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Date 2016-06-17 Reference 6P03968-F24 Page 1 (2)

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Radio measurements on Radio 2203 B2 B25 radio equipment with FCC ID TA8AKRC161 489-1 and IC: 287AB-AS1614891

(4 appendices)

Test object

Product name: Radio 2203 B2 B25
Product number: KRC 161 489/1

Summary

See appendix 1 for general information and appendix 4 for external photos.

Standard Listed part of		Compliant	Appendix
FCC CFR 47 / IC RSS-133 ISSUE 6			
2.1053 / RSS-136 6.5	Field strength of spurious radiation	Yes	2
2.1055 / RSS-133 6.3	Frequency stability	Yes	3

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Appendix 1

Description of the test object

Equipment:	Radio equipment Radio 2203 B2 B25 Product number KRC 161 489/1 FCC ID TA8AKRC161489-1 IC: 287AB-AS1614891 IC MODEL NO: AS1614891
HVIN:	AS1614891
Hardware revision state:	R1D
Tested configuration:	LTE and WCDMA FDD single RAT LTE+WCDMA FDD multi RAT
Frequency bands: 3GPP B2:	TX: 1930 – 1990 MHz RX: 1850 – 1910 MHz
3GPP B25:	TX: 1930 – 1995 MHz RX: 1850 – 1915 MHz
IBW:	45 MHz, for 5, 10, 15 and 20 MHz channel bandwidth 25 MHz for 1.4 and 3 MHz channel bandwidth Valid for all power classes in both contiguous and non-contiguous operation.
Antenna ports:	2 TX / 2 RX ports
RF configurations:	Single carrier, multi carrier and MIMO 2x2
RF power Tolerance:	+0.6/ - 2.0 dB
Frequency stability tolerance:	±0.1 PPM
CPRI Speed	10 Gbit/s
Optional internal antenna type:	Integrated wide sector antenna, cross polarized antenna elements for indoor and outdoor use. Product no KRE 101 2249/1, antenna gain 9.2 dBi
Tested external antenna types:	Semi-Integrated Omni Antenna for indoor and outdoor use. Product no KRE 101 2233/1, antenna gain 2 dBi Product no KRE 101 2245/1, antenna gain 2 dBi
Channel bandwidths:	WCDMA: 4.2 and 5 MHz LTE: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz in single and multi carrier configurations.
Modulations:	LTE: QPSK, 16QAM, 64QAM and 256QAM WCDMA: 64 QAM
Nominal supply voltage:	+36VDC (via PSU AC 10, Rated 120 VAC alt PSU 48 05, rated -48 VDC)

Purpose of test

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47 and Industry Canada RSS-133 and RSS-Gen.

Operation modes during measurements

WCDMA measurements were performed with the test object transmitting test models as defined in 3GPP TS 37.141. Test model 1 (TM1) was used to represent QPSK. Test model 5 (TM5) to represent 16QAM modulation and Test model 6 (TM6) to represent 64QAM modulation.

LTE measurements were performed with the test object transmitting test models as defined in 3GPP TS 37.141. Test model E-TM1.1 was used to represent QPSK, test model E-TM3.2 to represent 16QAM, test model E-TM3.1 to represent 64QAM modulation and E-TM3.1A to represent 256QAM modulation.

All measurements were performed with the test object configured for maximum transmit power.

Radiated measurements

The test object was supplied with +36VDC via the PSU AC 10 alt PSU 48 05. Additional connections are documented in the test setup drawings.

References

Measurements were done according to relevant parts of the following standards:
ANSI 63.4-2014
ANSI/TIA/EIA-603-D-2010
CFR 47 part 2, October 1st , 2014
CFR 47 part 24, October 1st, 2014
3GPP TS 36.141, version 11.4.0
RSS-Gen Issue 3
RSS-133 Issue 6

Measurement equipment

	Calibration Due	SP number
Test site Edison	2017-01	504 114
R&S ESU 40	2016-07	901 385
R&S FSQ 40	2016-07	504 143
Control computer with R&S software EMC32 version 9.15.0	-	503 899
High pass filter	2016-07	504 200
RF attenuator	2016-10	900 691
Chase Bilog Antenna CBL 6143A	2019-04	504 079
EMCO Horn Antenna 3115	2016-09	502 175
Std.gain horn FLANN model 20240-20	-	503 674
Std.gain horn FLANN model 16240-25	-	503 939
Std.gain horn FLANN model 18240-25	-	503 900
µComp Nordic, Low Noise Amplifier	2016-12	504 160
Miteq Low Noise Amplifier	2016-11	503 278
Schwarzbeck BBV 9744, Low Noise Amplifier	2016-12	BX52356
Temperature and humidity meter, Testo 635	2017-04	504 203
Temperature and humidity meter, Testo 625	2016-06	504 117
Temperature Chamber	-	503 360
Multimeter Fluke 87	2016-08	502 190

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP-QD 10885”. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).
Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

Reservation

The test results in this report apply only to the particular test object as declared in the report.

Delivery of test object

The test object was delivered: 2016-05-06.

Manufacturer's representative

Lars Wallin, Ericsson AB.

Test engineers

Tomas Isbring, Tomas Lennhager, Rolf Kühn, Andreas Johnson and Patric Augustsson, SP.

Test participant

None.

Test frequencies used for conducted and radiated measurements

LTE TX test frequencies

EARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
8047	1930.7	$B_{L1.4}$	TX bottom frequency in 1.4 MHz BW configuration
8365	1962.5	M_L	TX band mid frequency all BW configurations
8683	1994.3	$T_{L1.4}$	TX top frequency in 1.4 MHz BW configuration
8047 8061 8283	1930.7 1932.1 1954.3	$BIM_{L1.4}$	3 carrier TX 1.4 MHz BW bottom constellation
8447 8669 8683	1970.7 1992.9 1994.3	$TIM_{L1.4}$	3 carrier TX 1.4 MHz BW top constellation

WCDMA TX test frequencies

UARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
5112	1932.4	B_W	Single carrier TX bottom frequency
5263	1962.6	M_w	Single carrier TX band mid frequency
5413	1992.6	T_w	Single carrier TX top frequency
5112 5137 5313	1932.4 1937.4 1972.6	BIM_W	3 carrier TX bottom constellation
5212 5388 5413	1952.4 1987.6 1992.6	TIM_W	3 carrier TX top constellation

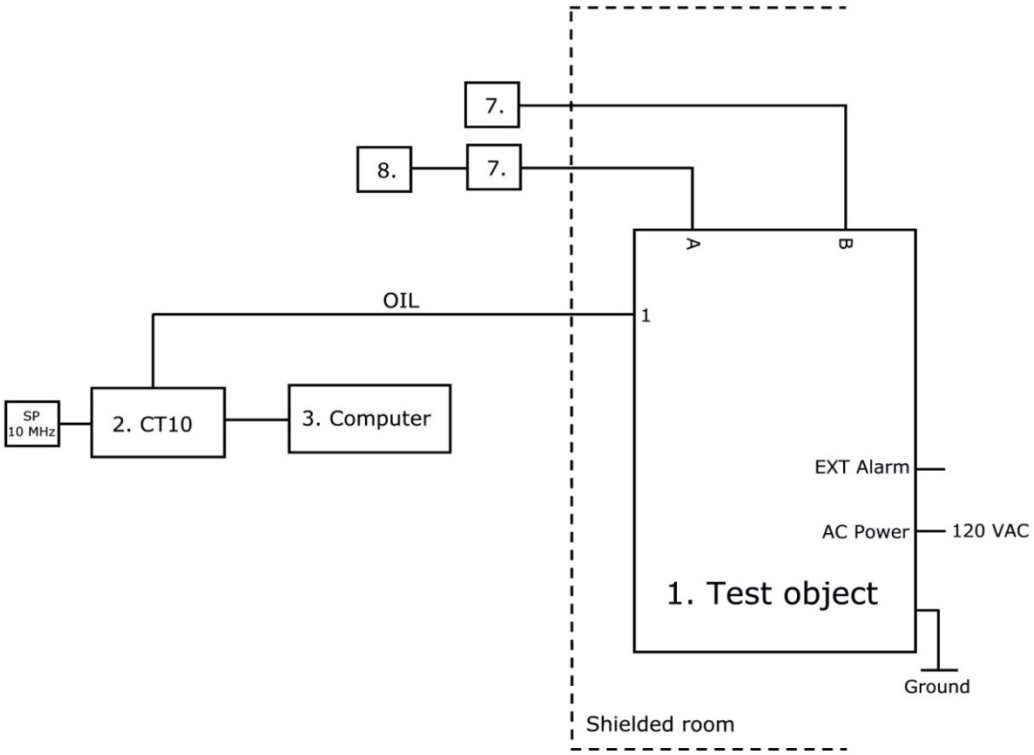
LTE+WCDMA TX test frequencies

EARFCN Downlink	Frequency [MHz]	UARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
8097	1935.7	5112	1932.4	B_{CS}	2 carrier TX bottom constellation
8483	1974.3	5112	1932.4	B_{non-CS}	2 carrier TX bottom constellation
8383 8483	1964.3 1974.3	5112 5162	1932.4 1942.4	B_{4c}	4 carrier TX bottom constellation

All RX frequencies were configured 80 MHz below the corresponding TX frequency according the appclicable duplex offset for the operating band.

Appendix 1

Test setup:



Test object:

1.	Radio 2203 B2 B25, KRC 161 489/1, rev. R1D, s/n: C82A522331 With Radio Software: CXP 901 7316/2, rev. R62EU. FCC ID TA8AKRC161489-1 and IC: 287AB-AS1614891

Associated equipment:

2.	Testing Equipment: CT10, LPC 102 487/1, rev. R1C, s/n: T01F375047, BAMS – 1001466801 with software CXA 104 446/1, rev. R8M01/7

Functional test equipment:

3.	HP EliteBook 8560w, BAMS – 1001236851
7	Attenuator/ Terminator
8.	Anritsu MS2691A, BAMS – 1000710578

Interfaces:	**Type of port:**
Power: 120 VAC 60Hz alt -48VDC	AC/DC Power
RF port A, 4.3-10 connector, combined TX/RX	Antenna
RF port B, 4.3-10 connector, combined TX/RX	Antenna
TX mon A, SMA connector, for maintenance purpose only	RF monitor
TX mon B, SMA connector, for maintenance purpose only	RF monitor
1, optical interface	Signal
2, optical interface, not used in this configuration	Signal
Ground wire	Ground

Appendix 2

Field strength of spurious radiation measurements according to 47 CFR 2.1053 / IC RSS-133 6.5

Date	Temperature	Humidity
2016-05-30	24 °C ± 3 °C	30 % ± 5 %
2016-05-31	23 °C ± 3 °C	53 % ± 5 %
2016-06-01	22 °C ± 3 °C	48 % ± 5 %
2016-06-02	23 °C ± 3 °C	51 % ± 5 %

The test sites are listed at FCC, Columbia with registration number: 93866. The test site complies with RSS-Gen, Industry Canada file no. 3482A-2.

The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 18 GHz and 1 m in the frequency range 18 GHz – 20 GHz.

The measurement was performed with a RBW of 1 MHz.

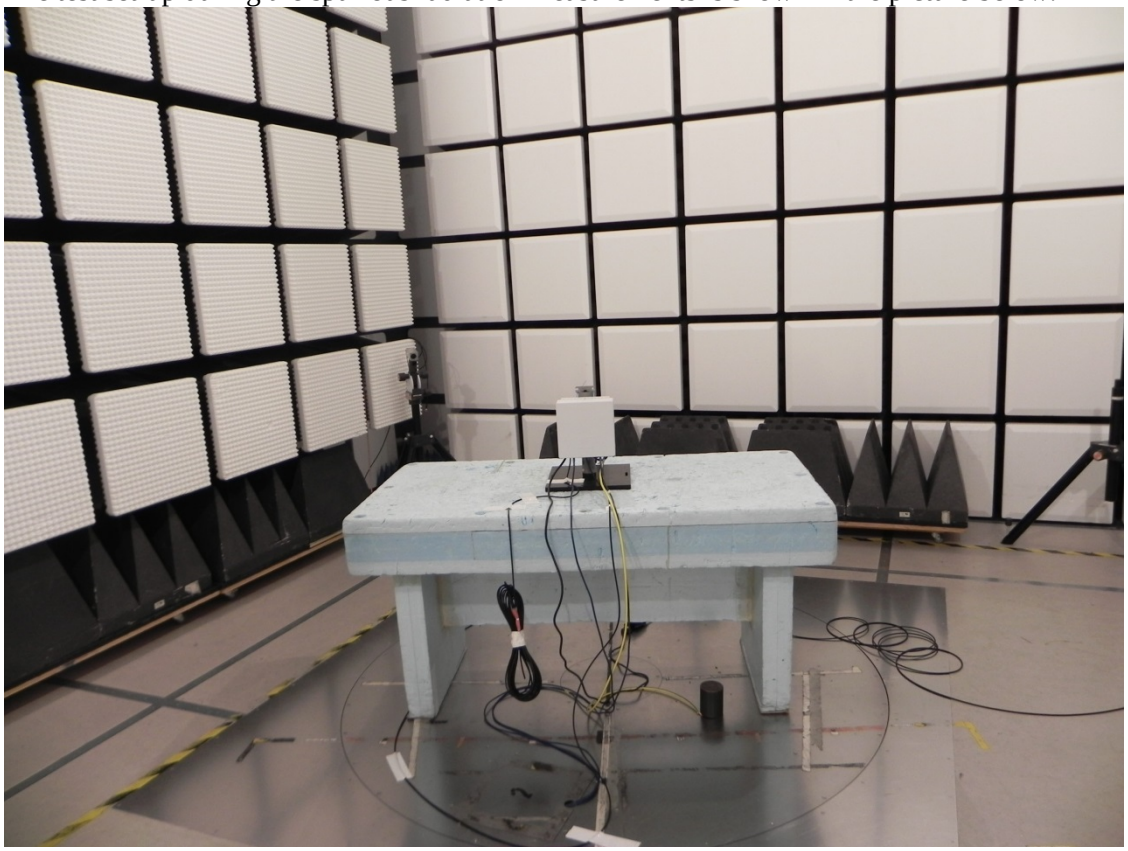
A propagation loss in free space was calculated. The used formula was $\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

The measurement procedure was as the following:

1. A pre-measurement is performed with peak detector. For measurement < 1 GHz the test object was measured in eight directions with the antenna at three heights, 1.0 m, 1.5 m and 2.0. For measurements > 1 GHz the test object was measured in seventeen directions with the antenna at 1.0 m height.
2. Spurious radiation on frequencies closer than 20 dB to the limit in the pre-measurement is scanned 0-360 degrees and the antenna is scanned 1- 4 m for maximum response. The emission is then measured with the RMS detector and the RMS value is reported. Frequencies closer than 10 dB to the limit when measured with the RMS detector were measured with the substitution method according to ANSI/TIA/-603-D-2010.

Appendix 2

The test set-up during the spurious radiation measurements is shown in the picture below:



Measurement equipment

Measurement equipment	SP number
Semi anechoic chamber	504 114
R&S ESU 40	901 385
EMC 32 ver. 9.15.0	503 899
Chase Bilog Antenna CBL 6143A	504 079
ETS Lindgren Horn Antenna 3115	502 175
Flann STD Gain Horn Antenna 16240-25	503 939
Flann STD Gain Horn Antenna 18240-25	503 900
Flann STD Gain Horn Antenna 20240-20	503 674
Schwarzbeck BBV 9744, Low Noise Amplifier	BX52356
µComp Nordic, Low Noise Amplifier	504 160
Miteq, Low Noise Amplifier	503 278
HP Filter 3-18 GHz	504 200
Temperature and humidity meter, Testo 625	504 117

Test frequencies

WCDMA	LTE	WCDMA+LTE
Symbolic name	Symbolic name	Symbolic name
B_w	$B_{L1.4}$	B_{CS}
M_W	M_L	B_{non-CS}
T_W	$T_{L1.4}$	B_{4c}
BIM_W	BIM_L	
TIM_W	TIM_L	

Results, representing worst case

Single rat WCDMA, symbolic name B_W: Diagram 1 a-d

Single rat LTE, symbolic name $B_{L1.4}$: Diagram 2 a-d

Multi rat WCDMA + LTE, symbolic name B_{cs}: Diagram 3 a-d

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-20 000	All emission > 20 dB below limit	All emission > 20 dB below limit

Measurement uncertainty:

3.2 dB up to 18 GHz, 3.6 dB above 18 GHz

Limits

CFR 47 §24.238 and IC RSS-133 6.5

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm.

Complies?	Yes

Appendix 2

Diagram 1a:

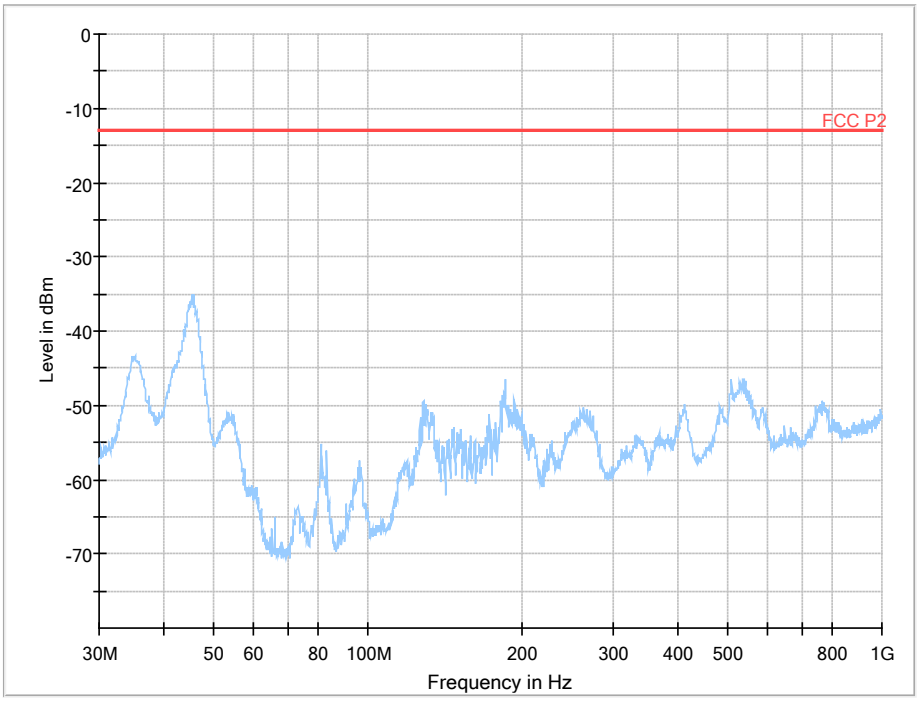
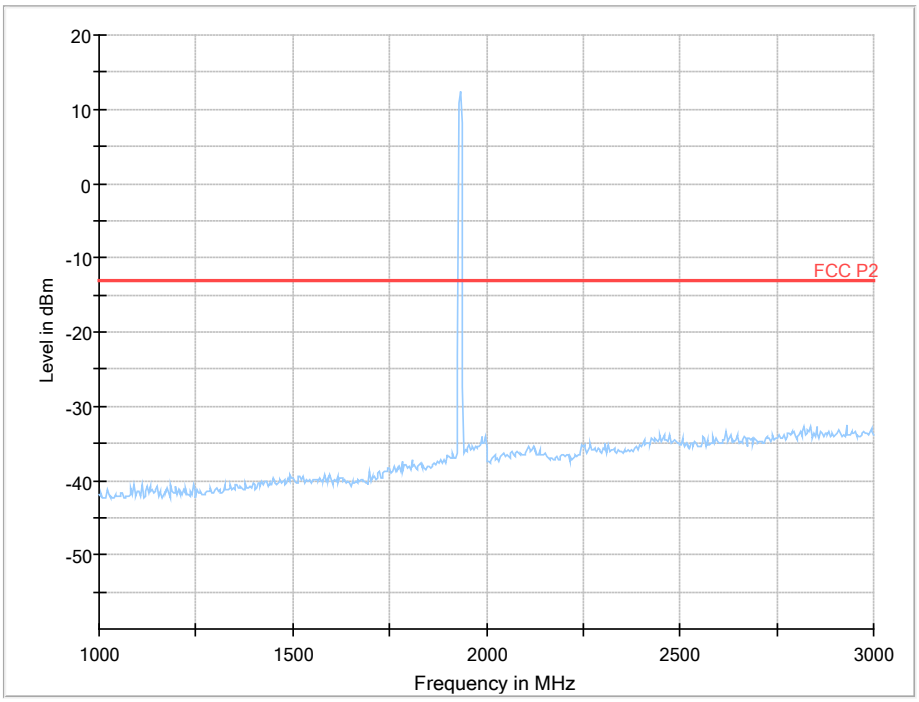
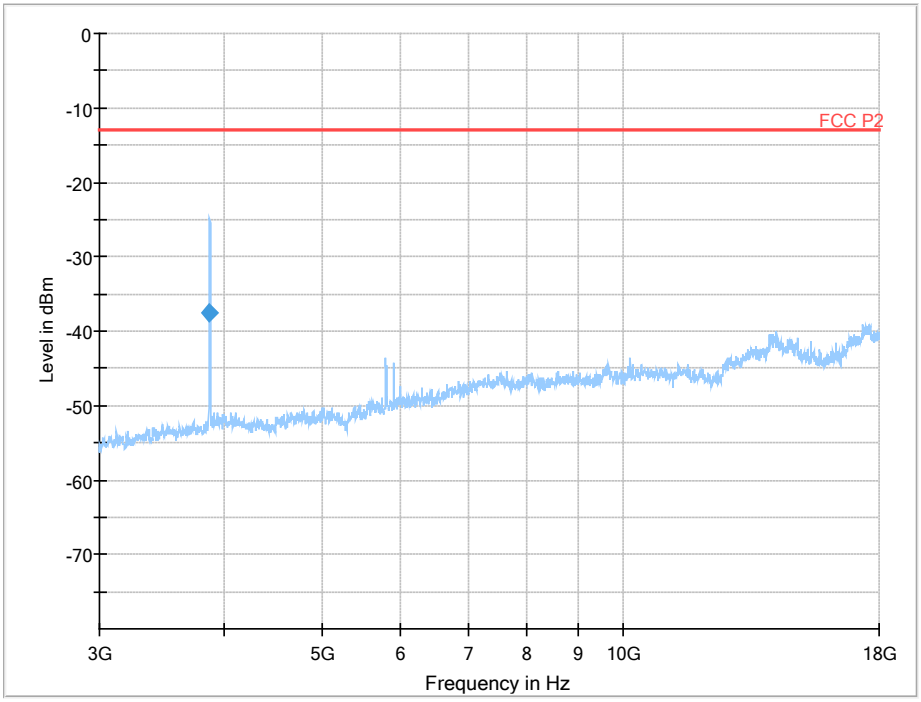


Diagram 1b:



Note: The emission at 1932.4 MHz is the carrier frequency and shall be ignored in the context.

Diagram 1c:

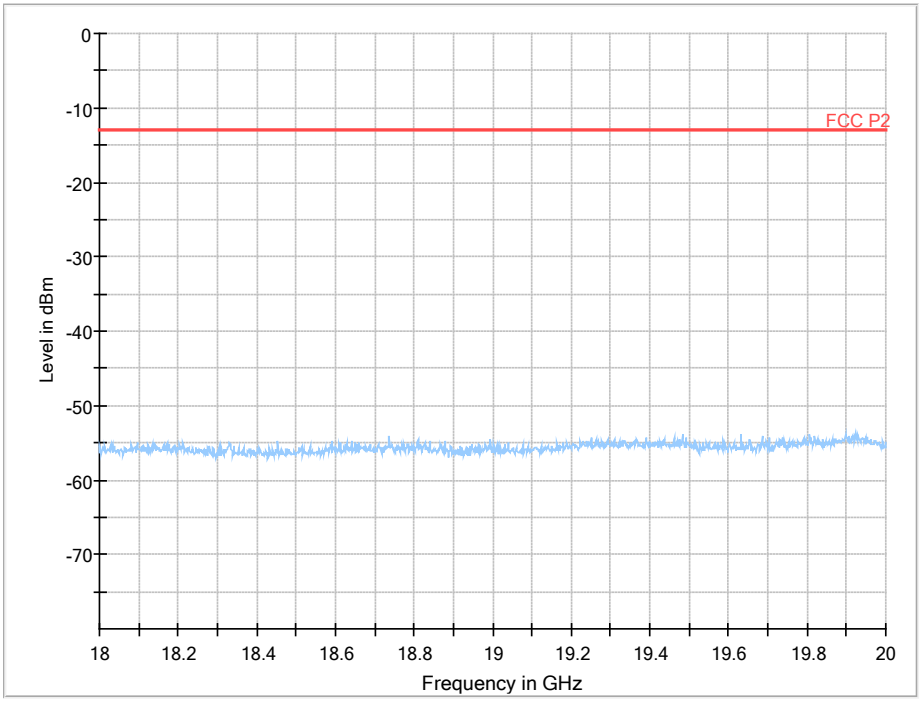


Final CISPR AV result

Frequency (MHz)	CAverage (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3866.041	-37.49	-13.00	24.49	5000.0	1000.000	125.0	V	0.0	-104.4

Appendix 2

Diagram 1d:



Appendix 2

Diagram 2a:

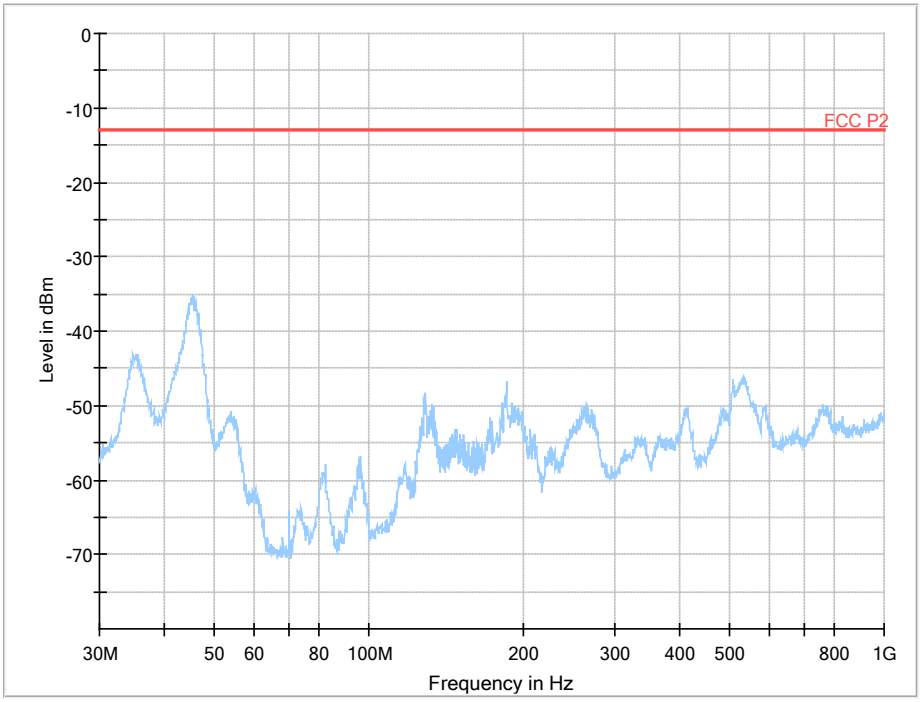
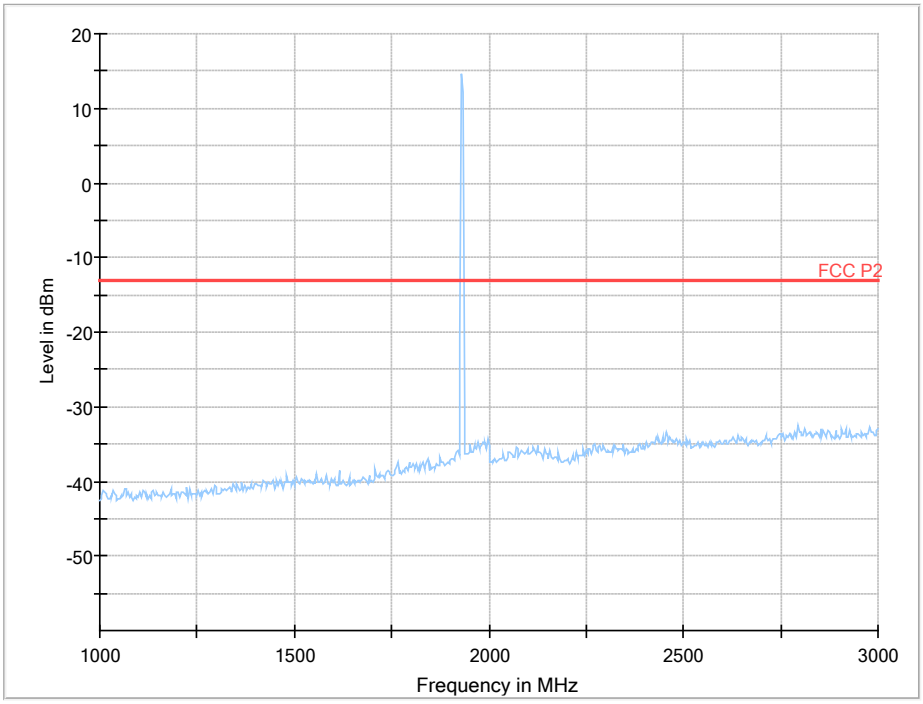


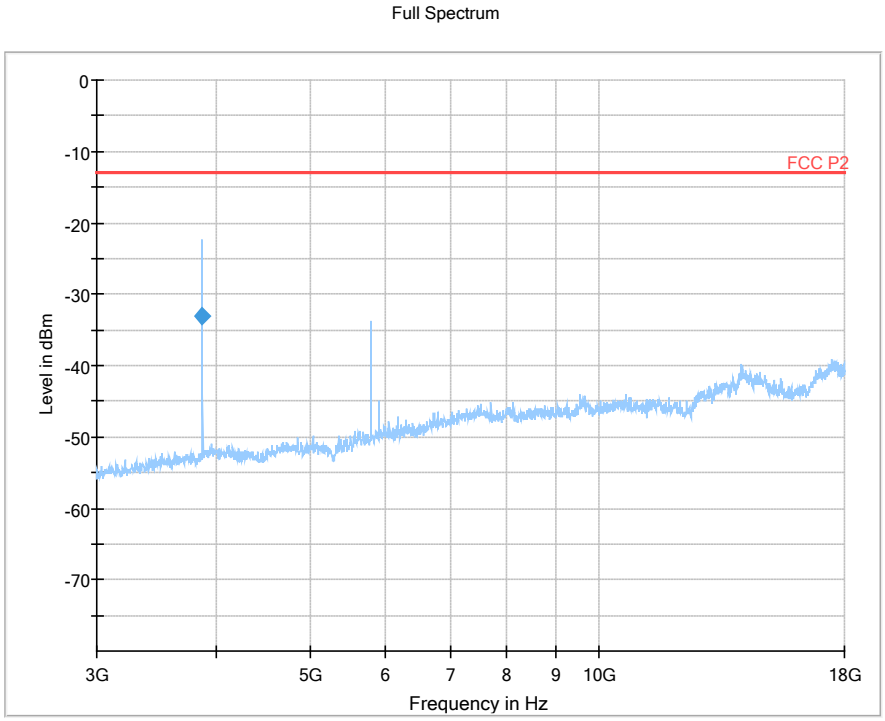
Diagram 2b:



Note: The emission at 1930.7 MHz is the carrier frequency and shall be ignored in the context.

Appendix 2

Diagram 2c:

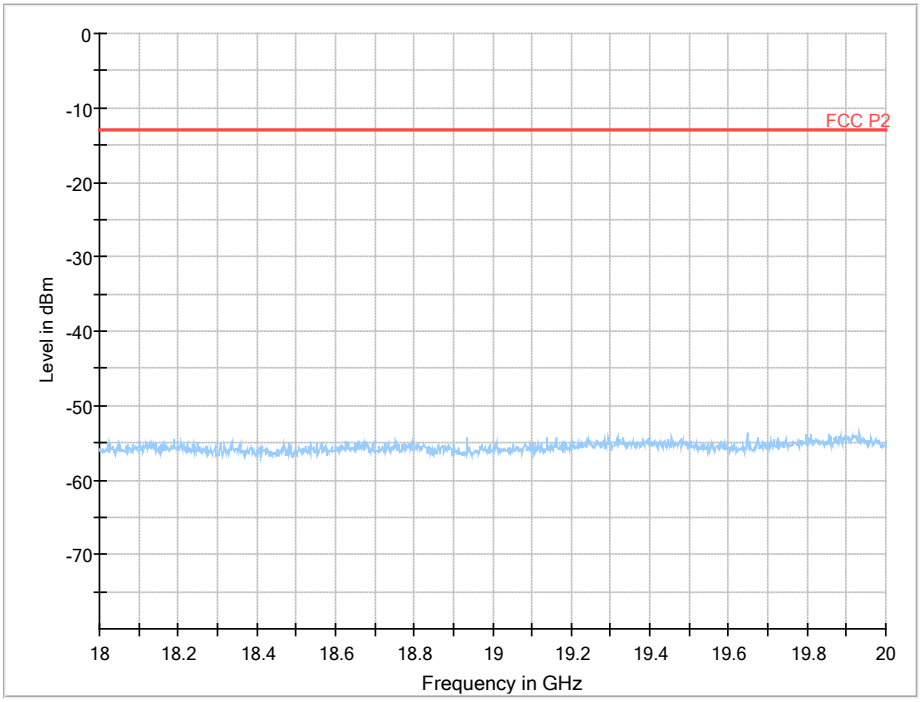


Final CISPR AV result

Frequency (MHz)	CAverage (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3861.025	-33.15	-13.00	20.15	5000.0	1000.000	125.0	V	0.0	-104.5

Appendix 2

Diagram 2d:



Appendix 2

Diagram 3a:

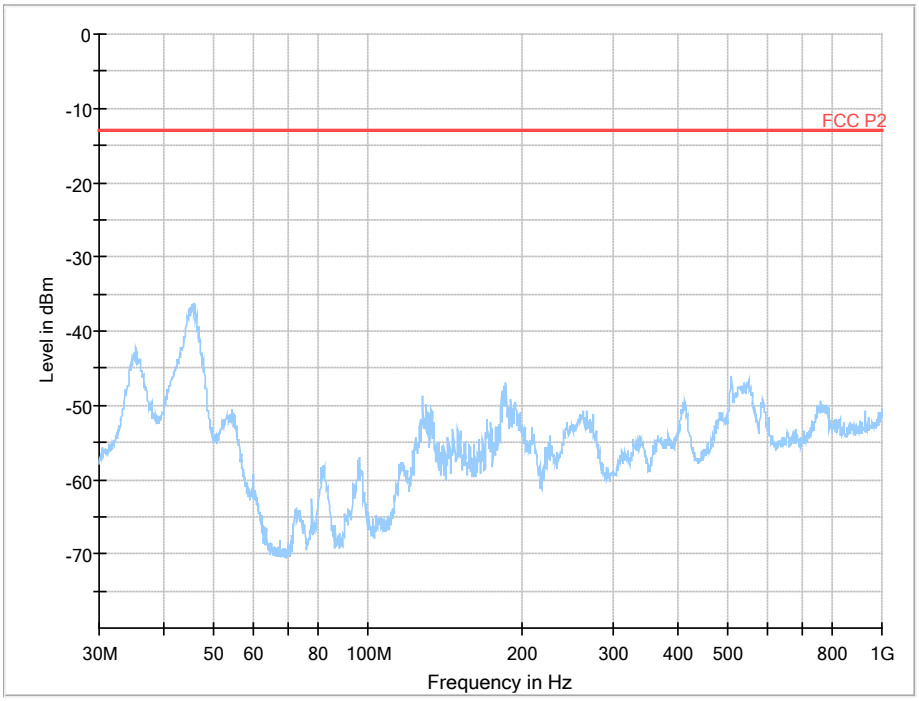
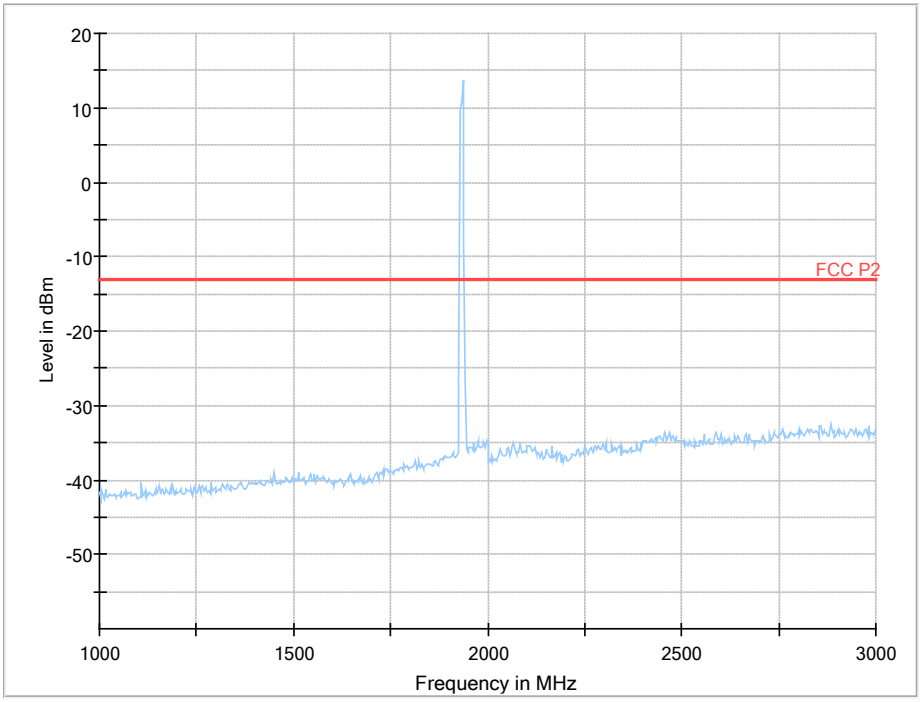


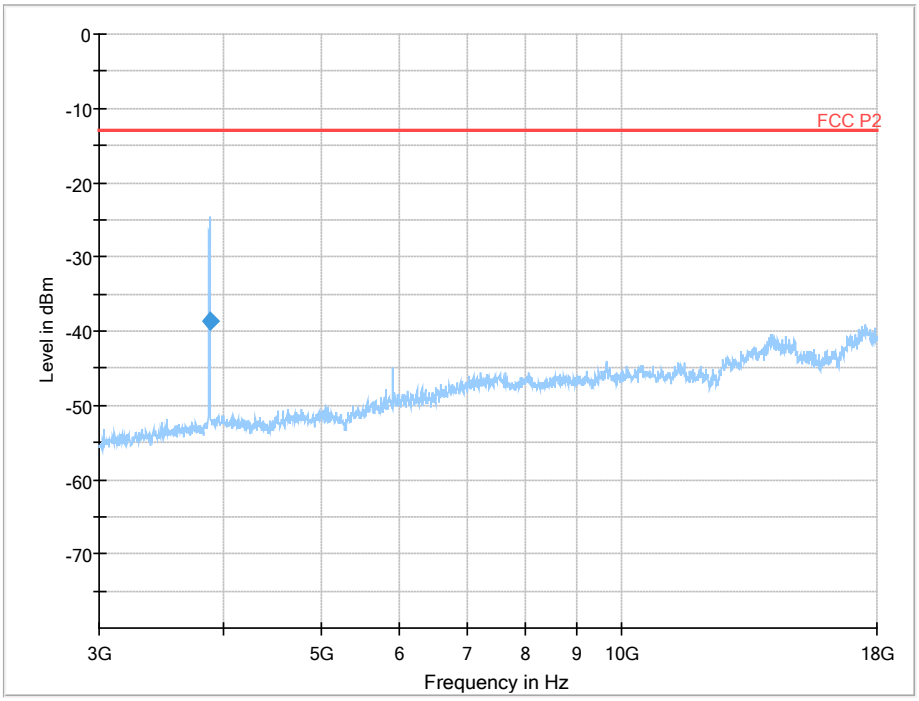
Diagram 3b:



Note: The emission between 1930 MHz to 1932.8 MHz is the carrier frequency and shall be ignored in the context.

Appendix 2

Diagram 3c:

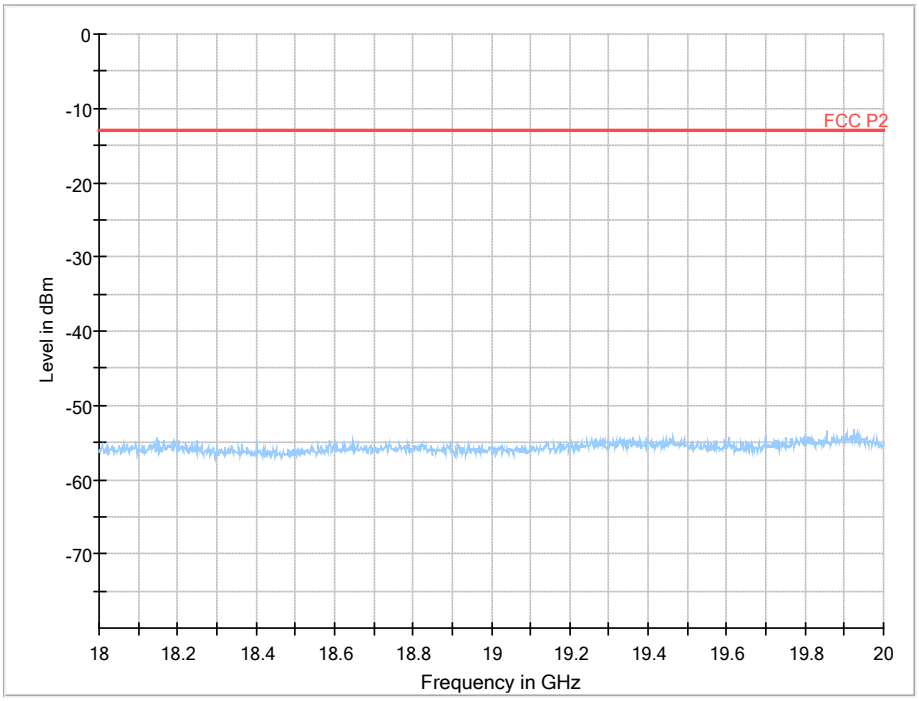


Final CISPR AV result

Frequency (MHz)	CAverage (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3871.153	-38.72	-13.00	25.72	5000.0	1000.000	125.0	V	0.0	-104.4

Appendix 2

Diagram 3d:



Appendix 3

Frequency stability measurements according to CFR 47 §24.235 / IC RSS 133 6.3

Date	Temperature (test equipment)	Humidity (test equipment)
2016-06-09 to 2016-06-13	23-24 °C ± 3 °C	18-23 % ± 5 %

Test set-up and procedure

The measurement was made per 3GPP TS 36.141. The output was connected to a spectrum analyser.

The measurement was also made using a resolution bandwidth of 1% of the emission bandwidth, a reference point at the unwanted emission level which complies with the attenuation of 43 + 10 log10 p (watts) (i.e. -13dBm) (for MIMO -16dBm) at the band edge of the lowest and highest channel was selected, and the frequency at these points was recorded as fL and fH respectively.

Measurement equipment	SP number
Rohde & Schwarz signal analyzer FSQ 40	504 143
RF attenuator	900 691
Testo 635, Temperature and humidity meter	504 203
Temperature cabinet	503 360

Results

WCDMA: Nominal transmitter frequency was 1962.6 MHz (M) with a bandwidth of 5 MHz.
LTE: Nominal transmitter frequency was 1962.5 MHz (M) with a bandwidth of 5 MHz.
Rated output power level at connector RF A (maximum): 37 dBm.
The optional fan unit was disconnected during the measurements in order to represent worst case configuration to include the optional configuration with maximum 34.8 dBm without fan.

The Radio 2203 B2 B25 was powered via the PSU 48 05.

Test conditions		WCDMA Frequency error (Hz)	LTE Frequency error (Hz)
Supply voltage DC (V)	Temp. (°C)		
-48.0	+20	-3	-14
-55.2	+20	+2	+17
-40.8	+20	+2	+16
-48.0	+30	+2	+25
-48.0	+40	-3	+22
-48.0	+50	-3	+20
-48.0	+10	-2	+22
-48.0	0	-2	-20
-48.0	-10	+2	-24
-48.0	-20	-2	-22
-48.0	-30	-2	-27
Maximum freq. error (Hz)		3	27
Measurement uncertainty		$< \pm 1 \times 10^{-7}$	$< \pm 1 \times 10^{-7}$

The Radio 2203 B25 was powered via the PSU AC 10.

Test conditions		WCDMA Frequency error (Hz)	LTE Frequency error (Hz)
Supply voltage AC (V)			
120	+20	-2	+33
138	+20	+2	-32
102	+20	-2	+27
Maximum freq. error (Hz)		2	33

Rated output power level at connector RF A (maximum): 37 dBm

Test conditions			Frequency margin to band edge at -16dBm			
Supply voltage DC [V]	Temp [°C].	Carrier Bandwidth RAT [MHz]	Test frequency Symbolic name Bottom		Test frequency Symbolic name Top	
			fL [MHz]	Offset to lower band edge (1930 MHz) [kHz]	fH [MHz]	Offset to upper band edge (1995 MHz) [kHz]
-48.0	+20	LTE 1.4	1930.034	34	1994.965	35
-48.0	+20	LTE 20	1930.704	704	1994.299	701
-48.0	+20	WCDMA 5	1930.026	26	1994.974	26

Remark

It was deemed sufficient to test one combination of TX frequency modulation, as all combinations share a common internal reference to derive the TX frequency from.

Limit according to:

§24.235
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-133 6.3 Frequency stability:
The carrier frequency shall not depart from the reference frequency in excess of ± 1.0 ppm (± 1962.5 Hz) for base stations when tested to the temperature and supply voltage variations specified in RSS-Gen.

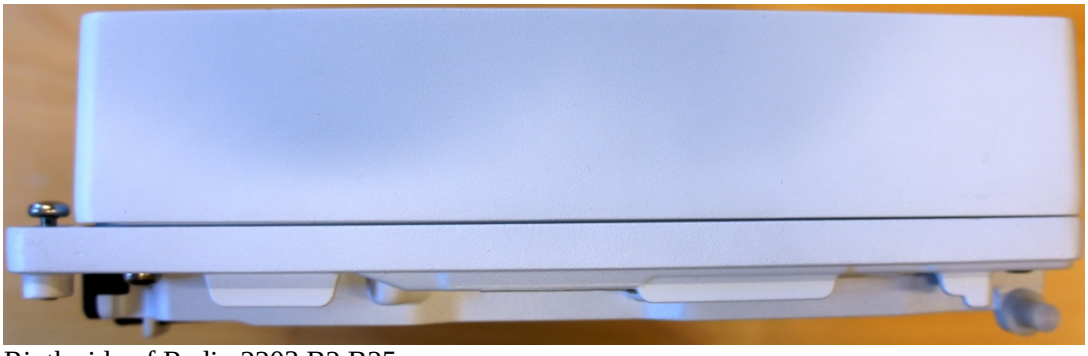
Complies?	Yes

Appendix 4

Photos of test object

Front side of Radio 2203 B2 B25

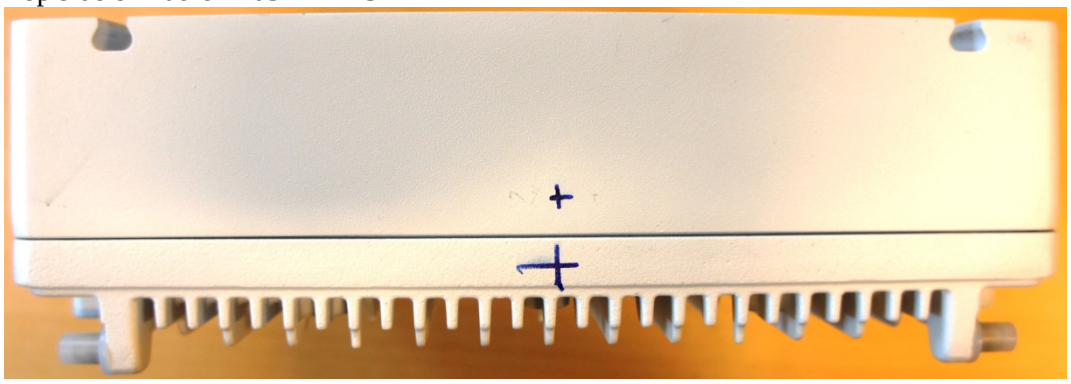
Left side of Radio 2203 B2 B25



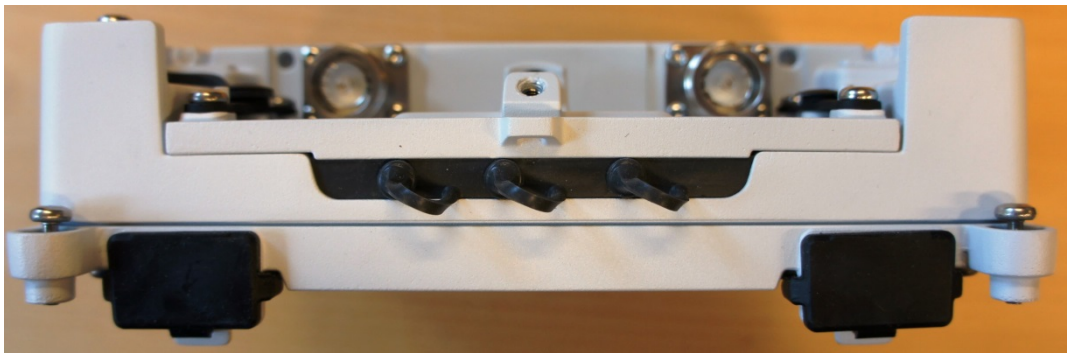
Rigth side of Radio 2203 B2 B25

Appendix 4

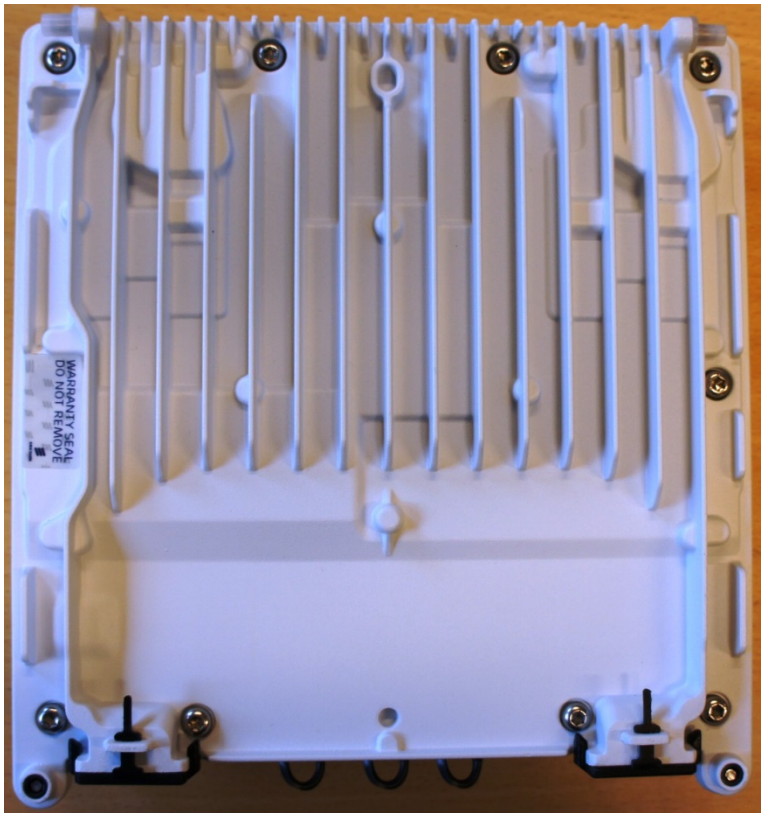
Top side of Radio 2203 B2 B25



Bottom side of Radio 2203 B2 B25

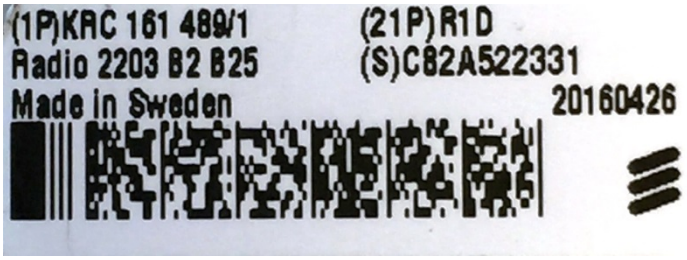


Rear side of Radio 2203 B2 B25



Appendix 4

Radio label:



SFP module: