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Radio measurements on AIR 21 B2A/B4P 1900 MHz radio equipment with FCC ID:TA8AKRC118023-1 and IC:287AB-AS1180231 (8 appendices)

Test object

AIR 21 B2A/B4P, KRC 118 023/1 Rev R1C

Summary

Standard	Compliant	Appendix
FCC CFR 47 / IC RSS-133		
2.1046 / RSS-133 6.4 RF power output	Yes	2
2.1049 / RSS-Gen 4.6.1 Occupied bandwidth	Yes	3
2.1051 / RSS-133 6.5 Band edge	Yes	4
2.1051 / RSS-133 6.5 Spurious emission at antenna terminals	Yes	5
2.1053 / RSS-133 6.5 Field strength of spurious radiation	Yes	6
2.1055 / RSS-133 6.3 Frequency stability	Yes	7

Note: Above RSS-133 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



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Table of contents

Description of the test object	Appendix 1
Operation mode during measurements	Appendix 1
Test setups	Appendix 1
Purpose of test	Appendix 1
RF power output	Appendix 2
Occupied bandwidth	Appendix 3
Band edge	Appendix 4
Spurious emission at antenna terminals	Appendix 5
Field strength of spurious radiation	Appendix 6
Frequency stability	Appendix 7
External photos	Appendix 8

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 1

Description – Test object

Equipment: Radio equipment AIR 21 B2 running in GSM mode supporting single and multi carrier.

Antenna ports: 2 TX ports

Frequency bands: TX: 1930 – 1990 MHz
RX: 1850 – 1910 MHz

Modulations: GMSK, 8-PSK, 16QAM, 32QAM and AQPSK.

Nominal output power per antenna port: Single carrier: 1x 44.8 dBm (1x 30W)
Multi carrier: 2x 41.8 dBm (2x 15W)
3x 40.0 dBm (3x 10W)
4x 38.8 dBm (4x 7.5W)

Nominal power voltage: -48 VDC

Tested channels

Channel	ARFCN	Frequency (MHz)	
		Downlink	Uplink
B+1	513	1930.4	1850.4
B+9	521	1932.0	1852.0
B+11	523	1932.4	1852.4
B+17	529	1933.6	1853.6
B+21	533	1934.4	1854.4
B+25	537	1935.2	1855.2
B+31	543	1936.4	1856.4
B+41	553	1938.4	1858.4
B+51	563	1940.4	1860.4
B+61	573	1942.4	1862.4
B+71	583	1944.4	1864.4
M-13	648	1957.4	1877.4
M-8	653	1958.4	1878.4
M	661	1960.0	1880.0
M+8	669	1961.6	1881.6
M+12	673	1962.4	1882.4
M+16	677	1963.2	1883.2
T-71	739	1975.6	1895.6
T-61	749	1977.6	1897.6
T-51	759	1979.6	1899.6
T-41	769	1981.6	1901.6
T-31	779	1983.6	1903.6
T-26	784	1984.6	1904.6
T-25	785	1984.8	1904.8
T-21	789	1985.6	1905.6
T-17	793	1986.4	1906.4
T-11	799	1987.6	1907.6
T-9	801	1988.0	1908.0
T-1	809	1989.6	1909.6

Operation mode during measurements

Unless otherwise stated, all measurements were performed with the test object transmitting pseudorandom data in all timeslots and settings for maximum transmitter output power applicable for each configuration. All supported modulations were tested to find worst case configuration. Occupied bandwidth and frequency error were only measured with single carrier configuration. For AQPSK modulation the SCPIR is 0 dB.

Conducted measurements

The EUT was a pole mounted unit supplied with -48 VDC by an external power supply. All RF conducted measurements were performed with the test object configured for maximum transmit power. 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 powered with -48 VDC. All measurements were performed with the test object configured for maximum transmit power. The configurations below 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.

The AIR unit was allocated to the following ARFCN:

Single Carrier: (One carrier configuration)

Antenna port A

Cell	1	1	1
Channel	B+1	M-13	T-1

Antenna port B

Cell	1	1	1
Channel	B+26	M+12	T-26

Multi Carrier: (Two carrier configuration)

Antenna port A

Cell	1	2
Channel	B+1	B+11
Channel	T-1	T-11

Antenna port B

Cell	1	2
Channel	B+21	B+31
Channel	T-21	T-31

Multi Carrier: (Four carrier configuration)

Antenna port A

Cell	1	2	3	4
Channel	B+1	B+11	B+21	B+31
Channel	T-1	T-11	T-21	T-31

Antenna port B

Cell	1	2	3	4
Channel	B+41	B+51	B+61	B+71
Channel	T-41	T-51	T-61	T-71

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 1

Purpose of test

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

References

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

ANSI 63.4-2009

ANSI/TIA/EIA-603-C-2004

CFR 47 part 2, October 1st, 2010

CFR 47 part 24, October 1st, 2010

3GPP TS 25.141, version 8.9.0

RSS-Gen Issue 3

RSS-133 Issue 5

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
µComp Nordic, Low Noise Amplifier	2013-03	901 545
MITEQ Low Noise Amplifier	2012-07	503 285
Temperature cabinet	-	503 360
Testo 635 Temperature and humidity meter	2013-05	504 203

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 2012-04-05.

Manufacturer's representative

Christer Gustavsson, Ericsson AB



REPORT

Date
2012-06-18

Reference
FX208964-F24G

Page
6 (9)

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 1

Test engineers

Andreas Johnson Tomas Isbring, Hyder Khalaf, Kexin Chen, Jörgen Wassholm, and Martin Theorin, SP

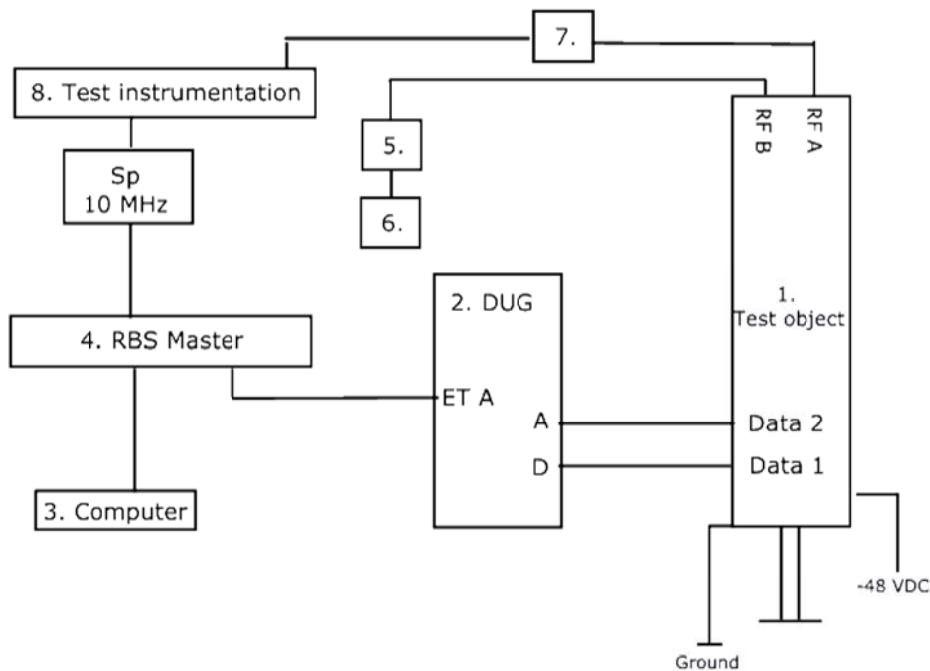
Test participant

Mikael Jansson, Ericsson AB (Partly present)

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 1

Test set-up conducted measurements TX



Test object

1. AIR 21 B2A/B4P, KRC 118 023/1, rev. R1C, s/n: CQ30000598
with software (PIS): CXP 901 3268/6 rev. R44FX
(FCC ID:TA8AKRC118023-1 / IC:287AB-AS1180231)

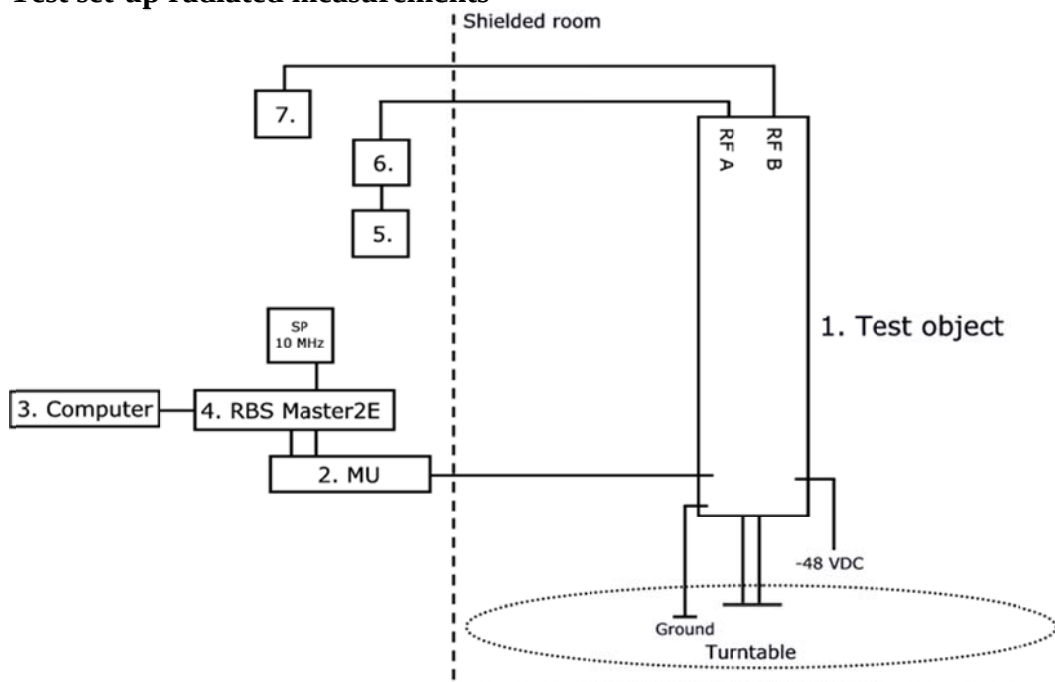
Functional test equipment

2. DUG 20 01, KDU 137 569/1, R2B, C823856122
3. Computer HP Compaq nc6220, BAMS – 1000208319
4. RBS Master 2E, LPY 107 1007/3, BAMS – 1001086304
5. Attenuator
6. Terminator
7. SP test instrument according measurement equipment list
8. SP test instrument according measurement equipment list

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 1

Test set-up radiated measurements



Test object

1. AIR 21 B2A/B4P, KRC 118 023/1, rev. R1C, s/n: CQ30000598
with software (PIS): CXP 901 3268/6 rev. R44FX
(FCC ID:TA8AKRC118023-1 / IC:287AB-AS1180231)

Functional test equipment:

2. Main Unit: RBS 6601, see table on next page
3. Computer HP Compaq nc6220, BAMS – 1000208319
4. RBS Master 2E, LPY 107 1007/3, BAMS – 1001086304
5. R&S FSIQ 40 for monitoring the RF signal
6. Attenuator
7. Terminator

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 1

Interfaces:
Type of port:

Power: -48 VDC	DC Power
Antenna port (A), 7/16 connector, N/A in this configuration	Antenna
Antenna port (B), 7/16 connector, N/A in this configuration	Antenna
Opto 1, Optical Interface Link, single mode opto fibre	Telecom
Opto 2, Optical Interface Link, single mode opto fibre	Telecom
Ground wire	Ground

RBS 6601 Main Unit

Product name	Product number	R-state	Serial number
SUP 6601	1/BFL 901 009/1	R3B	BR81526585
DUG 20 01	KDU 137 569/1	R2B	C823856122
DUMMY	SXX 109 897/1	R2B	A400920159

RBS Software:

Product number	Revision
CXP 104 0013/08	P2BJ

RF power output measurements according to CFR 47 §24.232 / IC RSS-133 6.4

Date	Temperature	Humidity
2012-05-21	23 °C ± 3 °C	44 % ± 5 %
2012-05-22	22 °C ± 3 °C	52 % ± 5 %
2012-05-23	21 °C ± 3 °C	53 % ± 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

Single carrier : Rated output power level at port RF A (maximum): 44.8 dBm

Transmitter power (dBm) RMS				
Channel	B+1	M	T-1	Nominal
GMSK	44.7	44.9	44.6	44.8
AQPSK	-	44.8	-	44.8
8-PSK	-	44.8	-	44.8
16QAM	-	44.8	-	44.8
32QAM	-	44.7	-	44.8

Single carrier : Rated output power level at port RF B (maximum): 44.8 dBm

Transmitter power (dBm) RMS				
Channel	B+1	M	T-1	Nominal
GMSK	-	44.8	-	44.8

Multi carrier 1x2 : Rated output power level at port RF A (maximum): 41.8 dBm

2 carriers combined power (dBm) RMS				
Channel	B+1+(B+9)	M+8	(T-1)+(T-9)	Nominal
GMSK	44.7	44.9	44.6	44.8

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 2

Multi carrier 1x4 : Rated output power level at port RF A (maximum): 38.8

4 carriers combined power (dBm) RMS		
Channel	(B+1)+(B+9)+(B+17)+(B+25)	Nominal
GMSK	44.7	44.8
Channel	(M-8) + M+ (M+8) +(M16)	
GMSK	44.8	44.8
Channel	(T-1)+(T-9)+(T-17)+(T-25)	
GMSK	44.8	44.8

Single Carrier

	Channel	Modulation
Diagram 1	B+1	GMSK
Diagram 2	M	GMSK
Diagram 3	M	AQPSK
Diagram 4	M	8-PSK
Diagram 5	M	16QAM
Diagram 6	M	32QAM
Diagram 7	T-1	GMSK

Multi carrier: 1x2

Diagram 8	(B+1)+(B+9)	GMSK
Diagram 9	M+8	GMSK
Diagram 10	(T-1)+(T-9)	GMSK

Multi carrier: 1x4

Diagram 11	(B+1)+(B+9)+(B+17)+(B+25)	GMSK
Diagram 12	(M-8)+M+(M-8)+(M16)	GMSK
Diagram 13	(T-1)+(T-9)+(T-17)+(T-25)	GMSK

Single Carrier

	Channel	Modulation
Diagram 14	M, RF B	GMSK

Limits

§24.232 Federal Register / Vol. 73, No. 86

The maximum output power may not exceed 1640 W/MHz (EIRP).

The Peak to Average Ratio (PAR) may not exceed 13 dB.

RSS-133: The average equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. Moreover, base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts.

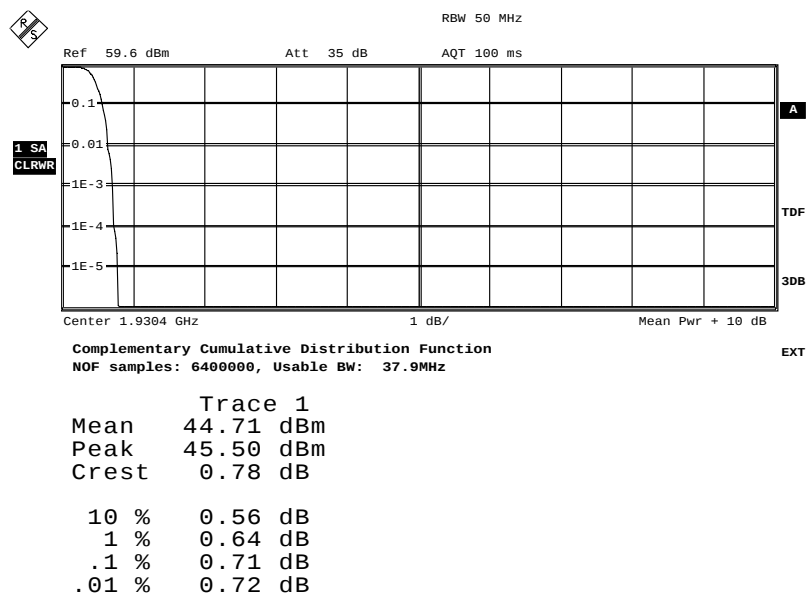
In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

Complies?	Yes
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FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

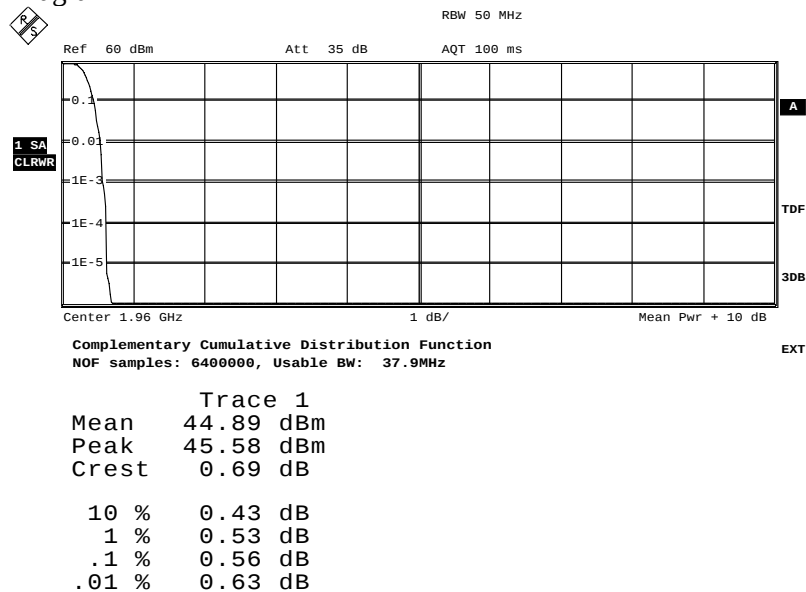
Appendix 2

Diagram 1



Date: 21.MAY.2012 13:22:50

Diagram 2

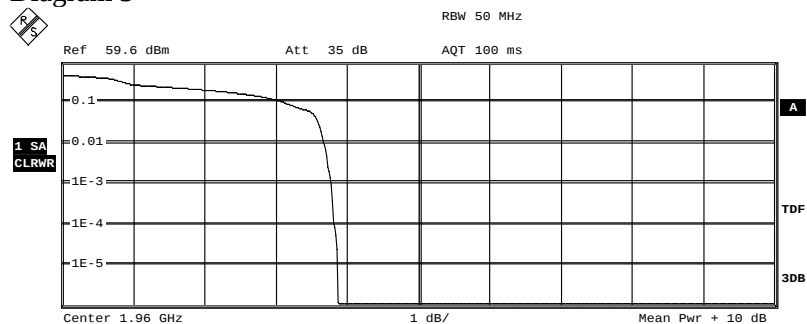


Date: 21.MAY.2012 09:50:28

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 2

Diagram 3



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

EXT

Trace 1
Mean 44.78 dBm
Peak 48.72 dBm
Crest 3.94 dB

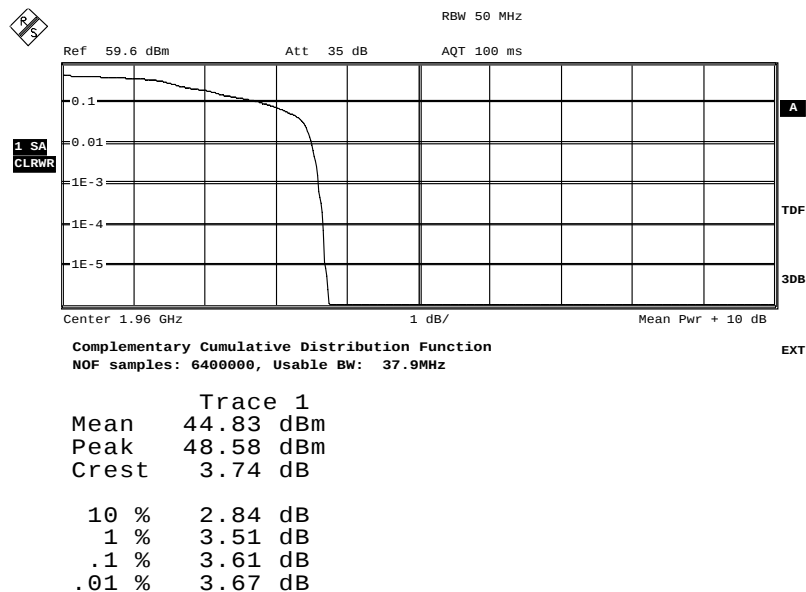
10 % 3.13 dB
1 % 3.67 dB
.1 % 3.78 dB
.01 % 3.81 dB

Date: 21.MAY.2012 10:00:47

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

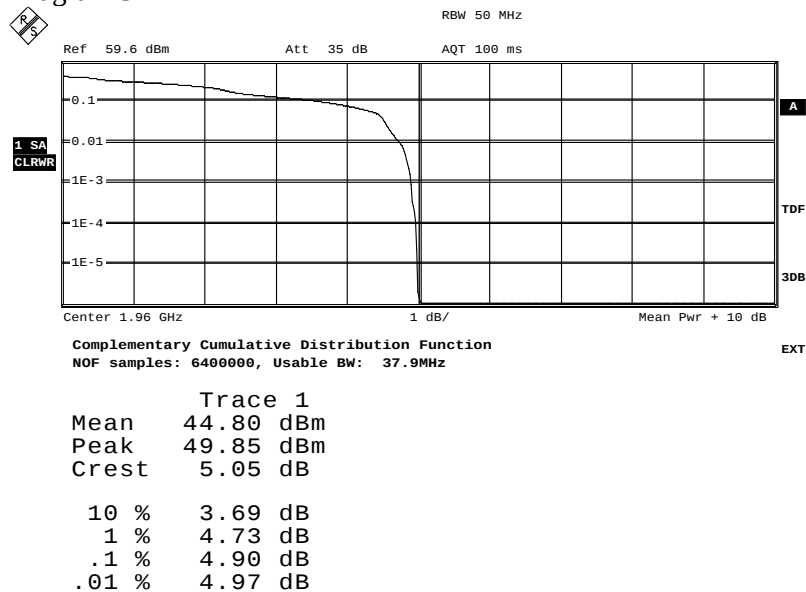
Appendix 2

Diagram 4



Date: 21.MAY.2012 10:12:00

Diagram 5

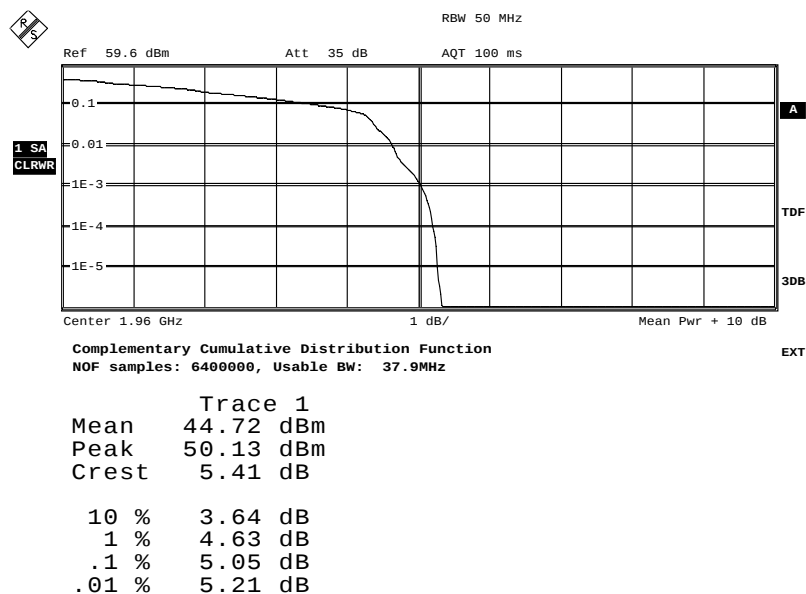


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IC:287AB-AS1180231

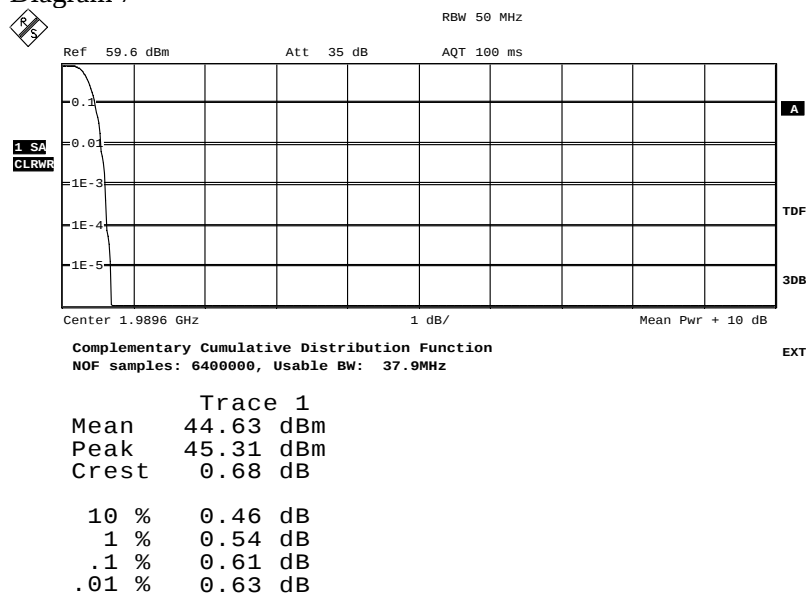
Appendix 2

Diagram 6



Date: 21.MAY.2012 10:56:27

Diagram 7

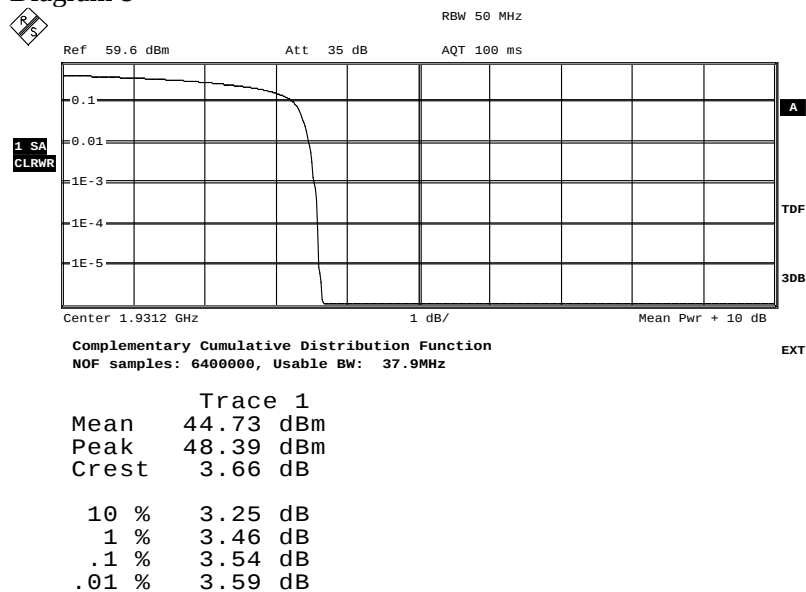


Date: 22.MAY.2012 09:27:35

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

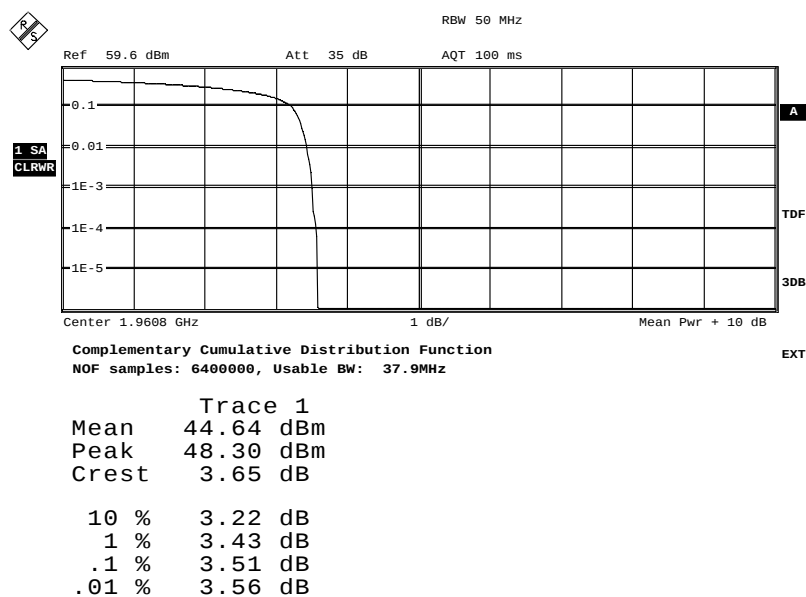
Appendix 2

Diagram 8



Date: 22.MAY.2012 14:43:30

Diagram 9

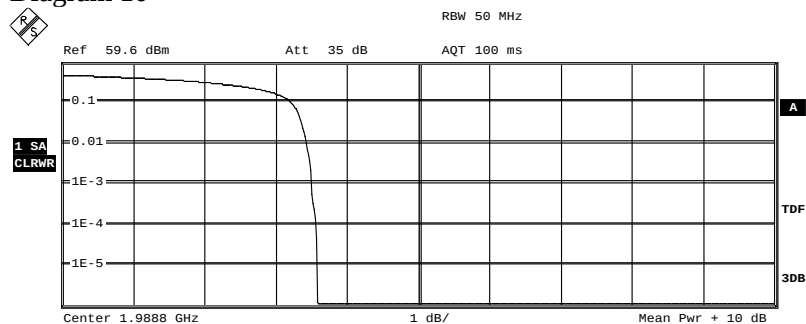


Date: 23.MAY.2012 10:02:03

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 2

Diagram 10



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

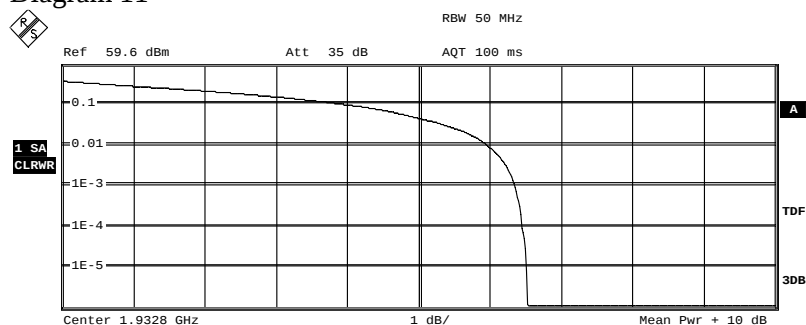
EXT

Trace 1
Mean 44.56 dBm
Peak 48.20 dBm
Crest 3.65 dB

10 % 3.21 dB
1 % 3.43 dB
.1 % 3.51 dB
.01 % 3.56 dB

Date: 22.MAY.2012 16:49:34

Diagram 11



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

EXT

Trace 1
Mean 44.98 dBm
Peak 51.57 dBm
Crest 6.59 dB

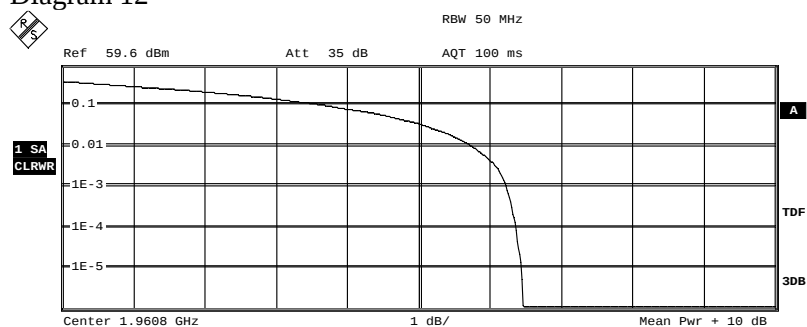
10 % 4.01 dB
1 % 5.96 dB
.1 % 6.35 dB
.01 % 6.46 dB

Date: 23.MAY.2012 16:04:57

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 2

Diagram 12



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

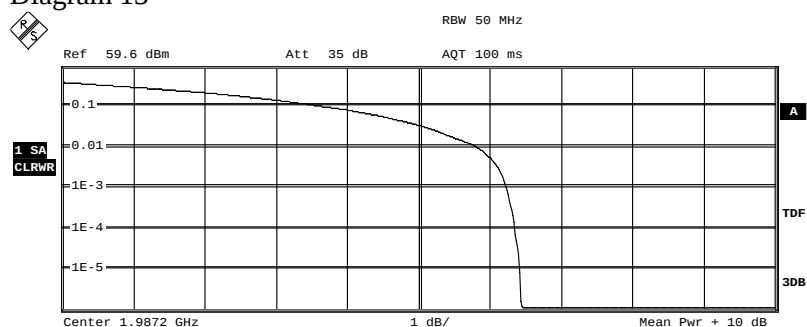
EXT

Trace 1
Mean 44.80 dBm
Peak 51.33 dBm
Crest 6.53 dB

10 % 3.73 dB
1 % 5.74 dB
.1 % 6.23 dB
.01 % 6.38 dB

Date: 23.MAY.2012 16:29:16

Diagram 13



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

EXT

Trace 1
Mean 44.81 dBm
Peak 51.30 dBm
Crest 6.49 dB

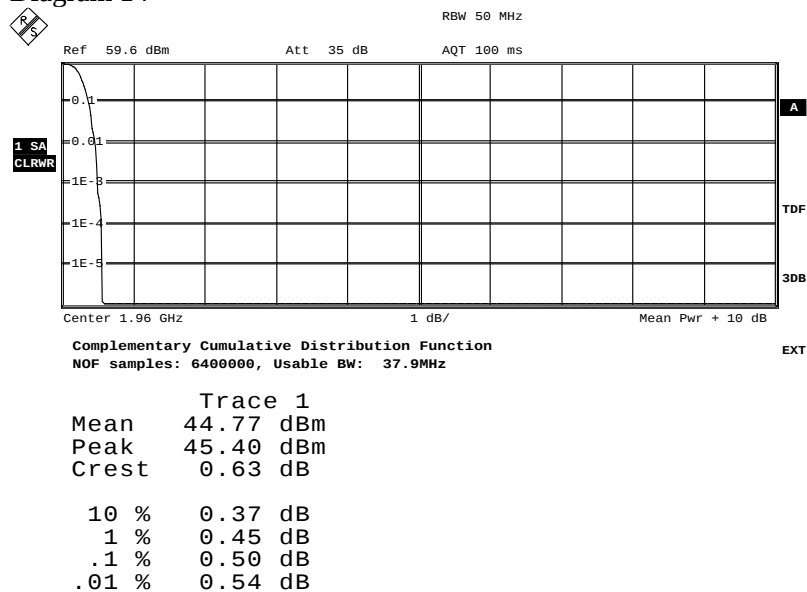
10 % 3.69 dB
1 % 5.82 dB
.1 % 6.23 dB
.01 % 6.35 dB

Date: 23.MAY.2012 17:24:20

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 2

Diagram 14



Date: 24.MAY.2012 09:11:37

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

Date	Temperature	Humidity
2012-05-21	23 °C ± 3 °C	44 % ± 5 %
2012-05-22	22 °C ± 3 °C	52 % ± 5 %
2012-05-23	21 °C ± 3 °C	53 % ± 5 %

Test set-up and procedure

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

Measurement equipment	SP number
Rohde & Schwarz signal analyzer FSQ40	504 143
RF attenuator	504 159
Testo 615 temperature and humidity meter	503 498

Measurement uncertainty: 3.7 dB

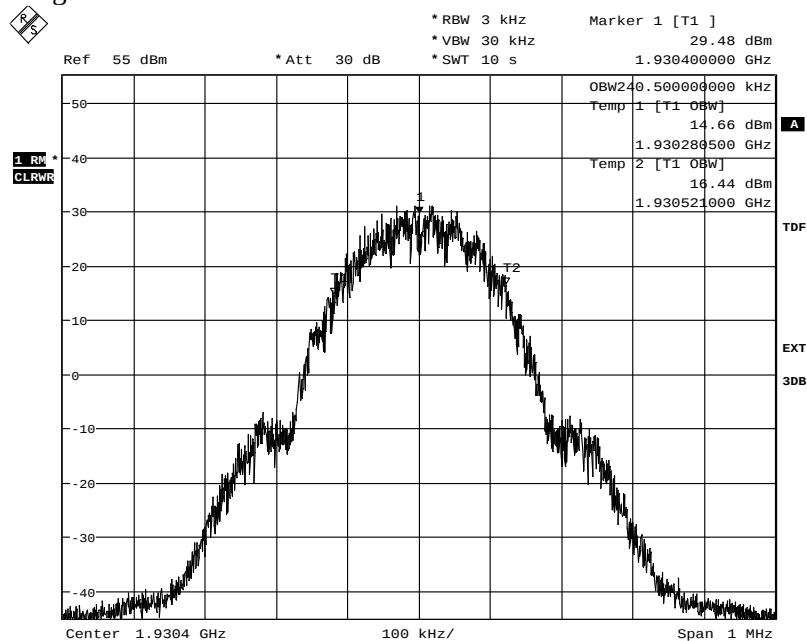
Results

Diagram	Modulation	Tested frequency	Occupied BW (99%) [kHz]
1	GMSK	B	241
2	GMSK	M	241
3	AQPSK	M	238
4	8-PSK	M	239
5	16QAM	M	240
6	32QAM	M	241
7	GMSK	T	241
8	GMSK	M, RF B	241

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

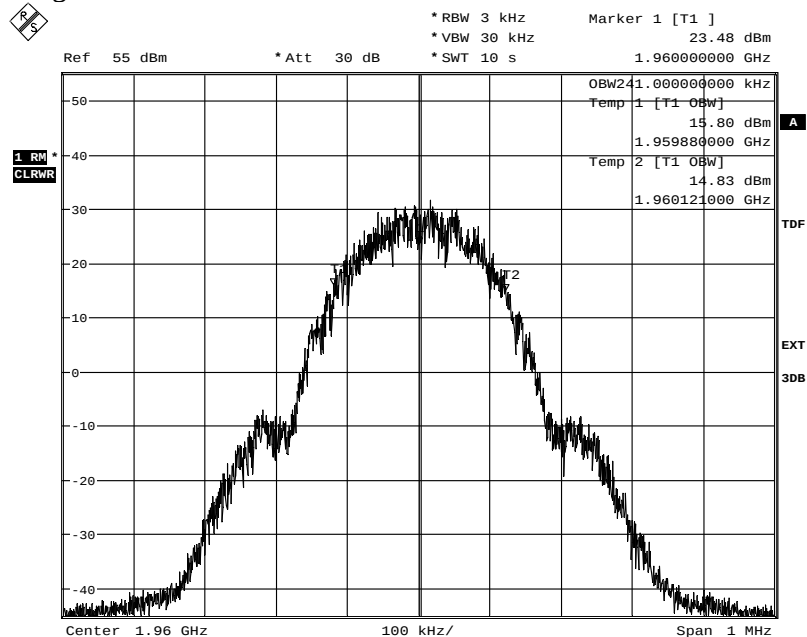
Appendix 3

Diagram 1



Date: 21.MAY.2012 13:26:28

Diagram 2

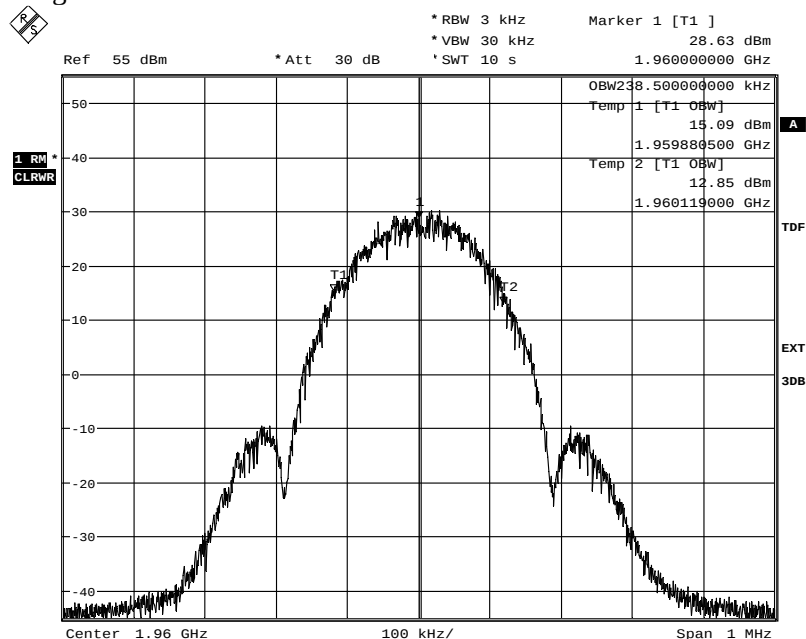


Date: 21.MAY.2012 10:07:04

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IC:287AB-AS1180231

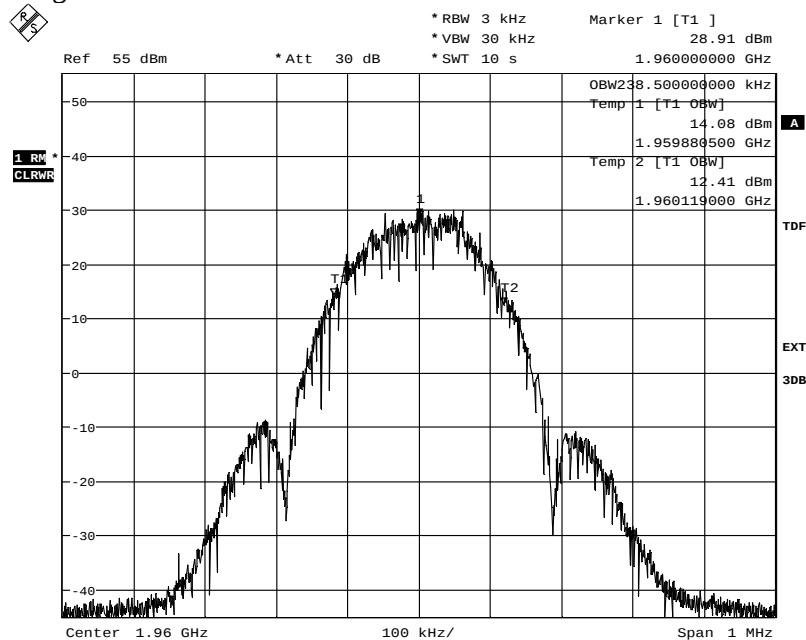
Appendix 3

Diagram 3



Date: 21.MAY.2012 10:05:22

Diagram 4

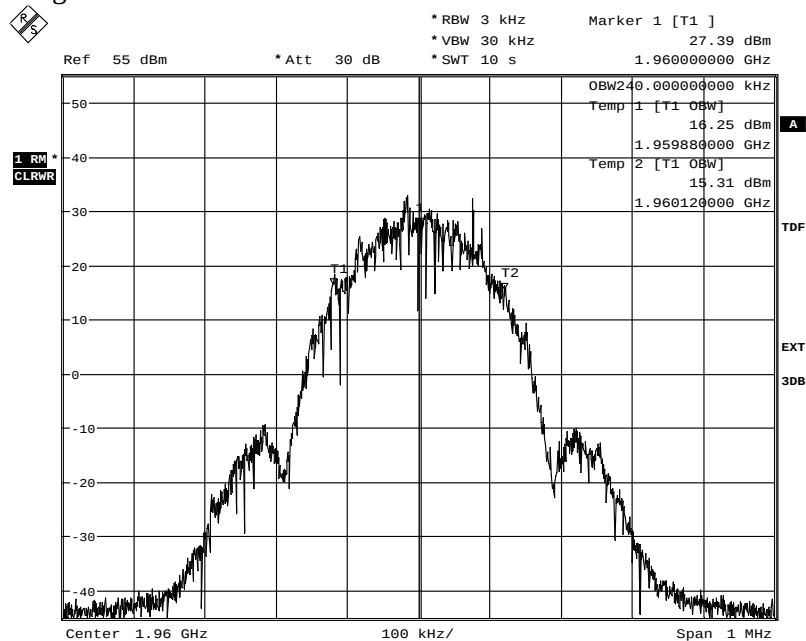


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IC:287AB-AS1180231

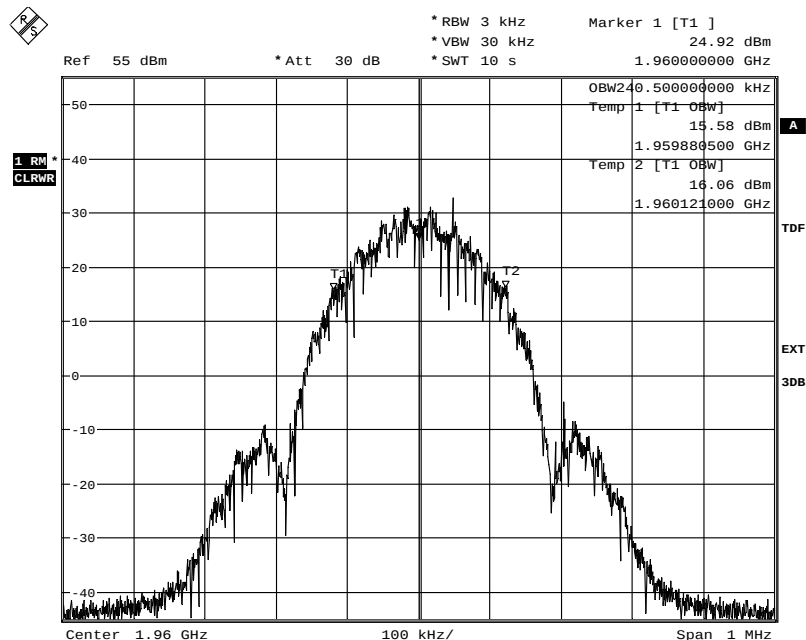
Appendix 3

Diagram 5



Date: 21.MAY.2012 10:29:09

Diagram 6

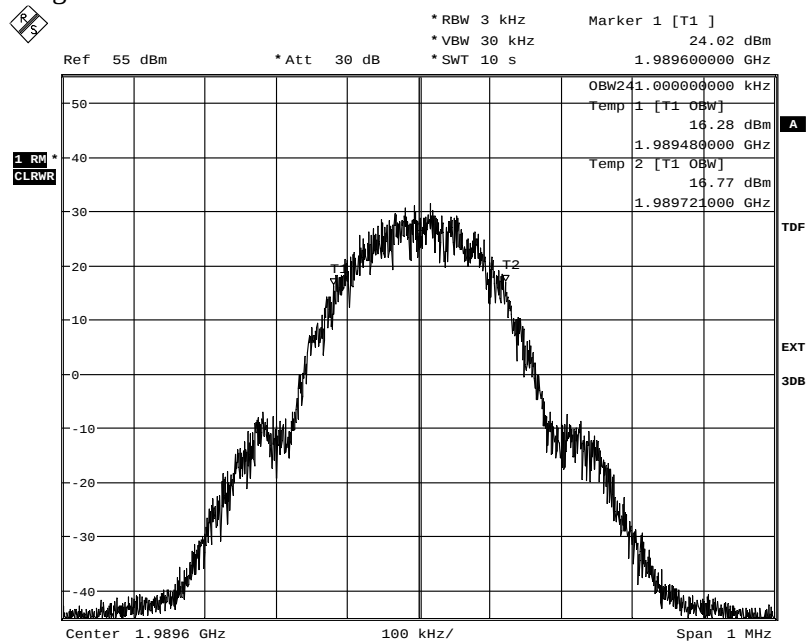


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FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

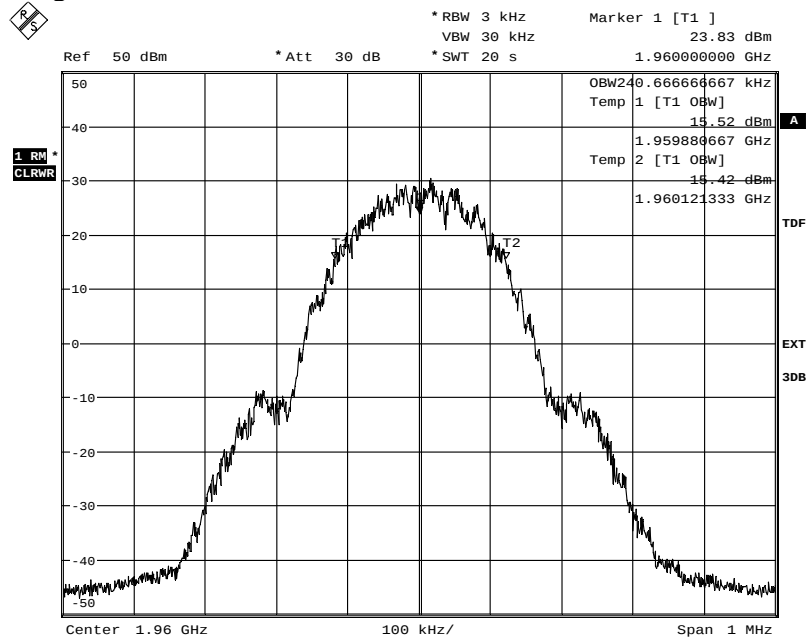
Appendix 3

Diagram 7



Date: 22.MAY.2012 09:20:59

Diagram 8



Date: 24.MAY.2012 09:19:44

Band edge measurements according to CFR 47 §24.238 / IC RSS-133 6.5

Date	Temperature	Humidity
2012-05-21	23 °C ± 3 °C	44 % ± 5 %
2012-05-22	22 °C ± 3 °C	52 % ± 5 %
2012-05-23	21 °C ± 3 °C	53 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. 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 RBW of 3 kHz (>1% of EBW) was used up to 1 MHz away from the band edges, from 1 MHz to 6 MHz away from the band edges a RBW of 50 kHz was used. To compensate for the reduced RBW the limit was adjusted by -13 dB to -26 dBm in this frequency range. A RBW of 1 MHz was used from 6 to 15 MHz away from the band edges.

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

Measurement uncertainty: 3.7 dB

Results

Single carrier:

		Channel	Modulation
Diagram	1 a,b,c:	B+1	GMSK
Diagram	2 a,b,c:	B+1	AQPSK
Diagram	3 a,b,c:	B+1	8-PSK
Diagram	4 a,b,c:	B+1	16QAM
Diagram	5 a,b,c:	B+1	32QAM
Diagram	6 a,b,c:	T-1	GMSK
Diagram	7 a,b,c:	T-1	AQPSK
Diagram	8 a,b,c:	T-1	8-PSK
Diagram	9 a,b,c:	T-1	16QAM
Diagram	10 a,b,c:	T-1	32QAM

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 4

Remark

The channel adjacent to the lower and higher band edge cannot be used. The lowest usable channel is 513 (1930.4 MHz) and the highest usable channel is 809 (1989.6 MHz).

Limits

CFR 47 §24.238 and RSS-133 6.5

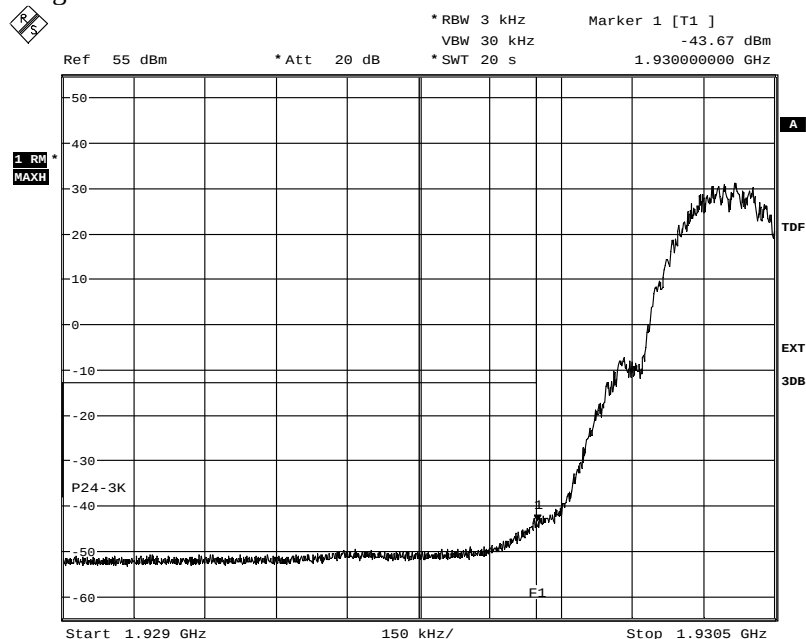
Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB, resulting in a limit of -13 dBm.

Complies?	Yes
-----------	-----

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

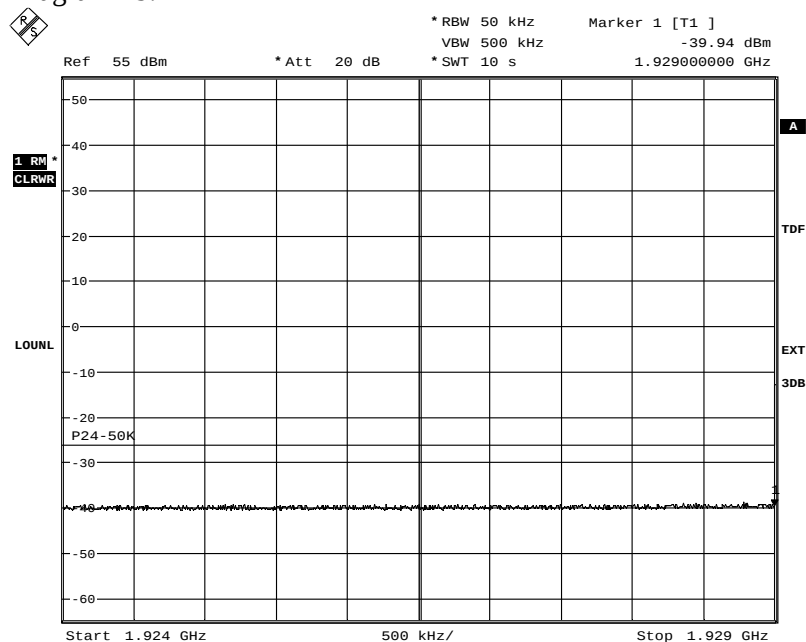
Appendix 4

Diagram 1a :



Date: 21.MAY.2012 14:55:52

Diagram 1b:

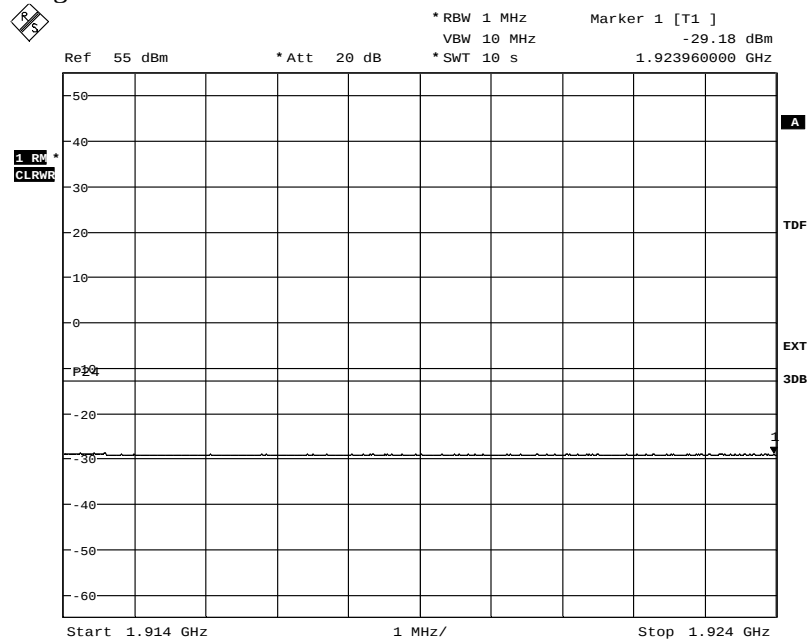


Date: 22.MAY.2012 06:51:55

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 4

Diagram 1c

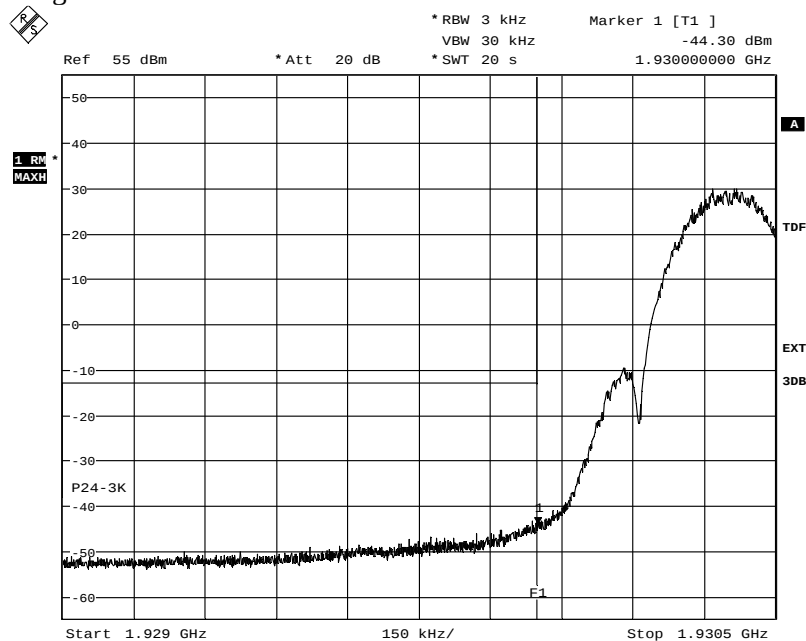


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FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

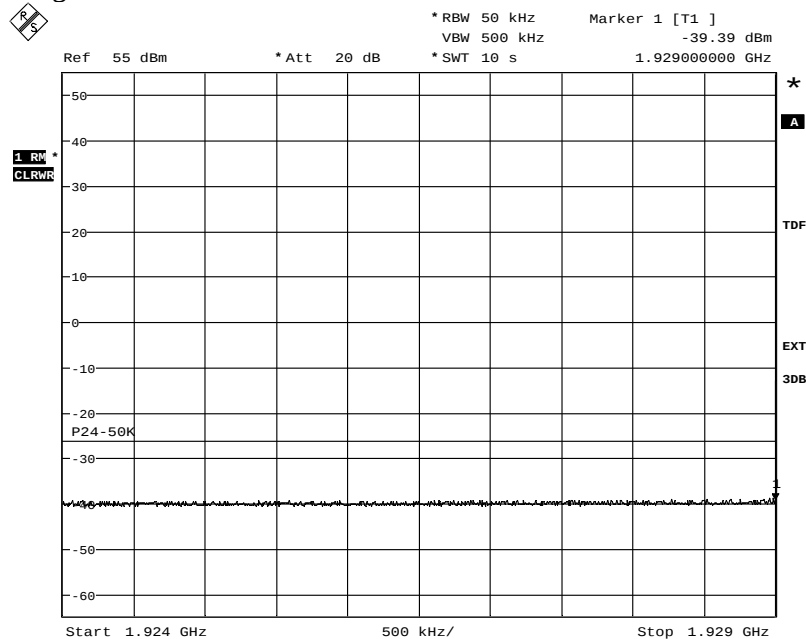
Appendix 4

Diagram 2a:



Date: 22.MAY.2012 07:10:49

Diagram 2b:

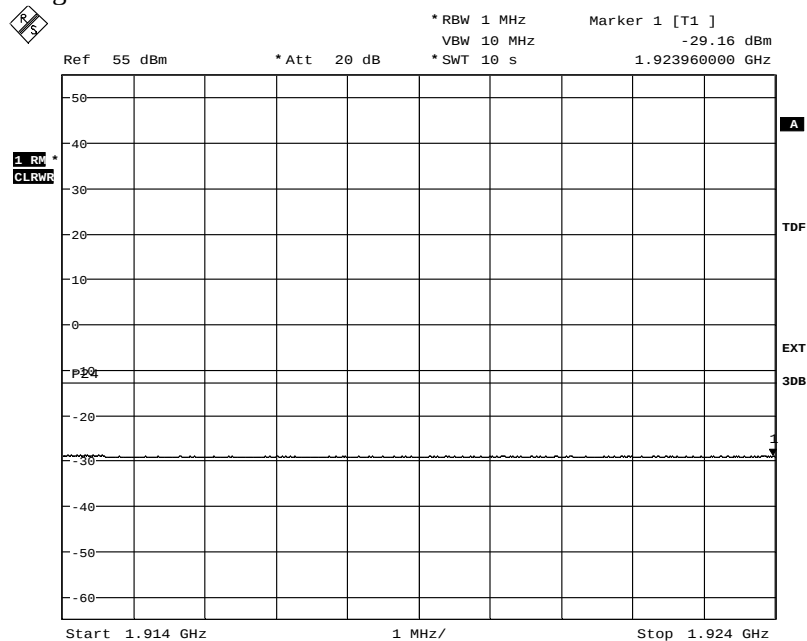


Date: 22.MAY.2012 07:06:29

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 4

Diagram 2c:

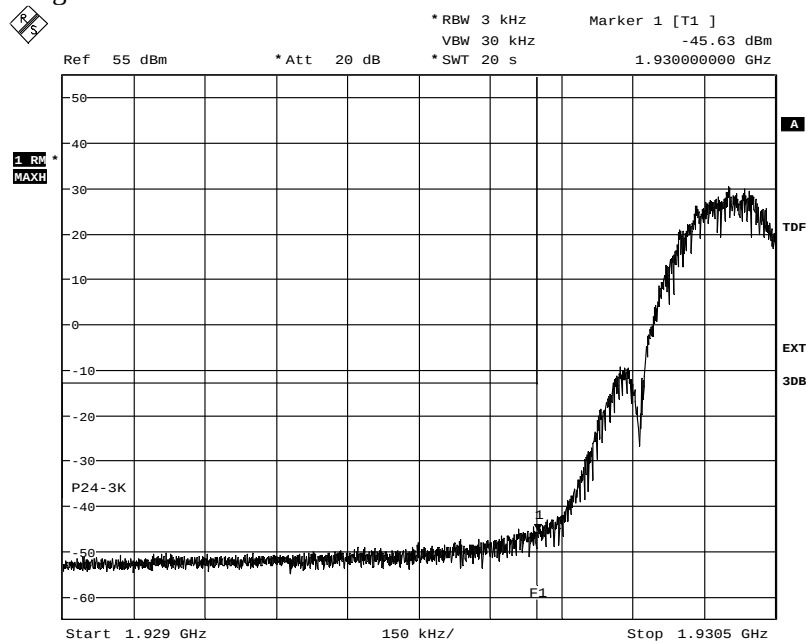


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IC:287AB-AS1180231

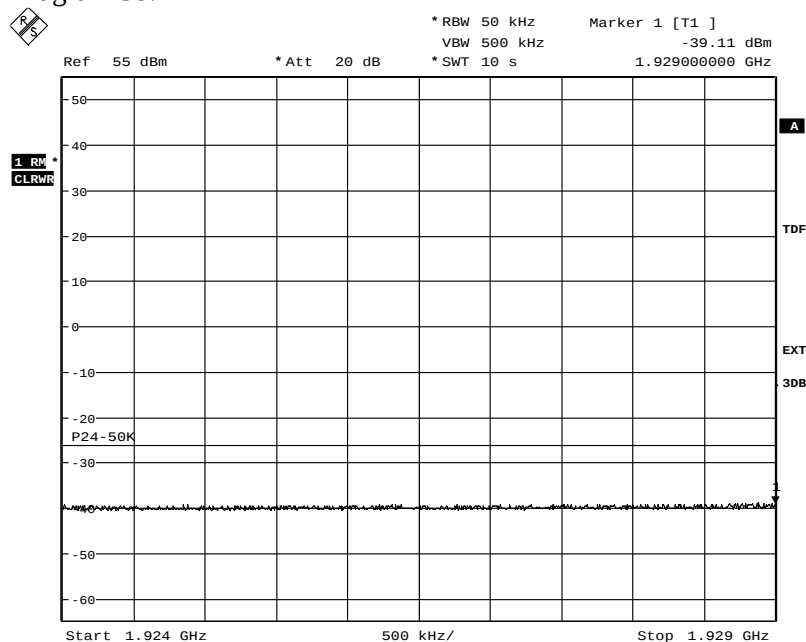
Appendix 4

Diagram 3a:



Date: 22.MAY.2012 07:13:16

Diagram 3b:

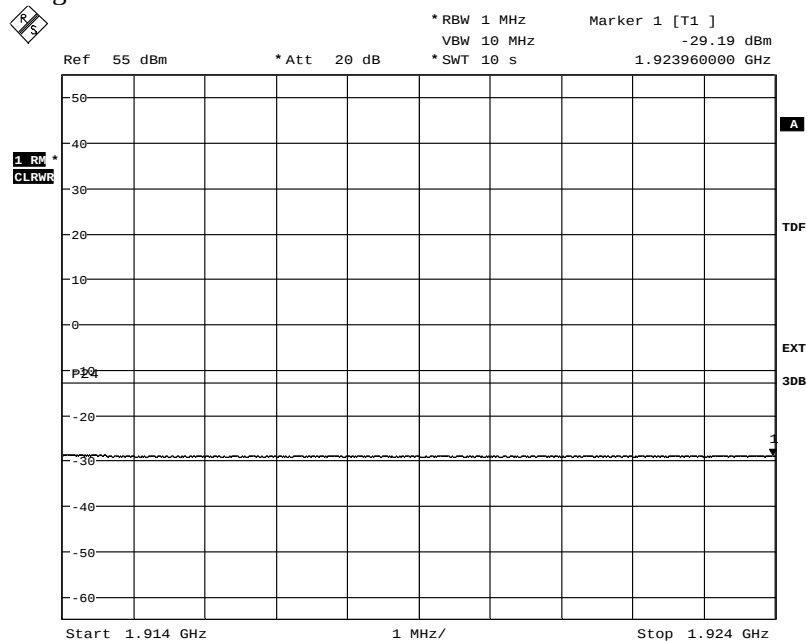


Date: 22.MAY.2012 07:15:17

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 4

Diagram 3c:

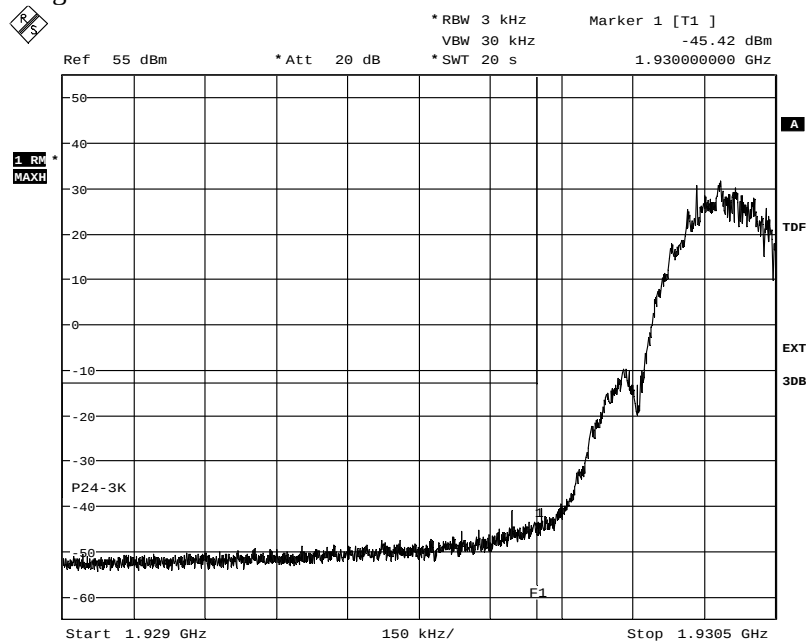


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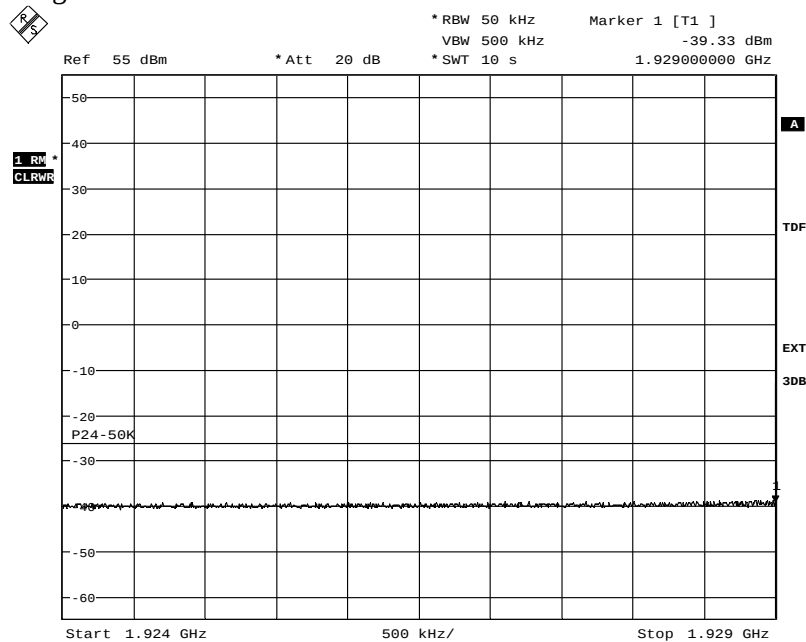
Appendix 4

Diagram 4a:



Date: 22.MAY.2012 07:35:35

Diagram 4b:

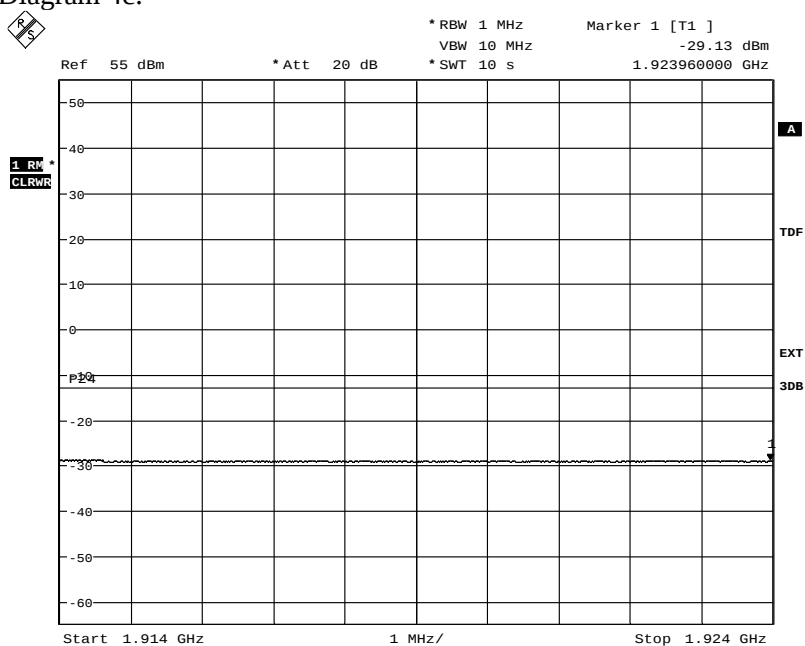


Date: 22.MAY.2012 07:33:09

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 4

Diagram 4c:

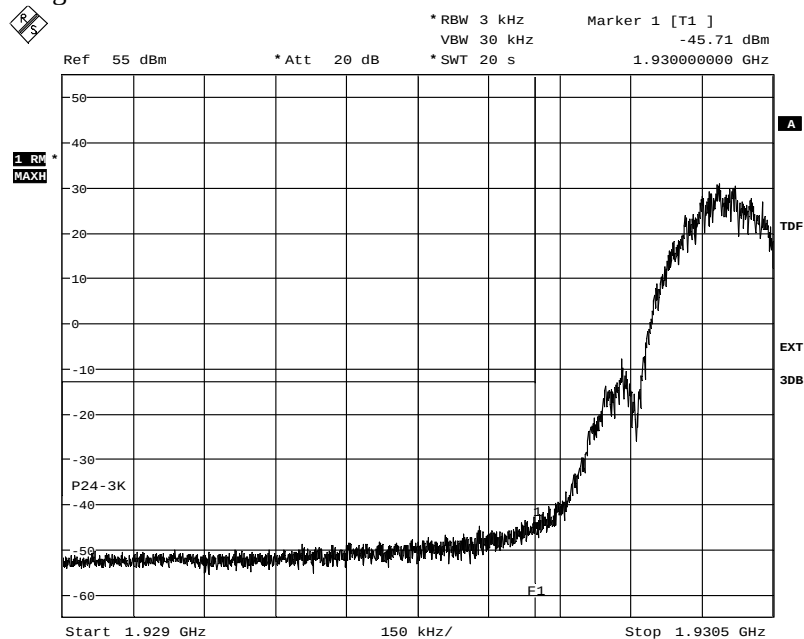


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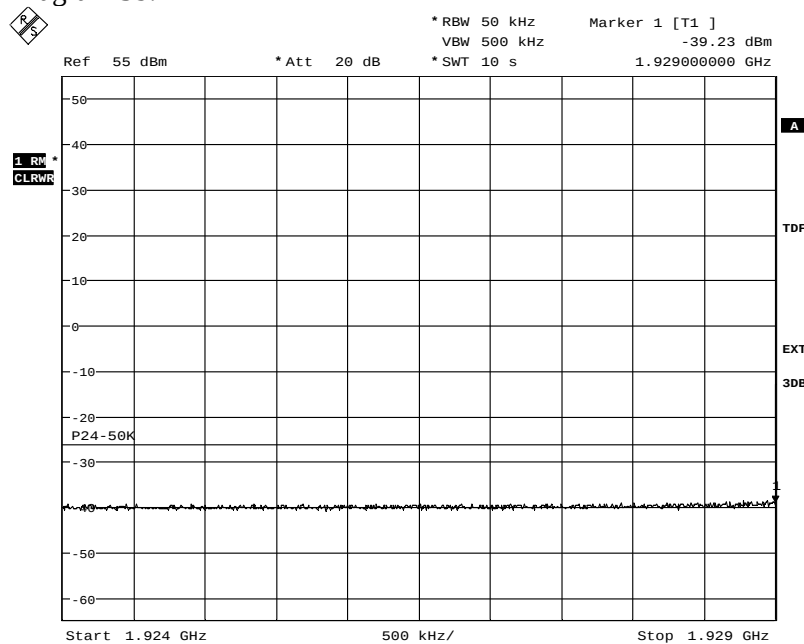
Appendix 4

Diagram 5a:



Date: 22.MAY.2012 07:39:00

Diagram 5b:

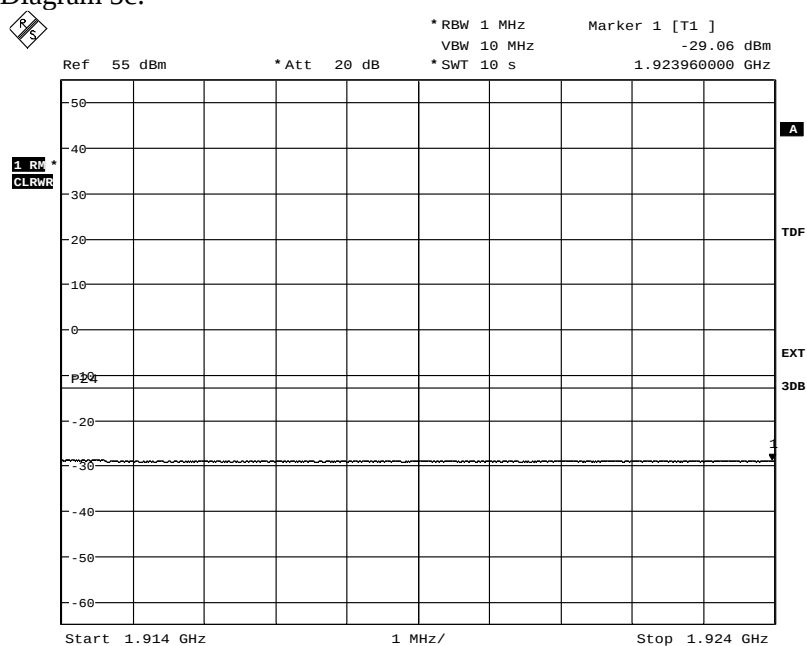


Date: 22.MAY.2012 07:40:50

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 4

Diagram 5c:

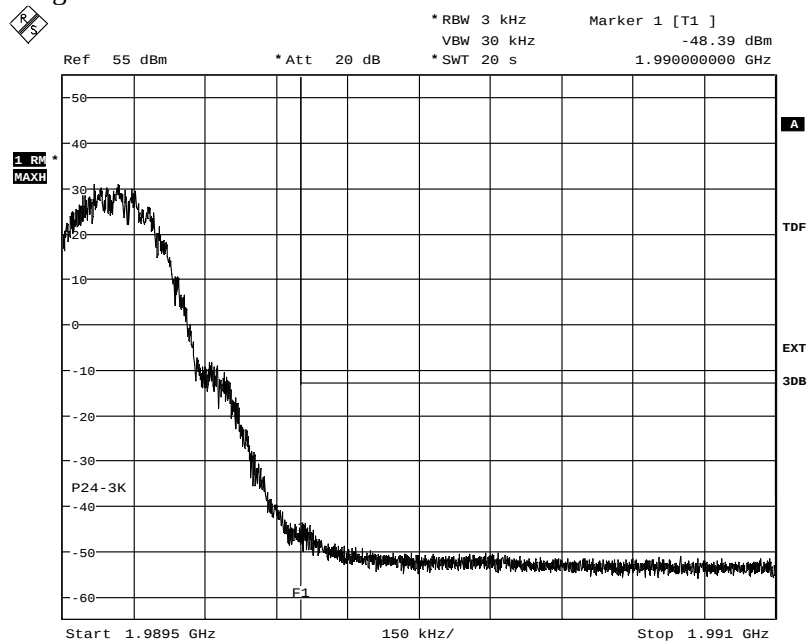


Date: 22.MAY.2012 07:42:19

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IC:287AB-AS1180231

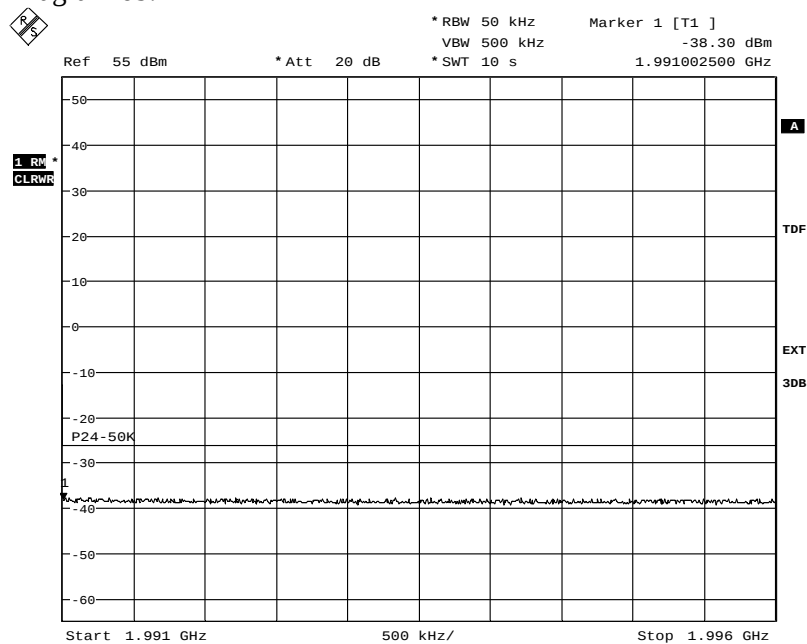
Appendix 4

Diagram 6a:



Date: 22.MAY.2012 10:20:36

Diagram 6b:

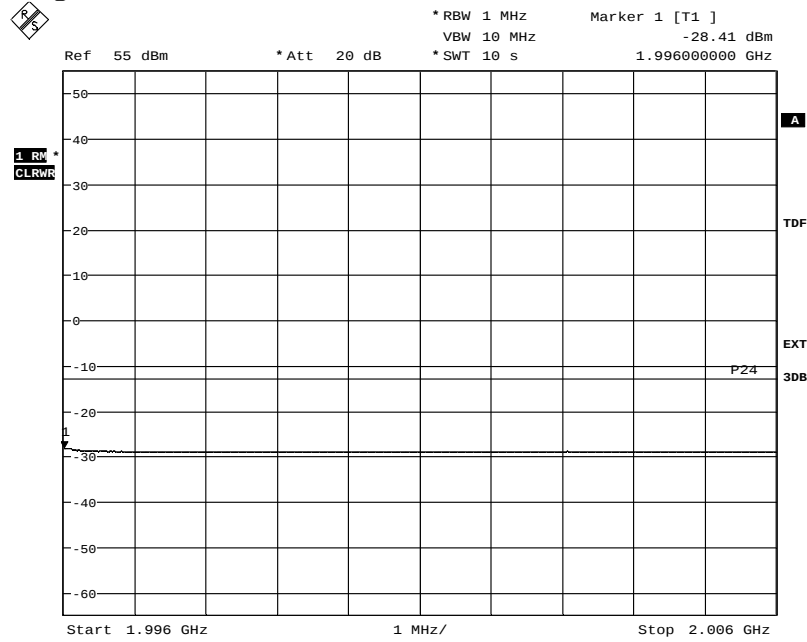


Date: 22.MAY.2012 10:27:47

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 4

Diagram 6c

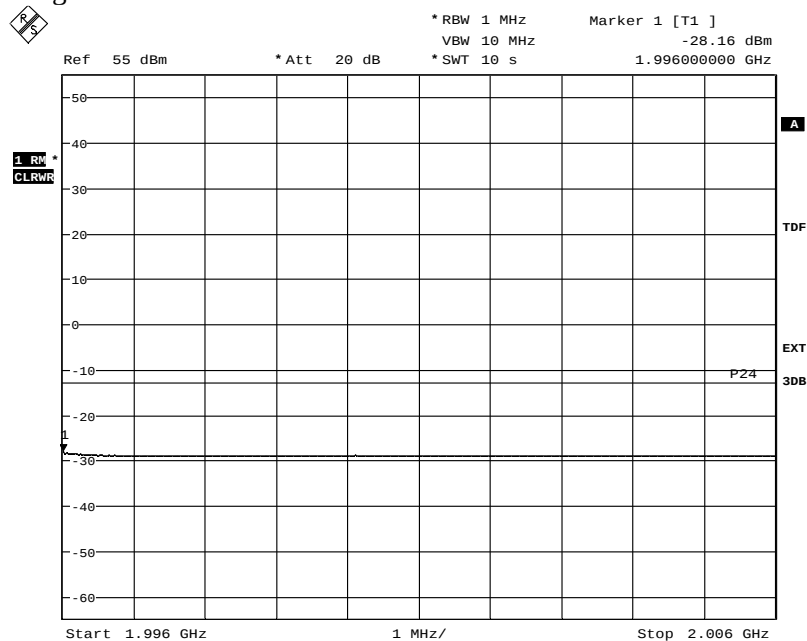


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IC:287AB-AS1180231

Appendix 4

Diagram 7c:

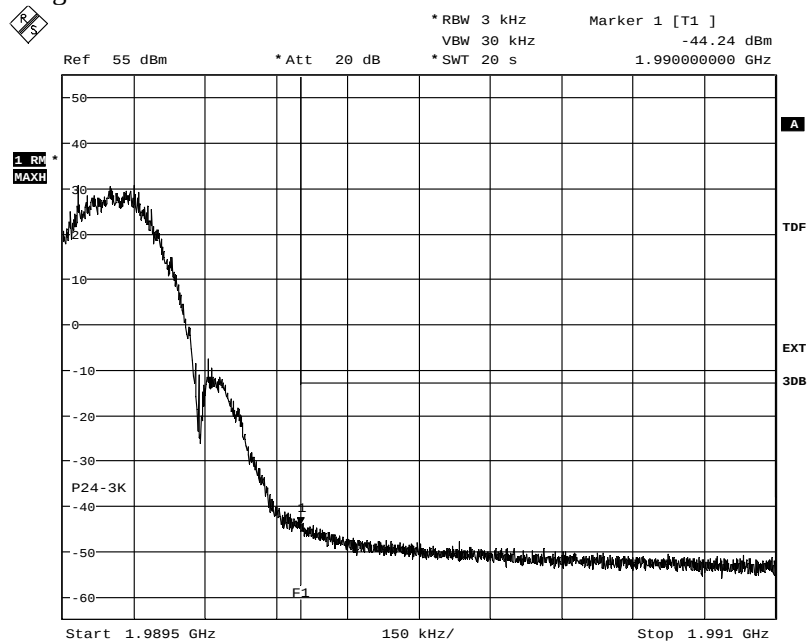


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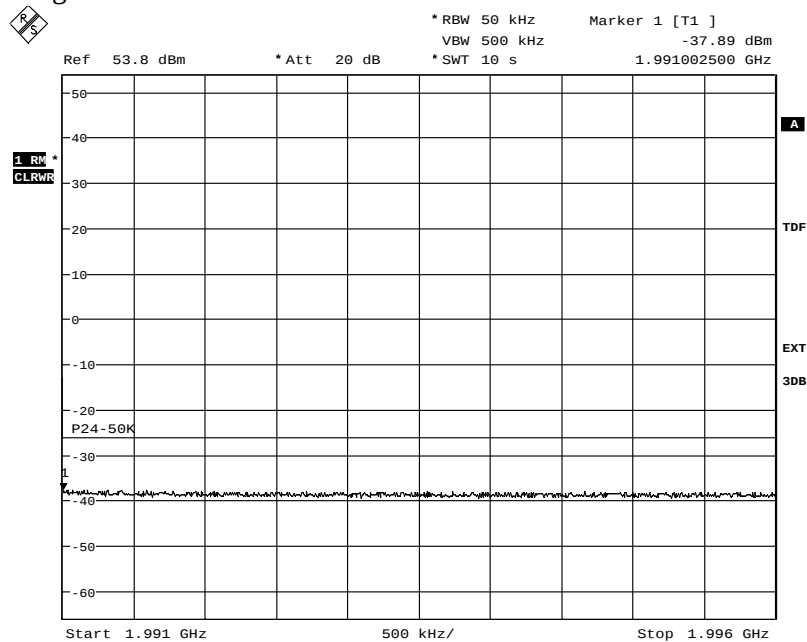
Appendix 4

Diagram 8a:



Date: 22.MAY.2012 10:36:45

Diagram 8b:

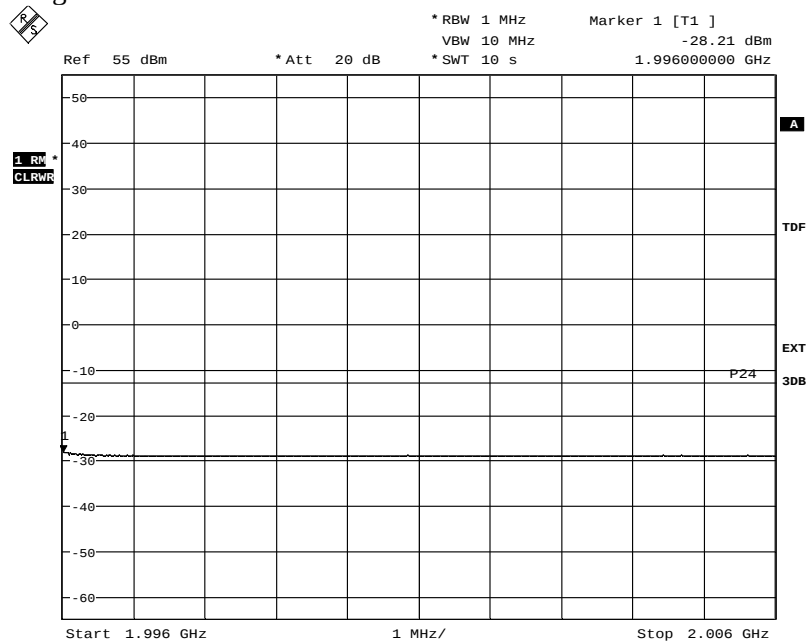


Date: 22.MAY.2012 10:39:04

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IC:287AB-AS1180231

Appendix 4

Diagram 8c:

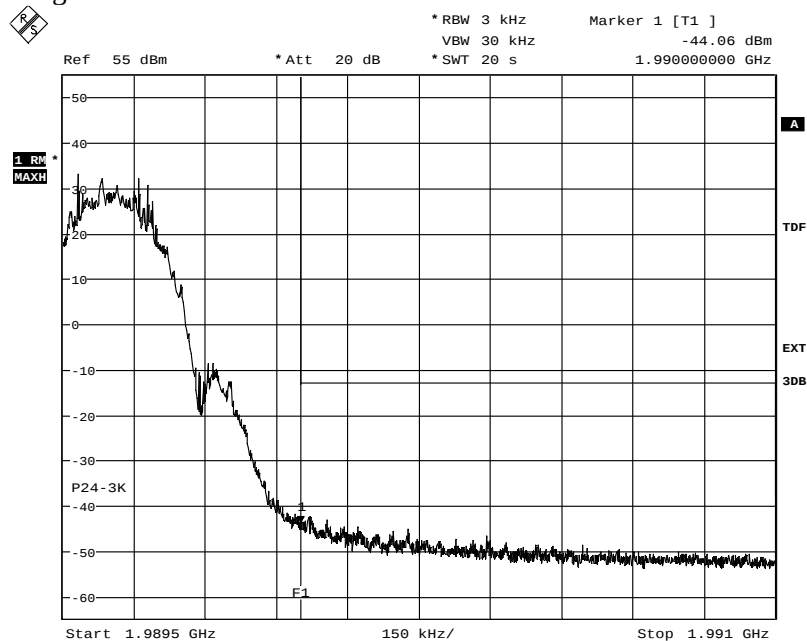


Date: 22.MAY.2012 10:40:31

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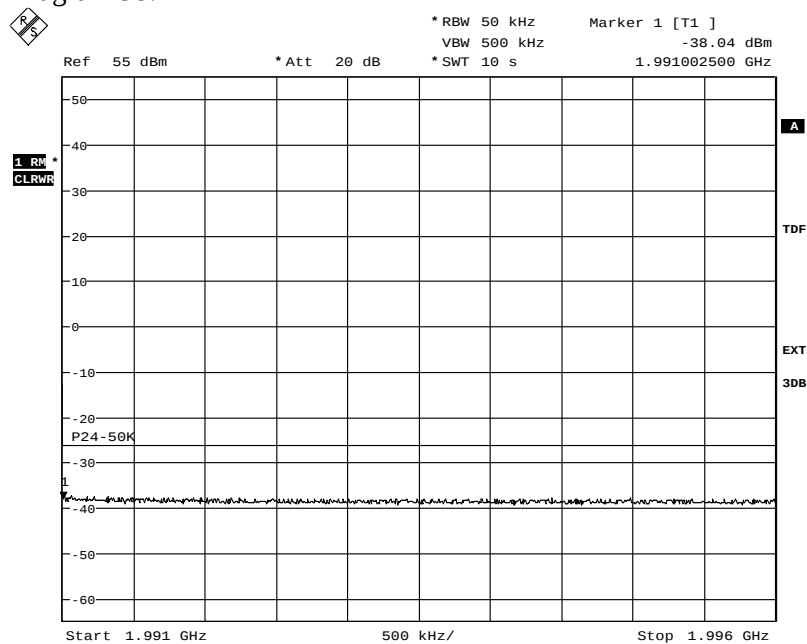
Appendix 4

Diagram 9a:



Date: 22.MAY.2012 10:47:55

Diagram 9b:

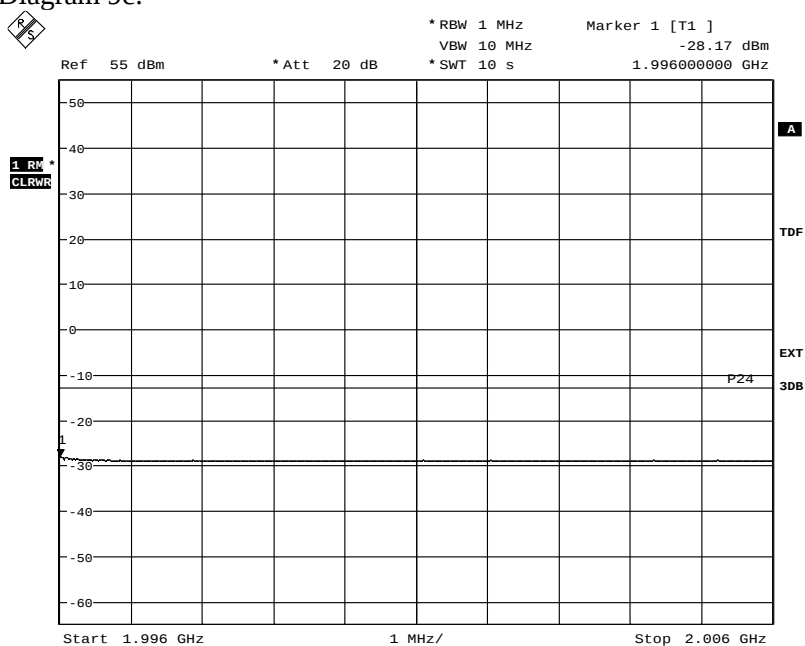


Date: 22.MAY.2012 10:45:46

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 4

Diagram 9c:

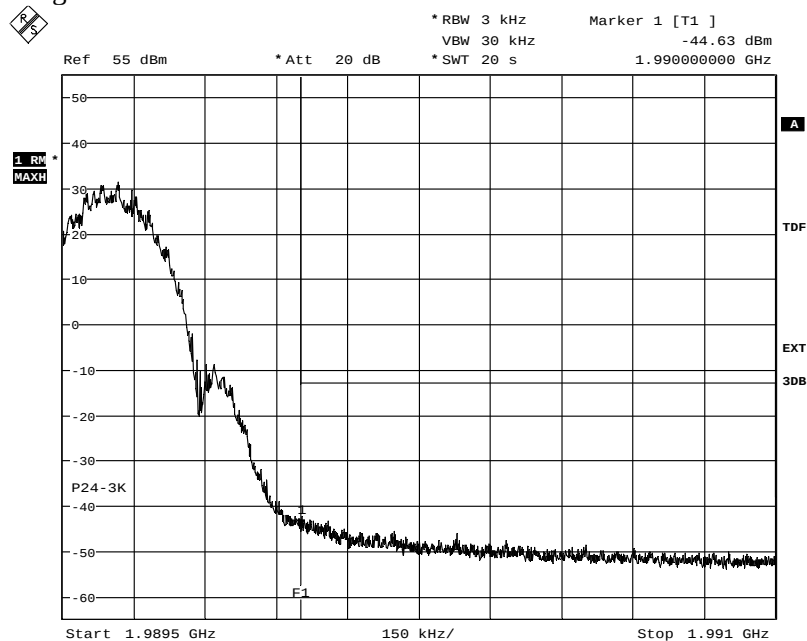


Date: 22.MAY.2012 10:42:31

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

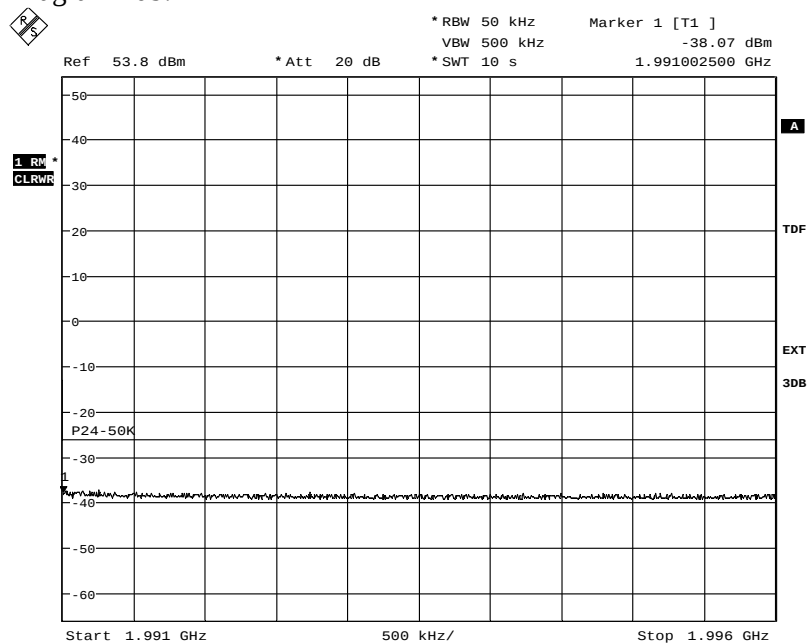
Appendix 4

Diagram 10a:



Date: 22.MAY.2012 10:54:27

Diagram 10b:

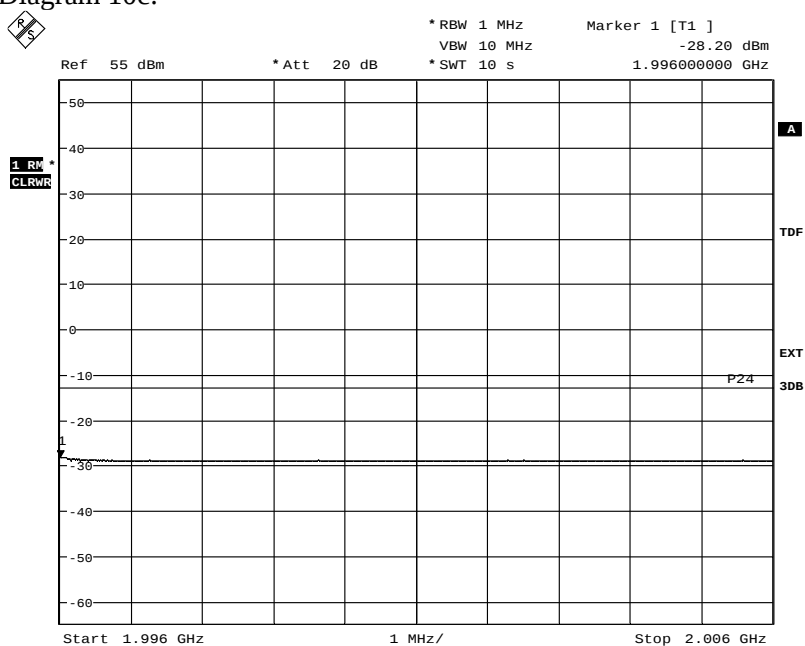


Date: 22.MAY.2012 10:55:45

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 4

Diagram 10c:



Date: 22.MAY.2012 10:58:48

Conducted spurious emission measurements according to CFR 47 §24.238 / IC RSS-133 6.5

Date	Temperature	Humidity
2012-05-21	23 °C ± 3 °C	44 % ± 5 %
2012-05-22	22 °C ± 3 °C	52 % ± 5 %
2012-05-23	21 °C ± 3 °C	53 % ± 5 %

Results

Single carrier:

	Channel	Modulation
Diagram 1 a-d:	B+1	GMSK
Diagram 2 a-d:	M	GMSK
Diagram 3 a-d:	M	AQPSK
Diagram 4 a-d:	M	8-PSK
Diagram 5 a-d:	M	16QAM
Diagram 6 a-d:	M	32QAM
Diagram 7 a-d:	T-1	GMSK

Multi carrier 1x2:

	Channels	Modulation
Diagram 8 a-e:	(B+1)+(B+9)	GMSK
Diagram 9 a-d:	M+8	GMSK
Diagram 10 a-e:	(T-1)+(T-9)	GMSK

Test set-up and procedure

The measurements were made per definition in §24.238. The output was connected to a spectrum analyzer with a RBW setting of 1 MHz and RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements

Measurement equipment	SP number
R&S FSQ	504 143
RF attenuator	504 159
High pass filter	504 200
RF attenuator	900 229
High pass filter	503 740
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

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 $10 \times 2.5 \text{ GHz} = 25 \text{ GHz}$ for emission measurements.



REPORT

Date
2012-06-18

Reference
FX208964-F24G

Page
2 (24)

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 5

Limits

§24.238 and RSS-133 6.5

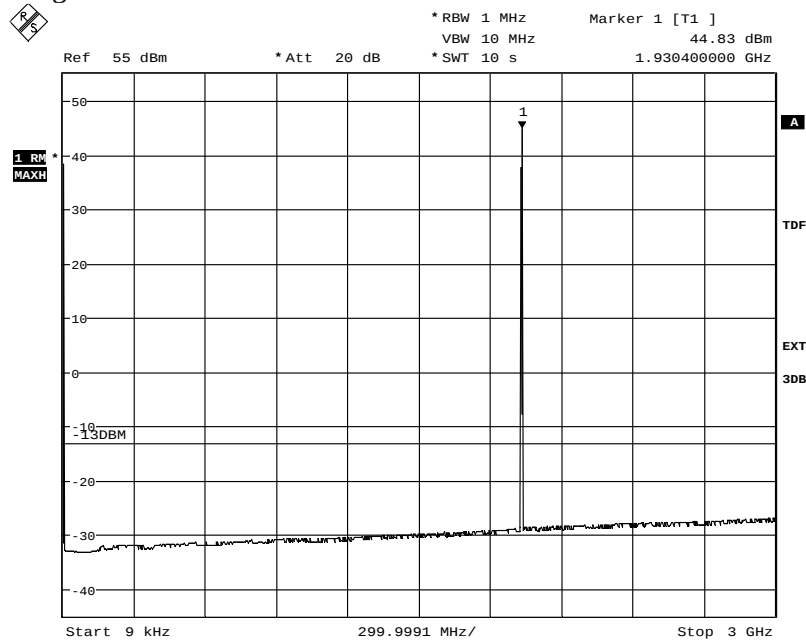
Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB, resulting in a limit of -13 dBm per 1 MHz RBW.

Complies?	Yes
-----------	-----

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

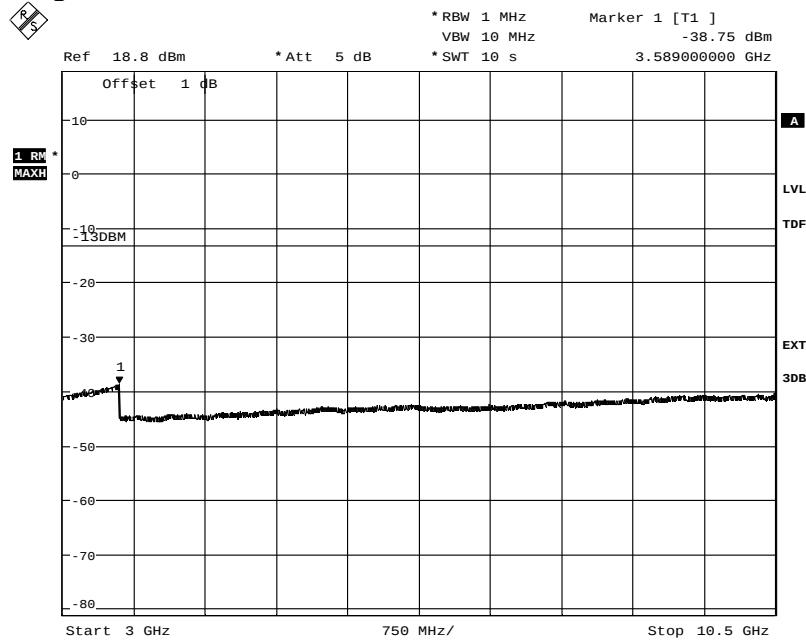
Appendix 5

Diagram 1a



Date: 21.MAY.2012 13:18:31

Diagram 1b

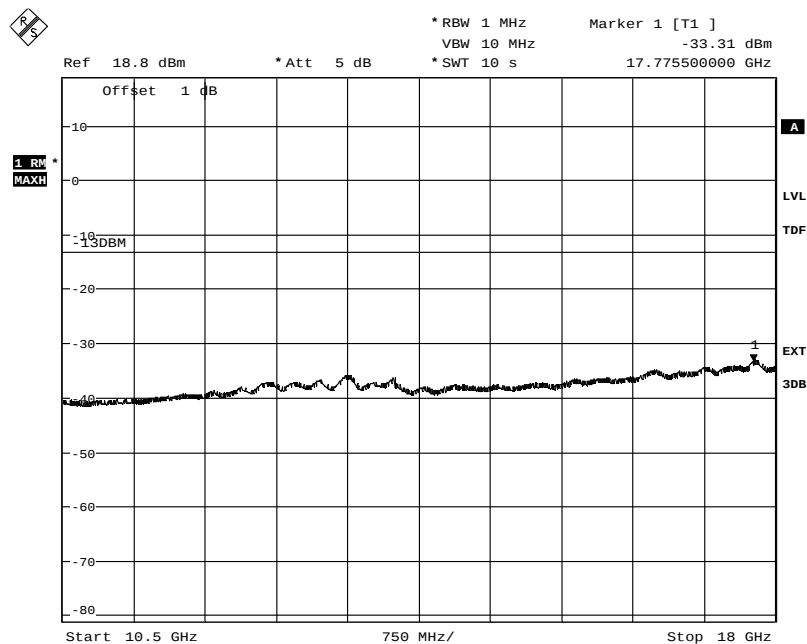


Date: 21.MAY.2012 13:19:38

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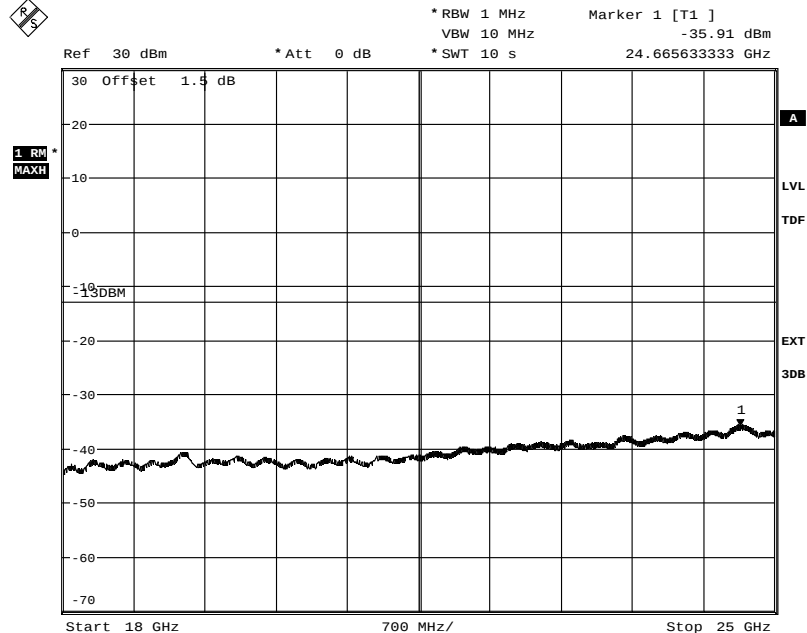
Appendix 5

Diagram 1c



Date: 21.MAY.2012 13:20:15

Diagram 1d

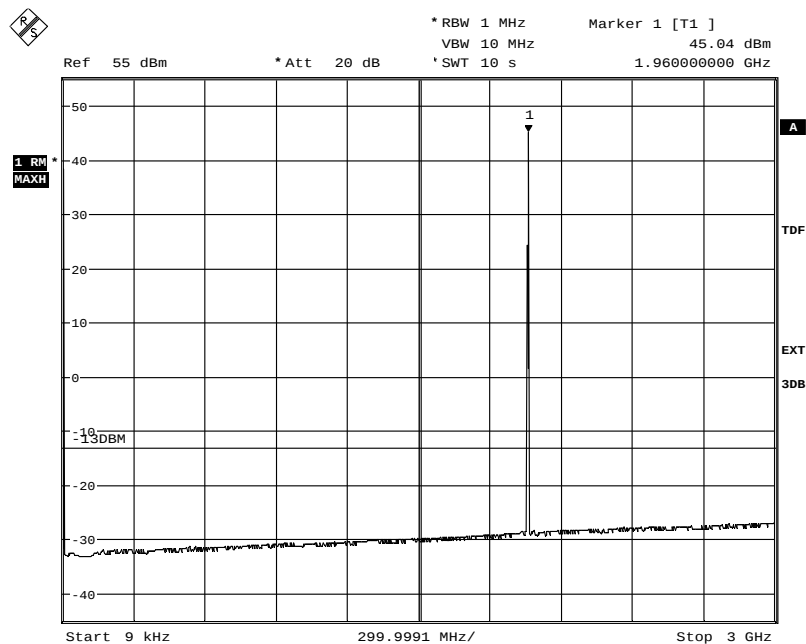


Date: 21.MAY.2012 13:08:36

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IC:287AB-AS1180231

Appendix 5

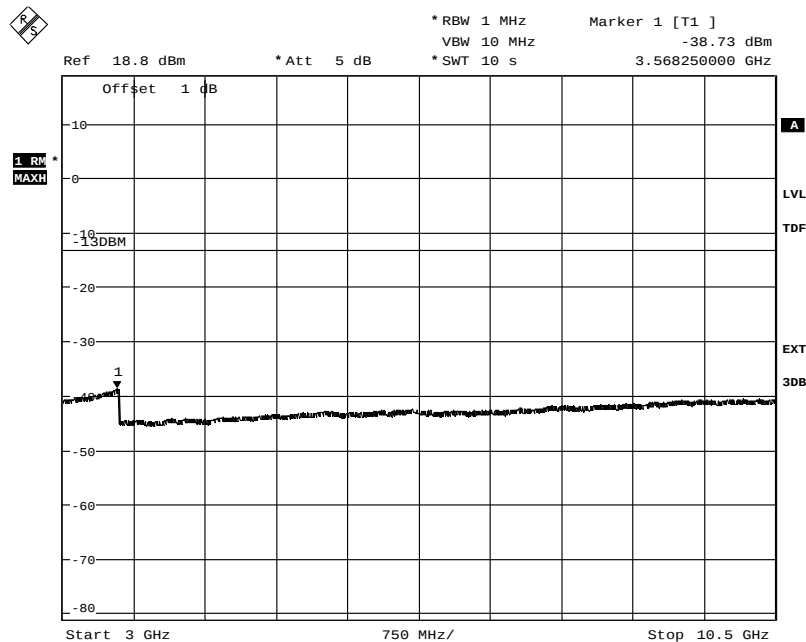
Diagram 2a



Date: 16.MAY.2012 10:06:34

The emissions around the carrier are within the operating frequency band

Diagram 2b

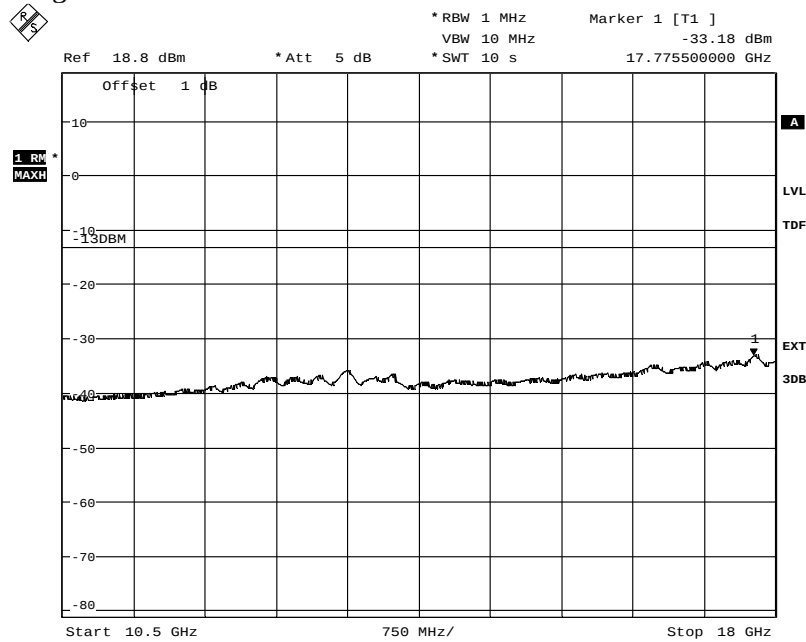


Date: 16.MAY.2012 10:09:07

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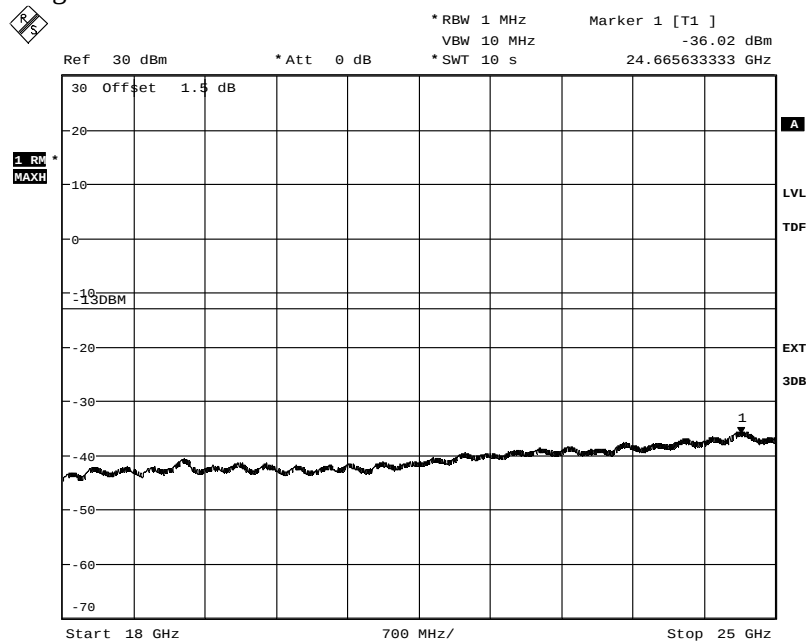
Appendix 5

Diagram 2c



Date: 21.MAY.2012 12:29:50

Diagram 2d

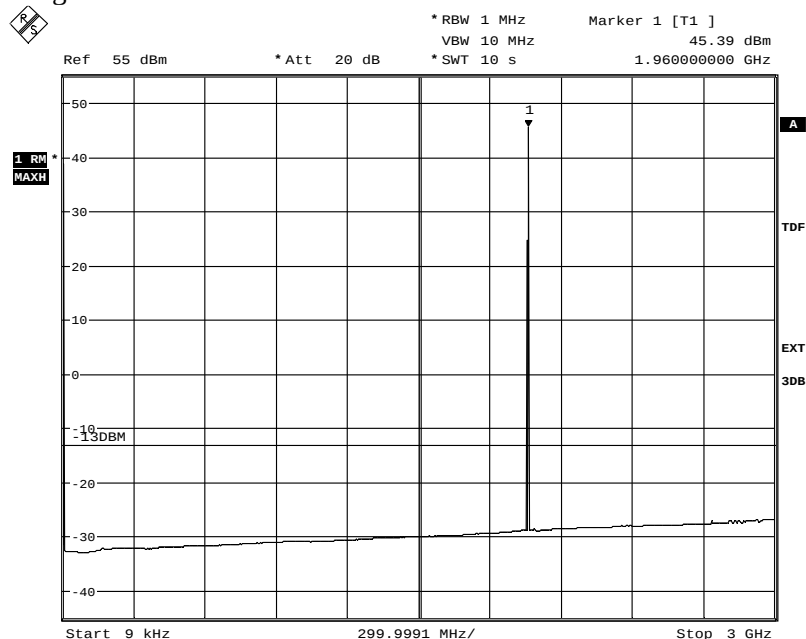


Date: 21.MAY.2012 13:03:05

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IC:287AB-AS1180231

Appendix 5

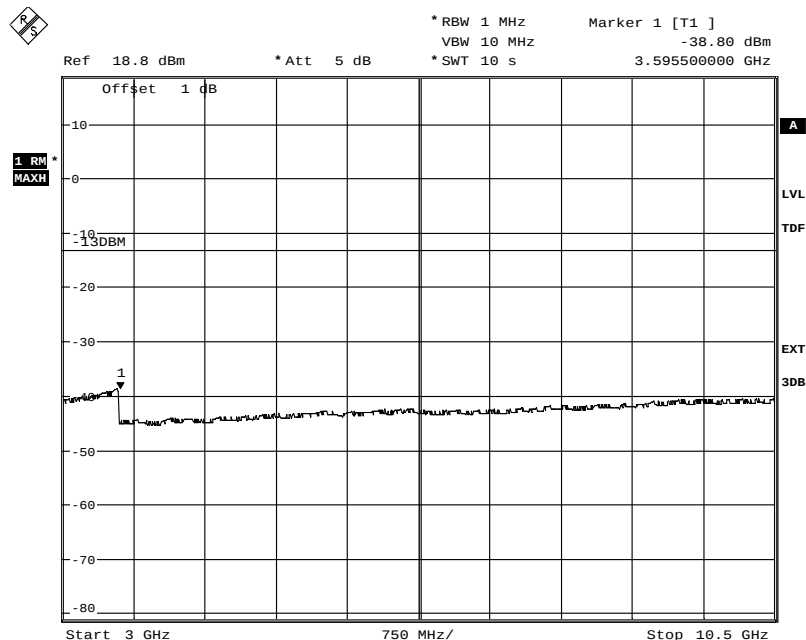
Diagram 3a



Date: 16.MAY.2012 10:36:09

The emissions around the carrier are within the operating frequency band

Diagram 3b

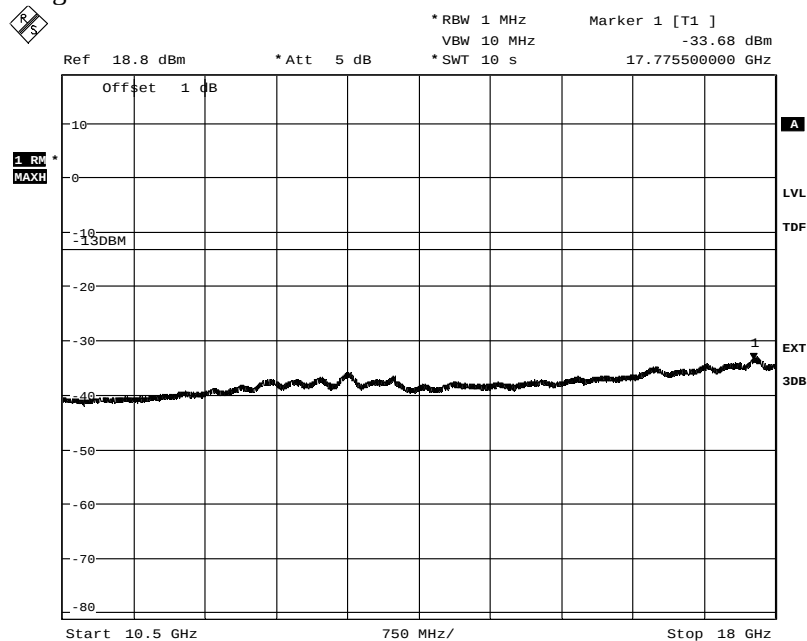


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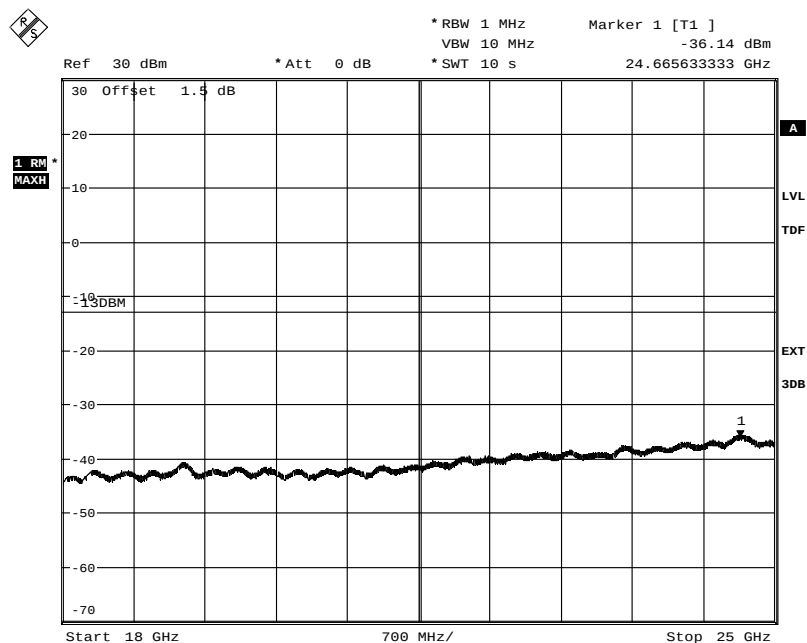
Appendix 5

Diagram 3c



Date: 21.MAY.2012 12:49:16

Diagram 3d

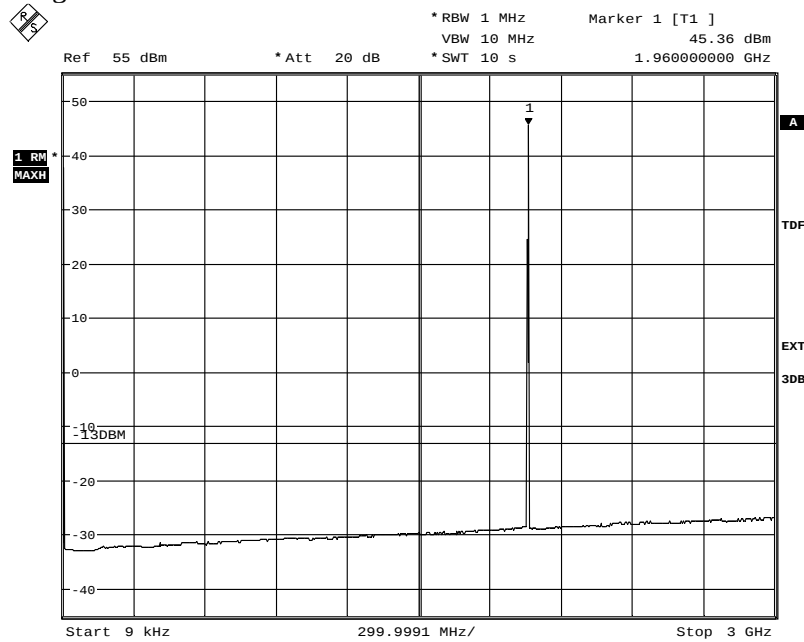


Date: 21.MAY.2012 13:14:14

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 5

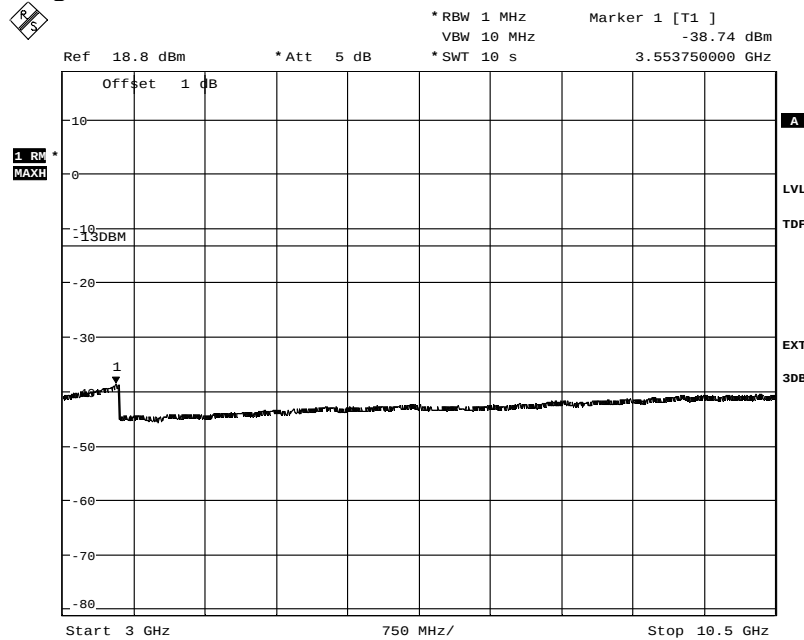
Diagram 4a



Date: 21.MAY.2012 10:14:06

The emissions around the carriers are within the operating frequency band

Diagram 4b

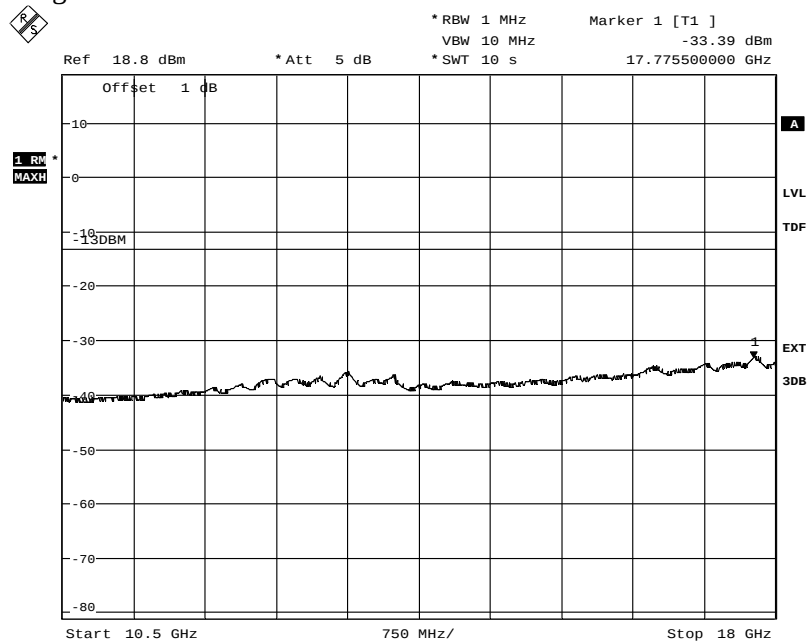


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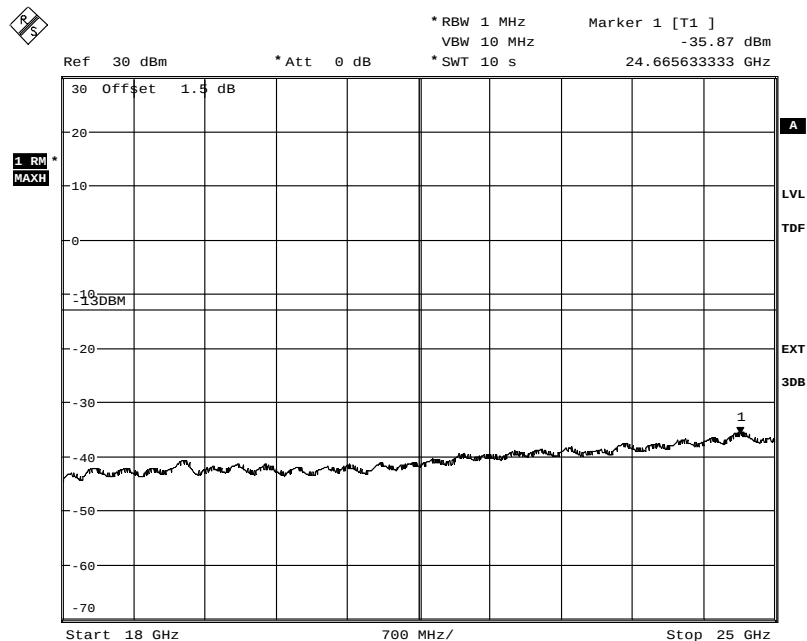
Appendix 5

Diagram 4c



Date: 21.MAY.2012 10:16:57

Diagram 4d

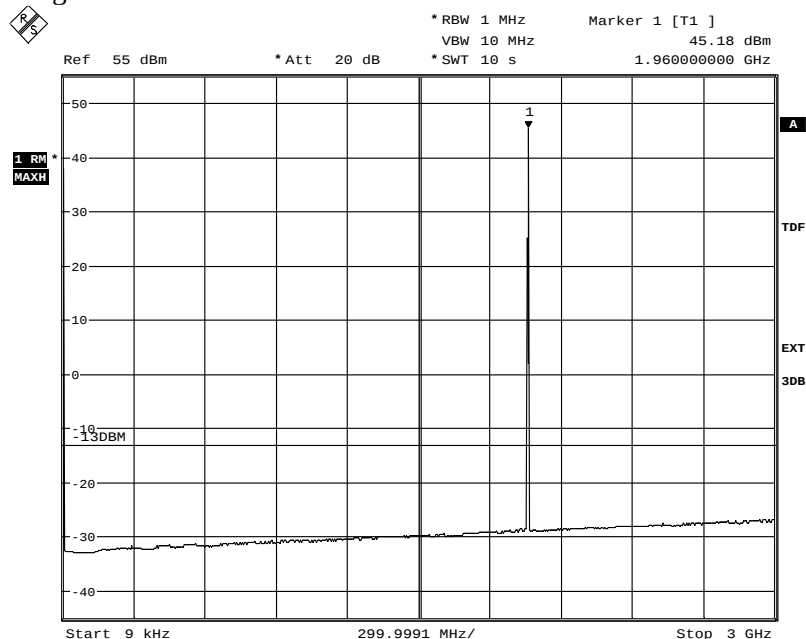


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Appendix 5

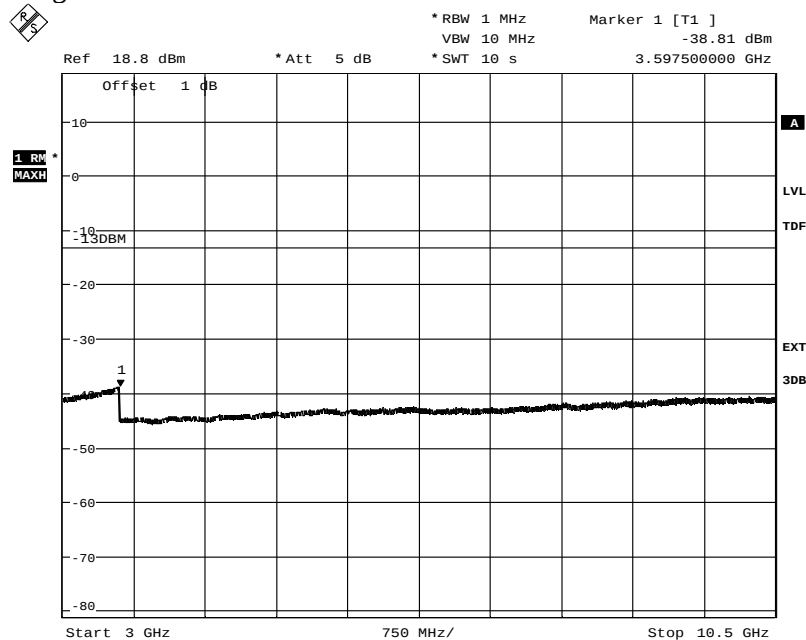
Diagram 5a



Date: 21.MAY.2012 10:42:57

The emissions around the carriers are within the operating frequency band

Diagram 5b

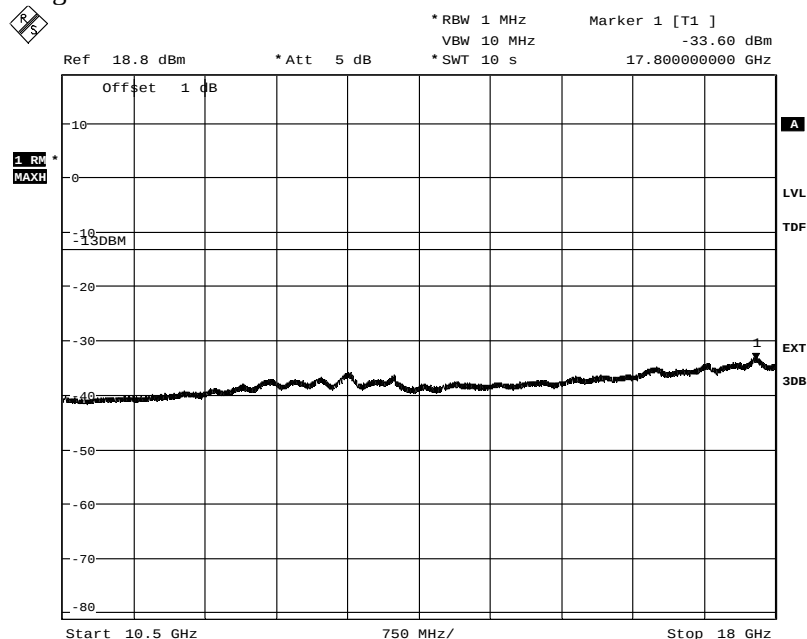


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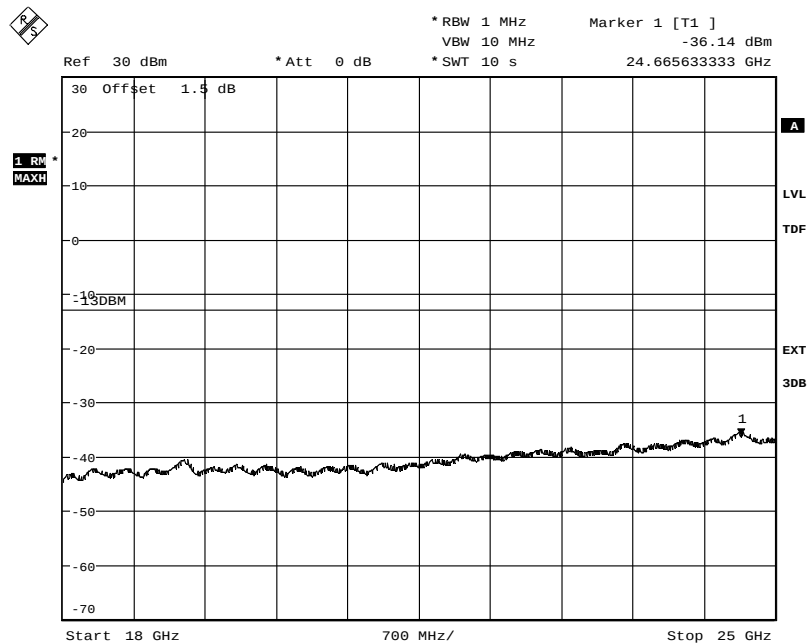
Appendix 5

Diagram 5c



Date: 21.MAY.2012 10:47:34

Diagram 5d

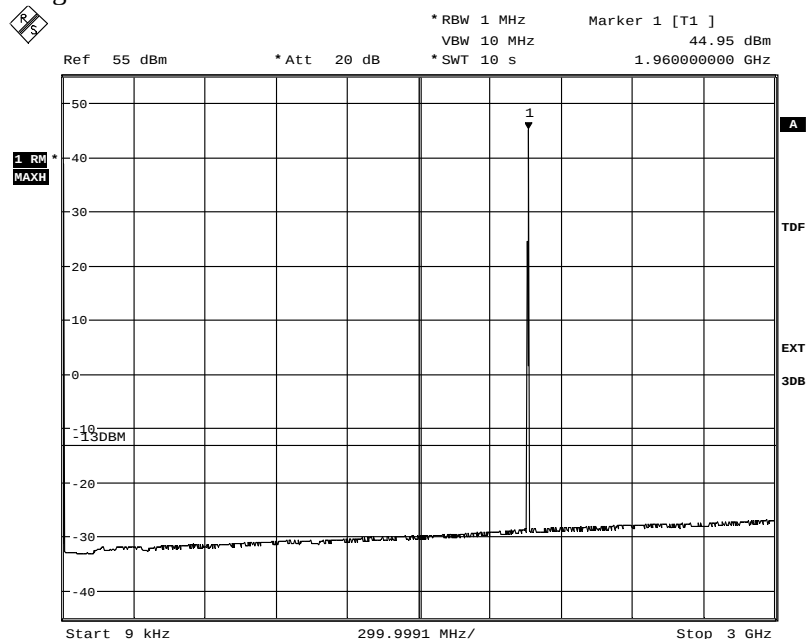


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FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 5

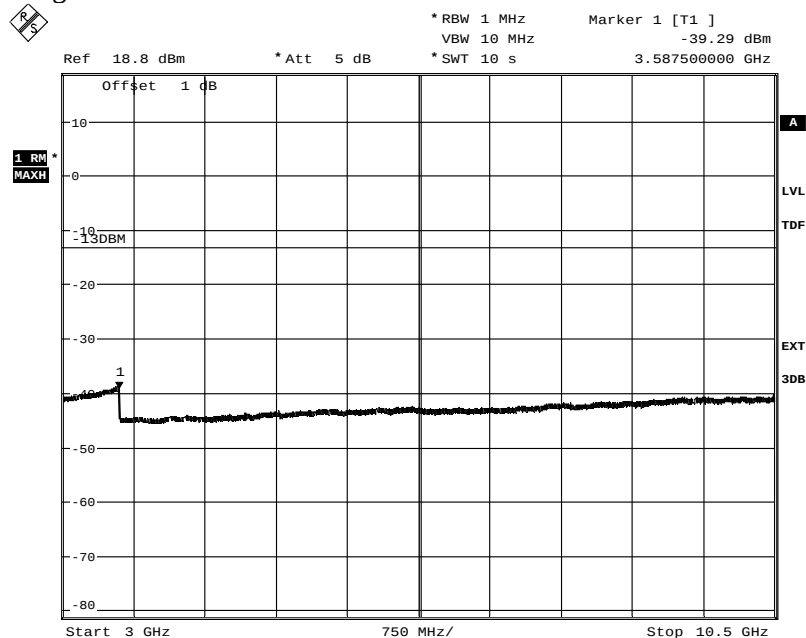
Diagram 6a



Date: 21.MAY.2012 10:53:02

The emissions around the carriers are within the operating frequency band

Diagram 6b

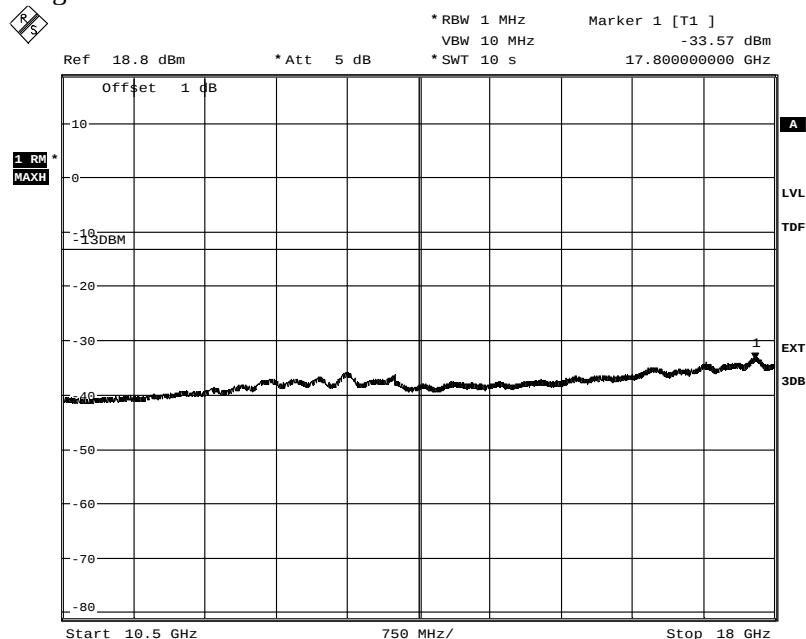


Date: 21.MAY.2012 10:51:38

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IC:287AB-AS1180231

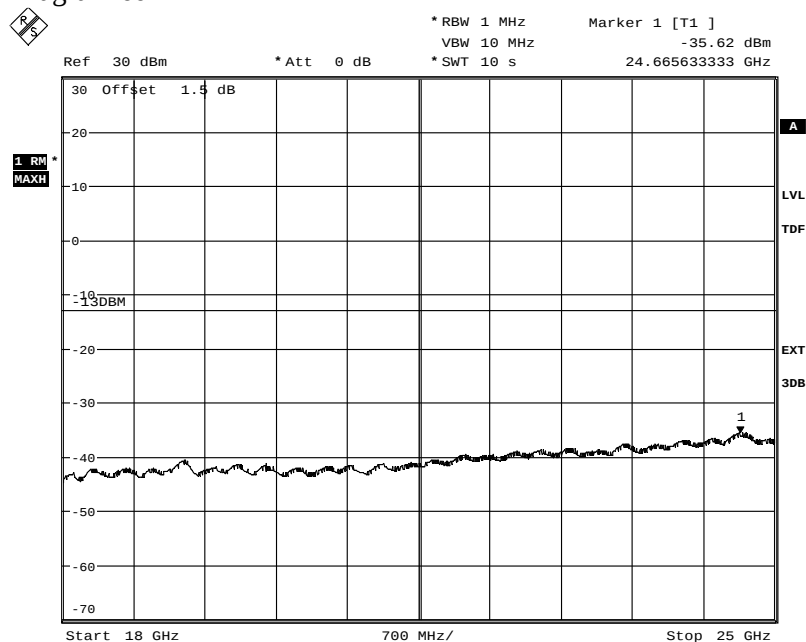
Appendix 5

Diagram 6c



Date: 21.MAY.2012 10:50:24

Diagram 6d

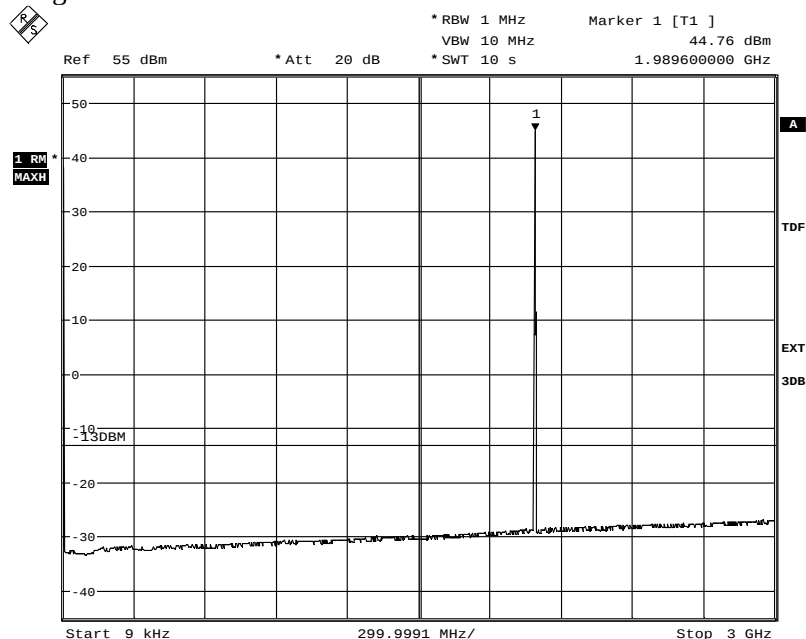


Date: 21.MAY.2012 12:59:55

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 5

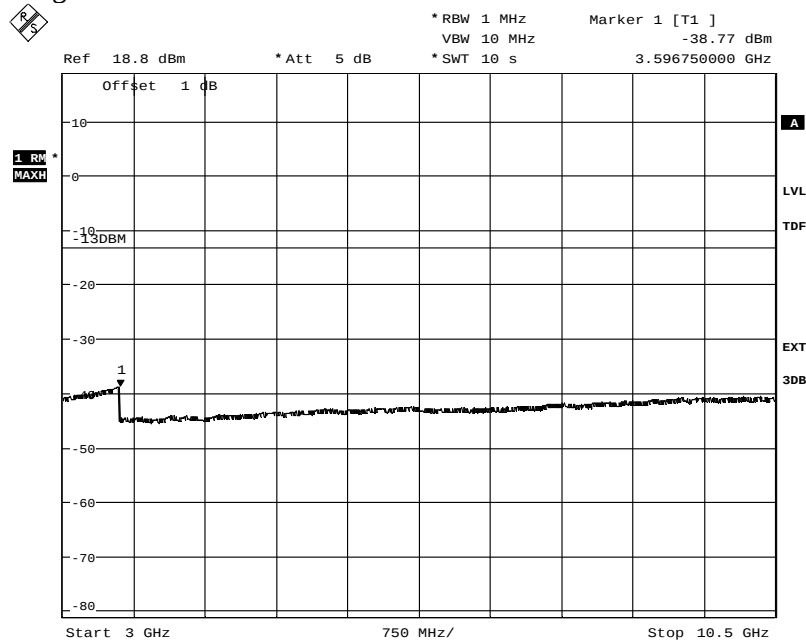
Diagram 7a



Date: 22.MAY.2012 08:00:03

The emissions around the carriers are within the operating frequency band

Diagram 7b

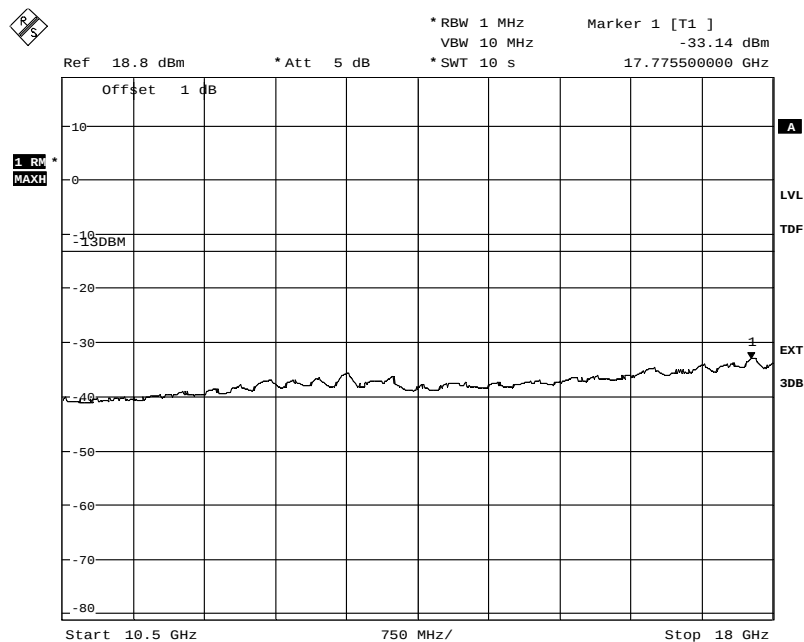


Date: 22.MAY.2012 08:07:22

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

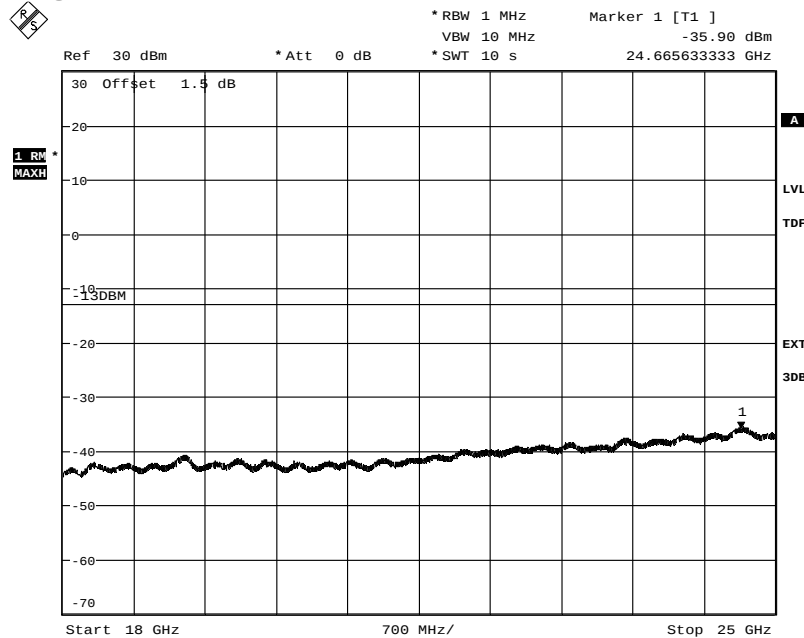
Appendix 5

Diagram 7c



Date: 22.MAY.2012 08:17:03

Diagram 7d

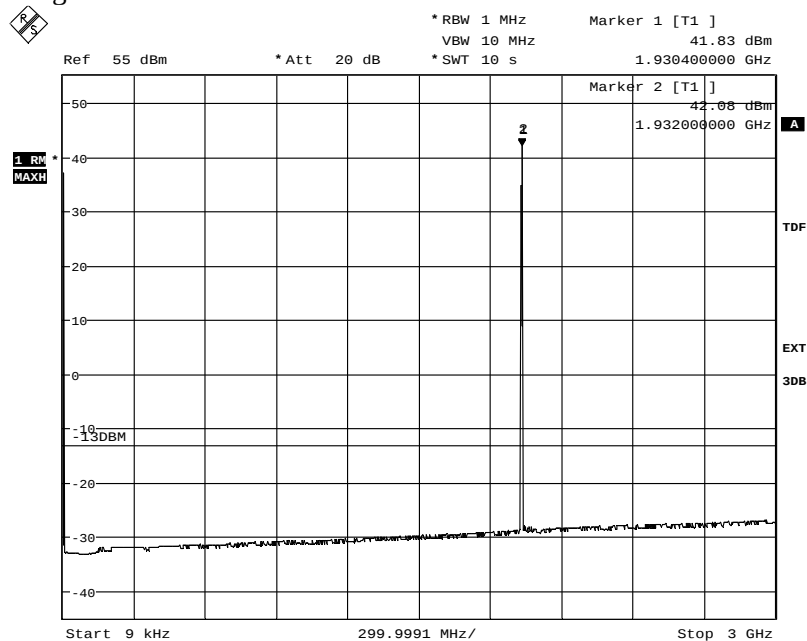


Date: 22.MAY.2012 09:31:24

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 5

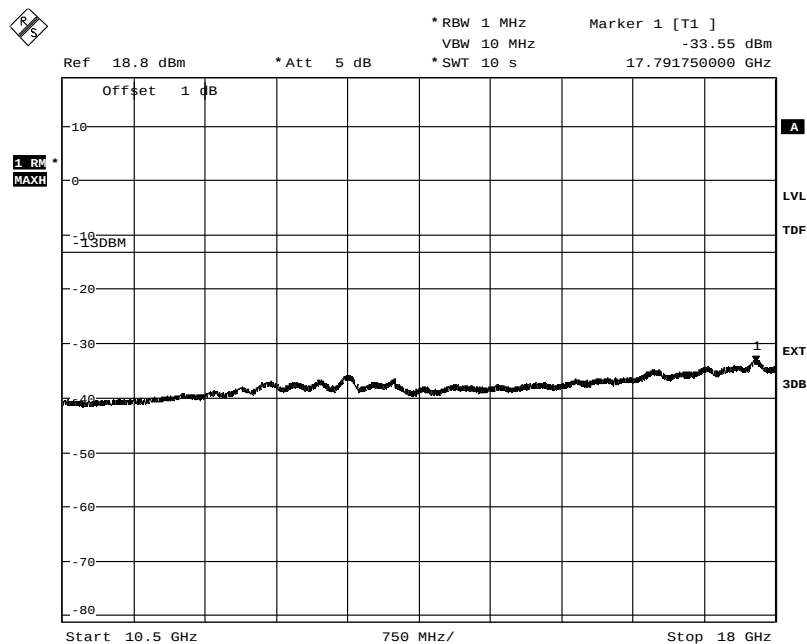
Diagram 8a



FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

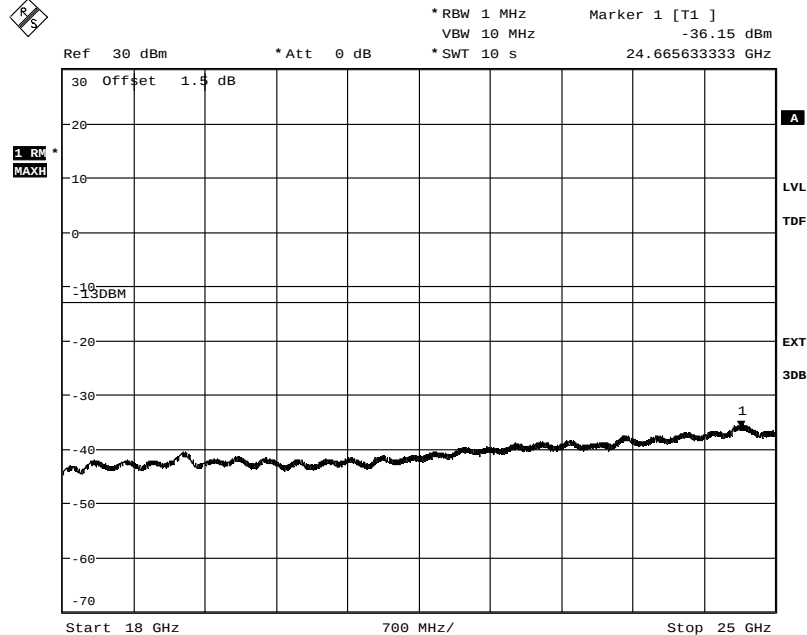
Appendix 5

Diagram 8c



Date: 22.MAY.2012 15:00:43

Diagram 8d

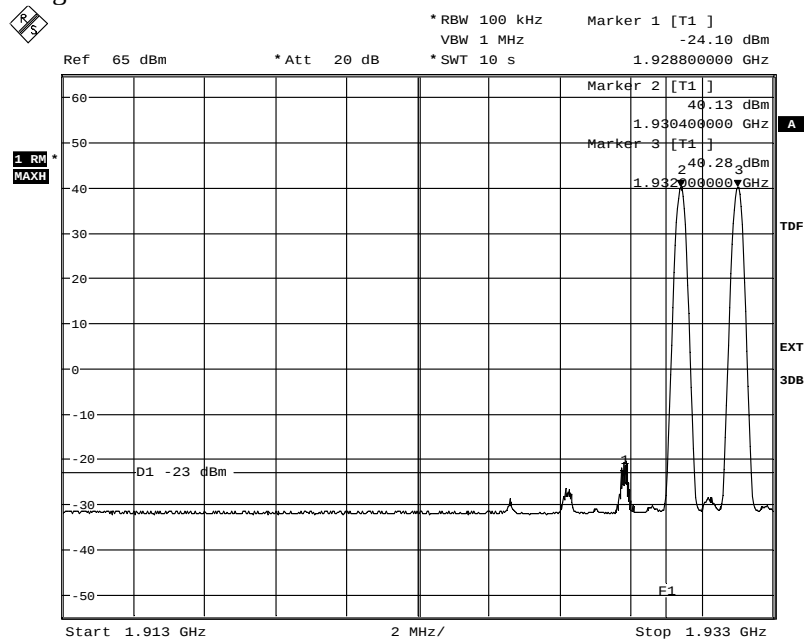


Date: 22.MAY.2012 15:06:45

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 5

Diagram 8e



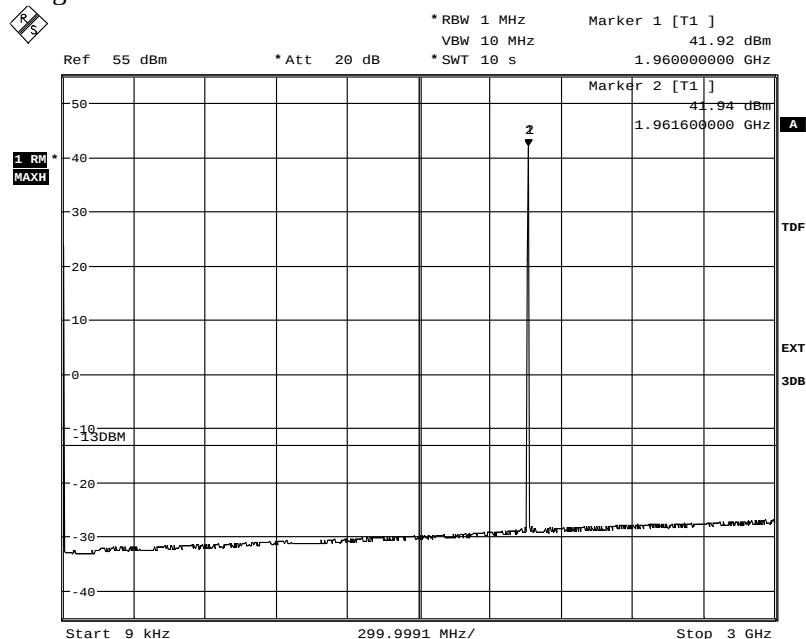
Date: 24.MAY.2012 07:53:49

The emission at 1928.8 MHz was -20.21 dBm measured with the channel power method with 1 MHz channel bandwidth

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

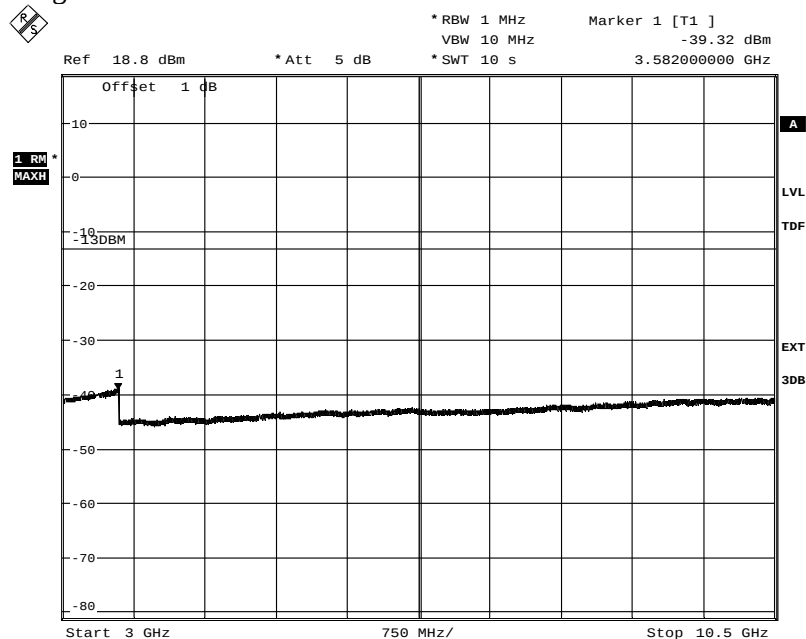
Appendix 5

Diagram 9a



Date: 23.MAY.2012 10:04:54

Diagram 9b

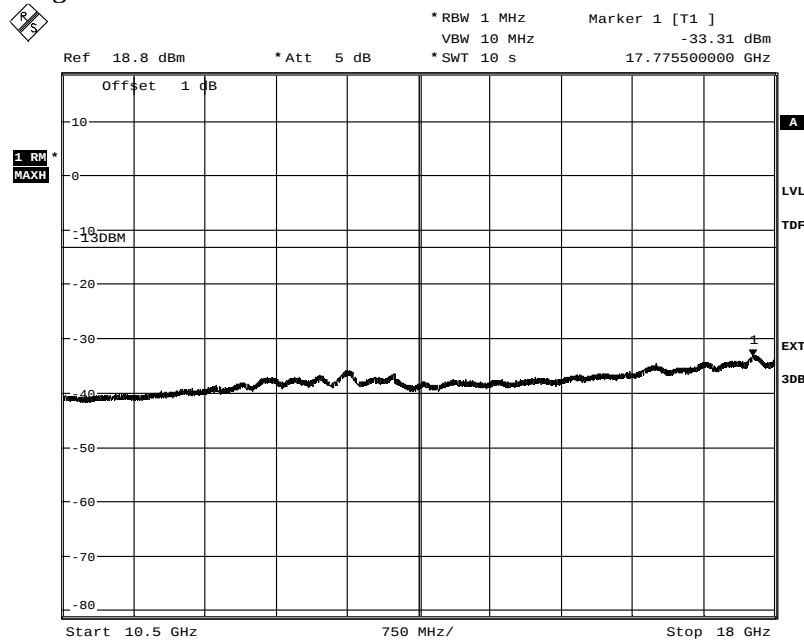


Date: 23.MAY.2012 10:06:36

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

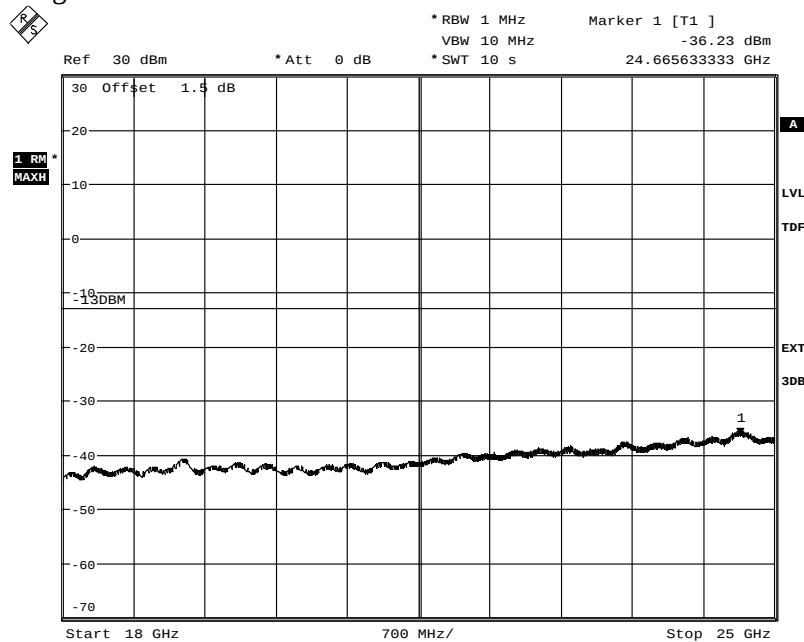
Appendix 5

Diagram 9c



Date: 23.MAY.2012 10:08:25

Diagram 9d

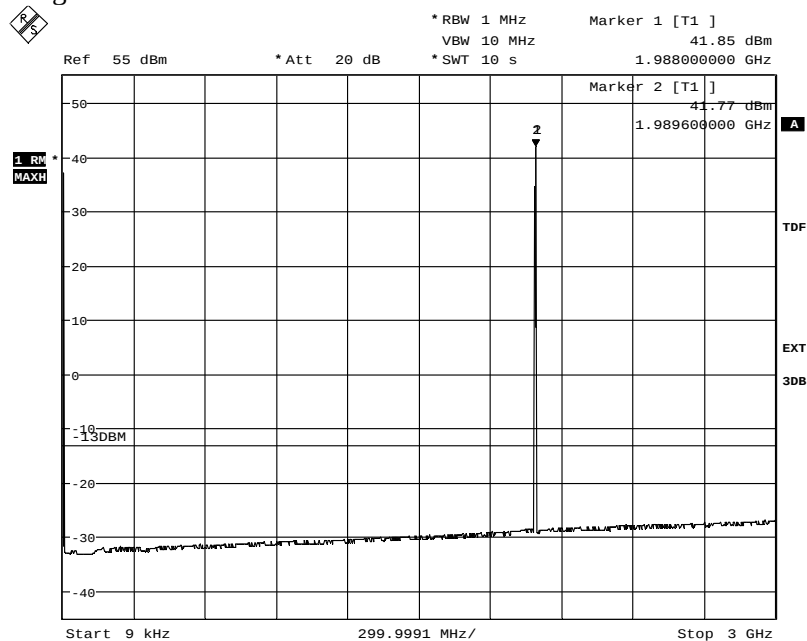


Date: 23.MAY.2012 10:14:38

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 5

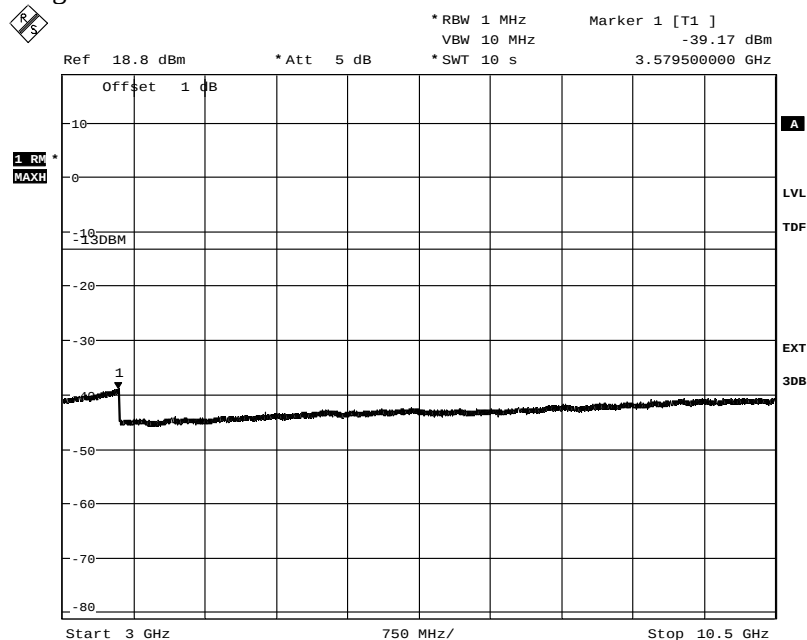
Diagram 10a



Date: 22.MAY.2012 16:54:24

The emissions around the carriers are within the operating frequency band

Diagram 10b

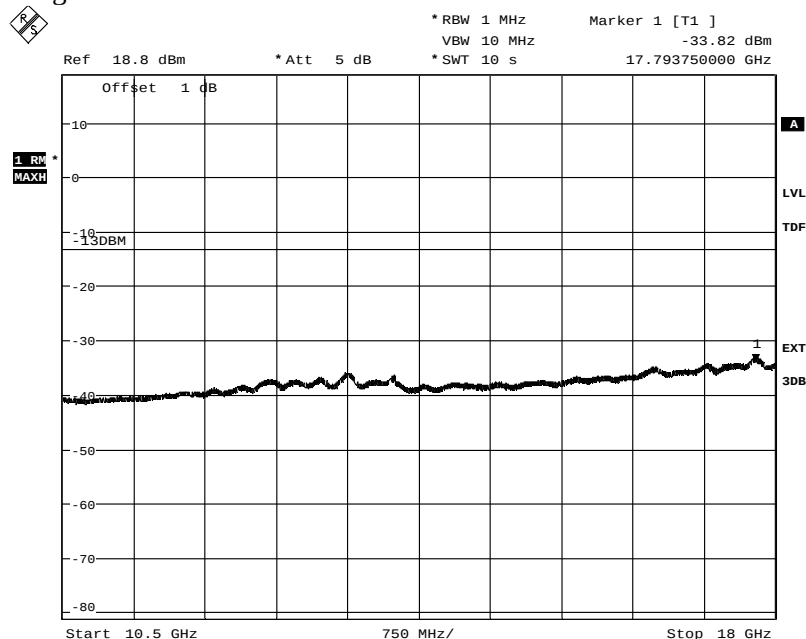


Date: 22.MAY.2012 16:56:43

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

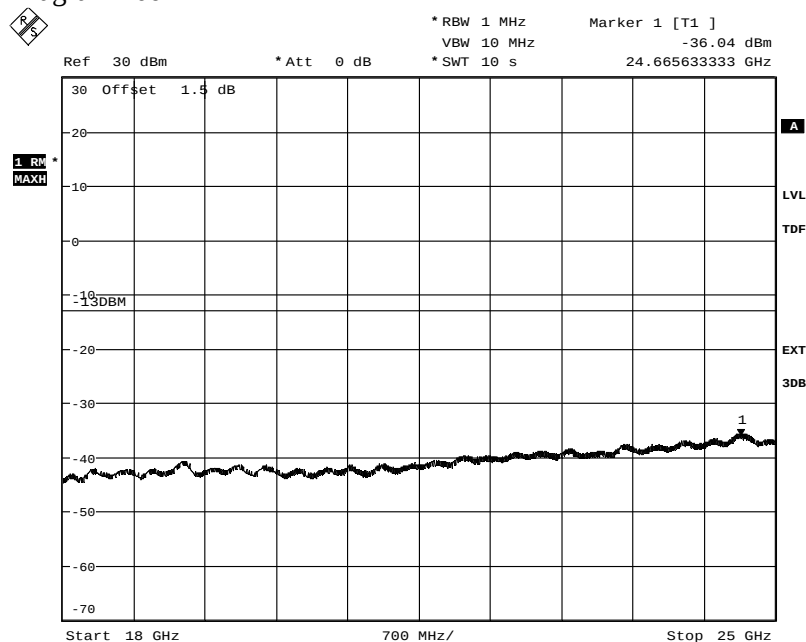
Appendix 5

Diagram 10c



Date: 22.MAY.2012 16:58:16

Diagram 10d

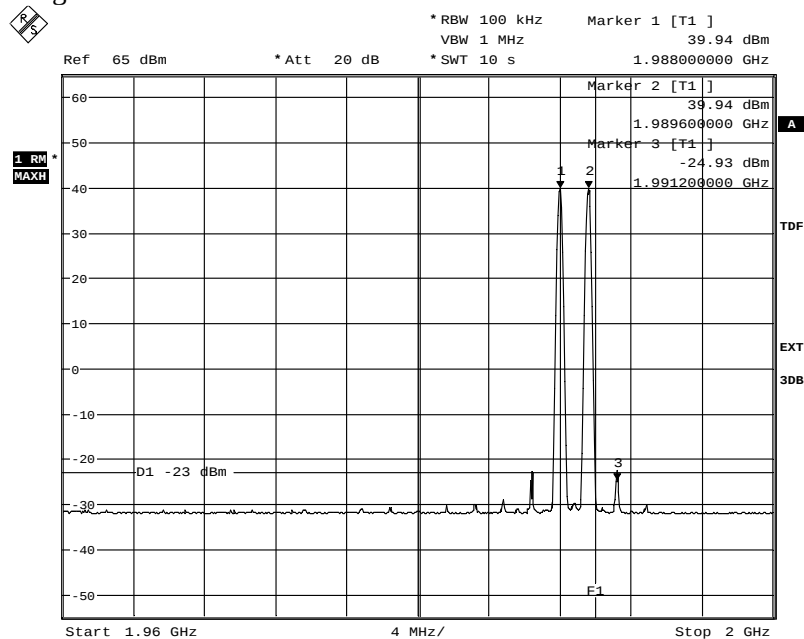


Date: 22.MAY.2012 17:01:43

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 5

Diagram 10e



Date: 24.MAY.2012 08:12:57

The emission at 1991.2 MHz was -22.69 dBm measured with the channel power method with 1 MHz channel bandwidth

Field strength of spurious radiation measurements according to CFR 47 §24.238 / IC RSS-133 6.5

Date 2012-04-16 to 2012-04-19	Temperature 22-23°C ± 3 °C	Humidity 23-27 % ± 5 %
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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.

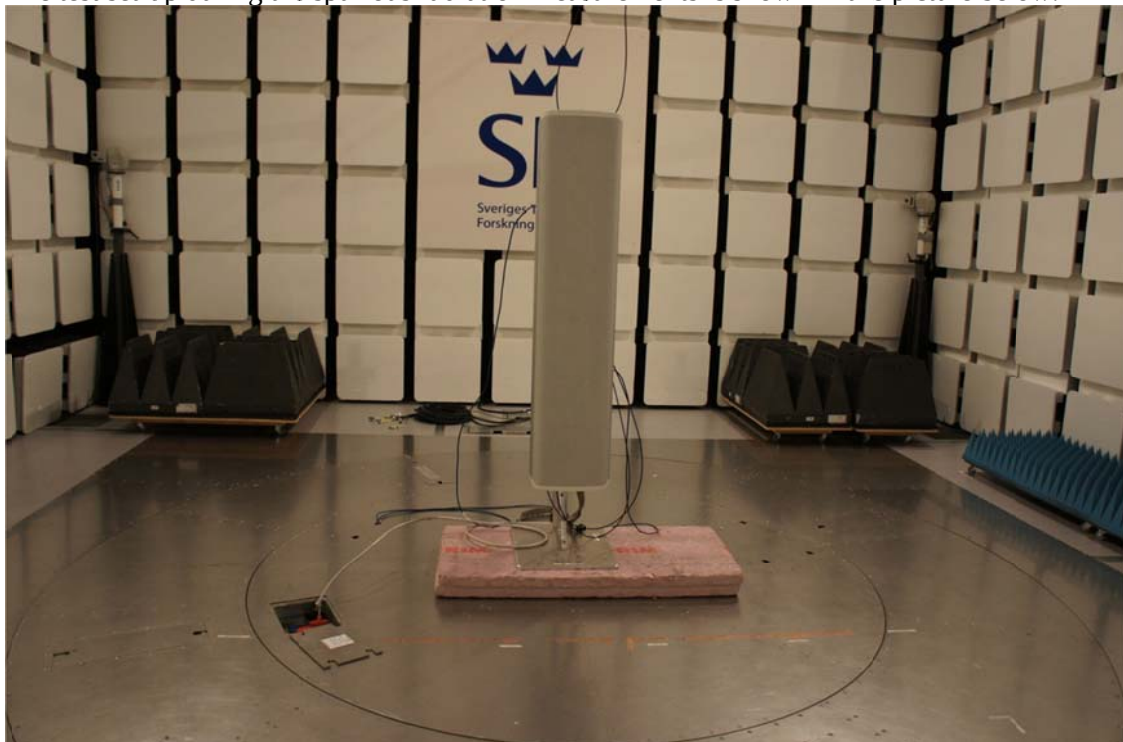
In the frequency range 30 MHz - 25 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was

$$\gamma = 20 \log \left(\frac{4\pi D}{\lambda} \right), \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

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:



FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 6

Measurement equipment

Measurement equipment	SP number
Semi anechoic chamber	503 881
R&S ESI 26	503 292
EMC 32 ver. 8.52.0	503 745
Chase Bilog antenna CBL 6111A	502 182
EMCO Horn Antenna 3115	502 175
FLANN Std gain 16240-25	503 939
HP-filter 3-18 GHz	503 739
µComp Nordic, Low Noise Amplifier	901 545
Temperature and humidity meter, Testo 625	504 188

Results, representing worst case

Diagram 1: a-d 0.03-25 GHz, GMSK M

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

§24.238 and RSS-133 6.5

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB, resulting in a limit of -13 dBm per 1 MHz RBW.

Complies?	Yes
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Diagram 1a:

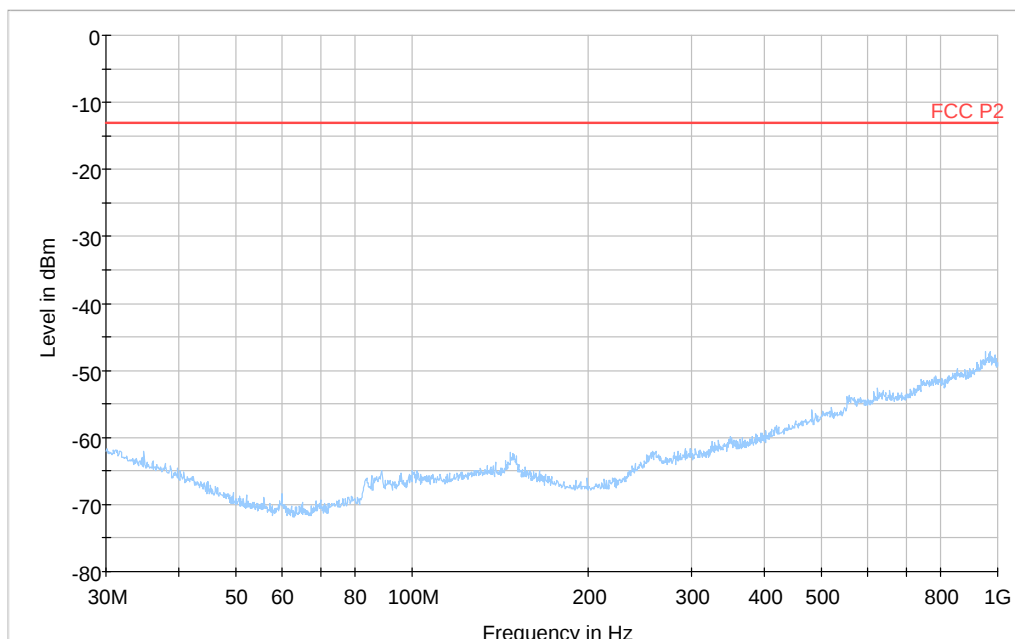
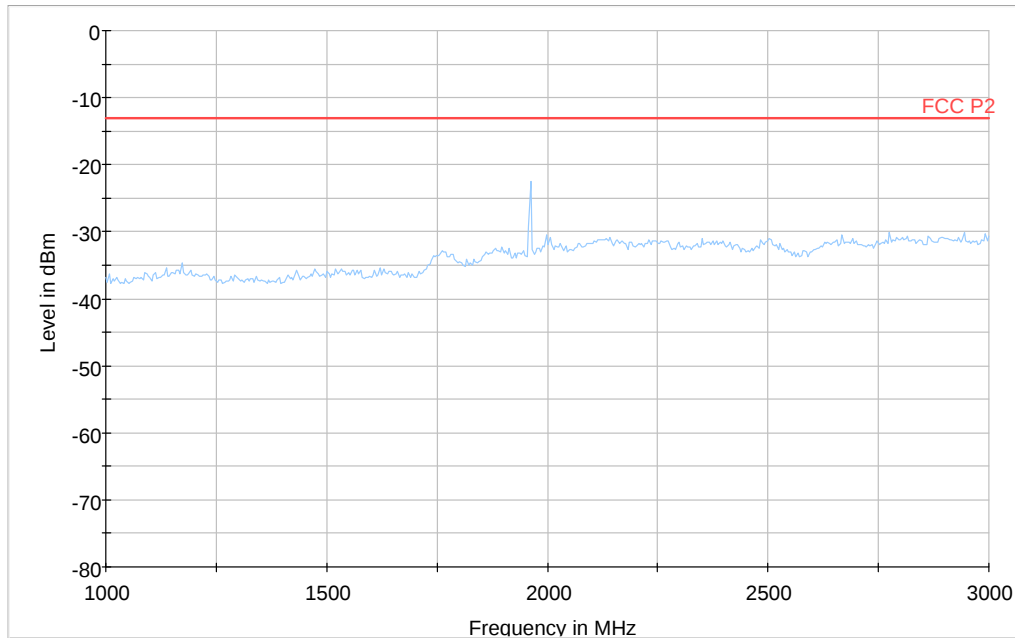


Diagram 1b:



Note: The emission at 1960 MHz is the carrier frequency and shall be ignored in the context.

FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 6

Diagram 1c:

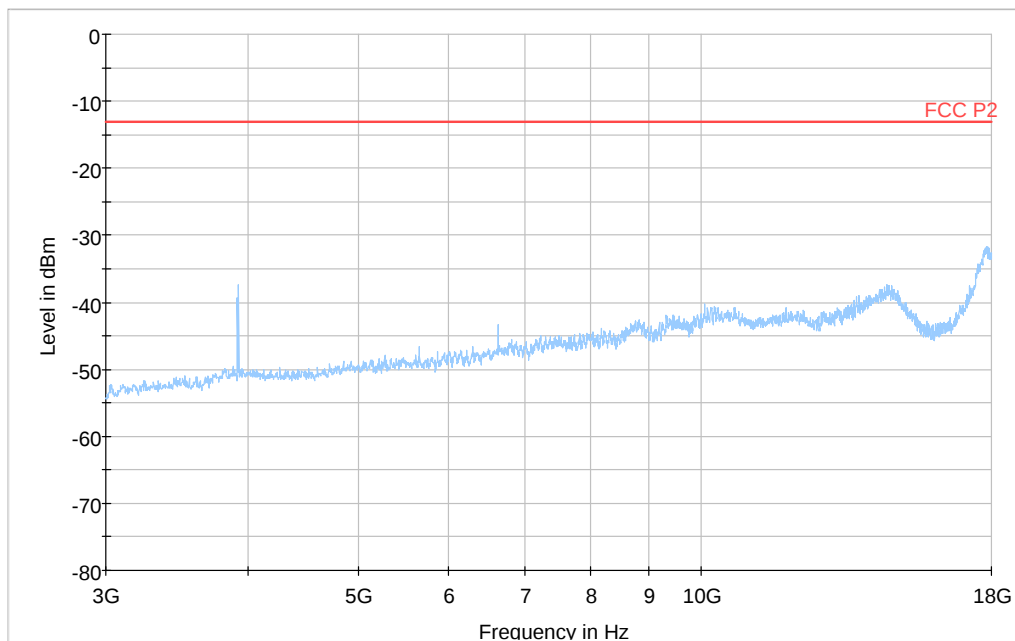
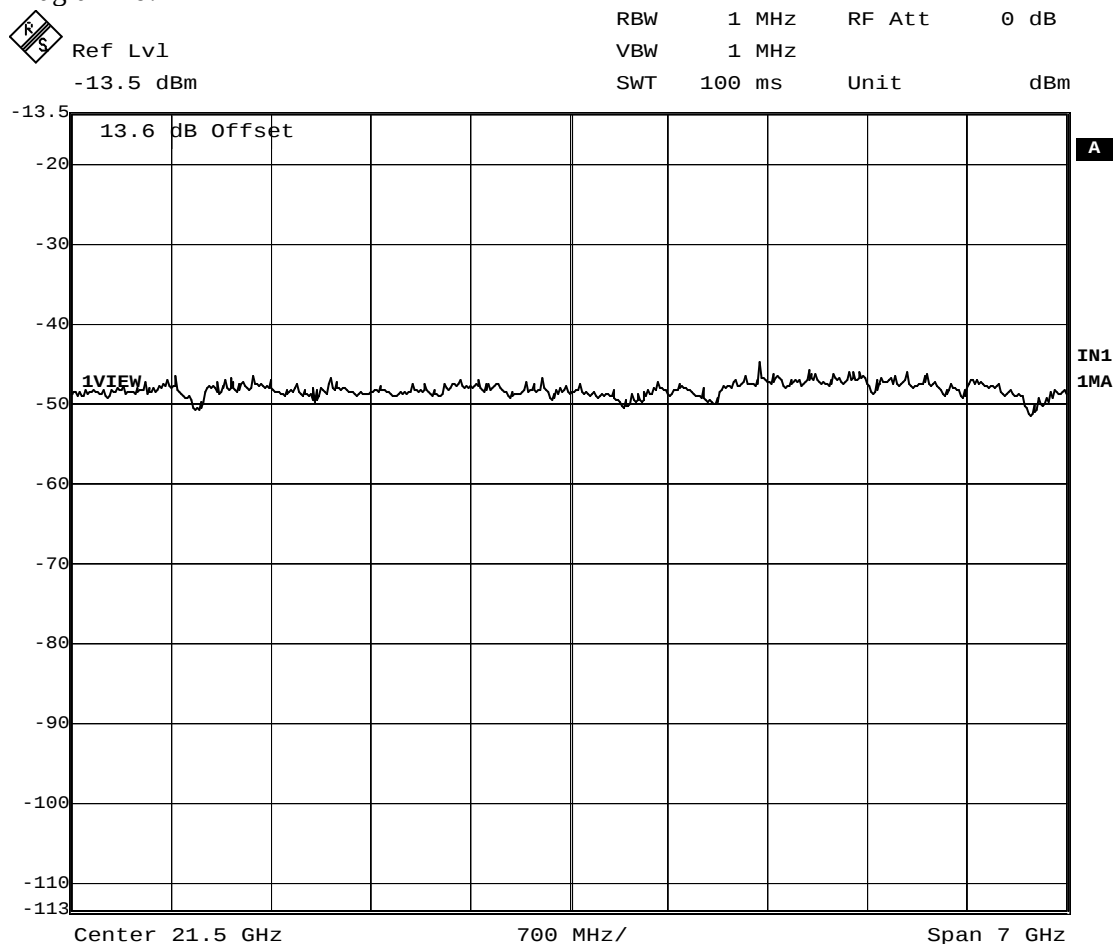


Diagram 1d:



FCC ID:TA8AKRC118023-1
IC:287AB-AS1180231

Appendix 7

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

Date 2012-06-08 to 2012-06-13	Temperature (test equipment) 22-23 °C ± 3 °C	Humidity (test equipment) 36-47 % ± 5 %
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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.

Measurement equipment	SP number
Rohde & Schwarz signal analyzer FSQ40, EAB equipment	--
RF attenuator	503 870
Testo 635, Temperature and humidity meter	504 203
Temperature cabinet	503 360

Results

Nominal Voltage -48 V DC

Maximum output power at mid channel (M)

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	T (°C)	
-48.0	+20	-10
-55.2	+20	-10
-40.8	+20	-12
-48.0	+30	-9
-48.0	+40	-6
-48.0	+50	-13
-48.0	+10	-14
-48.0	0	+11
-48.0	-10	-11
-48.0	-20	-9
-48.0	-30	-9
Maximum freq. error (Hz)		14
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Limits (according to 3GPP TS 25.141)

The frequency error shall be within ± 0.05 PPM ± 12 Hz (109.9 Hz).

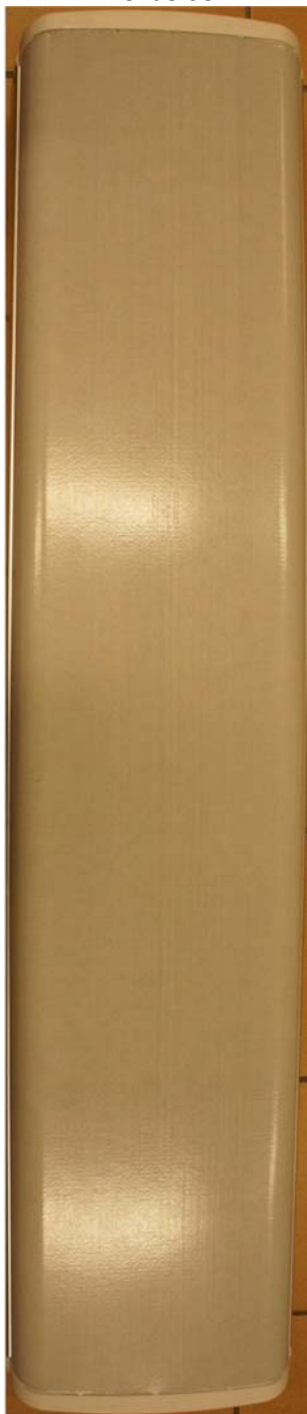
Complies?	Yes
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IC:287AB-AS1180231

Appendix 8

External photos

Front side



Rear side



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Appendix 8

Left side



Right side



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IC:287AB-AS1180231

Appendix 8

Top side



Bottom side

