Unit	R&S	CMD 65	825486	300003611	vlk!	03/2019	03/2021
L-4	Power Meter	R&S	NRP	100212	300003780	vlk!	12/2018	12/2020
L-5	Power Sensor	R&S	NRP-Z22	100031	400000188	vlk!	12/2019	12/2021

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	12/2019	12/2020
G-2	VISN	R&S	ESH 3-Z5	893045/004	300000584	vlk!	12/2018	12/2020

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	12/2019	12/2020
F-2	Spectrum Analyzer	R&S	FSU26	200809	300003874	k	12/2019	12/2020
F-3	Trilog Antenna	Schwarzbeck	VULB9163	371	300003854	vlk!	11/2017	11/2020
F-4	Horn antenna	Schwarzbeck	BBHA9120B	188	300003896	vlk!	04/2020	04/2022

### Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlk!	Attention: extended calibration interval	*	next calibration ordered / currently in progress
NK!	Attention: not calibrated		



## **9 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

## 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			
 <p>Deutsche Akkreditierungsstelle GmbH</p> <p>Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV 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 <b>CTC advanced GmbH</b> Untertürkheimer Straße 6-10, 66117 Saarbrücken is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields: <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  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. <a href="https://www.dakks.de/en/content/accredited-bodies-dakks">https://www.dakks.de/en/content/accredited-bodies-dakks</a> See notes overleaf.</small></p>	<p>Deutsche Akkreditierungsstelle GmbH</p> <table border="0"> <tr> <td>Office Berlin Spittelmarkt 10 10117 Berlin</td> <td>Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main</td> <td>Office Braunschweig Bundesallee 100 38116 Braunschweig</td> </tr> </table> <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: EA: <a href="http://www.european-accreditation.org">www.european-accreditation.org</a> ILAC: <a href="http://www.ilac.org">www.ilac.org</a> IAF: <a href="http://www.iaf.nu">www.iaf.nu</a></p>	Office Berlin Spittelmarkt 10 10117 Berlin	Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main	Office Braunschweig Bundesallee 100 38116 Braunschweig
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**Note:**  
The current certificate including annex can be received on request.