



Test report no. : 175366-3

Item tested : RC1290

**Type of equipment : Low power Transceiver
902 - 928MHz Evaluation Module**

FCC ID : Y2NRC1290

Client : Radiocrafts AS

FCC Part 15.249

Low Power Transceiver
902-928 MHz Band

RSS-210, Issue 8 and RSS-GEN, Issue 3

Low-Power Licence-exempt Radiocommunications devices
902 – 928 MHz Band

31 May 2011

A handwritten signature in blue ink, reading 'Frode Sveinsen'.

Authorized by :

Frode Sveinsen
Technical Verificator

CONTENTS

1	GENERAL INFORMATION	3
1.1	Testhouse Info	3
1.2	Client Information.....	3
1.3	Manufacturer.....	3
2	Test Information.....	4
2.1	Test Item	4
2.2	Test Environment.....	5
2.2.1	Normal test condition	5
2.3	Test Period.....	5
3	TEST REPORT SUMMARY	6
3.1	General	6
3.2	Test Summary.....	7
3.3	Description of modification for Modification Filing.....	7
3.4	Comments	7
3.5	Family List Rationale	7
4	TEST RESULTS	8
4.1	Power-line Conducted Emissions	8
4.2	Transmitter Frequency Stability	10
4.3	20 dB Bandwidth.....	11
4.4	Peak Power Output.....	21
4.5	Band Edge Emissions.....	37
4.6	Spurious Emissions (Radiated)	40
4.7	Receiver Spurious Emissions (Conducted)	60
5	LIST OF TEST EQUIPMENT	64
6	BLOCK DIAGRAM	65
6.1	System set up for radiated measurements	65
6.2	Power line Conducted Emission	65
6.3	Test Site Radiated Emission.....	66

1 GENERAL INFORMATION

1.1 Testhouse Info

Name : Nemko AS
Address : Nemko Kjeller
Instituttveien 6, Box 96
NO-2027 Kjeller, NORWAY
Telephone : +47 64 84 57 00
Fax : +47 64 84 57 05
Email: comlab@nemko.no
FCC test firm : 994405
IC OATS : 2040D-1
Total Number of Pages: 66

1.2 Client Information

Name : Radiocrafts AS
Address : Sandakerveien 64,
0484 Oslo, Norway
Telephone : +47 40 00 51 95
Fax : --

Contact:

Name : Ørjan Nottveit
Telephone : +47 40 00 51 95
E-mail : radiocrafts@radiocrafts.com

1.3 Manufacturer

Same as client

2 Test Information

2.1 Test Item

Name :	Radiocrafts
Model/version :	RC1290
Serial number :	-
Hardware identity and/or version:	-
Software identity and/or version :	-
Frequency Range :	902.5 – 927.5 MHz
Tunable Bands :	1
Number of Channels :	51 ¹
Operating Modes :	TX & RX
Type of Modulation :	FSK
Emissions Designator :	F1D
User Frequency Adjustment :	None, Software controlled
Output Power (Conducted) :	0.3 mW
Type of Power Supply :	2.8 - 5.5 V DC
Antenna Connector :	Reversed SMA
Antenna Diversity Supported :	None

1) Only one channel in use at a time.

Theory of Operation

The RC1290 RF-transceiver module for the 902-928 MHz ISM band. It is based on a transceiver device from Texas Instrument. The physical layer of the radio is an FSK radio covering 4.8 -19.2 kbit/s. The program is stored in flash and the temporary variables in the SW are stored in RAM. Data is received via UART, buffered in the radio and sent on RF.

2.2 Test Environment

2.2.1 Normal test condition

Temperature: 20 - 22 °C

Relative humidity: 20 - 40 %

Normal test voltage: 5.5 V DC

The values are the limit registered during the test period.

2.3 Test Period

Item received date: 2011-05-23

Test period : from 2011-05-23 to 2011-05-30

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Radiocrafts AS

Model No.: RC1290

Serial No.: -

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15.247.

Radiated tests were conducted in accordance with ANSI C63.4-2009 and ANSI C63.10-2009. The radiated tests were made in a semi-anechoic chamber at measuring distances of 3 and 10 meters.

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

DTS Equipment Code

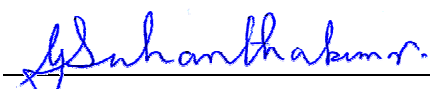
☐ Family Listing

THIS TEST REPORT RELATES ONLY TO THE ITEM (S) TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".



TEST REPORT #: 175366-3

TESTED BY: 
G.Suwanthakumar, Test engineer

DATE: 2011-06-20

Nemko AS authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any reproduction of parts of this report requires approval in writing from Nemko AS.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko AS accepts no responsibility for damages suffered by any third party as a result of decisions made or actions based on this report.

This test report applies only to the items and configurations tested.

3.2 Test Summary

Name of test	FCC Part 15 reference	RSS210 Issue 8 & RSS Gen Issue 3	Result
Supply Voltage Variations	15.31(e)	4.5	Complies ¹
Transmitter frequency stability	15.31(m)	7.2.4	Complies
Antenna Requirement	15.203	7.1.4	Complies ²
Power-line Conducted Emission	15.207(c)	7.2.2	Complies
20 dB bandwidth	15.215(c)	-	Complies
Peak Power Output	15.249(a)(c)	A2.9	Complies
Band edge Emissions	15.249(d)	A.2.9	Complies
Spurious Emissions (Radiated)	15.249 (e)	A2.9 & 4.3	Complies
Spurious Emissions (Antenna Conducted)	15.249	7.2.3.1	Complies
Receiver Spurious Emissions (Radiated)	N/A	6	Complies
Receiver Spurious Emissions (Conducted)	N/A	6	Complies

¹ The power is taken from extern power supply.

² Reversed SMA connector

RSS Gen issue 3 covers section 7 & 6

RSS 210 issue 8 covers section A2.9

3.3 Description of modification for Modification Filing

Not applicable.

3.4 Comments

The channels are selected with a computer connected to the EUT. The computer is only used for selection of channels. The measurements are performed at channels near top Ch 51, near middle Ch 26 and near bottom Ch 1. And the output level is set to maximum in the software. The EUT complies at these channels.

During radiated tests the selection of channels are done by manufacturer outside the test chamber..

The radiated measurements are tested on three axis.

Power supply variation within manufacturer specified range 2.8 – 5.5V DC has no influence on measured values in this test report.

All radiated measurements are done with antenna type “W915-RS from EAD”.

3.5 Family List Rationale

Not Applicable.

4 TEST RESULTS

4.1 Power-line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: G.Suwanthakumar

Date of Test: 30.05.2011

Measurement procedure: ANSI C63.4-2009 using 50 μ H/50 ohms LISN.

Test Results: **Complies.**

Measurement Data: **Peak detector was used.**

External DC power supply used- Type Oltronix B504D

The measured peak values are below the Quasi-Peak and Average limit

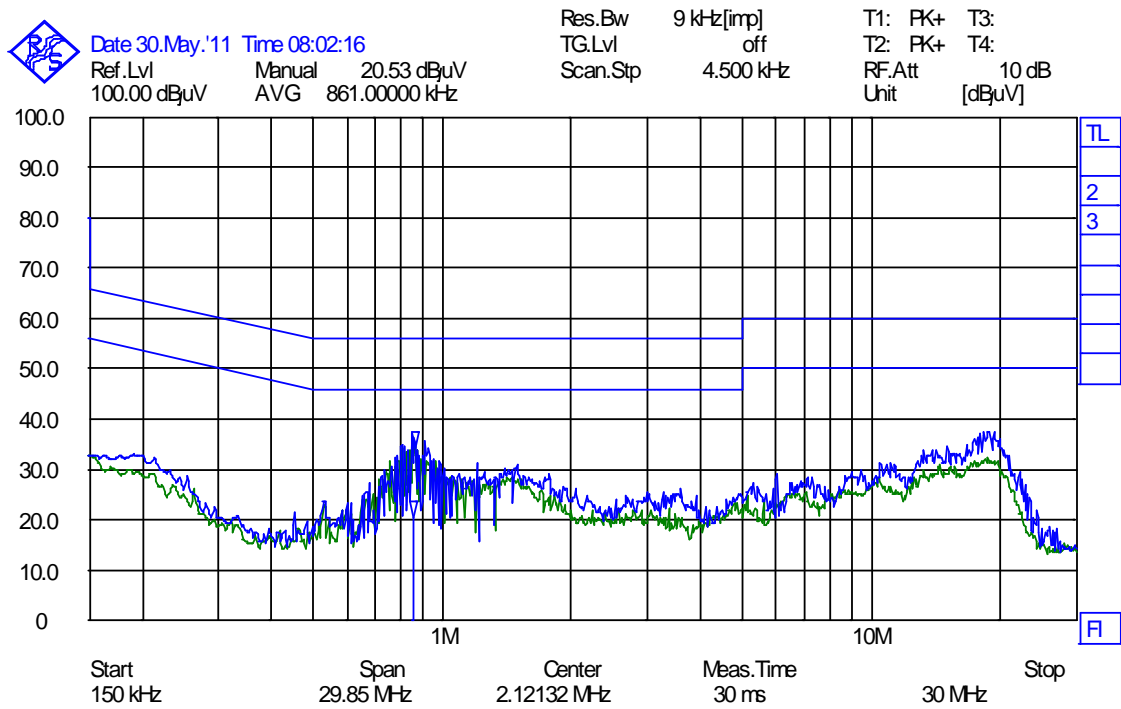
Measured at AC mains 120V AC/ 60 Hz.

Highest measured value (L and N):

Frequency	Detector	Measured value	Limit	Margin
MHz	QP/AV	dB μ V	dB μ V	dB
0.861	QP	30.12	56	25.88
0.861	AV	22.00	46	24.00

The power cables were longer than 10 cm during this test.

See the attached plot for Peak Detector scans.



L1 & N polarity - power line conducted emission

4.2 Transmitter Frequency Stability

Para. No.: 15.31(m)/7.2.4

Test Performed By: G.Suwanthakumar

Date of Test: 27.05.2011

Measurement Data:

Temperature	Channel nr.	Given Frequency (MHz)	Measured value (MHz)	Deviation (Hz)
20 ° C	Ch01	902.500	902.49749	-2510
	Ch26	915.000	914.99759	-2410
	Ch51	927.500	927.49769	-2310

Comment: Reported for information only. There are no requirements to frequency tolerance for low power devices in the 902-928 MHz band certified to 15.249 or RSS 210

4.3 20 dB Bandwidth

Para. No.: RSS-Gen

Test Performed By: G.Suwanthakumar

Date of Test: 27.05.2011

Test Results: Complies

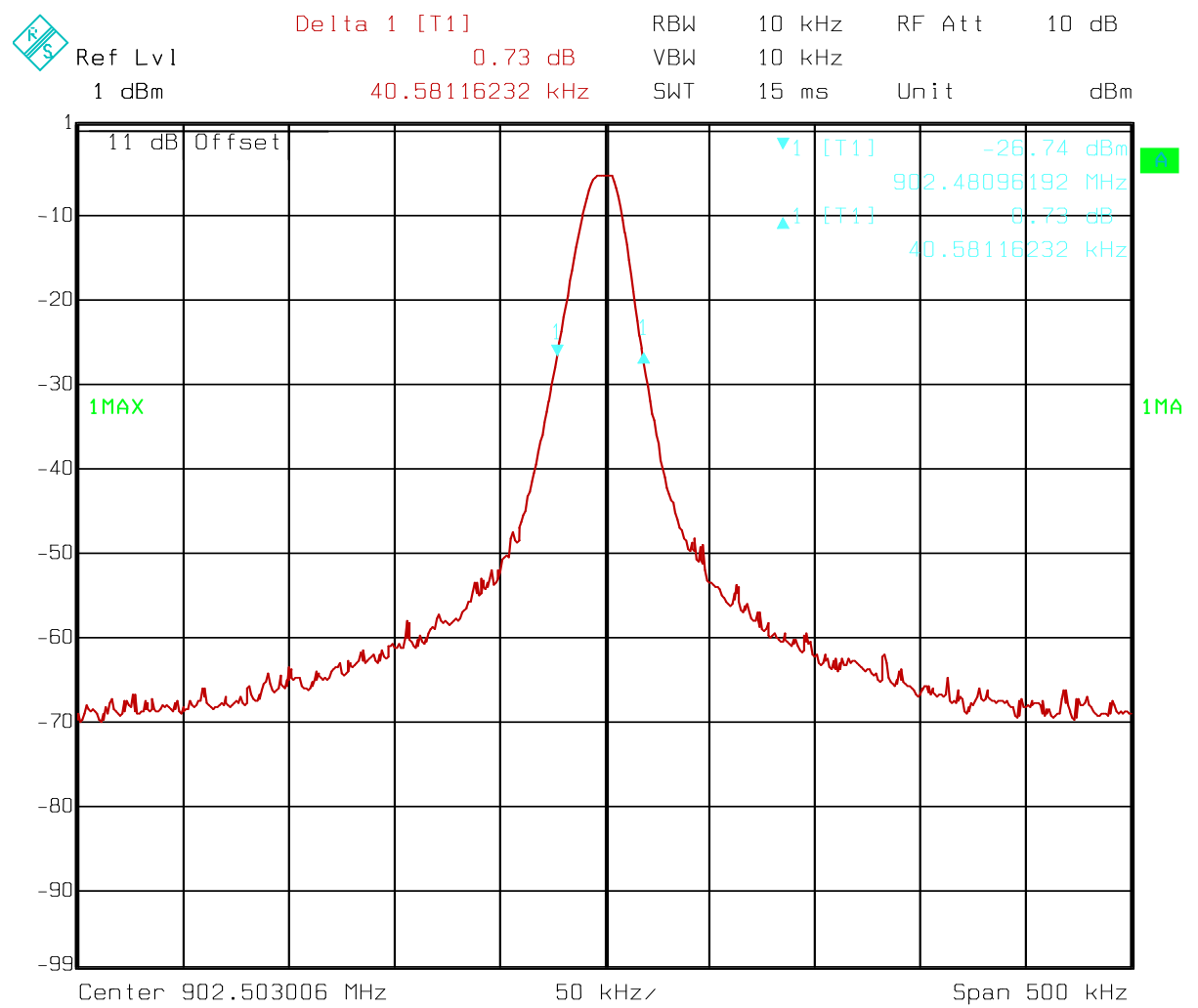
Measurement Data:

Data Rate	20 dB Bandwidth (kHz)		
	Ch 01 902.500MHz	Ch 26 915.000MHz	Ch 51 927.500MHz
4.8kbps	40.58	39.08	39.08
9.6kbps	44.59	44.09	45.09
19.2kbps	59.11	60.12	58.12

Power supply variation within manufacturer specified range 2.8 – 5.5V DC has no influence on measured value

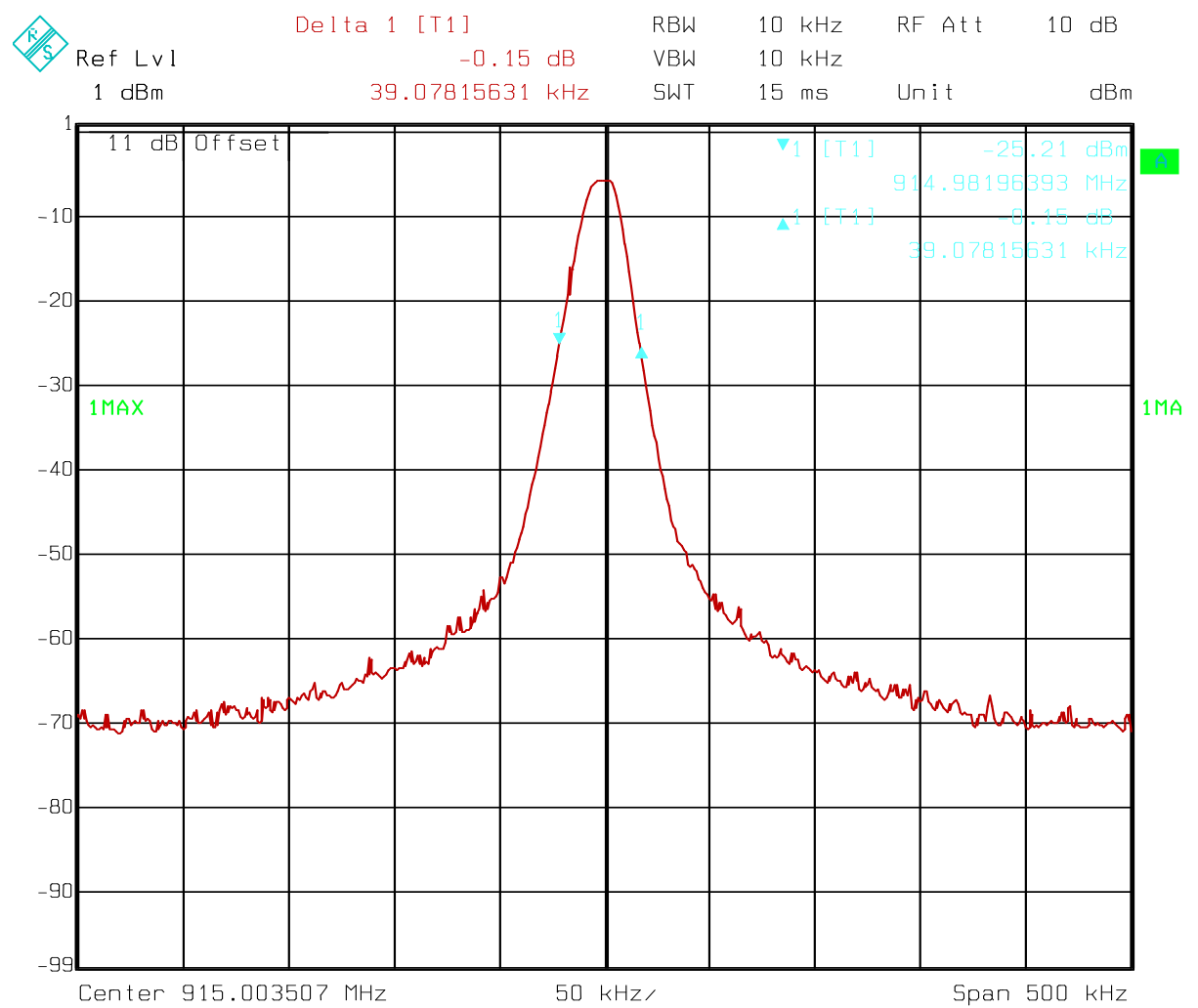
Requirements:

For information only

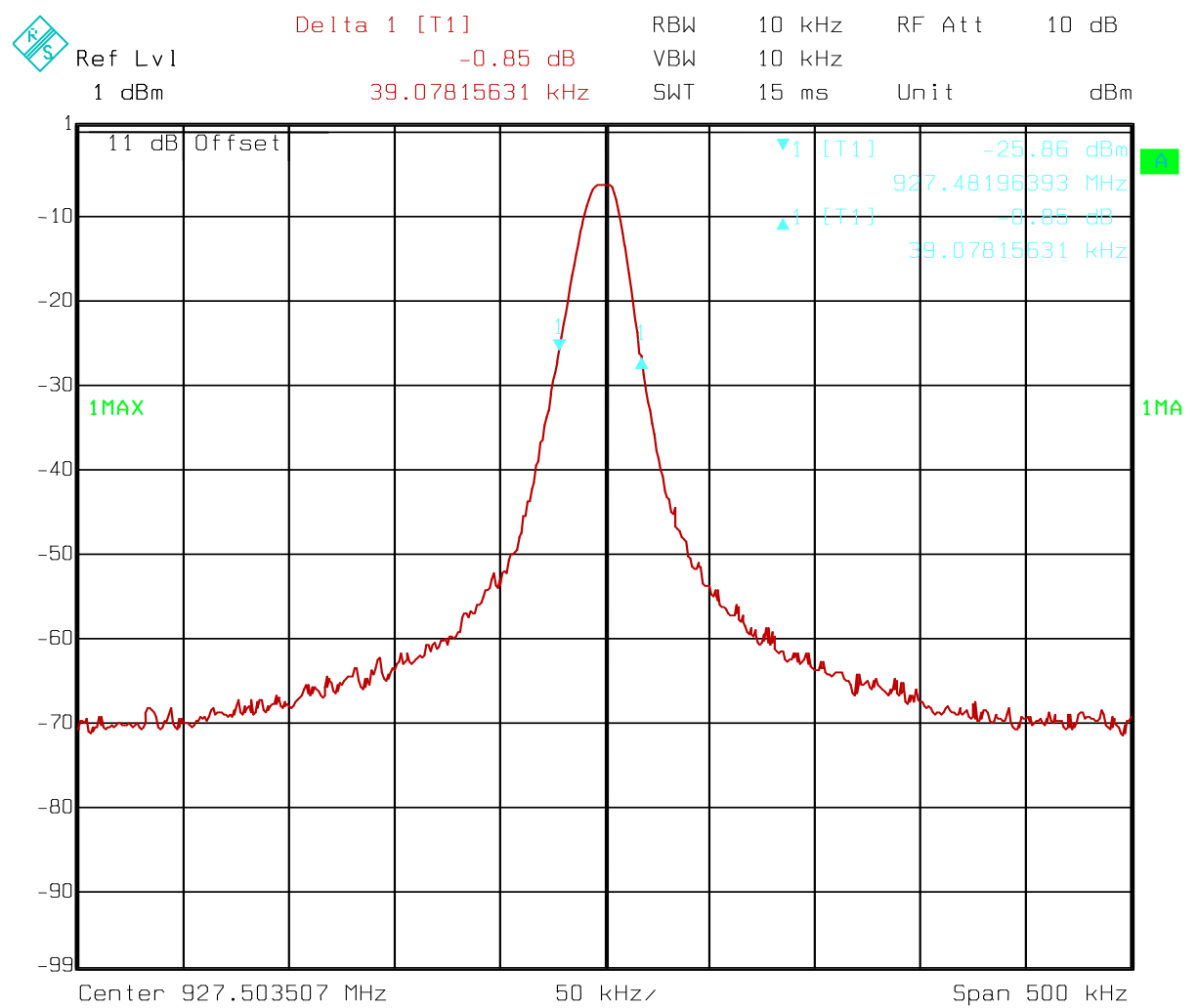


Date: 27.MAY 2011 08:10:56

Data Rate: 4,8kbps - CH01 – 20 dB bandwidth – 40.58kHz

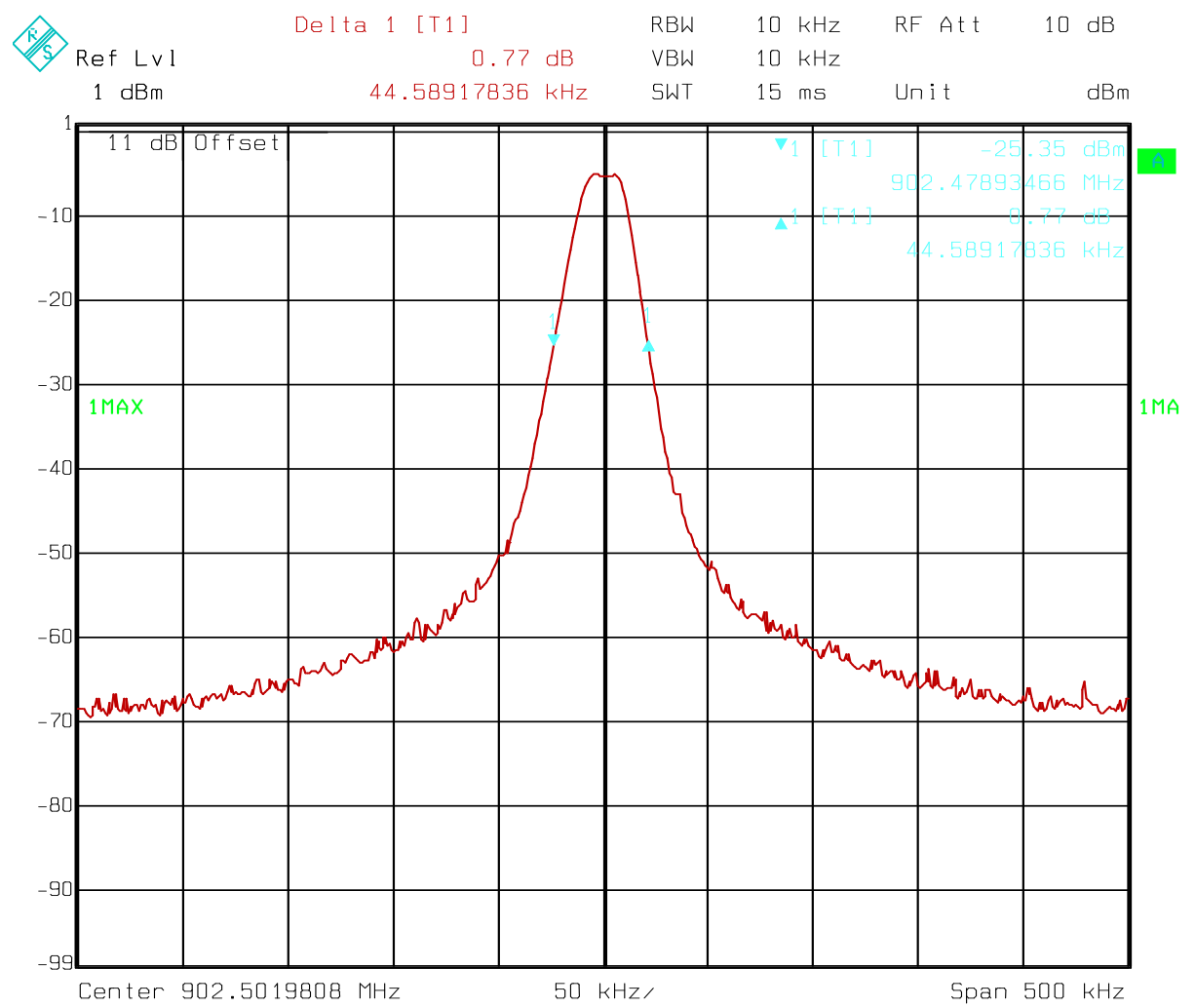


Date: 27.MAY 2011 08:07:01
Data Rate: 4,8kbps – CH26 – 20 dB bandwidth – 39.08kHz



Date: 27.MAY 2011 08:05:23

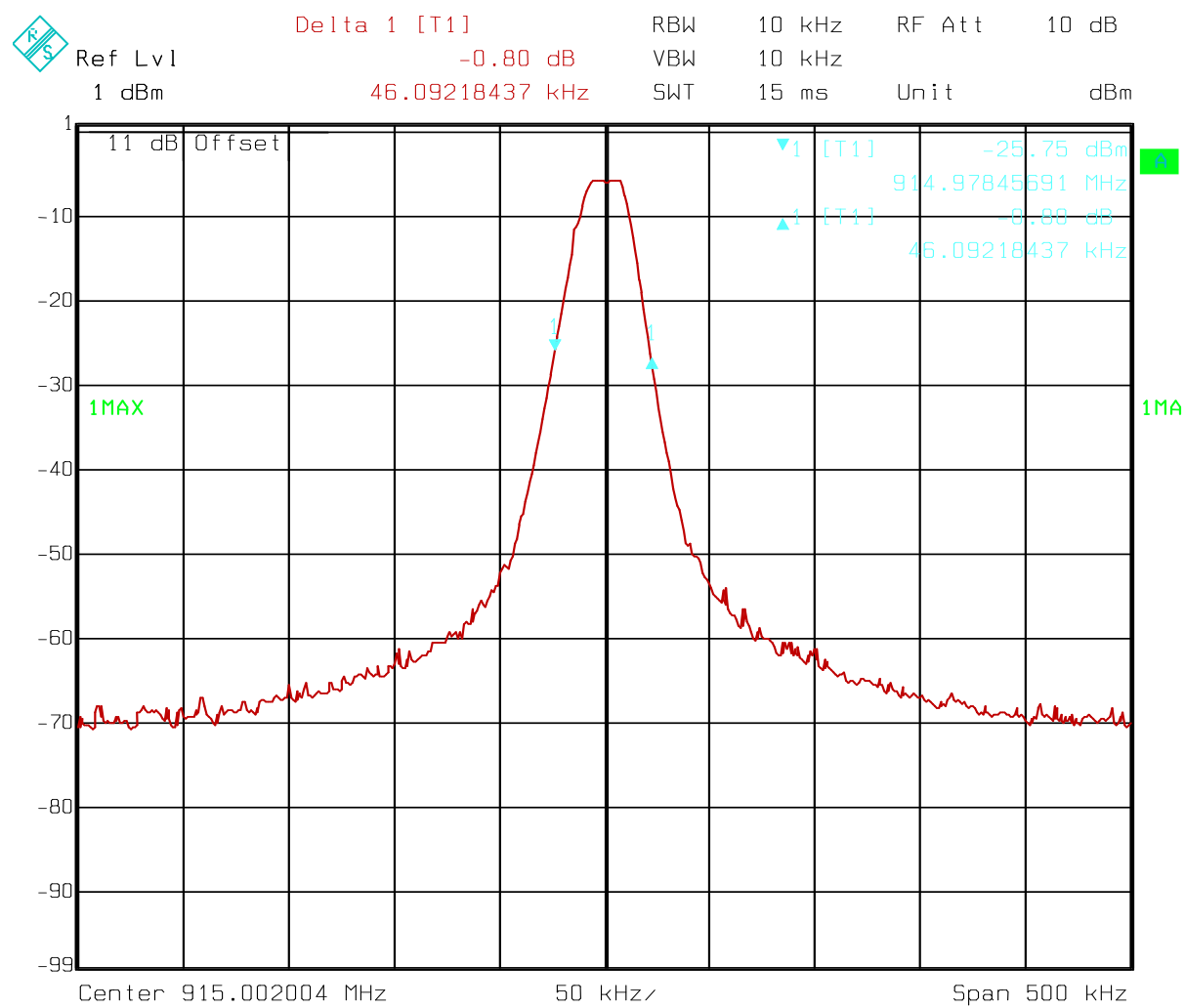
Data Rate: 4,8kbps – CH51 – 20 dB bandwidth – 39.08kHz



Date:

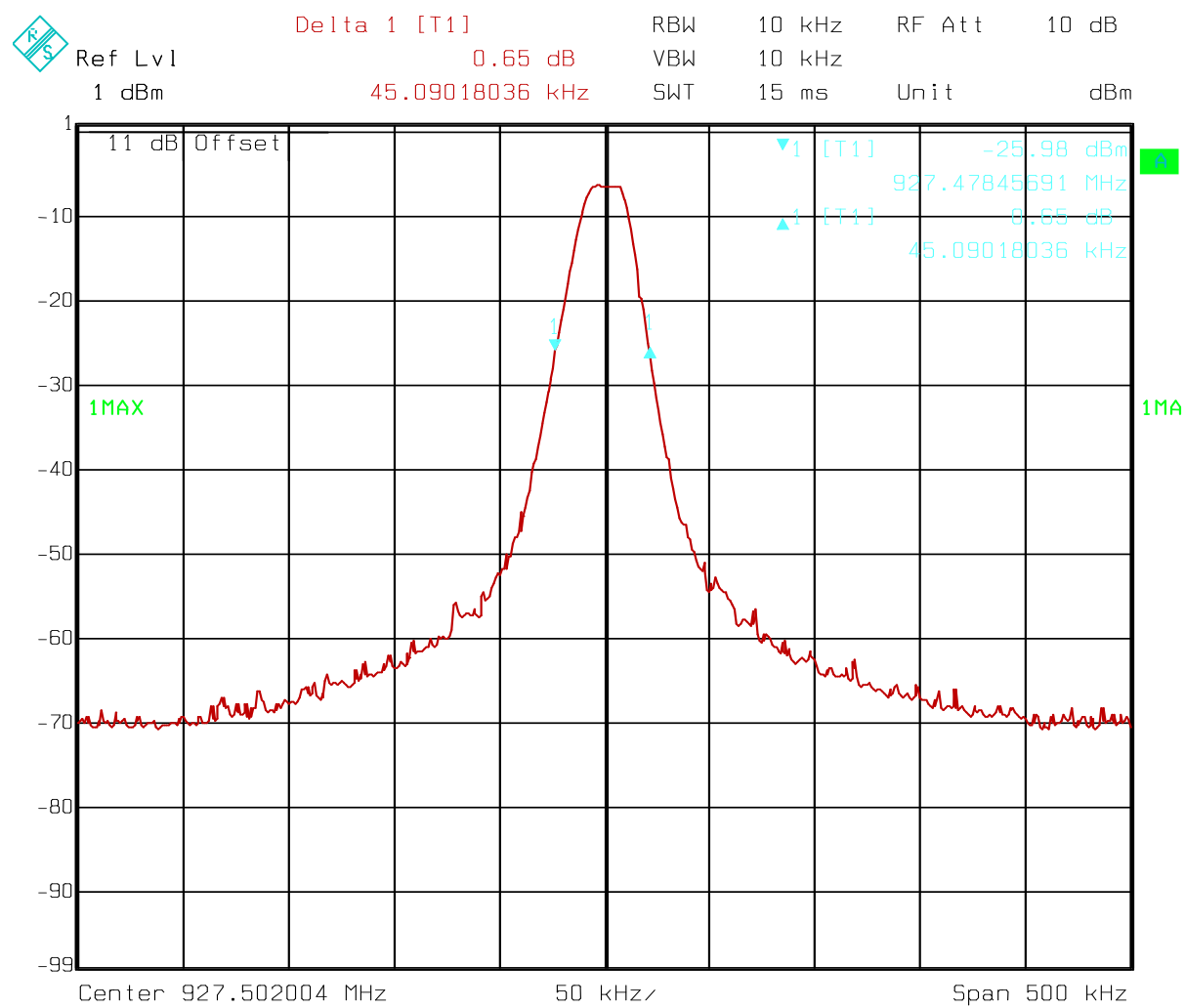
27.MAY 2011 07:28:15

Data Rate: 9.6kbps – CH01 – 20 dB bandwidth – 44.59kHz



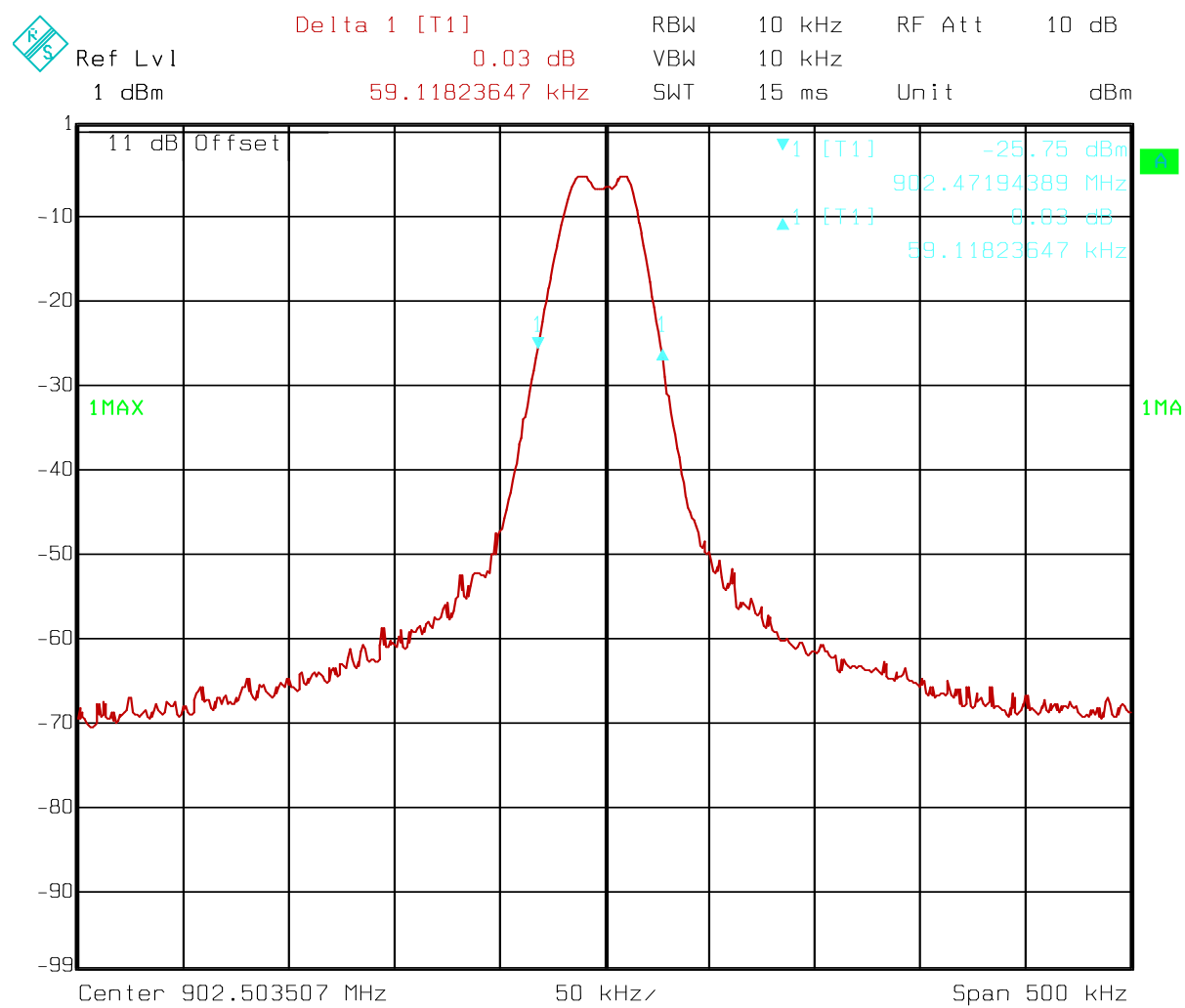
Date: 27.MAY 2011 07:37:06

Data Rate: 9.6kbps – CH26 – 20 dB bandwidth – 44.09kHz



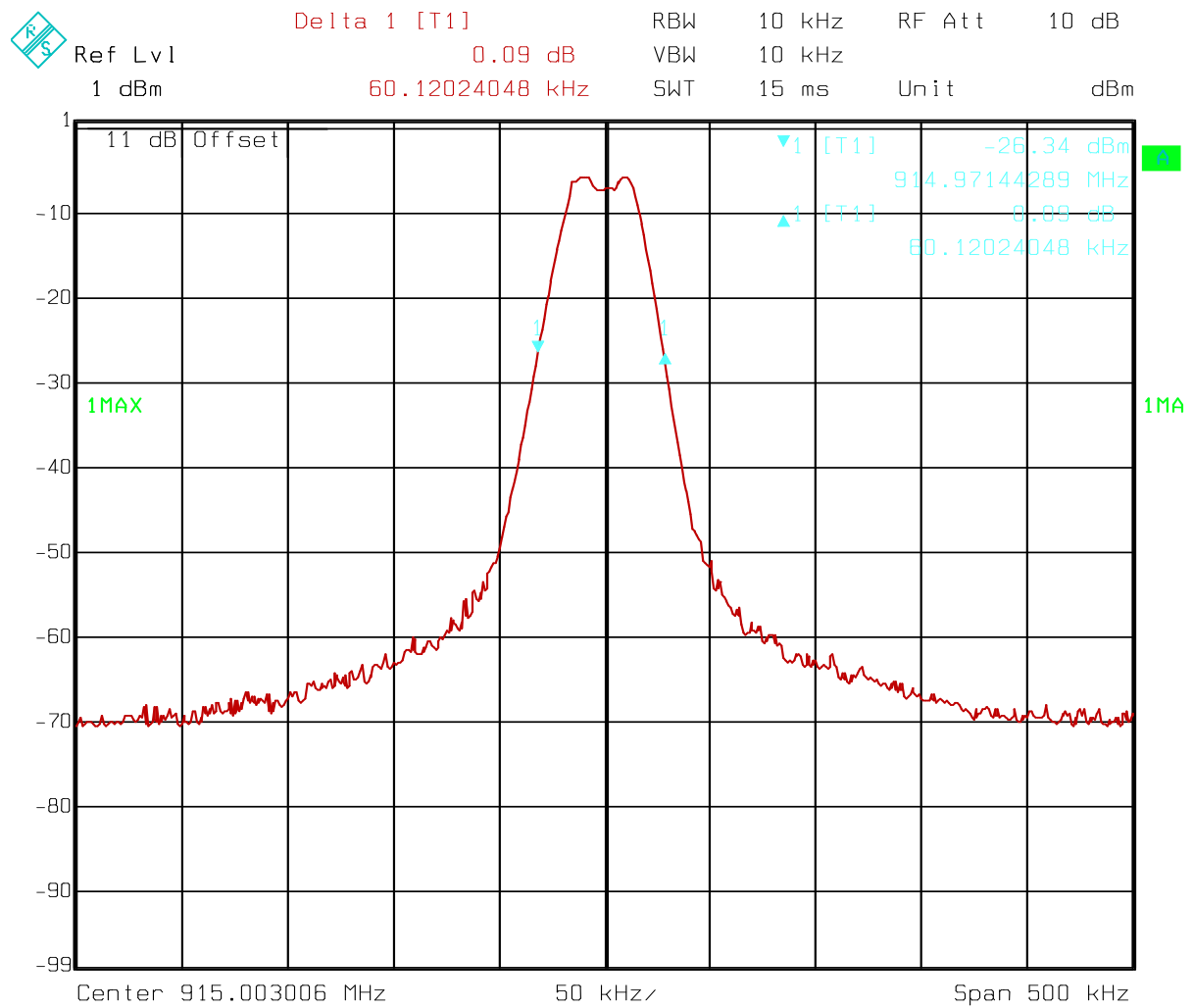
Date: 27.MAY 2011 07:39:39

Data Rate: 9.6kbps – CH51 – 20 dB bandwidth – 45.09kHz



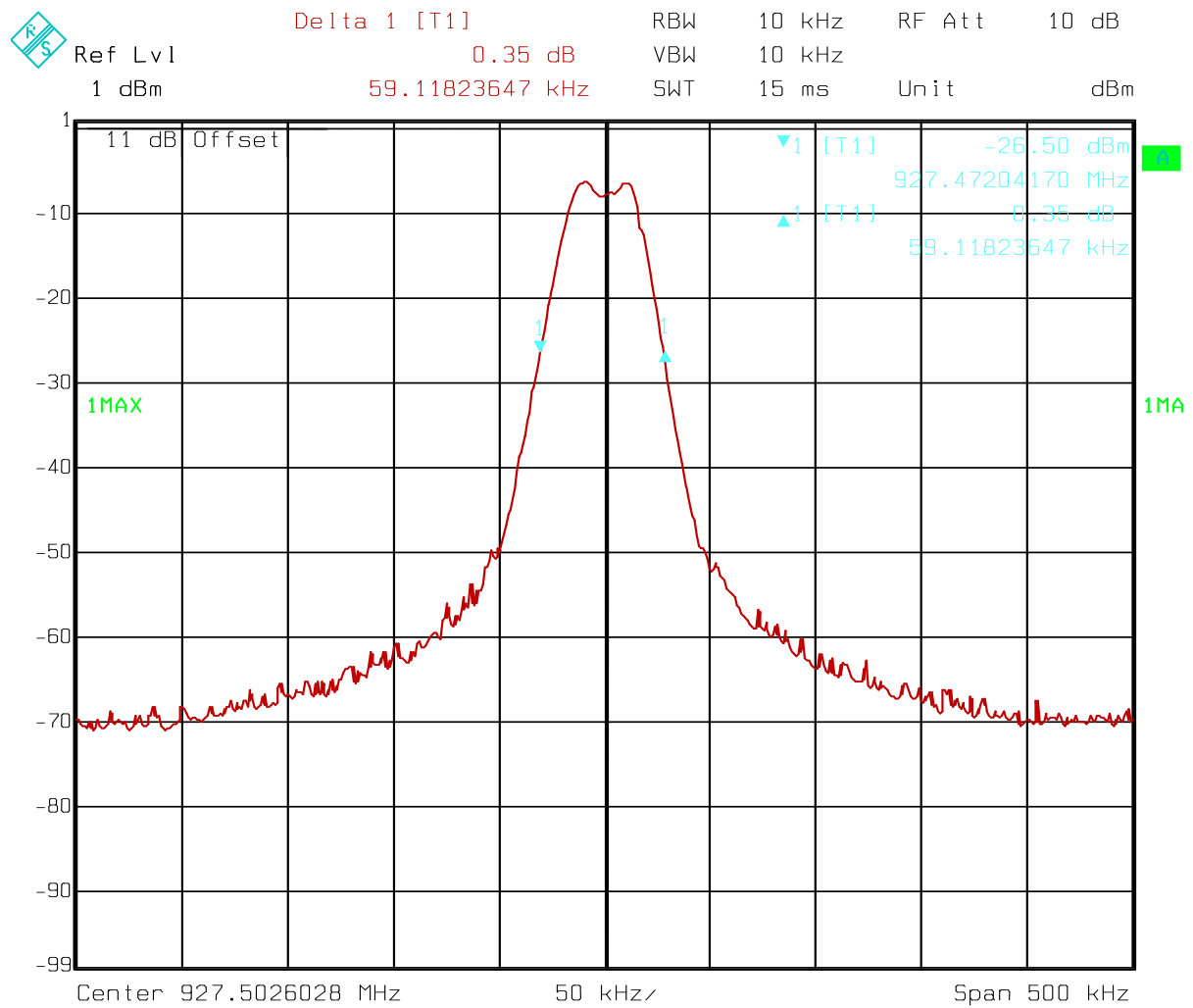
Date: 27.MAY 2011 07:52:13

Data Rate: 19.2kbps – CH01 – 20 dB bandwidth – 59.11kHz



Date: 27.MAY 2011 07:50:53

Data Rate: 19.2kbps – CH26 – 20 dB bandwidth – 60.12kHz



Date: 27.MAY 2011 07:47:50

Data Rate: 19.2kbps – CH51 – 20 dB bandwidth – 58.12kHz

4.4 Peak Power Output

Para. No.: 15.249 (a)/A.2,9

Test Performed By: G.Suwanthakumar

Date of Test: 23-May-2011

Test Results: Complies

Measurement Data:

Maximum Conducted Peak Output Power

RF channel	Ch 01	Ch 26	Ch 51
@ 4.8kbps, Measured value (dBm)	-5.45	-6.01	-6.51
@ 9.6kbps, Measured value (dBm)	-5.43	-5.95	-6.50
@ 19.2kbps, Measured value (dBm)	-5.35	-5.98	-6.52

Maximum Field strength

RF channel	Ch 01	Ch 26	Ch 51
VP: Measured value (dB μ V/m)	91.92	90.72	90.96
HP: Measured value (dB μ V/m)	92.94	92.64	91.26

Radiated measurements are done at 3 m distance. Please see page 66 for test-setup

Detachable antenna?

☒ Yes ☐ No

If detachable, is the antenna connector non-standard?

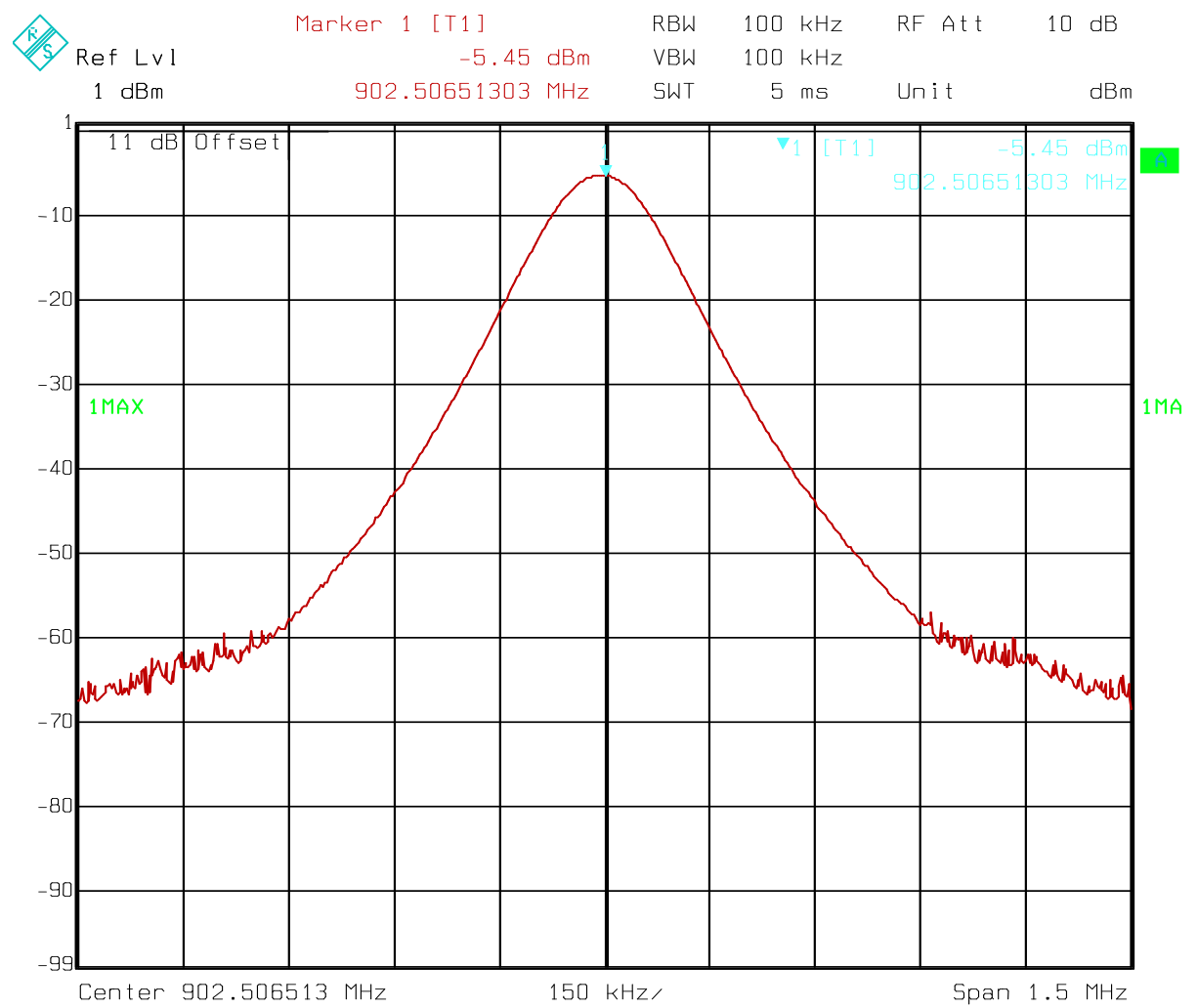
☒ Yes ☐ No

Reversed SMA connector

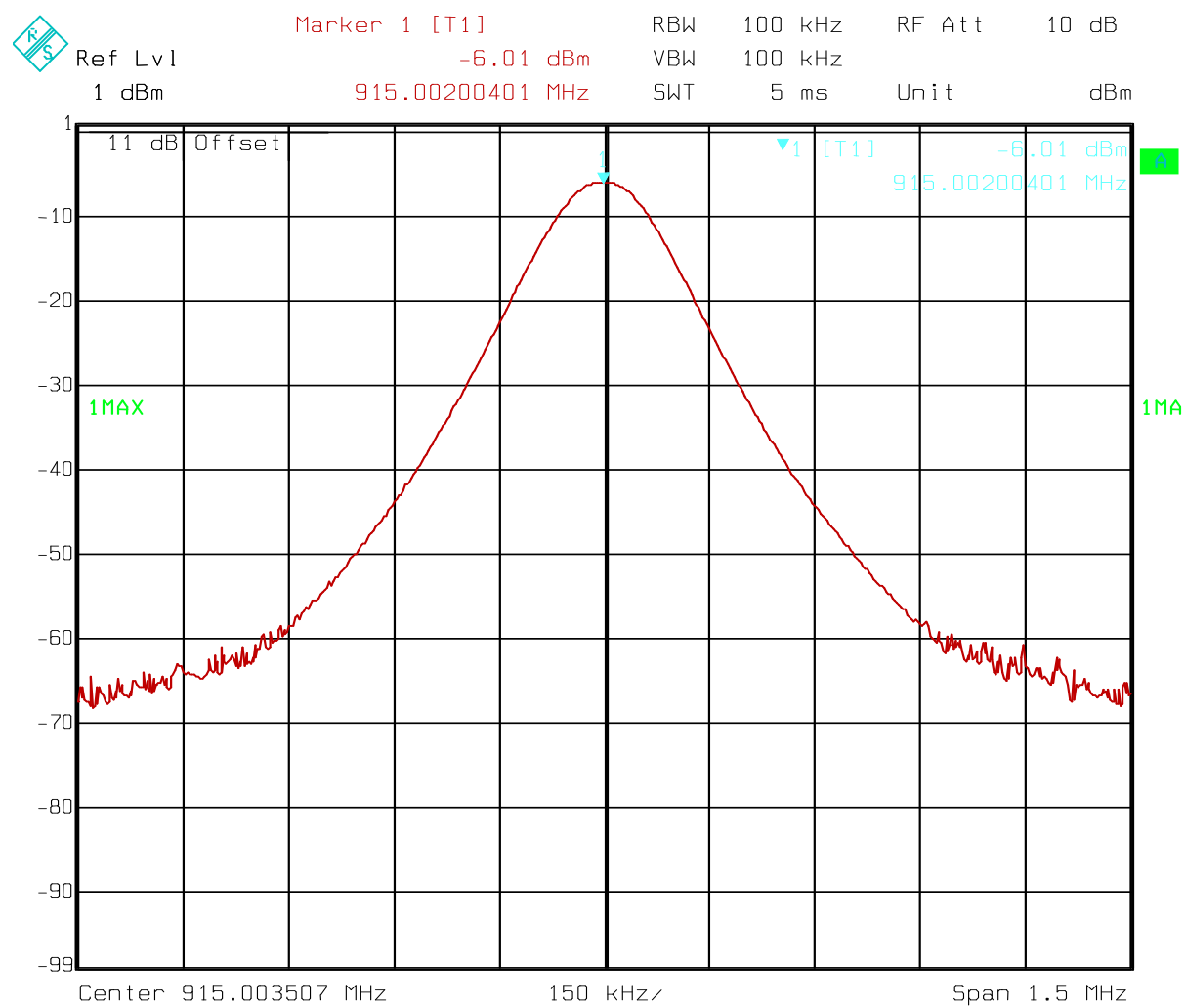
Power supply variation within manufacturer specified range 2.8 – 5.5V DC has no influence on measured values

Requirements:

The maximum peak output power shall be $\leq 94\text{dB}\mu\text{V/m}$

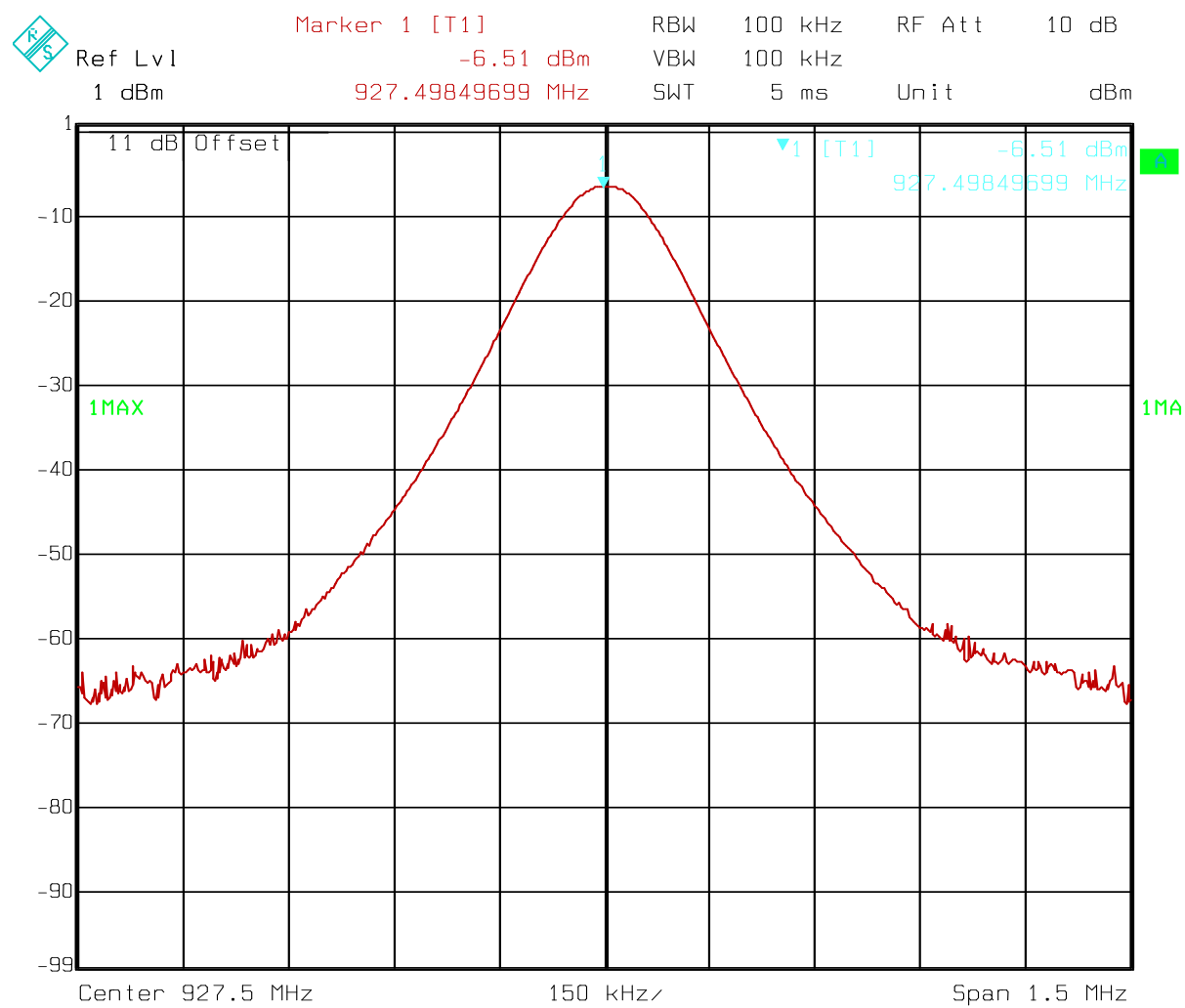


Date: 27.MAY 2011 08:09:00
 Data rate: 4.8kbps: Conducted power – Ch01



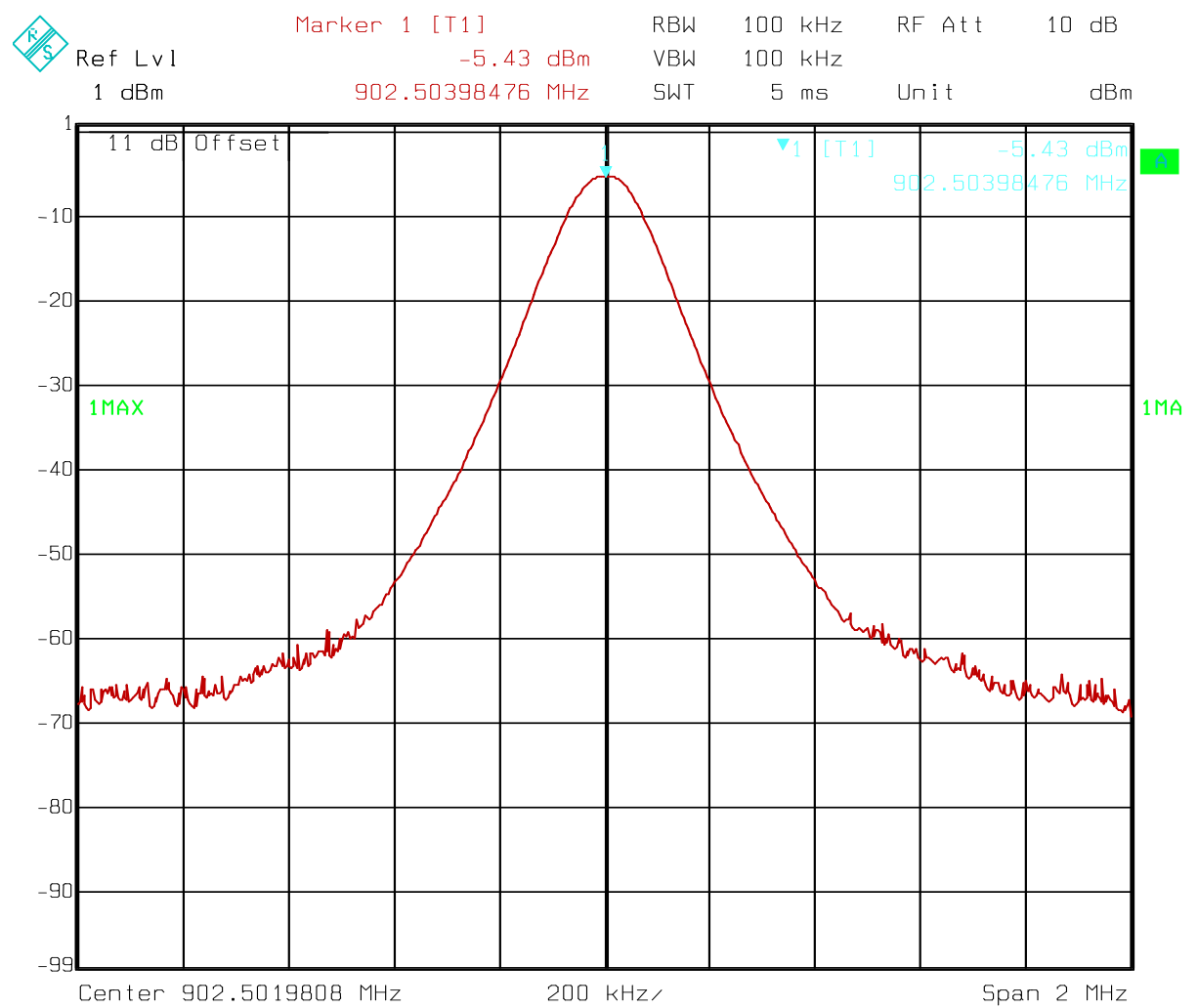
Date: 27.MAY 2011 08:07:38

Data rate: 4.8kbps: Conducted power – Ch26



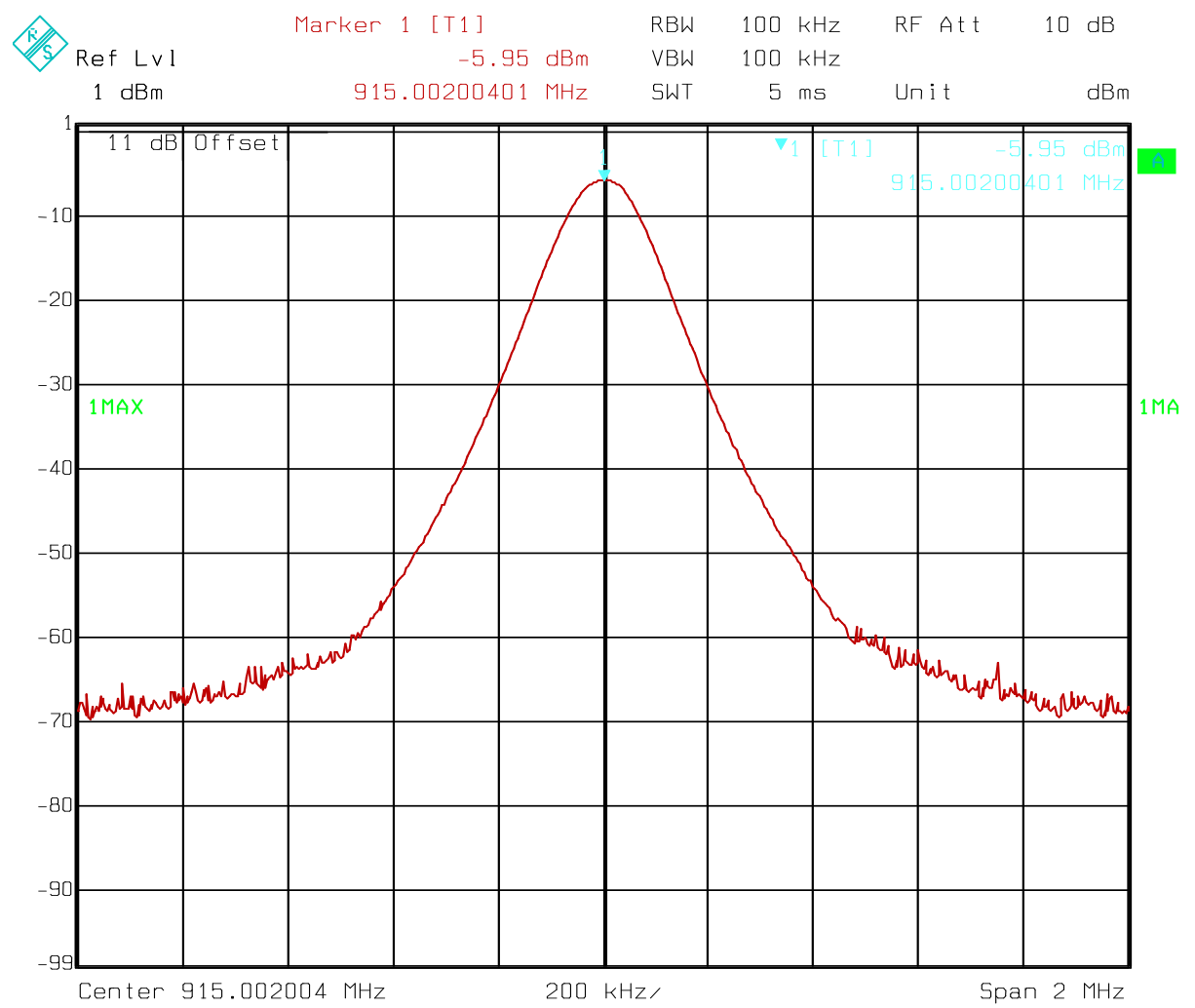
Date: 27.MAY 2011 08:03:08

Data rate: 4.8kbps: Conducted power – Ch01

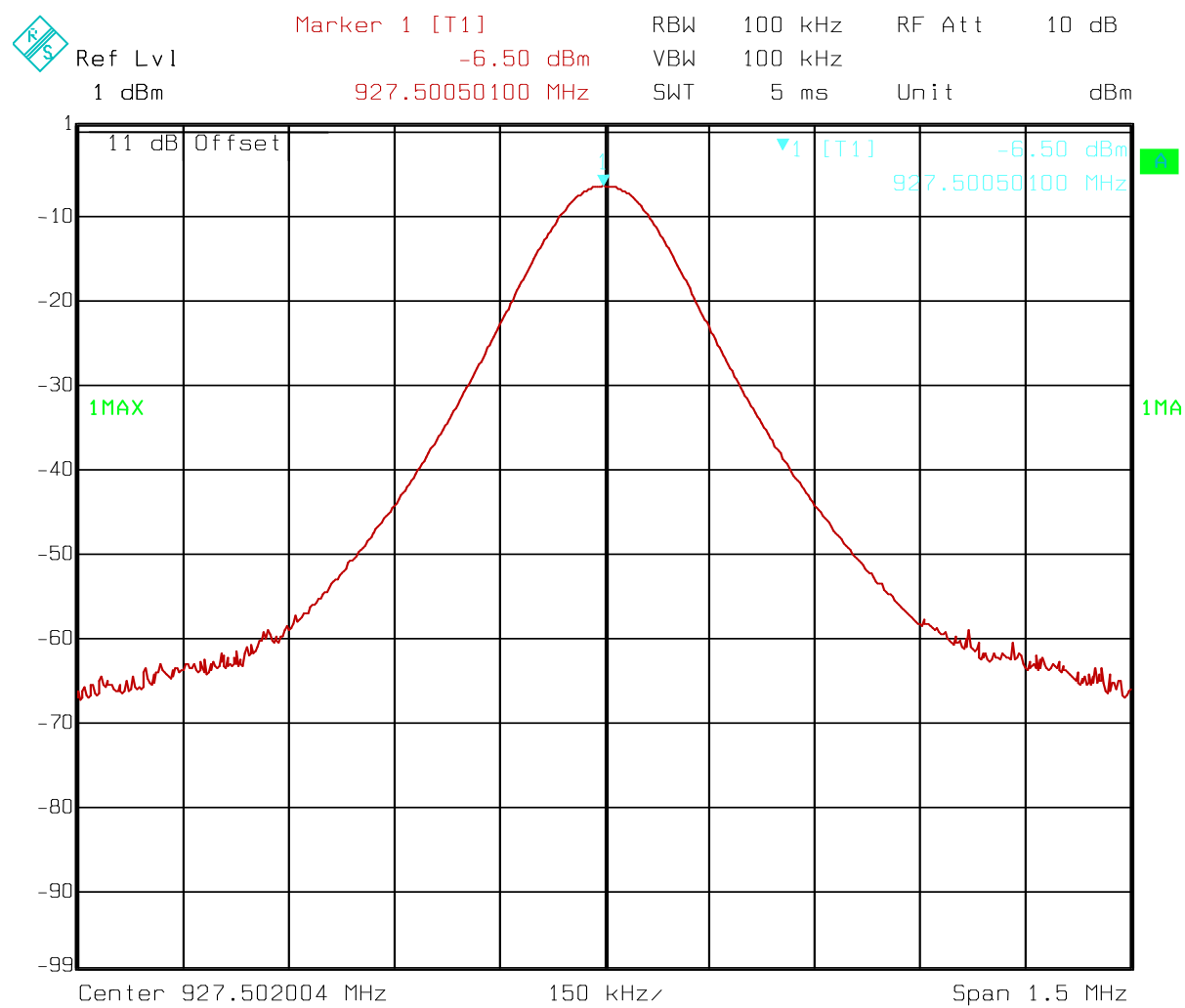


Date: 27.MAY 2011 07:29:50

Data rate: 9.6kbps: Conducted power – Ch01

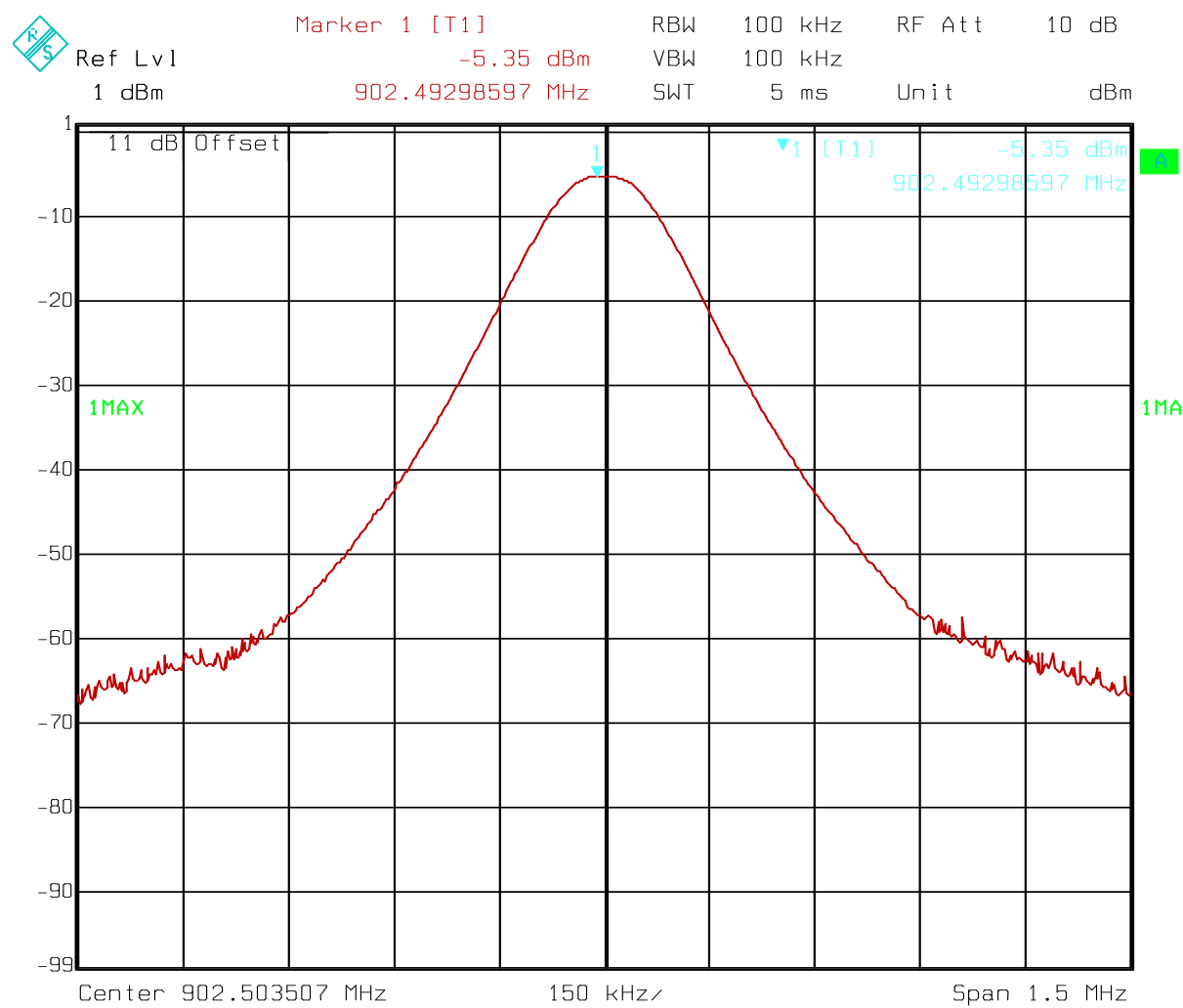


Date: 27.MAY 2011 07:35:42
 Data rate: 9.6kbps: Conducted power – Ch26

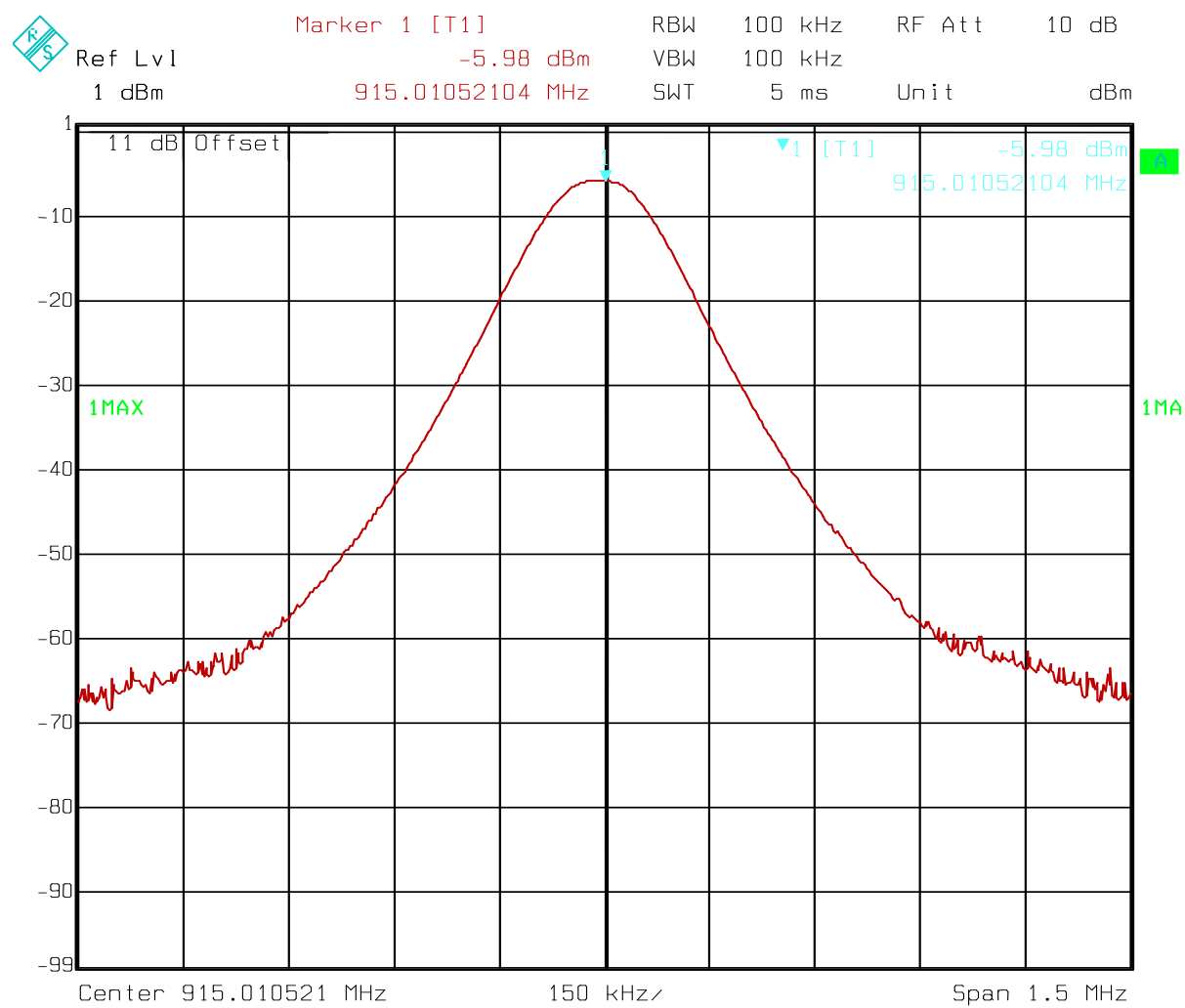


Date: 27.MAY 2011 07:41:51

Data rate: 9.6kbps: Conducted power – Ch51

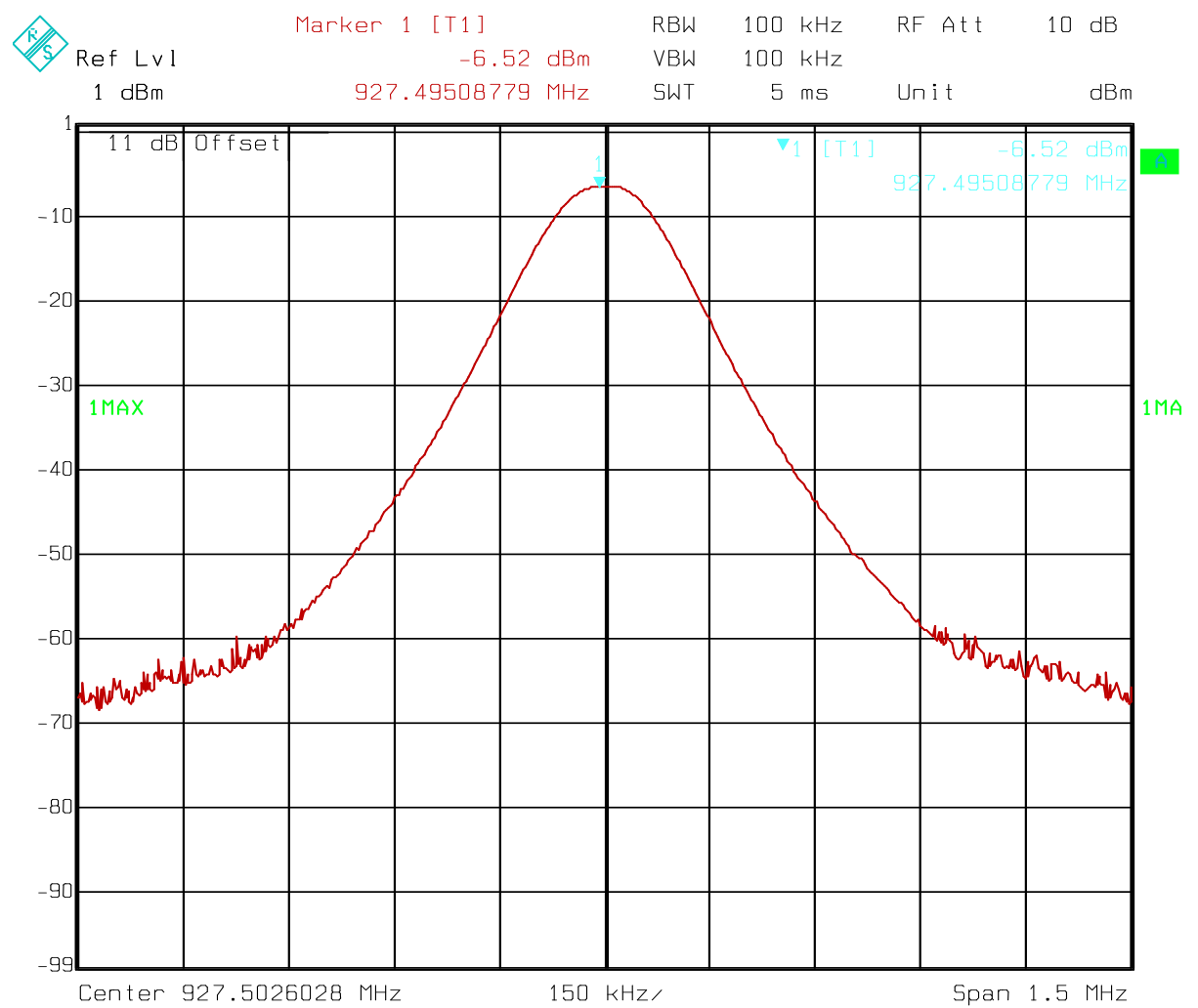


Date: 27.MAY 2011 07:53:34
 Data rate: 19.2kbps: Conducted power – Ch01

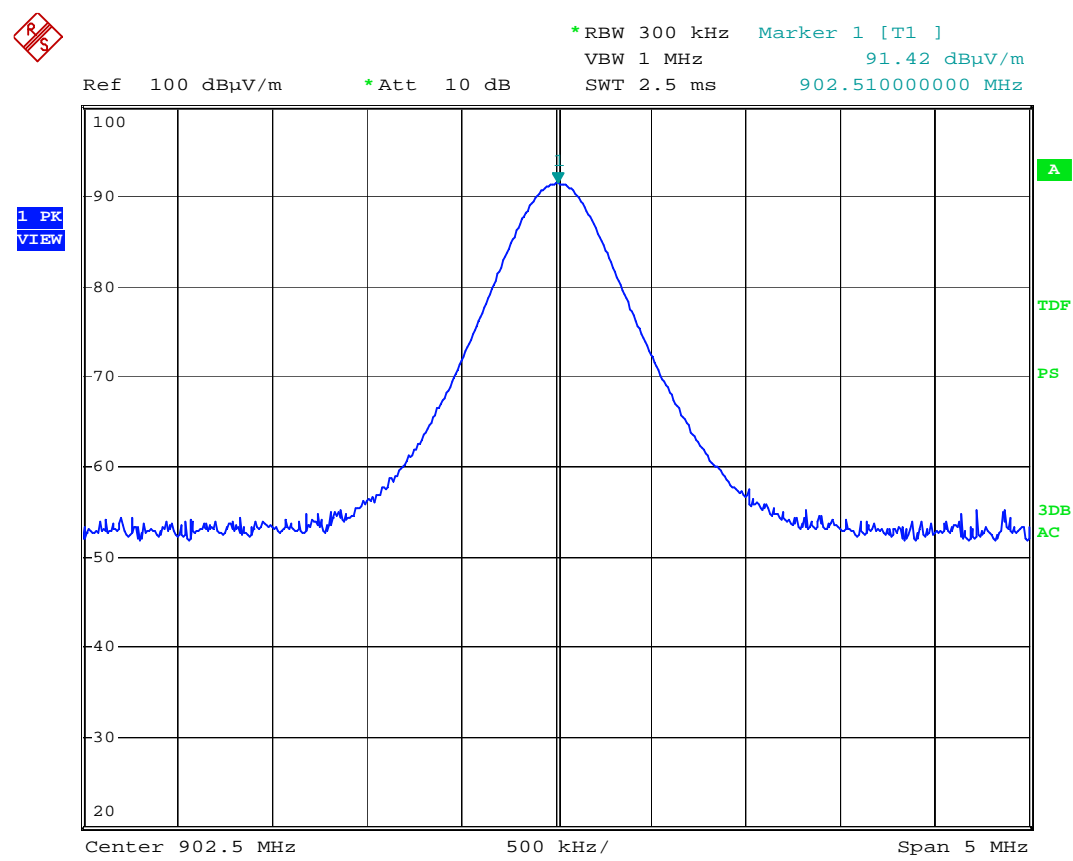


Date: 27.MAY 2011 07:49:48

Data rate: 19.2kbps: Conducted power – Ch26

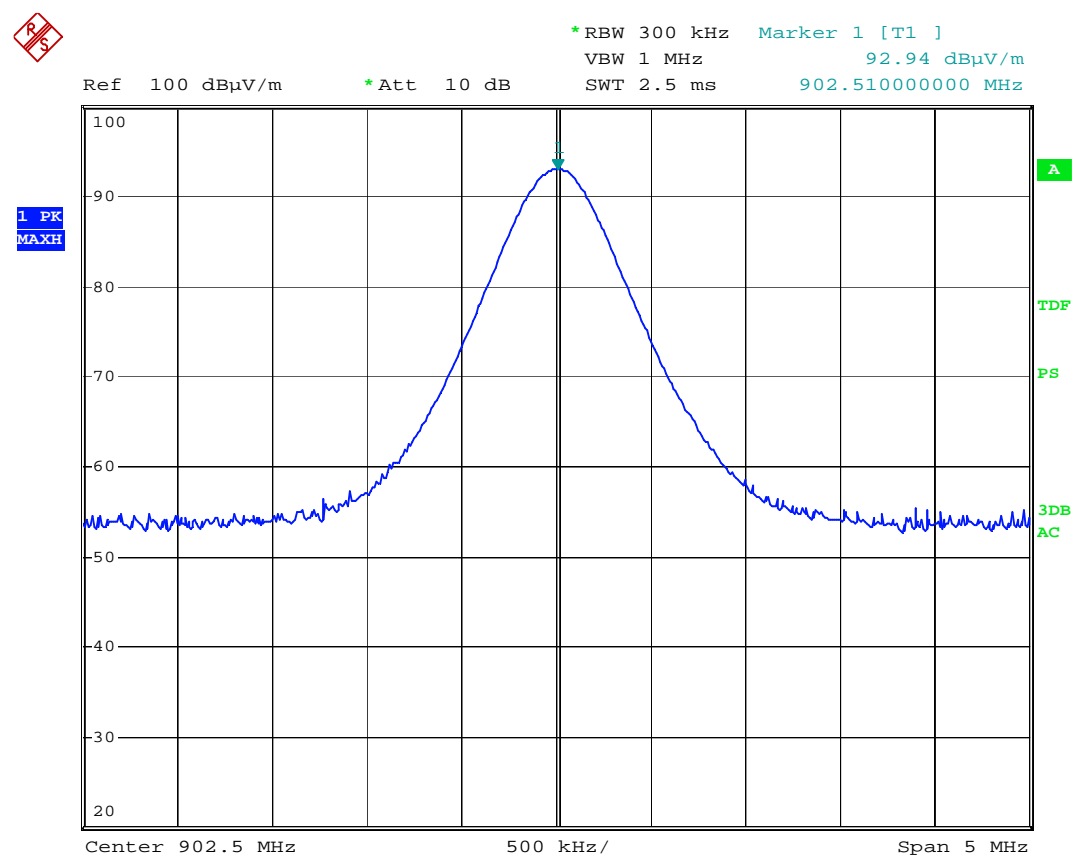


Date: 27.MAY 2011 07:48:36
 Data rate: 19.2kbps: Conducted power – Ch51



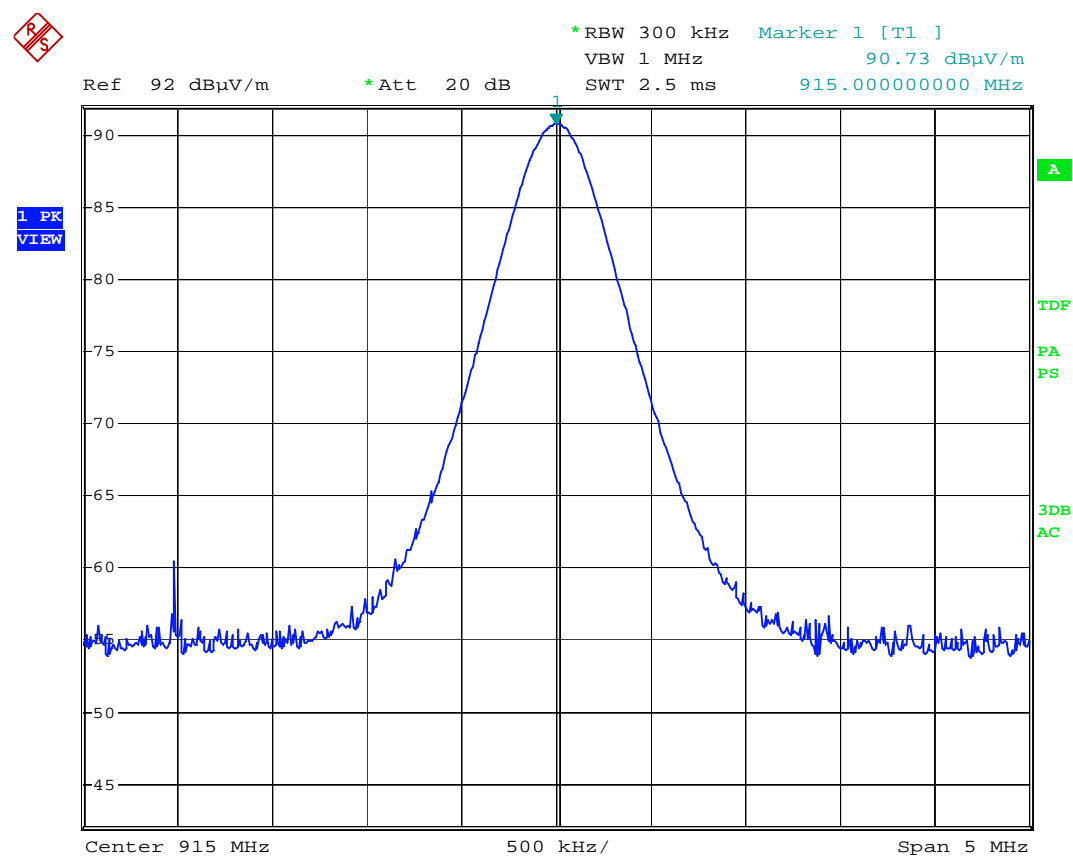
Date: 23.MAY.2011 08:57:07

VP: Ch01 – Field strength



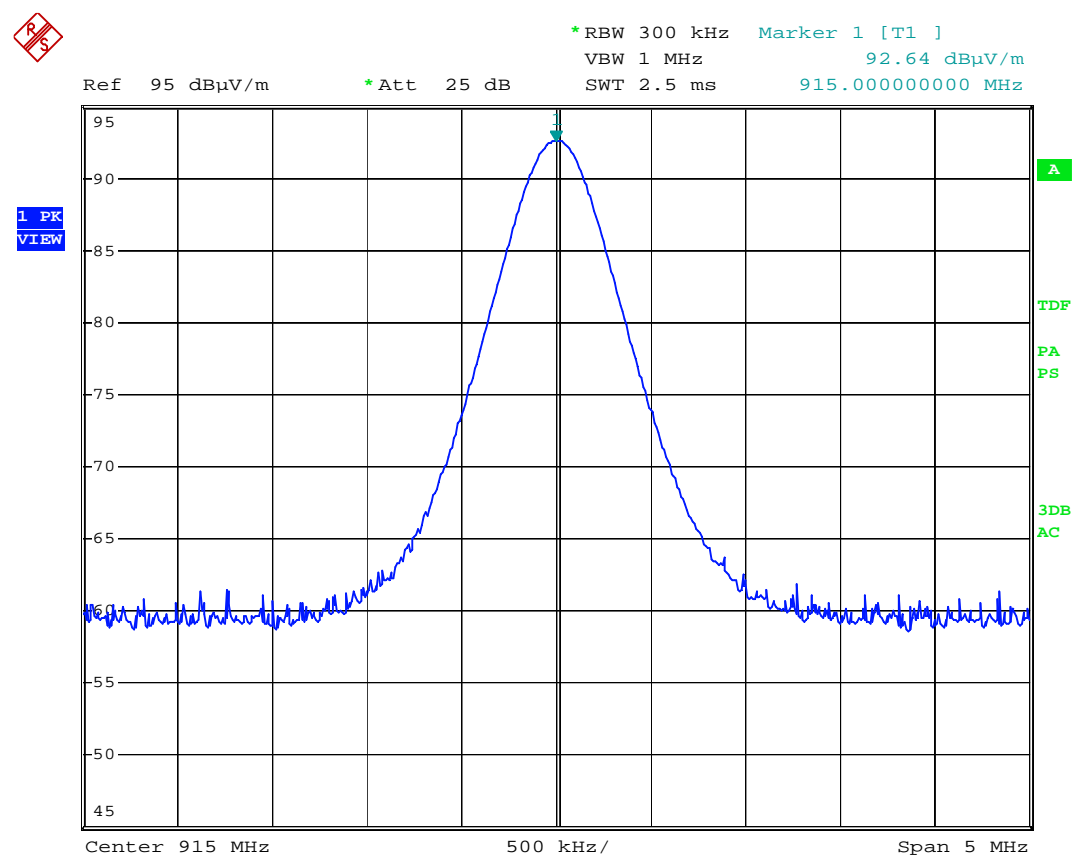
Date: 23.MAY.2011 09:05:55

VP: Ch01 – Field strength



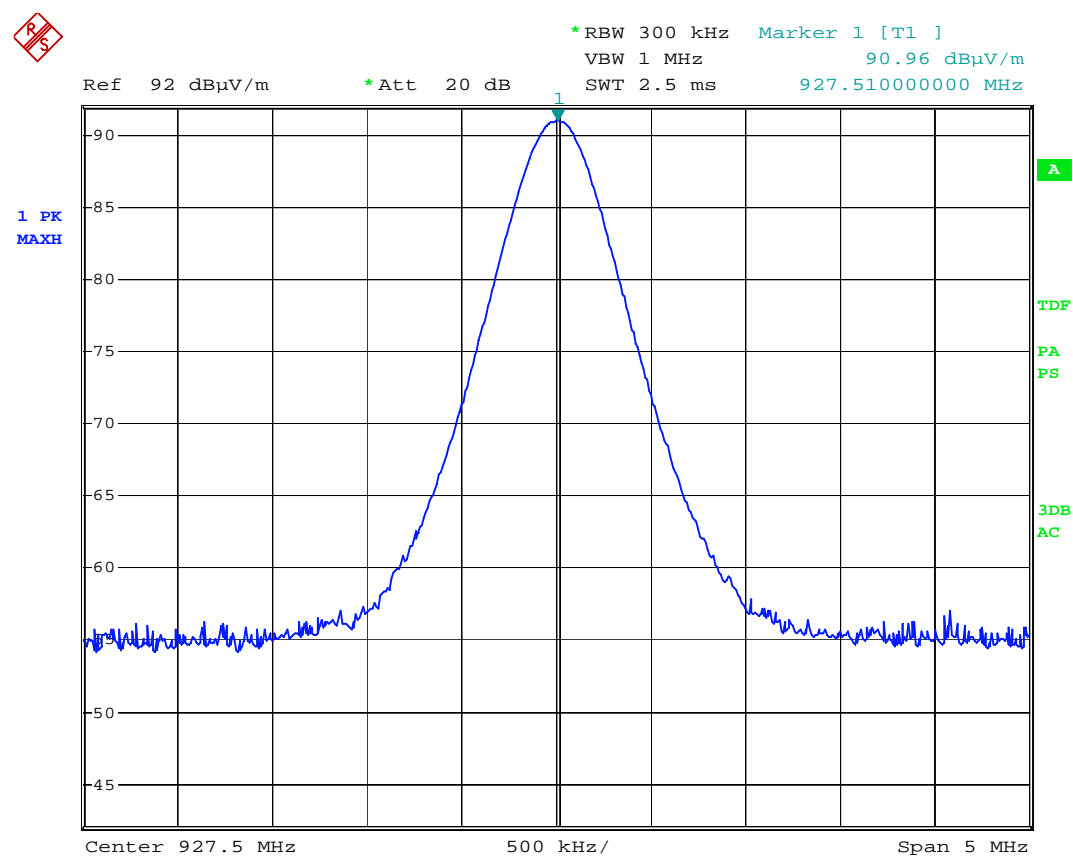
Date: 23.MAY.2011 09:46:53

VP: Ch26 – Field strength



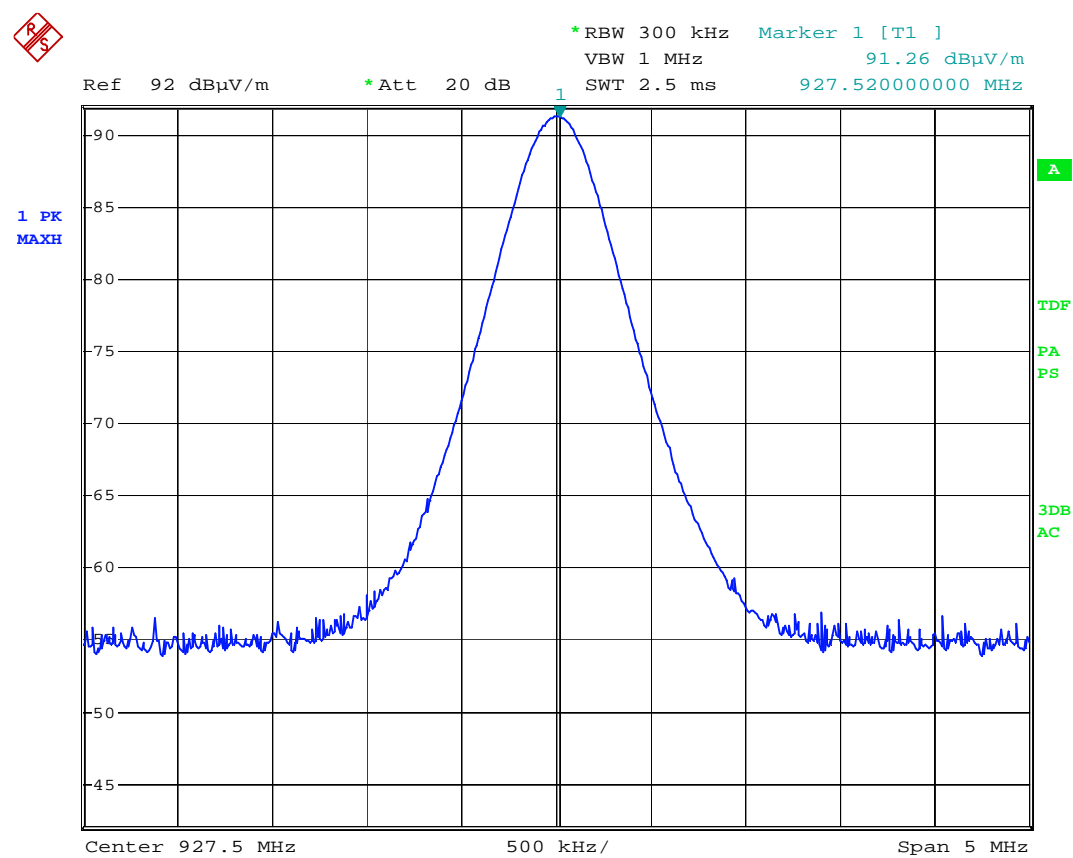
Date: 23.MAY.2011 09:49:39

HP: Ch26 – Field strength



Date: 23.MAY.2011 10:09:19

VP: Ch51 – Field strength



Date: 23.MAY.2011 10:12:23

HP: Ch51 – Field strength

4.5 Band Edge Emissions

Para. No.: 15.249 (d)

Test Performed By: G.Suwanthakumar

Date of Test: 27.05.2011

Test Results: Complies

Measurement Data:

Lower Band edge :

RF channel	Ch 01 902.500MHz
Measured maximum dBc	66.32

Upper Band edge :

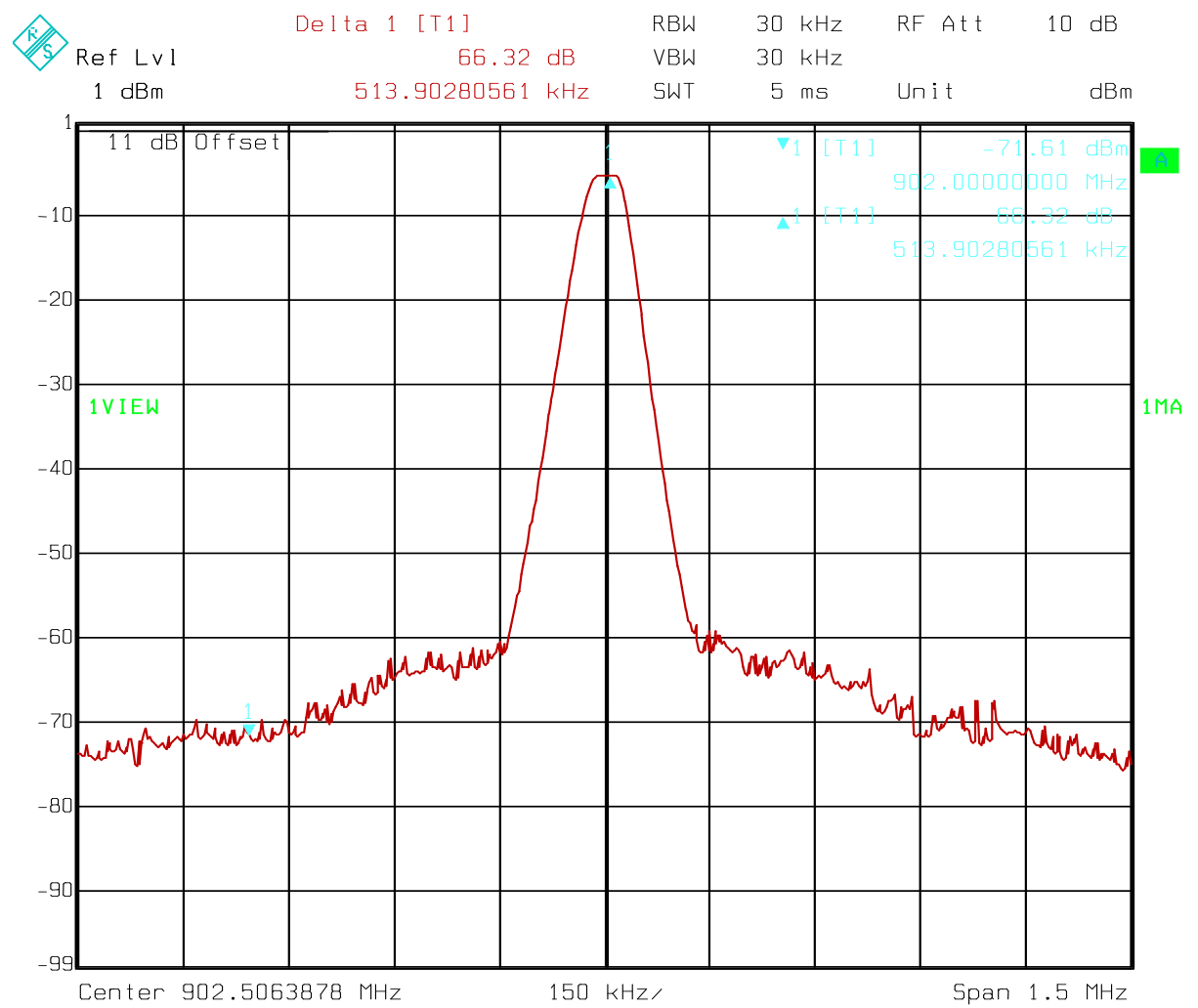
RF channel	Ch 51 927.500MHz
Measured maximum dBc	64.36

The test results are identical for all data rates. Therefore graphs only for 19.2kbps attached.

See the attached graphs

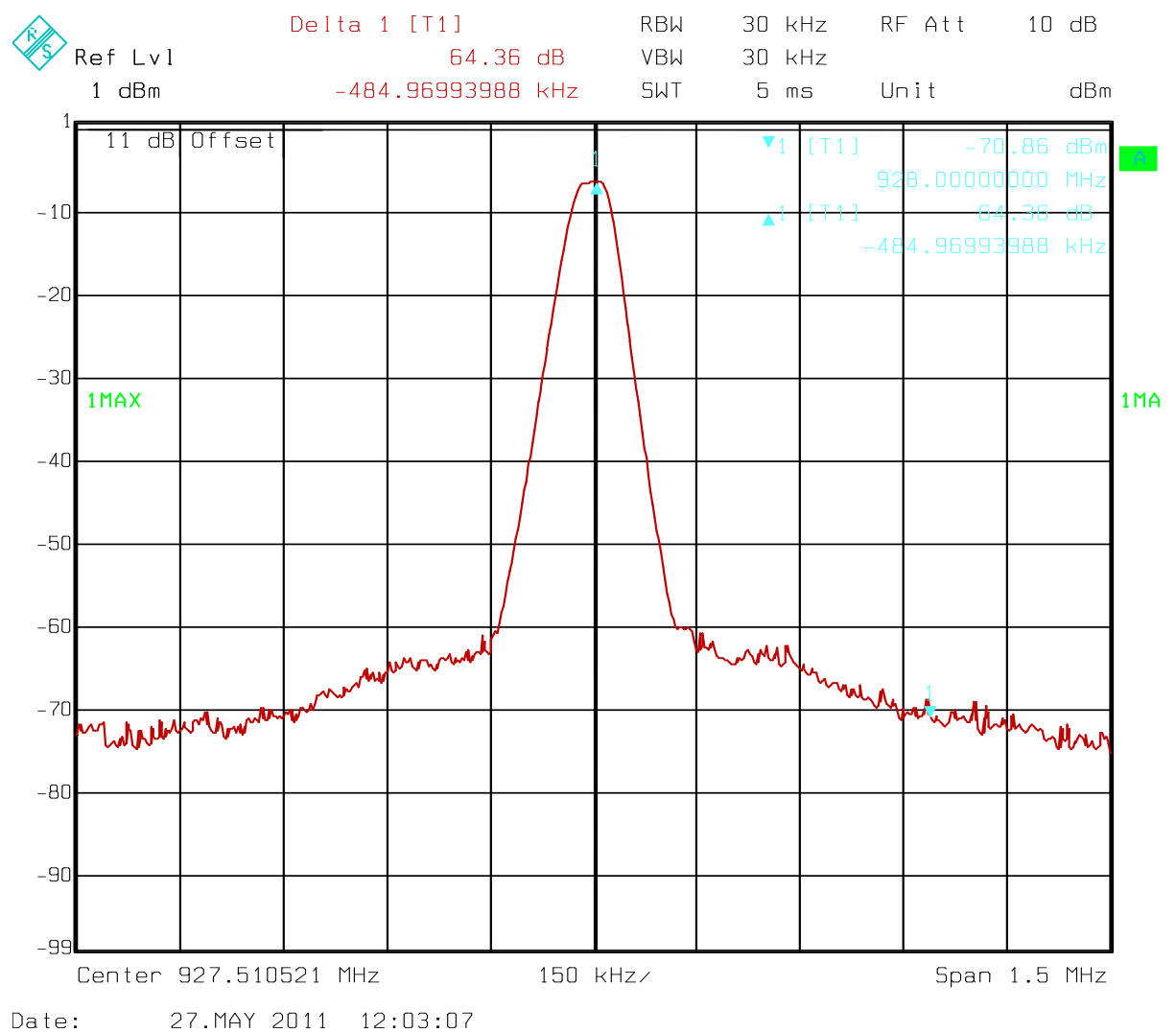
Requirements:

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental.



Date: 27.MAY 2011 12:00:41

CH01- Lower band edge



CH51- upper band edge

4.6 Spurious Emissions (Radiated)

Para. No.: 15.249 (e)

Test Performed By: G.Suwanthakumar

Date of Test: 27.05.2011

Test Results: Complies

Measurement Data:

According to manufacturer there is no duty cycle correction (worst case RF packets are over 100ms).

Tested item's transmission is with 100% duty cycle

RF conducted emissions 9kHz to 10 GHz

Maximum RF level outside operating band:

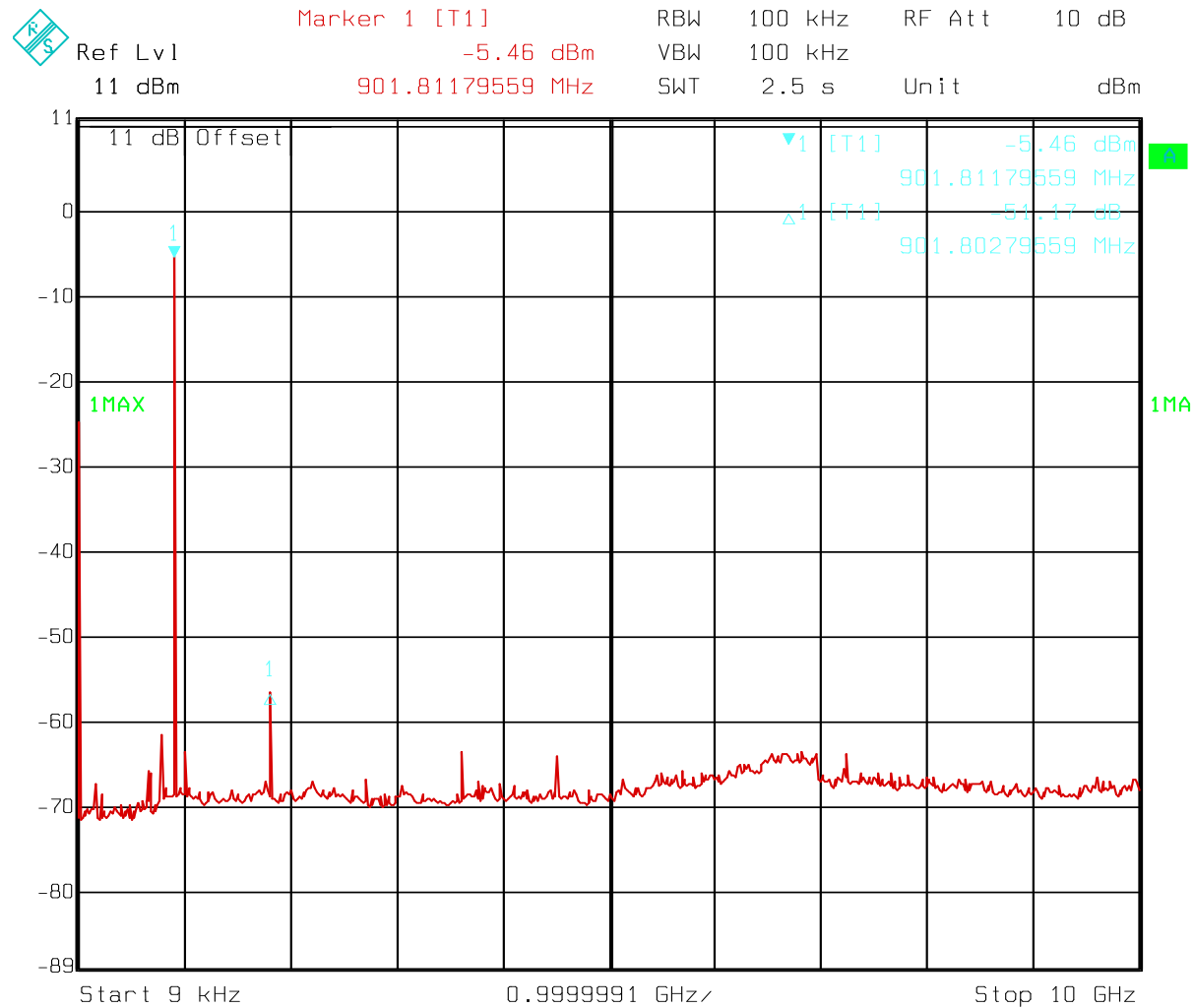
RF ch 01: 51.71 dBC, margin > 20 dB

RF ch 26: 51.00 dBC, margin > 20 dB

RF ch 51: 50.73 dBC, margin > 20 dB

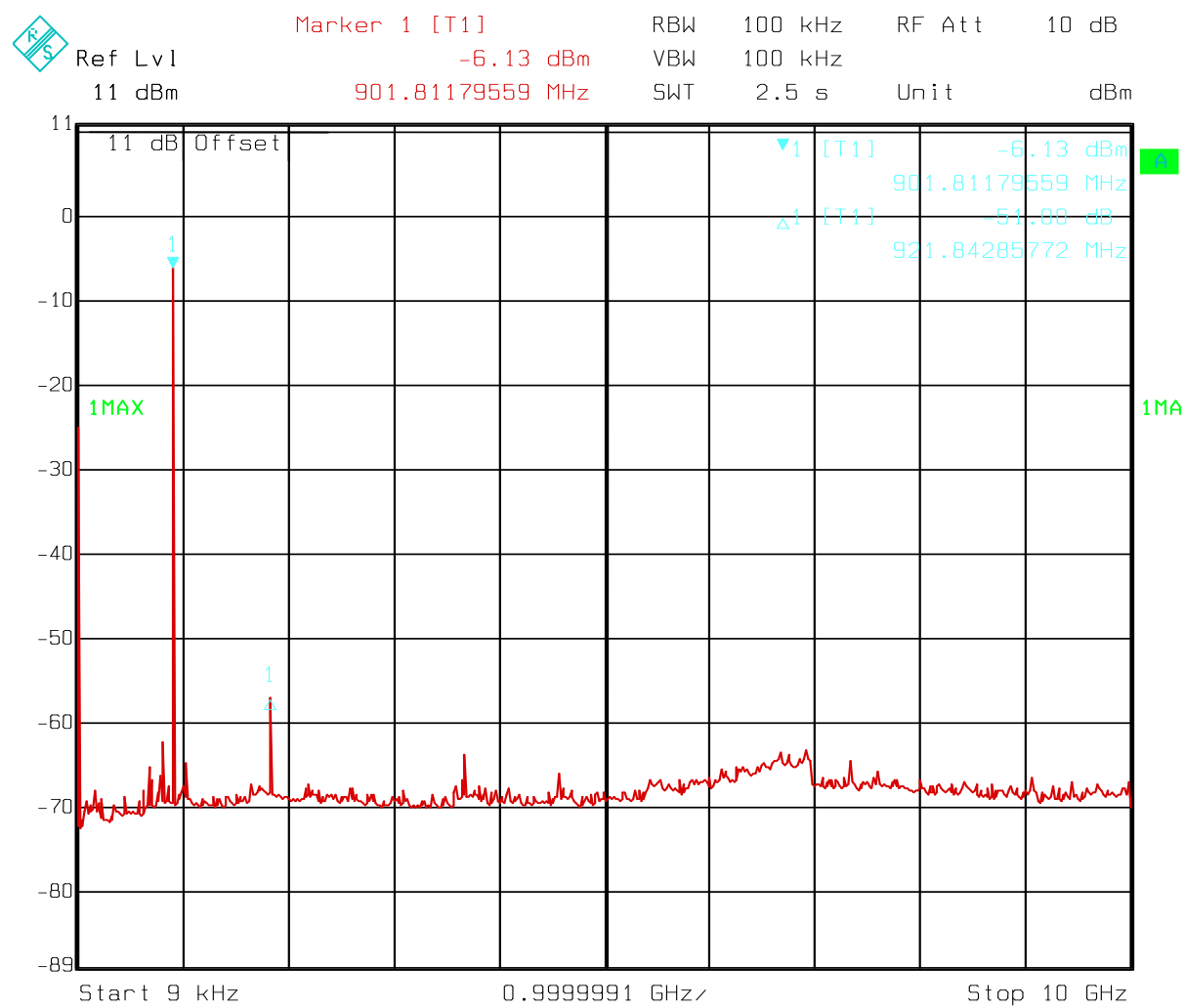
Requirements:

As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.



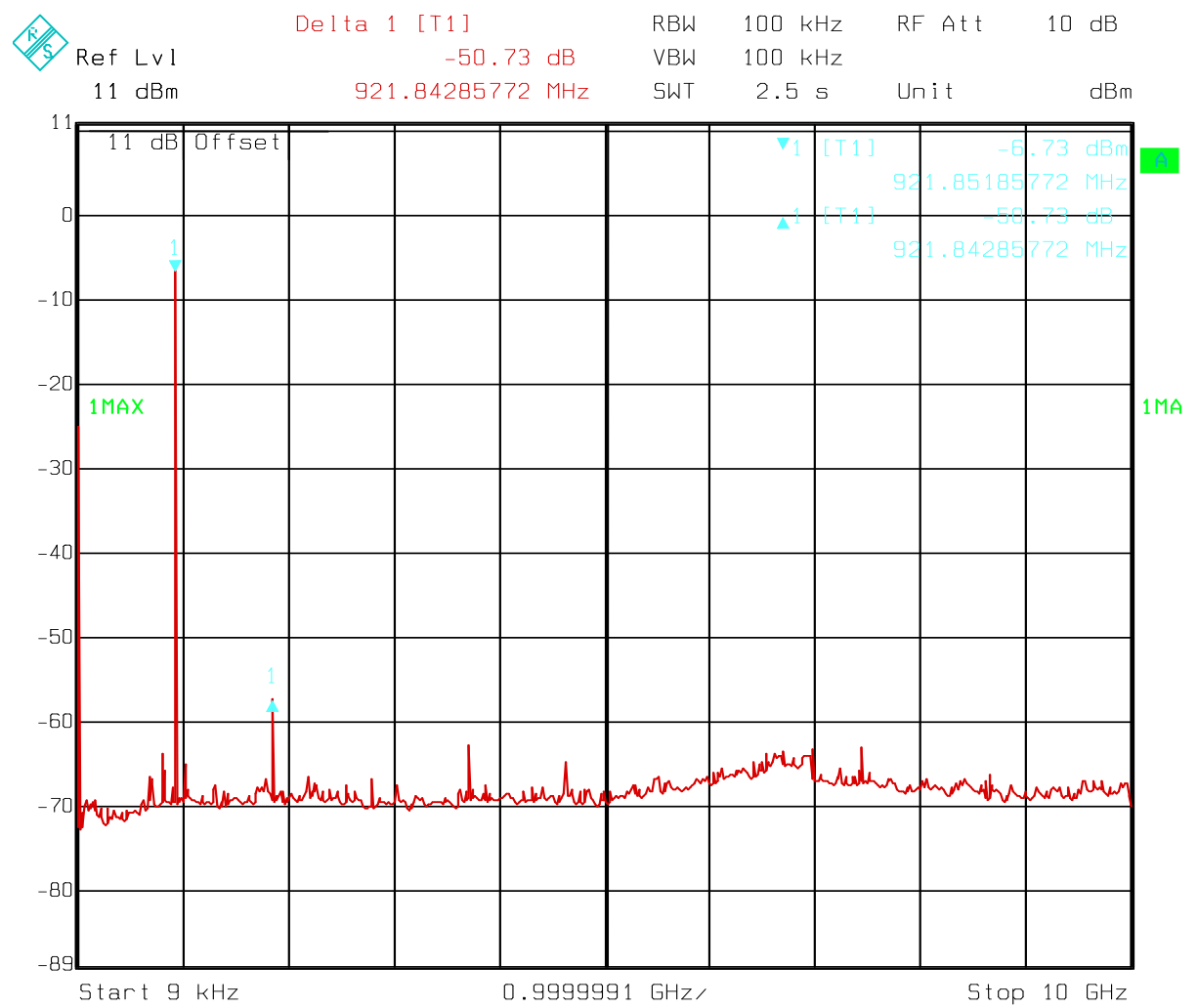
Date: 23.MAY 2011 12:10:58

Ch01 – Conducted Spurious – 9kHz – 10GHz



Date: 23.MAY 2011 12:09:49

Ch26 – Conducted Spurious – 9kHz – 10GHz



Date: 23.MAY 2011 12:08:51

Ch51 – Conducted Spurious – 9kHz – 10GHz

Duty Cycle Calculation:

Manufacturer statement:

None

Radiated Emissions with antenna, 1-10 GHz, peak

1-10 GHz measured at a distance of 3m..

Measured with Peak Detector

Frequency	RF channel	Dist. corr. factor	Field strength, Peak	Duty cycle corr. factor	Limit	Margin
GHz	01,26,51	dB	dB μ V/m	dB	dB μ V/m	dB
1.804	01	0	42.42	-	74	31.58
1.830	26	0	42.30	-	74	31.70
1.855	51	0	42.77	-	74	31.23
>1.8 - 10	01,26,51	0	None detected	-	74	-

Radiated emissions with antenna,1- 10 GHz, Average Detector

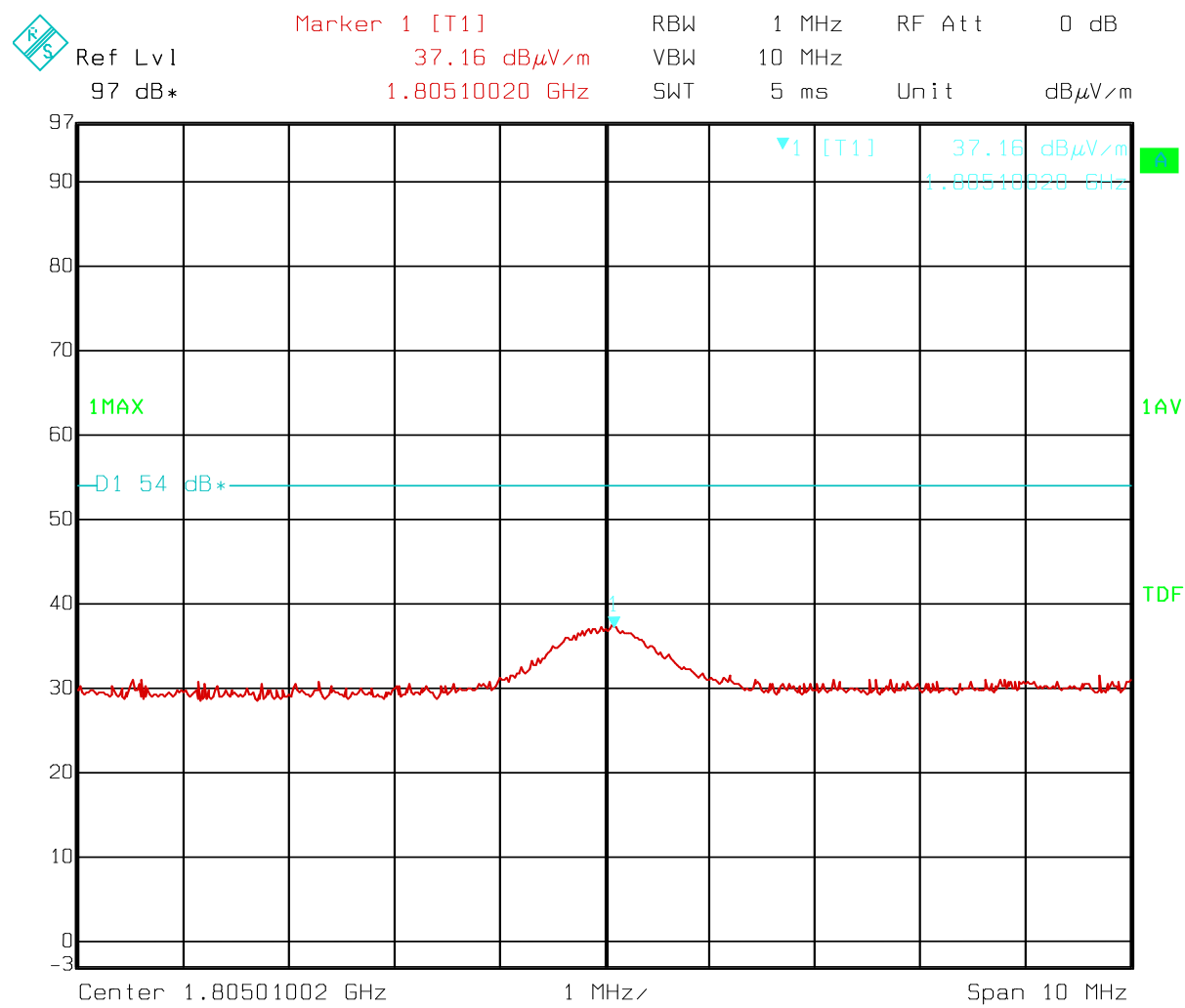
Frequency	RF channel	Dist. corr. factor	Duty cycle corr. factor	Field strength, AV	Limit	Margin
GHz	01,26,51	dB	dB	dB μ V/m	dB μ V/m	dB
1.804	01	0	0	37.16	54	16.84
1.830	26	0	0	35.80	54	18.20
1.855	51	0	0	35.75	54	18.25
>1.8 - 10	01,26,51	0	0	None detected	54	-

The maximum is observed in vertical polarization

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

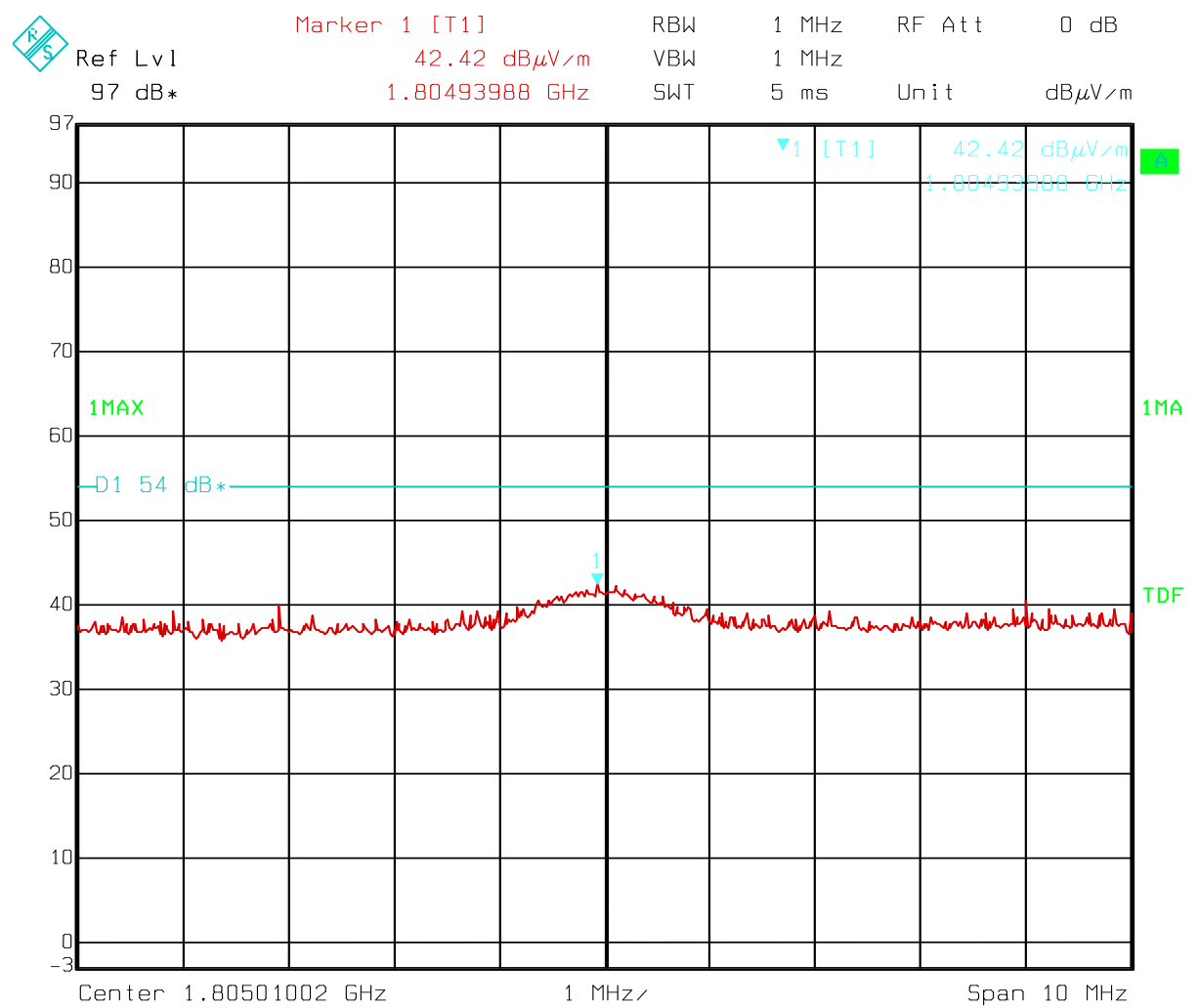
Requirement:

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.



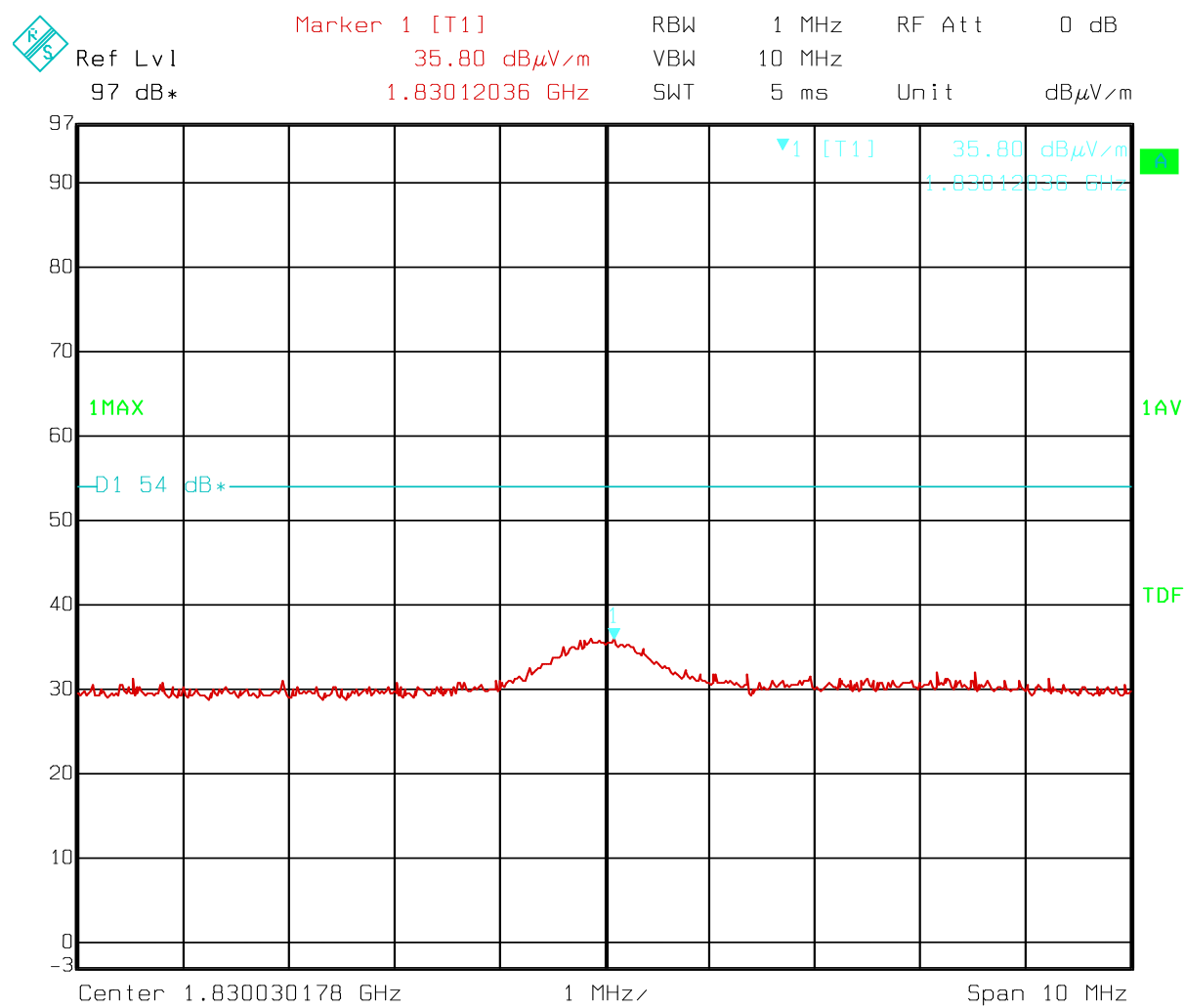
Date: 23.MAY 2011 10:21:52

Ch01 – 2nd harmonic- AV



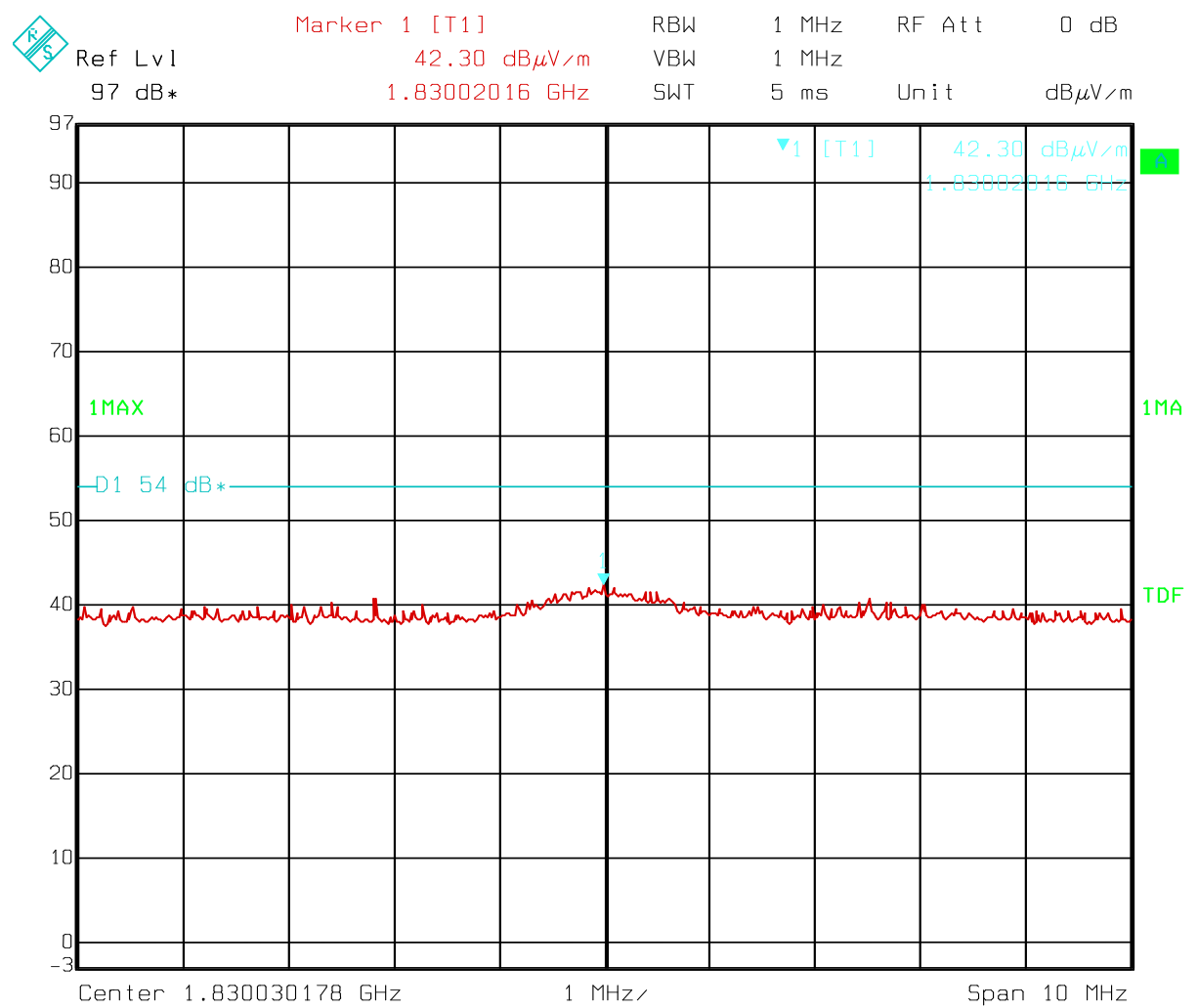
Date: 23.MAY 2011 10:21:15

Ch01 – 2nd harmonic- PK



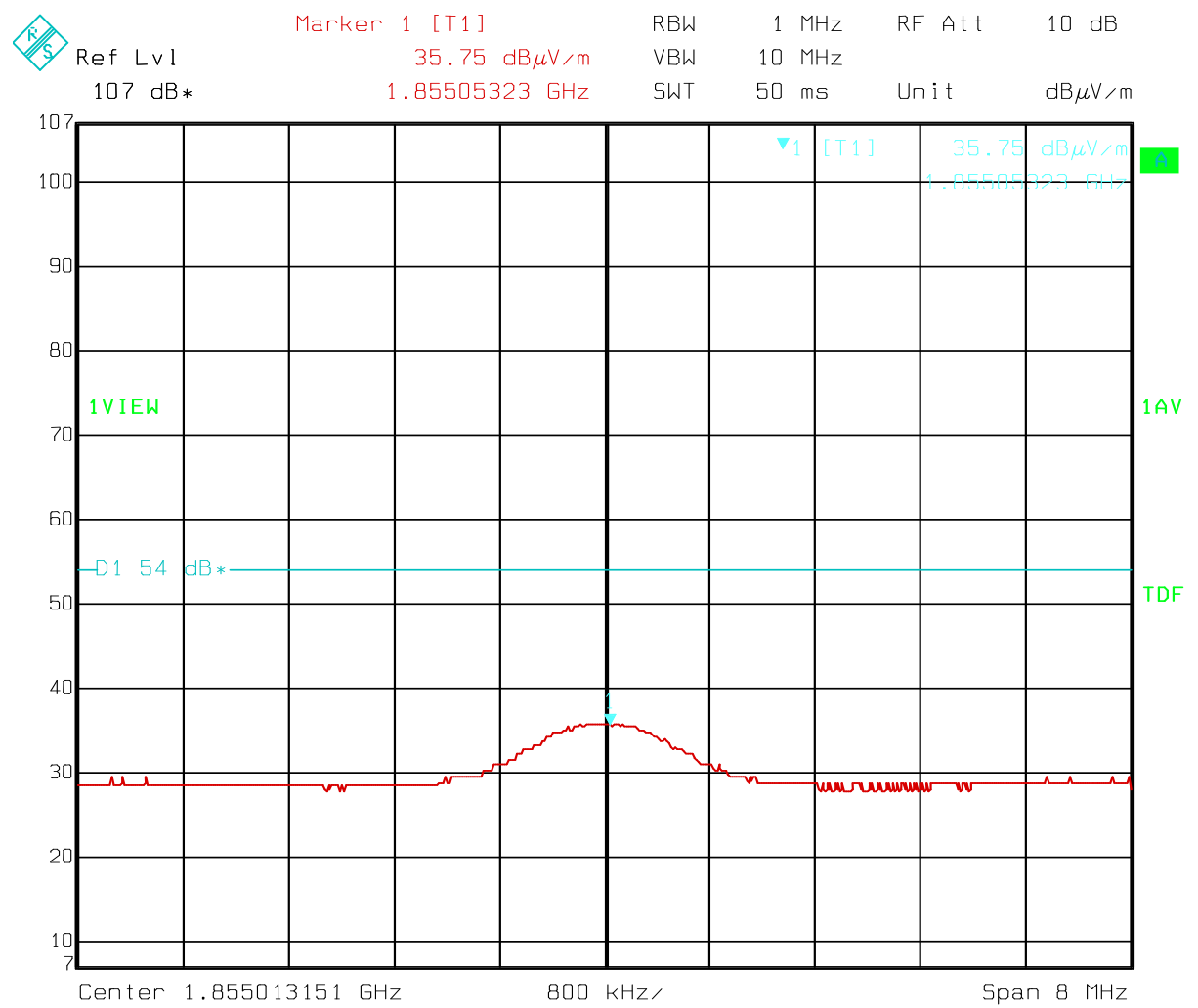
Date: 23.MAY 2011 10:16:32

Ch26 – 2nd Harmonic- VBW AV



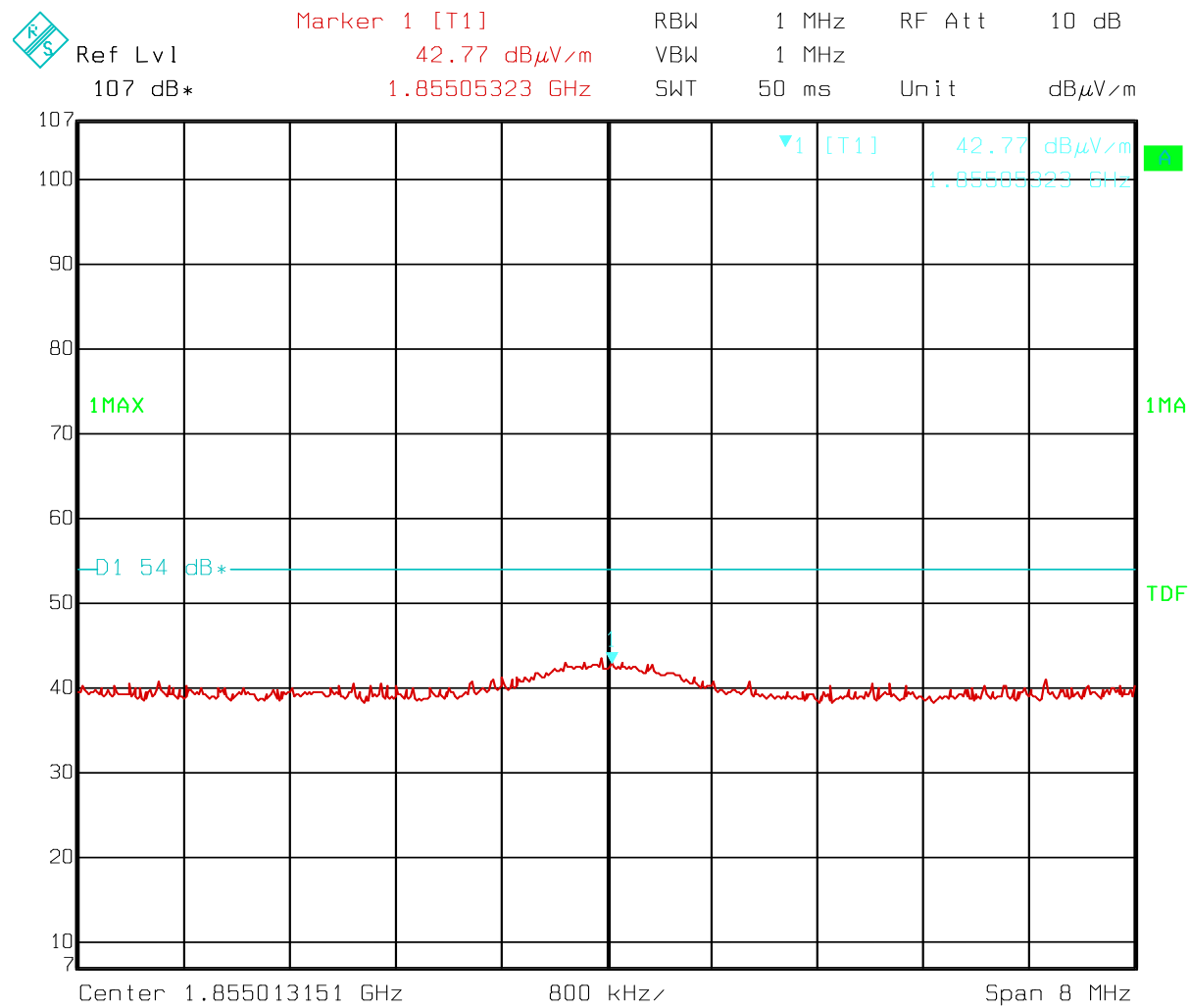
Date: 23.MAY 2011 10:15:48

Ch26 – 2nd harmonic- VBW PK



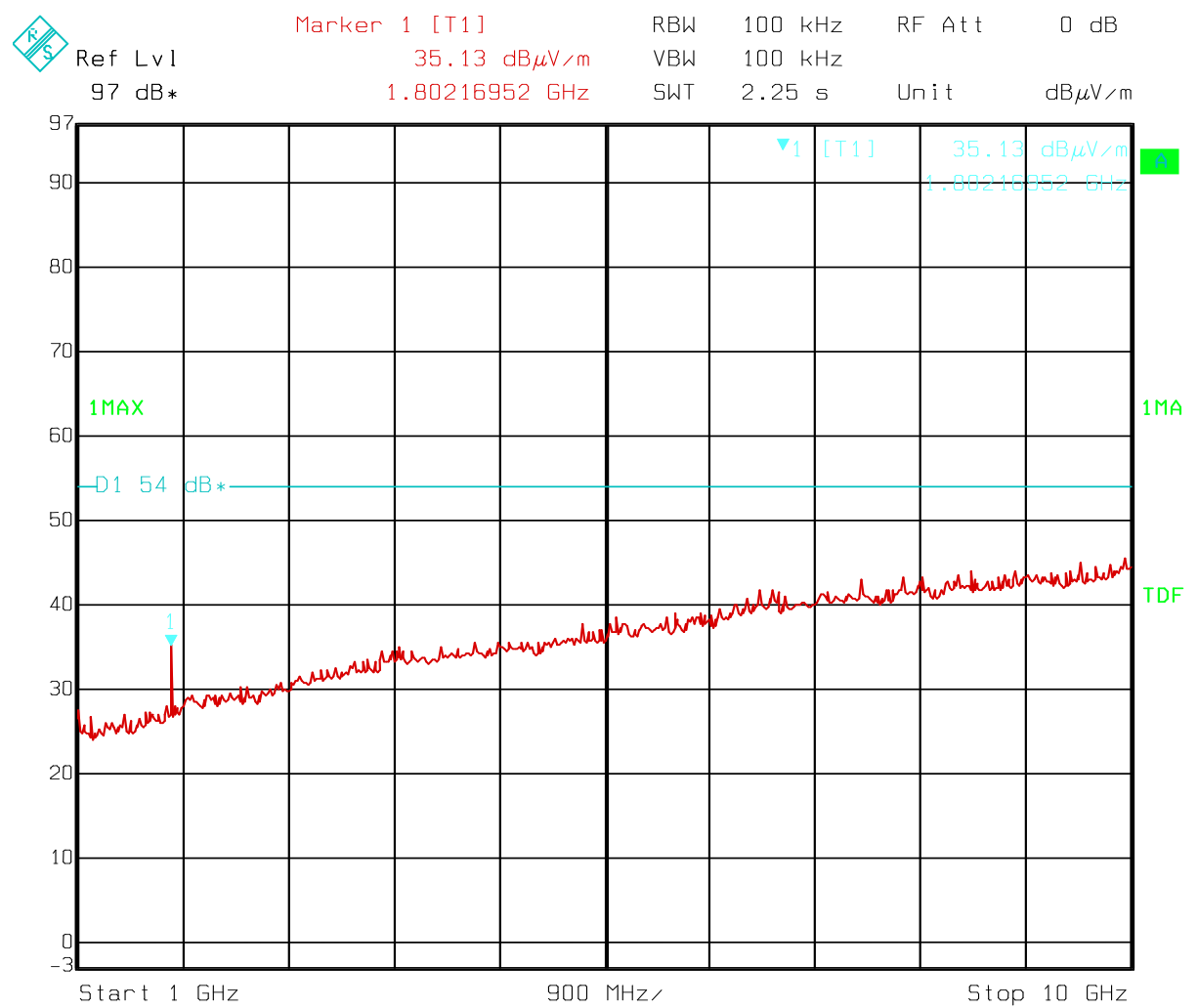
Date: 23.MAY 2011 10:05:42

Ch51 – 2nd Harmonic – VBW AV

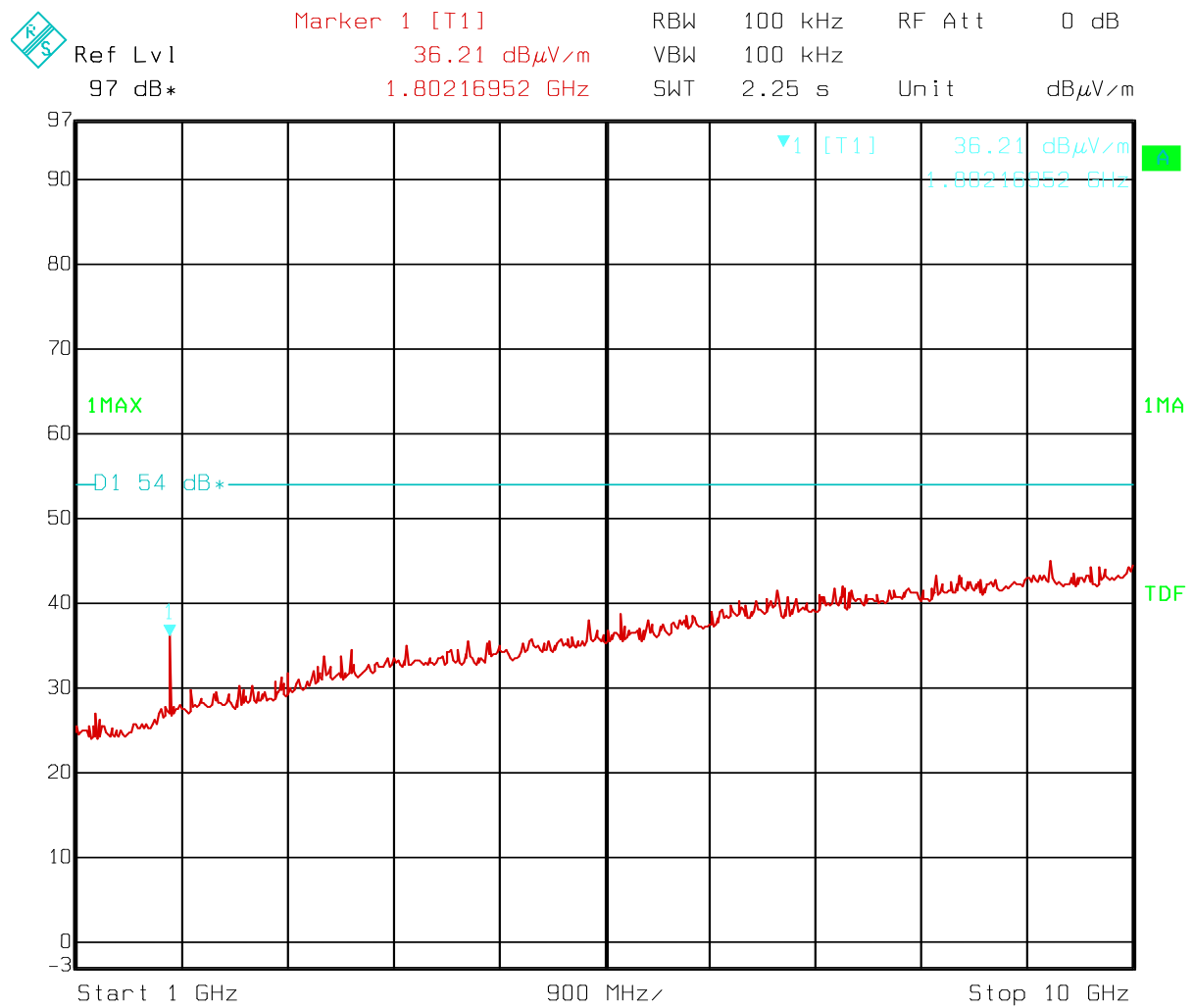


Date: 23.MAY 2011 10:04:04

Ch51 – 2nd harmonic- VBW PK



Date: 23.MAY 2011 10:19:48
 HP: CH 01 pre- scan 1 - 10GHz



Date: 23.MAY 2011 10:20:16

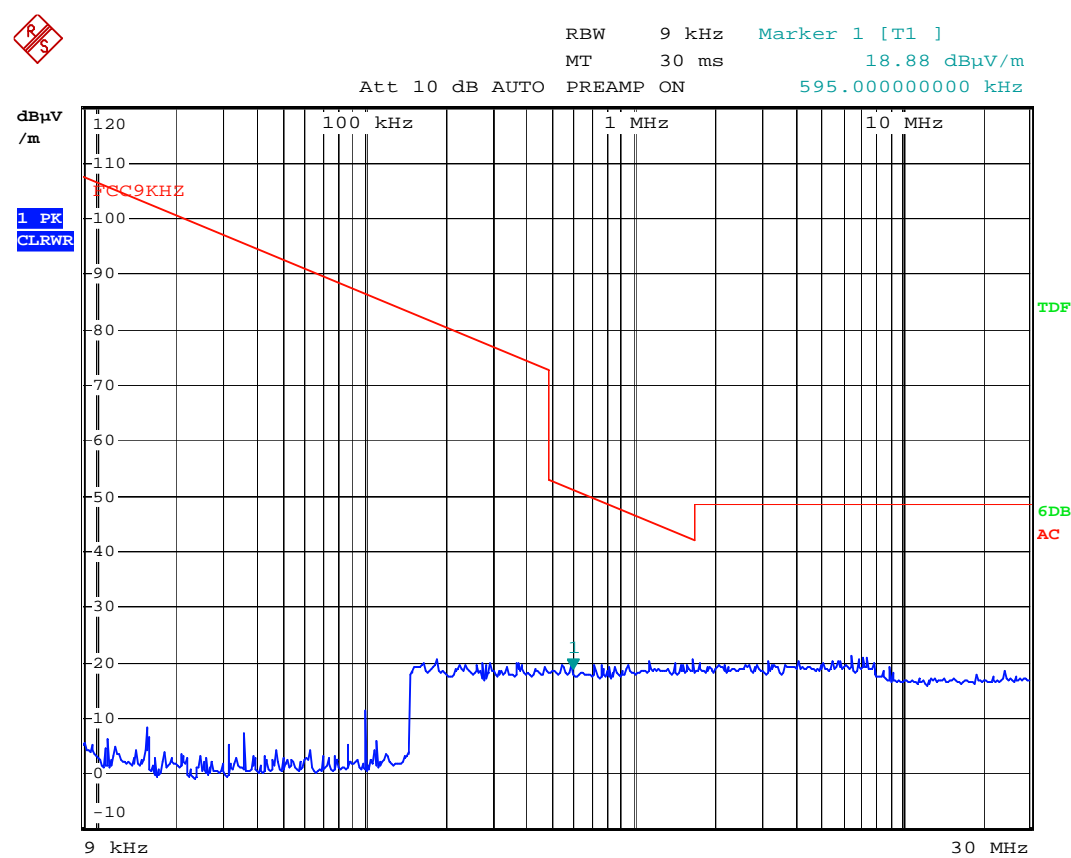
VP: Ch01 pre-view scan 1 - 10GHz

Radiated emissions 9kHz - 30 MHz.

Detector: Quasi-Peak

Measuring distance 10 m.

Frequency	Operational condition	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz		dBµV/m	m	dBµV/m	dB
0.595	TX on	18.88	10	71.2	52.32



Date: 23.MAY.2011 12:34:19

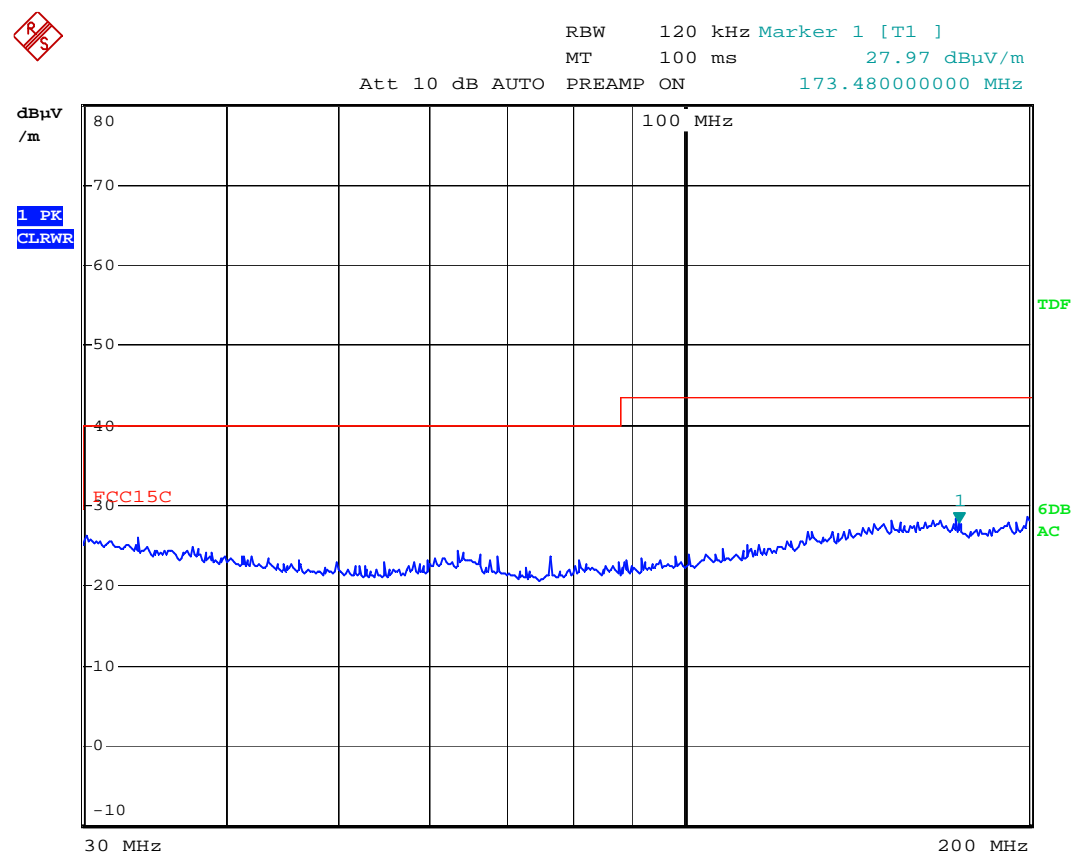
9kHz - 30MHz

Radiated emissions 30 – 1000 MHz.

Detector: Peak

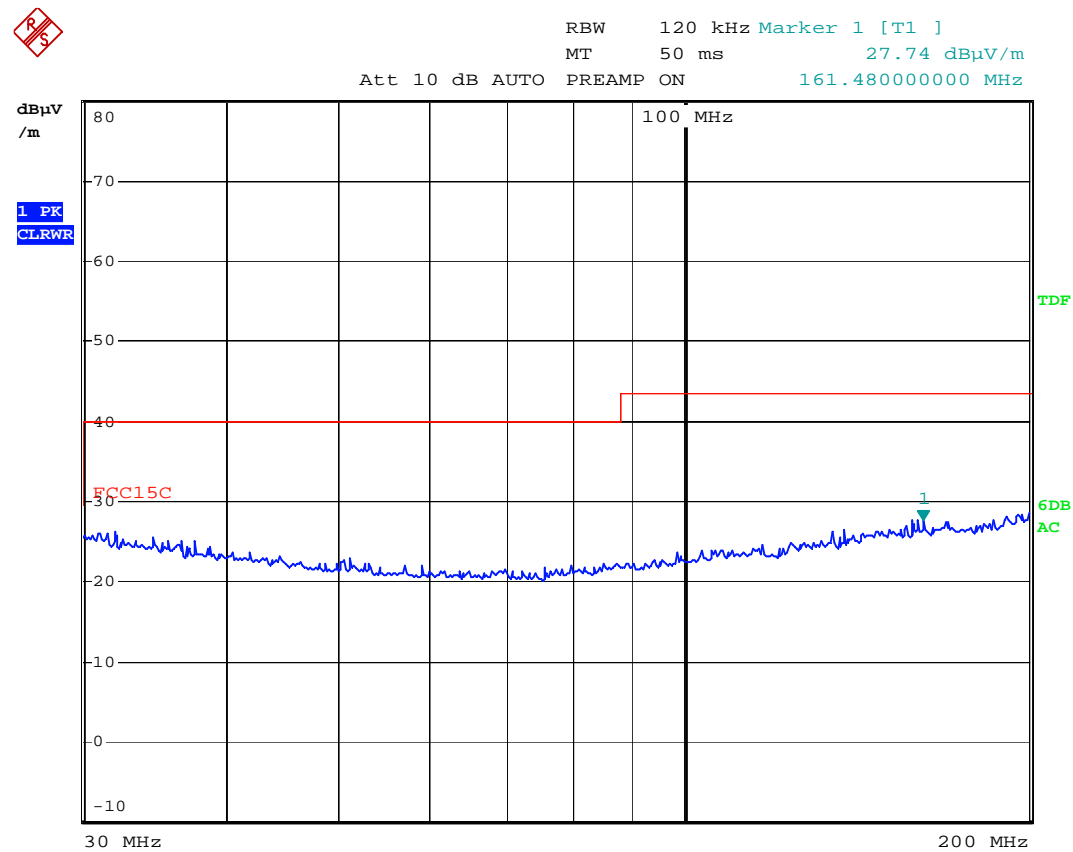
Measuring distance 3 m.

Frequency	Operational condition	Field strength	Measuring distance	Polarization	Limit FCC15.209	Margin
MHz		dBμV/m	m	-	dBμV/m	dB
173.48	TX ON	27.97	3	VP	43.5	20.93
161.48	TX ON	27.74	3	HP	43.5	15.76
442.35	TX ON	33.97	3	HP	46	12.03
486.75	TX ON	37.53	3	VP	46	8.47
575.45	TX ON	37.03	3	VP	46	8.97
763.95	TX on	41.33	3	VP	46	4.67



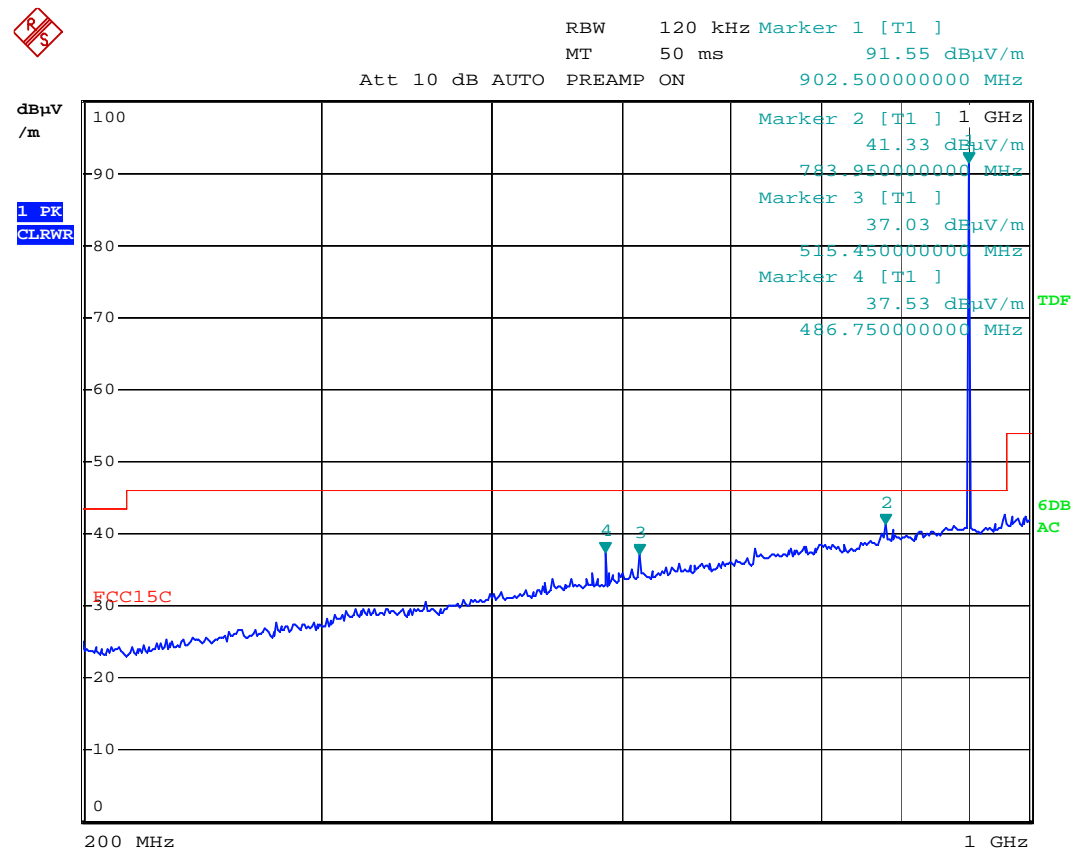
Date: 23.MAY.2011 10:32:17

VP – 30 – 200 MHz



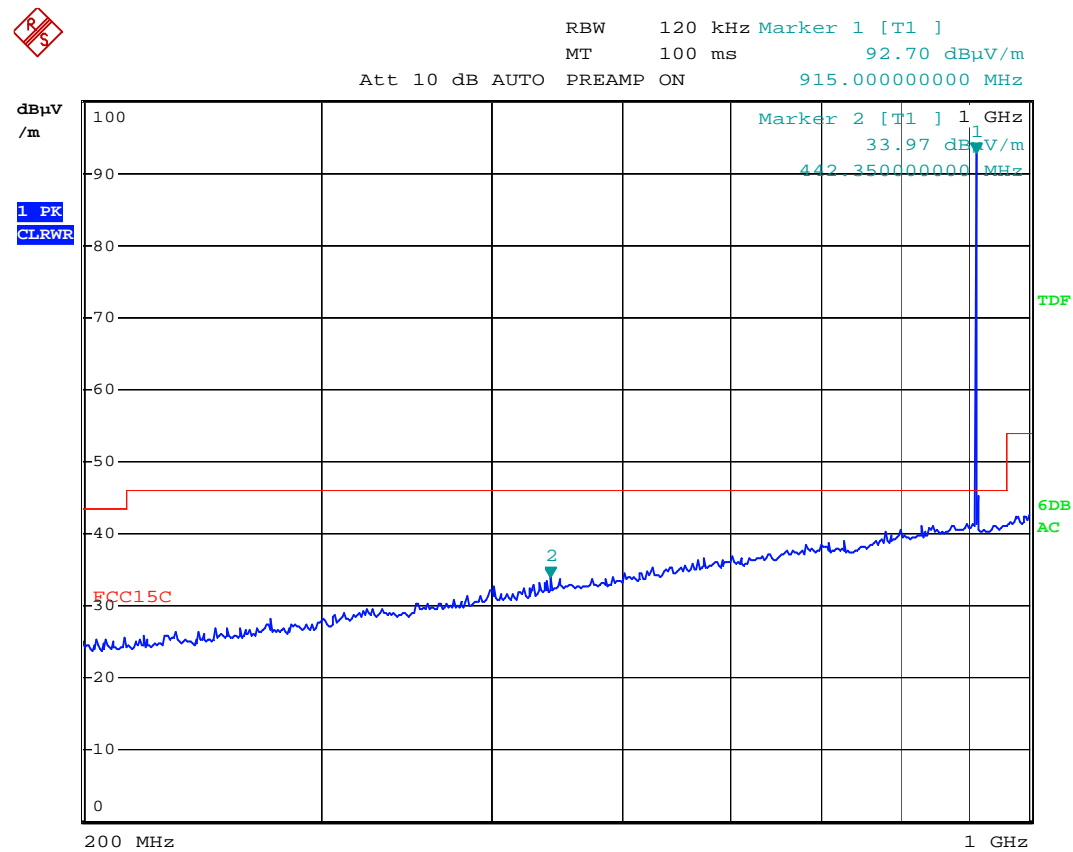
Date: 23.MAY.2011 10:36:26

HP – 30 – 200MHz



Date: 23.MAY.2011 09:41:02

VP – 200 – 1000GHz



Date: 23.MAY.2011 10:04:19

HP 200 – 1000MHz

4.7 Receiver Spurious Emissions (Conducted)

Para. No.: RSS-Gen (6)

Test Performed By: G.Suwanthakumar

Date of Test: 23.05.2011

Test Results: Complies

Measurement Data:

Conducted Emissions , 9kHz - 10 GHz, peak

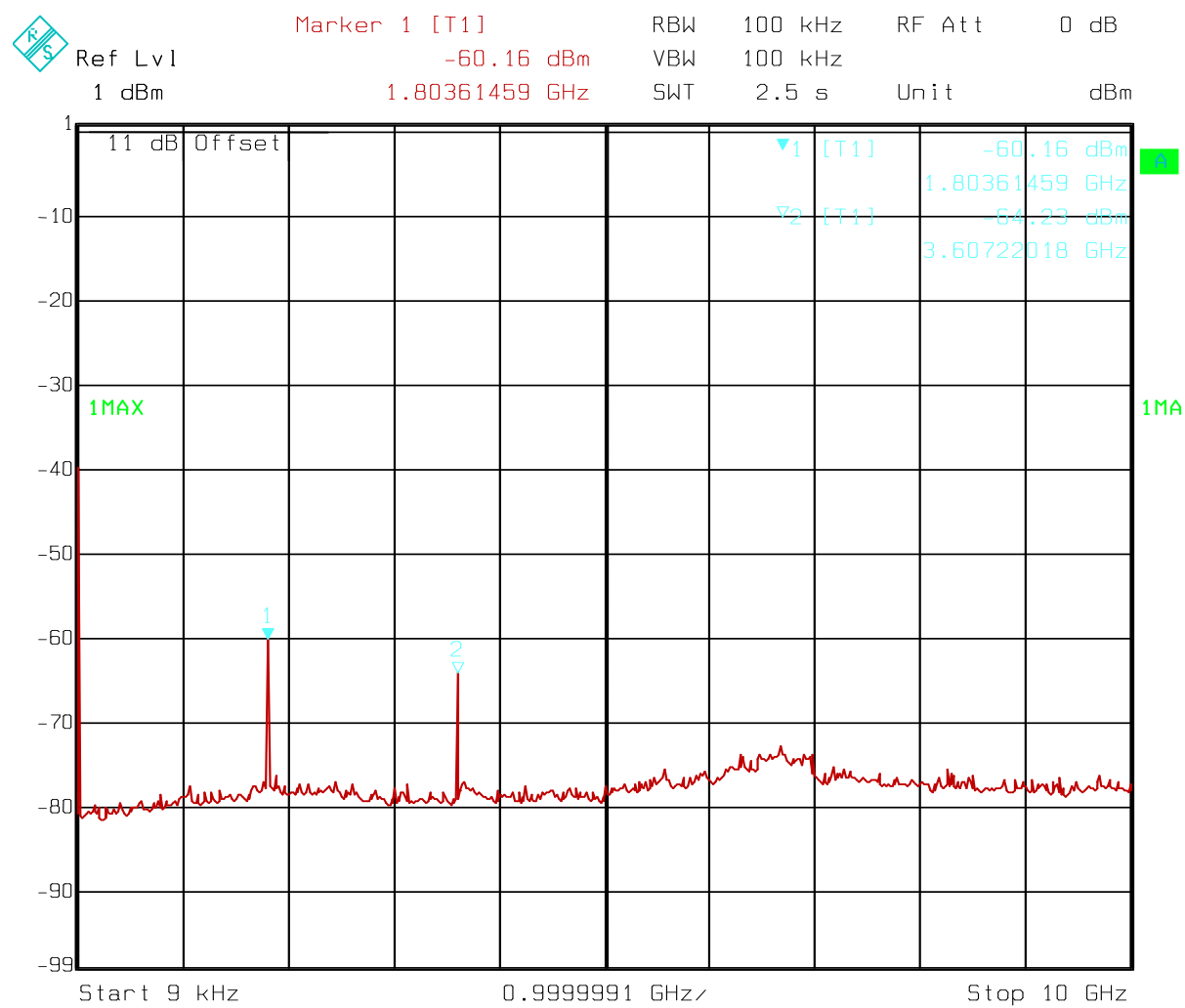
Measured with Peak Detector

Frequency	RF channel	Measured value	Limit	Margin
GHz	01,26,51	dBm	dBm	dB
1.803	01	-60.16	-53	7.16
3.607	01	-64.23	-53	11.23
1.823	26	-59.60	-53	6.60
3.647	26	-64.69	-53	11.69
1.843	51	-59.06	-53	6.06
3.707	51	-65.19	-53	12.19
>3.7 - 10	01,26,51	None detected	-57	-

VCO leakage detected from the receiver.

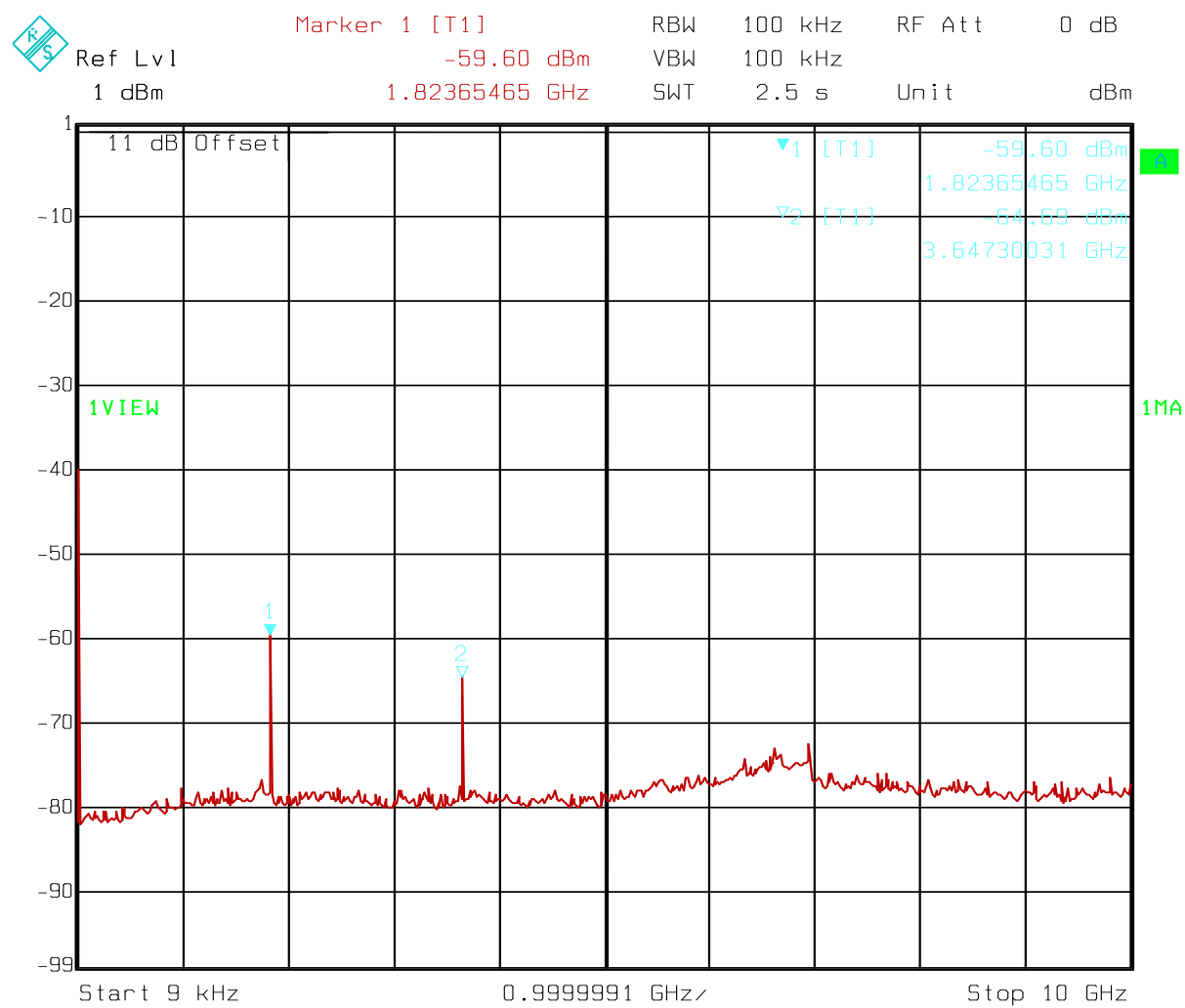
Requirement(conducted):

Receiver spurious emissions at any discrete frequency shall not exceed 2 nano watts in the band 30-1000 MHz, and 5 nano watts above 1000 MHz



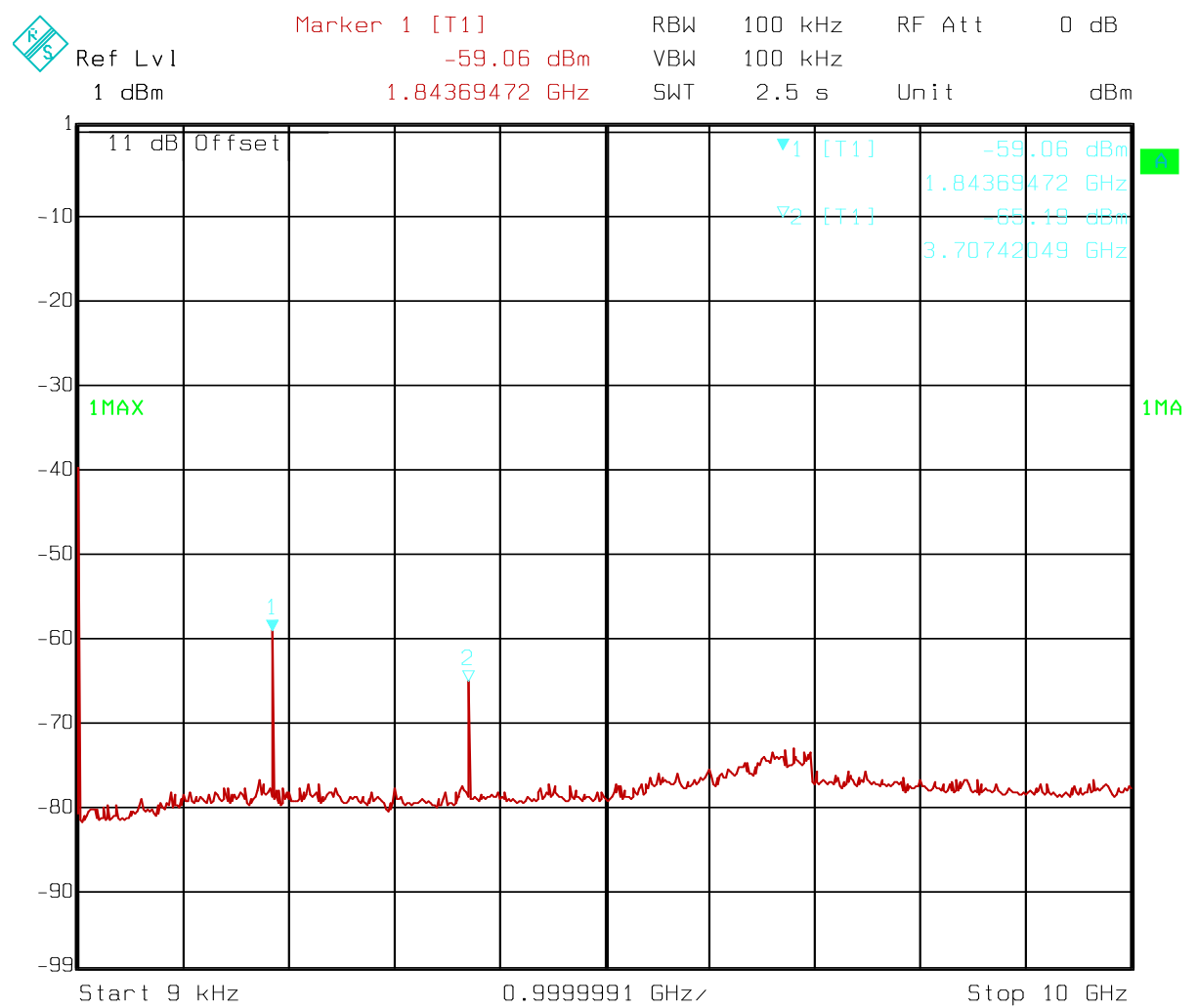
Date: 27.MAY 2011 08:13:45

RX: CH01 9kHz - 10GHz



Date: 27.MAY 2011 08:15:39

RX: CH26 9kHz - 10GHz



Date: 27.MAY 2011 08:16:52

RX: CH51 9kHz - 10GHz

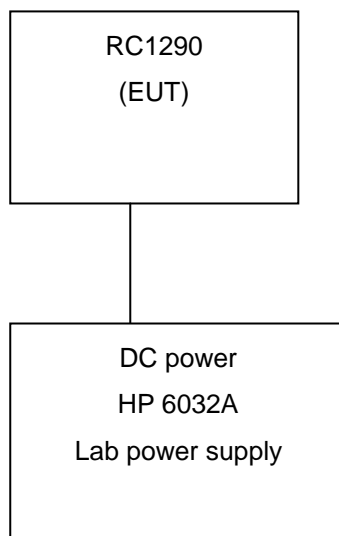
5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1.	ESCI	EMI Receiver	Rohde & Schwarz	N 4259	09.09.2010	09.09.2011
2.	FSEK 1088,3494,30	Spectrum Analyzer	R&S	1337	15.12.2010	15.12.2011
3.	3115	Antenna horn	EMCO	LR 1330	05.08.2010	05.08.2013
4.	643	Antenna horn	Narda	LR 093	26.01.2009	26.01.2012
5.	642	Antenna horn	Narda	LR 220	26.01.2009	26.01.2012
6.	PM7320X	Antenna horn	Sivers lab	LR 103	26.01.2009	26.01.2012
7.	DBF-520-20	Antenna horn	Systron Donner	LR 101	26.01.2009	26.01.2012
8.	638	Antenna horn	Narda	LR 098	26.01.2009	26.01.2012
9.	Sucoflex 102E	Cable microwave	Suhner	LR 1370	-	-
10.	6032A	Power supply	HP	LR 1062	-	-
11.	77	Multimeter, Digital	Fluke	LR155	03.11.2010	03.11.2011
12.	8449B	Amplifier	Hewlett Packard	LR 1322	04.08.2009	04.08.2011
13.	HFH2-Z2	Antenna loop	Rohde and Schwarz	LR 285	08.10.2010	08.10.2013
14.	10855A	Amplifier	Hewlett Packard	LR 1445	04.08.2010	04.08.2011
15.	HL223	Antenna log.per	Rohde & Schwarz	LR 1261	19.05.2010	09.05.2013
16.	HK116	Antenna biconic	Rohde & Schwarz	LR 1260	19.05.2010	09.05.2013
17.	ESN	Test Receiver	Rohde & Schwarz	LR 1237	16.09.2010	06.09.2011
18.	ESH3-Z3	LISN	Rohde & Schwarz	LR 1076	22.10.2009	22.10.2011
19.	B504D	Power supply	Oltronix	LR 534	-	-
20.	ESAI	EMI Receiver	Rohde & Schwarz	LR 1090/1089	14.04.2011	14.04.2012
21.	ESH3-Z2	Pulse Limiter	Rohde & Schwarz	LR 1074	03.03.2010	03.03.2012

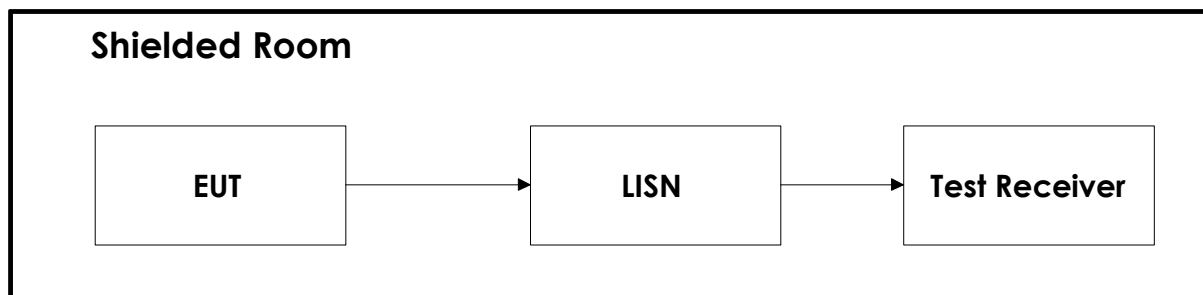
6 BLOCK DIAGRAM

6.1 System set up for radiated measurements



Test equipment: 2, 3, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18

6.2 Power line Conducted Emission



Test equipment: 17,18,19,20,21

6.3 Test Site Radiated Emission

