REPORT

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Date	Reference	Page
2008-03-19	F800029-F24	1 (2)

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Radio measurements on WCDMA 1900 MHz Transceiver unit with FCC ID: TA8AKRC11819-3

(8 appendices)

Test object

Radio Unit KRC 118 19/3 rev R2A

Appendix 1 provides information about the test object and the test set-up.
Appendix 8 provides external photos of the test object.

Summary

Standard		Compliant	Appendix
FCC CFR 47			
2.1046	RF power output	Yes	2
2.1049	Occupied bandwidth	Yes	3
2.1051	Band edge	Yes	4
2.1051	Spurious emission at antenna terminals	Yes	5
2.1053	Field strength of spurious radiation	Yes	6
2.1055	Frequency stability	Yes	7

SP Swedish National Testing and Research Institute
Electronics - EMC

Christer Karlsson
Technical Manager

Jonas Bremholt
Technical Officer

FCC ID: TA8AKRC11819-3

Table of contents

Description – Test object

Equipment: WCDMA Transceiver unit (RU) 1900 MHz, single and multi carrier.

Tx Frequency range: 1932.4-1987.6 MHz

Modulations: QPSK and 16QAM

Maximum output power: Single carrier: 1x 46 dBm (40W)
Multi carrier: 2x 43 dBm (20W)

Nominal power voltage: -48 VDC

Tested channels

UARFCN	Frequency
9662	1932.4 MHz
9712	1942.4 MHz
9763	1952.4 MHz
9788	1957.6 MHz
9813	1962.4 MHz
9888	1977.6 MHz
9938	1987.6 MHz

Operation mode during measurements

Test models

All measurements were performed with the test object transmitting the Test models 1 and 5 defined in 3GPP TS 25.141. Test model 1 uses the QPSK modulation only, and Test model 5 includes the 16QAM modulation.

Conducted measurements

All RF conducted measurements were done at the output connector (Ant A) of the Filter Unit (FU) KRC 118 20/1. The measurements were performed at maximum output power with both modulations. The test object was powered with -48 VDC during the measurements.

The settings below was found to be representative for all traffic scenarios when several settings were tested to find the setting for worst case.

Single carrier
Test model 1: 64 DPCH:s at 30 ksps (SF=128)
Test model 5: 30 DPCH:s at 30 ksps (SF=128) and 8 HS-PDSCH:s at 240 ksps (SF=16)

Multi carrier
Test model 1: 32 DPCH:s at 30 ksps (SF=128)
Test model 5: 30 DPCH:s at 30 ksps (SF=128) and 8 HS-PDSCH:s at 240 ksps (SF=16)

Radiated measurements

All radiated measurements were performed with the test object installed in a wooden rack without EMC shielding. This configuration represents worst case for radiated spurious emission measurements. The test object was powered with -48 VDC.

The RU unit was activated for maximum transmit power. The RU unit was activated as Single Carrier (1x46dBm) and Multi Carrier (2x43 dBm). The RF output power port was terminated with 50 ohm loads.

The settings below were found to be representative for all traffic scenarios when several settings were tested to find the setting for worst case.

The RU unit were allocated to the following UARFCN:

Single Carrier:

Modulation	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Downlink UARFCN	9662 (1932.4 MHz)	9662 (1932.4 MHz)	9787 (1957.6 MHz)	9787 (1957.6 MHz)	9938 (1987.6 MHz)	9938 (1987.6 MHz)
Uplink UARFCN	9262 (1852.4 MHz)	9262 (1852.4 MHz)	9387 (1877.4 MHz)	9387 (1877.4 MHz)	9538 (1907.6 MHz)	9538 (1907.6 MHz)
Test model	1	5	1	5	1	5

Test model 1: 64 DPCH:s at 30 ksps (SF=128)
Test model 5: 30 DPCH:s at 30 ksps (SF=128) and 8 HS-PDSCH:s at 240 ksps (SF=16)

Multi Carrier:

Cell	1	2
Modulation	QPSK	16QAM
Downlink	9662 (1932.4 MHz)	9712 (1942.4 MHz)
Uplink	9262 (1852.4 MHz)	9312 (1862.4 MHz)
Test model	1	5

Test model 1: 32 DPCH:s at 30 ksps (SF=128)
Test model 5: 30 DPCH:s at 30 ksps (SF=128) and 8 HS-PDSCH:s at 240 ksps (SF=16)

Purpose of test

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47.

References

Measurements were done according to relevant parts of the following standards:
ANSI 63.4-2003
ANSI/TIA/EIA-603-B-2002
3GPP TS 25.141

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: 2008-02-11

Manufacturer's representative

Christer Gustavsson, Ericsson AB.

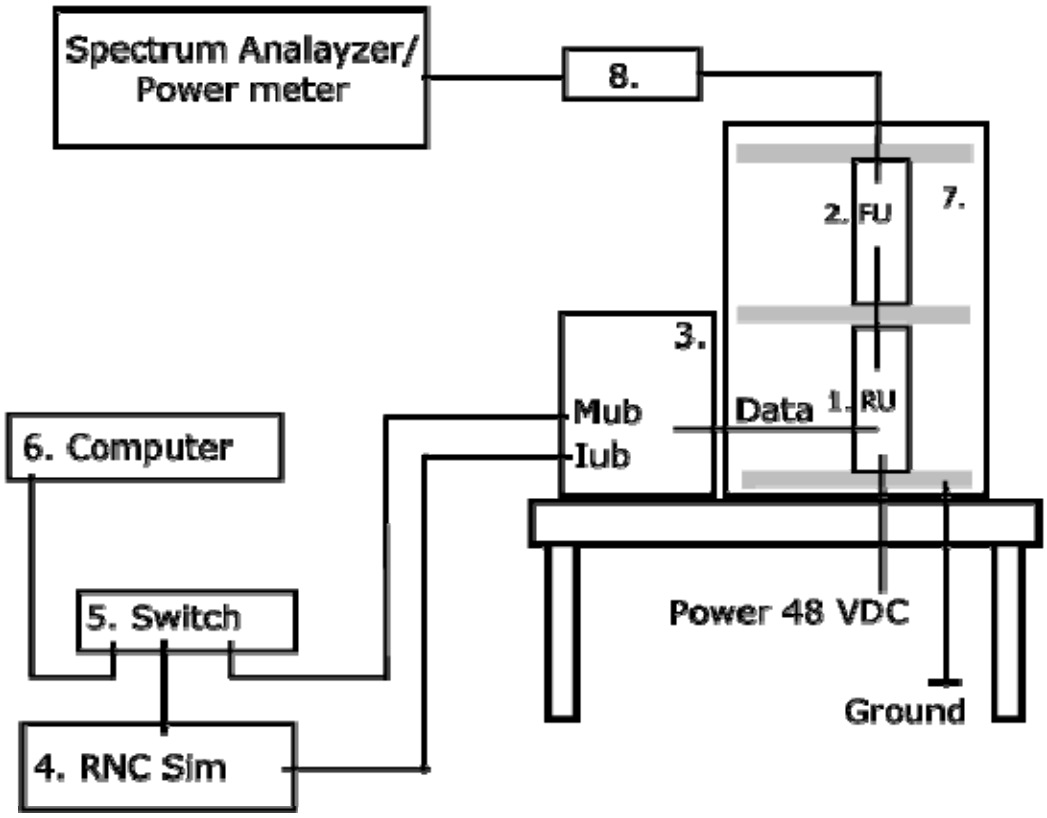
Test engineers

Jonas Bremholt and Jörgen Wassholm

Test witnesses

Christer Gustavsson and Gunnar Svensson, Ericsson AB.

Test set-up, conducted measurements



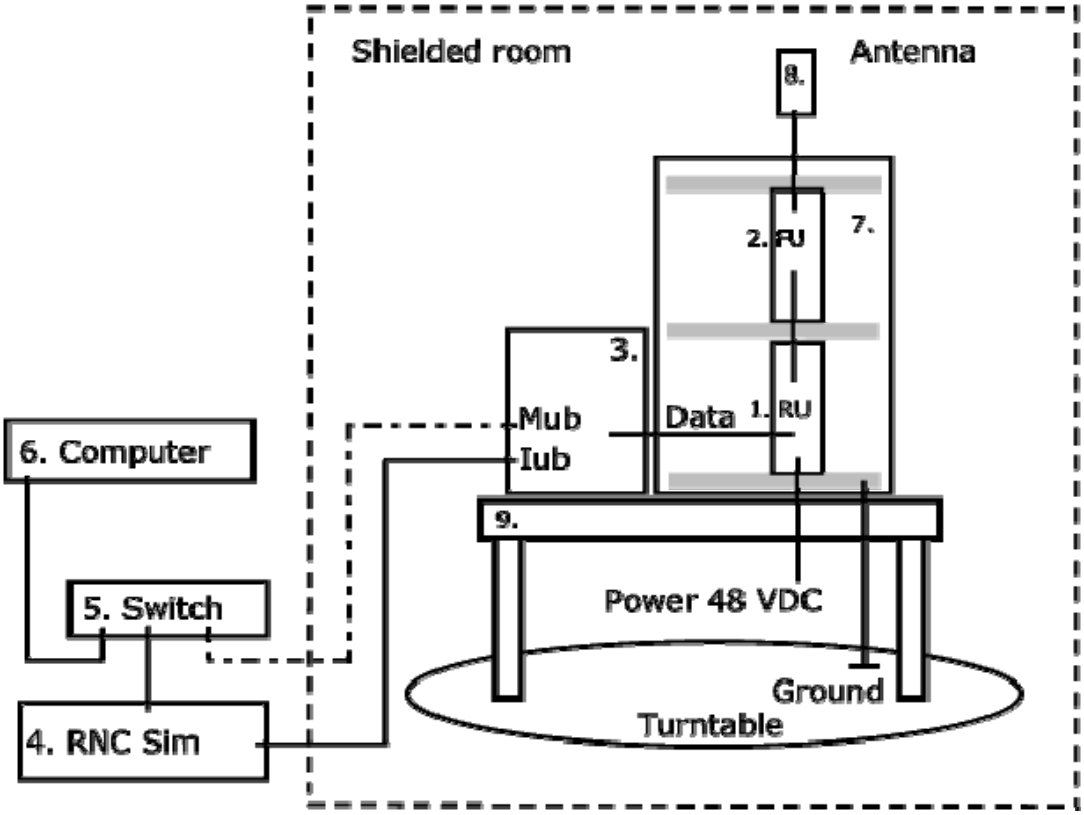
1. Test object, RU KRC 118 19/3 Rev. R2A, Serial No: AB20303776
   (FCC ID: TA8AKRC11819-3)
2. FU KRC 118 20/1 Rev. R1H, Serial No: A400578052

Functional test equipment

3. BB subrack with software CXP 901 2073-R5M06
4. RNC: Mini-sim #33 4780 DA BAMS-1000117285 (Iub transmission configured as T1)
5. Switch, Netgear Ethernet switch DS108
6. Computer: SunBlade 2500 (IOV S4)
7. Wooden rack
8. Attenuator

The test object was hosted in a RBS 3206M during the frequency error measurements.

Test set-up, radiated measurements



Note: The Mub cable were not attached during the measurements, only used to activate/ deactivate the transmitter.

Test object

1. Test object, RU KRC 118 19/3 Rev. R2A, Serial No: AB20303776 (FCC ID: TA8AKRC11819-3)
2. FU KRC 118 20/1 Rev. R1H, Serial No: A400578052

Functional test equipment

3. BB subrack with software CXP901 2073/1 rev R5M06
4. RNC: Mini-sim #51 4780 DA S/N 0205 (Iub transmission configured as T1)
5. Switch, Procurve 2810-24G, BAMS1000552539
6. Computer: SunBlade 2500 BAMS0000015232
7. Wooden rack
8. Terminator (50 ohn)
9. Non conductive table

FCC ID: TA8AKRC11819-3 Appendix 2

RF power output measurements according to 47 CFR 2.1046

Date	Temperature	Humidity
2008-02-13	23 °C ± 3 °C	25 % ± 5 %
2008-02-14	23 °C ± 3 °C	14 % ± 5 %

Test set-up and procedure

The output was connected to a peak power analyzer. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
Boonton RF Peak power meter/analyzer	2008-12	503 144
Boonton Power sensor 56518-S/4	2009-06	503 146
Multimeter Fluke 87	2009-01	502 190
Testo 610, Temperature and humidity meter	2009-04	502 658

Measurement uncertainty: 0.5 dB

Results

Single carrier

Rated output power level at Ant A connector (maximum): 1x 46 dBm

Test conditions	Transmitter power (dBm) RMS		
T_{nom} 22 °C/ V_{nom} -48 V DC	Frequency 1932.4 MHz	Frequency 1957.6 MHz	Frequency 1987.6 MHz
QPSK	46.2	46.2	46.3
16QAM	46.3	46.1	46.3

Multi carrier

Rated output power level at Ant A connector (maximum): 2x 43 dBm

Test conditions	Transmitter combined power (dBm) RMS		
T_{nom} 22 °C/ V_{nom} -48 V DC	Frequencies 1932.4 MHz 1942.4 MHz	Frequencies 1952.4 MHz 1962.4 MHz	Frequencies 1977.6 MHz 1987.6 MHz
QPSK	46.2	46.0	46.2
16QAM	46.2	46.0	46.2

Limit

§24.232 Maximum conducted output power shall not exceed 100W (50 dBm).

Complies?	Yes

Occupied bandwidth measurements according to 47 CFR 2.1049

Date	Temperature	Humidity
2008-02-13	23 °C ± 3 °C	25 % ± 5 %
2008-02-14	23 °C ± 3 °C	14 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §2.1049. Measurements were performed on the combined TX/RX antenna terminal Ant 1. The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
R&S FSIQ	2008-10	503 738
Testo 610, Temperature and humidity meter	2009-04	502 658

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 3.1

QPSK

	Frequency	OBW
Diagram 1	1932.4 MHz	4.2 MHz
Diagram 2	1957.6 MHz	4.2 MHz
Diagram 3	1987.6 MHz	4.2 MHz

16QAM

	Frequency	OBW
Diagram 4	1932.4 MHz	4.2 MHz
Diagram 5	1957.6 MHz	4.2 MHz
Diagram 6	1987.6 MHz	4.2 MHz

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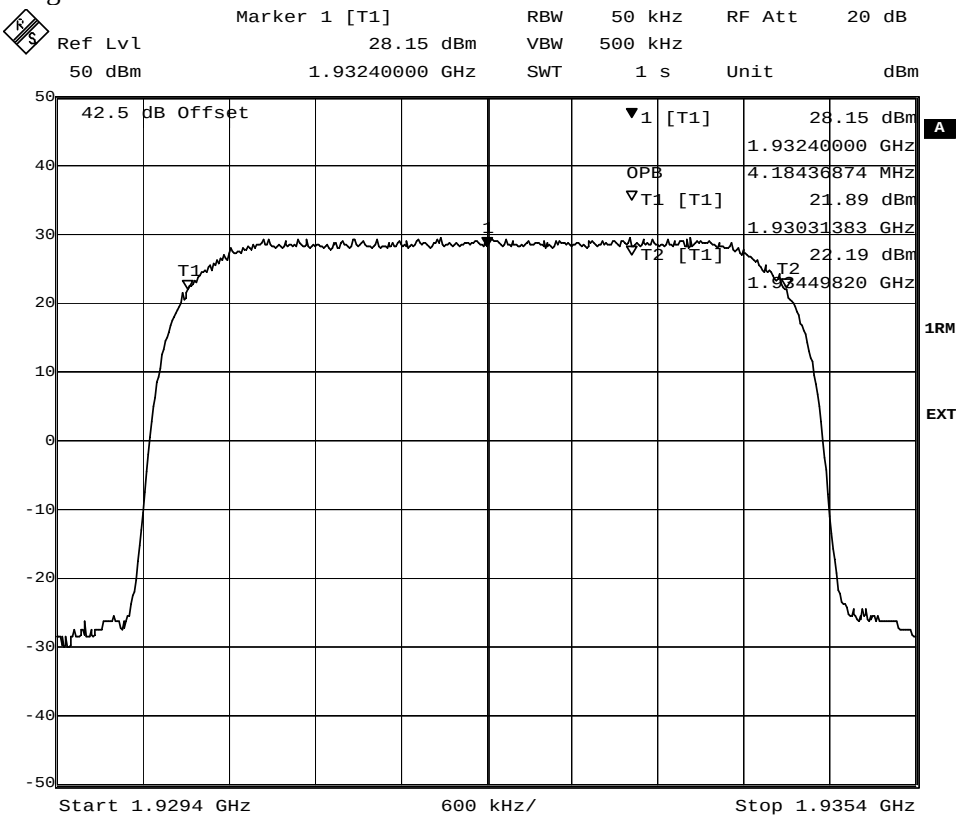
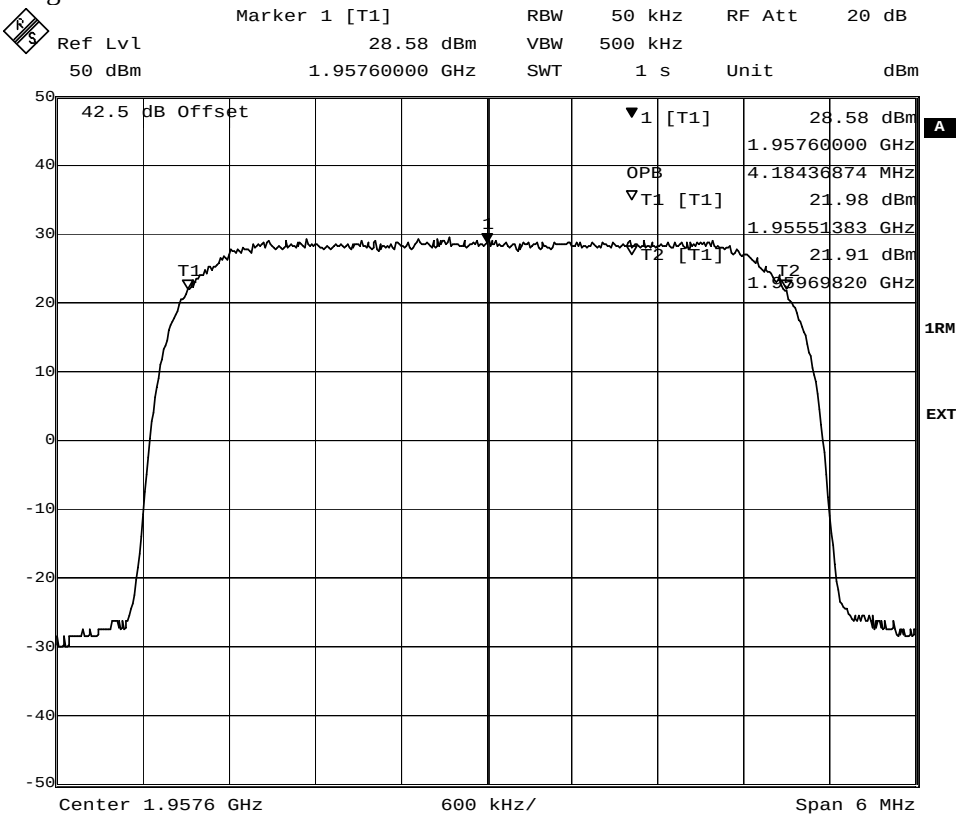
Diagram 1



Date: 13.FEB.2008 16:25:47

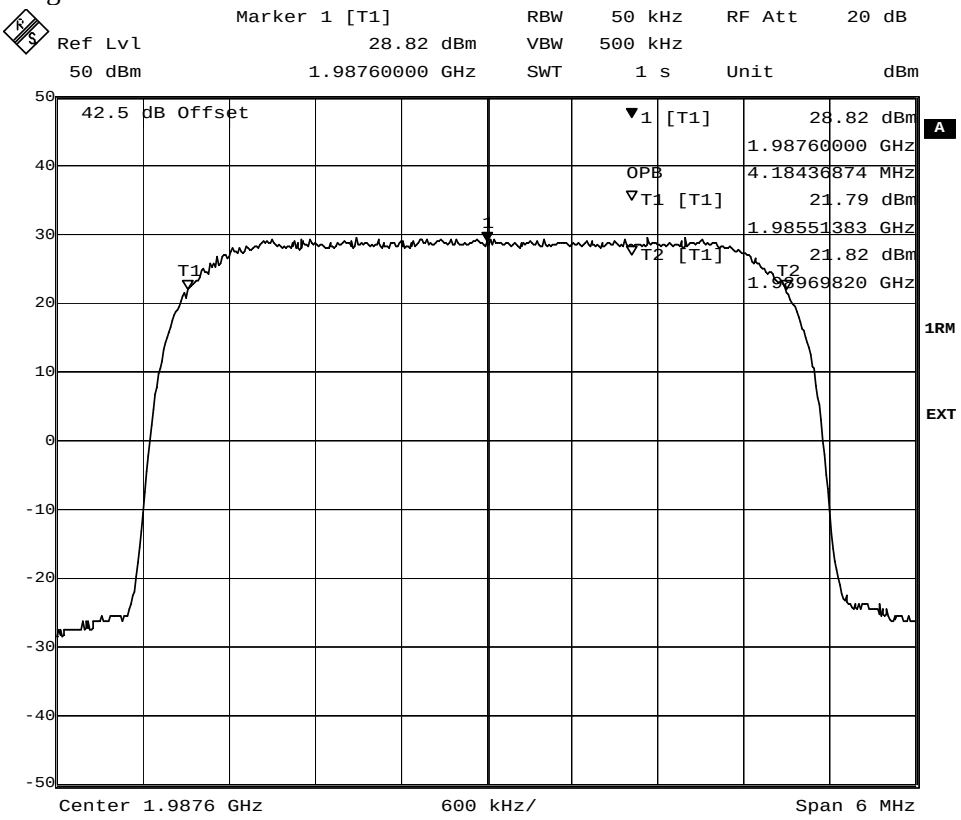
Diagram 2



Date: 14.FEB.2008 16:01:58

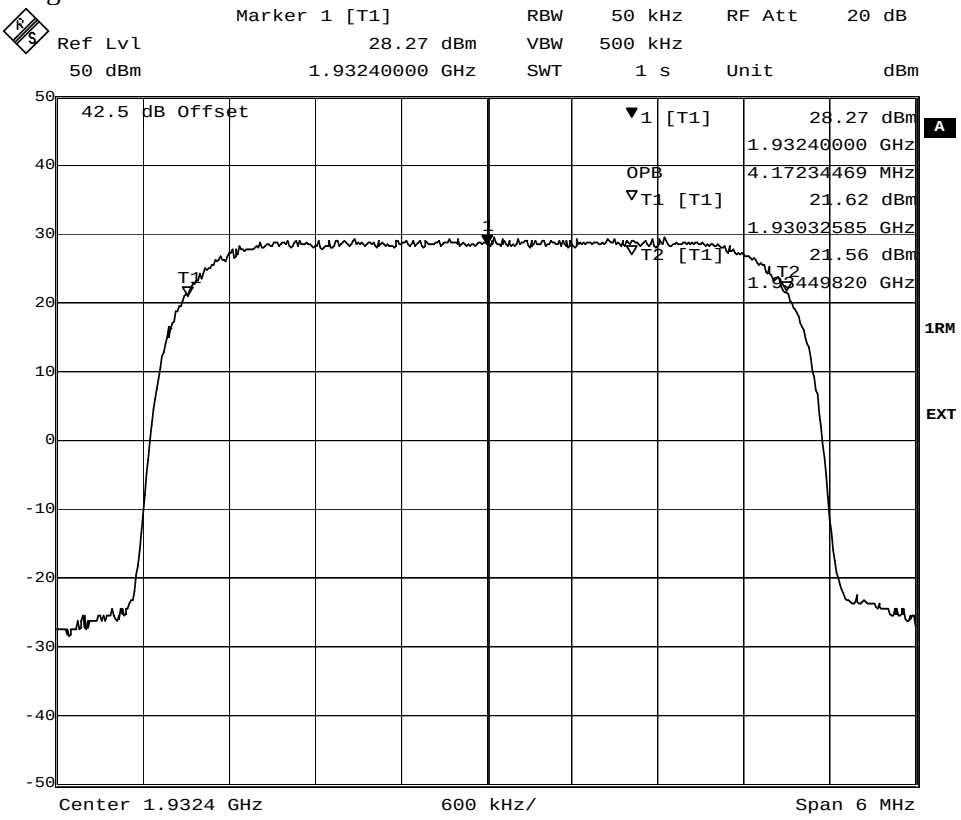
FCC ID: TA8AKRC11819-3 Appendix 3.1

Diagram 3



Date: 14.FEB.2008 13:17:32

Diagram 4



Date: 13.FEB.2008 16:14:35

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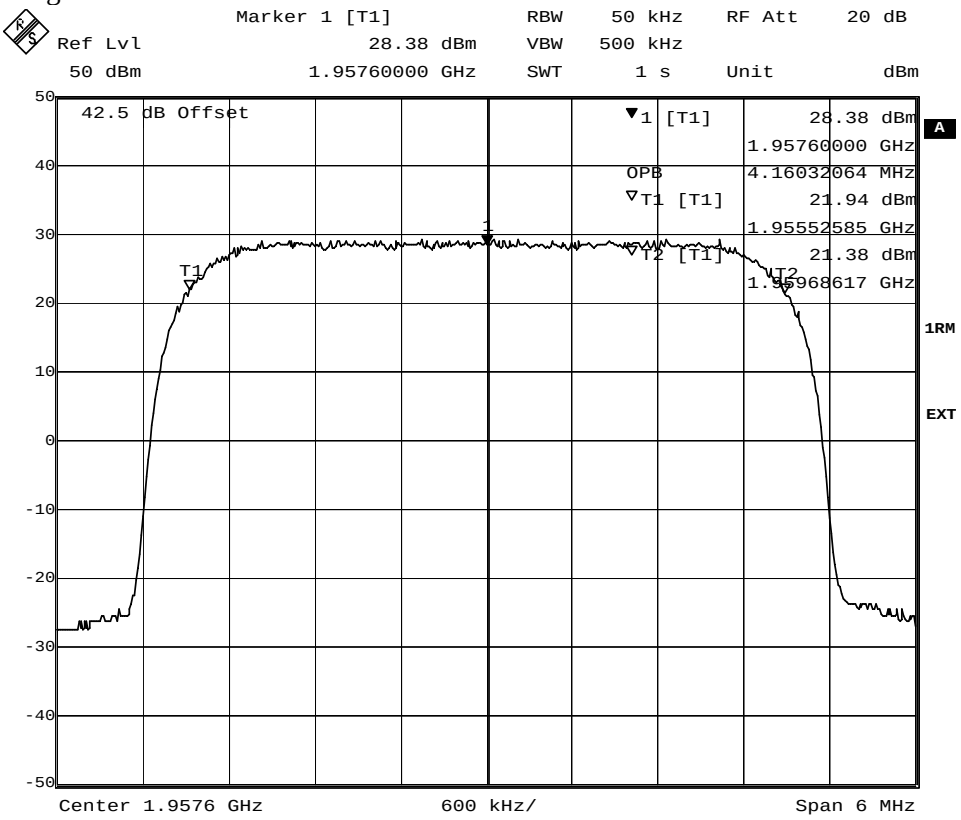
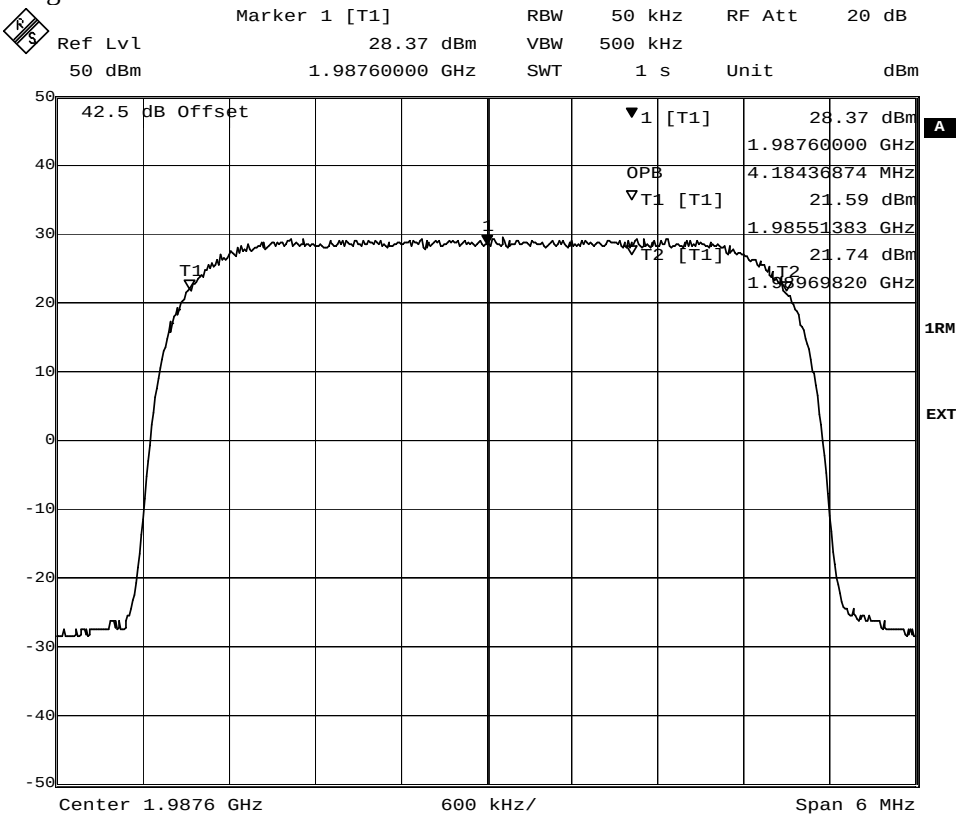
Diagram 5



Date: 14.FEB.2008 15:12:39

Diagram 6



Date: 14.FEB.2008 14:00:36

Band edge measurements according to 47 CFR 2.1051

Date	Temperature	Humidity
2008-02-13	23 °C ± 3 °C	25 % ± 5 %
2008-02-14	23 °C ± 3 °C	14 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. Measurements were performed on the combined TX/RX antenna terminal Ant 1. The output was connected to a spectrum analyzer with the RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements. A resolution bandwidth of 30 kHz was used up to 3.25 MHz away from the band edges. 30 kHz is <1% of the Emission BW(4.25 MHz between the 26 dB points). To compensate for the reduced measurement band width, the limit was adjusted with 1.5 dB to -14.5 dBm up to 1 MHz away from the band edges and with 15.2 dB to -28.2 dBm between 1 MHz to 3.25 MHz away from the band edges. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
R&S FSIQ	2008-10	503 738
Testo 610, Temperature and humidity meter	2009-04	502 658

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 4.1

Single carrier

	QPSK		**16QAM**
Diagram 1:	1932.4 MHz	Diagram 3:	1932.4 MHz
Diagram 2:	1987.6 MHz	Diagram 4:	1987.6 MHz

Multi carrier

	QPSK		**16QAM**
Diagram 5:	1932.4+1942.4 MHz	Diagram 7:	1932.4+1942.4 MHz
Diagram 6:	1977.6+1987.6 MHz	Diagram 8:	1977.6+1987.6 MHz

Limits

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

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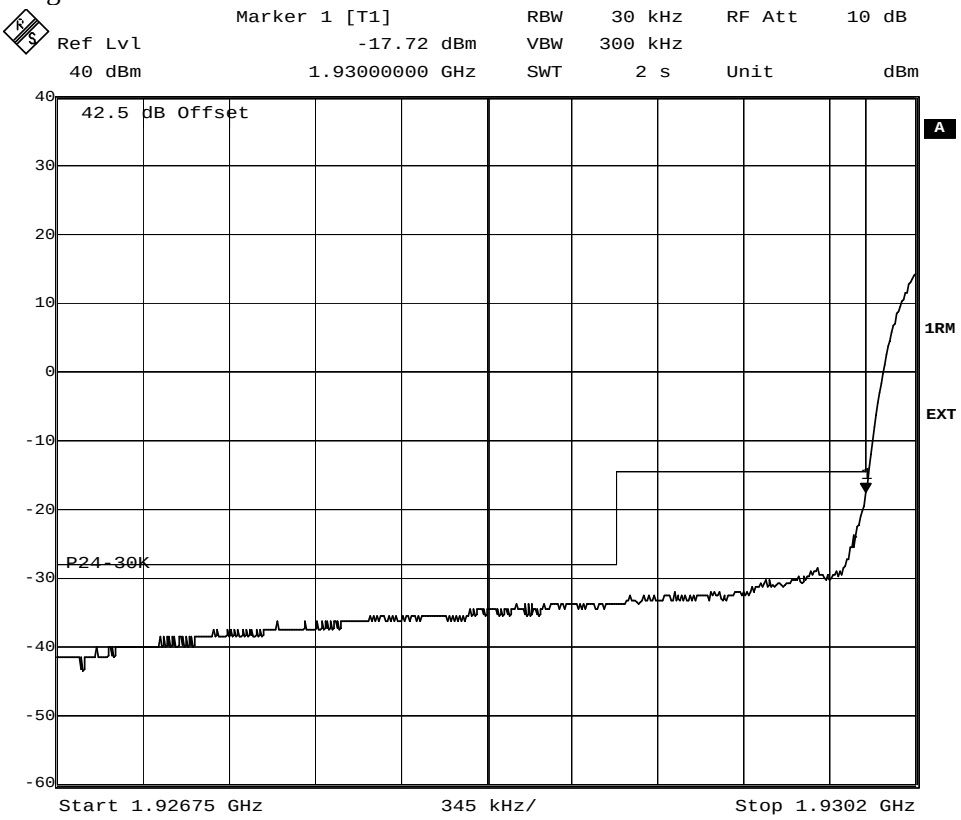
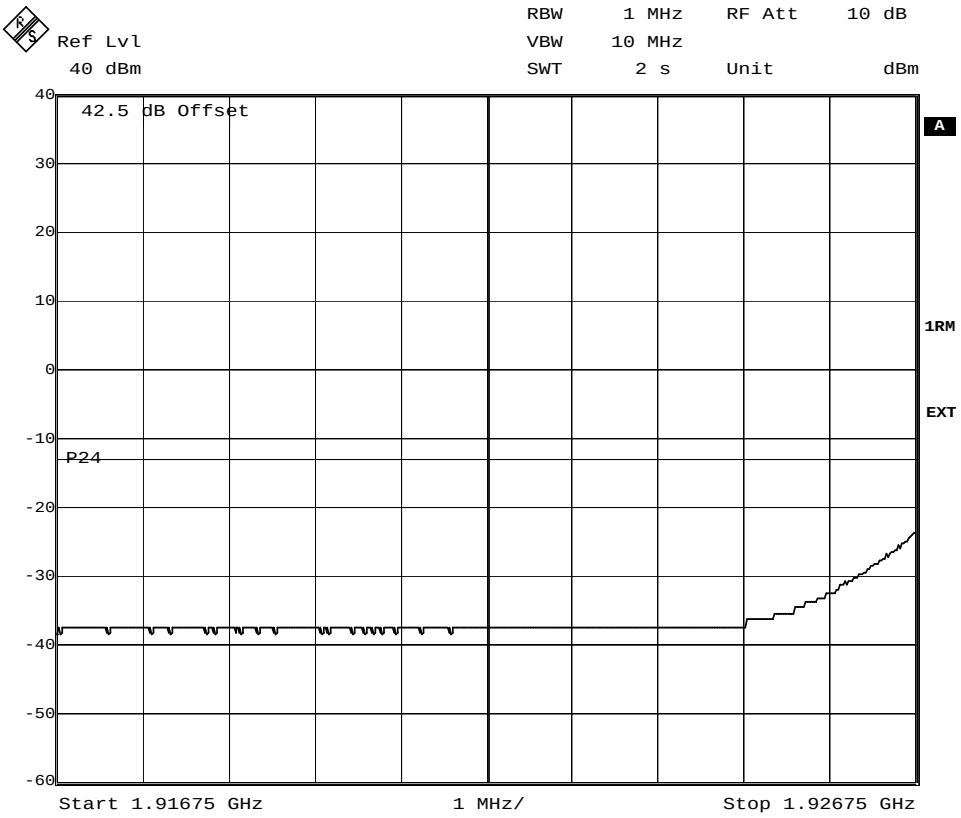
Diagram 1

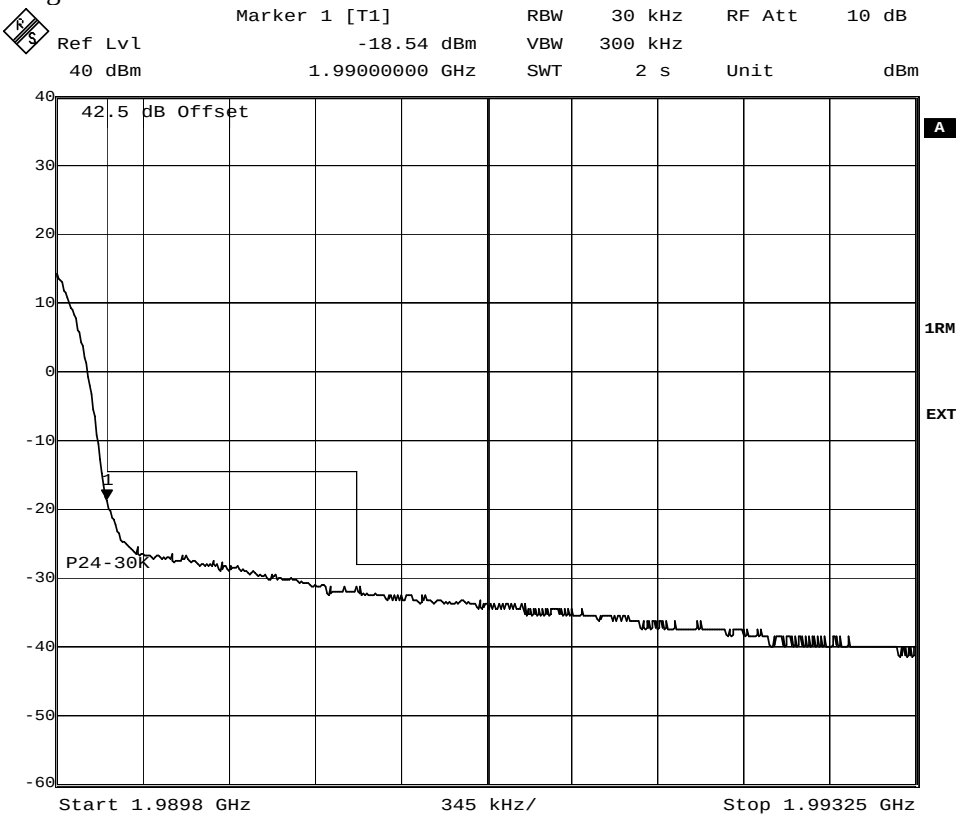


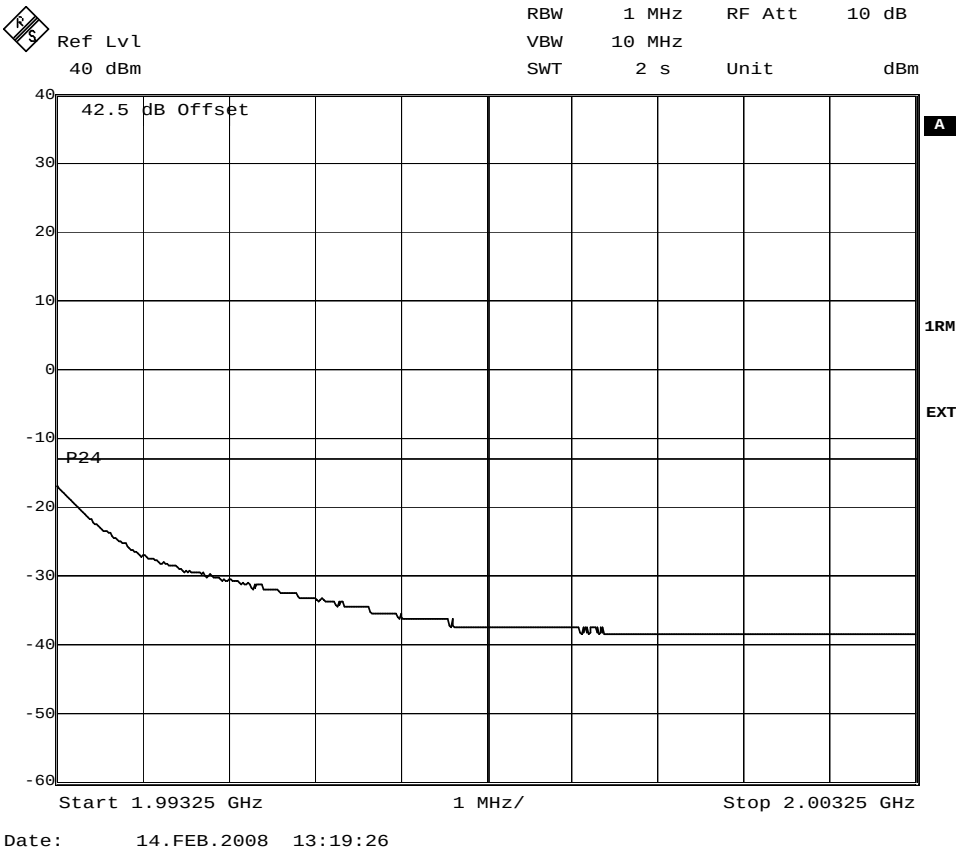
Date: 13.FEB.2008 16:23:35



Date: 13.FEB.2008 16:22:53

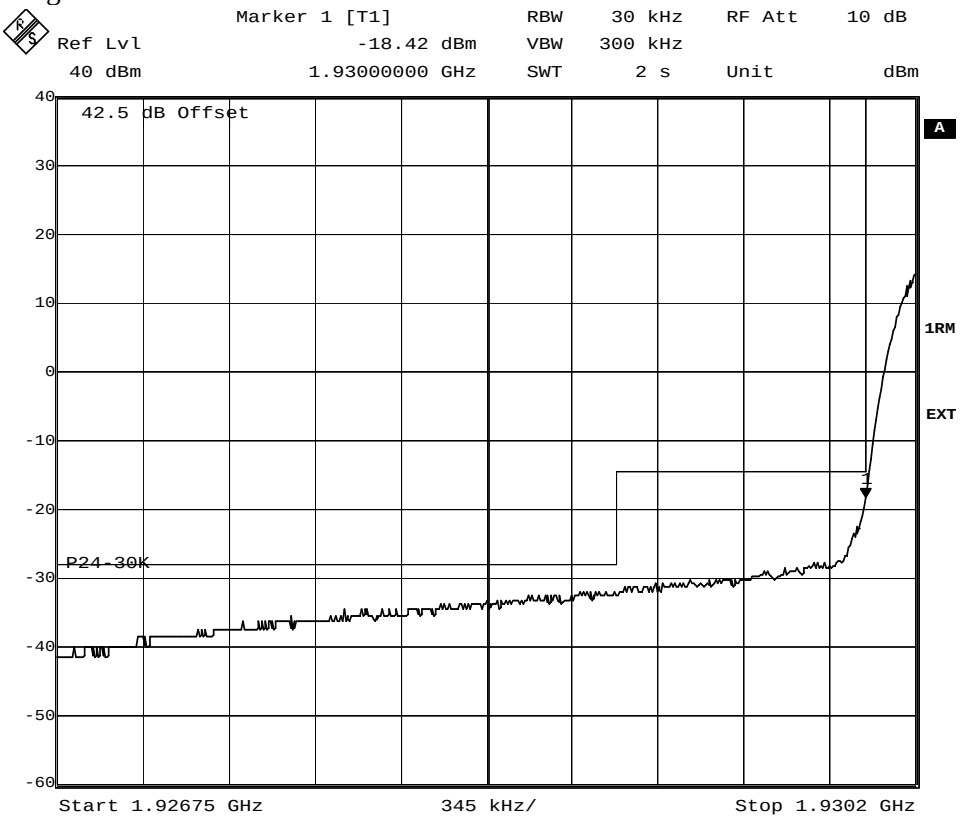
Diagram 2


Marker 1 [T1]
Ref Lvl
-18.54 dBm
40 dBm
1.99000000 GHz
RBW 30 kHz
VBW 300 kHz
SWT 2 s
RF Att 10 dB
Unit dBm
42.5 dB Offset
A
1RM
EXT
1
P24-30K
40
30
20
10
0
-10
-20
-30
-40
-50
-60
Start 1.9898 GHz
345 kHz/
Stop 1.99325 GHz
Date: 14.FEB.2008 13:18:51

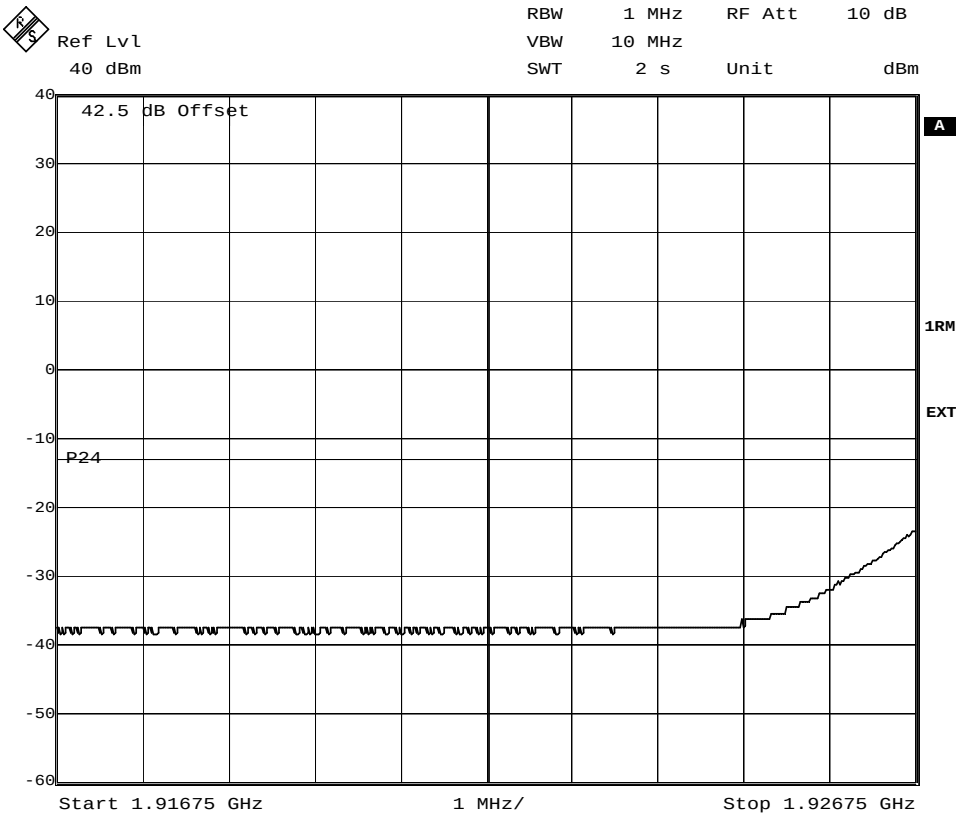

Ref Lvl
40 dBm
RBW 1 MHz
VBW 10 MHz
SWT 2 s
RF Att 10 dB
Unit dBm
42.5 dB Offset
A
1RM
EXT
P24
40
30
20
10
0
-10
-20
-30
-40
-50
-60
Start 1.99325 GHz
1 MHz/
Stop 2.00325 GHz
Date: 14.FEB.2008 13:19:26

FCC ID: TA8AKRC11819-3 Appendix 4.1

Diagram 3



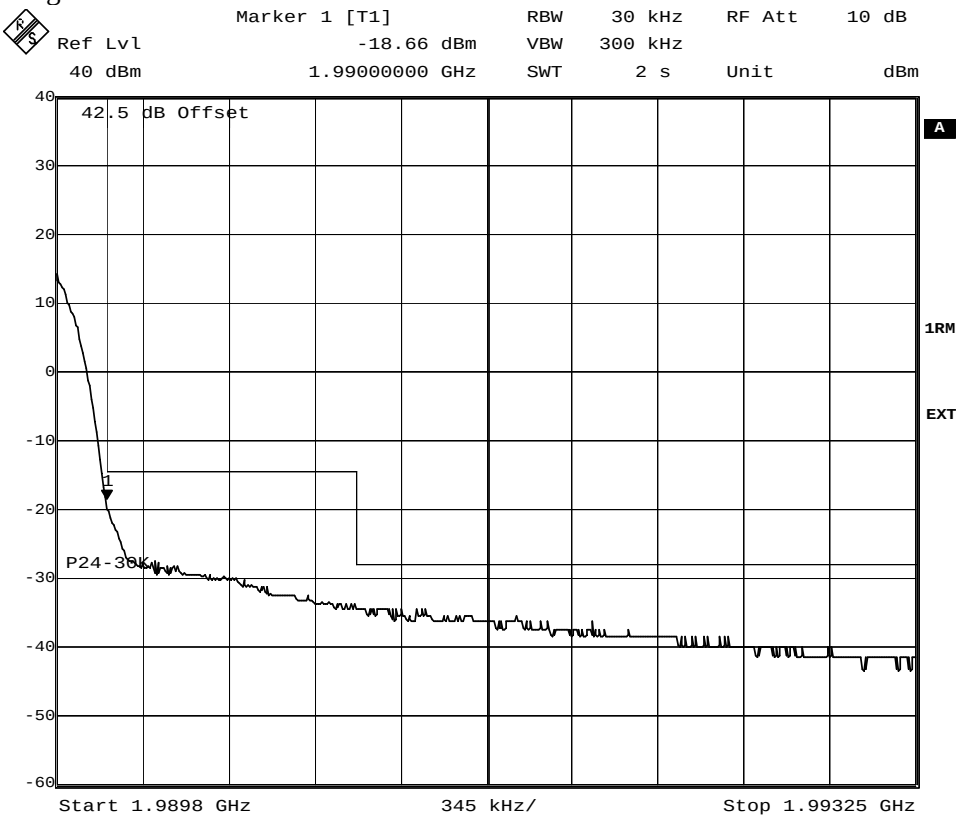
Date: 13.FEB.2008 16:17:03

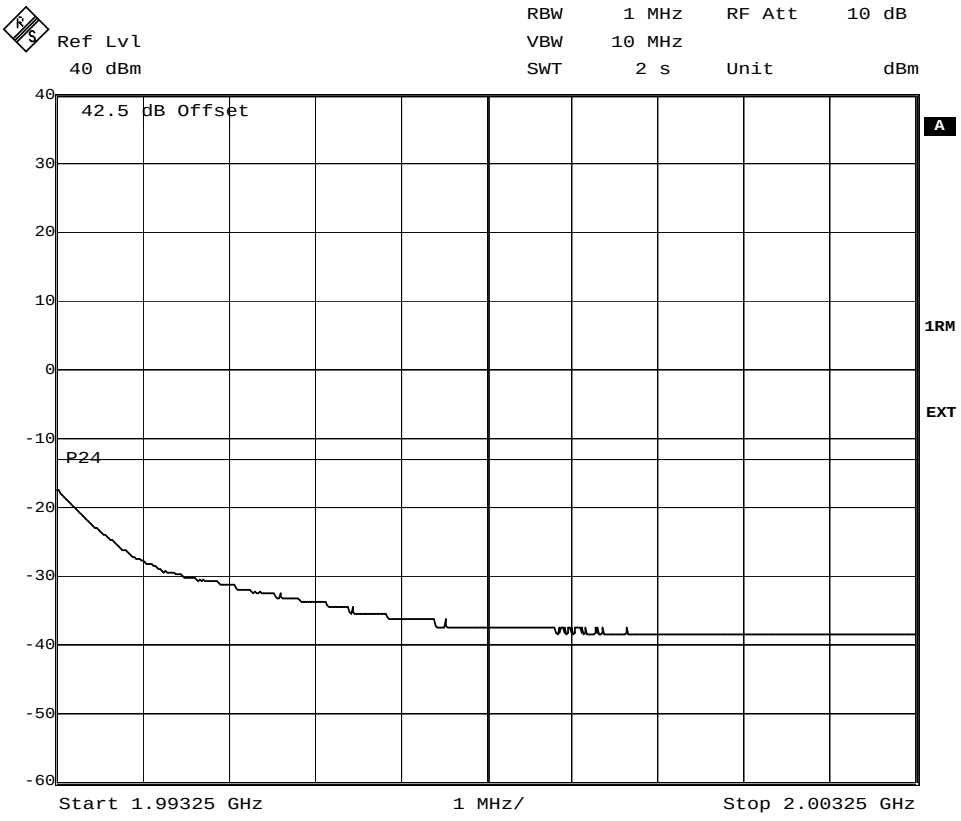


Date: 13.FEB.2008 16:18:24

FCC ID: TA8AKRC11819-3 Appendix 4.1

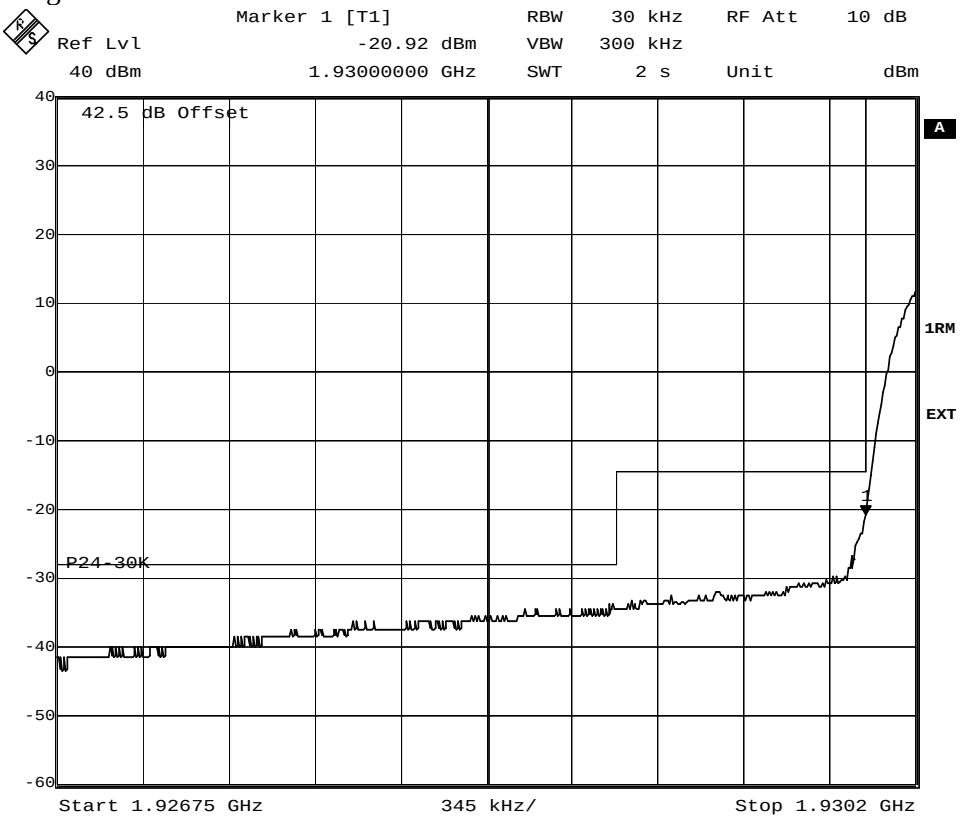
Diagram 4



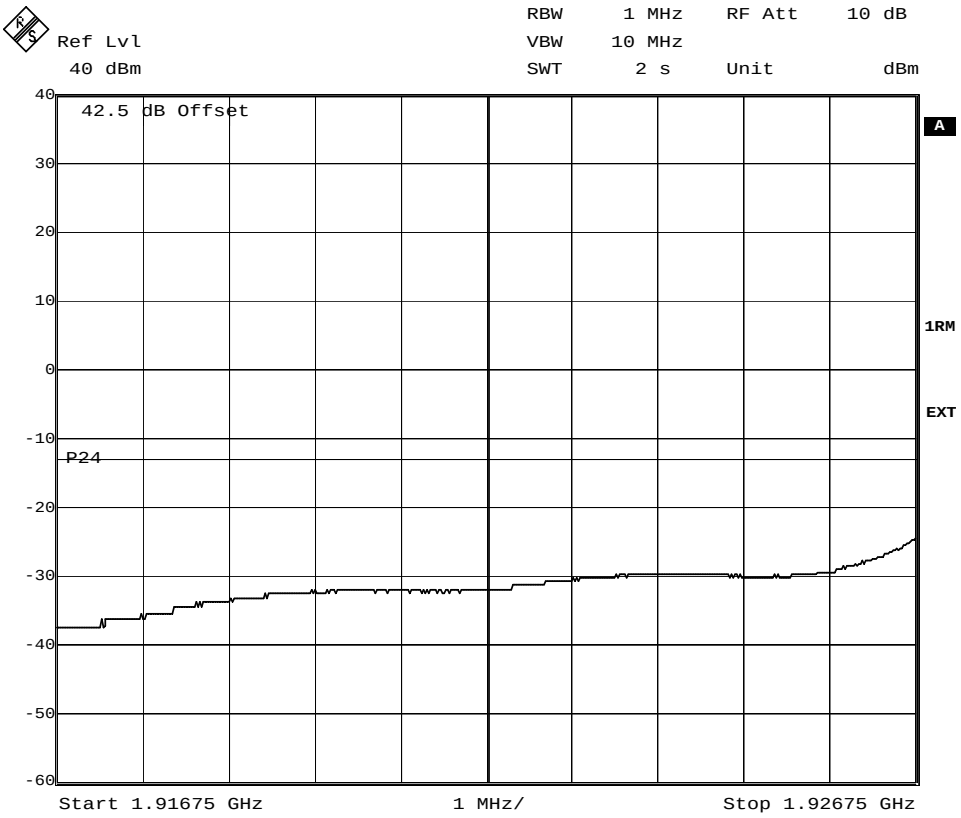


FCC ID: TA8AKRC11819-3 Appendix 4.1

Diagram 5

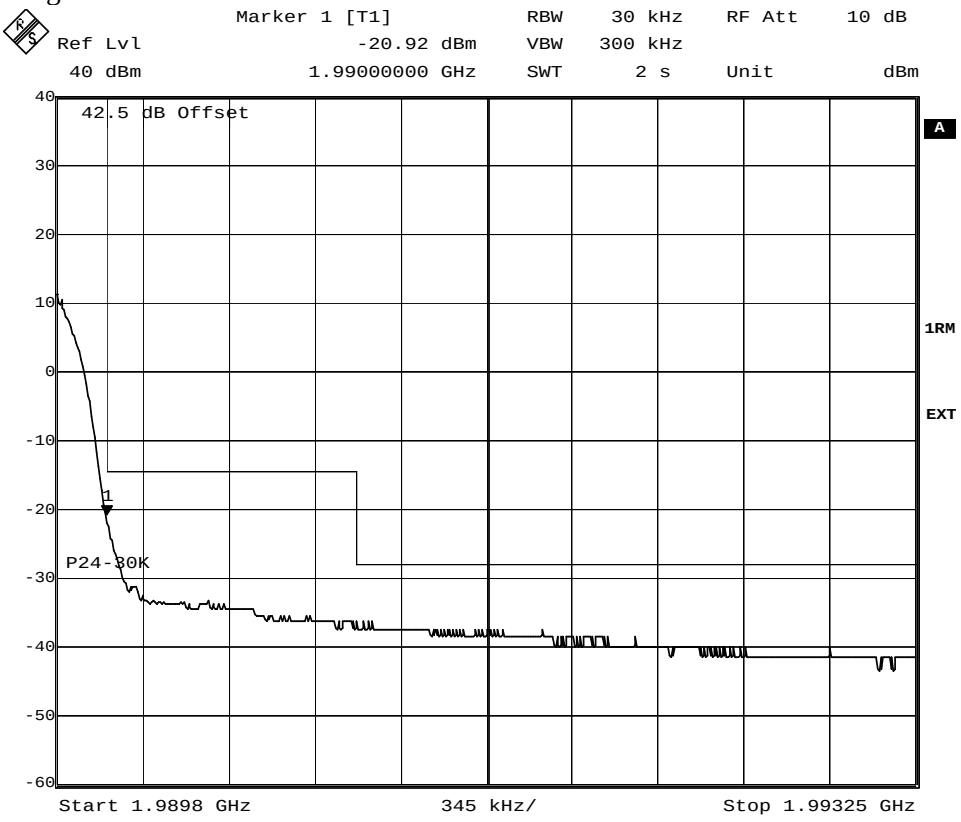


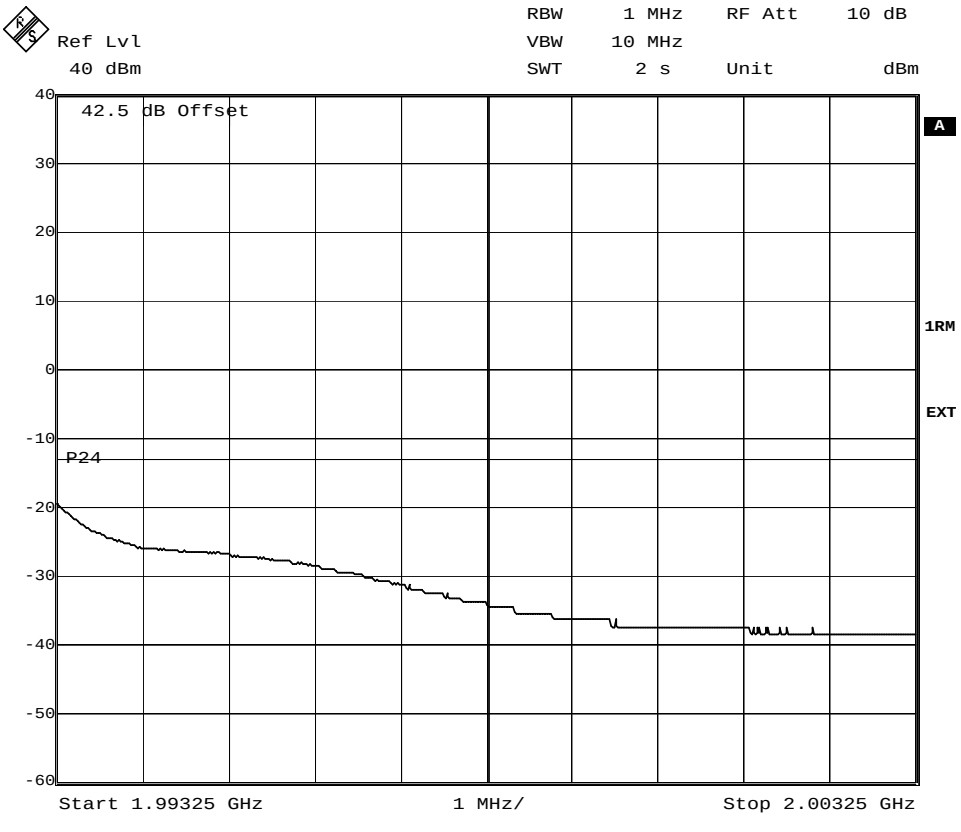
Date: 13.FEB.2008 17:00:45



Date: 13.FEB.2008 17:00:15

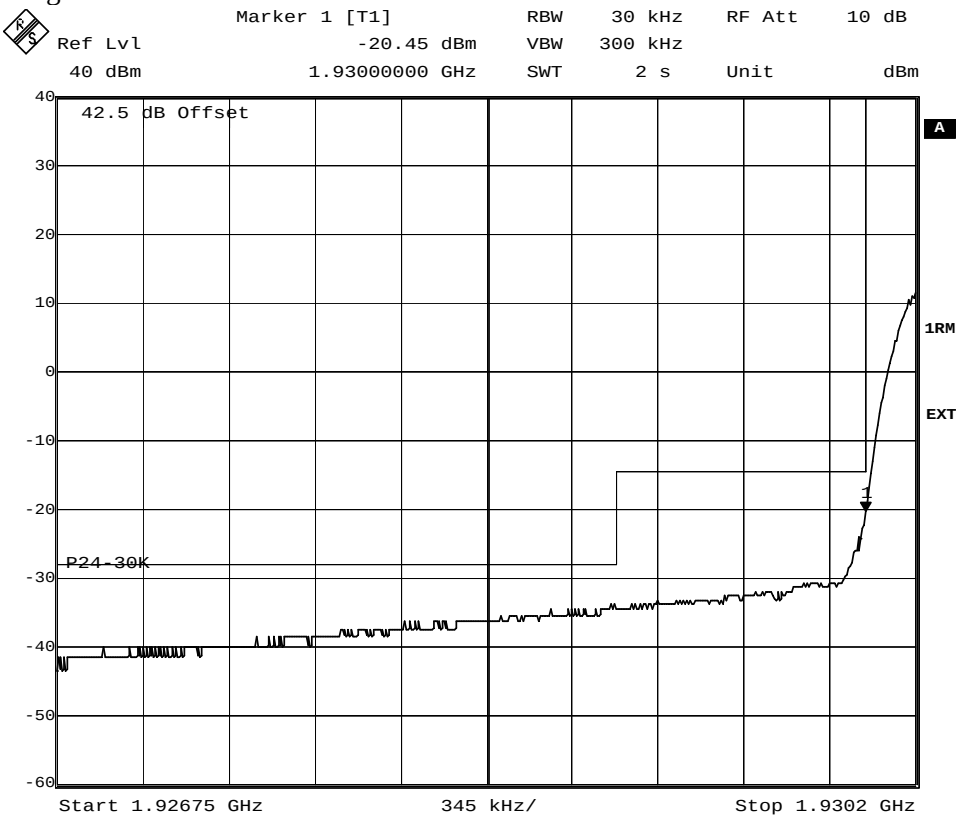
Diagram 6


Marker 1 [T1]
Ref Lvl
-20.92 dBm
40 dBm
1.99000000 GHz
RBW 30 kHz
VBW 300 kHz
SWT 2 s
RF Att 10 dB
Unit dBm
42.5 dB Offset
A
1RM
EXT
1
P24-30K
Start 1.9898 GHz
345 kHz/
Stop 1.99325 GHz
Date: 13.FEB.2008 17:20:08


Ref Lvl
40 dBm
RBW 1 MHz
VBW 10 MHz
SWT 2 s
RF Att 10 dB
Unit dBm
42.5 dB Offset
A
1RM
EXT
P24
Start 1.99325 GHz
1 MHz/
Stop 2.00325 GHz
Date: 13.FEB.2008 17:20:48

FCC ID: TA8AKRC11819-3 Appendix 4.1

Diagram 7



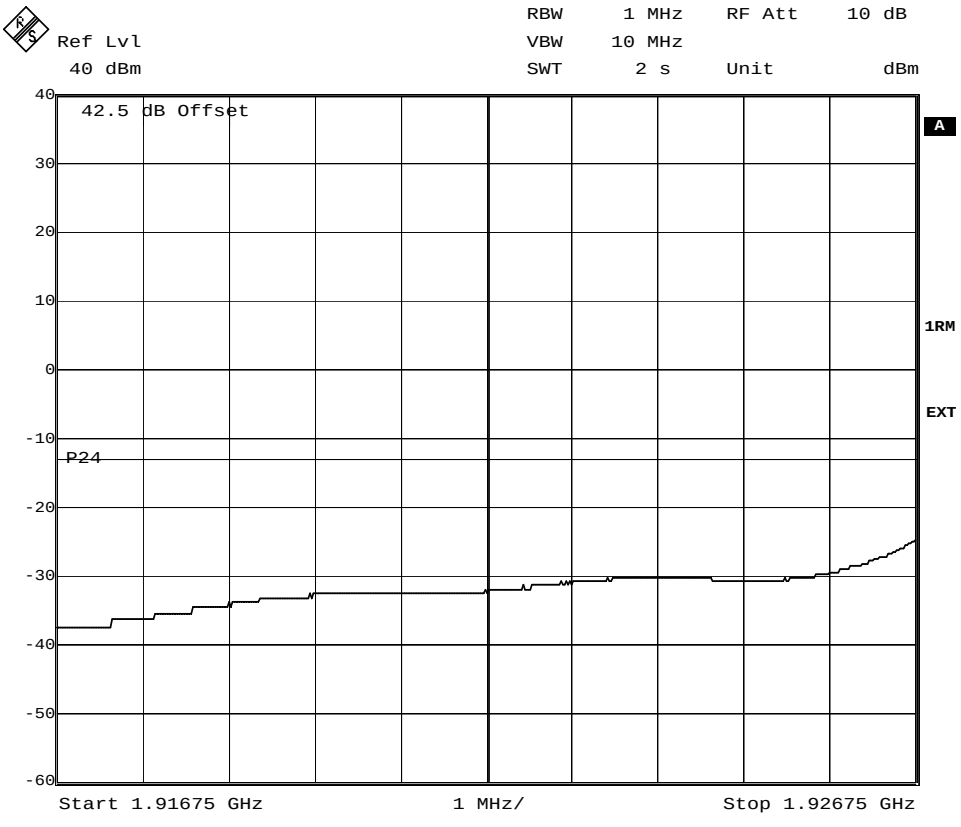


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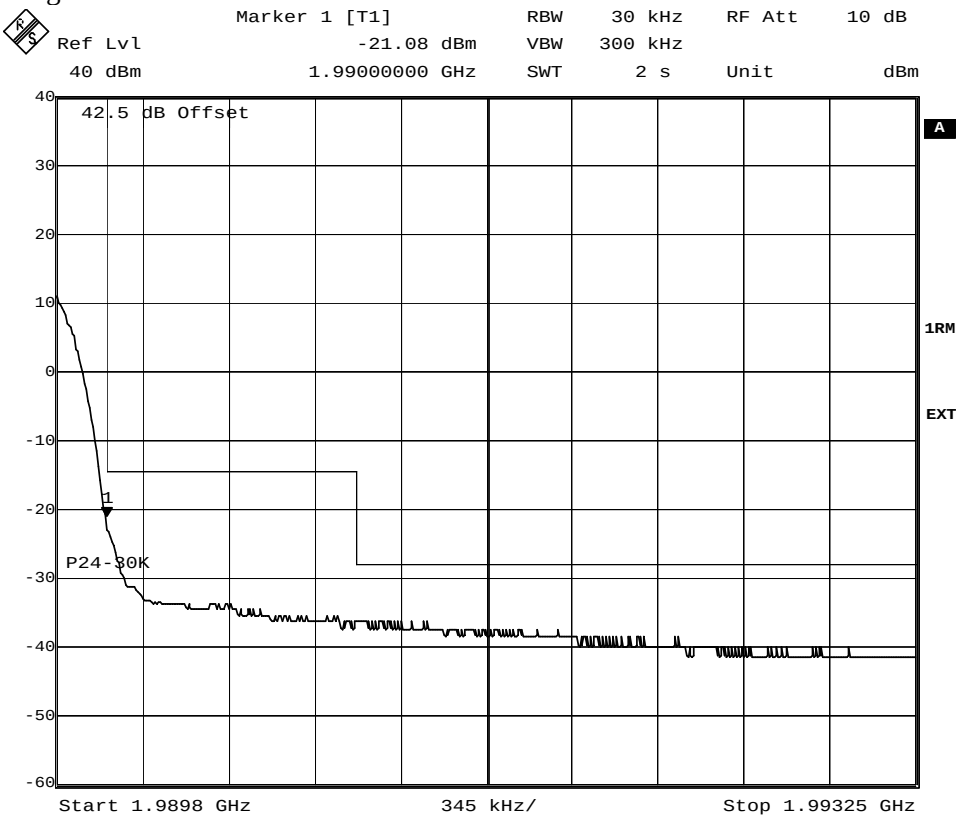
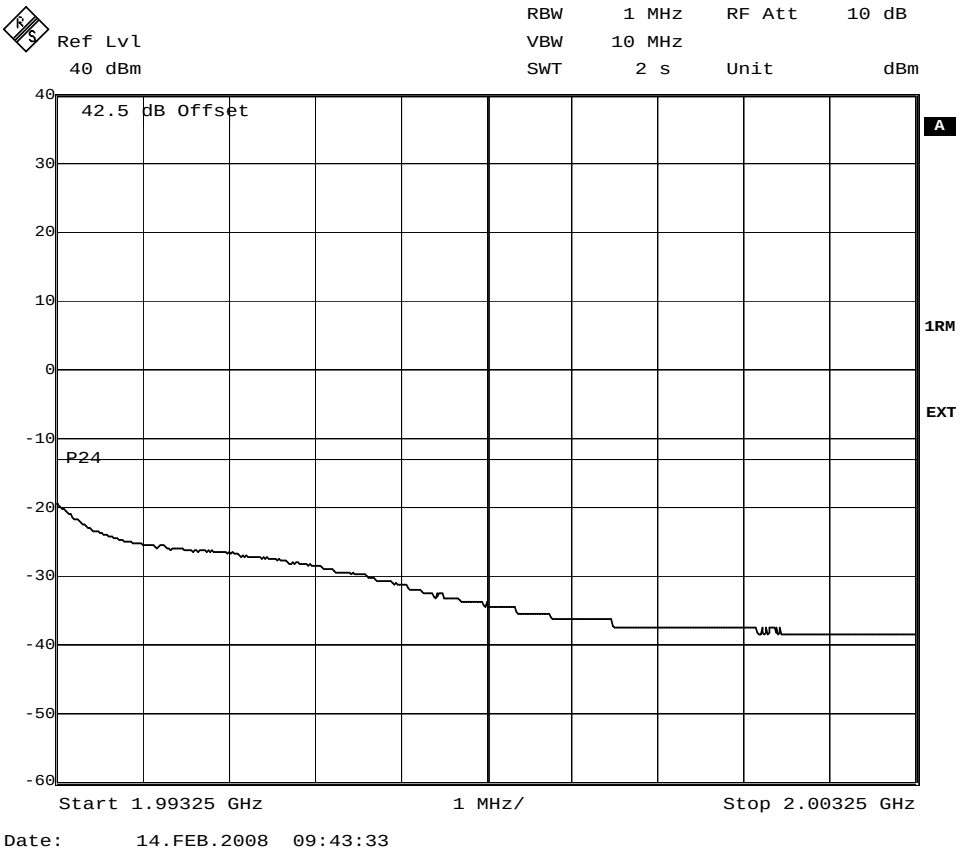
Diagram 8





Conducted spurious emission measurements according to 47 CFR 2.1051

Date	Temperature	Humidity
2008-02-13	23 °C ± 3 °C	25 % ± 5 %
2008-02-14	23 °C ± 3 °C	14 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. Measurements were performed on Ant A connector of the FU unit. The output was connected to a spectrum analyzer. First a pre-measurement with activated peak detector was performed. Emissions close to or above the limit is measured with activated RMS detector and the RMS measurement result is noted. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
R&S FSIQ	2008-10	503 738
High pass filter	2008-07	503 739
Testo 610, Temperature and humidity meter	2009-04	502 658

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 5.1

Single carrier

	QPSK		**16QAM**
Diagram 1:	1932.4 MHz	Diagram 4:	1932.4 MHz
Diagram 2:	1957.6 MHz	Diagram 5:	1957.6 MHz
Diagram 3:	1987.6 MHz	Diagram 6:	1987.6 MHz

Multi carrier

	QPSK		**16QAM**
Diagram 7:	1932.4+1942.4 MHz	Diagram 10:	1932.4+1942.4 MHz
Diagram 8:	1952.4+1962.4 MHz	Diagram 11:	1952.4+1962.4 MHz
Diagram 9:	1977.6+1987.6 MHz	Diagram 12:	1977.6+1987.6 MHz

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 feedthrough.

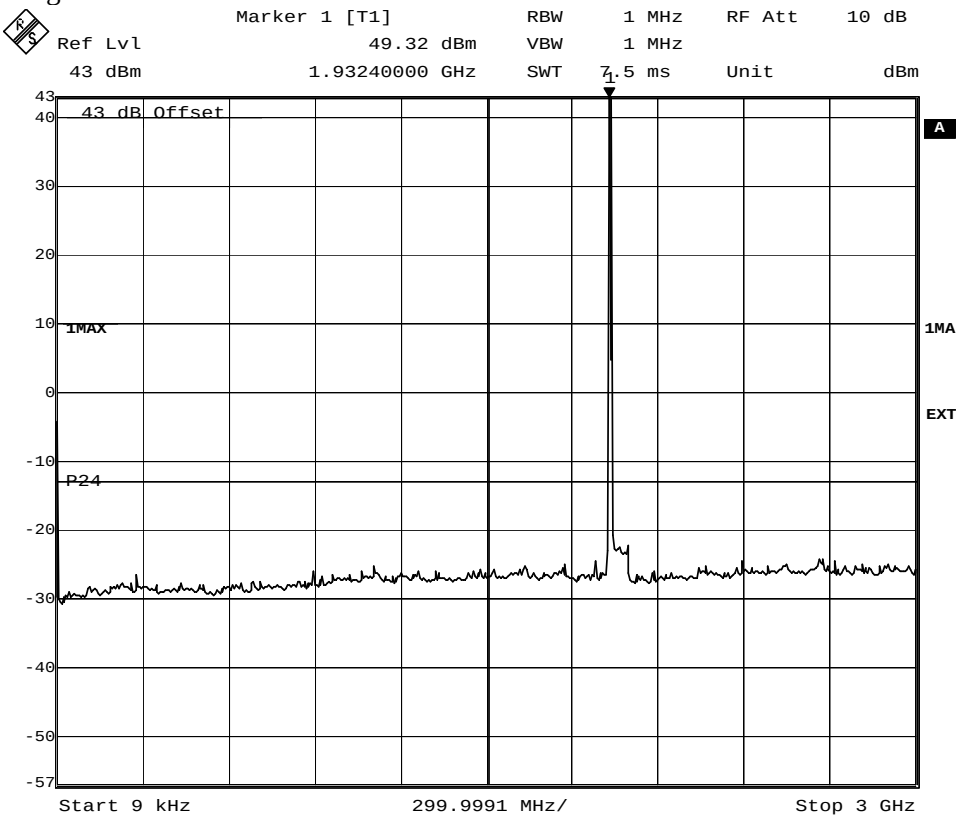
Limits

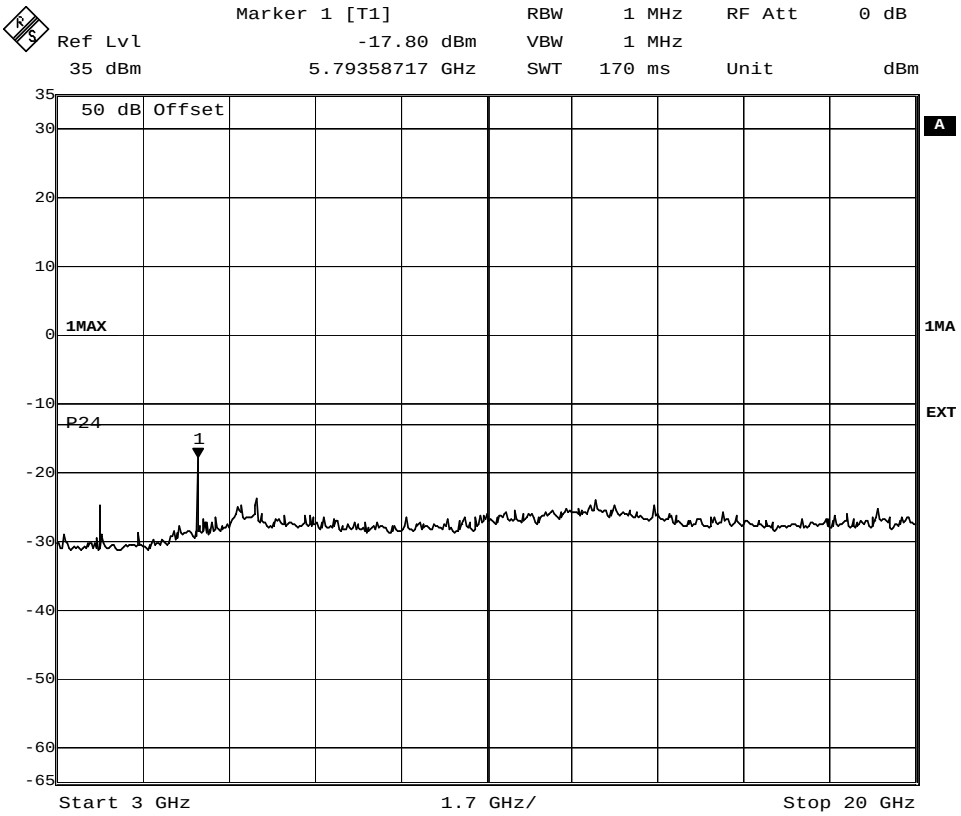
The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least 43 + 10 log P dB.

Complies?	Yes

FCC ID: TA8AKRC11819-3 Appendix 5.1

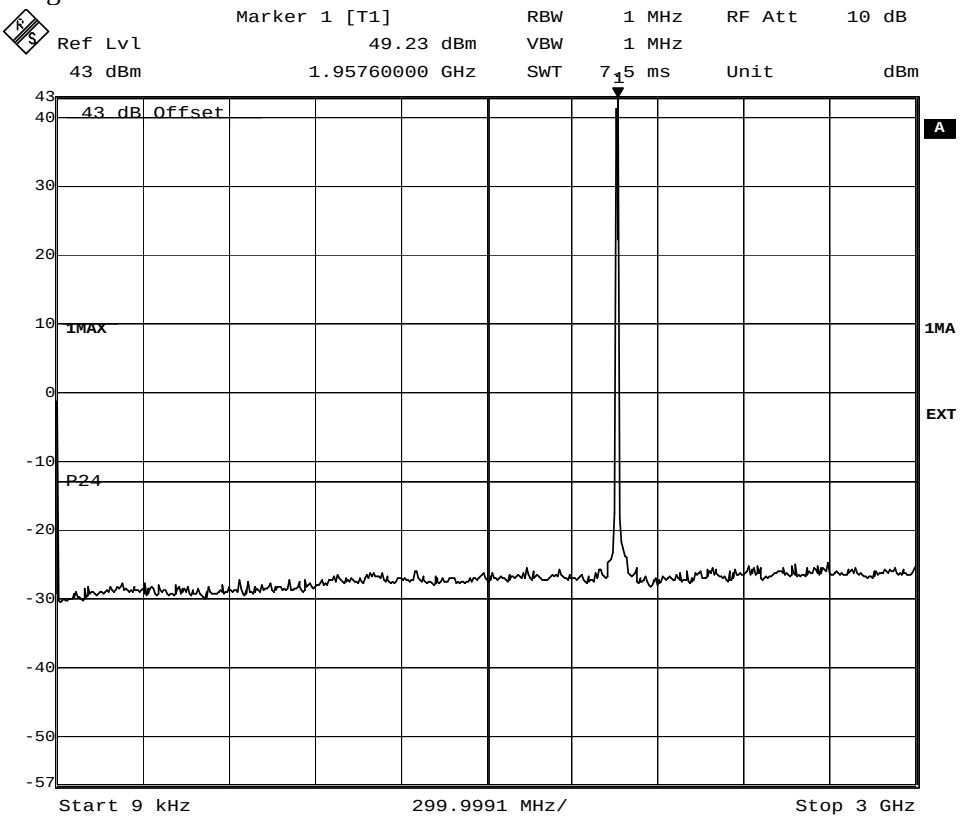
Diagram 1





FCC ID: TA8AKRC11819-3 Appendix 5.1

Diagram 2



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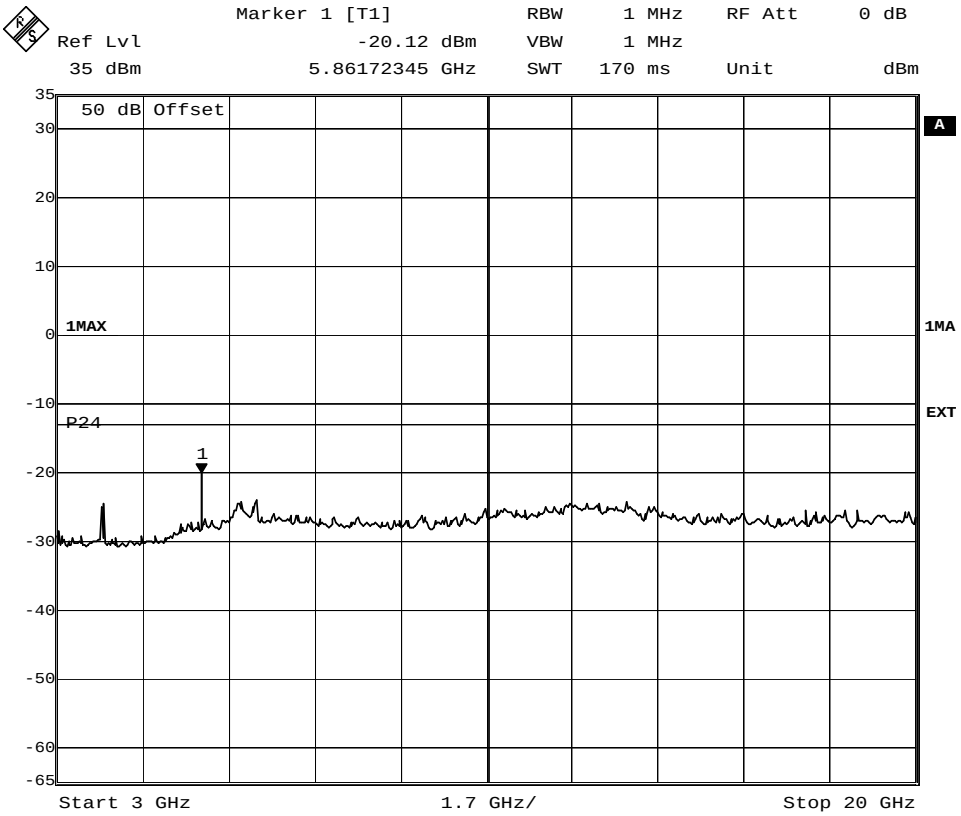

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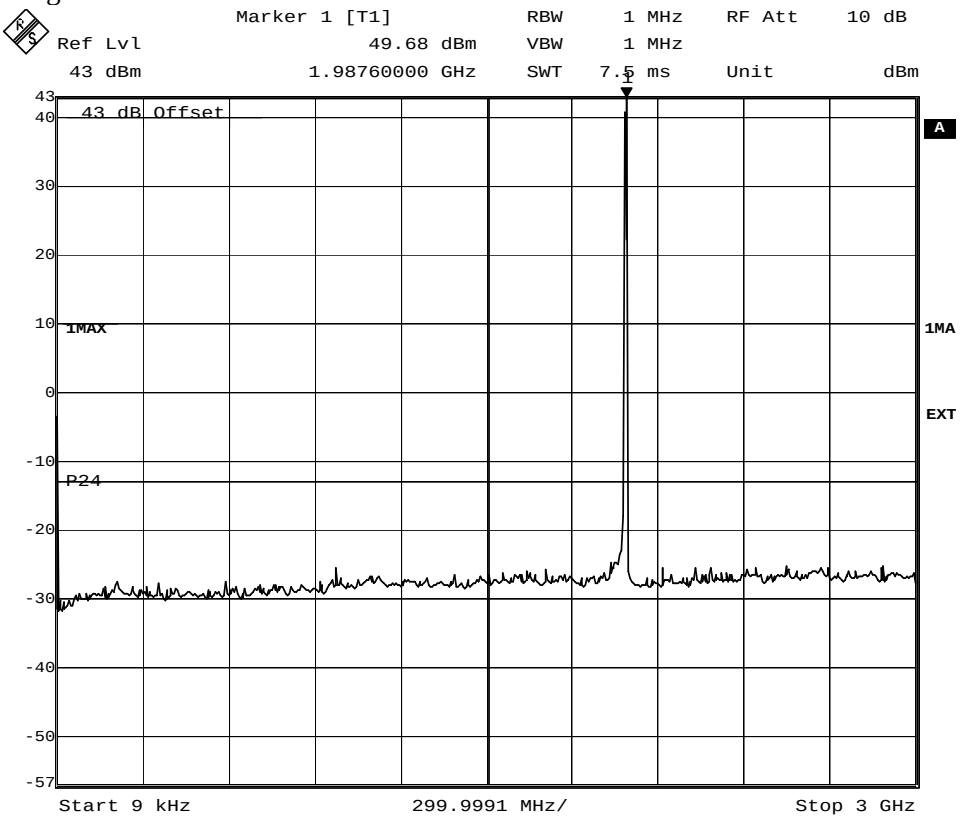
Diagram 3



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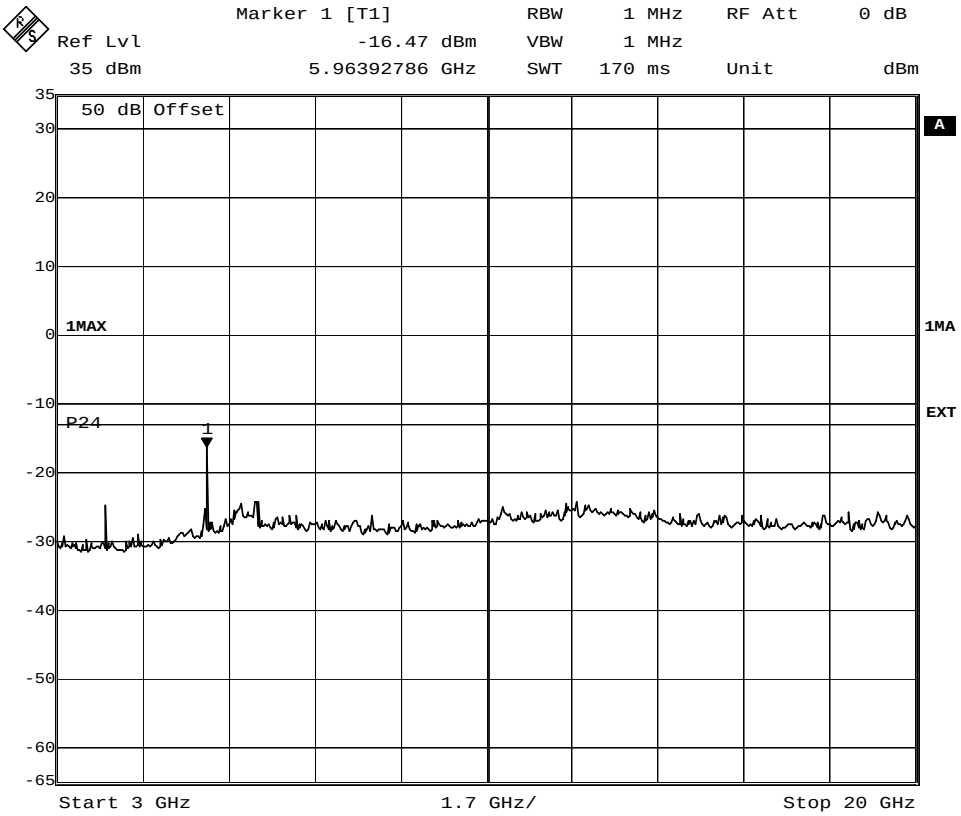

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FCC ID: TA8AKRC11819-3 Appendix 5.1

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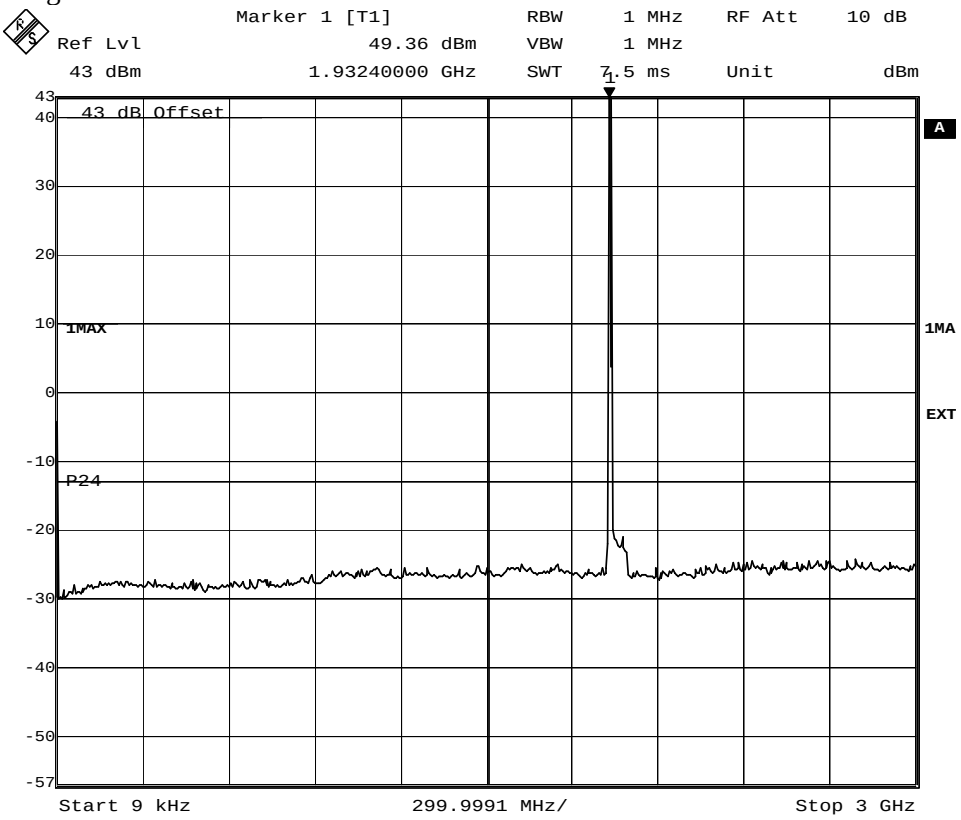

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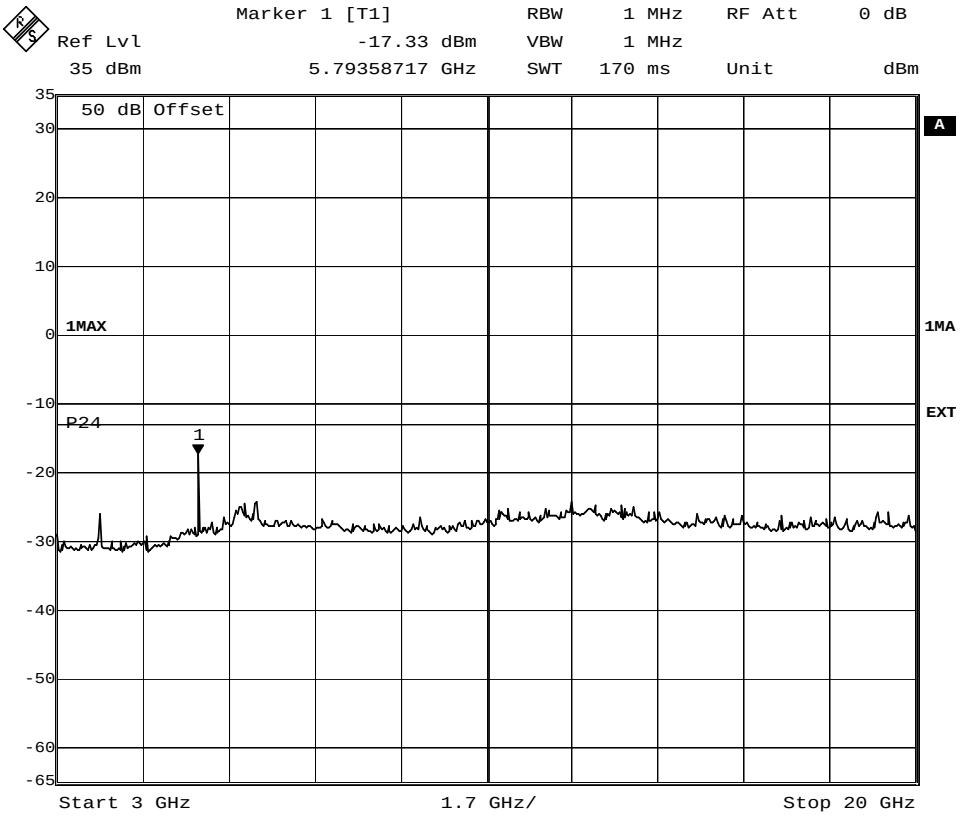

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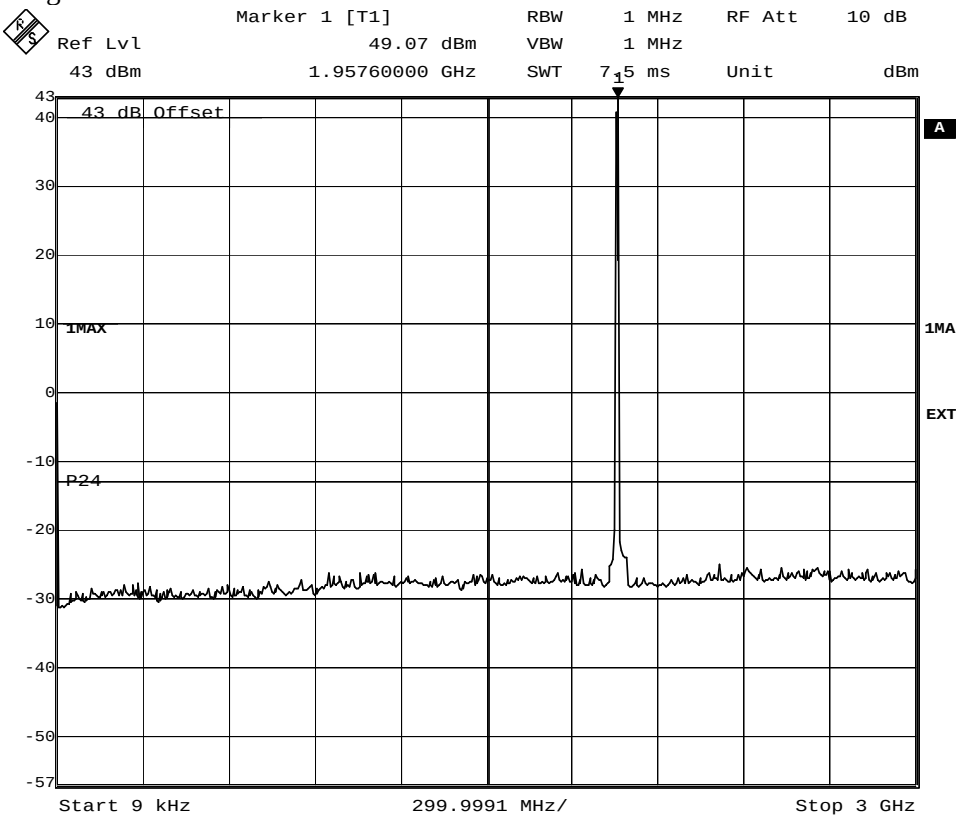
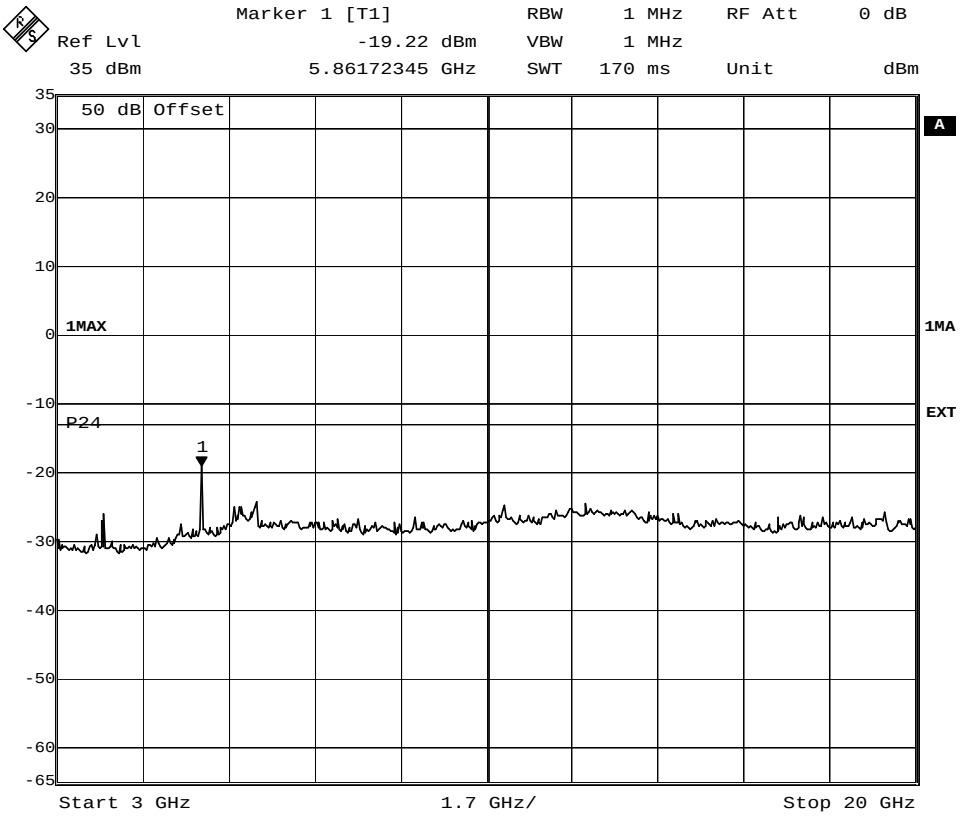
FCC ID: TA8AKRC11819-3 Appendix 5.1

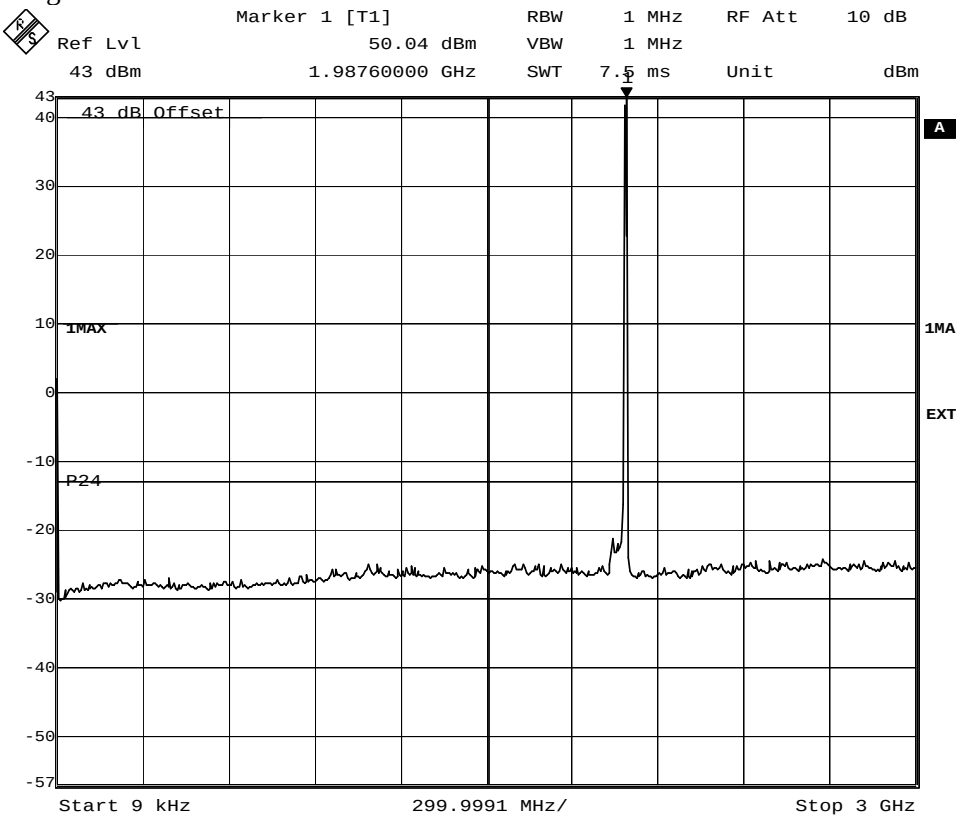
Diagram 5





FCC ID: TA8AKRC11819-3 Appendix 5.1

Diagram 6



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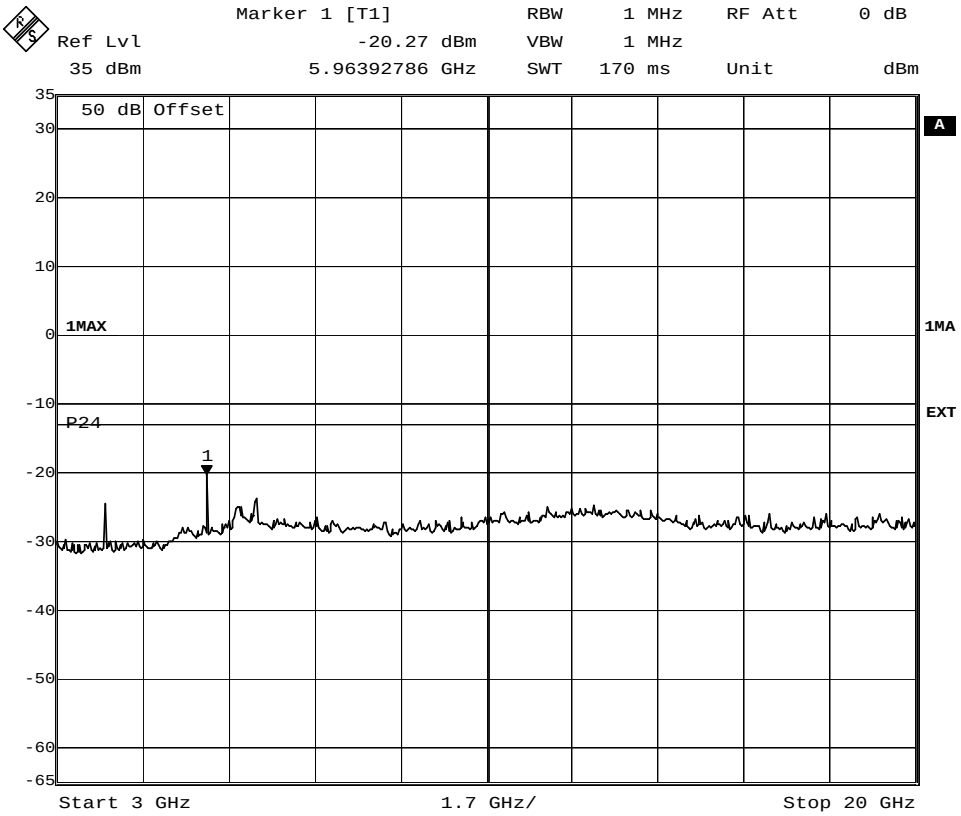

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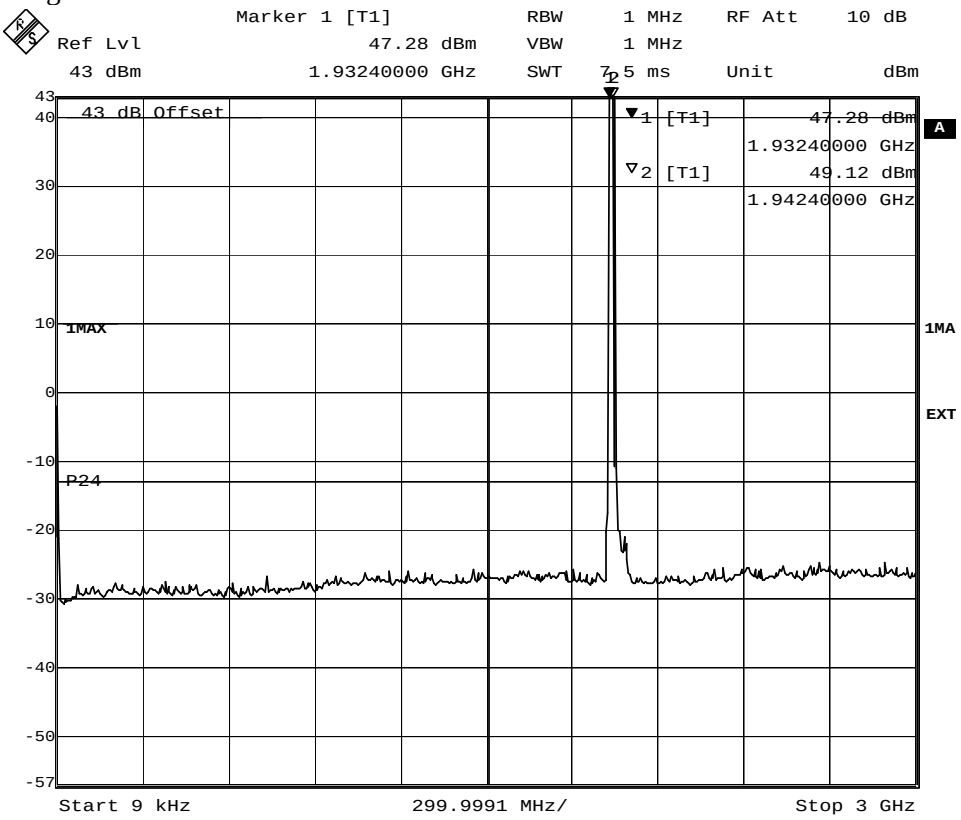
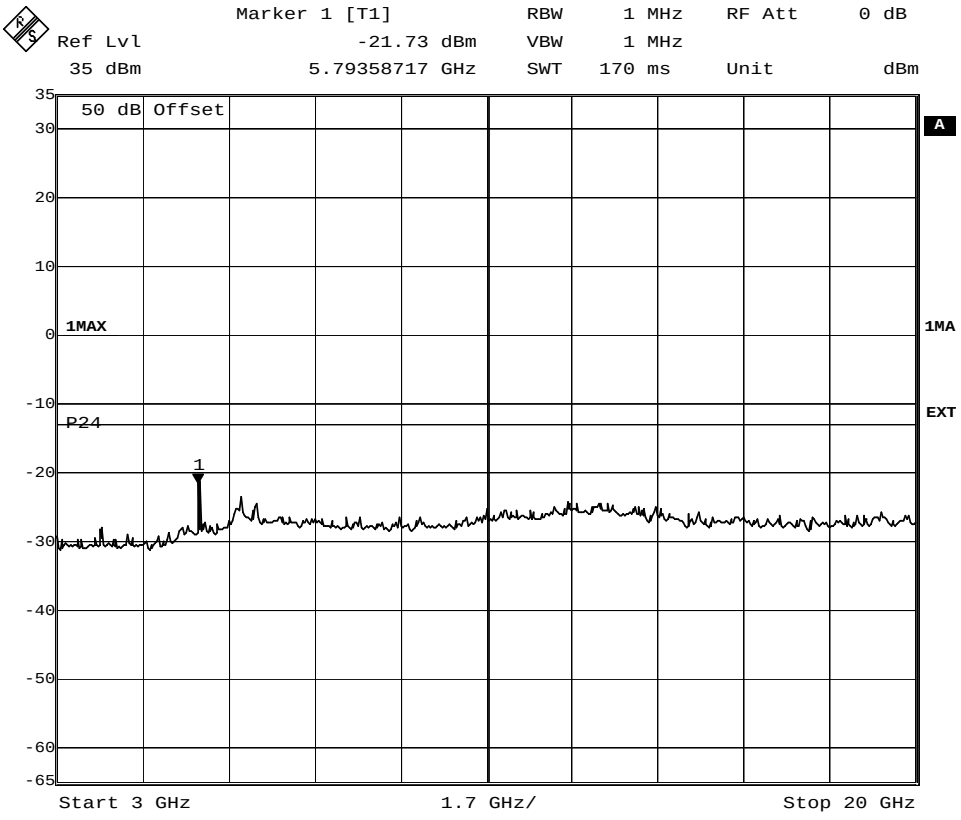
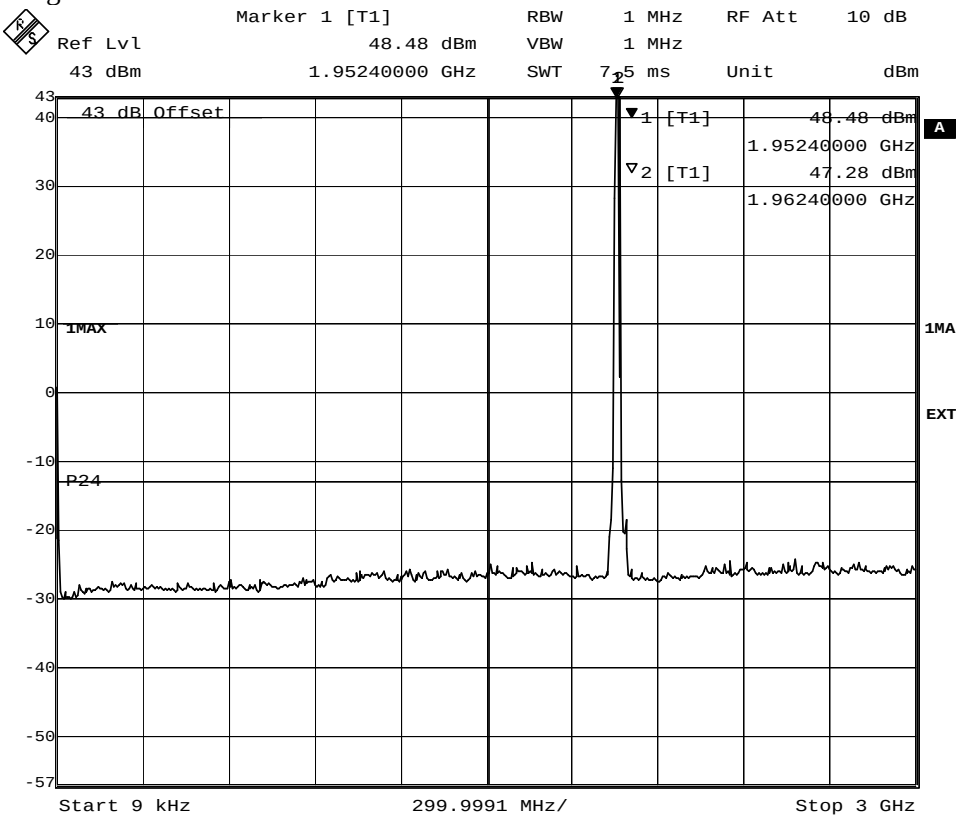
Diagram 7





FCC ID: TA8AKRC11819-3 Appendix 5.1

Diagram 8



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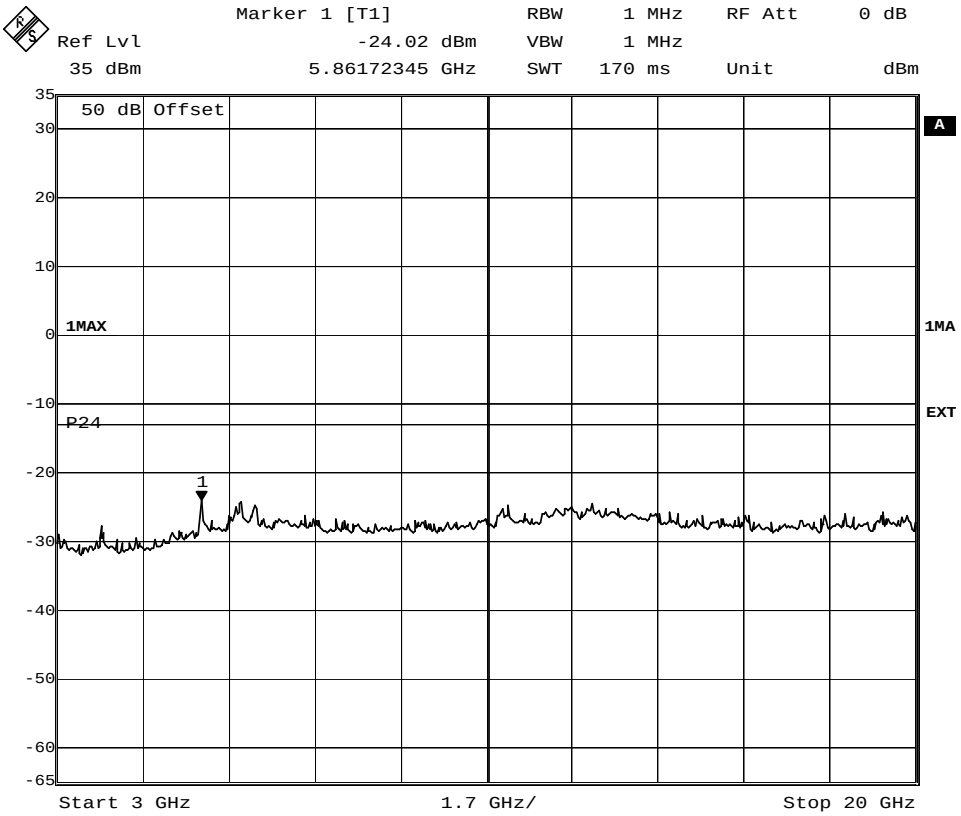

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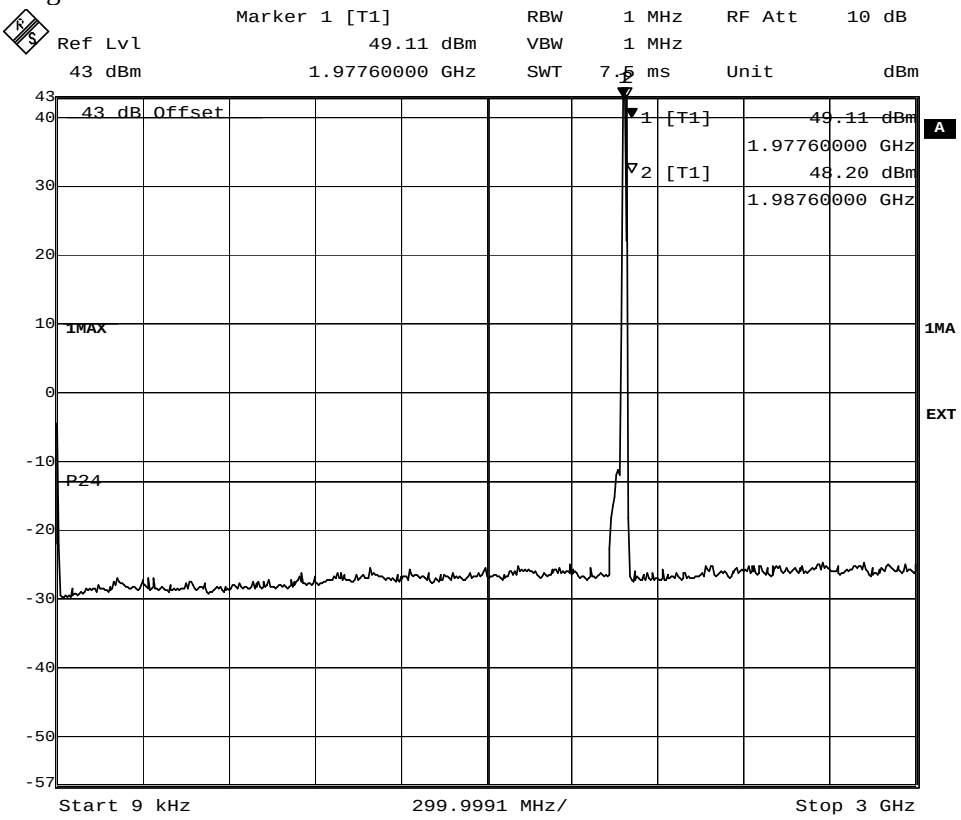

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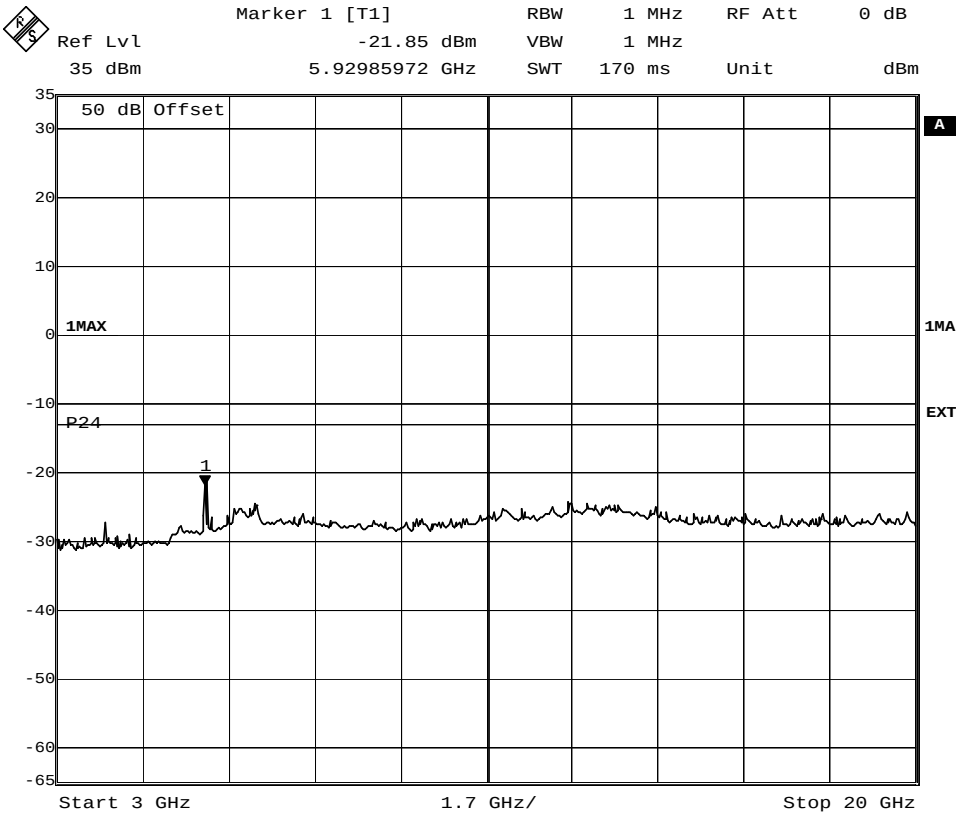

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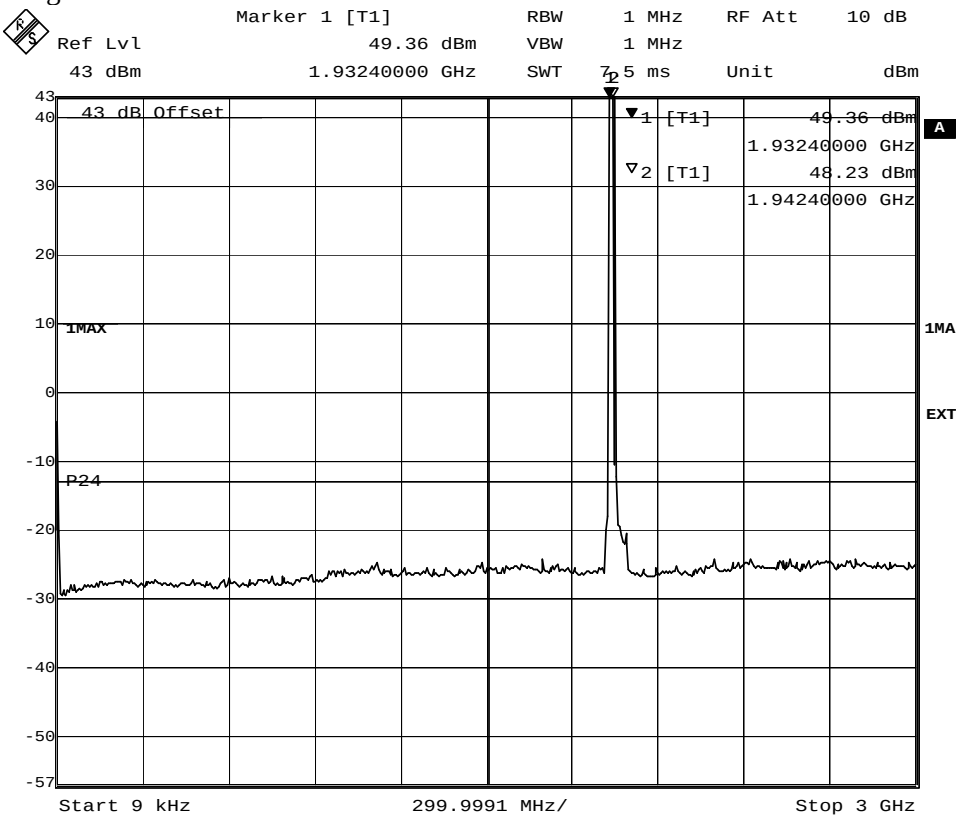
Diagram 10



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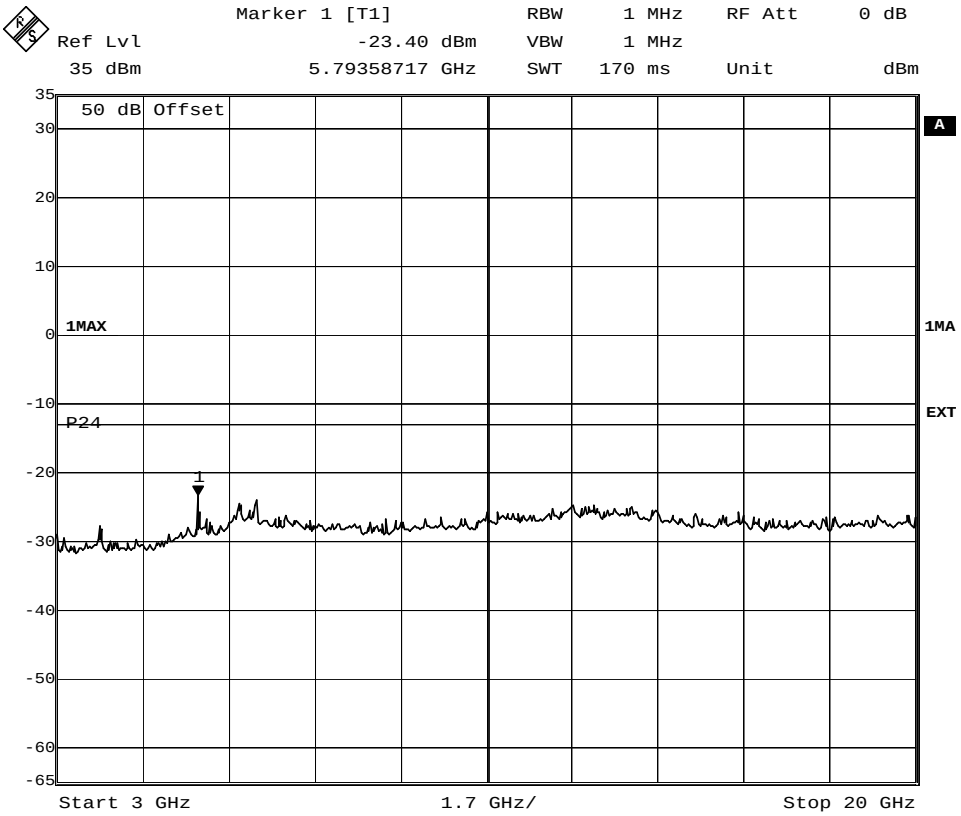

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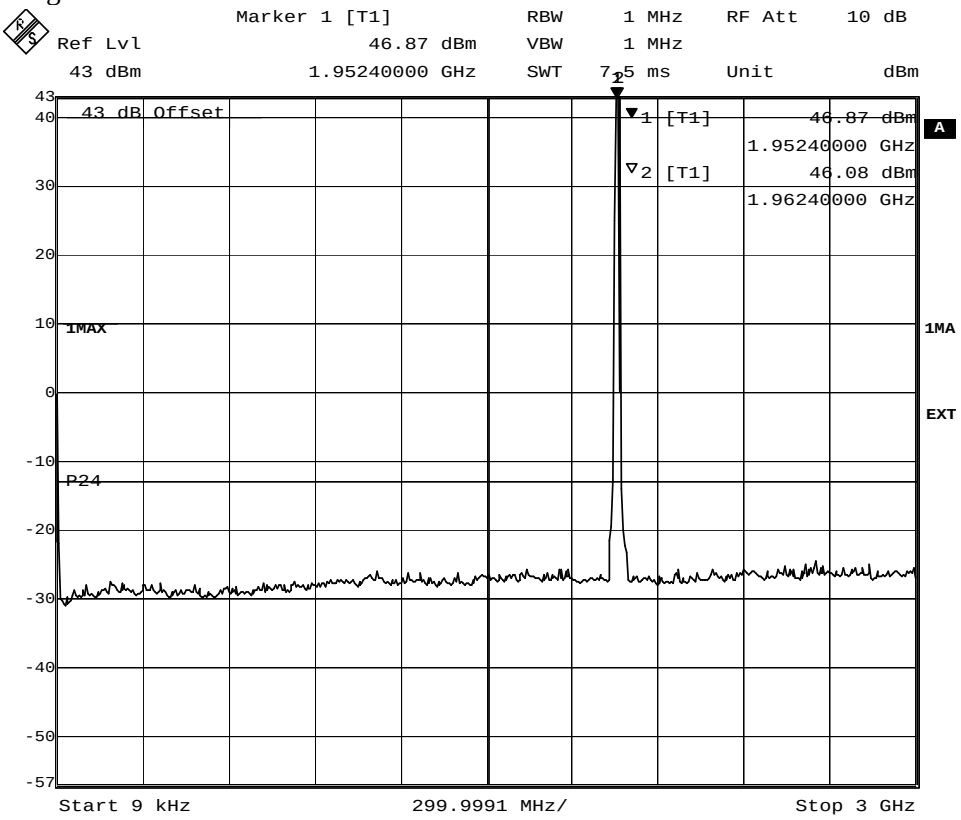
Diagram 11



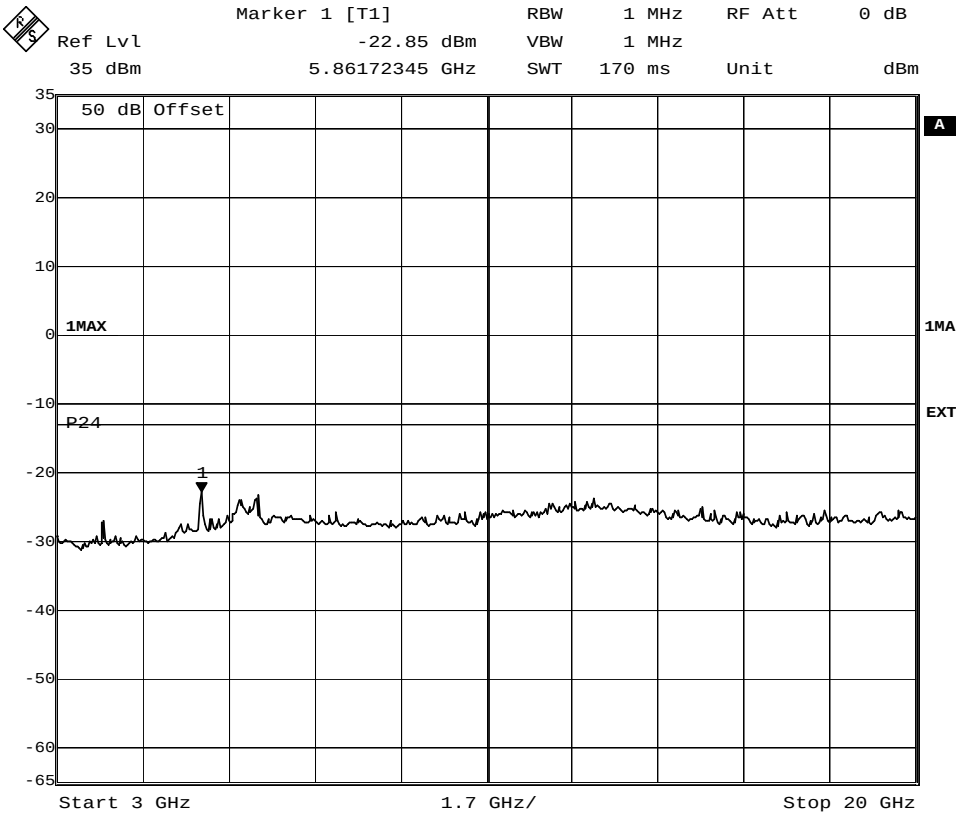


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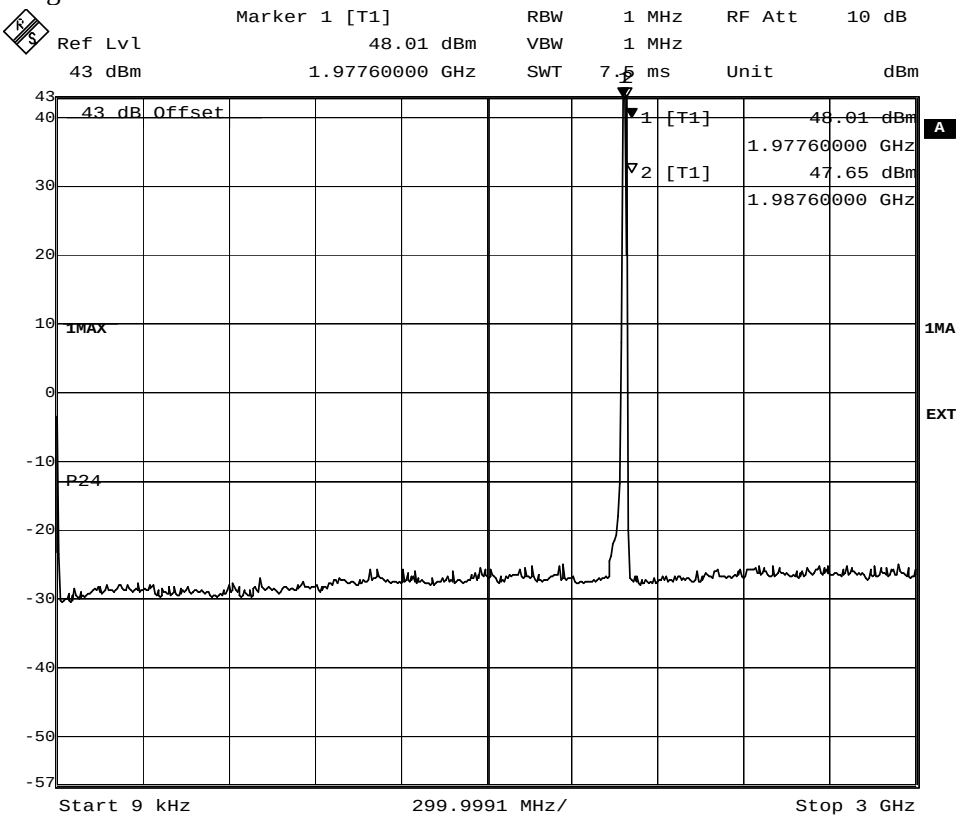
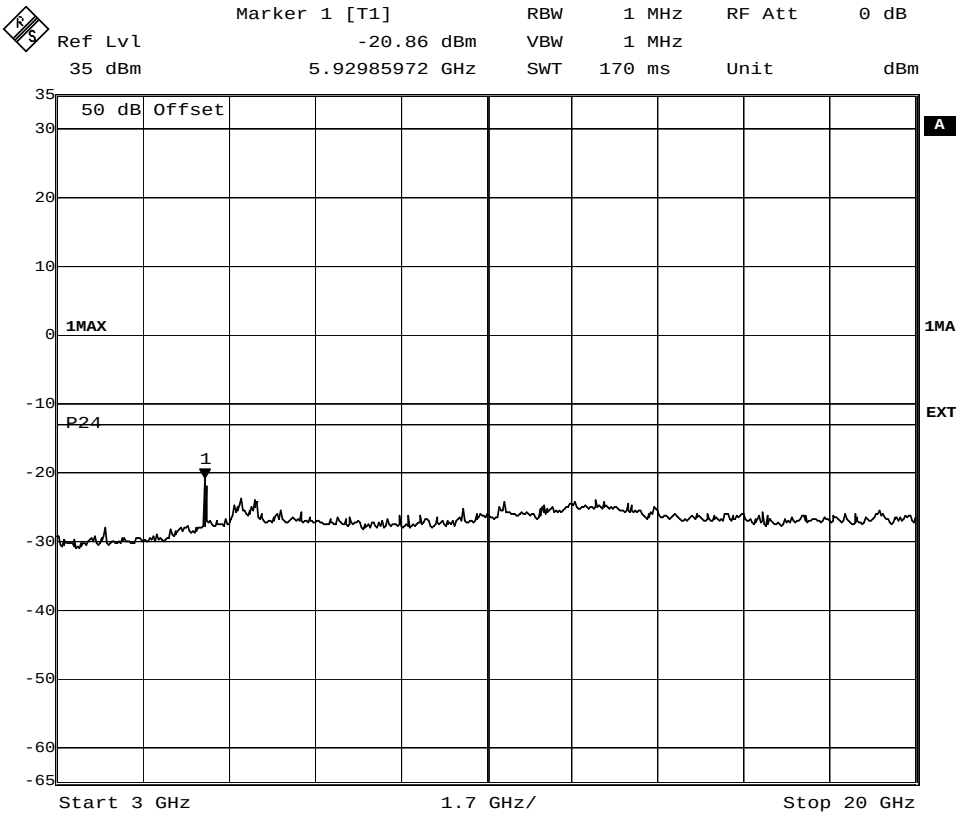
Diagram 12





Field strength of spurious radiation measurements according to 47 CFR 2.1053

Date	Temperature	Humidity
2008-02-18 to 2008-02-20	21-22 °C ± 3 °C	28-44 % ± 5 %

Test set-up and procedure

The test site is listed at FCC, Columbia with registration number: 93866. The test site also complies with RSS-Gen, Industry Canada file no.:IC 3482.
The transmitter was modulated with pseudorandom data during the measurements. The antenna ports were terminated with 50 ohm loads.

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 18-20 GHz.

A pre-measurement was first performed:
In the frequency range 30 MHz-20 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 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 measured with the RMS detector were measured with the substitution method according to the standard.

Measurement equipment	Calibration Due	SP number
Test site	2008-11	503 881
R&S ESI 26	2008-07	503 292
R&S FSIQ	2008-10	503 738
Control computer	-	503 479
Software: R&S ES-K1, ver. 1.60	-	-
Chase Bilog antenna CBL 6111A	2008-11	503 182
EMCO Horn Antenna 3115	2011-01	502 175
Flann Standard gain horn 16240-25	-	503 939
Flann Standard gain horn 18240-25	-	503 900
Flann Standard gain horn 20240-20	-	503 674
MITEQ Low Noise Amplifier	2008-08	503 285
High pass filter	2008-07	503 739
Testo 610, Temperature and humidity meter	2009-04	502 658

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The test set-ups during the spurious radiation measurements are shown in the picture below:

Results

Single carrier

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 4.7 dB		

Multi carrier

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 4.7 dB		

Limits

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

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Frequency stability according to 47 CFR 2.1055

Date	Temperature (test equipment)	Humidity (test equipment)
2008-02-25 to 2008-02-28	22-23 °C ± 3 °C	15-26 % ± 5 %

Test set-up and procedure

The measurement was made per 3GPP TS 25.141. The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
R&S FSIQ	2008-10	503 738
Testo 610, Temperature and humidity meter	2009-04	502 658
Rotronic, Temperature and humitity meter	2008-04	502 946
Temperature chamber	2009-12	501 031

Results

Nominal Voltage -48 V DC
46 dBm output power at 1957.6 MHz

Test conditions		Frequency error (Hz)	
Supply voltage DC (V)	T (°C)	QPSK	16QAM
-48.0	+20	+20	-24
-55.2	+20	-19	+16
-40.8	+20	+24	-18
-48.0	+30	+13	+18
-48.0	+40	+17	+17
-48.0	+50	+19	-26
-48.0	+10	+24	-20
-48.0	0	+14	+18
Maximum freq. error (Hz)		26	
Measurement uncertainty		$< \pm 1 \times 10^{-7}$	

Note: At -10°C it was not possible to enable the transmitter due to an temperature alarm.

Limits (according to 3GPP TS 25.141)

The frequency error shall be within ± 0.05 PPM ± 12 Hz (109.87 Hz).

Complies?	Yes

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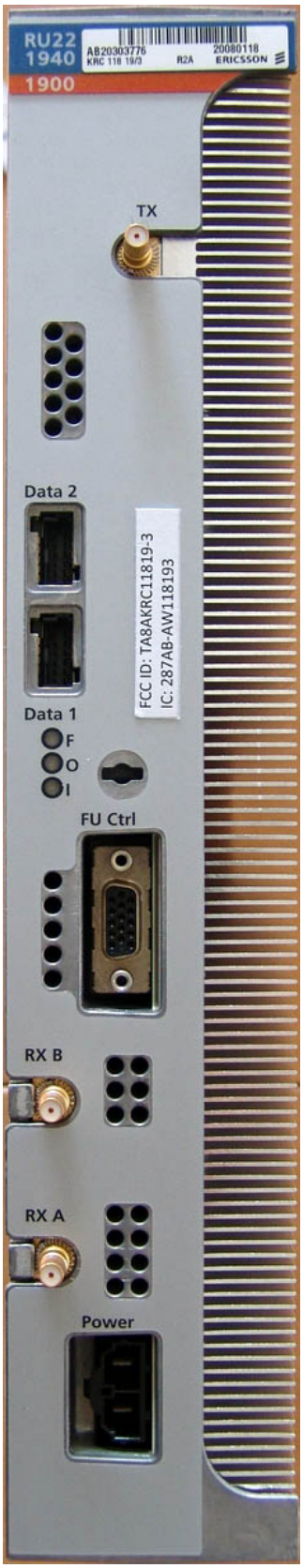
Photos
Radio Unit KRC 118 19/3

Front side



Rear side

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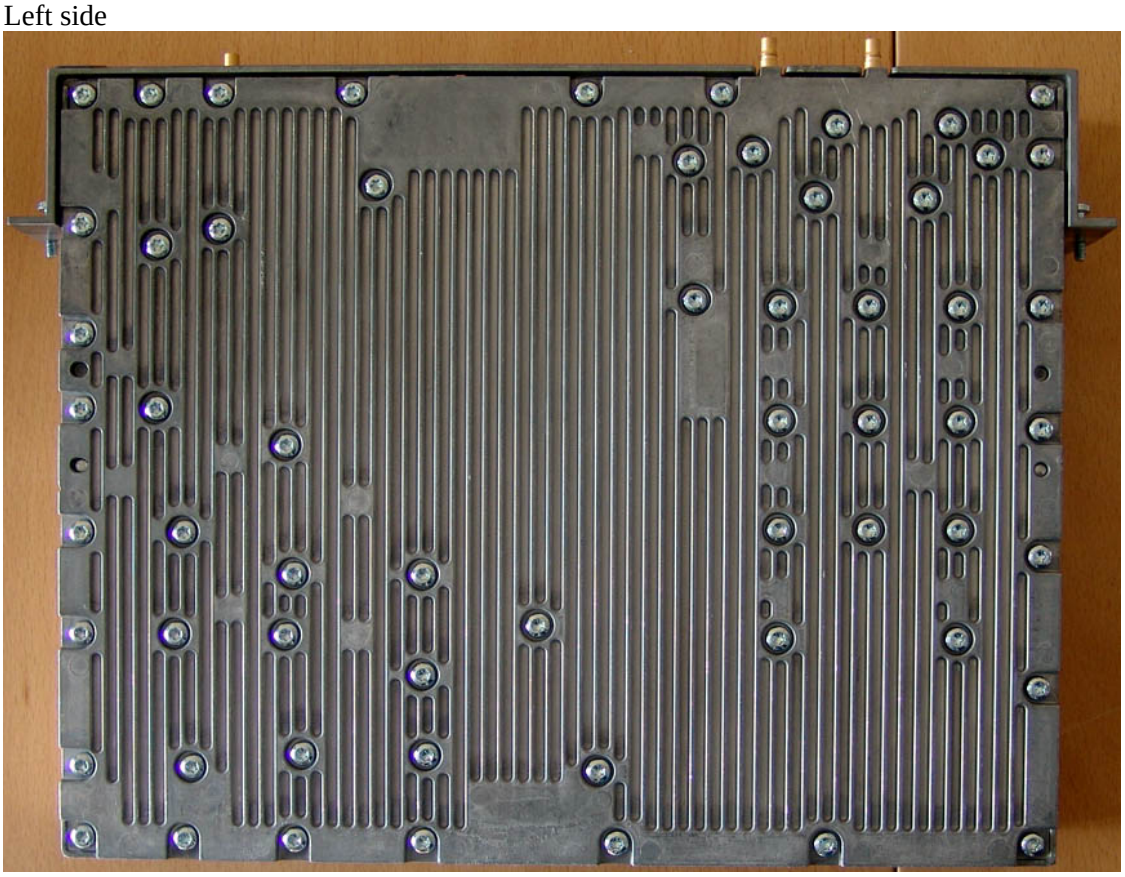
Left side



Right side