

RADIO TEST REPORT

No. 816633-3

EQUIPMENT UNDER TEST

Equipment: Wireless thermostat
Type / model: T54 Uponor thermostat
Manufacturer: Hager Controls SAS
33, rue St Nicolas B.P 10140
67703 Saverne Cedex
France
Tested by request of: Hager Controls SAS
33, rue St Nicolas B.P 10140
67703 Saverne Cedex
France

SUMMARY

The equipment complies with the requirements of the following standards:

FCC 47 CFR part 15 (2008) Subpart B – Unintentional radiators
FCC 47 CFR part 15 (2008) 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 2042G-1

Date of issue: January 12, 2010

Tested by:



Stefan Andersson

Approved by:



Niklas Boström

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company: Hager Controls SAS
33, rue St Nicolas B.P 10140
67703 Saverne Cedex
France

Name of contact: Patrick Walter

2. EQUIPMENT UNDER TEST (EUT)

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

Equipment:	Wireless thermostat
Type/Model:	T54 Uponor thermostat
Brand name:	Uponor
Serial number:	No visible serial number
Manufacturer:	Hager Controls SAS 33, rue St Nicolas B.P 10140 67703 Saverne Cedex France
Rating/Supplying voltage:	Two LR03 Size AAA battery 3VDC / 30 mA max.
Rating RF output power:	Approx. 9 dBm
Antenna gain:	Approx. 0 dBi
External antenna connector:	No
Frequency range:	902 – 928 MHz
Number of channels:	26
Channel separation:	1 MHz
Modulation characteristics:	2FSK
Stand by mode supported:	Yes
Receiver mode supported	No

2.2 Modifications during the test

No modifications have been made during the tests.

3. TEST SPECIFICATIONS

3.1 Standards

FCC 47 CFR part 15 (2008) Subpart B – Unintentional radiators
FCC 47 CFR part 15 (2008) 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: December 17, 2008

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

Spectrum analyser settings:

Span: 2 MHz

RBW: 1 MHz

VBW: 3 MHz

Sweep time: 20 ms

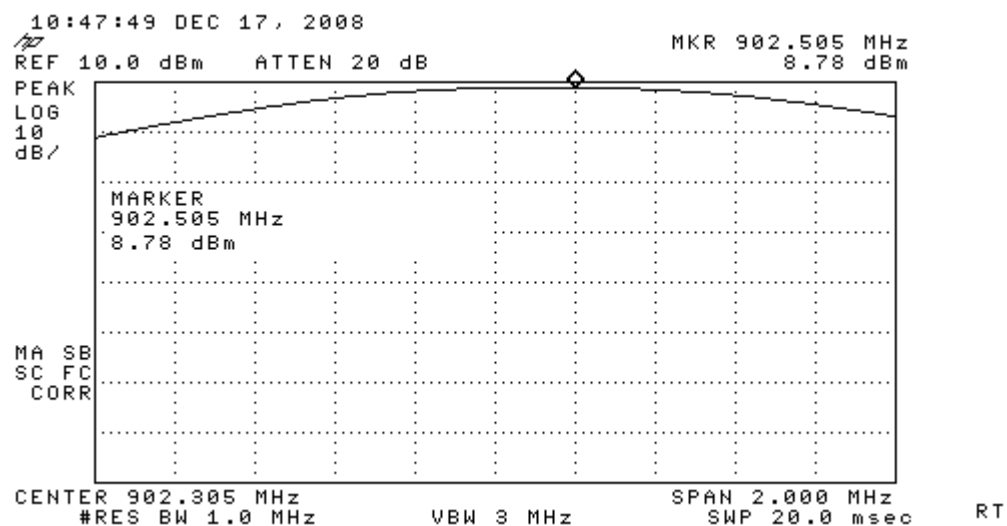
Detector: Peak

Trace: Max Hold

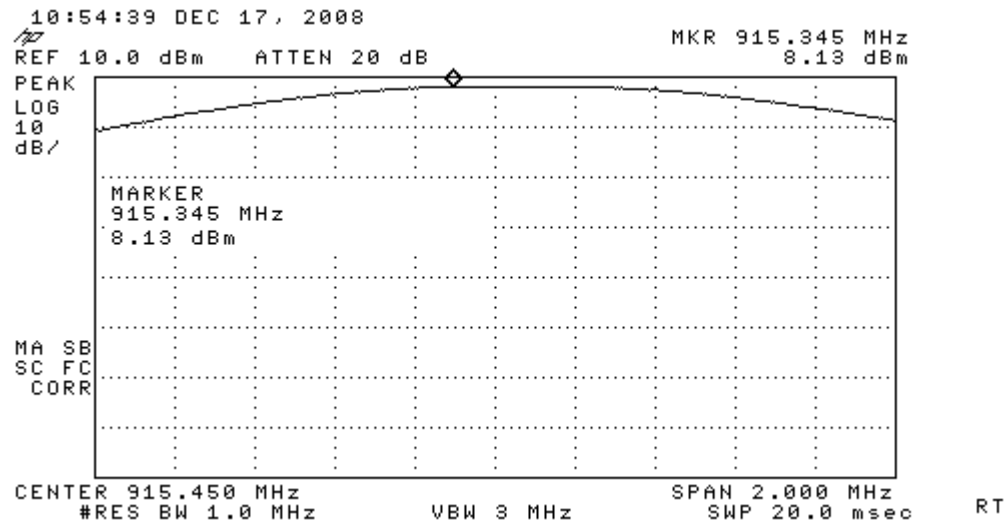
The measured power has been compensated for the cable loss with 0,4 dB.

Measured value, dBm			Limit, dBm
Lowest ch 0	Mid ch 12	Highest ch 25	
902.3	915.6	927.3	
9.2	8.5	9.0	0.25 W = 24.0 dBm

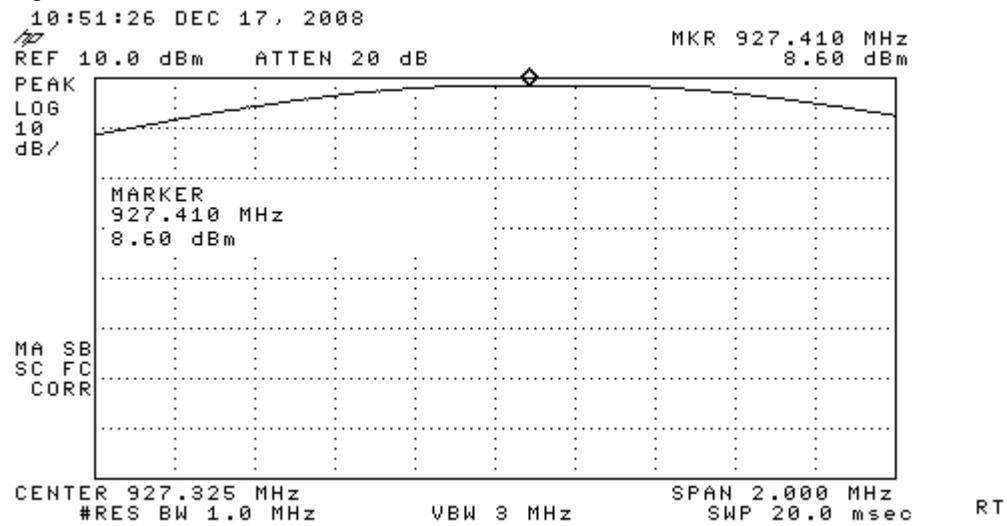
Lowest channel



Mid channel



Highest channel



6. 20 dB BANDWIDTH

6.1 Test protocol

Date of test: December 16, 2008

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

Spectrum analyser settings:

Span: 600 kHz

RBW: 30 kHz

VBW: 30 kHz

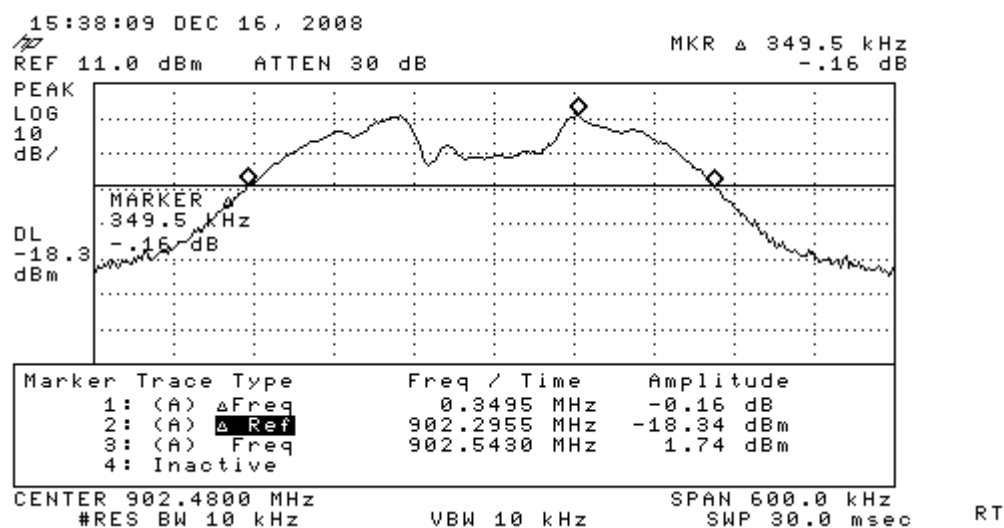
Sweep time: 30 ms

Detector: Peak

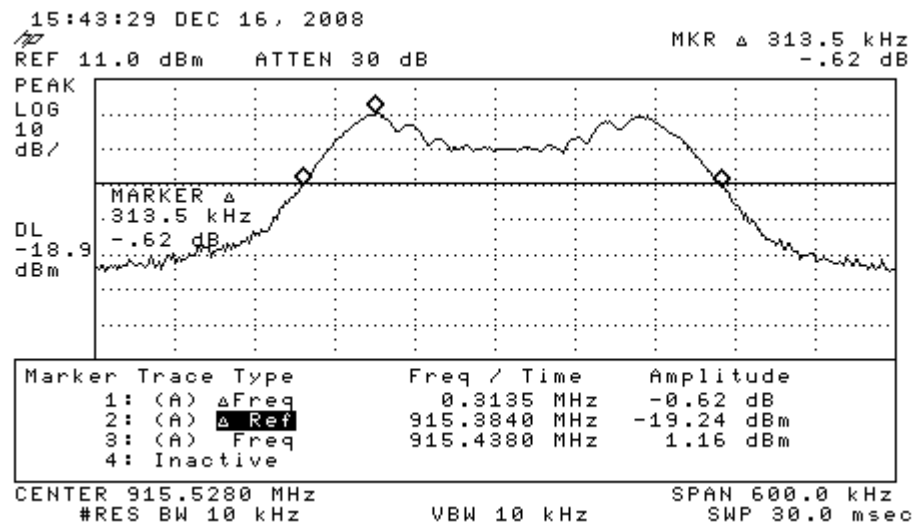
Trace: Max Hold

Channel no	Channel (MHz)	20 dB Bandwidth (kHz)	Limit value (kHz)
0	902.5	350	250 - 500
12	915.4	314	
25	927.5	296	

Lowest channel

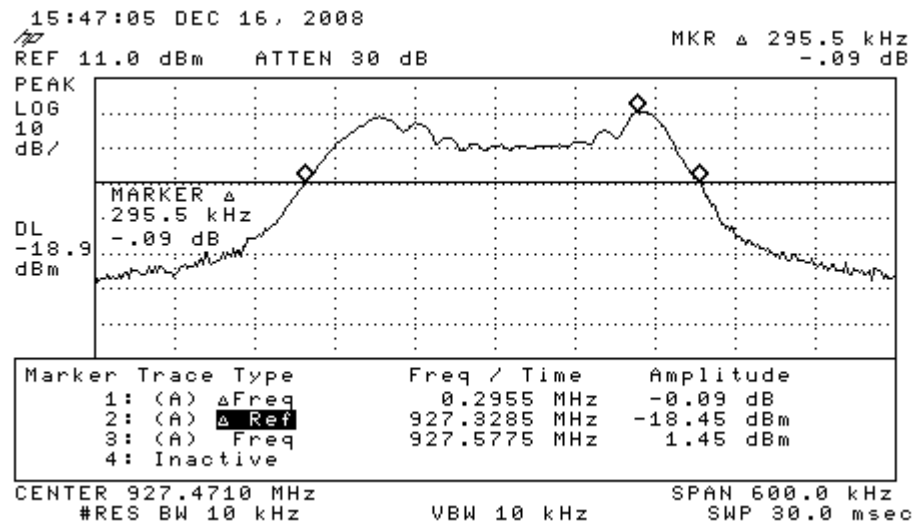


Mid channel



RT

Highest channel



RT

7. CARRIER FREQUENCY SEPARATION

7.1 Test protocol

Date of test: December 15, 2008

EUT mode of operation: TX and hopping on.

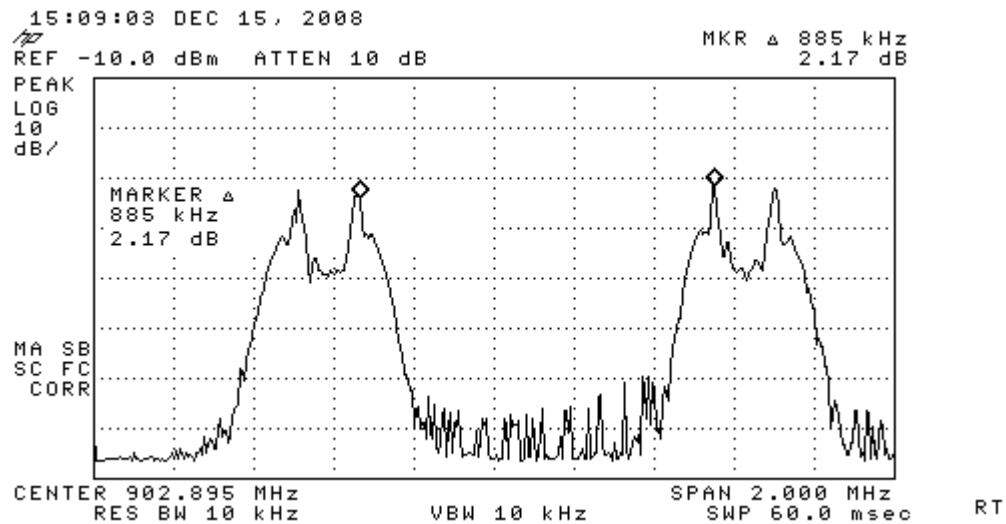
Spectrum analyser settings:

Span: 2 MHz
 RBW: 10 kHz
 VBW: 10 kHz
 Sweep time: Auto
 Detector: Peak
 Trace: Max Hold

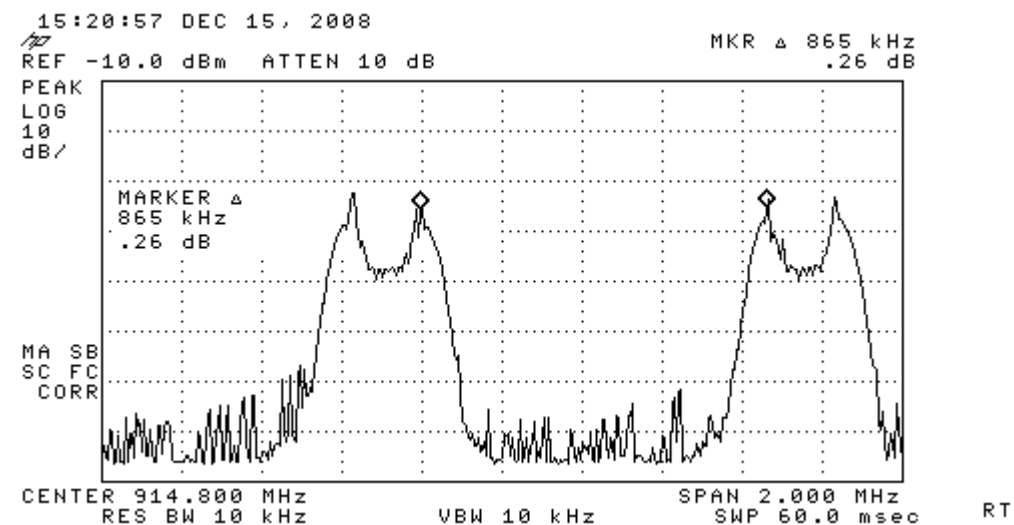
Channel (MHz)	Carrier frequency separation from the next channel		Limit value (> 20 dB bandwidth) (kHz)
	To the right (kHz)	To the left (kHz)	
902.473	885	-	> 350
914.502	865	-	> 314
927.481		845	> 296

Limit = Result from the 20 dB Bandwidth measurements

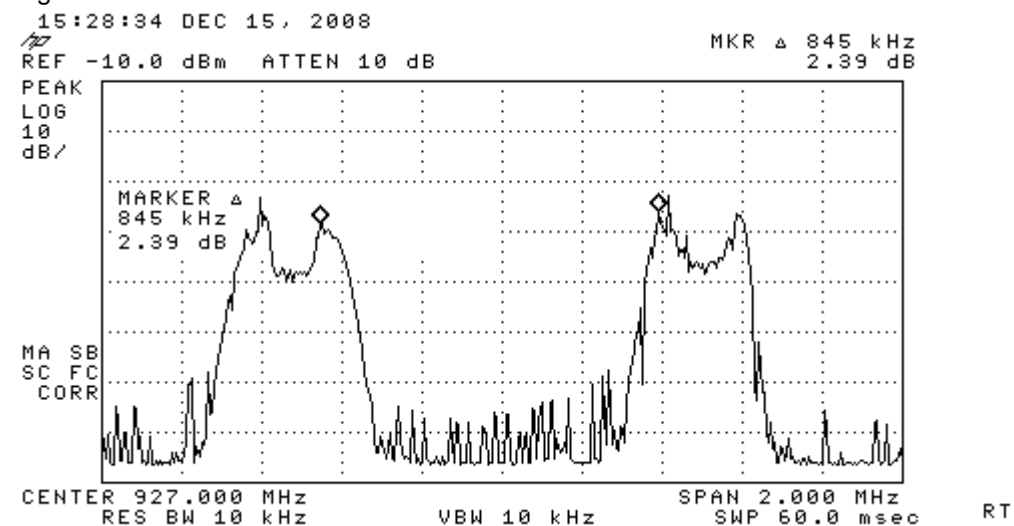
Lowest channel



Mid channel left



Highest channel



8. NUMBER OF HOPPING CHANNELS

8.1 Test protocol

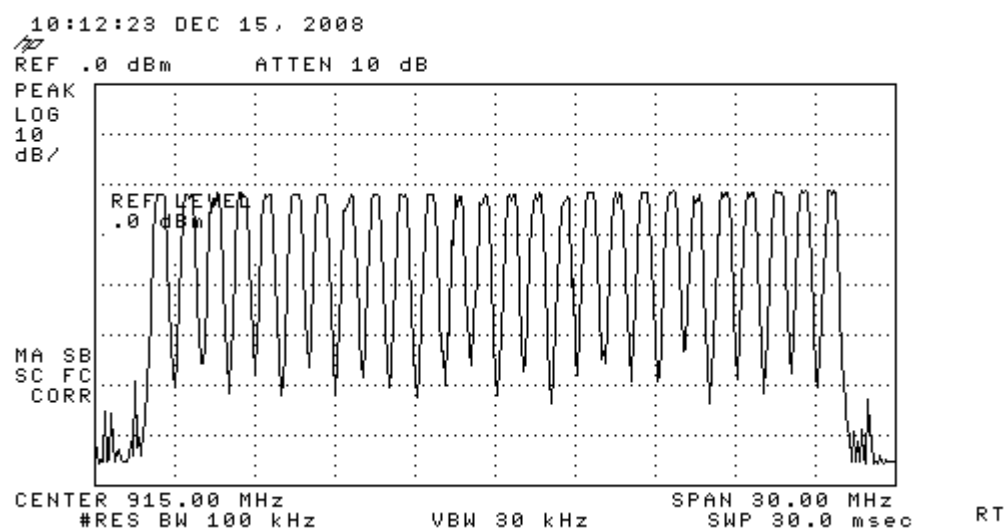
Date of test: December 15, 2008

EUT mode of operation: TX and hopping on.

Spectrum analyser settings:

RBW: 100 kHz
 VBW: 30 kHz
 Sweep time: 30ms
 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: December 15 & 19, 2008

EUT mode of operation: TX and hopping on.

Spectrum analyzer settings:

*Determination of transmitting time **T***

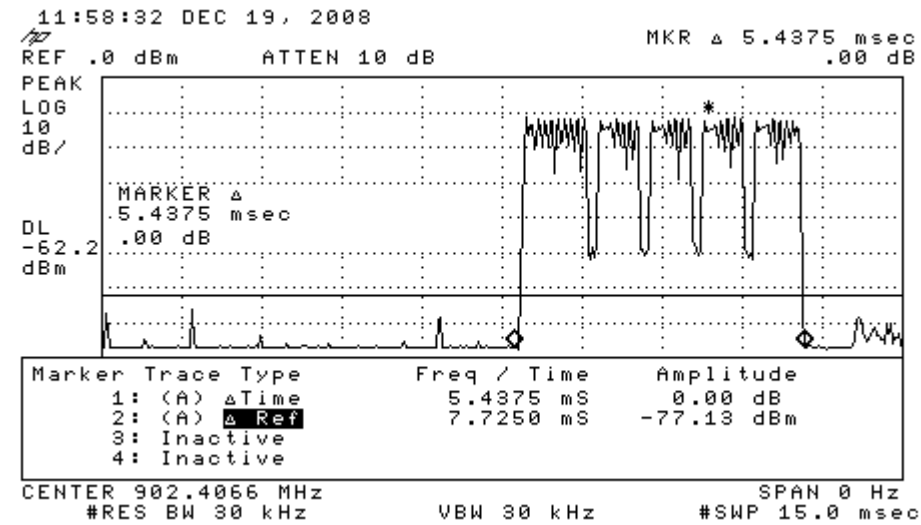
Span: 0 Hz
 RBW: 10 kHz
 VBW: 10 kHz
 Sweep time: 20 ms
 Continuous sweep
 Detector: Peak
 Trace: Clear/Write
 Trigger: Video

*Determination of the number of times **n** the channel is active during the sweep time of 10 s*

RBW: 10 kHz
 VBW: 10 kHz
 Sweep time: 10.0 s
 Single sweep

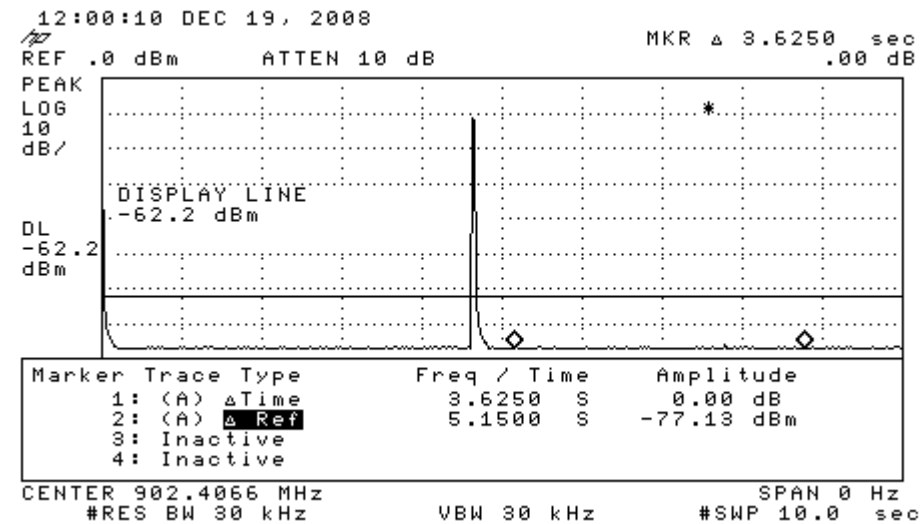
Test parameters	Channel (MHz)			Limit value (s)
	902,4	915.4	927.4	
T (ms)	5,4	5,4	5,3	-
n	2	2	1	-
Dwell time (s) = T · n	0,011	0,011	0.005	< 0,4

Lowest channel, transmitting time



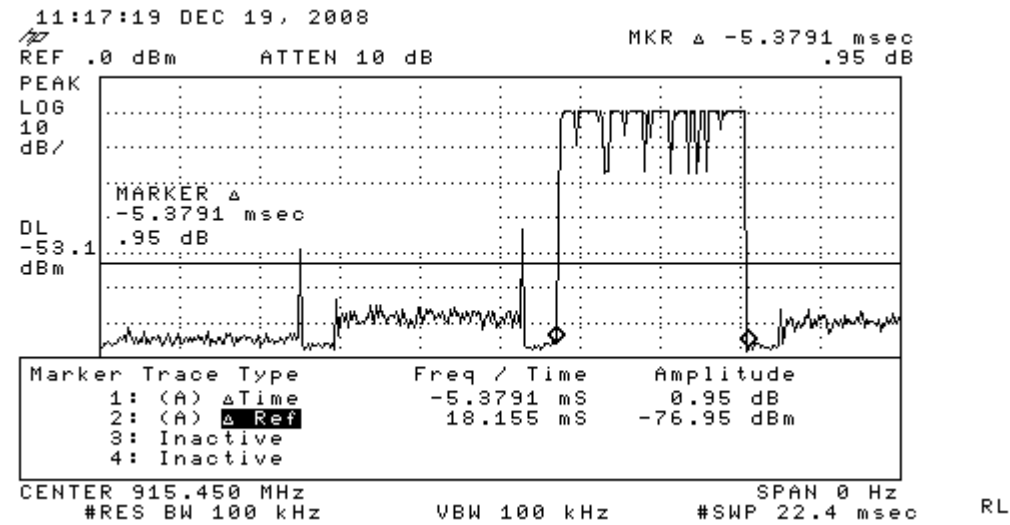
RT

Lowest channel, number of times the channel is active

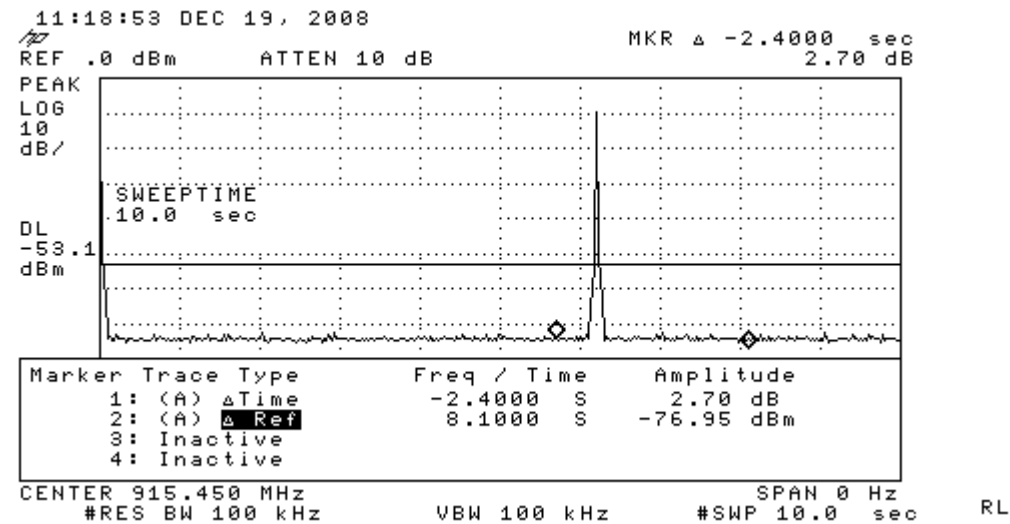


RL

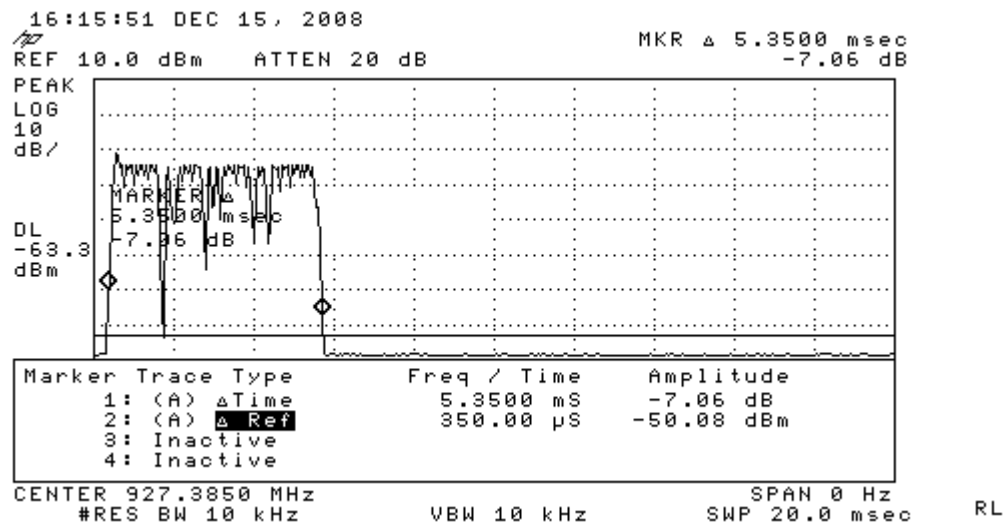
Middle channel, transmitting time



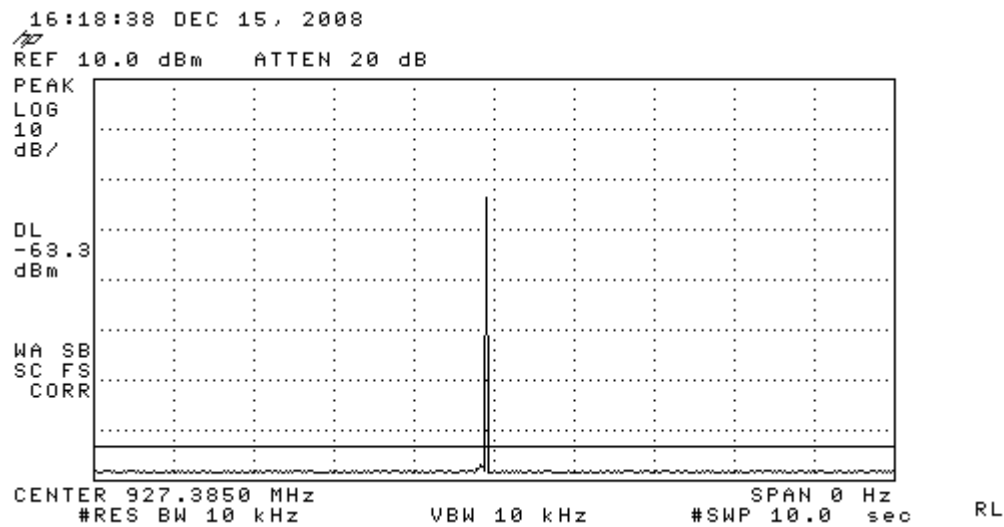
Middle channel, number of times the channel is active



Highest channel, transmitting time



Highest channel, number of times the channel is active



10. BAND EDGE COMPLIANCE

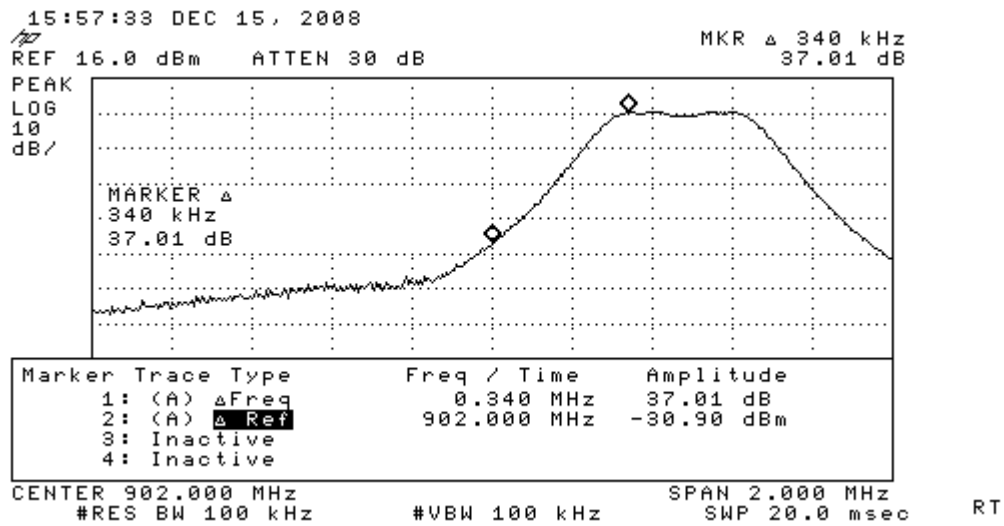
10.1 Test protocol

Span: 2 MHz
RBW: 100 kHz
VBW: 100 kHz
Sweep time: 20 ms
Continuous sweep
Detector: Peak
Trace: Max. hold

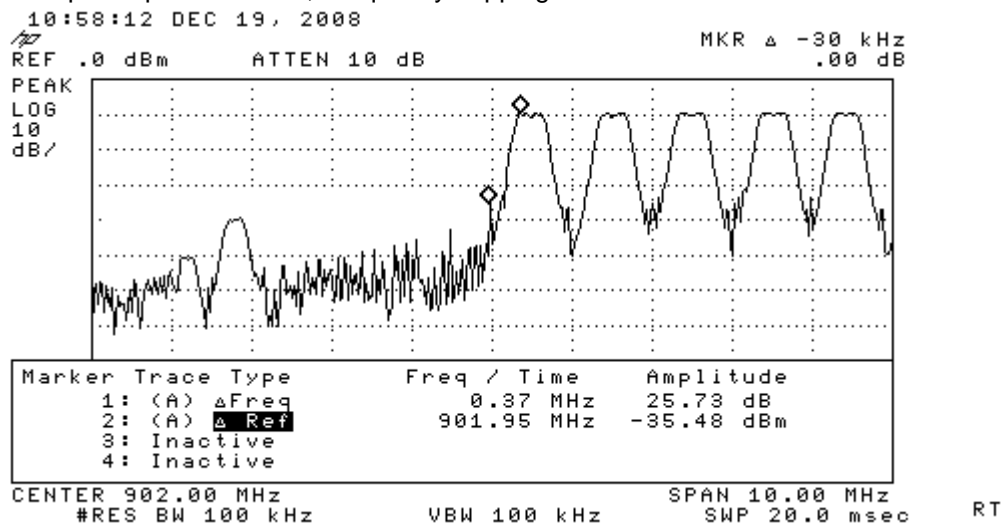
Date of test: December 15 & 19, 2008

Band edge compliance at lowest channel, 902.473 MHz

Sweep with peak detector, Frequency hopping disabled

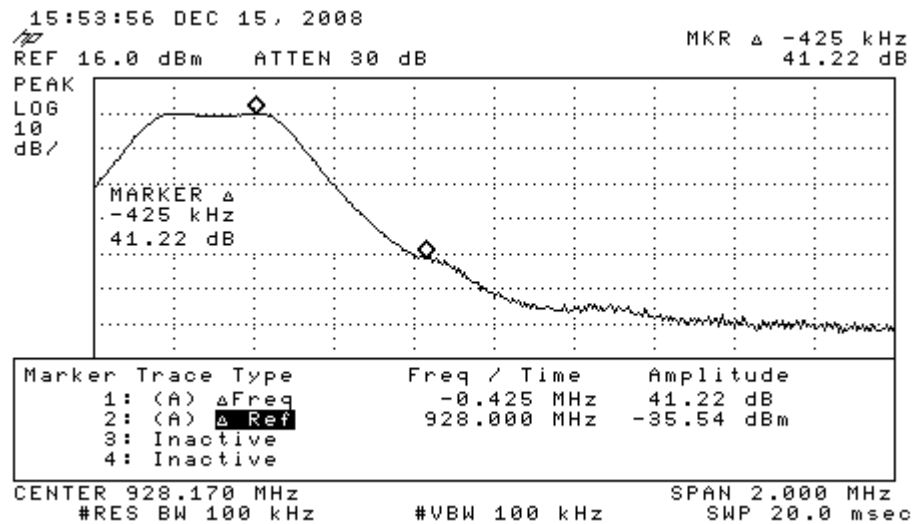


Sweep with peak detector, Frequency hopping enabled.



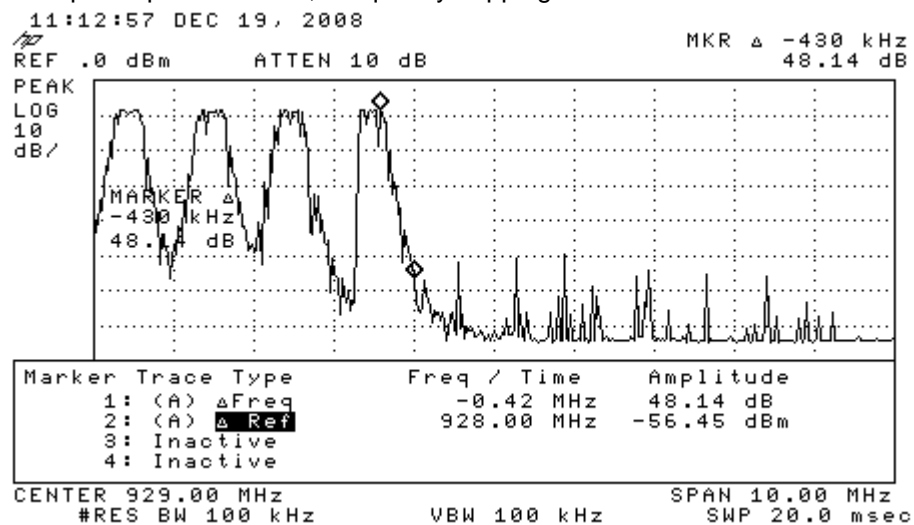
Band edge compliance at highest channel, 927.481 MHz

Sweep with peak detector, Frequency hopping disabled



RT

Sweep with peak detector, Frequency hopping enabled



RT

11. RADIATED SPURIOUS EMISSIONS

11.1 Measurement uncertainty

Radiated disturbance electric field intensity, 30 – 1000 MHz: $\pm 4,6$ dB

Radiated disturbance electric field intensity, 1000 – 18000 MHz: $\pm 6,0$ 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.
<i>Test site: Semi-anechoic shielded chamber, 6 x 9 x 6 m (W x L x H)</i>			30900, 30901
Software:	Rohde & Schwarz	EMC 32	
Measurement receiver:	Rohde & Schwarz	ESCI	12798
Antenna, bilog:	Rohde & Schwarz	HL-562	30711
<i>Test site: Bluetooth anechoic shielded chamber, 3,7 x 7,0 x 2,4 m (W x L x H)</i>			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 setup

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.

For test set-up photos, see document: Intertek 816633-3_photos

Test site: Radio anechoic shielded chamber (1 – 13 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.

For test set-up photos, see document: Intertek 816633-3_photos

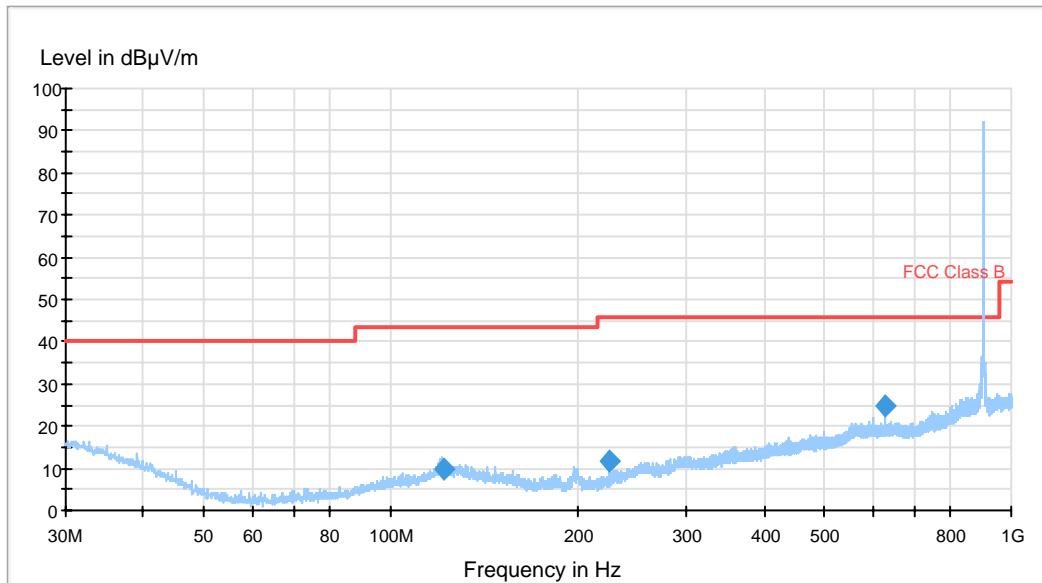
11.4 Test protocol

Semi-anechoic shielded chamber

Date of test: December 17, 2008

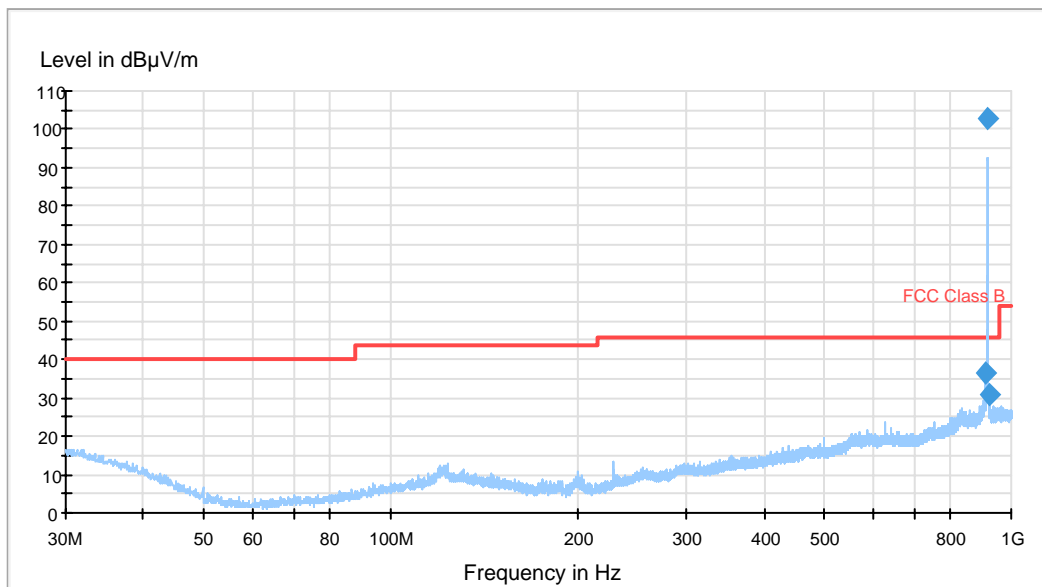
30 – 1000 MHz, max peak at a distance of 3 m, Lowest channel, 902.473 MHz

FCC 30 - 1000 MHz FCC class B 3m

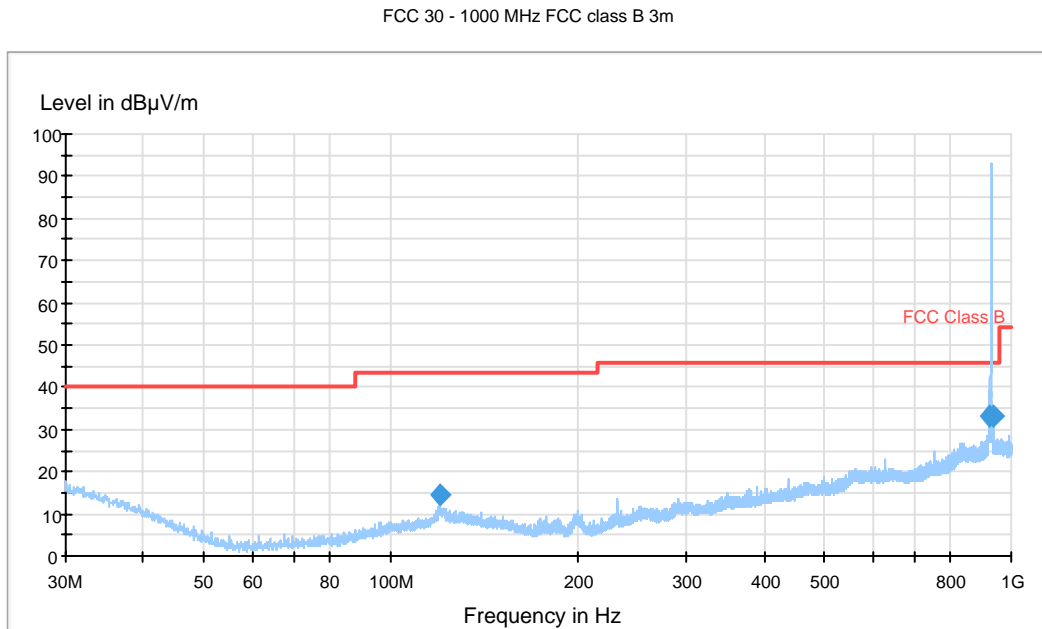


30 – 1000 MHz, max peak at a distance of 3 m, mid channel, 914.502 MHz

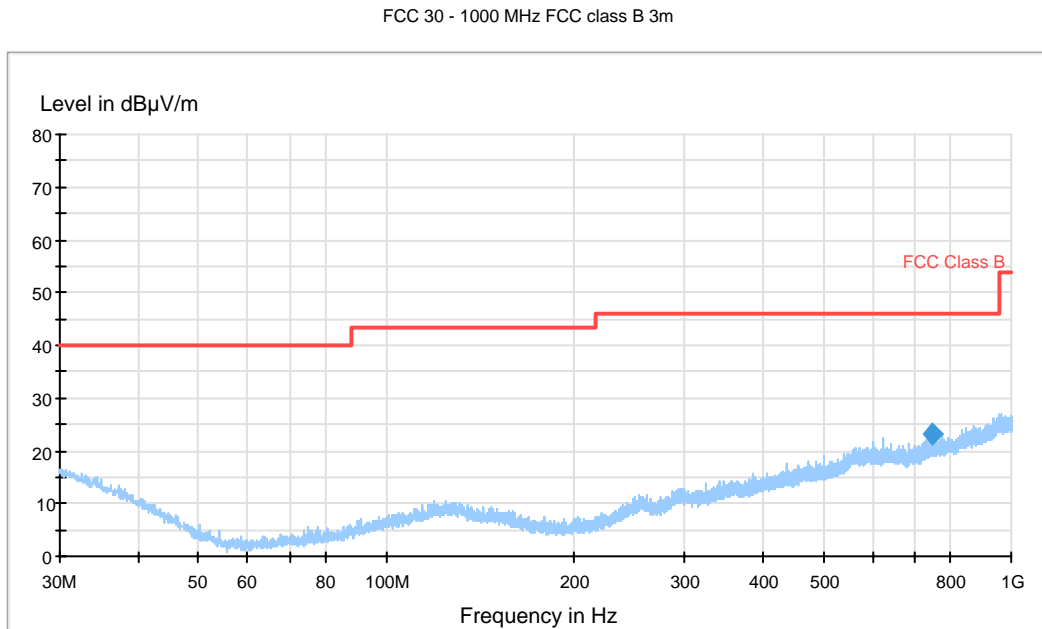
FCC 30 - 1000 MHz FCC class B 3m



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

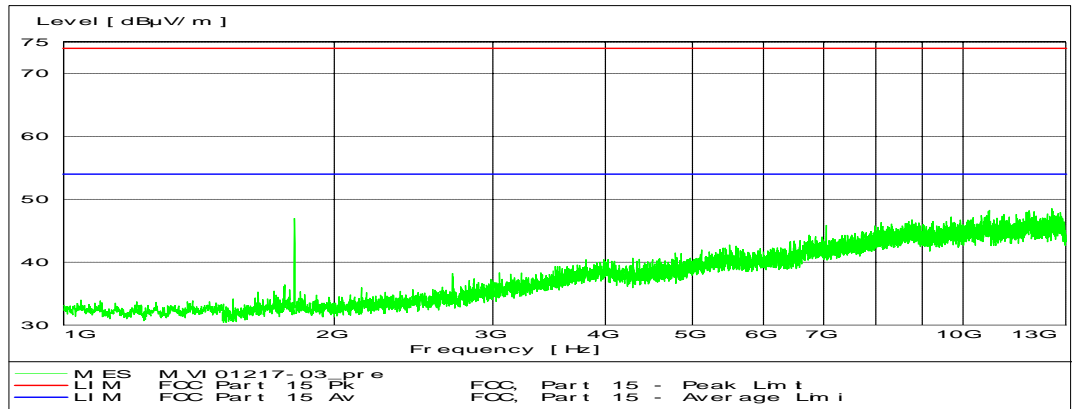


Radio anechoic shielded chamber

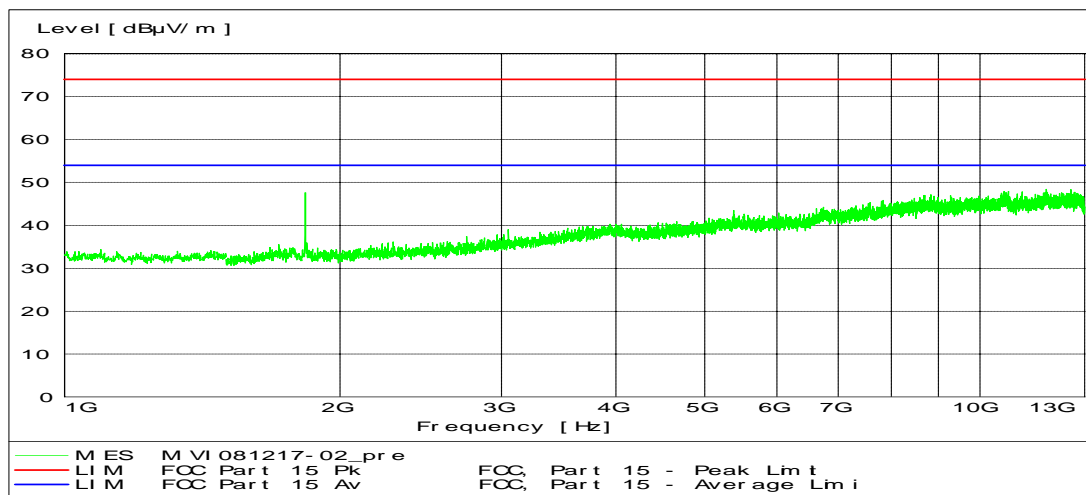
Date of test: December 17, 2008

1 - 13 GHz, max peak at a distance of 3 m, Lowest channel, 902.473 MHz

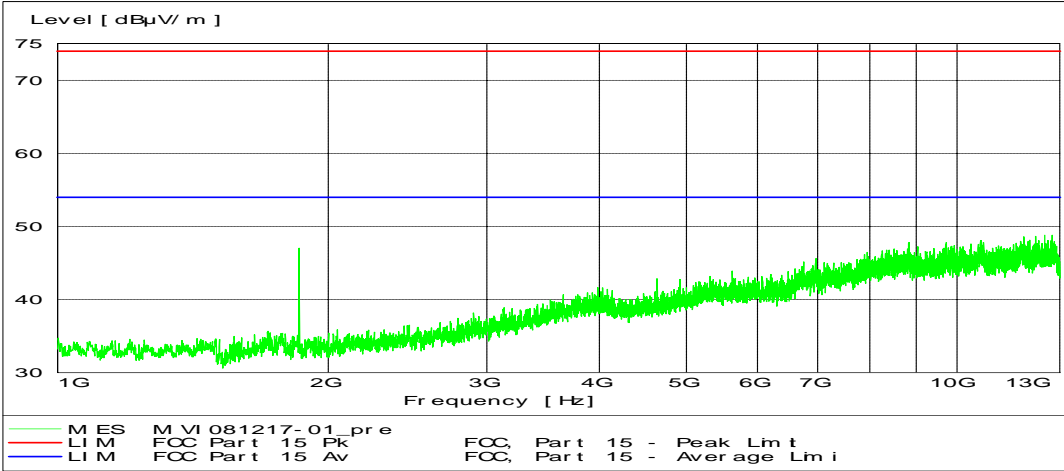
Carrier is attenuated by high pass filter



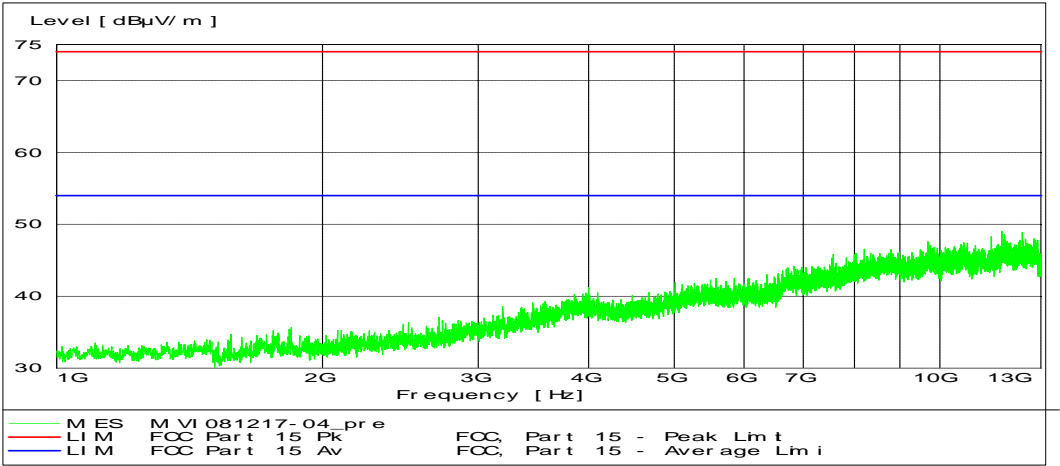
1 – 13 GHz, max peak at a distance of 3 m, mid channel, 914.502 MHz



1 – 13 GHz, max peak at a distance of 3 m, Highest channel, 927.481 MHz



1 – 13 GHz, max peak at a distance of 3 m, standby



Data summary

Stand by mode

Field strength of spurious emissions						
Frequency [MHz]	RBW [kHz]	Measured level		Limit		Note
		Peak [dB(μV/m)]	QP/AV [dB(μV/m)]	Peak [dB(μV/m)]	QP/AV [dB(μV/m)]	
30-1000	120	< 27			40-54	Noise floor
1000-10000	1000	<47			54	Noise floor

Lowest channel

Field strength of spurious emissions						
Frequency [MHz]	RBW [kHz]	Measured level		Limit		Note
		Peak [dB(μV/m)]	QP/AV [dB(μV/m)]	Peak [dB(μV/m)]	QP/AV [dB(μV/m)]	
902.530	120		102.8			Carrier
1804.91	1000	48.2			54	

Mid channel

Field strength of spurious emissions						
Frequency [MHz]	RBW [kHz]	Measured level		Limit		Note
		Peak [dB(μV/m)]	QP/AV [dB(μV/m)]	Peak [dB(μV/m)]	QP/AV [dB(μV/m)]	
915.6	120		103.0			Carrier
1831.16	1000	48.8			54	

Highest channel

Field strength of spurious emissions						
Frequency [MHz]	RBW [kHz]	Measured level		Limit		Note
		Peak [dB(μV/m)]	QP/AV [dB(μV/m)]	Peak [dB(μV/m)]	QP/AV [dB(μV/m)]	
927.58	120		103.1			Carrier
1854.66	1000	48.1			54	

Example calculation:

Measured level [dBμV/m] = Analyser reading [dBμV] + cable loss [dB] – preamplifier gain [dB] + antenna factor [1/m]

12. CONDUCTED SPURIOUS EMISSIONS AT ANTENNA PORT

12.1 Measurement uncertainty

Measurement uncertainty for conducted disturbances at the antenna port: $\pm 3,6$ 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: December 16, 2008

Lowest channel

Strength of conducted spurious emissions				
Frequency [MHz]	RBW [kHz]	Measured peak level [dBc]	Limit [dBc]	Note
30 - 1000	100	5.2		Carrier
1000 - 2000	100	-47.3	<20	
2000 - 3000	100	-59.5	<20	
3000 - 5000	100	-57.4	<20	
3000 - 5000	100	-63.0	<20	
5000 - 6500	100	-72.7	<20	
6500 - 10000	100	-62.2	<20	

Mid channel

Strength of conducted spurious emissions				
Frequency [MHz]	RBW [kHz]	Measured peak level [dBm]	Limit [dBc]	Note
30 - 1000	100	5.9		Carrier
1000 - 2000	100	-50.6	<20	
2000 - 3000	100	-42.5	<20	
3000 - 5000	100	-52.4	<20	
3000 - 5000	100	-66.2	<20	
5000 - 6500	100	-70.2	<20	
6500 - 10000	100	-61.7	<20	

Highest channel

Strength of conducted spurious emissions				
Frequency [MHz]	RBW [kHz]	Measured peak level [dBm]	Limit [dBc]	Note
30-1000	100	6.4		Carrier
1000-2000	100	-41.4	<20	
2000 -3000	100	-43.5	<20	
3000 -5000	100	-65.8	<20	
5000 – 6500	100	-76.2	<20	
6500 - 10000	100	-64.1	<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.