

Test Report

Report Number:

F151102E1

Equipment under Test (EUT):

CT-MultiPTT

Applicant:

CeoTronics AG

Manufacturer:

CeoTronics AG





Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

References

- [1] **ANSI C63.4:2014** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC 47 CFR Part 2:2014** General Rules and Regulations
- [3] **FCC 47 CFR Part 15:2014** Radio Frequency Devices (Subpart B)
- [4] **RSS-Gen Issue 4 (November 2014)** General Requirements and Information for the Certification of Radiocommunication Equipment
- [5] **RSS-210 Issue 8 (December 2010)** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

Test result

The requirements of the tests performed as shown in the overview (chapter 4 of this test report) were fulfilled by the equipment under test.
The complete test results are presented in the following.

Test engineer:	Michael DINTER		22.09.2015
	_____ Name	_____ Signature	_____ Date
Authorized reviewer:	Bernd STEINER		22.09.2015
	_____ Name	_____ Signature	_____ Date

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Contents:	Page
1 Identification	4
1.1 Applicant.....	4
1.2 Manufacturer.....	4
1.3 Test Laboratory.....	4
1.4 EUT (Equipment Under Test).....	5
1.5 Technical data of equipment	5
1.6 Dates	6
2 Operational states and test setup.....	7
3 Additional information.....	7
4 Overview	8
5 Results	9
5.1 Radiated emissions.....	9
5.1.1 Test method	9
5.1.2 Results preliminary measurement 30 MHz to 5 GHz	14
5.1.3 Result final measurement from 30 MHz to 1 GHz.....	16
5.1.4 Result final measurement from 1 GHz to 5 GHz.....	18
6 Test equipment	19
7 Report history.....	20
8 List of annexes	20

1 Identification

1.1 Applicant

Name:	CeoTronics AG
Address:	Adam-Opel-Str. 6
Country:	63322 Rödermark Germany
Name for contact purposes:	Mr. Neuhaus
Phone:	+49 6074 8751631
Fax:	+49 6074 8751659
eMail Address:	entwicklung@ceotronics.com
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	CeoTronics AG
Address:	Adam-Opel-Str. 6
Country:	63322 Rödermark Germany
Name for contact purposes:	Mr. Neuhaus
Phone:	+49 6074 8751631
Fax:	+49 6074 8751659
eMail Address:	entwicklung@ceotronics.com
Manufacturer represented during the test by the following person:	-

1.3 Test Laboratory

The tests were carried out at:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

Test Laboratory (CAB) accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under the Reg. No. D-PL-17186-01-02, recognized by Bundesnetzagentur under the Reg.-No. BNetzA-CAB-02/21-104.

FCC Test site registration number 90877 and Industry Canada Test site registration IC3469A-1

The tests were performed at:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

1.4 EUT (Equipment Under Test)

Test object:	CT-MultiPTT BT
Type:	CT-MultiPTT
Order number:	0291011
Serial number:	-
PCB identifier:	MP_BT-7
Hardware version:	-
Software version:	S-BTBG-0001-00, S-MEGA-0059-00

1.5 Technical data of equipment

Power supply:	2.4 V DC Batteries 2 x AA
Supply voltage ¹ :	U _{nom} = 2.4 VDC
highest internal frequency ¹ :	7.3 MHz

Remark ¹: As declared by the applicant.

Module inside EUT:

Module inside *	Receiver Module RCDM14
FCC ID*	-
Frequency Band(s) of Operation*:	916,5 MHz
No. of Channels*	1
Channel frequency spacing*	-
Type of Modulation*	FSK
Data rate*	-
Antenna type (if applicable all used antennas)*	-
Antenna gain*	-

* declared by the applicant.

Ports/Connectors of the EUT:

The following external I/O cables were used:

Identification	Connector		Length*
	EUT	Ancillary	
12 PIN Hirose	7 wires to Headset	12 PIN Hirose	0.5 m

*: Length during the test.

- Adapter Box from Ceotronics
- Small sized digital communication system CT-Multi PTT BT (No. 0291011)
- CT-ClipCom digital
- CT-WirelessPTT MIL for USA 916.5 MHz (No. 9800979)
- GSM Mobile Samsung S3 Mini i8190 for BT connection

1.6 Dates

Date of receipt of test sample:	17.06.2015
Start of test:	09.07.2015
End of test:	10.07.2015

2 Operational states and test setup

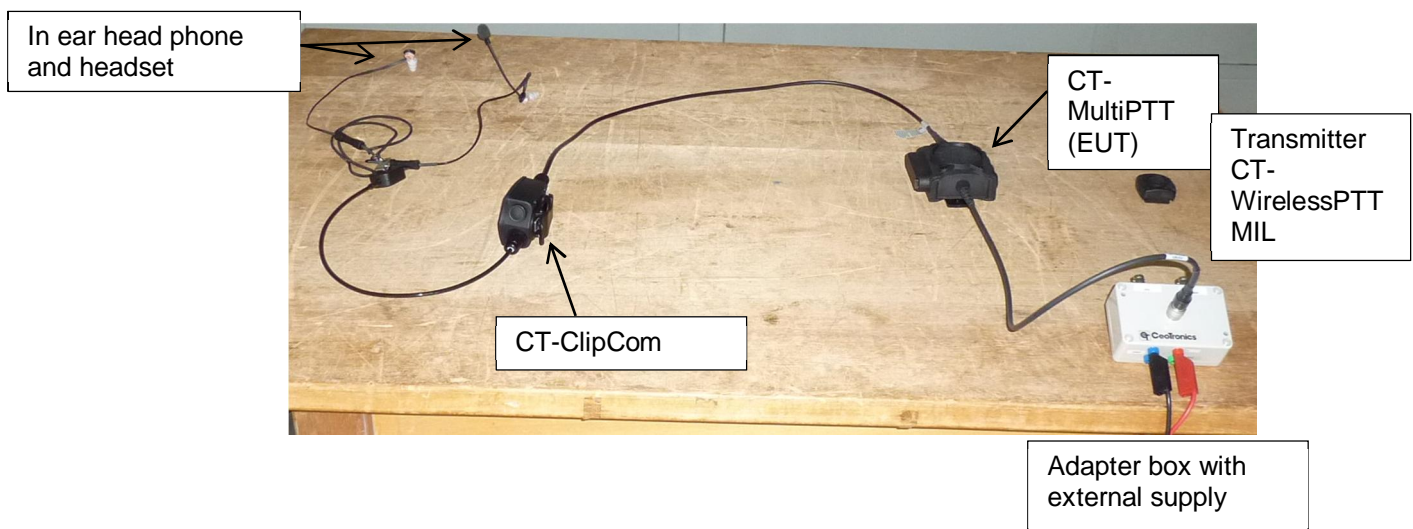
The EUT is part of a communication system for professional use.

The operation mode of the equipment under test was defined as follows:

- During the tests, the EUT was not sealed or labelled with a FCC-label.
- The EUT was battery supplied with 3.6 V DC and in receive mode.
- A BT link between the EUT and GSM Mobile was established and active during the test.
- The audio lines were terminated with the CT-ClipCom digital (in ear headphone Clip Com right and an in ear headset Clip Com Gooseneck left).
- The adapter Box was connected and supplied with 3.7 VDC to simulate a radio in receive mode.
- The CT-WirelessPTT MIL for USA 916.5 MHz was not in transmitting mode during the test.

The physical boundaries of the EUT are shown below:

Physical boundaries of the EUT



3 Additional information

The tested samples were not marked with a type plate according to the FCC-rules.

The device under test is classified as a class B device according to FCC 47 CFR Part 15 [3] by the manufacturer.

A Bluetooth module (FCC ID: QOQWT32AE and IC: 5123A-BGTWT32AE identical to FCC ID: L52-CTBT32AE and IC: 9714A-CTBT32AE by changing ID) is used inside the EUT. An evaluation of the module is not part of this document.

4 Overview

Conducted emissions FCC 47 CFR Part 15 section 15.107 (b) [3] / RSS Gen Issue 4 section 8.8 [4]					
Application	Frequency range	Limits	Reference standard	Remark	Status
AC supply line	0.15 to 0.5 MHz	79 dBμV (QP)	ANSI C63.4	Class A	-
	0.5 to 30 MHz	66 dBμV (AV) 73 dBμV (QP) 60 dBμV (AV)			
AC supply line	0.15 to 0.5 MHz	66 to 56 dBμV (QP)* 56 to 46 dBμV (AV)*	ANSI C63.4	Class B	-
	0.5 to 5 MHz	56 dBμV (QP) 46 dBμV (AV)			
	5 to 30 MHz	60 dBμV (QP) 50 dBμV (AV)			
*: Decreases with the logarithm of the frequency					
Radiated emissions FCC 47 CFR Part 15 section 15.109 (b) [3] / RSS Gen Issue 4 section 8.9 [4]					
Application	Frequency range	Limits	Reference standard	Remark	Status
Radiated Emission	30 to 88 MHz	39.0 dBμV /m QP at 10 m	ANSI C63.4	Class A	-
	88 to 216 MHz	43.5 dBμV /m QP at 10 m			
	216 to 960 MHz	46.5 dBμV /m QP at 10 m			
	960 to 1000 MHz	49.5 dBμV /m QP at 10 m			
	above 1000 MHz	49.5 dBμV /m AV at 10 m and 69.5 dBμV /m PK at 10 m			
Radiated Emission	30 to 88 MHz	40.0 dBμV/m QP at 3 m	ANSI C63.4	Class B	Passed
	88 to 216 MHz	43.5 dBμV/m QP at 3 m			
	216 to 960 MHz	46.0 dBμV/m QP at 3 m			
	960 to 1000 MHz	54.0 dBμV/m QP at 3 m			
	above 1000 MHz	54.0 dBμV/m AV at 3 m and 74.0 dBμV/m PK at 3 m			

Remark: As declared by the applicant the highest internal clock frequency is below 1 GHz. Therefore the radiated emission measurement was carried out up to 5 GHz.

5 Results

5.1 Radiated emissions

5.1.1 Test method

The radiated emission measurement is subdivided into four stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out on an open area test site with reflecting ground plane and various antenna heights in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 2 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 2 GHz.

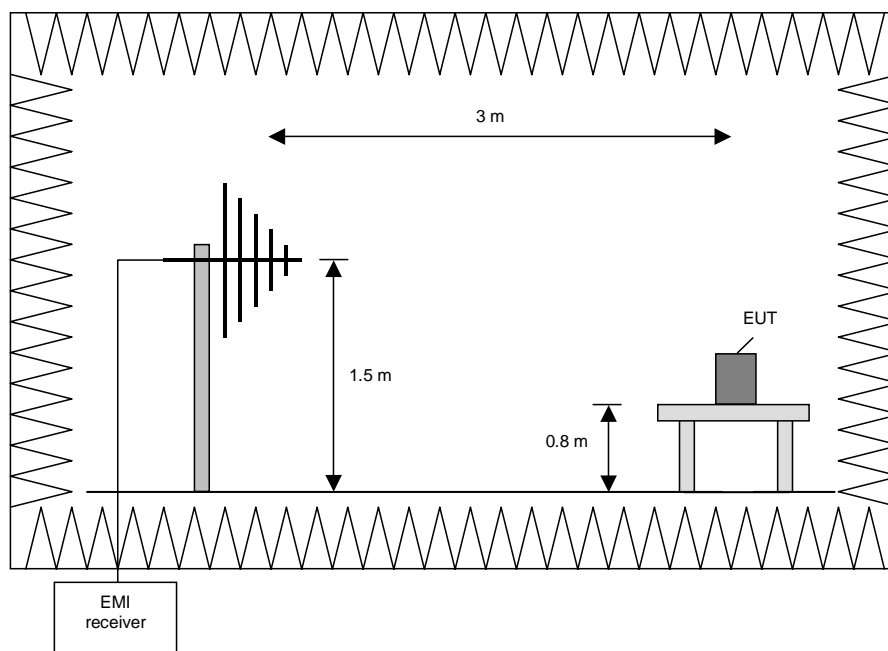
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 120 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 1 GHz.

The following procedure will be used:

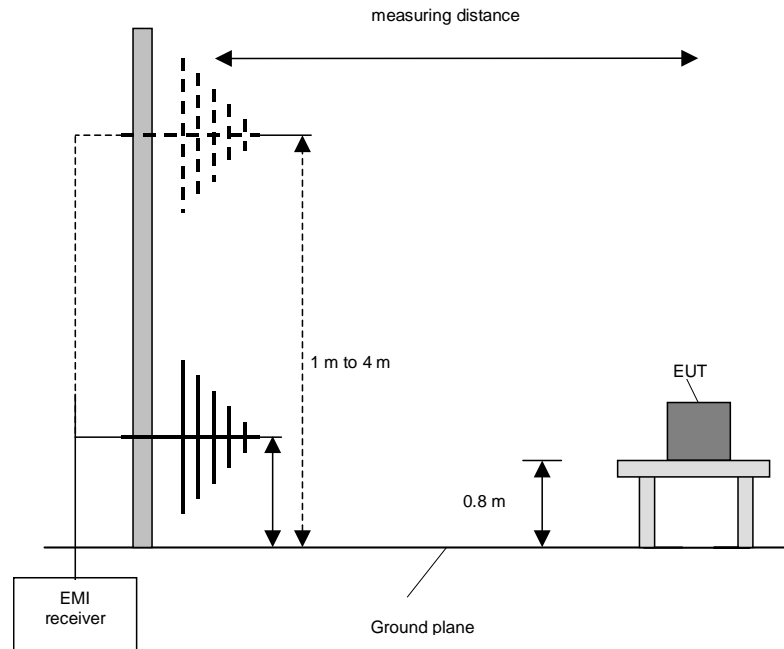
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT if handheld equipment.
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

- 1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
- 4) Repeat 1) to 3) for the other orthogonal antenna polarization.
- 5) Move the antenna and the turntable to the position where the maximum value is detected.
- 6) Measure while moving the antenna slowly +/- 1 m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable +/- 45 °.
- 9) Set the turntable to the azimuth where the maximum value is found.
- 10) Measure with Final detector (QP and AV) and note the value.
- 11) Repeat 5) to 10) for each frequency.
- 12) Repeat 1) to 11) for each orthogonal axes of the EUT if handheld equipment.

Preliminary and final measurement (1 GHz to 5 GHz)

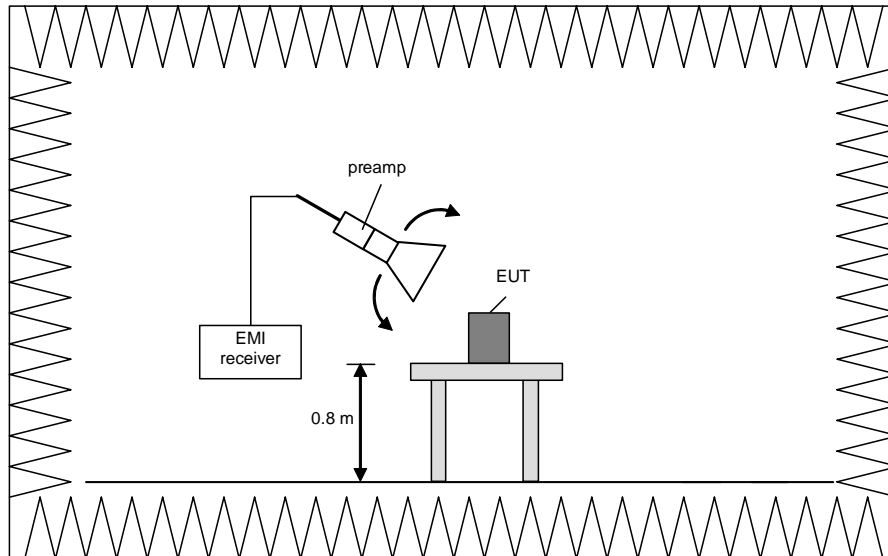
This measurement will be performed in a fully anechoic chamber. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4 [1].

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth (preliminary)	Resolution bandwidth (final)
1 GHz to 5 GHz	100 kHz	1 MHz

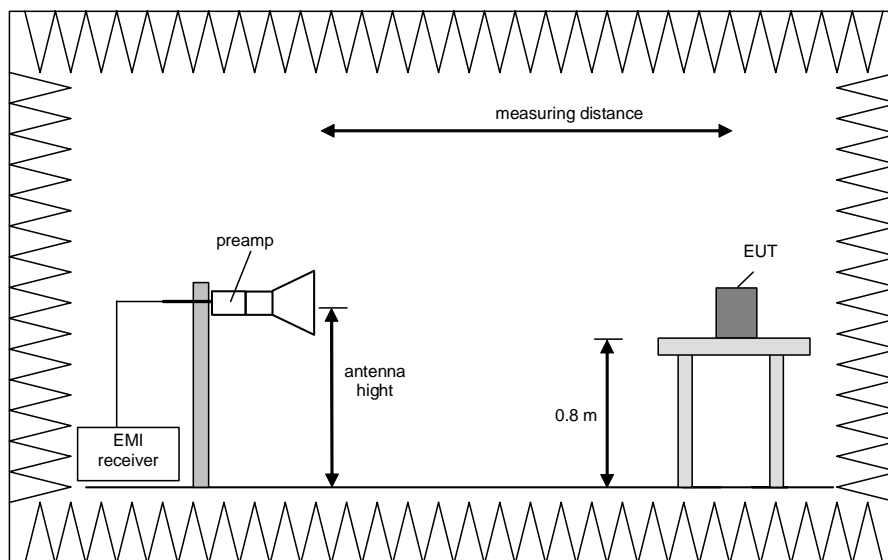
Preliminary measurement (1 GHz to 5 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found and than the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.



Final measurement (1 GHz to 5 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 ° in order to have the antenna inside the cone of radiation.



Procedure of measurement:

The measurements were performed in the frequency range 1 to 5 GHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
- 2) Change the antenna polarisation and repeat 1) with vertical polarisation.
- 3) Make a hardcopy of the spectrum.
- 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 5) Change the analyser mode to Clear / Write and found the cone of emission.
- 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
- 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
- 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beam width.

Step 1) to 6) are defined as preliminary measurement.

5.1.2 Results preliminary measurement 30 MHz to 5 GHz

Ambient temperature	21 °C	Relative humidity	29 %
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Position of EUT: The EUT was set-up on a table of a height of 0.8 m.

Cable guide: The cable of the EUT was fixed on the wooden table. For further information of the cable guide refer to the pictures in annex A of this test report.

EUT Information

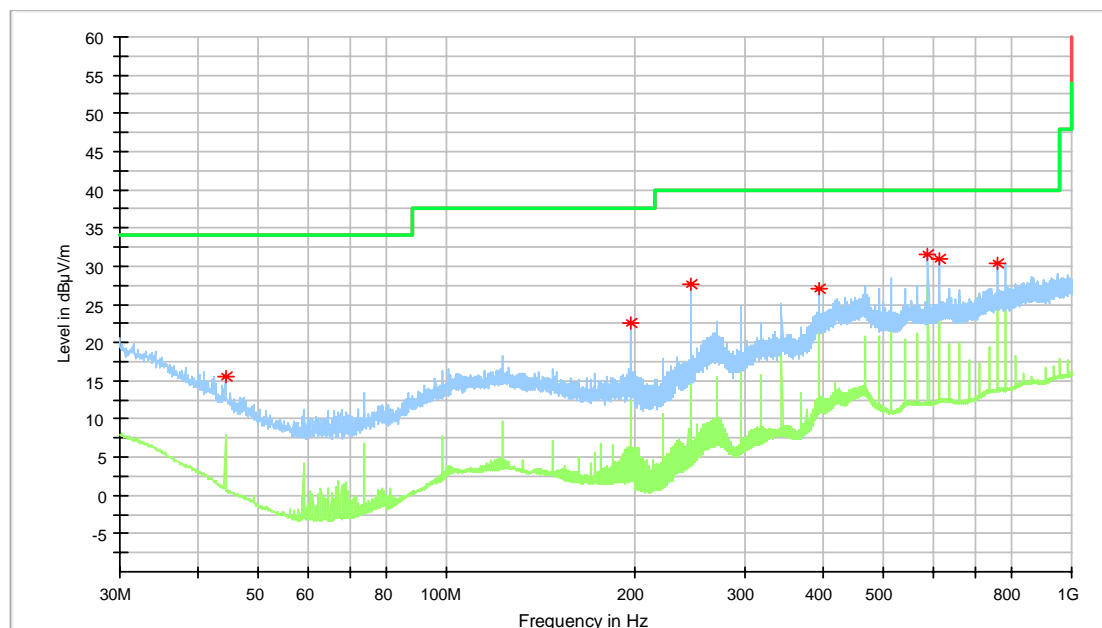
Test Description:	Radiated emission measurement
EUT:	CT-MultiPTT BT
Manufacturer:	Ceotronics AG
Operating Conditions:	BT active
Test Site:	PhoenixTESTLAB GmbH, anechoic chamber M20
Operator Name:	M. DINTER
Comment:	

The limit line and measurement curve shown in the diagram below refer to the preliminary measurements. Here, it must be noted that because of the reduced measuring distance and because of the floor absorbers, the measured values do not comply with the values of the above mentioned standard; they only serve as orientation in determining which frequencies must be measured on the open area test site.

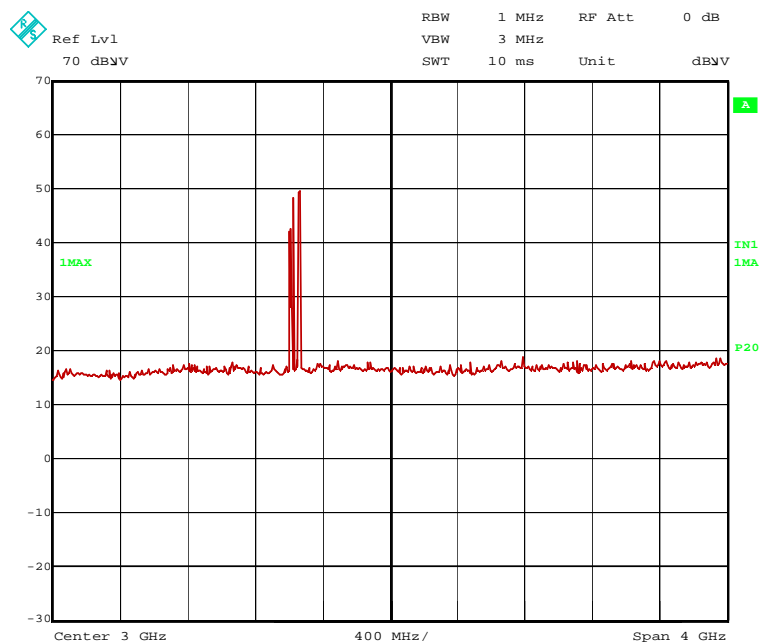
The limit line is achieved with the applied standard by converting to a 3 m measurement distance (+ 10 dB) and the correction for the free space in which in the "worst case" the reflected floor wave is missing entirely (– 6 dB). Therefore 4 dB is added to the limit line of the standard concerned.

The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with the EUT in various positions.

The top measured curve represents the peak measurement. The measured points marked with "?" are frequency points for which later measurements with a quasi-peak detector were carried out. These values are indicated in the following table. The bottom measured curve represents average values (marked with "+"), which are only required for control purposes.



Preliminary measurement 1 GHz to 5 GHz was carried out in a measuring distance of 1.9 m. The polarity of the antenna was changed and the antenna high was varied from 50 cm up to 250 cm. The EUT was turned around 360 ° and the plot below shows the maximum emission with 150 cm high and vertical antenna position.



Remark: The emissions around 2450 MHz were caused by the used Bluetooth module (FCC ID: QOQWT32AE and IC: 5123A-BGTWT32AE identical to FCC ID: L52-CTBT32AE and IC: 9714A-CTBT32AE by changing ID) inside the EUT. An evaluation of the module is not part of this document and therefore these emissions have not been taken in account for the results.

The following frequencies were found during the preliminary radiated emission test:

Frequency / MHz	Frequency / MHz
44.220	
196.620	
245.760	
393.240	
589.800	
614.400	
761.880	

Test equipment (refer chapter 6):

30 – 35 , 44 , 46, 56

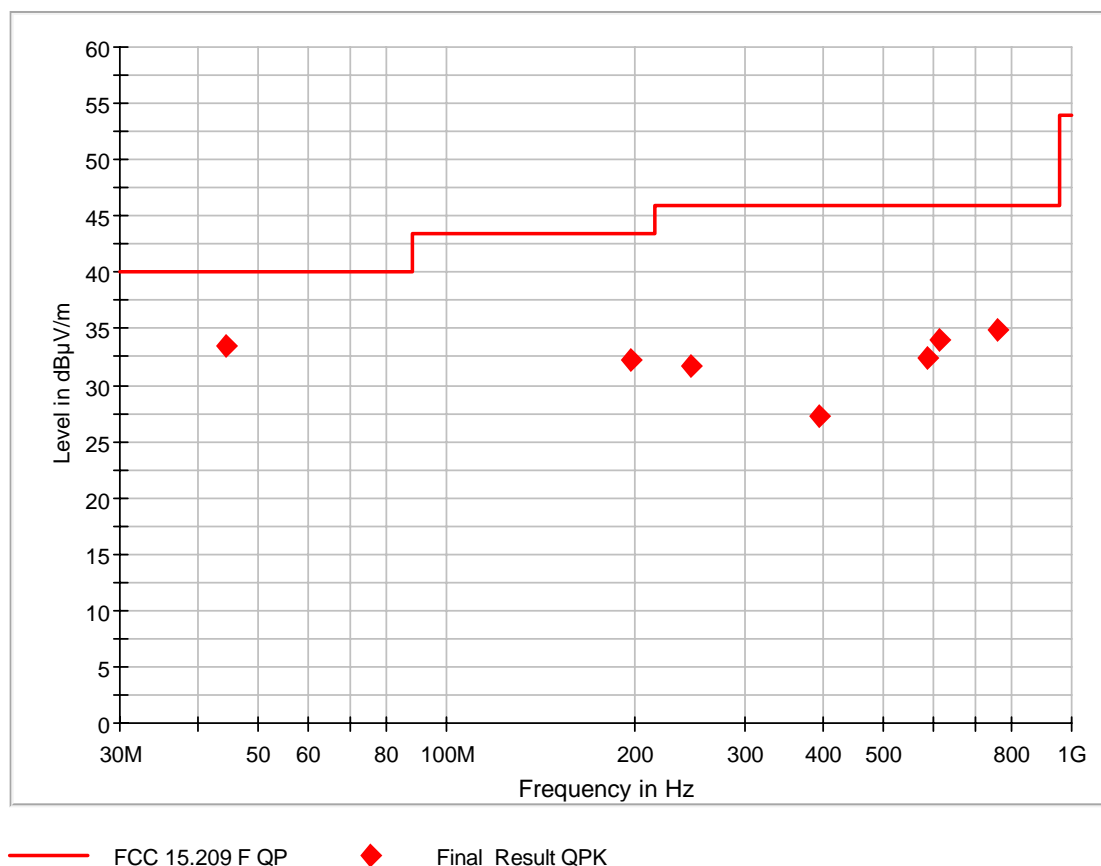
5.1.3 Result final measurement from 30 MHz to 1 GHz

Ambient temperature:	20 °C	Relative humidity:	38 %
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EUT Information

Test description:	Radiated emission measurement
EUT:	CT-MultiPTT BT
Manufacturer:	Ceotronics AG
Operating conditions:	BT active
Test site:	Phoenix TESTLAB GmbH, OATS M6
Operator:	M.DINTER
Comment:	

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above mentioned standard. The measured points marked with “?” are the measured results of the standard subsequent measurement on the open area test site.



The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

**Result measured with the quasipeak detector according to
FCC 47 CFR Part 15 and RSS Gen Issue 4:**

Frequency / MHz	Field Strength @ 3 m dBuV/m	Limit / dBuV/m*	Margin / dB	Reading / dBuV	Antenna Factor / 1/m	Preamp / dB	Cable Loss / dB	Height / cm	Antenna Polarization	Turntable Angle
44.220	33.4	40.0	6.6	20.0	12.7	-	0.7	104.0	V	258.0
196.620	32.2	43.5	11.3	21.8	8.9	-	1.5	112.0	H	16.0
245.760	31.61	46.0	14.4	18.1	11.8	-	1.7	124.0	H	23.0
393.240	27.16	46.0	18.8	9.5	15.5	-	2.2	100.0	H	13.0
589.800	32.37	46.0	13.6	10.5	19.1	-	2.8	104.0	V	203.0
614.400	34.06	46.0	11.9	11.8	19.5	-	2.8	121.0	V	292.0
761.880	34.87	46.0	11.1	10.0	21.7	-	3.1	114.0	H	157.0
Measurement uncertainty: +2.2 dB / -3.6 dB										

Test: Passed

Test equipment (Refer chapter 6):
14 - 21

5.1.4 Result final measurement from 1 GHz to 5 GHz

The results of the standard subsequent measurement in the anechoic chamber are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

Result measured with the peak detector according to FCC 47 CFR Part 15 and RSS Gen Issue 4:

Frequency / MHz	Field Strength @ 1.9 m dBuV/m	Limit / dBuV/m*	Margin / dB	Reading / dBuV	Antenna Factor / 1/m	Preamplifier / dB	Cable Loss / dB	Height / cm	Antenna Polarization	Turntable Angle
		No significant emissions at least 20 dB below the limit found.								
Measurement uncertainty: +2.2 dB / -3.6 dB										

Remark*: The measurement was carried out at a distance from 1.9 m instead of 3 m.
Therefore 4 dB were added to the 3 m limit according FCC part 15.109 Class B devices.
Limits extrapolated from 3 m distance to 1.9 m distance by 20 dB /decade

Result measured with the average detector according to FCC 47 CFR Part 15 and RSS Gen Issue 4:

Frequency / MHz	Field Strength @ 1.9 m dBuV/m	Limit / dBuV/m*	Margin / dB	Reading / dBuV	Antenna Factor / 1/m	Preamplifier / dB	Cable Loss / dB	Height / cm	Antenna Polarization	Turntable Angle
		No significant emissions at least 20 dB below the limit found.								
Measurement uncertainty: +2.2 dB / -3.6 dB										

Remark*: The measurement was carried out at a distance from 1.9 m instead of 3 m.
Therefore 4 dB were added to the 3 m limit according FCC part 15.109 Class B devices.
Limits extrapolated from 3 m distance to 1.9 m distance by 20 dB /decade

Test result: Passed.

Test equipment (Refer chapter 6):
30 – 34 , 44 , 46

6 Test equipment

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M4	-	Siemens	B83117S1-X158	480088	Weekly verification (system cal.)	
2	Measuring receiver	ESIB 26	Rohde & Schwarz	100292	481182	21.03.2014	03.2016
3	LISN	NSLK8128	Schwarzbeck	8128155	480058	22.01.2015	01.2016
5	AC-filter	B84299-D87-E3	Siemens	930262292	480097	Weekly verification (system cal.)	
6	EMI Software	EMC 32	Rohde & Schwarz	-	481022	-	-
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	06.03.2015	03.2017
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	AS615P	Deisel	615/310	480086	-	-
19	Antenna	CBL6111 D	Chase	25761	480894	18.09.2014	09.2017
20	EMI Software	EMC 32	Rohde & Schwarz	-	481022	-	-
21	Attenuator	6 dB	Radial	9833	410082	-	
30	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	26.02.2014	02.2016
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna	CBL6112 B	Chase	2688	480328	14.04.2014	04.2017
43	RF-cable No. 3	Sucoflex 106B	Suhner	0563/6B	480670	Weekly verification (system cal.)	
44	RF-cable No. 36	Sucoflex 106B	Suhner	0522/6B	480571	Weekly verification (system cal.)	
45	RF-cable No. 40	Sucoflex 106B	Suhner	0708/6B	481330	Weekly verification (system cal.)	
46	Antenna	HL050	Rohde & Schwarz	100438	481170	27.08.2014	11.2017
47	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	09.07.2015	07.2016
50	Fully anechoic chamber M8	-	Siemens	B83117-E7019-T231	480190	Weekly verification (system cal.)	
51	Measuring receiver	ESU 8	Rohde & Schwarz	100218	480998	25.02.2014	02.2016
52	Controller	MCU	Maturo	MCU/040/971107	481353	-	-
53	Turntable	DS420	Deisel	420/435/97	480186	-	-
54	Antenna support	AS200P	Inn-Co GmbH	AS200P/030/8921004	480455	-	-
55	Antenna	CBL6112B	Chase	2689	480327	14.03.2011	03.2016
56	EMI Software	EMC 32	Rohde & Schwarz	-	481800	-	-

7 Report history

Report Number	Date	Comment
F151102E1	22.09.2015	Document created
-	-	-
-	-	-

8 List of annexes

Annex A	Test Setup Photos	4 Pages
	151102emi1	Test setup fully anechoic chamber
	151102emi2	Test setup fully anechoic chamber
	151102emi3	Test setup fully anechoic chamber
	151102emi4	Test setup open area test site
Annex B	External Photos	3 Pages
	151102eut1	EUT 3 D view 1
	151102eut2	EUT 3 D view 2
	151102eut3	EUT 3 D view battery case
Annex C	Internal Photos	6 Page
	151102eut4	inside view 1
	151102eut5	inside view 2
	151102eut6	PCB 1 rear view
	151102eut7	PCB 1 front view
	151102eut8	PCB 2 rear view
	151102eut9	PCB 2 front view