

FCC Part 15C Compliance Test Report

Test Report no.:	FCC15CNFC_RM-983_12.docx	Date of Report:	10-Sep-2014
Number of pages:	18	Customer's Contact person:	Victoria Abadilla
Testing laboratory:	TCC Microsoft Tampere Laboratory P.O. Box 403 Visiokatu 3 FIN-33101 TAMPERE, FINLAND Tel. +358 71 800 8000 Fax. +358 71 804 6880	Customer:	Microsoft 16620 West Bernardo Drive San Diego, CA 92127 USA Tel. +1 858 831 5000 Fax. +1 858 385 1598
FCC listing no.:	94436		
IC recognition no.:	661AK-1		
Tested devices/ accessories:	Phone RM-983 / Charger AC-60E / USB Cable CA-190CD / Headset WH-208		
FCC ID:	QMNRM-983	IC:	-
Supplement reports:	-		
Testing has been carried out in accordance with:	CFR 47, FCC rules Part 15 Subpart C, ANSI C63.4 (2009), IC standards. Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 15 years at TCC Microsoft.		
Test Results:	The EUT complies with the requirements in respect of all parameters subject to the test. The test results relate only to devices specified in this document		
Date and signature for the contents:			

Kalle Hannila, System Manager, EMC

1. Summary for FCC Part 15C Compliance Test Report

Date of receipt	09-Jul-2014
Testing completed	15-Jul-2014
The customer's contact person	Victoria Abadilla
Test Plan referred to	T:\Projects\RM-983\TestPlan\RS_TestPlan_RM-983.xlsm
Notes	-
Document name	T:\Projects\RM-983\EMC\FCC15CNFC_RM-983_12.docx

1.1. EUT and Accessory Information

The EUT is a mobile phone with following features:

GSM/WCDMA/WLAN/Bluetooth

The EUT is tested with maximum rated TX power.

Devices under tests

Product	Type	SN	HW	MV	SW	DUT
Phone	RM-983	354250060000364	0200	-	02028.00000.14224.06004	43191
Phone	RM-983	354250060000257	0200	-	02028.00000.14224.06004	43198
Battery	BV-L4A	4181574243S114000270670727	3.0	1.0	-	43188
Charger	AC-60E	-	-	-	-	43161
USB Cable	CA-190CD	-	-	-	-	43162
Headset	WH-208	-	-	-	-	43189

1.2. Summary of Test Results

NFC:

Section in CFR 47	Section in RSS-GEN or RSS-210	Name of the test	Result
15.209	2.6	Radiated emission below 30 MHz	PASSED
15.209	A2.6	Radiated emission above 30 MHz	PASSED
15.225(a-d)	A2.6	Field strength in the 13.56 MHz band	PASSED
-	4.6.1	Occupied Bandwidth	PASSED
15.225(e)	A2.6	Frequency stability, temperature variation	PASSED
15.225(e)	A2.6	Frequency stability, voltage variation	PASSED
15.207	7.2.2	AC power line conducted emission	PASSED

PASSED

The EUT complies with the essential requirements in the standard.

FAILED

The EUT does not comply with the essential requirements in the standard.

NP

The test was not performed by the TCC Microsoft Laboratory.

CONTENTS

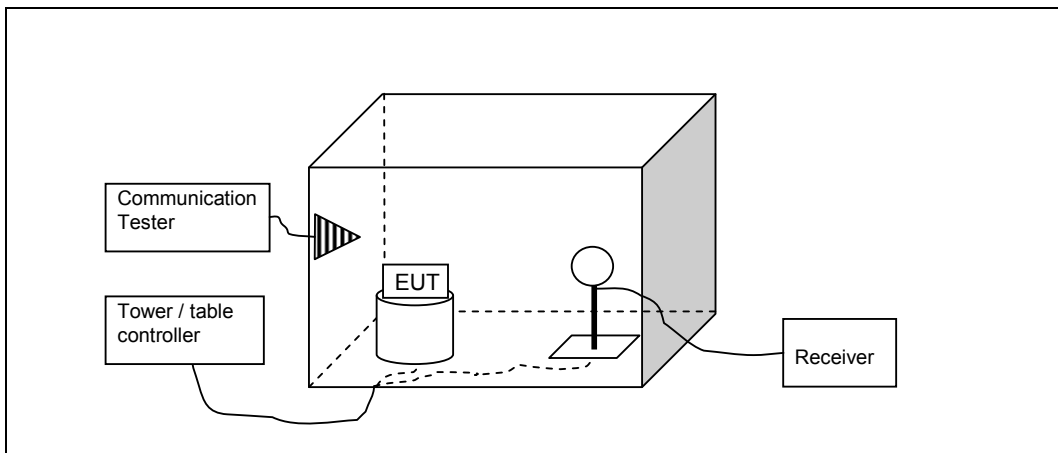
1. Summary for FCC Part 15C Compliance Test Report.....	2
1.1. EUT and Accessory Information.....	2
1.2. Summary of Test Results.....	2
2. Radiated emission below 30 MHz (FCC 15.209, RSS-210 2.6).....	5
2.2. Test method and limit.....	5
2.3. Limits for radiated emissions measurements (3 m measurement distance)	6
2.4. NFC test results	6
3. Radiated emissions above 30MHz (FCC §15.209, RSS-210 2.6).....	7
3.2. Test method and limit.....	7
3.3. NFC test results	9
4. Field strength in the 13.56 MHz band	10
4.2. Test method and limit.....	10
4.3. NFC test results	11
5. Occupied bandwidth	12
5.1. Test Setup.....	12
5.2. Test method and limit.....	12
5.3. NFC Test results	12
6. Frequency stability, temperature variation (FCC §15.225 (e) [2], RSS-210 A2.6.....	13
6.1. Test Setup.....	13
6.2. Test method and limit.....	13
6.3. NFC Test results	13
7. Frequency stability, voltage variation (FCC §15.225 (e) [2], RSS-210 A2.6.....	14
7.1. Test Setup.....	14
7.2. Test method and limit.....	14
7.3. NFC Test results	14
8. AC powerline conducted emissions (FCC §15.207, RSS-GEN 7.2.2)	15
8.1. Test Setup.....	15
8.2. Test method and limit.....	15
8.3. NFC Test results	16
9. Test Equipment.....	17
9.1. Conducted measurements	17

9.2.	Radiated measurements	17
------	-----------------------------	----

2. Radiated emission below 30 MHz (FCC 15.209, RSS-210 2.6)

EUT with DUT number	RM-983, DUT 43198
Accessories with DUT numbers	BV-L4A, DUT 43188 ; AC-60E, DUT 43161 ; CA-190CD, DUT 43162 ; WH-208, DUT 43189
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	19 / 38 / 101.9
Date of measurements	15-Jul-2014
Measured by	Timo Raiskio

2.1.1 Test setup



2.2. Test method and limit

The measurement is made according to ANSI C63.4-2009 and RSS-GEN as follows:

The measurement distance is 3 m.

The limit line has been adjusted with the distance correction factor (+40 dB for 30 m distance, +80 dB for 300 m distance).

The measurement is divided into the Preliminary Measurement and the Final Measurement. The suspected frequencies are searched for in Preliminary Measurement with measuring antenna at fixed height using 2-axis EUT position system, set on the turntable, which is rotated 360 degrees. For all identified emissions, the antenna is adjusted for maximum reading.

The measurement results are obtained as described below:

$$E [dB\mu V/m] = U_{RX} + 20 \text{ dB } [1/m] + L_{CABLES}$$

Where U_{RX} is receiver reading, 20 dB the antenna factor of the loop antenna and L the cable attenuation.

2.3. Limits for radiated emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit [$\mu\text{V/m}$]	Distance [m]	Detector	RBW [kHz]
0.009 - 0.09	2400 / f[kHz]	300	Pk & Avg*	0.2
0.09 - 0.11	2400 / f[kHz]	300	QP	0.2
0.11 - 0.15	2400 / f[kHz]	300	Pk & Avg	0.2
0.15 - 0.49	2400 / f[kHz]	300	Pk & Avg*	9
0.49 - 1.705	24000 / f[kHz]	30	QP	9
1.705 - 30	30	30	QP	9

* These are average limits. The peak limit is 20 dB above the average limit.

2.4. NFC test results

Transmit

MaxPeak

Frequency [MHz]	Reading [dB $\mu\text{V/m}$]	Limit [$\mu\text{V/m}$]	Distance CF [dB]	Limit @ 3m [dB $\mu\text{V/m}$]	Height [cm]	Pol	Results
0.031	63.96	77.42	80	137.81	170	H	PASSED

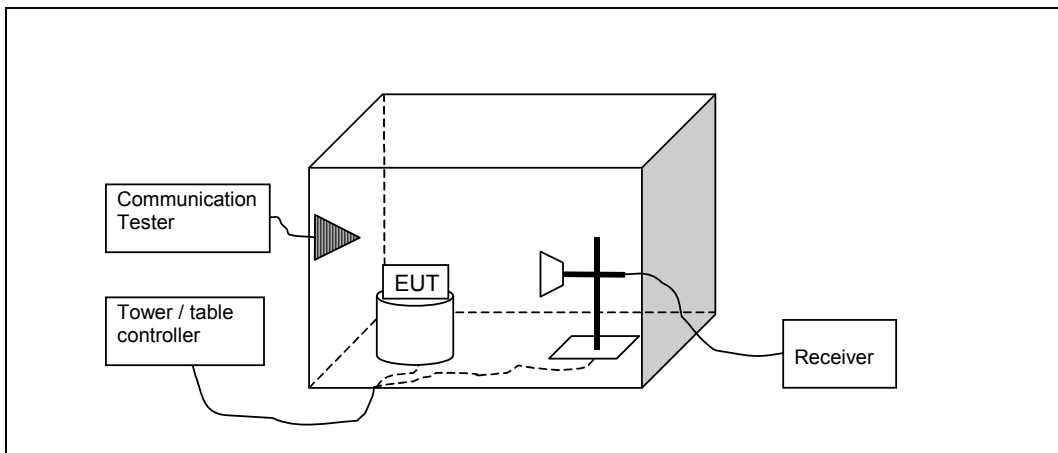
Average

Frequency [MHz]	Reading [dB $\mu\text{V/m}$]	Limit [$\mu\text{V/m}$]	Distance CF [dB]	Limit @ 3m [dB $\mu\text{V/m}$]	Height [cm]	Pol	Results
0.031	63.49	77.42	80	117.81	170	H	PASSED

3. Radiated emissions above 30MHz (FCC §15.209, RSS-210 2.6)

EUT with DUT number	RM-983, DUT 43198
Accessories with DUT numbers	BV-L4A, DUT 43188 ; AC-60E, DUT 43161 ; CA-190CD, DUT 43162 ; WH-208, DUT 43189
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	19 / 38 / 101.9
Date of measurements	15-Jul-2014
Measured by	Timo Raiskio

3.1.1 Test setup



3.2. Test method and limit

The measurement is made according to the ANSI C63.4-2009 and RSS-GEN as follows:
The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with absorbers on the floor and measuring antenna at fixed height using 2-axis EUT position system.

The Final Measurement is performed in the Semi-Anechoic Chamber with conducting metal floor, if the Preliminary Measurement results are closer than 20 dB to the permissible value.

The EUT is placed at nonconductive plate at the turntable center.

For each suspected frequency, the turntable is rotated 360 degrees and antenna is scanned from 1 to 4 m. This is repeated for both horizontal and vertical receive antenna polarizations.

The emissions less than 20 dB below the permissible value are reported.

The measurement results are obtained as described below:

$$E [dB\mu V/m] = U_{RX} + A_{TOT}$$

Where U_{RX} is receiver reading and A_{TOT} is total correction factor including cable loss, antenna factor and preamplifier gain ($A_{TOT} = L_{CABLES} + A_F - G_{PREAMP}$).

Limits for spurious radiated emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit [$\mu V/m$]	Limit [$dB\mu V/m$]	Detector
30 - 88	100	40	Quasi peak
88 – 216	150	43.5	Quasi peak
216 – 960	200	46	Quasi peak
960 – 1000	500	54	Quasi peak
Above 1000	500	54	Average
Above 1000	5000	74	Peak

3.3. NFC test results

Transmit

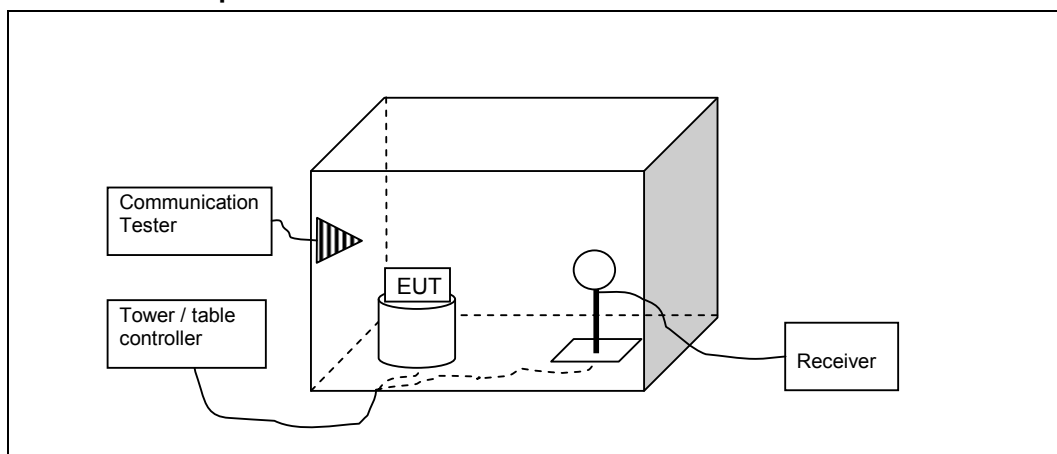
Quasi peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	E [dB μ V/m]	E [μ V/m]	U _{RX} [dB μ V]	A _{TOT} [dB]	Limit [dB μ V/m]	Margin	Results
30.33	18.6	8.511	38.7	-20.1	40	21.4	PASSED
30.39	18.54	8.453	38.64	-20.1	40	21.46	PASSED
205.913	5.87	1.966	37.27	-31.4	44	37.65	PASSED

4. Field strength in the 13.56 MHz band

EUT with DUT number	RM-983, DUT 43198
Accessories with DUT numbers	BV-L4A, DUT 43188 ; AC-60E, DUT 43161 ; CA-190CD, DUT 43162 ; WH-208, DUT 43189
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	19 / 38 / 101.9
Date of measurements	15-Jul-2014
Measured by	Timo Raiskio

4.1.1 Test setup



4.2. Test method and limit

The measurement is made according to EN 302 291-01, Section 7.1.1
The measuring distance was 3 meter in RF anechoic chamber.

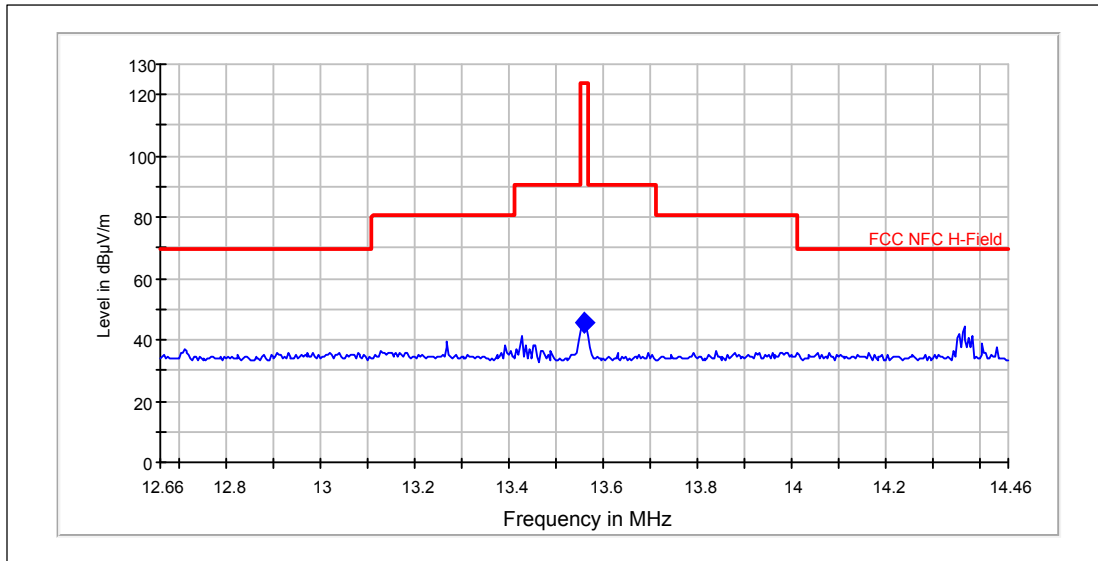
The Result [dBμA/m] is derived from formula:

Result [dBμA/m] = Result [dBμV/m] – 31.5 dBohm.

Where -31.5 stands for magnetic field to electric field conversion for HFH2-Z4 loop antenna.

4.3. NFC test results

Radiated H-Field, 3 meter distance



QuasiPeak

Frequency [MHz]	Reading [dBμV/m]	Limit [dBμV/m]	Result [dBμA/m]	Pol	Results
13.558	45.8	124	14.3	H	PASSED

5. Occupied bandwidth

EUT with DUT number	RM-983, DUT 43198
Accessories with DUT numbers	BV-L4A, DUT 43188 ; AC-60E, DUT 43161 ; CA-190CD, DUT 43162 ; WH-208, DUT 43189
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	22 / 45 / 102.0
Date of measurements	14-Jul-2014
Measured by	Timo Raiskio

5.1. Test Setup

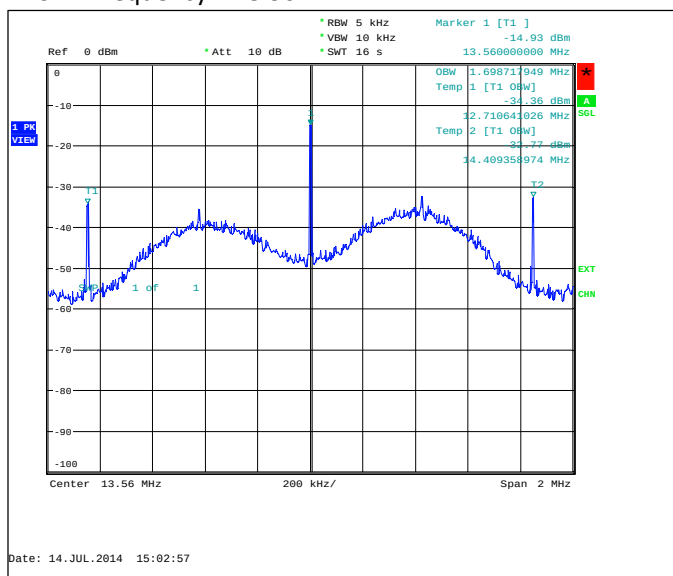
A small whip antenna was placed close to the EUT, and connected to the measuring Spectrum Analyzer.

5.2. Test method and limit

The Test was carried out with the EUT in Test mode with modulation on.

5.3. NFC Test results

NFC TX Frequency = 13.56 MHz



Operation mode (TX on)	Occupied bandwidth [kHz]
NFC, modulated	1698.7

6. Frequency stability, temperature variation (FCC §15.225 (e) [2], RSS-210 A2.6)

EUT with DUT number	RM-983, DUT 43191
Accessories with DUT numbers	BV-L4A, DUT 43188 ; AC-60E, DUT 43161 ; CA-190CD, DUT 43162 ; WH-208, DUT 43189
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	22 / 45 / 102.0
Date of measurements	14-Jul-2014
Measured by	Timo Raiskio

6.1. Test Setup

The EUT was placed in a Climatic Chamber. A small whip antenna was placed close to the EUT, and connected to the measuring Spectrum Analyzer. Measurement performed without modulation on TX.

6.2. Test method and limit

The measurement is made according to FCC rules FCC 47 CFR Part 15 section 15.225 (e) [2] and RSS-210 A2.6

- The EUT is placed in the chamber in transmit mode.
- The climate chamber temperature is set to the maximum value and allowed to stabilize.
- The transmit frequency is measured.
- Temperature is lowered to the next temperature value and allowed to stabilize.
- The steps c - d is repeated for each temperature.

Limits for frequency stability, temperature variation measurements

Frequency deviation [%]
+/- 0.01

6.3. NFC Test results

NFC TX Frequency = 13.56 MHz

Temperature [°C]	Frequency [MHz]	Deviation [kHz]	Deviation [%]	Result
50	13.559266	-0.734	-0.005413	PASSED
40	13.55927	-0.730	-0.005383	PASSED
30	13.559285	-0.715	-0.005273	PASSED
20	13.559311	-0.689	-0.005081	PASSED
10	13.559343	-0.657	-0.004845	PASSED
0	13.559376	-0.624	-0.004602	PASSED
-10	13.559396	-0.604	-0.004454	PASSED
-20	13.55939	-0.610	-0.004499	PASSED
-30	13.559331	-0.669	-0.004934	PASSED

7. Frequency stability, voltage variation (FCC §15.225 (e) [2], RSS-210 A2.6)

EUT with DUT number	RM-983, DUT 43191
Accessories with DUT numbers	Dummy Battery
Operation Voltage [V] / [Hz]	3.6 / 3.8 / 4.2 VDC
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	22 / 45 / 102.0
Date of measurements	14-Jul-2014
Measured by	Timo Raiskio

7.1. Test Setup

A small whip antenna was placed close to the EUT, and connected to the measuring Spectrum Analyzer.

7.2. Test method and limit

The EUT battery was replaced with an adjustable power supply. The frequency stability was measured at nominal voltage and at +5% and -15%. Measurement performed without modulation on TX.

Limits for frequency stability, voltage variation measurements

Frequency deviation [%]
+/- 0.01

7.3. NFC Test results

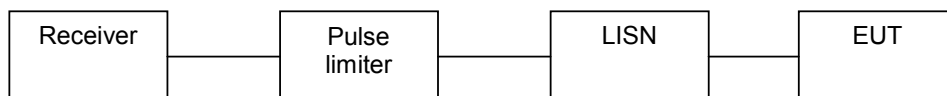
NFC TX Frequency = 13.56 MHz

Voltage [V]	Frequency [MHz]	Deviation [kHz]	Deviation [%]	Result
4.2	13.559317	-0.683	-0.005037	PASSED
3.6	13.55932	-0.680	-0.005015	PASSED
3.8	13.559321	-0.679	-0.005007	PASSED

8. AC powerline conducted emissions (FCC §15.207, RSS-GEN 7.2.2)

EUT with DUT number	RM-983, DUT 43198
Accessories with DUT numbers	BV-L4A, DUT 43188 ; AC-60E, DUT 43161 ; CA-190CD, DUT 43162 ; WH-208, DUT 43189
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	22 / 46 / 101.9
Date of measurements	15-heinä-2014
Measured by	Timo Raiskio

8.1. Test Setup



8.2. Test method and limit

The EUT is placed on a wooden table 80 cm above the reference groundplane.

The EUT is connected via LISN to a test power supply.

The measurement results are obtained as described below:

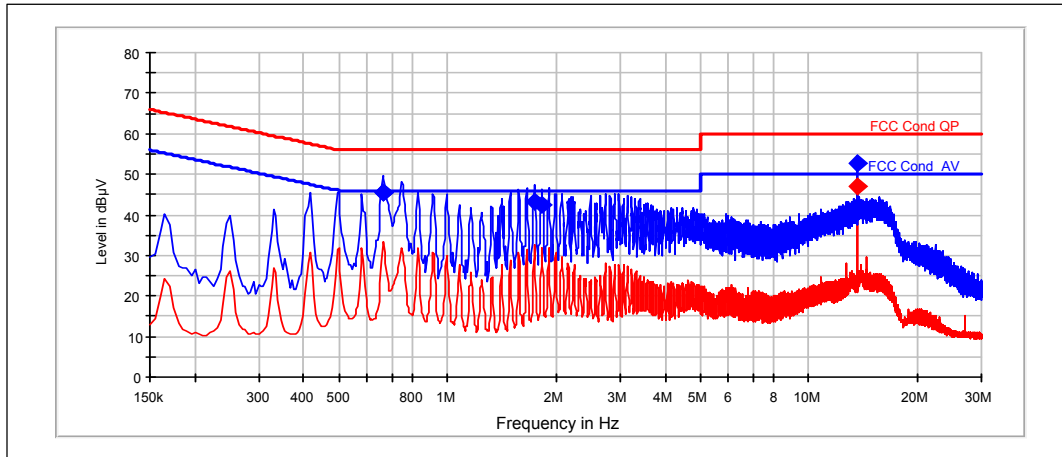
$$U [dB\mu V] = U_{RX} + A_{TOT}$$

Where U_{RX} is receiver reading and A_{TOT} is total correction factor including cable and pulse limiter attenuations.

CISPR 22 Class B limits

Frequency range [MHz]	Quasi peak limit [dBμV]	Average limit [dBμV]
0.15 - 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

8.3. NFC Test results



QuasiPeak (RBW: 9 kHz)

Frequency [MHz]	U [dBµV]	Line	Result
0.66	45.51	L1	PASSED
0.665	45.62	L1	PASSED
1.74	43.32	L1	PASSED
1.82	42.61	L1	PASSED
13.56	52.68	L1	PASSED

Average (RBW: 9 kHz)

Frequency [MHz]	U [dBµV]	Line	Result
13.56	46.96	L1	PASSED

9. Test Equipment

9.1. Conducted measurements

Eq. No	Equipment	Type	Manufacturer	Used in
TM38112	Power supply	6632A	Agilent	22/24/27, 15C, 15E
TM38114	Power supply	6632A	Agilent	22/24/27, 15C, 15E
TM37773	Communication Tester	CMU200	R&S	22/24/27, 15B
TM30600	Impulse limiter	ESH3-Z2	R&S	15C, 15B
TM26490	LISN 50 µH	ESH3-Z5	R&S	15C, 15B
TM26491	LISN 50 µH	ESH3-Z5	R&S	15C, 15B
TM37610	Spectrum Analyzer	FSU26	R&S	22/24/27, 15C, 15E
TM23007	Oscilloscope	TDS684B	Tektronix	15E
TM22806	Battery	BAT 20/E	Fiskars	15C, 15B
TM22805	UPS	PS 20/1.2	Fiskars	15C, 15B
-	Temperature and humidity logger	175-H2	Testo	15C, 15B
-	Temperature and humidity logger	175-H2	Testo	22/24/27, 15C
-	Air pressure and temperature logger	635-2	Testo	22/24/27, 15C, 15B
-	Air pressure sensor	0638-1835	Testo	22/24/27, 15C, 15B
-	Temperature test chamber	VT 4002	Vötsch	22/24/27
2001	Bluetooth tester	CBT	R&S	15C, 15B
2009	LISN 50 µH	ENV216	R&S	15C, 15B
2010	LISN 50 µH	ENV216	R&S	15C, 15B
2012	Power splitter	11667B	Agilent	22/24/27, 15C
2013	Attenuator	8493C	Agilent	22/24/27, 15C
2014	Attenuator	8493C	Agilent	22/24/27, 15C
2019	Power splitter	ZN2PD-9G-S+	Mini-Circuits	15E
2020	Power splitter	ZN2PD-9G-S+	Mini-Circuits	15E
2021	Communication Tester	CMW500	R&S	22/24/27
2022	Communication Tester	CMU200	R&S	22/24/27
2023	Spectrum Analyzer	ESMI-RF	R&S	15B/15C
2024	Analyzer display unit	ESAI-D	R&S	15B/15C
2026	Signal Generator	SMF 100A	R&S	22/24/27, 15C, 15E, 15B
-	Bluetooth tester	CBT	R&S	15C, 15B

9.2. Radiated measurements

Eq. No	Equipment	Type	Manufacturer	Used in
-	Antenna	BBHA 9120 D	Schwarzbeck	22/24/27, 15C
TM37678	Communication Tester	CMU200	R&S	22/24/27, 15B
TM38845	Receiver	ESIB 26	R&S	22/24/27, 15C, 15E, 15B
-	Antenna	HL562	R&S	22/24/27, 15C, 15E, 15B
-	Turntable	2188	EMCO	22/24/27, 15C, 15E, 15B
-	Turntable controller	2090	EMCO	22/24/27, 15C, 15E, 15B
-	RF system panel	OSP130	R&S	22/24/27, 15C, 15E, 15B
-	Mini mast	2075-2	ETS Lindgren	22/24/27, 15C, 15B
TM38843	Mini mast	2075	Emco	22/24/27, 15C, 15B
TM38842	Antenna mast controller	2090	Emco	22/24/27, 15C, 15B
TM30643	LISN 50 µH	LISN-5-20-2	FCC	22/24/27, 15C, 15B
TM30644	LISN 50 µH	LISN-5-20-2	FCC	22/24/27, 15C, 15B

Eq. No	Equipment	Type	Manufacturer	Used in
-	Temperature and humidity logger	175-H2	Testo	22/24/27, 15C, 15B
-	Air pressure and temperature logger	635-2	Testo	22/24/27, 15C, 15B
-	Air pressure sensor	0638-1835	Testo	22/24/27, 15C, 15B
TM37523	Preamplifier	AMF-4D-10M-3G-25-20P	Miteq	22/24/27, 15C, 15B
TM37498	Preamplifier	AMF-5D-020180-26-10P	Miteq	22/24/27, 15C, 15B
TM30599	Semi anechoic chamber	UNKNOWN	TDK	22/24/27, 15C, 15B
TM22638	Power supply	OL63743-901	-	22/24/27, 15C, 15E, 15B
TM38066	High pass filter	WHKX3.0/18G-12SS	Wainwright	22/24/27, 15C, 15E, 15B
2028	High pass filter	WHKX 1.0/15G-12SS	Wainwright	22/24/27, 15C, 15E, 15B
TM37545	Tunable notch filter	800.0/960.0-0.2/40-8SSK	Wainwright	22
TM26512	Tunable notch filter	WRCD1850/1910-0.2/40-10SSK	Wainwright	24
-	Band reject filter	WRCG1877/1883-1870/1890-40/6EE	Wainwright	24
-	Band reject filter	WRCG1729.4/1735.4-1722.4/1742.4-40/6SS	Wainwright	27
TM23892	Controller	G-1000SDX	Yaesu	22/24/27, 15C, 15E
2001	Bluetooth tester	CBT	R&S	15C, 15B
6023	Antenna	VUBA 9117	Schwarzbeck	22/24/27
2021	Communication Tester	CMW500	R&S	22/24/27
2025	Antenna	HFH2-Z2	R&S	15C
2026	Signal Generator	SMF 100A	R&S	22/24/27, 15C, 15E, 15B
2052	Antenna	BBHA 9120 D	Schwarzbeck	22/24/27, 15C, 15B, 15E
-	Antenna	QSH18S20	Q-Par	22/24/27, 15C, 15B, 15E
-	Antenna	QSH20S20	Q-Par	22/24/27, 15C, 15B, 15E
-	Antenna	QSH20S20	Q-Par	22/24/27, 15C, 15B, 15E
-	Bluetooth tester	CBT	R&S	15C, 15B