DAT-PL-002/91-03

Center for Quality Engineering

Test Report No.: D0Q80002

FCC ID: WIZEX5UR

Order No.: D0Q8	**Pages:** 44	**Munich,** Jul 26, 2010

Client:	Kyosho Deutschland GmbH
Equipment Under Test:	Kyosho Perfex EX5-UR ASF
Manufacturer:	Kyosho Deutschland GmbH
Task:	Conformance test according to the test specifications mentioned below
Test Specification(s): [covered by accreditation]	FCC 47 CFR Part 15
Result:	The EUT complies with the requirements of the specification.

The results relate only to the items tested as described in this test report.

approved by:	**Date**	**Signature**
Neuhäusler Lab Manager Wireless & Software	Jul 26, 2010	
Bauer Lab Manager EMC	Jul 26, 2010	

This document was signed electronically.

CONTENTS

1 Summary

The measurements described in this report were conducted pursuant to 47 CFR § 2.947, § 2.1041 and [1] § 15.31. All applicable paragraphs of the [1] 47 CFR part 15 of the most current version of the rules were considered.

The following tests were performed according to the FCC rules in order to verify the compliance of the EUT with the FCC requirements:

Test No.	Measurement	FCC Rule	Page Number of this Report	Result
1	Conducted emissions	§ 15.207	11	n/a[1]
2	Field strength correction for pulse operation (Duty Cycle)	§ 15.35(c)	11	-
3	Carrier frequency separation	§ 15.247(a1)	13	n/a[2]
4	Number of hopping channels		13	n/a[2]
5	Time of occupancy		13	n/a[2]
6	6dB bandwidth	§ 15.247(a2)	14	compliant
7	Maximum peak conducted output power	§ 15.247(b)	16	compliant
8	Conducted emissions	§ 15.247(d)	18	compliant
9	Radiated emissions (9kHz – 30MHz)	§ 15.247(d), § 15.205(a), § 15.209(a)	22	compliant
10	Radiated emissions (30MHz – 1GHz)		27	compliant
11	Radiated emissions (1GHz – 24GHz)		32	compliant
12	Power spectral density	§ 15.247(e)	42	compliant

1) Measurement is not applicable since the EUT has no AC mains connection
2) Measurement is not applicable since the EUT uses digital modulation techniques (no FHSS)

Table 1-1: Results – Summary

2 References

2.1 Specifications

No.	Standard	Title	Date
[1]	FCC 47 CFR Part 15	Code of Federal Regulations, Title 47: Telecommunication Part 15: Radio Frequency Devices	2009-10
[2]	ANSI C63.4-2003	American National Standard for Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2004-01

2.2 Glossary of Terms

°C	Degree Celsius
AC	Alternating Current
ANT	Antenna
chk	checked against a calibrated reference
cnn	calibration not necessary
DAR	Deutscher Akkreditierungsrat (German Accreditation Council)
DATech	Deutsche Akkreditierungsstelle Technik e.V.
dB	Decibel
dBc	Decibel per Carrier
dBm	Decibel per Milliwatt
EUT	Equipment Under Test
ind	for indication only
kbps	Kilobits per second
max	Maximum
min	Minimum
n/a	Not Applicable
n/p	Not Performed
P	Power
Pmax	Maximum Output Power
Prat	Rated Output Power
RBW	Resolution Bandwidth
Ref	Reference
RF	Radio Frequency
RMS	Root Mean Square
RX	Receive Path
SW	Software
T	Temperature
TRX	Transceiver
TX	Transmit Path
V	Volt
W	Watt
w/	with
w/o	without

3 General Information

3.1 Identification of Client

Kyosho Deutschland GmbH
Nikolaus-Otto-Straße 4
D-24568 Kaltenkirchen
Germany

3.2 Test Laboratory

Center for Quality Engineering
SGS Germany GmbH
Hofmannstraße 50
81379 München

Federal Communications Commission (FCC):
Testfirm registration numbers – MZ2: 97242
– MZ3: 299569

3.3 Time Schedule

Test No.:	1, 3, 4, 5	2, 6, 7, 8, 12	9, 10, 11
Start of Test:	n/a	Jun 24, 2010	Jun 23, 2010
End of Test:		Jul 26, 2010	Jun 25, 2010

3.4 Participants

Name	Function
Michael Sperling	Accredited Testing, Editor
Katarzyna Jagiello	Accredited Testing

4 Equipment Under Test

The tested equipment is representative for serial production.

4.1 Description of EUT

The Kyosho Perfex EX5-UR ASF transmits control data by using DSSS modulation through its 2.4GHz carrier signal.

Figure 4-1: Picture of EUT

4.2 Configuration of EUT

The used different EUT configurations are shown by the following tables.

Module Type		Model Control Transmitter		
Operating Band		2.400-2.4835GHz		
Operating Frequencies		Bottom	Middle	Top
		2.404GHz	2.440GHz	2.480GHz
Maximum conducted Output Power		-27.7 dBm		
Modulation	**Type**	DSSS		
	Carrier frequency separation	n/a		
	Number of hopping channels	n/a		
Antenna	**Type**	integrated		
	Number of Antenna Ports	1		
	Gain	3 dBi		
Power Src.	**Type**	DC Supply		
	Battery type (if applicable)	NiCd		
	Voltage nominal	6V		

Table 4-1: Overview of EUT Configuration

The tests were performed with two identical EUTs (Config. A for conducted tests, Config. B for radiated tests).

The used different EUT configurations are shown by the following table.

Module Name	Part No. incl. HW Vers.	Serial-No.	Module Type	Config.
Transmitter (EUT) RF module[1]	- 004WWA0492	Not available 00009839	Perfex EX5-UR ASF KTSS-701	A
Transmitter (EUT)	-	0699680	Perfex EX5-UR ASF	B

1) The EUT in config A does not provide a serial number. Therefore the serial-no of the RF module is shown.

Table 4-2: Configuration of EUT

For a functional description of the modules, please refer to the appropriate related parts and exhibit sections of this certification application.

4.3 Operating Conditions

If not stated otherwise, the following standard setup procedure for the EUT was used:

The EUT was set up in a continuously transmitting operating mode. The TX signal was thus permanently activated during the test. The throttle control was locked in maximum position.

The EUT was supplied with 6V DC.
For the emissions tests EUT was supplied with 4 x Alkaline Battery Size AA (LR6) 1.5V.

4.4 Compliance Criteria

The EUT must fulfill the requirements (described in the specifications mentioned in chapter 2.1, Specifications) for the selected test cases.

5 General Description of Tests

5.1 Tested Carrier Frequencies

The measurements were performed on 3 carrier frequencies, according to the following table:

Frequency [GHz]	Remark
2.404GHz	Bottom frequency
2.440GHz	Middle frequency
2.480GHz	Top frequency

Table 5-1: Carrier Frequencies

5.2 Calibration of the Test Equipment

All relevant test equipment has a valid calibration from an external calibration laboratory. Additionally the used spectrum and EMI analyzers have a built-in self-calibration procedure. This calibration procedure was activated prior to the measurements so that the analyzer is deemed accurate. High quality cables were used to connect the measurement equipment. The actual loss of the attenuators and the cables was measured with a high precision network analyzer and taken into account for all measurements.

6 Test Results

6.1 Test No. 1: Conducted Emissions (§ 15.207)

Test is not relevant, because the EUT has no AC Power line.

6.2 Test No. 2: Field strength correction for pulse operation (Duty Cycle) (§ 15.35(c))

6.2.1 Purpose

When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed according to [1] § 15.35(c) the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.
As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted.

6.2.2 Limits

According to [1] § 15.35(b) the duty cycle correction factor must be not below -20dB.

6.2.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.2.4 Test Configuration

The measurement of the duty cycle of the EUT's pulse train was performed conducted by means of a spectrum analyzer operating in the zero span mode.
For the parts list of used test equipment see chapter 7.1

Figure 6-1: Test Configuration – Duty Cycle

6.2.5 Test Procedure and Results

The following duty cycle correction factor (dB) was calculated with following formula:

$$CF = 20 \log \frac{n \cdot t_p}{100ms}$$

With:
CF: Duty cycle correction factor
n: number of pulses within 100ms
t_p: Puls duration

t_p [ms]	t_t [ms]	*CF* [dB]
26 x 0.769	100	-14.0

Table 6-1: Results – Duty Cycle

6.2.6 Test Protocol

The following figures show the number of pulses within 100ms (time domain) and the pulse train details (time domain):

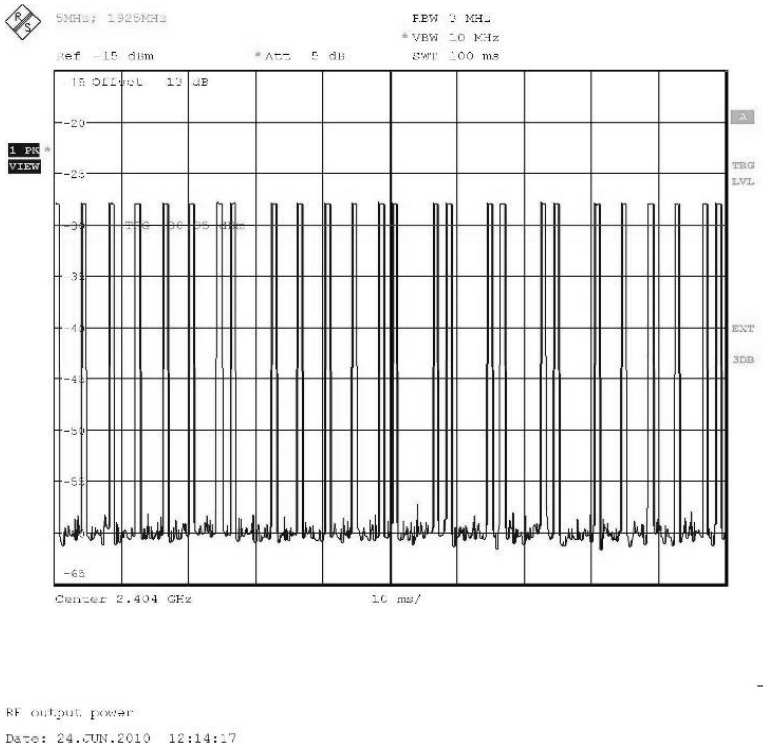

Figure 6-2: Pulses within 100ms (26 pulses, no constant duty cycle)

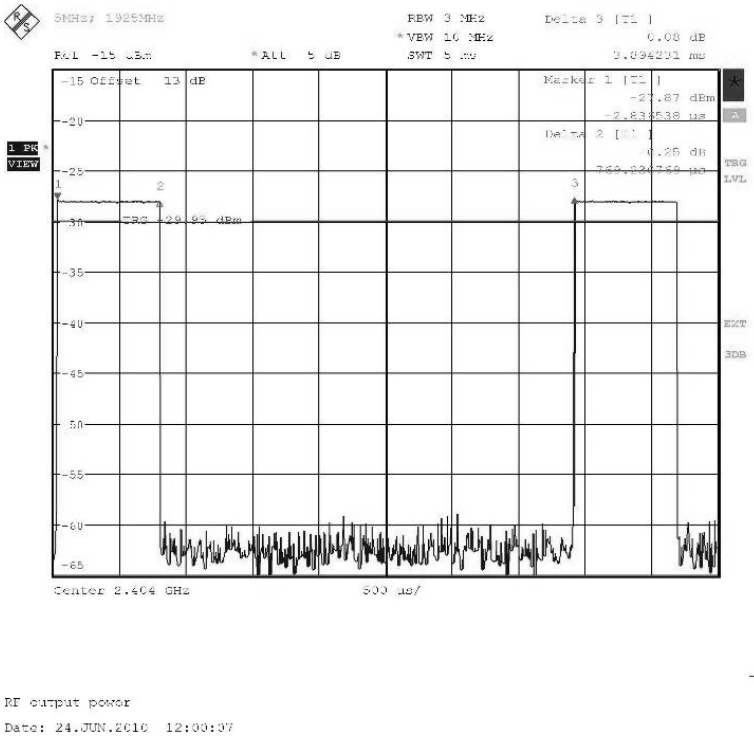

Figure 6-3: Duty Cycle (Pulse details)

The determined duty cycle correction factor will be applied for the field strength and radiated emission measurements.

6.3 Test No. 3: Carrier frequency separation (§ 15.247(a1))

Not applicable since the EUT is not a frequency hopping system.

6.4 Number of hopping channels (§ 15.247(a1))

Not applicable since the EUT is not a frequency hopping system.

6.5 Time of occupancy (§ 15.247(a1))

Not applicable since the EUT is not a frequency hopping system.

6.6 Test No. 6: 6dB Bandwidth (§ 15.247(a2))

6.6.1 Purpose

The emission bandwidth of the EUT was measured pursuant to [2] Clause 13.1.7. The measurement was performed to verify the 6 dB bandwidth of the emission.

6.6.2 Limits

According to § 15.247(a1) systems using digital modulation techniques and operating in the 2400.0–2483.5 MHz band must have a minimum 6 dB bandwidth of at least 500 kHz.

6.6.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.6.4 Test Configuration

The measurement was performed conducted with activated modulation using a spectrum analyzer. The analyzer frequency span was set wide enough to capture the most of the power envelope of the modulated signal.
For the parts list of used test equipment see chapter 7.1

Figure 6-4: Test Configuration – 6dB Bandwidth

6.6.5 Test Procedure and Results

The 6 dB bandwidth of the carrier emission is measured using a spectrum analyzer.
In order to measure the modulated signal properly, a resolution bandwidth that is small compared with the emission bandwidth limit shall be used on the measuring instrument
According to [2] the resolution bandwidth was set to 100kHz. The '6dB down' signal analyzer functionality was used to determine emission bandwidth. The measurement was performed with the peak detector and the trace mode maximum hold.
The following table summarizes the results:

Carrier Frequency	6dB Bandwidth	Result
[GHz]	[kHz]	
2.404	966.3	compliant
2.440	976.0	compliant
2.480	971.2	compliant
Measurement Uncertainty:		±9.6kHz

Table 6-2: Results – 6dB Bandwidth

6.6.6 Test Protocol

The following figure shows the test protocol of the 6dB bandwidth measurement.

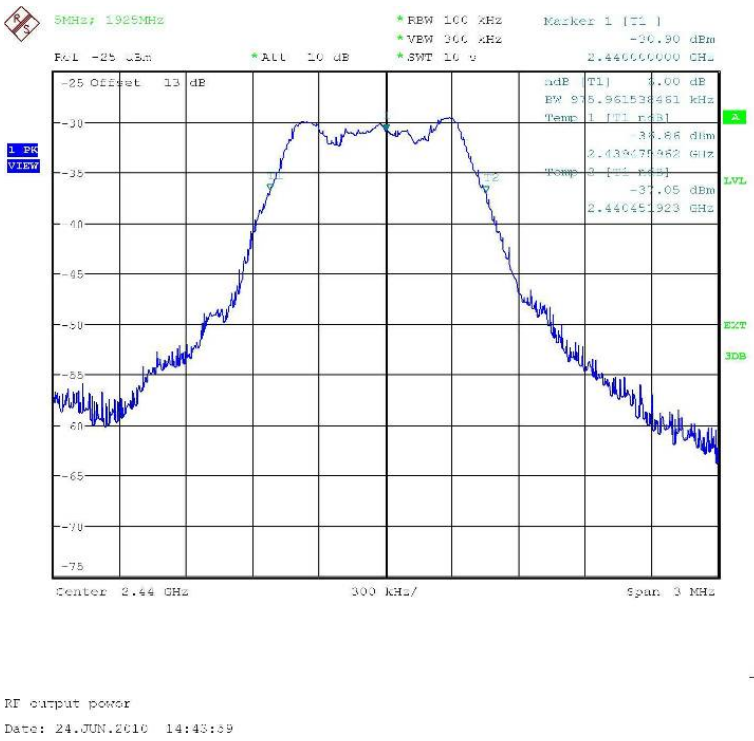

Figure 6-5: 6dB Bandwidth (middle channel)

The measured 6dB bandwidth was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

6.7 Test No. 7: Maximum peak conducted output power (§ 15.247(b))

6.7.1 Purpose

The maximum peak conducted output power was measured to verify that the output power does not exceed the specified limit.

6.7.2 Limits

According to § 15.247(b) the maximum peak conducted output power of the intentional radiator shall not exceed 1W for systems using digital modulation in the 2400.0–2483.5 MHz band.

6.7.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.7.4 Test Configuration

The measurement was performed conducted with activated modulation using a spectrum analyzer with max peak detector in frequency span mode.
For the parts list of used test equipment see chapter 7.1

Figure 6-6: Test Configuration – Maximum peak conducted Output Power

6.7.5 Test Procedure and Results

The maximum peak conducted output power is measured using a spectrum analyzer.
In order to measure the modulated signal properly, a resolution bandwidth greater the emission bandwidth limit was used.
The following table summarizes the results:

Carrier Frequency	Peak conducted output Power	Result
[GHz]	[dBm]	
2.404	-27.7	compliant
2.440	-28.2	compliant
2.480	-28.7	compliant
Measurement Uncertainty:		±0.5dB

Table 6-3: Results – Maximum peak conducted Output Power

6.7.6 Test Protocol

The following figure shows the test protocol of the maximum peak conducted output power measurement.

Figure 6-7: Maximum peak conducted Output Power (middle channel)

The measured maximum peak conducted output power was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

6.8 Test No. 8: Conducted Emissions (§ 15.247(d))

6.8.1 Purpose

The maximum conducted spurious emission was measured to verify that the spurious emissions do not exceed the specified limit.

6.8.2 Limits

According to § 15.247(d) in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

6.8.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.8.4 Test Configuration

The measurement was performed conducted with activated modulation using a spectrum analyzer with max peak detector.
For the parts list of used test equipment see chapter 7.1

Figure 6-8: Test Configuration – Conducted Emissions

6.8.5 Test Procedure and Results

The conducted emissions are measured using a spectrum analyzer. Measurements were performed up to the 10th harmonic (24.85GHz).
In accordance with [1] a resolution bandwidth of 100kHz was used. For measurements above 3GHz the resolution bandwidth was increased to 300kHz, above 12GHz a resolution bandwidth of 1MHz was used.
The following table summarizes the results of the detected maximum emission per tested transmit channel:

Carrier Frequency	Peak conducted Emission		Result
[GHz]	[dBm]	[MHz]	
2.404	-53.7	3304.3	compliant
2.440	-52.9	3205.7	compliant
2.480	-53.9	3252.9	compliant
Measurement Uncertainty:			f < 3.6 GHz: ±0.5dB 3.6 GHz ≤ f < 8 GHz: ±1.2dB 8 GHz ≤ f < 26.5GHz: ±1.5dB

Table 6-4: Results – Conducted Emissions

All out of band conducted emissions were more than 20dB below the carriers

6.8.6 Test Protocol

The following figure shows the test protocol of the conducted emissions measurement.

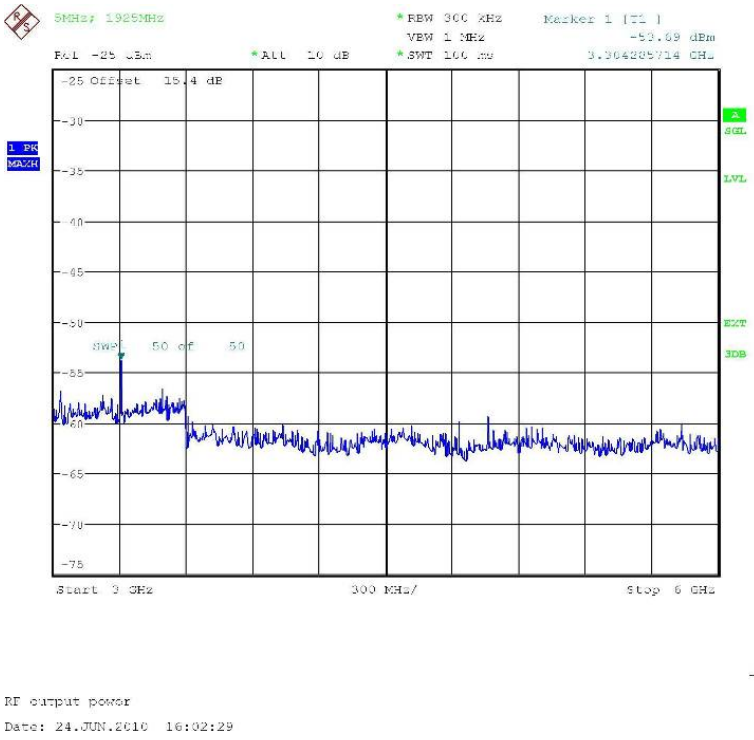

Figure 6-9: Conducted Emissions (bottom frequency)

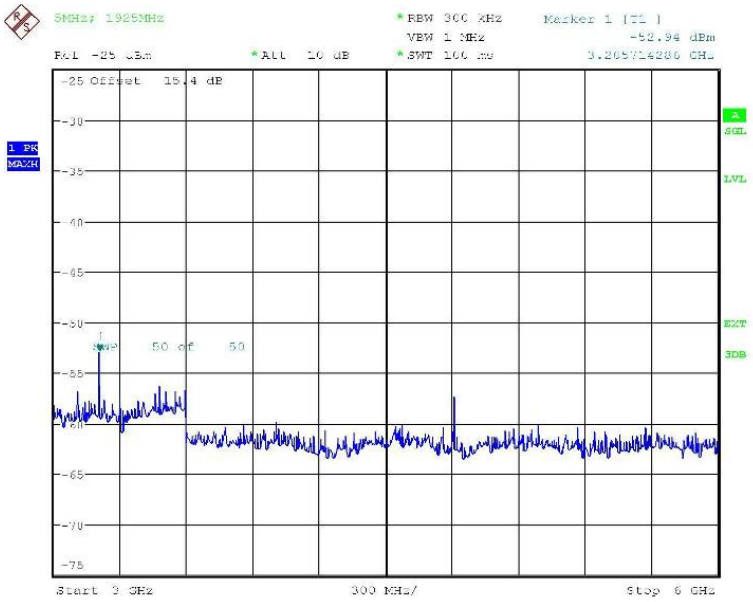

Figure 6-10: Conducted Emissions (middle frequency)

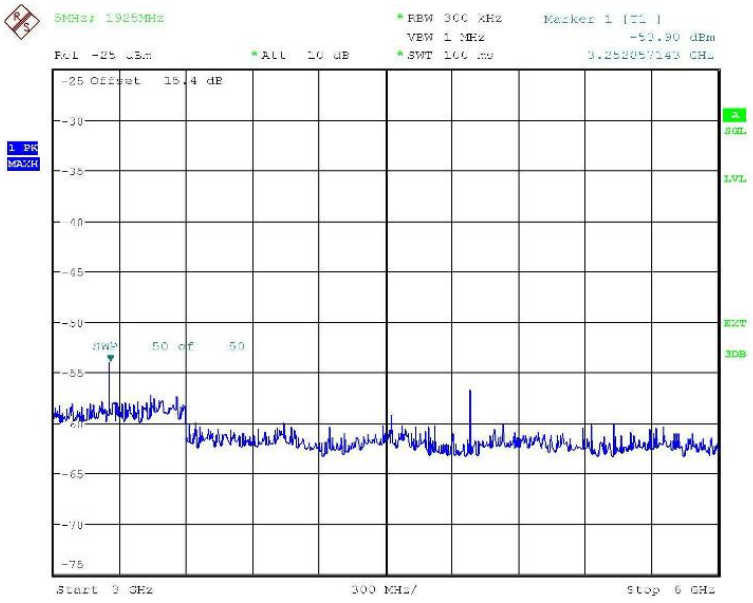

Figure 6-11: Conducted Emissions (top frequency)

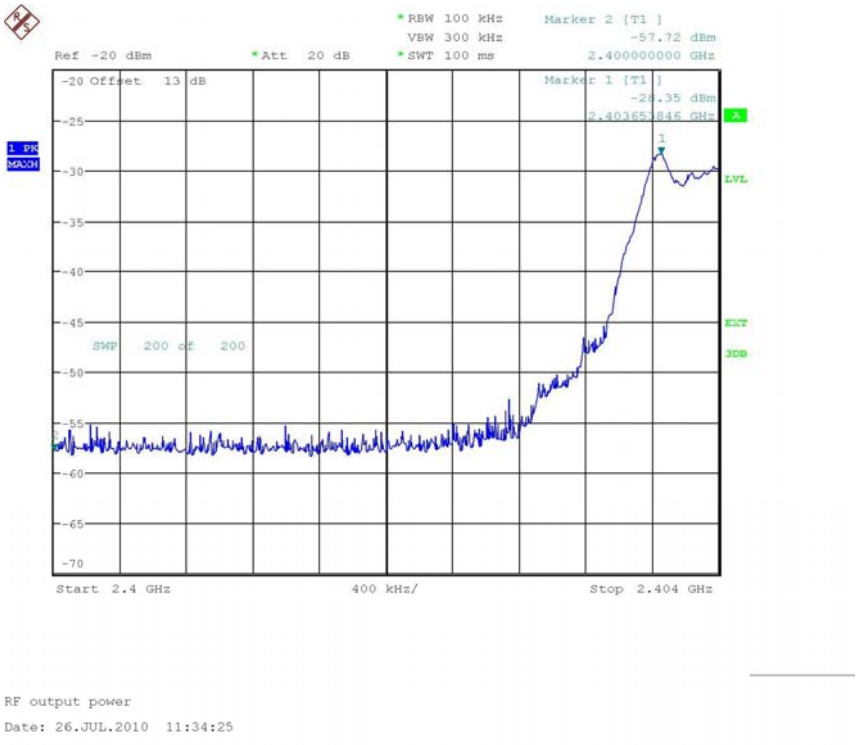

Figure 6-12: Conducted Emissions (lower band edge)

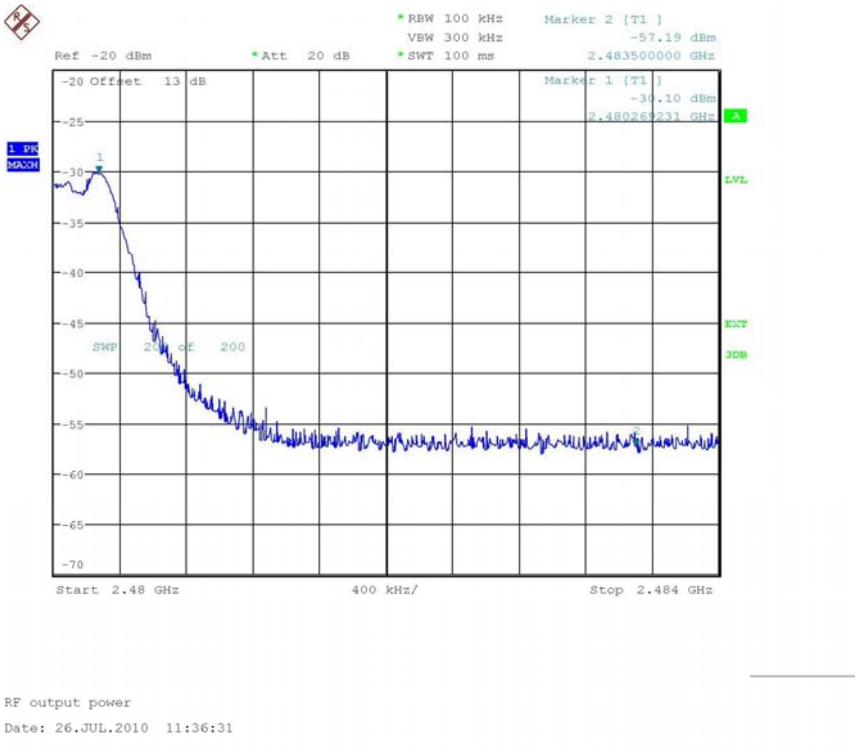

Figure 6-13: Conducted Emissions (upper band edge)

The measured conducted emissions were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

6.9 Test No. 9: Radiated Emissions (9kHz – 30MHz) (§ 15.247(d))

6.9.1 Purpose

The radiated emissions of the EUT were measured pursuant to [2] Clause 13.1.4. The measurement was performed to verify that emissions radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements are attenuated below the specified limits.

6.9.2 Limits

According to [1] § 15.247(d) the radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must comply with the radiated emission limits specified in § 15.209(a)

MHz	MHz	MHz	MHz
0.090–0.110	6.215–6.2	8.41425–8.41475	16.42–16.423
0.495–0.505	6.26775–6.26825	12.29–12.293	16.69475–16.69525
2.1735–2.1905	6.31175–6.31225	12.51975–12.52025	16.80425–16.80475
4.125–4.128	8.291–8.294	12.57675–12.57725	25.5–25.67
4.17725–4.17775	8.362–8.366	13.36–13.41	
4.20725–4.20775	8.37625–8.38675	16.42–16.423	

Table 6-5: Restricted Bands (9kHz – 30MHz) (§ 15.205(a))

Frequency of Emission [MHz]	Field strength [µV/m]	Meas. Distance [m]
0.009–0.490	2400/F [kHz]	300
0.490–1.705	24000/F [kHz]	30
1.705–30	30	30

Table 6-6: Limits – Radiated Emissions (9kHz – 30MHz) (§ 15.209)

6.9.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.9.4 Test Configuration

The measurements were performed in an anechoic chamber. The radiated test site complies with the site attenuation requirements of [2] and is listed with the FCC.
The resolution bandwidth used during the emission measurement was as follows:

9kHz – 150 kHz: 200Hz
150kHz – 30MHz: 9kHz

For the parts list of used test equipment see chapter 7.1

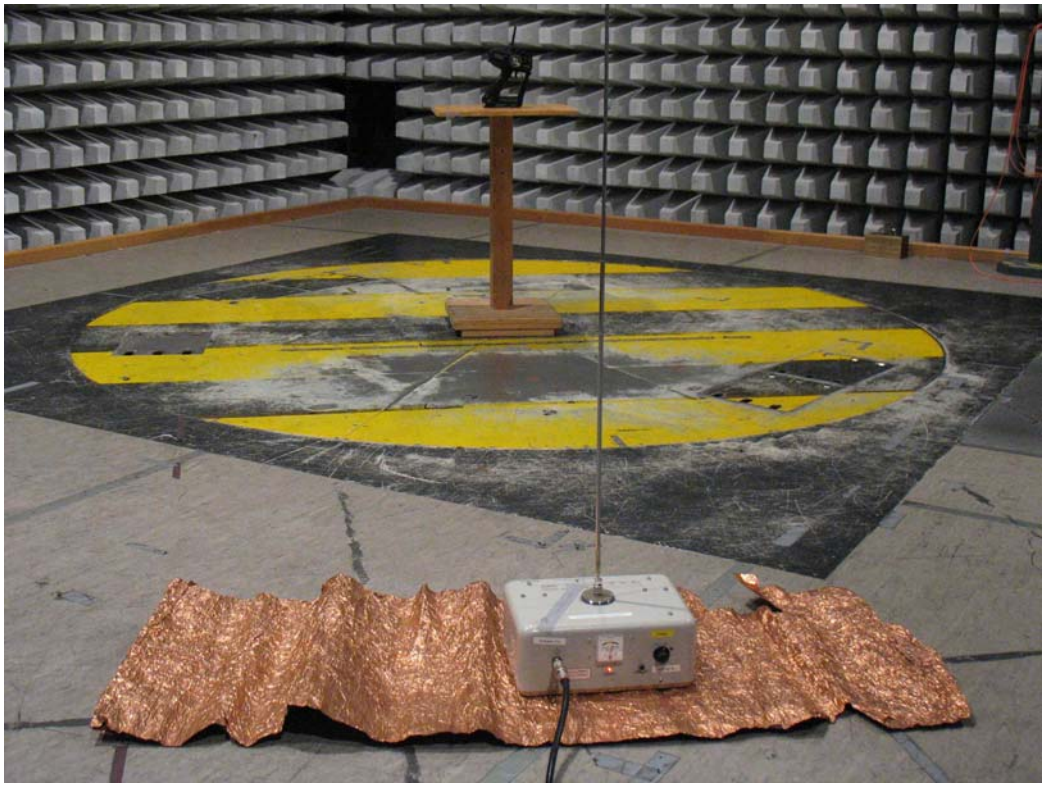

Figure 6-14: Test Configuration – Radiated Emissions (9kHz – 30MHz)

6.9.5 Test Procedure and Results

This investigation is performed with the EUT rotated 360°.

All radiated emissions in the frequency range from 9kHz to 30MHz are > 25dB below the limit are not recorded.

6.9.6 Test Protocol

The following figure shows the test protocol of the radiated emissions (9kHz – 30MHz) measurement.

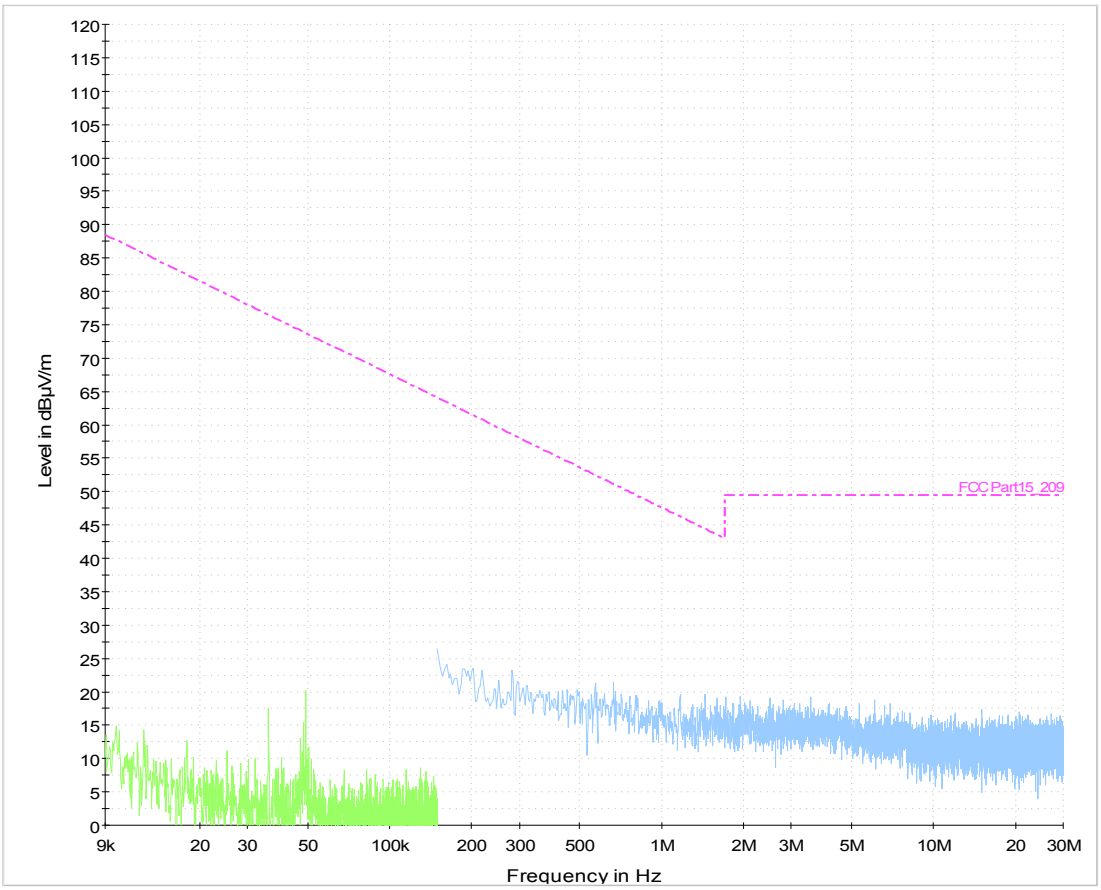

Figure 6-15: Radiated Emissions (9kHz – 30MHz) (bottom frequency)

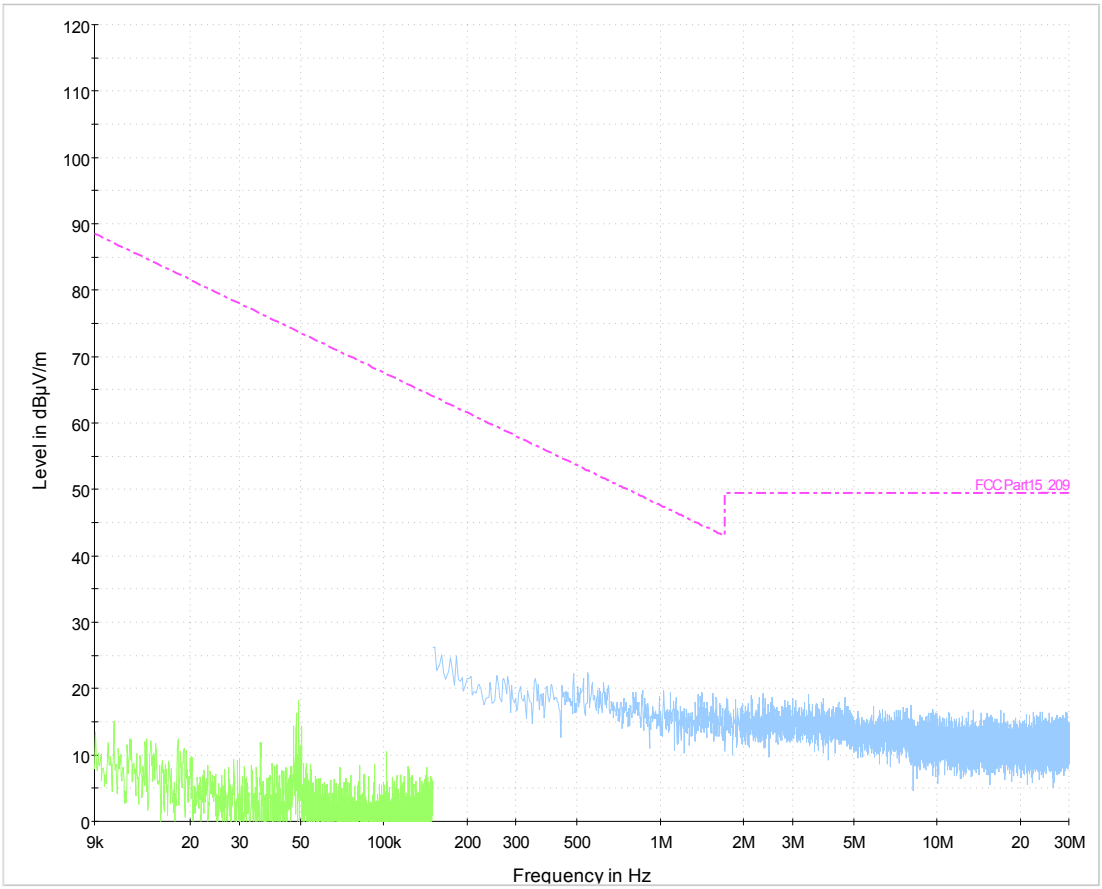

Figure 6-16: Radiated Emissions (9kHz – 30MHz) (middle frequency)

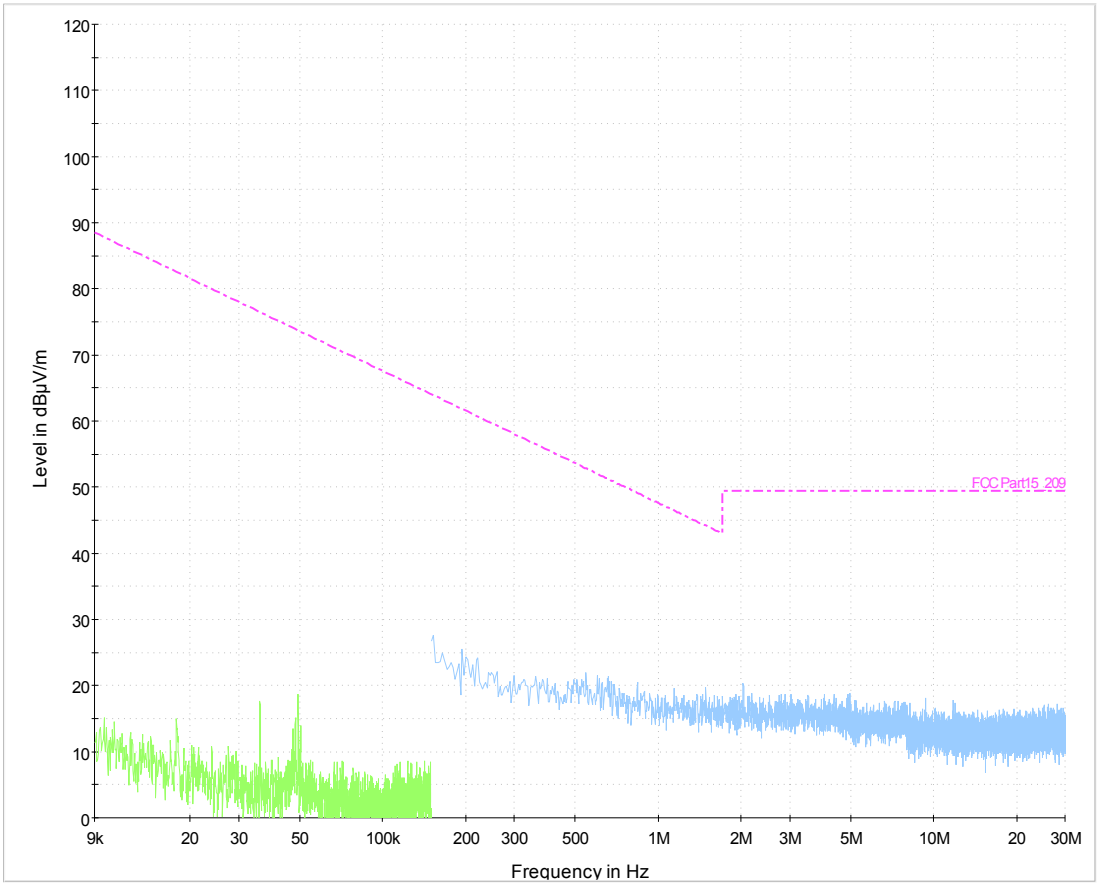

Figure 6-17: Radiated Emissions (9kHz – 30MHz) (top frequency)

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

6.10 Test No. 10: Radiated Emissions (30MHz – 1GHz) (§ 15.247(d))

6.10.1 Purpose

The radiated emissions of the EUT were measured pursuant to [2] Clause 13.1.4. The measurement was performed to verify that emissions radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements are attenuated below the specified limits.

6.10.2 Limits

According to [1] § 15.247(d) the radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must comply with the radiated emission limits specified in § 15.209(a)

MHz	MHz	MHz	GHz
37.5–38.25	123–138	162.0125–167.17	399.9–410
73–74.6	149.9–150.05	167.72–173.2	608–614
74.8–75.2	156.52475–156.52525	240–285	960–1000
108–121.94	156.7–156.9	322–335.4	

Table 6-7: Restricted Bands (30MHz – 1GHz) (§ 15.205(a))

Frequency of Emission [MHz]	Field strength [µV/m]	Meas. Distance [m]
30–88	100	3
88–216	150	3
216–960	200	3
Above 960	500	3

Table 6-8: Limits – Radiated Emissions (30MHz – 4GHz) (§ 15.209)

6.10.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.10.4 Test Configuration

The measurements were performed in an anechoic chamber. The radiated test site complies with the site attenuation requirements of [2] and is listed with the FCC.
The resolution bandwidth used during the emission measurement was as follows:

30MHz – 1GHz: 120kHz

For the parts list of used test equipment see chapter 7.1

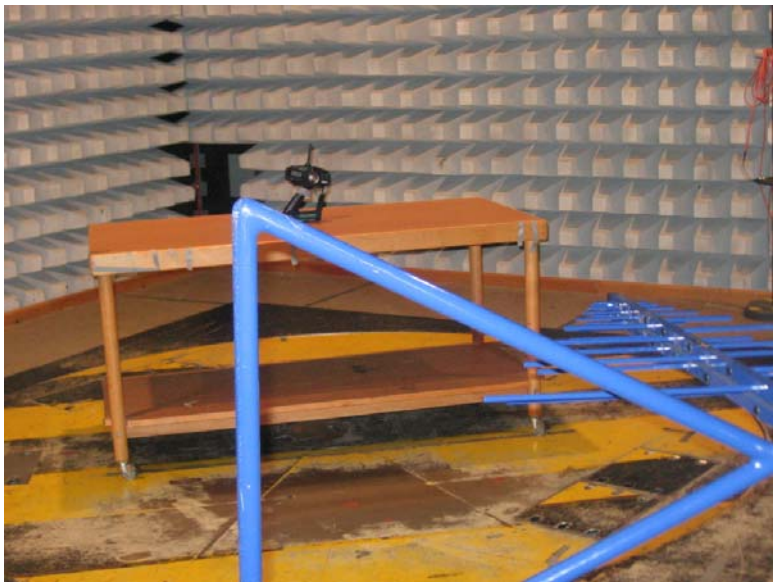

Figure 6-18: Test Configuration – Radiated Emissions (30MHz – 1GHz)

6.10.5 Test Procedure and Results

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Carrier Frequency 2.404 GHz (bottom):

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
801.040000	37.1	1000.0	H	2.0	23.9	8.9	46.0
801.360000	36.8	1000.0	H	-5.0	23.9	9.2	46.0
801.600000	37.3	1000.0	H	5.0	23.9	8.7	46.0
Measurement Uncertainty:						+3.1 dB / -3.9 dB	

Carrier Frequency 2.440 GHz (middle):

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
813.000000	35.3	1000.0	H	1.0	23.9	10.7	46.0
813.320000	38.0	1000.0	H	-5.0	23.9	8.0	46.0
813.600000	36.8	1000.0	H	-4.0	23.9	9.24	46.0
Measurement Uncertainty:						+3.1 dB / -3.9 dB	

Carrier Frequency 2.480 GHz (top):

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
826.360000	35.7	1000.0	H	-4.0	24.5	10.3	46.0
Measurement Uncertainty:						+3.1 dB / -3.9 dB	

Table 6-9: Results – Radiated Emissions (30MHz – 1GHz)

All radiated emissions in the frequency range from 30MHz to 1GHz which are at least 20dB below the limit are not recorded.

6.10.6 Test Protocol

The following figure shows the test protocol of the radiated emissions (30MHz – 1GHz) measurement.

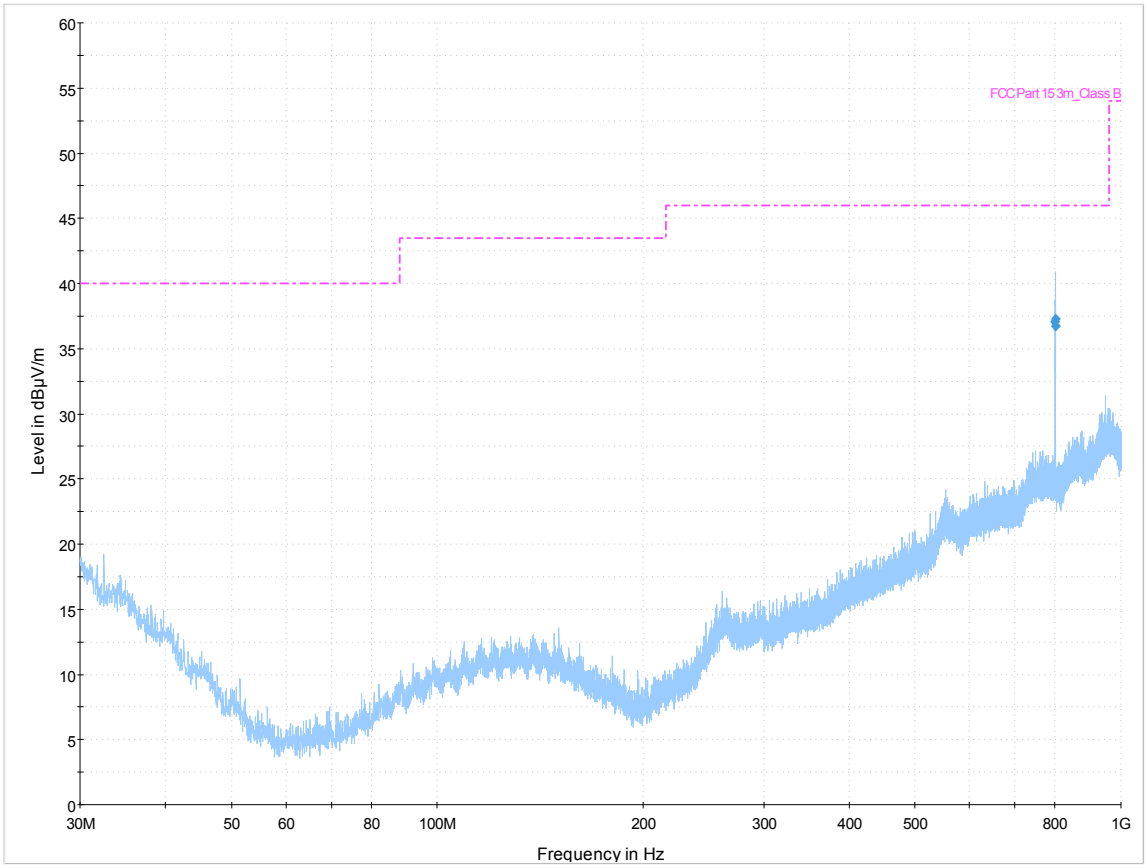

Figure 6-19: Radiated Emissions (30MHz – 1GHz) (bottom frequency)

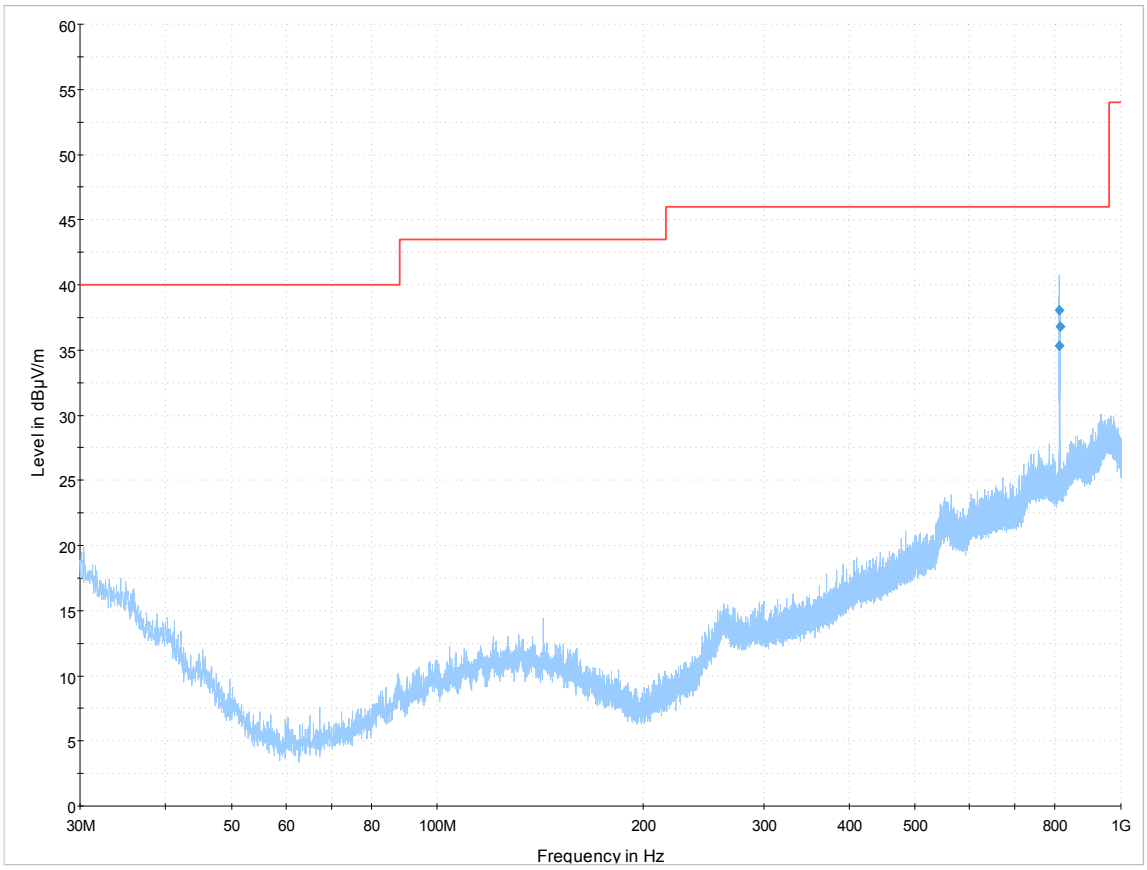

Figure 6-20: Radiated Emissions (30MHz – 1GHz) (middle frequency)

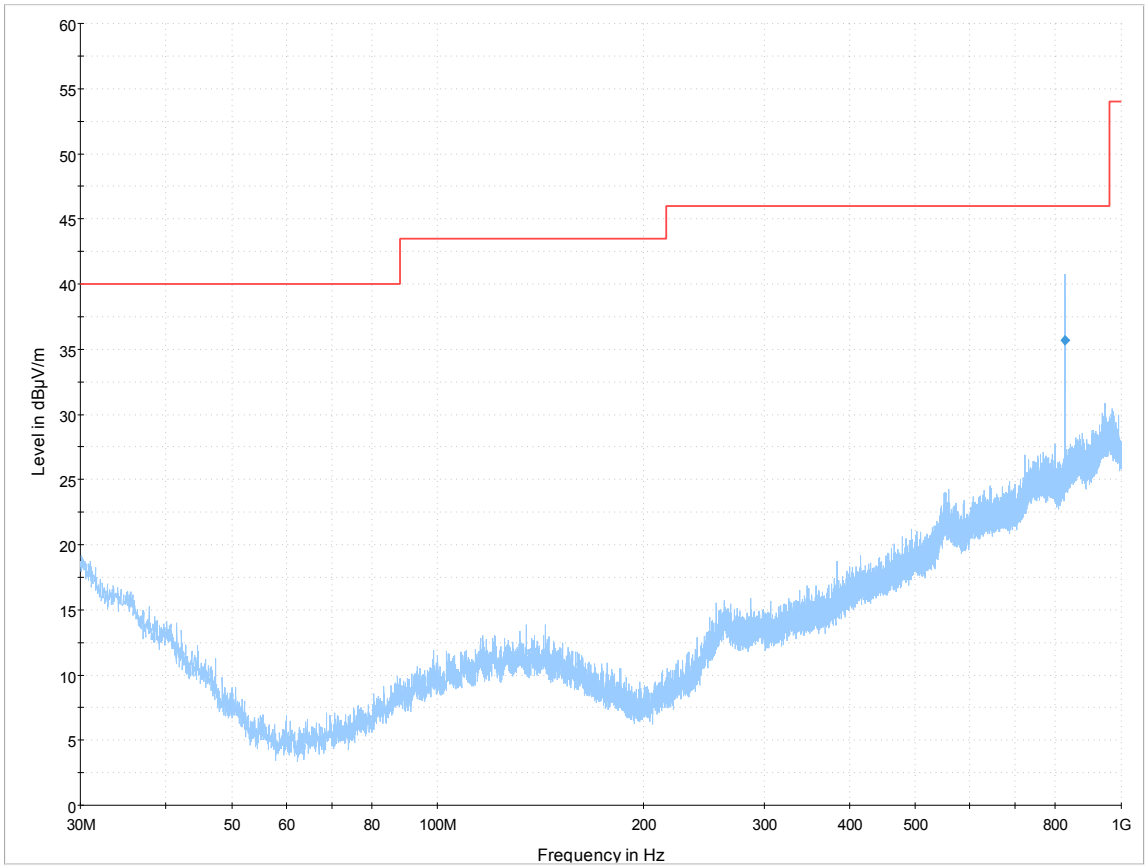

Figure 6-21: Radiated Emissions (30MHz – 1GHz) (top frequency)

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

6.11 Test No. 11: Radiated Emissions (1GHz – 24.84GHz) (§ 15.247(d))

6.11.1 Purpose

The radiated emissions of the EUT were measured pursuant to [2] Clause 13.1.4. The measurement was performed to verify that emissions radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements are attenuated below the specified limits.

6.11.2 Limits

According to [1] § 15.247(d) the radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must comply with the radiated emission limits specified in § 15.209(a)

MHz	MHz	GHz	GHz
1000–1240	2310–2390	4.5–5.15	13.25–13.4
1300–1427	2483.5–2500	5.35–5.46	14.47–14.5
1435–1626.5	2690–2900	7.25–7.75	15.35–16.2
1645.5–1646.5	3260–3267	8.025–8.5	17.7–21.4
1660–1710	3332–3339	9.0–9.2	22.01–23.12
1718.8–1722.2	3345.8–3358	9.3–9.5	23.6–24.0
2200–2300	3600–4400	10.6–12.7	

Table 6-10: Restricted Bands (1GHz – 24.84GHz) (§ 15.205(a))

Frequency of Emission [MHz]	Field strength [µV/m]	Meas. Distance [m]
Above 960	500	3

Table 6-11: Limits – Radiated Emissions (1GHz – 24.84GHz) (§ 15.209)

6.11.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.11.4 Test Configuration

The measurements were performed in an anechoic chamber. The radiated test site complies with the site attenuation requirements of [2] and is listed with the FCC.
The resolution bandwidth used during the emission measurement was as follows:

1GHz – 24.64GHz: 1MHz

For the parts list of used test equipment see chapter 7.1

Figure 6-22: Test Configuration – Radiated Emissions (1GHz – 24.84GHz)

6.11.5 Test Procedure and Results

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Carrier Frequency 2.404 GHz (bottom):

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2404.233333	67.9	1000.0	H	-3.0	4.6	-	Carrier
17701.666667	53.2	1000.0	H	-13.0	31.5	0.8	54.0
19003.000000	49.6	1000.0	H	122.0	19.2	4.4	54.0
21565.200000	50.2	1000.0	V	31.0	21.2	3.8	54.0
23459.600000	50.9	1000.0	V	83.0	21.6	3.1	54.0
23467.000000	50.8	1000.0	V	1.0	21.6	3.2	54.0
23749.600000	51.0	1000.0	V	60.0	21.7	3.0	54.0
23757.400000	50.7	1000.0	V	-13.0	21.7	3.3	54.0
Measurement Uncertainty:						+4.4 dB / -6.3 dB	

Frequency (MHz)	Average (dBµV/m)[1]	Meas. Time (ms)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2404.233333	53.9	1000.0	H	12.0	4.6	-	Carrier
17698.966667	40.7	1000.0	H	173.0	31.5	13.3	54.0
23605.800000	38.5	1000.0	V	56.0	21.6	15.5	54.0
Measurement Uncertainty:						+4.4 dB / -6.3 dB	

1) The average field strength was calculated by applying the duty cycle correction factor of -20dB (see chapter 6.2) to the measured peak field strength.

Carrier Frequency 2.440 GHz (middle):

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2440.333333	68.0	1000.0	V	3.0	4.3	-	Carrier
17869.000000	51.6	1000.0	H	-2.0	30.1	2.4	54.0
21285.024000	50.5	1000.0	H	105.0	21.0	3.5	54.0
22278.876000	50.1	1000.0	H	2.0	21.5	3.9	54.0
23043.360000	50.7	1000.0	V	273.0	21.5	3.3	54.0
23376.240000	50.3	1000.0	H	179.0	21.6	3.7	54.0
24023.988000	50.4	1000.0	V	277.0	21.7	3.6	54.0
24707.988000	51.5	1000.0	V	83.0	22.1	2.5	54.0
Measurement Uncertainty:						+4.4 dB / -6.3 dB	

Frequency (MHz)	Average (dBµV/m)[1]	Meas. Time (ms)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2439.933333	54.0	1000.0	V	8.0	4.3	-	Carrier
17700.633333	40.7	1000.0	H	3.0	31.5	13.3	54.0
21756.528000	37.7	1000.0	V	269.0	21.4	16.3	54.0
24664.212000	38.4	1000.0	V	167.0	22.1	15.6	54.0
Measurement Uncertainty:						+4.4 dB / -6.3 dB	

1) The average field strength was calculated by applying the duty cycle correction factor of -20dB (see chapter 6.2) to the measured peak field strength.

Carrier Frequency 2.480 GHz (top):

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2479.533333	66.9	1000.0	H	285.0	4.7	-	Carrier
3306.700000	52.0	1000.0	V	-11.0	8.7	2.0	54.0
4959.266667	51.5	1000.0	H	175.0	11.3	2.5	54.0
17708.366667	53.1	1000.0	H	81.0	31.4	0.9	54.0
20946.216000	51.3	1000.0	V	270.0	20.8	2.7	54.0
23458.320000	50.8	1000.0	H	285.0	21.6	3.2	54.0
24539.496000	51.0	1000.0	H	83.0	22.0	3.0	54.0
Measurement Uncertainty:						+4.4 dB / -6.3 dB	

Frequency (MHz)	Average (dBµV/m)[1]	Meas. Time (ms)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2480.566667	52.9	1000.0	H	255.0	4.7	-	Carrier
17400.333333	39.2	1000.0	H	171.0	30.8	14.8	54.0
17703.366667	40.5	1000.0	H	184.0	31.5	13.5	54.0
21893.556000	37.4	1000.0	H	285.0	21.5	16.6	54.0
23600.592000	38.0	1000.0	H	175.0	21.6	16.0	54.0
Measurement Uncertainty:						+4.4 dB / -6.3 dB	

1) The average field strength was calculated by applying the duty cycle correction factor of -20dB (see chapter 6.2) to the measured peak field strength.

Table 6-12: Results – Radiated Emissions (1GHz – 24.84GHz)

All radiated emissions in the frequency range from 1GHz to 24.84GHz which are at least 20dB below the limit are not recorded.

6.11.6 Test Protocol

The following figure shows the test protocol of the radiated emissions (1GHz – 24.84GHz) measurement.

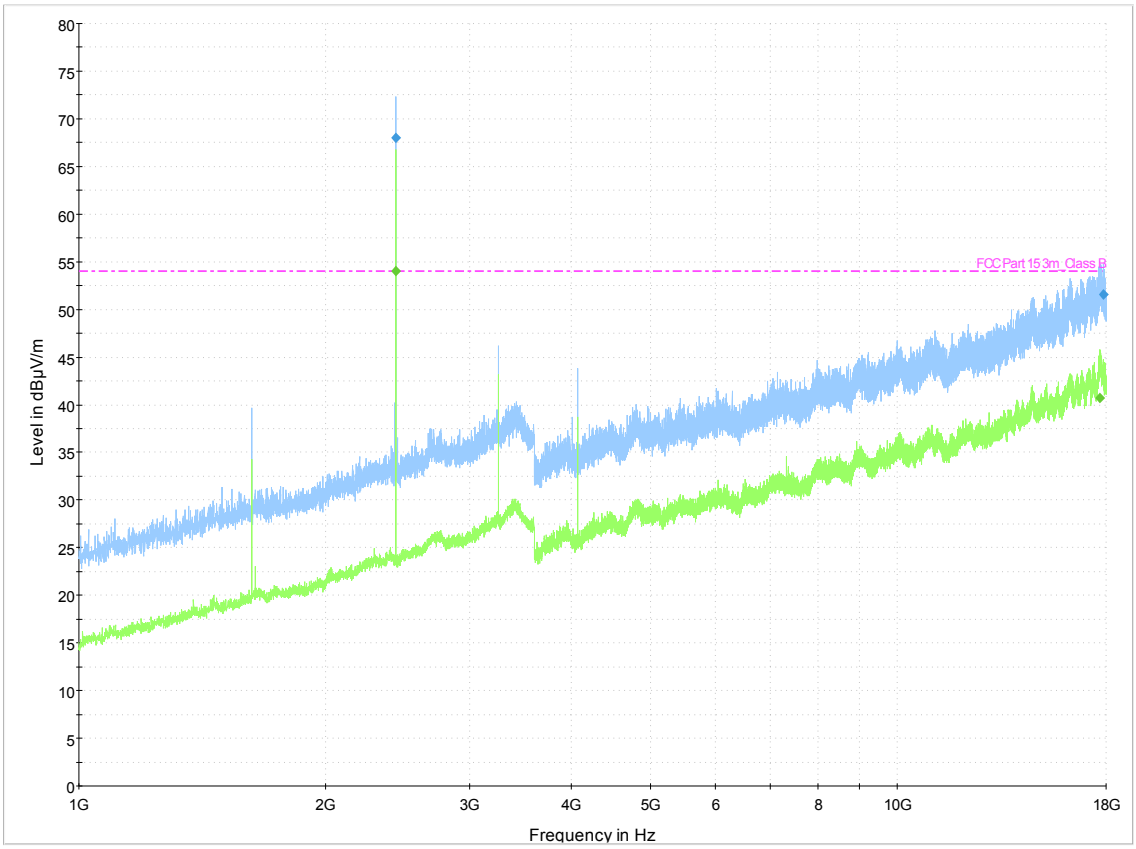

Figure 6-23: Radiated Emissions (1GHz – 18GHz) (bottom frequency)

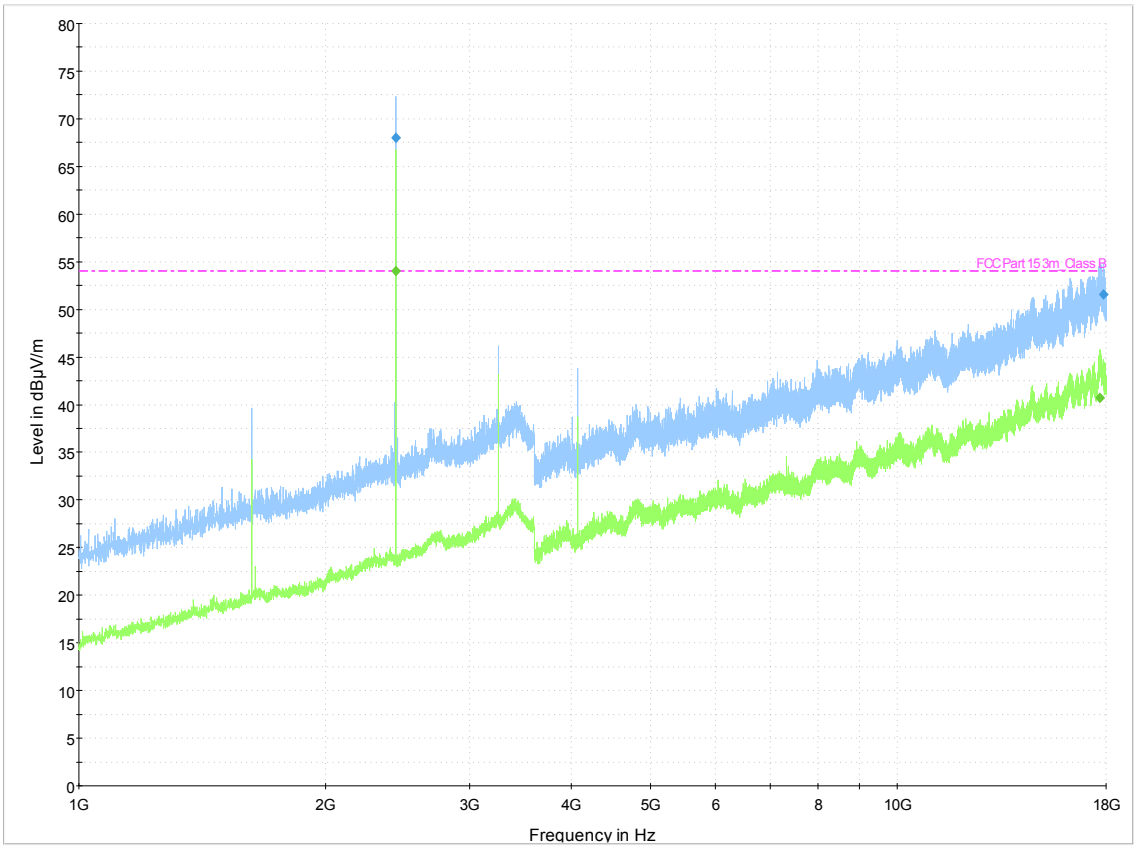

Figure 6-24: Radiated Emissions (1GHz – 18GHz) (middle frequency)

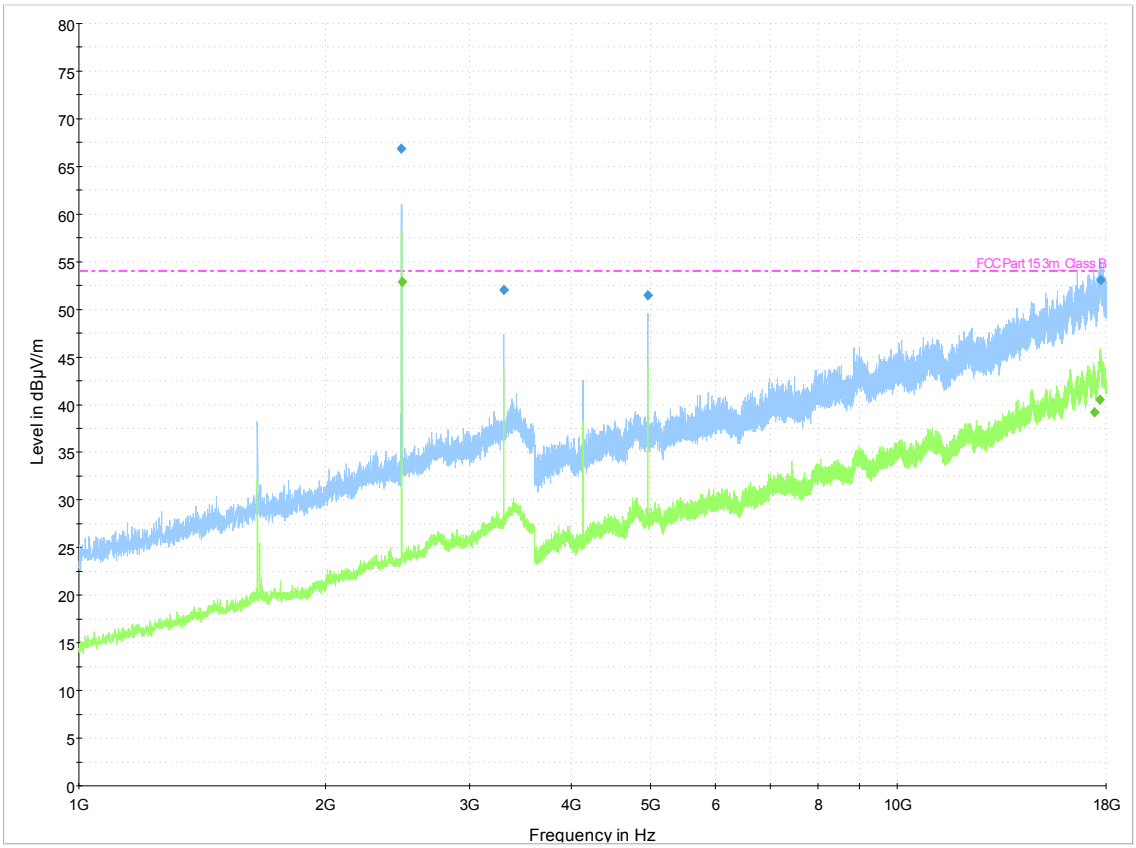

Figure 6-25: Radiated Emissions (1GHz – 18GHz) (top frequency)

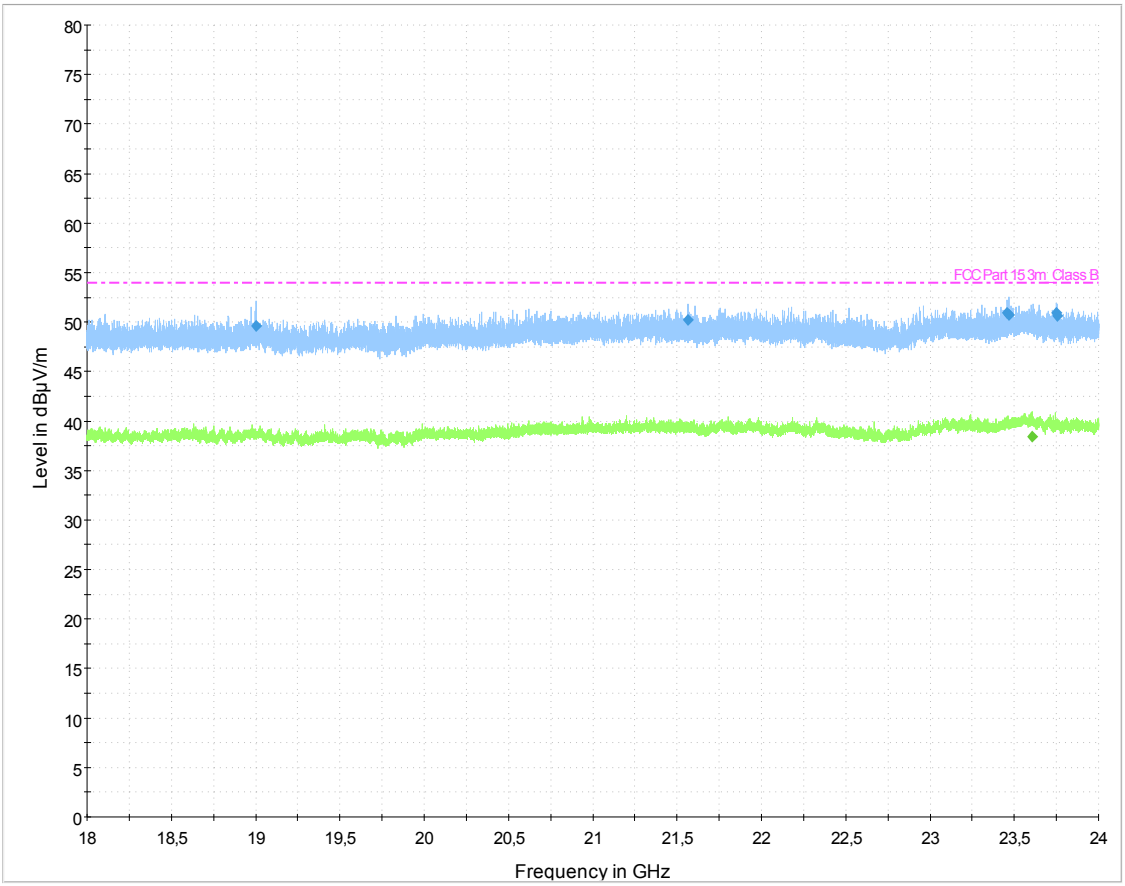

Figure 6-26: Radiated Emissions (18GHz – 24.84GHz) (bottom frequency)

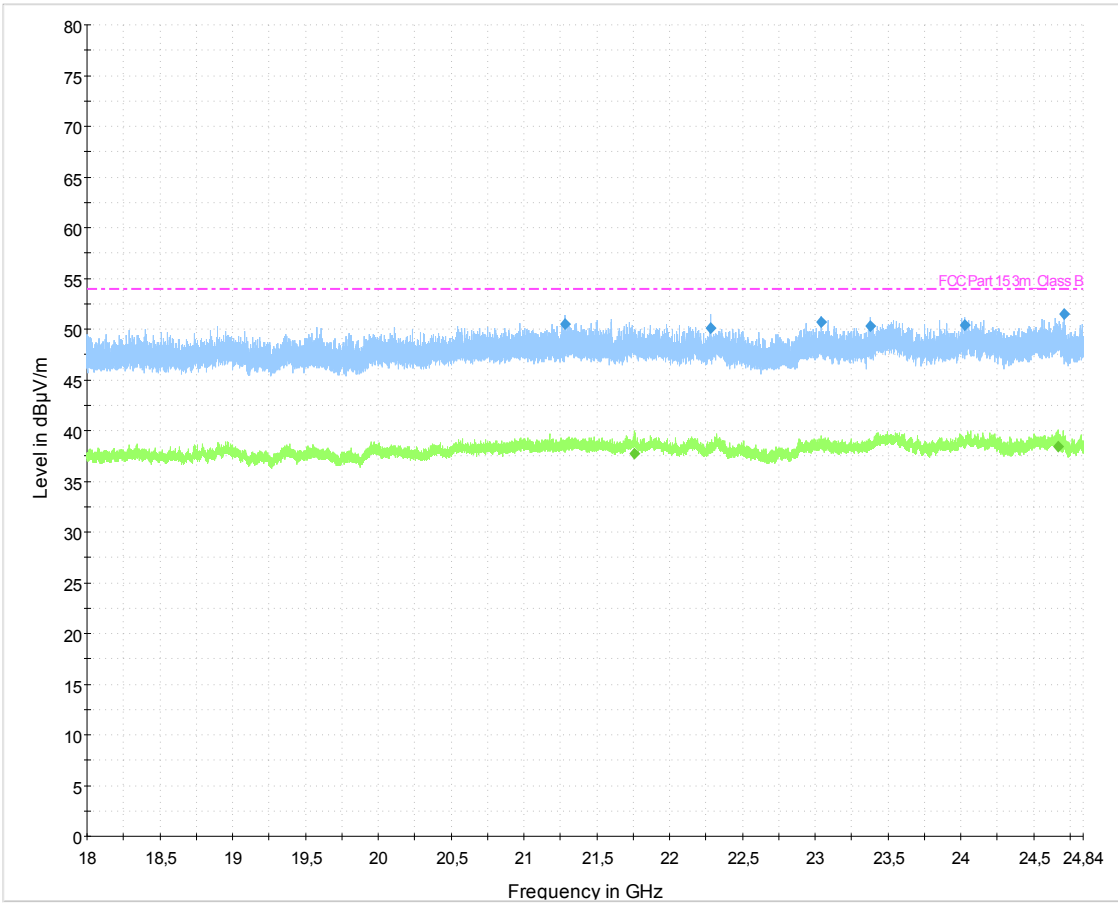

Figure 6-27: Radiated Emissions (18GHz – 24.84GHz) (middle frequency)

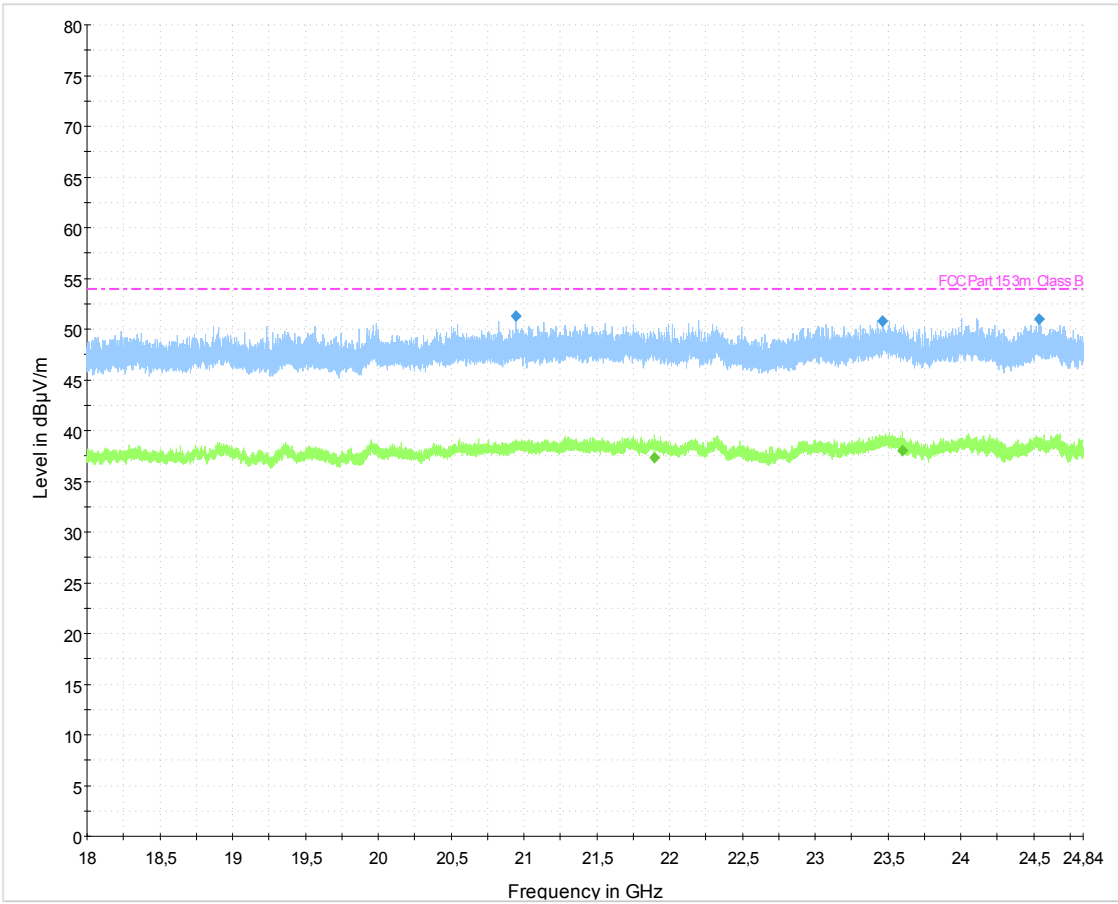

Figure 6-28: Radiated Emissions (18GHz – 24.84GHz) (top frequency)

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

6.12 Test No. 12: Power spectral density (§ 15.247(e))

6.12.1 Purpose

The power spectral density was measured to verify that the output power is equally distributed over the used frequency range and does not exceed the specified limit.

6.12.2 Limits

According to § 15.247(e) for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

6.12.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.12.4 Test Configuration

The power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
For the parts list of used test equipment see chapter 7.1

Figure 6-29: Test Configuration – Power Spectral Density

6.12.5 Test Procedure and Results

The power spectral density is measured using a spectrum analyzer.
The following table summarizes the results:

Carrier Frequency	Peak Power Spectral Density	Result
[GHz]	[dBm/3kHz]	
2.404GHz	-41.3	compliant
2.440GHz	-42.2	compliant
2.480GHz	-42.5	compliant
Measurement Uncertainty:		±0.5dB

Table 6-13: Results – Power Spectral Density

6.12.6 Test Protocol

The following figure shows the test protocol of the power spectral density measurement.

Figure 6-30: Power Spectral Density (middle frequency)

The measured power spectral density was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

7 Test Data

7.1 Part List of the Test Equipment

No.	Test Equipment	Type (Manufacturer)	Identification No.	Calibration date	Calibration due	Test No.
1	Test Chamber 3	(Siemens)	P0338	02/2010	02/2011	10
2	EMI Receiver	ESPI-3 (R&S)	P1325	03/2009	03/1011	10
3	Antenna	95010-1(Singer)	P0065	06/2009	06/2011	9
4	EMI Receiver	ESU40 (R&S)	P1327	06/2009	06/2011	9, 11
5	Test Chamber 2	(Siemens)	P0337	02/2010	02/2011	9, 11
6	Antenna (MZ2)	3115 (Emco)	P0961	04/2010	04/2012	9, 11
7	Preamplifier (MZ2)	AFS4-00101800 -35-S-4-L (miteq)	P1193	12/2009	12/2010	11
8	Antenna	CBL6111 (Chase)	P0018	03/2010	03/2011	10
9	Coax cable 40 GHz	FA147A102000 2020 (Rosenberger)	P1248			11
10	Preamplifier 18-40GHz	JS4-18004000-33-5A (miteq)	P1197	03/2010	03/2012	11
11	Antenna (horn 18-40GHz)	3116 (Emco)	P1148	05/2010	05/2012	11

Table 7-1: Part List of the EMC Measurement Test Equipment

No.	Test Equipment	Type (Manufacturer)	Identification No.	Calibration date	Calibration due	Test No.
1	Spectrum Analyzer	FSU 26 (R&S)	F0366	11/2009	11/2011	2, 6, 7, 8, 12
2	Network Analyzer	ZVM (R&S)	F0092	10/2009	10/2011	2, 6, 7, 8, 12
3	Frequency Standard	Rubisource (Datum)	F0076	11/2009	05/2011	2, 6, 7, 8, 12

Table 7-2: Part List of the RF Measurement Test Equipment