

Equipment Authorization measurements on 2402 MHz Transceiver Unit

FCC ID: XTYMTM01A

(8 appendices)

Rev.1, 2010-01-12: Appendix 1, 2, 3, 3.1 and 6 has been revised. The duty cycle measurements has been moved from appendix 2 to 1. All levels has been corrected due to the normal operation duty cycle, when applicable. The limit of the harmonics was 50 μ V/m, it shall be 500 μ V/m instead.

Test object

Product name: Marine Short Range Transceiver Module

Three different test samples were used,

EUT 1: Part/serial number: 1703220-02-1036-3 (the fundamental RF power was decreased one step, to power mode 3)

EUT 2: Part/serial number: 1703220-02-1030-7 (full RF power at fundamental)

EUT 3: Part/serial number: 1703220-02-1058-9 (normal operation/duty cycle)

Software: FCC-test 1.1

Summary

See appendix 1 for general information and appendix 8 for photos.

Emission measurements as specified below have been performed.

Standard	Compliant	Appendix	Remarks
FCC 47 CFR Part 15 C (07-10-08)			
§15.249 Operation within the band 2400-2483.5 MHz	Yes		
§15.249 (a) Field strength of fundamental	Yes	2	
§15.249 (d) (e) Radiated emission	Yes	3	
§15.215 (c) 20 dB bandwidth	Yes	4	
§15.207 Conducted emission limits	N/A	-	Note 1
§2.1049 Occupied bandwidth	Yes	5	
§2.1049 Band Edge	Yes	6	
RF Safety	Yes	7	

Note 1: Test not applicable, battery powered.

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SP Technical Research Institute of Sweden
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Appendix 1

Performance test and requirements

The tests were performed to verify that the electromagnetic compatibility of Short Range Transceiver Module meets the requirements of FCC 47 CFR part 15 C.

Test facility

The used test site (SP 504 114) is compliant with the requirements of section 2.948 of the FCC rules and listed, registration number 96866, as a facility accepted for certification under parts 15 and 18. The site complies with RSS-Gen, Issue 2 and is accepted by Industry Canada for the performance of radiated measurements, file number: IC 3482A-2.

Test object

Transceiver:	Marine Short Range Transceiver Module
Antenna:	Integral
Antenna gain:	0 dBi
Frequency:	2402 MHz
Frequency used during test:	2402 MHz
Modulation:	GFSK
Data rate:	10 kbps
Supply voltage:	3.0 V DC, internal battery Lithium, CR2450

Operational test mode

To simplify the measurements a modified test sample was used to be able to transmit continuous with modulation. The duty cycle was set to the maximum possible duty cycle supported by the hardware, to simplify the measurements. This will not be in normal operation. For normal operation see EUT 3.
The EUT was tested stand alone.

EUT 1

The fundamental RF power was decreased one step (to power mode 3), which was used during the measurements if not either stated. Maximum possible duty cycle.

EUT 2

Full RF power at fundamental. Maximum possible duty cycle.

Duty cycle calculations: EUT 1 and EUT 2 (maximum possible duty cycle)

Number of pulses during 100 ms= $100/2,292$ ms=43.6 pulses
Total Tx on time during 100 ms= 0.539 ms x 43 pulses=23.177 ms
Duty cycle during 100 ms= $23.177/100$ ms=0.23177
Duty cycle correction factor= $20 \times \log(0.23177)$ =-12.7 dB
Average level=measured peak level-duty cycle correction factor

EUT 3

Normal operation (normal duty cycle).

Duty cycle calculations, EUT 3 (normal operation/duty cycle)
Number of pulses during 100 ms= $100/14.016$ ms=7.13 pulses
Total Tx on time during 100 ms= 0.549 ms x 7 pulses=3.843 ms
Duty cycle during 100 ms= $3.843/100$ ms=0.0384
Duty cycle correction factor= $20 \times \log(0.0384)$ =-28.3 dB
Average level=measured peak level-duty cycle correction factor

Diagram 1: EUT 2, Duty cycle measurements, Tx on.

Diagram 2: EUT 2, Duty cycle measurements, T, period time.

Diagram 3: EUT 3 (normal operation), Duty cycle measurements, Tx on.

Diagram 4: EUT 3 (normal operation), Duty cycle measurements, T, period time.

Diagram 5: EUT 3 (normal operation), Duty cycle measurements, complete pulse train.



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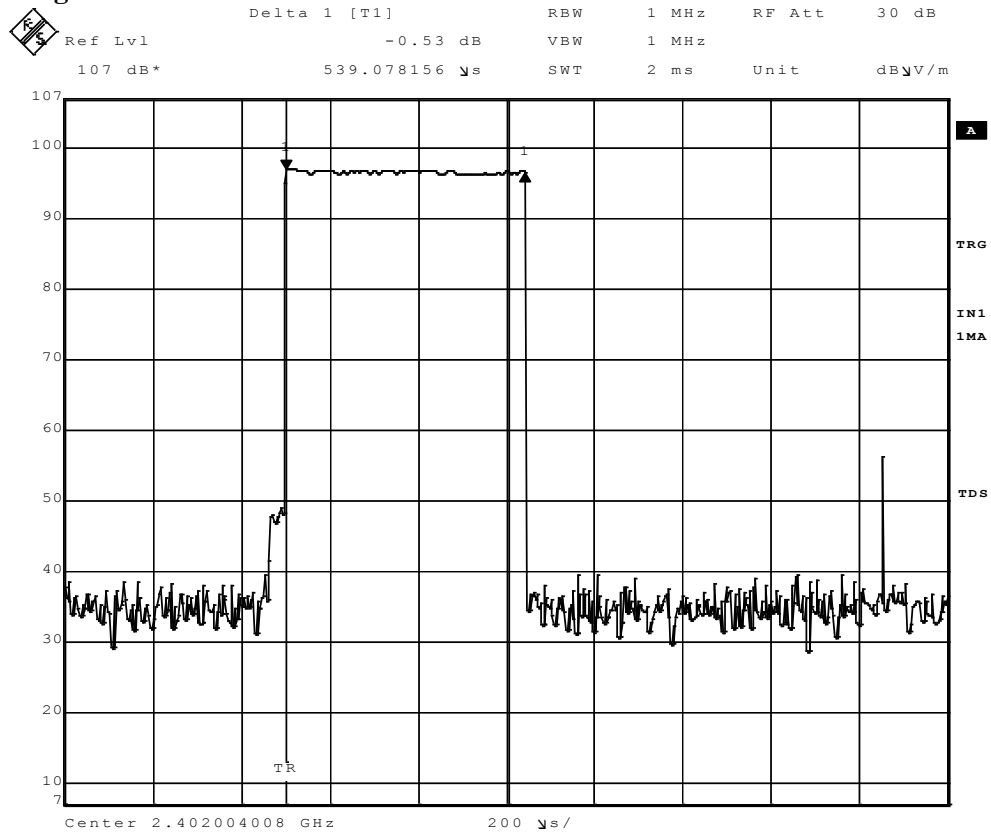
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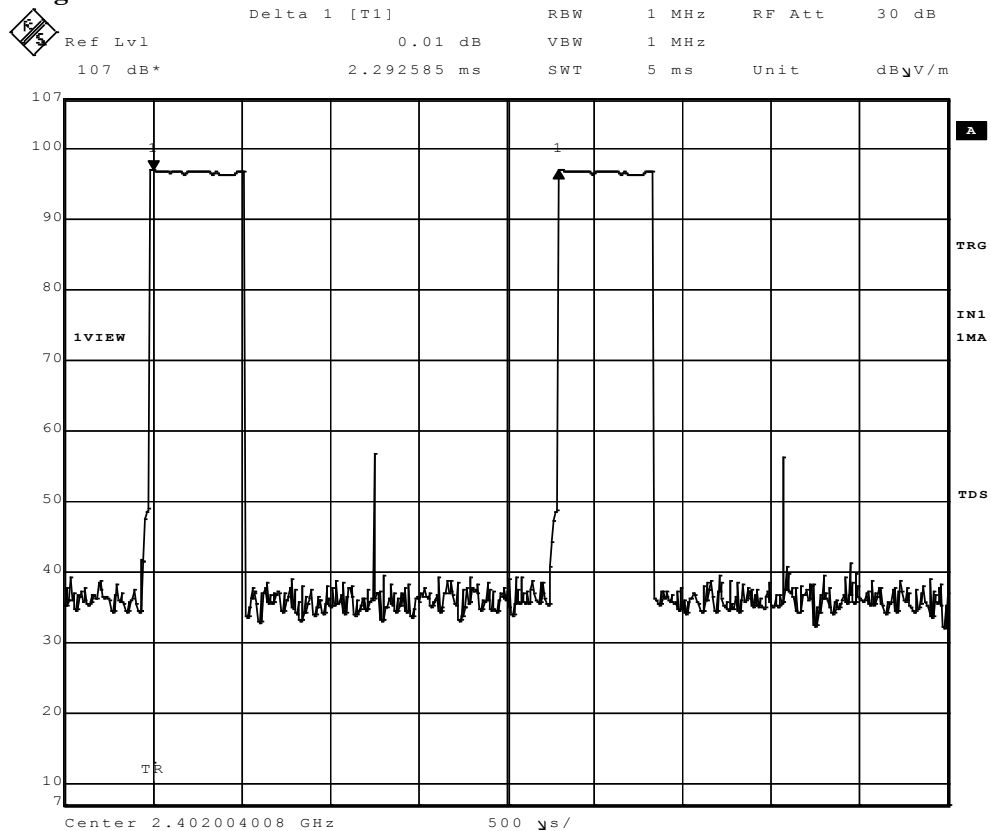
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Appendix 1

Diagram 1



Date: 6.OCT.2009 08:26:53

Diagram 2



Date: 6.OCT.2009 08:28:54



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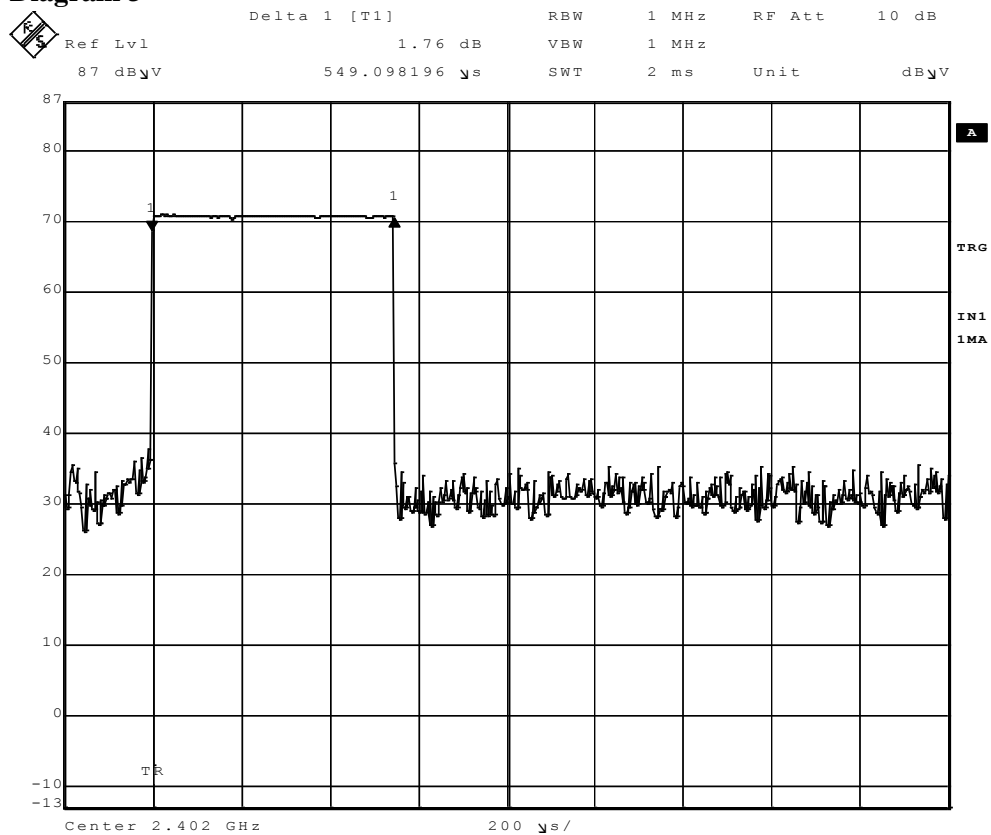
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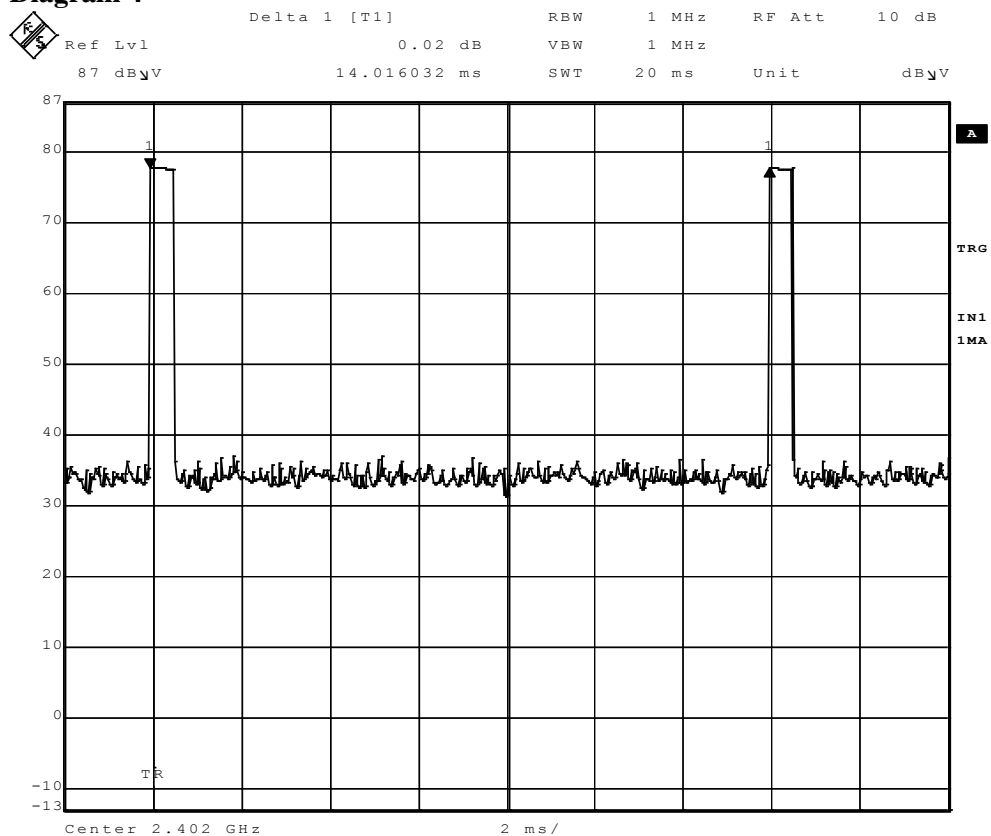
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Diagram 3



Date: 23.OCT.2009 11:13:01

Diagram 4



Date: 23.OCT.2009 11:17:29



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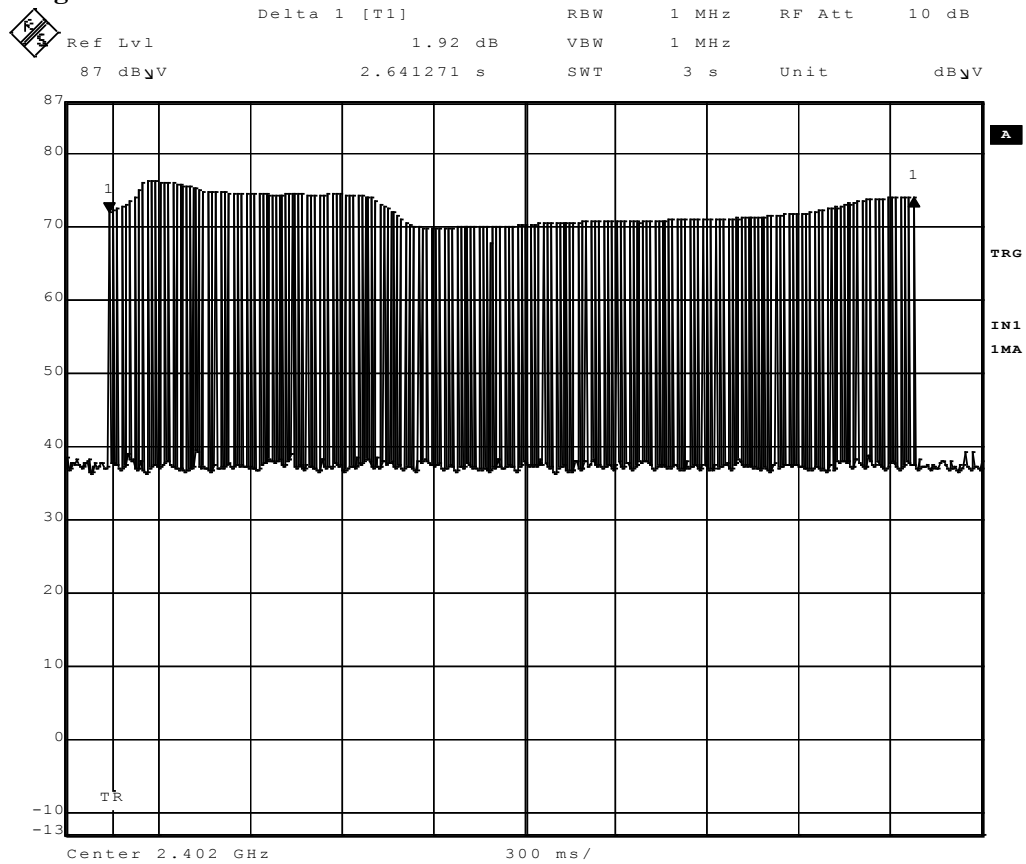
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Appendix 1

Diagram 5



Date: 23.OCT.2009 11:56:22

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation "EL-QD 8.2". The measurement uncertainties can be found in the table below. The uncertainties are calculated with a coverage factor $k=2$ (95% level of confidence).

The measurement uncertainties can be found in the table below:

Method	Uncertainty
Radiated emission, 30 – 1000 MHz	4.8/5.6 dB (V/H-pol)
Radiated emission, 1 – 40 GHz	2.6 dB
Conducted emission	3.5 dB
20 dB bandwidth and Occupied bandwidth	2.6 %

Reservation

The test results in this report apply only to the particular test object as declared in the report.

To fulfill the radiated emission test the power level of the EUT was decreased one step, to power mode 3.

Delivery of test object

The test objects were delivered: 2009-10-06, 2009-10-07 and 2009-10-22.

Test participant

Anders Lundqvist and Per-Anders Welz, Seakey AB (partly present).

Test engineer

Fredrik Isaksson

Field strength of fundamental measurements according to FCC 47 CFR part 15.249 (a)

Date	Temperature	Humidity
2006-10-06	22 °C ± 3 °C	32 % ± 5 %
2009-10-07	22 °C ± 3 °C	40 % ± 5 %
2009-10-15	22 °C ± 3 °C	23 % ± 5 %
2009-10-23	23 °C ± 3 °C	31 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003.

The test was performed with continuous transmission (23.2% duty cycle, see the diagrams) and with modulation.

The radiated maximum peak radiated output power measurements were performed in the semi-anechoic chamber. The test was also performed with rotation of the EUT through three orthogonal axes to determine the position that produces the highest emission relative to the limit.

The fundamental was scanned with PEAK-detector with the antenna height 1-4 m and the turntable was varied between 0-360 degrees for maximum response. The antenna distance during the measurements was 3.0 m.

Test set-up photos during the tests can be found in appendix 8.

Measurement equipment	Calibration Due	SP number
Test site Edison	2010-01	504 114
R&S EMI test receiver ESIB 26	2010-07	503 885
EMI measurement computer	-	-
Software: R&S EMC32, ver. 6.30.10	-	503 745
Antenna Schaffner CBL 6143	2010-03	504 079
EMCO Horn Antenna 3115	2011-10	501 548
MITEQ Low Noise Amplifier	2010-06	504 160
Temperature and humidity meter Testo 625	2010-03	504 117



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Appendix 2

Results

EUT 1: Field strength of fundamental, RBW=1 MHz

		Max peak output power Average level Note 1 (3.8% duty cycle)		
		2402 MHz	2402 MHz	2402 MHz
	EUT axes	X-axes	Y-axes	Z-axes
	Antenna height	1.00 m	1.14 m	1.00 m
	Azimuth	0 deg	197 deg	212 deg
	Polarization	Horizontal	Vertical	Horizontal
	Measured peak level	94.5 dB μ V/m	91.0 dB μ V/m	93.7 dB μ V/m
	Duty cycle correction factor, 3.8%	-28.3 dB	-28.3 dB	-28.3 dB
T _{nom} 22°C	Average level V _{nom} 3.0 V DC	66.2 dBμV/m (=-29.0 dBm ERP) Note 2	62.7 dBμV/m (=-32.5 dBm ERP) Note 2	65.4 dBμV/m (=-29.8 dBm ERP) Note 2

Note 1: According to 47CFR 15.35(c) the peak level was measured and then the average level was calculated due to the duty cycle.

Note 2: The measurements were performed in field strength in dB μ V/m. The ERP level was then calculated by the formula $ERP = E(\text{dB}\mu\text{V/m}) - 90 + 20\log(d) - 10\log(30)$.

Note 3: According 47CFR 15.31(e), For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Limits

According to 47CFR 15.249(a), The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field strength of fundamental	Field strength of harmonics
2400-2483.5 MHz	50 mV/m = 94 dB μ V/m	500 μ V/m = 54 dB μ V/m

Complies?	Yes
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Radiated emission measurements according to FCC 47 CFR part 15.249 (d) (e)

Date	Temperature	Humidity
2009-10-06	22 °C ± 3 °C	32 % ± 5 %
2009-10-07	22 °C ± 3 °C	40 % ± 5 %
2009-10-09	22 °C ± 3 °C	32 % ± 5 %
2009-10-15	22 °C ± 3 °C	23 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003.

The test was performed with continuous transmission (23.2% duty cycle) and with modulation.

The test of radiated emission was performed in a semi anechoic chamber. The measurements were performed with both horizontal and vertical polarizations of the antenna. The antenna distance was 3 m for frequencies below 18 GHz. For frequencies above 18 GHz the antenna distance was 1.0 m.

Exploratory tests were also performed with rotation of the EUT through three orthogonal axes to determine the position that produces the highest emission relative to the limit. Final measurements were the performed at the EUT in the orthogonal axes that produces the highest emission relative to the limit.

The measurement procedure is as the following:

1. A pre-measurement is performed with peak detector. The test object is measured in eight directions with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
2. If the emission is close or above the limit during the pre-measurement, the test object is scanned 360 degrees and the antenna height scanned from 1 to 4 m for maximum response. Then the emission is measured with the quasi-peak detector on frequencies below 1 GHz and with the average detector above 1 GHz.

The measurement was first performed with peak detector.

The following RBW were used:

30 MHz-1 GHz: RBW=120 kHz

1-25 GHz: RBW=1 MHz

Test set-up photos during the tests can be found in appendix 8.

Measurement equipment	Calibration Due	SP number
Test site Edison	2010-01	504 114
R&S EMI test receiver ESIB 26	2010-07	503 885
R&S Signal analyzer FSIQ40	2010-07	503 738
EMI measurement computer	-	-
Software: R&S EMC32, ver. 6.30.10	-	503 745
Antenna Schaffner CBL 6143	2010-03	504 079
EMCO Horn Antenna 3115	2011-10	501 548
Flann Standard gain horn 16240-25	-	503 939
Flann Standard gain horn 18240-25	-	503 900
Flann Standard gain horn 20240-20	-	503 674
High pass filter Wainwright WHKX	2010-01	504 200
MITEQ Low Noise Amplifier	2010-06	503 285
MITEQ Low Noise Amplifier	2010-06	504 160
Temperature and humidity meter Testo 625	2010-03	504 117



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Appendix 3

Results

The emission spectra and final measurements can be found in appendix 3.1:

2402 MHz

- Diagram 1: Radiated emission 30-1000 MHz, vertical and horizontal polarizations.
EUT 2, part/serial number: 1703220-02-1030-7 (full RF power at fundamental)
- Diagram 2: Radiated emission 1-3 GHz, vertical and horizontal polarizations.
- Diagram 3: Radiated emission 3-8.2 GHz, vertical and horizontal polarizations.
- Diagram 4: Radiated emission 8.2-12 GHz, vertical and horizontal polarizations.
- Diagram 5: Radiated emission 12-18 GHz, vertical and horizontal polarizations.
EUT 2, part/serial number: 1703220-02-1030-7 (full RF power at fundamental)
- Diagram 6: Radiated emission 18-25 GHz, vertical and horizontal polarizations.

Limits

According to 47CFR 15.249(a), The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field strength of harmonics
902-928 MHz	500 μ V/m = 54 dB μ V/m

According to 47CFR 15.249(d), Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lesser attenuation.

According to 47CFR 15.249(e), The peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Complies?	Yes
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Diagram 1, pre-measurement X-axes

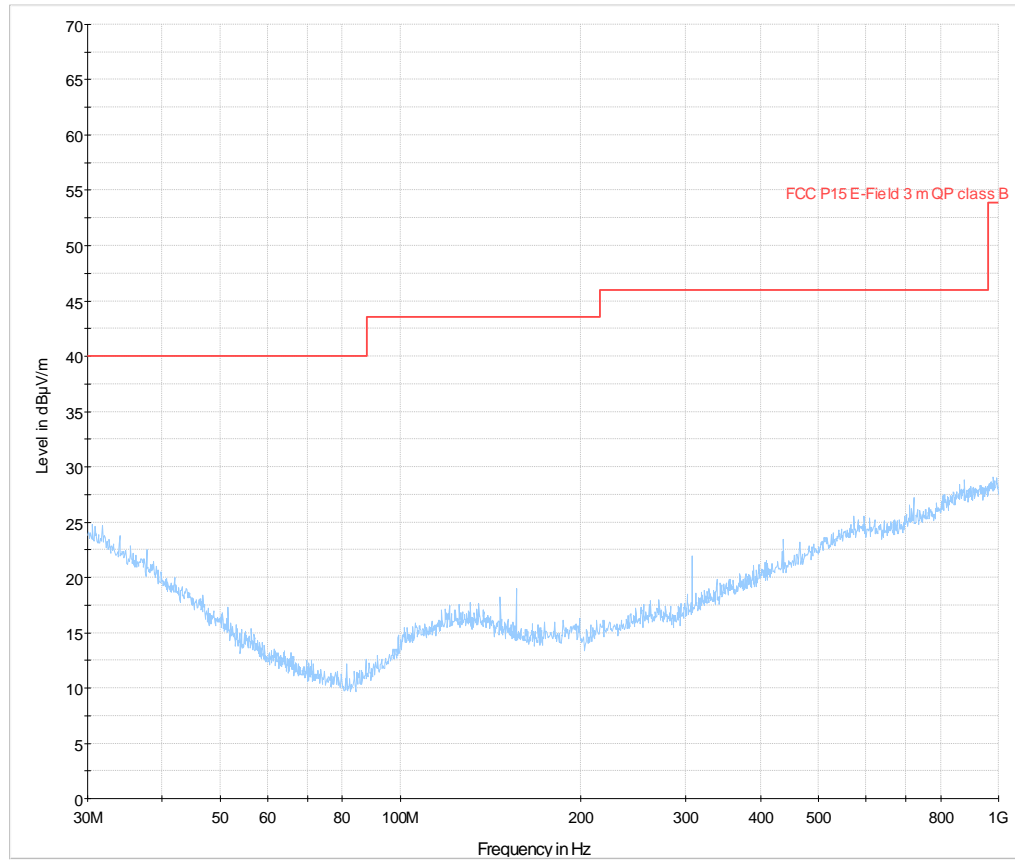
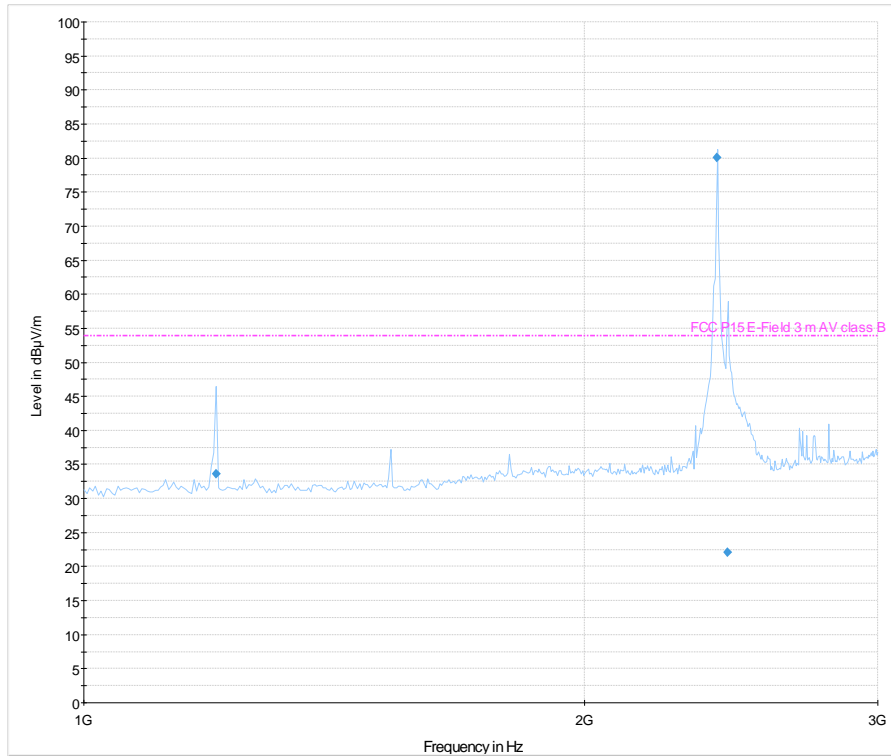


Diagram 2, pre-measurement X-axes

Final Result, X-axes

Frequency (MHz)	Average (dBµV/m)	Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol.	Turntable position (deg)	Corr (dB)	Margin AV (dB)	AV Limit (dBµV/m)
1201.03206	33.7	-	1000.0	1000.000	150.0	H	90.0	-20.9	20.3	53.9
2393.73347	39.1, Note 1	67.4	1000.0	1000.000	100.0	H	122.0	-17.2	14.8	53.9
2398.00000	41.3, Note 1	69.6	1000.0	1000.000	100.0	H	122.0	-17.2	12.6	53.9
2402.01402	66.2, Note 1	94.5	1000.0	1000.000	100.0	H	122.0	-17.2	12.2	94.0
2437.86573	22.1	-	1000.0	1000.000	100.0	H	130.0	-17.0	31.8	53.9

Final Result, Y-axes

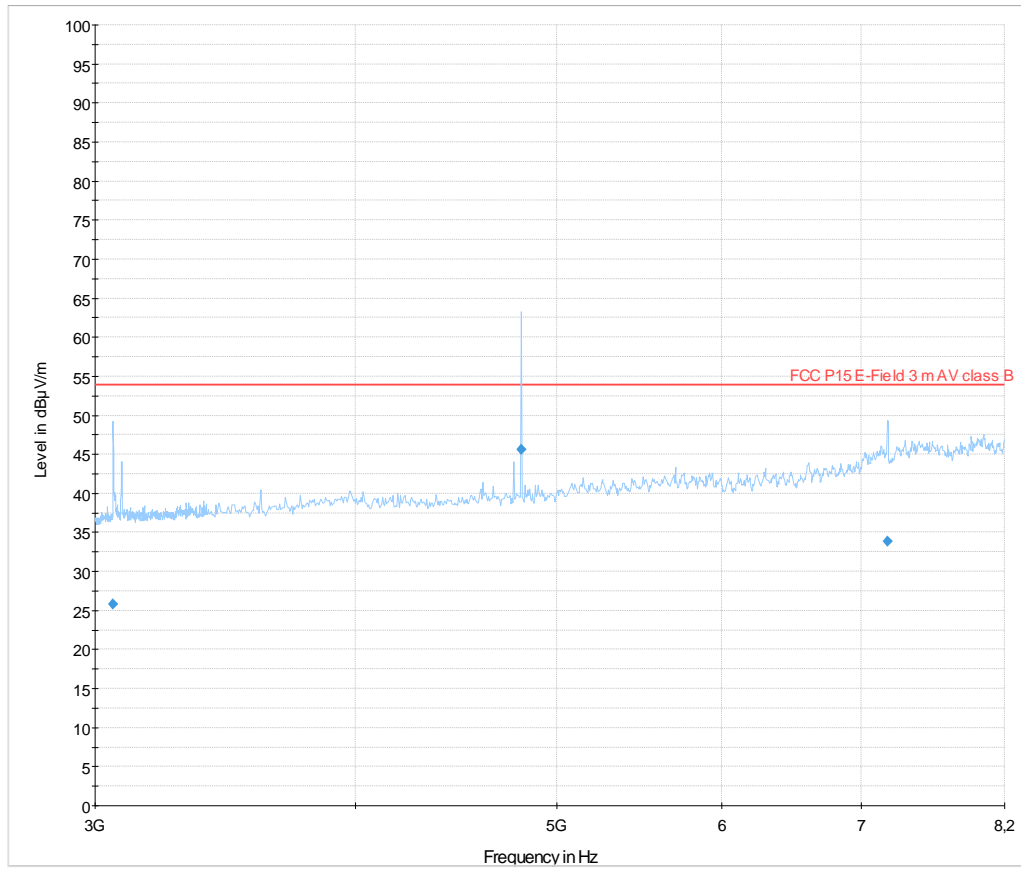
Frequency (MHz)	Average (dBµV/m)	Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol.	Turntable position (deg)	Corr (dB)	Margin AV (dB)	AV Limit (dBµV/m)
1201.03206	34.0	-	1000.0	1000.000	149.0	H	109.0	-20.9	19.9	53.9
2347.14428	21.9	-	1000.0	1000.000	154.0	H	133.0	-17.4	32.0	53.9
2401.85370	62.7, Note 1	91.0	1000.0	1000.000	114.0	V	197.0	-17.2	15.7	94.0
2748.52705	24.6	-	1000.0	1000.000	100.0	V	136.0	-15.7	29.3	53.9

Final Result, Z-axes

Frequency (MHz)	Average (dBµV/m)	Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol.	Turntable position (deg)	Corr (dB)	Margin AV (dB)	AV Limit (dBµV/m)
1201.05210	34.3	-	1000.0	1000.000	150.0	H	182.0	-20.9	19.6	53.9
2348.52705	21.6	-	1000.0	1000.000	144.0	V	261.0	-17.4	32.3	53.9
2393.73347	36.7, Note 1	65.0	1000.0	1000.000	100.0	H	212.0	-17.2	17.2	53.9
2398.00000	39.4, Note 1	67.7	1000.0	1000.000	100.0	H	212.0	-17.2	14.5	53.9
2401.81362	65.4, Note 1	93.7	1000.0	1000.000	100.0	H	212.0	-17.2	13.0	94.0

Note 1: The average level was calculated from the peak level due to the normal duty cycle, with the correction factor -28.3 dB, see the EUT 3 calculation in appendix 1.

Diagram 3, pre-measurement Z-axes



Final Result, X-axes

Frequency (MHz)	Average (dBμV/m)	Peak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol	Turntable position (deg)	Corr (dB)	Margin AV (dB)	AV Limit (dBμV/m)
3060.55110	26.1	-	1000.00	1000.000	100.0	H	97.0	-13.9	27.8	53.9
3602.99599	30.1	-	1000.00	1000.000	170.0	H	259.0	-12.8	23.8	53.9
4804.33867	31.4, Note 1	59.7	1000.00	1000.000	114.0	V	265.0	-10.7	6.9	53.9

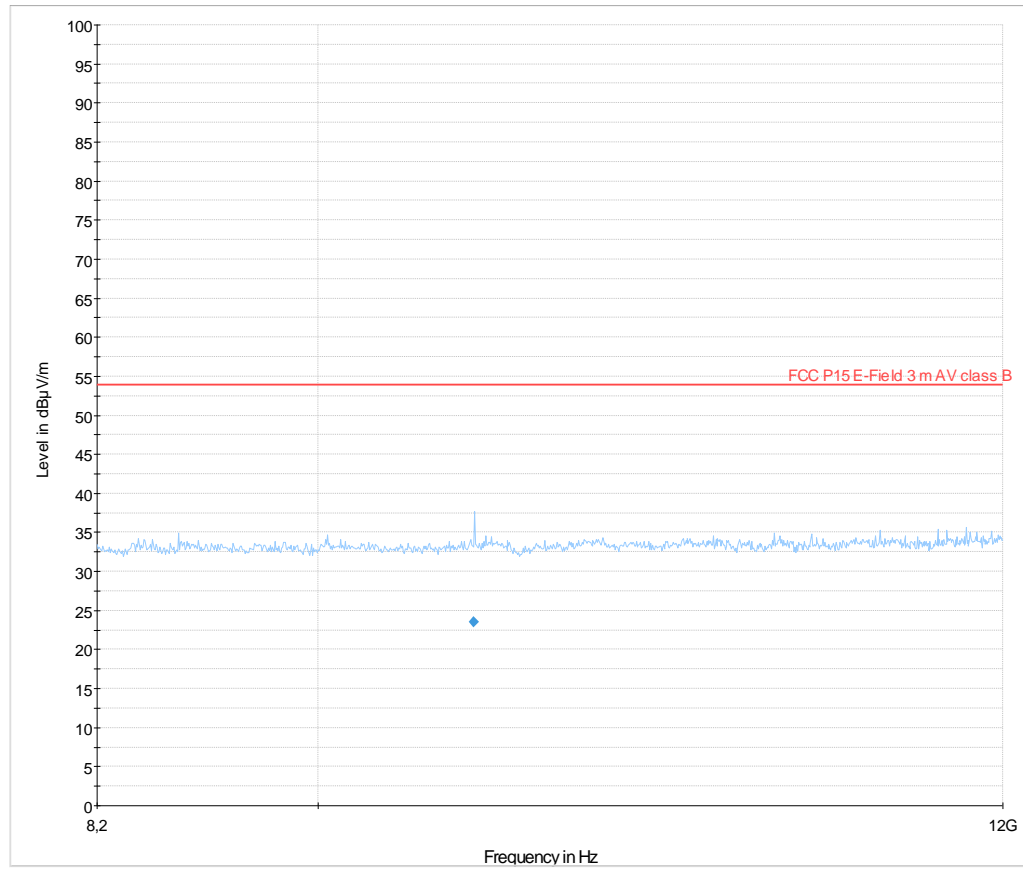
Final Result, Y-axes

Frequency (MHz)	Average (dBμV/m)	Peak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol	Turntable position (deg)	Corr (dB)	Margin AV (dB)	AV Limit (dBμV/m)
4803.75751	39.0, Note 1	67.3	1000.00	1000.000	115.0	V	265.0	-10.7	14.9	53.9
7206.49098	24.6, Note 1	52.9	1000.00	1000.000	131.0	H	244.0	-4.2	13.7	53.9

Final Result, Z-axes

Frequency (MHz)	Average (dBμV/m)	Peak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol	Turntable position (deg)	Corr (dB)	Margin AV (dB)	AV Limit (dBμV/m)
3060.25050	25.8	-	1000.00	1000.000	100.0	H	319.0	-13.9	28.1	53.9
4804.31863	34.2, Note 1	62.5	1000.00	1000.000	100.0	H	339.0	-10.7	4.1	53.9
7204.97996	33.9	-	1000.00	1000.000	100.0	V	334.0	-4.2	20.0	53.9

Note 1: The average level was calculated from the peak level due to the normal duty cycle, with the correction factor -28.3 dB, see the EUT 3 calculation in appendix 1.

Diagram 4, pre-measurement Y-axes

Final Result, X-axes (EUT 2, full RF power at fundamental)

Frequency (MHz)	Average (dBμV/m)	Peak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol	Turntable position (deg)	Corr (dB)	Margin AV (dB)	AV Limit (dBμV/m)
9608.58517	17.7, Note 1	46.0	1000.00	1000.000	100.0	V	248.0	-16.0	26.9	53.9

Final Result, Y-axes

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol	Turntable position (deg)	Corr (dB)	Margin AV (dB)	AV Limit (dBμV/m)
9608.52505	23.5	1000.000	1000.000	114.0	V	225.0	-16.0	30.4	53.9

Note 1: The average level was calculated from the peak level due to the normal duty cycle, with the correction factor -28.3 dB, see the EUT 3 calculation in appendix 1.



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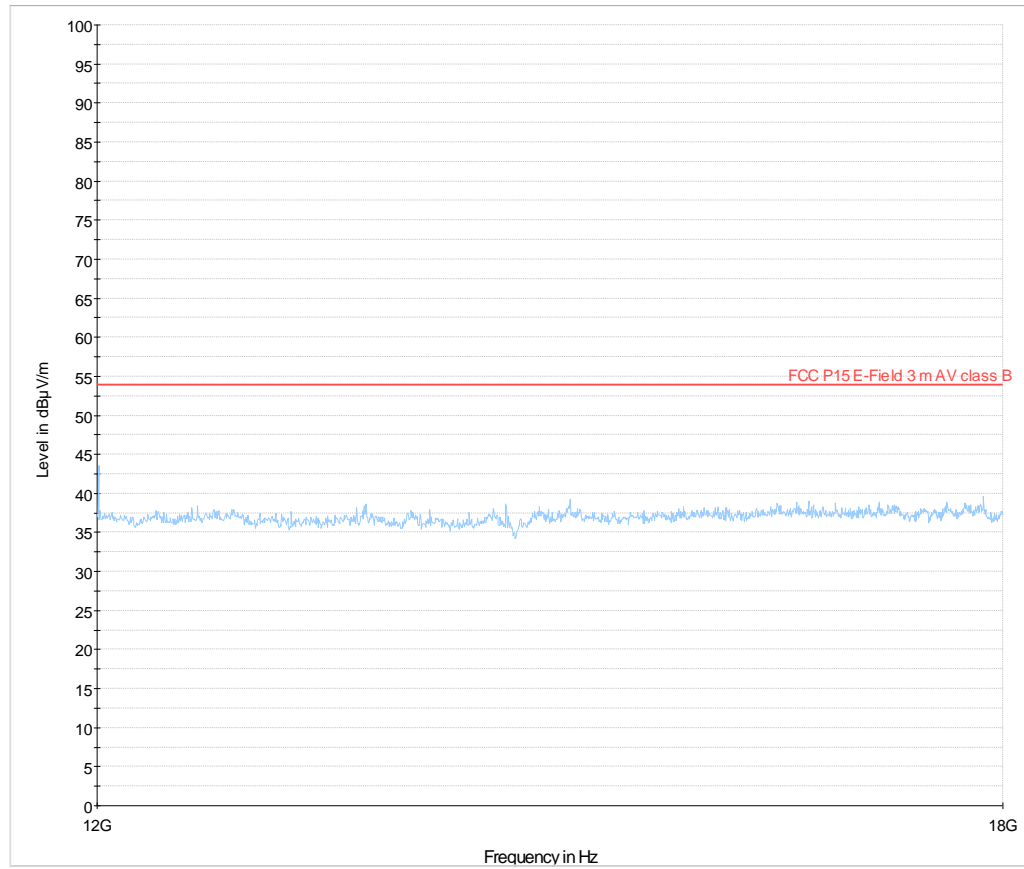
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Diagram 5, pre-measurement X-axes





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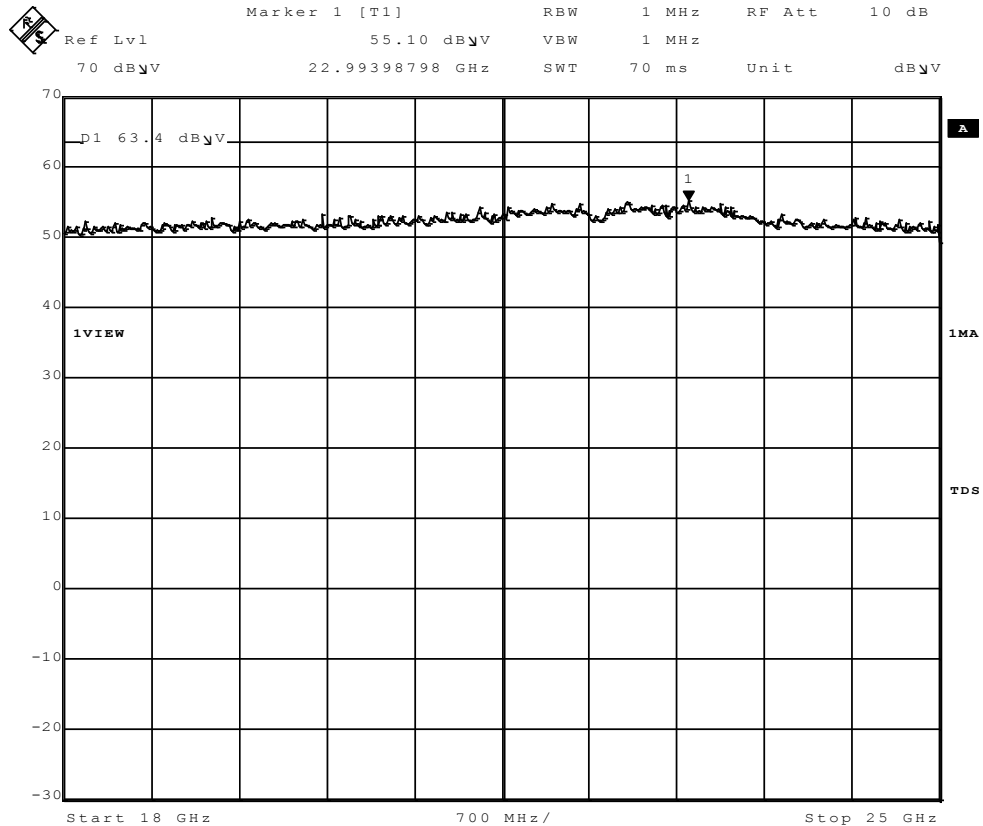
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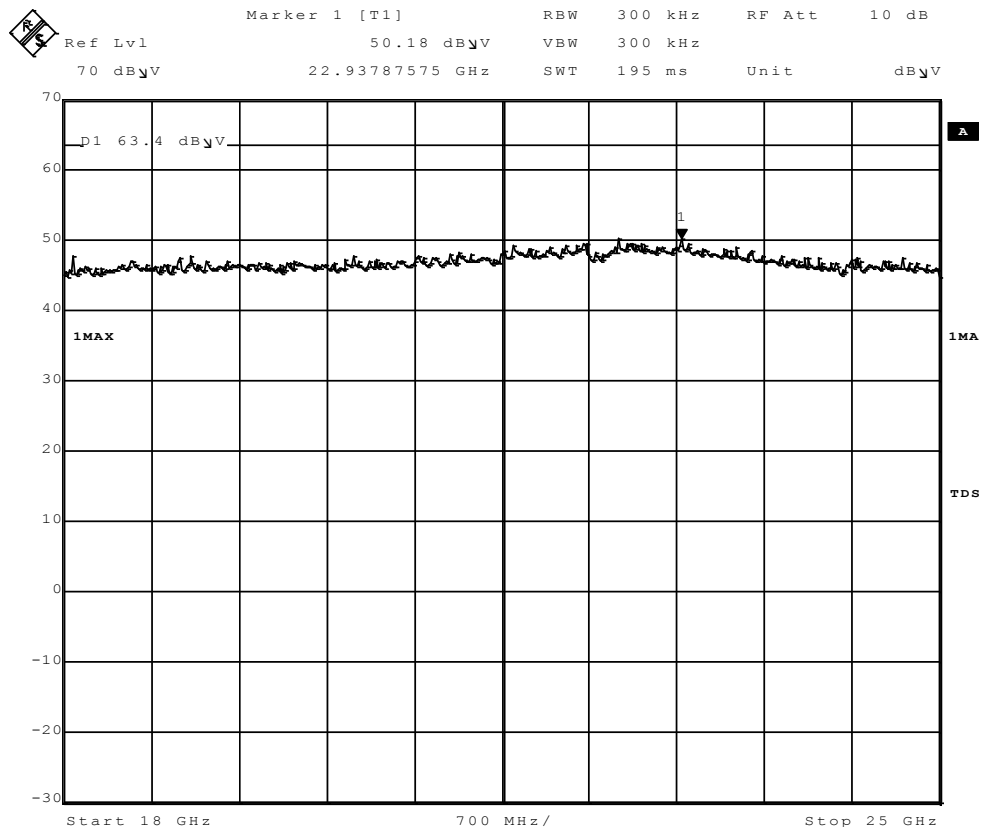
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Appendix 3.1

Diagram 6, pre-measurement X-axes RBW=1 MHz



Date: 15.OCT.2009 15:33:04

RBW=300 kHz



Date: 15.OCT.2009 15:35:11

20 dB bandwidth measurements according to FCC 47 CFR part 15.215 (c)

Date 2009-10-15	Temperature 22 °C ± 3 °C	Humidity 23 % ± 5 %
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Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003.

The test was performed with continuous transmission (23.2% duty cycle) and with modulation.

The radiated measurements were performed in the semi-anechoic chamber. The test was also performed with the position of the EUT in the orthogonal axes that produces the highest emission relative to the limit.

The fundamental was scanned with PEAK-detector with the antenna height 1-4 m and the turntable was varied between 0-360 degrees for maximum response, see appendix 2. The antenna distance during the measurements was 3.0 m.

Test set-up photos during the tests can be found in appendix 8.

Measurement equipment	Calibration Due	SP number
Test site Edison	2010-01	504 114
R&S EMI test receiver ESIB 26	2010-07	503 885
EMI measurement computer	-	-
Software: R&S EMC32, ver. 6.30.10	-	503 745
EMCO Horn Antenna 3115	2011-10	501 548
MITEQ Low Noise Amplifier	2010-06	504 160
Temperature and humidity meter Testo 625	2010-03	504 117



Results

The diagram can be found in the appendix 4.1.

Diagram 1 2402 MHz 20 dB BW = 693.39 kHz

Limits

According to 47CFR 15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Complies?	Yes
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Occupied bandwidth measurements according to 47CFR 2.1049

Date 2009-10-15	Temperature 22 °C ± 3 °C	Humidity 23 % ± 5 %
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Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003.

The test was performed with continuous transmission (23.2% duty cycle) and with modulation.

The radiated measurements were performed in the semi-anechoic chamber. The test was also performed with the position of the EUT in the orthogonal axes that produces the highest emission relative to the limit.

The fundamental was scanned with PEAK-detector with the antenna height 1-4 m and the turntable was varied between 0-360 degrees for maximum response, see appendix 2. The antenna distance during the measurements was 3.0 m.

Test set-up photos during the tests can be found in appendix 8.

Measurement equipment	Calibration Due	SP number
Test site Edison	2010-01	504 114
R&S Signal analyzer FSIQ40	2010-07	503 738
EMI measurement computer	-	-
Software: R&S EMC32, ver. 6.30.10	-	503 745
EMCO Horn Antenna 3115	2011-10	501 548
MITEQ Low Noise Amplifier	2010-06	504 160
Temperature and humidity meter Testo 625	2010-03	504 117

Results

The diagram can be found in the appendix 5.1.

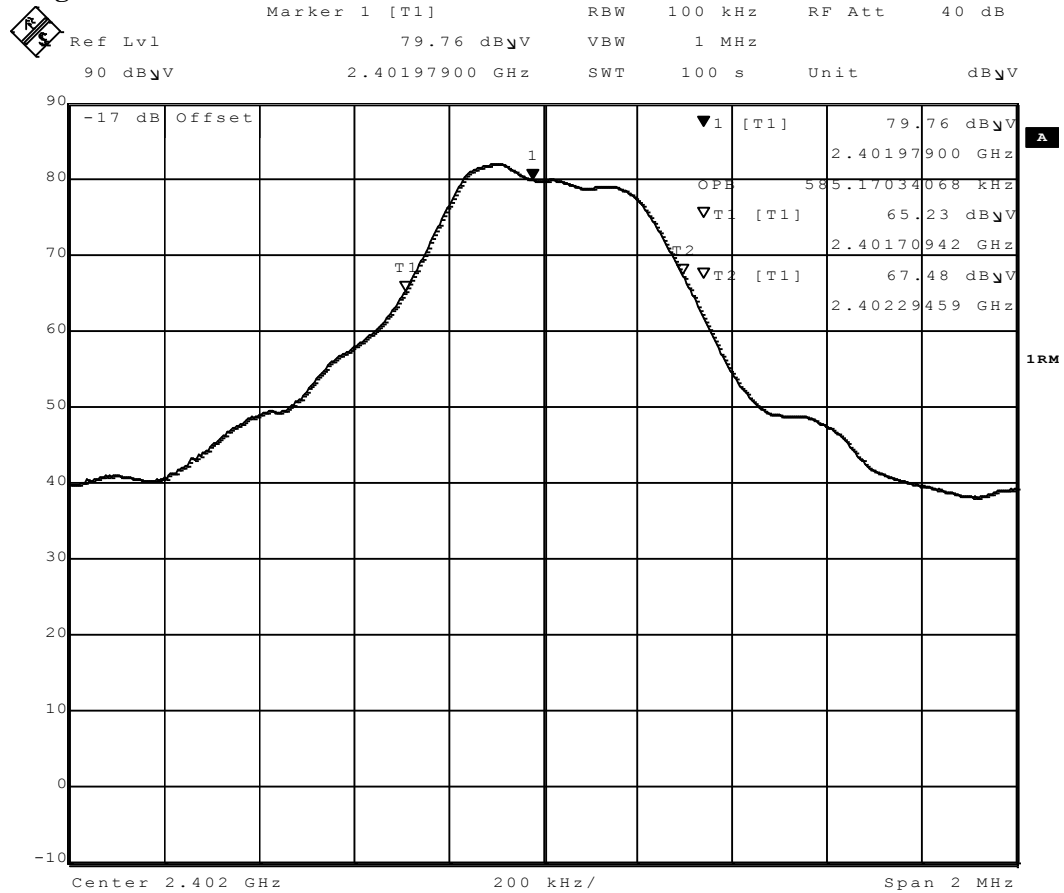
Diagram 1 2402 MHz OBW = 585.17 kHz (99%)



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Appendix 5.1

Diagram 1



Date: 15.OCT.2009 13:29:44



REPORT

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Appendix 6

Band edge measurements according to 47CFR 2.1049

Date 2009-10-15	Temperature 22 °C ± 3 °C	Humidity 23 % ± 5 %
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Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003 and the Marker-delta method according to FCC public note, Filing and Measurement for frequency Hopping Spread Spectrum Systems:2000.

The test was performed with continuous transmission (23.2% duty cycle) and with modulation.

The radiated maximum peak radiated output power measurements were performed in the semi-anechoic chamber. The test was also performed with the position of the EUT in the orthogonal axes that produces the highest emission relative to the limit.

The measurement was scanned with PEAK-detector with the antenna height 1-4 m and the turntable was varied between 0-360 degrees for maximum response, see appendix 2. The antenna distance during the measurements was 3.0 m.

Test set-up photos during the tests can be found in appendix 8.

Measurement equipment	Calibration Due	SP number
Test site Edison	2010-01	504 114
R&S EMI test receiver ESIB 26	2010-07	503 885
EMI measurement computer	-	-
Software: R&S EMC32, ver. 6.30.10	-	503 745
EMCO Horn Antenna 3115	2011-10	501 548
MITEQ Low Noise Amplifier	2010-06	504 160
Temperature and humidity meter Testo 625	2010-03	504 117



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Appendix 6

Results

Operation band 2400-2483.5 MHz

The diagram can be found in the appendix 6.1.

	2402 MHz	Band edge at 2400 MHz Marker-delta method, step 1: Peak level at fundamental=94.5 dB μ V/m Duty cycle correction factor, EUT 3=-28.3 dB (see appendix 1)
Diagram 1	2402 MHz	Marker-delta method. Step 2: Delta between fundamental and 2400 MHz = 40.2 dB. Step 3: Decrease the measured peak level in step 1: Peak level=94.5-40.2 = 57.1 dBμV/m = level at 2400 MHz Average level due to the duty cycle=57.1-28.3 = 28.8 dBμV/m = level at 2400 MHz
Diagram 2	2402 MHz	Band edge at 2483.5 MHz Peak level at 2483.5 MHz = 47.7 dBμV/m

Limits

According to 47CFR 15.249(d), Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lesser attenuation.

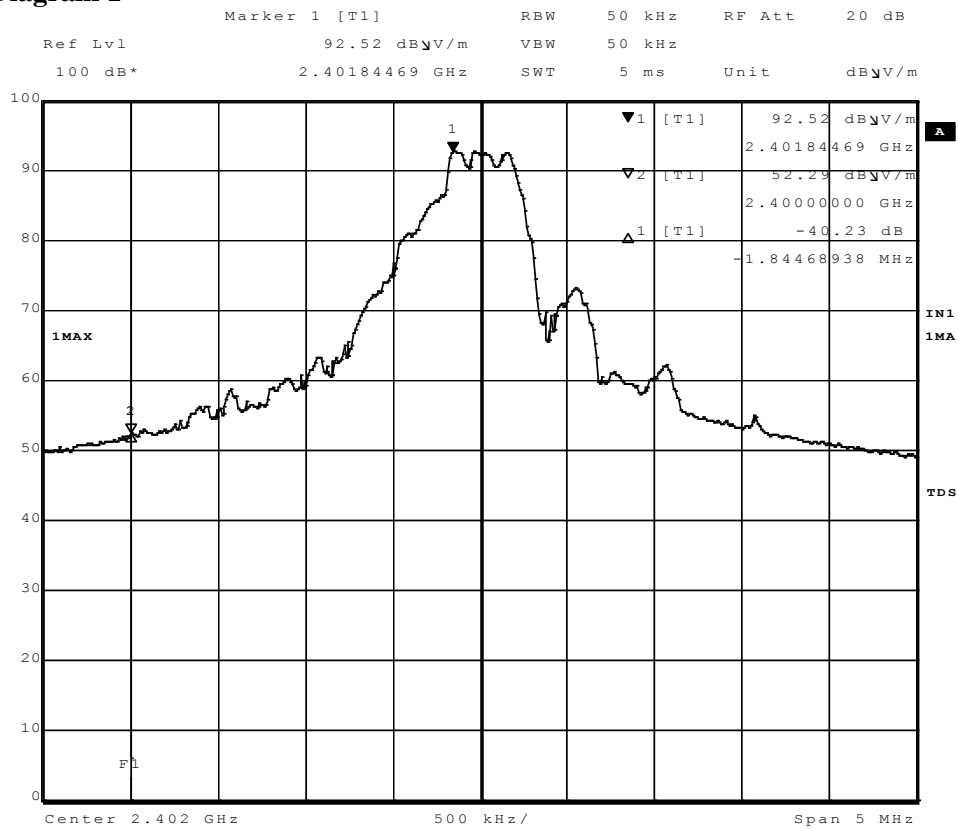
Complies?	Yes
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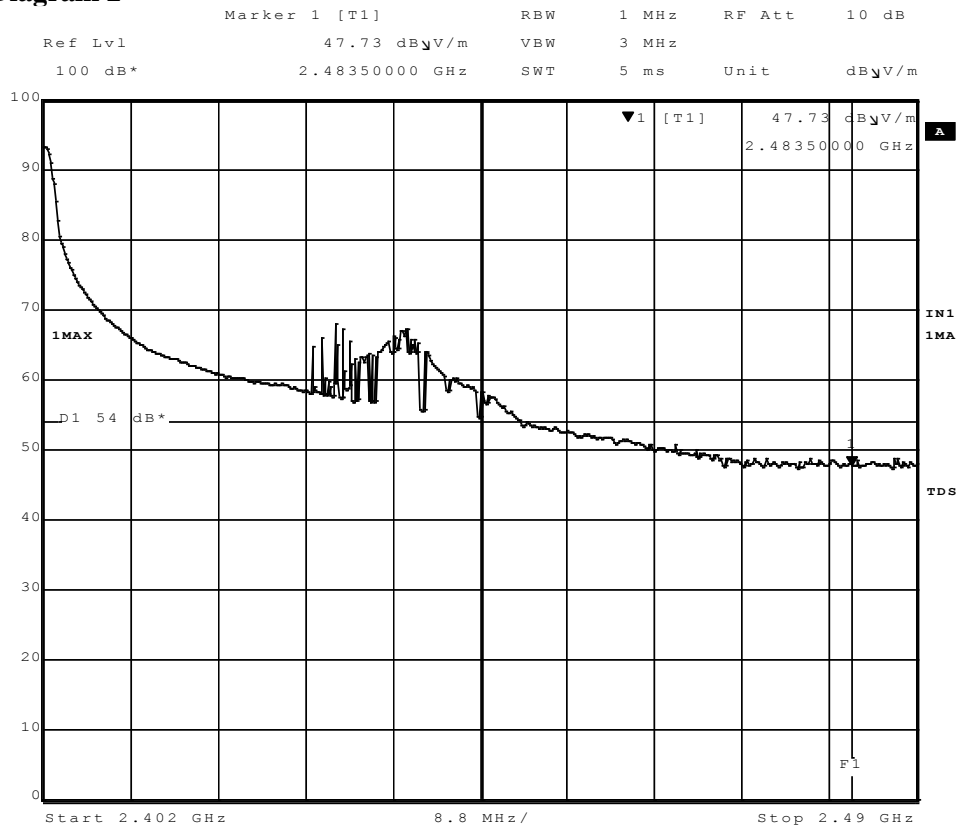
Appendix 6.1

Diagram 1



Date: 15.OCT.2009 11:15:33

Diagram 2



Date: 15.OCT.2009 12:25:17

**RF exposure evaluation: Portable equipment**

Date	Temperature	Humidity
2009-10-07	22 °C ± 3 °C	40 % ± 5 %
2009-10-15	22 °C ± 3 °C	23 % ± 5 %

Procedure

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1093 this device has been defined as a portable device .

Results

The following formula was used to calculate the RF exposure,
 $P_d = P_{out} \times G / (4 \times \pi \times r^2_{cm})$

where,

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

r = distance between observation and center of the radiator in cm

The maximum radiated peak output power from appendix 2 was used for calculation.

Antenna Gain (dBi)	Antenna Gain (numeric)	ERP Peak output power (dBm)	Peak output power (mW)	Power density, P_d [S] (mW/cm ²)	Limit of power density (mW/cm ²)
Note 1	Note 1	-13.4	0.046	N/A, Note 2	N/A, Note 2

Note 1: The antenna gain is not used in the MPE calculation as the ERP value (including the antenna) is used.

Note 2: Not applicable as the EUT is a portable device and the peak output power is
 $< 60/f_{GHz} = 60/0.9183 = 65.3$ mW

Complies?	Yes
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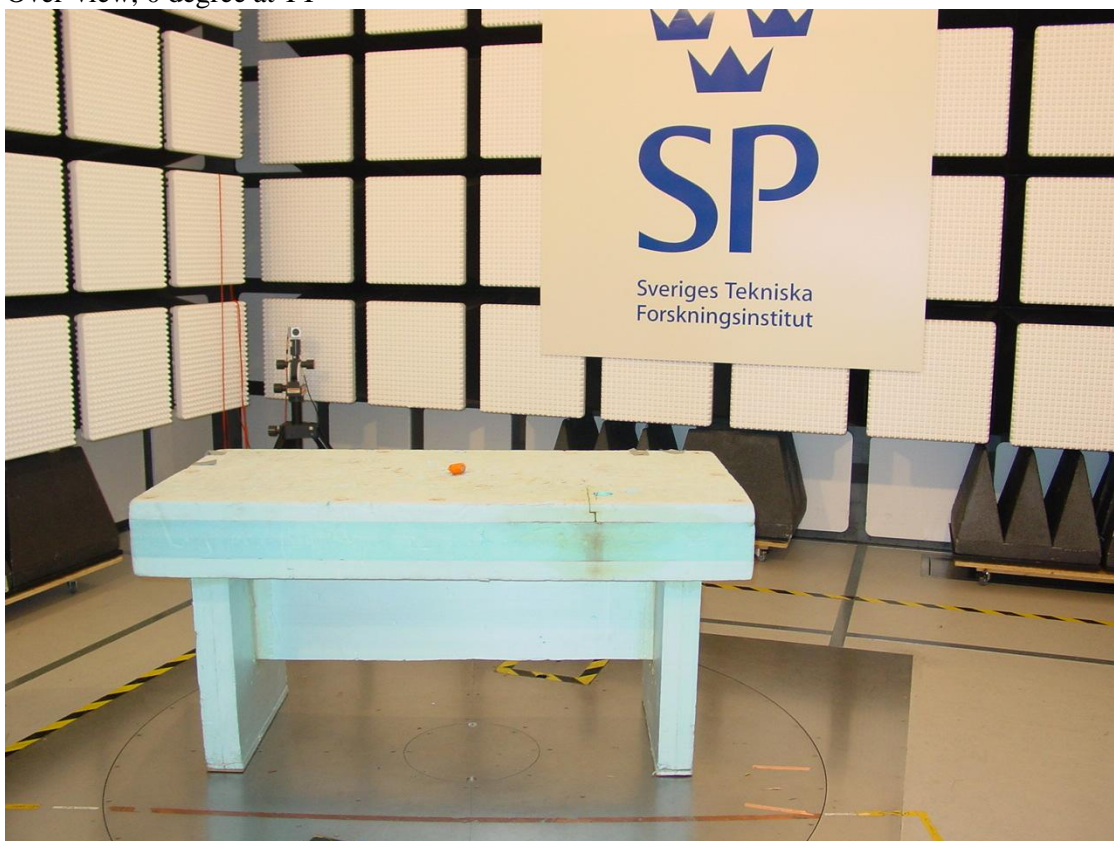
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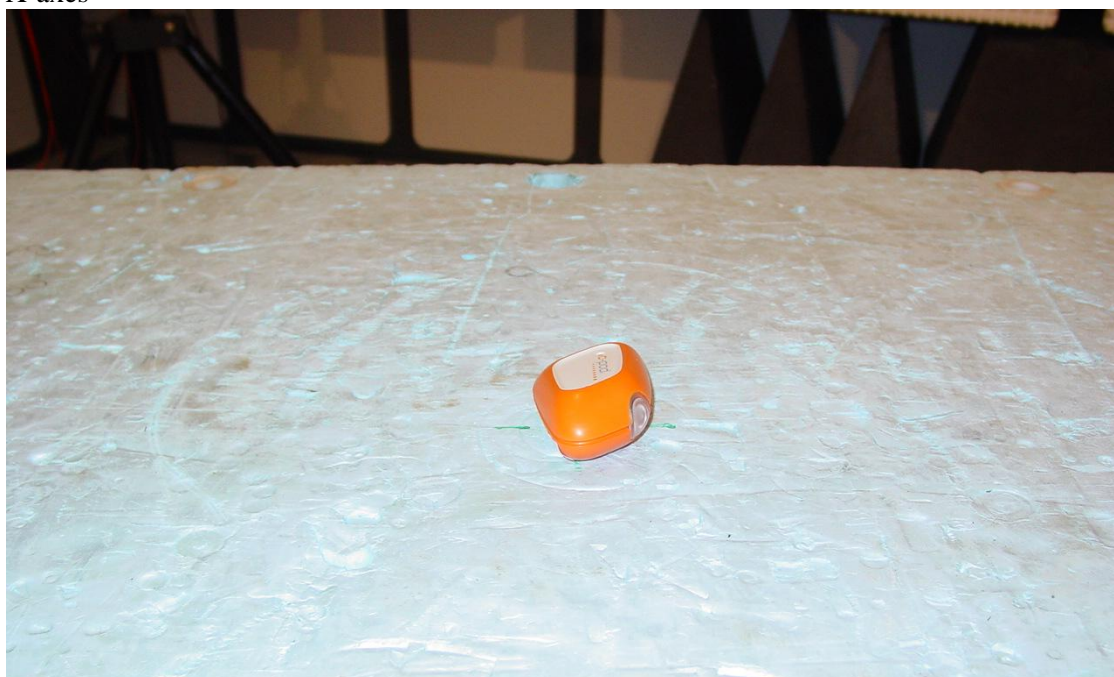
Photos

The test set-up during all the radiated tests can be seen in the pictures below.

Over-view, 0 degree at TT



X-axes



Y-axes



Z-axes



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Appendix 8

EUT 1

Identity



Side 1



Side 2



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Appendix 8

Top



Inside view 1, over-view



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