REPORT

Issued by a FCC listed Laboratory Reg. no. 93866.
The test site complies with RSS-Gen, IC file no. 3482A-1
issued by an Accredited Testing Laboratory

ISO/IEC 17025

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Radio measurements on RRUS E2 B29 717-728 MHz radio equipment with FCC ID: TA8AKRC161408-1 and IC: 287AB-AS1614081

(8 appendices)

Test object

Product name: RRUS E2 B29
Product number: KRC 161 408/1, R1A

Summary

See appendix 1 for general information and appendix 8 for external photos.

Standard		Compliant	Appendix
FCC CFR 47 / IC RSS-130 ISSUE 1			
2.1046 / RSS-130 4.4	RF power output conducted	Yes	2
2.1049 / RSS-Gen 4.6.1	Occupied bandwidth	Yes	3
2.1051 / RSS-130 4.6	Band edge	Yes	4
2.1051 / RSS-130 4.6	Spurious emission at antenna terminals	Yes	5
2.1053 / RSS-130 4.6	Field strength of spurious radiation	Yes	6
2.1055 / RSS-130 4.3	Frequency stability	Yes	7

Note: Above RSS-130 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

Anders Nordlöf

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Appendix 1

Description of the test object

Equipment:	Product name: RRUS E2 B29 Product number: KRC 161 408/1, R1A FCC ID TA8AKRC161408-1 IC 287AB-AS1614081 IC MODEL NO: AS1614081
Tested configuration:	LTE single RAT
Frequency bands:	TX: 717 – 728 MHz RX: N/A
Antenna ports:	2 TX ports
RF configuration:	Single carrier, multi carrier and MIMO mode 2x2
Nominal output power per antenna port:	Single carrier: 1x 46.0 dBm (1 x 40W) Multi carrier: 2x 43.0 dBm (2 x 20W)
Antenna:	No dedicated antenna, handled during licensing
Channel bandwidths:	3 MHz, 5 MHz and 10 MHz
Modulations:	QPSK, 16QAM and 64QAM
Nominal supply voltage:	-48VDC

Operation mode during measurements

Measurements were performed with the test object transmitting test models as defined in 3GPP TS 36.141. Test model E-TM1.1 represent QPSK modulation, test model E-TM3.2 represent 16QAM modulation and test model E-TM3.1 represent 64QAM modulation.

The settings below were deemed representative for all traffic scenarios when settings with different modulations, channel bandwidths, number of carriers and RF configurations has been tested to find the worst case setting. All measurements were performed with the test object configured for maximum transmit power. The settings below were used for all measurements if not otherwise noted.

MIMO mode, single carrier: E-TM1.1
MIMO mode, multi carrier: 2 carriers E-TM1.1

Conducted measurements

The test object was supplied with -48 VDC by an external power supply if not noted otherwise. Additional connections are documented in the setup drawings below. Complete measurements were made on RF A with additional measurements on RF B to verify that the ports are identical.

Radiated measurements

The test object was supplied with -48 VDC by an external power supply. Additional connections are documented in the setup drawings below.

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 IC RSS-130 and IC RSS-Gen.

References

Measurements were done according to relevant parts of the following standards:

ANSI 63.4-2009
ANSI/TIA/EIA-603-C-2004
3GPP TS 36.141, version 11.4.0
CFR 47 part 2, December 16th , 2013
CFR 47 part 27, December 16th, 2013
RSS-Gen Issue 3
RSS-130 Issue 1

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 2013-12-16.

Manufacturer’s representative

Mihai Simon, Ericsson AB.

Test engineers

Tomas Isbring, Kexin Chen, Jörgen Wassholm, Tomas Lennhager, Andreas Johnson and Rolf Kühn, SP.

Test participants

Mihai Simon and Ove Nilsson, Ericsson AB.

Measurement equipment

	Calibration due	SP number
Test site Tesla	2015-01	503 881
R&S FSIQ 40	2014-07	503 738
R&S ESU 26	2014-05	901 553
R&S FSW43	2014-07	902 073
R&S FSQ 40	2014-03	504 143
Control computer with R&S software EMC32 version 8.52.0	-	503 899
High pass filter	2014-07	901 501
High pass filter	2014-07	901 502
High pass filter	2014-07	504 199
High pass filter	2014-09	901 373
High pass filter	2014-09	503 739
High pass filter	2014-07	503 740
RF attenuator	2014-07	504 159
RF attenuator	2014-07	900 233
RF attenuator	2014-07	900 691
RF attenuator	2014-07	901 384
Chase Bilog Antenna CBL 6111A	2014-10	503 182
EMCO Horn Antenna 3115	2015-09	502 175
Std.gain horn FLANN model 20240-20	-	503 674
µComp Nordic, Low Noise Amplifier	2014-04	901 545
Miteq Low Noise Amplifier	2014-09	503 285
Schwartzbeck preamplifier BBV 9742	2014-14	504 085
Temperature and humidity meter, Testo 635	2014-06	504 203
Temperature and humidity meter, Testo 625	2014-06	504 188
Temperature Chamber	-	501 031
Multimeter Fluke 87	2014-08	502 190

Appendix 1

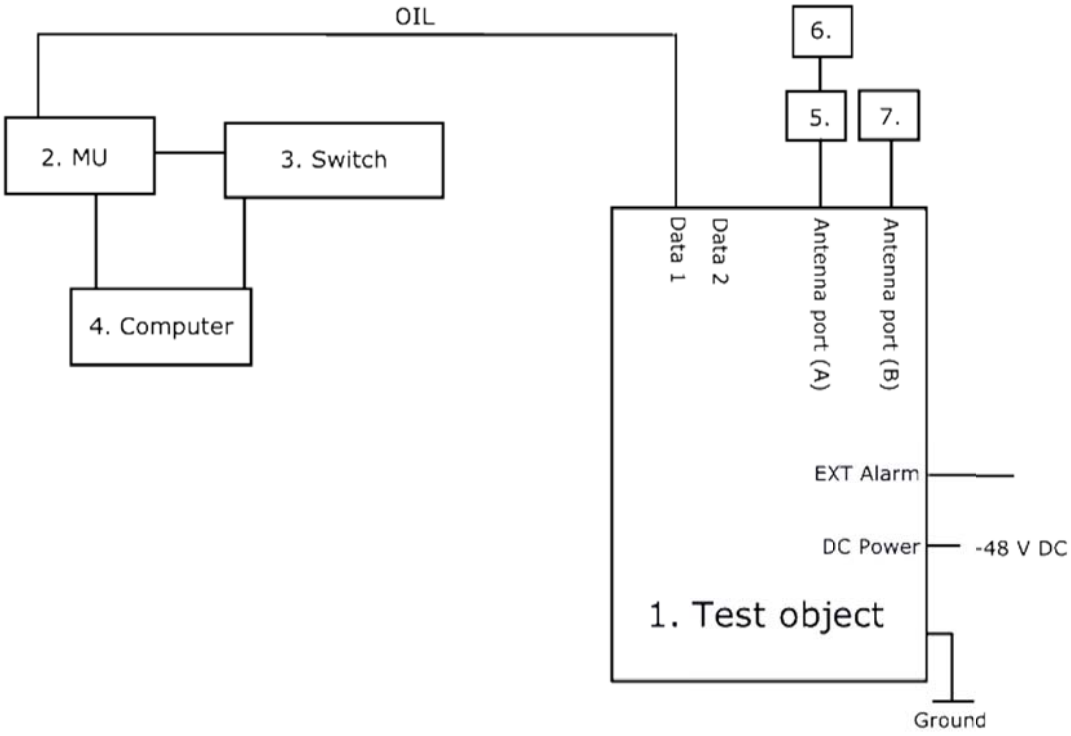
Test frequencies used for conducted and radiated measurements

TX test frequencies

EARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
9695 9725	720.5 723.5	B2 3 3	2 carrier TX bottom constellation 3 MHz BW configuration
9695 9735	720.5 724.5	B2 3 5	2 carrier TX bottom constellation 3 MHz and 5MHz BW configuration
9685 9725	719.5 723.5	B2 5 3	2 carrier TX bottom constellation 5 MHz and 3MHz BW configuration
9695	720.5	B	TX bottom frequency in 3 MHz BW configuration
9685	719.5	B	TX bottom frequency in 5 MHz BW configuration
9710	722.0	B	TX bottom frequency in 10 MHz BW configuration
9715	722.5	M	TX band mid frequency all BW configurations
9690 9730	721.0 724.0	M2 3 3	2 carrier TX mid constellation 3 MHz BW configuration
9755	726.5	T	TX top frequency in 3 MHz BW configuration
9745	725.5	T	TX top frequency in 5 MHz BW configuration
9720	723.0	T	TX top frequency in 10 MHz BW configuration
9725 9755	723.5 726.5	T2 3 3	2 carrier TX top constellation 3 MHz BW configuration
9705 9745	721.5 725.5	T2 3 5	2 carrier TX top constellation 3 MHz and 5 MHz BW configuration

Appendix 1

Test setup conducted measurements



Test object:

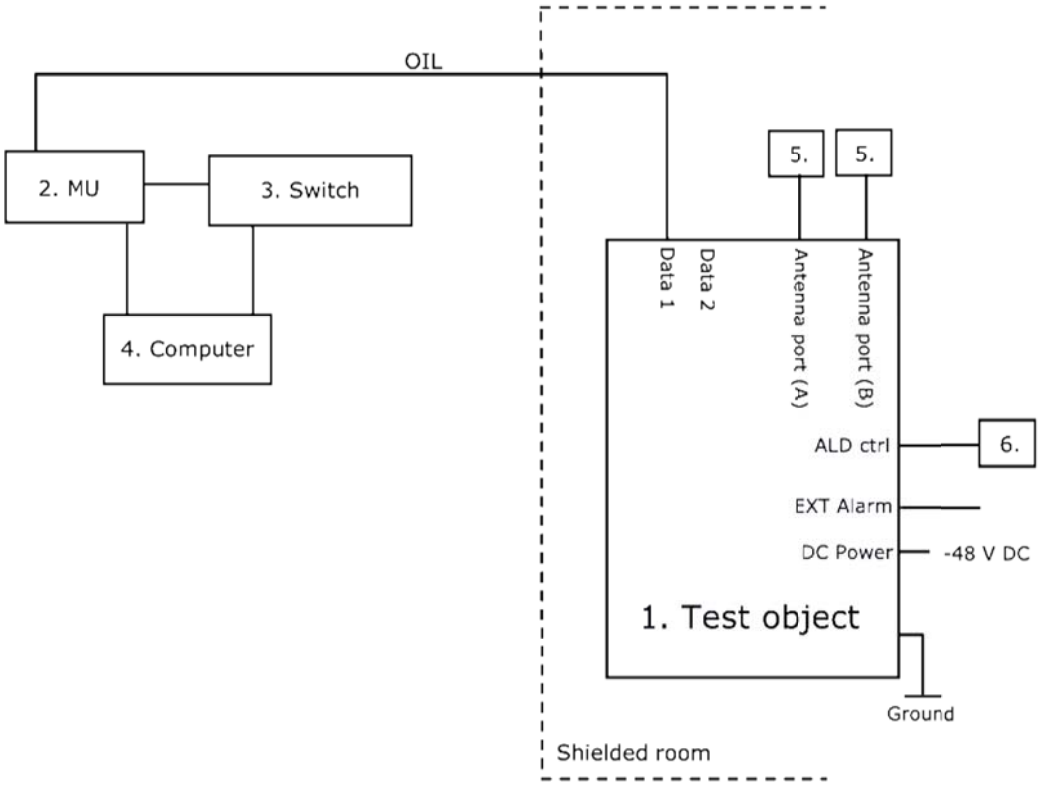
1.	RRUS E2 B29, KRC 161 408/1, revision R1A, s/n: C827525947 Software CXP 901 7316/2, revision R54VB (FCC ID: TA8AKRC161408-1 and IC: 287AB-AS1614081)

Functional test equipment

2.	SUP 6601, 1/BFL 901 009/4, revision R1E, s/n: BR88258944 DUL 20 01, KDU 137 533/4, revison R1C, s/n: C824435943
3.	Fast Ethernet switch, Netgear GSM7224, BAMS – 1000517289
4.	Controlling computer SUN ULTRA 27, BAMS 1000758440
5	SP test Instrumentation according to measurement equipment list
6.	SP Test Instrumentation according to measurement equipment list
7.	Terminator

Appendix 1

Test setup radiated measurements



Test object:

1.	RRUS E2 B29, KRC 161 408/1, revision R1A, s/n: C827525956 Software CXP 901 7316/2 revision R54VB (FCC ID: TA8AKRC161408-1 and IC: 287AB-AS1614081)

Functional test equipment:

2.	Main Unit SUP 6601, 1/BFL 901 009/4, revision R1E, s/n: BR88237597 DUL 20 01, KDU 137 533/4, revision R1C, s/n: C824321473
3.	Switch Netgear GSM7212, BAMS – 1000517299
4.	Computer Sun ultra27-01, BAMS – 1000758436
5.	Terminator
6.	RET – Remote Electrical Tilt unit, KRY 121 67/2, revision R1N

Interfaces:

Power: -48 VDC	DC Power
Antenna port (A), 7/16 connector	Antenna
Antenna port (B), 7/16 connector	Antenna
Data 1, Optical Interface Link, single mode opto fibre	Signal
Data 2, Optical Interface Link, single mode opto fibre, not in use	Signal
EXT Alarm, shielded multi-wire	Signal
ALD Ctrl, shielded multi-wire	Signal
Ground wire	Ground

RBS software:

Software	**Revision**
CXP 102 051/21	R8GT

Appendix 2

RF power output measurements according to CFR 47 §27.50 / IC RSS-130 4.4, conducted

Date	Temperature	Humidity
2013-12-20	22 °C ± 3 °C	26 % ± 5 %
2014-01-07	20 °C ± 3 °C	34 % ± 5 %
2014-01-08	23 °C ± 3 °C	30 % ± 5 %

Test set-up and procedure

The test object was connected to a signal analyser measuring peak and RMS output power in CDF mode. A resolution bandwidth of 50 MHz was used.
For the 1 MHz power averaging measurement method acc. to KDB971168, chapter 5.4.1

Measurement equipment	SP number
R&S FSQ	504 143
RF attenuator	902 282
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results

Single carrier, MIMO

Rated output power level at RF connector 1x 46.0 dBm.

Carrier BW [MHz]	Symbolic name	[RMS dBm/ PAR dB]		
		Port RF A	Port RF B	Total power[1)]
3	B	46.19/ 6.85	46.04/ 6.85	49.13
5	B	45.99/ 7.24	45.85/ 7.28	48.93
3	M	46.22/ 6.80	46.06/ 6.83	49.15
5	M	46.21/ 6.83	46.08/ 6.85	49.16
10	M	46.10/ 7.24	46.01/ 7.24	49.07
3	T	45.79/ 6.83	45.84/ 6.83	48.83
5	T	45.88/ 6.80	45.91/ 6.83	48.91

[1)]: Summed output power according to FCC KDB662911 D01Multiple transmitter output v02r01.

Note: The PAR value is the 0.1 % Peak to Average Ratio.

MIMO mode, multicarrier

Rated output power level at RF connector 2x 43.0 dBm.

Carrier BW [MHz]	Symbolic name	[RMS dBm/ PAR dB]		
		Port RF A	Port RF B	Total power[1)]
3 and 3	B2 3 3	46.07/ 6.97	46.06/ 6.97	49.08
3 and 5	B2 3 5	46.01/ 7.43	45.98/ 7.50	49.01
5 and 3	B2 5 3	46.01/ 7.43	45.98/ 7.50	49.01
3 and 3	M2 3 3	46.05/ 7.07	46.03/ 7.09	49.05
3 and 3	T2 3 3	45.94/ 6.83	45.94/ 6.85	48.95
3 and 5	T2 3 5	45.98/ 6.88	45.99/ 6.88	49.00

[1)]: Summed output power according to FCC KDB662911 D01 Multiple transmitter output v02r01. Method E), 2), a) .

Note: The PAR value is the 0.1 % Peak to Average Ratio.

MIMO mode, single carrier

Measured output power per 1 MHz.

Carrier BW [MHz]	Symbolic name	[RMS dBm]		Total power[1)] [RMS dBm]
		Port RF A	Port RF B	
3	B	42.48	42.23	45.48
5	B	40.43	40.14	43.43
3	M	42.64	42.32	45.64
5	M	40.43	40.18	43.43
10	M	37.45	37.25	40.45
3	T	42.16	42.08	45.16
5	T	40.15	40.08	43.15

[1)]: Measured according to FCC KDB662911 D01 Multiple Transmitter Output v02r01. Method E), 2), c). "Measure and add 10 log(N_{Ant})"

Remark

This unit is tested without antenna. ERP/EIRP compliance is addressed at the time of licensing, as required by the responsible FCC/IC Bureau(s). Licensee's are required to take into account maximum allowed antenna gain used in combination with power settings to prevent the radiated output power to exceed the limits.

Limits

CFR 47 §27.50 / IC RSS-130 4.4

§27.50:

A licensee authorized to operate in the 716-722 or 722-728 MHz bands may operate a fixed or base station at an ERP up to a total of 50 kW within its authorized, 6 MHz spectrum block.

RSS-130 4.4:

The average equivalent isotropically radiated power (e.i.r.p.) limits in SRSP-518 apply, resulting in a maximum EIRP of 3280 W/ MHz for the scope of this report.

The peak-to-average ratio PAR of the power shall not exceed 13 dB.

Complies?	Yes

Appendix 3

Occupied bandwidth measurements according to 47 CFR 2.1049 / RSS-Gen 4.6.1

Date	Temperature	Humidity
2013-12-20	22 °C ± 3 °C	26 % ± 5 %
2014-01-07	20 °C ± 3 °C	34 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §2.1049. The output was connected to a signal analyser with the RMS detector activated. The signal analyser was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
R&S FSQ	504 143
RF attenuator	902 282
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

MIMO mode, single carrier

Diagram	BW configuration	Symbolic name	Tested Port	Occupied BW (99%) [MHz]
1	3 MHz	B	RF A	2.69
2	5 MHz	B	RF A	4.48
3	3 MHz	M	RF A	2.69
4	3 MHz	M	RF B	2.69
5	5 MHz	M	RF A	4.48
6	5 MHz	M	RF B	4.48
7	10 MHz	M	RF A	8.93
8	10 MHz	M	RF B	8.93
9	3 MHz	T	RF A	2.69
10	5 MHz	T	RF A	4.48

Appendix 3

Diagram 1:

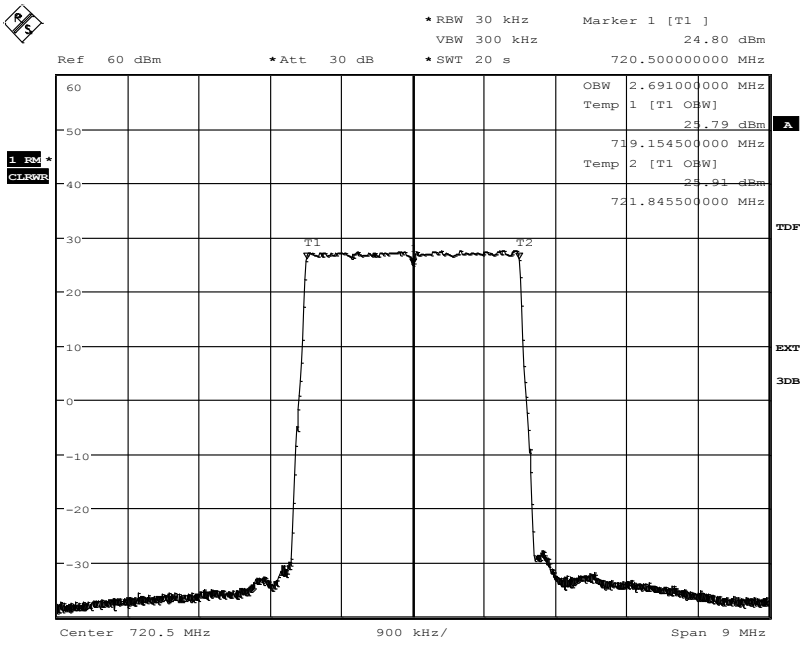


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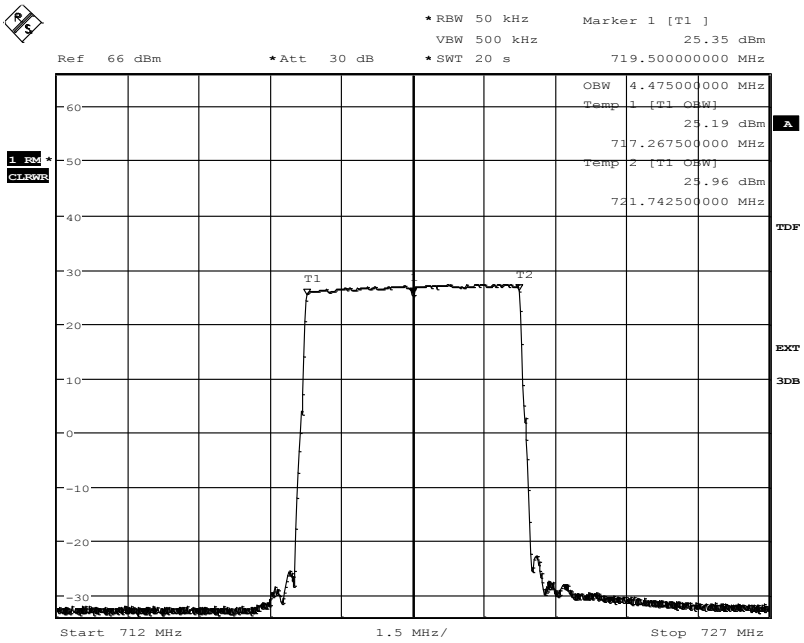
Diagram 2:



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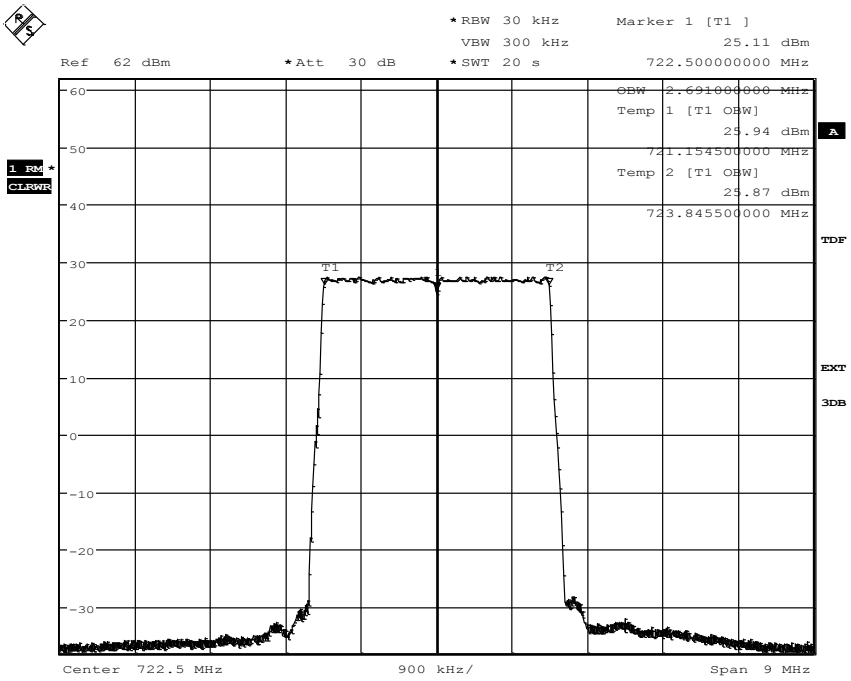
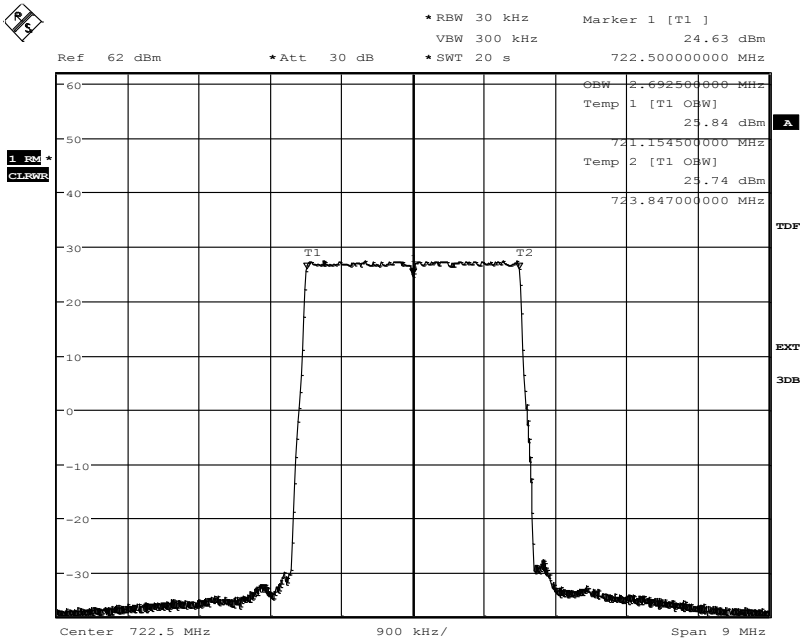
Appendix 3

Diagram 3:



Date: 20.DEC.2013 16:16:33

Diagram 4:



Date: 7.JAN.2014 09:10:29

Appendix 3

Diagram 5:

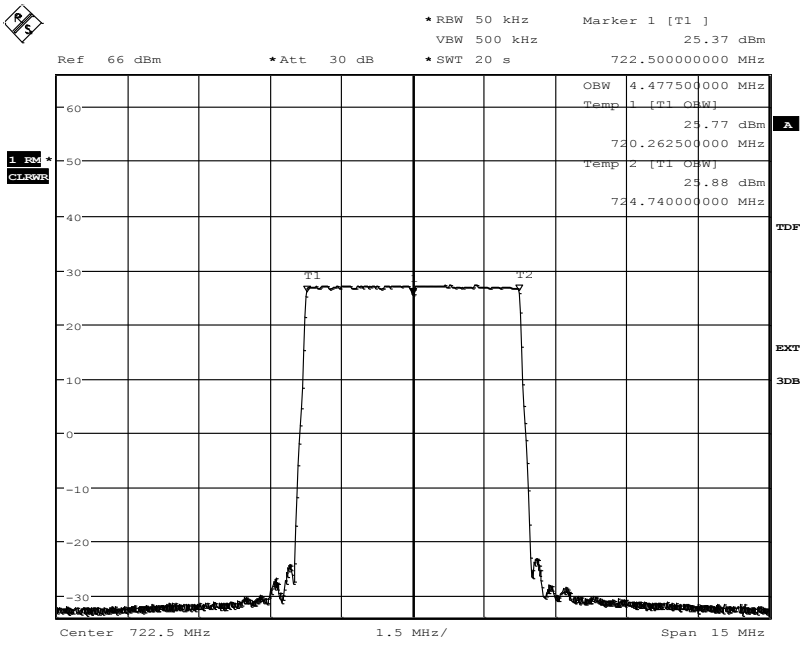


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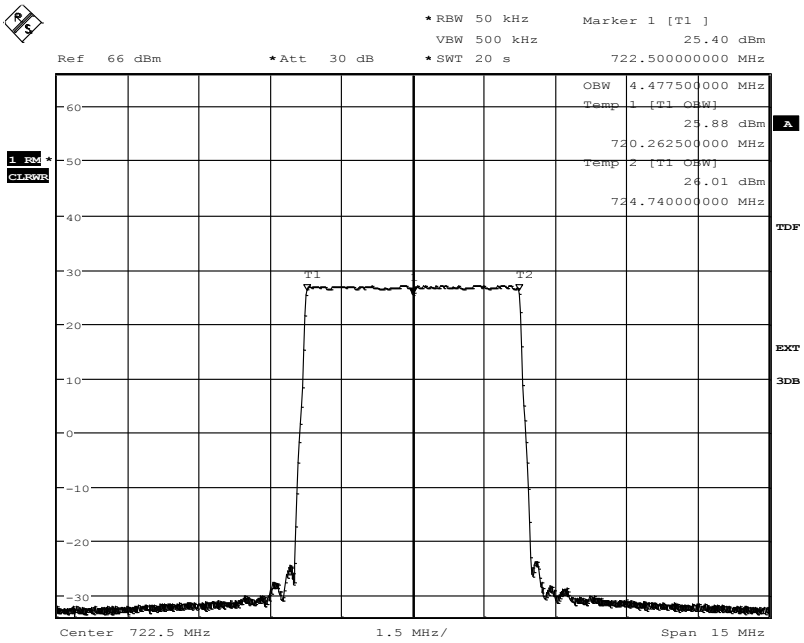
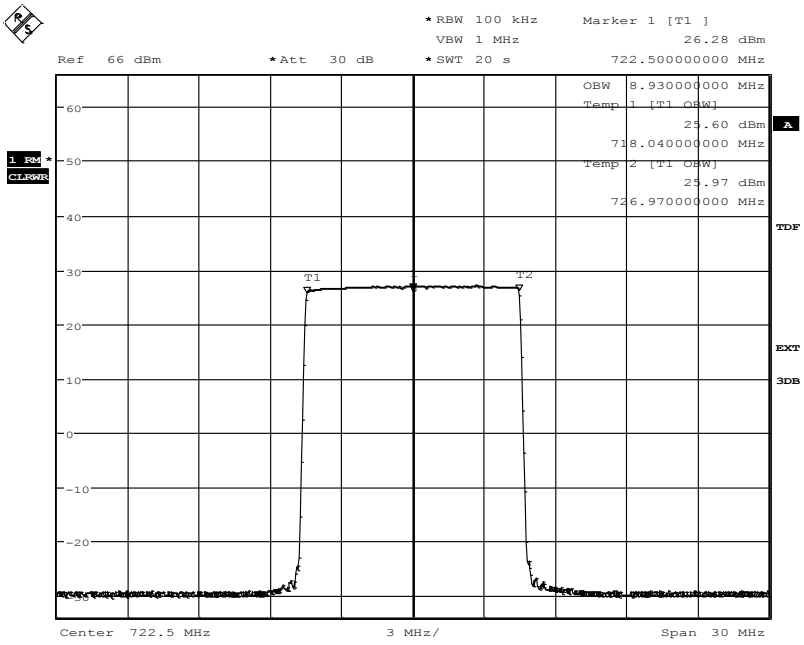
Diagram 6:



Date: 7.JAN.2014 09:27:16

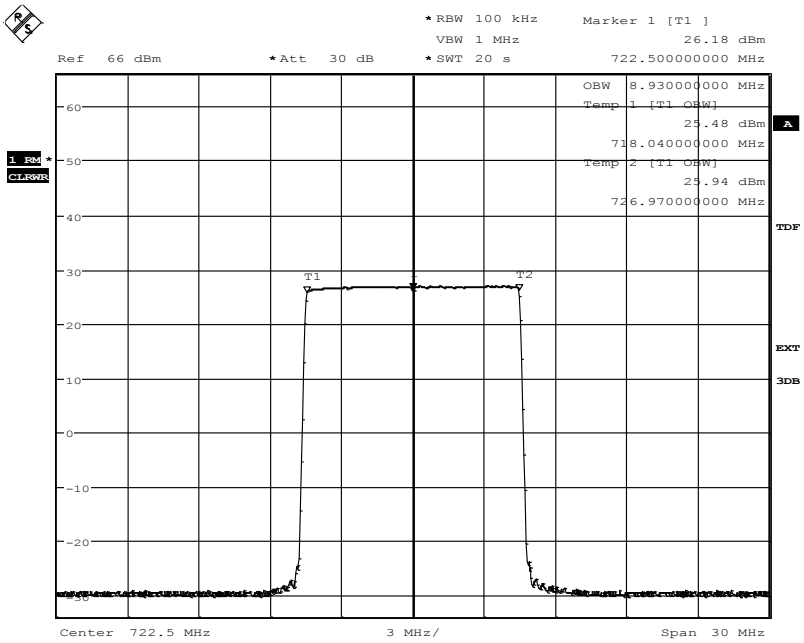
Appendix 3

Diagram 7:



Date: 20.DEC.2013 16:36:21

Diagram 8:



Date: 7.JAN.2014 09:22:27

Appendix 3

Diagram 9:

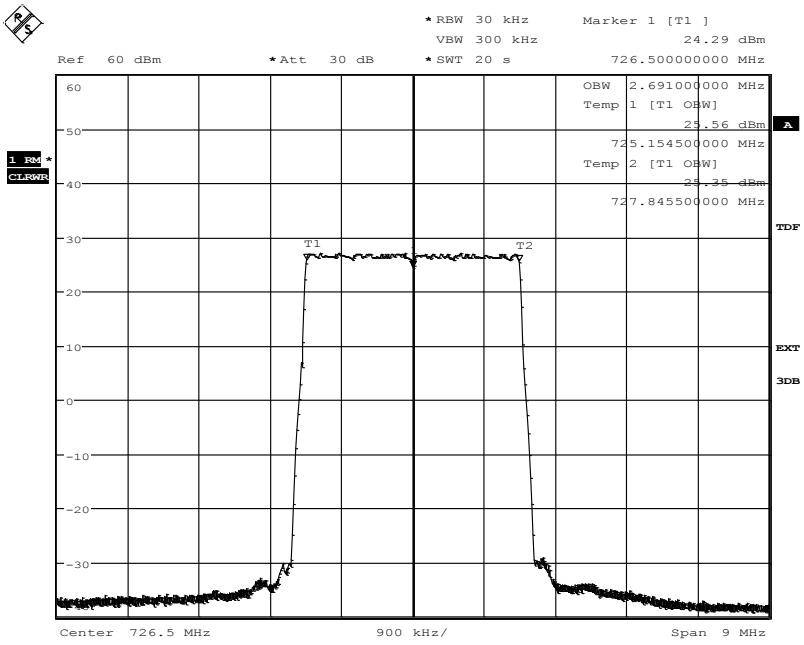


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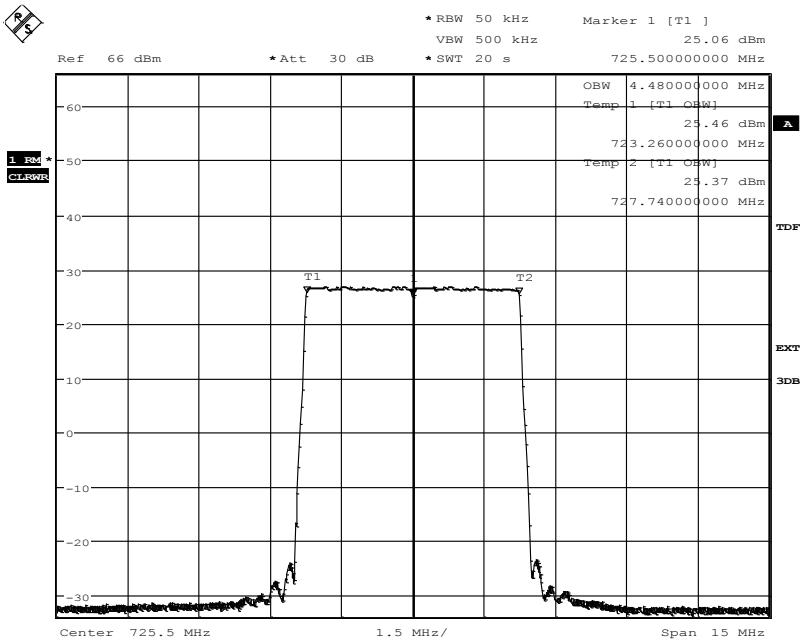
Diagram 10:



Date: 7.JAN.2014 09:40:26

Appendix 4

Band edge measurements according to CFR 47 §27.53(f) / IC RSS-130 4.6

Date	Temperature	Humidity
2013-12-20	22 °C ± 3 °C	26 % ± 5 %
2014-01-07	20 °C ± 3 °C	34 % ± 5 %
2014-01-08	23 °C ± 3 °C	30 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §27.53(f). The test object was connected to a spectrum analyser with the RMS detector activated. The spectrum analyser was connected to an external 10 MHz reference standard during the measurements.

Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

Before comparing the results to the limit, 3 dB [10 log (2)] should be added according to method E), 3), a), (iii) Measure and add 10 log(N_{ANT})" of FCC KDB662911 D01 Multiple Transmitter Output v02r01.

Measurement equipment	SP number
R&S FSQ	504 143
RF attenuator	902 282
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

MIMO mode, Single carrier

Diagram	BW configuration	Symbolic name	Tested Port
1 a+b	3 MHz	B	RF A
2 a+b	5 MHz	B	RF A
3 a	10 MHz	B	RF A
4 a+b	3 MHz	T	RF A
5 a+b	3 MHz	T	RF B
6 a+b	5 MHz	T	RF A
7 a	10MHz	T	RF A

MIMO mode, multi carrier

Diagram	BW configuration	Symbolic name	Tested Port
8 a+b	3 and 3 MHz	B2 3 3	RF A
9 a+b	5 and 3 MHz	B2 5 3	RF A
10 a+b	3 and 3 MHz	T2 3 3	RF A
11 a+b	3 and 5 MHz	T2 3 5	RF A

Limits

CFR 47 §27.53(f) and RSS-130 4.6

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 4

Diagram 1 a:

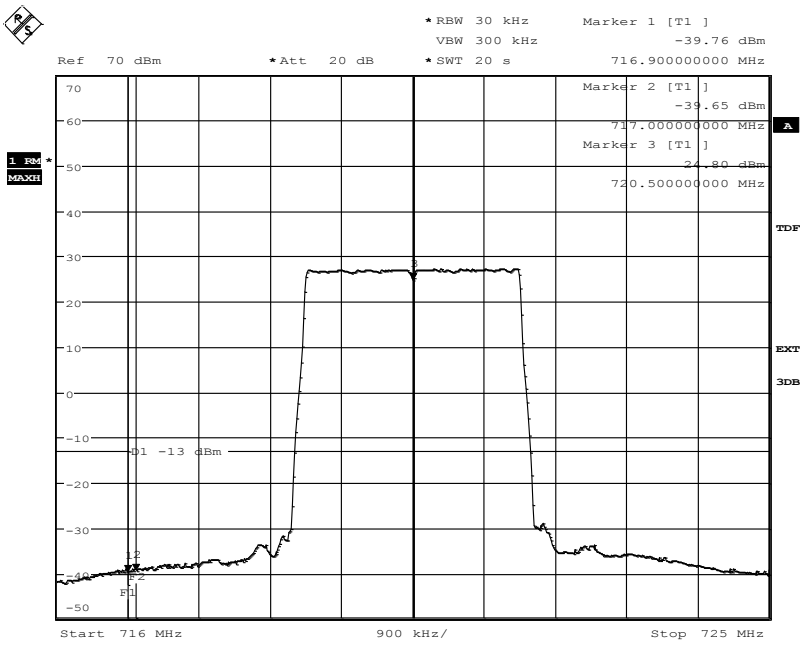


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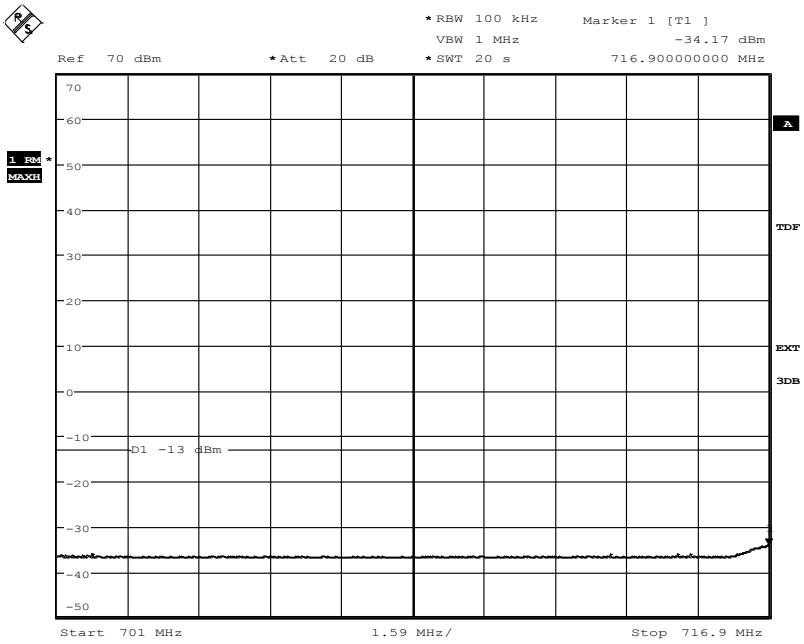
Diagram 1 b:



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Appendix 4

Diagram 2 a:

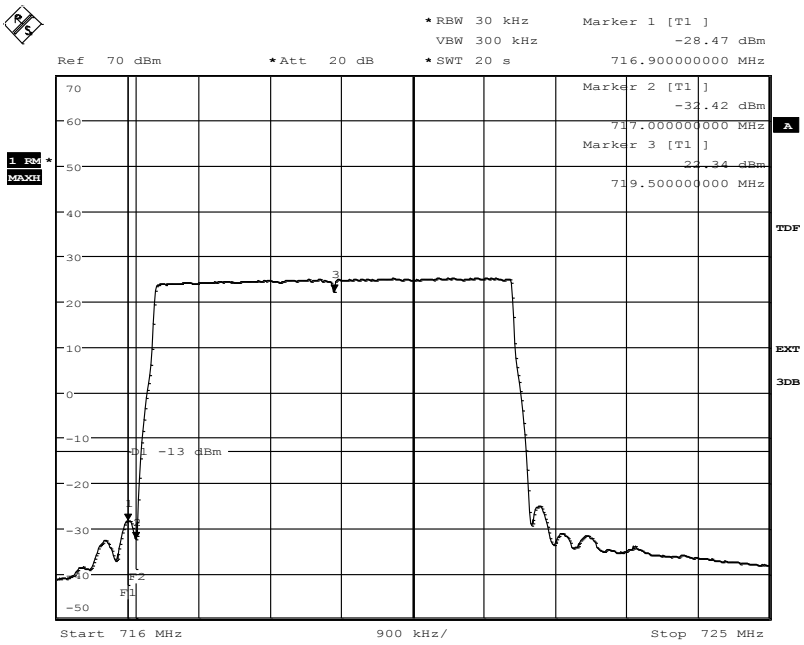

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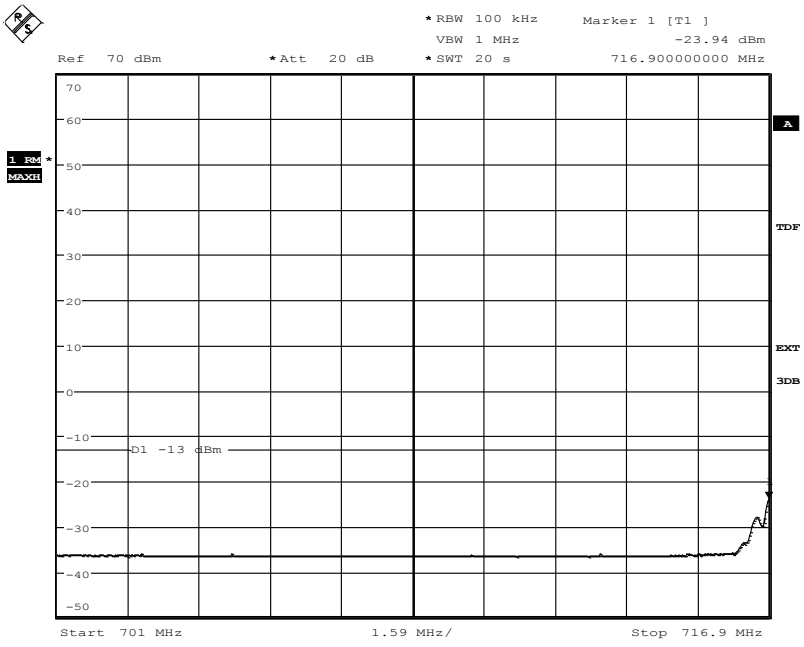
Diagram 2 b:



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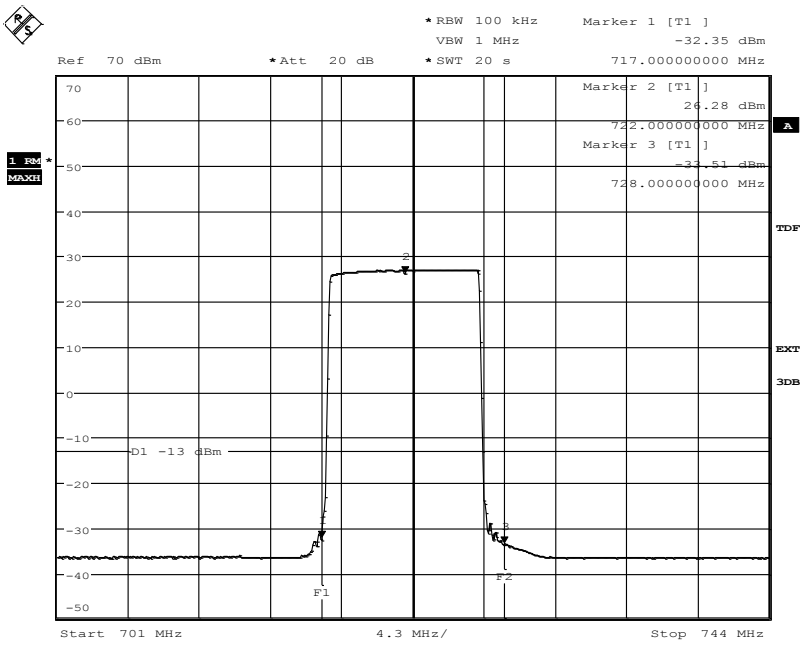
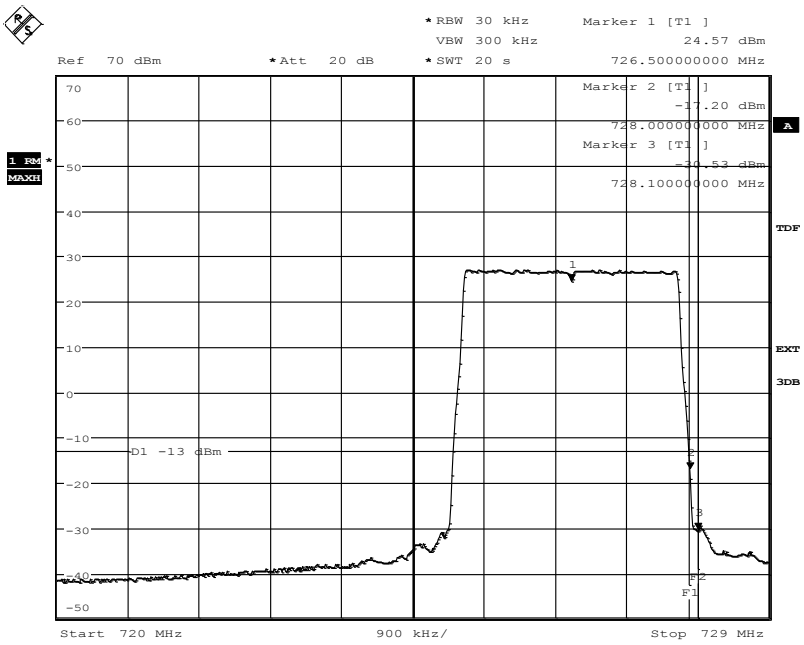
Appendix 4

Diagram 3 a:



Appendix 4

Diagram 4 a:



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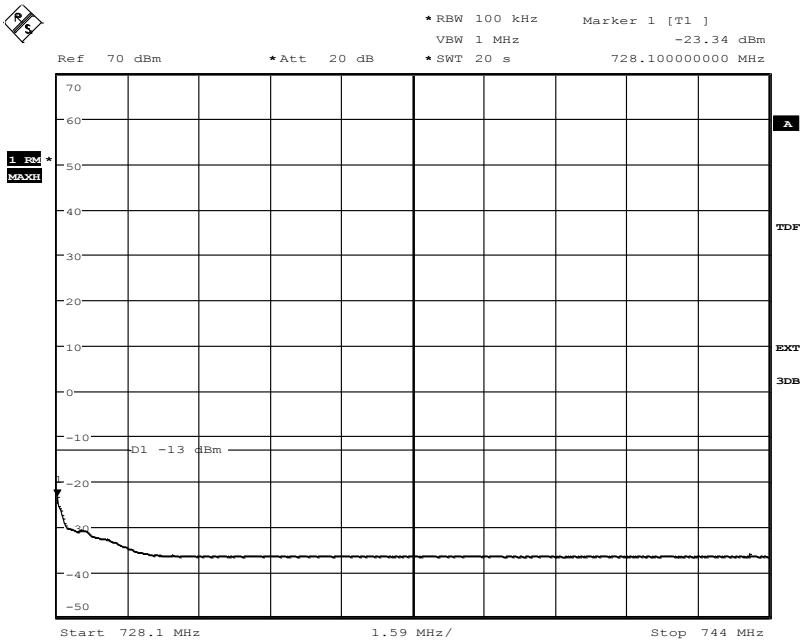

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Appendix 4

Diagram 5 a:

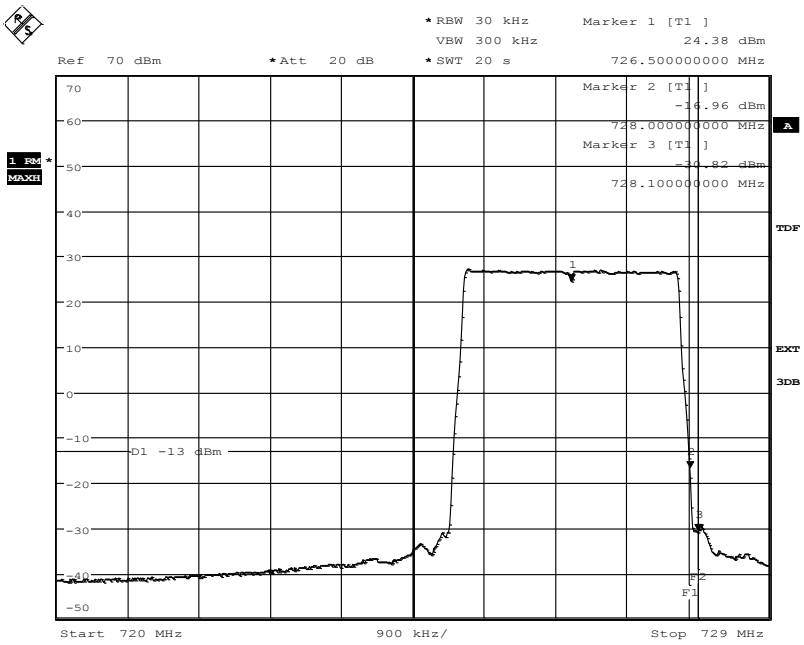

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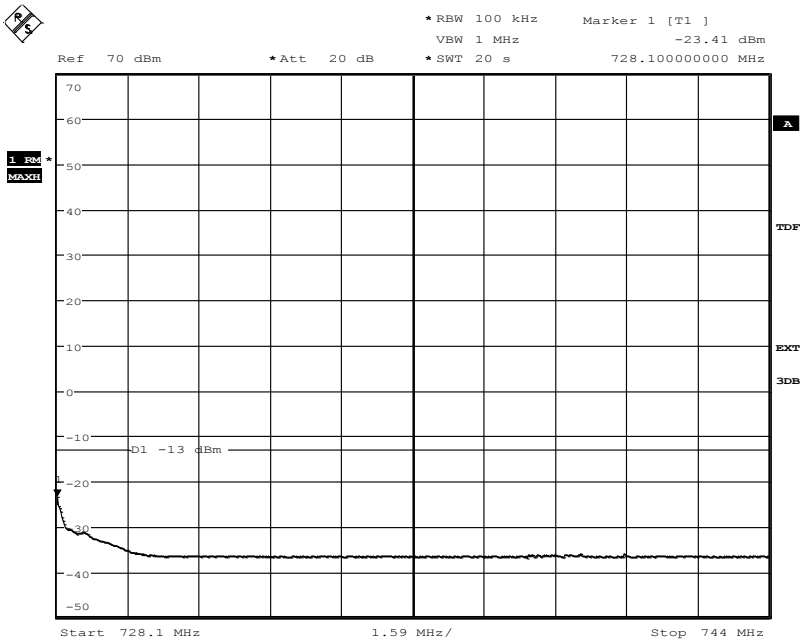
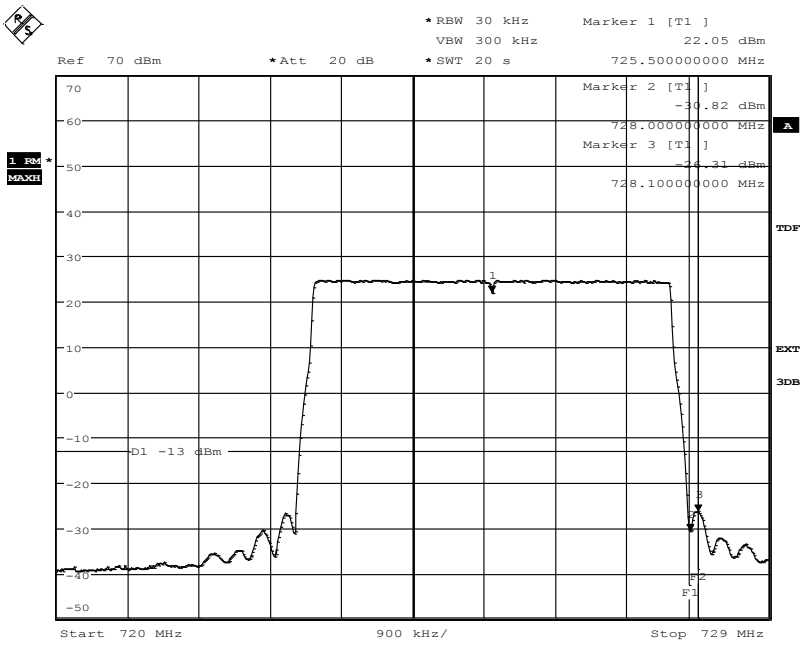
Diagram 5 b:



Date: 7.JAN.2014 09:33:36

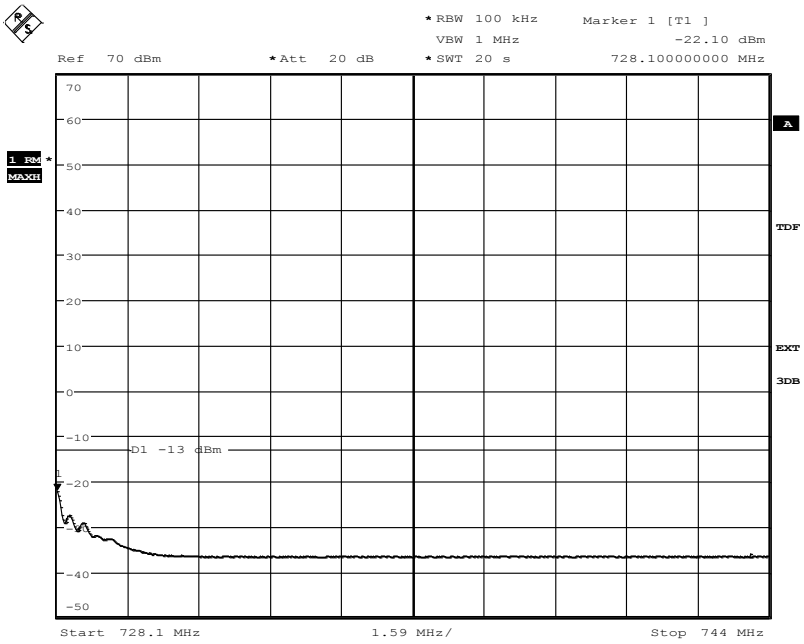
Appendix 4

Diagram 6 a:



Date: 7.JAN.2014 09:43:25

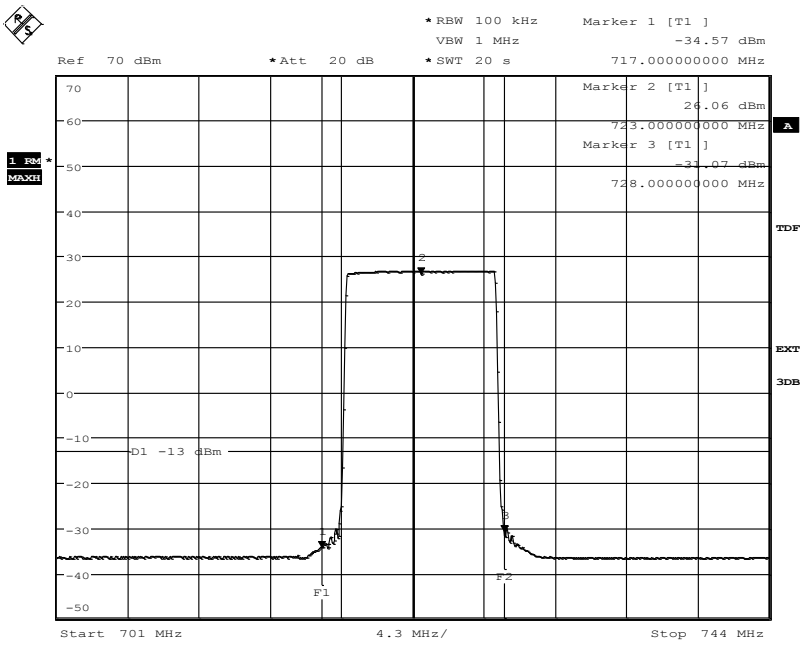
Diagram 6 b:



Date: 7.JAN.2014 09:44:51

Appendix 4

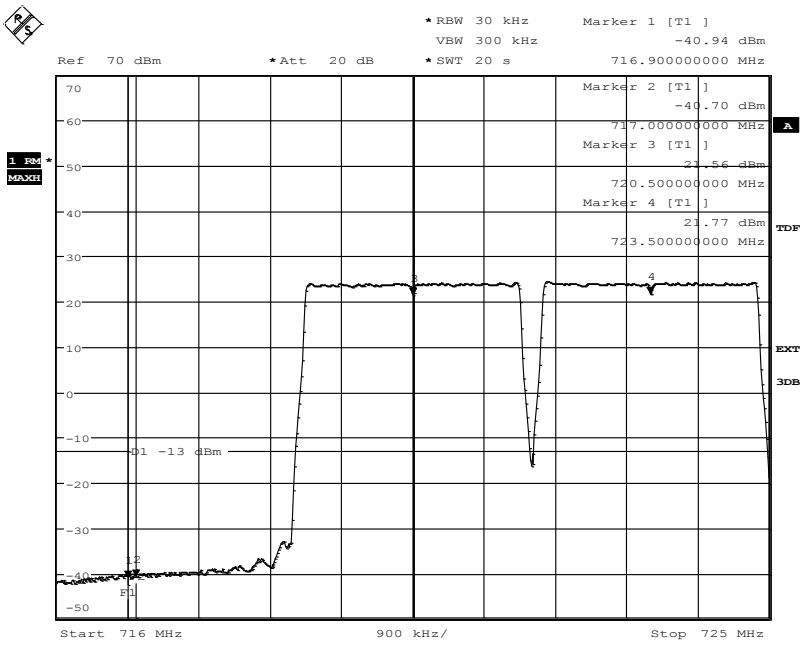
Diagram 7 a:



Date: 7.JAN.2014 10:08:06

Appendix 4

Diagram 8 a:



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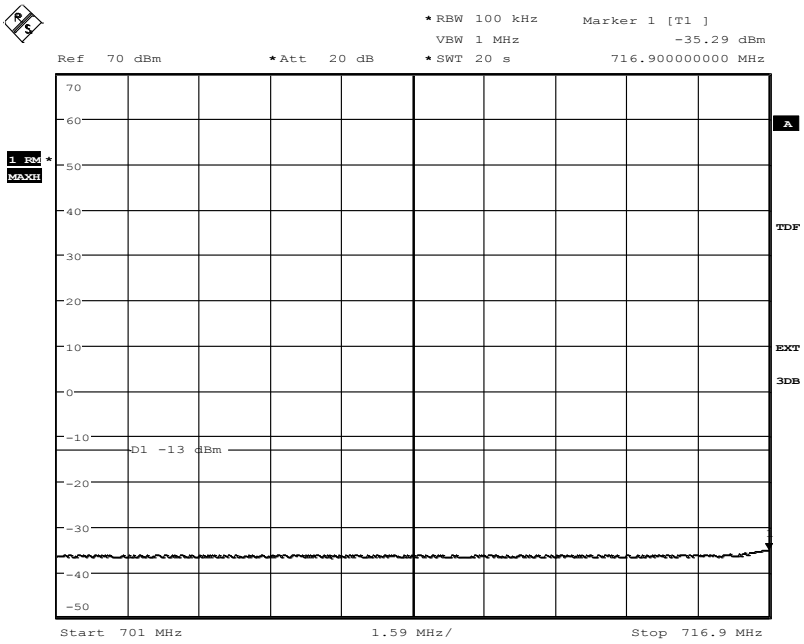

Date: 7.JAN.2014 10:41:56

Appendix 4

Diagram 9 a:

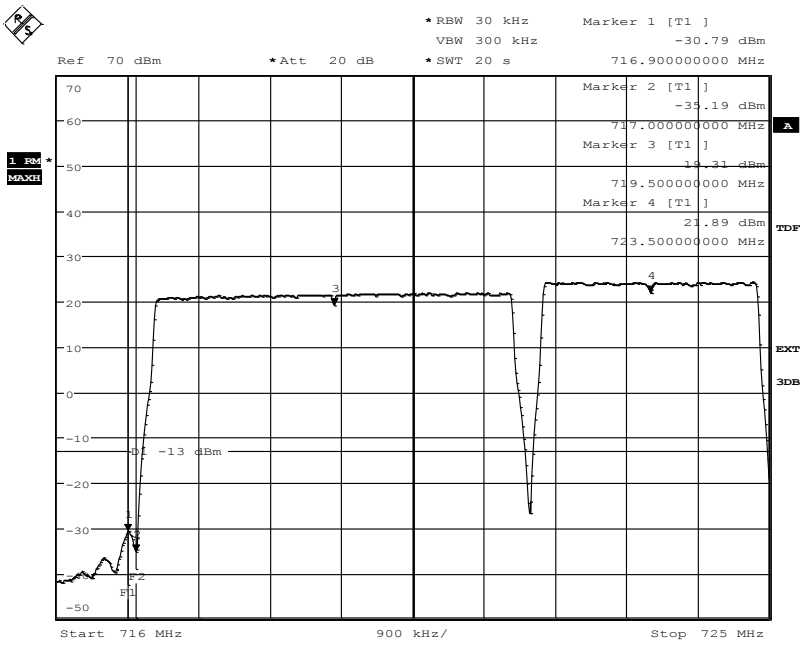

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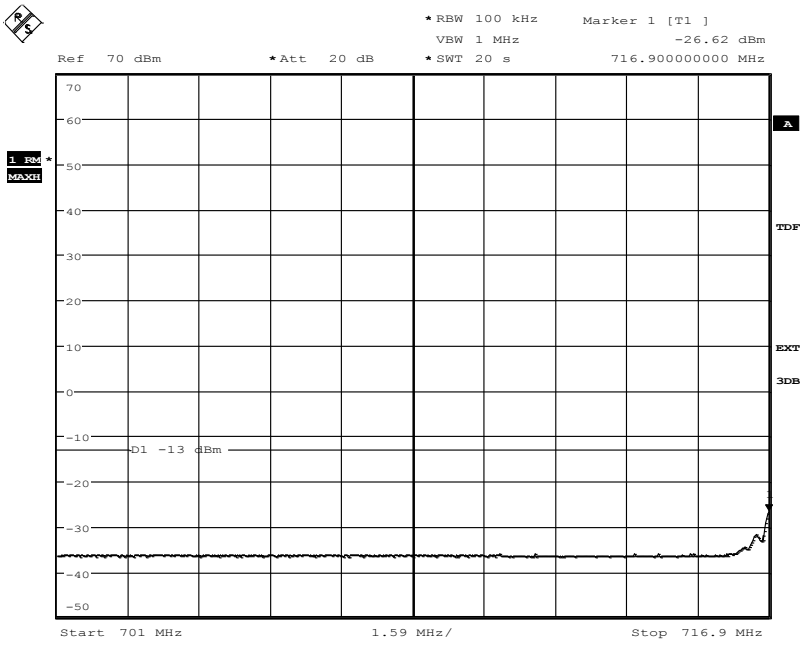
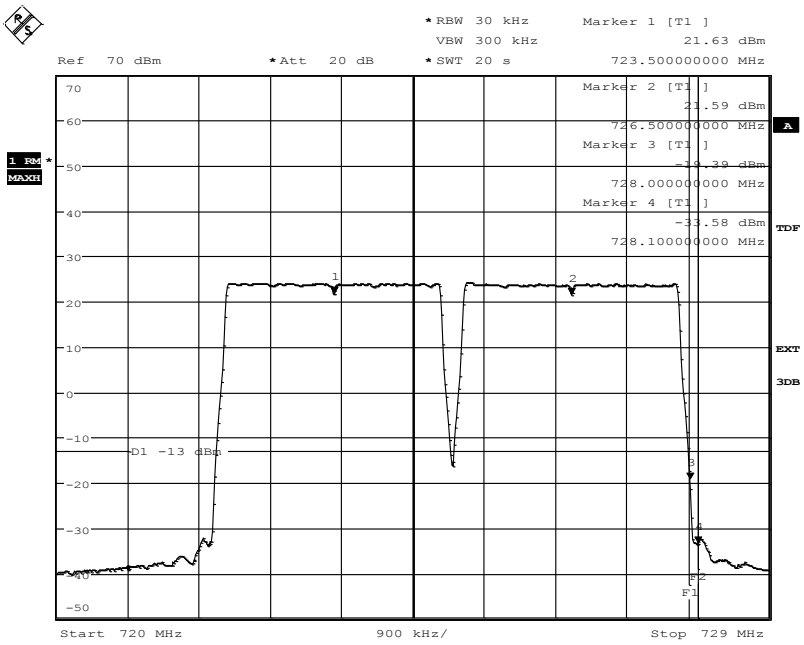
Diagram 9 b:



Date: 8.JAN.2014 18:37:02

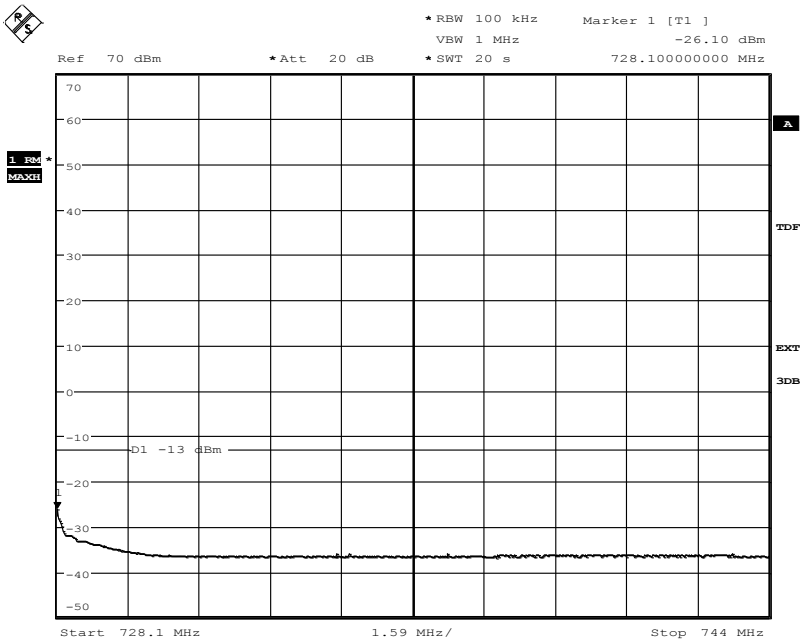
Appendix 4

Diagram 10 a:



Date: 7.JAN.2014 12:09:04

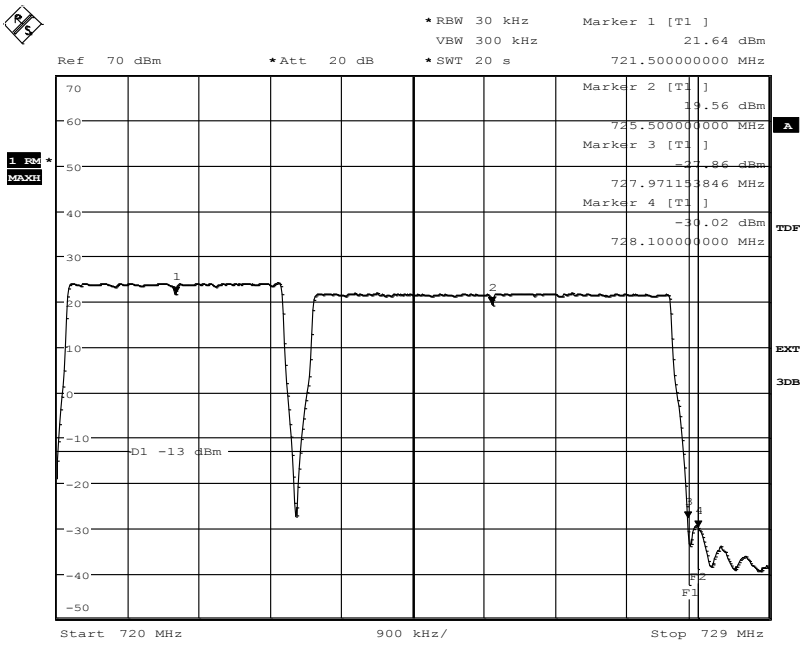
Diagram 10 b:



Date: 7.JAN.2014 12:10:26

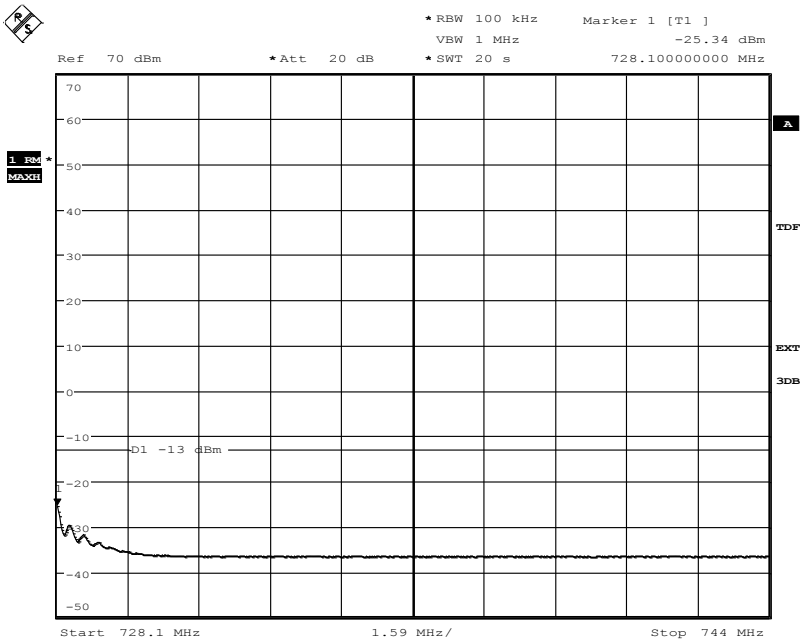
Appendix 4

Diagram 11a:



Date: 8.JAN.2014 19:00:20

Diagram 11 b:



Date: 8.JAN.2014 19:01:33

Appendix 5

Conducted spurious emission measurements according to CFR 47 §27.53(f)/ IC RSS-130 4.6

Date	Temperature	Humidity
2013-12-20	22 °C ± 3 °C	26 % ± 5 %
2014-01-07	20 °C ± 3 °C	34 % ± 5 %
2014-01-08	23 °C ± 3 °C	30 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §27.53(f). The output was connected to a spectrum analyser with a RBW setting of 1 MHz and RMS detector activated. The spectrum analyser was connected to an external 10 MHz reference standard during the measurements.

Before comparing the results to the limit, 3 dB [10 log (2)] should be added according to method E), 3), (iii) “measure and add 10 log(N_{ANT})” of FCC KDB662911 D01 Multiple Transmitter Output v02r01.

Measurement equipment	SP number
R&S FSQ	504 143
RF attenuator	902 282
HP filter	901 502
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

MIMO mode, single carrier

Diagram	BW configuration / [MHz]	Symbolic name	Tested Port
1 a+b	3 MHz	B	RF A
2 a+b	5 MHz	B	RF A
3 a+b	3 MHz	M	RF A
4 a+b	3 MHz	M	RF B
5 a+b	5 MHz	M	RF A
6 a+b	10 MHz	M	RF A
7 a+b	10 MHz	M	RF B
8 a+b	3 MHz	T	RF A
9 a+b	5 MHz	T	RF A

MIMO mode, 2 carrier

Diagram	BW configuration	Symbolic name	Tested Port
10 a+b	3 and 3 MHz	B2 3 3	RF A
11 a+b	3 and 5 MHz	B2 3 5	RF A
12 a+b	3 and 3 MHz	M2 3 3	RF A
13 a+b	3 and 3 MHz	M2 3 3	RF B
14 a+b	3 and 3 MHz	T2 3 3	RF A
15 a+b	3 and 5 MHz	T2 3 5	RF A
16 a+b	5 and 3 MHz	B2 5 3	RF A

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 fundamental frequency is 728 MHz. The measurements were made up to 8 GHz (10x728 MHz = 7.28 GHz).

Limits

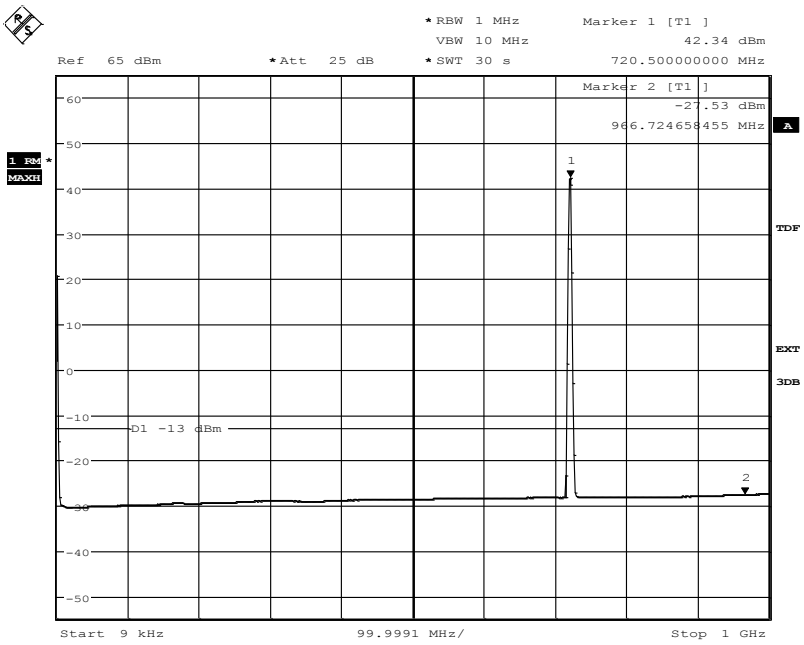
§27.53(f) and RSS-130 4.6

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 100 kHz RBW.

Complies?	Yes

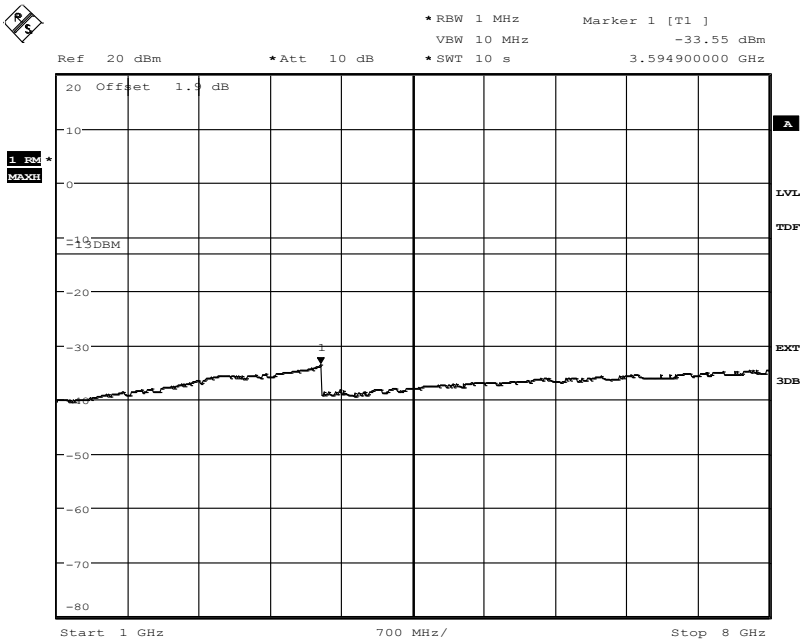
Appendix 5

Diagram 1 a:



Date: 20.DEC.2013 15:58:00

Diagram 1 b:



Date: 20.DEC.2013 12:51:08

Appendix 5

Diagram 2 a:

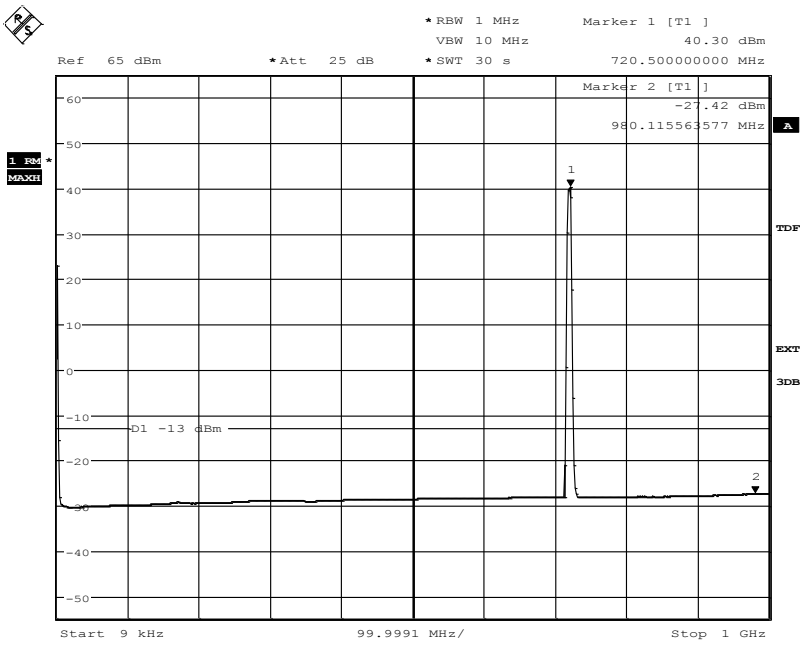


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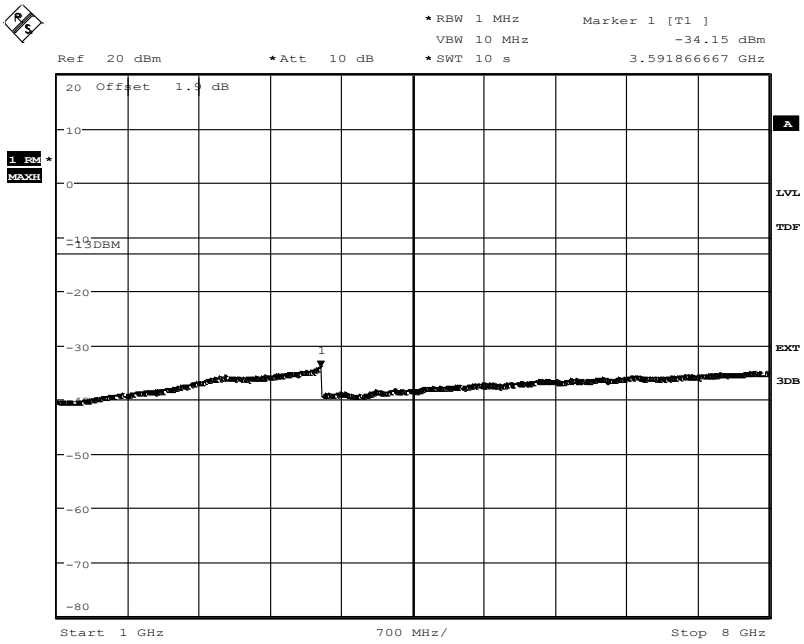
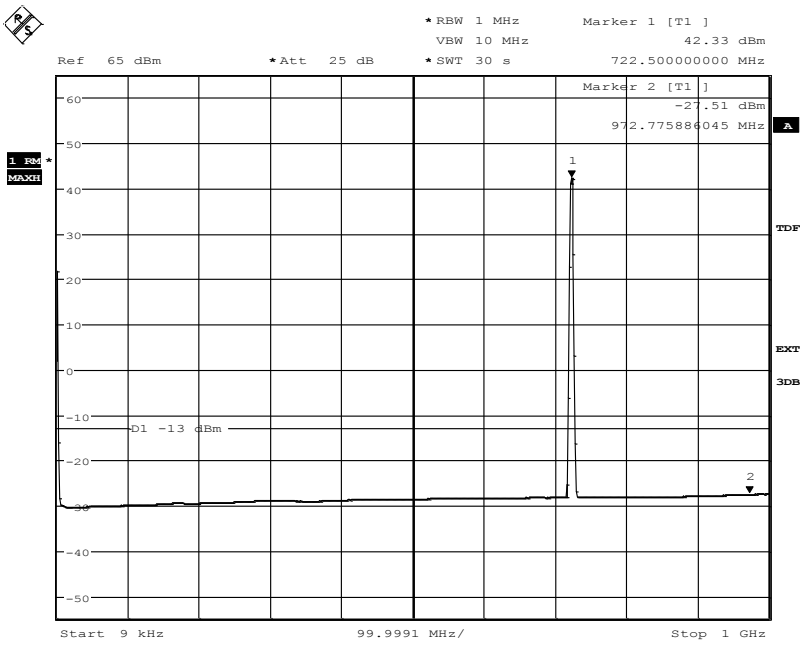
Diagram 2 b:



Date: 20.DEC.2013 13:12:24

Appendix 5

Diagram 3 a:



Date: 20.DEC.2013 16:18:52

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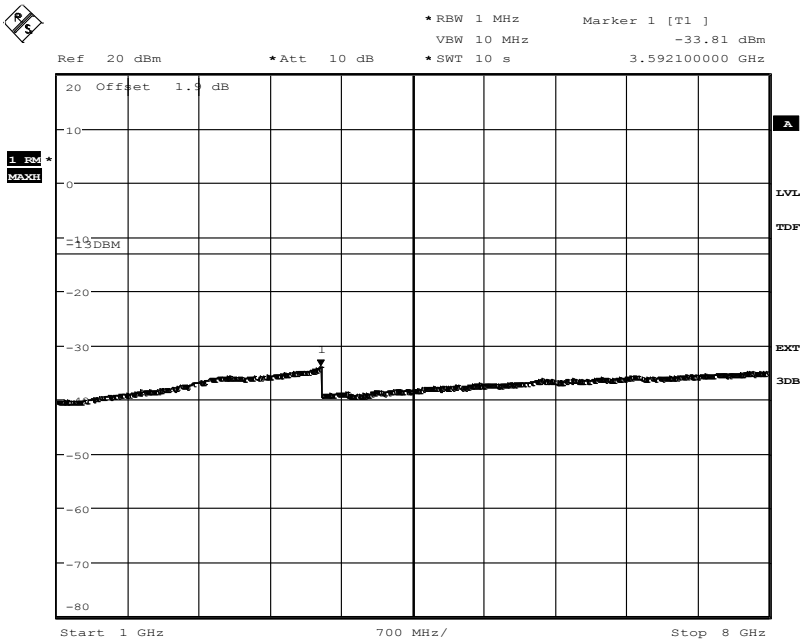

Date: 20.DEC.2013 16:21:03

Appendix 5

Diagram 4 a:

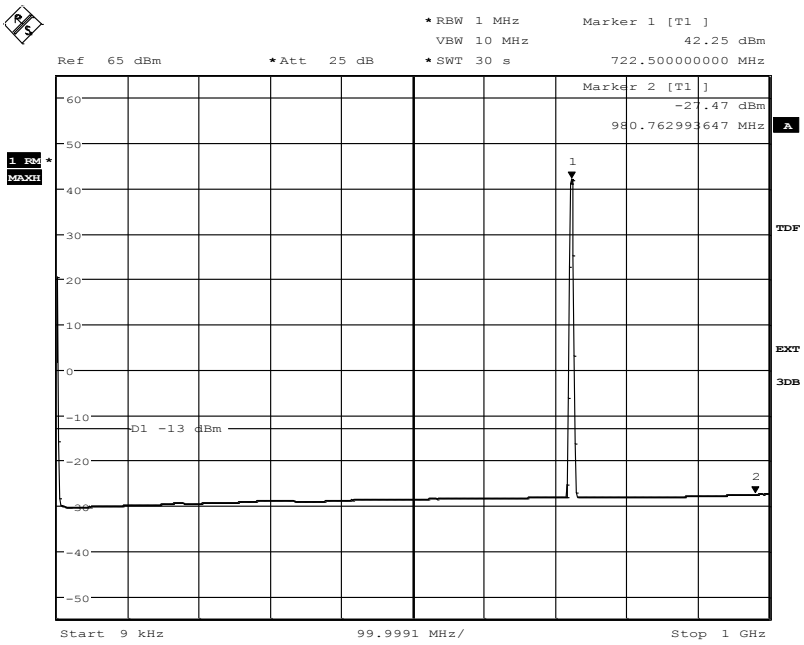

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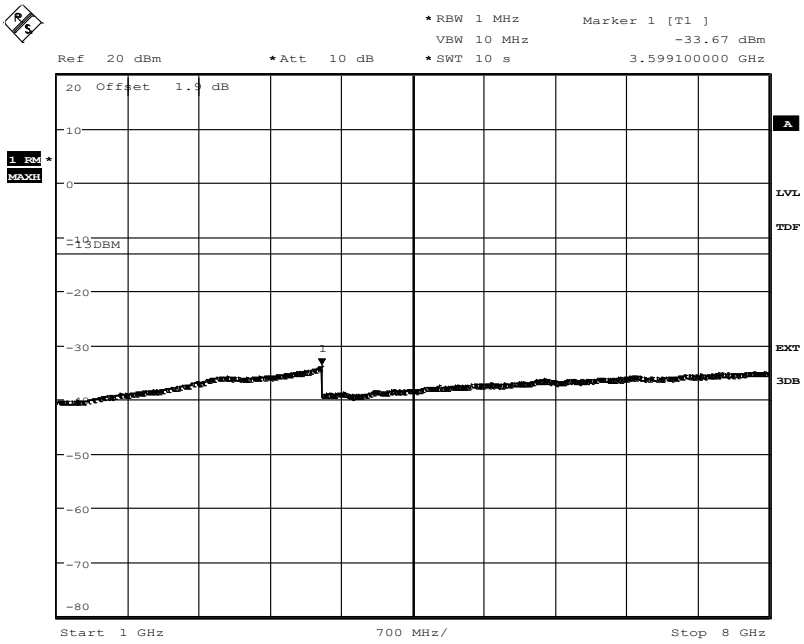
Diagram 4 b:



Date: 7.JAN.2014 09:14:41

Appendix 5

Diagram 5 a:

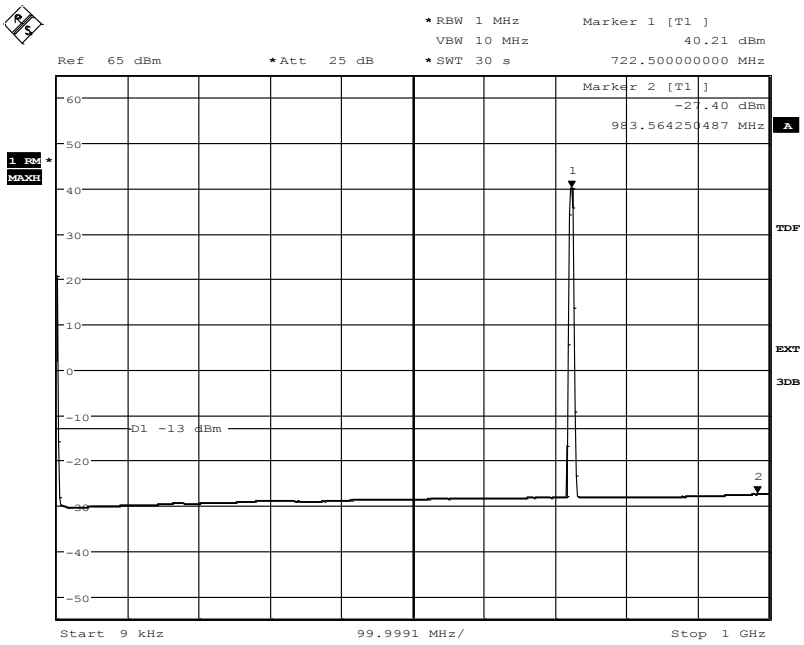


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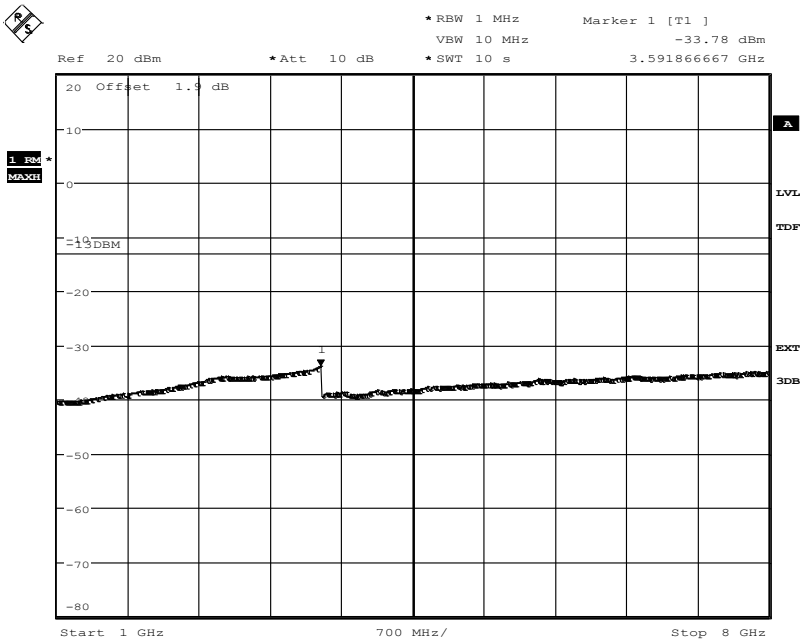
Diagram 5 b:



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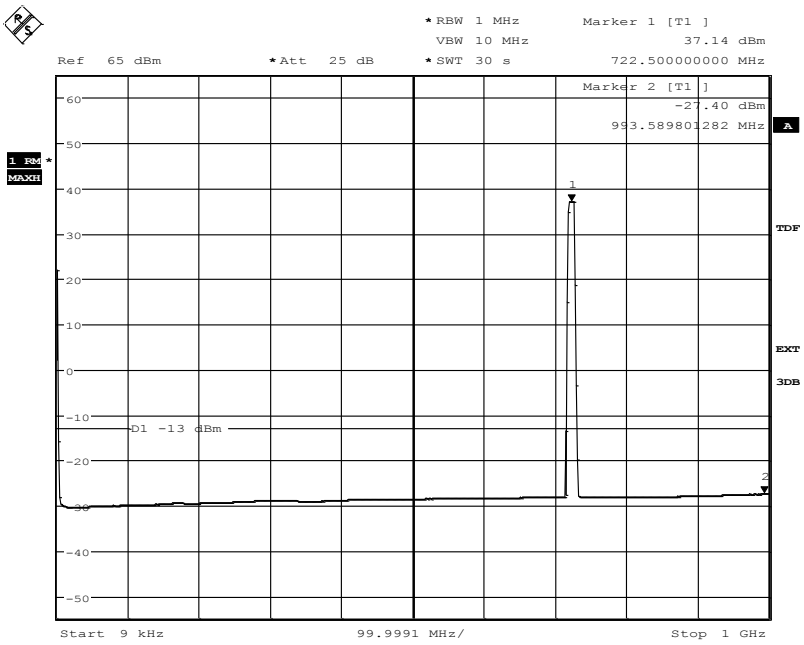
Appendix 5

Diagram 6 a:



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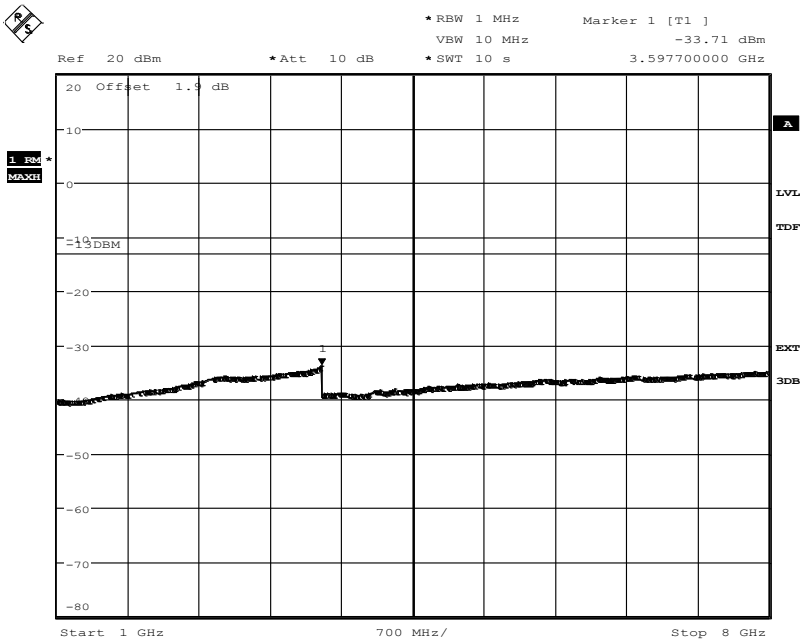
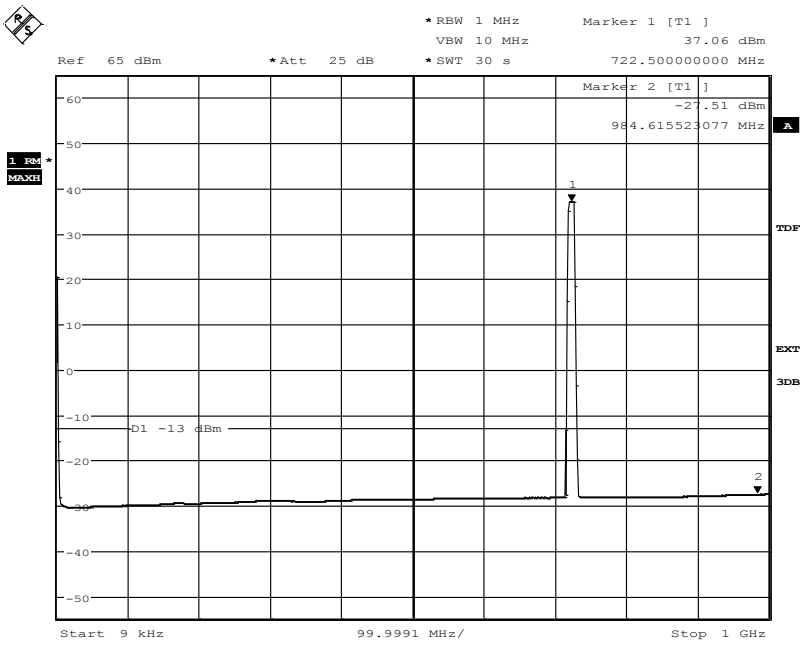


Date: 20.DEC.2013 16:42:38

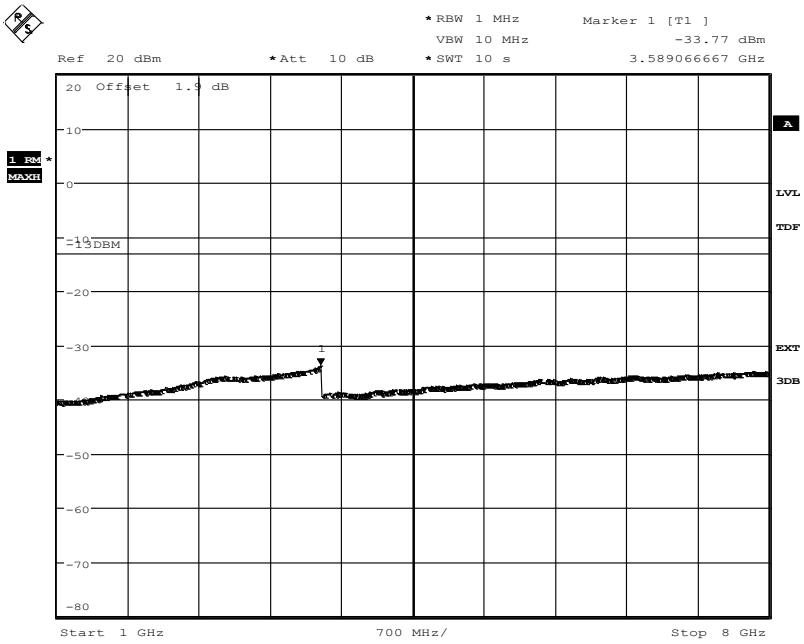
Appendix 5

Diagram 7 a:



Date: 7.JAN.2014 09:19:51

Diagram 7 b:



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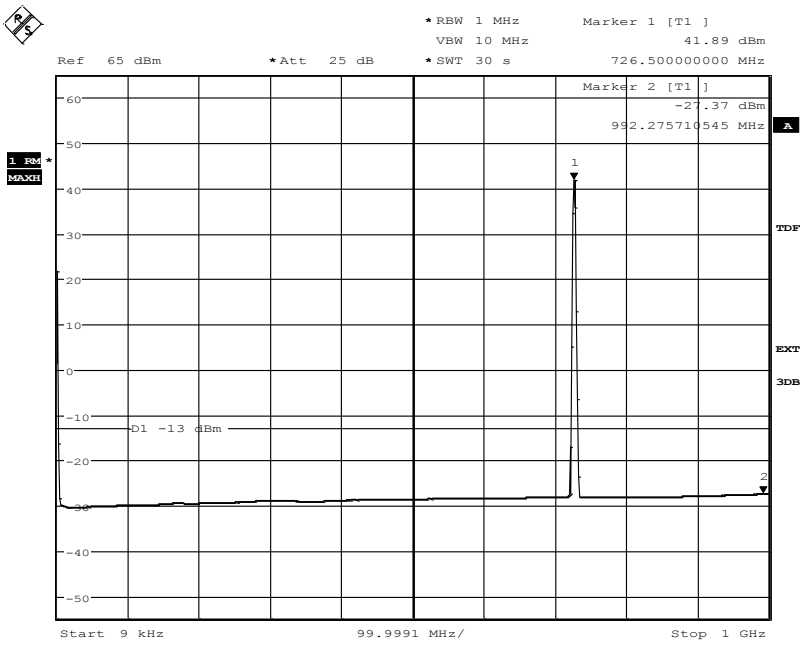
Appendix 5

Diagram 8 a:



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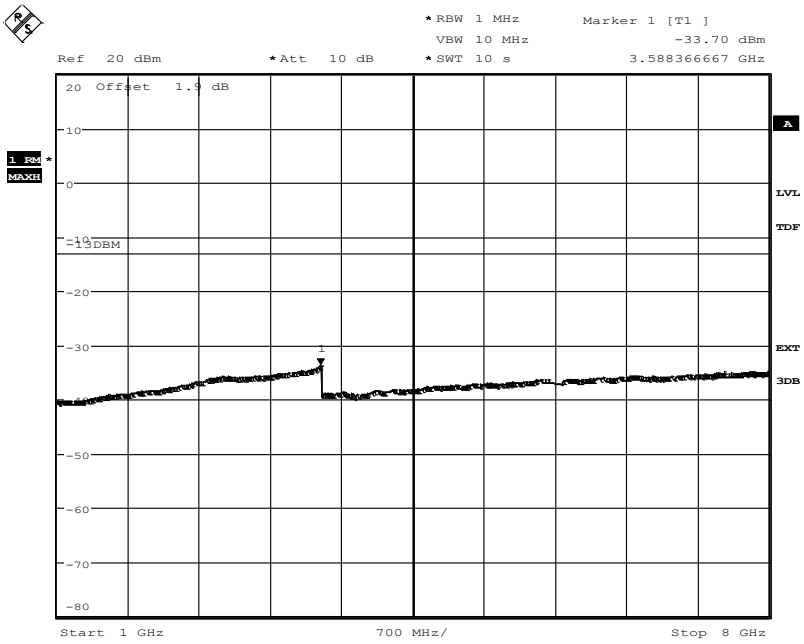

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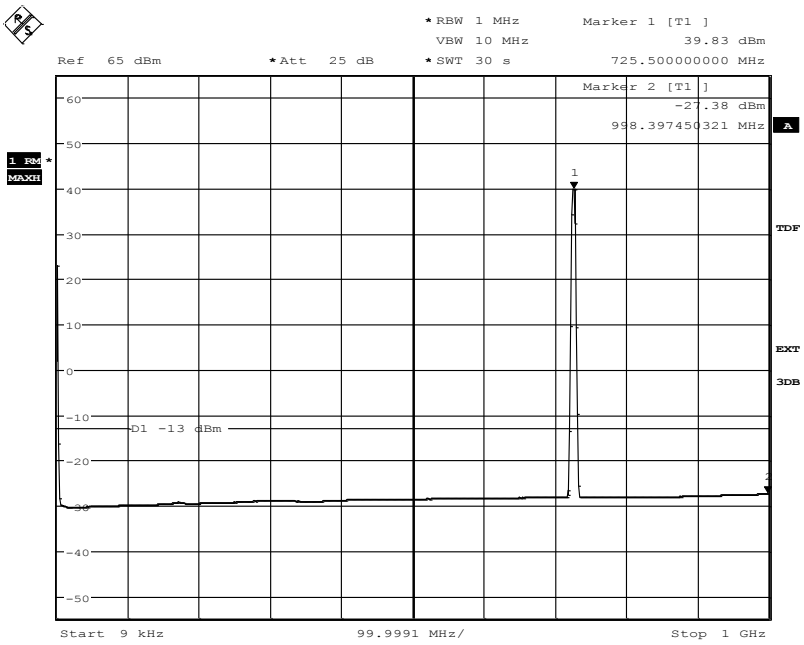
Appendix 5

Diagram 9 a:



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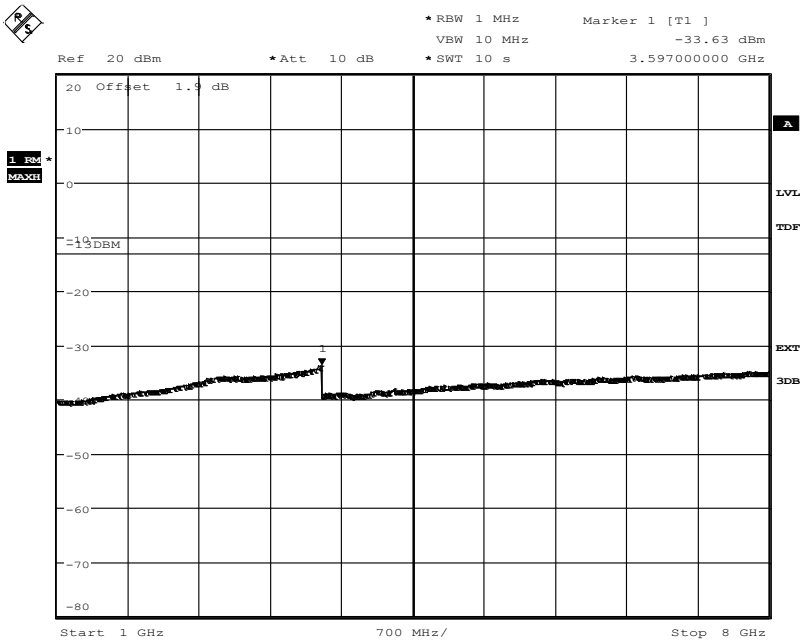

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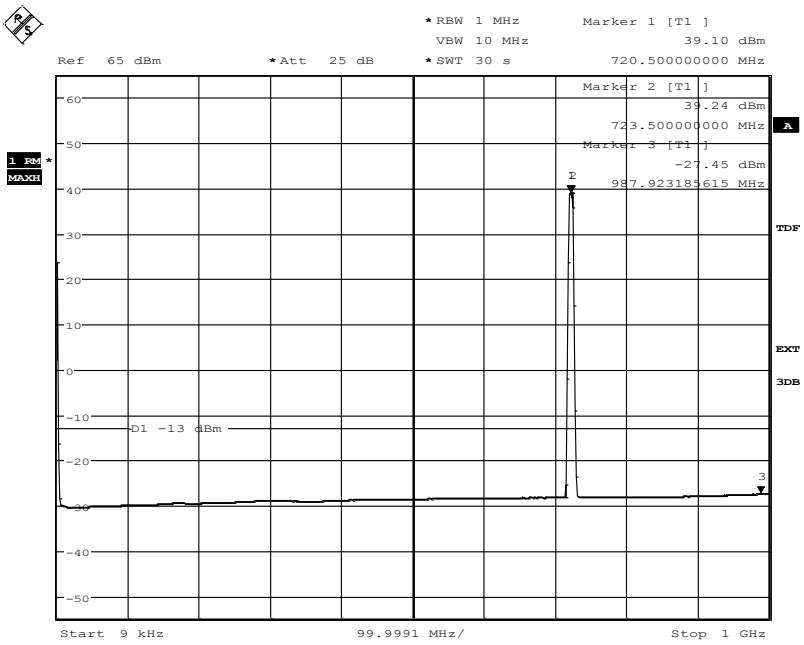
Appendix 5

Diagram 10 a:



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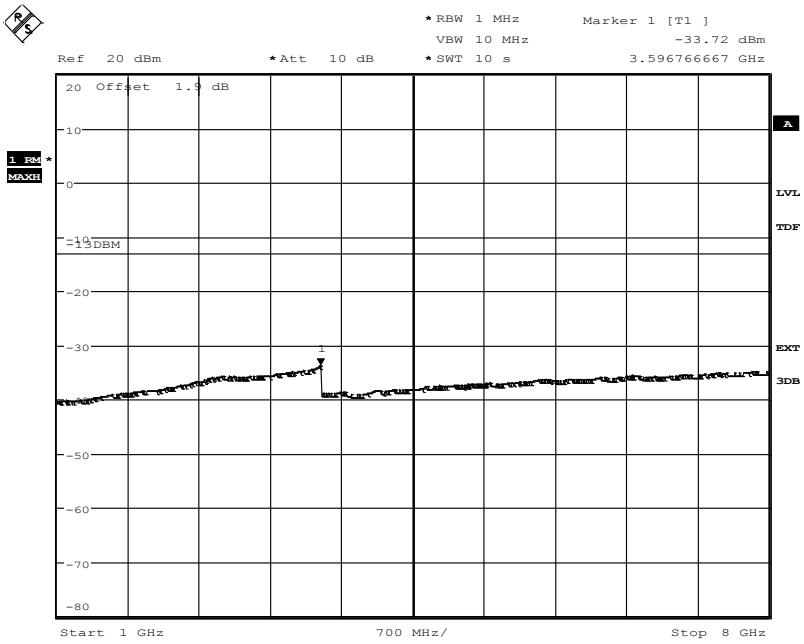

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Appendix 5

Diagram 11 a:

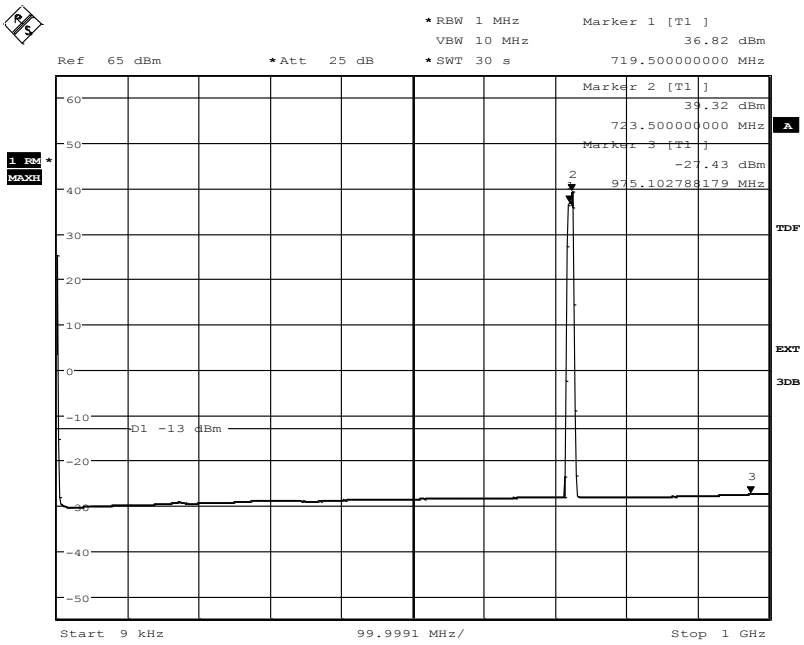

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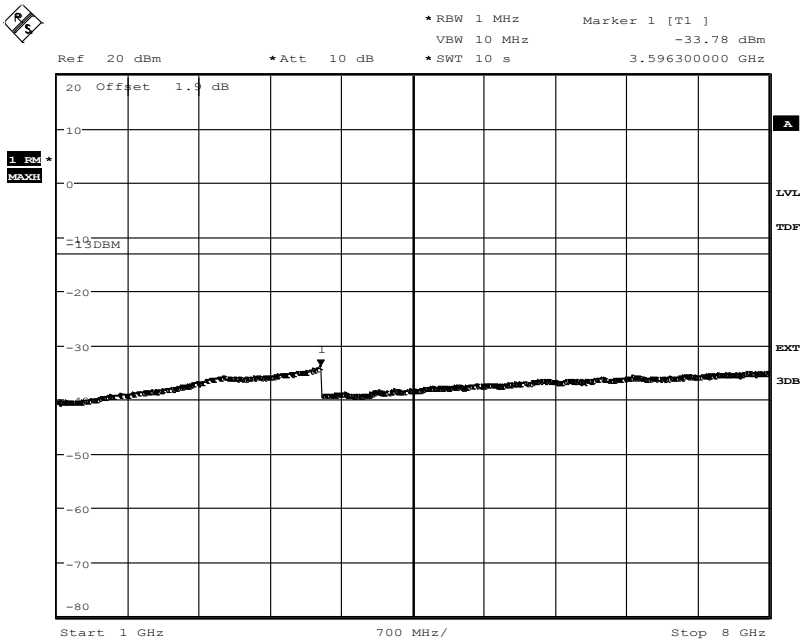
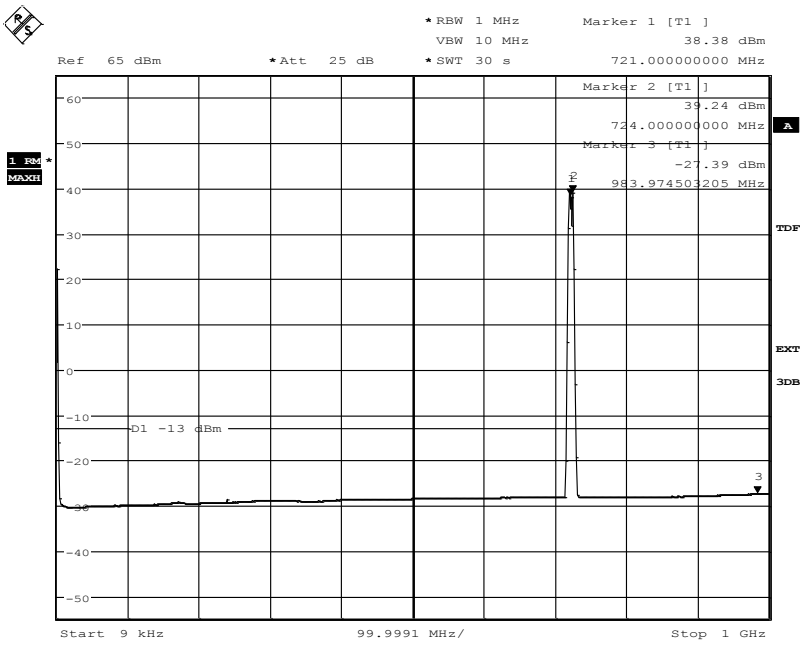
Diagram 11 b:



Date: 8.JAN.2014 18:44:05

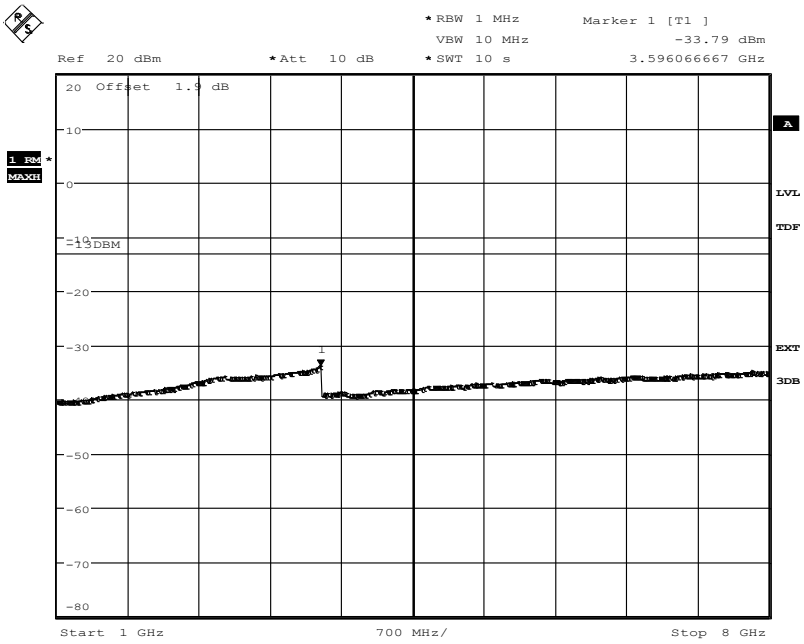
Appendix 5

Diagram 12 a:



Date: 7.JAN.2014 11:59:24

Diagram 12 b:



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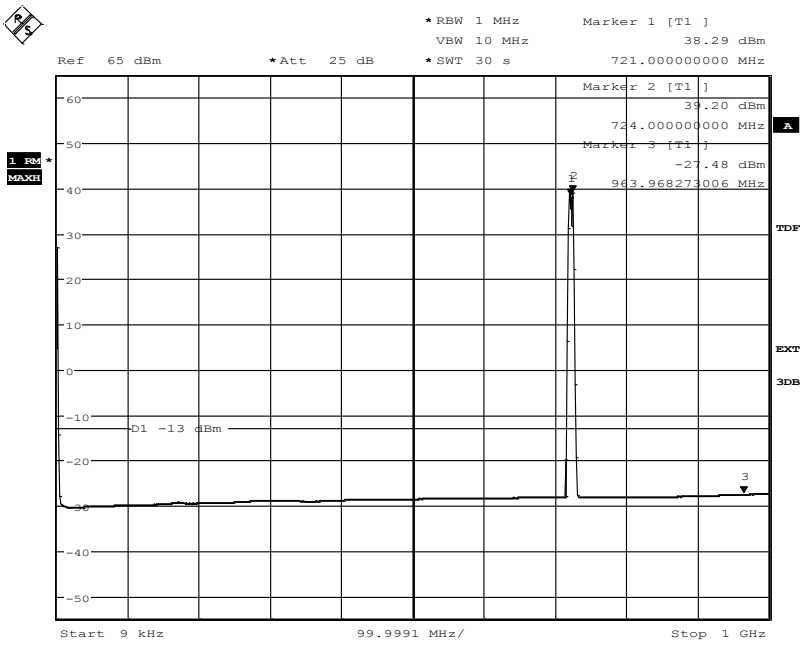
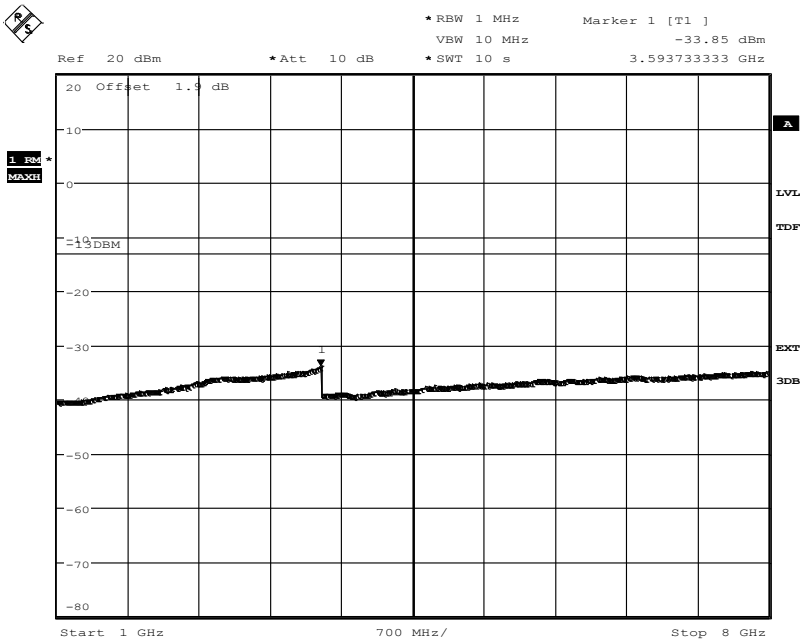
Appendix 5

Diagram 13 a:



Date: 7.JAN.2014 11:48:55

Diagram 13 b:



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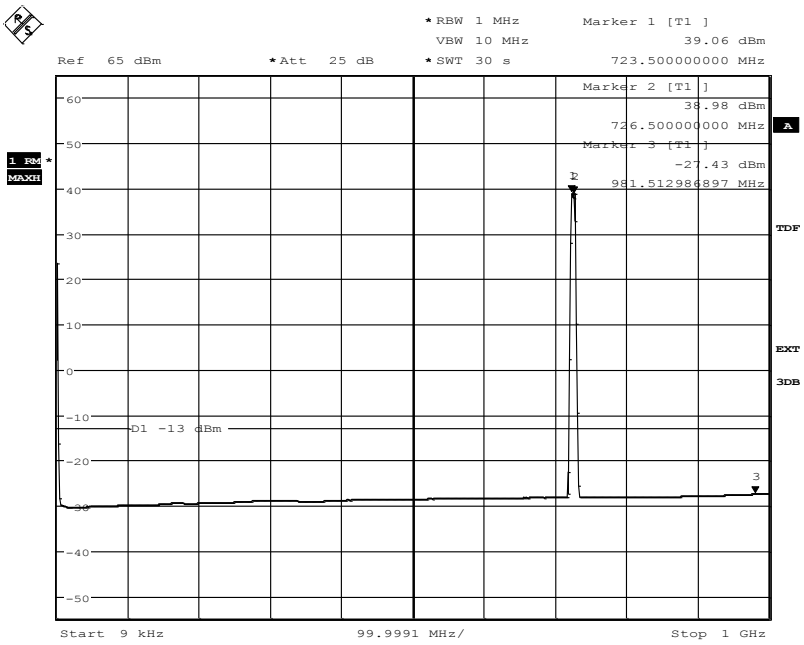
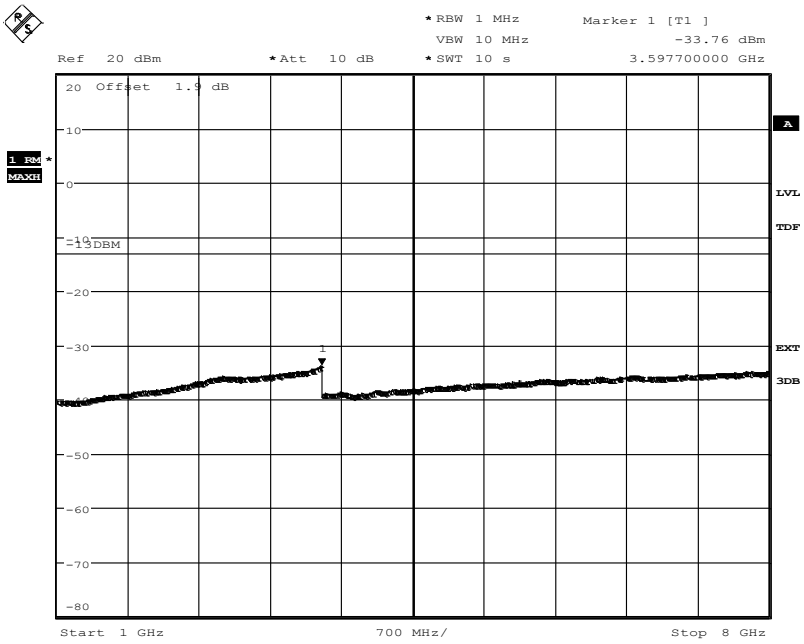
Appendix 5

Diagram 14 a:



Date: 7.JAN.2014 12:12:38

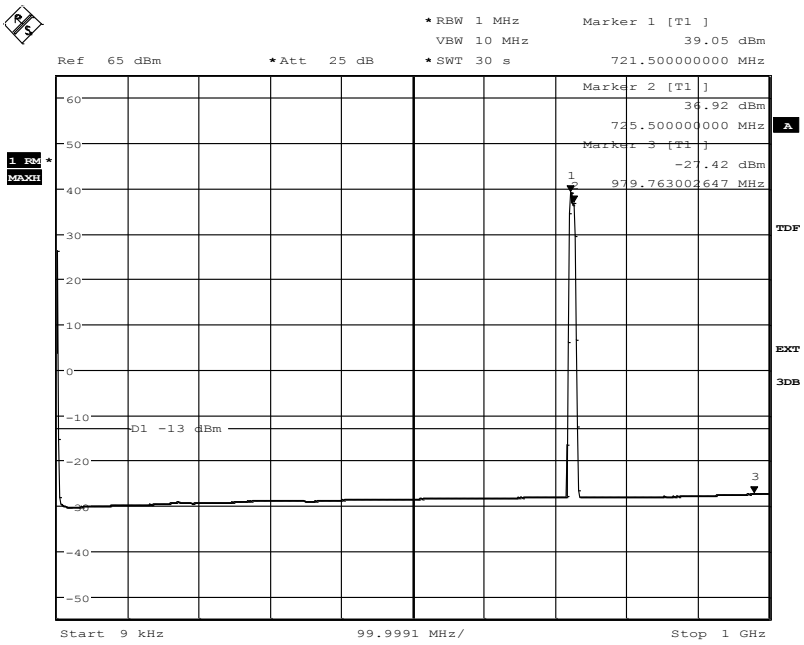
Diagram 14 b:



Date: 7.JAN.2014 12:14:24

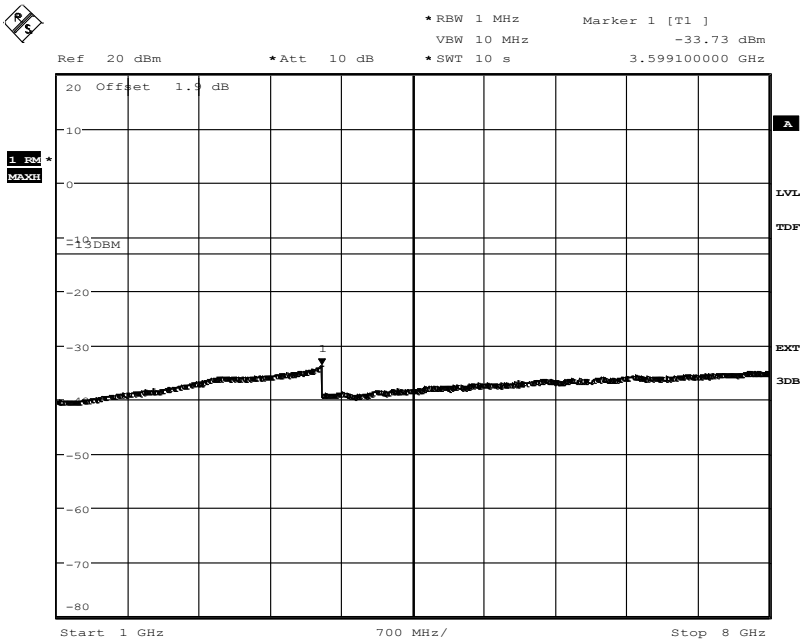
Appendix 5

Diagram 15 a:



Date: 8.JAN.2014 19:03:25

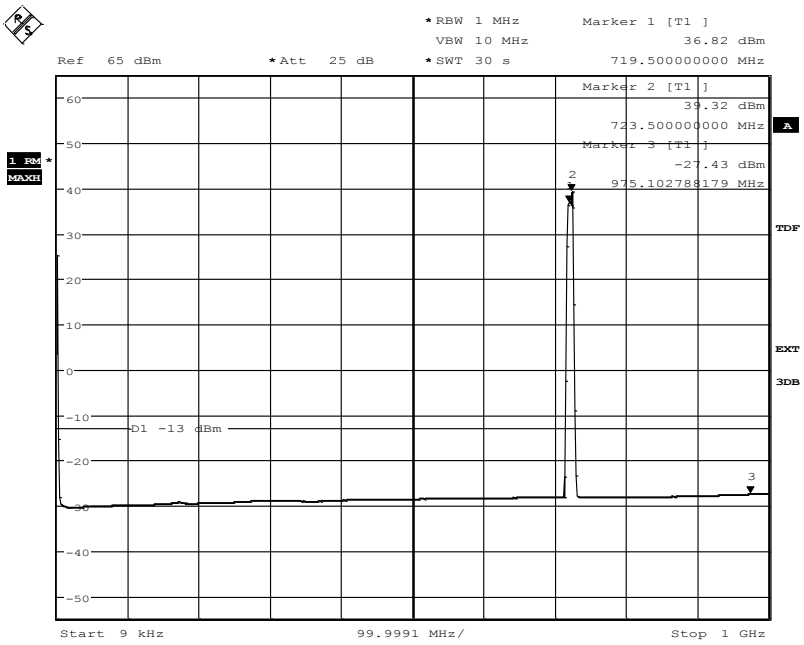
Diagram 15 b:



Date: 8.JAN.2014 19:05:12

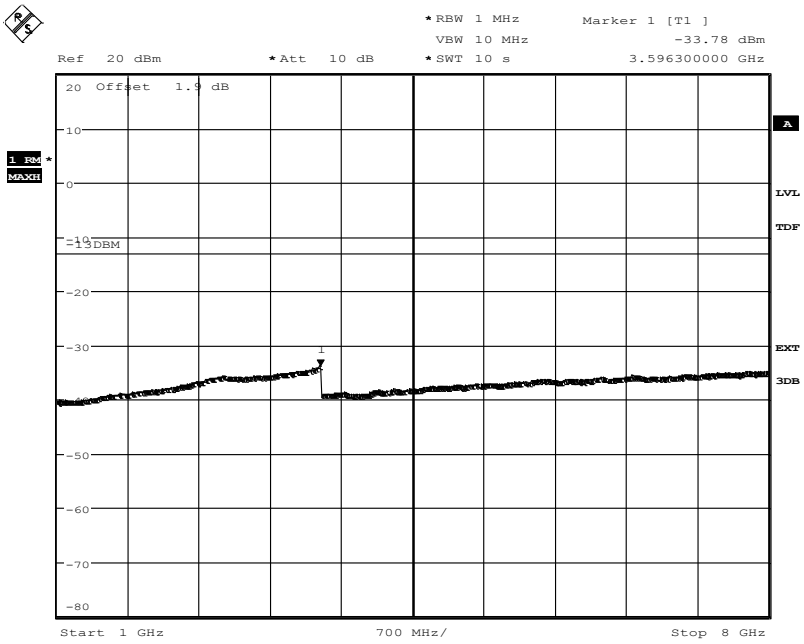
Appendix 5

Diagram 16 a:



Date: 8.JAN.2014 18:42:20

Diagram 16 b:



Date: 8.JAN.2014 18:44:05

Appendix 6

Field strength of spurious radiation measurements according to 47 CFR 27.53 (f) / IC RSS-130 4.6

Date	Temperature	Humidity
2013-12-20	23°C ± 3°C	35 % ± 5 %
2014-01-07	22°C ± 3°C	30 % ± 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.

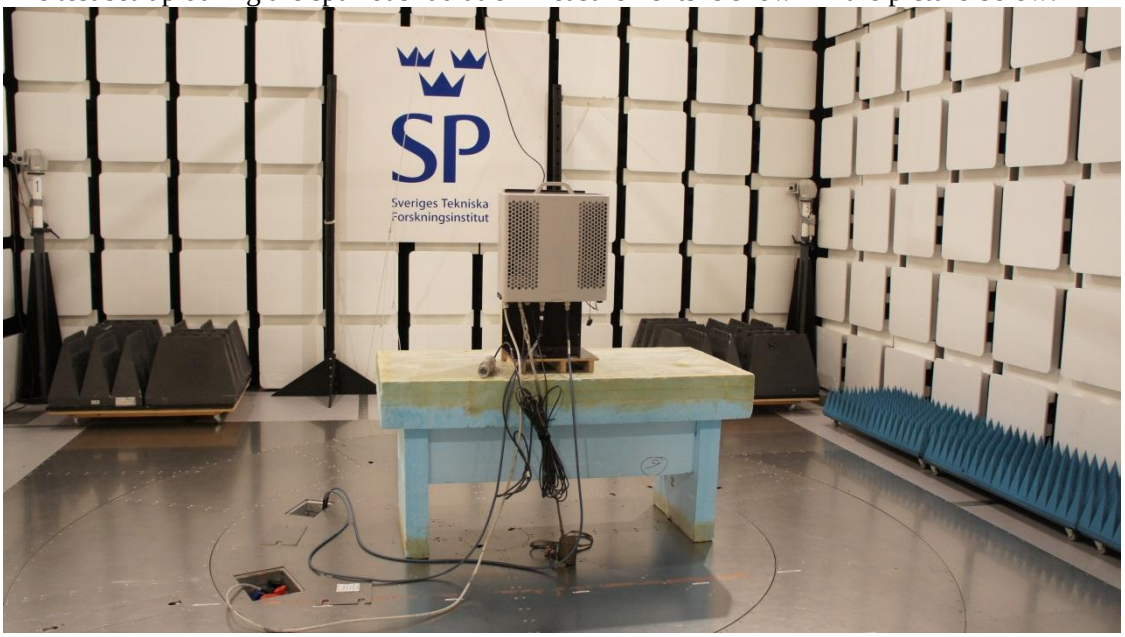
The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 8 GHz.

In the frequency range 30 MHz – 8 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
Semi anechoic chamber	503 881
R&S ESU 26	901 553
EMC 32 ver. 8.52.0	503 899
Chase Bilog Antenna CBL 6111A	502 182
EMCO Horn Antenna 3115	502 175
Flann STD Gain Horn Antenna 20240-20	503 674
High pass filter	901 373
Miteq, Low Noise Amplifier	503 285
Temperature and humidity meter, Testo 625	504 188

Tested configurations

Symbolic name	BW configuration
B2 3 3	Multi carrier: 3 and 3 MHz
B2 3 5	Multi carrier: 3 and 5 MHz
B	3, 5 and 10 MHz
M	3, 5 and 10 MHz
M2 3 3	Multi carrier: 3 and 3 MHz
T	3, 5 and 10 MHz
T2 3 3	Multi carrier: 3 and 3 MHz
T2 3 5	Multi carrier: 3 and 5 MHz

Results, representing worst case

M, BW: 3 MHz Diagram 1 a-b

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-8 000	All emission > 20 dB below limit	All emission > 20 dB below limit

Measurement uncertainty:

3.2 dB up to 8 GHz.

Limits

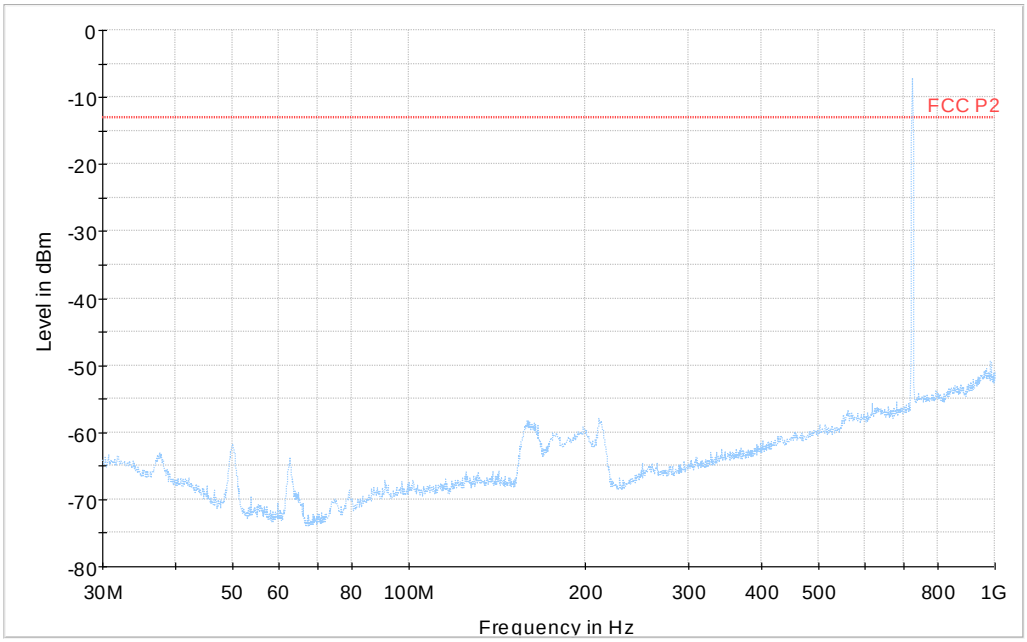
§27.53(f) and RSS-130 4.6

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

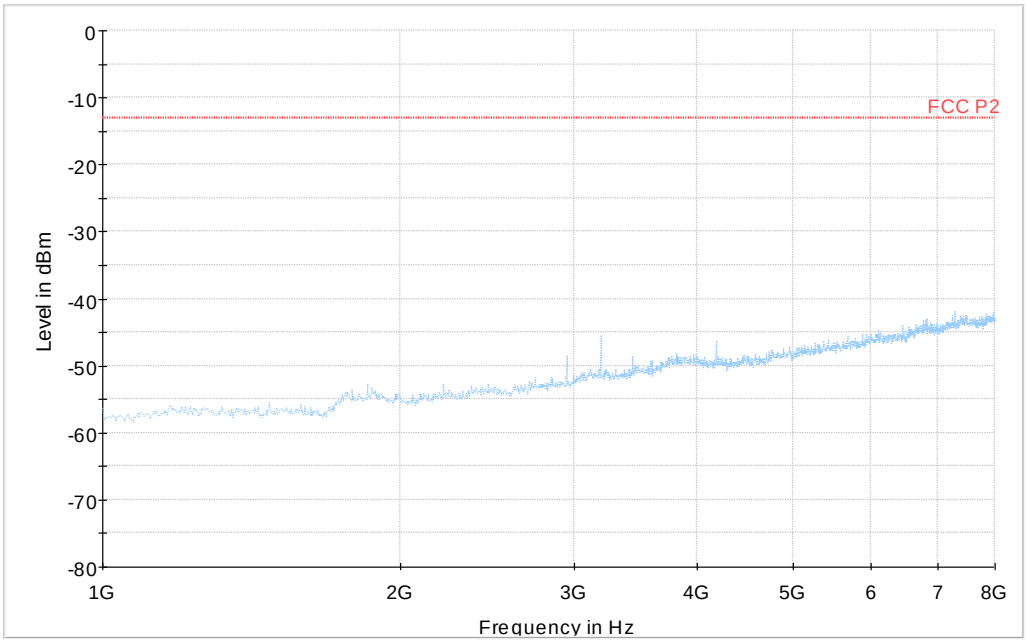
Appendix 6

Diagram 1 a:



Note: The emission at 722.5 MHz is the carrier frequency and shall be ignored in the context.

Diagram 1 b:



Frequency stability measurements according to CFR 47 §27.54 / IC RSS 130 4.3

Date	Temperature (test equipment)	Humidity (test equipment)
2014-01-09 to 2014-01-13	22-23 °C ± 3 °C	26-36 % ± 5 %

Test set-up and procedure

The measurement was made per 3GPP TS 36.141. The output was connected to a spectrum analyser. The spectrum analyser was connected to an external 10 MHz reference standard during the measurements.

The measurement was also made per IC RSS 130 4.3. Using a resolution bandwidth of 1% of the occupied 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
R&S FSQ	504 143
RF attenuator	902 282
Testo 635, Temperature and humidity meter	504 203
Temperature cabinet	503 360

Results

Nominal transmitter frequency was 722.5 MHz (M) with a bandwidth of 5 MHz. Rated output power level at connector RF A (maximum): 46.0 dBm (40 W)

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

Measurements according to 3GPP TS 36.141.

Rated output power level at connector RF A (maximum): 46.0 dBm (40 W)

Test conditions			Frequency margin to band edge at -16dBm			
Supply voltage DC (V)	Temp (°C).	Carrier Bandwidth (MHz)	Test frequency Symbolic name Bottom		Test frequency Symbolic name Top	
			fL (MHz)	Offset to lower band edge (>716 MHz) (kHz)	fH (MHz)	Offset to upper band edge (<728 MHz) (kHz)
-48.0	+20	3	719.000	3000	727.99658	3.42
-48.0	+20	5	717.051	1051	727.95577	44.23
-48.0	+20	10	717.266	1266	727.75312	246.88

Measurements according to IC RSS 130 4.3.

The frequency error results clearly shows that the frequency stability is good enough to ensure that the transmitted carrier stay within the operating band.

Limits
Limit according to 3GPP TS 36.141:
The frequency error shall be within ± 0.05 PPM ± 12 Hz (±48.125Hz).

§27.54:
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

RSS-130 4.3 Frequency:
The frequency stability shall be sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

Complies?	Yes

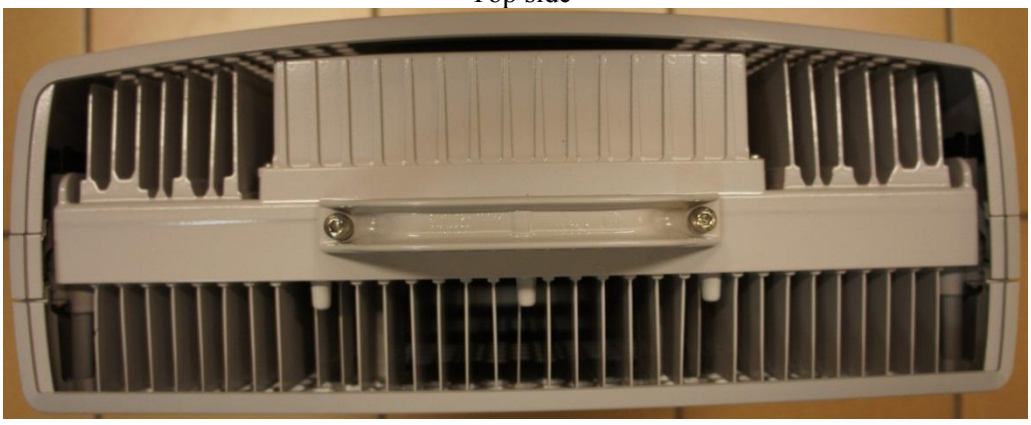
Appendix 8

External photos

Front side

Rear side

Top side



Bottom side

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Appendix 8

ID-label