

EMC TEST REPORT

No. 1600301STO-002, Ed. 1

Electromagnetic disturbances

EQUIPMENT UNDER TEST

Equipment: Radio Base Station
Product name: RBS 6402
Product number: KRD 901 060/6
Additional product number*: KRD 901 060/1
KRD 901 060/2
KRD 901 060/4
KRD 901 060/8
Manufacturer: LM Ericsson AB
Tested by request of: LM Ericsson AB

*See opinions and interpretations clause 2.7

SUMMARY

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

47 CFR Part 2 (2016)
47 CFR Part 27 (2016): Subpart C
47 CFR Part 15 (2016): Subpart B
RSS-GEN Issue 4 (2014)
RSS-139 Issue 3 (2016)
ICES-003 Issue 6 (2016)

Only radiated emissions above 1 GHz were tested.

For details, see clause 2 – 4.

Date of issue: 2016-03-09

Tested by:



Matti Virkki

Approved by:



Stefan Andersson

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

Intertek Semko AB

Torshamnsgatan 43, Box 1103, SE-164 22 Kista, Sweden

Telephone +46 8 750 00 00, Fax +46 8 750 60 30

www.intertek.se

Registered in Sweden: No: SE556024059901, Registered office: As address

Revision History

Edition	Date	Description	Changes
1	2016-03-09	First release	

Version 1.02

CONTENTS

	Page
1. Client Information	4
2. Equipment under test (EUT).....	4
2.1 Identification of the EUT	4
2.2 FCC ID, IC and IC model number	4
2.3 EUT description.....	5
2.4 Additional information about the EUT	7
2.5 Peripheral equipment	7
2.6 Modifications made to improve EMC-characteristics	7
2.7 Opinions and interpretations	8
3. Test Specifications	9
3.1 Standards	9
3.2 Additions, deviations and exclusions from standards and accreditation	9
3.3 Test site.....	9
3.4 Mode of operation during the test	10
3.5 Test setup block diagram	10
4. Test Summary	11
5. Out of band spurious emissions the frequency-range 1 GHz to 22 GHz	12
5.1 Test set-up and test procedure.	12
5.2 Test conditions	12
5.3 Radiated Emission requirements	12
5.4 Test results.....	13
6. Test equipment.....	17
7. Measurement uncertainty	18
8. Test set up and EUT photos.....	18

1. CLIENT INFORMATION

The EUT has been tested by request of

Company 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

Product name: RBS 6402

Product number: KRD 901 060/6

Additional product number: KRD 901 060/1
KRD 901 060/2
KRD 901 060/4
KRD 901 060/8

Brand name: Ericsson

Serial number: C82A249853

Manufacturer: LM Ericsson AB

Transmitter frequency ranges: FDD Band 4 2110 – 2155 MHz

Receiver frequency ranges: FDD Band 4 1710 – 1755 MHz

Frequency agile or hopping: ☐ Yes ☒ No

Antenna: ☒ Internal antenna ☐ External antenna

Antenna gain: 4.6 dBi max

Rating RF output power: 13 – 24 dBm to antenna

Type of modulation: WCDMA (QPSK)

Channel BW: 4.8 MHz

Transmitter stand by mode supported: ☒ Yes ☐ No

2.2 FCC ID, IC and IC model number

Function Designation	Product no.	FCC ID:	IC:	IC model no:
RBS 6402	KRD 901 060/6	TA8AKRD901060	287AB-AS901060	AS9010606
RBS 6402	KRD 901 060/1	TA8AKRD901060	287AB-AS901060	AS9010601
RBS 6402	KRD 901 060/2	TA8AKRD901060	287AB-AS901060	AS9010602
RBS 6402	KRD 901 060/4	TA8AKRD901060	287AB-AS901060	AS9010604
RBS 6402	KRD 901 060/8	TA8AKRD901060	287AB-AS901060	AS9010608

2.3 EUT description

RBS 6402 is a modular dual band indoor product for 3GPP LTE. The main characteristics of the RBS 6402 product are:

- Full modularity
- Dual band, FDD
- IBW 20/40 MHz
- Ericsson DFE algorithms (CFR, DPD)
- WCDMA
- LTE/WCDMA mixed mode (supported later)
- Integrated internal antennas for RBS, external antennas as an option (3GPP).
- Wi-Fi with integrated internal antennas as a separate module (Wi-Fi is an option.)

RBS 6402 eNodeB RM A 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). Wi-Fi module's maximum configurable output power is 50 mW (+17 dBm).

The RBS 6402 configuration (KRD 901 060/6) will include modules presented in the figure below. Two multi band RF modules (RM A) and a Wi-Fi module are included in the configuration to be tested.

Single carrier setup for RM A modules is selected according to 3GPP standard. Wi-Fi configuration includes 2.4 GHz (802.11n) and 5.150–5.350 and 5.475–5.825 GHz (802.11ac) WLAN areas.

Wi-Fi module is equipped with two integrated antenna modules which include 3 antennas each (one for 2.4 GHz and two for 5 GHz (PRE 105 211/1) or vice versa (PRE 105 211/2)).

Only one RF path out of three at each side of the 3GPP radio module is active at the time to support 2*2 MIMO operations.

RBS 6402 is multimode (e)NodeB supporting following operational modes:

- LTE FDD
- WCDMA FDD
- Mixed mode (own RF module for LTE and WCDMA)

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 in the EMC tests although it is labelled so on RBS 6402 chassis.

AC/DC power supply adapter is as a power supply for Regulatory approval testing and will be delivered as a site product with RBS 6402. Also PoE 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.

The radio performance of the Wi-Fi module is tested and certified by its manufacturer. EMC conformance of Wi-Fi module is tested when connected to RBS 6402. There is only one model of Wi-Fi available for RBS 6402. Its' functionality and performance for FCC demands shall be stated with Wi-Fi software.

The RBS 6402 configuration (KRD 901 060/6) will include modules presented in the figure below.

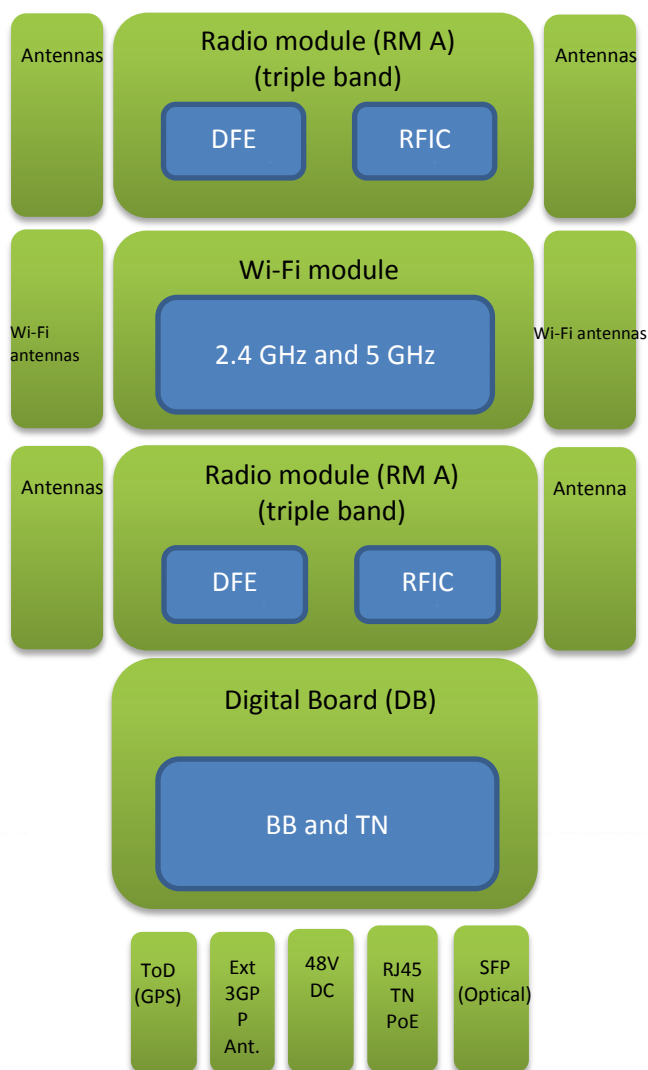


Figure: RBS 6402 high level block diagram and structure. Wi-Fi module is assembled in the middle slot of RBS 6402

Maximum power rating

The maximum nominal power rating on the licensed band (3GPP) Radio Module capable to dual-TX (two RF chains are identical) is equal to 2 x 24 dBm (2 x 250 mW) with tolerance ± 1 dB.

The maximum nominal power rating on the unlicensed band Wi-Fi module is equal to 3 x 16 dBm (2.4 GHz Wi-Fi) and 3 x 17 dBm (5 GHz Wi-Fi) with tolerances ± 2 dB.

2.4 Additional information about the EUT

The EUT consists of the following units:

Unit	Model	Serial number
RBS 6402	AS9010606	C82A249853
AC/DC Power supply adapter	DP10054P3L-403	L837R1000ABL

The EUT was tested with the following cables:

Port:	Type:	Length: [m]	Specifications:
1a) AC port	AC power supply for AC/DC adapter	2	Three core
1b) DC port	Power input of RBS	1.2	Coaxial
2a) AC port	AC power supply for PoE injector	2	Three core
2b) WAN A	LAN/Power input	10	Unshielded signal cable, CAT 6, RJ45
WAN A / PoE	LAN (Telecommunication port)	10	Unshielded signal cable, CAT 6, RJ45
GRU	Signal	15	Shielded signal cable, CAT 6, Mini I/O connector

1a) AC port + 1b) DC port compose DC power supply for RBS 6402 via AC/DC adapter.

2a) AC port + 2b) WAN A port compose DC power supply for RBS 6402 via PoE injector.

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
GRU line termination	Termination instead of GRU	LM Ericsson AB	-
LAN line termination *	Termination for Ethernet test model PHY *	LM Ericsson AB	-
Laptop	Dell Latitude E6420	Dell	VVF52 A01

* In the radiated emission tests below 1 GHz the control PC has to be disconnected and LAN line (WAN A) terminated (Ethernet test model used).

2.6 Modifications made to improve EMC-characteristics

No modifications have been made during the tests.

2.7 Opinions and interpretations

The following types/type are/is also included as additional type in this test report:

RBS 6402 with product number KRD 901 060/1
RBS 6402 with product number KRD 901 060/2
RBS 6402 with product number KRD 901 060/4
RBS 6402 with product number KRD 901 060/8

The differences as compared to the tested type are (according to the manufacturer):

KRD 901 060/1 has only one 3GPP radio module (RM A) and no Wi-Fi module.
KRD 901 060/2 has no Wi-Fi module.
KRD 901 060/4 has only one 3GPP radio module (RM A).
KRD 901 060/8 is single band (B4) and has no Wi-Fi module.

The difference is considered not to imply different EMC-characteristics when compared to the tested type. Therefore, this type is not tested, but considered to have the same EMC-characteristics as the tested type.

3. TEST SPECIFICATIONS

3.1 Standards

Requirements:

47 CFR Part 2 (2016)

47 CFR Part 27 (2016): Subpart C

47 CFR Part 15 (2016): Subpart B

RSS-GEN Issue 4 (2014)

RSS-139 Issue 3 (2016)

ICES-003 Issue 6 (2016)

Test methods:

ANSI-TIA-603-C-2004

ANSI C63.4-2014

3.2 Additions, deviations and exclusions from standards and accreditation

RSS-GEN Issue 4 (2014) and RSS-139 Issue 3 (2016) are not within the scope of accreditation.

Only radiated spurious emission above 1 GHz parts of the standards are measured.

No other additions, deviations or exclusions have been made from standards and accreditation.

3.3 Test site

Measurements were performed at:

Intertek Semko AB.
Torshamnsgatan 43,
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

3.4 Mode of operation during the test

The EUT was tested with 120 V, 60 Hz. AC/DC adapter is used.

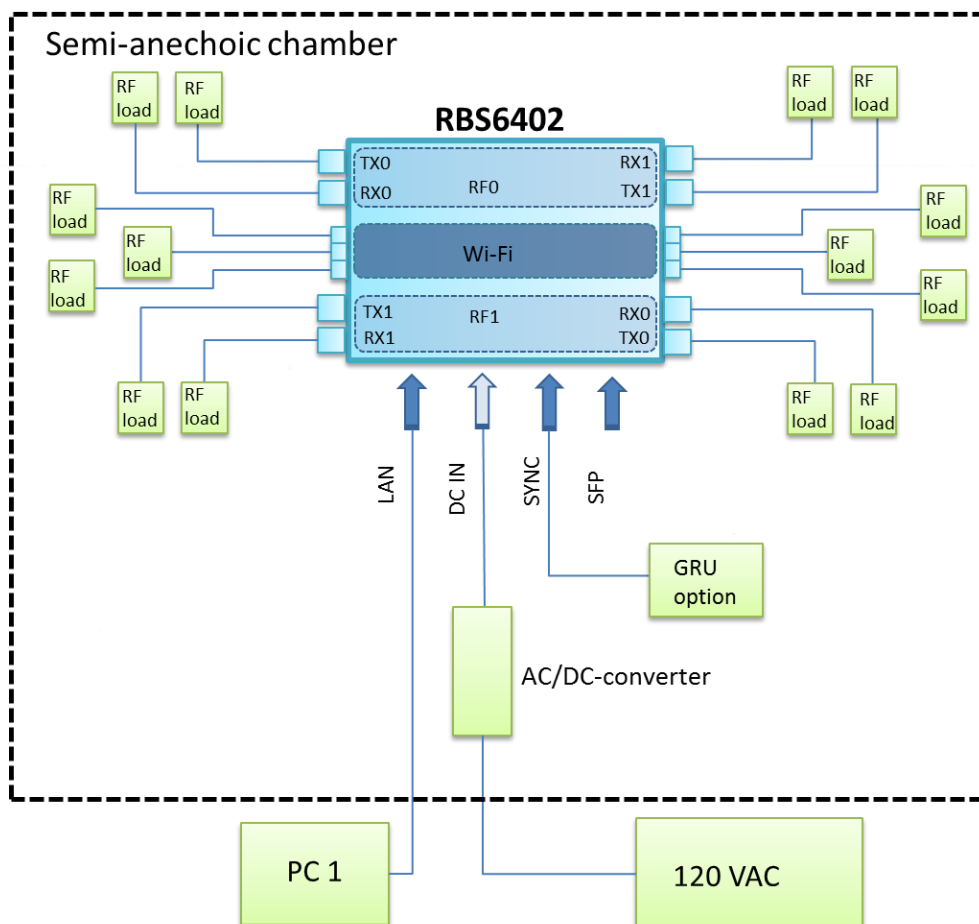
The EUT was transmitting with maximum power on the bottom (B), middle (M) and top (T) channels. Both transmitter and receiver are active during the tests. The channel frequencies are stated in detail in the table below.

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
WCDMA	4.8	2112.4 2132.6 2152.6	1537 1637 1738	1712.4 1732.6 1752.6	1312 1413 1513

The EUT is mounted in vertical position during the tests. The fan module of RBS6402 was assembled. Wi-Fi module is not active during the tests.

3.5 Test setup block diagram

Radiated emissions



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 Not tested in this report.	NT
CFR 47, Part 2.1049 RSS-Gen section 4.6	Occupied bandwidth Not tested by request of the client. Test is performed by the client in another test house and reported in the corresponding documents.	NT
CFR 47, Part 2.1051, Part 24.238	Intermodulation Not tested by request of the client. Test is performed by the client in another test house and reported in the corresponding documents.	NT
CFR 47, Part 2.1051, Part 24.238 RSS-Gen section 4.9 RSS-139 section 6.5	Out of band spurious emissions, conducted Not tested by request of the client. Test is performed by the client in another test house and reported in the corresponding documents.	NT
CFR 47, Part 2.1053, Part 24.238 RSS-Gen section 4.9 RSS-139 section 6.6	Transmitter out of band spurious emissions 30 – 1000 MHz, radiated Not tested in this report. The EUT complies with the limits. For results see Intertek Test report No. 1600301STO-001.	NT
CFR 47, Part 2.1053, Part 24.238 RSS-Gen section 4.9 RSS-139 section 6.6	Transmitter out of band spurious emissions above 1 GHz, radiated The EUT complies with the limits. The margin to the limit was at least 30 dB. See clause 5.	PASS
CFR 47, Part 2.1055 RSS-Gen section 4.7 RSS-139 section 6.3	Frequency stability Not tested by request of the client. Test is performed by the client in another test house and reported in the corresponding documents.	NT
CRF 47, Part 15.109 RSS-Gen section 6.1 ICES-003 section 6.2	Receiver out of band spurious emissions 30 – 1000 MHz, radiated Not tested in this report. The EUT complies with the limits. For results see Intertek Test report No. 1600301STO-001.	NT
CRF 47, Part 15.109 RSS-Gen section 6.1 ICES-003 section 6.2	Receiver out of band spurious emissions above 1 GHz, radiated The EUT complies with the limits. The margin to the limit was at least 13 dB. See clause 5.	PASS
CRF 47, Part 15.107 ICES-003 section 6.1	Conducted spurious emissions from AC-Mains Not tested in this report. The EUT complies with the limits. For results see Intertek Test report No. 1600301STO-001.	NT

5. OUT OF BAND SPURIOUS EMISSIONS THE FREQUENCY-RANGE 1 GHZ TO 22 GHZ

Date of test:	2016-01-28 – 29	Test location:	5m SAC
EUT Serial:	C82A249853	Ambient temp:	22 – 23 °C
Tested by:	Antonio De Oliveira Macedo, Matti Virkki	Relative humidity:	26 – 30 %
Test result:	Pass	Margin:	>13 dB

5.1 Test set-up and test procedure.

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

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 and average detector activated.

5.2 Test conditions

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

5.3 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 (dB μ V/m)	Detector
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 6.6

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.

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

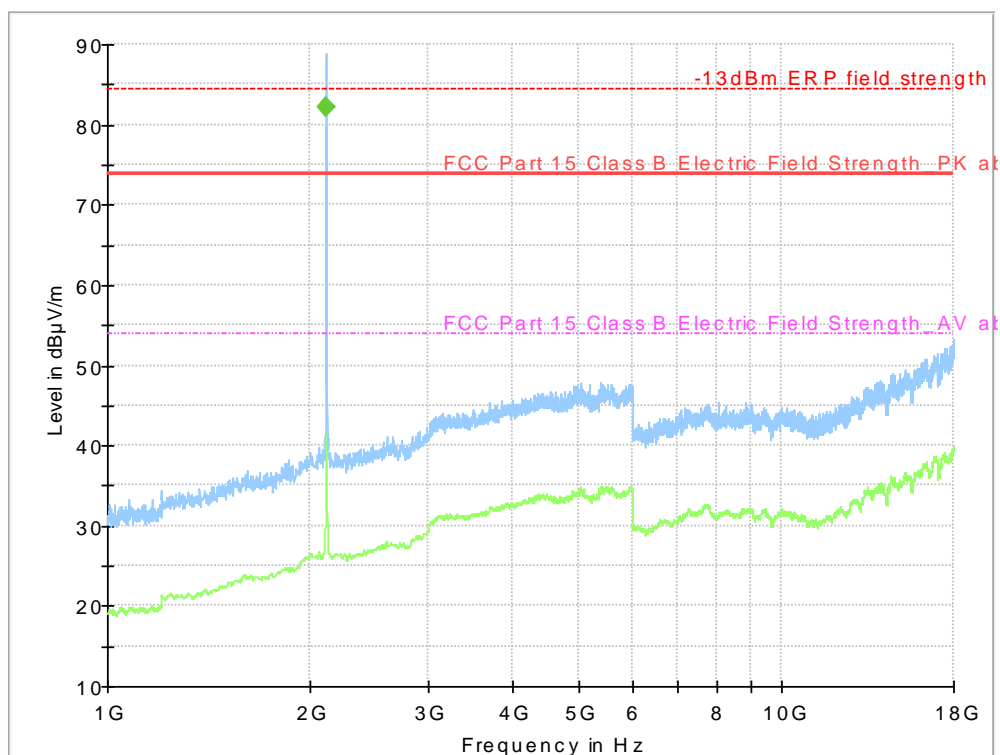
G: antenna gain

P: power (W)

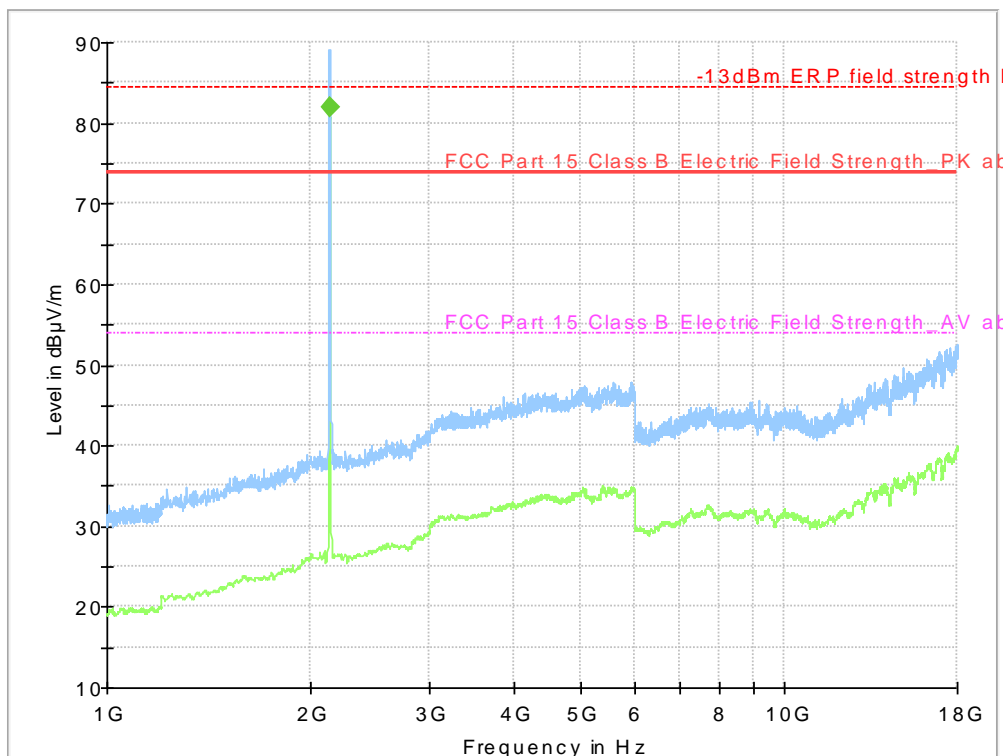
R: measurement distance (m)

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

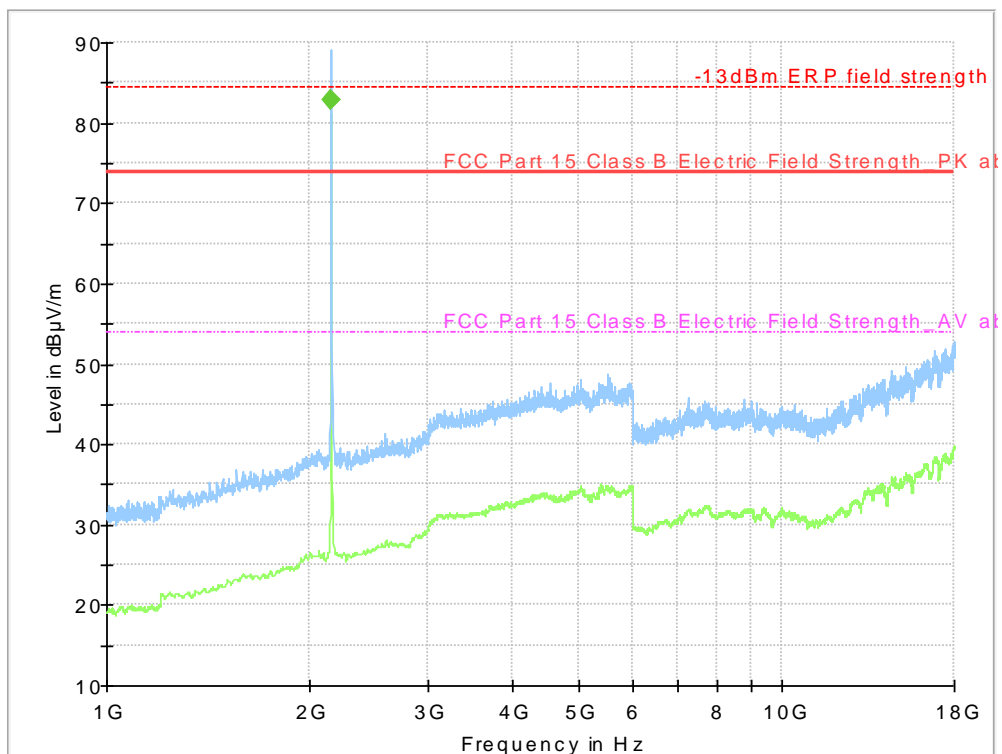
5.4 Test results



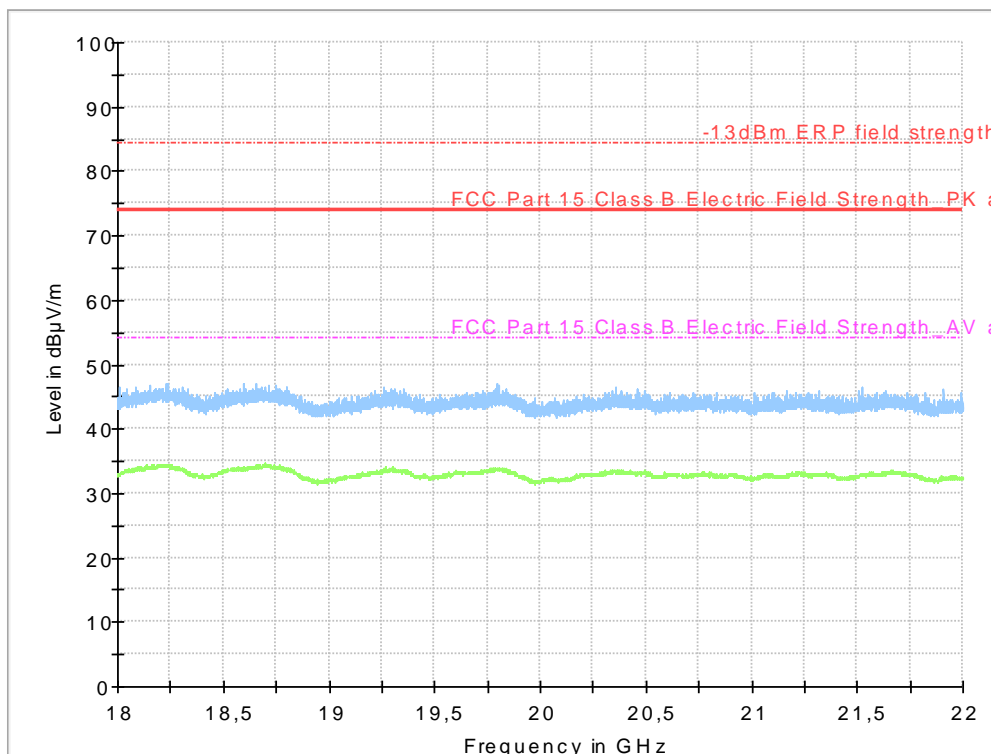
Diagram, Peak overview sweep, 1 – 18 GHz at 3 m distance, B4 bottom channel



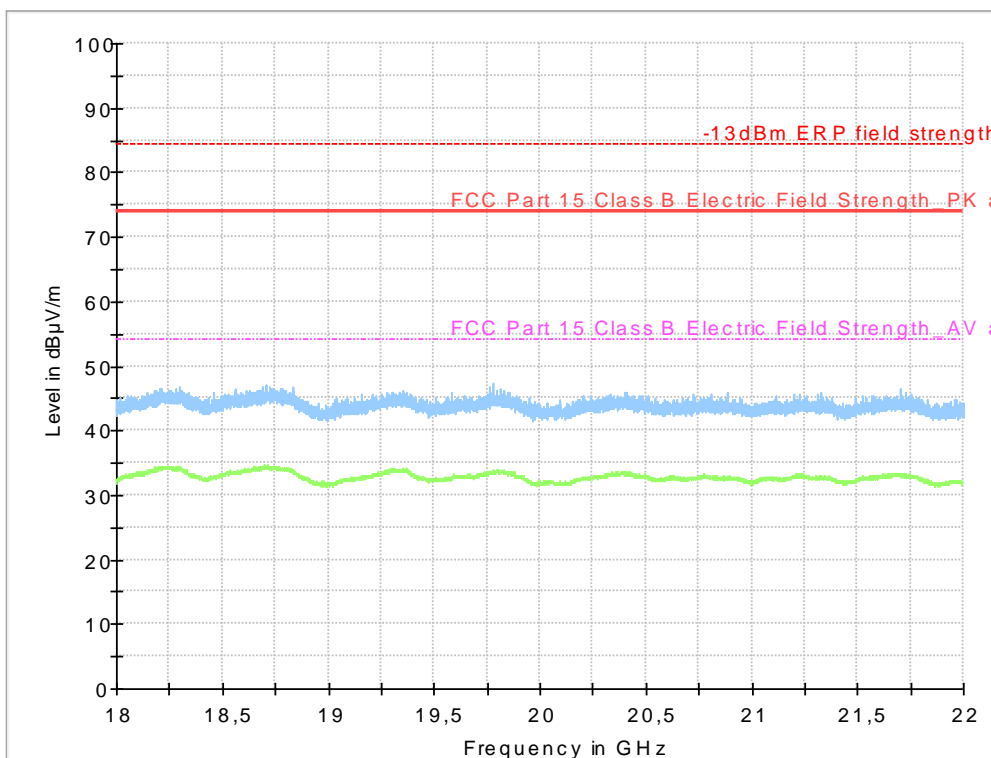
Diagram, Peak overview sweep, 1 – 18 GHz at 3 m distance, B4 middle channel



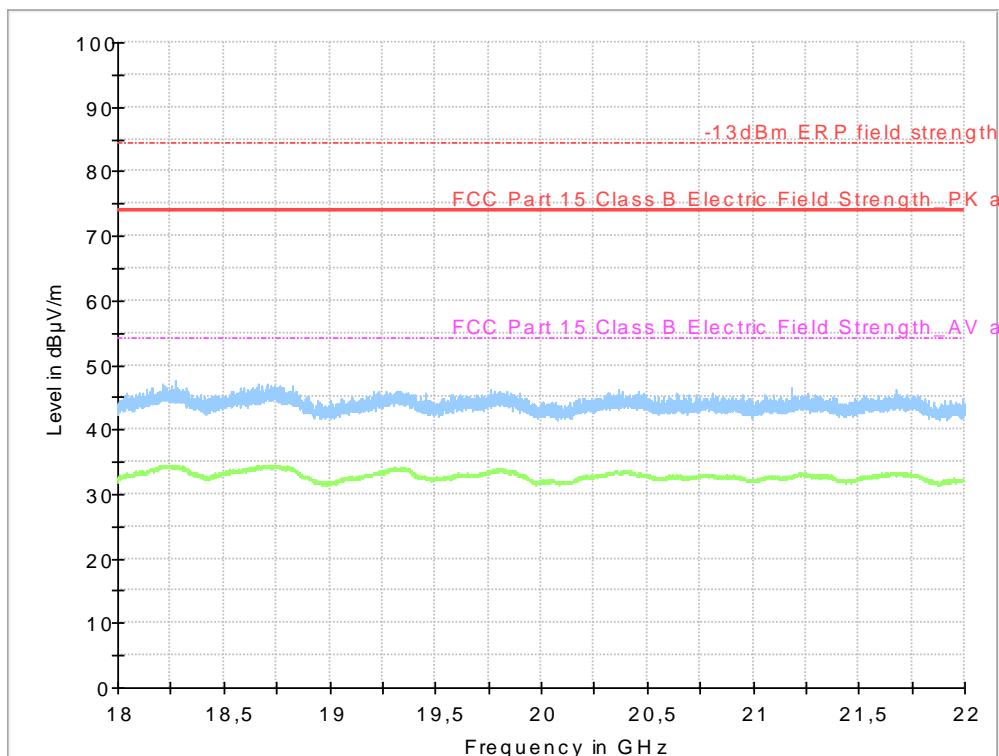
Diagram, Peak overview sweep, 1 – 18 GHz at 3 m distance, B4 top channel



Diagram, Peak overview sweep, 18 – 22 GHz at 3 m distance, B4 bottom channel



Diagram, Peak overview sweep, 18 – 22 GHz at 3 m distance, B4 middle channel



Diagram, Peak overview sweep, 18 – 22 GHz at 3 m distance, B4 top channel

No emissions except WCDMA carrier is found above noise floor.

For RX the noise floor has a margin of at least 13 dB to the average limit and 20 dB to the peak limit.
For TX the noise floor has a margin of at least 30 dB to the limit.

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

6. TEST EQUIPMENT

Radiated emissions 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	06-2015	1 year
Receiver	Rohde & Schwarz	ESU 40	13178	07-2015	1 year
Horn antenna	Rohde & Schwarz	HF907	32550	04-2015	3 years
Preamplifier + HP filter	Rohde & Schwarz	TS-PRE1	32297	07-2015	1 year
Horn antenna + pre-amplifier	Bonn	BLMA 1826-5A	31247	01-2014	3 years
Horn antenna + pre-amplifier	Bonn	BLMA 2640-5A	31248	01-2014	3 years
Coaxial cable	Rosenberger	UFB311A	39053	06-2015	1 year
Coaxial cable	Rosenberger	JFB2936C	9981	06-2015	1 year
Coaxial cable	Rosenberger	JFB293C	9982	06-2015	1 year
Coaxial cable	Megaphase	GC12-K1K1-315	39127	12-2015	1 year

7. MEASUREMENT UNCERTAINTY

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz ± 3.7 dB

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 30 to 1000 MHz at 3 m	± 5.1 dB
Uncertainty for the frequency range 30 to 1000 MHz at 10 m	± 5.0 dB
Uncertainty for the frequency range 1.0 to 18 GHz at 3 m	± 4.7 dB
Uncertainty for the frequency range 18 to 26 GHz at 3 m	± 4.8 dB
Uncertainty for the frequency range 26 to 40 GHz at 3 m	± 5.7 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.

The measurement uncertainty is given with a confidence of 95 %.

8. TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1600301STO-002 Annex 1.

Test set up photos are in separate document 1600301STO-002 Annex 2.