SGS Germany GmbH

Test Report No.: G2BK0004

FCC ID: 2ABRZ-TIPTEL3110

Order No.: G2BK	**Pages:** 33	**Munich,** Jul 21, 2014

Client:	Tiptel.com GmbH Business Solutions
Equipment Under Test:	Premium IP-Phone TIPTEL 3110 with Extension Module TIPTEL KM 27
Manufacturer / Importer:	Tiptel.com GmbH
Task:	Compliance with the requirements of the test specifications mentioned below:
Test Specification(s): [covered by accreditation]	• FCC 47 CFR Part 15 §15.107 §15.109
Result:	The EUTs comply with the requirements of the test specifications.

The results relate only to the items tested as described in this test report.
It is the responsibility of the manufacturer to ensure that all serial production models meet the intent of the requirements detailed within this report.

edited by:	**Date**	**Signature**
Nakpane Qualification Engineer	Jul 21, 2014	
approved by:	**Date**	**Signature**
Bauer Lab Manager EMC	Jul 21, 2014	

This document was signed electronically.

CONTENTS

1 Result Summary

The measurements described in this report were conducted pursuant to 47 CFR § 2.947 and § 2.1041. All applicable paragraphs of the 47 CFR parts 2 and 15 of the most current version of the rules were considered.

The following test program was performed according to the FCC rules to assess the ability of the tested sample(s) to successfully satisfy the FCC requirements listed in section 2.1 Specification(s) of this test report:

Test No.	Measurement	FCC Rule	Page Number of this Report	Result
1	Conducted Emissions	§ 15.107	12	compliant
2	Radiated Emissions	§ 15.109	15	compliant

Table 1-1: Results – Summary

In accordance with the FCC Rule §15.3 (z) the equipment was tested with the limits that are valid for an *unintentional radiator*.

2 References

2.1 Specification(s)

No.	Standard	Title	Date
[1]	FCC 47 CFR Part 15	Code of Federal Regulations, Title 47: Telecommunication Part 15: Radio Frequency Devices	2013-10
[2]	ANSI C63.4-2003	American National Standard for Methods of Measurement of RadioNoise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2004-01
[3]	ANSI C63.4-2009	American National Standard for Methods of Measurement of RadioNoise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2009-09

2.2 Glossary

AC	Alternating Current
AMN	Artificial Mains Network
ANSI	American National Standards Institute
AV	Average Detector
CFR	Code of Federal Regulations
CISPR	Comité International Spécial des Perturbations Radioélectriques (Special International Committee on Radio Interference)
DC	Direct Current
EMC	Electromagnetic Compatibility
EUT	Equipment Under Test
FCC	Federal Communication Commission
GUM	Guide to the Expression of Uncertainty in Measurement
HW	Hardware
IEC	International Electrotechnical Commission
ISO	Internation Organization for Standardization
LISN	Line Impedance Stabilization Network
POE	Power Over Ethernet
QP	Quasi Peak Detector

3 General Information

3.1 Identification of Client

Tiptel.com GmbH Business Solutions
Halskestraße 1
40880 Ratingen
Anna Gäng

3.2 Test Laboratory

SGS Germany GmbH
Hofmannstraße 50
81379 München

3.3 Time Schedule

Test No.:	1	2
Start of Test:	Mai 26, 2014	Oct 30, 2013
End of Test:	Mai 26, 2014	Nov 29, 2013

3.4 Participants

Name	Function
Afrim Peci (SGS; EMC department)	Accredited testing
Daniel Tomruk (SGS; EMC department)	Testing
André Stéphane Nakpane (SGS; EMC department)	Testing Editor

4 Equipment Under Test

The tested equipment is representative for serial production.

4.1 Description of EUT

Test item description ..:	Premium IP-Phone TIPTEL 3110
Manufacturer / Importer.:	Tiptel.com GmbH
Model/Type .....:	Premium IP-Phone TIPTEL 3110
	with Extension Module TIPTEL KM 27
Number of tested samples	1 TIPTEL 3110 combined with 3 x TIPTEL KM27
Serial Number(s) .....:	54831087959; 54831087958 (TIPTEL 3110 x 2)
	001618; 001621; 001653 (KM 27 x 3)
Ratings .....:	POE IEEE-802.3af Class 0 (48 VDC / 250 mA) or adapter 5 V / 2 A DC

4.1.1 Test Configuration

If not stated otherwise, the following test configurations were used to perform all measurements (see figures below).

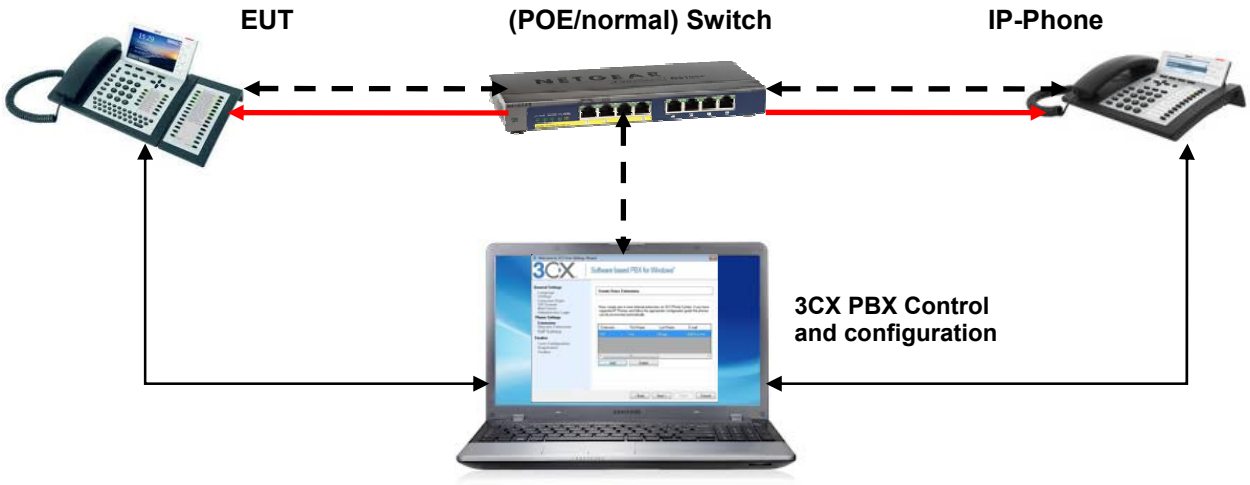

Figure 4-1: Test configuration with EUT powered over Ethernet (operation mode 1)

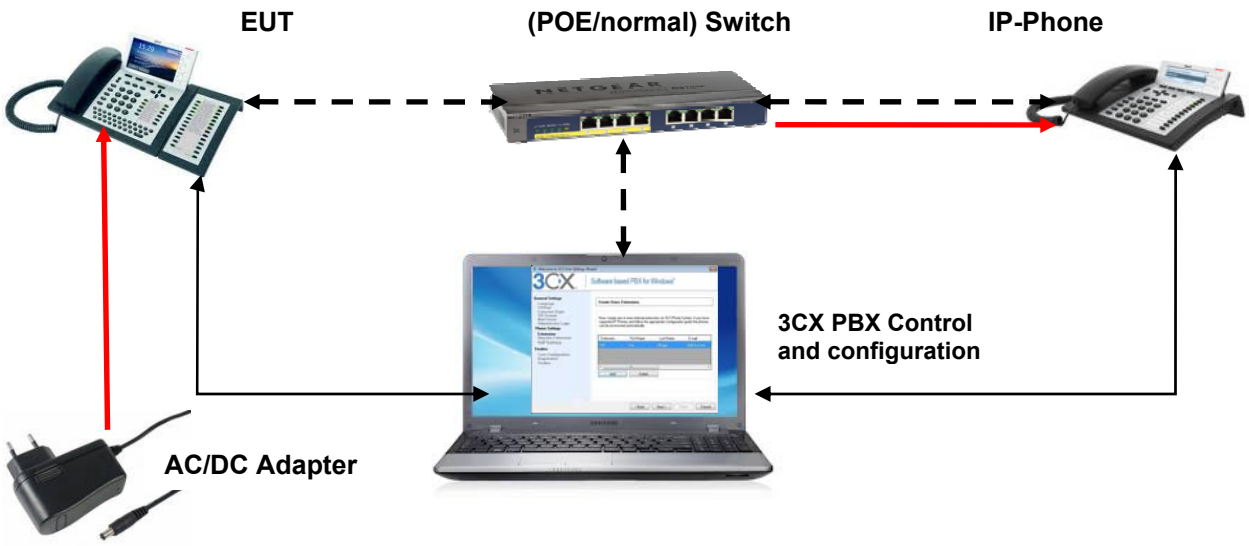

Figure 4-2: Test configuration with EUT powered by AC/DC adapter (Operation mode 2)

In the operation mode 1, the POE Switch provides ethernet connection (dashed lines) and power supply (red line) to the 2 peers IP-Phones, while in the operation mode 2 the EUT was powered by an AC/DC adapter. The IP-Phones were configured and controlled (thin black line) using the laptop-based simulation software 3CX Phone System for Windows which served as PBX system simultaneously. All calls from or to the EUT were directed through the PBX. During all tests a full communication were running between the two phones to simulate normal user operation.

4.1.2 Operational conditions

☐ Normal operation

☒ Other operation:

Operation mode 1 .....: POE IECC-802.3af Class 0 (48 VDC / 250 mA)

Operation mode 2 .....: adapter 5 V / 2 A DC

During all tests, a connection was established between the Equipment under test located inside the Semi-Anechoic chamber and another phone outside of the chamber using Ethernet switches with Power over Ethernet capability and the laptop-based simulation software 3CX Phone System for Windows.

During the measurements, the Premium IP-Phone was operated with the maximum configuration of 3 extension key modules KM 27; all LEDs illuminated.

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:
Temperature: 20 - 26 °C
Relative humidity: 30 - 60 %

4.3 Compliance Criteria

The EUT must fulfil the requirements (described in the specifications mentioned in chapter 2.1, Specifications) for the selected test cases.

5 General Description of Tests

5.1 Test Facility

The EMC-tests are carried out in the EMC-Lab of SGS CTS Technik in Munich, Hofmannstraße 50, 81379 München, Germany.

Chamber	1	2	3	4 / 5	6
Dimensions (net)	17.7 * 10.8 * 6.8m	9.6 * 8.5 * 5.3m	7.4 * 6.6 * 5.2m	4.1 * 3.5 * 3.5m	6.4 * 4.3 * 4.3m
Max. Door Exit (w x h)	2.9 * 3.86m	3.9 * 4.0m	2.0 * 2.7m	0.9 * 2.25m	1.8 * 3.0m
Shielding material	Sheet steel (Thick-ness:1.5mm on floor, 1.0mm on walls and ceil-ing)	Sheet steel	Sheet steel	Sheet steel	Sheet steel
Absorbers	Hybrid absorbers on walls and ceiling (TDK), length 1m	Hybrid absorbers on walls and ceiling (E+C), length 0.5m	Hybrid absorbers on walls and ceiling (E+C), length 0.3m	Without ab-sorbers	Without ab-sorbers
Floor	Metallic ground plane floor load: 12 t/m²	Metallic ground plane floor load: 1.5 t/m²	Metallic ground plane floor load: 1 t/m²	Metallic ground plane	Metallic ground plane
Turntable	∅ 4m / 6t	∅ 3.2m / 1.5t	∅ 2.0m / 1t		
Listings	FCC-listed until Dec. 2014, Reg. No.: 90932 Industry Canada listed until June 2015 Reg. No. 9058A-1	FCC-listed until Dec. 2014, Reg. No.: 97242 Industry Canada listed until June 2015 Reg. No. 9058A-2 VCCI-listed until Oct. 2016, Reg. No. R-2623, G-266	FCC-listed until Dec. 2014, Reg. No.: 299569 Industry Canada listed until June 2015 Reg. No. 9058A-3		VCCI-listed until Oct. 2016, Reg. No. C-2866 & No. T-326
Specials	***Emission*:** ***30 – 1000 MHz (d = 10 m)*** - NSA acc. to: ・ EN 55022 / 2010 ・ CISPR 16-1-4 / 2008 ・ ANSI C63.4 / 2003 ***1 – 18 GHz (d = 3 m)*** - Site VSWR 1 – 18GHz acc. to CISPR 16-1-4 / 2008 ***Immunity:*** Field uniformity 27 – 3000 MHz acc. EN 61000-4-3:2006	***Emission*:** ***30 – 1000 MHz (d = 3 m)*** - NSA acc. to: ・ EN 55022 / 2010 ・ CISPR 16-1-4 / 2008 ・ ANSI C63.4 / 2003 ***1 – 18 GHz (d = 3 m)*** - Site VSWR 1 – 18GHz acc. to CISPR 16-1-4 / 2008 ***Immunity:*** Field uniformity 80 – 3000 MHz acc. EN 61000-4-3:2006	***Emission*:** ***30 – 1000 MHz (d = 3 m)*** - NSA acc. to: ・ EN 55022 / 2010 ・ CISPR 16-1-4 / 2008 ・ ANSI C63.4 / 2003 ***1 – 18 GHz (d = 3 m)*** - Site VSWR 1 – 18GHz acc. to CISPR 16-1-4 / 2008 ***Immunity:*** Field uniformity 80 – 3000 MHz acc. EN 61000-4-3:2006		

5.2 Calibration of the Test Equipment

All relevant test equipment has a valid calibration. Additionally the used signal analyzers have a built-in self-calibration procedure. This calibration procedure was activated prior to the measurements so that the analyzer is deemed to be accurate. High quality cables were used to connect the measurement equipment. The actual loss of the attenuators and the cables was measured with a high precision network analyzer and taken into account for all measurements.

5.3 Measurement Uncertainty

As far as the underlying standards include requirements concerning the uncertainty of measuring instruments or measuring methods, they are met.

The expanded measurement uncertainty of the measuring chain was calculated for all tests according to the “ISO Guide to the expression of uncertainty in measurement (GUM)”. The results are documented in an “internal controlled document” at “SGS Germany GmbH, CTS Technik München” archives.

The measuring accuracy for all measuring devices is given in their technical description. The measuring instruments, including any accessories, are calibrated respectively verified to ensure the necessary accuracy. Depending on the kind of measuring equipment it is checked within regular intervals or directly before the measurement is performed. Adjustments are made and correction factors applied to measured data in accordance with the specifications of the specific instrument.

The expanded measurement instrumentation uncertainty of our Test Laboratory meets the requirements of IEC CISPR 16-4-2 (2003-11) “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modeling – Uncertainty in EMC measurements” for all listed Tests.

5.4 Modifications during the test

None

5.5 Deviations from Standard

None

6 Test Results

6.1 Test No. 1: Conducted Emissions (§ 15.107)

6.1.1 Purpose

The AC power-line conducted emissions caused by the EUT via the power lines were measured pursuant to [3] ANSI 63.4 Clause 13.3 in the frequency range from 150kHz to 30MHz.

6.1.2 Limits

Following conducted emission limits are specified by [1] § 15.107:

Frequency of Emission [MHz]	Conducted Limit [dBµV]	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5.0	56	46
5.0-30.0	60	50

Table 6-1: Limits – Conducted Emissions

6.1.3 EUT Operating Condition

The standard setup procedure as described in section 5 of this report was used. The EUT was additionally operated with an AC/DC network adapter with nominal voltage of 120V AC/60Hz.

6.1.4 Test Configuration

The power supply used for the conducted emission test had following specifications:

Original designation

Manufacturer: PHIHONG.

Model No.: PSAC10R-050

AC Input: AC 100-240 V, 0.3 A, 50-60Hz; 23 – 32 VA

DC Output: DC 5 V, 2.0A

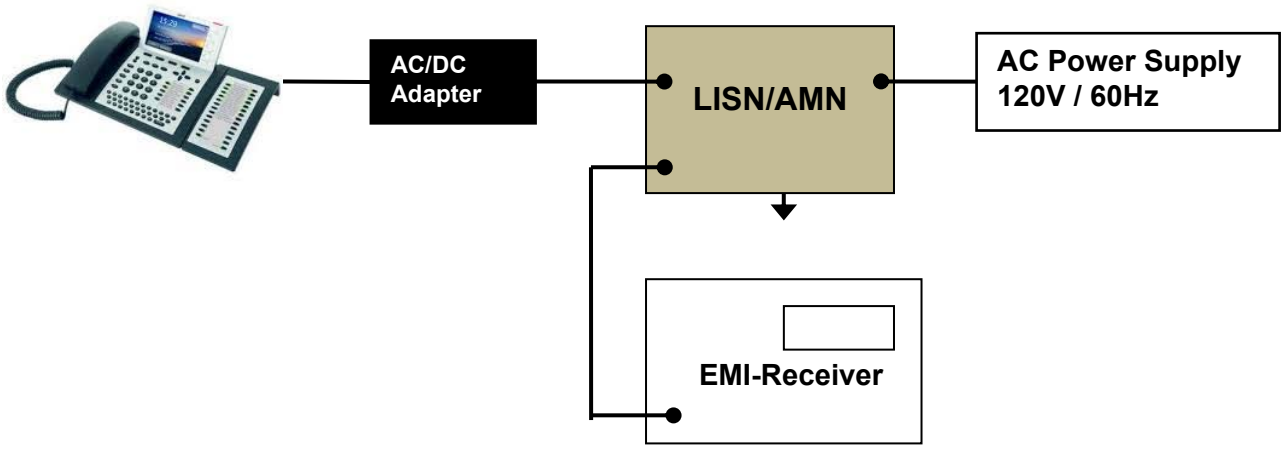

Figure 6-1: Test Configuration – Conducted Emissions (150 kHz – 30 MHz)

Photographs of the EUT setup for conducted emission measurement are shown on page 27 of this report.

6.1.5 Test Procedure and Results

The conducted emission on AC power leads is measured according to FCC 47 CFR Part 15 with an AMN and a receiver with peak and average detector. The voltage is measured separately on each power lead (Phase and Neutral). Only if the measured peak value is near or above the quasi-peak limit the detector function is changed to quasi-peak.

The following table shows the measured conducted emissions. Plots of the measurements are included on pages 23 of this report.

Final result (QuasiPeak):

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.154000	48.15	65.78	17.63	1000.0	9.000	N	GND	10.1
10.498000	46.53	60.00	13.47	1000.0	9.000	N	GND	10.5
10.570000	47.46	60.00	12.54	1000.0	9.000	L1	GND	10.5
10.594000	48.02	60.00	11.98	1000.0	9.000	N	GND	10.5
10.622000	47.90	60.00	12.10	1000.0	9.000	L1	GND	10.5
10.638000	48.16	60.00	11.84	1000.0	9.000	N	GND	10.5
10.650000	47.74	60.00	12.26	1000.0	9.000	L1	GND	10.5
10.706000	46.93	60.00	13.07	1000.0	9.000	L1	GND	10.5
11.218000	46.49	60.00	13.51	1000.0	9.000	N	GND	10.5
11.282000	46.55	60.00	13.45	1000.0	9.000	N	GND	10.5
Measurement Uncertainty:						+2.2 dB / -2.5 dB		

Table 6-2: Results – Conducted Emissions – Quasi Peak

Final result (Average):

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
10.594000	36.18	50.00	13.82	1000.0	9.000	N	GND	10.5
10.610000	34.25	50.00	15.75	1000.0	9.000	L1	GND	10.5
10.638000	34.49	50.00	15.51	1000.0	9.000	L1	GND	10.5
10.662000	36.48	50.00	13.52	1000.0	9.000	N	GND	10.5
10.690000	36.46	50.00	13.54	1000.0	9.000	N	GND	10.5
10.706000	34.66	50.00	15.34	1000.0	9.000	L1	GND	10.5
10.730000	36.14	50.00	13.86	1000.0	9.000	N	GND	10.5
11.266000	40.19	50.00	9.81	1000.0	9.000	N	GND	10.5
11.282000	39.87	50.00	10.13	1000.0	9.000	N	GND	10.5
11.334000	39.57	50.00	10.43	1000.0	9.000	N	GND	10.5
Measurement Uncertainty:						+2.2 dB / -2.5 dB		

Table 6-3: Results – Conducted Emissions – Average

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

Test Equipment (see chapter 7.1):

1, 2, 3, 4, 5, 6, 7, 8, 9

6.2 Test No. 2: Radiated Emissions (§ 15.109a)

6.2.1 Purpose

The radiated emissions of the EUT were measured pursuant to [3] ANSI 63.4 Clause 13.4. The measurement was performed to verify that emissions radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements are attenuated below the specified limits.

6.2.2 Limits

According to § 15.109a, the radiated emissions of an intentional radiator must not exceed following field strength levels:

Frequency of Emission [MHz]	Field strength [µV/m]	Meas. Distance [m]
30–88	100	3
88–216	150	3
216–960	200	3
Above 960	500	3

Table 6-4: Limits – Radiated Emissions

6.2.3 EUT Operating Condition

The standard setup procedure as described in section 5 of this report was used.

6.2.4 Test Configuration

The measurements were performed in an anechoic chamber. The radiated test site complies with the site attenuation requirements listed in ANSI C63.4 and is listed with the FCC.

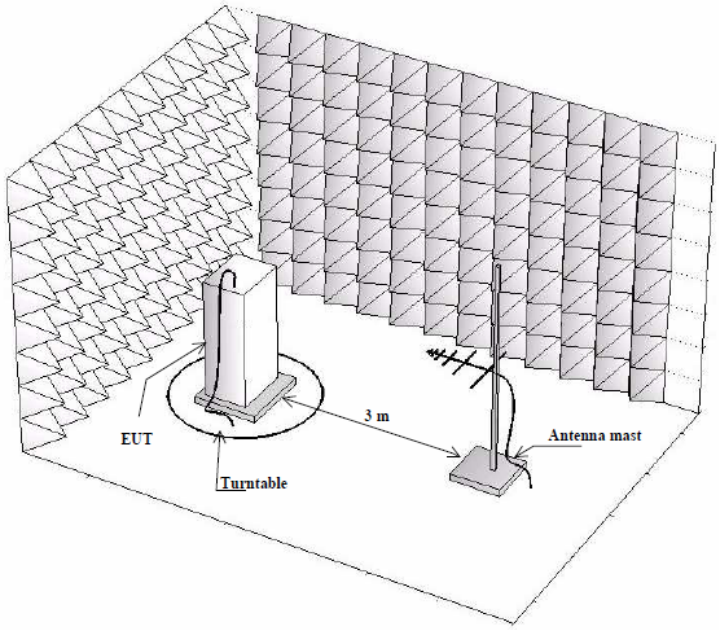

Figure 6-2: Test Configuration – Radiated Emissions

Photographs of the EUT in the anechoic chamber are shown on page 28 of this report.

6.2.5 Test Procedure and Results

6.2.5.1 Radiated Emissions – 30 MHz to 1 GHz

Phenomena	Reference	Test Specification	Criteria	Verdict [1]
Radio Disturbance Electric Field	FCC 47 CFR Part 15 §15.109	30 MHz - 1 GHz Distance 3 m	Class B	P

Test procedure:

Radiated measurements are performed in a semi-anechoic chamber meeting the normalized site attenuation of ANSI C63.4 and listed with the FCC. The applicable frequency spectrum is scanned with a calibrated RF measuring system using an appropriate broadband antenna and an EMI-receiver/spectrum analyzer and compared to the required limits. The measuring instrument performs the field strength calculations automatically. The measuring software provides resident AF and CF figures for individual antennas and cables. The receiver/analyzer is set to "peak" mode from 30 MHz to 1 GHz. On any emission of concern, the receiver is set to quasi-peak mode.

“Maximization” of each suspect frequency is accomplished by a combination of a 360° azimuth search using a turntable and varying the antenna to ground plane height from 1 m to 4 m. Also, both the vertical and horizontal polarization is scanned in the required frequency range per ANSI C63.4.
Maximization of emission results starts at 0° of the turn table with antenna in horizontal polarization set to a height of 1 m. While the turntable slowly moves to 360°, the spectrum analyzer is sweeping from 30 to 1000 MHz and maximum data is recorded. Antenna is set to 2 m and turntable slowly moves back to 0° while the spectrum analyzer is sweeping again. This is repeated until the antenna height of 4 m is reached.
The antenna polarization is set to vertical and the procedure described above is repeated.
For each frequency the measuring software stores the maximum level as well as the corresponding settings of turntable and antenna. An azimuth resolution of about 3° is realized using this method.
At least the six highest frequencies are selected automatically by the software for performing the final measurements.
At each of these frequencies the turntable as well as the antenna is set to the corresponding settings. Then the antenna is slowly moved 50 cm down/up related to initial position while the receiver is measuring at this frequency. The highest emission level and the corresponding height are recorded. At this final position, the measurement is performed with quasi-peak detector.

[1] P (Pass): test object meets the requirement; F (Fail): test object does not meet the requirement; N/A: test case does not apply to the test object; NR: test case is not requested by the client.

6.2.5.1.1 Radiated Emissions – 30 MHz to 1 GHz; Operation mode 1 with POE switch

The following table shows the measured radiated emissions. Plots of the measurements are included on pages 24 of this report.

Final result (QuasiPeak):

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time	Height (cm)	Pol	Azimuth (deg)	Type
36.827000	35.64	40.00	4.36	1000.0	100.0	V	337.0	SB
375.029000	41.71	46.00	4.29	1000.0	100.0	H	146.0	SB
299.999000	42.72	46.00	3.28	1000.0	100.0	H	359.0	SB
500.014000	39.68	46.00	6.32	1000.0	166.0	H	184.0	SB
875.015000	39.72	46.00	6.28	1000.0	100.0	H	0.0	SB
70.449000	27.30	40.00	12.70	1000.0	134.0	V	247.0	BB
45.751000	27.39	40.00	12.61	1000.0	100.0	v	63.0	BB
Measurement Uncertainty:						+3.1 dB / -3.9 dB		

Table 6-5: Results – Radiated Emissions 30 MHz to 1 GHz – Quasi Peak

Final result (Average):

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time	Height (cm)	Pol	Azimuth (deg)	Type
36.827000	30.34	40.00	9.66	1000.0	100.0	V	337.0	SB
375.029000	39.79	46.00	6.21	1000.0	100.0	H	146.0	SB
299.999000	41.31	46.00	4.69	1000.0	100.0	H	359.0	SB
500.014000	35.60	46.00	10.40	1000.0	166.0	H	184.0	SB
875.015000	37.62	46.00	8.38	1000.0	100.0	H	0.0	SB
70.449000	20.39	40.00	19.61	1000.0	134.0	V	247.0	BB
45.751000	20.57	40.00	19.43	1000.0	100.0	v	63.0	BB
Measurement Uncertainty:						+3.1 dB / -3.9 dB		

Table 6-6: Results – Radiated Emissions 30 MHz to 1 GHz – Average

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

Test Equipment (see chapter 7.1):

10, 11, 12, 13, 14, 15, 16, 17, 18

6.2.5.1.2 Radiated Emissions – 30 MHz to 1 GHz; Operation mode 2 with AC/DC adapter

The following table shows the measured radiated emissions. Plots of the measurements are included on pages 24 of this report.

Final result (QuasiPeak):

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time	Height (cm)	Pol	Azimuth (deg)	Type
375.029000	44.66	46.00	1.34	1000.0	100.0	H	144.0	SB
299.999000	43.06	46.00	2.94	1000.0	100.0	H	4.0	SB
500.014000	41.63	46.00	4.37	1000.0	166.0	H	154.0	SB
875.015000	39.42	46.00	6.58	1000.0	100.0	H	0.0	SB
39.652000	27.74	40.00	12.26	1000.0	100.0	V	154.0	BB
625.047000	34.58	46.00	11.42	1000.0	100.0	V	336.0	SB
69.624000	27.13	40.00	12.87	1000.0	150.0	V	328.0	BB
Measurement Uncertainty:						+3.1 dB / -3.9 dB		

Table 6-7: Results – Radiated Emissions 30 MHz to 1 GHz – Quasi Peak

Final result (Average):

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time	Height (cm)	Pol	Azimuth (deg)	Type
375.029000	42.78	46.00	3.22	1000.0	100.0	H	144.0	SB
299.999000	41.61	46.00	4.39	1000.0	100.0	H	4.0	SB
500.014000	37.85	46.00	8.15	1000.0	166.0	H	154.0	SB
875.015000	37.61	46.00	8.39	1000.0	100.0	H	0.0	SB
39.652000	20.88	40.00	19.12	1000.0	100.0	V	154.0	BB
625.047000	30.21	46.00	15.79	1000.0	100.0	V	336.0	SB
69.624000	20.26	40.00	19.74	1000.0	150.0	V	328.0	BB
Measurement Uncertainty:						+3.1 dB / -3.9 dB		

Table 6-8: Results – Radiated Emissions 30 MHz to 1 GHz – Average

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

Test Equipment (see chapter 7.1):

10, 11, 12, 13, 14, 15, 16, 17, 18

6.2.5.2 Radiated Emissions – 1 GHz to 2 GHz

Phenomena	Reference	Test Specification	Criteria	Verdict [2]
Radio Disturbance Electric Field	FCC 47 CFR Part 15 §15.109	1 GHz - 2 GHz Distance 3 m	Class B	P

Test procedure:

Radiated measurements are performed in a semi-anechoic chamber meeting the normalized site attenuation of ANSI C63.4 as well as the Site VSWR requirements of CISPR16 and listed with the FCC. The applicable frequency spectrum is scanned with a calibrated RF measuring system using an appropriate broadband antenna and an EMI-receiver/spectrum analyzer and compared to the required limits. The measuring instrument performs the field strength calculations automatically. The measuring software provides resident AF and CF figures for individual antennas and cables. The receiver/analyzer is set to "peak" mode from 1 GHz to 6 GHz. On any emission of concern, the receiver is set to average mode.

For EUTs having a size larger than the beamwidth of the antenna, appropriate countermeasures shall be taken, e.g. increasing the measuring distance or different antenna positions (lateral) to scan the complete surface of EUT.

“Maximization” of each suspect frequency is accomplished by a combination of a 360° azimuth search using a turntable and varying the antenna to ground plane height from 1 m to 4 m. Also, both the vertical and horizontal polarization is scanned in the required frequency range per ANSI C63.4.
Maximization of emission results starts at 0° of the turn table with antenna in horizontal polarization set to a height of 1 m. While the turntable slowly moves to 360°, the spectrum analyzer is sweeping from 1 to 2 GHz and maximum data is recorded. Antenna is set to 1.5 m and turntable slowly moves back to 0° while the spectrum analyzer is sweeping again. This is repeated until the antenna height of 4 m is reached (step: 0.5m).
The antenna polarization is set to vertical and the procedure described above is repeated.
For each frequency the measuring software stores the maximum level as well as the corresponding settings of turntable and antenna. An azimuth resolution of about 3° is realized using this method.
At least the six highest frequencies are selected automatically by the software for performing the final measurements.
At each of these frequencies the turntable as well as the antenna is set to the corresponding settings. Then the antenna is slowly moved 25 cm down/up related to initial position while the receiver is measuring at this frequency. The highest emission level and the corresponding height are recorded. At this final position, the measurement is performed with average detector.

2 P (Pass): test object meets the requirement; F (Fail): test object does not meet the requirement;
N/A: test case does not apply to the test object; NR: test case is not requested by the client. FCC requires radiated emission testing up to the 5th harmonic of the highest clock rate of the tested system.

6.2.5.2.1 Radiated Emissions – 1 GHz to 2 GHz; Operation mode 1 with POE switch

The following table shows the measured radiated emissions. Plots of the measurements are included on pages 25 of this report.

Final result (MaxPeak)

Frequency (MHz)	MaxPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1034.3333	34.0	54.0	20.0	1000.0	1000.0	100.0	H	113.0	-7.8
1049.5666	40.3	54.0	13.7	1000.0	1000.0	107.0	V	322.0	-7.8
1049.9000	39.8	54.0	14.2	1000.0	1000.0	141.0	H	111.0	-7.8
1050.2333	42.9	54.0	11.1	1000.0	1000.0	137.0	H	141.0	-7.8
1057.0333	37.4	54.0	16.6	1000.0	1000.0	100.0	V	306.0	-7.7
1124.8333	38.5	54.0	15.5	1000.0	1000.0	100.0	V	5.0	-7.1
1350.2000	41.7	54.0	12.3	1000.0	1000.0	132.0	V	80.0	-5.2
1350.7000	37.0	54.0	17.0	1000.0	1000.0	100.0	H	27.0	-5.2
1374.9000	38.1	54.0	15.9	1000.0	1000.0	100.0	V	169.0	-4.8
1874.8333	38.9	54.0	15.1	1000.0	1000.0	100.0	H	336.0	-1.9
Measurement Uncertainty:							+4.4 dB / -5.8 dB		

Table 6-9: Results – Radiated Emissions 1 GHz to 2 GHz – Max Peak

Final result (Average):

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1000.0000	30.7	54.0	23.3	1000.0	1000.0	100.0	H	119.0	-8.4
1050.1333	22.4	54.0	31.6	1000.0	1000.0	137.0	H	146.0	-7.8
1124.8666	33.9	54.0	20.1	1000.0	1000.0	100.0	V	5.0	-7.1
1374.9000	32.5	54.0	21.5	1000.0	1000.0	100.0	V	169.0	-4.8
1500.2000	26.2	54.0	27.8	1000.0	1000.0	100.0	H	65.0	-4.0
1625.1666	31.1	54.0	22.9	1000.0	1000.0	100.0	H	97.0	-3.0
1750.1333	26.8	54.0	27.2	1000.0	1000.0	100.0	V	89.0	-2.3
1800.1666	32.0	54.0	22.0	1000.0	1000.0	100.0	V	89.0	-2.1
1875.2333	31.8	54.0	22.2	1000.0	1000.0	100.0	H	336.0	-1.9
1950.2000	24.7	54.0	29.3	1000.0	1000.0	100.0	H	43.0	-1.1
Measurement Uncertainty:							+4.4 dB / -5.8 dB		

Table 6-10: Results – Radiated Emissions 1 GHz to 2 GHz – Average

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

Test Equipment (see chapter 7.1):

10, 11, 12, 13, 14, 15, 16, 17, 19

6.2.5.2.2 Radiated Emissions – 1 GHz to 2 GHz; Operation mode 1 with AC/DC Adapter

The following table shows the measured radiated emissions. Plots of the measurements are included on pages 26 of this report.

Final result (MaxPeak)

Frequency (MHz)	MaxPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1049.5333	40.5	54.0	13.5	1000.0	1000.0	100.0	H	134.0	-7.8
1050.3000	42.1	54.0	11.9	1000.0	1000.0	100.0	H	145.0	-7.8
1124.8666	39.1	54.0	14.9	1000.0	1000.0	100.0	V	21.0	-7.1
1350.0333	36.4	54.0	17.6	1000.0	1000.0	118.0	V	90.0	-5.2
1350.4333	39.9	54.0	14.1	1000.0	1000.0	125.0	V	70.0	-5.2
1374.9000	38.1	54.0	15.9	1000.0	1000.0	100.0	V	158.0	-4.8
1625.0000	39.6	54.0	14.4	1000.0	1000.0	125.0	H	80.0	-3.0
1799.8333	39.2	54.0	14.8	1000.0	1000.0	100.0	V	90.0	-2.1
1875.0666	38.9	54.0	15.1	1000.0	1000.0	112.0	H	0.0	-1.9
1950.1000	37.9	54.0	16.1	1000.0	1000.0	100.0	H	337.0	-1.1
Measurement Uncertainty:							+4.4 dB / -5.8 dB		

Table 6-11: Results – Radiated Emissions 1 GHz to 2 GHz – Max Peak

Final result (Average):

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1000.0000	30.7	54.0	23.3	1000.0	1000.0	100.0	H	124.0	-8.4
1049.6333	21.5	54.0	32.5	1000.0	1000.0	151.0	H	134.0	-7.8
1049.7666	22.7	54.0	32.3	1000.0	1000.0	151.0	H	134.0	-7.8
1050.3333	22.0	54.0	32.0	1000.0	1000.0	151.0	H	134.0	-7.8
1124.8333	35.0	54.0	19.0	1000.0	1000.0	100.0	V	21.0	-7.1
1375.1666	32.6	54.0	21.4	1000.0	1000.0	100.0	V	164.0	-4.8
1499.8333	24.5	54.0	29.5	1000.0	1000.0	201.0	H	67.0	-4.0
1625.1000	33.8	54.0	20.2	1000.0	1000.0	125.0	H	75.0	-3.0
1800.2000	30.0	54.0	24.0	1000.0	1000.0	100.0	V	107.0	-2.1
1875.2333	31.7	54.0	22.3	1000.0	1000.0	100.0	H	0.0	-1.9
Measurement Uncertainty:							+4.4 dB / -5.8 dB		

Table 6-12: Results – Radiated Emissions 1 GHz to 2 GHz – Average

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

Test Equipment (see chapter 7.1):

10, 11, 12, 13, 14, 15, 16, 17, 19

7 Test Data and Screenshots

7.1 Part List of the Test Equipment

No.	Equipment	(Type)	Manufacturer	ID. No.	(Specification)	Last Cal.	Next Cal.
1	EMI receiver	ESPI-3	R&S	P1325	9 kHz - 3 GHz, with preselector	2013/03	2015/03
2	EMI receiver, MZ4	ESCS30	R&S	P0320	9 kHz - 2.75 GHz	2014/03	2016/03
3	LISN (integrated pulse limiter P0489)	ESH3-Z5	R&S	P0439	2 x 10 A; 50 Ohm	2014/03	2016/03
4	Frequency Converter	2kVA 1-phase	HEIDEN power GmbH	P1546	2,0 kVA 1-phase; AC-input-input: 230V 50/60Hz +/- 10% 1-phase; idle approx. 0,3 A;	cnn	cnn
5	multimeter, digital (MZ04)	METRAHIT2+	GMC-I Gossen-Metrawatt GmbH	P1812	60 mV...600V, 60mA....10A, 600Ohm...40MOhm, 0.1Hz...1kHz, -50,0 °C ...+400,0°C	2013/06	2014/06
6	data logger temperature/humidity	Hygrolog-D-Set	rotronic messgeräte GmbH	P1318	0 - 100%rF, -40 - 85°C	2014/05	2015/05
7	Notebook Labor EMV 02	Think Pad T440p	Lenovo	P1556	sound card: 20Hz - 22kHz	cnn	cnn
8	Notebook, Labor EMV 04	Think Pad T440p	Lenovo	P1627	sound card: 20Hz - 22kHz	cnn	cnn
9	test chamber 4		Siemens	P0339	4.1 • 3.5 • 3.0 m; without absorbers	2014/01	2015/01
10	EMI receiver	ESU40	R&S	P1327	20Hz - 40GHz, FFT-Scan, Preamplifier 100kHz - 40GHz, 30dB	2012/02	2014/02
11	Signal Analyzer	FSU26	R&S	1523	20 Hz - 26,5 GHz	2011/07	2014/07
12	DC-Block (9kHz - 18 GHz)		Aeroflex/ Weinschel	P1544	9 kHz - 18 GHz; 0.9 dB max; +50 VDC / 20W max.	2013/03	2014/03
13	preamplifier and low freq. preamplifier (MZ2)	8447F Opt. H64	HP -Agilent	P1572	1: 9 kHz - 50 MHz, 28dB; 2: Achtung geänderter Messbereich: Gain: 27 dB --> F-Bereich 1-1000 MHZ	2012/04	2014/04
14	Mast	MA 4000	innco GmbH	P1283	1 - 4m, hor./vert.	cnn	cnn
15	Controller	CO 2000	innco GmbH	P1284	P1523	cnn	cnn
16	test chamber 2		Siemens	P0337	11.0 • 10.0 • 6.0 m; 0.5 m pyramid absorbers + ferrite tiles	2013/03	2014/03
17	preamplifier (MZ2)	KU LNA BB 202 A, Freq. 0,1 - 20GHz	Kuhne electronic	P1590	0.1 - 20GHz, gain ca. 28dB	2013/06	2014/06
18	antenna	CBL6111	Chase	P0018	30 - 1000 MHz E	2011/03	2014/03
19	antenna (MZ2)	HL050	R&S	P1575	0.85 GHz - 26.5 GHz	2012/10	2014/10

cal = Calibration, car = Calibration restricted use, chk = Check, chr = Check restricted use, cpu = Check prior to use, calchk = Calibration and check, ind = for indication only, cnn = Calibration not necessary

Table 7-1: Part List of the EMC Measurement Test Equipment

7.2 Spectral Plots

7.2.1 Test No. 1: Conducted Emissions (§ 15.107)

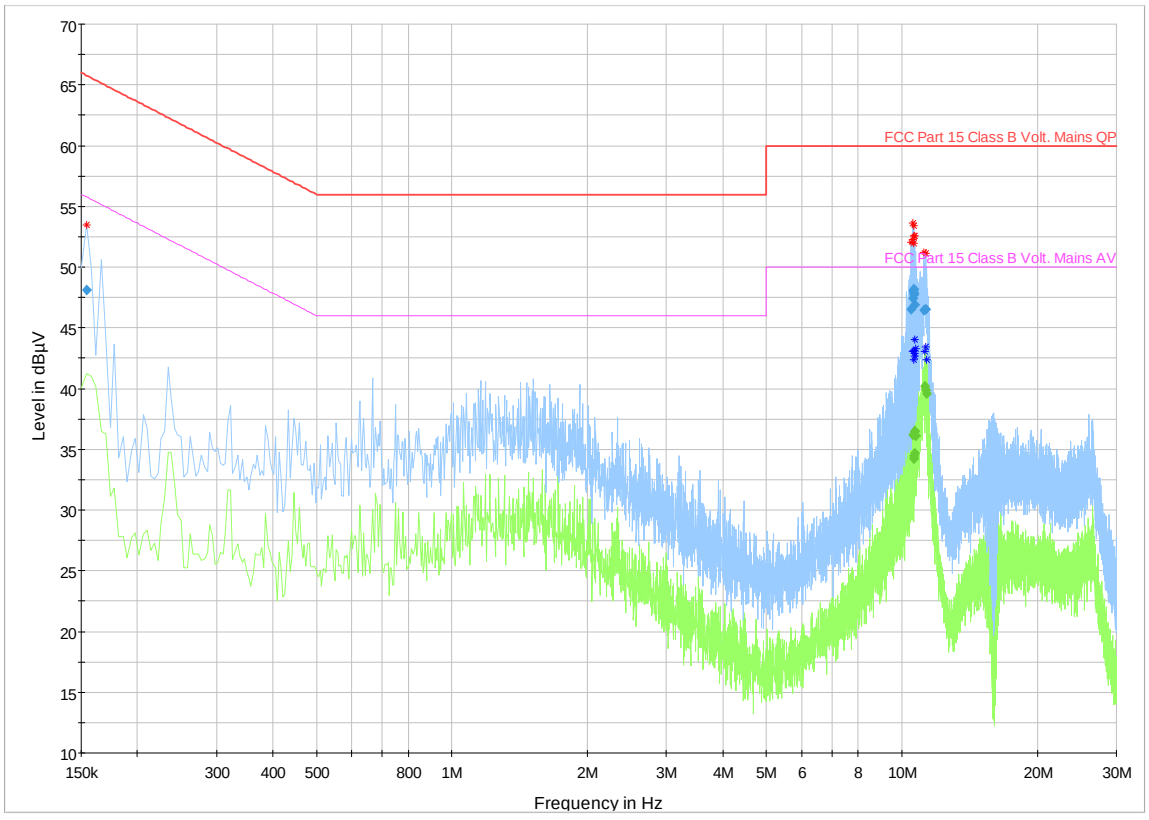

Figure 7-1: Conducted Emissions (150 kHz – 30 MHz)

7.2.2 Test No. 2: Radiated Emissions (§ 15.109a)

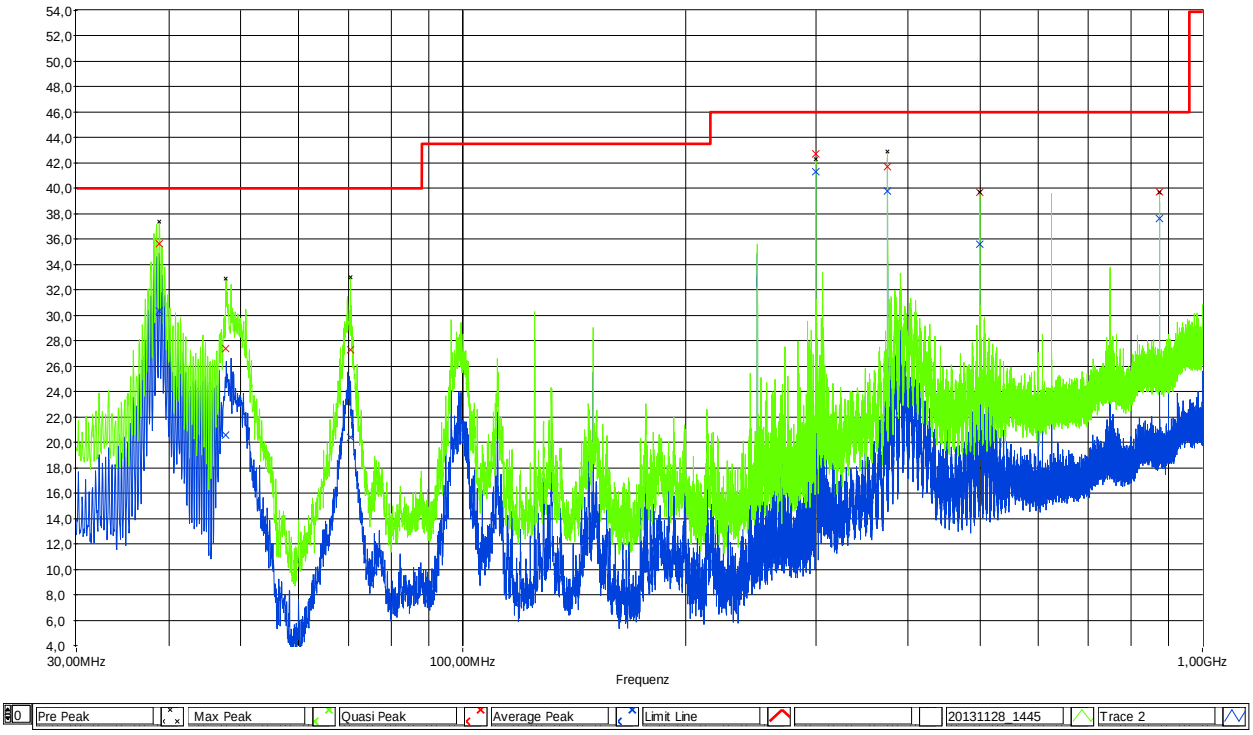

Figure 7-2: Radiated Emissions (30 MHz – 1 GHz) – Operation mode 1 with POE

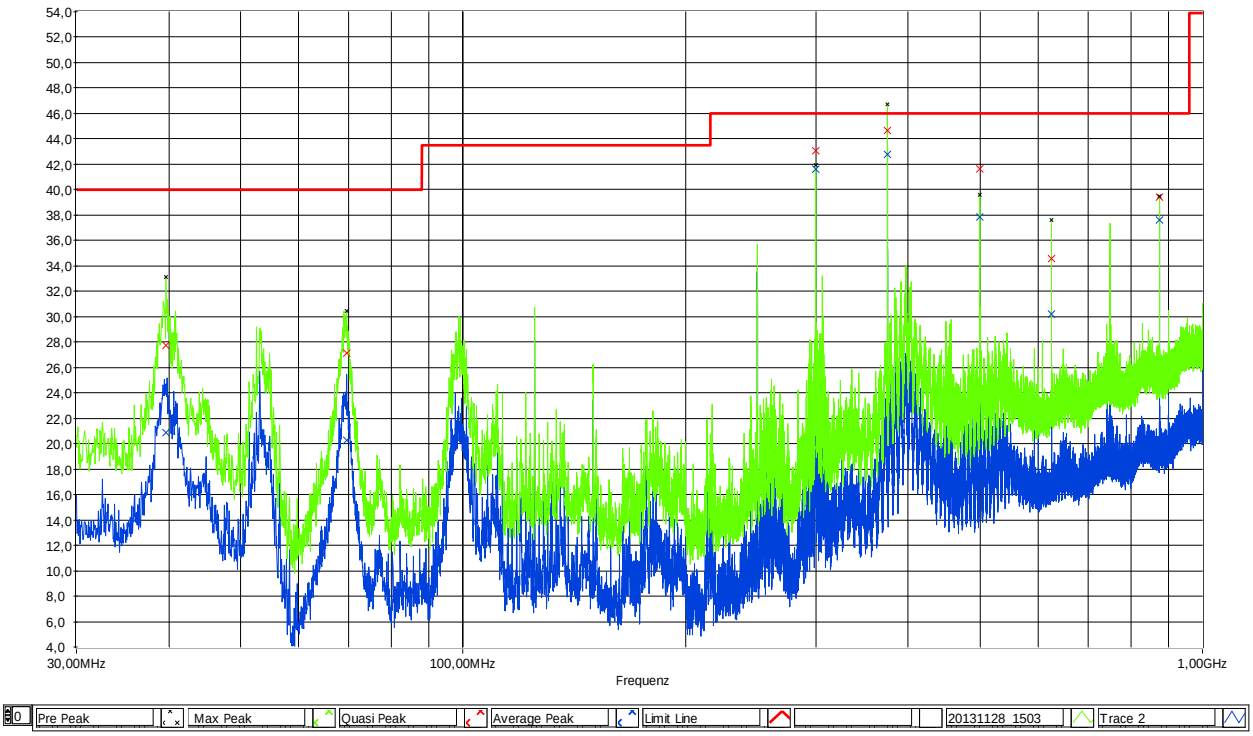

Figure 7-3: Radiated Emissions (30 MHz – 1 GHz) – Operation mode 2 with AC/DC Adapter

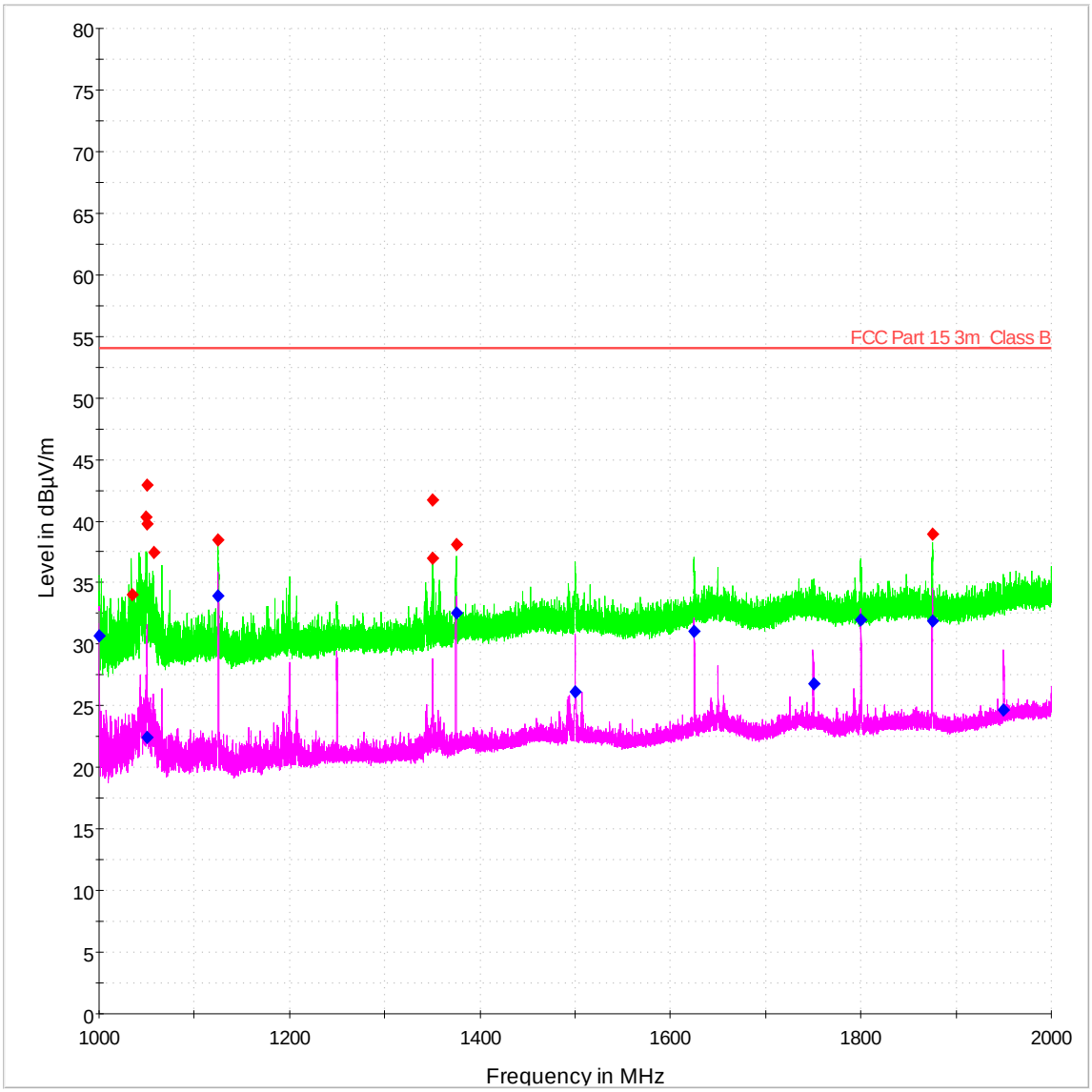

Figure 7-4: Radiated Emissions (1 GHz – 6 GHz) – Operation mode 1 with POE

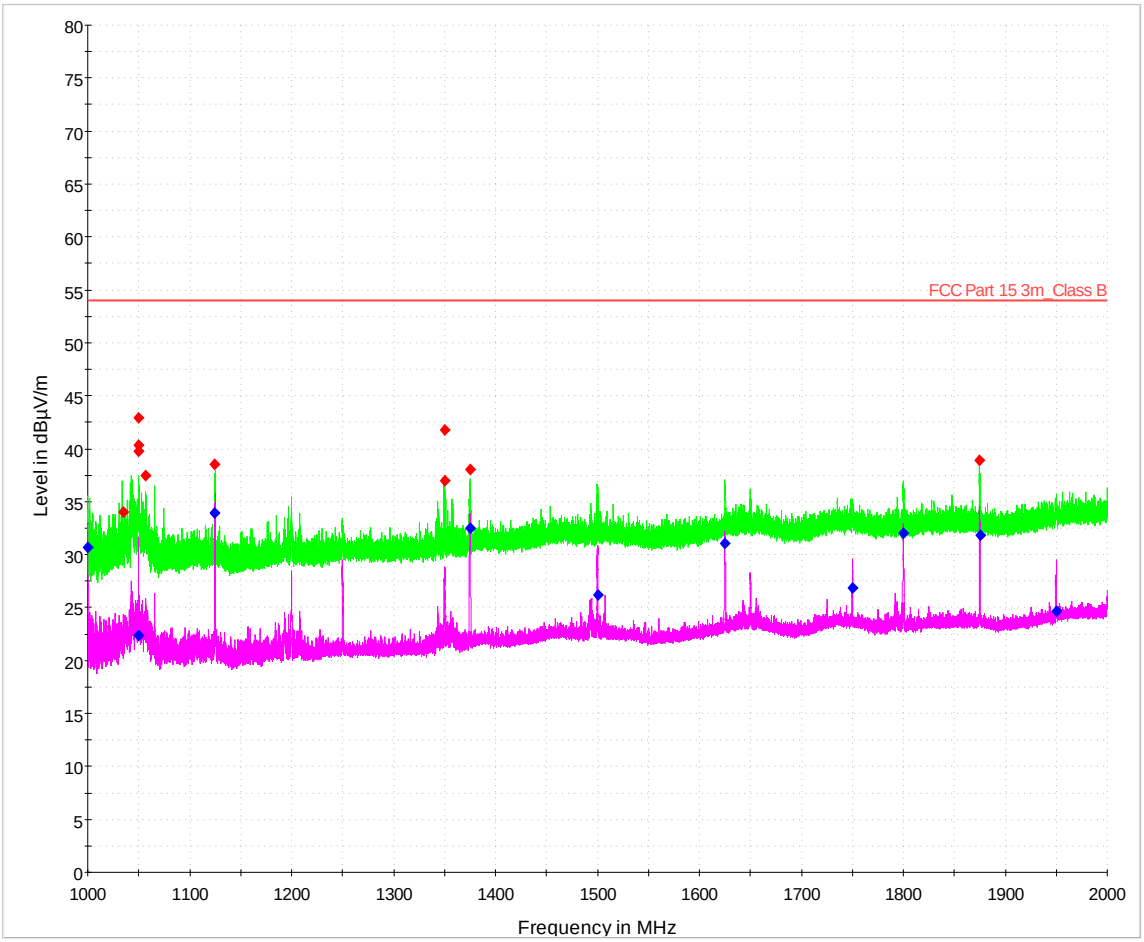

Figure 7-5: Radiated Emissions (1 GHz – 6 GHz) – Operation mode 2 with AC/DC Adapter

7.3 Test Setups

7.3.1 Test No. 1: Conducted Emissions (§ 15.107)

Figure 7-6: Test Setup Conducted Emissions (150 kHz – 30 MHz)

7.3.2 Test No. 2: Radiated Emissions (§ 15.109a)

Figure 7-7: Test Setup Radiated Emission (30 MHz – 1 GHz) – Operation mode 1 with POE

Figure 7-8: Test Setup Radiated Emission (30 MHz – 1 GHz) – Operation mode 2 with AC/DC Adapter

Figure 7-9: Test Setup Radiated Emission (1 GHz – 2 GHz) – – Operation mode 1 with POE

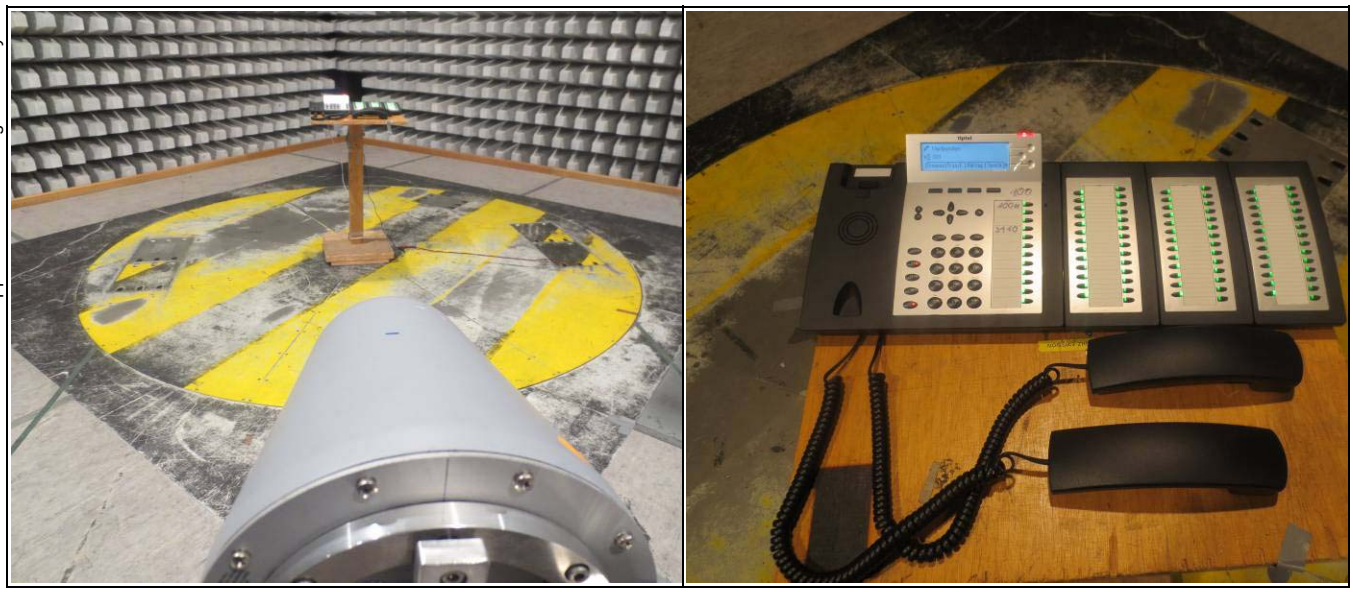

Figure 7-10: Test Setup Radiated Emission (1 GHz – 2 GHz) – Operation mode 2 with AC/DC Adapter

7.4 Photographs of EUT and accessories

Figure 7-11: Premium IP-Phones TIPTEL 3110, S/N: 54831087958 (Test No.1) and S/N: 54831087959 (Test No. 2)

7.4.1 Auxiliary Equipment of the EUTs

Figure 7-12: Keypad extensions KM27, S/N: 001618; 001621; 001653 (All tests)
(Tests were performed with maximum configuration of 3x KM 27)

Figure 7-13: Switching power supply, S/N: D24501396A

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