COMLAB
Accredited Testing and Certification
EMC, Radio and Telecommunications

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Test report : 04/750/2
Item tested : 13192-EVB
Type of equipment : WPAN transceiver
FCC ID : O2O13192-EVB
Client : Digianswer A/S

Tested according to :

FCC part 15.247
DTS Transmitter
2405 - 2480 MHz

Date of issue : 20 September 2004

Authorized by :

Kjell G. Haga
Managing Director

Frode Sveinsen
Technical Supervisor

CONTENTS

1 GENERAL INFORMATION 3
1.1 Test house Info 3
1.2 Client Information 3
1.3 Manufacturer 3
2 Test Information 4
2.1 Tested Item 4
2.2 Test Environment 4
2.3 Test Period 4
3 TEST REPORT SUMMARY 5
3.1 General 5
3.2 Test Summary 6
3.3 Description of modification for Modification Filing 6
3.4 Comments 6
3.5 Family List Rational 6
4 TEST RESULTS 7
4.1 Power line Conducted Emissions 7
4.2 Minimum 6 dB Bandwidth 10
4.3 Peak Power Output 13
4.4 Spurious Emissions (conducted scan up to 25 GHz) 16
4.5 Upper Band Edge Radiated Emissions 19
4.6 Out-of-band emissions (Radiated) 20
4.7 Power Spectral Density (PSD) 31
LIST OF TEST EQUIPMENT 34
5 BLOCK DIAGRAM 35
5.1 System set up 35
5.2 Power line Conducted Emission 35
5.3 Test Site Radiated Emission and peak power output 36

1 GENERAL INFORMATION

1.1 Test house Info

Name : Nemko Comlab AS

Address : Gåsevikveien 8, Box 96
N-2027 Kjeller, NORWAY

Telephone : +47 64 84 57 00

Fax : +47 64 84 57 05

E-mail: mailto:post@comlab.no

Managing Director: Kjell G. Haga

FCC test firm registration number : 994405

Industry Canada OATS registration number : 4443

1.2 Client Information

Name : Digianswer A/S

Address : Skalhuse 5, 9240 Nibe, Denmark

Telephone : +45 967 10 000

Fax : +45 983 50 052

Contact:

Name : Johnny Jonassen

Telephone : +45 967 12 153

E-mail : jjonas1@freescale.com

1.3 Manufacturer

Name : Digianswer A/S

Address : Skalhuse 5, 9240 Nibe, Denmark

Telephone : +45 967 10 000

Fax : +45 983 50 052

2 Test Information

2.1 Tested Item

Name :	13192-EVB
FCC ID :	O2O13192-EVB
Model/version :	13192-EVB
Serial number :	Marked on PCB “13192-EVB”
Hardware identity and/or version:	80000528000_R0203
Software identity and/or version :	PTC Version 1.00
Frequency Range :	2405 - 2480 MHz
Tunable Bands :	1
Number of Channels :	16[1]
Modulation :	0-QPSK
Emissions Designator :	G1D
User Frequency Adjustment :	None, Software controlled.
Rated Output Power :	10 mW

1) 16 channels in use.

Theory of Operation

The MC13192-EVB is a “WPAN” low data rate wireless device according to IEEE 802.15.4 (Zigbee), with 5 MHz channel bandwidth.

2.2 Test Environment

2.2.1 Normal test condition

Temperature: 20 - 25 °C

Relative humidity: 25 - 50 %

Normal test voltage: 115 V AC

The values are the limit registered during the test period.

2.3 Test Period

Item received date: 2004-08-23

Test period : from 2004-08-24 to 2004-08-30

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Digianswer A/S

Model No.: 13192-EVB

Serial No.: Marked on PCB "13192-EVB"

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC §15.247 for Digital Modulation devices. Radiated tests were conducted in accordance with ANSI C63.4-1992.

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".

COMLAB

NEMKO COMLAB REF: 04/750/2

TESTED BY: _____ DATE: **30 Aug 2004**

G.Suhanthakumar, Test engineer

3.2 Test Summary

Name of test	Paragraph #	Result
Supply voltage variations	15.31 (e)	Complied[2]
Number of operating frequencies	15.31 (m)	Complied
Conducted Emission (Receiver)	15.107(a)	ref. 15.207(a)
Radiated Emission limits (receiver)	15.109(a)	ref. 15.209(a)
Antenna requirement	15.203	Complied
Radiated emissions limits for restricted bands	15.205(a)	Complied
Power line Conducted Emission	15.207(a)	Complied
Radiated emission limits	15.209(a)	Complied
Bandwidth	15.247(a)(2)	Complied
Peak Power Output	15.247(b)(3)	Complied
Power Spectral Density	15.247(d)	Complied
Out-of-band emissions (Antenna Conducted)	15.247(c)	Complied[1]
Out-of-band emissions (Radiated)	15.247(c)	Complied

[1] The tested equipment has integrated antennas only, but is fitted with a SMA connector that is disabled by default but can be enabled for test and development purposes.

Power supply variation within 85 % to 115% of nominal value has been checked and has no influence on the measured values

3.3 Description of modification for Modification Filing

Not Applicable.

3.4 Comments

The channels are selected with a laptop PC connected to the EUT. The laptop and the software for communication/test mode is delivered for testing by the manufacturer. The laptop is only used for selection of channels. The measurements are performed at channels near top ch 11, near middle ch 19 and near bottom ch 26. And the output level is set to maximum in the software (code 00FF)The EUT complies at these channels.

The measurements are done with AC adapter. All ports were populated during spurious emissions measurements.

The board is fitted with a 50 ohm SMA connector that is disabled by default but can be enabled by moving a capacitor. In the default position the SMA connector is disabled and the integrated antenna is enabled.

The EUT is a development kit that will be sold only to developers and not to end-users. The antenna connector is there to make it easier for developers to make measurements on the board.

3.5 Family List Rational

None.

4 TEST RESULTS

4.1 Power line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: G.Suhanthakumar	**Date of Test: 25 Aug 2004**

Measurement procedure: CISPR 22 1997 Clause 5.1 Class B ITE using 50 μH/50 ohms LISN.

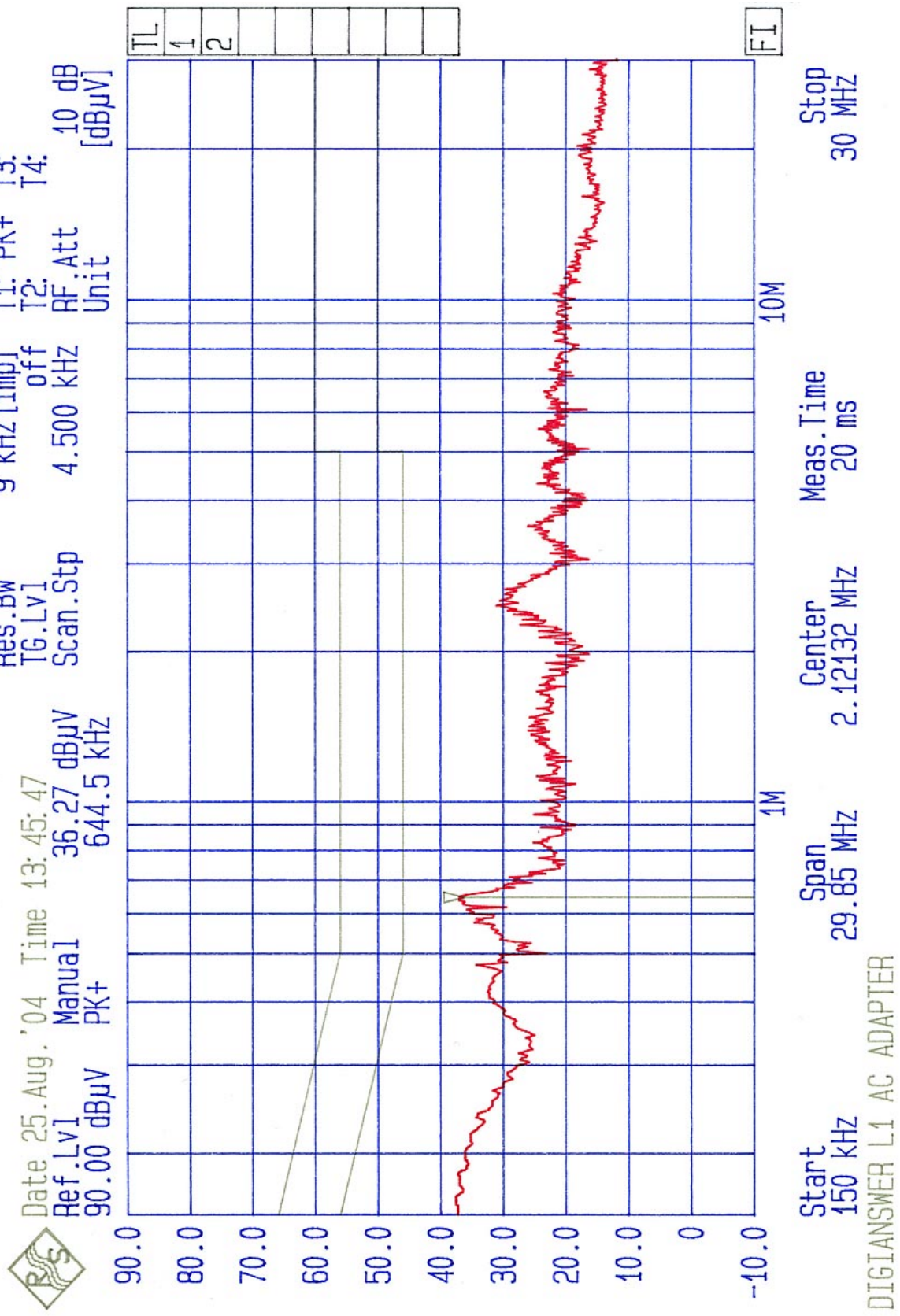
Test Results: **Complies.**

Measurement Data: **See attached graph, (Peak detector).**

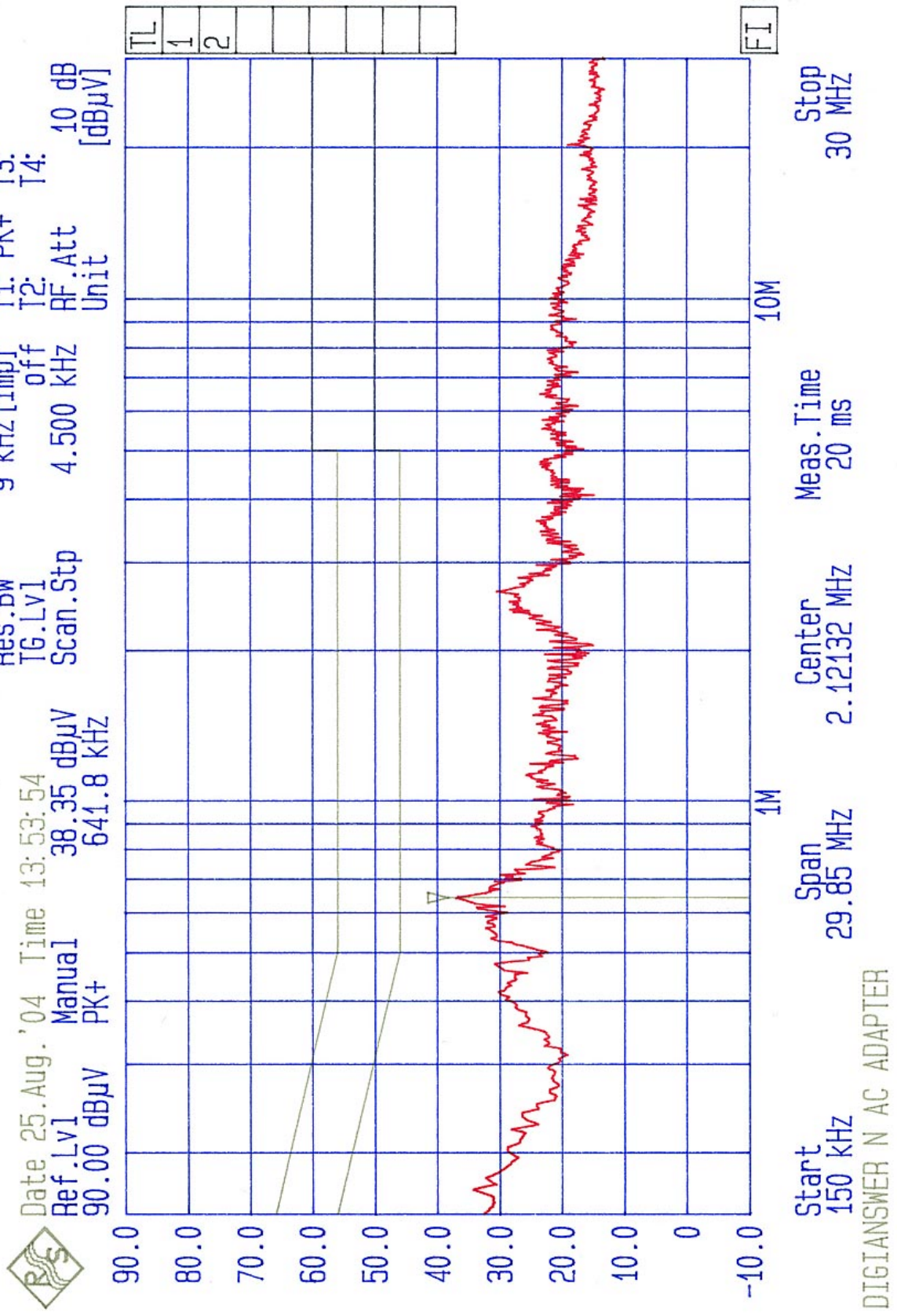
Highest measured value: for AC adapter

Frequency	Line	Detector	Measured value	Limit	Margin
MHz	L1/ N	Peak/QP/AV	dBμV	dBμV	dB
0.644	L1	QP	36.8	56	17.2
0.644	L1	AV	36.3	46	17.7
0.641	N	QP	38.2	56	17.8
0.641	N	AV	38.0	46	18.0

Test equipments used: 2, 4 & 16



AC adapter, phase L1



AC adapter, phase N

4.2 Minimum 6 dB Bandwidth

Para. No.: 15.247 (a)(2)

Test Performed By: G.Suhanthakumar	**Date of Test: 26. Aug 2004**

Test Results: Complies

Measurement Data:

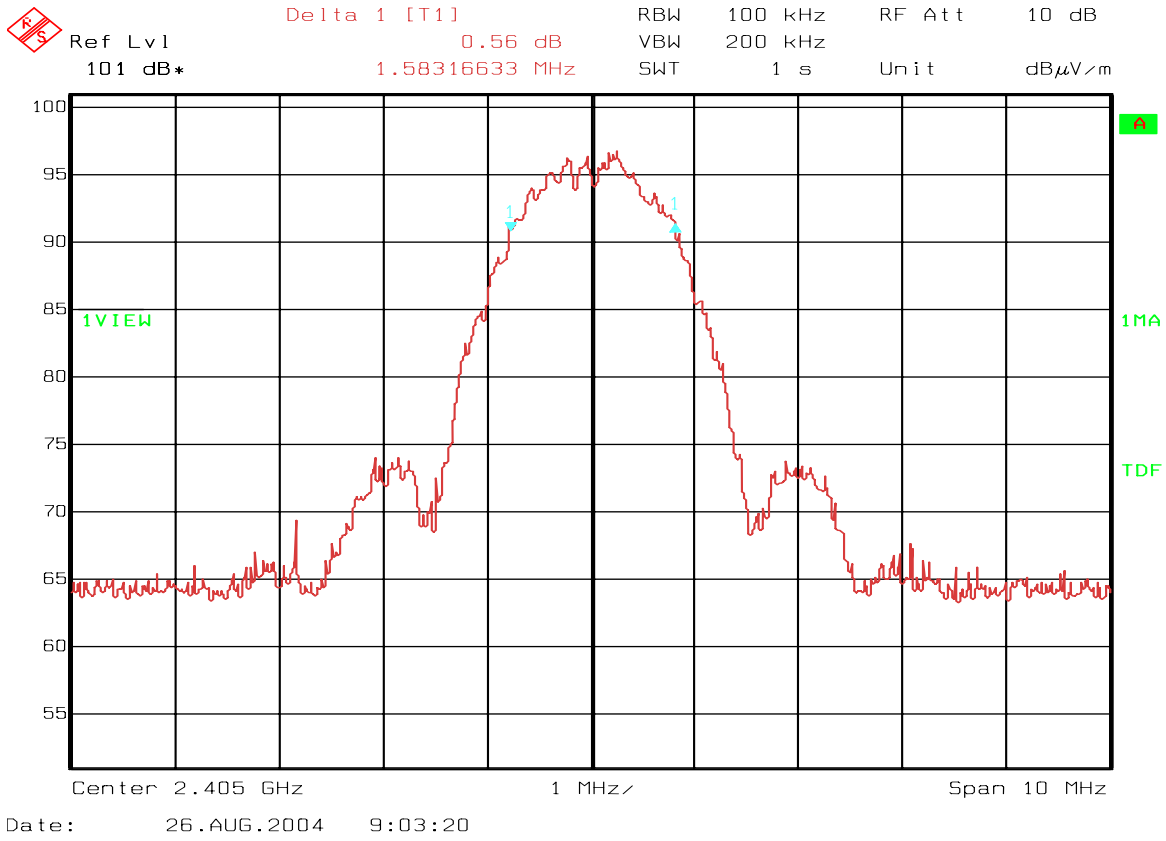
6 dB Bandwidth (MHz)		
Ch 11	**Ch 19**	**Ch 26**
1.64	1.60	1.68

Power supply variation within 85 % to 115% of nominal value has no influence on measured value.

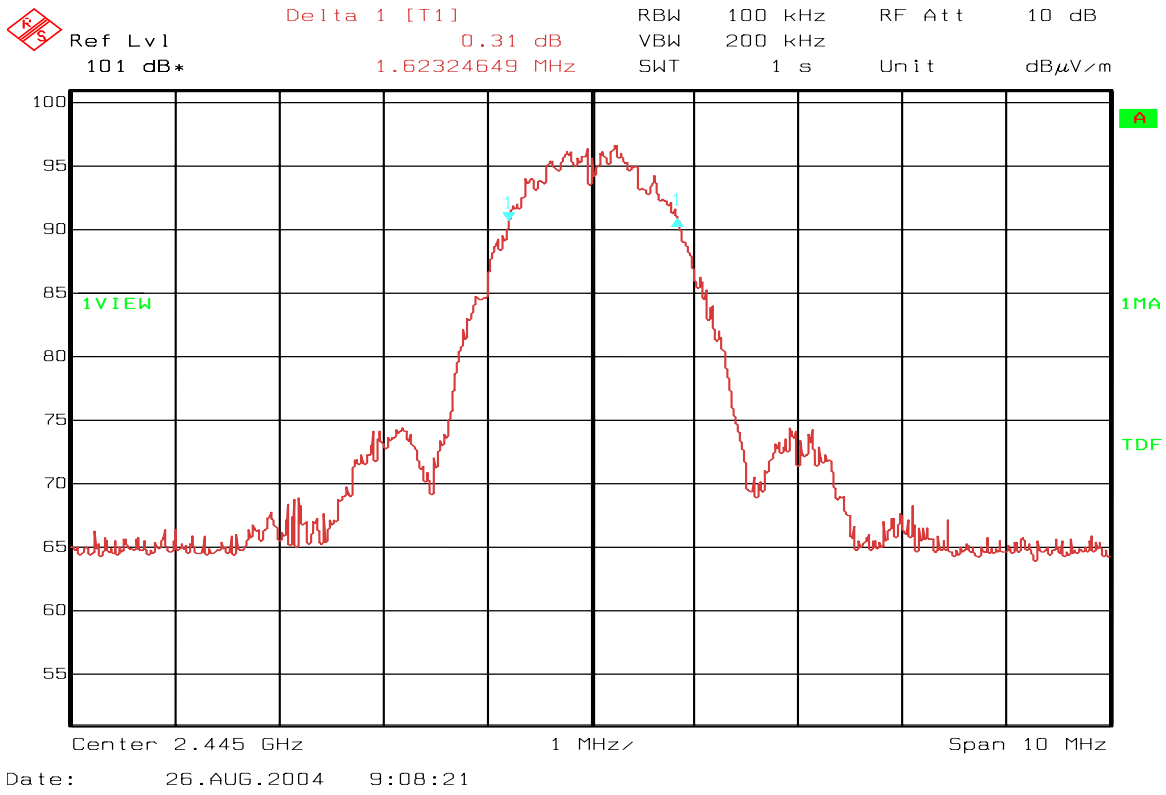
Requirements:

The minimum 6 dB bandwidth shall be at least 500 KHz.

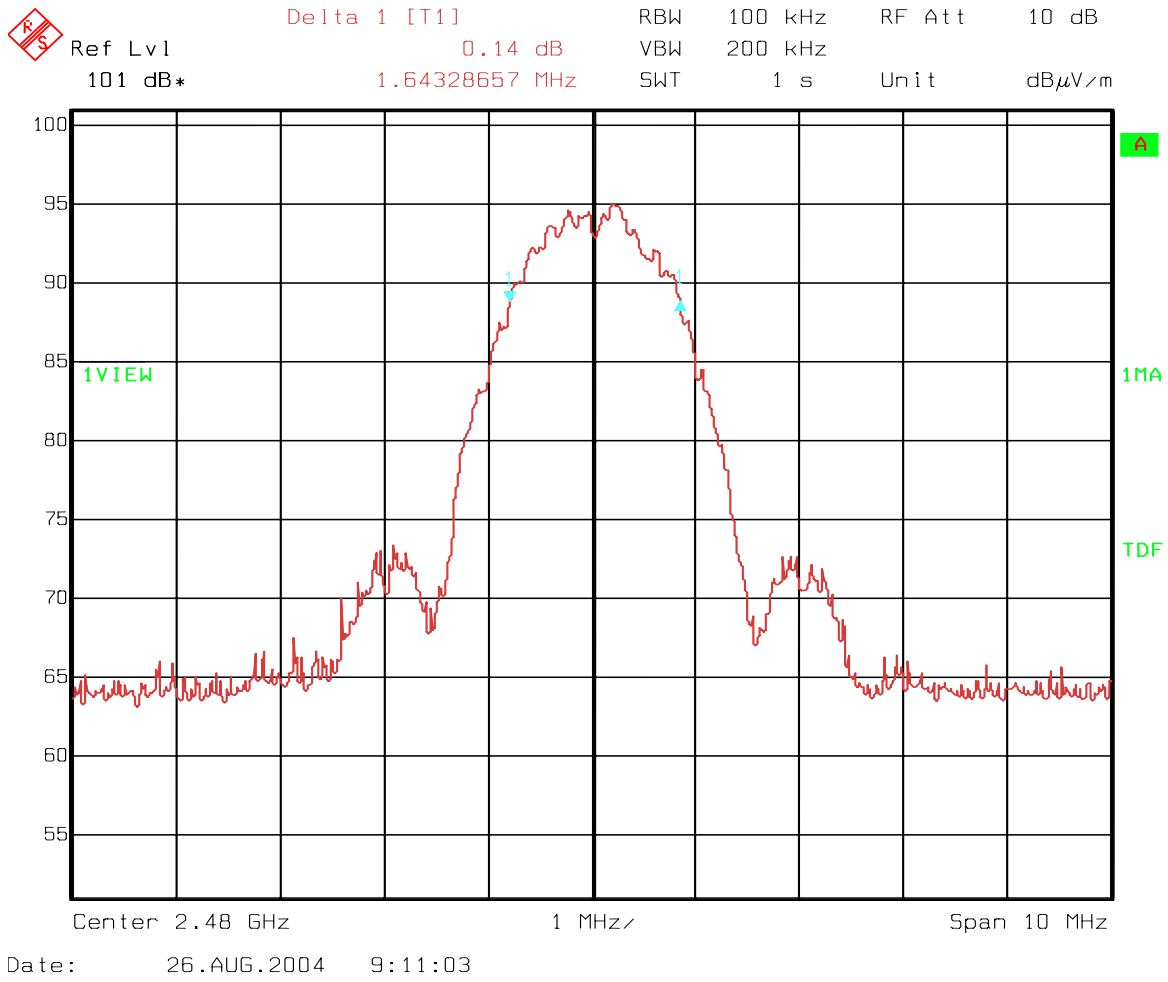
Test equipments used: 1, 3, 12 & 19



Ch 11, 6 dB bandwidth - 1.58 MHz



Ch 19, 6 dB bandwidth - 1.62 MHz



Ch 26, 6 dB bandwidth - 1.64 MHz

4.3 Peak Power Output

Para. No.: 15.247 (b)

Test Performed By: G.Suhanthakumar	**Date of Test: 28.Aug 2004**

Test Results: Complies

Measurement Data:

Maximum Conducted Peak Output Power, mW:

RF channel	11	19	26
Conducted	13.3	7	6

Maximum EIRP, mW:

RF channel	11	19	26
EIRP with integrated antenna	11.5	10.5	8.2
Antenna gain for integrated antenna dBi	–0.6	1.8	1.4

Antenna gain = 10*log(EIRP/Conducted power) dBi

EIRP is obtained as shown below:

Measurement Data (Radiated measurements):

The maximum field strength of fundamental, RBW = 10MHz, Ch 11 : 105.83 dBμV/m

The maximum field strength of fundamental, RBW = 10MHz, Ch 19 : 105.44 dBμV/m

The maximum field strength of fundamental, RBW = 10MHz, Ch 26 : 104.35 dBμV/m

Calculated Data:

- The maximum field strength of fundamental in V/m ($10^{((105.83)/20)}$ x 1^{-6}) Ch 11: 0.196 V/m
- The maximum field strength of fundamental in V/m ($10^{((105.44)/20)}$ x 1^{-6}) Ch 19: 0.187 V/m
- The maximum field strength of fundamental in V/m ($10^{((104.35)/20)}$ x 1^{-6}) Ch 26: 0.165 V/m

Calculated maximum EIRP using free field formula:

- Ch11: P(EIRP) watts: $(3x\ 0.196)^2 / 30 = 11.5$ mW
- Ch19: P(EIRP) watts: $(3x\ 0.187)^2 / 30 = 10.5$ mW
- Ch26: P(EIRP) watts: $(3x\ 0.165)^2 / 30 = 8.2$ mW

See attached graph for conducted power.(During the conducted peak power measurements a 10 dB attenuator is used. The total loss with cable is +10.54 dB.)

Antenna connector on the unit is SMA (50 ohm).

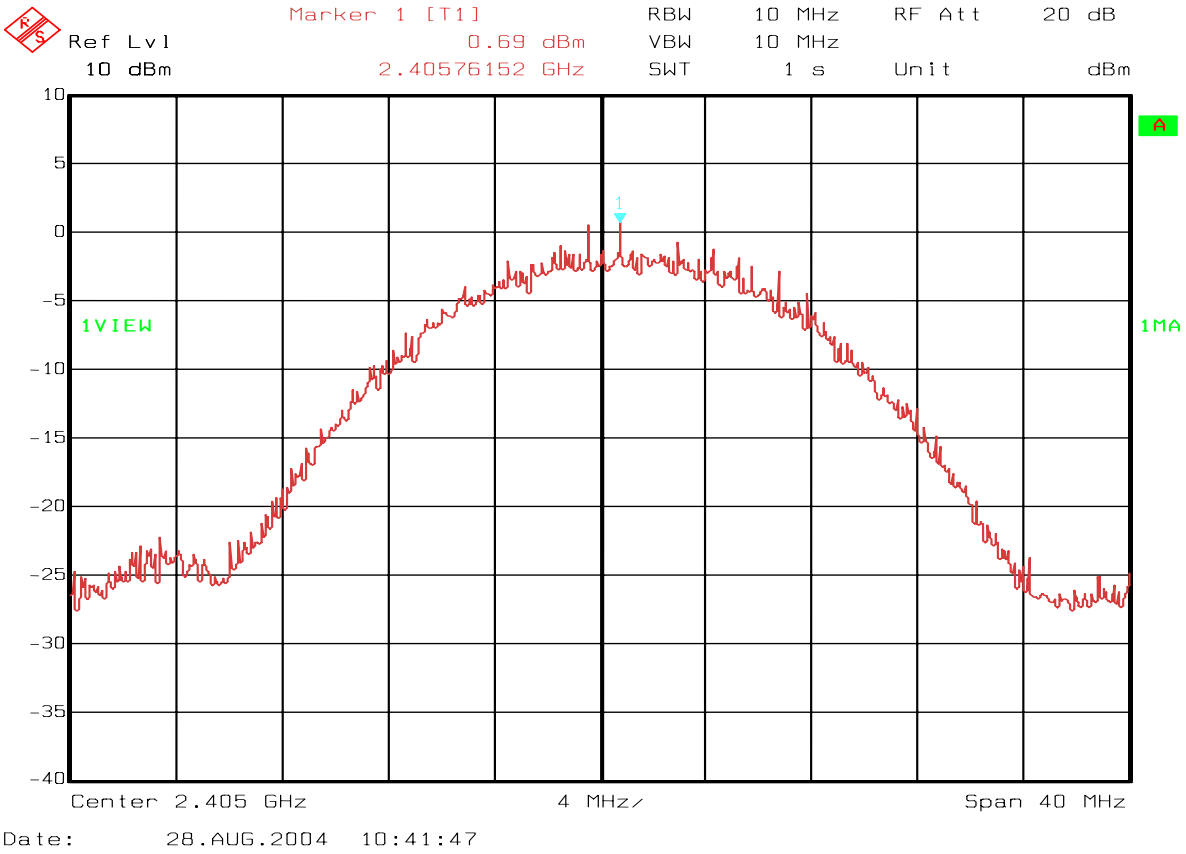
Power supply variation within 85 % to 115% of nominal value has no influence on measured values.

Requirements:

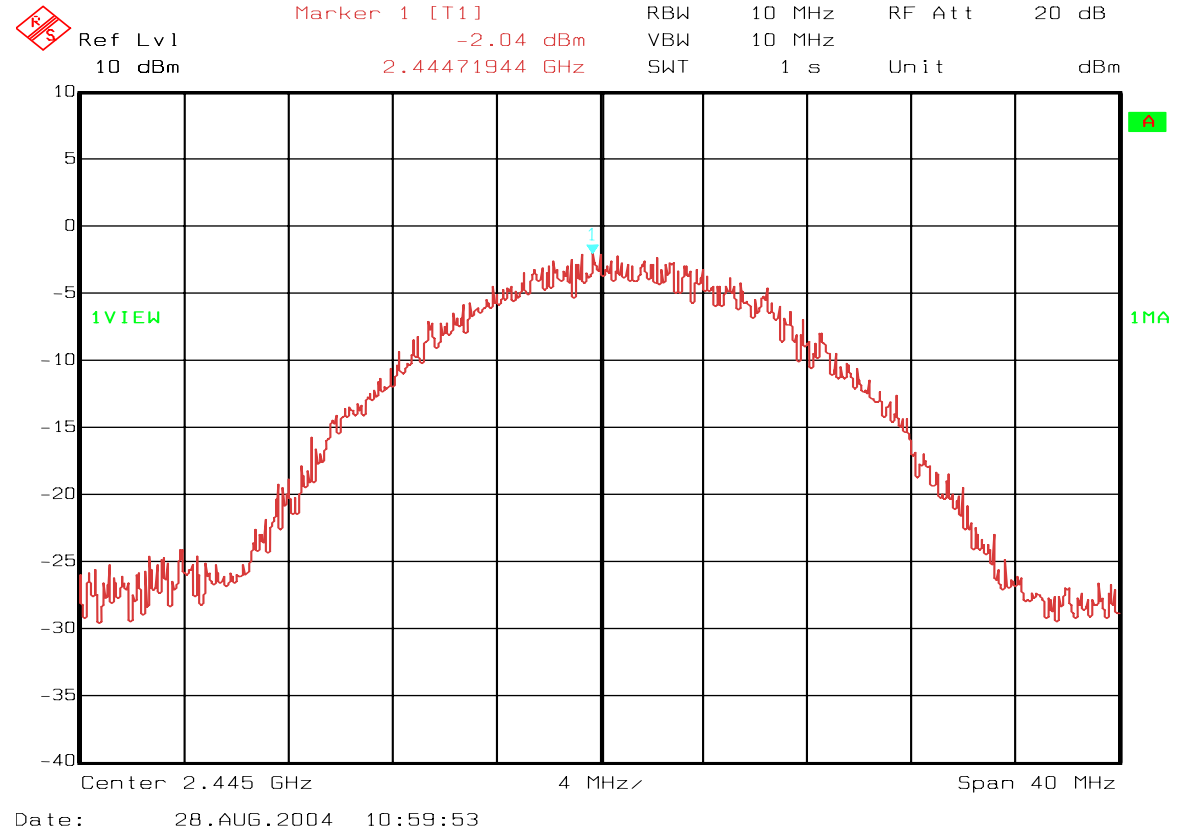
The maximum peak output power for DS systems shall not exceed the following limits:

For systems using Digital Modulation in the 2400 - 2483.5 MHz band: less than or equal to 1 watt

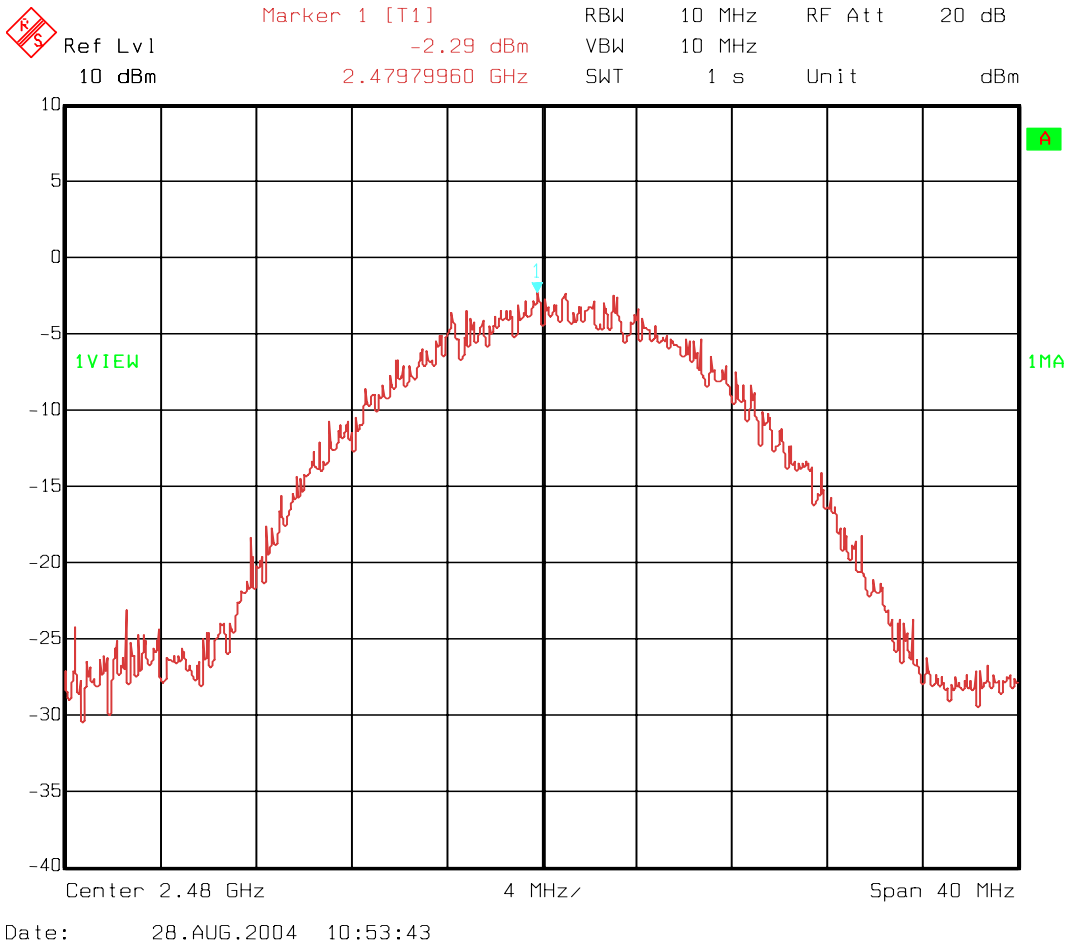
Test equipments used: 1, 21, 3, 7,8,9,10,11,12,17,18 , 19 & 20



Ch 11, Peak output power - conducted(without cable and 10 dB correction)



Ch 19, Peak output power -conducted(without cable and 10 dB correction)



Ch 26, Peak output power -conducted(without cable and 10 dB correction)

4.4 Spurious Emissions (conducted scan up to 25 GHz)

Para. No.: 15.247 (c)

Test Performed By: G.Suhanthakumar	**Date of Test: 27 Aug. 2004**

Test Results: Complies

Measurement Data:

RF conducted power to 10 GHz see attached graph.

Maximum RF level outside operating band:

RF ch 11: -26.3 dB/C, margin 6.3 dB, 3 rd harmonic

RF ch 19: -29.7 dB/C, margin 9.7 dB, 2 nd harmonic

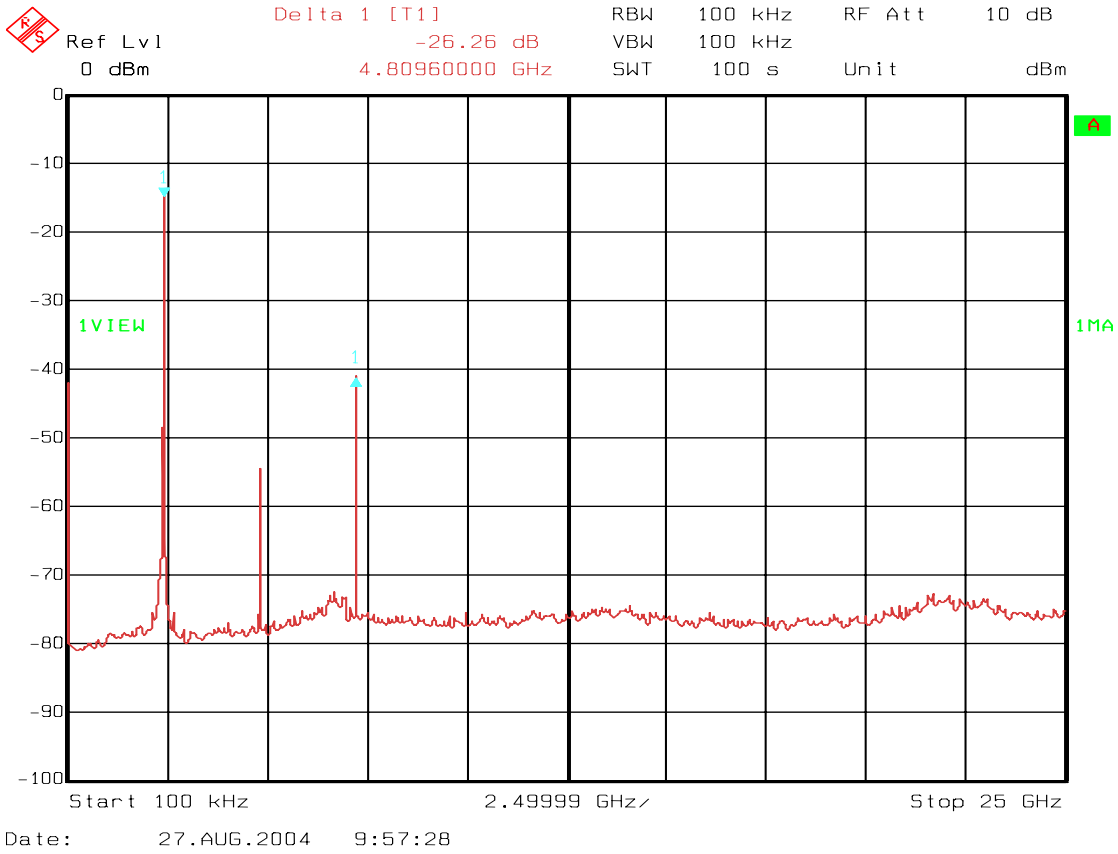
RF ch 26: -48.5 dB/C, margin 28.5 dB, 3 rd harmonic

Power supply variation within 85 % to 115% of nominal value has no influence on measured value

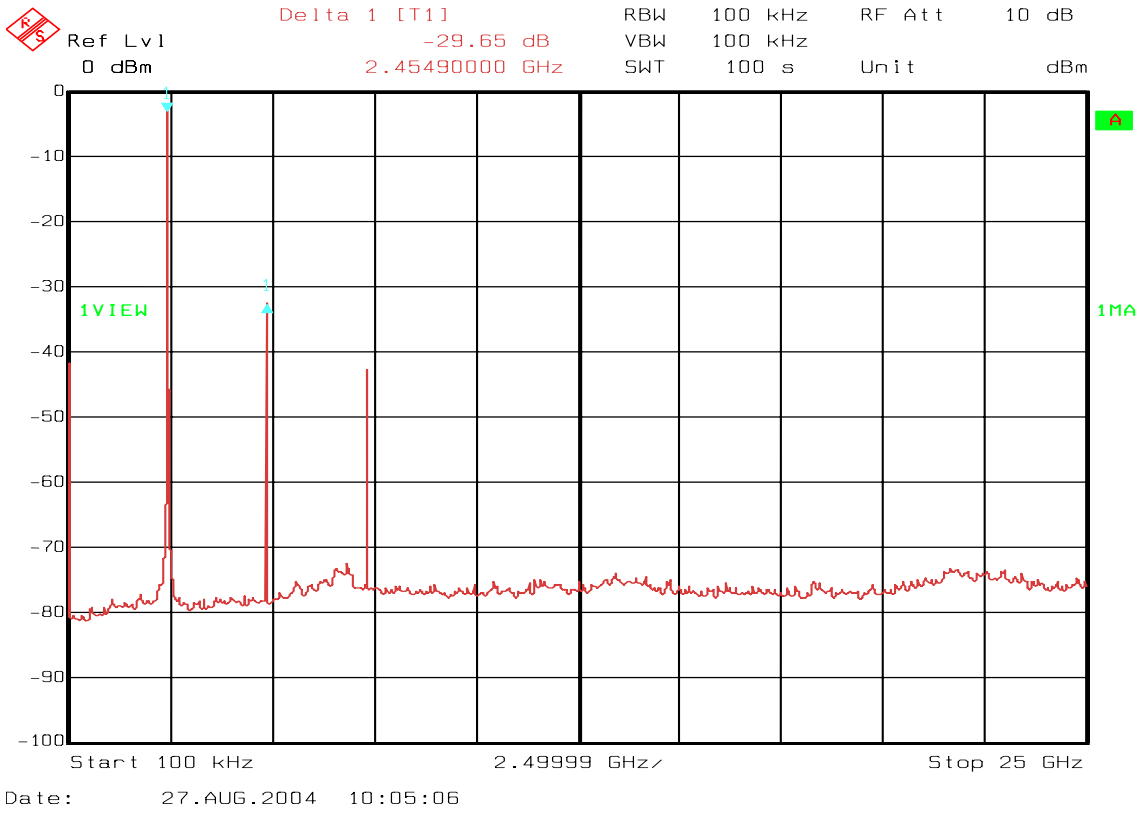
Requirements:

Not greater than –20dBc

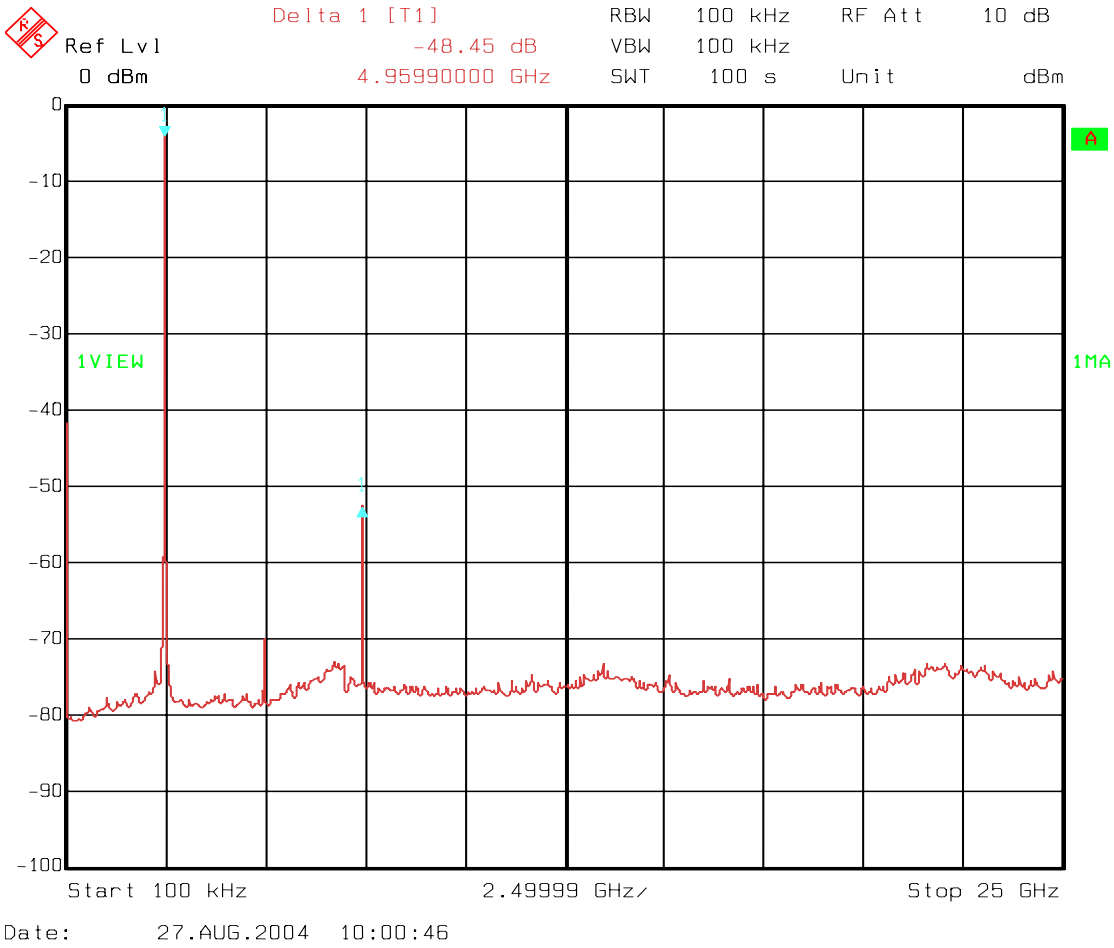
Test equipments used: 1, 21



Ch 11, RF conducted spurious



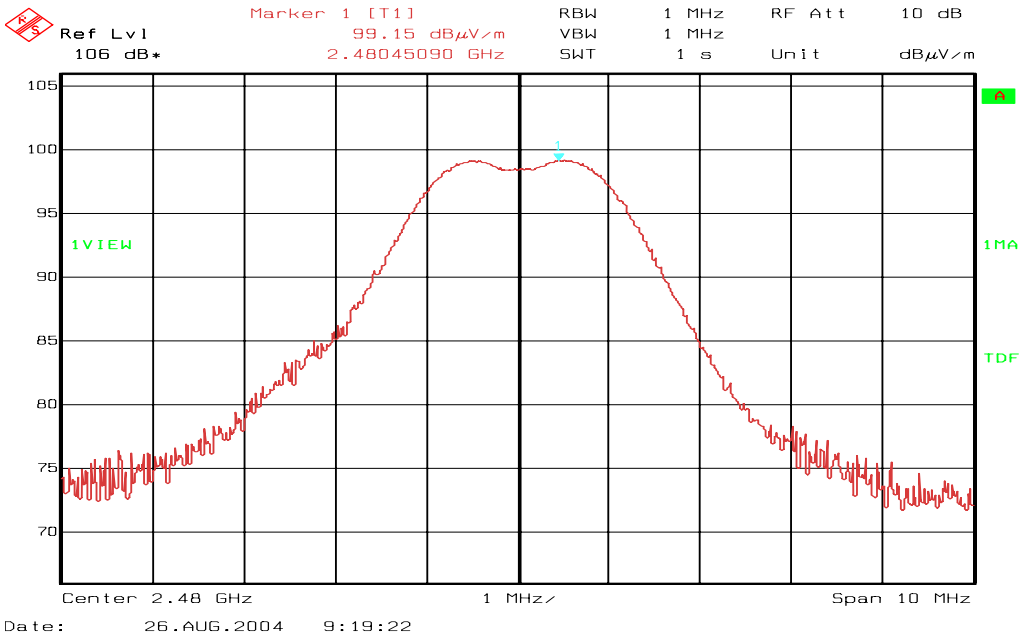
Ch 19, RF conducted spurious



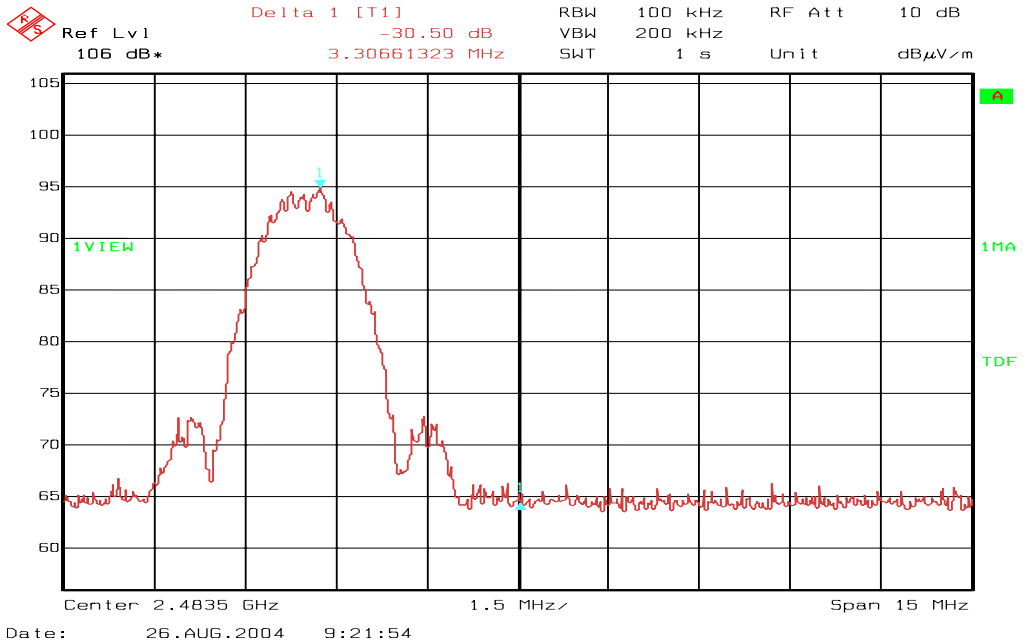
Ch 26, RF conducted spurious

Upper Band Edge Radiated Emissions according to the "Marker-Delta Method"

Calculate at the upper band edge (at 2483.5 MHz) when the equipment is transmitting on channel 26. The measurements were performed at 3 meters.



Peak field strength at 2.480GHz, ch 26



Marker delta , ch 26, Upper Band Edge

Peak Field Strength: 99.2 dBµV/m

Marker Delta 100kHz RBW: 30.5 dB

Therefore:

Peak Field Strength 99.2 - 30.5 = 68.7 dBµV/m

Average Field Strength: 68.7 dBµV/m - 20.0 dB = 48.7 dBµV/m

4.5 Out-of-band emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: G.Suhanthakumar	**Date of Test: 26. Aug 2004**

Test Results: complies

Measurement Data:

Radiated emission (Integrated ant), 1-25 GHz, see attached table.

Highest value RF Ch 11: Peak 57.3 dBμV/m, average 40.6 dBμV/m, 7.216 GHz

Ch 19: Peak 59.2 dBμV/m, average 44.4 dBμV/m, 7.333 GHz

Ch 26: Peak 59.1 dBμV/m, average 44.2 dBμV/m, 7.441 GHz

No components above 8 GHz were detected

Duty Cycle Calculation:

RF duty cycle: Calculation according to RF burst Para 15.35 (c)

20*log (1.9ms/29.8ms) = -23.9 dB

Maximum duty cycle according to Para 15.35 (b): -20 dB

This value is used when measuring average field strength above 1 GHz with Peak Detector function employed on the spectrum analyzer.

Example of frequency graph of radiated emission is also attached.

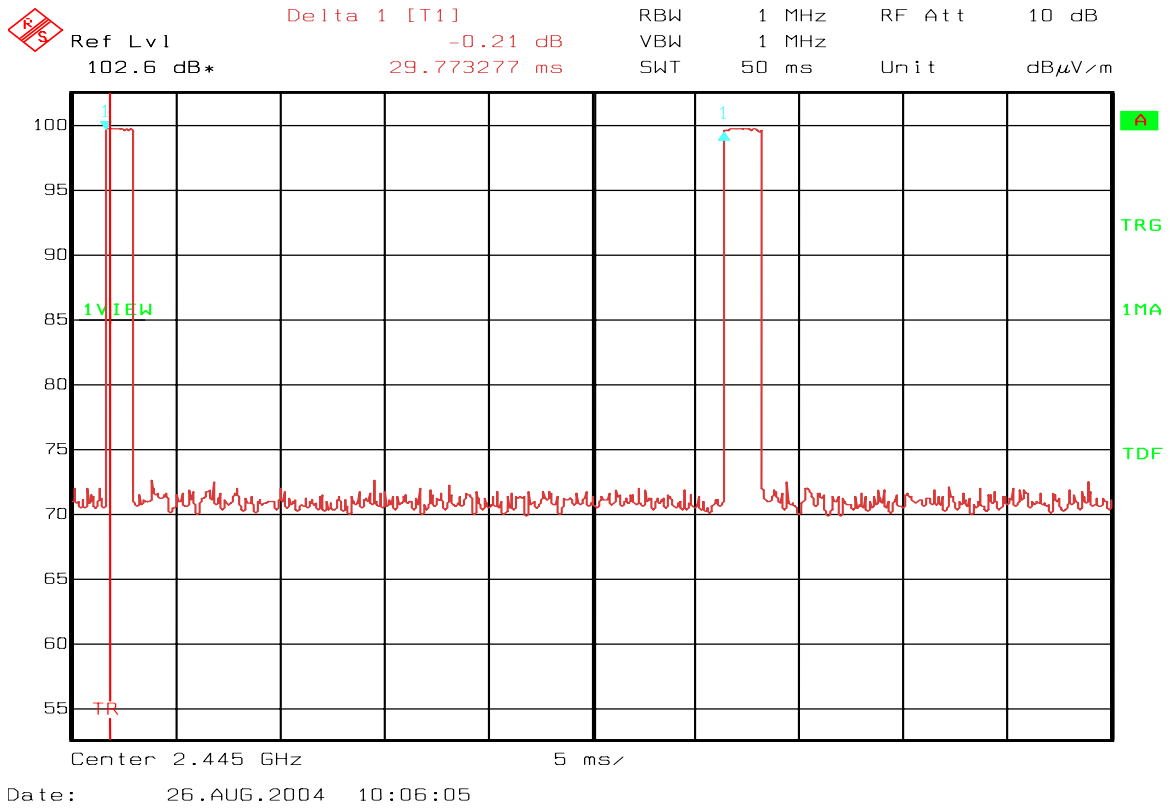
Antenna factor, amplifier gain and cable loss are included in the spectrum analyzer "Transducer factor".

Power supply variation within 85 % to 115% of nominal value has no influence on measured value

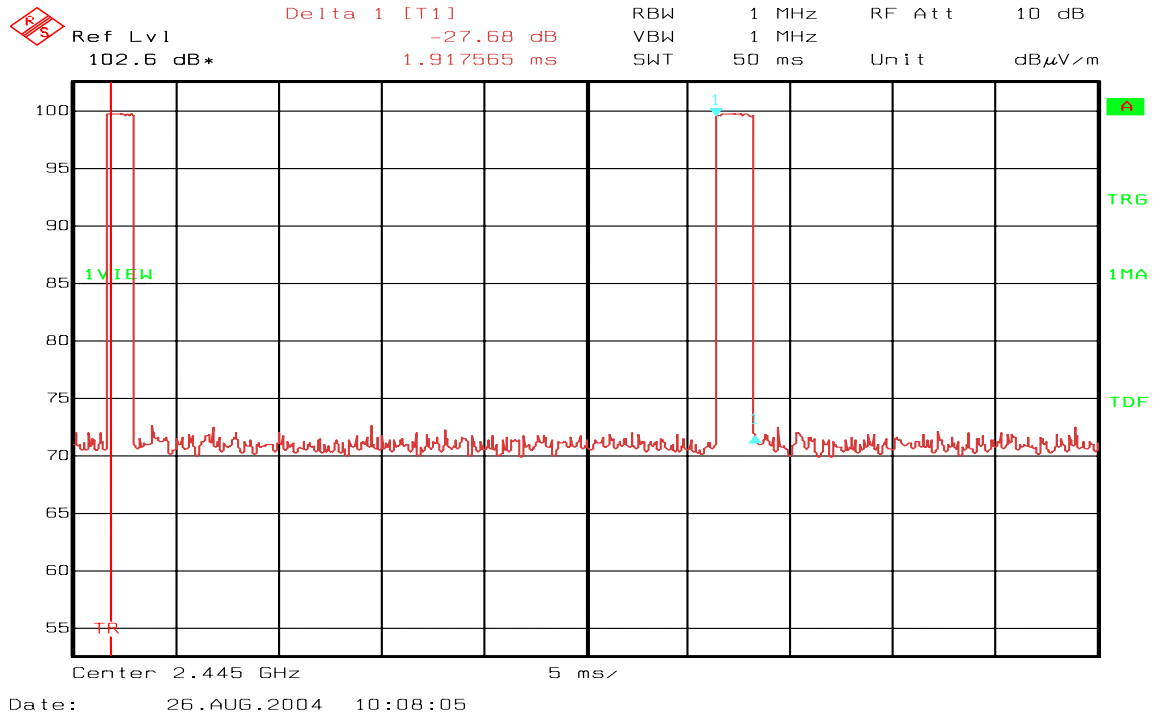
Requirements:

See section 15.205 , 15.35(b) and (c)

Test equipments used: 1, 3, 7,8,9,10,11,12,17,18 , 19 & 20



OFF time



ON time

Radiated Emission 1 – 25 GHz, Peak

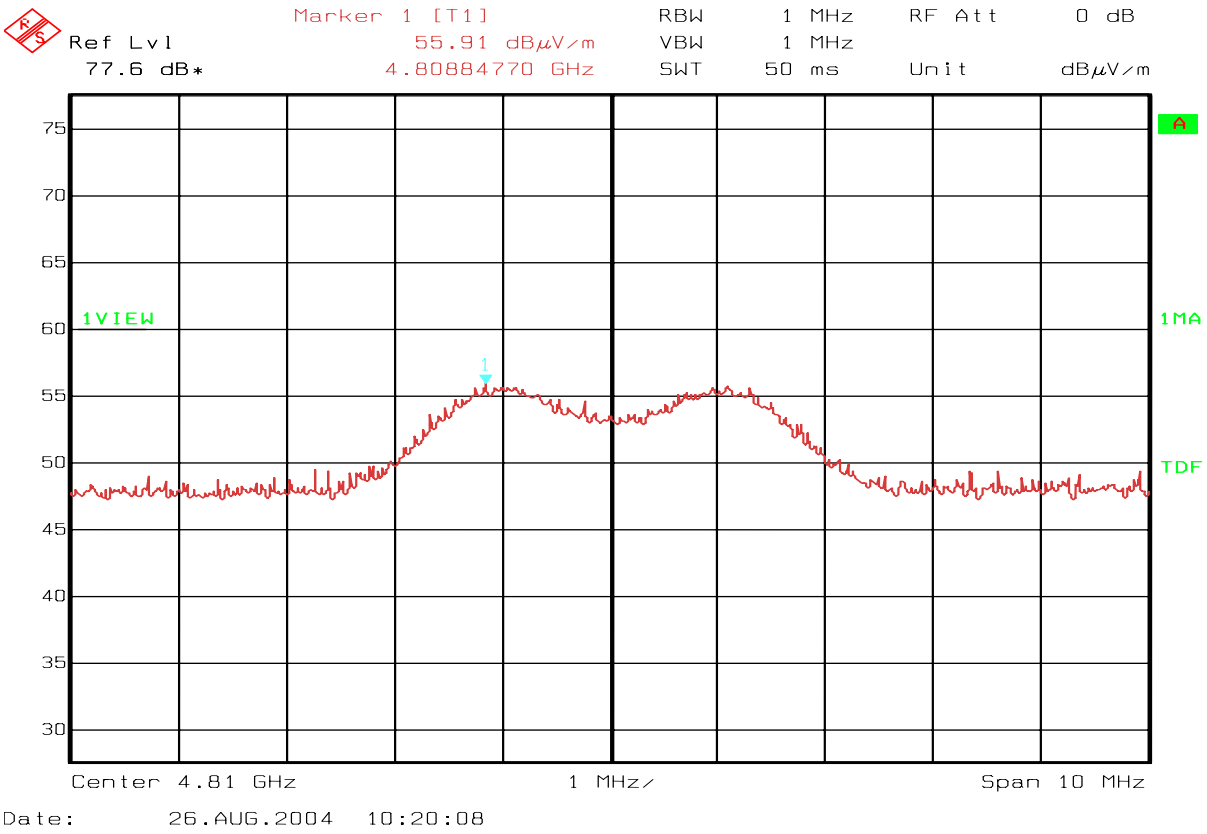
Measured with Peak Detector

Frequency	RF channel	Dist. corr. factor	Field strength, Peak, 3m	Duty cycle corr. factor	Limit	Margin
GHz	11-26	dB	dBμV/m	dB	dBμV/m	dB
4.808	11	0	55.9	-	74	18.1
4.889	19	0	52.5	-	74	21.5
4.961	26	0	51.4	-	74	22.6
7.216	11	0	57.3	-	74	16.7
7.333	19	0	59.2	-	74	14.8
7.441	26	0	59.1	-	74	14.9
7.5 -24	11	0	None detected	-	74	-
7.5 -24	19	0	None detected	-	74	-
7.5 - 24	26	0	None detected	-	74	-

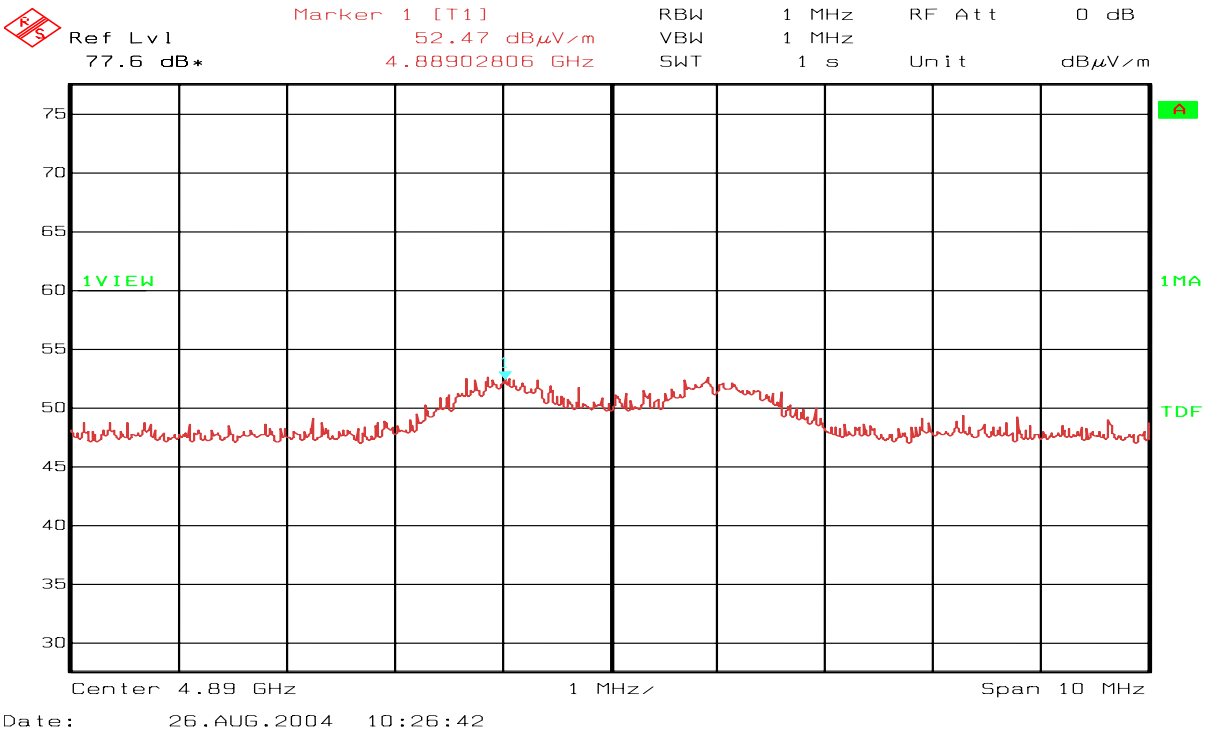
Radiated emission 1- 25 GHz, Average

Measured with Peak Detector

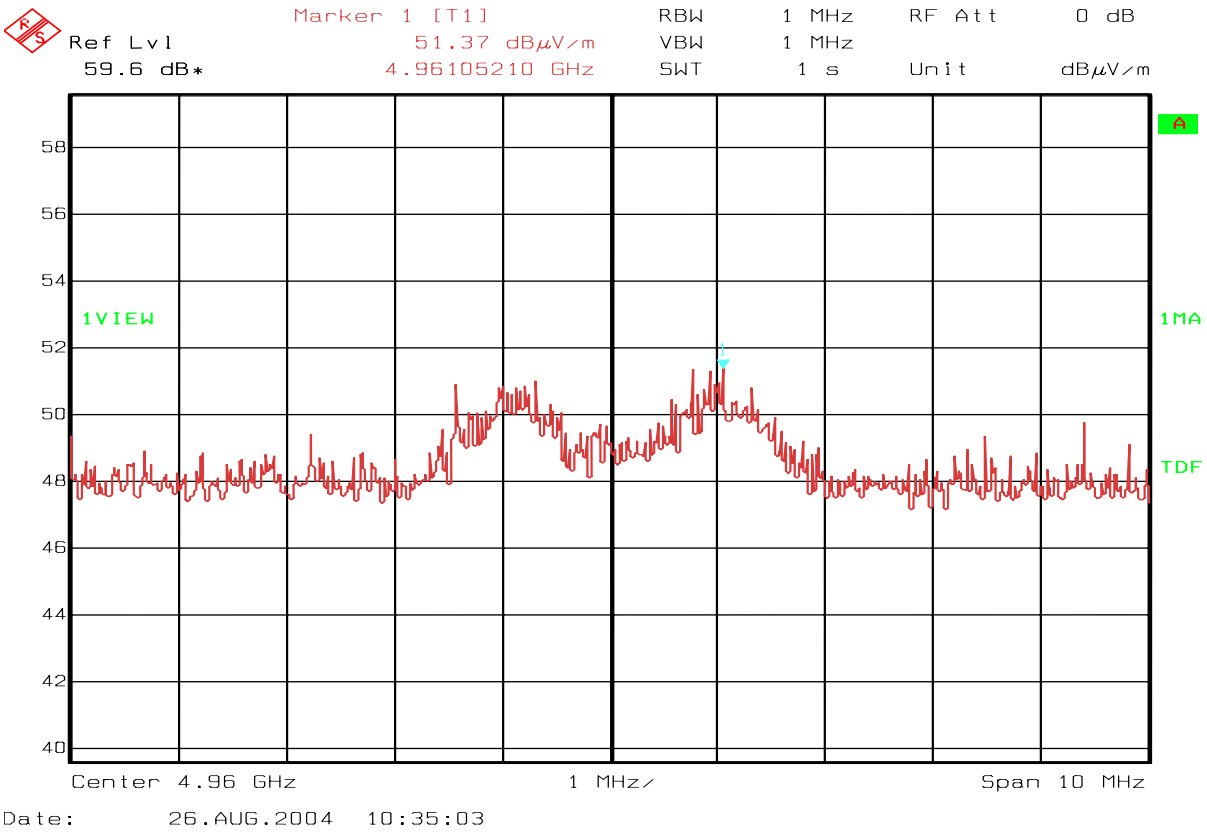
Frequency	RF channel	Dist. corr. factor	Field strength, Peak, 3 meters	Duty cycle corr. factor	Limit	Margin
GHz	11-26	dB	dBμV/m	DB	dBμV/m	dB
4.808	11	0	55.9	-20	54	18.1
4.889	19	0	52.5	-20	54	21.5
4.961	26	0	51.4	-20	54	22.6
7.216	11	0	57.3	-20	54	16.7
7.333	19	0	59.2	-20	54	14.8
7.441	26	0	59.1	-20	54	14.9
7.5 -24	11	0	None detected	-20	54	-
7.5 -24	19	0	None detected	-20	54	-
7.5 - 24	26	0	None detected	-20	54	-



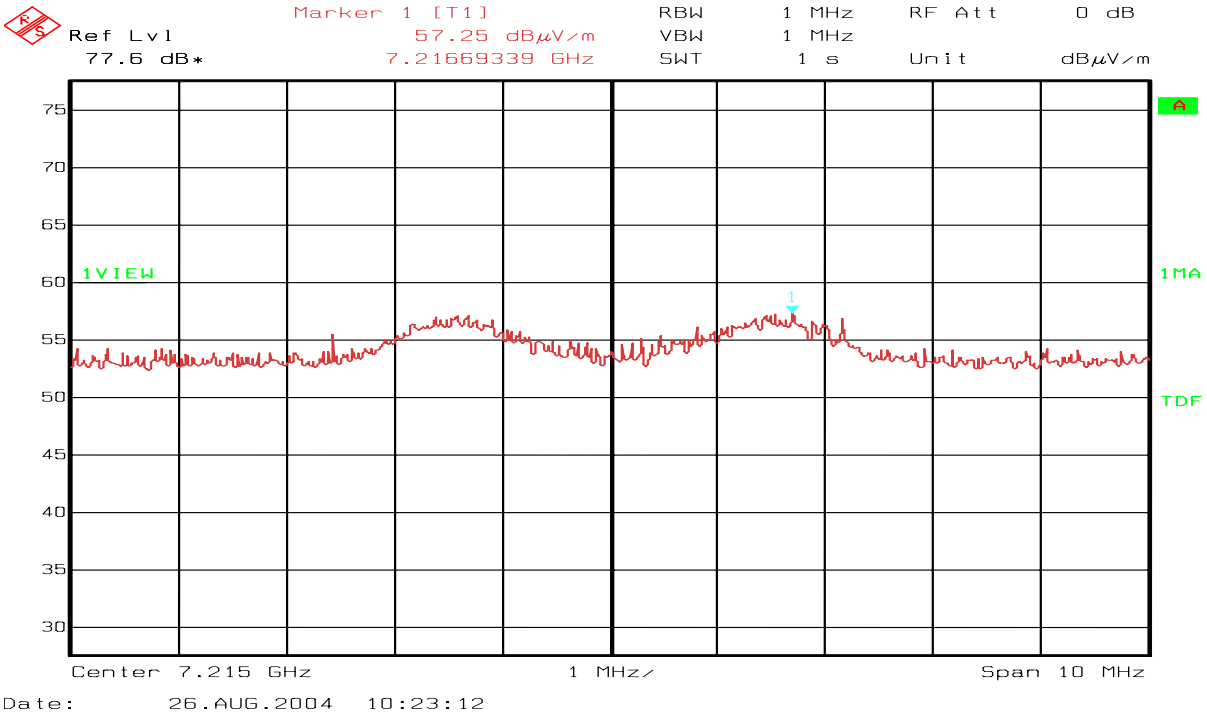
Max field strength – radiated emission, 2nd Harmonic , ch 11



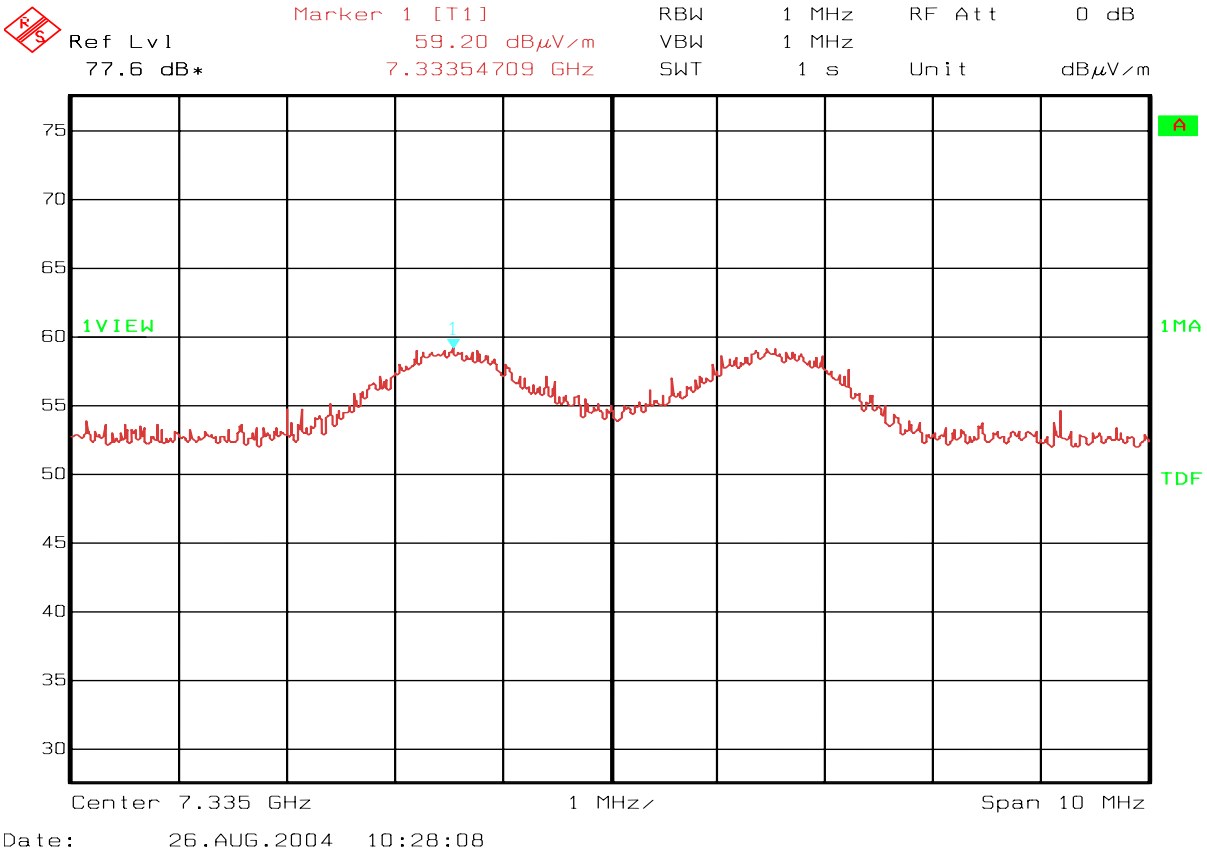
Max field strength – radiated emission, 2nd Harmonic , ch 19



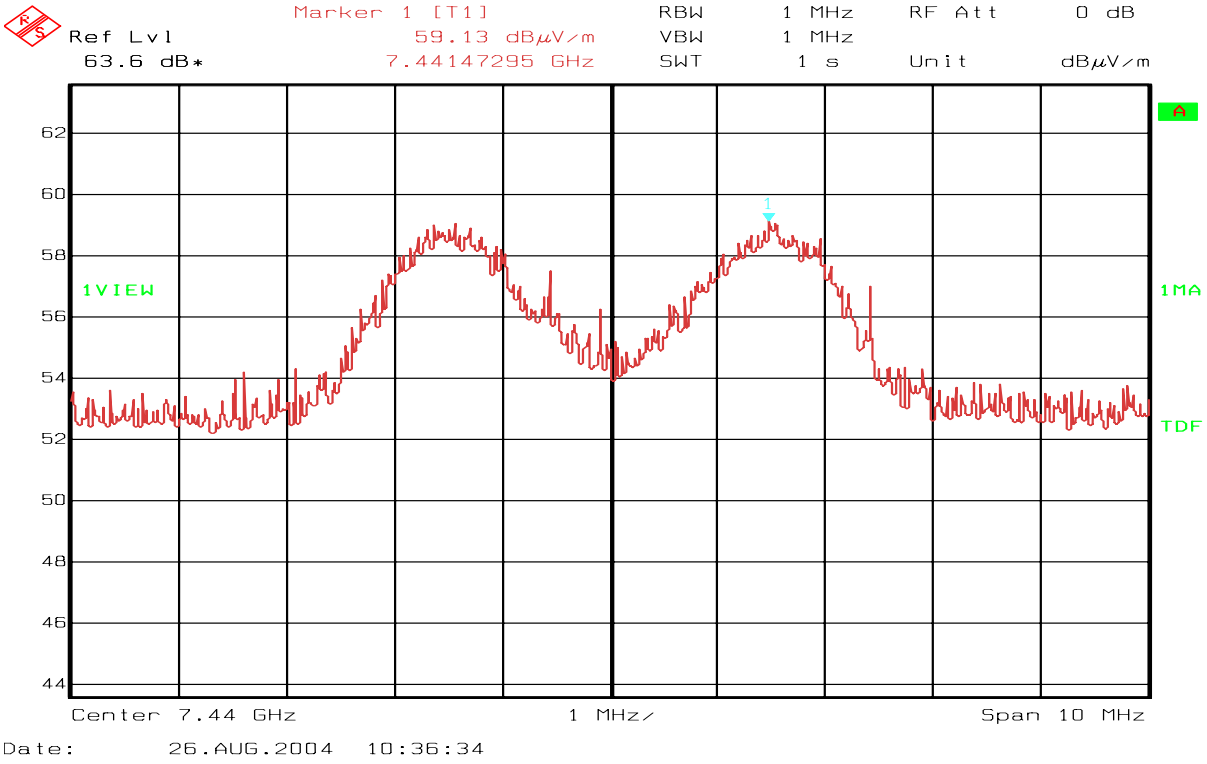
Max field strength –radiated emission, 2nd Harmonic , ch 26



Max field strength –radiated emission, 3rd Harmonic , ch 11.



Max field strength –radiated emission, 3rd Harmonic , ch 19



Max field strength –radiated emission, 3rd Harmonic , ch 26

Radiated emission 10 kHz - 30 MHz.

Measuring distance 10 m, measured with Peak detector.

No component detected, see attached graph.

Limit is converted to 10 m using 40 dB/decade according to 15.31 (f) (2).

Nemko Comlab AS
Peak

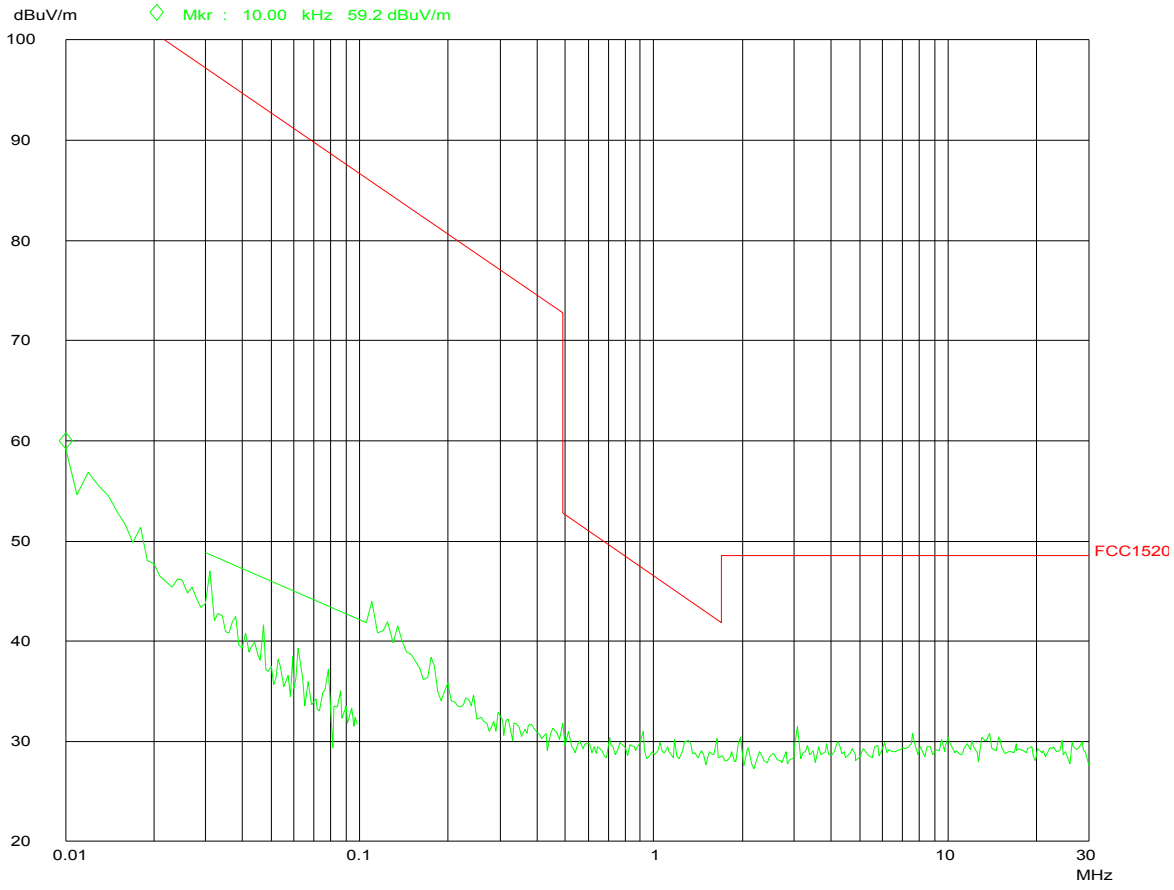
26. Aug 04 12:43

Operator: gns
Comment: Digianswer
MC13192evb
loop antenna

Scan Settings (4 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp OpRge
10k	100k	1k	1k	PK	20ms	0dBLN OFF	60dB
20k	20k	5k	9k	PK	20ms	AUTO LN ON	60dB
20k	10M	5k	9k	PK	20ms	AUTO LN OFF	60dB
10M	30M	5k	9k	PK	20ms	AUTO LN OFF	60dB

Transducer No.	Start	Stop	Name
13	10k	30M	HFH2Z2



10 kHz – 30MHz –radiated emission

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

Measuring distance 3 m according to CISPR 22.

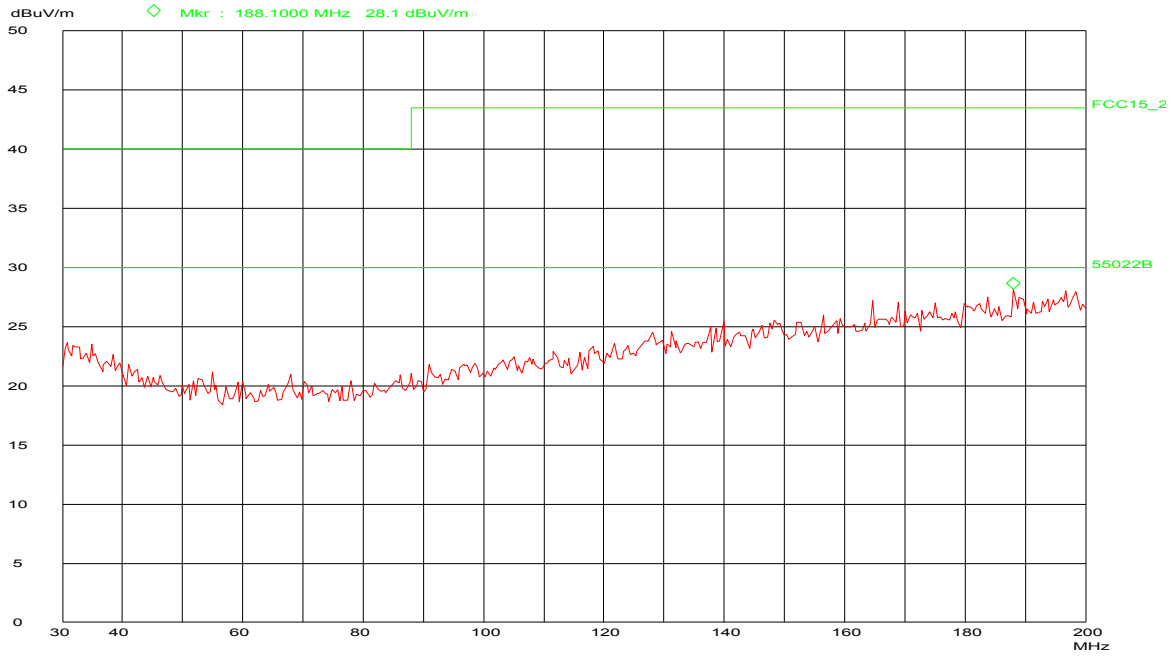
No component detected, see attached graphs.

Nemko Comlab AS 26. Aug 04 11:58
Peak

EUT: MC 13192/EVB
Manuf: Digianswer AS
Op Cond: 3 m hP
Operator: gns
Test Spec: FCC 15

Scan Settings (1 Range)
|--------- Frequencies ----------||---------- Receiver Settings ----------|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 200M 50k 120k PK 20ms AUTO LN ON 60dB

Transducer No. Start Stop Name
20 30M 200M HK116



Radiated emission 30 –200MHz, Horizontal polarization

Frequency	Operational condition	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz		dBµV/m	meters	dBµV/m	dB
188.1	TX on	28.1	3	43.5	15.4

In the column 3 peak values are given for 3 meter.

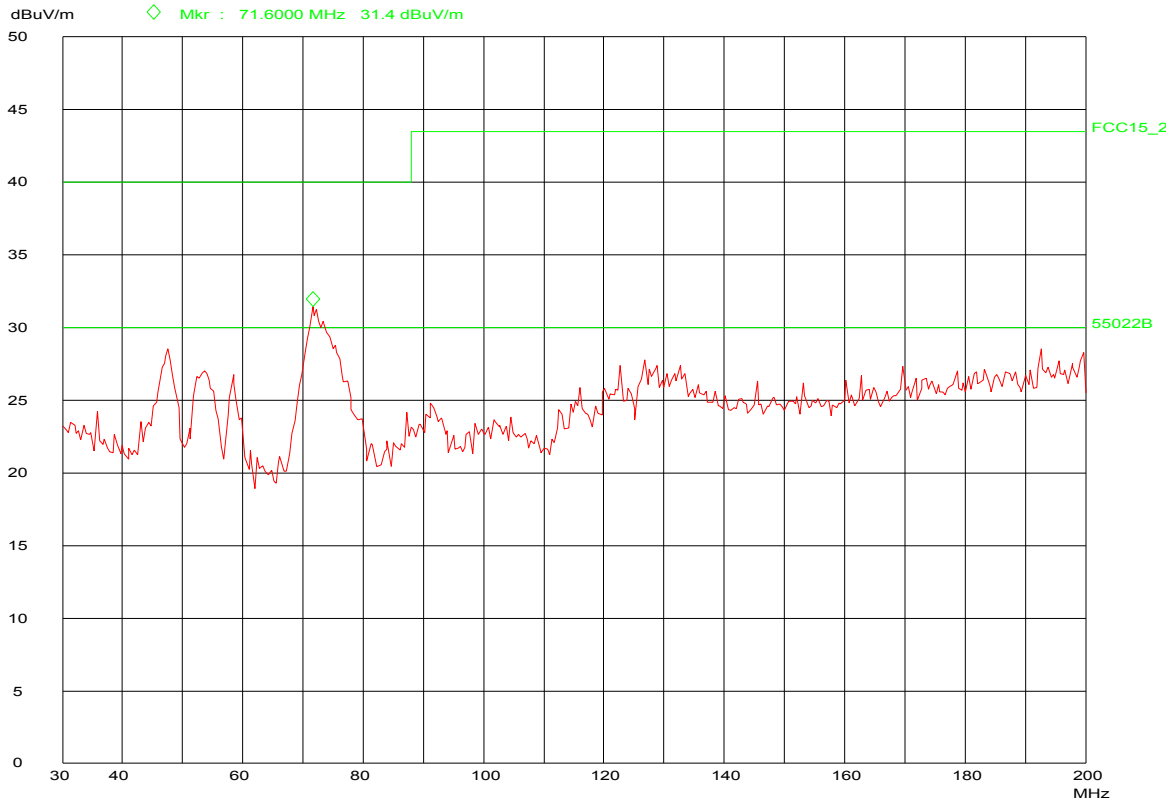
Nemko Comlab AS
Peak

26. Aug 04 12:01

EUT: MC 13192/EVB
Manuf: Digianswer AS
Op Cond: 3 m vP
Operator: gns
Test Spec: FCC 15

Scan Settings (1 Range)
|--------- Frequencies ----------||---------- Receiver Settings ----------|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 200M 50k 120k PK 20ms AUTO LN ON 60dB

Transducer No. Start Stop Name
20 30M 200M HK116



Radiated emission 30 –200MHz, Vertical polarization

Frequency	Operational condition	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz		dBµV/m	meters	dBµV/m	dB
71.6	TX on	31.4	3	43.5	12.1

Nemko Comlab AS

26. Aug 04 12:18

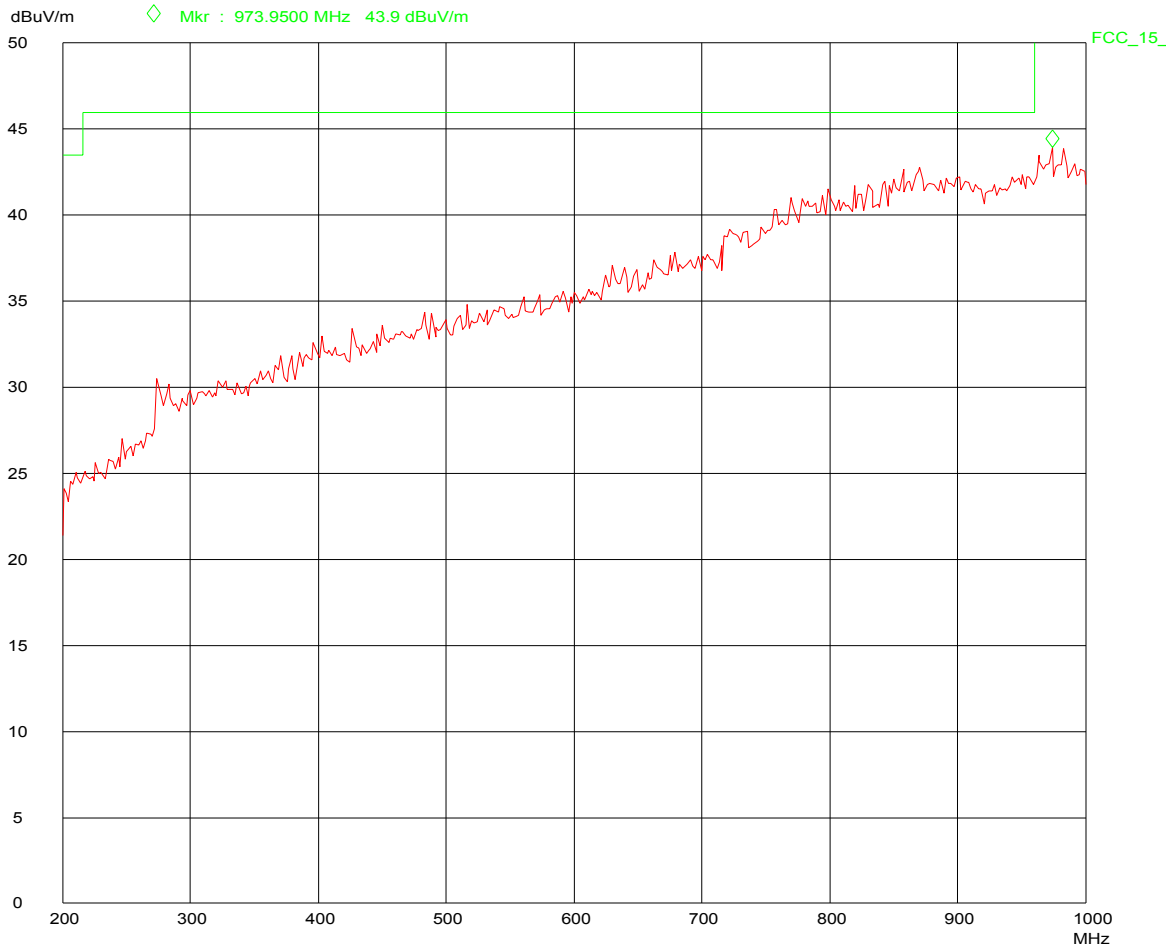
Peak

EUT: MC 13192/EVB
Manuf: Digianswer AS
Op Cond: 3 m hP
Operator: gns
Test Spec: FCC 15
Comment: 200 1000mhz

Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
200M	1000M	50k	120k	PK	20ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
21	200M	1000M	HL223



Radiated emission 200 –1GHz, Horizontal polarization

Nemko Comlab AS

26. Aug 04 12:08

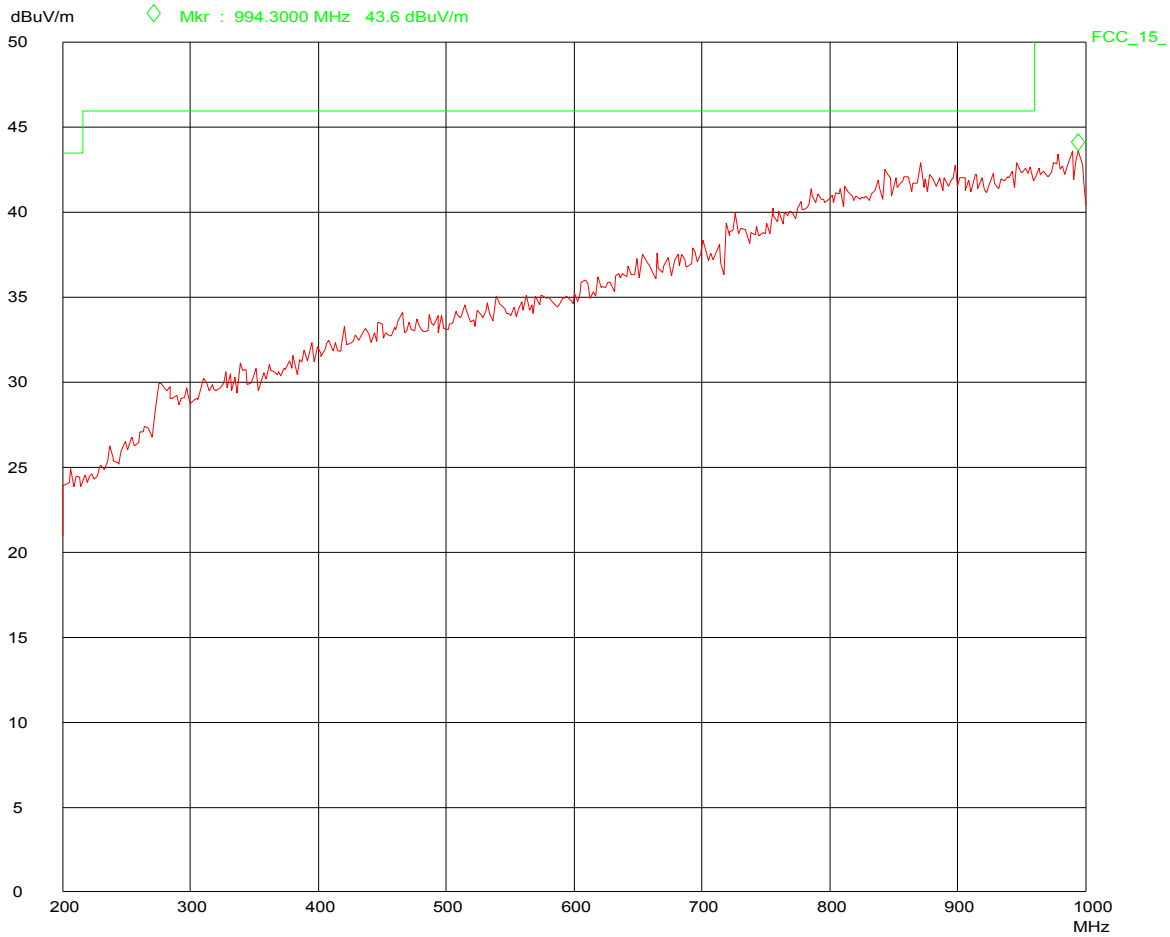
Peak

EUT: MC 13192/EVB
Manuf: Digianswer AS
Op Cond: 3 m vP
Operator: gns
Test Spec: FCC 15
Comment: 200 1000mhz

Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
200M	1000M	50k	120k	PK	20ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
21	200M	1000M	HL223



Radiated emission 200 – 1GHz, Vertical polarization

4.6 Power Spectral Density (PSD)

Para. No.: 15.247 (d)

Test Performed By: G.Suhanthakumar	**Date of Test: 16.Aug.2004**

Test Results: Passed

Measured Data (Conducted):

Cable + 10 attenuator= 10.54 dB

Ch11:

- The measured peak level at RBW= 3kHz, VBW= 3kHz, Span =1.5MHzz, Sweep= 500sec is -19.96 dBm +10.54 dB = -9.42 dBm

Ch19:

- The measured peak level at RBW= 3kHz, VBW= 3kHz, Span =1.5MHzz, Sweep= 500sec is -19.81 dBm +10.54 = -9.27 dBm

Ch26:

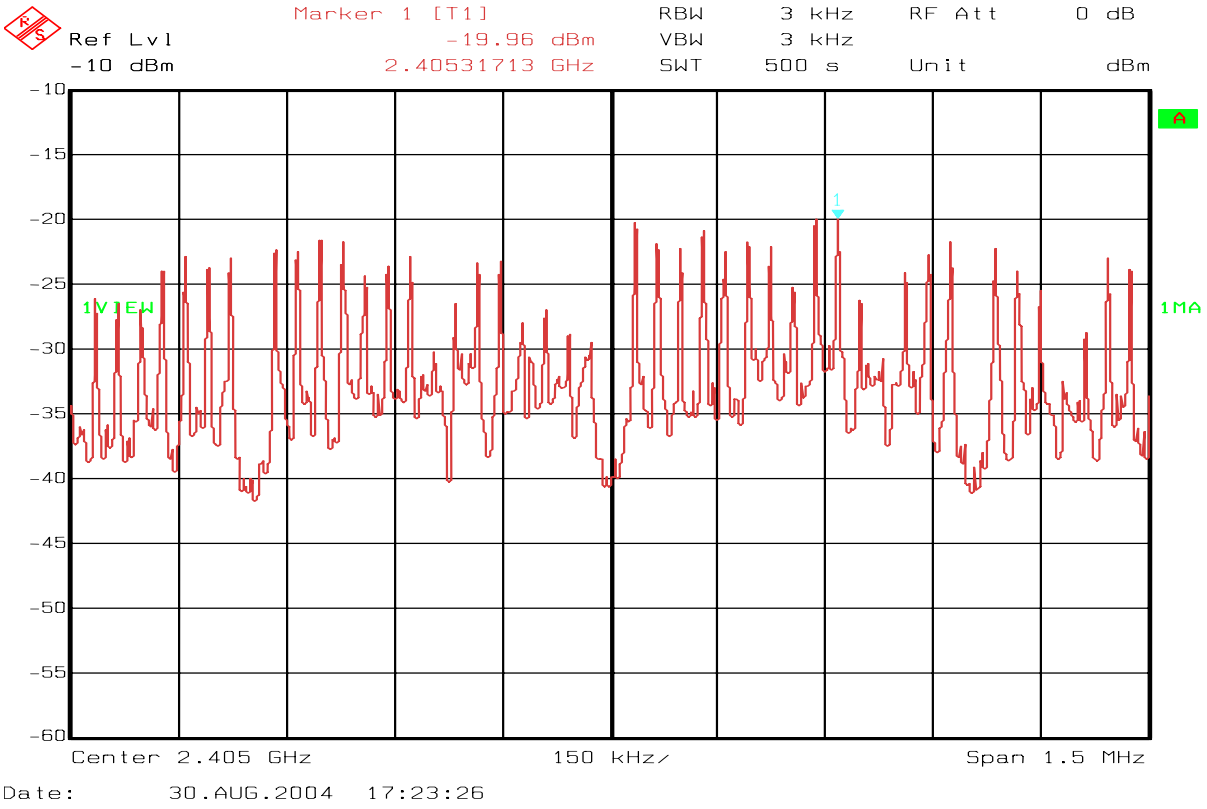
- The measured peak level at RBW= 3kHz, VBW= 3kHz, Span =1.5MHzz, Sweep= 500sec is -20.54 dBm + 10.54 = -10 dBm

Power supply variation within 85 % to 115% of nominal value has no influence on measured value

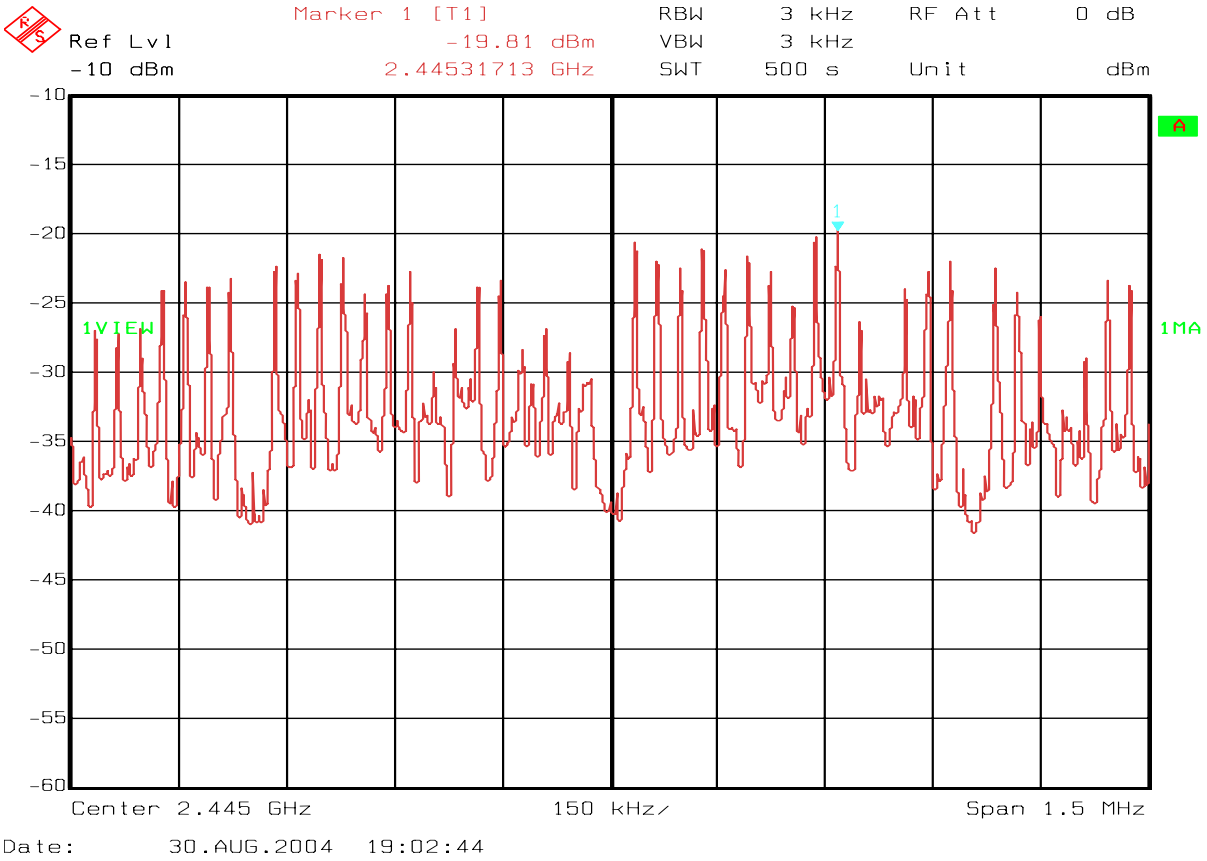
Requirements:

No greater than +8 dBm in any 3kHz band

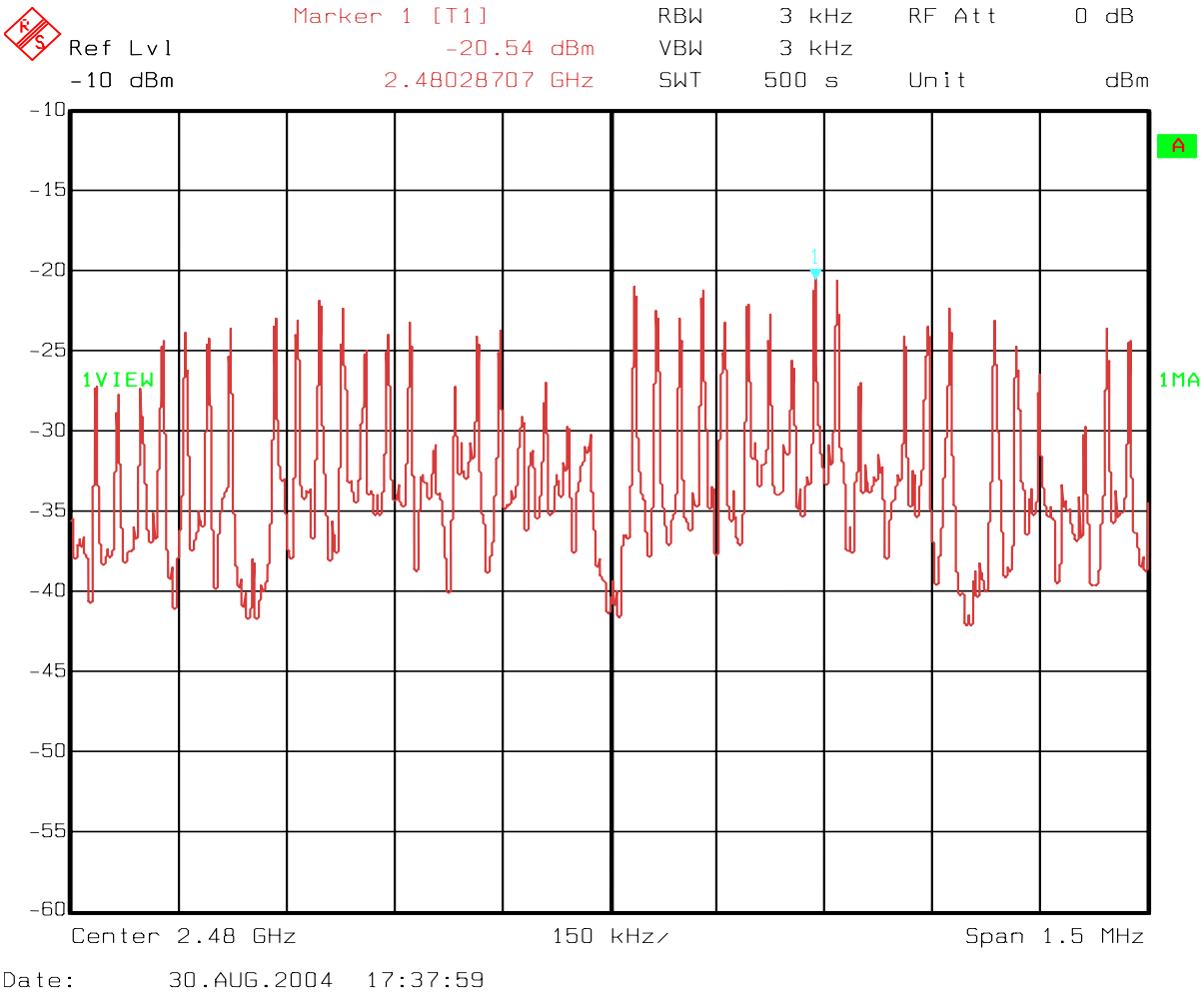
The Test equipments used: 1, 21



Ch11, Power spectral density within the passband (without correction)



Ch19, Power spectral density within the passband (without correction)



Ch26, Power spectral density within the passband (without correction)

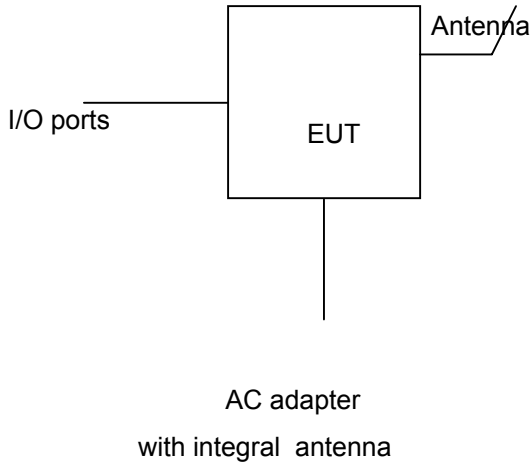
LIST OF TEST EQUIPMENT

To facilitate inclusion of the test equipment used for related tests on each page, each item is numbered by the test house.

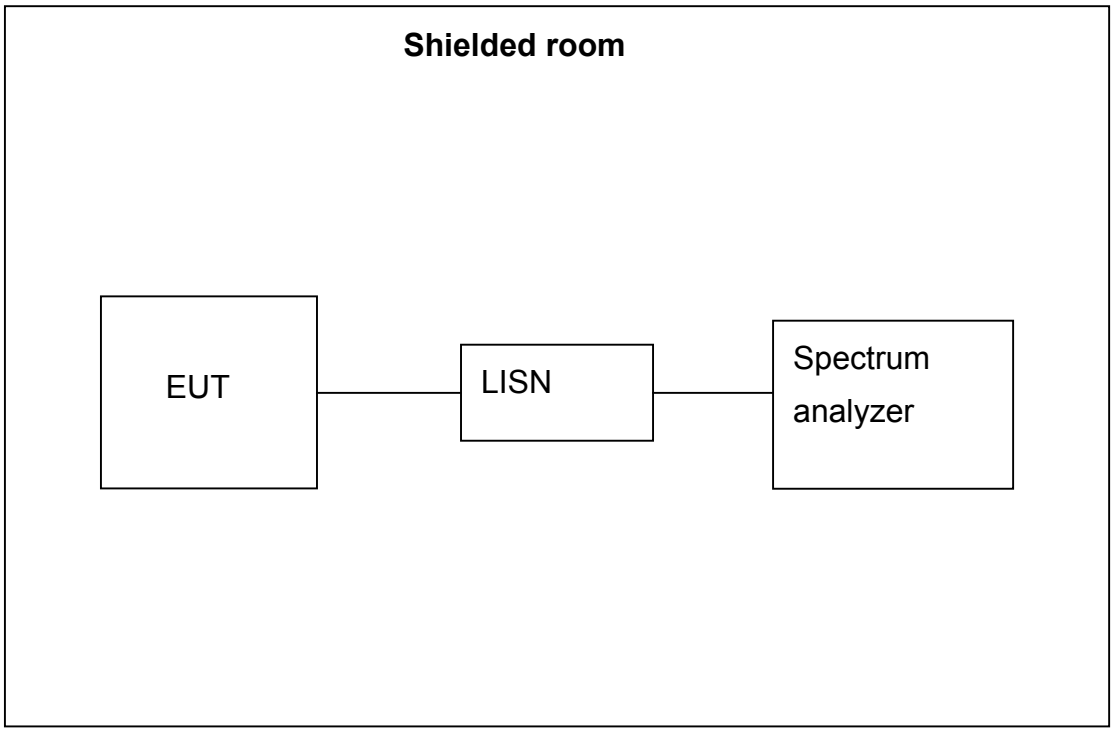
No.	Instrument/ancillary	Type of instrument/ancillary	Manufacturer	Ref. no.
1.	FSEK	Spectrum Analyzer	Rohde & Schwarz	1337
2.	ESAI	Spectrum Analyzer	Rohde & Schwarz	1090
3.	3115	Antenna horn	EMCO	1330
4.	ESH3-Z3	LISN	Rohde & Schwarz	1076
5.	8449B	Amplifier	Hewlett Packard	1322
6.	959C	Printer	Hewlett Packard	1414
7.	HFH2-Z2	Antenna loop	Rohde and Schwarz	285
8.	10855A	Amplifier	Hewlett Packard	1445
9.	HL223	Antenna log.per	Rohde & Schwarz	1261
10.	3104C	Antenna biconical	EMCO	1262
11.	ESN	Test Receiver	R&S	1237
12.	HP6032A	Power Supply, program.	HP	1062
13.	5VF2000/400	Filter Band Pass	Texn	042
14.	5VF1000/2000	Filter Band Pass	Trilithic	1174
15.	77	Multimeter, Digital	Fluke	302
16.	B504D	Power Supply	Oltronix	600
17.	EMCO	Antenna Horn	3116	1328
18.	Suhner	Cable Microwave	Sucoflex 102E	1369
19.	ETS	Shielded room	Semi-anechoic	1410
20.	ESVS30	EMI-Receiver	R&S	1101
21.		Attenuator	suhner	1139

5 BLOCK DIAGRAM

5.1 System set up



5.2 Power line Conducted Emission



5.3 Test Site Radiated Emission and peak power output