RADIO TEST REPORT

No. 803813R1

EQUIPMENT UNDER TEST

Equipment:	Wireless thermostat
Type / model:	T75
Manufacturer:	Hager Controls SAS 33, rue St Nicolas B.P 10140 67703 Saverne Cedex France
Tested by request of:	Uponor, Inc. 5925 148th Street West Apple Valley, MN 55124 USA

SUMMARY

The equipment complies with the requirements of the following standards:

FCC 47 CFR part 15 (2007) Subpart B – Unintentional radiators
FCC 47 CFR part 15 (2007) Subpart C – Intentional Radiators; §15.247 Operation within the bands 902-928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz.

IC RSS-210 Issue 7, June 2007, Annex 8
IC RSS-Gen, Issue 2, June 2007

Industry Canada listed test facility No. IC 3481

Date of issue: June 18, 2008

Tested by: Björn Utermöhl

Approved by: Stefan Andersson

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company:	Uponor, Inc. 5925 148th Street West Apple Valley, MN 55124 USA
Name of contact:	Ulf Jonsson

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT according to the manufacturer/client declaration

Equipment:	Wireless thermostat
Type/Model:	T75
Brand name:	Uponor
FCC ID	V9M-UCS-RT1
IC ID	7664A-UCS-RT1
Serial number:	--
Manufacturer:	Hager Controls SAS 33, rue St Nicolas B.P 10140 67703 Saverne Cedex France
Rating/Supplying voltage:	3 V battery alkaline
Rating RF output power:	11 dBm conducted
Antenna gain:	-6 dBi
External antenna connector:	No
Operating temperature range:	0° - 55° C degrees
Frequency range:	902.473 – 927.481 MHz
Number of channels:	26
Channel separation:	400 kHz
Modulation characteristics:	2FSK
Stand by mode supported:	Yes
Receiver mode supported	No

2.2 Additional software information about the EUT

During the tests the EUT supported the following software:

Software	Version	Comment
	1,03	

2.3 Peripheral equipment

Peripheral equipment is defined as equipment needed for correct operation of the EUT during the tests, but not included as a part of the testing and evaluation of the EUT.

Equipment	Manufacturer / Type	Serial number
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2.4 Modifications during the test

No modifications have been made during the tests.

3. TEST SPECIFICATIONS

3.1 Standards

FCC 47 CFR part 15 (2007) Subpart B – Unintentional radiators
FCC 47 CFR part 15 (2007) Subpart C – Intentional Radiators; §15.247 Operation within the bands 902-928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz.

Measurements methods according to ANSI C63.4-2003

RSS-210, Issue 7 (June 2007): Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment.

RSS-Gen, Issue 2 (June 2007): General Requirements and Information for the Certification of Radiocommunication Equipment.

3.2 Additions, deviations and exclusions from standards

No additions, deviations or exclusions have been made from standards.

3.3 Test set-up

Measurement set-ups for the test out-of-band spurious emissions test are described in corresponding sections. During other tests the EUT was connected to the spectrum analyser by cable.

3.4 Operating environment

If not additionally specified, the tests were performed under the following environmental conditions:

Air temperature:	22 – 23	°C
Relative humidity:	23 – 53	%

4. TEST SUMMARY

The results in this report apply only to the sample tested.

FCC reference	Industry Canada reference	Test	Result	Note
15.247(b)	A2.9(1)	Peak output power	Pass	
15.247(a)	A8.1(1)	20 dB Bandwidth	Pass	
15.247(a)	A8.1(2)	Carrier frequency separation	Pass	
15.247(a)	A8.1(4)	Number of hopping frequencies (channels)	Pass	
15.247(a)	A8.1(4)	Time of occupancy (dwell time)	Pass	
15.247	A8.1	Band edge compliance	Pass	
15.247(d)	2.7, A2.9(1), A8.5	Out of band spurious emissions, radiated	Pass	
15.247(d)	2.7, A8.5	Out of band spurious emissions, conducted	Pass	
15B	6 (a)(Table1)	Out of band spurious emissions, radiated	Pass	

NA = Not Applicable

5. PEAK OUTPUT POWER

5.1. Test protocol

Date of test: June 4, 2008

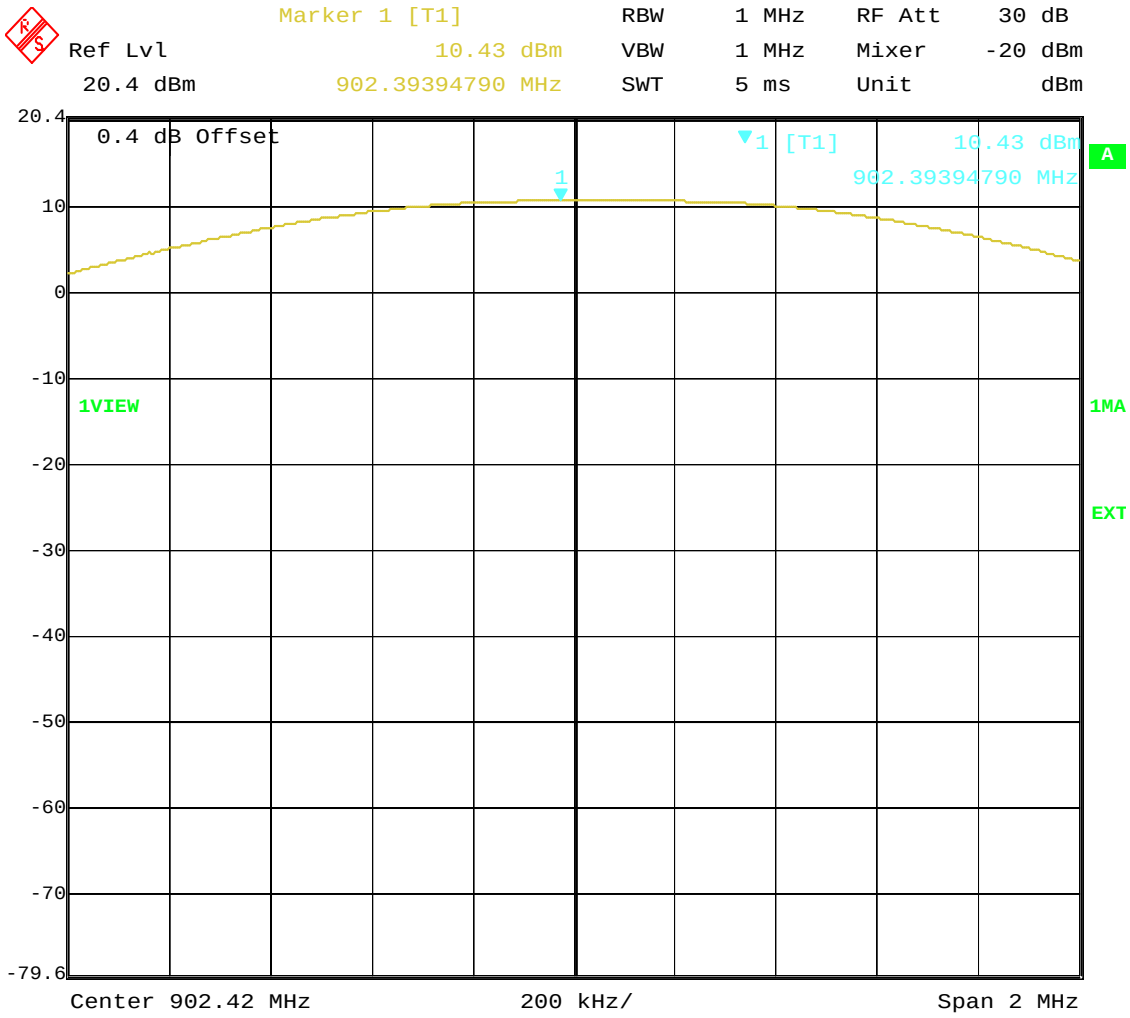
EUT mode of operation: TX, hopping on one channel.

Spectrum analyser settings:

Span: 2 MHz
RBW: 1 MHz
VBW: 1 MHz
Sweep time: 5 ms
Detector: Peak
Trace: Max Hold
The measured power has been compensated for the cable loss with 0,4 dB.

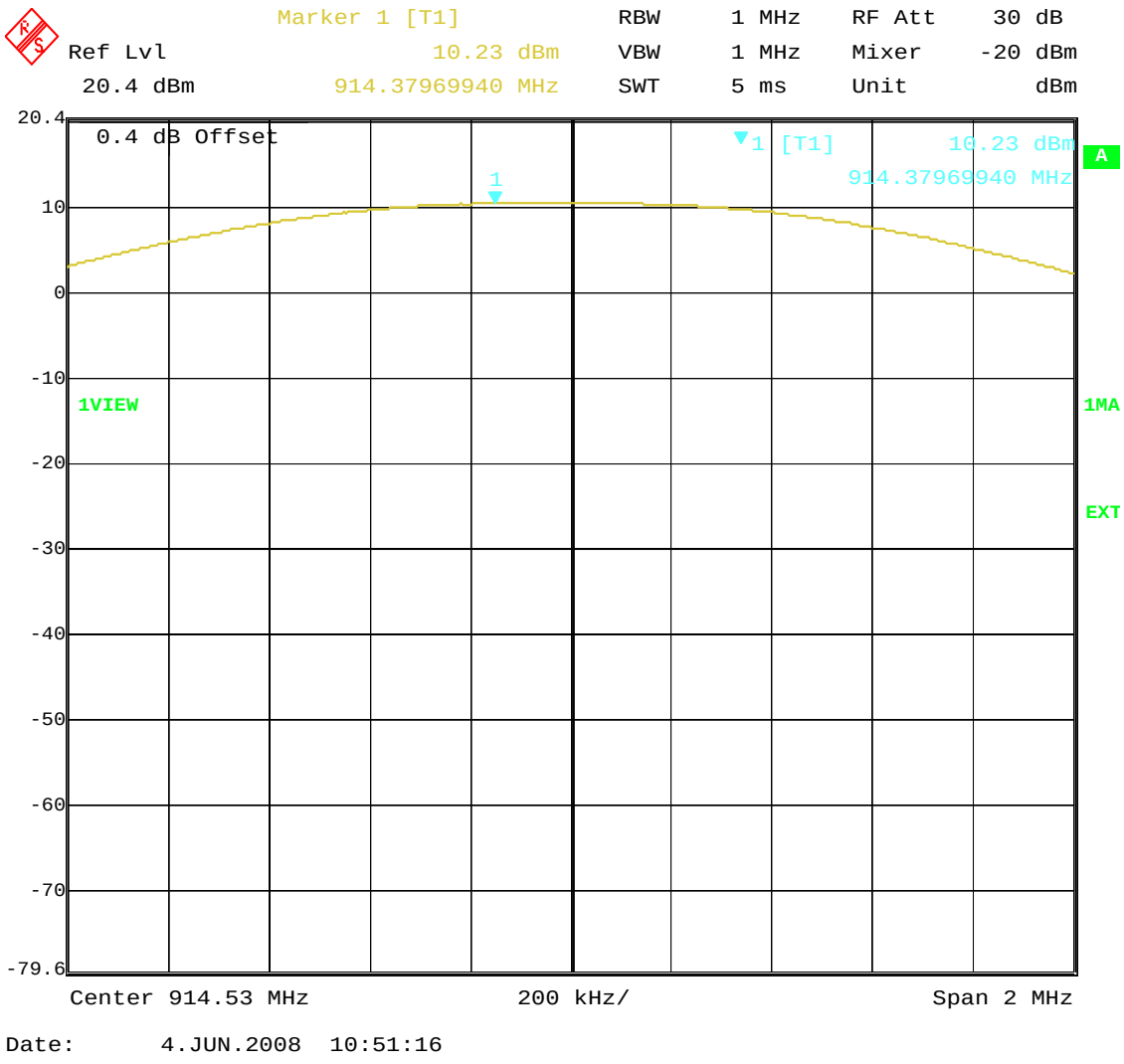
Measured value, dBm			Limit, dBm
Lowest ch 0	Mid ch 12	Highest ch 25	
902.473 MHz	914.502 MHz	927.481 MHz	
10.43	10.23	9.88	0.25 W = 24.0 dBm

Lowest channel

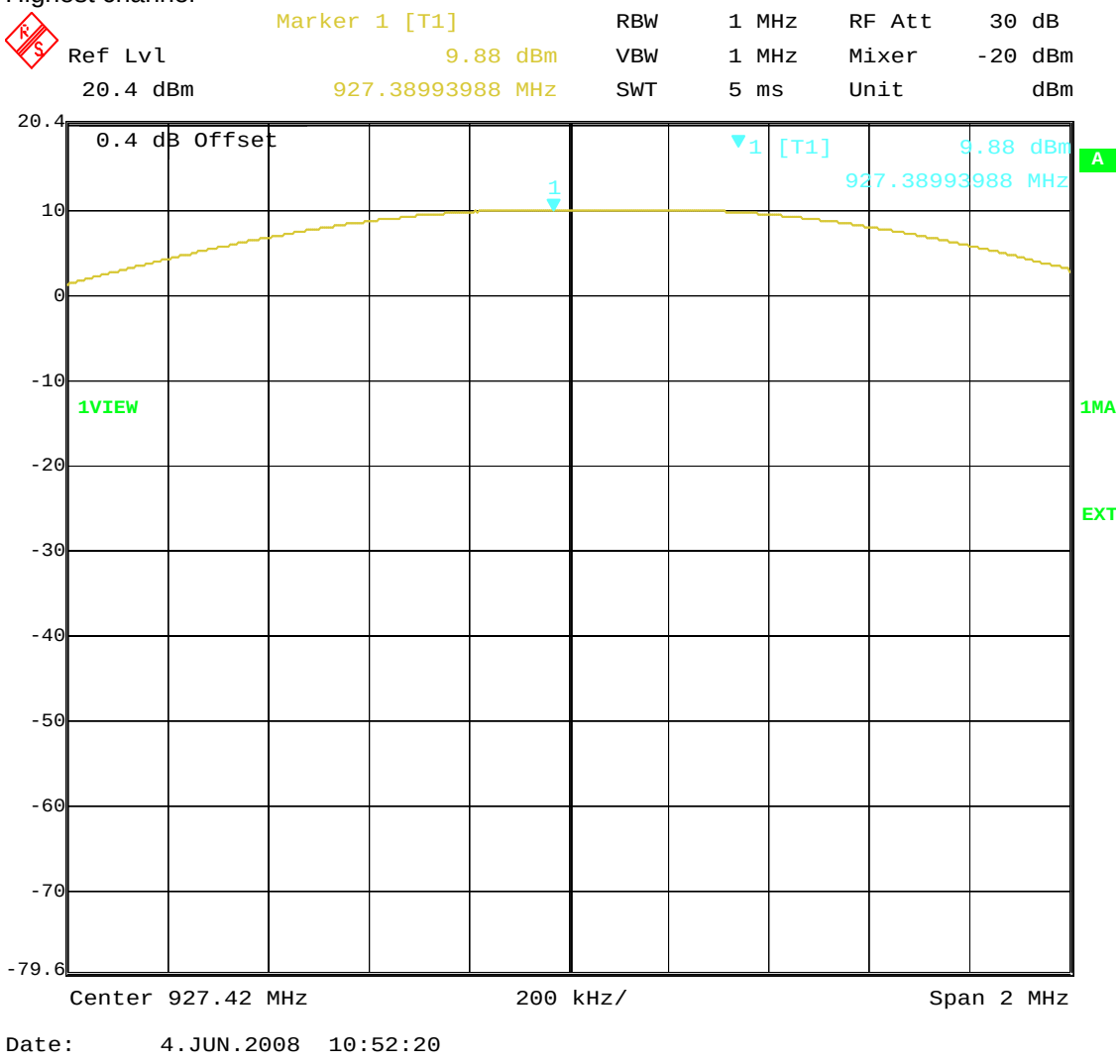


Date: 4.JUN.2008 10:53:07

Mid channel


Marker 1 [T1]
RBW 1 MHz
RF Att 30 dB
Ref Lvl
10.23 dBm
VBW 1 MHz
Mixer -20 dBm
20.4 dBm
914.37969940 MHz
SWT 5 ms
Unit dBm
20.4
0.4 dB Offset
1 [T1]
10.23 dBm
914.37969940 MHz
A
10
0
-10
1VIEW
1MA
-20
EXT
-30
-40
-50
-60
-70
-79.6
Center 914.53 MHz
200 kHz/
Span 2 MHz
Date: 4.JUN.2008 10:51:16

Highest channel



6. 20 dB BANDWIDTH

6.1 Test protocol

Date of test: June 4, 2008

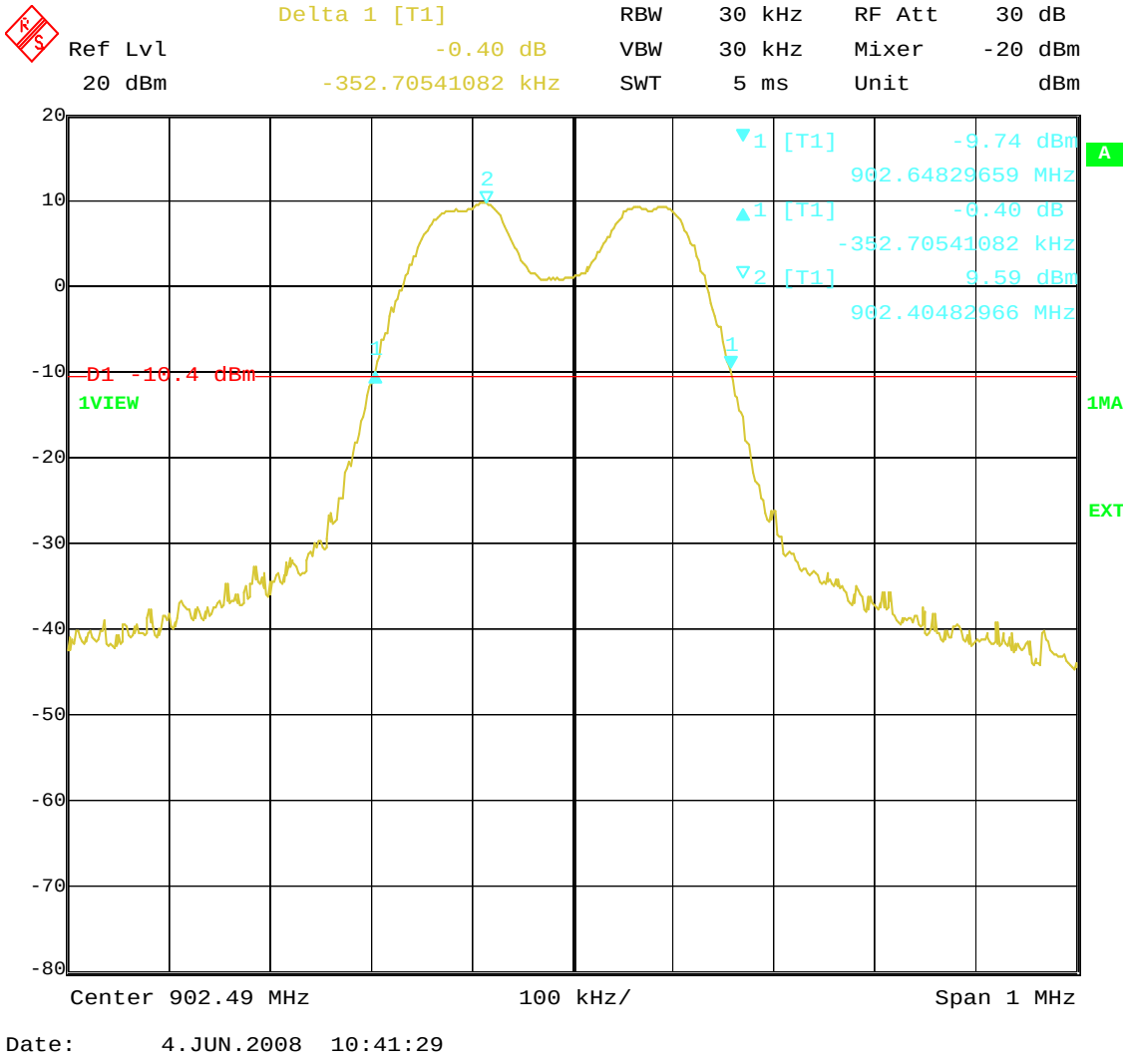
EUT mode of operation: TX, hopping on one channel.

Spectrum analyser settings:

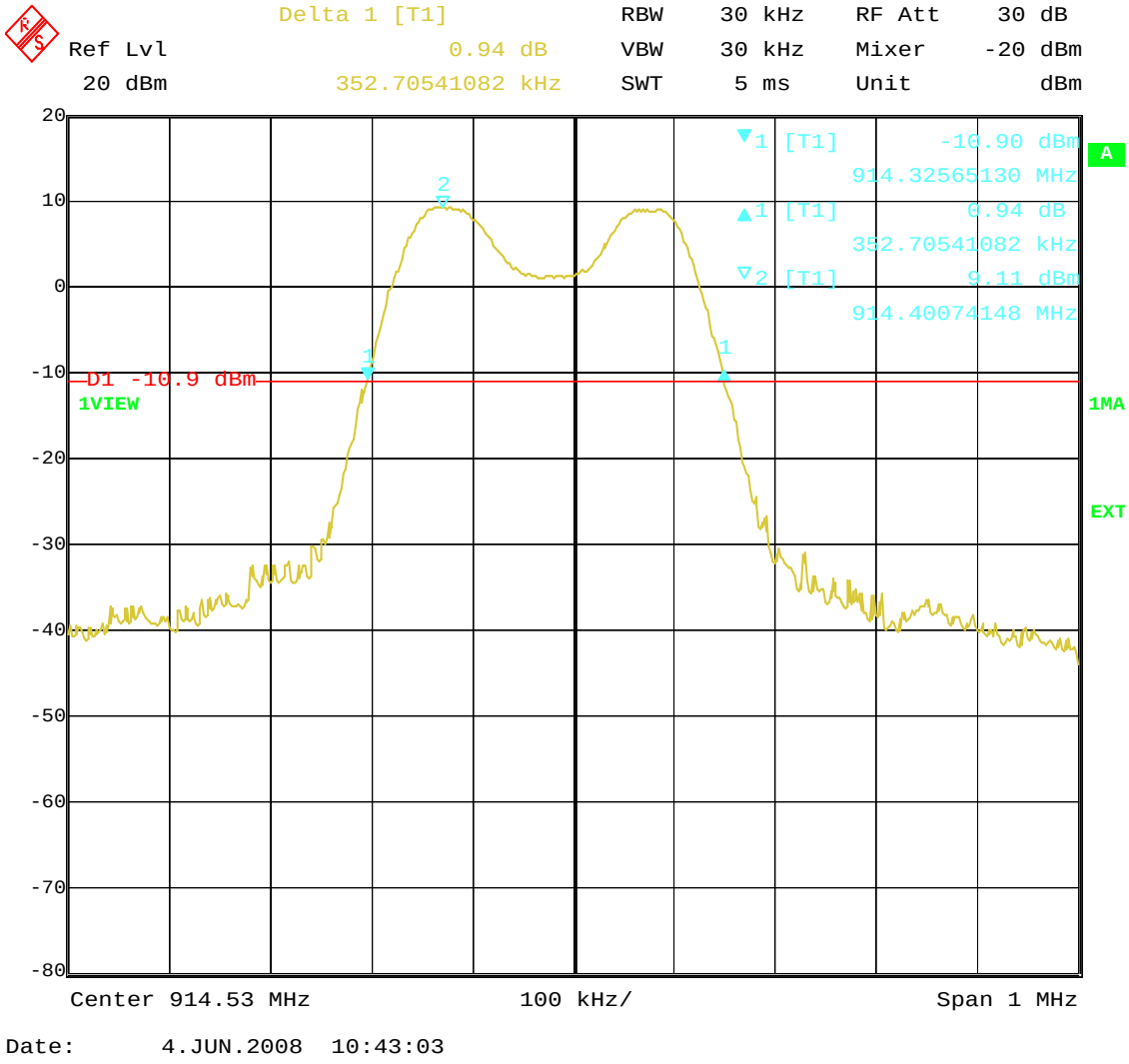
Span: 1 MHz
RBW: 30 kHz
VBW: 30 kHz
Sweep time: 5 ms
Detector: Peak
Trace: Max Hold

Channel no	Channel (MHz)	20 dB Bandwidth (kHz)	Limit value (kHz)
0	902.473	353	250 - 500
12	914.502	353	
25	927.481	341	

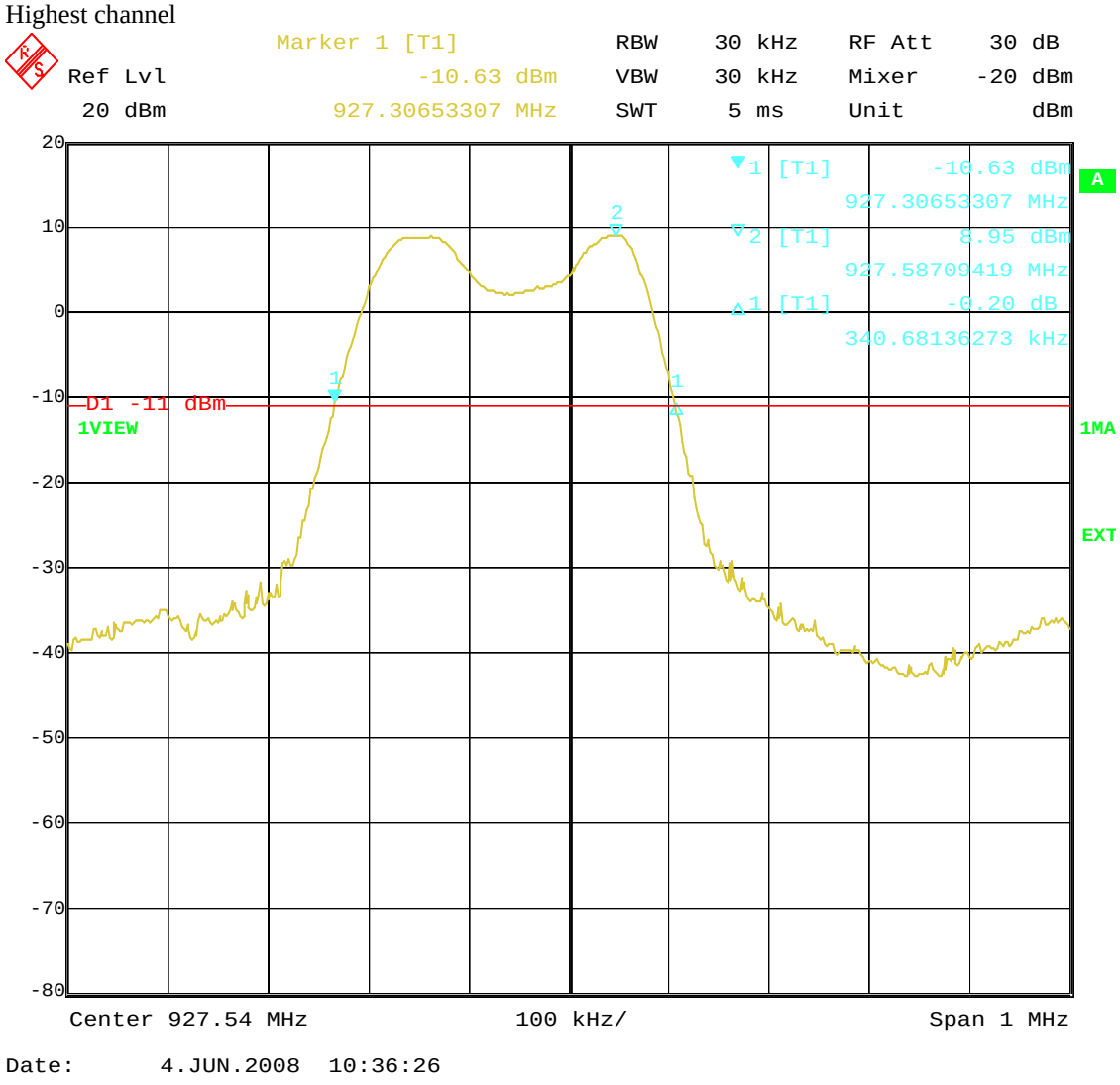
Lowest channel



Mid channel


Delta 1 [T1]
0.94 dB
352.70541082 kHz
RBW 30 kHz
VBW 30 kHz
SWT 5 ms
RF Att 30 dB
Mixer -20 dBm
Unit dBm
Ref Lvl
20 dBm
1 [T1] -10.90 dBm
914.32565130 MHz
1 [T1] 0.94 dB
352.70541082 kHz
2 [T1] 9.11 dBm
914.40074148 MHz
D1 -10.9 dBm
1VIEW
A
1MA
EXT
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 914.53 MHz
100 kHz/
Span 1 MHz
Date: 4.JUN.2008 10:43:03

Highest channel



Date: 4.JUN.2008 10:36:26

7. CARRIER FREQUENCY SEPARATION

7.1 Test protocol

Date of test: June 4, 2008

EUT mode of operation: TX and hopping on.

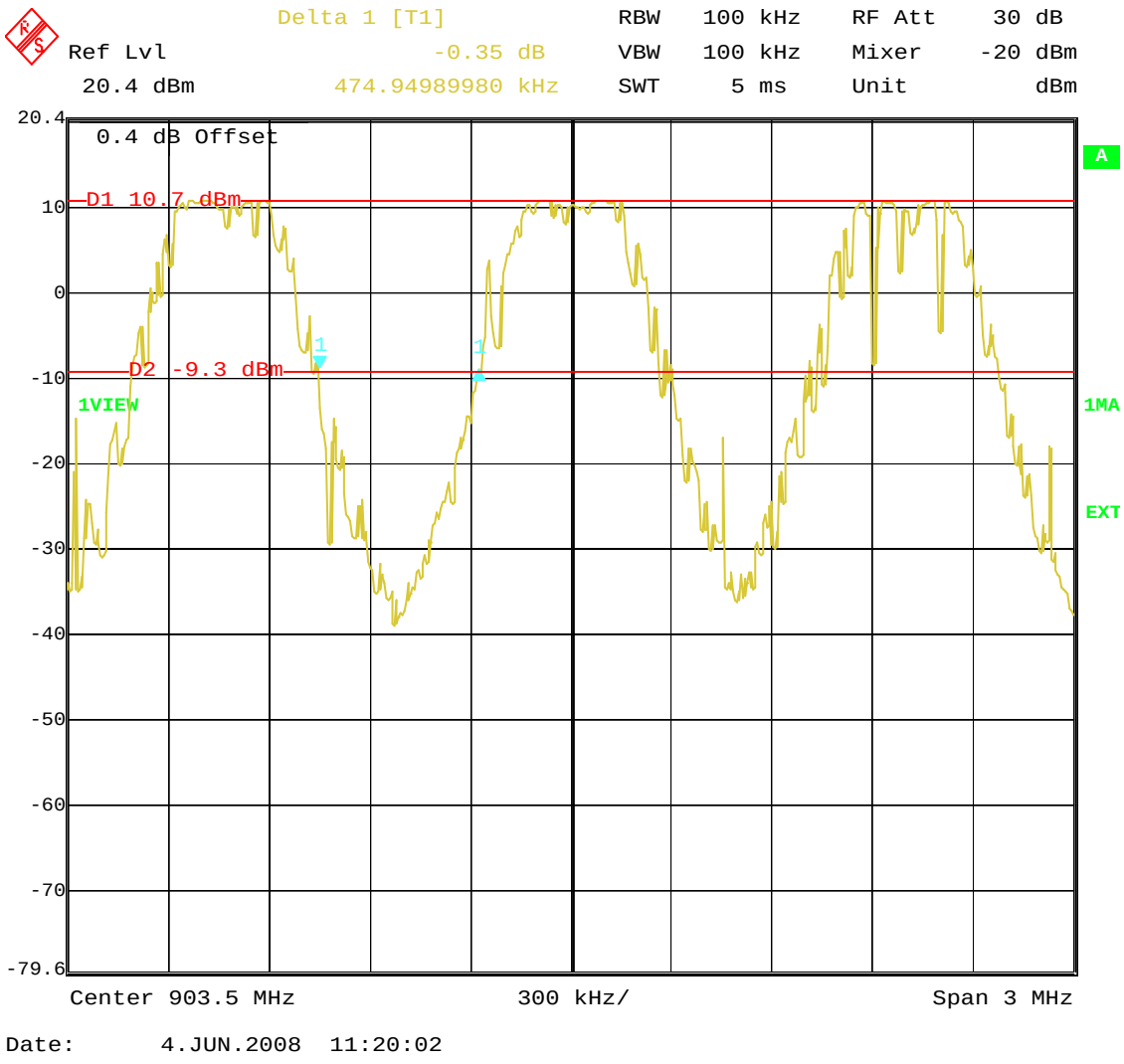
Spectrum analyser settings:

Span: 3 MHz
RBW: 100 kHz
VBW: 100 kHz
Sweep time: Auto
Detector: Peak
Trace: Max Hold

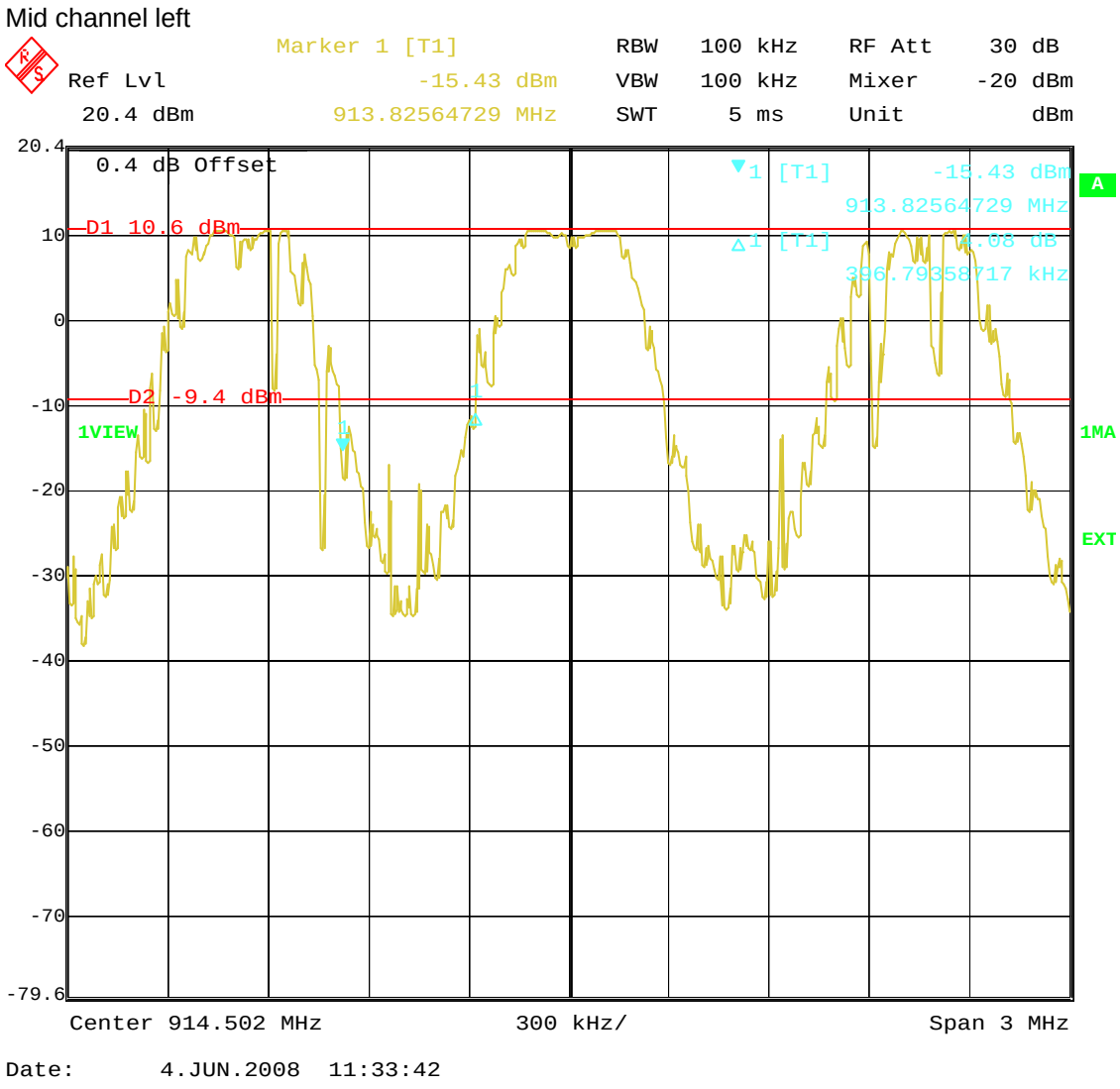
Channel	Carrier frequency separation from the next channel		Limit value (> 20 dB bandwidth)
	To the right	To the left	
(MHz)	(kHz)	(kHz)	(kHz)
902.473	475	-	> 353
914.502	397	475	> 353
927.481	-	439	> 341

Limit = Result from the 20 dB Bandwidth measurements

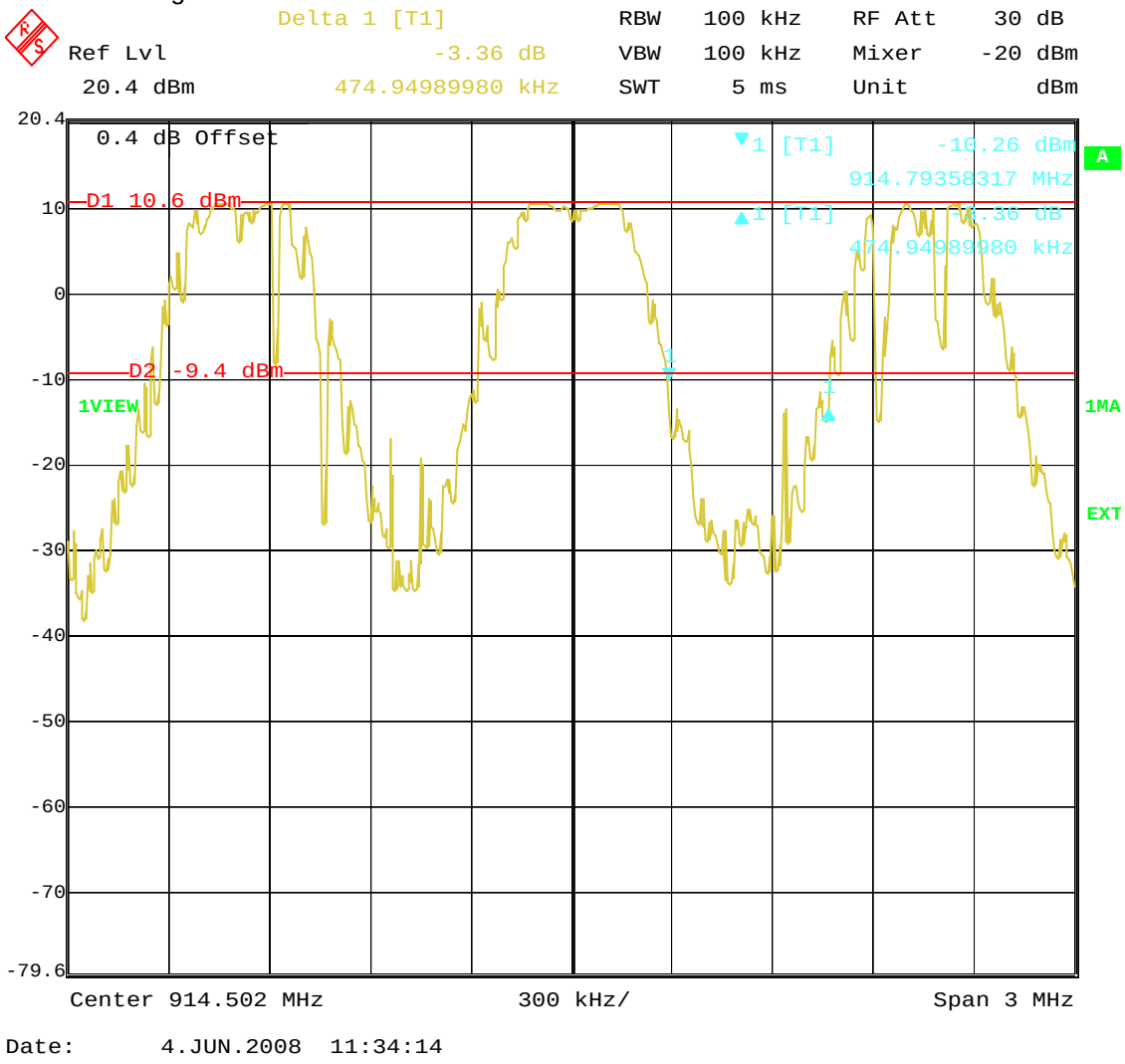
Lowest channel



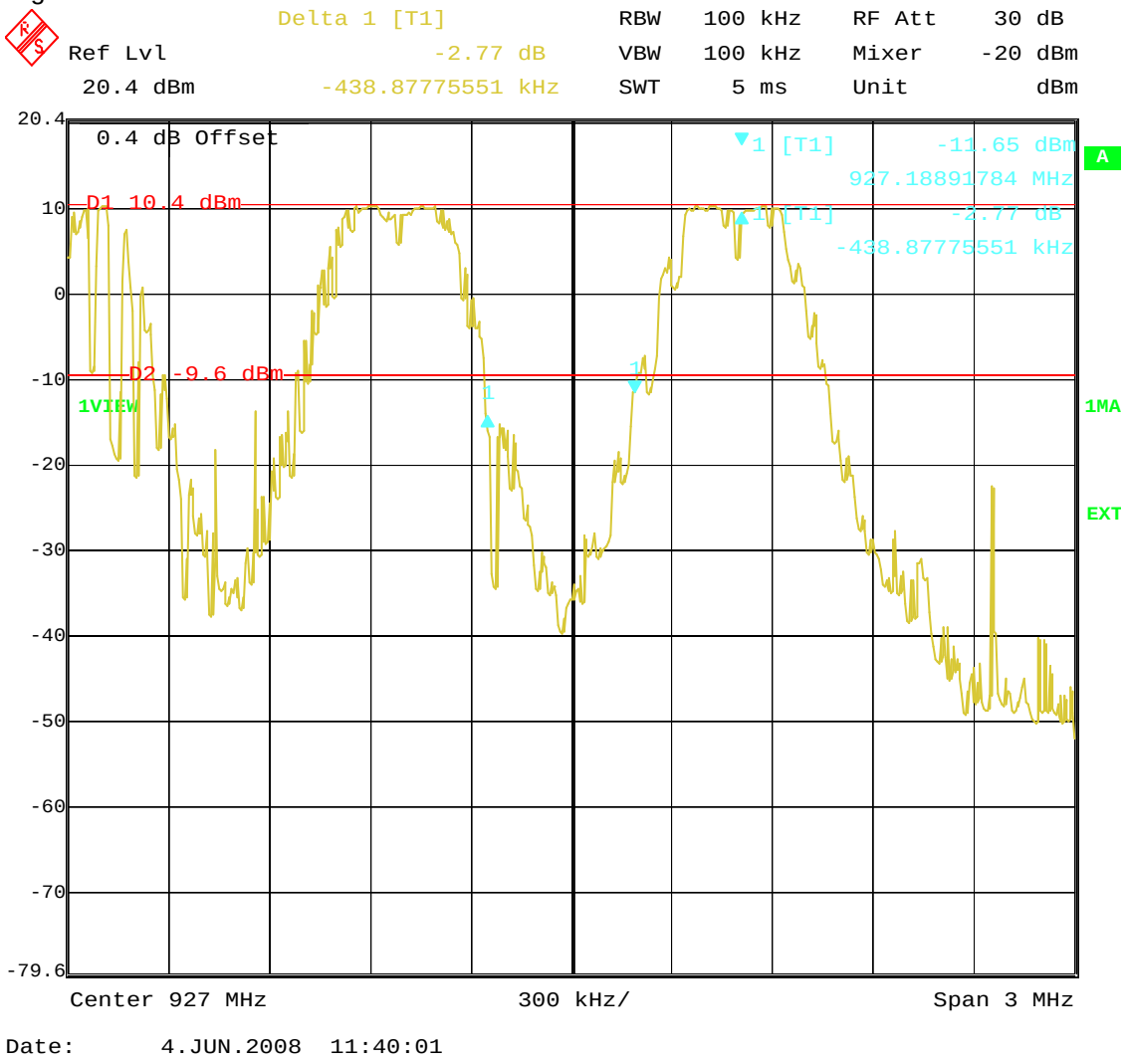
Mid channel left



Mid channel right



Highest channel



8. NUMBER OF HOPPING CHANNELS

8.1 Test protocol

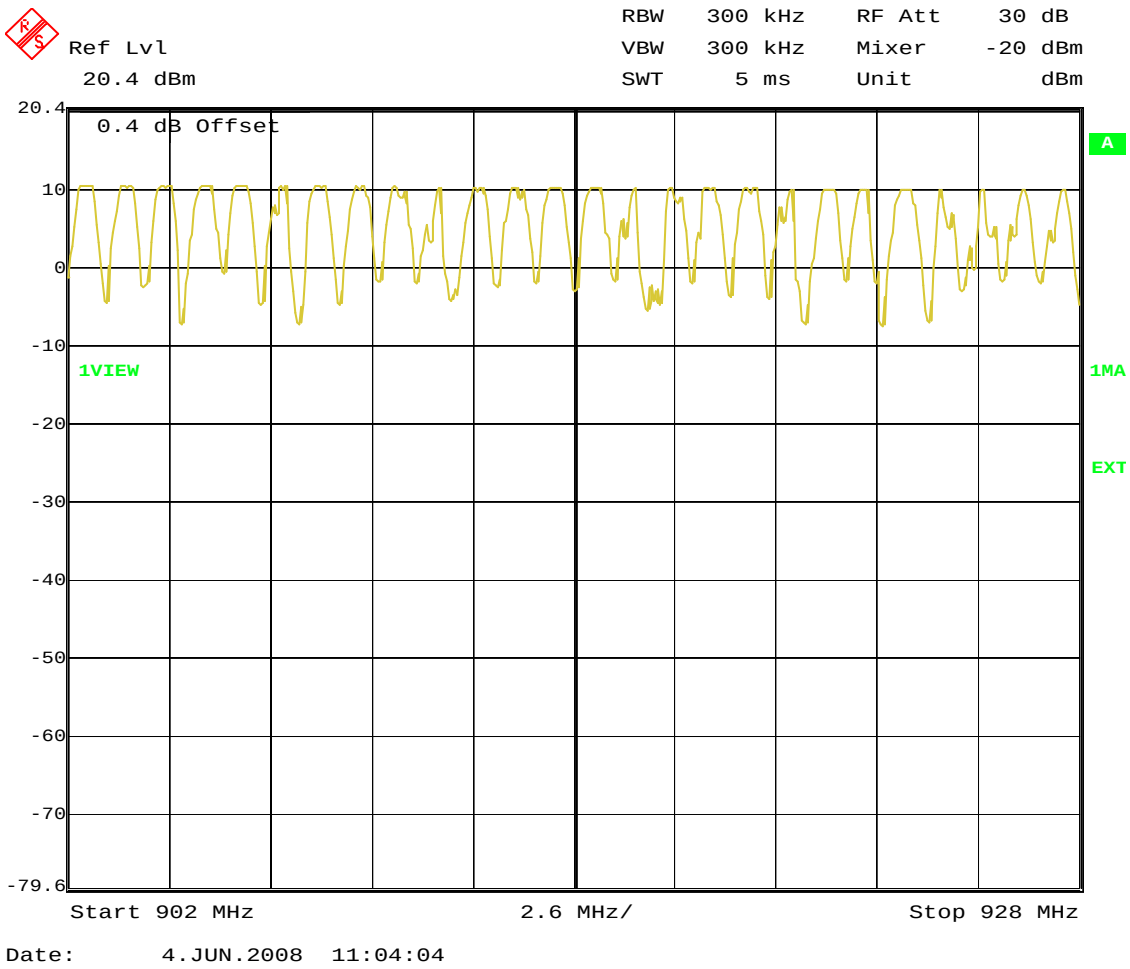
Date of test: June 4, 2008

EUT mode of operation: TX and hopping on.

Spectrum analyser settings:

RBW: 300 kHz
VBW: 300 kHz
Sweep time: Auto
Detector: Peak
Trace: Max Hold

Frequency band	Number of hopping channels	Limit value
902-928	26	25-50



9. TIME OF OCCUPANCY (DWELL TIME)

9.1 Test protocol

Date of test: June 4, 2008

EUT mode of operation: TX and hopping on.

Spectrum analyzer settings:

Determination of transmitting time **T**

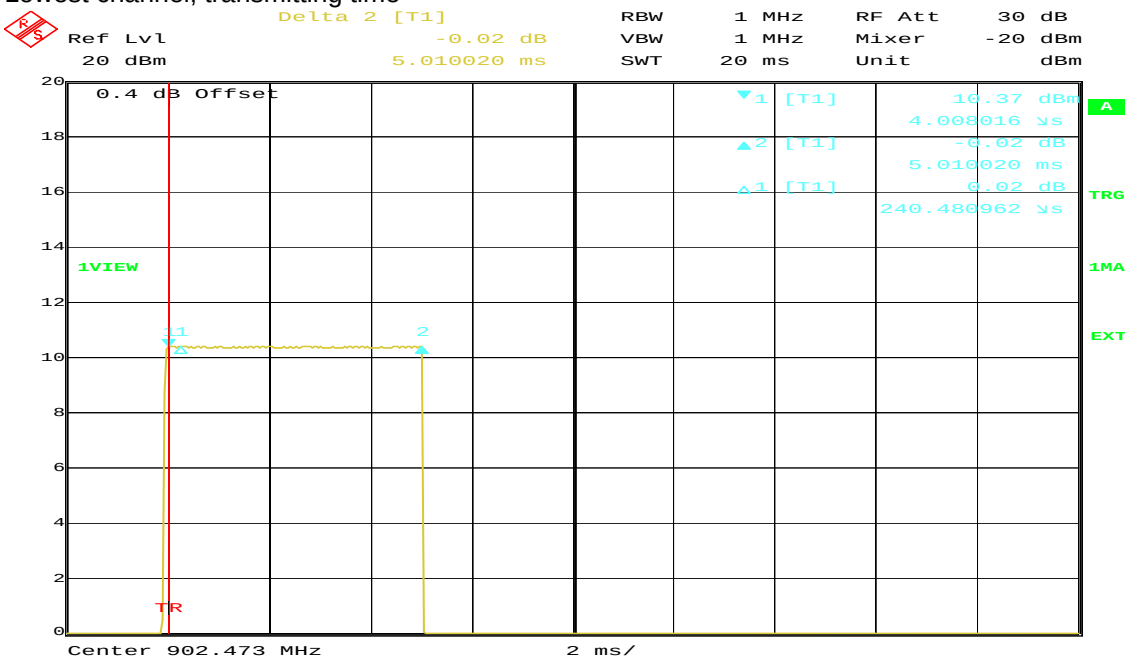
Span: 0 Hz
RBW: 1 MHz
VBW: 1 MHz
Sweep time: 20 ms
Continuous sweep
Detector: Peak
Trace: Clear/Write
Trigger: Video

*Determination of the number of times **n** the channel is active during the sweep time of 10.5 s*

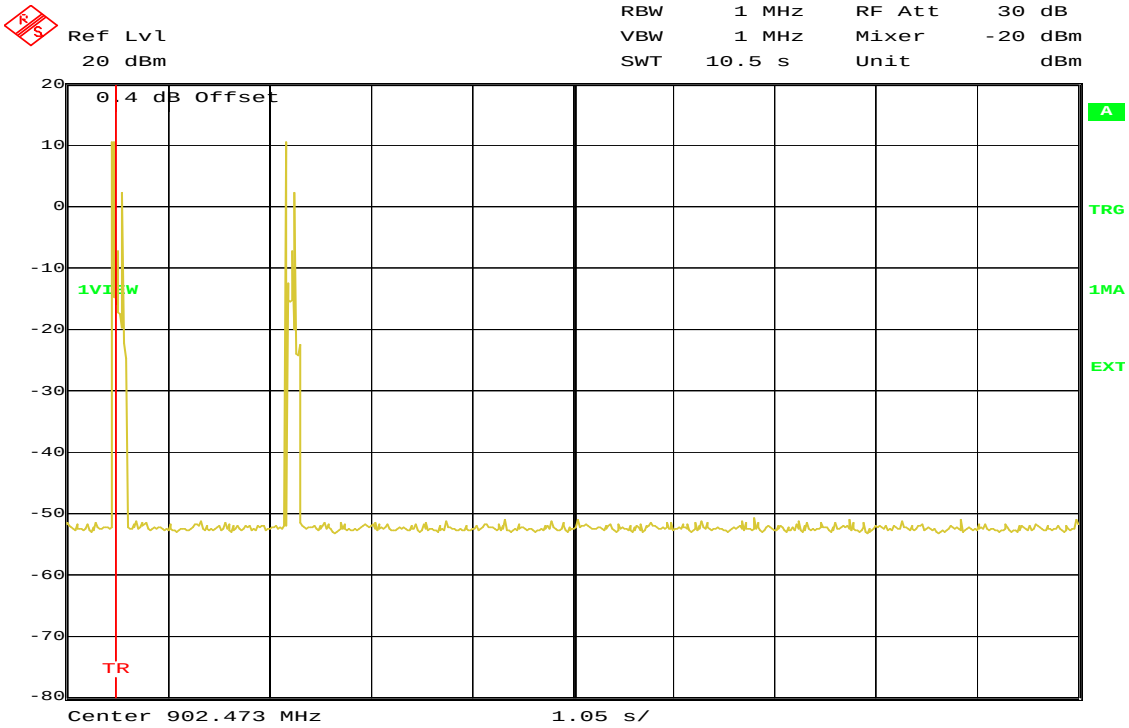
RBW: 1 MHz
VBW: 1 MHz
Sweep time: 10.5 s
Single sweep

Test parameters	Channel (MHz)			Limit value (s)
	902.473	914.502	927.481	
T (ms)	5,0	5,1	5,0	-
n	2	2	2	-
Dwell time (s) = T · n	0.01	0.0114	0.01	< 0,4

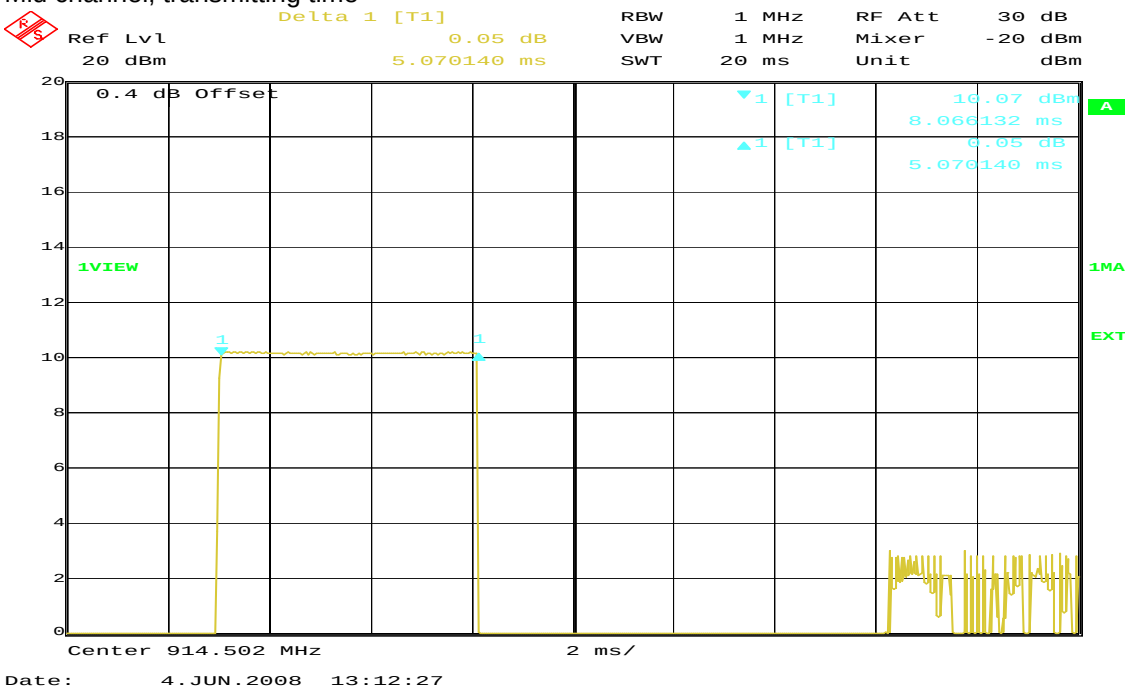
Lowest channel, transmitting time



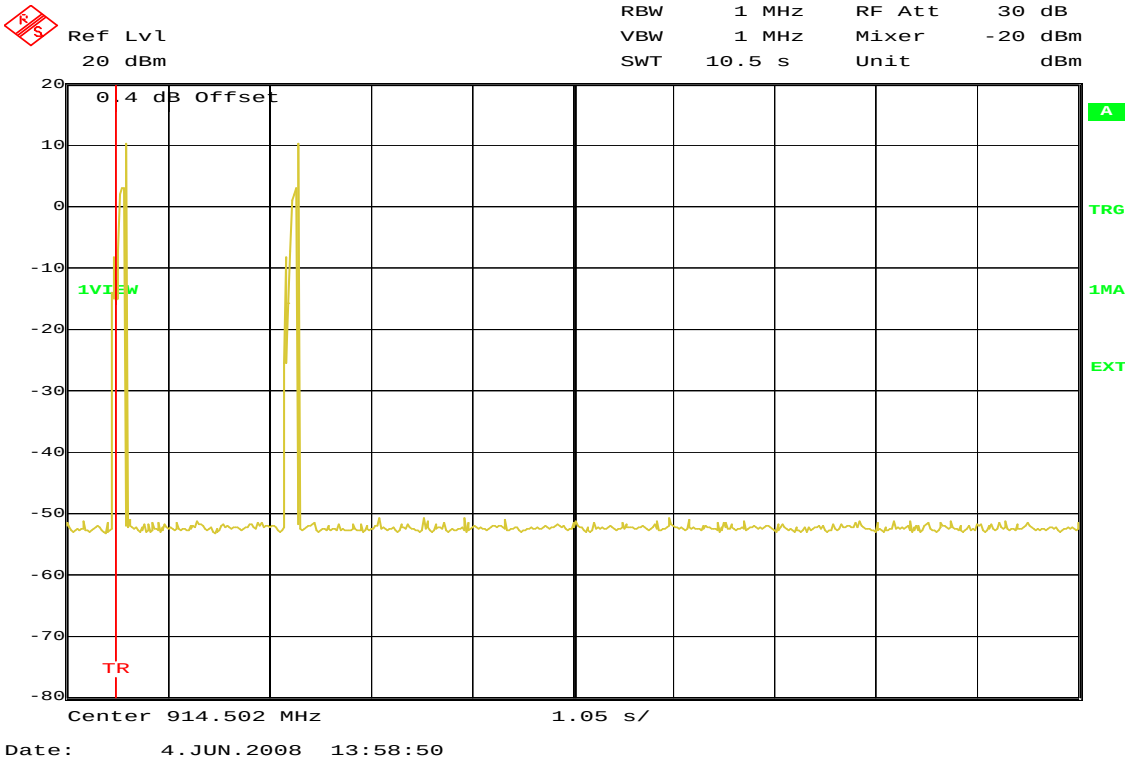
Lowest channel, number of times the channel is active



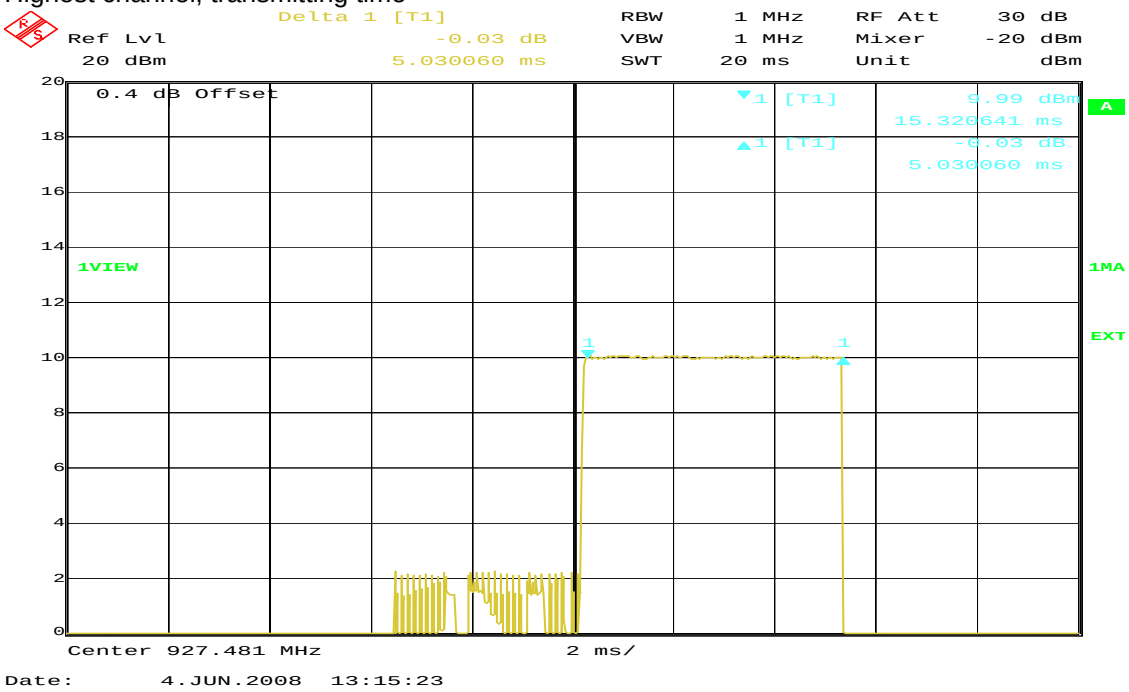
Mid channel, transmitting time



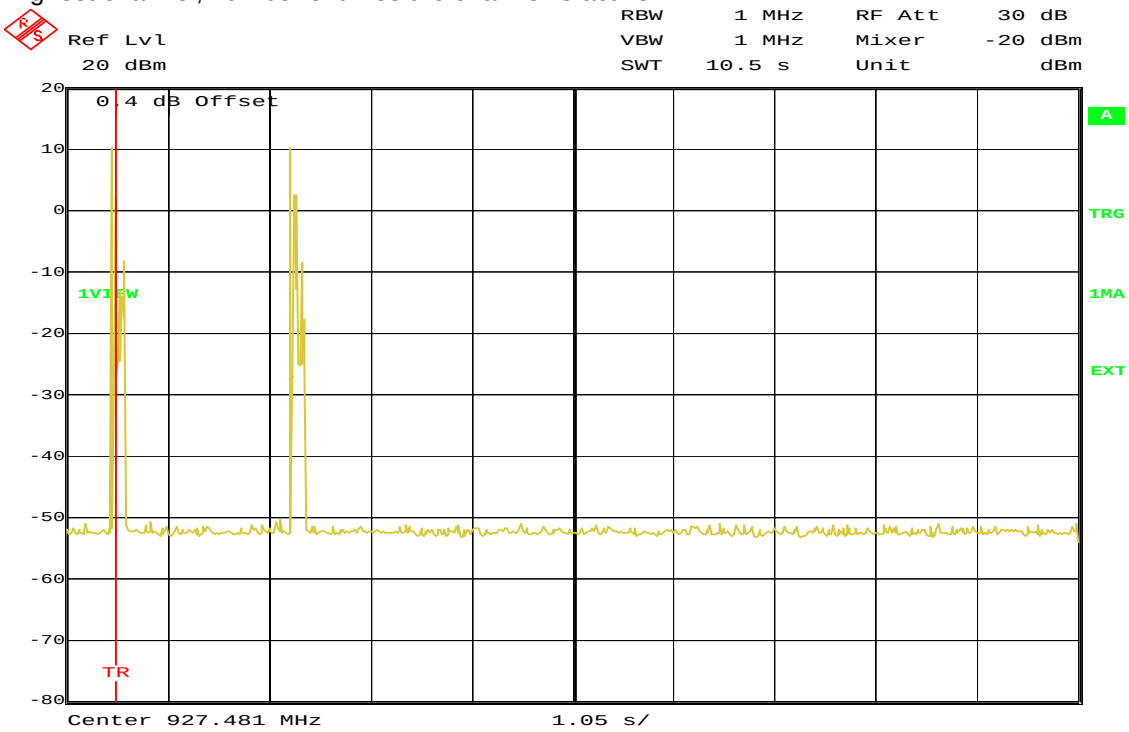
Mid channel, number of times the channel is active



Highest channel, transmitting time



Highest channel, number of times the channel is active



10. BAND EDGE COMPLIANCE

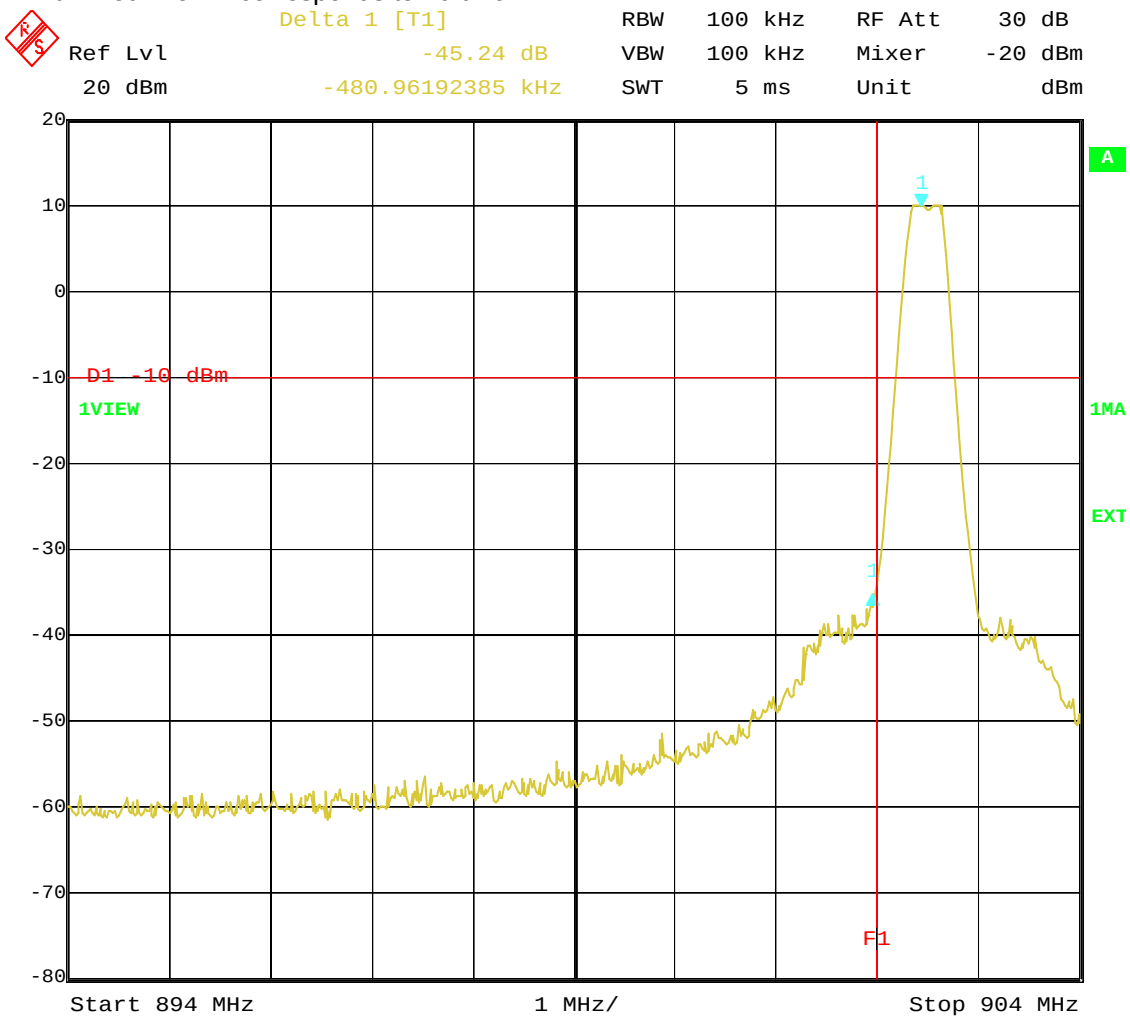
10.1 Test protocol

Date of test: June 4, 2008

Band edge compliance at lowest channel, 902.473 MHz

Sweep with peak detector, Frequency hopping disabled

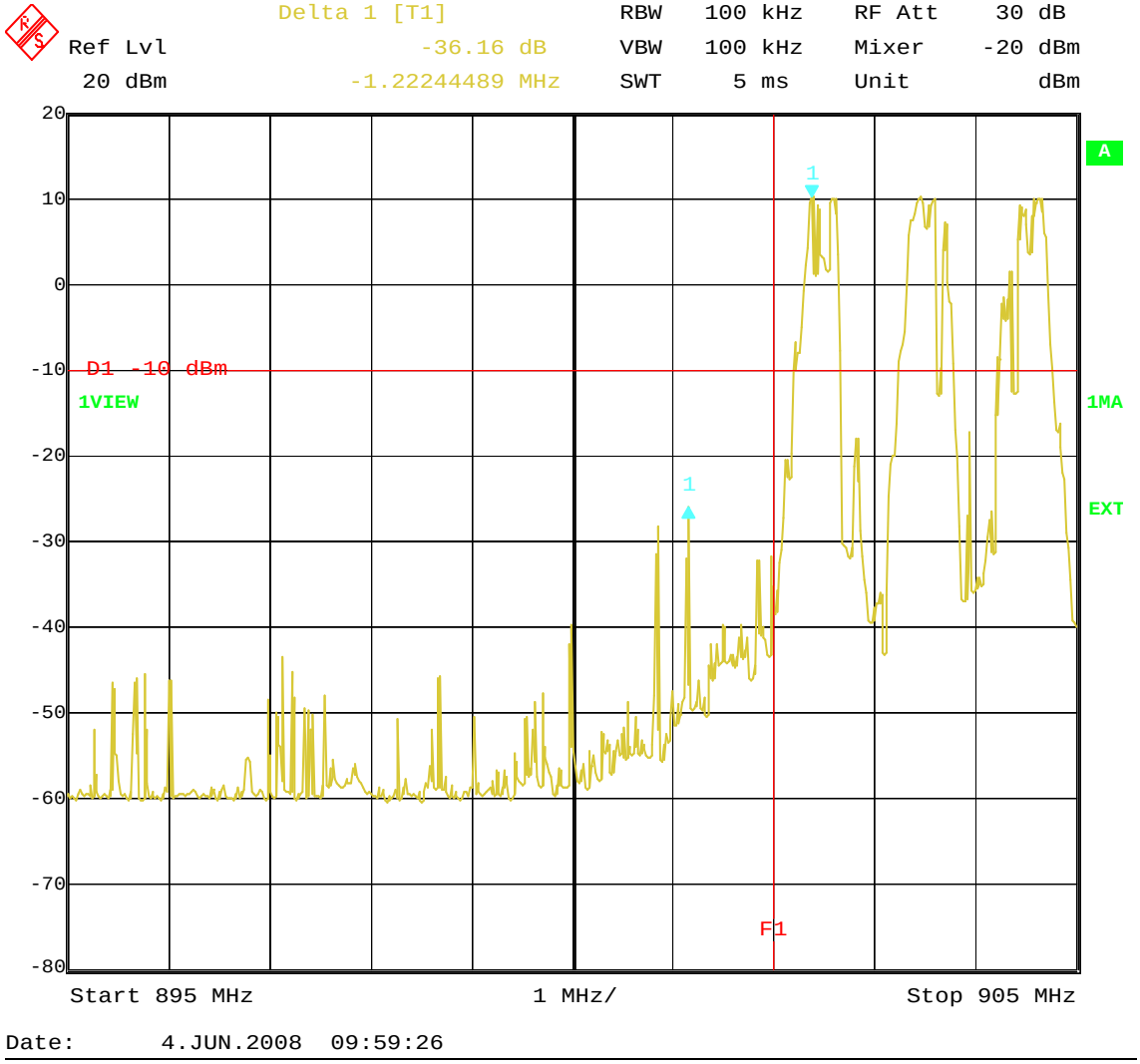
Limit = Red line D1 corresponds to 20 dBc.



Date: 4.JUN.2008 09:39:18

Sweep with peak detector, Frequency hopping enabled

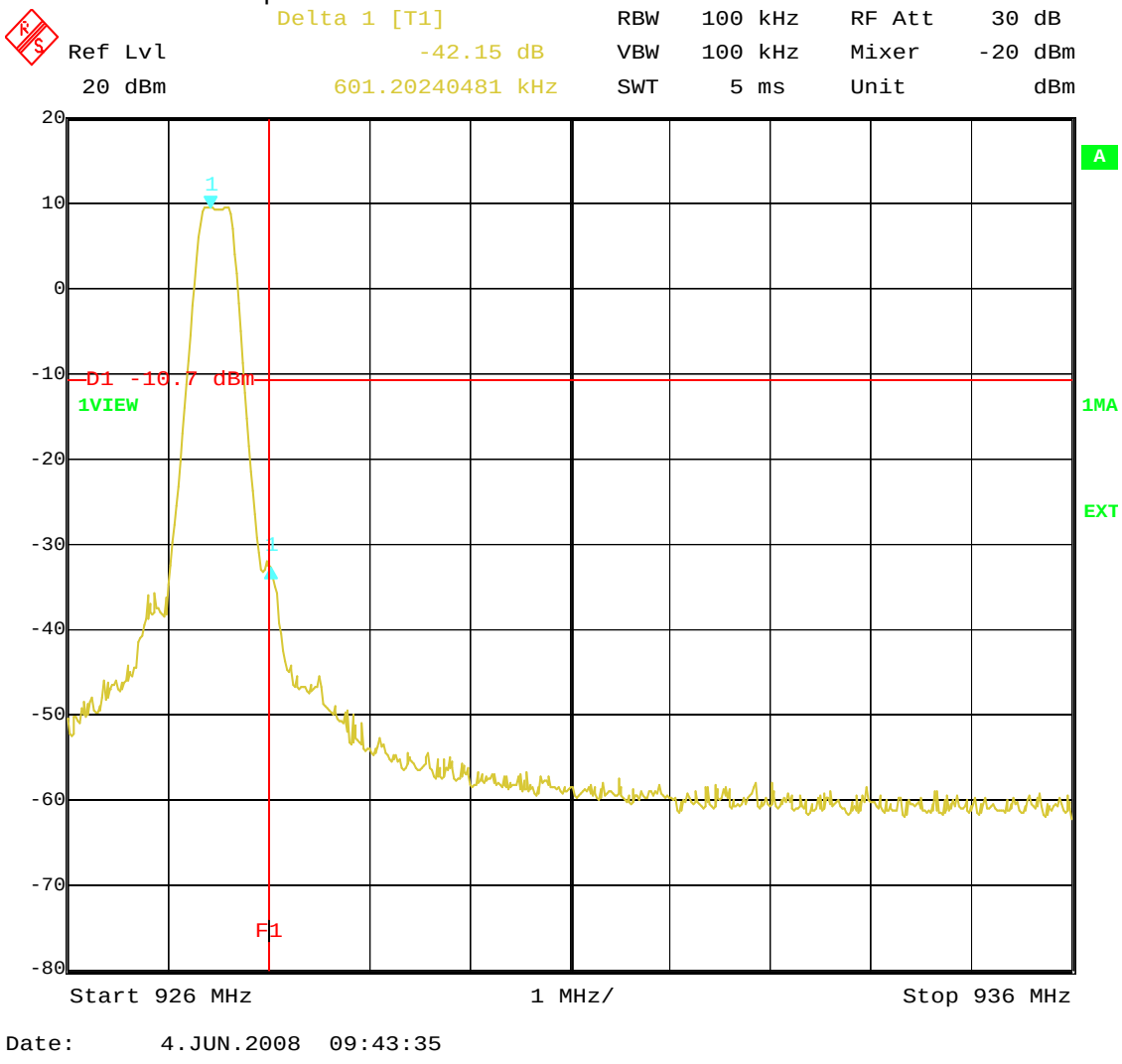
Limit = Line D1 corresponds to 20 dBc.



Band edge compliance at highest channel, 927.481 MHz

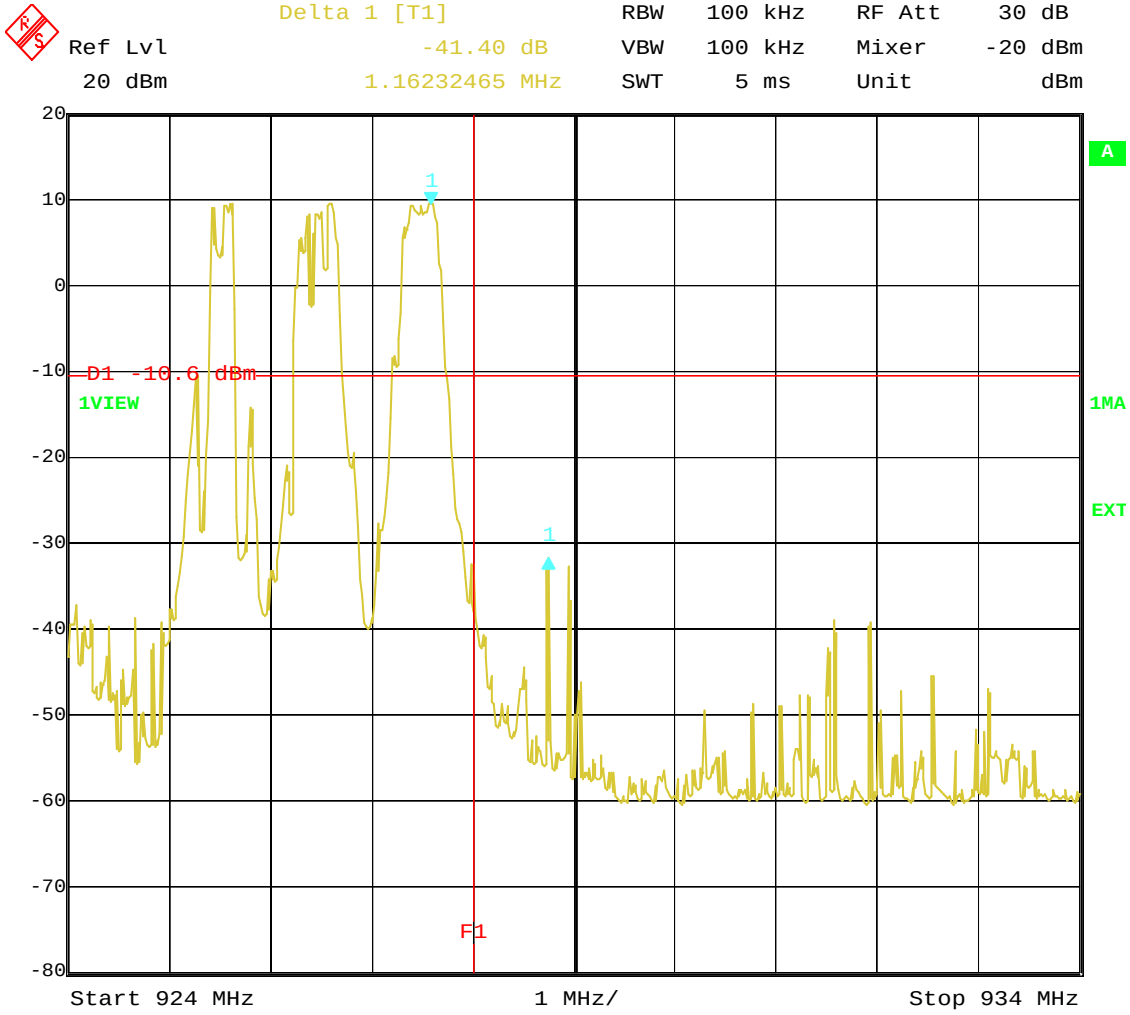
Sweep with peak detector, Frequency hopping disabled

Limit = Line D1 corresponds to 20 dBc.



Sweep with peak detector, Frequency hopping enabled

Limit = Line D1 corresponds to 20 dBc.



Date: 4.JUN.2008 09:53:53

11. RADIATED SPURIOUS EMISSIONS

11.1 Measurement uncertainty

Radiated disturbance electric field intensity, 30 – 1000 MHz: ± 4,6 dB
Radiated disturbance electric field intensity, 1000 – 18000 MHz: ± 6,0 dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT.

Measurement uncertainty is calculated in accordance with EA-4/02-1997.
The measurement uncertainty is given with a confidence of 95%.

11.2 Test equipment

Equipment	Manufacturer	Type	SEMKO No.
Test site: Semi-anechoic shielded chamber, 6 x 9 x 6 m (W x L x H)			30900, 30901
Software:	Rohde & Schwarz	EMC 32	
Measurement receiver:	Rohde & Schwarz	ESCI	12798
Antenna, bilog:	Rohde & Schwarz	HL-562	30711
Test site: Bluetooth anechoic shielded chamber, 3,7 x 7,0 x 2,4 m (W x L x H)			12285
Software:	Rohde & Schwarz	ES-K1, V1.70	
Signal analyser:	Rohde & Schwarz	FSIQ 40	40023
Preamplifier:	MITEQ	AFS6/AFS44	12335
Antennas:			
Double Ridge Guide Horn:	EMCO	3115	4936
Horn antenna:	EMCO	3160-08	30099
Horn antenna:	EMCO	3160-09	30101
High pass filter	K & L	11SH10-1300-U4000-0/0	5133
Band rejection filter	K & L	3TNF-800/1000-0.2-N/N	12389
Transformer	Tufvassons	AFM-1500	30317

11.3 Measurement set-up

Test site: Semi-anechoic shielded chamber (30 – 1000 MHz)

The radiated disturbance electric field intensity was measured in a semi-anechoic chamber at a distance of 3 m and the EUT was placed on a non-metallic table, 0,8 m above the reference ground plane. The specified test mode was enabled. Test set-up photos are given below.

An overview sweep with peak detection of the electric field intensity was performed with the measurement receiver in max-hold and with the antenna placed 1,5 m, 2,5 m and 3,5 m above the floor. The polarisation was horizontal and vertical. The measurements were repeated with the EUT rotated in 90-degree steps.

At the frequencies where high disturbance levels were found a search for max disturbance level was performed. With the EUT and antenna in the worst-case configuration new measurements with quasi-peak detector were carried out.

Test set-up photos:

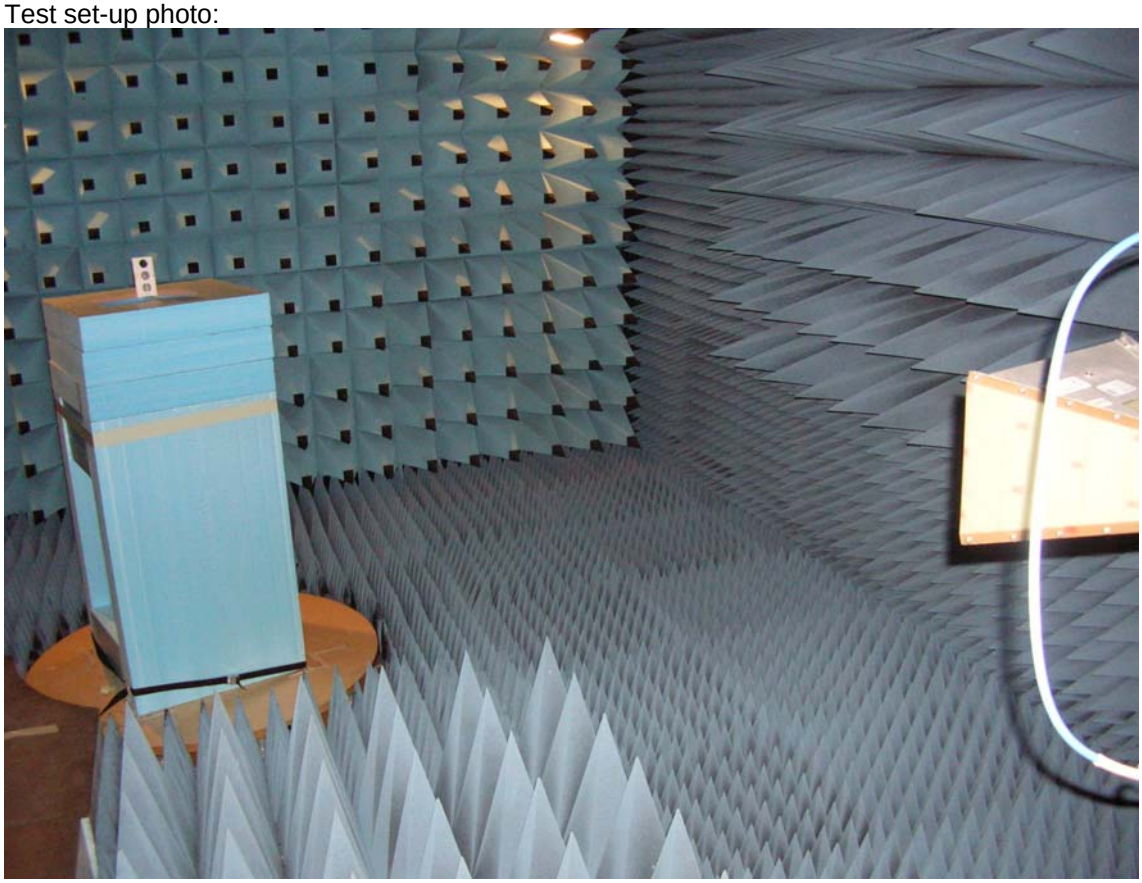
Test site: Radio anechoic shielded chamber (1 – 10 GHz)

In the Radio anechoic chamber the EUT was placed on a non-metallic table, 1,4 m above the floor. The radiated disturbance electric field intensity was measured at a distance of 3 m. The specified test mode was enabled.

An overview sweep with peak detection of the electric field intensity was performed with the spectrum analyser in max-hold and with the antenna placed 1,4 m above the floor. The polarisation was horizontal and vertical. The measurements were repeated with the EUT rotated in 90-degree steps.

At the frequencies where high disturbance levels were found a search for max disturbance level was performed. With the EUT and antenna in the worst-case configuration new measurements with peak and average detectors were carried out.

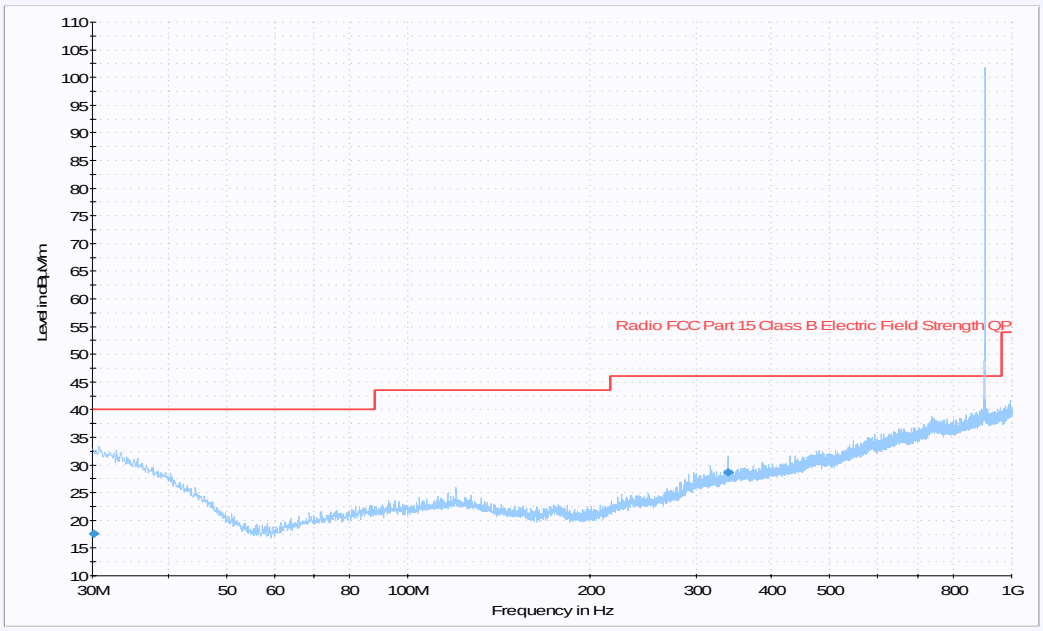
Test set-up photo:



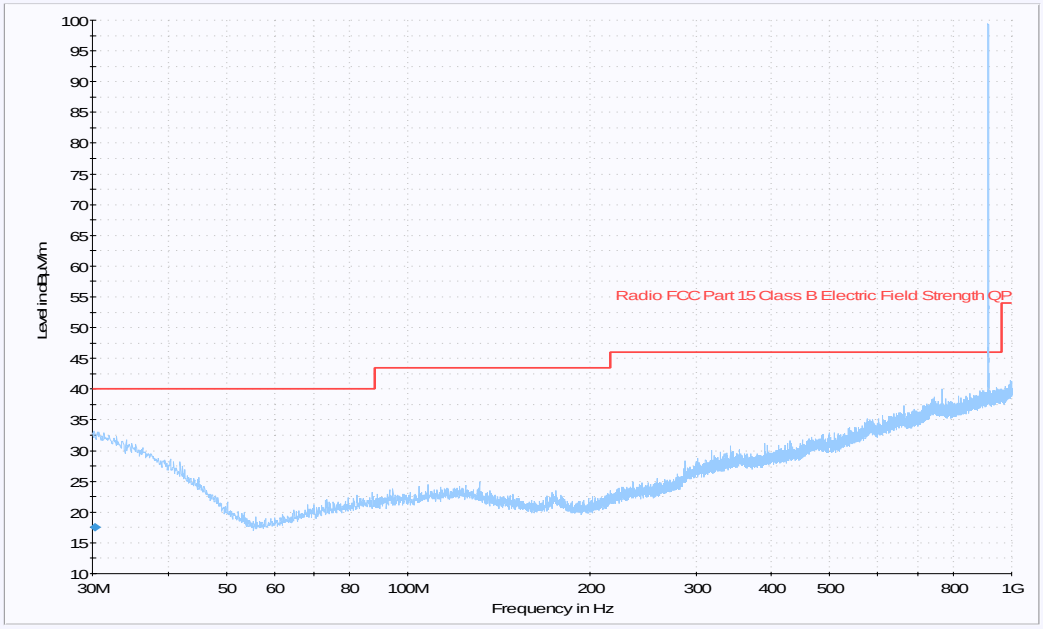
11.4 Test protocol

Semi-anechoic shielded chamber

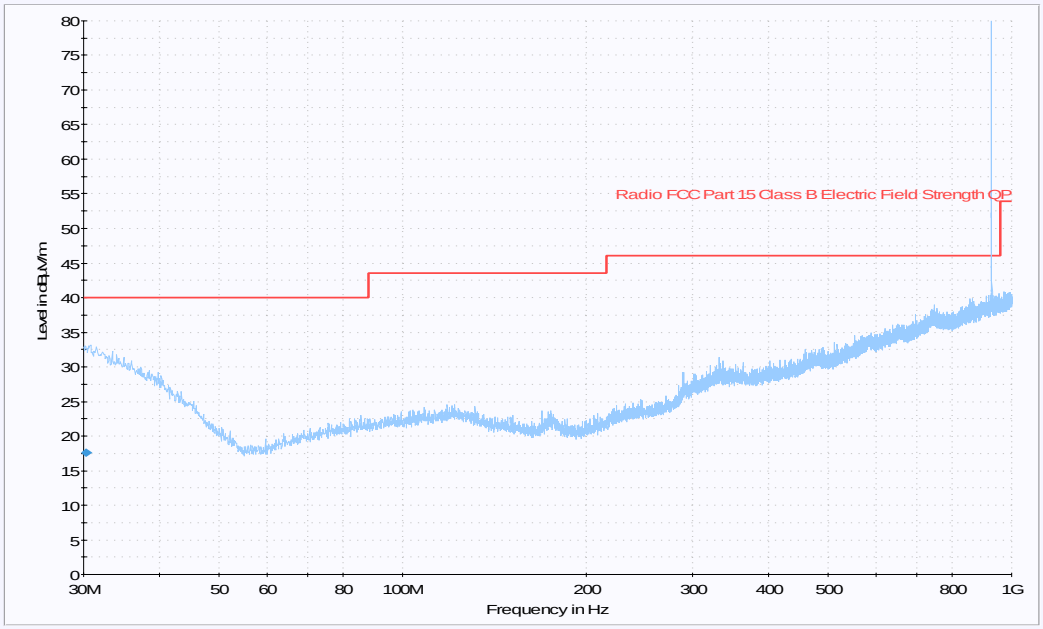
Date of test: June 03, 2008
30 – 1000 MHz, max peak at a distance of 3 m, Lowest channel, 902.473 MHz



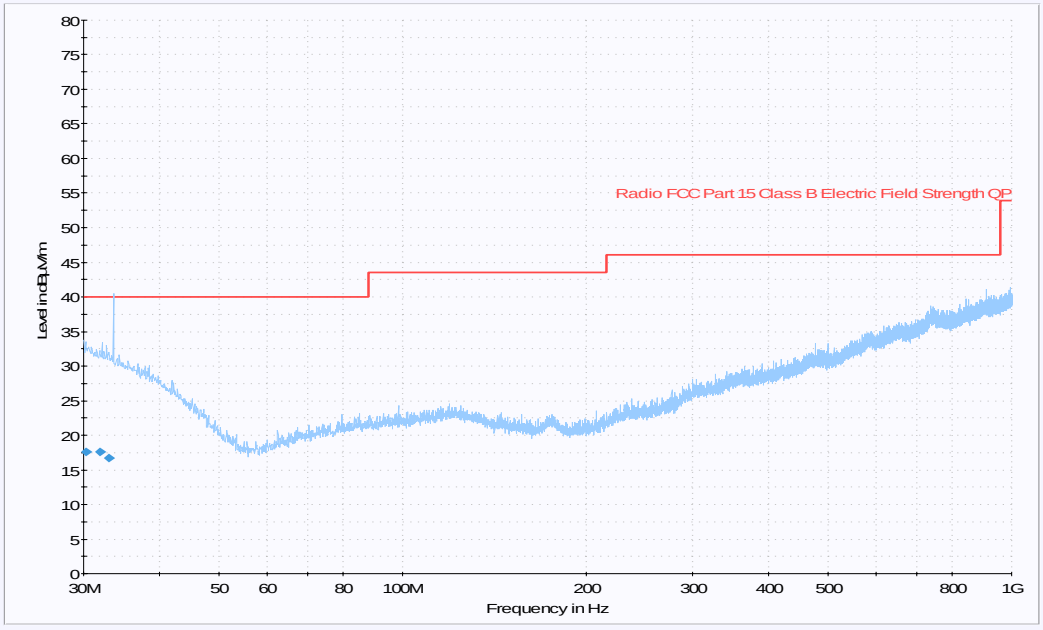
30 – 1000 MHz, max peak at a distance of 3 m, mid channel, 914.502 MHz



30 – 1000 MHz, max peak at a distance of 3 m, Highest channel, 927.481 MHz



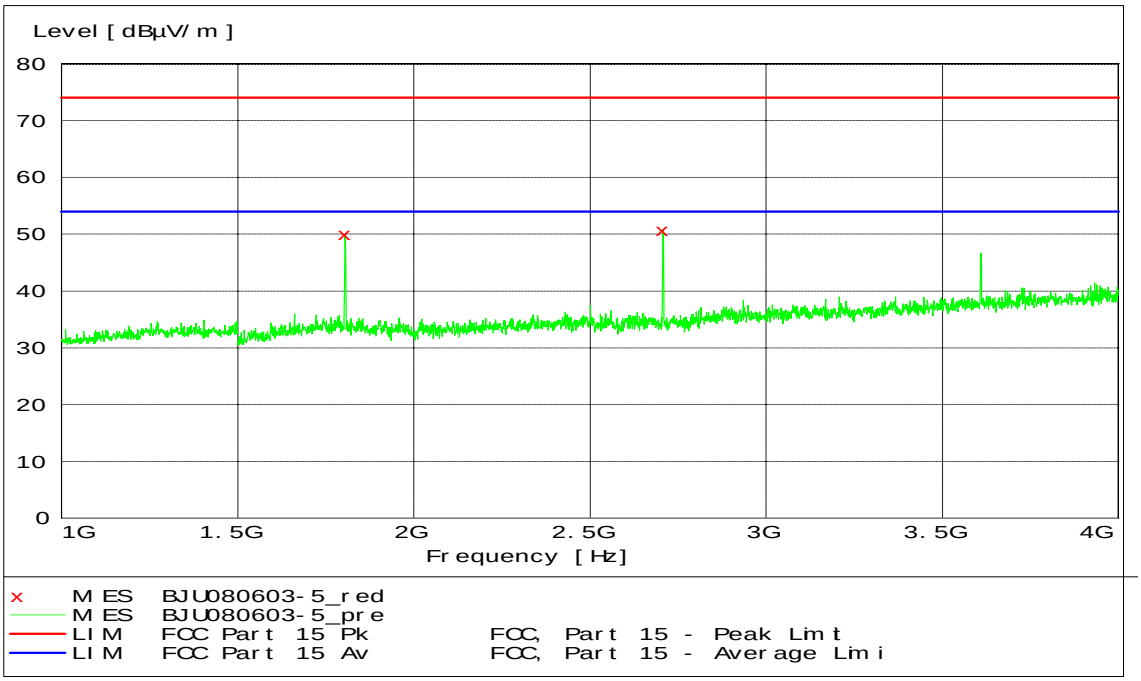
30 – 1000 MHz, max peak at a distance of 3 m, standby mode



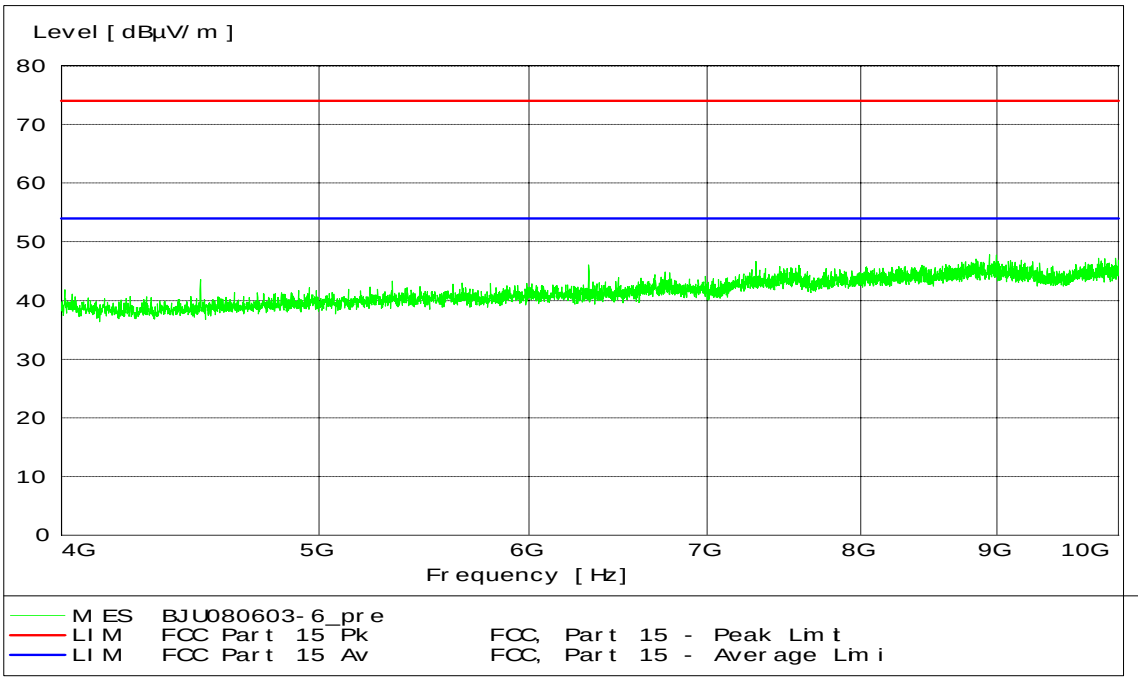
Radio anechoic shielded chamber

Date of test: June 03, 2008

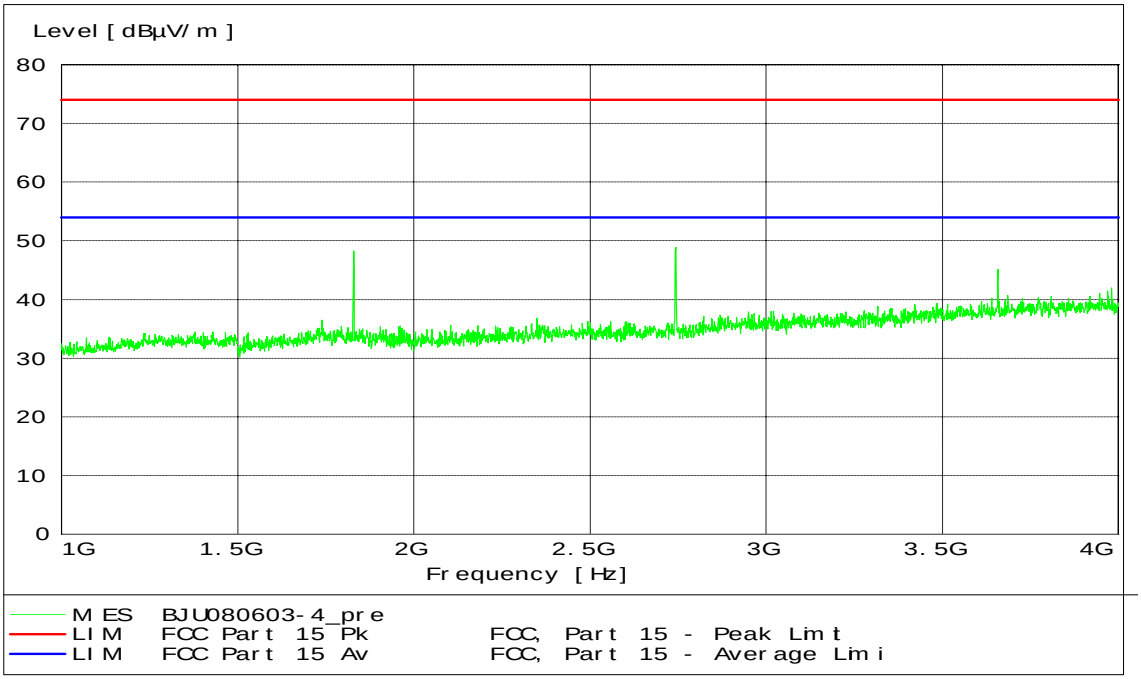
1 – 4 GHz, max peak at a distance of 3 m, Lowest channel, 902.473 MHz
Carrier is attenuated by high pass filter 1-4 GHz, inv no S7991



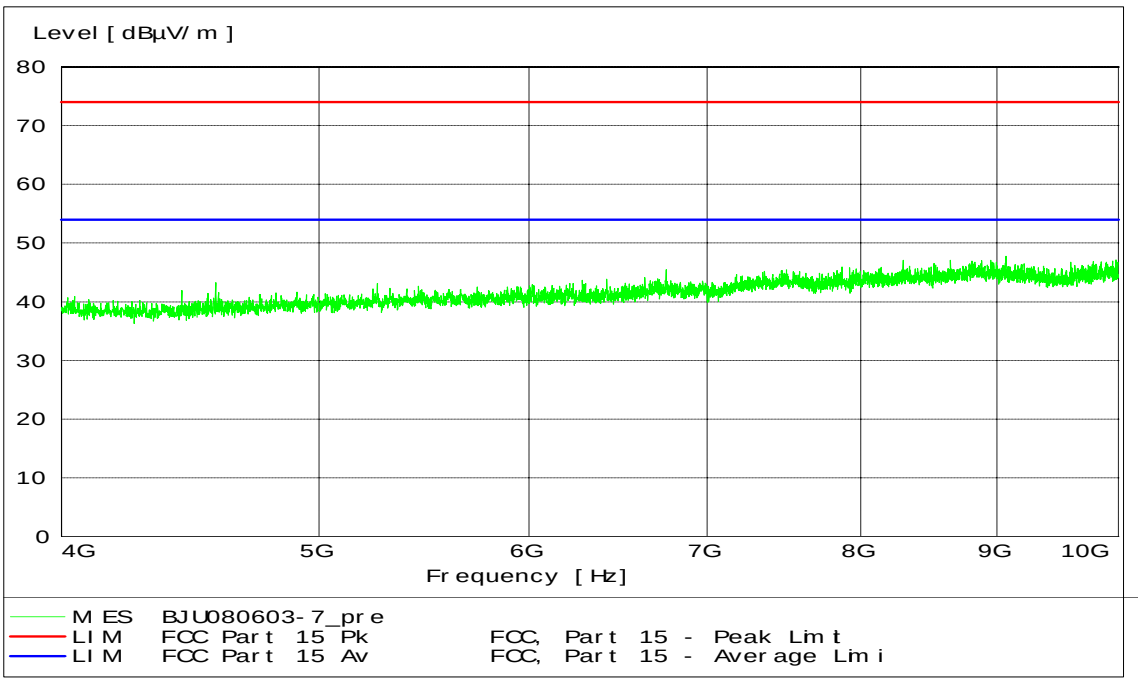
4 – 10 GHz, max peak at a distance of 3 m, Lowest channel, 902.473 MHz
Carrier is attenuated by high pass filter 4-10 GHz, inv no S5133



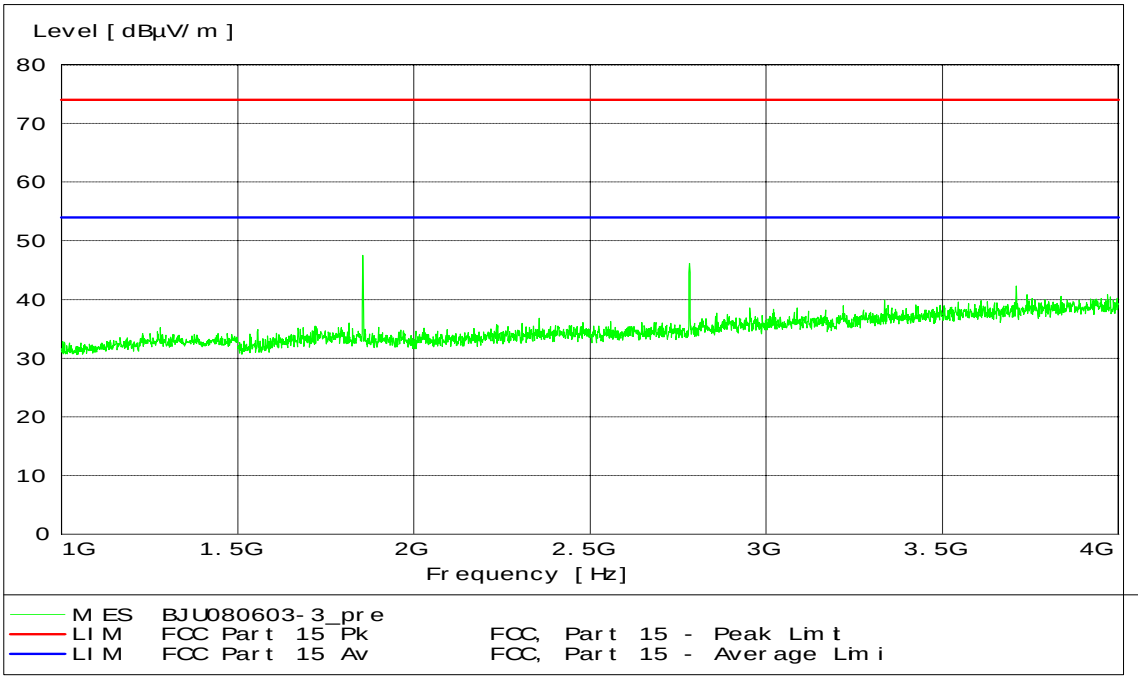
1 – 4 GHz, max peak at a distance of 3 m, mid channel, 914.502 MHz
Carrier is attenuated by high pass filter 1-4 GHz, inv no S7991



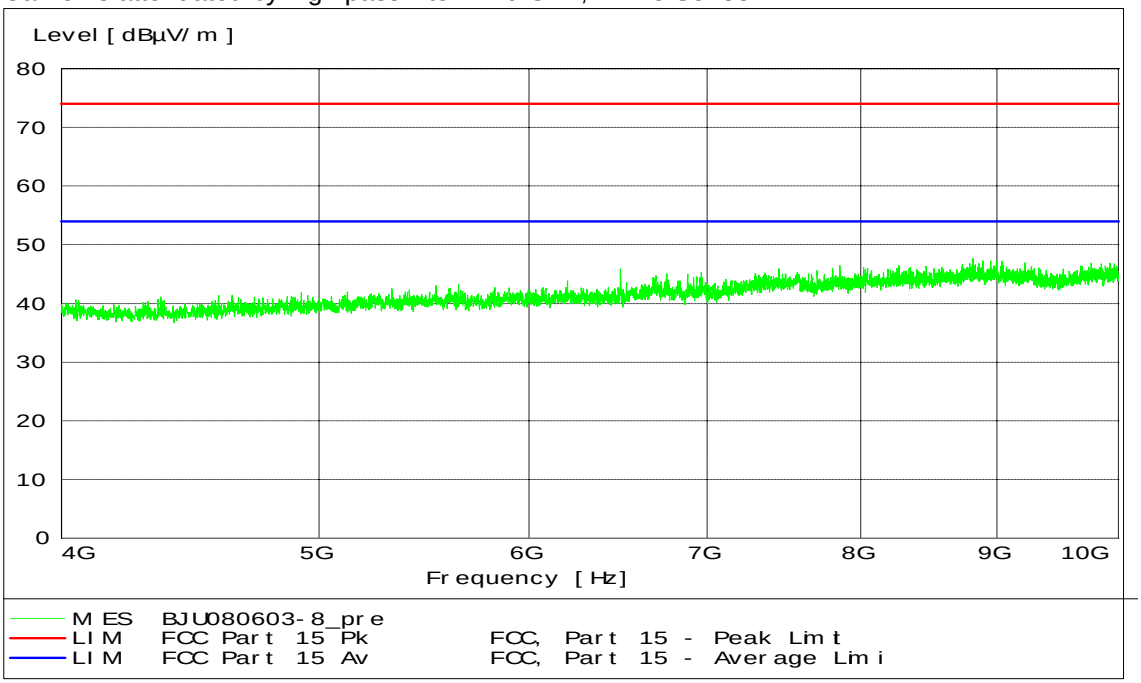
4 – 10 GHz, max peak at a distance of 3 m, mid channel, 914.502 MHz
Carrier is attenuated by high pass filter 4-10 GHz, inv no S5133



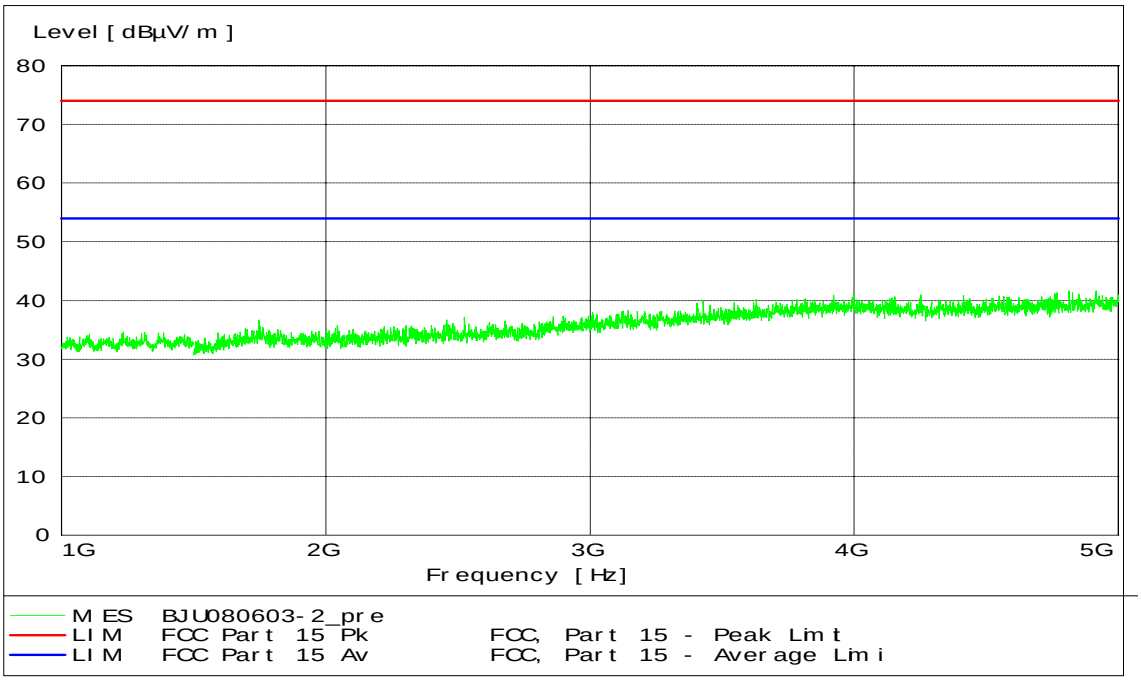
1 – 4 GHz, max peak at a distance of 3 m, Highest channel, 927.481 MHz
Carrier is attenuated by high pass filter 1-4 GHz, inv no S7991



4 – 10 GHz, max peak at a distance of 3 m, Highest channel, 927.481 MHz
Carrier is attenuated by high pass filter 4-10 GHz, inv no S5133



1 – 5 GHz, max peak at a distance of 3 m, standby mode



Data summary

Stand by mode

Field strength of spurious emissions						
Frequency	RBW	Measured level		Limit		Note
		Peak	QP/AV	Peak	QP/AV	
[MHz]	[kHz]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	
30 - 1000	120	--	--	--	40 - 54	Noise floor
33.0	120	--	--	--	46	1
1000 - 5000	1000	--	--	74	54	Noise floor

1 = The peak shown in the graph was not found when re-measured.

Lowest channel

Field strength of spurious emissions						
Frequency	RBW	Measured level		Limit		Note
		Peak	QP/AV	Peak	QP/AV	
[MHz]	[kHz]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	
30 - 1000	120	--	--	--	40 - 54	Noise floor
1804.6	1000	51.9	--	74	54	20 dBc
2708.4	1000	49.3	-	74	54	Restricted band
3610.2	1000	49.4	--	74	54	Restricted band
4512.0	1000	50.3	--	74	54	Restricted band
6317.6	1000	51.4	--	74	54	20 dBc
902.473	120	--	QP 105.2	--	--	Carrier

Mid channel

Field strength of spurious emissions						
Frequency	RBW	Measured level		Limit		Note
		Peak	QP/AV	Peak	QP/AV	
[MHz]	[kHz]	[dB(µV/m)]	[dB(µV/m)]	[dB(µV/m)]	[dB(µV/m)]	
30 - 1000	120	--	--	--	40 - 54	Noise floor
1829,7	1000	48,4	--	74	54	20 dBc
2744,5	1000	48,1	-	74	54	Restricted band
3658,0	1000	48,2	--	74	54	Restricted band
4572,5	1000	49,5	--	74	54	Restricted band
914,502	120	--	QP 104,7	--	--	Carrier

Highest channel

Field strength of spurious emissions						
Frequency	RBW	Measured level		Limit		Note
		Peak	QP/AV	Peak	QP/AV	
[MHz]	[kHz]	[dB(µV/m)]	[dB(µV/m)]	[dB(µV/m)]	[dB(µV/m)]	
30 - 1000	120	--	--	--	40 - 54	Noise floor
1855,7	1000	48,0	--	74	54	20 dBc
2782,6	1000	49,6	-	74	54	Restricted band
3609,9	1000	44,8	--	74	54	Restricted band
4637,4	1000	48,6	--	74	54	Restricted band
6492,4	1000	50,8	--	74	54	Restricted band
927,481	120	--	QP 102,5	--	--	Carrier

12. CONDUCTED SPURIOUS EMISSIONS AT ANTENNA PORT

12.1 Measurement uncertainty

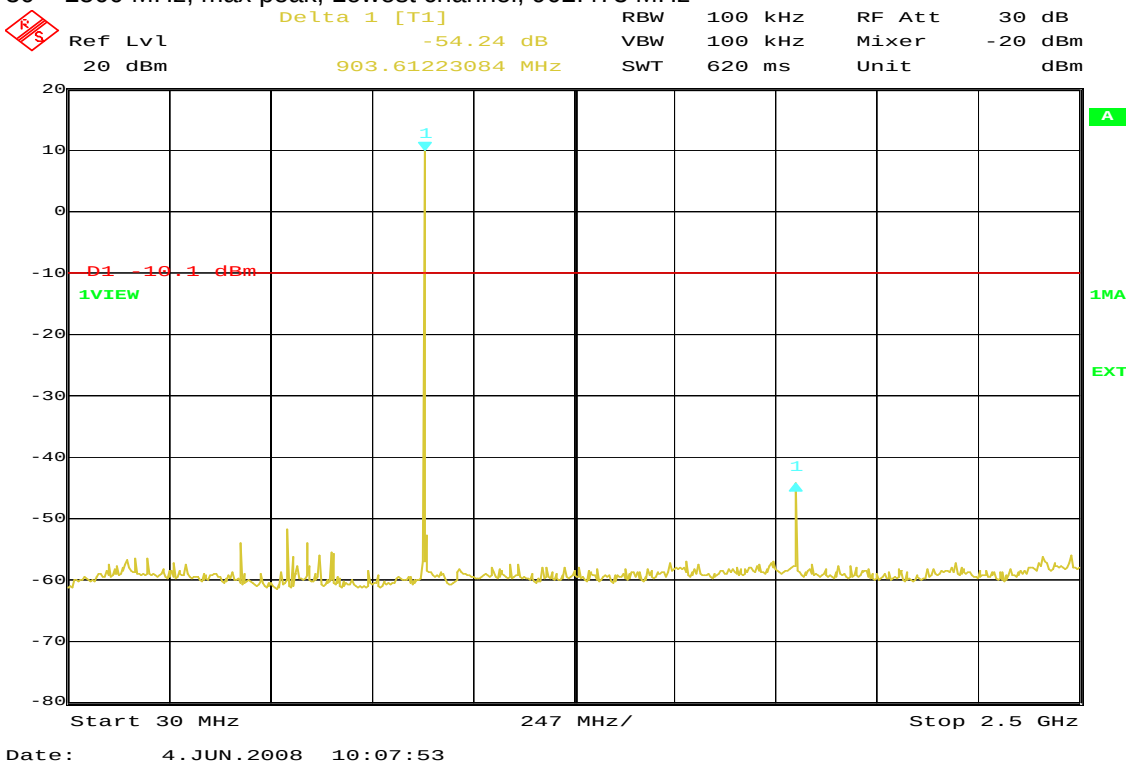
Measurement uncertainty for conducted disturbances at the antenna port: ± 3,6 dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT. Measurement uncertainty is calculated in accordance with EA-4/02-1997. The uncertainty is given with a level of confidence of approximately 95% (k=2).

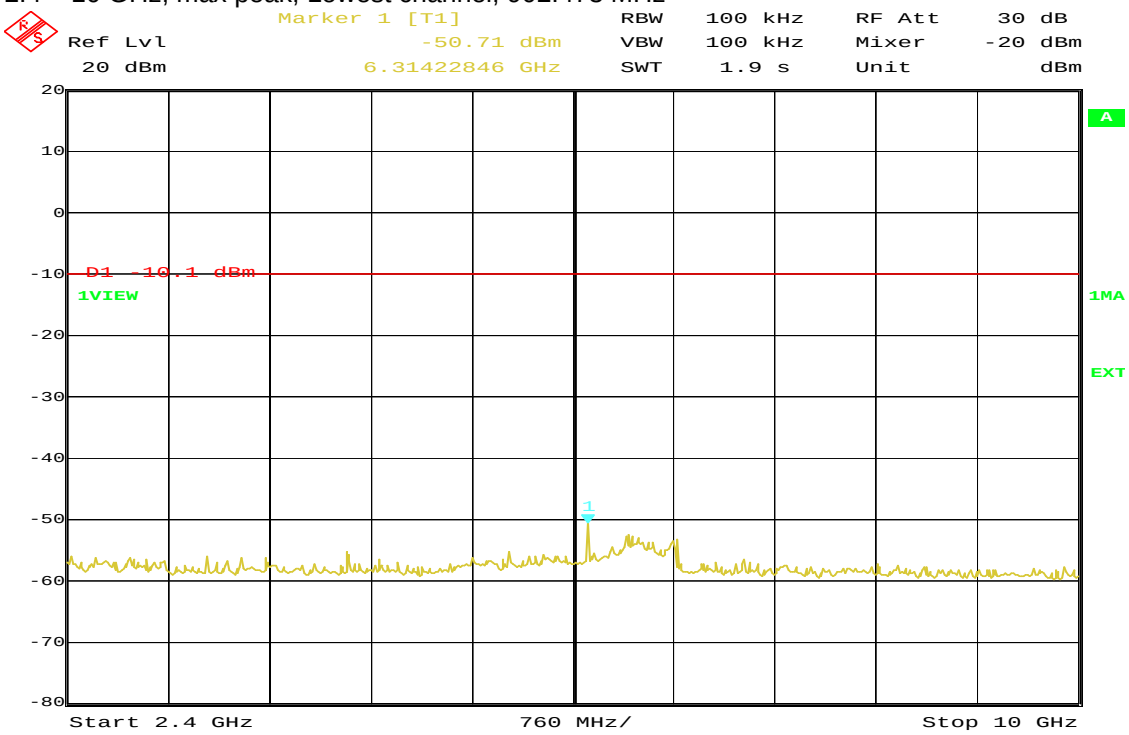
12.2 Test protocol

Date of test: June 4, 2008

30 – 2500 MHz, max peak, Lowest channel, 902.473 MHz

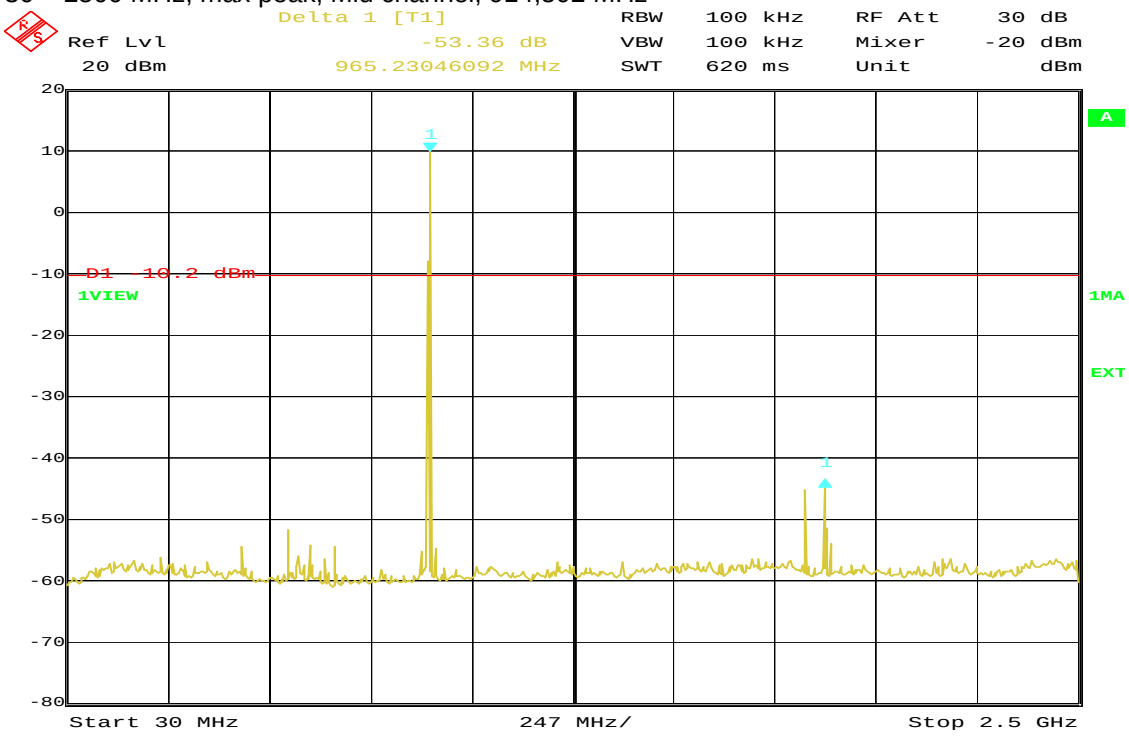


2.4 – 10 GHz, max peak, Lowest channel, 902.473 MHz



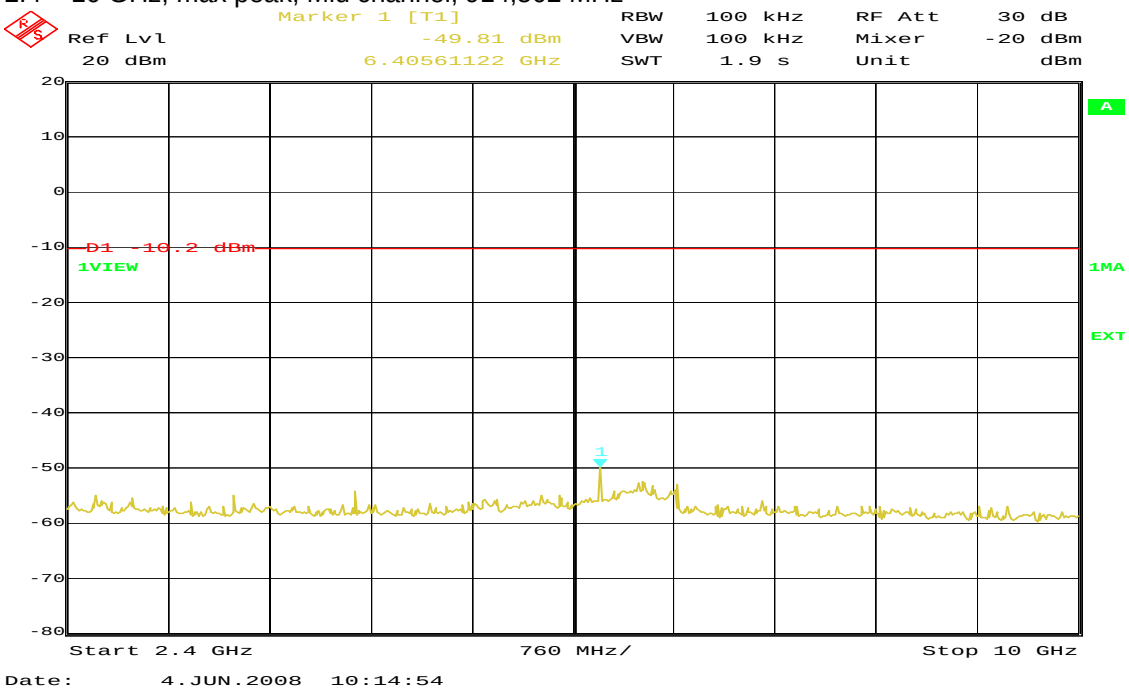
Date: 4.JUN.2008 10:09:13

30 – 2500 MHz, max peak, Mid channel, 914,502 MHz

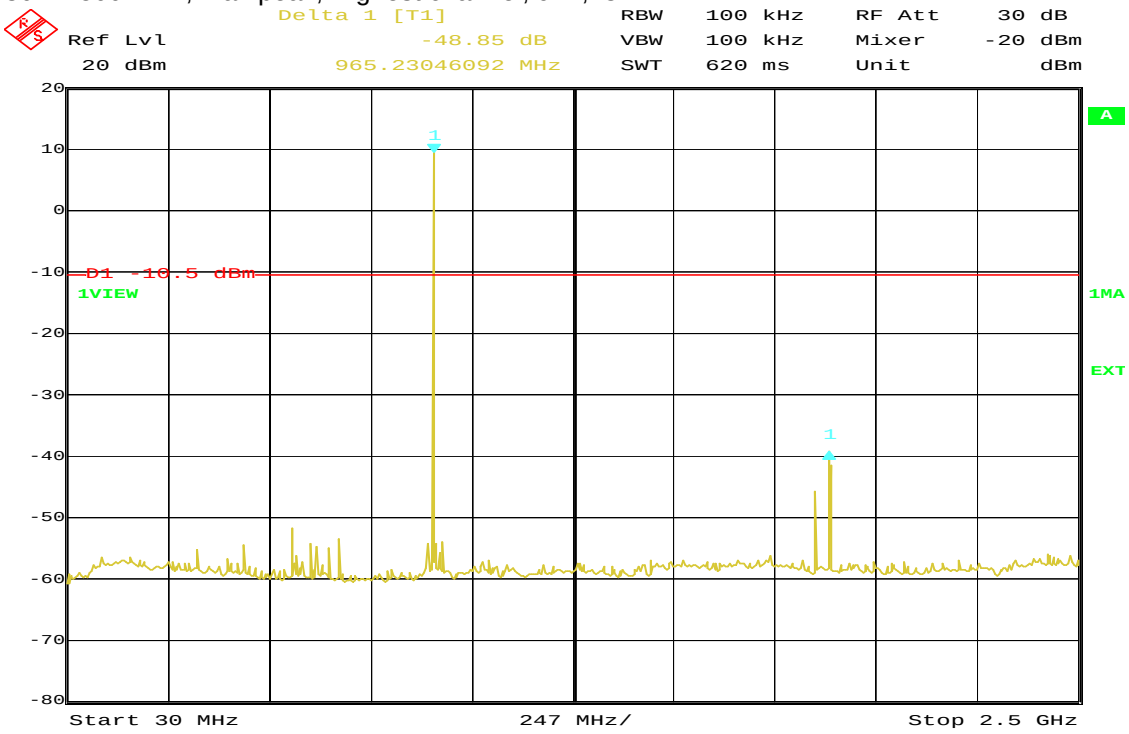


Date: 4.JUN.2008 10:13:58

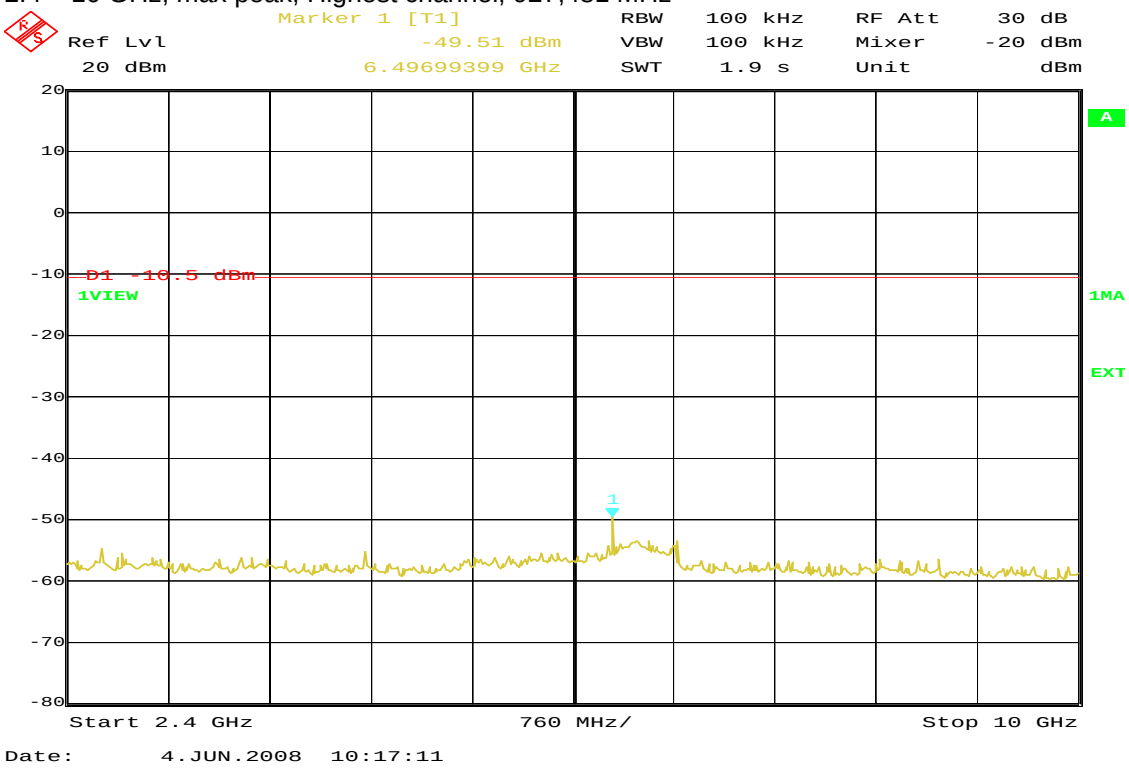
2.4 – 10 GHz, max peak, Mid channel, 914,502 MHz



30 – 2500 MHz, max peak, Highest channel, 927,481 MHz



2.4 – 10 GHz, max peak, Highest channel, 927,481 MHz



Lowest channel

Strength of conducted spurious emissions				
Frequency [MHz]	RBW [kHz]	Measured peak level [dBc]	Limit [dBc]	Note
30 - 2500	100	-54,2	-20	
2400 - 10000	100	-60,8	-20	

Mid channel

Strength of conducted spurious emissions				
Frequency [MHz]	RBW [kHz]	Measured peak level [dBm]	Limit [dBc]	Note
30 - 2500	100	-53,4	-20	
2400 - 10000	100	-60,0	-20	

Highest channel

Strength of conducted spurious emissions				
Frequency [MHz]	RBW [kHz]	Measured peak level [dBm]	Limit [dBc]	Note
30 - 2500	100	-48,9	-20	
2400 - 10000	100	-60	-20	

Limit: In any 100 kHz bandwidth outside the operating frequency band (902 – 928 MHz), the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

Measurement results are corrected for attenuation in the set-up configuration.

APPENDIX I – PHOTOS OF THE EUT

General view