**CETECOM™****CETECOM ICT Services**
consulting - testing - certification >>>**TEST REPORT**

Test Report No.: 1-0042/15-01-10-B

**Testing Laboratory****CETECOM ICT Services GmbH**

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) 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-12076-01-00

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Test Standard/s

47 CFR Part 15	2014-10	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
ICES-003, Issue 5	2012-08	Interference-Causing Equipment Standard Digital Apparatus

Test Item

Kind of test item: Smartphone
Model name: RHM181LW (STV100-4)
FCC ID: L6ARHM180LW
S/N serial number: 1161467034 |
IMEI: 004402243072901
HW hardware status: CER-62543-001 Rev 2-x06-01
SW software status: SW Build: AAC273
Power Supply: AC 100-240V | 50-60Hz

This test report is electronically signed and valid without handwritten signature. The public keys can be requested at the test laboratory to verify the electronic signatures.

Test performed:**Test Report authorised:**

Hans-Joachim Wolsdorfer
Radio Communications & EMC

Uli Kraus
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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. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations 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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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

This test report replaces the test report with the number 1-0042_15-01-10_A and dated 2015-09-30

2.2 Application details

Date of receipt of order:	2015-06-08
Date of receipt of test item:	2015-08-11
Start of test:	2015-08-18
End of test:	2015-08-19
Person(s) present during the test:	---

3 Test standard/s:

Test Standard	Version	Test Standard Description
47 CFR Part 15	2014-10	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
ICES-003, Issue 5	2012-08	Interference-Causing Equipment Standard Digital Apparatus
ANSI C63.4	2009-01	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:	20°C – 25°C
Relative humidity content:	30 % - 50 %
Air pressure:	1020 hPa
Power supply:	230 V / 50 Hz

5 Test Laboratories sub-contracted

6 Information about Test Conditions

6.1 Test Item

Kind of test item	Smartphone		
Type identification	RHM181LW (STV100-4)		
Equipment classification:	Equipment for mobile use		
Environment classification:	Residential, commercial and light industry		
Supply voltage	AC 115 V/ 60 Hz		
Ports (maximum cable lengths declared by manufacturer)	Description	Direction	Length
	AC power port	Input	> 3m
	Signal/control port: headset	In / output	< 3m
Is mounting position / usual operating position defined?			hand held
Additional information:			
- tests have been performed according to customers tests plan			
- the radio part with FCC ID: L6ARHM180LW of this device are already tested and not part of this test report			

6.2 EUT: Type, S/N etc. and Short Descriptions Used in this Test Report

short descrip- tion*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	Smartphone	RHM181LW (STV100-4)	1161467034 IMEI:00440224 3072901	CER-62543- 001 Rev 2-x06- 01	SW Build: AAC273

*) EUT short description is used to simplify the identification of the EUT in this test report.

6.3 Auxiliary Equipment (AE): Type, S/N etc. and Short Descriptions

AE description*)	Auxiliary equipment	Type	S/N serial number	HW hardware status	SW software status
AE A	USB charger	Scarlet NA Fixed Blade 1300mA (Salcomp Rev B) HDW-58920-001	-/-	unknown	-/-
AE B	USB cable	HDW-50071-001 0.9m (HL Rev 2)	-/-	unknown	-/-
AE C	USB cable	HDW-51800-001 0.9m (HL Rev 2)	-/-	unknown	-/-
AE D	headset	Wired Headset (Stereo - BlackBird, Cresyn Rev 2) HDW-49299-001	-/-	unknown	-/-
AE E	headset	Wired Headset (Typhon) HDW-61938-001	-/-	unknown	-/-

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

6.4 EUT Set-up(s)

EUT set-up no.*)	Combination of EUT and AE	Remarks
set. 1	EUT A + AE A + AE B + AE D	slider open
set. 2	EUT A + AE A + AE C + AE E	slider closed

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

6.5 EUT Operating Modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	idle	GSM850 idle + charging
op. 2	idle	PCS1900 idle + charging

*) EUT operating mode no. is used to simplify the test report.

7 Summary of Test Results

- ☒ No deviations from the technical specifications were ascertained
☐ There were deviations from the technical specifications ascertained

7.1 Emission

7.1.1 Enclosure

EMI Phenomenon	Frequency range	Basic standard	Result
Radiated Interference Field Strength	30 - 1000 MHz	FCC Part 15 Class B	passed
Radiated Interference Field Strength	> 1 GHz	FCC Part 15 Class B	passed

7.1.2 AC Mains Power Input/Output Ports

EMI Phenomenon	Frequency range	Basic standard	Result
Conducted interference voltage	0,15– 30 MHz	FCC Part 15 Class B	passed

Remarks:

NA1	Not tested because not required by used standard
NA2	Test not applicable because port does not exists
NA3	Test not applicable because port only for services
NA4	Test not applicable because port lengths not longer than 3m
NA5	Not tested because not required by customer
NA6	Not tested because used frequency < 108 MHz

7.2 Measurement and Test Set-up

Note: The test configuration is in accordance with the requirements given in the standards in point 3

7.3 Measurement uncertainty

The uncertainty of the measurement equipment fulfils CISPR 16 and the related European and national standards.

The semi anechoic chamber fulfils the requirements of CISPR 16-1 (ANSI C63.4) for a test volume of 4m Ø.

The table below shows the measurement uncertainties for each measurement method. The expended uncertainty (k=2 or 95%) was calculated with worst case values.

Measurement Method	Frequency area Impulse duration time	Description	Expanded uncertainty (k=2 or 95%)
Radiated Emission FCC part 15 B, ANSI C63.4	30 MHz – 18 GHz	- / -	± 4.28 dB
Conducted Emission FCC part 15 B, ANSI C63.4	9 kHz – 30 MHz	- / -	± 3.49 dB

8 Detailed test results - Emission

8.1 Conducted Emission

8.1.1 Instrumentation for Test (see equipment list)

G 1	G 2	F 21									
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8.1.2 Test Plan

EUT set-up	set 1, set 2		
Operating mode	Port / Line	Limit	Result
see test details	AC power line	FCC part 15 Class B	passed

Remark :	Powered by external power supply (115V / 60Hz)
-----------------	--

8.1.3 Conducted Limits (Power-Line)

Frequency- range	FCC part 15 B Class B		FCC part 15 B Class A	
	Quasi-Peak (dBμV)	Average (dBμV)	Quasi-Peak (dBμV)	Average (dBμV)
0,15 MHz – 0,5 MHz	66-56	56-46	79	66
0,5 MHz -5 MHz	56	46	73	60
5 MHz -30 MHz	60	50	73	60

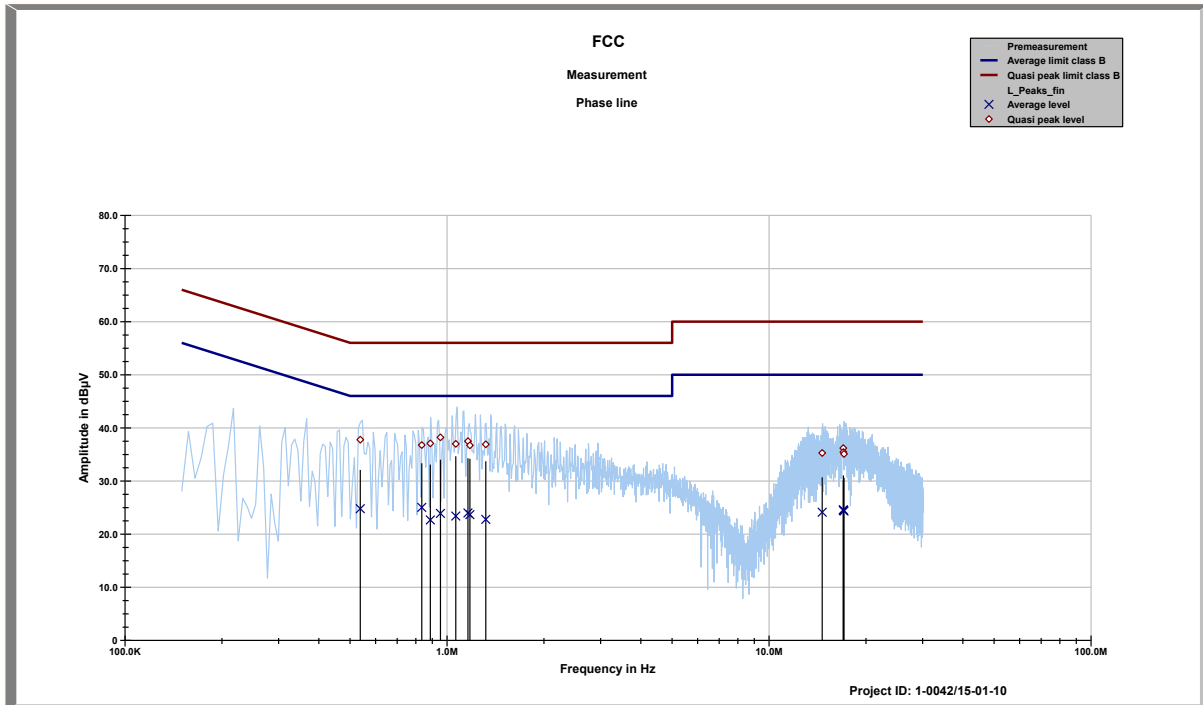
8.1.4 Calibration Information

Device	Serial number	ICT Number	Calibration valid until	Calibration interval
HP 8542 EMI Receiver with RF Filter Unit	3617A00170	300000568	01 / 2016	12 month
VISN ESH 3-Z5	892475/017	300002209	06 / 2016	24 month

Remarks: All emission components and the shielded room were checked weekly
Cable loss: 0.6 to 2.4 dB (150kHz to 30 MHz)

8.1.5 Test Results of Main

set 1:



FCC

Phase line tbl

Project ID: 1-0042/15-01-10

11:34:55 AM, Thursday, August 20, 2015

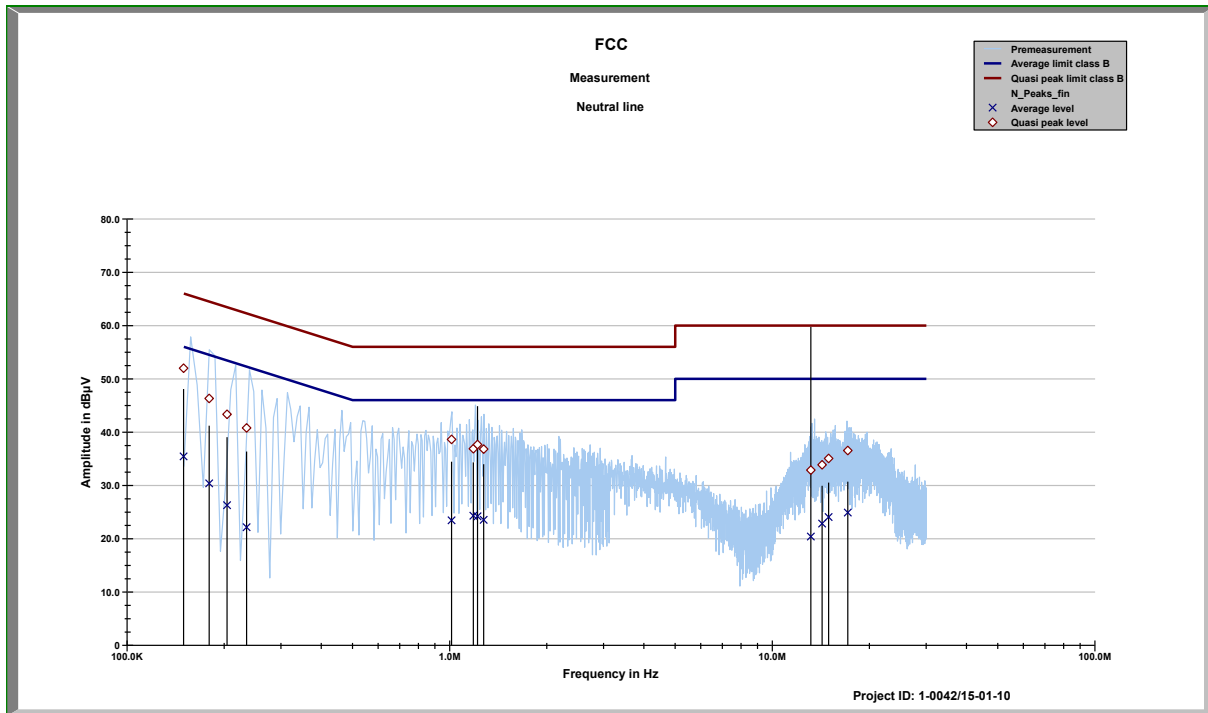
Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dBµV	dBµV	dBµV	dBµV
0.53779	37.77	18.23	24.79	21.21
0.83452	36.77	19.23	25.03	20.97
0.88717	37.07	18.93	22.67	23.33
0.954	38.21	17.79	23.89	22.11
1.06447	36.99	19.01	23.41	22.59
1.16111	37.50	18.50	23.97	22.03
1.17731	36.71	19.29	23.66	22.34
1.319	36.90	19.10	22.77	23.23
14.61	35.27	24.73	24.12	25.88
16.997	36.19	23.81	24.60	25.40
17.007	35.45	24.55	24.46	25.54
17.078	35.10	24.90	24.34	25.66

Project ID - 1-0042/15-01-10

EUT - RHM181LW

Serial Number - 1161467034 | IMEI:004402243072901

Operating mode - GSM850 idle + charging



FCC

Neutral line tbl

Project ID: 1-0042/15-01-10

11:34:55 AM, Thursday, August 20, 2015

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dBµV	dBµV	dBµV	dBµV
0.1797	46.32	18.18	30.40	24.76
0.2042	43.35	20.09	26.29	28.16
0.23476	40.79	21.49	22.15	31.43
1.01339	38.63	17.37	23.46	22.54
1.1833	36.89	19.11	24.30	21.70
1.21975	37.68	18.32	24.21	21.79
1.2738	36.82	19.18	23.54	22.46
13.154	32.88	27.12	20.41	29.59
14.256	33.87	26.13	22.85	27.15
14.939	35.06	24.94	24.07	25.93
17.13	36.56	23.44	24.91	25.09

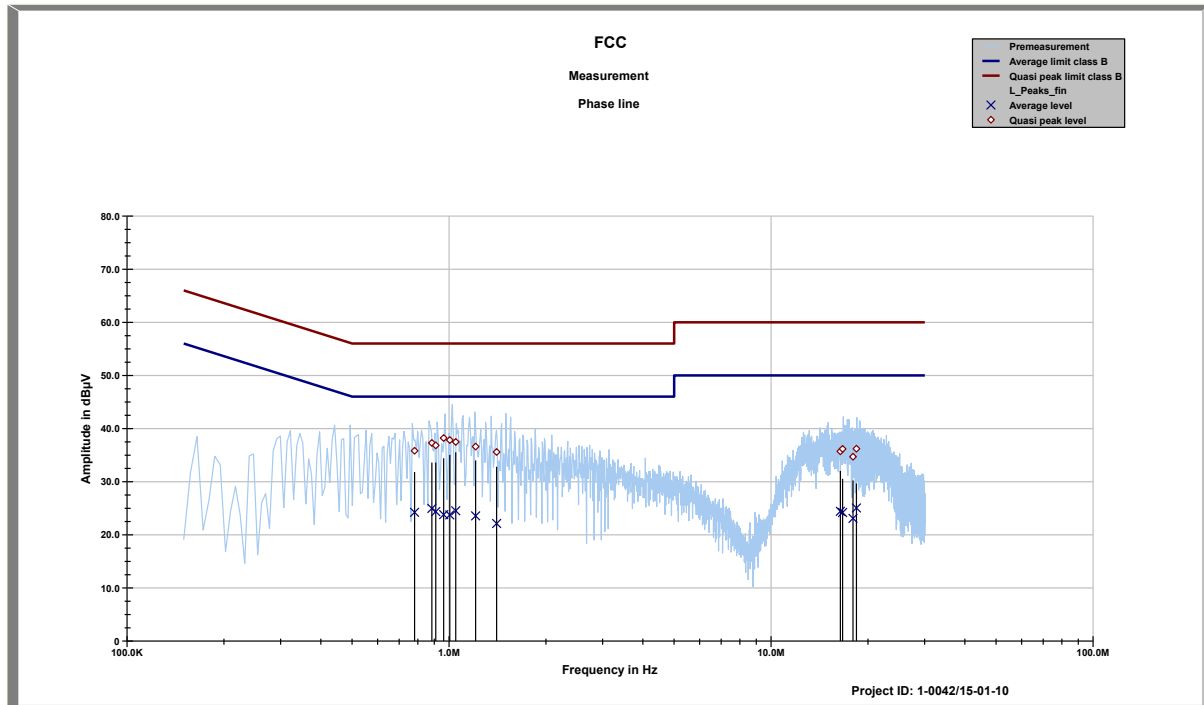
Project ID - 1-0042/15-01-10

EUT - RHM181LW

Serial Number - 1161467034 | IMEI:004402243072901

Operating mode - GSM850 idle + charging

set 2:



FCC

Phase line tbl

Project ID: 1-0042/15-01-10

12:58:30 PM, Thursday, August 20, 2015

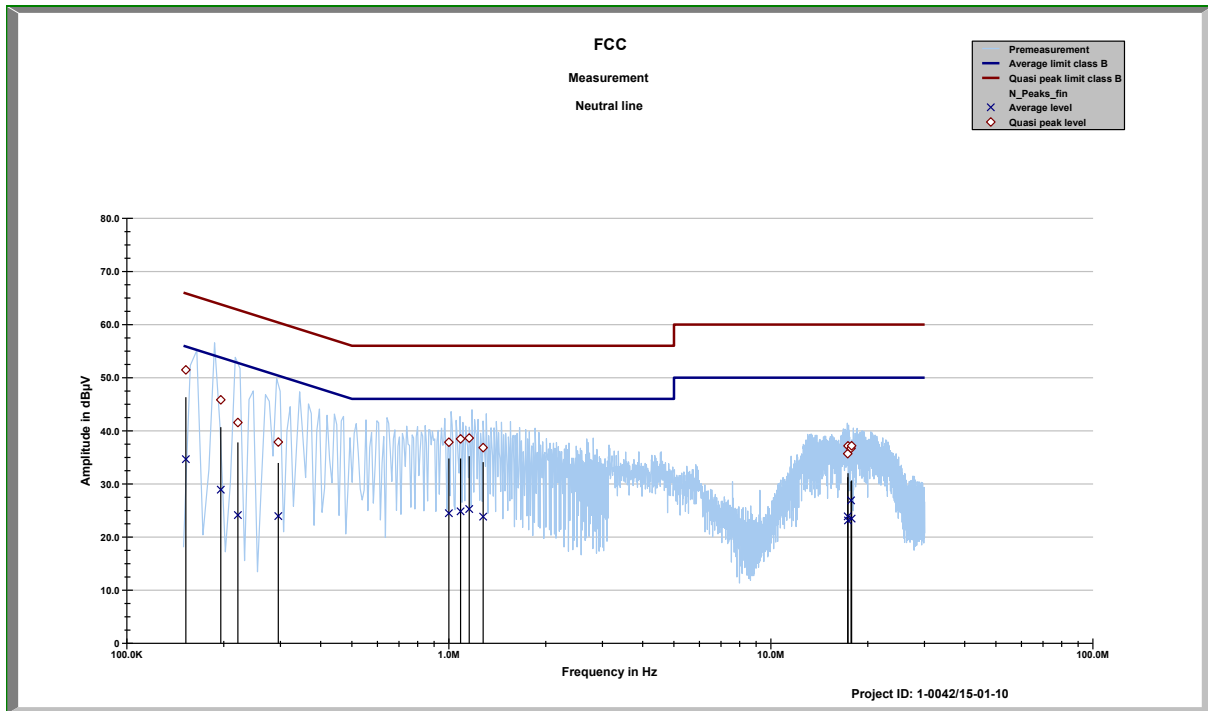
Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dBµV	dBµV	dBµV	dBµV
0.78166	35.81	20.19	24.22	21.78
0.88446	37.28	18.72	24.97	21.03
0.90914	36.83	19.17	24.36	21.64
0.96192	38.21	17.79	23.78	22.22
1.00519	37.83	18.17	23.74	22.26
1.04886	37.48	18.52	24.53	21.47
1.20869	36.60	19.40	23.56	22.44
1.4048	35.58	20.42	22.12	23.88
16.406	35.71	24.29	24.41	25.59
16.663	36.16	23.84	24.20	25.80
17.959	34.69	25.31	23.08	26.92
18.404	36.20	23.80	25.04	24.96

Project ID - 1-0042/15-01-10

EUT - RHM181LW

Serial Number - 1161467034 | IMEI:004402243072901

Operating mode - PCS1900 idle + charging



FCC

Neutral line tbl

Project ID: 1-0042/15-01-10

12:58:30 PM, Thursday, August 20, 2015

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dBµV	dBµV	dBµV	dBµV
0.15253	51.47	14.39	34.66	21.27
0.19583	45.83	17.95	28.92	25.77
0.22118	41.55	21.22	24.15	29.82
0.29542	37.88	22.50	23.95	27.90
1.0001	37.84	18.16	24.49	21.51
1.08692	38.47	17.53	24.84	21.16
1.15657	38.63	17.37	25.27	20.73
1.2775	36.83	19.17	23.83	22.17
17.308	35.70	24.30	23.90	26.10
17.34	37.16	22.84	23.13	26.87
17.725	36.71	23.29	26.90	23.10
17.798	37.18	22.82	23.46	26.54

Project ID - 1-0042/15-01-10

EUT - RHM181LW

Serial Number - 1161467034 | IMEI:004402243072901

Operating mode - PCS1900 idle + charging

8.1.6 Signal strength calculation

Calculation formula:

$$SS = UR + CF + VC$$

List of abbreviations:

SS	▶	signal strength
UR	▶	voltage at the receiver
CF	▶	loss of the cable and filter (passband filter 130 kHz – 30 MHz)
VC	▶	correction factor of the ISN (ESH3-Z5)

List with correction factors:

Frequency [MHz]	CF [dB]	VC [dB]
0,150	9,80	1,42
1,000	9,80	0,41
5,000	9,90	0,32
10,000	9,90	0,23
15,000	10,00	0,39
20,000	10,00	1,19
25,000	10,20	1,55
30,000	10,30	1,31

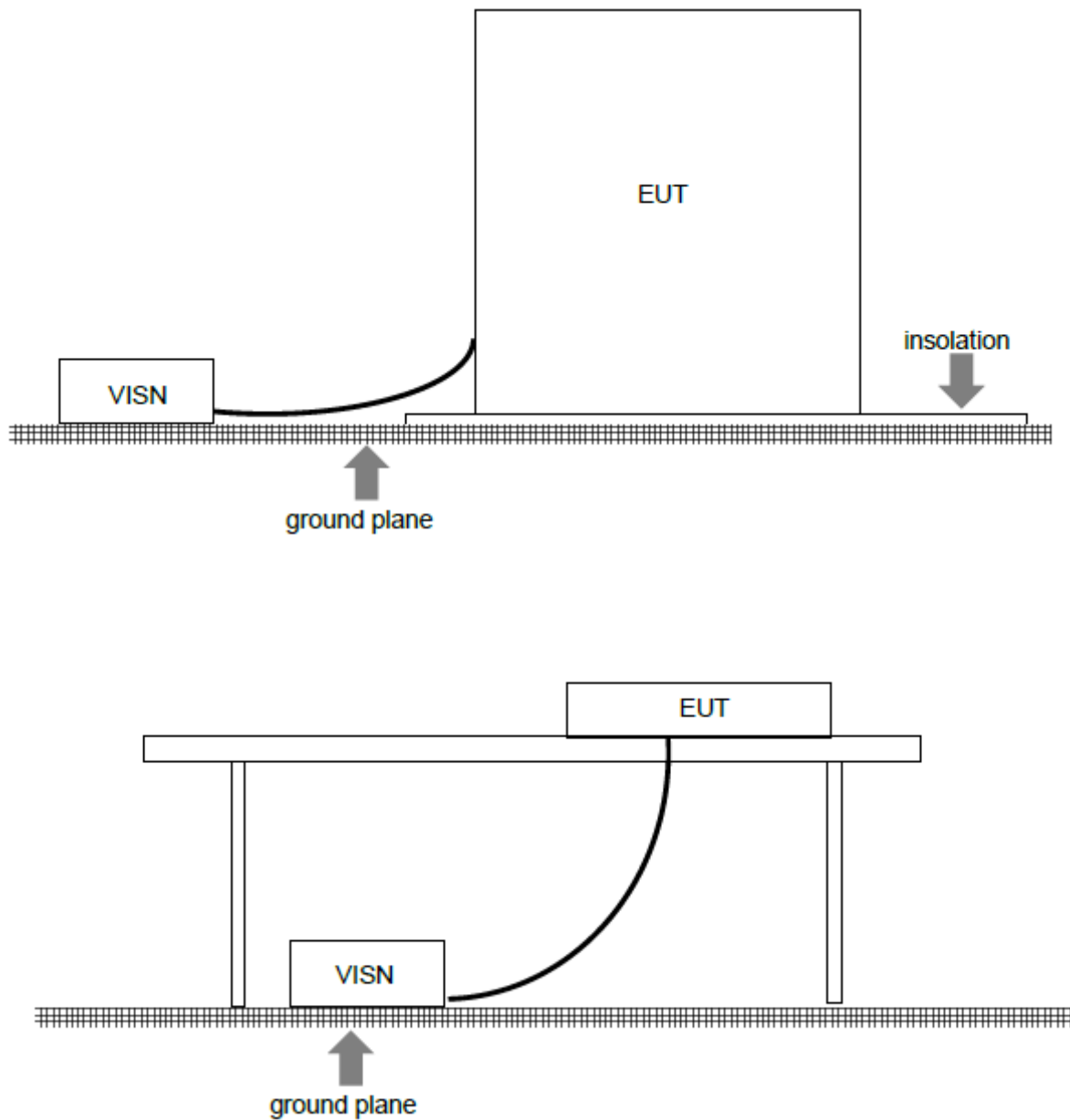
Example calculation:

For example at 10,000 000 MHz the measured Voltage (UR) is 37,62 dBμV, the loss of the cable and filter (CF) is 9,90 dB and the correction factor of the ISN (VC) is 0,23 dB the final result will be calculated:

$$SS \text{ [dB}\mu\text{V]} = 37,62 \text{ [dB}\mu\text{V]} + 9,90 \text{ [dB]} + 0,23 \text{ [dB]} = \underline{47,75 \text{ [dB}\mu\text{V]}} \text{ (244, 06 } \mu\text{V)}$$

8.1.7 Test Set-up

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



8.2 Electromagnetic Radiated Emissions (Distance 10 m)

8.2.1 Instrumentation for Test (see equipment list)

F 1	F 2	F 4b	F 5	F 6	F 7	F 8	F 21				
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8.2.2 Test Plan

EUT set-up	set 1, set 2		
Operating mode	Application	Limit	Result
see test details	Enclosure	FCC part 15 B Class B	passed

Remarks: Powered by external power supply (115V / 60Hz)

8.2.3 Radiated Limits

Frequency- range	FCC part 15 B Class B	FCC part 15 B Class A
30 MHz – 88 MHz	30 dBμV/m	39,1 dBμV/m
88 MHz – 216 MHz	33,5 dBμV/m	43,5 dBμV/m
216 MHz – 960 MHz	36 dBμV/m	46,4 dBμV/m
960 MHz – 40000 MHz	44 dBμV/m	49,5 dBμV/m
	* This values are recalculated from the class B limits at 3 m antenna distance in §15.109 (g 2) of the FCC rules	

8.2.4 Calibration Information

Device	Serial number	ICT Number	Calibration valid until	Calibration interval
ESCI 3 Receiver	100083/003	300003312	01/2016	12 month
Trilog Antenna	9163-295	300003787	04/2016	24 month

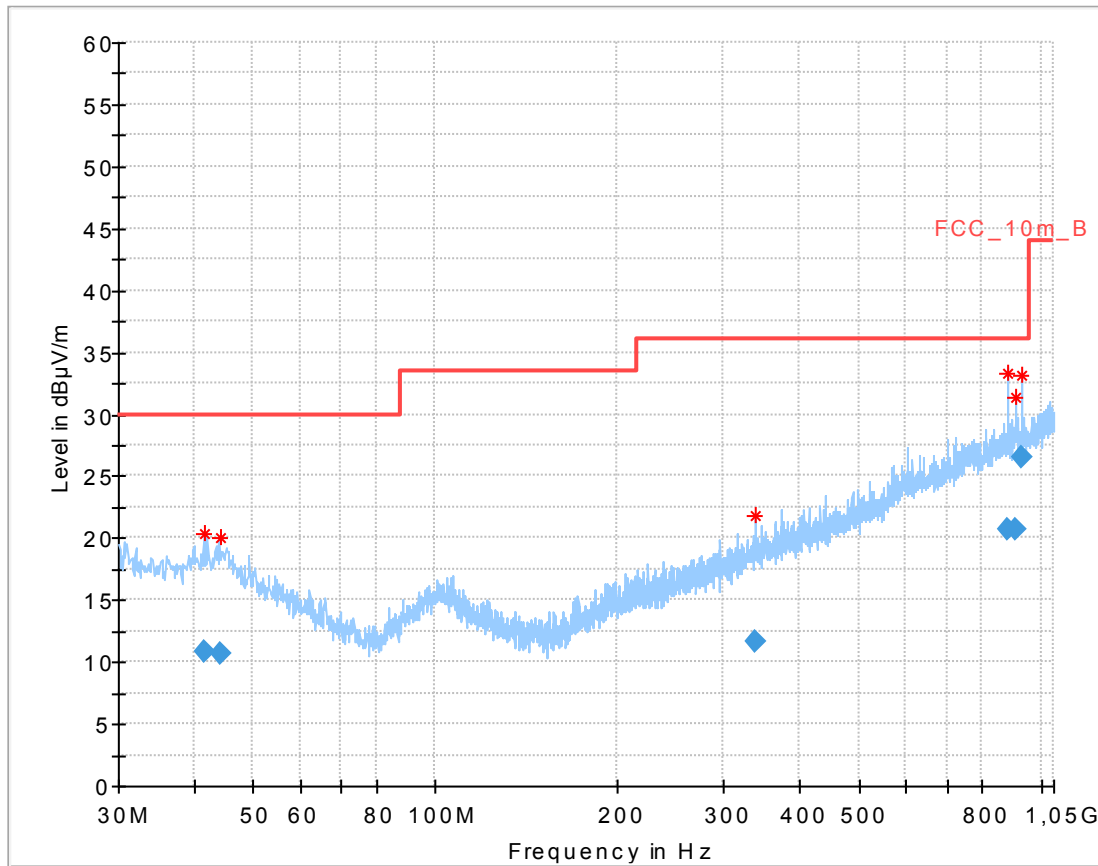
Remarks:
System check of all relevant devices and the chamber (weekly)

8.2.5 Test Results

set 1:

Common Information

EUT: RHM181LW
 Serial number: 1161467034 | IMEI:004402243072901
 Test description: FCC part 15 class B @ 10 m
 Operating condition: GSM850 idle + charging
 Operator name: Wolsdorfer
 Comment: AC: 115 V / 60 Hz; slider open



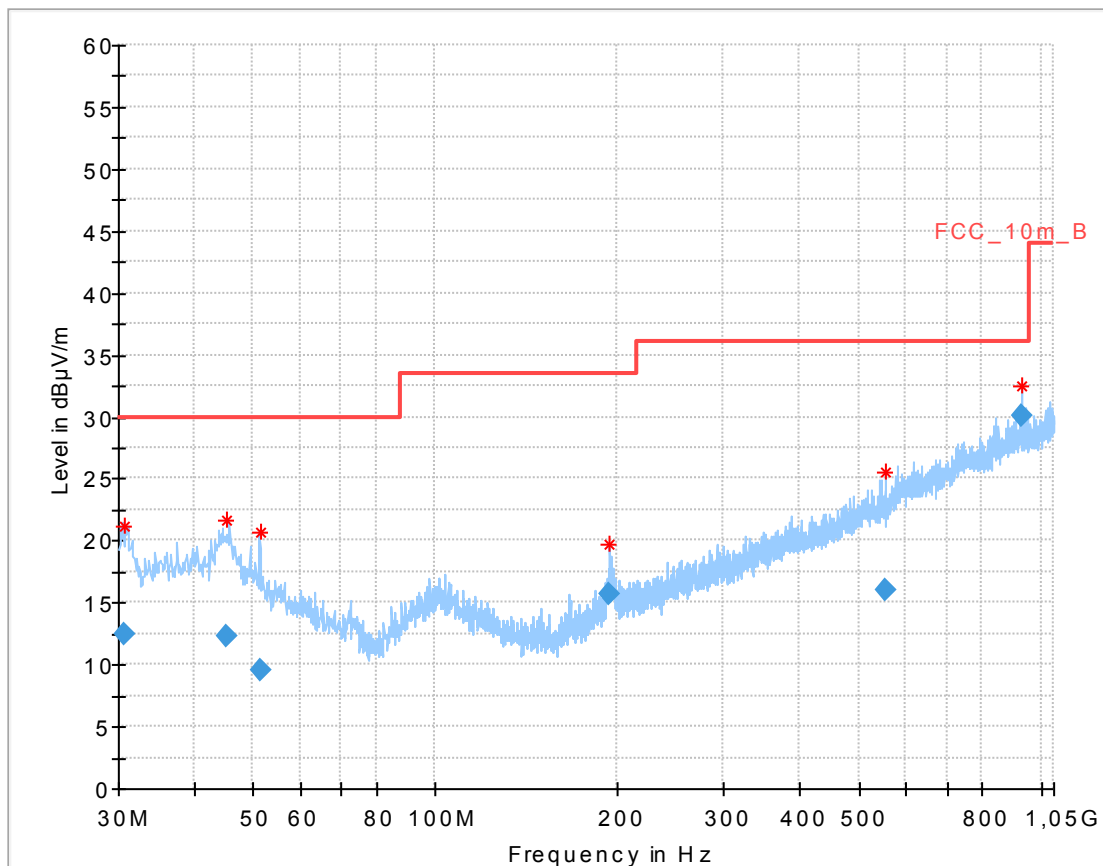
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
41.746350	10.85	30.00	19.15	1000.0	120.000	172.0	V	-12	14.0
44.319000	10.61	30.00	19.39	1000.0	120.000	172.0	V	161	13.9
338.335500	11.66	36.00	24.34	1000.0	120.000	200.0	H	320	15.7
880.116450	20.75	36.00	15.25	1000.0	120.000	103.0	V	72	23.9
906.040650	20.77	36.00	15.23	1000.0	120.000	400.0	H	230	24.1
927.412200	26.51	36.00	9.49	1000.0	120.000	400.0	H	95	24.2

set 2:

Common Information

EUT: RHM181LW
 Serial number: 1161467034 | IMEI:004402243072901
 Test description: FCC part 15 class B @ 10 m
 Operating condition: PCS1900 idle + charging
 Operator name: Wolsdorfer
 Comment: AC: 115 V / 60 Hz; slider closed



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.702150	12.49	30.00	17.51	1000.0	120.000	103.0	V	298	13.4
45.129900	12.36	30.00	17.64	1000.0	120.000	173.0	V	140	13.8
51.325200	9.56	30.00	20.44	1000.0	120.000	103.0	V	72	12.4
194.028450	15.68	33.50	17.82	1000.0	120.000	98.0	V	281	11.3
555.404700	16.04	36.00	19.96	1000.0	120.000	272.0	H	117	19.5
927.445200	30.15	36.00	5.85	1000.0	120.000	102.0	H	77	24.2

8.2.6 Hardware Set-up

Subrange 1

Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.42
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table (vertical): Cable_EN_1GHz (1005) Correction Table (horizontal): Cable_EN_1GHz (1005)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12
Software version	EMC32 V9.12.10

8.2.7 Sequence of testing

Setup

- 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 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 10 or 3 meter (see ANSI C 63.4) – see each test details
- The EUT was set into operation.

Premeasurement

- The turntable rotates from 0° to 315° with 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the EMI receiver sweeps three times in peak to find the maximum of all emissions

Final measurement

- The final measurement will be performed with minimum the six highest peaks.
- 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 QP (Quasi-Peak / 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.

8.2.8 Signal strength calculation

Calculation formula:

$$SS = U_R + CL + AF$$

List of abbreviations:

SS	►	signal strength
U_R	►	voltage at the receiver
CL	►	loss of the cable
AF	►	antenna factor

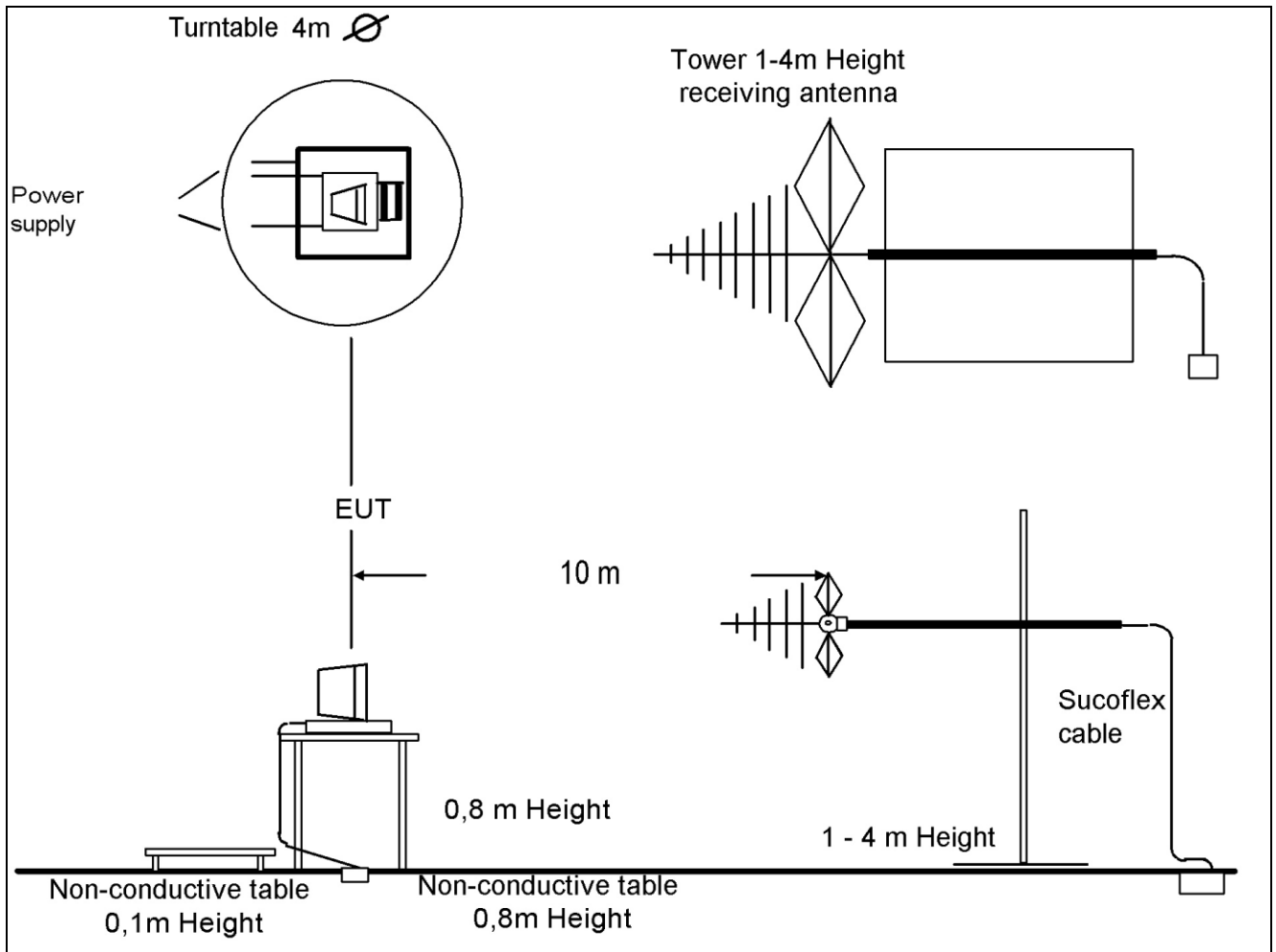
List with correction factors:

Frequency [MHz]	CL [dB]	AF [dB μ V/m]
30,000	0,20	12,30
100,000	0,60	11,30
200,000	1,10	10,60
300,000	1,30	13,20
400,000	1,60	15,30
500,000	1,90	16,80
600,000	2,00	18,80
700,000	2,20	20,30
800,000	2,30	21,50
900,000	2,40	22,80
1000,000	2,50	23,30

Example calculation:

For example at 500,000 000 MHz the measured Voltage (U_R) is 12,35 dB μ V/m, the loss of the cable (CL) is 1,90 dB and the antenna factor (AF) is 16,80 dB μ V/m the final result will be calculated:

$$SS \text{ [dB}\mu\text{V]} = 12,35 \text{ [dB}\mu\text{V/m]} + 1,90 \text{ [dB]} + 16,80 \text{ [dB}\mu\text{V/m]} = \underline{31,05 \text{ [dB}\mu\text{V/m]}} \text{ (35,69 } \mu\text{V/m)}$$

8.2.9 Test Set-up

8.3 Electromagnetic Radiated Emissions (Distance 5 m)

8.3.1 Instrumentation for Test (see equipment list)

F 1	F 6	F 21	F 29	F 30	F 33						
-----	-----	------	------	------	------	--	--	--	--	--	--

8.3.2 Test Plan

EUT set-up	set 1, set 2		
Operating mode	Application	Limit	Result
see test details	Enclosure	FCC part 15 class B	passed

Remarks:	The measured values are recalculated from 5m to 3m distance Powered by external power supply (115V / 60Hz)
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8.3.3 Radiated Limits

Frequency- range	47CFR15: (FCC part 15 B) Class B	47CFR15: (FCC part 15 B) Class A *
30 MHz – 88 MHz	40 dBµV/m	49,1 dBµV/m
88 MHz – 216 MHz	43,5 dBµV/m	53,5 dBµV/m
216 MHz – 960 MHz	46 dBµV/m	56,4 dBµV/m
960 MHz – 18000 MHz	54 dBµV/m	59,5 dBµV/m
		* This values are recalculated from the class A limits at 10 m antenna distance in §15.109 (g 2) of the FCC rules.

8.3.4 Calibration Information

Device	Serial number	ICT Number	Calibration valid until	Calibration interval
FSU 26	200809	300003874	01/2016	12 month
Horn Antenna	9120B188	300003896	05/2017	24 month

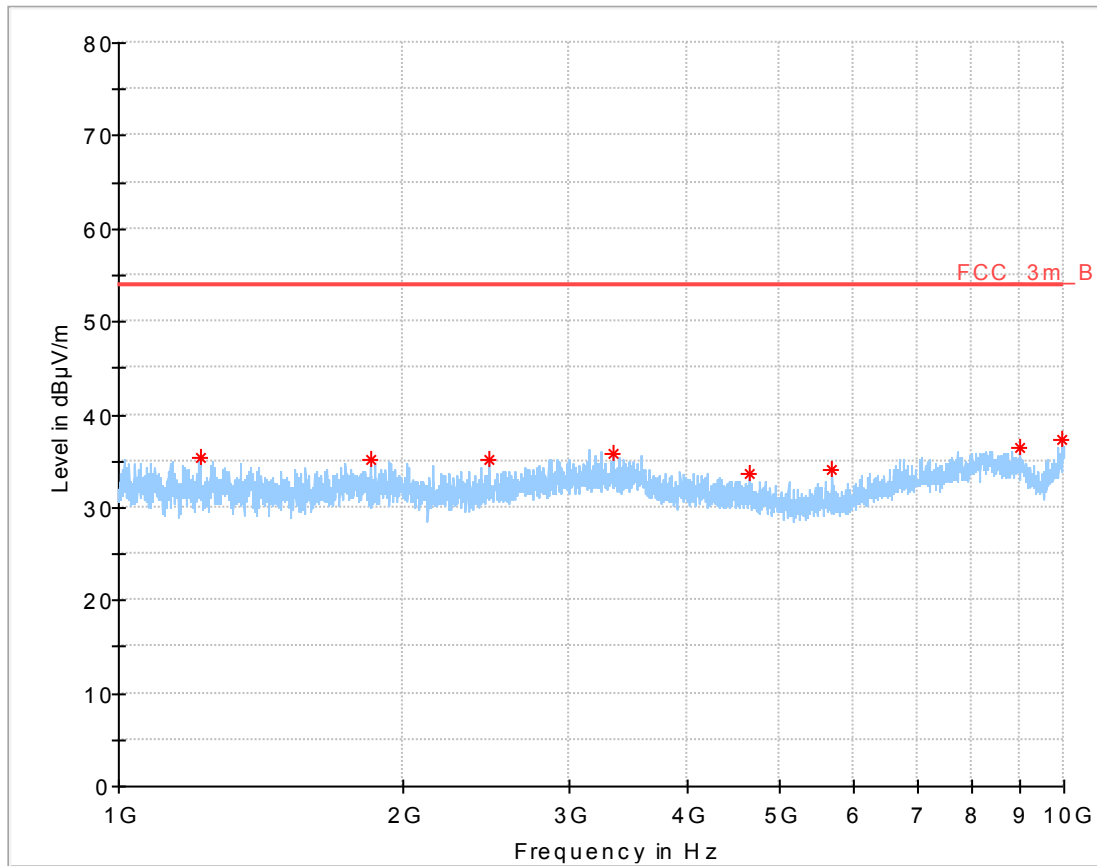
Remarks:
System check of all relevant devices and the chamber (weekly)

8.3.5 Test Results

set 1:

Common Information

EUT: RHM181LW
 Serial number: 1161467034 | IMEI:004402243072901
 Test description: FCC part 15 class B
 Operating condition: GSM850 idle + charging
 Operator name: Wolsdorfer
 Comment: AC: 115 V / 60 Hz; slider open



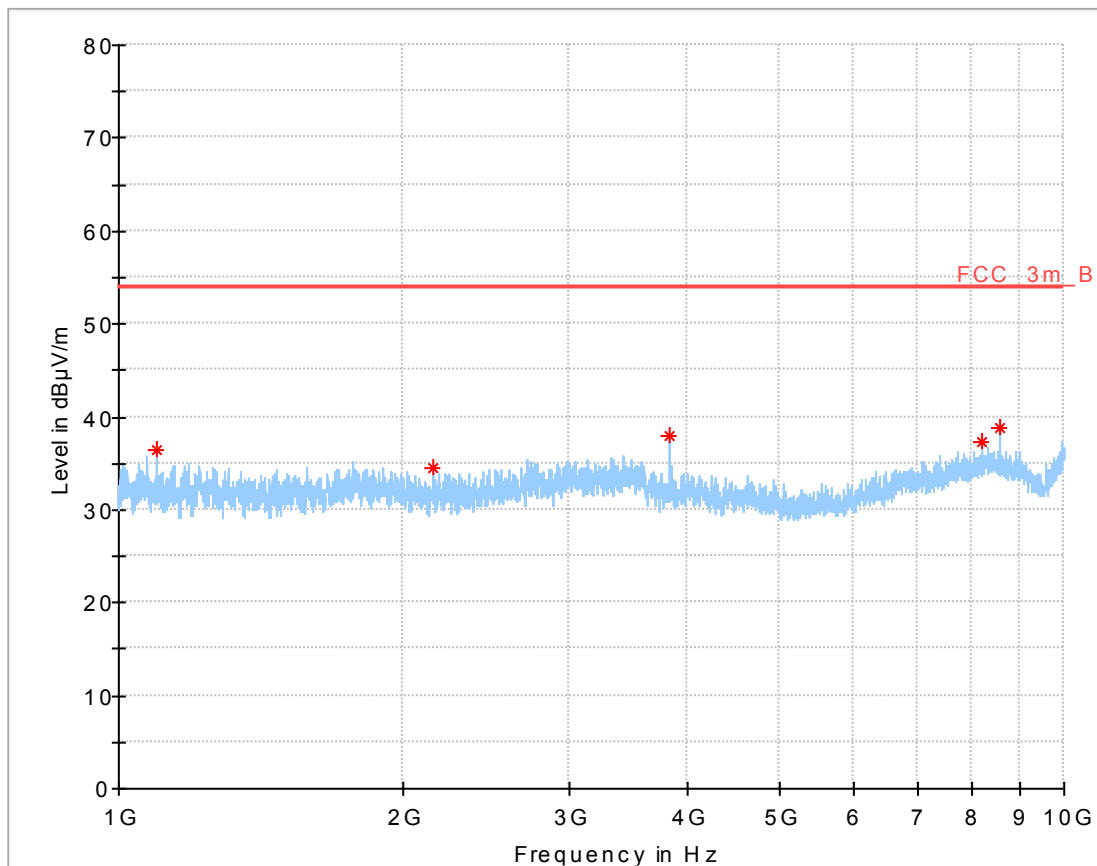
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1222.750000	35.39	54.00	18.61	---	---	100.0	H	104	-4.7
1845.100000	35.09	54.00	18.91	---	---	100.0	H	298	-4.3
2468.800000	35.06	54.00	18.94	---	---	100.0	H	266	-4.2
3335.500000	35.80	54.00	18.20	---	---	100.0	H	29	-2.3
4641.850000	33.73	54.00	20.27	---	---	100.0	H	173	-1.6
5691.250000	34.07	54.00	19.93	---	---	100.0	V	320	0.0
8973.550000	36.43	54.00	17.57	---	---	100.0	V	161	3.4
9937.450000	37.24	54.00	16.76	---	---	100.0	H	232	4.4

set 2:

Common Information

EUT:	RHM181LW
Serial number:	1161467034 IMEI:004402243072901
Test description:	FCC part 15 class B
Operating condition:	PCS1900 idle + charging
Operator name:	Wolsdorfer
Comment:	AC: 115 V / 60 Hz; slider closed



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1096.750000	36.55	54.00	17.45	---	---	100.0	V	181	-4.7
2149.300000	34.57	54.00	19.43	---	---	100.0	V	25	-4.2
3830.050000	37.92	54.00	16.08	---	---	100.0	H	320	-2.1
8178.850000	37.32	54.00	16.68	---	---	100.0	V	282	4.0
8548.750000	38.90	54.00	15.10	---	---	100.0	V	181	4.1

8.3.6 Hardware Set-up

Subrange 1
Frequency Range: 1 GHz - 10 GHz

Receiver: ESU [ESU 26]
@ GPIB0 (ADR 17), SN 100037/026, FW 4.43

Signal Path: 1_6_EN
FW 1.0
Correction Table: 3_5m
Correction Table: LNA_EN (matix)

Antenna: BBHA 9120 B
Correction Table (vertical): BBHA9120
Correction Table (horizontal): BBHA9120
Correction Table (vertical): Cable_Horn_EN (1103)
Correction Table (horizontal): Cable_Horn_EN (1103)

Antenna Tower: Generic Tripod [Generic Tripod]
@ GPIB0 (ADR 19), SN ?

Turntable: Turntable [EMCO Turntable]
@ GPIB0 (ADR 9), FW REV 3.12

8.3.7 Sequence of testing

Setup

- 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 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.

8.3.8 Signal strength calculation

Calculation formula:

$$SS = U_R + CL + AF + PA + DC$$

List of abbreviations:

SS	▶	signal strength
U_R	▶	voltage at the receiver
CL	▶	loss of the cable and gain of the preamp
AF	▶	antenna factor
DC	▶	distance correction (results measured on 5 m calculated to 3 m)

List with correction factors: column CL in table contains cable factor and preamplifier correction

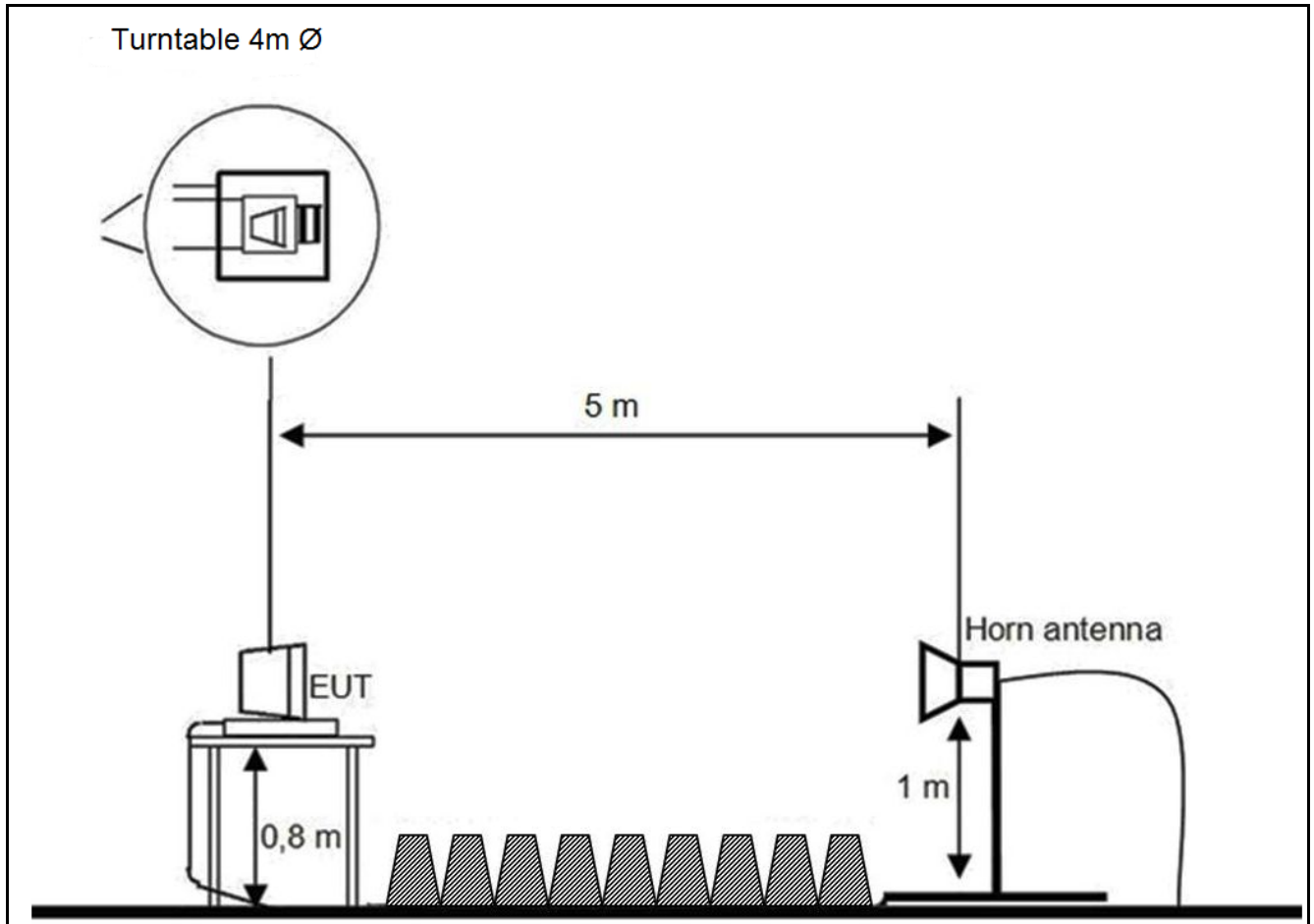
Frequency [GHz]	CL [dB]	AF [dB μ V/m]	DC [dB]
1,000	-35,50	26,20	4,40
1,500	-35,20	26,10	4,40
2,000	-35,10	26,70	4,40
2,500	-35,00	26,50	4,40
3,000	-34,70	27,60	4,40
3,500	-34,80	28,40	4,40
4,000	-35,00	28,60	4,40
4,500	-34,90	28,90	4,40
5,000	-34,80	29,30	4,40
5,500	-34,35	29,80	4,40
6,000	-34,00	30,30	4,40
6,500	-33,50	31,20	4,40
7,000	-33,10	31,20	4,40
7,500	-33,40	31,70	4,40
8,000	-33,80	32,10	4,40
8,500	-33,75	32,30	4,40
9,000	-33,70	31,70	4,40
9,500	-33,50	29,40	4,40
10,000	-33,40	33,00	4,40

Example calculation:

For example at 4,000 000 000 GHz the measured Voltage (U_R) is 46,13 dB μ V/m, the loss of the cable (CL) is -35,00 dB, the antenna factor (AF) is 28,60 dB μ V/m and the distance correction (DC) is 4,40 dB the final result will be calculated:

$$SS \text{ [dB}\mu\text{V]} = 46,13 \text{ [dB}\mu\text{V/m]} + (-35,00) \text{ [dB]} + 28,60 \text{ [dB}\mu\text{V/m]} + 4,4 \text{ [dB]} = \underline{44,13 \text{ [dB}\mu\text{V/m]}} \text{ (160,88 } \mu\text{V/m)}$$

8.3.9 Test Set-up



9 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.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
Radiated emission in chamber F					
F-1	Control Computer	F+W		FW0502032	300003303
F-2	Trilog-Antenna	Schwarzbeck	VULB 9163	9163-295	300003787
F-3a	Amplifier	Veritech Microwave Inc.	0518C-138	- / -	- / -
F-4b	Switch	HP	3488A	- / -	300000368
F-5	EMI Test receiver	R&S	ESCI	100083	300003312
F-6	Turntable Interface-Box	EMCO / ETS-LINDGREN	Model 105637	44583	300003747
F-7	Tower/Turntable Controller	EMCO / ETS-LINDGREN	Model 2090	64672	300003746
F-8	Tower	EMCO / ETS-LINDGREN	Model 2175	64762	300003745
F-9	Ultra Notch-Filter Rejected band Ch. 62	WRCD		9	
Radiated immunity in chamber F					
F-10	Control Computer	F+W		FW0502032	300003303
F-11	Signal Generator	R&S	SMB 100A	1406.6000k02	300004881
F-13	RF-Amplifier	ar	60S1G3	313649	300003410
F-14	Stacked Logper Antenna	Schwarzbeck	STLP9128 E	9128 E 013	300003408
F-15	RF-Amplifier	BONN	BLWA 0810-250	129100	300004536
F-16	Directional Coupler	ar	DC7144A	312786	300003411
F-17	Horn Antenna	ar	AT 4002	19739	300000633
F-18	Power Meter	R&S	NRV	860327/024	F033
F-19	Power sensor	R&S	URV5-Z2	839080/005	300002844.02
F-20	Power sensor	R&S	URV5-Z2	830755/057	F032
Harmonics and flicker in front of chamber F					
F-21	Flicker and Harmonics Test System	Spitzenberger & Spies	PHE4500/B I PHE4500/B II	B5983 B5984	300000210
F-28	Power Supply	Hewlett Packard	6032 A	2920 A 04466	300000580
Radiated emission in chamber F > 1GHz					
F-29	Horn antenna	Schwarzbeck	BBHA 9120 B	188	300003896
F-30	Amplifier	ProNova	0518C-138	005	F 024
F-31	Amplifier	Miteq	42-00502650-28-5A	1103782	300003379
F-32	Horn antenna	Emco	3115	9709-5289	300000213
F-33	Spectrum Analyzer	R&S	FSU26	200809	300003874
F-34	Loop antenna	EMCO	6502	8905-2342	300000256

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
Conducted emission in chamber G					
G-1	EMI Receiver	Hewlett Packard	8542 E	3617A00170	300000568
G-2	V-ISN	Rohde & Schwarz	ESH 3-Z5	892475/017	300002209
G-2a	V-ISN	Rohde & Schwarz	ESH 2-Z5	892602/024	300000587
G-3	2-Wire ISN	Schaffner	ISN T200	19075	300003422
G-4	4-Wire ISN	Schaffner	ISN T400	22325	300003423
G-5	Shielded wire ISN	Schaffner	ISN ST08	22583	300003433
G-6	Unshielded 8 wire ISN	Teseq	ISN T800	26113	300003833
G-7	Unshielded 8 wire ISN	Teseq	ISN T8-Cat. 6	26374	300003851
G-8	RF Current probe	FCC	F-33-4	46	300003257
G-9	V-ISN	Schaffner	ISN PLC-150	21579	300003318
G-10	V-ISN	Schaffner	ISN PLC-25-30	21584	300003319
G 10a	PLC Filter	TESEQ	Filter PLC	23436	300003598
G 10b	Coupling unit 75 Ohm	Fiedler	AC	----	300003272.04
Conducted immunity in chamber G					
G-11	Signal generator	R&S	SMG	8610647025	300000204.01
G-12	RF-Amplifier	BONN	BSA 0125-75	066502-01	300003545
G-13	Power Meter	R&S	URV 5	837723/025	300002844.01
G-14	Power Sensor	R&S	URV 5-Z2	832874/021	300002239
G-15	Directional coupler	emv	DC 2000	9401-1677	300000592
G-16	Attenuator 6dB	Alan	50HP6-100 N	121048 0348	300003148
G-17	EM-Injection Clamp	FCC	203i	232	300000626
G-18	CDN	FCC	FCC-801-M3-16	237	300000627
G-19	CDN	FCC	FCC-801-T2	78	300000629
G-20	CDN	FCC	FCC-801-AF 2	62	300000630
G-21	CDN	FCC	FCC-801-AF 4	61	300000631
G-22	CDN	FCC	FCC-801-M1	2027	300002761
G-23	CDN	TESEQ	CDN M016S	38741	300004847
G-23a	CDN	TESEQ	CDN M516A	35049	300004848
G-24	Transformator for 50Hz Loop Antenna	EM-Test	MC2630	0200-10	300002659.01
G-25	50Hz Loop Antenna	EM-Test	MS 100	none	300002659
Surge, Burst, Dips and Interruptions in chamber G					
G-26	Hybrid-Generator	EM-Test	UCS 500N5	V112711033	300004257
G-27	Motor Variac	EM-Test	MV 2616	0600-01	300002658
G-28	Capacitive Coupling Clamp	MWB	KKS 100	---	300000589
G-29a	Coupling Decoupling Network	EMC-Partner	CDN-2000-06-32	158	300004108
G-29	Coupling Decoupling Network	EMC-Partner	CDN-UTP8 ED3	1503	300004752
ESD in chamber G					
G-30	ESD generator	Schaffner	NSG 435	308	300002249
Emission on bench in chamber G					
G-31	Absorbing Clamp	R&S	MDS-21	832 231/006	300000527
generic in chamber G					
G-32	power supply	Hewlett Packard	6038A	2848A06673	300001512
Conducted interference in chamber G					
G 33	Signal generator	R&S	AFGU	862490/032	300001201
G 34	Audio amplifier	Crown 5002VZ	MACRO-TECH 5002VZ	8001641218	300004094
G 35	Shunt	Schwarzbeck	Shunt 9570	9570118	300004107
G 36	Coupling network	EM-Test	CN 200N1	P1322118851	300004742

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
Conducted measurements acc. EN 50561					
G 37	Coupling Unit	Schwarzbeck	CU 50561-1	CU50561-1-006	- / -
G 38	100 Ω to 50 Ω Balun	Schwarzbeck	SY9223-50561-1	SY9223-50561-1-0007	- / -
G 39	Symmetrical Splitter 100 Ω	Schwarzbeck	SPLIT 100	SPLIT100#11	- / -
G 40	100 Ω symmetrical variable attenuator	Schwarzbeck	SYMAT	SYMAT40-010	- / -
G 41	Coaxial Splitter 50 Ω	Schwarzbeck	CS 50	CS50-007	- / -
G 42	AC-Separator	Schwarzbeck	AC-Separator	AC-Separator 008	- / -
G 43	AC-Separator	Schwarzbeck	AC-Separator	AC-Separator 013	- / -
G 44	ISN	TESEQ	ISN PLT-A	32786	400000802
G 45	Vector signal generator	R&S	SMU 200A	100631	300003894

10 Observations

No observations, exceeding those reported with the single test cases, have been made.

Photographs of the EUT

see external document:

1-0042/15-01-10_Annex_A.pdf

Photographs of the Test setup

see external document:

1-0042/15-01-10_Annex_D.pdf

Annex A Document history

Version	Applied changes	Date of release
-/-	Initial release	2015-09-28
-A	editorial changes	2015-09-30
-B	calibration info updated	2015-09-30

Annex B 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