

FCC Part 15C Compliance Test Report

Test Report no.:	FCC15CNFC_RM-1154_06.docx	Date of Report:	11-Dec-2015
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FCC listing no.:	94436		
IC recognition no.:	661AK-1		
Tested devices/ accessories:	Phone RM-1154 / Dummy battery SD-134 / Battery BV-T3G / Charger AC-18E / Headset WH-108		
FCC ID:	PYARM-1154	IC:	661X-RM1154
Supplement reports:	-		
Testing has been carried out in accordance with:	47 CFR 15C, ANSI C63.10 (2013), RSS-210 (Issue 8) and RSS-Gen (Issue 4). 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:			
	Hannu Söderholm, Engineer, EMC		

1. Summary for FCC Part 15C Compliance Test Report

Date of receipt	21-Oct-2015
Testing completed	16-Nov-2015
The customer's contact person	Juha Paukku
Test Plan referred to	T:\Projects\RM-1152\TestPlan\Test_plan EMC FCC_RM-1152.xlsx
Notes	-
Document name	T:\Projects\RM-1154\EMC\Copy Reports\FCC15CNFC_RM-1154_06.docx

1.1. EUT and Accessory Information

Product	Type	SN	HW	MV	SW	DUT
Phone	RM-1152	004402742963030	1540	-	01078.10006.15421.42000	400049
Dummy battery	SD-134	2301637	v.1	-	-	400053
Charger	AC-18E	4090493521750501701;0675695	-	-	-	400050
Battery	BV-T3G Samsung	41815754112S10500025;0670783	2.2	-	-	400054
Headset	WH-108	-	4.0	4.0	-	42927
Battery	BV-T3G (LG)	4955405343010304094;0670783	1.0	-	-	400051

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	8.9	Radiated emission below 30 MHz	PASSED
15.209	8.9	Radiated emission above 30 MHz	PASSED
15.225(a-d)	A2.6	Field strength in the 13.56 MHz band	PASSED
	6.6	99 % bandwidth	PASSED
15.225(e)	A2.6	Frequency stability, temperature variation	PASSED
15.225(e)	A2.6	Frequency stability, voltage variation	PASSED
15.207	8.8	AC power line conducted emission	PASSED

The test results of RM-1152 are re-used for certification of the RM-1154. The table above indicates the results, which will be re-used.

PASSED
FAILED
NP

The EUT complies with the essential requirements in the standard.
The EUT does not comply with the essential requirements in the standard.
The test was not performed by the TCC Microsoft Laboratory.

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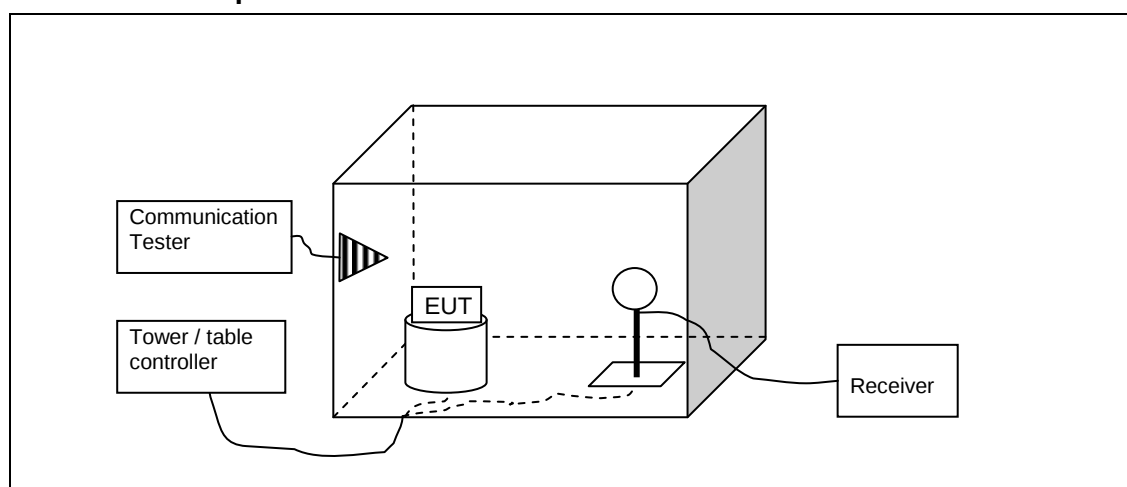
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2. Radiated emission below 30 MHz

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	BV-T3G (LG), DUT 400051 ; AC-18E, DUT 400050 ; WH-108, DUT 42927
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21/40/ 100.8
Date of measurements	16-Nov-2015
Measured by	Hannu Söderholm

2.1.1 Test setup



2.2. Test method and limit

The measurement is made according to ANSI C63.10 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 and EUT set in three orthogonal positions on the turn table, 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 [$\mu V/m$]	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.

2.3. NFC test results (9...500 KHz), Orthogonal position 1 and 2

MaxPeak

Frequency [MHz]	Reading [dBμV/m]	Limit [μV/m]	Distance CF [dB]	Limit @ 3m [dBμV/m]	Height [cm]	Pol	Results
0.0271	70.36	88.56	80	139.08	171	H	PASSED

Average

Frequency [MHz]	Reading [dBμV/m]	Limit [μV/m]	Distance CF [dB]	Limit @ 3m [dBμV/m]	Height [cm]	Pol	Results
0.0271	61.65	88.56	80	119.08	171	H	PASSED

2.4. NFC test results (9...500 kHz), Orthogonal position 3

MaxPeak

Frequency [MHz]	Reading [dBμV/m]	Limit [μV/m]	Distance CF [dB]	Limit @ 3m [dBμV/m]	Height [cm]	Pol	Results
0.027	69.55	88.89	80	139.12	171	H	PASSED
0.0271	69.13	88.56	80	139.08	171	H	PASSED
0.0272	67.83	88.24	80	139.05	171	H	PASSED

Average

Frequency [MHz]	Reading [dBμV/m]	Limit [μV/m]	Distance CF [dB]	Limit @ 3m [dBμV/m]	Height [cm]	Pol	Results
0.027	62.1	88.89	80	119.12	171	H	PASSED
0.0271	61.42	88.56	80	119.08	171	H	PASSED
0.0272	60.65	88.24	80	119.05	171	H	PASSED

The measurement was repeated with the EUT removed from the chamber. The spike was still there, on the same level. Therefore, the 27.1 kHz emission is disregarded.

Full Spectrum NFC below 30MHz, Empty Chamber

MaxPeak

Frequency [MHz]	Reading [dBμV/m]	Limit [μV/m]	Distance CF [dB]	Limit @ 3m [dBμV/m]	Height [cm]	Pol	Results
0.027	68.7	88.89	80	139.12	170	H	PASSED
0.0271	69.03	88.56	80	139.08	170	H	PASSED

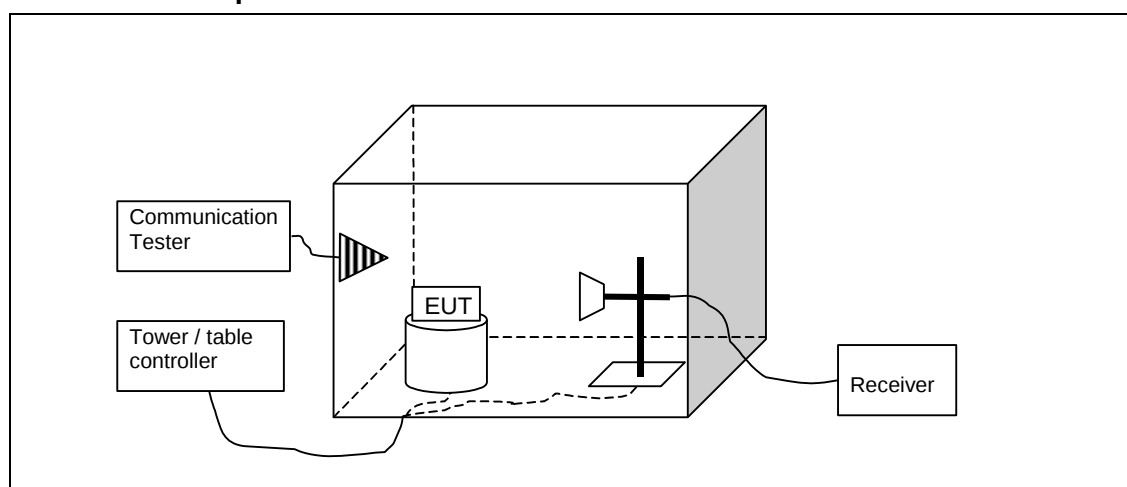
Average

Frequency [MHz]	Reading [dBμV/m]	Limit [μV/m]	Distance CF [dB]	Limit @ 3m [dBμV/m]	Height [cm]	Pol	Results
0.027	61.39	88.89	80	119.12	170	H	PASSED
0.0271	61.39	88.56	80	119.08	170	H	PASSED

3. Radiated emission above 30 MHz

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	BV-T3G (LG), DUT 400051 ; AC-18E, DUT 400050 ; WH-108, DUT 42927
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 40 / 100
Date of measurements	11-Nov-2015
Measured by	Hannu Söderholm

3.1.1 Test setup



3.2. Test method and limit

The measurement is made according to ANSI C63.10 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, measuring antenna at fixed height and EUT set in three orthogonal positions on the turn table.

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.

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 is made up to 10th harmonic of the EUT highest TX channel.

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 (30...2000 MHz), Orthogonal position 1 and 2

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

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
35.571	17.34	7.362	40.34	-23	40	22.66	PASSED
35.711	18.75	8.66	41.85	-23.1	40	21.25	PASSED
35.971	18.55	8.463	41.75	-23.2	40	21.45	PASSED

3.4. NFC test results (30...2000 MHz), Orthogonal position 3

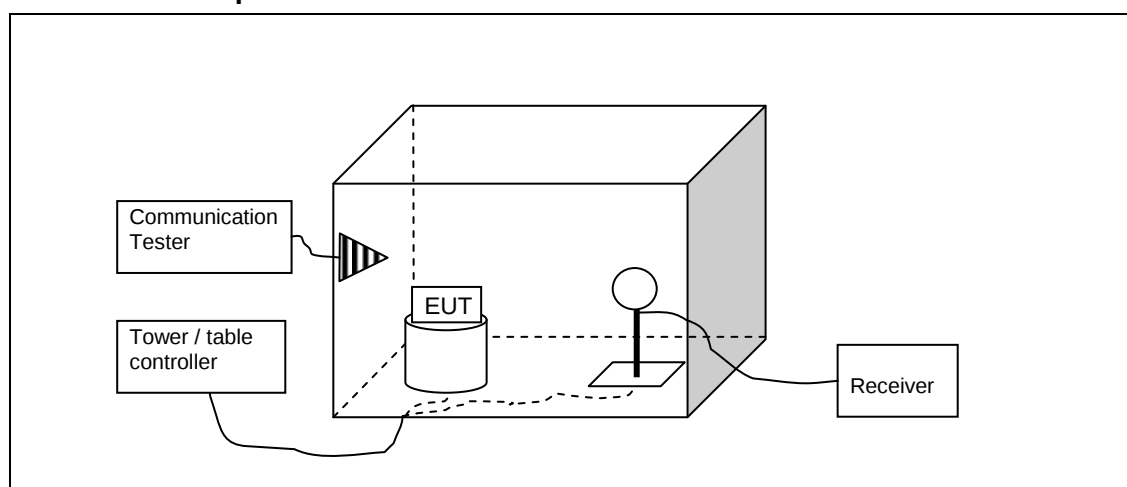
Quasi peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
34.376	25.18	18.155	47.68	-22.5	40	14.82	PASSED
35.45	24.94	17.66	47.94	-23	40	15.06	PASSED
909.382	21.52	11.912	38.22	-16.7	46	24.5	PASSED

4. Field strength in the 13.56 MHz band

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	BV-T3G (LG), DUT 400051 ; AC-18E, DUT 400050 ; WH-108, DUT 42927
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21/40/ 100.8
Date of measurements	16-Nov-2015
Measured by	Hannu Söderholm

4.1.1 Test setup



4.2. Test method and limit

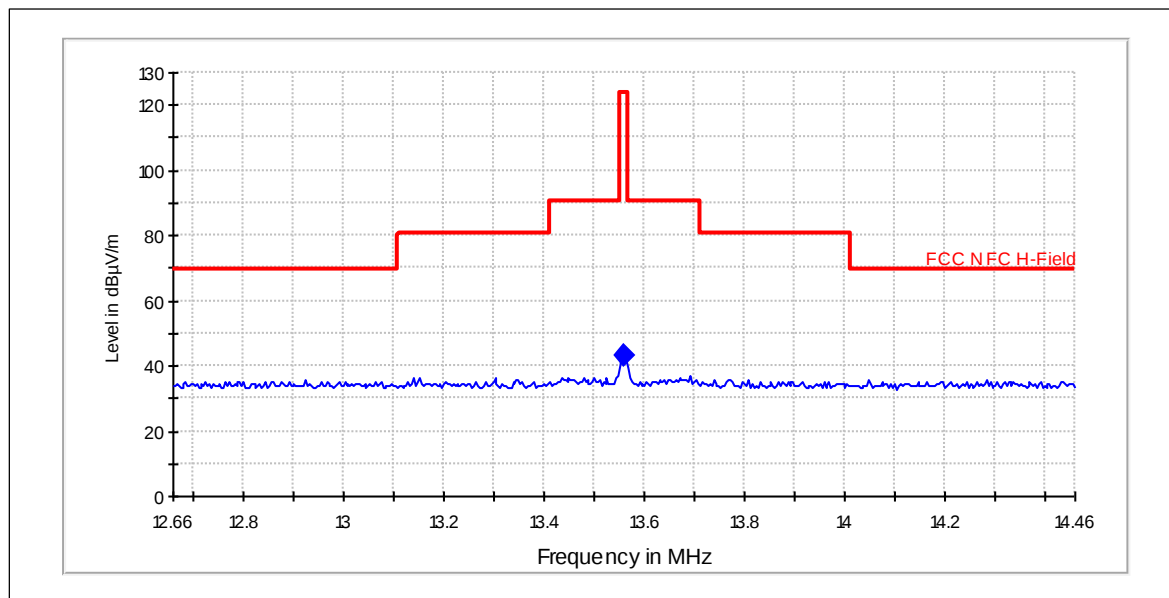
The measurement was made according to ANSI C63.10 and RSS-Gen.

$$\text{dBuA/m} = \text{dBuV/m} - 51.5 \text{ dB}$$

51.5 dB is the magnetic field to electric field conversion factor.

4.3. NFC test results, Orthogonal position 1 and 2

Radiated H-Field, 3 meter distance



QuasiPeak

Frequency [MHz]	Result [dBµV/m]	Limit [dBµV/m]	Result [dBµA/m]	Pol	Results
13.558	42.92	124	-8.58	H	PASSED

4.4. Conversion to 30 m measurement distance

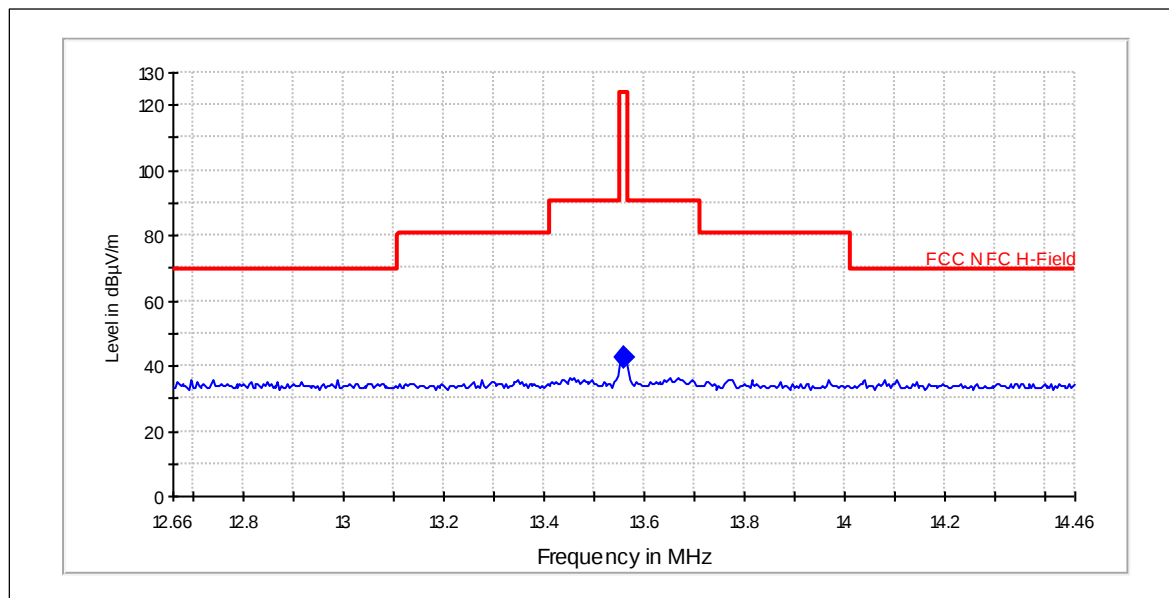
The result can be converted to 30 m distance by subtracting 40 dB/decade. For the value above, that results:

$$E_{30\text{ m}} = E_{3\text{ m}} - 40 * \log(30\text{ m} / 3\text{ m})$$

Result [dBµV/m] @ 30 m
2.92

4.5. NFC test results, Orthogonal position 3

Radiated H-Field, 3 meter distance



QuasiPeak

Frequency [MHz]	Result [dBμV/m]	Limit [dBμV/m]	Result [dBμA/m]	Pol	Results
13.558	42.71	124	-8.79	H	PASSED

4.6. Conversion to 30 m measurement distance

The result can be converted to 30 m distance by subtracting 40 dB/decade. For the value above, that results:

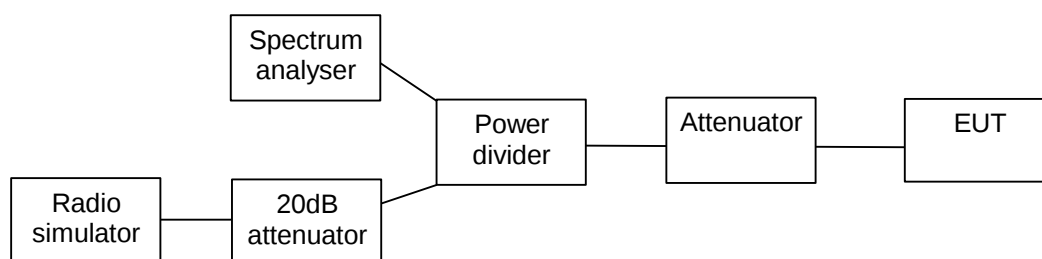
$$E_{30\text{ m}} = E_{3\text{ m}} - 40 * \log(30\text{ m} / 3\text{ m})$$

Result [dBμV/m] @ 30 m
2.71

5. 99% occupied bandwidth

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	SD-134, DUT 400053
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	RF Cond 2
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	25 / 40 / 100
Date of measurements	05-Nov-2015
Measured by	Hannu Soderholm

5.1. Test Setup



5.2. Test method and limit

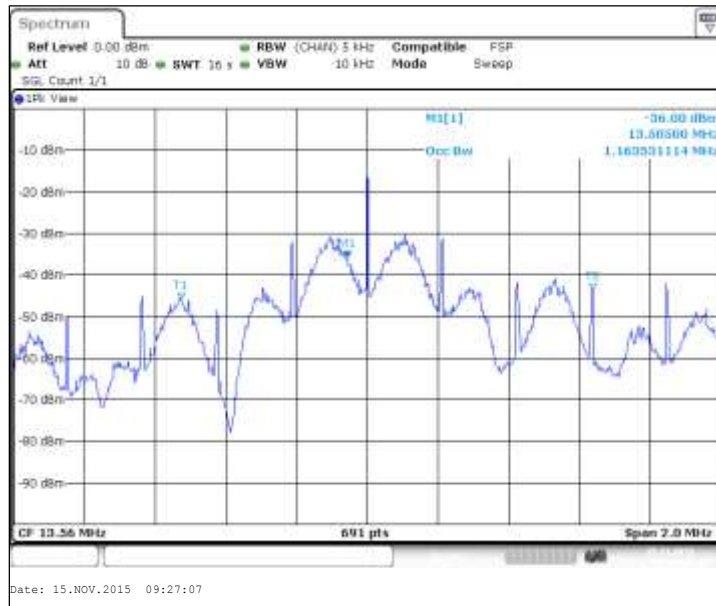
The measurement is made according to ANSI C63.10 and RSS-Gen.

Limits for 99 % occupied bandwidth

Limit [kHz]
No limit

5.3. NFC Test results

NFC TX Frequency = 13.56 MHz



Operation mode (TX on)	Occupied bandwidth [kHz]
NFC, modulated	1163.5

6. Frequency stability, temperature variation

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	SD-134, DUT 400053
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	RF Cond 2
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	25 / 40 / 100
Date of measurements	05-Nov-2015
Measured by	Hannu Soderholm

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 was performed without modulation.

6.2. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-210.

- 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	13.559038	-0.962	-0.007096	PASSED
40	13.558997	-1.003	-0.007399	PASSED
30	13.559065	-0.935	-0.006897	PASSED
20	13.559067	-0.933	-0.006883	PASSED
10	13.559129	-0.871	-0.006427	PASSED
0	13.559149	-0.851	-0.006278	PASSED
-10	13.559165	-0.835	-0.006159	PASSED
-20	13.559127	-0.873	-0.006436	PASSED
-30	13.559053	-0.947	-0.006986	PASSED

7. Frequency stability, voltage variation

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	SD-134, DUT 400053
Operation Voltage [V] / [Hz]	3.5V, 3.8V, 4.35V
Results	PASSED
Remarks	RF Cond 2
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	25 / 40 / 100
Date of measurements	05-Nov-2015
Measured by	Hannu Soderholm

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.

Limits for frequency stability, voltage variation measurements

Frequency deviation [%]
+/- 0.01

7.3. NFC Test results

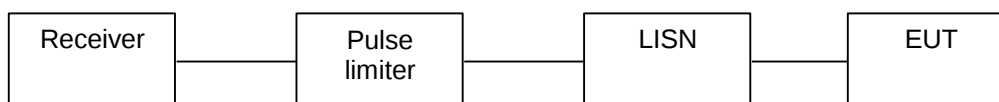
NFC TX Frequency = 13.56 MHz

Voltage [V]	Frequency [MHz]	Deviation [kHz]	Deviation [%]	Result
4.4	13.559123	-0.877	-0.006470	PASSED
3.5	13.559132	-0.868	-0.006399	PASSED
3.8	13.559123	-0.877	-0.006468	PASSED

8. AC powerline conducted emissions

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	AC-18E, DUT 400050 ; BV-T3G Samsung, DUT 400054 ; WH-108, DUT 42927
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 35 / 102
Date of measurements	05-Nov-2015
Measured by	Hannu Söderholm

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:

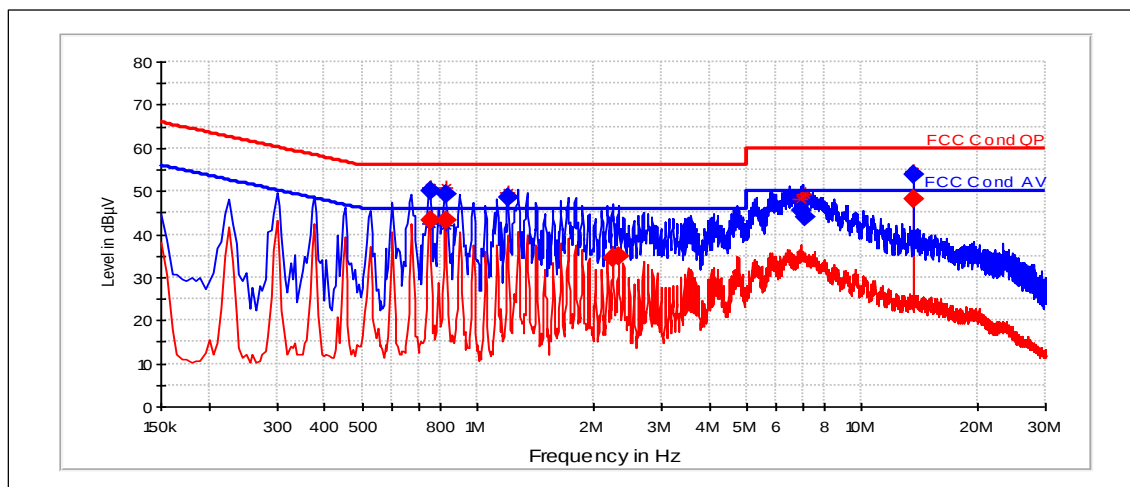
$$U [dB\mu V] = U_{RX} + A_{TOT}$$

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

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
0.75	49.86	L1	PASSED
0.825	49.43	L1	PASSED
1.195	48.45	L1	PASSED
6.965	45.54	L1	PASSED
7.08	43.94	L1	PASSED
13.56	53.89	L1	PASSED

Average (RBW: 9 kHz)

Frequency [MHz]	U [dBµV]	Line	Result
0.75	43.32	L1	PASSED
0.825	43.15	L1	PASSED
2.255	34.33	L1	PASSED
2.325	34.7	L1	PASSED
13.56	48.31	L1	PASSED

9. Test Equipment

The calibration dates for all test equipment are maintained in the equipment register. The register alerts the test lab about expired calibrations. Therefore, tests are always done with calibrated equipment. The dates are provided by request.

9.1. Conducted measurements

Eq. No	Equipment	Type	Manufacturer	Used in
TM350089	Power supply	6632A	Agilent	22/24/27, 15C, 15E
TM350090	Power supply	6632A	Agilent	22/24/27, 15C, 15E
TM30600	Impulse limiter	ESH3-Z2	R&S	15C, 15B
TM490017	LISN 50 μ H	ESH3-Z5	R&S	15C, 15B
TM490018	LISN 50 μ H	ESH3-Z5	R&S	15C, 15B
TM150128	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 μ H	ENV216	R&S	15C, 15B
2010	LISN 50 μ H	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
TM210166	Communication Tester	CMW500	R&S	22/24/27
TM210205	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
TM110070	Signal Generator	SMF 100A	R&S	22/24/27, 15C, 15E, 15B
TM220065	Bluetooth tester	CBT	R&S	15C, 15B
TM210246	Communication Tester	CMU200	R&S	22/24/27, 15B
TM150131	Spectrum Analyzer	FSP30	R&S	22/24/27, 15C, 15E
TM210049	Communication Tester	CMU200	R&S	22/24/27

9.2. Radiated measurements

Eq. No	Equipment	Type	Manufacturer	Used in
-	Antenna	BBHA 9120 D	Schwarzbeck	22/24/27, 15C
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
-	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
TM210203	Communication Tester	CMU200	R&S	22/24/27, 15B
6023	Antenna	VUBA 9117	Schwarzbeck	22/24/27
TM210166	Communication Tester	CMW500	R&S	22/24/27
2025	Antenna	HFH2-Z2	R&S	15C
TM110070	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
TM220065	Bluetooth tester	CBT	R&S	15C, 15B

END OF REPORT