RADIO TEST REPORT

No. 1512825STO-003, Ed. 1

RF Performance

EQUIPMENT UNDER TEST

Equipment:	Radio Base Station
Type/Model:	AS9010602
Additional type/model*:	AS9010601 AS9010607
Manufacturer:	Oy LM Ericsson AB
Tested by request of:	Oy LM Ericsson AB

*See opinions and interpretations clause 2.6

SUMMARY

All selected test cases specified in this report comply with the requirements according to the following standards:

47 CFR Part 2 (2013)
47 CFR Part 27 (2013): Subpart C
47 CFR Part 15 (2013): Subpart B
RSS-GEN Issue 4 (2014)
RSS-139 Issue 2 (2009)
ICES-003 Issue 5 (2012)

For details, see clause 2 – 4.

Date of issue: 2015-07-16

Tested by: Approved by:

Per Larsson Per Larsson

Matti Virkki Matti Virkki

Leif Hinnelund

Revision History

Edition	Date	Description	Changes
1	2015-07-16	First release	

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company	Oy LM Ericsson AB Elektroniikkatie 10 90590 OULU FINLAND
Name of contact	Mika Savilakso Phone +358 442654000
Client observer	Esko Korhonen

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment:	Radio base station	
Tested Model:	AS9010602	
Additional models:	AS9010601, AS9010608	
Brand name:	Ericsson	
Serial number:	SC829918658	
Manufacturer:	Oy LM Ericsson AB	
Transmitter frequency range:	FDD Band 4	2110 – 2155 MHz
Receiver frequency range:	FDD Band 4	1710 – 1755 MHz
Antenna:	☒ Internal antennas	☐ External antenna
Antenna gain:	4.6 dBi max	
Rating RF output power:	13 – 24 dBm to antenna	
Type of modulation:	LTE (QPSK, 16-QAM, 64-QAM)	
Channel BW:	5, 10, 15, 20 MHz	
Transmitter standby mode supported:	☒ Yes	☐ No

2.2 FCC ID, IC and IC model number

Function Designation	Product nr.	FCC ID:	IC:	IC MODEL NO:
RBS 6402;B2/25 B4 B7	KRD 901 060/1	TA8AKRD901060	287AB-AS901060	AS9010601
RBS 6402;2x B2/25 B4 B7	KRD 901 060/2	TA8AKRD901060	287AB-AS901060	AS9010602
RBS 6402;B4	KRD 901 060/8	TA8AKRD901060	287AB-AS901060	AS9010608

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2.3 EUT description

RBS 6402 is a modular dual band indoor product for 3GPP LTE and WCDMA with optional Wi-Fi module. The main characteristics of the product are:

- Full modularity
- Dual band, FDD
- IBW 20/40 MHz
- Ericsson DFE algorithms (CFR, DPD), in previosly test report FPGA was used, now replacement with eASIC
- LTE 20+20 w/ CA over the bands
- WCDMA 20 MHz (supported later)
- Wi-Fi with integrated internal antennas as a separate module supported later)

RBS 6402 eNodeB product's maximum configurable output power is 20…250 mW (+13…+24 dBm) complying with the 3GPP Local Area requirement specification (maximum output power equal or less than +24 dBm).

RBS 6402 will include modules presented in Figure 1. Two triple band RF modules are included. RBS 6402 will support 2*three FDD bands (one band enabled at time / RF module) and four internal antenna modules.

RBS 6402 has four integrated antenna modules for TX/RX, which can be alternatively changed to external antennas with specified external antenna kits.

Only one RF path out of three at each side of the radio module is active at the time to support 2*2 MIMO operations. In multi band configuration (KRD 901 060/2) two radio modules are installed and thus both radio modules are operating in own 3GPP frequency band. In 4x4 MIMO configuration both radio modules are operating in the same 3GPP frequency band.

The radio module can support single carrier dual channel operation in both radio modules at the same time. Dual carrier operation can be configured only to the one radio module (RF 0) at these RBS versions.

RBS 6402 shall always be powered via a specified power supply (AC/DC adapter) or PoE injector. The power input of RBS 6402 is not defined as DC input port although it is labelled so on RBS 6402. AC/DC Power supply adapter (190 09_BML 901 3021_1_A, or corresponding one) will be used as a power supply for regulatory approval testing and will be delivered as a site product with RBS 6402. Also PoE injector power supply can be used as an alternative power supply.

RBS 6402 is designed to get the clock synchronization from the GPS signal via the separate GRU module of Ericsson. This is connected to GRU port of RBS 6402.

Wi-Fi module was not included in the tested configuration.

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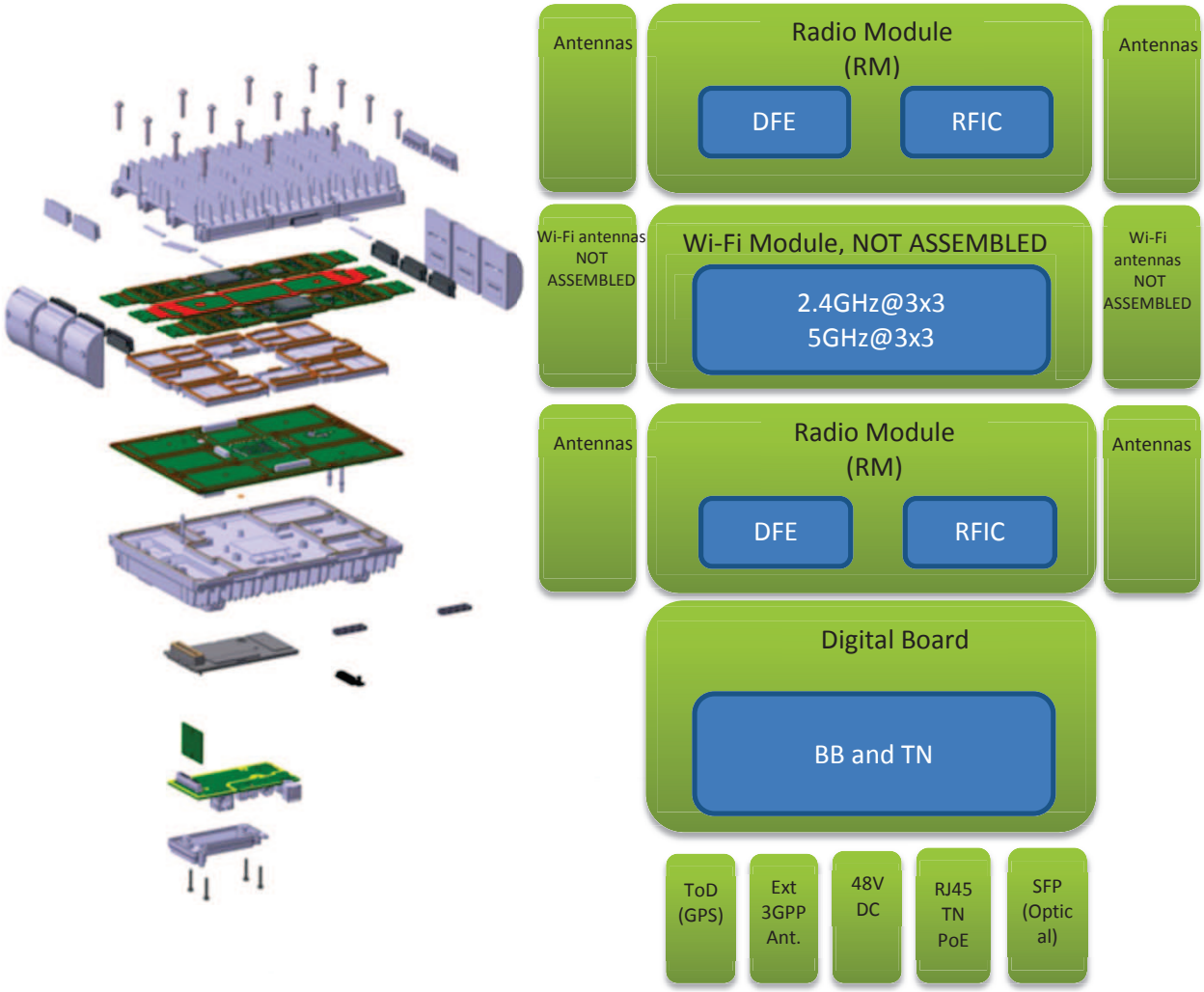
Below is a block diagram of RBS 6402 indoor base station.



Figure, RBS 6402 block diagram.

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2.4 Additional information about the EUT

The EUT consists of the following units:

Unit	Type	Serial number	Note
Radio base station	RBS 6402	SC829918658	
AC/DC Power supply adapter	190 09_BML 901 302/1	D880000891	

The EUT was tested with the following cables:

Port:	Type:	Length: [m]	Specifications:
AC port	AC power supply for AC/DC adapter or PoE injector	2	Three core
DC port	Power	1.2	Coaxial
LAN/Power input port	Signal cable	10	Unshielded, CAT 6, RJ45
LAN (Telecommunication port)	Signal cable	10	Unshielded, CAT 6, RJ45
GRU signal port	Signal cable	2.9	Shielded,CAT 6, Mini I/O connector

2.5 Peripheral equipment

Peripheral equipment is equipment needed for correct operation of the EUT, but not included as part of the testing and evaluation of the EUT.

Equipment	Type / Model	Manufacturer	Serial number
PoE injector *	PowerDsine 9601G	Microsemi	N14356610000243A00
Laptop	Dell Latitude E6420	Dell	4rkfbs1

* PoE injector was used as an alternative power supply in part of tests.

2.6 Opinions and interpretations

The following types are also included as additional types in this test report.
The difference as compared to the tested type is (according to the manufacturer)

AS9010601 only one RF module has been assembled in the equipment.

AS9010608 only one RF module has been assembled in the equipment, and has a software block to only operate on the B4 band.

The difference is considered not to imply different EMC-characteristics when compared to the tested type. Therefore, this type is/these types are not tested, but considered to have the same EMC-characteristics as the tested type(s).

2.7 Modifications made to improve EMC-characteristics

No modifications have been made during the tests.

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3. TEST SPECIFICATIONS

3.1 Standards

Requirements:
47 CFR Part 2 (2013)
47 CFR Part 27 (2013): Subpart C
47 CFR Part 15 (2013): Subpart B
RSS-GEN Issue 4 (2014)
RSS-139 Issue 2 (2009)
ICES-003 Issue 5 (2012)

Test methods:
ANSI-TIA-603-C-2004
ANSI C63.4-2009
KDB 971168 D01 v02r01

3.2 Additions, deviations and exclusions from standards and accreditation

RSS-GEN Issue 4 (2014) and RSS-139 Issue 2 (2009) are not within the scope of accreditation.

Only radiated spurious emission and conducted spurious emissions from AC-mains parts of the standards are measured by request from the client.
No other additions, deviations or exclusions have been made from standards and accreditation.

3.3 Test site

Measurements were performed at:

Intertek Semko AB.
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P.O. Box 1103
SE-164 22 Kista

Intertek Semko AB is a FCC listed test site with site registration number 90913
Intertek Semko AB is a FCC accredited conformity assessment body with designation number SE0002
Intertek Semko AB is an Industry Canada listed test facility with IC assigned code 2042G

Measurement chambers

Measurement Chamber	Type of chamber	IC Site filing #
5 m CHAMBER	Semi-anechoic 5 m	2042G-3

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3.4 Mode of operation during the test

The EUT was tested with 120 V, 60 Hz. AC/DC adapter or PoE injector is used for powering EUT during tests.

Tests was made with QPSK modulation on the bottom (B), middle (M) and top (T) channels. Used in the dual carrier measurements channel spacing 35MHz, dual carrier and bandwith 5+5 MHz .The channel frequencies are stated in detail in the table below.

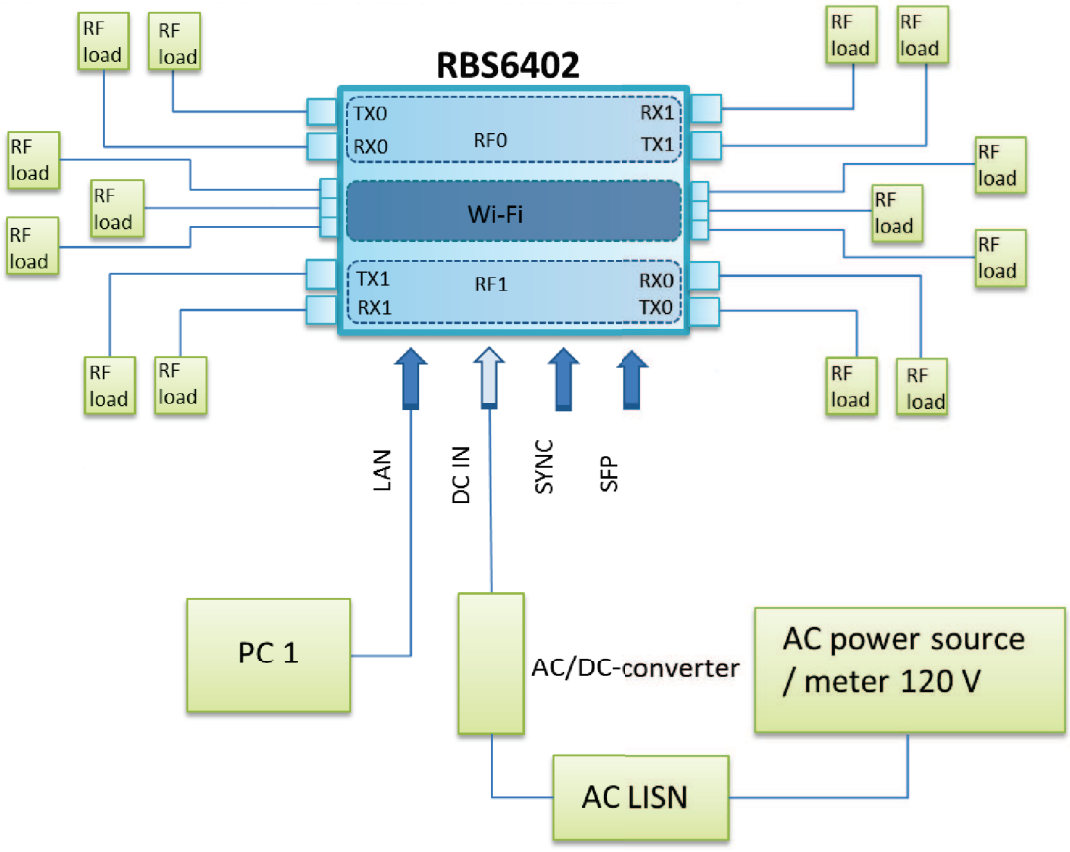
Mode	Channel BW [MHz]	TX B, M, T Frequencies [MHz]	TX B, M, T Channels	RX B, M, T Frequencies [MHz]	RX B, M, T Channels
LTE	5	2112.5 2132.5 2152.5	1975 2175 2375	1712.5 1732.5 1752.5	19975 20175 20375

Because RBS 6402 can be mounted on the wall (vertical position) or on the ceiling (horizontal position) a part of the radiated emission test cases are performed at the both positions.
The fan module of RBS6402 was assembled in all performed test cases

3.5 Test setup block diagram

Conducted emissions

Wifi module was not assembled.



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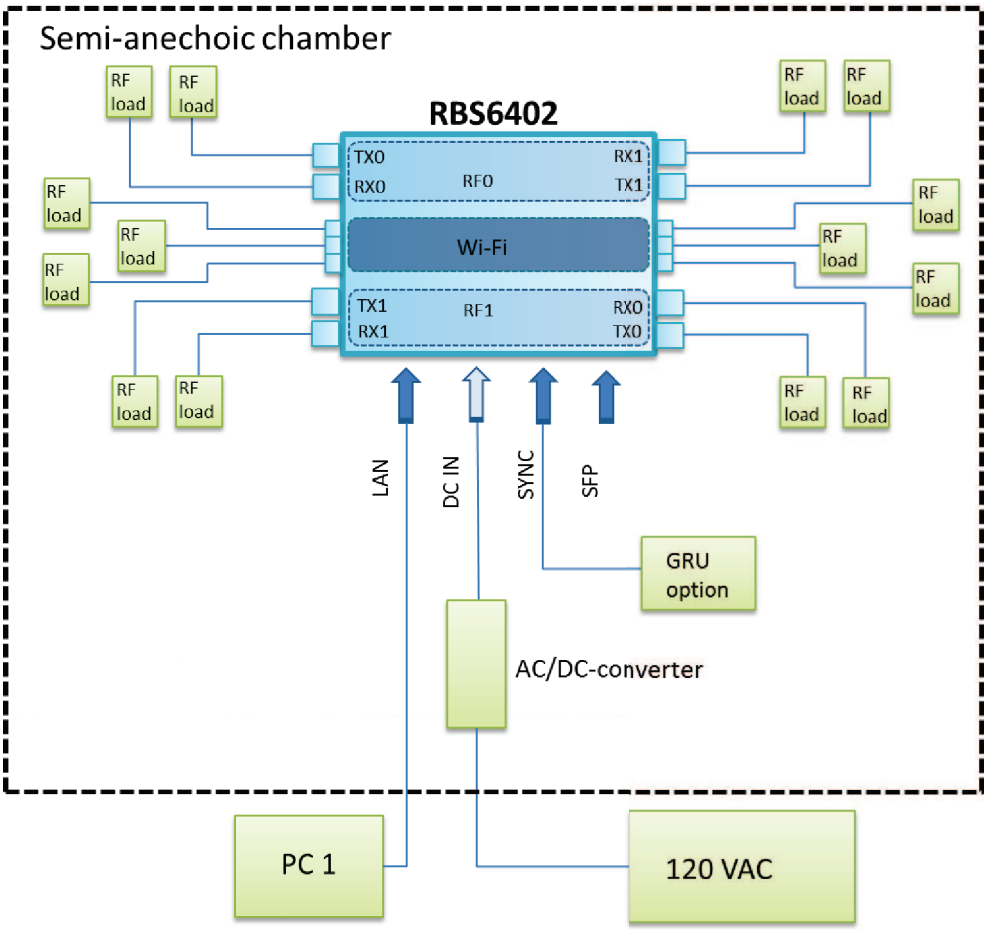
Radiated emissions

Wifi was not assembled.



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4. TEST SUMMARY

The results in this report apply only to sample tested:

Standard	Description	Result
	Emission	
CFR 47, Part 2.1046, Part 24.232 RSS-Gen section 4.8 RSS-139 section 6.4	**RF output power**	**NT**
	Not considered to be retested for this report The EUT complies with the limits. For results see previous report.	
CFR 47, Part 2.1049 RSS-Gen section 4.6	**Occupied bandwidth**	**NT**
	Not Tested by request of the client. Test is **performed by the client in another test house and reported in the corresponding documents.**	
CFR 47, Part 2.1051, Part 24.238	**Intermodulation**	**NT**
	Not Tested by request of the client. Test is **performed by the client in another test house and reported in the corresponding documents.**	
CFR 47, Part 2.1051, Part 24.238 RSS-Gen section 4.9 RSS-139 section 6.5	**Out of band spurious emissions, conducted**	**NT**
	Not Tested by request of the client. Test is **performed by the client in another test house and reported in the corresponding documents.**	
CFR 47, Part 2.1053, Part 24.238 RSS-Gen section 4.9 RSS-139 section 6.5	**Transmitter out of band spurious emissions, radiated**	**PASS**
	The EUT complies with the limits. The margin to the limit was at least 30 dB at 18.0 GHz See clause 6.	
CFR 47, Part 2.1055 RSS-Gen section 4.7 RSS-139 section 6.3	**Frequency stability**	**NT**
	Not Tested by request of the client. Test is **performed by the client in another test house and reported in the corresponding documents.**	
CRF 47, Part 15.109 RSS-Gen section 6.1 ICES-003 section 6.2	**Receiver out of band spurious emissions, radiated**	**PASS**
	The EUT complies with the limits. The margin to the limit was at least 9.4 dB at 41.684 MHz See clause 6.	
CRF 47, Part 15.107 ICES-003 section 6.1	**Conducted spurious emissions from AC-Mains**	**PASS**
	The EUT complies with the limits. The margin to the limit was at least 9.6 dB at 0.251MHz See clause 5.	

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5. CONDUCTED CONTINUOUS DISTURBANCES IN THE FREQUENCY-RANGE 0.15 TO 30 MHZ

Date of test:	2015-06-10	**Test location:**	5 m CHAMBER
EUT Serial:	SC829918658	**Ambient temp:**	22 °C
Tested by:	Per Larsson	**Relative humidity:**	28 %
Test result:	Pass	**Margin:**	9.6 dB

5.1 Test set-up and test procedure

The test method is in accordance with ANSI C63.4 (2009).

The EUT was connected to the power via Artificial Mains Networks AMN.
The EUT was placed on an insulating support 0.8 m above the floor, 0.4 m from the vertical reference ground plane (RGP) and 0.8 m from the AMN/ISN.

Overview sweeps were performed for each lead.

During the tests the EUT was in receive and transmit mode simultaneously.

Tests are made with EUT powered by both AC/DC adapter and PoE injector.

5.2 Conducted emission requirements:

The EUT shall meet the limits for the standards.
Reference: 47 CFR §15.107
ICES-003, section 8.8 table 3

Limits for conducted emission

Frequency range [MHz]	Limits [dBµV]	
	Quasi-Peak	Average
0.15 – 0.50	66 – 56	56 – 46
0,50 – 5.00	56	46
5.00 – 30.0	60	50

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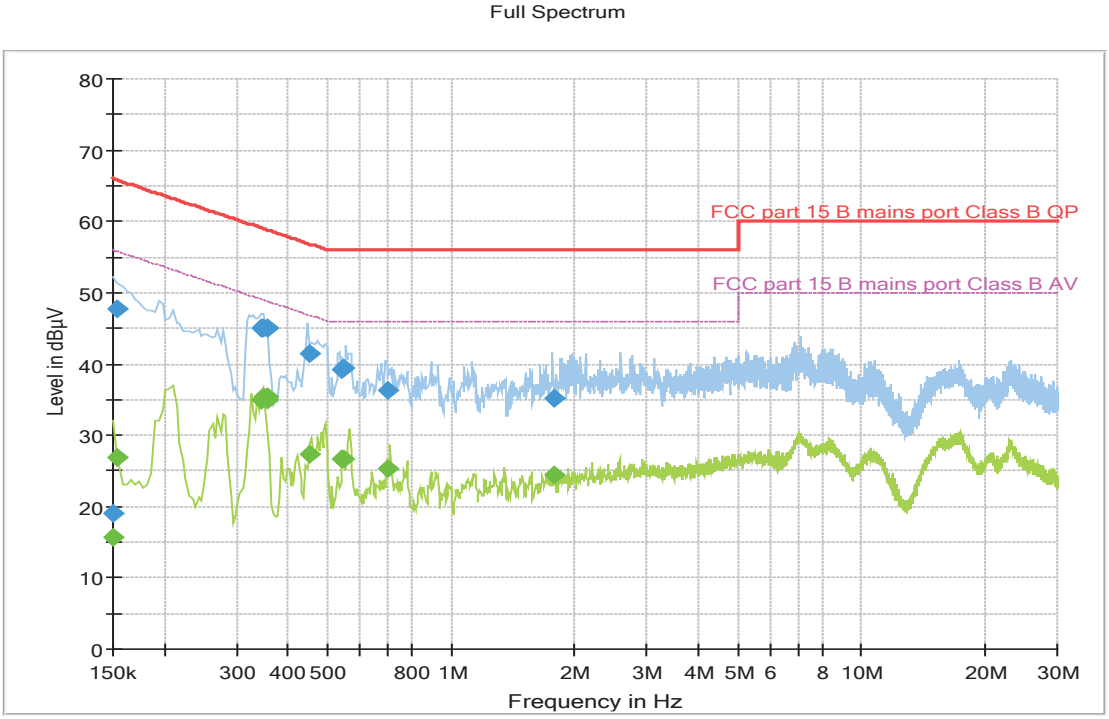
5.3 Test results: AC Power input port on AC/DC adapter



Diagram, Peak and Average overview sweep, EUT powered by AC/DC adapter

Measurement results, Quasi-peak

Frequency [MHz]	Level [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.150	19.0	66.0	N	47.0
0.154	47.7	65.8	L1	18.1
0.344	45.0	59.1	N	14.1
0.345	45.0	59.1	N	14.1
0.349	45.0	59.0	N	14.0
0.355	44.9	58.8	N	13.9
0.356	45.0	58.8	N	13.8
0.451	41.5	56.9	N	15.4
0.543	39.2	56.0	N	16.9
0.545	39.4	56.0	N	16.6
0.703	36.4	56.0	N	19.6
1.787	35.3	56.0	N	20.7

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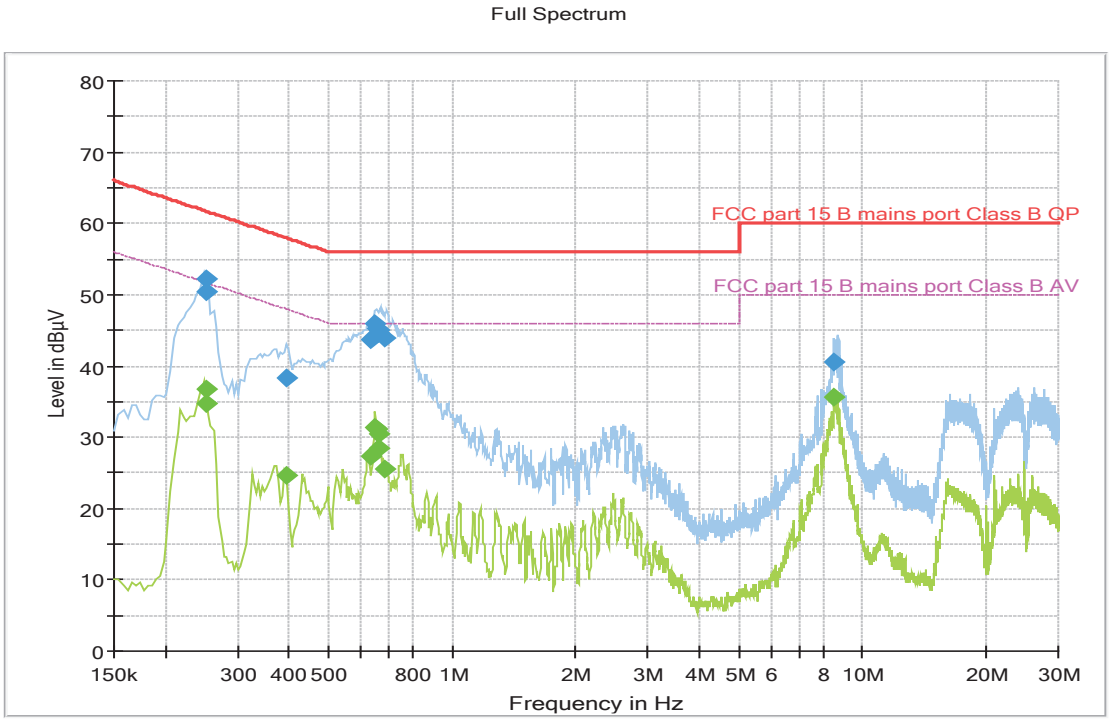
Measurement results, Average

Frequency [MHz]	Level [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.150	15.7	56.0	N	40.3
0.154	26.9	55.8	L1	28.9
0.344	34.9	49.1	N	14.2
0.345	35.0	49.1	N	14.1
0.349	35.5	49.0	N	13.5
0.355	35.4	48.8	N	13.5
0.356	34.9	48.8	N	13.9
0.451	27.4	46.9	N	19.5
0.543	26.6	46.0	N	19.4
0.545	26.7	46.0	N	19.3
0.703	25.3	46.0	N	20.7
1.787	24.4	46.0	N	21.6

Result [dBµV] = Analyser reading [dBµV] + cable loss [dB] + LISN insertion loss [dB]

5.4 Test results: AC Power input port on PoE injector



Diagram, Peak and Average overview sweep, EUT powered by PoE injector

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Measurement results, Quasi-peak

Frequency [MHz]	Level [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.251	52.1	61.7	N	9.6
0.253	50.5	61.7	N	11.2
0.393	38.4	58.0	L1	19.6
0.630	43.7	56.0	L1	12.3
0.651	45.9	56.0	L1	10.1
0.657	45.2	56.0	N	10.8
0.659	45.0	56.0	N	11.0
0.664	44.6	56.0	N	11.4
0.682	43.9	56.0	N	12.1
8.546	40.6	60.0	N	19.4

Measurement results, Average

Frequency [MHz]	Level [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.251	36.8	51.7	N	14.9
0.253	34.8	51.7	N	16.9
0.393	24.7	48.0	L1	23.3
0.630	27.4	46.0	L1	18.6
0.651	31.3	46.0	L1	14.7
0.657	31.2	46.0	N	14.8
0.659	30.4	46.0	N	15.6
0.664	28.4	46.0	N	17.6
0.682	25.5	46.0	N	20.5
8.546	35.5	50.0	N	14.5

Result [dBµV] = Analyser reading [dBµV] + cable loss [dB] + LISN insertion loss [dB]

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6. OUT OF BAND SPURIOUS EMISSIONS THE FREQUENCY-RANGE 30 MHZ TO 22 GHZ

Date of test:	2015-06-25	**Test location:**	5m SAC
EUT Serial:	SC829918658	**Ambient temp:**	23 °C
Tested by:	Per Larsson	**Relative humidity:**	48 %
Test result:	Pass	**Margin:**	9.4 dB

6.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.4 and ANSI-TIA-603-C-2004.

Both receiver and transmitter are active during the tests.

In single carrier measurements the EUT was set up in order to transmit maximum power, QPSK modulation and 5 MHz channel BW. Below 1 GHz two different carrier frequencies (bands) at the same time were used. Above 1 GHz 2*2 MIMO mode was used.

RBS was configured in dual carrier measurements to transmit maximum power, QPSK modulation at 5 MHz + 5 MHz channel BW at 35 MHz offset in the same channel.

Antenna ports are terminated during the tests.

Both vertical and horizontal position of the EUT is evaluated. Below 1 GHz emissions are measured on EUT power by both AC/DC adapter and PoE injector. Above 1 GHz only PoE adapter is used.

Since the margin to the limit for the transmitter is large (more than 30 dB) not every combination of channel and EUT position is measured.

The EUT was placed on an insulating support 0.8 m above the turntable which is part of the reference ground plane.

Overview sweeps were performed with the measurement receiver in max-hold mode and the peak detector activated. Above 1 GHz both peak and average detector is activated.

6.2 Test conditions

Test set-up: **30 MHz to 1000 MHz**
Test receiver set-up:
Preview test: Peak, RBW 120 kHz. VBW 1 MHz
Final test: Quasi-Peak, RBW 120 kHz

Measuring distance: 3 m
Measuring angle: 0 – 359°
Antenna
- Height above ground plane: 1 – 4 m
- Polarisation: Vertical and Horizontal
- Type: Bilog

Test set-up: **1 GHz – 22 GHz**
Test receiver set-up:
Preview test: Peak, RBW 1 MHz. VBW 3 MHz
Average, RBW 1 MHz
Final test: Average, RBW 1 MHz
Peak, RBW 1 MHz

Measuring distance: 3 m

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Measuring angle: 0 – 359°
Antenna
Height above ground plane: 1 – 4 m
Polarisation: Vertical and Horizontal
Type: Horn
Antenna tilt: Activated

6.3 Radiated Emission requirements

The EUT shall meet the limits for the standards.

Receiver
Reference: 47 CFR §15.109
IC RSS-GEN Table 2
ICES-003 Table 5, Table 7

Limits for general radiated emission:

Frequency range [MHz]	Field strength at 3 m (dBμV/m)	Detector (dBμV/m)
30 – 88	40.0	Quasi Peak
88 – 216	43.5	Quasi Peak
216 – 960	46.0	Quasi Peak
960 – 1000	54.0	Quasi Peak
Above 1000	54.0 / 74.0	Average / Peak

The values for each measurement distance are given using an extrapolation factor of 20 dB/decade above 30 MHz and 40 dB/decade below 30 MHz according to §15.31(f)(1), §15.31(f)(2) and RSS-GEN sections 6.4 and 6.5.

The frequency range to be inspected is up to the fifth harmonics of the highest fundamental frequency according to 47 CFR §15.33 and ICES-003 Table 3.

Transmitter
Reference: 47 CFR §27.53
RSS-139 Section 6.5

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
This gives a limit at -13 dBm.

The frequency range to be inspected is up to the tenth harmonics of the highest fundamental frequency according to 47 CFR 2.1057 and RSS-Gen Section 6.13.

The field strength limit is calculated using the plane wave relation.

$GP/4\pi R^2 = E^2 / 120\pi$

G: antenna gain
P: power (W)
R: measurement distance (m)

-13 dBm EIRP gives a field strength limit of 84.4 dBμV/m at a 3m measurement distance in an anechoic chamber.

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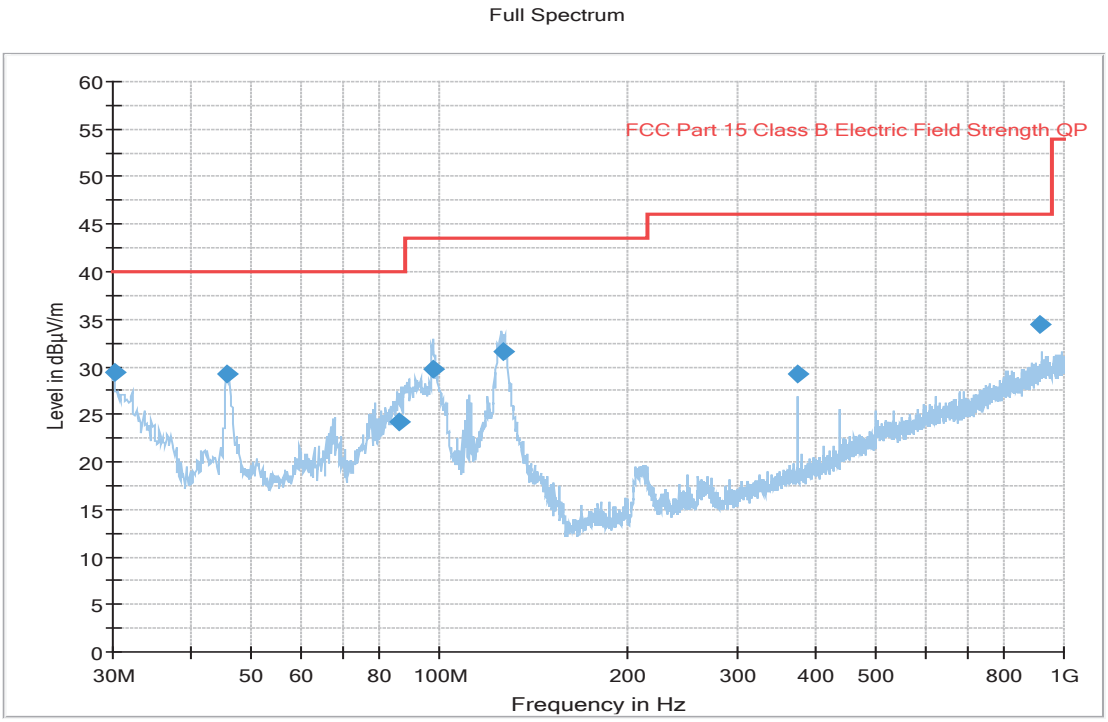
6.4 Test results 30 MHz – 1000 MHz



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. Dual carrier 5+5 MHz, 35 MHz spacing QPSK mid channels. EUT vertical position, powered by AC/DC adapter.

Measurement results, Quasi Peak

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
30.260	29.4	40.0	V	10.6
45.791	29.2	40.0	V	10.8
86.031	24.2	40.0	V	15.8
97.616	29.8	43.5	V	13.7
126.352	31.6	43.5	V	11.9
374.990	29.3	46.0	V	16.7

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

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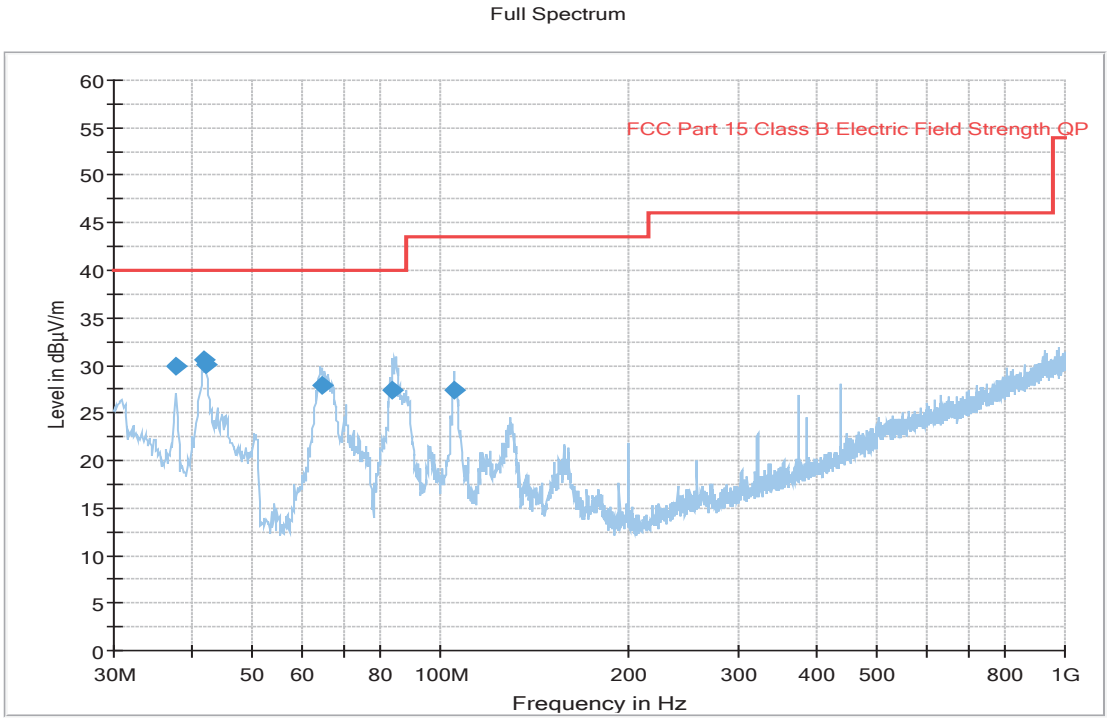

Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance, Dual carrier 5+5 MHz, 35 MHz spacing QPSK mid channels, EUT horizontal position, powered by PoE injection,

Measurement results, Quasi Peak

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
37.795	29.9	40.0	V	10.1
41.684	30.6	40.0	V	9.4
42.105	30.0	40.0	V	10.0
64.808	27.9	40.0	V	12.1
83.930	27.3	40.0	V	12.7
105.230	27.3	43.5	V	16.2

All other measured disturbances have a margin of more than 20 dB to the limits,

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

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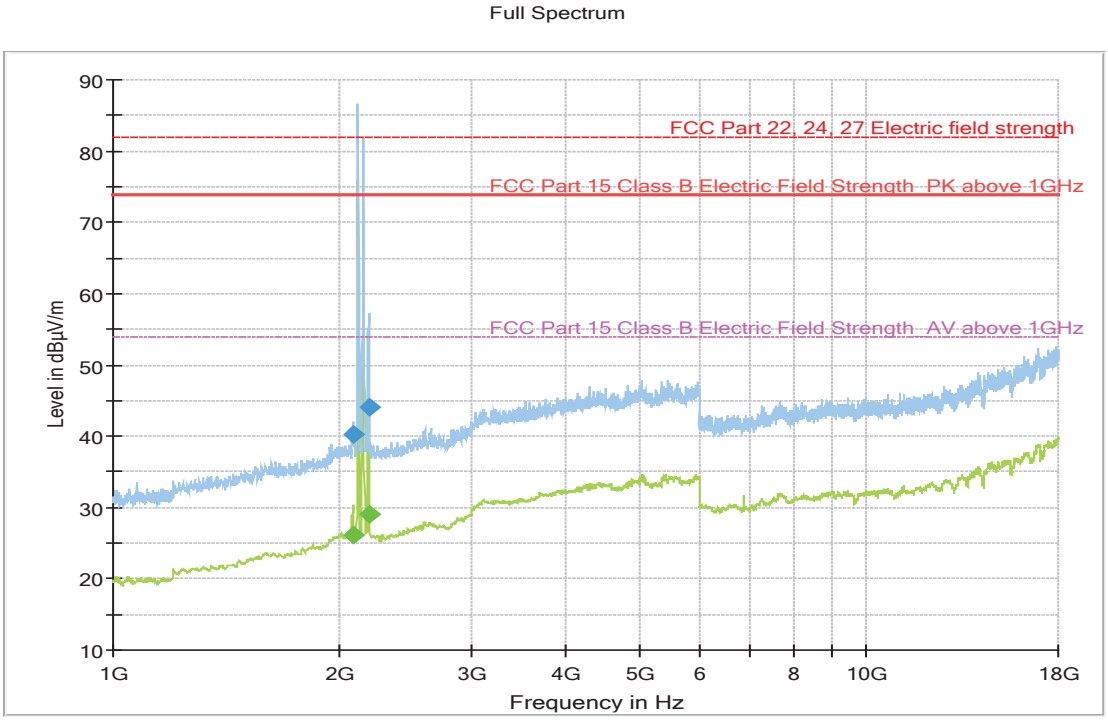
6.5 Test results 1 GHz – 22 GHz

Preview sweep is repeated for bottom, middle and top channel with EUT in vertical position and for middle channel with EUT in horizontal position, No significant diffrence in results are found for different channels or positions of EUT, Only dual carrier mode has been measured for this report due to single carrier mode has previous been measured,



Diagram, Peak overview sweep, 1 – 18 GHz at 3 m distance, Middle channel, EUT in vertical position, powered by PoE injector,

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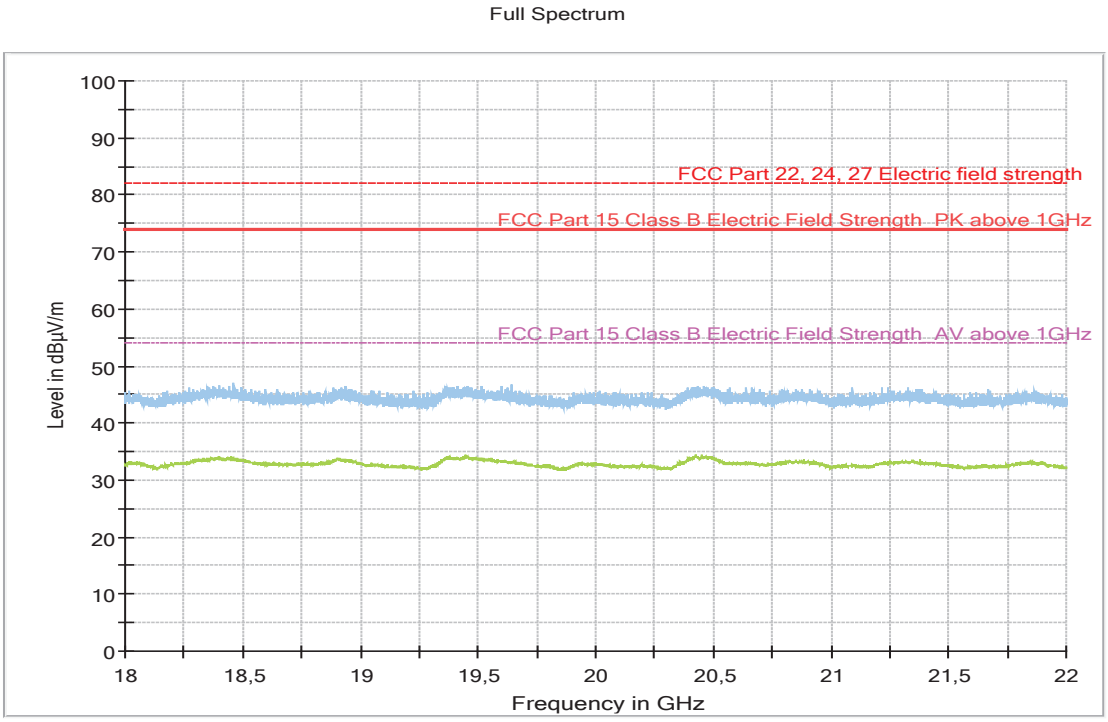

Diagram, Peak overview sweep, 18 – 22 GHz at 3 m distance, Middle channel, EUT in vertical position, powered by PoE injection

All measured emissions in RX mode have a margin of more than 12 dB to the average limit and more than 20 dB to the peak limit,

All measured emissions in TX mode have a margin of more than 30 dB to the limit,

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss. [dB]

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7. TEST EQUIPMENT

Conducted emission, test site 5m SAC

Equipment type	Manufacturer	Model	Inv, No,	Last Cal, date	Cal, interval
Measurement software	Rohde & Schwarz	EMC32	--	--	--
Receiver	Rohde & Schwarz	ESIB26	32287	31-07-2014	1 year
AMN / LISN	Rohde & Schwarz	ESH3-Z5	32711	07-2014	2 years
Pulse limiter	Rohde & Schwarz	ESH3-Z2	32456	31-07-2014	1 year

Radiated emission, test site 5m SAC

Equipment type	Manufacturer	Model	Inv, No,	Last Cal, date	Cal, interval
Measurement software	Rohde & Schwarz	EMC32	--	--	--
Receiver	Rohde & Schwarz	ESIB26	32287	31-07-2014	1 year
Receiver	Rohde & Schwarz	ESU 40	13178	31-07-2014	1 year
Bilog antenna	Rhode Swarz	HL562	32310	02-2015	3 years
Preamplifier + antenna	BONN Elektronik	BLMA 1826-5A	31247	01-2014	3 years
Horn antenna	Rohde & Schwarz	HF907	32550	07-2014	3 years
Preamplifier	Rohde & Schwarz	TS-Pre1	32297	07-2014	3 years
Preamplifier + antenna	BONN Elektronik	BLMA 2640-5A	31248	01-2014	3 years
Horn antenna	EMCO	3115	4628	10-2012	3 years
Open switch and control platform	Rohde & Schwarz	OSP130	32299	08-2014	1 year
Control unit	Maturo GMBH	NCD	32390	--	--

8. MEASUREMENT UNCERTAINTY

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz ± 3.6 dB

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 30 to 1000 MHz at 3 m	± 4.9 dB
Uncertainty for the frequency range 30 to 1000 MHz at 10 m	± 4.8 dB
Uncertainty for the frequency range 1.0 to 18 GHz at 3 m	± 5.4 dB
Uncertainty for the frequency range 18 to 26 GHz at 3 m	± 5.5 dB
Uncertainty for the frequency range 26 to 40 GHz at 3 m	± 5.6 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.
The measurement uncertainty is given with a confidence of 95 %.

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9. TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1512825STO, Annex 1, Ed 1.

Test setup photos are in separate document 1512825STO, Annex 2, Ed 1.

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