REPORT

issued by an FCC listed Laboratory Reg. no. 93866.
The test site complies with RSS-Gen, IC file no: 3482A

Date	Reference	Page
2012-05-22	FX205892-F22	1 (2)

1002
ISO/IEC 17025

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Class II permissive change measurements on RRUS 01 B5 850 MHz radio equipment with FCC ID:TA8AKRC11870-2 and IC:287AB-AS118702

(5 appendices)

Test object

RRUS 01 B5, product KRC 118 70/2, revision R1C, serial no: C823924709

Summary

Standard		Compliant	Appendix
FCC CFR 47 / IC RSS-132			
2.1046 / RSS-132 4.4	RF power output	Yes	2
2.1051 / RSS-132 4.5	Spurious emission at antenna terminals	Yes	3
2.1053 / RSS-132 4.5	Field strength of spurious radiation	Yes	4

Note: Above RSS-132 items are given as cross-reference only. Measurements were performed according to ANSI procedures referenced by FCC and covered by SP's accreditation.

SP Technical Research Institute of Sweden
Electronics - EMC

Performed by

Jörgen Wassholm

Examined by

Bengt Andersson

Table of contents

Description – Test object

Equipment:	Multi standard radio equipment RRUS 01 B5 running in WCDMA and GSM mode in multi standard configuration.
Antenna ports:	1 TX/RX port and 1 RX port
Frequency bands:	TX: 869 – 894 MHz RX: 824 – 849 MHz
Modulations:	QPSK, 16QAM and 64QAM (WCDMA) GMSK, 16QAM, 32QAM, AQPSK and 8PSK (GSM)
Number of carriers:	Maximum 4 carrier (1-2 WCDMA carriers and 1-3 GSM carriers)
Nominal output power: (Maximum)	47.8 dBm total power (60W)
Channel distribution:	Contiguous and Non-contiguous spectrum
IF band width	20 MHz
Channel bandwidth:	4.2 to 5 MHz (configurable in steps of 100/200 kHz)
Channel spacing:	4.4 to 5 MHz (configurable in steps of 100/200 kHz)
Nominal power voltage:	-48 VDC

WCDMA operation mode during measurements

Measurements were performed with the test object transmitting the Test model TM1 which are defined in 3GPP TS 25.141.

The settings below were found to be representative for all traffic scenarios when several settings with the different number of carriers were tested to find the worst case setting. These settings were used for all measurements if not otherwise noted.

One WCDMA carrier
TM1: 64 DPCH:s at 30 ksps (SF=128)
Channel bandwidth 5 MHz
Modulation: QPSK

GSM operation mode during measurements

The settings below were found to be representative for all traffic scenarios when several settings with the different modulations and number of carriers were tested to find the worst case setting.
Unless otherwise stated, all measurements were performed with GMSK modulation with the test object transmitting pseudorandom data in all timeslots and settings for maximum transmitter output power applicable for each configuration.

Two GSM carriers

Appendix 1

Tested configurations:

Configuration 1:

GSM			**WCDMA**
Carrier	1 (20 W)	2 (20 W)	1 (20 W)
Downlink	129 (869.4 MHz)	137 (871.0 MHz)	4420 (884 MHz)
Uplink	129 (824.4 MHz)	137 (826.0 MHz)	4195 (839 MHz)

Configuration 2:

GSM			**WCDMA**
TRX	1 (20 W)	2 (20 W)	1 (20 W)
Downlink	129 (869.4 MHz)	137 (871.0 MHz)	4369 (873.8 MHz)
Uplink	129 (824.4 MHz)	137 (826.0 MHz)	4144 (828.8 MHz)

Configuration 3:

GSM			**WCDMA**
TRX	1(20 W)	2 (20 W)	1 (20 W)
Downlink	242 (892 MHz)	250 (893.6 MHz)	4403 (880.6 MHz)
Uplink	242 (847 MHz)	250 (848.6 MHz)	4178 (835.6 MHz)

Configuration 4:

GSM			**WCDMA**
TRX	1 (20 W)	2 (20 W)	1 (20 W)
Downlink	180 (879.6MHz)	239 (891.4 MHz)	4427 (885.4 MHz)
Uplink	180 (834.6MHz)	239 (846.4 MHz)	4202 (840.5 MHz)

Configuration 5:

GSM			**WCDMA**
TRX	1 (20 W)	2 (20 W)	1 (20 W)
Downlink	140 (871.6 MHz)	199 (883.4 MHz)	1037 (877.5 MHz)
Uplink	140 (826.6MHz)	199 (838.4 MHz)	812 (832.5 MHz)

Conducted measurements

All RF conducted measurements were performed with the test object configured for maximum transmit power. All TX measurements were done at the RF A connector.

Radiated measurements

The test object was powered with -48 VDC. All measurements were performed with the test object configured for maximum transmit power. The configurations represents worst case for radiated spurious emission measurements.

The RF output power port was via a RF attenuator connected to functional test equipment for supervision.

Purpose of test

The purpose of this test is to justify a Class II Permissive Change of the test object to include the use of multi- standard radio (MSR) for access technologies GSM and WCDMA running in Contiguous and Non- contiguous mode.

References

Measurements were done according to relevant parts of the following standards:
ANSI C63.4-2009
ANSI/TIA/EIA-603-C-2004
3GPP TS 25.141, version 8.5.0
CFR 47 part 2, October 1st , 2011
CFR 47 part 22 Subpart H, October 1st, 2011
RSS-132 Issue 2
RSS-Gen Issue 3

Appendix 1

Measurement equipment

Measurement equipment	Calibration Due	SP number
Test site Tesla	2014-01	503 881
R&S FSIQ 40	2012-07	503 738
R&S FSQ 40	2012-07	504 143
R&S ESI 26	2012-07	503 292
Control computer with R&S software EMC32 version 8.52.0	-	503 479
High pass filter	2012-07	504 199
High pass filter	2013-01	901 373
High pass filter	2012-07	503 739
High pass filter	2012-07	503 740
RF attenuator	2012-07	504 159
RF attenuator	2012-07	900 233
Boonton RF Peak power meter/analyzer	2012-11	503 144
Boonton Power sensor 56518-S/4	2012-11	503 145
Chase Bilog Antenna CBL 6111A	2013-10	503 182
EMCO Horn Antenna 3115	2014-01	502 175
Std.gain horn FLANN model 20240-20	-	503 674
MITEQ Low Noise Amplifier	2012-07	503 285
Temperature cabinet	-	503 360
Multimeter Fluke 87	2012-05	502 190
Testo 625, Temperature and humidity meter	2012-06	504 188
Testo 635 Temperature and humidity meter	2012-05	504 203

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP-QD 10885”. The measurement uncertainties can be found in the table below. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).

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 2012-03-21.

Manufacturer's representative

Christer Gustavsson, Ericsson AB

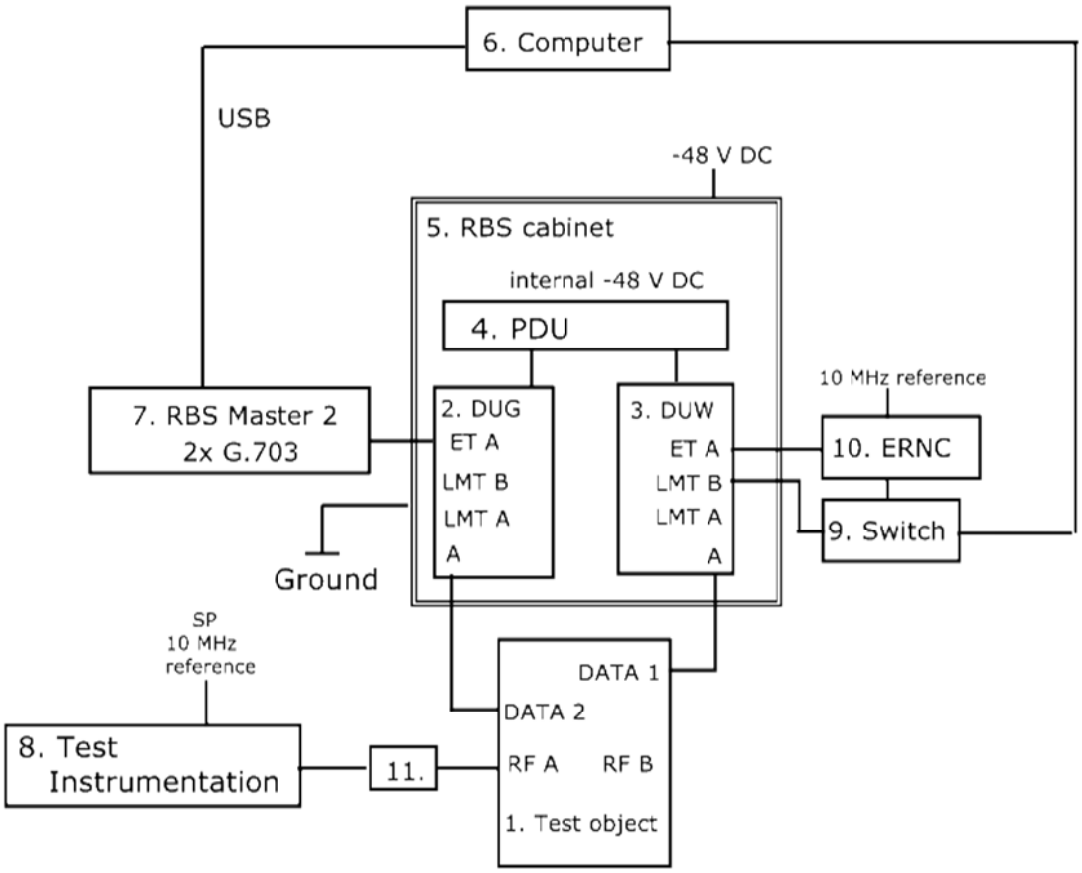
Test engineers

Tomas Lennhager, Andreas Johnson, Tomas Isbring, Jörgen Wassholm and Martin Theorin

Test participant

Samir Catic, Ericsson AB (Partly present)

Test set-up conducted measurements TX



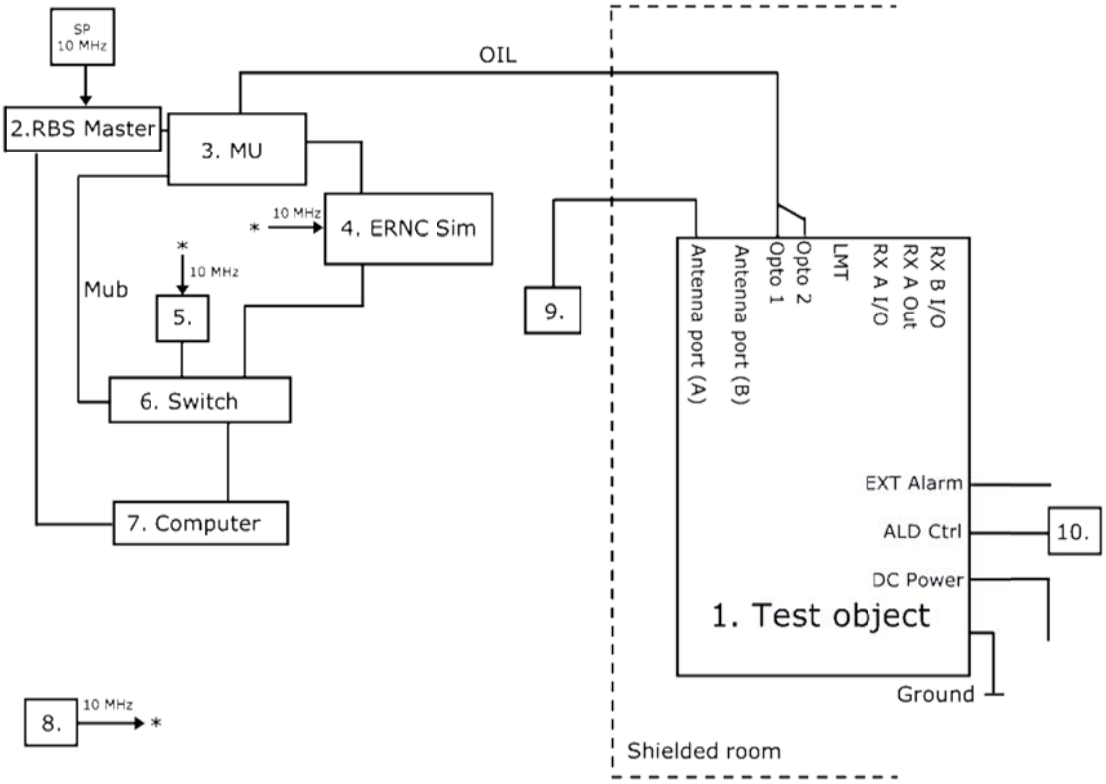
Test object

1. RRUS 01 B5, KRC 118 70/2, revision R1C, S/N: C825514621
(FCC ID:TA8AKRC11870-2 / IC:287AB-AS118702) with preinstalled software (PIS) CXP9017316/ 1_R25NS

Functional test equipment

2. DUG 20 01 KDU 137 569/1 Rev R2B, S/N: C823659455
3. DUW 30 01 KDU 127 161/3 Rev R4C, S/N: C824609611
4. PDU 02 01, BMG 980336/4, R2A, (S)BJ31528316
5. RBS 6201 cabinet, BAMS 1000778792
6. Computer, BAMS 1001052042
7. RBS Master, 2E LPY 107 1007/3, BAMS 1000878432
8. SP test instrument according measurement equipment list
9. Switch Netgear FS726T
10. ERNC, BAMS – 1000759880
11. RF attenuator

Test set-up radiated measurements



Test object

1. RRUS 01 B5, KRC 118 70/2, revision R1C, s/n: C823924709
(FCC ID:TA8AKRC11870-2 / IC:287AB-AS118702) with preinstalled software (PIS) CXP9017316/ 1_R25NS

Functional test equipment

2. RBS Master 2E, LPY 107 1007/3, rev R1C/A BAMS – 1000878432
3. Main Unit: RBS 6601, see details in the table below
4. ERNC SIM 127
5. NTP server, Symmetricom, BAMS – 1000714181
6. Fast Ethernet switch, Netgear FS726 & Netgear GSM7212
7 Computer HP Elitbook, BAMS – 1001052042
8. 10 MHz reference, Symmetricom model 8040, BAMS – 1000714186
9. Terminator
10. RET – Remote Electrical Tilt unit

RBS 6601 Main Units

Product name	Product number	R-state	Serial number
PDU 02 01	BMG 980 336/4	R2A	BJ31534775
SUP 6601	1/BFL 901 009/1	R3B	BR81262561
DUG 20 01	KDU 137 569/1	R2B	C823659455
DUMMY	SXK 109 8971/1	R1A	-
SUP 6601	1/BFL 901 009/1	R2A	BR80879339
DUW 30 01	KDU 127 161/3	R4C	C824609611

Test object interfaces	Type of port:
Power configuration: -48 VDC	DC Power
Ground wire	Ground
Antenna port RF A, combined TX/RX, female 7/16 connector	Antenna
Antenna port RF B, RX only, female 7/16 connector	Antenna
LMT, for maintenance only	Telecom
Cross connect RX A, not supported, omitted in set-up drawings above	Antenna
Cross connect RX B, not supported, omitted in set-up drawings above	Antenna
RXA CO-site, not supported, omitted in set-up drawings above	Antenna
Data 1, connected to DUW port A	Telecom
Data 2, connected to DUG port A	Telecom
EXT Alarm, shielded multi-wire	Signal
ALD Ctrl, shielded multi-wire	Signal

RBS software

WCDMA

Software	Revision
CXP 901 8350/1	R4A02

GSM

Software	Revision
CXP104 0013_07 (g12a1g7_r65G)	R65G

RF power output measurements according to 47 CFR 2.1046, 22.913 / RSS-132 4.4

Date	Temperature	Humidity
2012-04-11	22 °C ± 3 °C	23 % ± 5 %
2012-04-12	22 °C ± 3 °C	21 % ± 5 %
2012-04-13	19 °C ± 3 °C	33 % ± 5 %

Test set-up and procedure

The test object was connected to a signal analyzer measuring peak and RMS output power in CDF mode. A resolution bandwidth of 50 MHz was used.

Measurement equipment	SP number
R&S FSQ 40	504 143
RF attenuator	504 159
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results

Diagram 1: Configuration 1
Diagram 2: Configuration 2
Diagram 3: Configuration 3
Diagram 4: Configuration 4
Diagram 5: Configuration 5

Limits

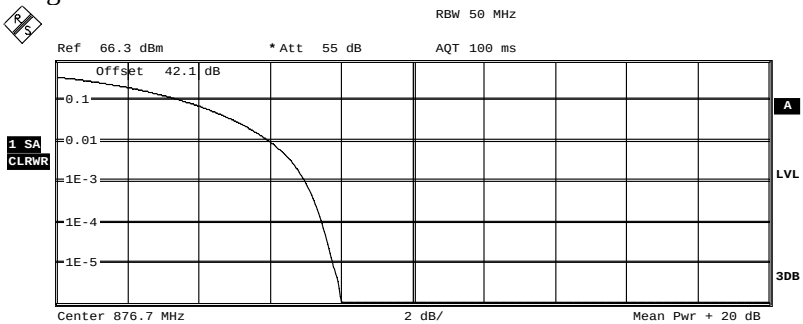
According to CFR 47/ RSS there are no conducted limits at the antenna connector.

CFR § 22.913/ SRSP-503 5.1: The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts (57 dBm).

RSS-132: The transmitter output power shall not exceed the limits given in SRSP-503

Appendix 2

Diagram 1:

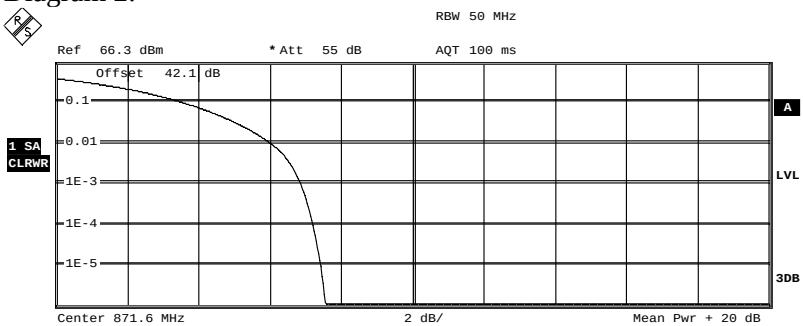


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.31 dBm
Peak	55.58 dBm
Crest	8.27 dB
10 %	3.56 dB
1 %	5.96 dB
.1 %	6.99 dB
.01 %	7.44 dB

Date: 11.APR.2012 16:13:30

Diagram 2:



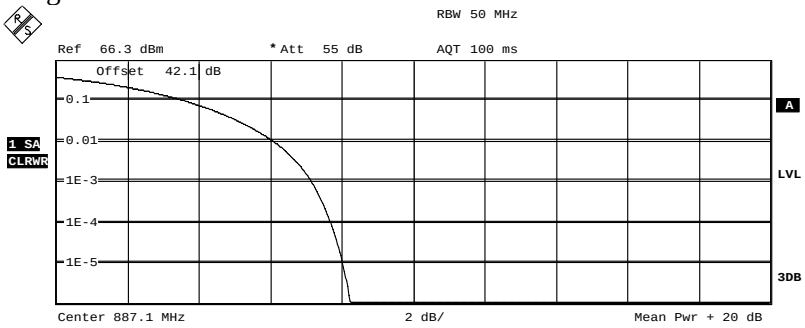
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.41 dBm
Peak	55.15 dBm
Crest	7.74 dB
10 %	3.56 dB
1 %	5.99 dB
.1 %	6.86 dB
.01 %	7.21 dB

Date: 12.APR.2012 08:19:19

Appendix 2

Diagram 3:

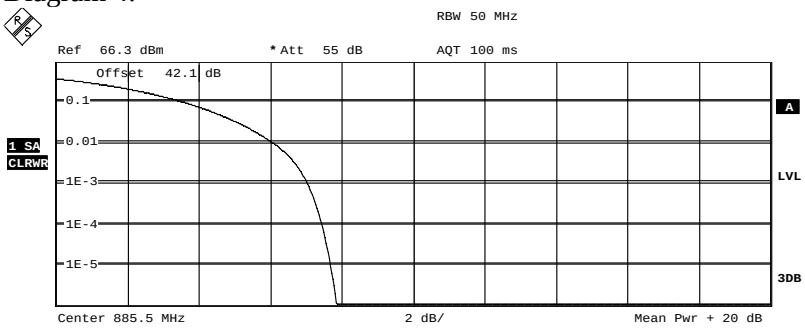


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.01 dBm
Peak	55.38 dBm
Crest	8.36 dB
10 %	3.62 dB
1 %	6.09 dB
.1 %	7.15 dB
.01 %	7.69 dB

Date: 12.APR.2012 09:30:42

Diagram 4:



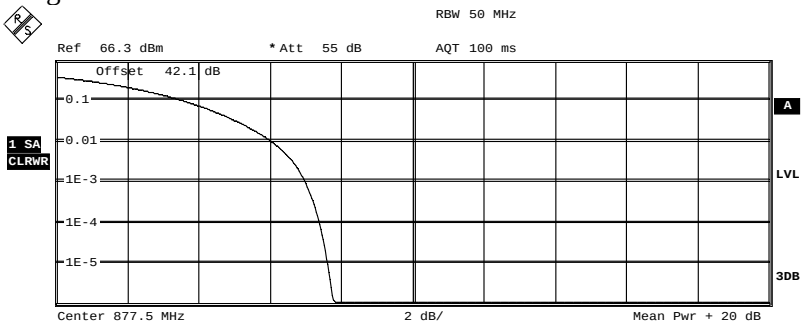
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.27 dBm
Peak	55.23 dBm
Crest	7.97 dB
10 %	3.62 dB
1 %	6.06 dB
.1 %	7.02 dB
.01 %	7.44 dB

Date: 12.APR.2012 11:59:56

Appendix 2

Diagram 5:



Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.42 dBm
Peak	55.36 dBm
Crest	7.94 dB
10 %	3.59 dB
1 %	6.03 dB
.1 %	6.99 dB
.01 %	7.37 dB

Date: 12.APR.2012 13:20:42

Conducted spurious emission measurements according to 47 CFR 2.1051, 22.917 / RSS-132 4.5

Date	Temperature	Humidity
2012-04-11	22 °C ± 3 °C	23 % ± 5 %
2012-04-12	22 °C ± 3 °C	21 % ± 5 %
2012-04-13	19 °C ± 3 °C	33 % ± 5 %

Test set-up and procedure

The measurements were made with a resolution bandwidth of 1 MHz instead of 100 kHz as RSS-132 specifies a resolution bandwidth of 1 MHz for equipment with an emission bandwidth of ≥4 MHz. The output was connected to a spectrum analyzer with the RMS detector activated.

Measurement equipment	SP number
R&S FSQ	504 143
RF attenuator	504 159
High pass filter	504 199
High pass filter	503 739
RF attenuator	900 691
High pass filter	503 740
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

Diagram 1:a-e Configuration 1
Diagram 2:a-e Configuration 2
Diagram 3:a-e Configuration 3
Diagram 4:a-e Configuration 4
Diagram 5: a-e Configuration 5

Remark

The emission at 9 kHz on the plots was not generated by the test object. A complementary measurement with a smaller RBW showed that it was related to the LO feed-through.

The highest internal frequency as declared by the client was 2.4576 GHz, thus the choice of the upper frequency boundary was set to 10x2.5 GHz = 25 GHz for emission measurements.

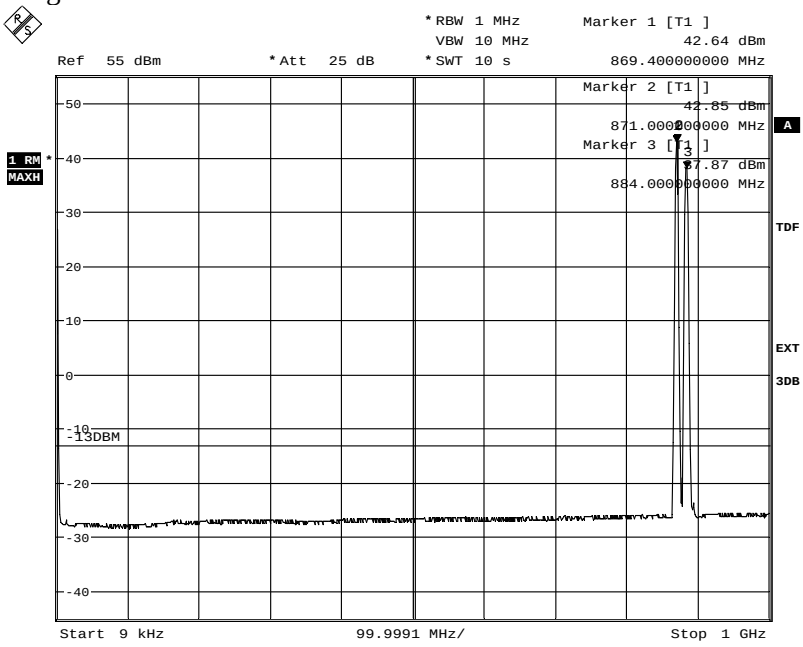
Limits

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 per 1 MHz RBW.

Complies?	Yes

Appendix 3

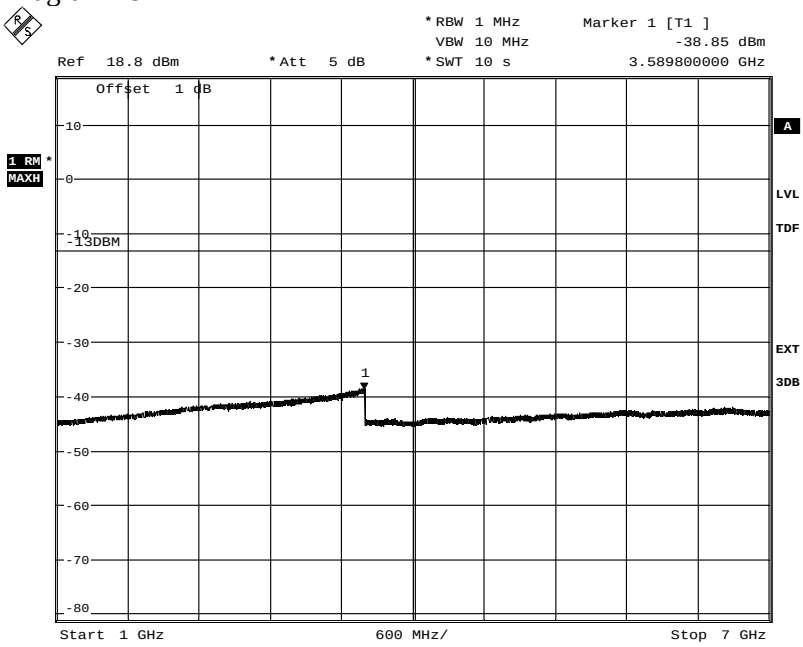
Diagram 1a



Date: 11.APR.2012 15:57:23

The emissions around the carriers are within the operating frequency band

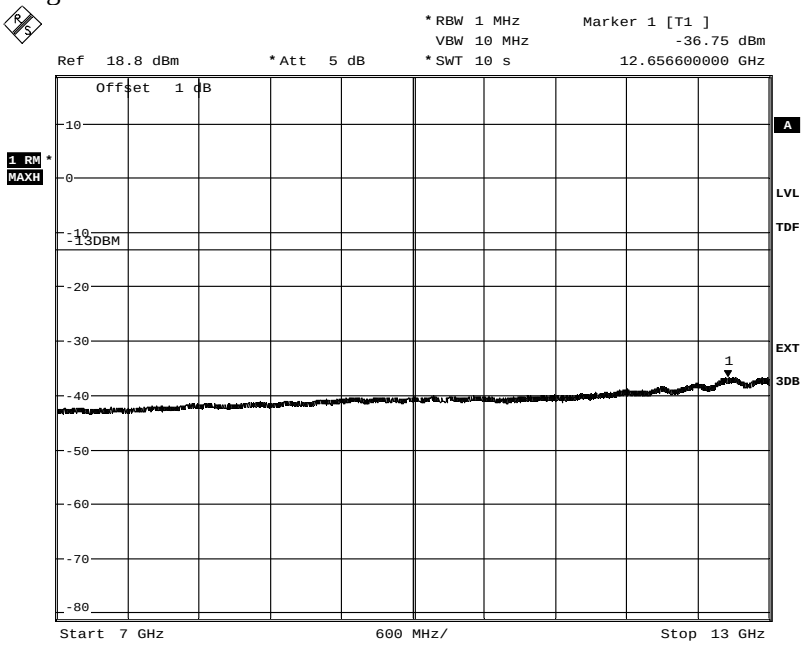
Diagram 1b



Date: 11.APR.2012 16:03:37

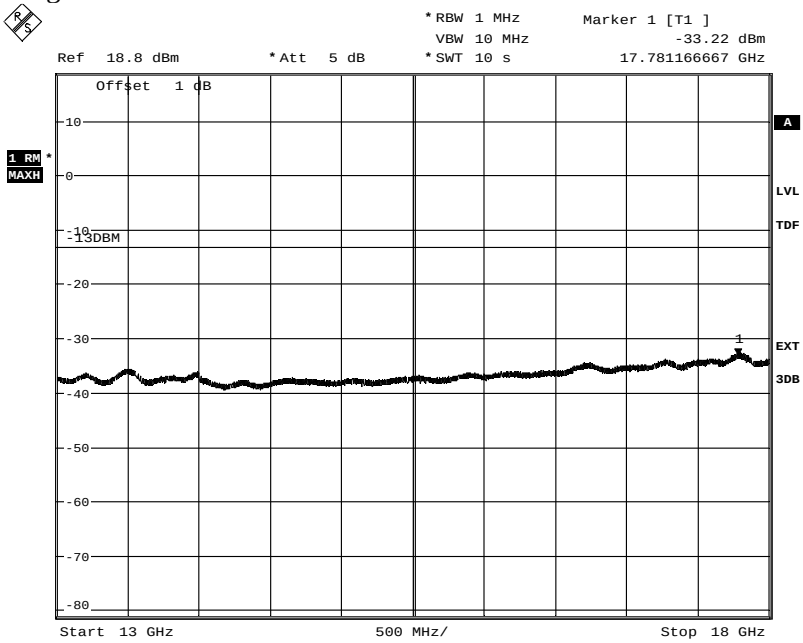
Appendix 3

Diagram 1c



Date: 11.APR.2012 16:04:37

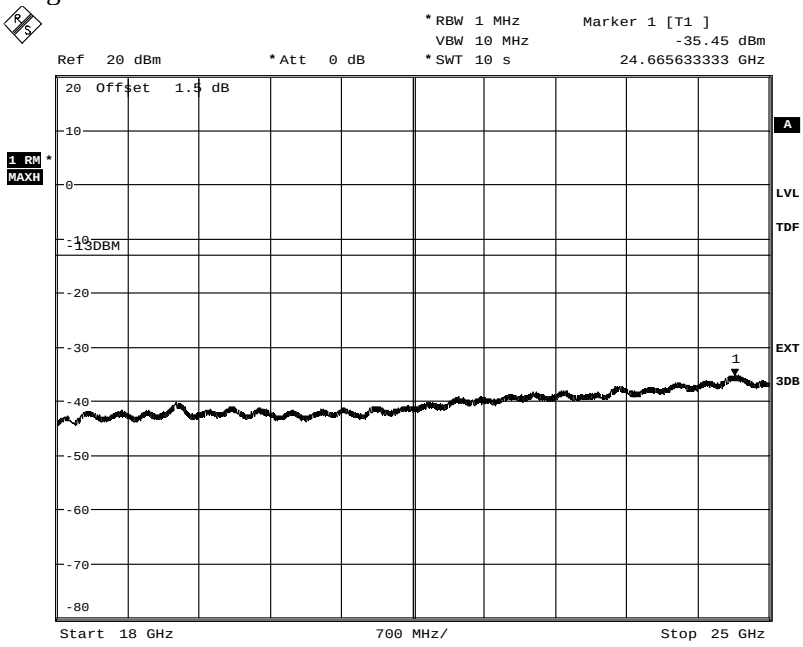
Diagram 1d



Date: 11.APR.2012 16:06:37

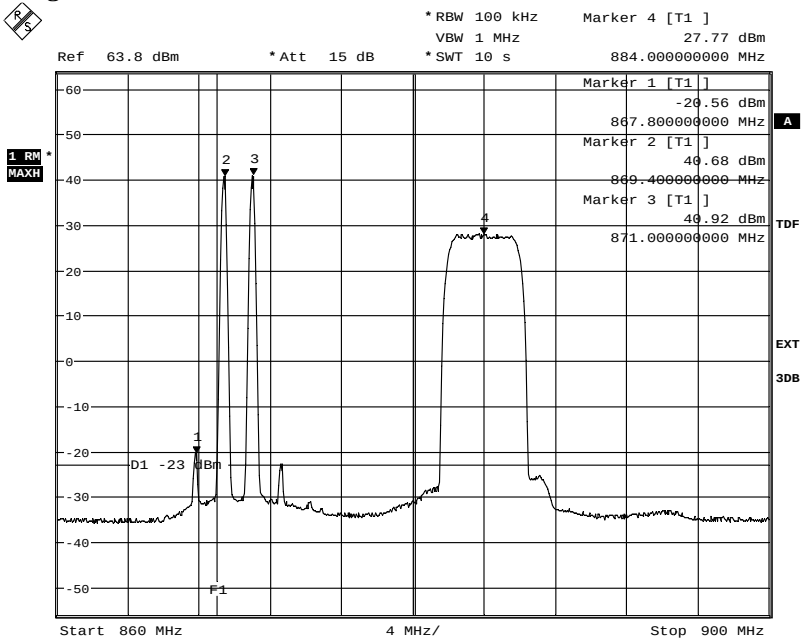
Appendix 3

Diagram 1e



Date: 12.APR.2012 08:00:09

Diagram 1f

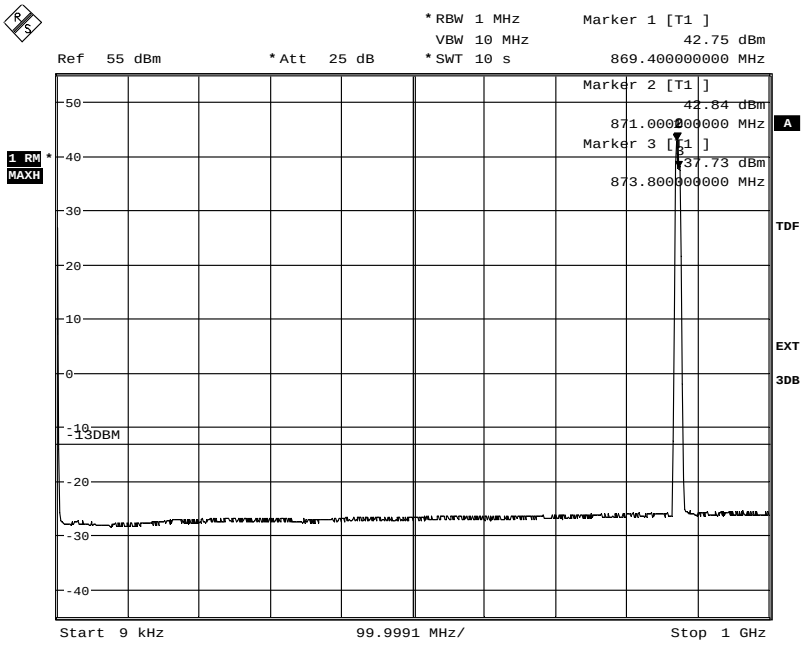


Date: 11.APR.2012 16:15:26

The emission at 867.8 MHz was -16.59 dBm measured with the channel power method with 1 MHz channel bandwidth.

Appendix 3

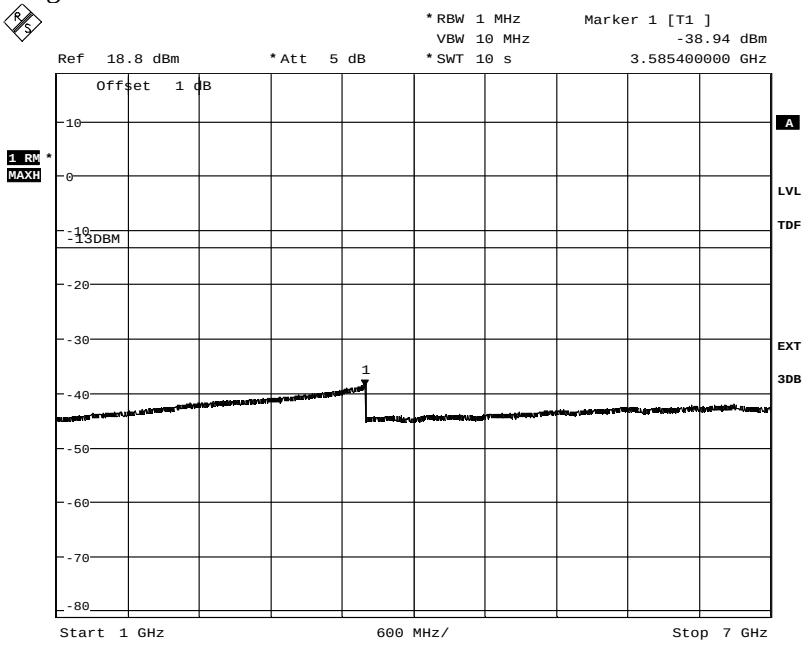
Diagram 2a



Date: 12.APR.2012 10:20:17

The emissions around the carriers are within the operating frequency band

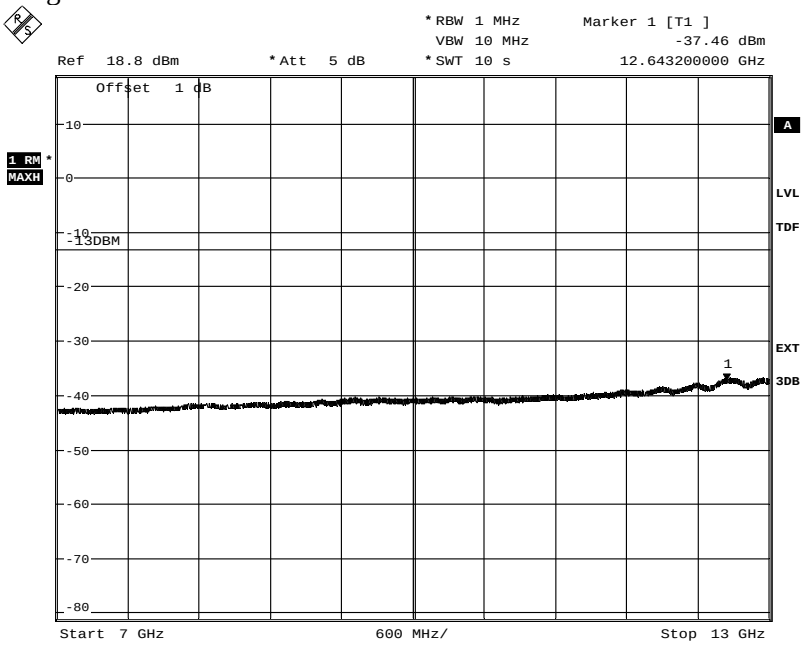
Diagram 2b



Date: 12.APR.2012 08:26:05

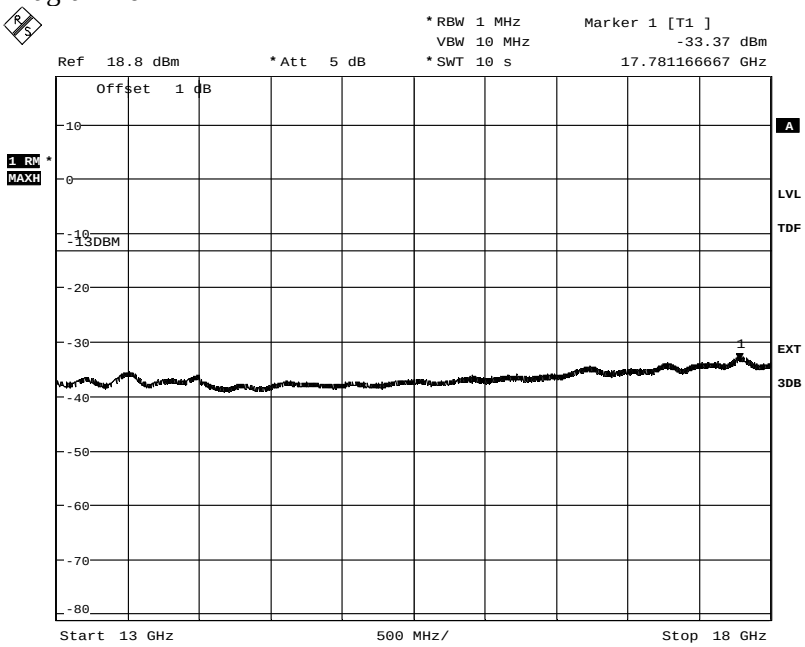
Appendix 3

Diagram 2c



Date: 12.APR.2012 08:28:43

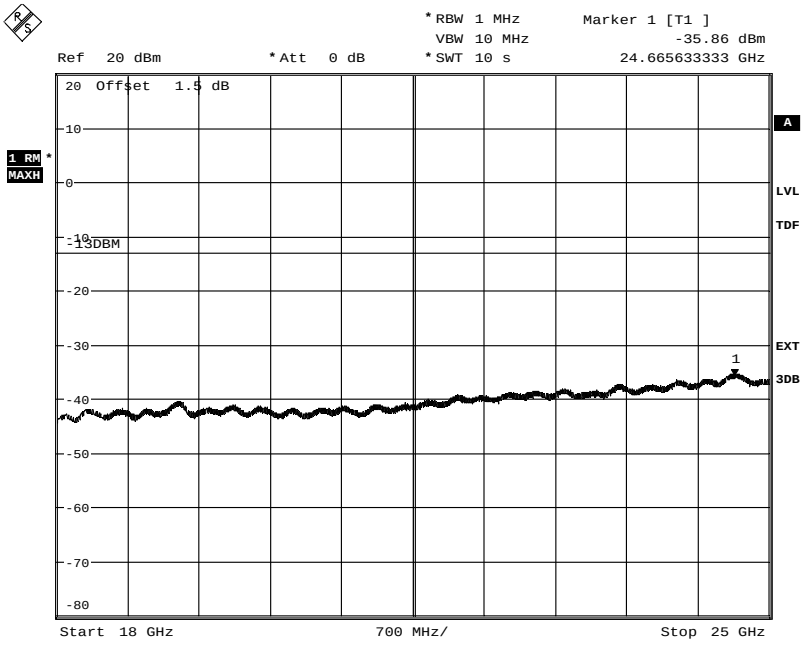
Diagram 2d



Date: 12.APR.2012 08:30:55

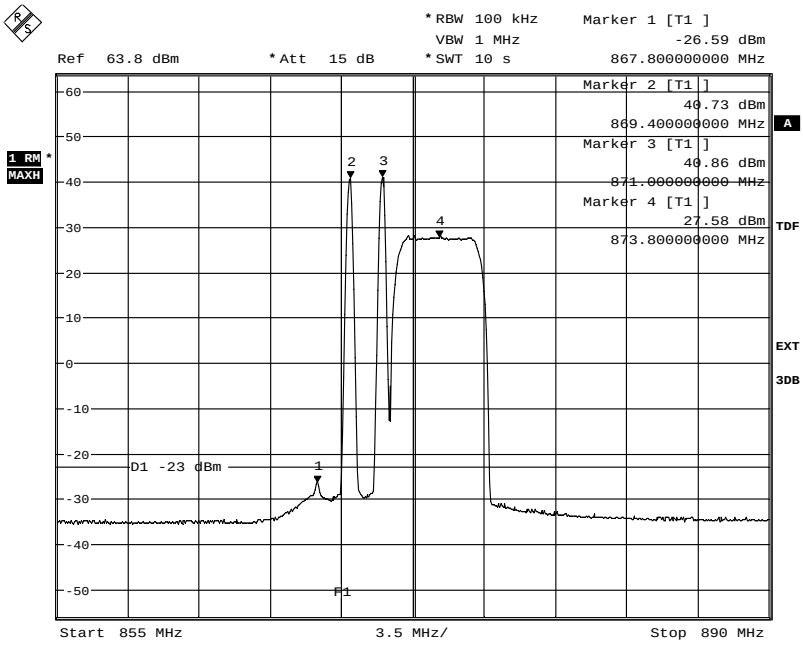
Appendix 3

Diagram 2e



Date: 12.APR.2012 07:53:03

Diagram 2f

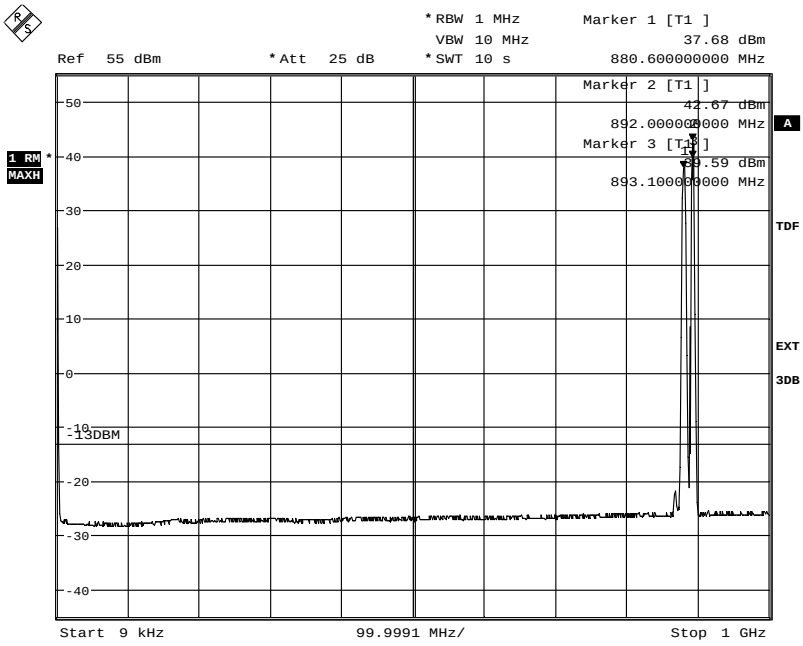


Date: 12.APR.2012 08:11:57

The emission at 867.8 MHz was -20.98 dBm measured with the channel power method with 1 MHz channel bandwidth.

Appendix 3

Diagram 3a



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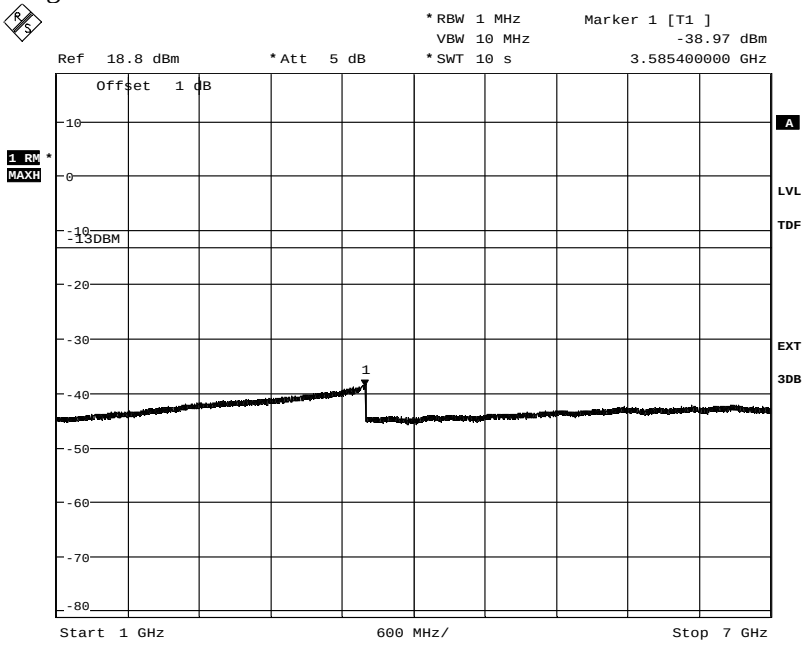
The emissions around the carriers are within the operating frequency band

Diagram 3b



Date: 12.APR.2012 09:39:38

Appendix 3

Diagram 3c

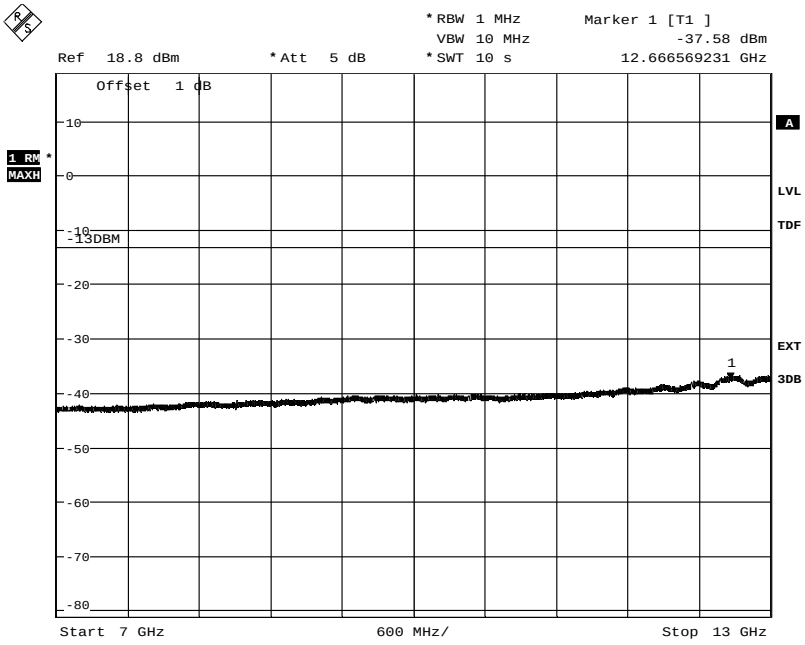


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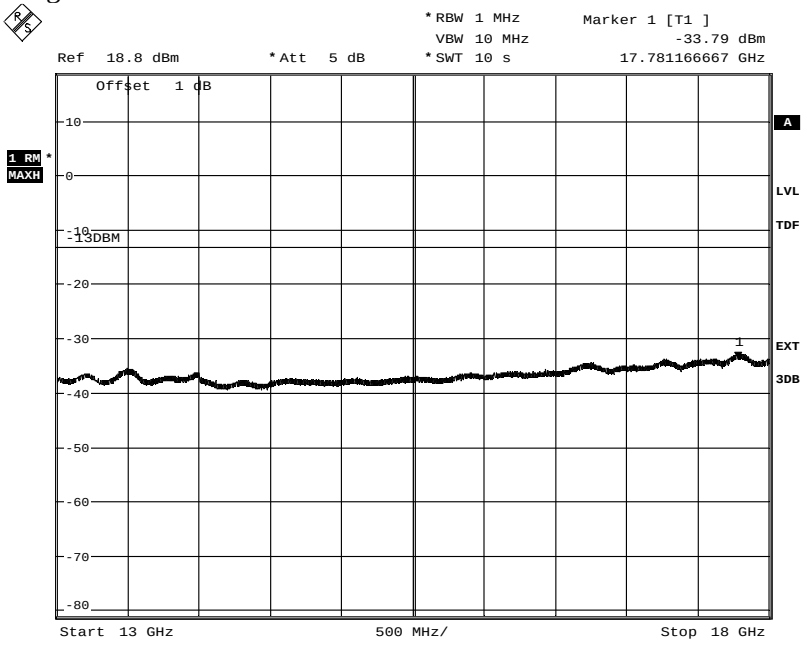
Diagram 3d



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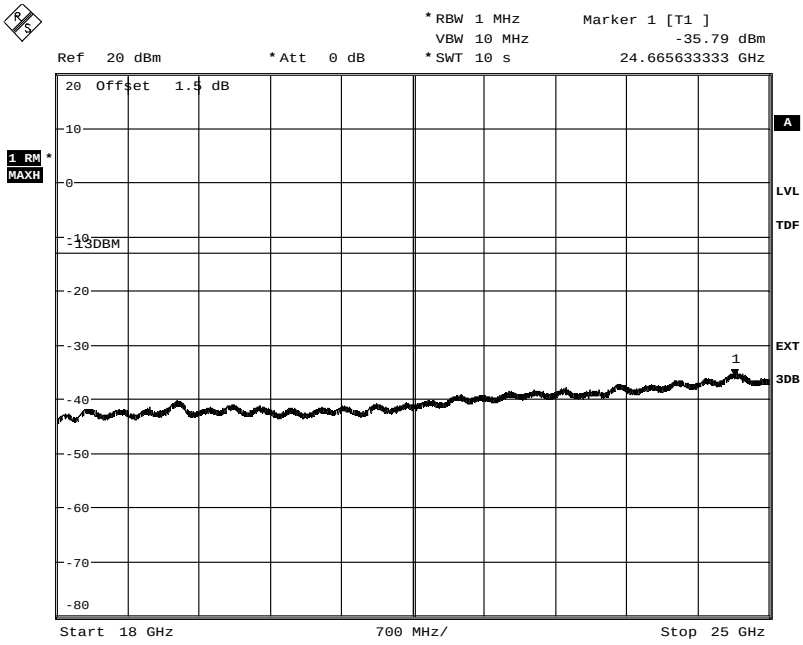
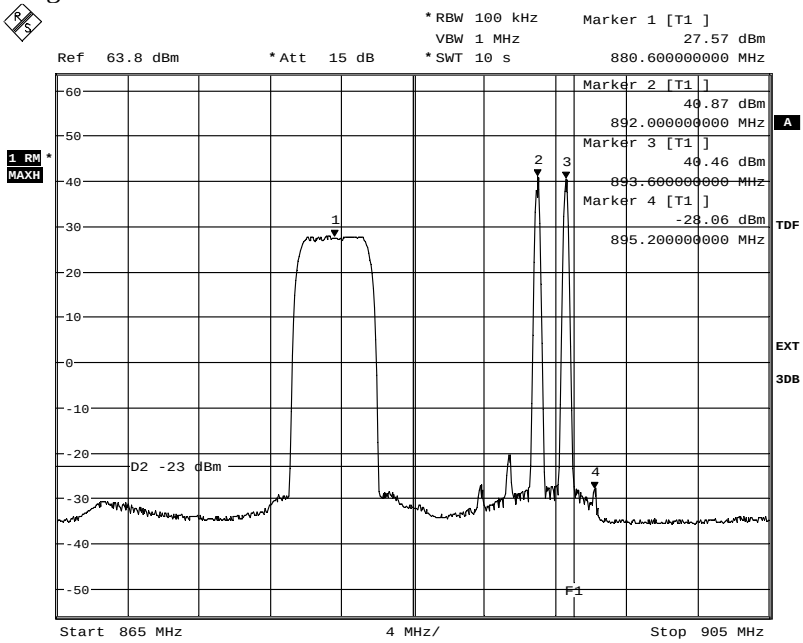
Appendix 3

Diagram 3e



Date: 12.APR.2012 09:50:49

Diagram 3f

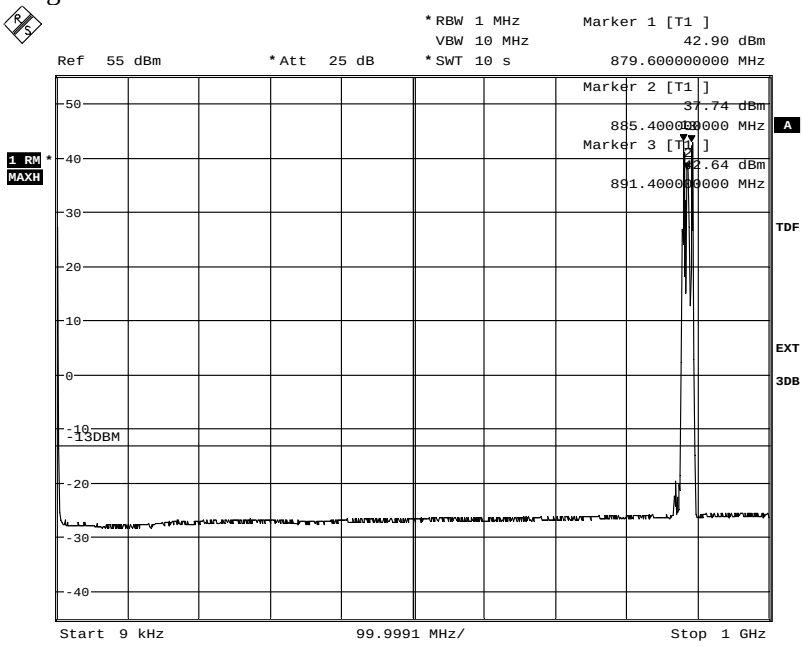


Date: 12.APR.2012 09:25:22

The emission at 895.2 MHz was -23.02 dBm measured with the channel power method with 1 MHz channel bandwidth

Appendix 3

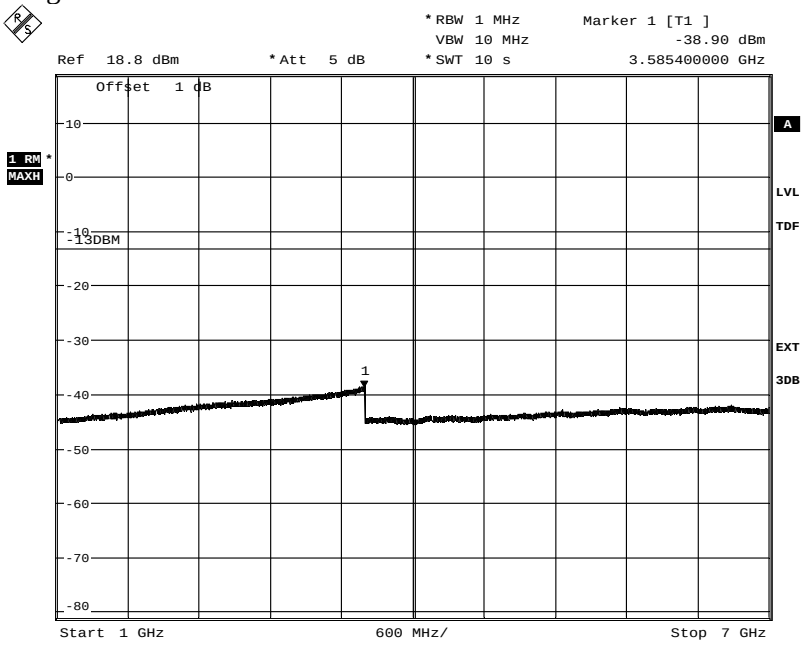
Diagram 4a



Date: 12.APR.2012 11:00:37

The emissions around the carriers are within the operating frequency band

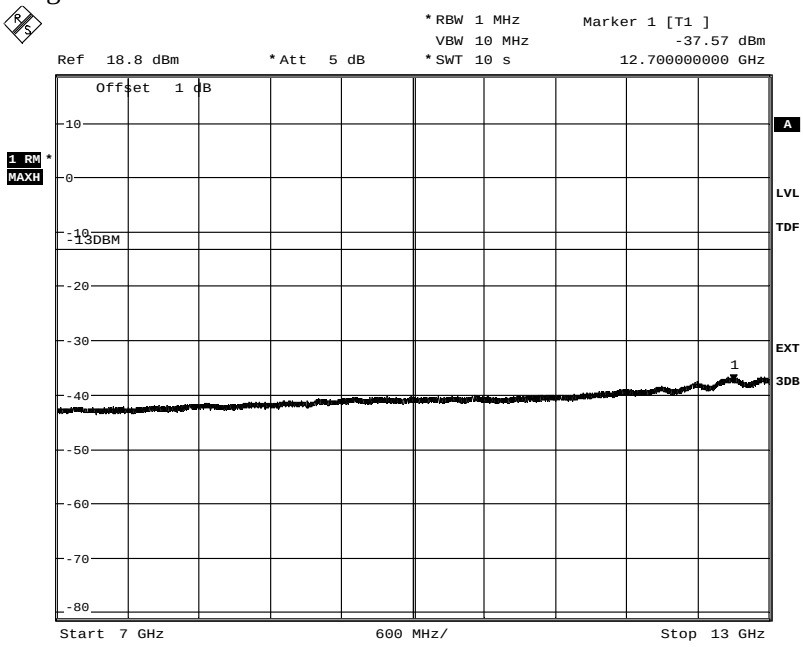
Diagram 4b



Date: 12.APR.2012 12:02:58

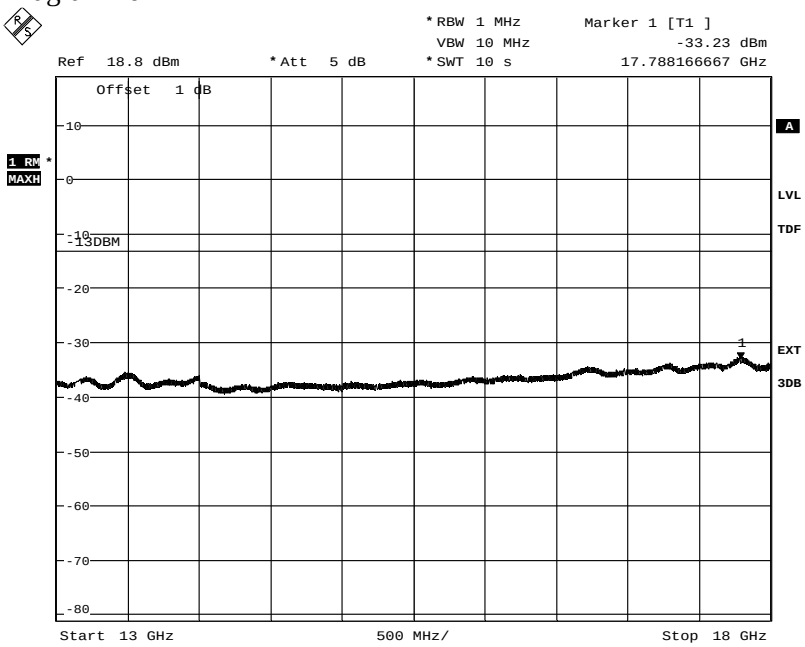
Appendix 3

Diagram 4c



Date: 12.APR.2012 12:06:14

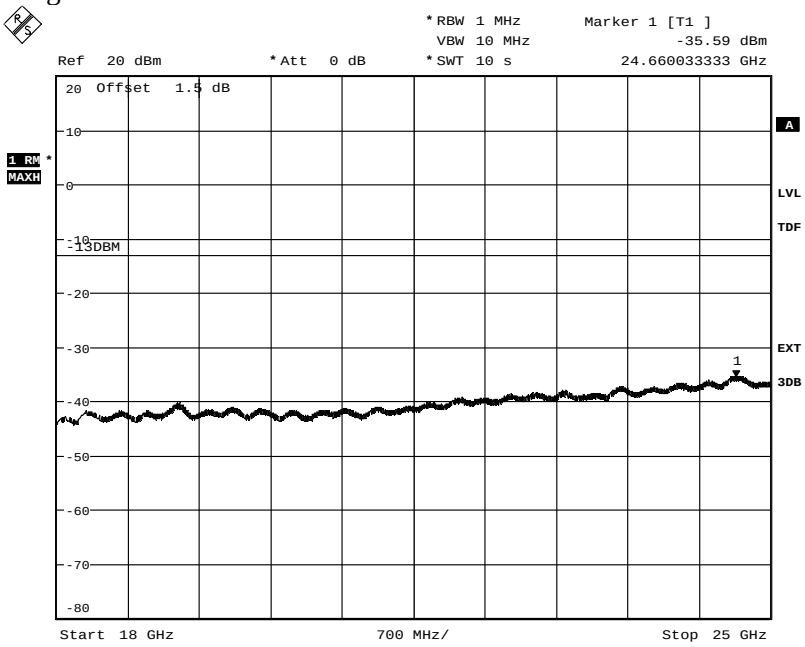
Diagram 4d



Date: 12.APR.2012 12:08:17

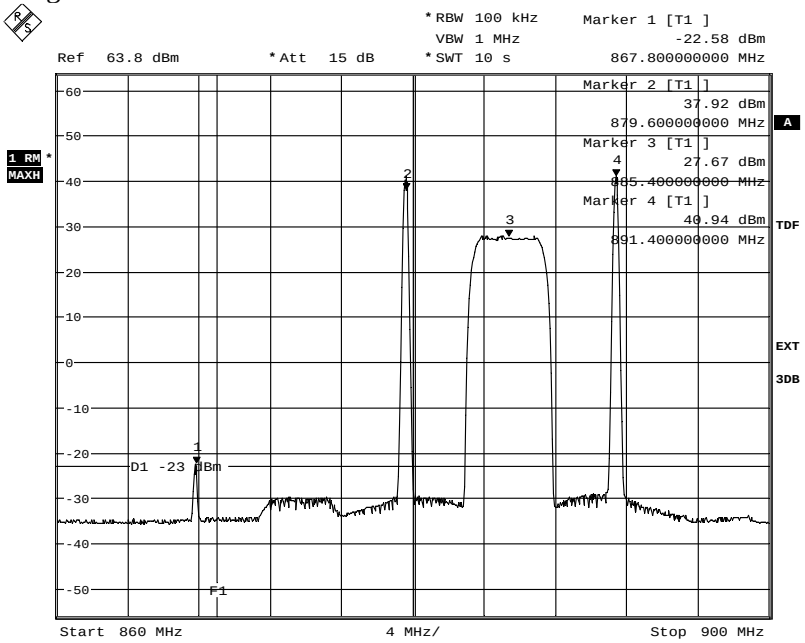
Appendix 3

Diagram 4e



Date: 12.APR.2012 12:11:07

Diagram 4f

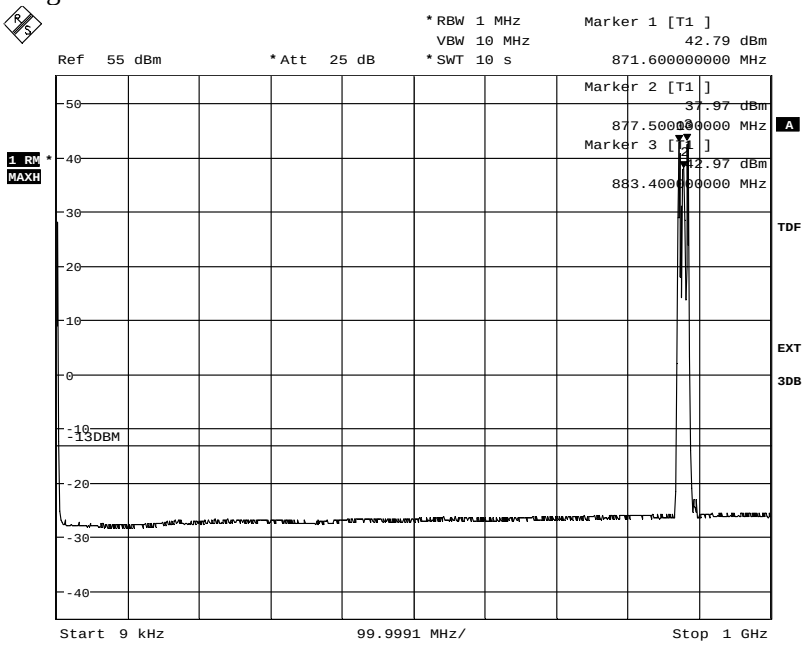


Date: 12.APR.2012 10:54:52

The emission at 867.8 MHz was -20.41 dBm measured with the channel power method with 1 MHz channel bandwidth

Appendix 3

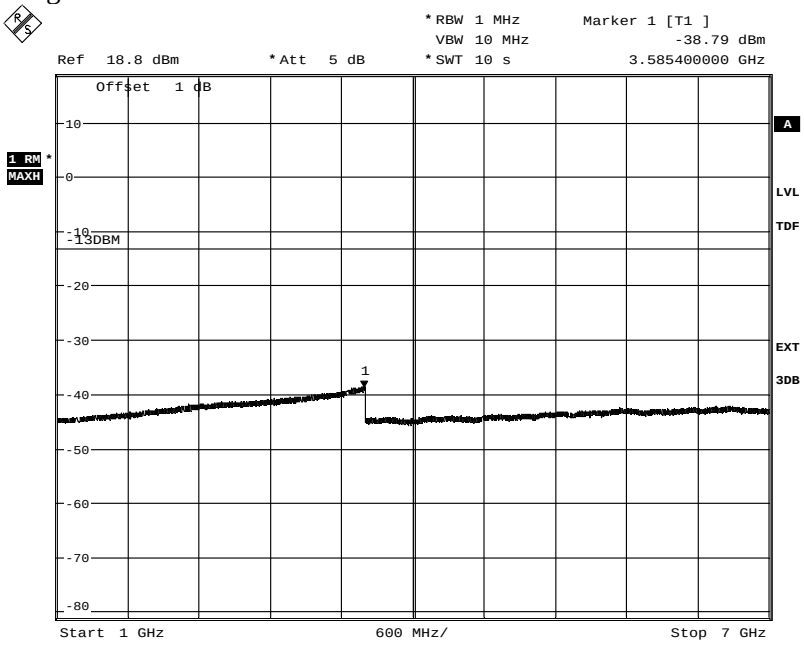
Diagram 5a



Date: 12.APR.2012 13:11:00

The emissions around the carriers are within the operating frequency band

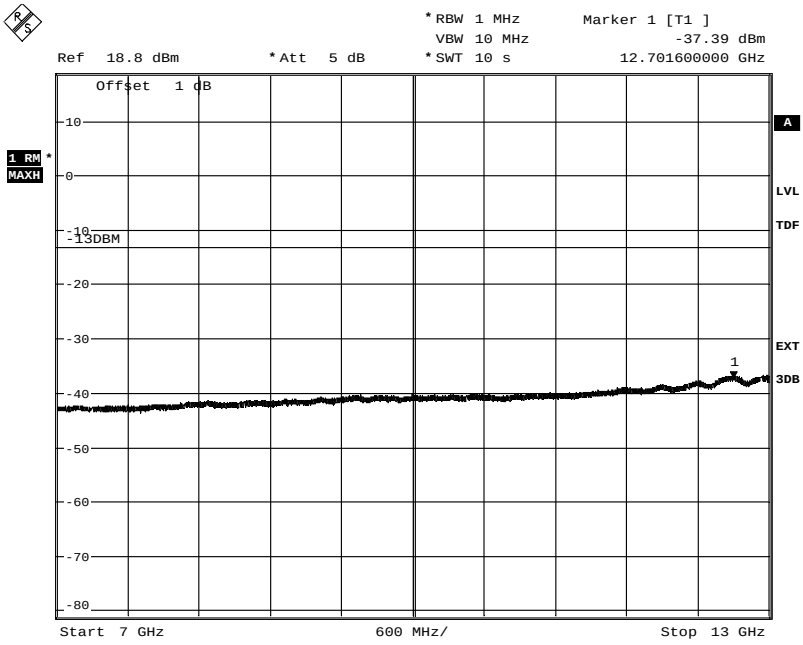
Diagram 5b



Date: 12.APR.2012 13:13:36

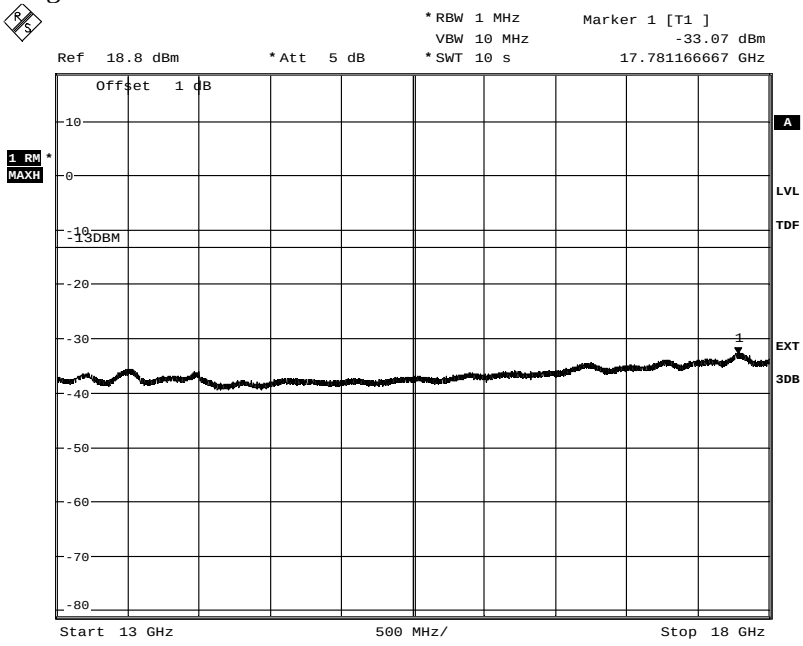
Appendix 3

Diagram 5c



Date: 12.APR.2012 13:16:14

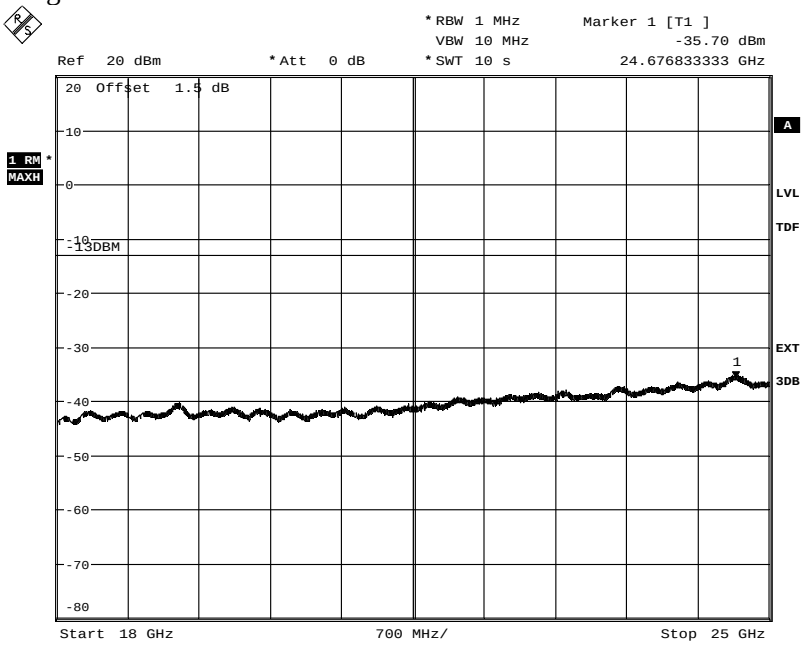
Diagram 5d



Date: 12.APR.2012 13:18:17

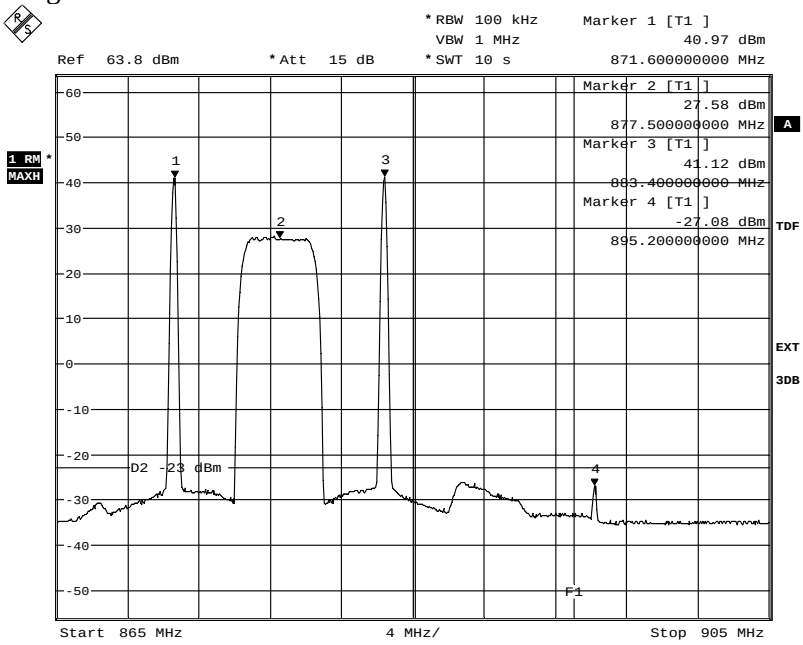
Appendix 3

Diagram 5e



Date: 12.APR.2012 13:24:03

Diagram 5f



Date: 12.APR.2012 13:01:20

The emission at 895.2 MHz was -22.88 dBm measured with the channel power method with 1 MHz channel bandwidth

Field strength of spurious radiation measurements according to CFR 47 §22.917 / IC RSS-132 4.5

Date	Temperature	Humidity
2012-03-27	23 °C ± 3 °C	32 % ± 5 %
2012-03-28	23 °C ± 3 °C	28 % ± 5 %

Test set-up and procedure

The test sites are listed at FCC, Columbia with registration number: 93866. The test site complies with RSS-Gen, Industry Canada file no. 3482A-1.

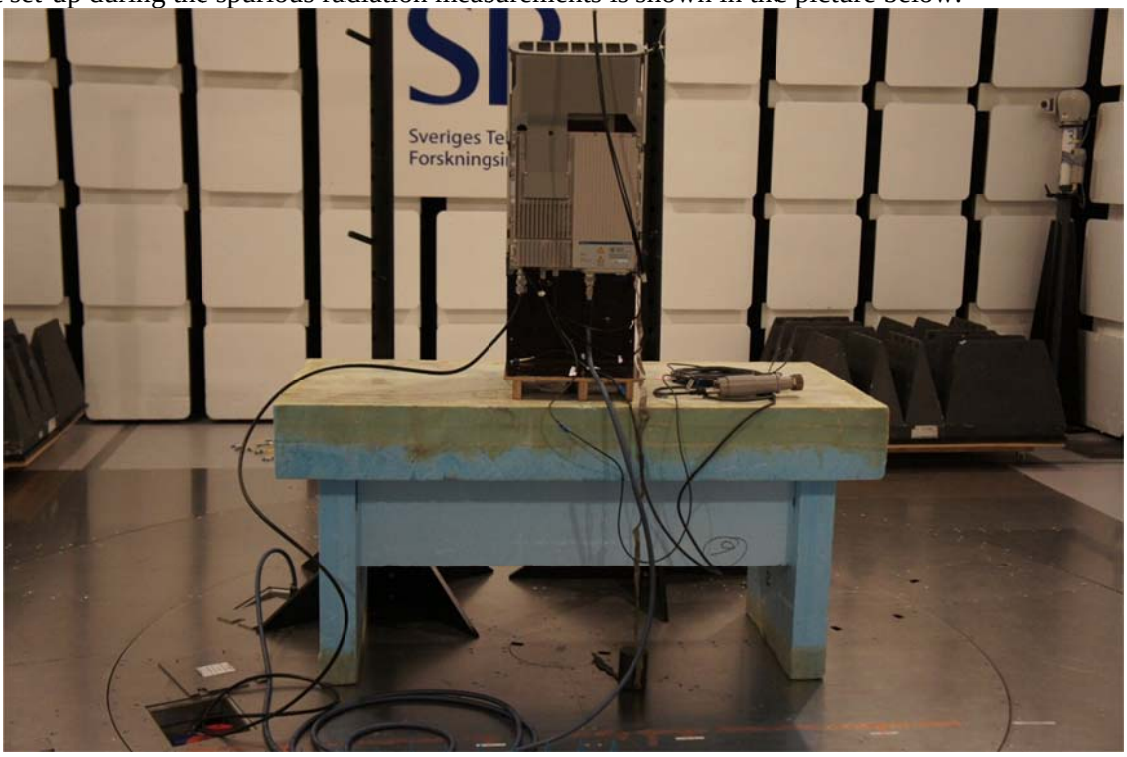
The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 18 GHz and 1m in the frequency range 18 - 25 GHz.

In the frequency range 30 MHz - 25 GHz the measurement was performed in power 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. The pre-measurement was first performed with peak detector. The EUT was measured in eight directions and with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
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 the standard.

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



Measurement equipment

Measurement equipment	SP number
Test site Tesla	503 881
R&S ESI 26	503 292
Control computer	503 479
Software: R&S EMC32, ver. 8.52.0	503 745
Chase Bilog antenna CBL 6111A	503 182
Miteq, Low Noise Amplifier	503 285
EMCO Horn Antenna 3115	502 175
Standard gain antenna 20240-20	503 674
High pass filter, Wainright 1-18 GHz	901 373
Testo 625 temperature and humidity meter	504 188

Tested configurations:

Configuration 1
Configuration 2
Configuration 3

Results, representing worst case

Diagram 1:a-c Configuration 2

Results

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-25 000	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

§22.917 and RSS-132 6.5

The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least 43 + 10 log P dB.

Complies?	Yes

Diagram 1a

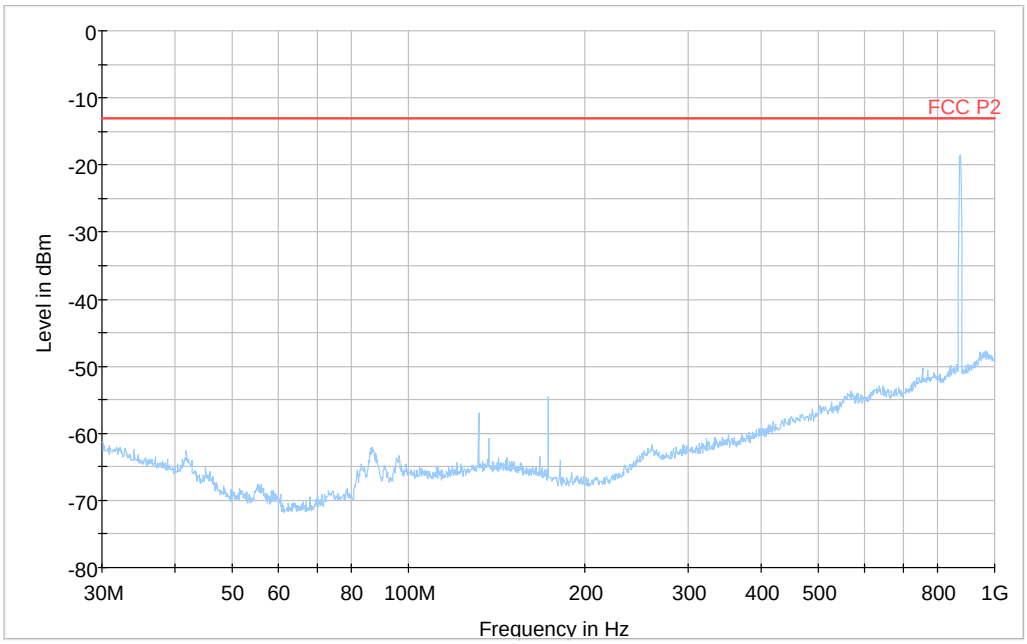
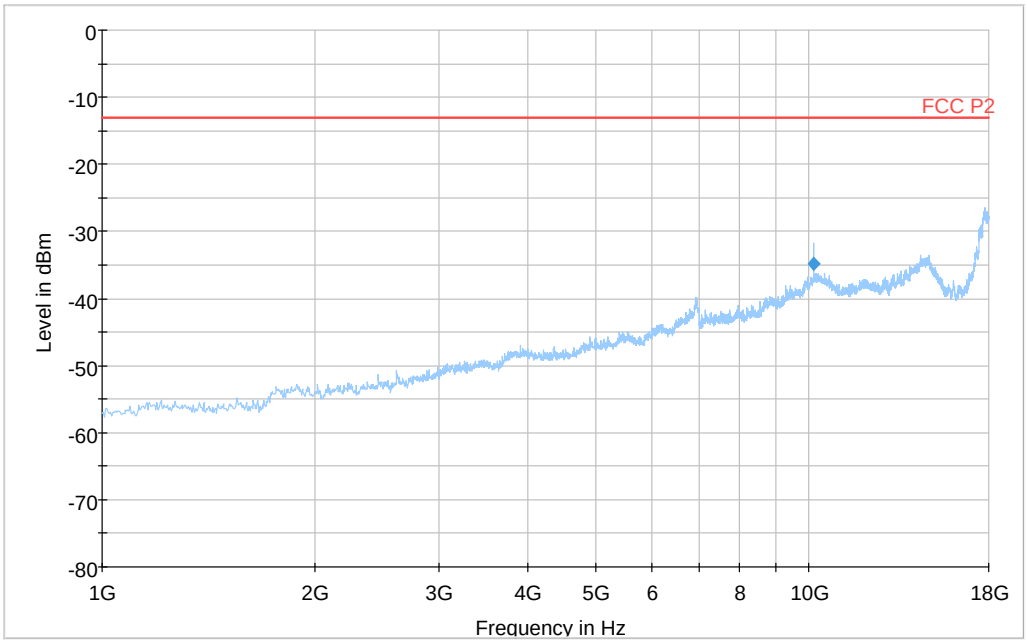


Diagram 1b

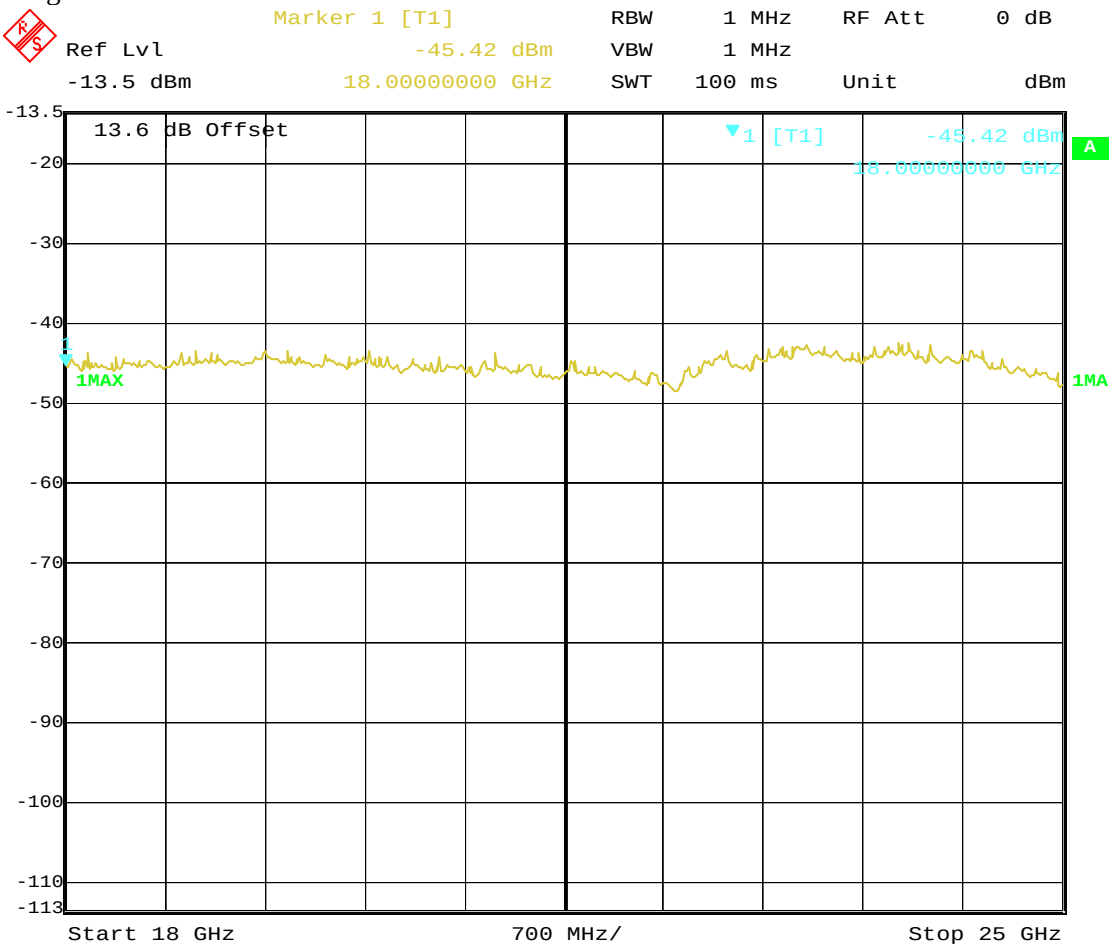


Final RMS Result

Frequency (MHz)	RMS (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)
10181.349	-34.8	5000.0	1000.000	147.0	V	8.0	-71.7	21.8	-13.0

Appendix 4

Diagram 1c

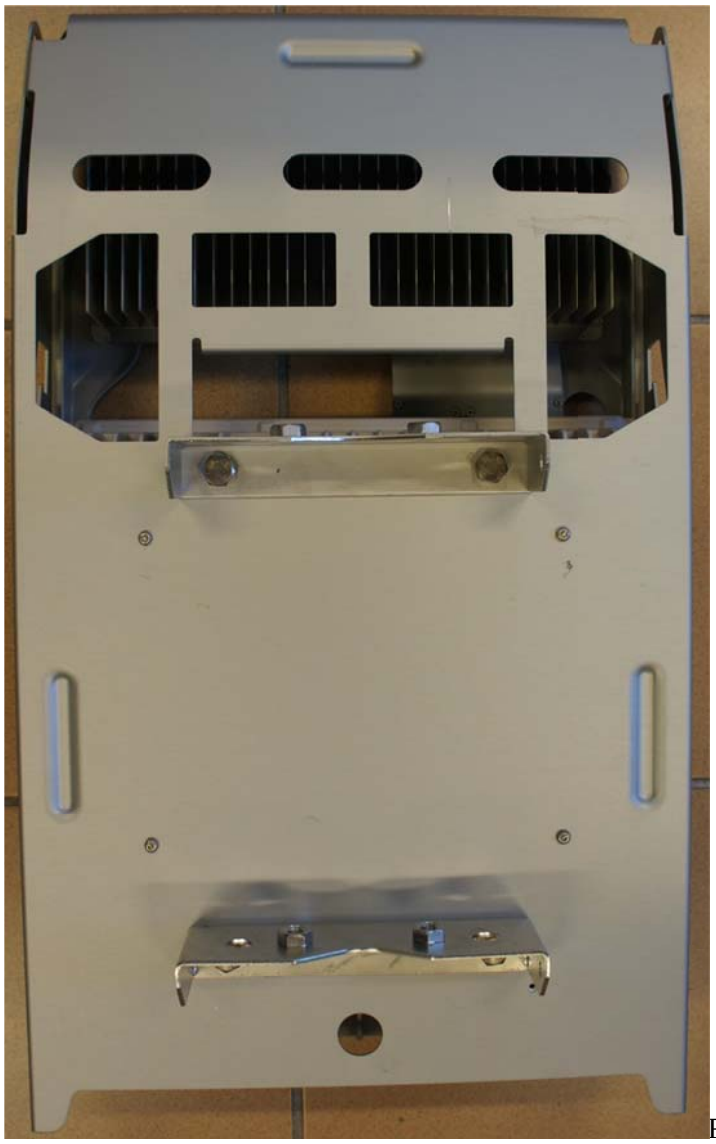


External photos

Photos show the sample used for conducted measurements

Front Side

Appendix 5



Rear Side

Appendix 5

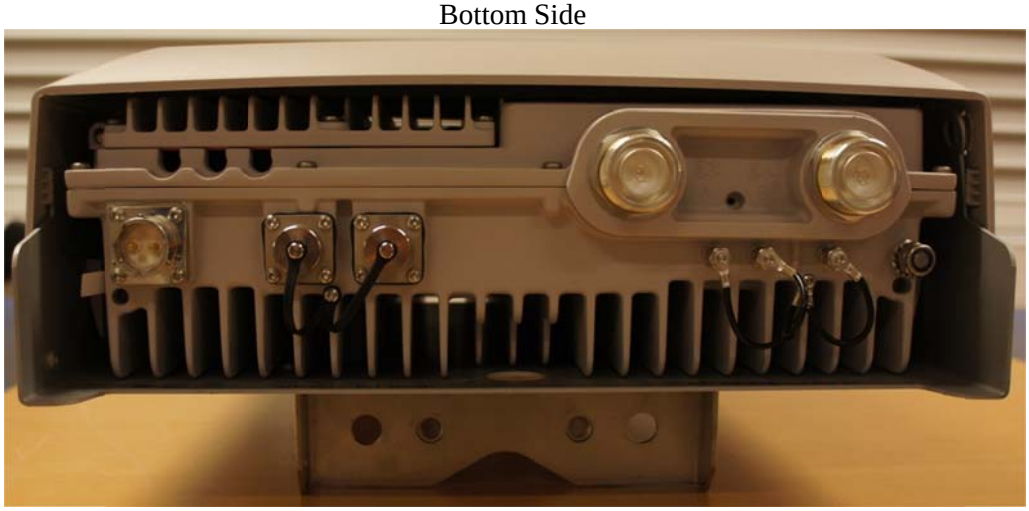
Left side

Appendix 5

Right side

Appendix 5

Bottom Side



Top Side