

FCC Part 15C Compliance Test Report

Test Report no.:	FCC15CNFC_RM-985_13.docx	Date of Report:	10-Sep-2014
Number of pages:	19	Customer's Contact person:	Victoria Abadilla
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FCC listing no.:	533467		
IC recognition no.:	661V-1		
Tested devices/ accessories:	Phone RM-985 / Battery BV-L4A / Headset WH-208 / USB Cable CA-190CD / AC-Charger AC-60E / Dummy Battery SD-224R		
FCC ID:	QMNRM-985	IC:	661X-RM985
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	21-Jun-2014
Testing completed	25-Jul-2014
The customer's contact person	Victoria Abadilla
Test Plan referred to	T:\Projects\RM-984\TestPlan\RS_testplan_RM-984.xlsm
Notes	-
Document name	T:\Projects\RM-985\EMC\FCC15CNFC_RM-985_13.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-984	0044024782225856059V6T6	0200	-	02028.00000.14224.06001	18423
Phone	RM-984	0044024782223616059V6T6	0200	-	02028.00000.14225.06001	18469
Phone	RM-984	0044024782224526059V6T6	0200	-	02028.00000.14224.06001	18426
Battery	BV-L4A	4181574243S1140000160670727	v3	-	-	18424
Battery	BV-L4A	4181574243S1140002660670727	v3	-	-	18427
Headset	WH-208	3342R31	-	-	-	18425
Headset	WH-208	3342R31	-	-	-	18428
USB Cable	CA-190CD	-	-	-	-	16183
USB-Cable	CA-190CD	07304562136C28	-	-	-	18219
AC-Charger	AC-60E	409049326462030555360675677	-	-	-	17841
AC-Charger	AC-60E	409049326161030412560675677	-	-	-	18217
Dummy Battery	SD-224R	-	V.1	-	-	18470

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.

The test results of QMNRM-984 are re-used for certification of the QMNRM-985. The table above indicates the results, which will be re-used.

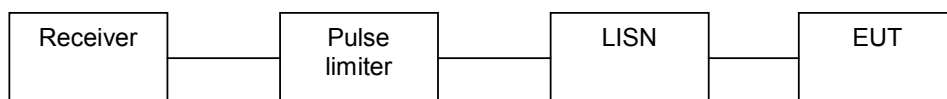
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2. AC powerline conducted emissions (FCC §15.207, RSS-GEN 7.2.2)

EUT with DUT number	RM-984, DUT 18423
Accessories with DUT numbers	BV-L4A, DUT 18424 ; WH-208, DUT 18425 ; CA-190CD, DUT 16183 ; AC-60E, DUT 17841
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 50 / 101
Date of measurements	03-Jul-2014
Measured by	Kalle Hannila / Kari Salminen

2.1. Test Setup



2.2. 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:

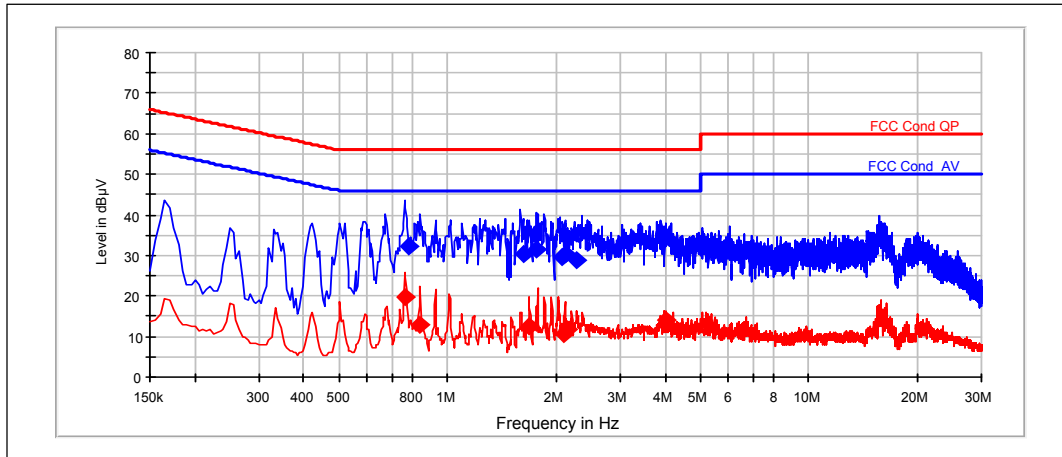
$$U [dB\mu V] = U_{RX} + A_{TOT}$$

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

2.3. NFC Test results



QuasiPeak (RBW: 9 kHz)

Frequency [MHz]	U [dBµV]	Line	Result
0.78	32.17	N	PASSED
1.62	30.39	N	PASSED
1.77	31.31	L1	PASSED
2.065	29.74	N	PASSED
2.125	30.41	N	PASSED
2.275	28.65	N	PASSED

Average (RBW: 9 kHz)

Frequency [MHz]	U [dBµV]	Line	Result
0.765	19.69	N	PASSED
0.84	13.01	N	PASSED
1.685	12.55	N	PASSED
2.095	10.64	N	PASSED
2.14	11.9	N	PASSED
4.04	14.01	N	PASSED

3. Occupied bandwidth

EUT with DUT number	RM-984, DUT 18469
Accessories with DUT numbers	SD-224R, DUT 18470
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 50 / 101
Date of measurements	03-Jul-2014
Measured by	Tomi Lipponen

3.1. Test Setup

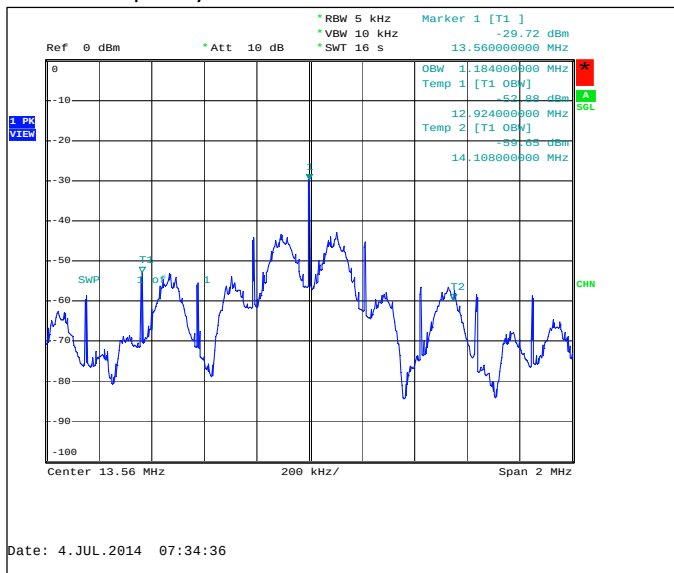
A small whip antenna was placed close to the EUT, and connected to the measuring Spectrum Analyzer.

3.2. Test method and limit

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

3.3. NFC Test results

NFC TX Frequency = 13.56 MHz



Operation mode (TX on)	Occupied bandwidth [kHz]
NFC, modulated	1184

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

EUT with DUT number	RM-984, DUT 18469
Accessories with DUT numbers	SD-224R, DUT 18470
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 50 / 101
Date of measurements	03-Jul-2014
Measured by	Tomi Lipponen

4.1. 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.

4.2. 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

4.3. NFC Test results

NFC TX Frequency = 13.56 MHz

Temperature [°C]	Frequency [MHz]	Deviation [kHz]	Deviation [%]	Result
50	13.559274	-0.726	-0.005354	PASSED
40	13.559305	-0.695	-0.005125	PASSED
30	13.55935	-0.650	-0.004794	PASSED
20	13.559403	-0.597	-0.004403	PASSED
10	13.559447	-0.553	-0.004078	PASSED
0	13.55948	-0.520	-0.003835	PASSED
-10	13.559491	-0.509	-0.003754	PASSED
-20	13.55947	-0.530	-0.003909	PASSED
-30	13.559415	-0.585	-0.004314	PASSED

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

EUT with DUT number	RM-984, DUT 18469
Accessories with DUT numbers	SD-224R, DUT 18470
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 50 / 101
Date of measurements	03-Jul-2014
Measured by	Tomi Lipponen

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 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

5.3. NFC Test results

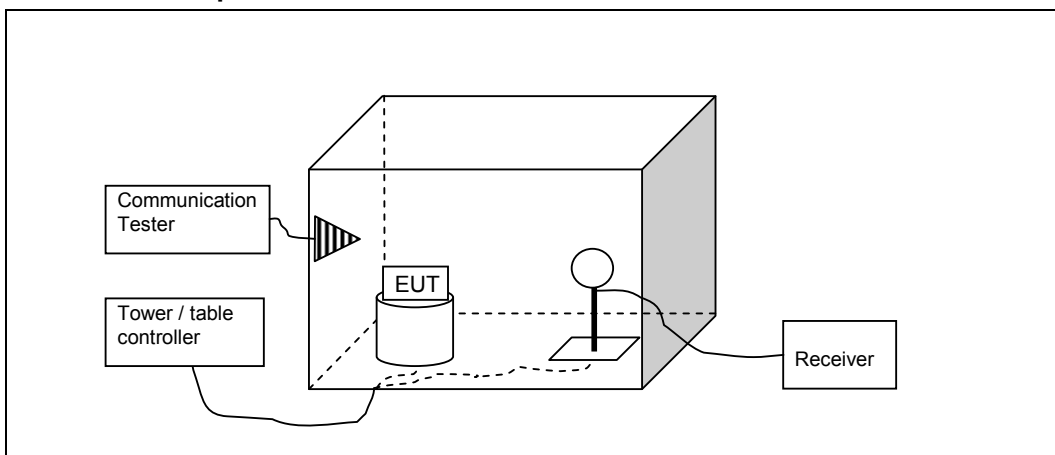
NFC TX Frequency = 13.56 MHz

Voltage [V]	Frequency [MHz]	Deviation [kHz]	Deviation [%]	Result
4.2	13.559415	-0.585	-0.004314	PASSED
3.6	13.559414	-0.586	-0.004322	PASSED
3.8	13.559413	-0.587	-0.004329	PASSED

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

EUT with DUT number	RM-984, DUT 18426
Accessories with DUT numbers	BV-L4A, DUT 18427 ; WH-208, DUT 18428 ; CA-190CD, DUT 18219 ; AC-60E, DUT 18217
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 42 / 101
Date of measurements	04-Jul-2014
Measured by	Kalle Hannila / Kari Salminen

6.1.1 Test setup



6.2. 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.

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	$2400 / f[\text{kHz}]$	300	Pk & Avg*	0.2
0.09 - 0.11	$2400 / f[\text{kHz}]$	300	QP	0.2
0.11 - 0.15	$2400 / f[\text{kHz}]$	300	Pk & Avg	0.2
0.15 - 0.49	$2400 / f[\text{kHz}]$	300	Pk & Avg*	9
0.49 - 1.705	$24000 / f[\text{kHz}]$	30	QP	9
1.705 - 30	30	30	QP	9

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

6.3. NFC test results

Transmit

MaxPeak

Frequency [MHz]	Reading [dB μ V/m]	Limit [μ V/m]	Distance CF [dB]	Limit @ 3m [dB μ V/m]	Height [cm]	Pol	Results
0.0097	67.66	247.42	80	147.88	170	H	PASSED

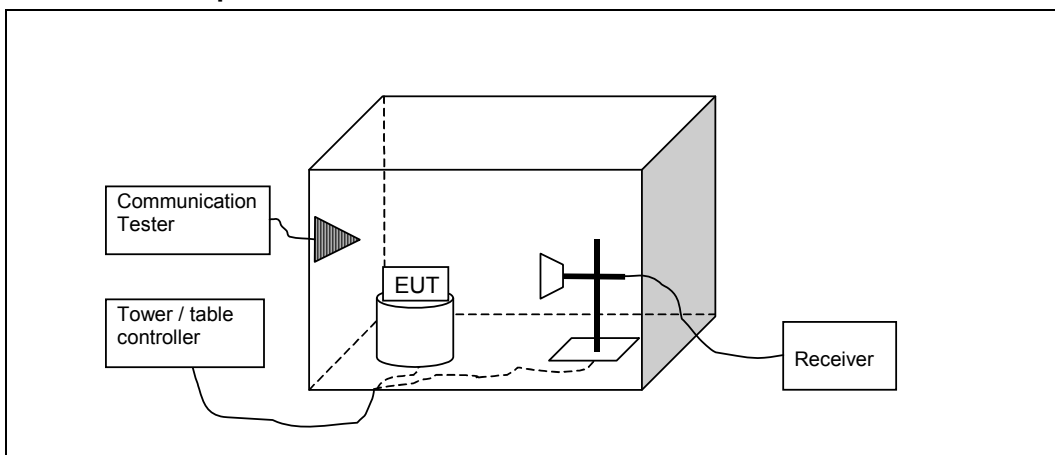
Average

Frequency [MHz]	Reading [dB μ V/m]	Limit [μ V/m]	Distance CF [dB]	Limit @ 3m [dB μ V/m]	Height [cm]	Pol	Results
0.0097	62.43	247.42	80	127.88	170	H	PASSED

7. Radiated emission above 30 MHz (FCC 15.209, RSS-210 A2.6)

EUT with DUT number	RM-984, DUT 18426
Accessories with DUT numbers	BV-L4A, DUT 18427 ; WH-208, DUT 18428 ; CA-190CD, DUT 18219 ; AC-60E, DUT 18217
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 42 / 101
Date of measurements	04-Jul-2014
Measured by	Kalle Hannila / Kari Salminen

7.1.1 Test setup



7.2. 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

7.3. NFC test results

Transmit

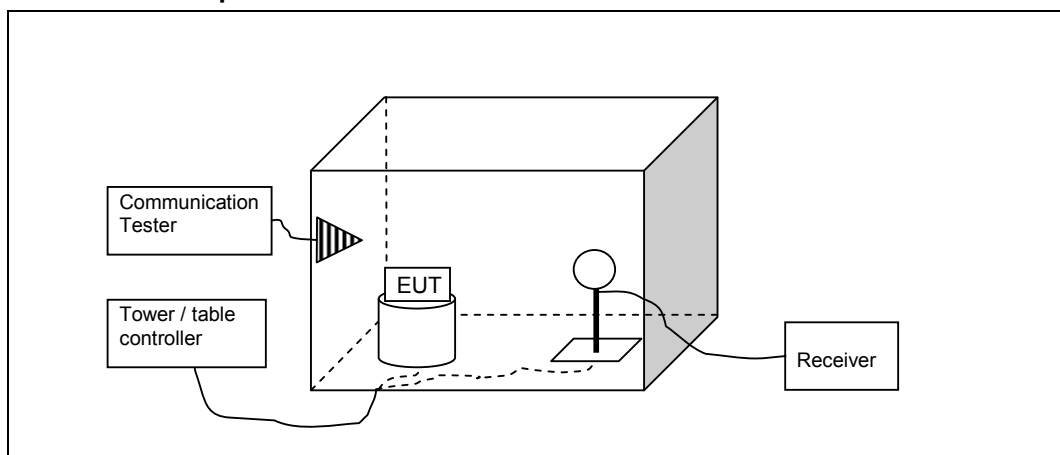
Quasi peak (RBW: 100 kHz, VBW: 100 kHz)

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
41.472	27.04	22.491	38.04	-11	40	12.96	PASSED
42.474	27.39	23.415	38.99	-11.6	40	12.61	PASSED
42.574	27.32	23.227	39.02	-11.7	40	12.68	PASSED

8. Field strength in the 13.56 MHz band

EUT with DUT number	RM-984, DUT 18426
Accessories with DUT numbers	BV-L4A, DUT 18427 ; WH-208, DUT 18428 ; CA-190CD, DUT 18219 ; AC-60E, DUT 18217
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 42 / 101
Date of measurements	25-Jul-2014
Measured by	Sami Lehtonen

8.1.1 Test setup



8.2. 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.

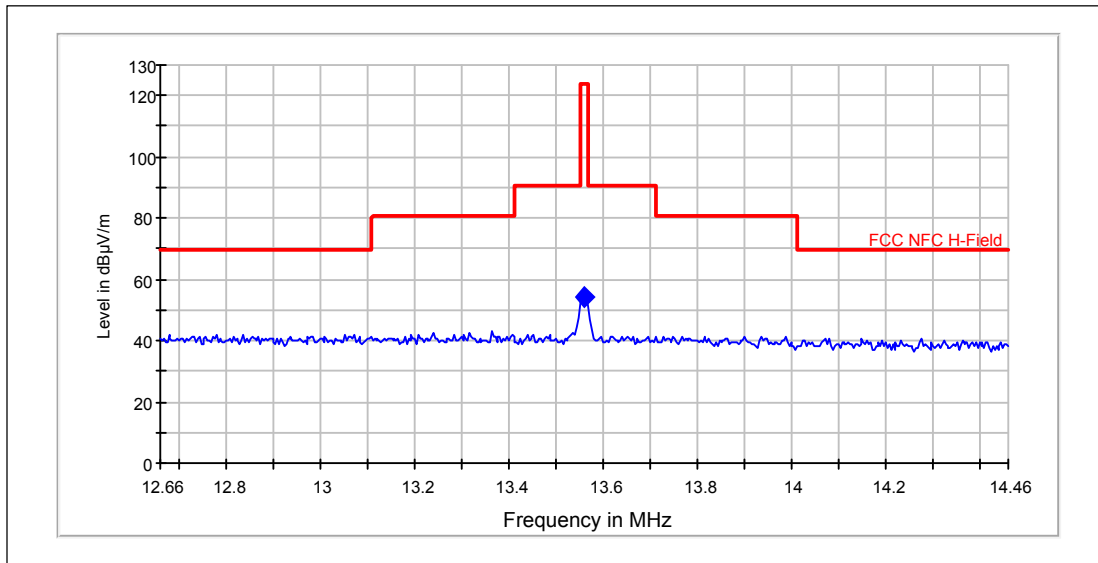
The Result [dBμA/m] is derived from formula:

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.

8.3. NFC test results

Radiated H-Field, 3 meter distance



QuasiPeak

Frequency [MHz]	Reading [dBμV]	Limit [dBμV/m]	Result [dBμA/m]	Pol	Results
13.562	54.4	124	22.9	H	PASSED

9. Test Equipment

9.1. Conducted measurements

Eq. No	Equipment	Type	Manufacturer	Used in
6039	USB Interface	5541765	Testo	22/24/27, 15C, 15B
6044	V-network	ESH3-Z6	R&S	-
2059	V-network	ESH3-Z6	R&S	-
1759	LISN 50 µH	ESH3-Z5	R&S	22/24/27, 15C, 15B
2097	Pulse Limiter	ESH3-Z2	R&S	22/24/27, 15C, 15B
1999	Receiver	ESIB26	R&S	22/24/27, 15C, 15B
2180	Communication Tester	CMU200	R&S	22/24/27, 15C, 15B
2390	Directional Coupler	DC2600	AR	-
-	RF immunity / Emission Software	EMC32	R&S	22/24/27, 15C, 15B
2060	LISN 50 µH	ESH3-Z5	R&S	15C, 15B
1759	LISN 50 µH	ESH3-Z5	R&S	15C, 15B
2039	Power Supply	PL330QMD	Thurlby	15C, 15B
6036	Data Logger	175-H2	Testo	22/24/27, 15C, 15B
2359	Temperature Test Chamber	VT4002	Vötsch	22/24/27
2352	Spectrum Analyzer	FSP-30	R&S	22/24/27, 15C
6109	Communication Tester	CMU200	R&S	22/24/27, 15C
6246	Power Supply	66332A	HP	22/24/27, 15C
1992	Signal Generator	83630B	Agilent	15C, 15B
6098	Signal Generator	8648C	Agilent	-
6046	Attenuator 10dB	8493C	Agilent	22/24/27, 15C
6047	Attenuator 20dB	8493C	Agilent	22/24/27, 15C
6045	Power splitter	11667B	Agilent	22/24/27, 15C
6247	Communication Tester	CBT	R&S	22/24/27, 15C 15B
6052	Communication Tester	CMU200	R&S	22/24/27, 15C 15B
6248	Power Supply	6632B	-	22/24/27, 15C 15B
6106	Spectrum Analyzer	FSP-30	R&S	22/24/27, 15C 15B
6113	Signal Generator	SMF100A	R&S	22/24/27, 15C 15B
6202	Temperature Test Chamber	VT4002	Vötsch	22/24/27, 15C 15B
6122	Power Splitter	11667B	Agilent	22/24/27, 15C 15B
6134	Attenuator 10dB	BW-S10-2W263+	Mini-Circuits	22/24/27, 15C
6136	Attenuator 20dB	BW-S20-2W263+	Mini-Circuits	22/24/27, 15C
6103	Bluetooth tester	CBT	R&S	22/24/27, 15C 15B
6250	Power Supply	6651A	Agilent	22/24/27, 15C 15B
6108	Communication Tester	CMU200	R&S	22/24/27, 15C 15B
6105	Spectrum Analyzer	FSV-30	R&S	22/24/27, 15C 15B
6251	Temperature Test Chamber	VT4002	Vötsch	22/24/27, 15C 15B
6243	Power Splitter	1167B	Agilent	22/24/27, 15C 15B
6245	Attenuator 10dB	BW-S10-2W263+	Mini-Circuits	22/24/27, 15C 15B
6244	Attenuator 20dB	BW-S20-2W263+	Mini-Circuits	22/24/27, 15C 15B

9.2. Radiated measurements

Eq. No	Equipment	Type	Manufacturer	Used in
2388	Bluetooth Tester	CBT	R&S	15B
10479	Communication Tester	CMW500	R&S	22/24/27, 15C, 15B
2347	Communication Tester	CMU200	R&S	22/24/27, 15C, 15B
2009	Signal Generator	SMP 22	R&S	22/24/27, 15C, 15B
2348	Controller	G-1000DXC	Yaesu	22/24/27, 15C, 15B
2349	Computer Controller	g-1000DXC	Yaesu	22/24/27, 15C, 15B
2116	Controller	EMCO 2090	ETS	22/24/27, 15C, 15B
2109	Power Supply	PL330QMD	Thurlby	22/24/27, 15C, 15B
2353	Receiver	ESIB26	R&S	22/24/27, 15C, 15B
6115	Open switch and control unit	OSP 130	R&S	22/24/27, 15C, 15B
6116	Open switch and control unit	OSP 150	R&S	22/24/27, 15C, 15B
6117	Open switch and control unit	OSP 150	R&S	22/24/27, 15C, 15B
6131	Notch Filter	WRCT902.4-0.4/40-8SS	Wainwright	22/24/27, 15C, 15B
6130	Notch Filter	WRCD1880-1.1.25/50-10SS	Wainwright	22/24/27
6159	Band Reject Filter	WRCD1747.8-0.4/40-5SS	Wainwright	22/24/27, 15C, 15B
6158	Band Reject Filter	WRCT836.6-0.4/40-8SS	Wainwright	22/24/27, 15C, 15B
6197	Band Reject Filter	WRCJV2531/2539-2523/2547-60/12SS	Wainwright	22/24/27, 15C, 15B
2231	Band Reject Filter	WRCG1947/1953-1940/1960-40/6SS	Wainwright	22/24/27, 15C, 15B
2391	Band Reject Filter	WRCG1729.4/1735.4-1722.4/1742.4-40/6SS	Wainwright	27
2386	Band Reject Filter	WRCG1764.4/1770.4-1760.4/1774.4-40/6SS	Wainwright	22/24/27, 15C, 15B
2385	Band Reject Filter	WRCG1744.4/1750.4-1740.4/1754.4-40/6SS	Wainwright	22/24/27, 15C, 15B
2357	Band Reject Filter	WRCG2400/2483-2390/2493-35/10SS	Wainwright	15C
2188	Preamplifier	AFS4-00100300-20-23P-6	Miteq	22/24/27, 15C, 15B
6195	High Pass Filter	-	Wainwright	22/24/27, 15C, 15B
2364	Band Reject Filter	WRCG1877/1883 - 1870/1890-40/6SS	Wainwright	24
2361	Anechoic Chamber	3 m Semi / Full Anechoic Chamber	Euroshield	22/24/27, 15C, 15B
6212	Antenna Array system	-	TCC	22/24/27, 15C, 15B
-	RF immunity / Emission Software	EMC32	R&S	22/24/27, 15C, 15B
6089	Antenna	HFH2-Z2	R&S	15C, 15B
2027	CDN	M2 (modified) DC1	MEB	22/24/27, 15C, 15B
2028	CDN	M3 (modified) DC2	MEB	22/24/27, 15C, 15B
2176	CDN	CDN 801-M3	Lüthi	22/24/27, 15C, 15B
2135	CDN	CDN 801-M3	Lüthi	22/24/27, 15C, 15B
2029	Power Supply	PL330	Thurlby	22/24/27, 15C
6038	Data Logger	Testo 580	Testo	22/24/27, 15C, 15B
6037	Data Logger	175-H2	Testo	22/24/27, 15C, 15B
6039	USB Interface	5541765	Testo	22/24/27, 15C, 15B