

RADIO TEST REPORT

No. 811670-1

EQUIPMENT UNDER TEST

Equipment: Remote Control
Type / model: DRC-JOY D2
Manufacturer: Scanreco AB
Tested by request of: Scanreco AB

SUMMARY

The equipment complies with the requirements of the following standards:

47 CFR, Part 15, Subpart B (2008) and Subpart C (2008);

RSS-GEN, Issue 2 (June 2007)

RSS-210, Issue 7 (June 2007)

Industry Canada listed test facility No. IC 2042G-1



Date of issue: December 11, 2008



Tested by:

Stefan Andersson
Niklas Boström

Stefan Andersson /
Niklas Boström

Approved
by:

Niklas Boström

Niklas Boström



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1. CLIENT INFORMATION

The EUT has been tested by request of

Company: SCANRECO AB
Box 47144
100 74 Stockholm
Sweden
Name of contact: Ramin Fardi

2. EQUIPMENT UNDER TEST (EUT)**2.1 Identification of the EUT according to the manufacturer/client declaration**

Equipment: Remote Control
Type/Model: DRC-JOY D2
Brand name: Scanreco
Serial number: 016836
Manufacturer: Scanreco AB
Rating/Supplying voltage: 7.2 VDC NiMH battery
Rating RF output power: 12 ± 2 dBm
Antenna gain: 0 dBi
External antenna connector: NO
Operating temperature range: -10 to +55 °C
Frequency range: 903.000 – 926.120 MHz
Number of channels: 50
Channel spacing: 340 kHz
Modulation characteristics: GFSK
Stand by mode supported: Yes



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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 - Methods of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

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

RSS-210, Issue 7 (June 2007): Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I 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 of conducted disturbance voltage in the frequency range 0,15-30 MHz and out-of-band spurious emissions test are described in corresponding sections. During other tests the EUT was connected to the spectrum analyzer by cable.

3.4 Operating environment

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

Air temperature: 20-25 °C
Relative humidity: 25-45 %



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4. TEST SUMMARY

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

FCC reference	IC reference	Test	Result	Note
15.247(b)	RSS-210 A8.4 (1)	Peak output power	PASS	
15.247(a)	RSS-210 A8.1 (c)	20 dB Bandwidth	PASS	
15.247(a)	RSS-210 A8.1 (b)	Carrier frequency separation	PASS	
15.247(a)	RSS-210 A8.1 (c)	Number of hopping frequencies (channels)	PASS	
15.247(a)	RSS-210 A8.1 (c)	Time of occupancy (dwell time)	PASS	
15.247(d)	RSS-210 A8.5	Band edge compliance	PASS	
15.247(d)	RSS-210 A8.5	Out of band spurious emissions, radiated	PASS	
15.247(d)	RSS-210 A8.5	Out of band spurious emissions, conducted	PASS	
15B	RSS-Gen Table 1	Out of band spurious emissions, radiated	PASS	1
15B	RSS-Gen Table 2	Conducted emission at AC port	PASS	1



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5. PEAK OUTPUT POWER

5.1 Test protocol

Date of test: 2008-12-03

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

Spectrum analyzer settings:

Span: 100 kHz
 RBW: 30 kHz
 VBW: 30 kHz
 Sweep time: Auto
 Detector: Peak
 Trace: Max Hold

Channel (MHz)	Peak Output Power (dBm)	Plot	Limit value (dBm)
903,00	9,5	plot P5.1	< 30
914,56	9,8	plot P5.2	
926,12	9,6	plot P5.3	

Measurement results are corrected for attenuation in the set-up configuration and antenna gain declared by the manufacturer.

Example calculation:

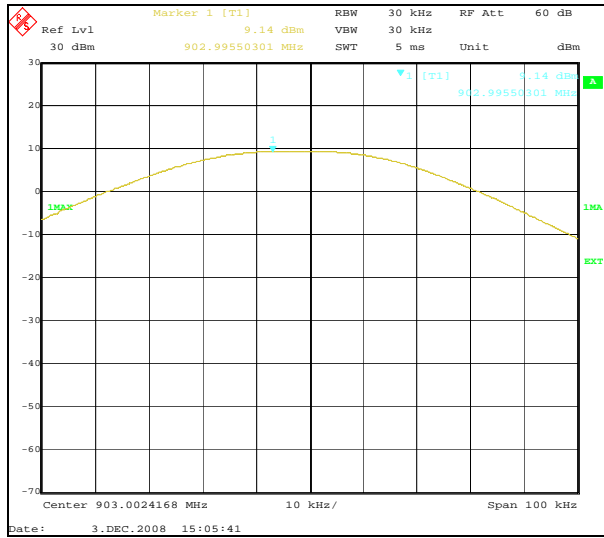
$$\text{Peak output power [dBm]} = \text{Analyser reading [dBm]} + \text{cable loss [dB]} + \text{EUT antenna gain [dBi]}$$



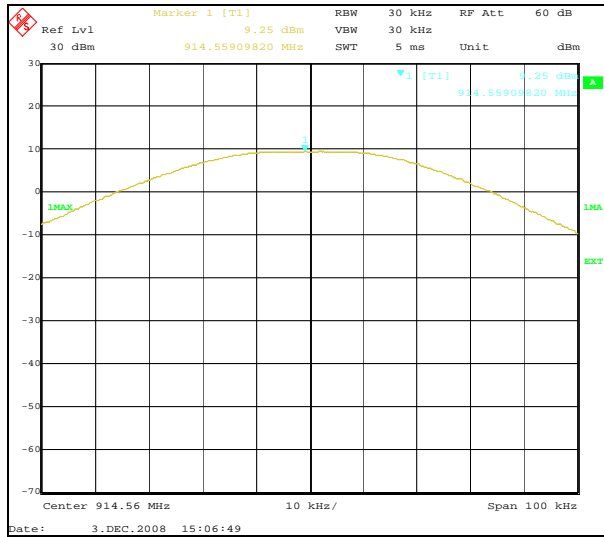
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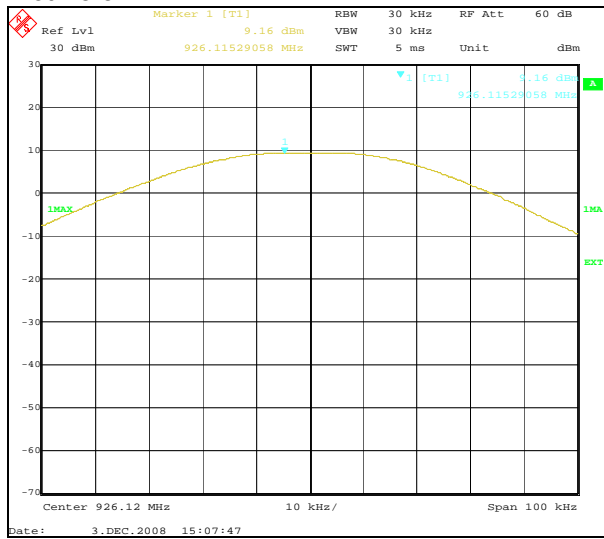
Plot P5.1



Plot P5.2



Plot P5.3



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6. 20 dB BANDWIDTH

6.1 Test protocol

Date of test: 2008-12-03

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

Spectrum analyzer settings:

Span: 60 kHz
 RBW: 1 kHz
 VBW: 1 kHz
 Sweep time: 5 ms
 Detector: Peak
 Trace: Max Hold

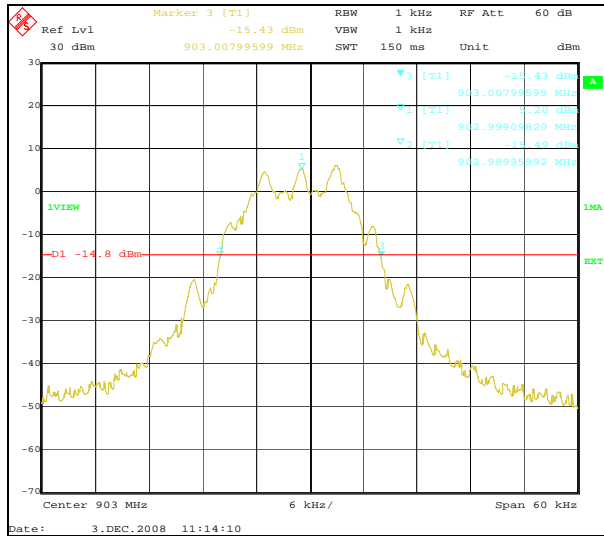
Channel (MHz)	20 dB Bandwidth (kHz)	Plot	Limit value (kHz)
903,00	18,0	plot P6.1	< 500
914,56	18,0	plot P6.2	
926,12	18,0	plot P6.3	



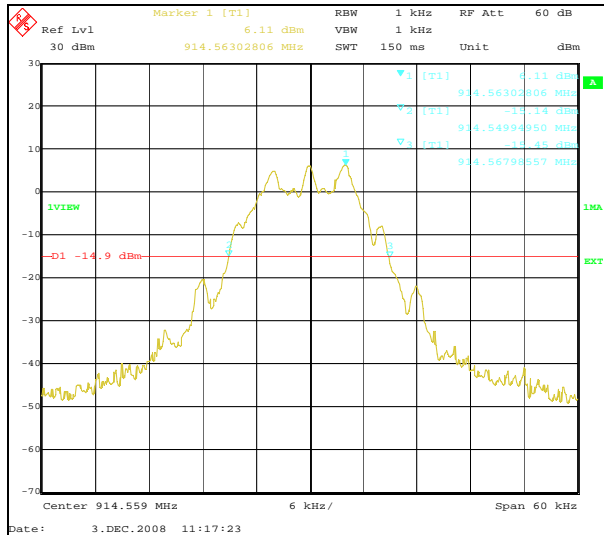
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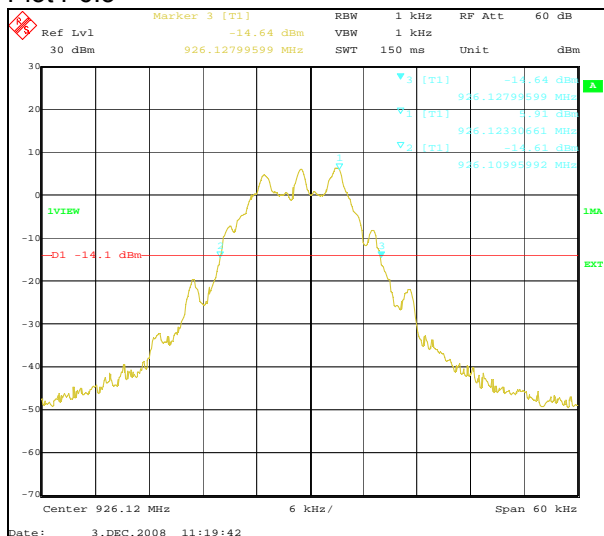
Plot P6.1



Plot P6.2



Plot P6.3



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7. CARRIER FREQUENCY SEPARATION

7.1 Test protocol

Date of test: 2008-12-03

EUT mode of operation: TX and hopping on.

Spectrum analyzer settings:

Span: 1 MHz
 RBW: 100 kHz
 VBW: 100 kHz
 Sweep time: Auto
 Detector: Peak
 Trace: Max Hold

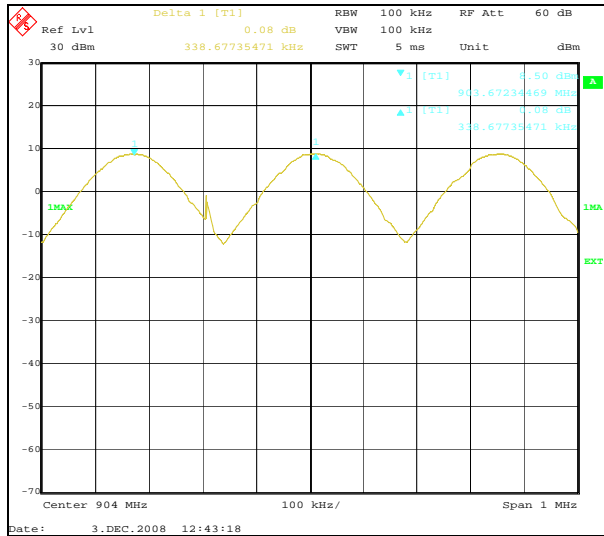
Channel	Carrier frequency separation from the next channel (kHz)	Plot	Limit value (kHz)
Low	338,7	plot P7.1	> 25
Mid	338,7	plot P7.2	> 25
High	334,7	plot P7.3	> 25



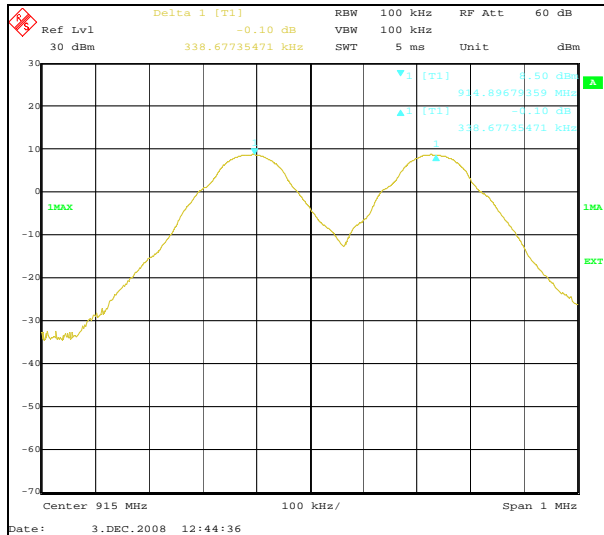
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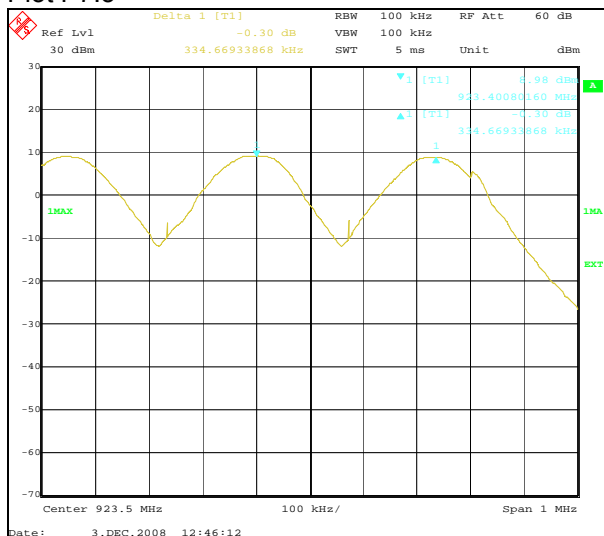
Plot P7.1



Plot P7.2



Plot P7.3



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8. NUMBER OF HOPPING CHANNELS**8.1 Test protocol**

Date of test: 2008-12-03

EUT mode of operation: TX and hopping on.

Spectrum analyzer settings:

Start frequency: 902 and 915 MHz

Stop frequency: 915 and 928 MHz

RBW: 200 kHz

VBW: 200 kHz

Sweep time: Auto

Detector: Peak

Trace: Max Hold

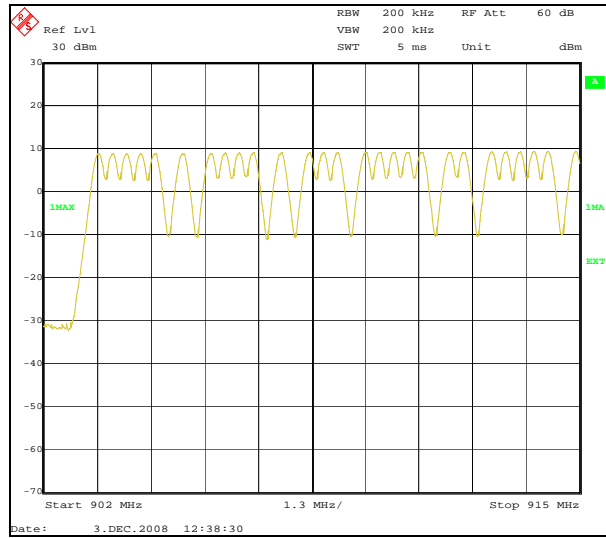
Number of hopping channels	Plot	Limit value
27 + 23 = 50	plot P8.1 and plot P8.2	≥ 50



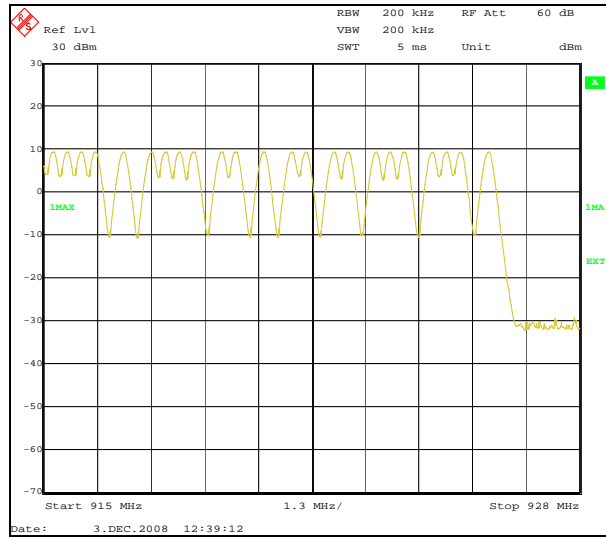
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Plot P8.1



Plot P8.2



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9. TIME OF OCCUPANCY (DWELL TIME)

9.1 Test protocol

Date of test: 2008-12-02

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: 200 ms
 Single 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: 100 kHz
 VBW: 100 kHz
 Sweep time: 20 s

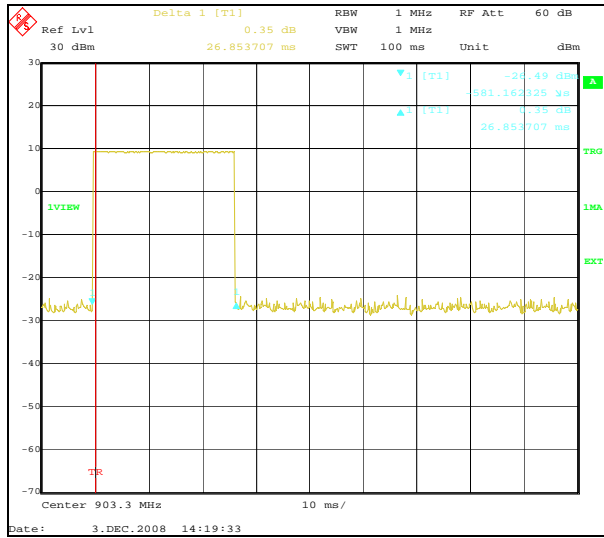
Test parameters	Channel (MHz)			Limit value (ms)
	low	Mid	high	
T (ms)	26,865 (plot P9.1)	26,653 (plot P9.2)	26,653 (plot P9.3)	-
n	8 (plot P9.4)	8 (plot P9.5)	8 (plot P9.6)	-
Dwell time (ms) =	214,9	213,2	213,2	< 400



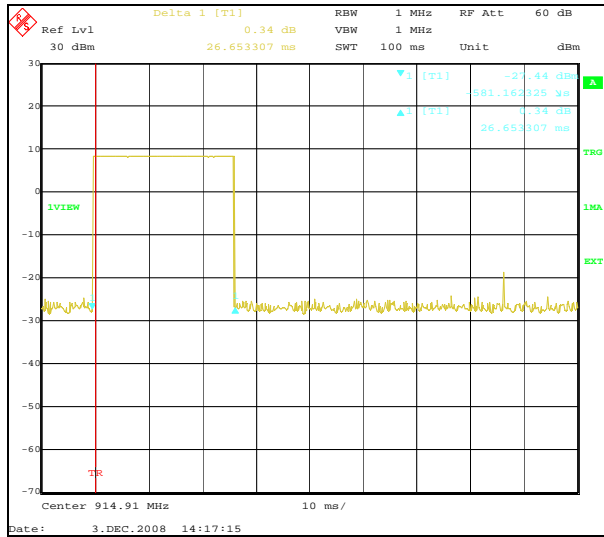
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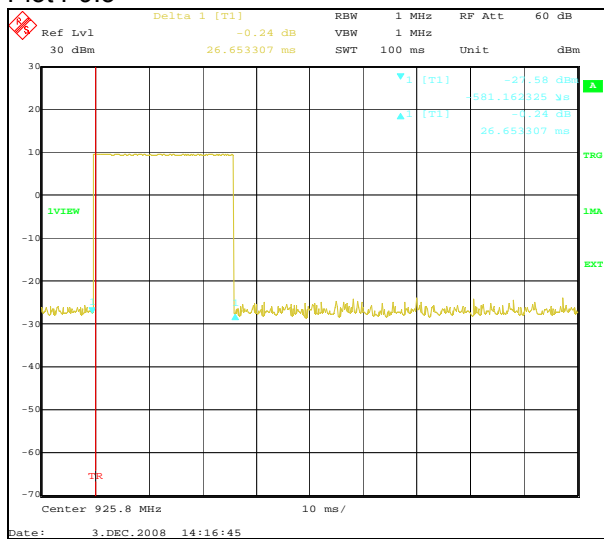
Plot P9.1



Plot P9.2



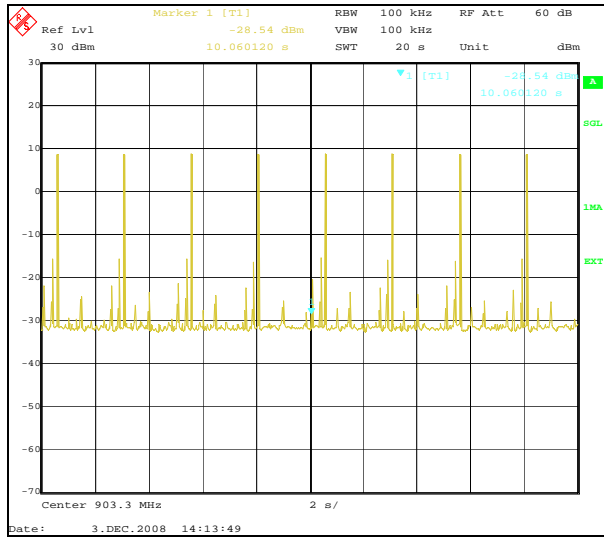
Plot P9.3



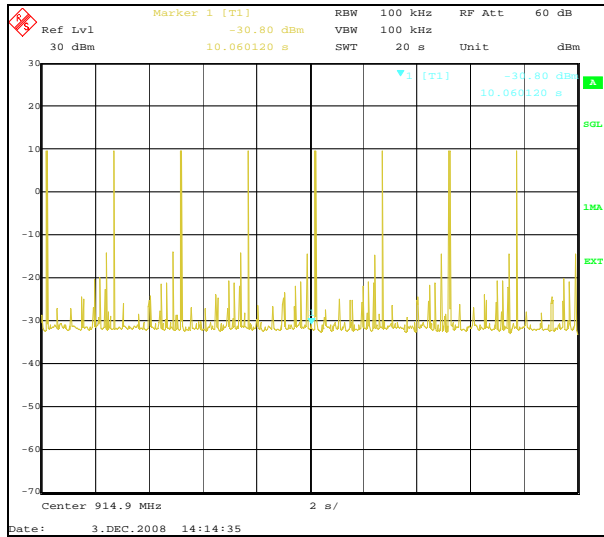
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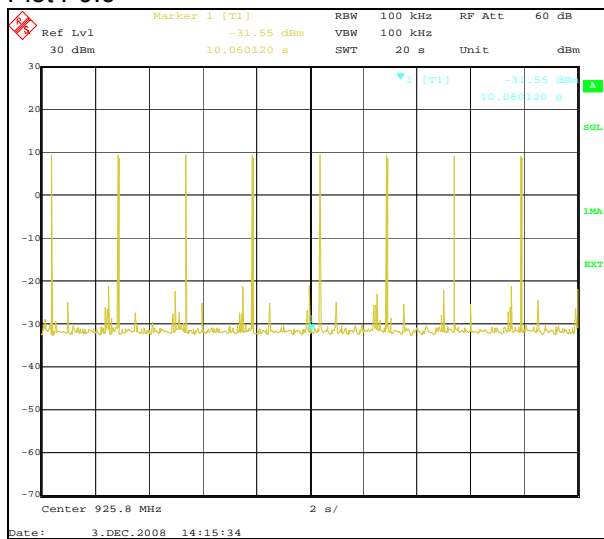
Plot P9.4



Plot P9.5



Plot P9.6



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10. BAND EDGE COMPLIANCE

10.1 Test protocol

Date of test: 2008-12-03

EUT mode of operation: TX and hopping on.

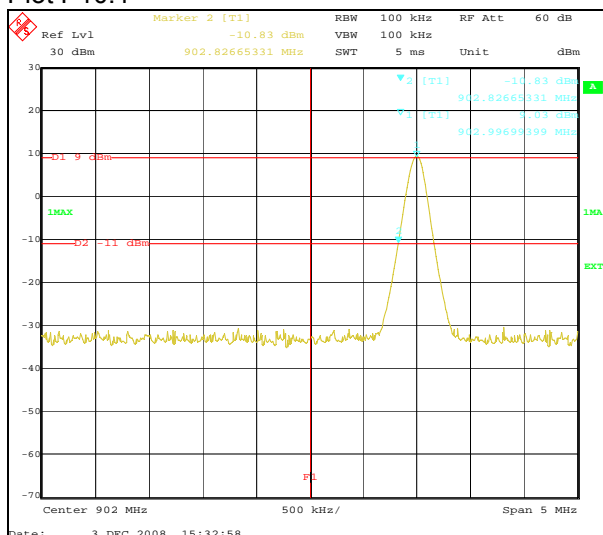
TX and hopping on one channel. (low and high channels)

Spectrum analyzer settings:

Span: 5 MHz
 Center frequency: at band edges
 RBW: 100 kHz
 VBW: 100 kHz
 Sweep time: Auto
 Detector: Peak
 Trace: Max Hold

Channel	Plot	Results	Limit value (dBc)
Low	plot P10.1	PASS	20
High	plot P10.2	PASS	20
Hopping	plot P10.3 and plot P10.4	PASS	20

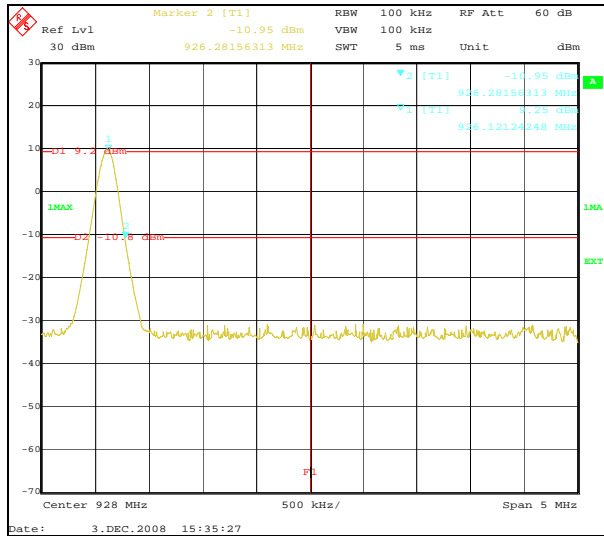
Plot P10.1



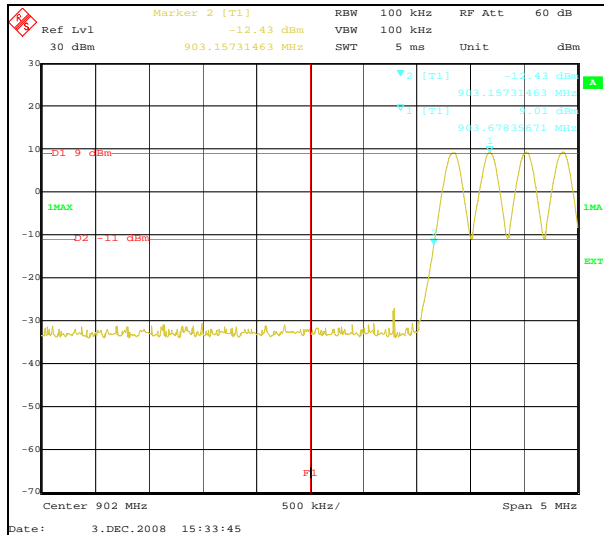
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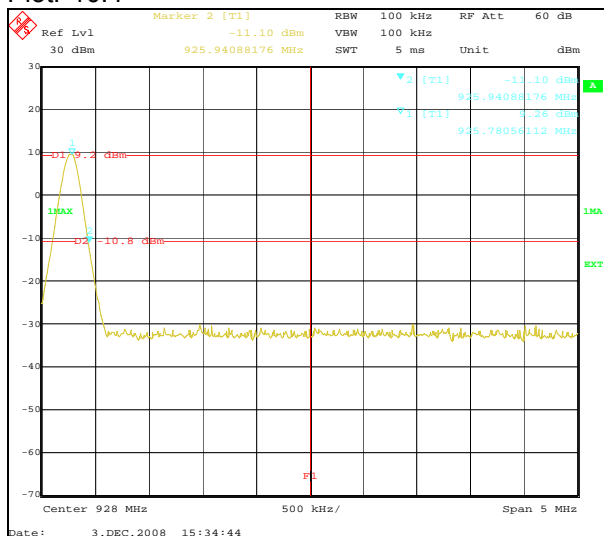
Plot P10.2



Plot P10.3



Plot P10.4



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11. RADIATED SPURIOUS EMISSIONS

11.1 Operating environment

Temperature: 20-25 °C (10 – 40 °C)
 Relative Humidity: 25-45 % (10 - 90 %)

11.2 Measurement uncertainty

Radiated disturbance electric field intensity, 30 – 1000 MHz: ± 4,6 dB
 Radiated disturbance electric field intensity, 1000 – 13000 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%.

11.3 Test equipment

Equipment	Manufacturer	Type	SEMKO No.
<i>Test site: Semi-anechoic shielded chamber, 5,7 x 8,7 x 5,4 m (W x L x H)</i>			
Software:	Rohde & Schwarz	EMC32	
Measurement receiver:	Rohde & Schwarz	ESCI	12798
Integrated Measurement System:	Rohde & Schwarz	IMS	12800
Antenna: Ultra Broadband	Rohde & Schwarz	HL562	30711
<i>Test site: Radio anechoic shielded chamber, 3,7 x 7,0 x 2,4 m (W x L x H)</i>			
Software:	Rohde & Schwarz	ES-K1, V1.70	
Signal analyser:	Rohde & Schwarz	FSIQ 40	12793
Preamplifier:	MITEQ	AFS6/AFS44	12335
Antenna: Double Ridge Guide Horn (1-13GHz)	EMCO	3115	4936
Transformer	Tufvassons	AFM-1500	30317



11.4 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 photo is 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 were carried out.

Test set-up photo:



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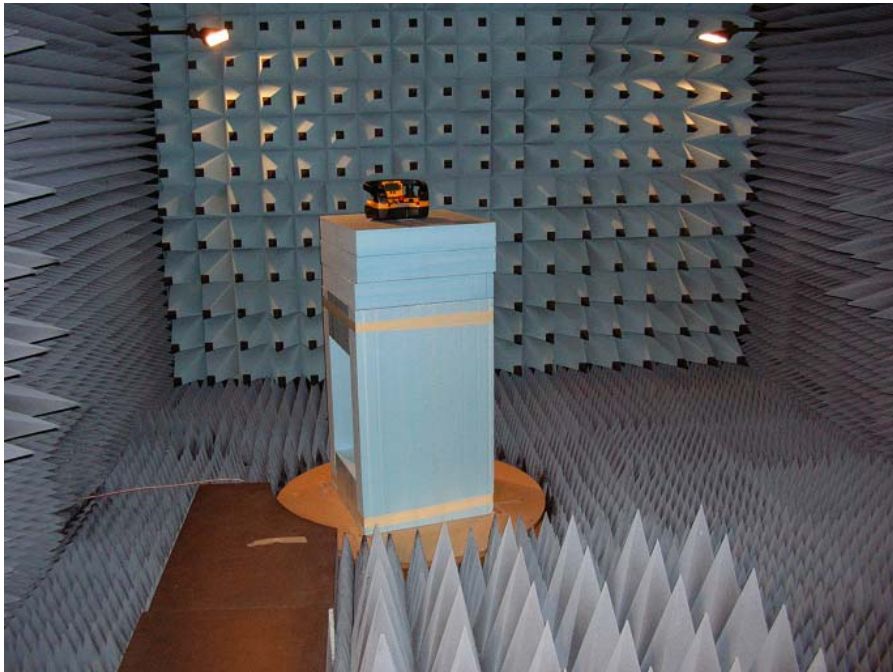
Test site: Radio anechoic shielded chamber (1 – 26 GHz)

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 were carried out.

Test set-up photo:



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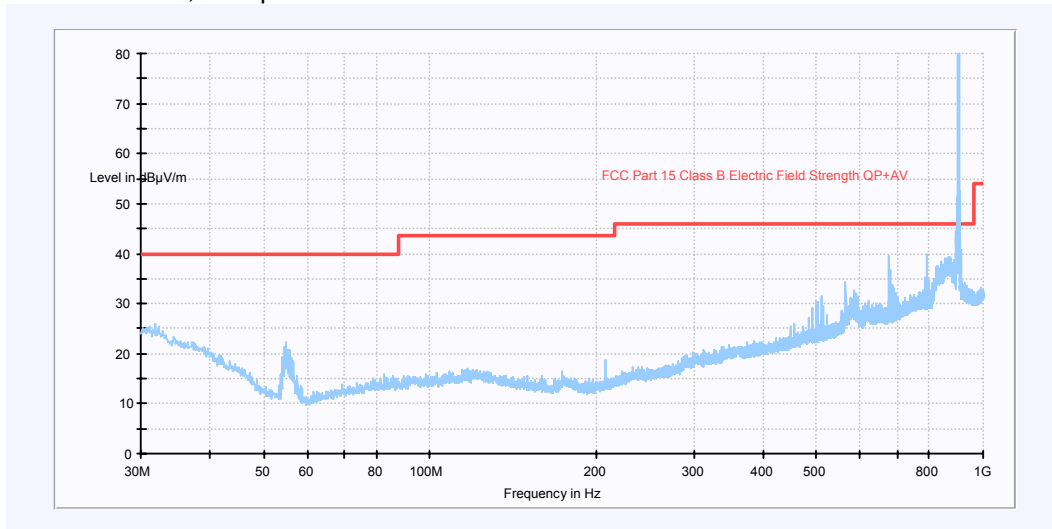
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11.5 Test protocol

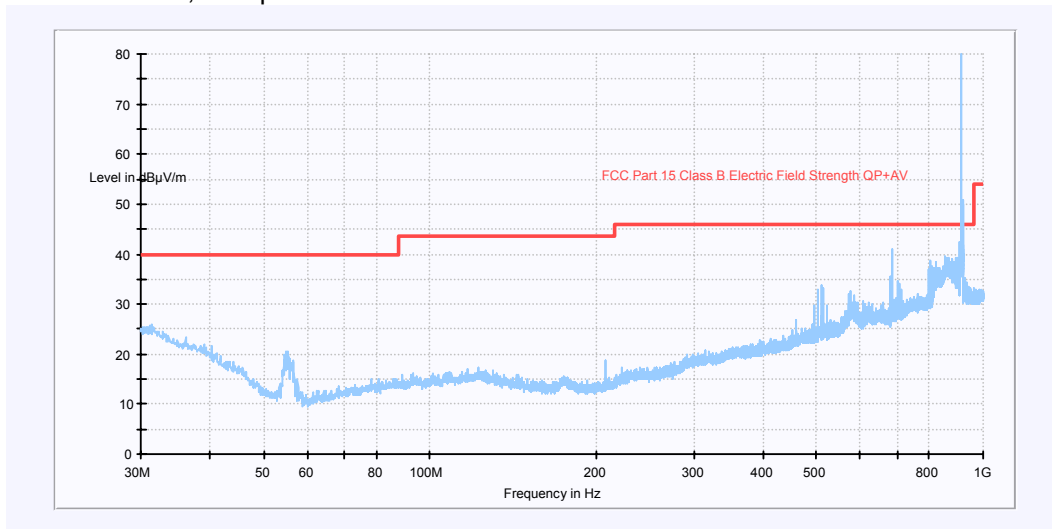
Semi-anechoic shielded chamber

Date of test: 2008-09-02

30 – 1000 MHz, max peak at a distance of 3 m on the lower TX channel



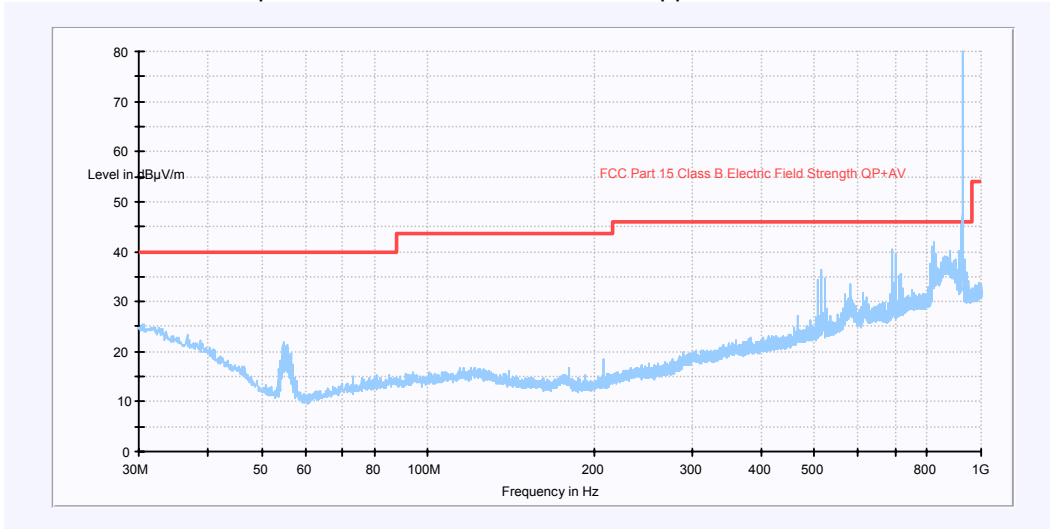
30 – 1000 MHz, max peak at a distance of 3 m on the middle TX channel



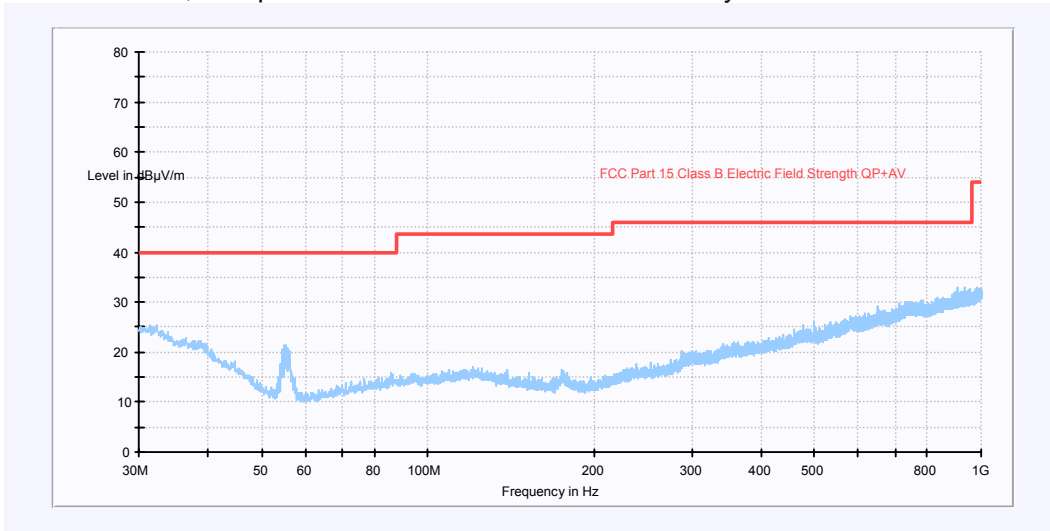
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30 – 1000 MHz, max peak at a distance of 3 m on the upper TX channel



30 – 1000 MHz, max peak at a distance of 3 m in the stand by mode



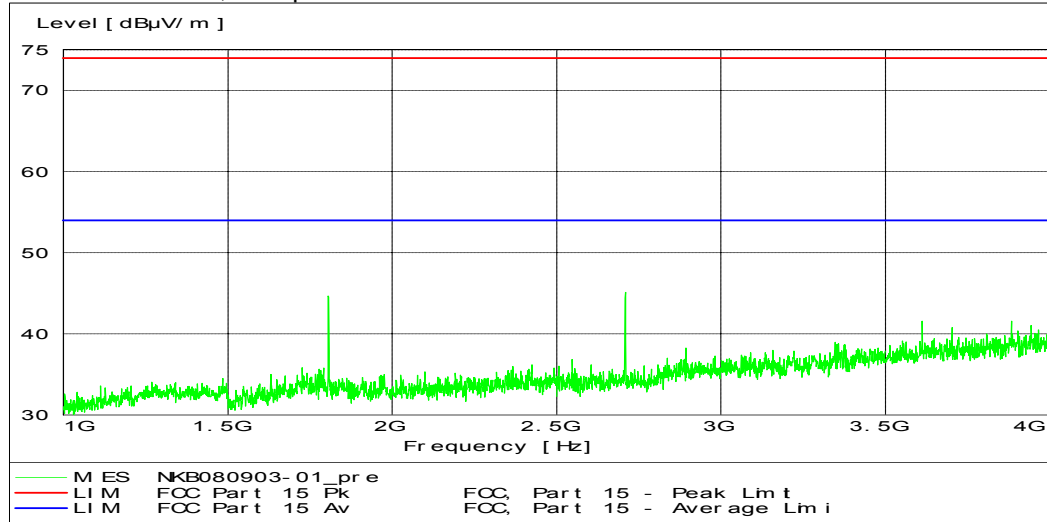
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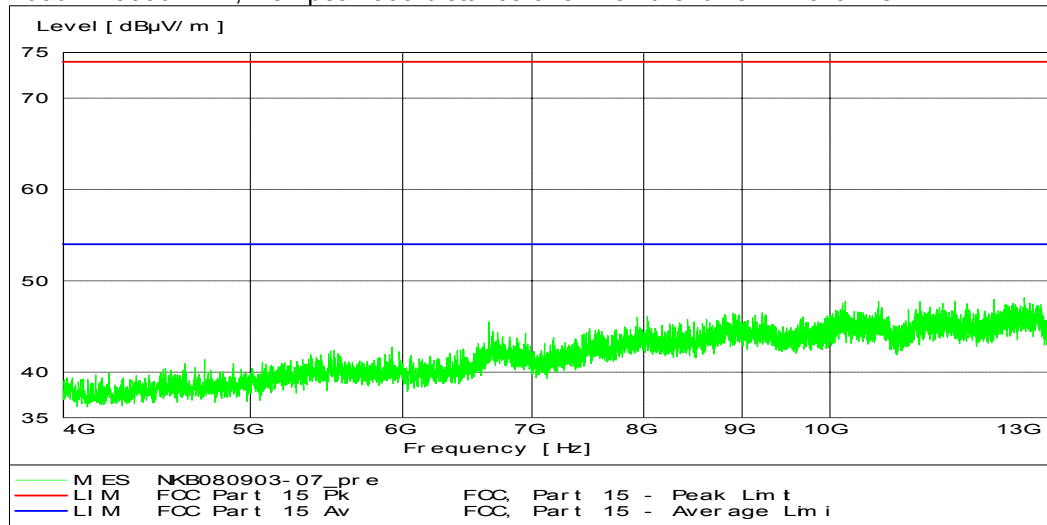
Radio anechoic shielded chamber

Date of test: 2008-12-05

1000 – 4000 MHz, max peak at a distance of 3 m on the lower TX channel



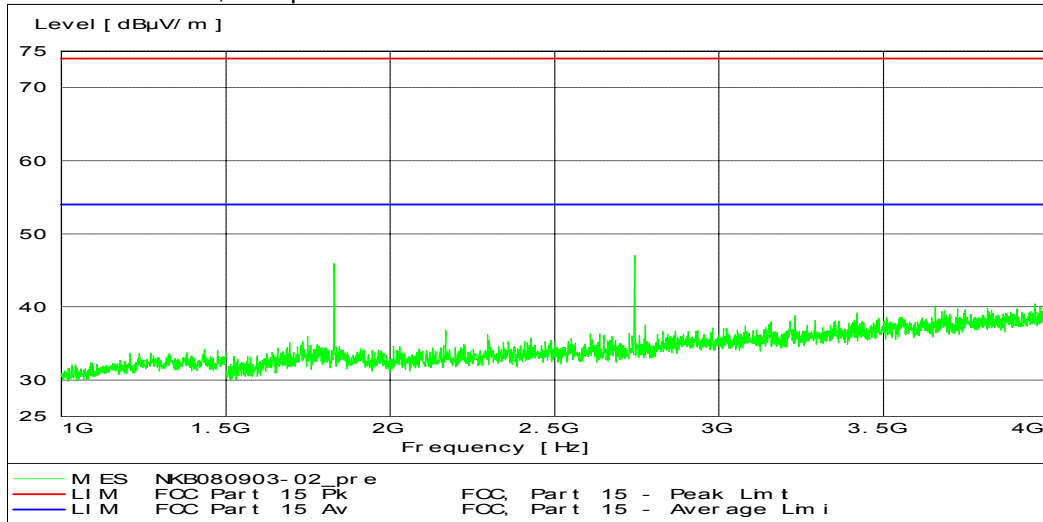
4000 – 13000 MHz, max peak at a distance of 3 m on the lower TX channel



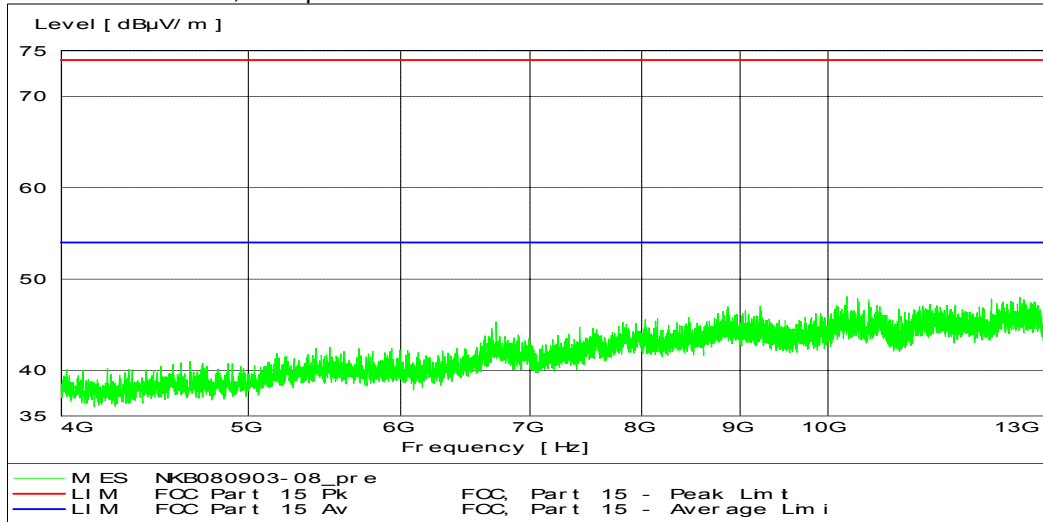
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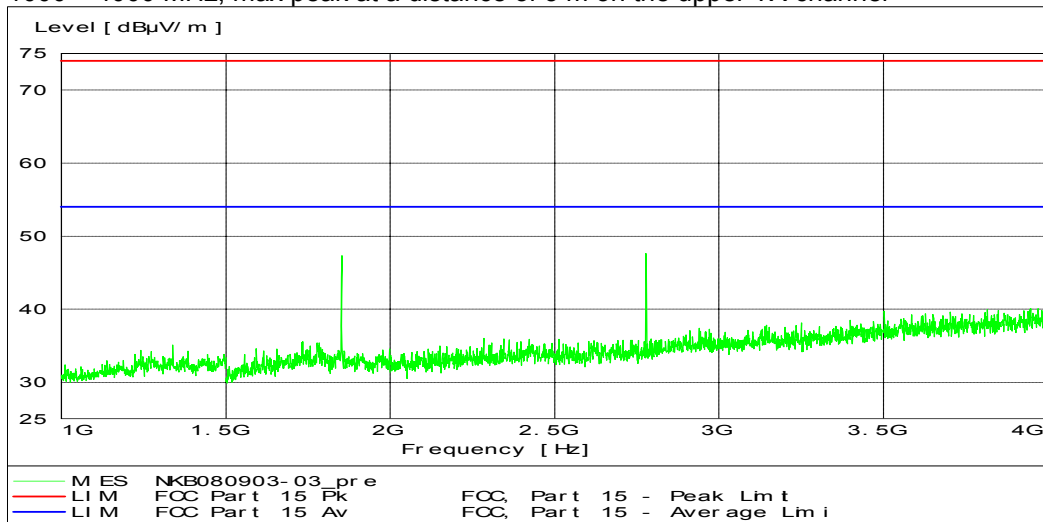
1000 – 4000 MHz, max peak at a distance of 3 m on the middle TX channel



4000 – 13000 MHz, max peak at a distance of 3 m on the middle TX channel



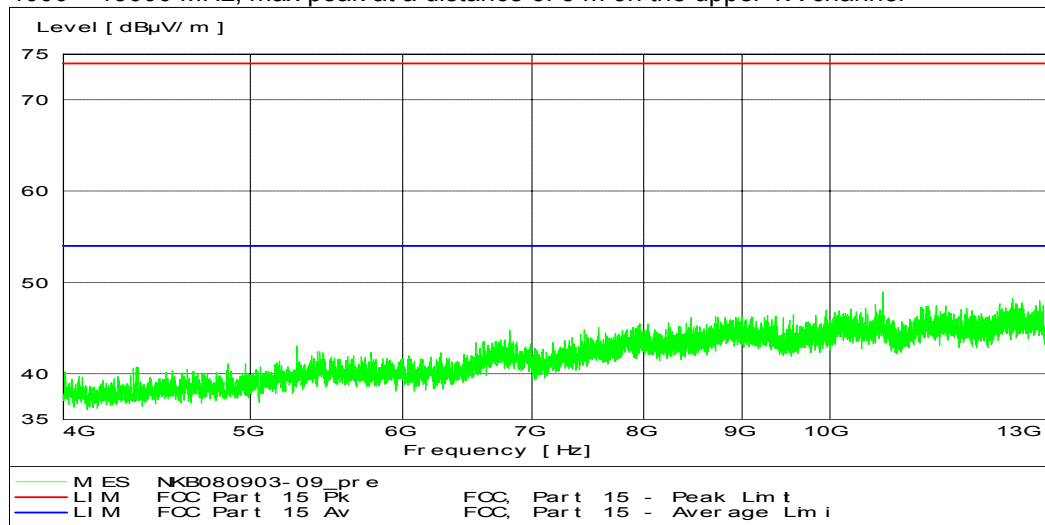
1000 – 4000 MHz, max peak at a distance of 3 m on the upper TX channel



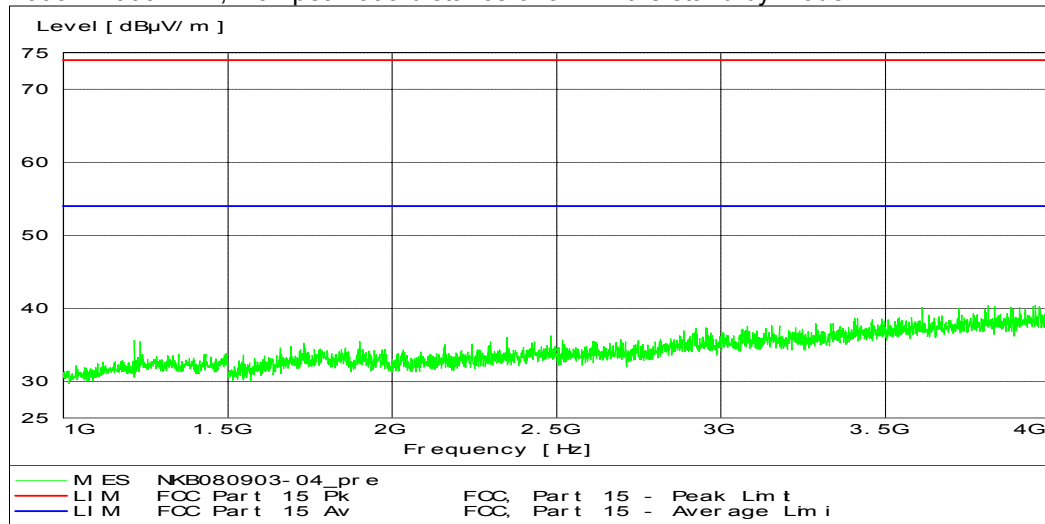
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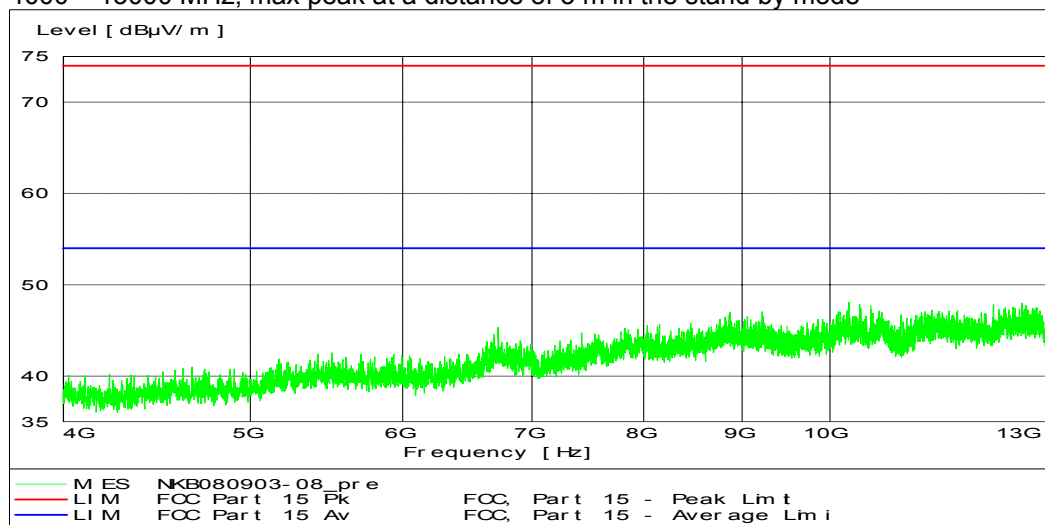
4000 – 13000 MHz, max peak at a distance of 3 m on the upper TX channel



1000 – 4000 MHz, max peak at a distance of 3 m in the stand by mode



4000 – 13000 MHz, max peak at a distance of 3 m in the stand by mode



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Data summary

Field strength of spurious emissions low channel						
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)]	
675.677	120	-	44.9	--	89.8	1
681.792	120	-	37.8	-	89.8	1
792.397	120	-	41.3	-	89.8	1
875.463	120	-	36.1	-	89.8	1
893.850	120	-	42.6	-	89.8	1
900.006	120	-	51.0	-	89.8	1
1000-13000	1000	< 46	-	89.8	-	1

Note 1) Not in a restricted band, so the field strength limit is 20 dB below highest emission in TX band. This was measured to be 109.8 dBμV/m. This gives a limit of 89.8 dBμV/m

Field strength of spurious emissions middle channel						
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)]	
687.218	120	-	43.4	-	90.0	1
803.980	120	-	43.0	-	90.0	1
822.407	120	-	36.9	-	90.0	1
856.623	120	-	34.0	-	90.0	1
881.044	120	-	33.3	-	90.0	1
899.641	120	-	38.8	-	90.0	1
1000-13000	1000	< 47	-	90.0	-	1

Note 1) Not in a restricted band, so the field strength limit is 20 dB below highest emission in TX band. This was measured to be 110.0 dBμV/m. This gives a limit of 90.0 dBμV/m



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Field strength of spurious emissions high channel						
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)]	
514.460	120	-	37.3	-	89.9	1
692.645	120	-	43.1	-	89.9	1
698.801	120	-	42.4	-	89.9	1
815.522	120	-	42.3	-	89.9	1
821.678	120	-	42.0	-	89.9	1
880.849	120	-	35.4	-	89.9	1
930.016	120	-	46.8	-	89.9	1
	1000		-	89.9	-	1

Note 1) Not in a restricted band, so the field strength limit is 20 dB below highest emission in TX band. This was measured to be 109.9.0 dBμV/m. This gives a limit of 89.9 dBμV/m

Field strength of spurious emissions standby						
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)]	
54.995	120	-	20.4	-	40	
88-216	120	< 25	-	-	43.5	Noise
216-960	120	< 34	-	-	46	Noise
960-1000	120	< 34	-	-	54	Noise
1000-13000	1000	< 48	-	-	54	Noise

Example calculation:

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



12. OUT OF BAND SPURIOUS EMISSIONS, CONDUCTED AT ANTENNA PORT

Date of test: 2008-12-03

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

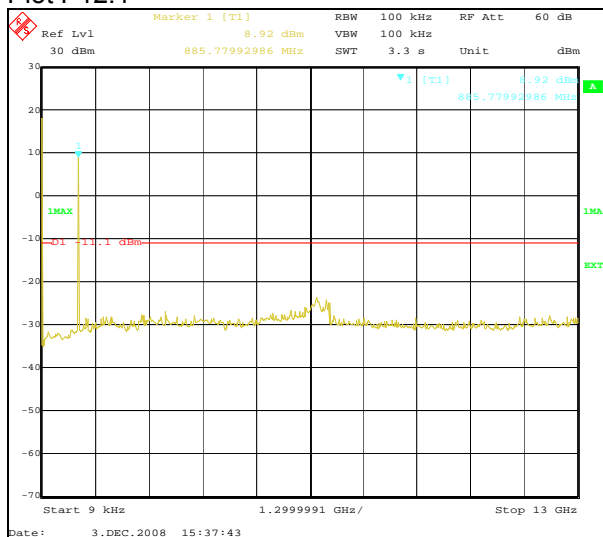
Spectrum analyzer settings:

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

Channel	Plot	Results	Limit value (dBc)
Low	plot P12.1	PASS	20
Middle	plot P12.2	PASS	20
High	plot P12.3	PASS	20
Hopping	plot P12.4	PASS	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.

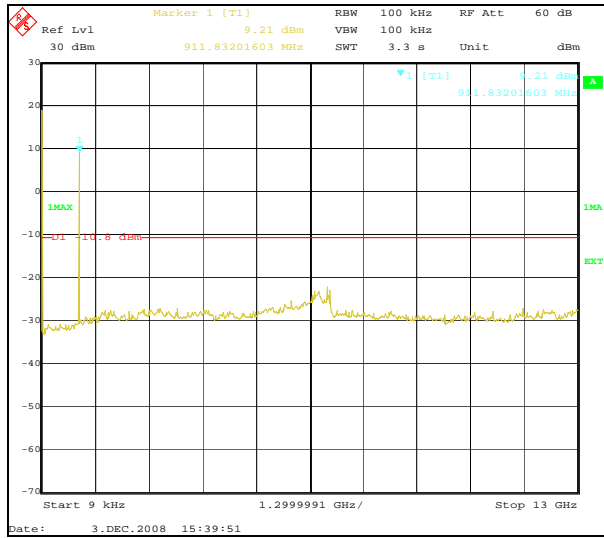
Plot P12.1



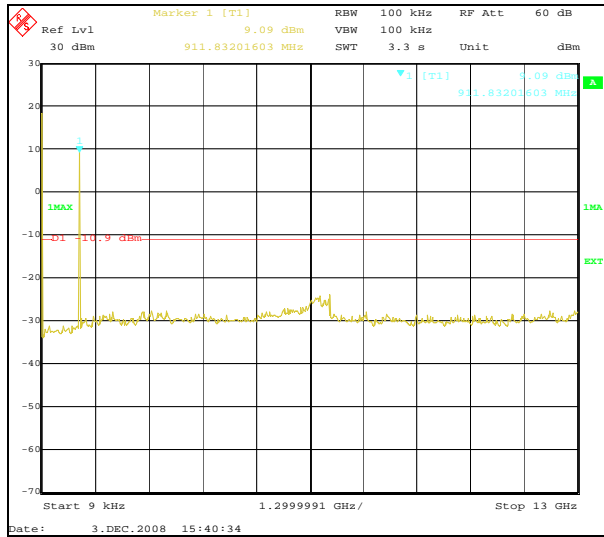
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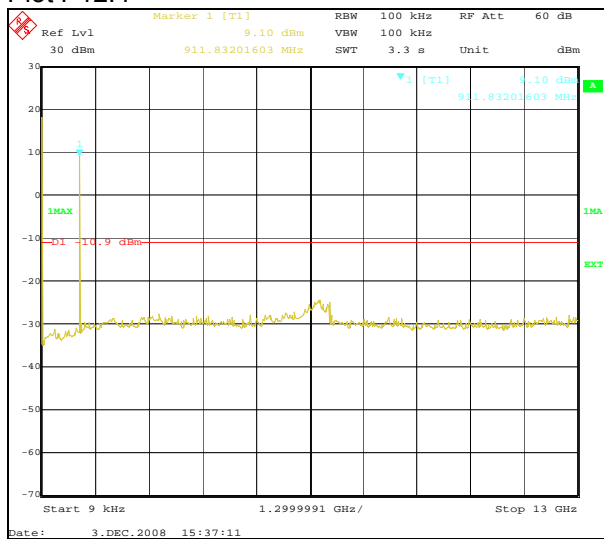
Plot P12.2



Plot P12.3



Plot P12.4



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APPENDIX – PHOTO OF THE EUT



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