InterLab®

FCC Measurement / Technical Report on

Vehicle Mount Computer
JLT 1213

Report Reference: MDE_SVEP_0802_FCCa

Test Laboratory:

Deutscher Akkreditierungs Rat
DAR
DAT-P-192/99-01

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Note:
The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the testing laboratory.

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0 Summary

0.1 Technical Report Summary

Type of Authorization
Certification for an Intentional Radiator (Frequency Hopping Spread Spectrum and Digital Device / Spread Spectrum).

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 (10-1-07 Edition).

The following parts and subparts are applicable to the results in this test report.

- Part 2, Subpart J - Equipment Authorization Procedures, Certification

- Part 15, Subpart C – Intentional Radiators

Note:
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Summary Test Results:

The EUT complied with all performed tests as listed in chapter 0.2 Measurement Summary.

0.2 Measurement Summary

FCC Part 15, Subpart C		§15.35, §15.205, §15.209	
Spurious radiated emissions			
The measurement was performed according to ANSI C63.4			2003
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_01	Enclosure	passed
op-mode 2	Setup_01	Enclosure	passed
op-mode 4	Setup_01	Enclosure	passed
op-mode 5	Setup_01	Enclosure	passed
op-mode 7	Setup_01	Enclosure	passed
op-mode 8	Setup_01	Enclosure	passed
op-mode 10	Setup_01	Enclosure	passed
op-mode 11	Setup_01	Enclosure	passed
op-mode 13	Setup_01	Enclosure	passed
op-mode 14	Setup_01	Enclosure	passed
op-mode 16	Setup_01	Enclosure	passed
op-mode 17	Setup_01	Enclosure	passed
op-mode 20	Setup_01	Enclosure	passed
op-mode 21	Setup_01	Enclosure	passed
op-mode 22	Setup_01	Enclosure	passed

FCC Part 15, Subpart C		§15.35, §15.205, §15.209	
Band edge compliance			
The measurement was performed according to ANSI C63.4			2003
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_01	Enclosure	passed
op-mode 2	Setup_01	Enclosure	passed
op-mode 4	Setup_01	Enclosure	passed
op-mode 5	Setup_01	Enclosure	passed
op-mode 7	Setup_01	Enclosure	passed
op-mode 8	Setup_01	Enclosure	passed
op-mode 11	Setup_01	Enclosure	passed
op-mode 13	Setup_01	Enclosure	passed
op-mode 14	Setup_01	Enclosure	passed
op-mode 16	Setup_01	Enclosure	passed
op-mode 17	Setup_01	Enclosure	passed

The purpose of the test case and operating mode selection is the evaluation of co-location effects.

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Responsible for Accreditation Scope: B. Rathe

Responsible for Test Report: C. Bk

1 Administrative Data

1.1 Testing Laboratory

Company Name:	7 Layers AG
Address	Borsigstr. 11 40880 Ratingen Germany

This facility has been fully described in a report submitted to the FCC and accepted under the registration number 96716 .

The test facility is also accredited by the following accreditation organisation:

- Deutscher Akkreditierungs Rat	DAR-Registration no. DAT-P-192/99-01
Responsible for Accreditation Scope:	Dipl.-Ing. Bernhard Retka Dipl.-Ing. Robert Machulec Dipl.-Ing. Thomas Hoell Dipl.-Ing. Andreas Petz
Report Template Version:	2007-12-03

1.2 Project Data

Responsible for testing and report:	Dipl.-Ing. Andreas Petz
Date of Test(s):	2008-06-02 to 2008-06-27
Date of Report:	2008-08-15

1.3 Applicant Data

Company Name:	Svep Design Center AB
Address:	S:t Lars väg 42A SE-222 70 Lund Sweden
Contact Person:	Mikael Bergqvist

1.4 Manufacturer Data

Company Name:	JLT Mobile Computers AB
Address:	Isbjörnsvägen 3 SE-352 45 Växjö Sweden
Contact Person:	Jan Olofsson

2 Product labelling

2.1 FCC ID label

At the time of the report there was no FCC label available.

2.2 Location of the label on the EUT

see above

3 Test object Data

3.1 General EUT Description

Equipment under Test	Vehicle Mount Computer
Type Designation:	JLT 1213
Kind of Device:	Tablet PC; Bluetooth & WLAN transceiver
(optional)	
Voltage Type:	DC
Low voltage level:	18.0 V
Normal voltage level	24.0 V
High voltage level	72.0 V

General product description:

Bluetooth is a short-range radio link intended to be a cable replacement between portable and/or fixed electronic devices.

Bluetooth operates in the unlicensed ISM Band at 2.4 GHz. In the US a band of 83.5 MHz width is available. In this band, the Bluetooth technology defines 79 RF channels spaced 1 MHz (2402 - 2480 MHz). The actual RF channel is chosen from a pseudo-random hopping sequence through the 79 channels. A channel is occupied for a defined amount of time slots, with a nominal slot length of 625 µs. The maximum dwell time on one channel is defined by the packet type and is 0.625 ms for DH1 packets, 1.875 ms for DH3 and 3.125 ms for DH5. The nominal hop rate is 1600 hops/s for DH1, 1600/3 for DH3 and 1600/5 for DH5. All frequencies are equally used. The maximum nominal average time of occupancy is 0.4 s within a period of 79*0.4 seconds.

WLAN Transceiver operating in the 2.4 GHz ISM band using Direct Sequence Spread Spectrum (DSSS) Modulation. The EUT supports the modes 802.11b (maximum data rate 11 Mbps), 802.11g (maximum data rate 54 Mbps) and 802.11g Turbo (maximum data rate = two times 54 Mbps = 108 Mbps distributed). This mode is available at channel 6 (2437 MHz) only.

The EUT provides the following ports:

Ports
Enclosure
DC Port
USB ports
LAN port

The main components of the EUT are listed and described in Chapter 3.2

3.2 EUT Main components

Type, S/N, Short Descriptions etc. used in this Test Report

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status	Date of Receipt
EUT A (Code: DI000a01)	Vehicle Mount Computer	JLT 1213	–	D0	Windows XP	2008-06-02
Remark: EUT A is equipped with integral antennae for Bluetooth and WLAN with a gain of 0.0 dBi (Bluetooth) and 2.15 dBi (WLAN)						

NOTE: The short description is used to simplify the identification of the EUT in this test report.

3.3 Ancillary Equipment

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	HW Status	SW Status	Serial No.	FCC ID
–	–	–	–	–	–	–

3.4 EUT Setups

This chapter describes the combination of EUTs and ancillary equipment used for testing.

Setup No.	Combination of EUTs	Description
Setup_01	EUT A	setup for radiated measurements

3.5 Operating Modes

This chapter describes the operating modes of the EUTs used for testing.

Op. Mode	Description of Operating Modes	Remarks
op-mode 1	EUT transmits on 2402 MHz (Bluetooth) and on 2412 MHz (WLAN, 802.11b)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 2	EUT transmits on 2402 MHz (Bluetooth) and on 2412 MHz (WLAN, 802.11g)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 4	EUT transmits on 2402 MHz (Bluetooth) and on 2462 MHz (WLAN, 802.11b)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 5	EUT transmits on 2402 MHz (Bluetooth) and on 2462 MHz (WLAN, 802.11g)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 7	EUT transmits on 2412 MHz (Bluetooth) and on 2412 MHz (WLAN, 802.11b)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 8	EUT transmits on 2412 MHz (Bluetooth) and on 2412 MHz (WLAN, 802.11g)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 10	EUT transmits on 2462 MHz (Bluetooth) and on 2462 MHz (WLAN, 802.11b)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 11	EUT transmits on 2462 MHz (Bluetooth) and on 2462 MHz (WLAN, 802.11g)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 13	EUT transmits on 2480 MHz (Bluetooth) and on 2412 MHz (WLAN, 802.11b)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 14	EUT transmits on 2480 MHz (Bluetooth) and on 2412 MHz (WLAN, 802.11g)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 16	EUT transmits on 2480 MHz (Bluetooth) and on 2462 MHz (WLAN, 802.11b)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 17	EUT transmits on 2480 MHz (Bluetooth) and on 2462 MHz (WLAN, 802.11g)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 20	EUT transmits on 2402 MHz (Bluetooth) and on 2437 MHz (WLAN, 802.11g Turbo)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 21	EUT transmits on 2437 MHz (Bluetooth) and on 2437 MHz (WLAN, 802.11g Turbo)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power
op-mode 22	EUT transmits on 2480 MHz (Bluetooth) and on 2437 MHz (WLAN, 802.11g Turbo)	Bluetooth: Loopback mode, max output power WLAN: local TX mode, max output power

4 Test Results

4.1 Spurious radiated emissions

Standard FCC Part 15, 10-1-07
Subpart C

The test was performed according to: ANSI C 63.4, 2003

4.1.1 Test Description: Measurement up to 30 MHz

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003. The Equipment Under Test (EUT) was set up on a non-conductive table in the anechoic chamber.
The radiated emissions measurements were made in a typical installation configuration.
The measurement procedure is implemented into the EMI test software ES-K1 from R&S.
The Loop antenna HFH2-Z2 is used.
Step 1: pre measurement
- Anechoic chamber
- Antenna distance: 10m
- Detector: Peak-Maxhold
- Frequency range: 0.009 - 0.15 and 0.15 – 30 MHz
- Frequency steps: 0.1 kHz and 5 kHz
- IF–Bandwidth: 0.2 kHz and 10 kHz
- Measuring time / Frequency step: 100 ms

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.
Step 2: final measurement
For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.
- Open area test side
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 – 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF–Bandwidth: 200 Hz - 10 kHz
- Measuring time / Frequency step: 100 ms

4.1.2 Test Description: Measurement above 30 MHz and up to 1 GHz

The following modifications apply to the measurement procedure for the frequency range above 1 GHz: The tests were performed in the semi-anechoic chamber using a log.-per. antenna HL 562 Ultralog.
Step 1: Preliminary scan
Preliminary test to identify the highest amplitudes relative to the limit.
Settings for step 1:
- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF–Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 µs
- Turntable angle range: –180 to 180 °

- Turntable step size: 90 °
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: second measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: –180 to 180 °
- Turntable step size: 45 °
- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m
- Polarisation: horizontal + vertical

After this step the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable): 45 °
- Antenna height: 0.5 m

Step 3: final measurement

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value for every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by +/- 22.5 ° around this value. During this action the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by +/– 25 cm around the antenna height determined. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 2 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: –22.5 ° to +22.5 ° around the determined value
- Height variation range: –0.25 m to +0.25 m around the determined value

Step 4: final measurement with QP detector

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak(< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

4.1.3 Test Description: Measurement above 1 GHz

The following modifications apply to the measurement procedure for the frequency range above 1 GHz:
The measurement distance was reduced to 1 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurements, inverse linear-distance squared for the power reference level measurements). Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 GHz) and a horn antenna (18–25 GHz, 25–40 GHz) are used, the steps 2–4 are omitted. Step 1 was performed only at one height of the receiving antenna.
EMI receiver settings:
- Detector: Peak, Average
- RBW = VBW = 100 kHz

4.1.4 Test Requirements / Limits

FCC §15.205 (b)
“Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.”

FCC §15.209 (a)
“Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:”

FCC §15.209, Radiated Emission Limits

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limit(dBµV/m @10m)
0.009 – 0.49	2400/F(kHz)	300	Limit (dBµV/m)+30dB
0.49 – 1.705	24000/F(kHz)	30	Limit (dBµV/m)+10dB
1.705 - 30	30	30	Limit (dBµV/m)+10dB

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limit (dBµV/m)
30 - 88	100	3	40.0
88 - 216	150	3	43.5
216 - 960	200	3	46.0
above 960	500	3	54.0

FCC §15.35(b)
“..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit. ...”

Used conversion factor: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

4.1.5 Test Protocol

Temperature: 26–29 °C
Air Pressure: 1010–1019 hPa
Humidity: 33–55 %

4.1.5.1 Measurement up to 30 MHz

Op. Mode	Setup	Port
–	–	–

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
0°									
90°									

Remark: No measurement was performed.

4.1.5.2 Measurement above 30 MHz

Op. Mode	Setup	Port
op-mode 1	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	39	25.70	-	-	40.00	–	–	14.30	–
Vertical + horizontal	999	45.90	-	-	54.00	–	–	8.10	–
Vertical + horizontal	1000	-	47.21	41.50	-	74.00	54.00	26.79	12.50
Vertical + horizontal	1120	-	44.47	34.38	-	74.00	54.00	29.53	19.62
Vertical + horizontal	1167	-	44.23	34.17	-	74.00	54.00	29.77	19.83
Vertical + horizontal	1200	-	43.75	34.12	-	74.00	54.00	30.25	19.88
Vertical + horizontal	1400	-	44.70	35.50	-	74.00	54.00	29.30	18.50
Vertical + horizontal	2387	-	53.06	44.12	-	74.00	54.00	20.94	9.88

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 30 MHz to 3 GHz.

Op. Mode	Setup	Port
op-mode 7	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	47.46	42.01	-	74.00	54.00	26.54	11.99
Vertical + horizontal	1200	-	43.48	34.36	-	74.00	54.00	30.52	19.64
Vertical + horizontal	1400	-	44.16	34.18	-	74.00	54.00	29.84	19.82
Vertical + horizontal	2387	-	53.34	43.83	-	74.00	54.00	20.66	10.17
Vertical + horizontal	2486	-	50.18	38.21	-	74.00	54.00	23.82	15.79
Vertical + horizontal	4824	-	58.60	45.65	-	74.00	54.00	15.40	8.35

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 25 GHz.

Op. Mode	Setup	Port
op-mode 13	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	46.70	40.96	-	74.00	54.00	27.30	13.04
Vertical + horizontal	1120	-	45.16	34.60	-	74.00	54.00	28.84	19.40
Vertical + horizontal	1200	-	44.43	34.36	-	74.00	54.00	29.57	19.64
Vertical + horizontal	1400	-	44.29	35.64	-	74.00	54.00	29.71	18.36
Vertical + horizontal	2344	-	53.17	43.14	-	74.00	54.00	20.83	10.86
Vertical + horizontal	2387	-	56.09	44.44	-	74.00	54.00	17.91	9.56
Vertical + horizontal	2484	-	55.03	39.82	-	74.00	54.00	18.97	14.18

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 3 GHz.

Op. Mode	Setup	Port
op-mode 2	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	47.96	42.32	-	74.00	54.00	26.04	11.68
Vertical + horizontal	1400	-	44.85	35.99	-	74.00	54.00	29.15	18.01
Vertical + horizontal	2390	-	61.68	46.92	-	74.00	54.00	12.32	7.08
Vertical + horizontal	2484	-	50.17	38.20	-	74.00	54.00	23.83	15.80
Vertical + horizontal	2688	-	53.31	38.19	-	74.00	54.00	20.69	15.81
Vertical + horizontal	4831	-	63.53	47.62	-	74.00	54.00	10.47	6.38

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 10 GHz.

Op. Mode	Setup	Port
op-mode 8	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	47.33	41.25	-	74.00	54.00	26.67	12.75
Vertical + horizontal	1120	-	44.88	35.62	-	74.00	54.00	29.12	18.38
Vertical + horizontal	1400	-	44.16	34.67	-	74.00	54.00	29.84	19.33
Vertical + horizontal	2390	-	62.69	46.28	-	74.00	54.00	11.31	7.72
Vertical + horizontal	2484	-	50.16	38.00	-	74.00	54.00	23.84	16.00
Vertical + horizontal	2688	-	54.44	37.86	-	74.00	54.00	19.56	16.14
Vertical + horizontal	4824	-	63.90	47.85	-	74.00	54.00	10.10	6.15

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 25 GHz.

Op. Mode	Setup	Port
op-mode 14	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	42.43	48.22	-	74.00	54.00	31.57	5.78
Vertical + horizontal	1120	-	44.33	34.01	-	74.00	54.00	29.67	19.99
Vertical + horizontal	1400	-	44.97	35.78	-	74.00	54.00	29.03	18.22
Vertical + horizontal	2347	-	54.96	38.50	-	74.00	54.00	19.04	15.50
Vertical + horizontal	2390	-	61.18	45.82	-	74.00	54.00	12.82	8.18
Vertical + horizontal	2484	-	63.72	44.27	-	74.00	54.00	10.28	9.73
Vertical + horizontal	2674	-	52.09	37.86	-	74.00	54.00	21.91	16.14

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 3 GHz.

Op. Mode	Setup	Port
op-mode 4	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	47.48	41.83	-	74.00	54.00	26.52	12.17
Vertical + horizontal	1400	-	44.70	34.18	-	74.00	54.00	29.30	19.82
Vertical + horizontal	2390	-	50.94	38.89	-	74.00	54.00	23.06	15.11
Vertical + horizontal	2488	-	51.24	40.55	-	74.00	54.00	22.76	13.45

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 3 GHz.

Op. Mode	Setup	Port
op-mode 10	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	47.33	41.77	-	74.00	54.00	26.67	12.23
Vertical + horizontal	1120	-	44.33	35.36	-	74.00	54.00	29.67	18.64
Vertical + horizontal	1200	-	43.75	34.13	-	74.00	54.00	30.25	19.87
Vertical + horizontal	1400	-	44.70	35.71	-	74.00	54.00	29.30	18.29
Vertical + horizontal	2390	-	50.94	38.98	-	74.00	54.00	23.06	15.02
Vertical + horizontal	2484	-	51.37	40.30	-	74.00	54.00	22.63	13.70
Vertical + horizontal	4924	-	61.37	51.23	-	74.00	54.00	12.63	2.77
Vertical + horizontal	7384	-	45.13	38.21	-	74.00	54.00	28.87	15.79

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 25 GHz.

Op. Mode	Setup	Port
op-mode 16	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	46.81	41.12	-	74.00	54.00	27.19	12.88
Vertical + horizontal	1200	-	43.75	34.05	-	74.00	54.00	30.25	19.95
Vertical + horizontal	1400	-	44.97	35.99	-	74.00	54.00	29.03	18.01
Vertical + horizontal	2390	-	51.06	39.80	-	74.00	54.00	22.94	14.20
Vertical + horizontal	2484	-	53.51	41.11	-	74.00	54.00	20.49	12.89

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 3 GHz.

Op. Mode	Setup	Port
op-mode 5	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	48.22	39.46	-	74.00	54.00	25.78	14.54
Vertical + horizontal	1400	-	44.29	35.06	-	74.00	54.00	29.71	18.94
Vertical + horizontal	2390	-	53.86	39.56	-	74.00	54.00	20.14	14.44
Vertical + horizontal	2484	-	59.53	46.20	-	74.00	54.00	14.47	7.80

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 3 GHz.

Op. Mode	Setup	Port
op-mode 11	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	47.46	42.04	-	74.00	54.00	26.54	11.96
Vertical + horizontal	1120	-	44.47	34.88	-	74.00	54.00	29.53	19.12
Vertical + horizontal	1200	-	44.42	34.28	-	74.00	54.00	29.58	19.72
Vertical + horizontal	1400	-	44.16	35.13	-	74.00	54.00	29.84	18.87
Vertical + horizontal	2390	-	51.11	40.26	-	74.00	54.00	22.89	13.74
Vertical + horizontal	2484	-	60.75	45.59	-	74.00	54.00	13.25	8.41
Vertical + horizontal	4924	-	59.66	44.55	-	74.00	54.00	14.34	9.45

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 GHz to 25 GHz.

Op. Mode	Setup	Port
op-mode 17	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	38	29.50	-	-	40.00	-	-	10.50	-
Vertical + horizontal	253	31.40	-	-	46.00	-	-	14.60	-
Vertical + horizontal	999	47.90	-	-	54.00	-	-	6.10	-
Vertical + horizontal	1000	-	47.08	41.71	-	74.00	54.00	26.92	12.29
Vertical + horizontal	1120	-	44.22	34.31	-	74.00	54.00	29.78	19.69
Vertical + horizontal	1400	-	45.37	35.64	-	74.00	54.00	28.63	18.36
Vertical + horizontal	2390	-	52.05	40.33	-	74.00	54.00	21.95	13.67
Vertical + horizontal	2484	-	64.40	46.27	-	74.00	54.00	9.60	7.73
Vertical + horizontal	4922	-	57.89	38.14	-	74.00	54.00	16.11	15.86
Vertical + horizontal	4960	-	58.38	40.92	-	74.00	54.00	15.62	13.08
Vertical + horizontal	7379	-	57.87	33.40	-	74.00	54.00	16.13	20.60

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 30 MHz to 10 GHz.

Op. Mode	Setup	Port
op-mode 20	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	47.08	41.41	-	74.00	54.00	26.92	12.59
Vertical + horizontal	1200	-	44.03	34.05	-	74.00	54.00	29.97	19.95
Vertical + horizontal	1400	-	44.97	35.64	-	74.00	54.00	29.03	18.36
Vertical + horizontal	2390	-	57.14	42.81	-	74.00	54.00	16.86	11.19
Vertical + horizontal	2484	-	58.93	42.29	-	74.00	54.00	15.07	11.71
Vertical + horizontal	4804	-	58.61	41.56	-	74.00	54.00	15.39	12.44
Vertical + horizontal	4864	-	56.23	39.04	-	74.00	54.00	17.77	14.96

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 10 GHz.

Op. Mode	Setup	Port
op-mode 21	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	999	48.50	-	-	54.00	-	-	5.50	-
Vertical + horizontal	1000	-	48.99	43.67	-	74.00	54.00	25.01	10.33
Vertical + horizontal	1120	-	45.76	36.11	-	74.00	54.00	28.24	17.89
Vertical + horizontal	1200	-	44.90	36.35	-	74.00	54.00	29.10	17.65
Vertical + horizontal	1400	-	44.50	34.83	-	74.00	54.00	29.50	19.17
Vertical + horizontal	2385	-	61.16	43.86	-	74.00	54.00	12.84	10.14
Vertical + horizontal	2484	-	61.61	46.88	-	74.00	54.00	12.39	7.12

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 30 MHz to 10 GHz.

Op. Mode	Setup	Port
op-mode 22	Setup_01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit dBµV/m	Limit dBµV/m	Limit dBµV/m	Delta to limit dB	Delta to limit dB
		QP	Peak	AV	QP	Peak	AV	QP/Peak	AV
Vertical + horizontal	1000	-	47.08	41.19	-	74.00	54.00	26.92	12.81
Vertical + horizontal	1120	-	45.97	34.95	-	74.00	54.00	28.03	19.05
Vertical + horizontal	1200	-	43.48	34.28	-	74.00	54.00	30.52	19.72
Vertical + horizontal	1400	-	44.42	35.50	-	74.00	54.00	29.58	18.50
Vertical + horizontal	2390	-	57.64	43.03	-	74.00	54.00	16.36	10.97
Vertical + horizontal	2484	-	63.36	44.32	-	74.00	54.00	10.64	9.68

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Tested from 1 to 25 GHz.

4.1.6 Test result: Spurious radiated emissions

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 1	passed
	op-mode 2	passed
	op-mode 4	passed
	op-mode 5	passed
	op-mode 7	passed
	op-mode 8	passed
	op-mode 10	passed
	op-mode 11	passed
	op-mode 13	passed
	op-mode 14	passed
	op-mode 16	passed
	op-mode 17	passed
	op-mode 20	passed
	op-mode 21	passed
	op-mode 22	passed

4.2 Band edge compliance

Standard FCC Part 15, 10-1-07
Subpart C

The test was performed according to: ANSI C 63.4, 2003

4.2.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003. The Equipment Under Test (EUT) was placed inside FAC (fully anechoic chamber) to perform the measurements.

The measurement was carried out with a spectrum analyser, cable and horn antenna in a distance of 1 m using peak and average detector.

The measurement was preformed at the lowest and highest band edges of the used ISM bands:

- 2400.0 MHz
- 2483.5 MHz

4.2.2 Test Requirements / Limits

For the measurement at the band edges the limit is specified in §15.209.

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limit(dBµV/m @10m)
0.009 – 0.49	2400/F(kHz)	300	Limit (dBµV/m)+30dB
0.49 – 1.705	24000/F(kHz)	30	Limit (dBµV/m)+10dB
1.705 - 30	30	30	Limit (dBµV/m)+10dB

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limit (dBµV/m)
30 - 88	100	3	40.0
88 - 216	150	3	43.5
216 - 960	200	3	46.0
above 960	500	3	54.0

“In the emission table above, the tighter limit applies at the band edges.”

FCC §15.35(b)
“..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit. ...”

Used conversion factor: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

4.2.3 Test Protocol

4.2.3.1 Lower band edge

Temperature: 29 °C
Air Pressure: 1012 hPa
Humidity: 43 %

Op. Mode	Setup	Port
op-mode 1	Setup_01	Enclosure

Frequency MHz	Measured value dBµV/m	Reference value dBµV/m	Limit dBµV/m	Delta to limit dB
2400.00	58.82	102.52	82.52	43.70

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 2	Setup_01	Enclosure

Frequency MHz	Measured value dBµV/m	Reference value dBµV/m	Limit dBµV/m	Delta to limit dB
2400.00	70.27	98.35	78.35	8.08

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 7	Setup_01	Enclosure

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta to limit dB
2400.00	58.46	101.30	81.30	22.84

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 8	Setup_01	Enclosure

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Delta to limit dB
2400.00	69.69	99.52	79.52	9.83

Remark: Please see annex for the measurement plot.

4.2.3.2 Higher band edge

Temperature: 26–29 °C
Air Pressure: 1010–1013 hPa
Humidity: 43–55 %

Op. Mode	Setup	Port
op-mode 4	Setup_01	Enclosure

Frequency MHz	Polarisation	Corrected value dBµV/m		Limit Peak dBµV/m	Limit AV dBµV/m	Delta to Peak limit / dB	Delta to AV limit / dB
		Peak	AV				
2483.50	Vertical + horizontal	51.45	39.57	74.00	54.00	22.55	14.25

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 5	Setup_01	Enclosure

Frequency MHz	Polarisation	Corrected value dBµV/m		Limit Peak dBµV/m	Limit AV dBµV/m	Delta to Peak limit / dB	Delta to AV limit / dB
		Peak	AV				
2483.50	Vertical + horizontal	59.54	46.20	74.00	54.00	14.46	7.8

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 13	Setup_01	Enclosure

Frequency MHz	Polarisation	Corrected value dBµV/m		Limit Peak dBµV/m	Limit AV dBµV/m	Delta to Peak limit / dB	Delta to AV limit / dB
		Peak	AV				
2483.50	Vertical + horizontal	55.02	39.81	74.00	54.00	18.98	14.19

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 14	Setup_01	Enclosure

Frequency MHz	Polarisation	Corrected value dBµV/m		Limit Peak dBµV/m	Limit AV dBµV/m	Delta to Peak limit / dB	Delta to AV limit / dB
		Peak	AV				
2483.50	Vertical + horizontal	63.23	43.17	74.00	54.00	10.77	10.83

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 11	Setup_01	Enclosure

Frequency MHz	Polarisation	Corrected value dBµV/m		Limit Peak dBµV/m	Limit AV dBµV/m	Delta to Peak limit / dB	Delta to AV limit / dB
		Peak	AV				
2483.50	Vertical + horizontal	60.14	45.59	74.00	54.00	13.86	8.14

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 16	Setup_01	Enclosure

Frequency MHz	Polarisation	Corrected value dBµV/m		Limit Peak dBµV/m	Limit AV dBµV/m	Delta to Peak limit / dB	Delta to AV limit / dB
		Peak	AV				
2483.50	Vertical + horizontal	53.51	41.11	74.00	54.00	20.49	12.89

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 17	Setup_01	Enclosure

Frequency MHz	Polarisation	Corrected value dBµV/m		Limit Peak dBµV/m	Limit AV dBµV/m	Delta to Peak limit / dB	Delta to AV limit / dB
		Peak	AV				
2483.50	Vertical + horizontal	64.40	46.27	74.00	54.00	9.60	7.73

Remark: Please see annex for the measurement plot.

4.2.4 Test result: Band edge compliance

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 1	passed
	op-mode 2	passed
	op-mode 4	passed
	op-mode 5	passed
	op-mode 7	passed
	op-mode 8	passed
	op-mode 11	passed
	op-mode 13	passed
	op-mode 14	passed
	op-mode 16	passed
	op-mode 17	passed

5 Test Equipment

EUT Digital Signalling System

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz	01.12.05	01.12.08
Signalling Unit for Bluetooth	PTW60	100004	Rohde & Schwarz	-	-
Universal Radio Communication Tester	CMU200	102366	Rohde & Schwarz	22.09.07	22.09.09

EMI Test System

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Comparison Noise Emitter	CNE III	99/016	York	-	-
EMI Analyzer	ESI 26	830482/004	Rohde & Schwarz	06.12.07	06.12.09
Signal Generator	SMR 20	846834/008	Rohde & Schwarz	05.12.07	05.12.09
AC Power Source	6404	64040000B04	Croma ATE INC.	01.06.08	N/A the parameters will be checked before testing

EMI Radiated Auxiliary Equipment

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Antenna mast 4m	MA 240	240/492	HD GmbH H. Deisel	-	-
Biconical dipole	VUBA 9117	9117108	Schwarzbeck	02.07.03	02.07.08
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32	849785	Miteq	06.02.08	06.08.08
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35	896037	Miteq	06.02.08	06.08.08
Broadband Amplifier 45MHz-27GHz	JS4-00102600-42	619368	Miteq	06.02.08	06.08.08
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2 W38.01-2	Kabel Kusch	06.02.08	06.08.08
Cable "ESI to Horn Antenna"	UFB311A UFB293C	W18.02-2 W38.02-2	Rosenberger-Microcoax	06.02.08	06.08.08
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz	12.05.06	12.05.08
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz	20.01.04	N/A – spare antenna
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic	06.02.08	06.08.08
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic	06.02.08	06.08.08
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic	06.02.08	06.08.08
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz	17.05.06	17.05.09
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz	19.08.02	N/A – only used for pre-testing
Pyramidal Horn Antenna 26.5 GHz	Model 3160-09	9910-1184	EMCO	06.02.08	06.08.08

EMI Conducted Auxiliary Equipment

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber+Suhner	06.02.08	06.08.08
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz	01.11.05	01.11.08
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz	-	-

Auxiliary Test Equipment – calibration not applicable; spare equipment

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Broadband Resist. Power Divider N	1506A / 93459	LM390	Weinschel	-	-
Broadband Resist. Power Divider SMA	1515 / 93459	LN673	Weinschel	-	-
Digital Multimeter 01	Voltcraft M-3860M	IJ096055	Conrad	-	-
Digital Multimeter 02	Voltcraft M-3860M	IJ095955	Conrad	-	-
Digital Oscilloscope	TDS 784C	B021311	Tektronix	-	-
Fibre optic link Satellite	FO RS232 Link	181-018	Pontis	-	-
Fibre optic link Transceiver	FO RS232 Link	182-018	Pontis	-	-
I/Q Modulation Generator	AMIQ-B1	832085/018	Rohde & Schwarz	-	-
Notch Filter ultra stable	WRCA800/960-6E	24	Wainwright	-	-
Spectrum Analyzer 9 kHz to 3 GHz	FSP3	838164/004	Rohde & Schwarz	-	-
Temperature Chamber	VT 4002	58566002150010	Vötsch	-	-
Temperature Chamber	KWP 120/70	59226012190010	Weiss	-	-
ThermoHygro Datalogger 03	Opus10 THI (8152.00)	7482	Lufft Mess- und Regeltechnik GmbH	-	-

Anechoic Chamber – calibration not applicable

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Air Compressor (pneumatic)			Atlas Copco	-	-
Controller	CO 2000	CO2000/328/12470406/L	Innco innovative constructions GmbH	-	-
EMC Camera	CE-CAM/1		CE-SYS	-	-
EMC Camera for observation of EUT	CCD-400E	0005033	Mitsubishi	-	-
Filter ISDN	B84312-C110-E1		Siemens & Matsushita	-	-
Filter telephone systems / modem	B84312-C40-B1		Siemens & Matsushita	-	-
Filter Universal 1A	B84312-C30-H3		Siemens & Matsushita	-	-
Fully/Semi AE Chamber	10.58x6.38x6		Frankonia	-	-
Turntable	DS 420S	420/573/99	HD GmbH, H.Deisel	-	-
Valve Control Unit (pneum.)	VE 615P	615/348/99	HD GmbH, H.Deisel	-	-

Equipment	Type	Serial No.	Manufacturer	Cal data	Next cal
Power Meter 832025/059	NRVD	832025/059	Rohde & Schwarz	22.08.07	22.08.08
Power Sensor A 832279/013	NRV-Z1	832279/013	Rohde & Schwarz	23.08.07	23.08.08
Power Sensor B 832279/015	NRV-Z1	832279/015	Rohde & Schwarz	23.08.07	23.08.08
Power Supply	E3632A	MY40003776	Agilent	-	-
Power Supply	PS-2403D	-	Conrad	-	-
RF Step Attenuator 833695/001	RSP	833695/001	Rohde & Schwarz	09.08.06	09.08.08
Rubidium Frequency Normal	MFS	002	Efratom	24.08.07	24.08.08
Signal Analyzer FSIQ26 832695/007	FSIQ26	832695/007	Rohde & Schwarz	23.08.07	23.08.09
Signal Generator 833680/003	SMP 03	833680/003	Rohde & Schwarz	04.07.06	04.07.09
Signal Generator A 834344/002	SMIQ03B	834344/002	Rohde & Schwarz	04.07.06	04.07.09
Signal Generator B 832870/017	SMIQ03B	832870/017	Rohde & Schwarz	24.05.07	24.05.10
Signal Switching and Conditioning Unit	SSCU	338826/005	Rohde & Schwarz	-	-
Signalling Unit PTW60 838312/014	PTW60 for TS8960	838312/014	Rohde & Schwarz	-	-
System Controller 829323/008	PSM12	829323/008	Rohde & Schwarz	-	-

6 Photo Report

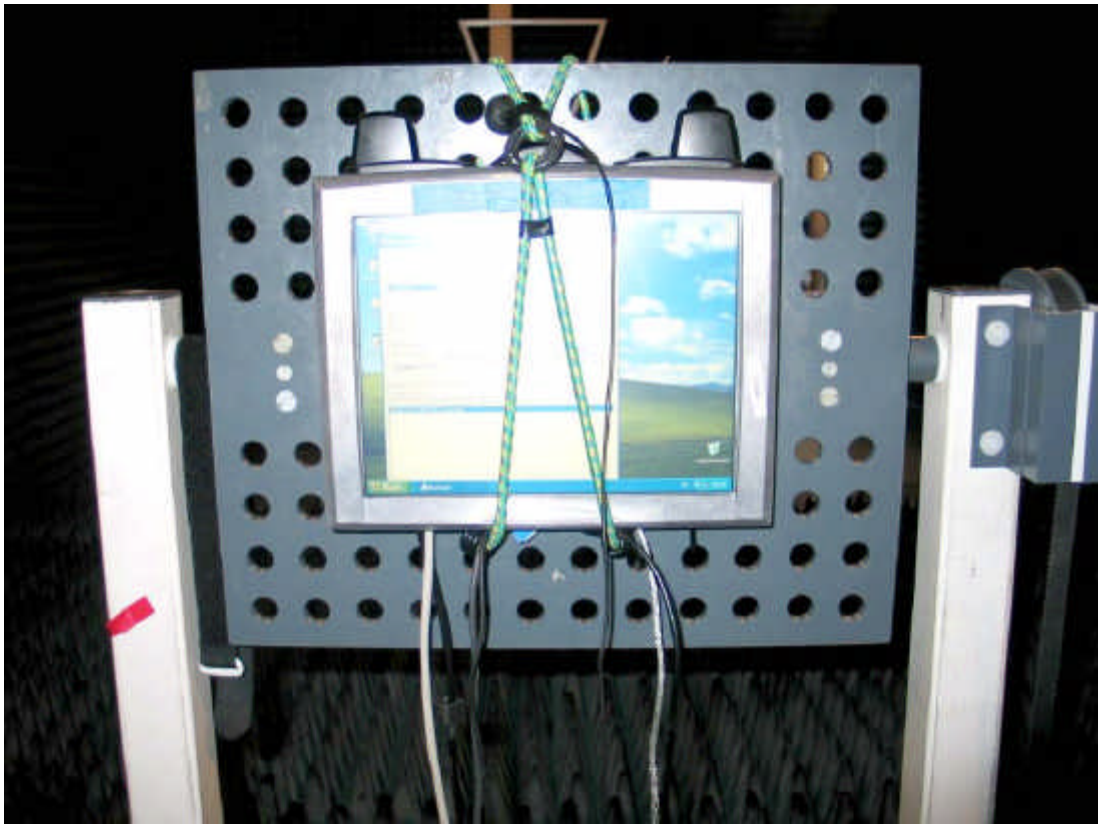


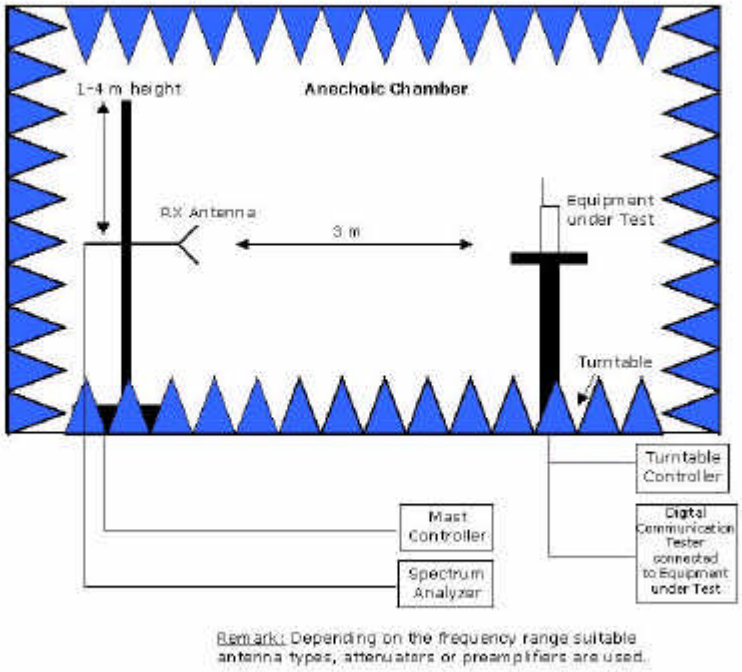
Photo 1: Test setup for radiated measurements above 1 GHz

Photo 2: Test setup for radiated measurements below 1 GHz

Photo 3: EUT (top side)

Photo 4: EUT (bottom side, with interfaces)

7 Setup Drawings



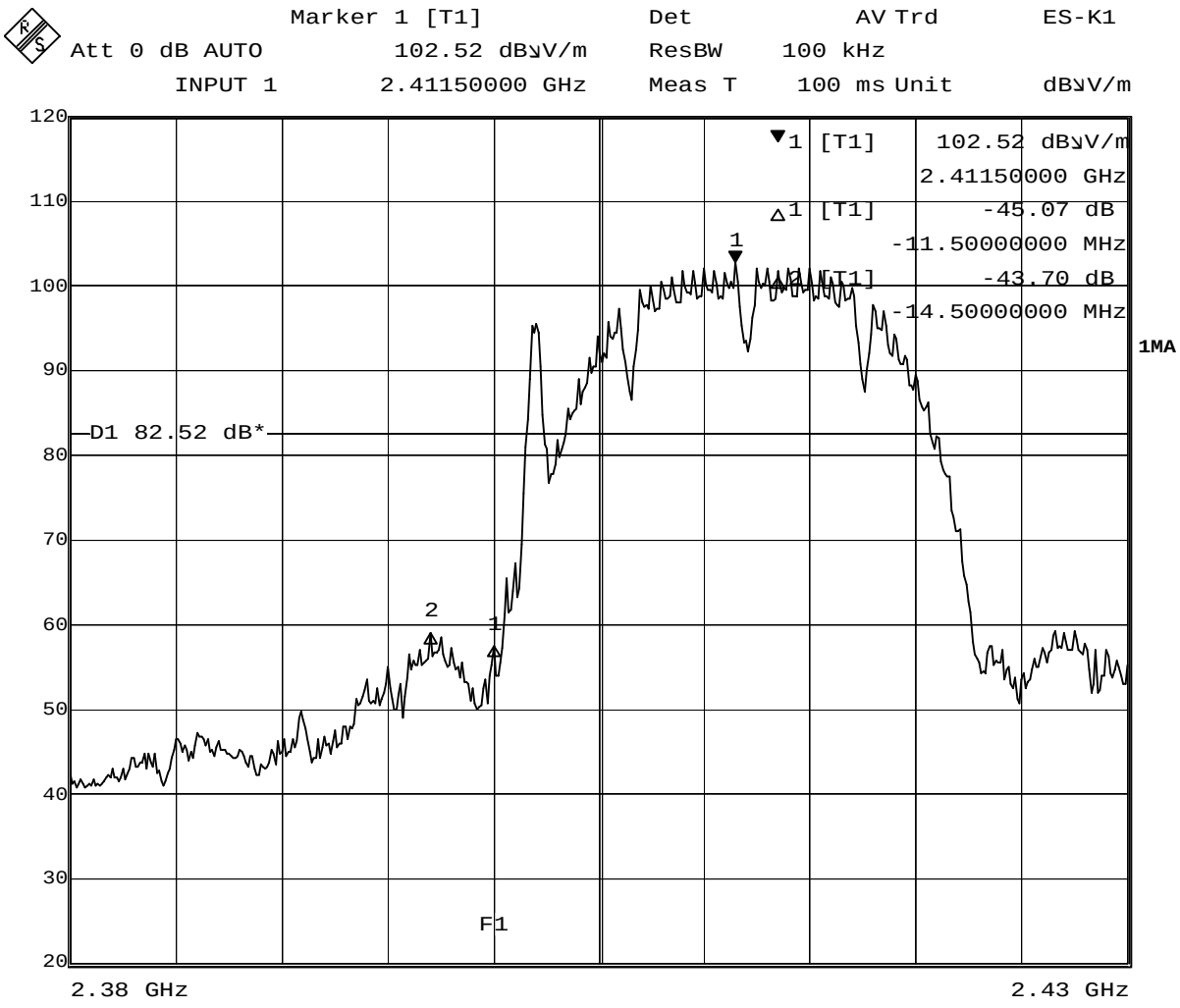
Drawing 1: Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting ground plane.

8 Annex measurement plots

8.1 Band edge compliance

8.1.1 Lower band edge

op-mode 1



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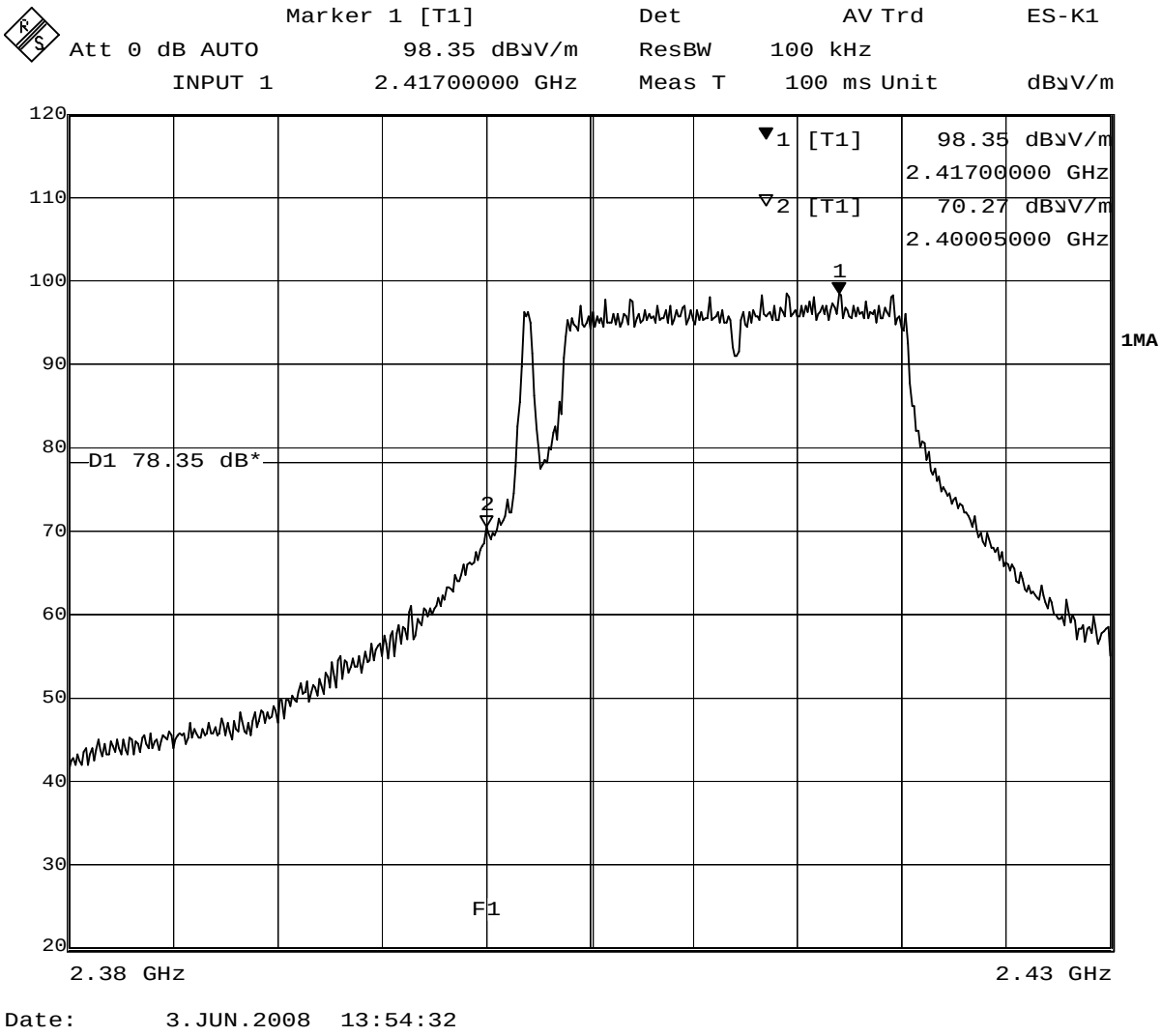
Op. Mode

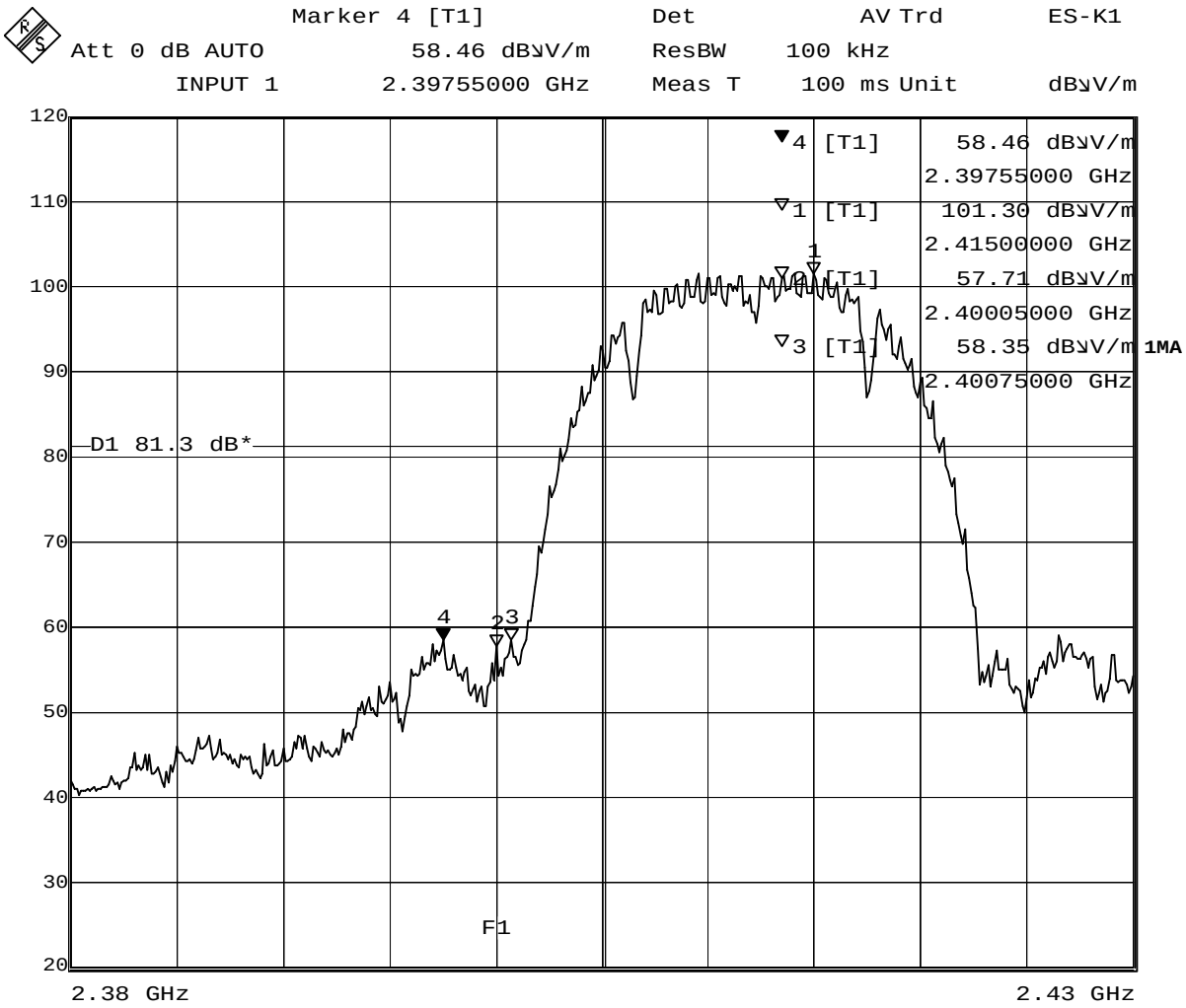
op-mode 2



Date: 3.JUN.2008 13:54:32

Op. Mode

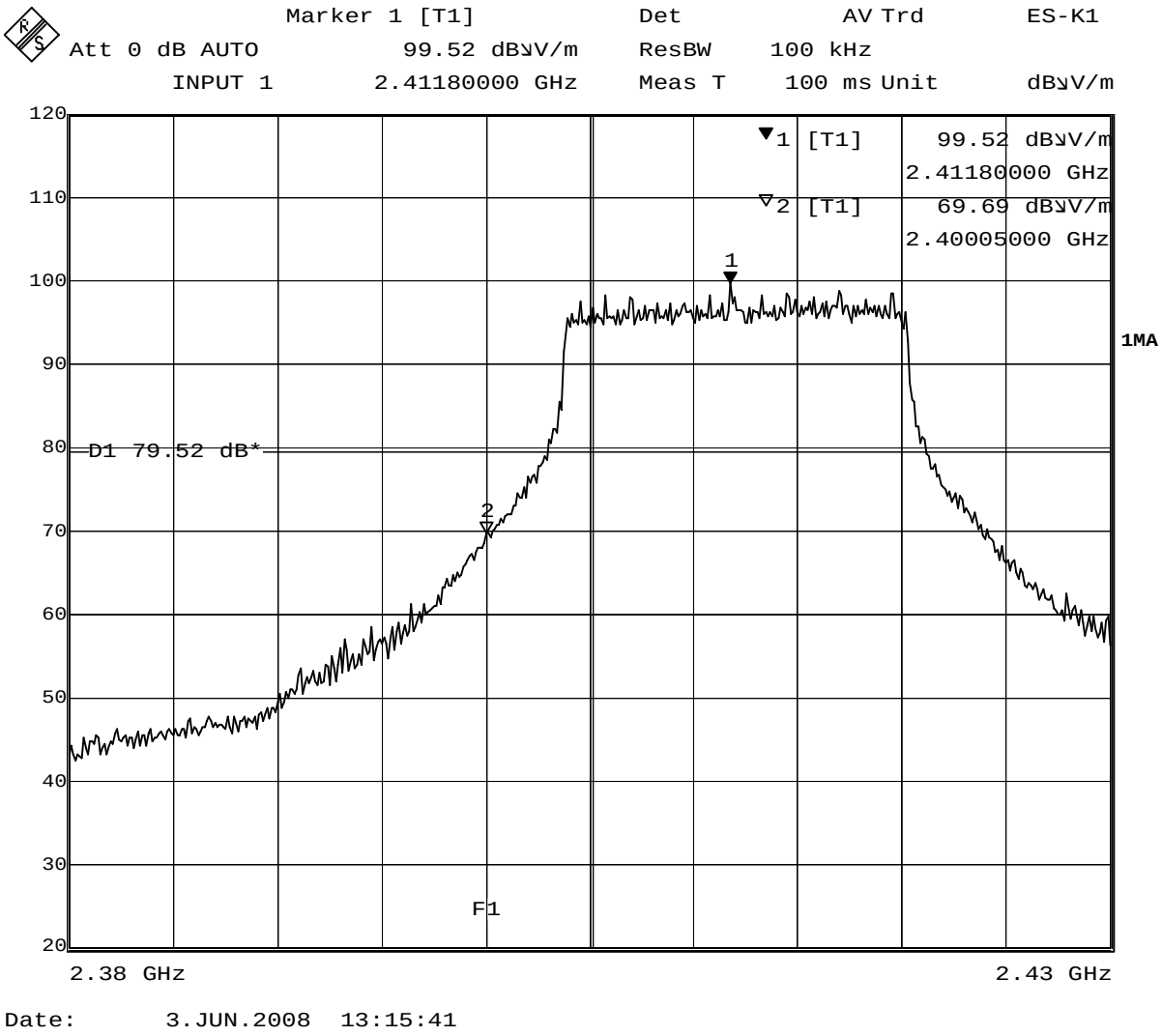
op-mode 7



Date: 3.JUN.2008 13:36:36

Op. Mode

op-mode 8

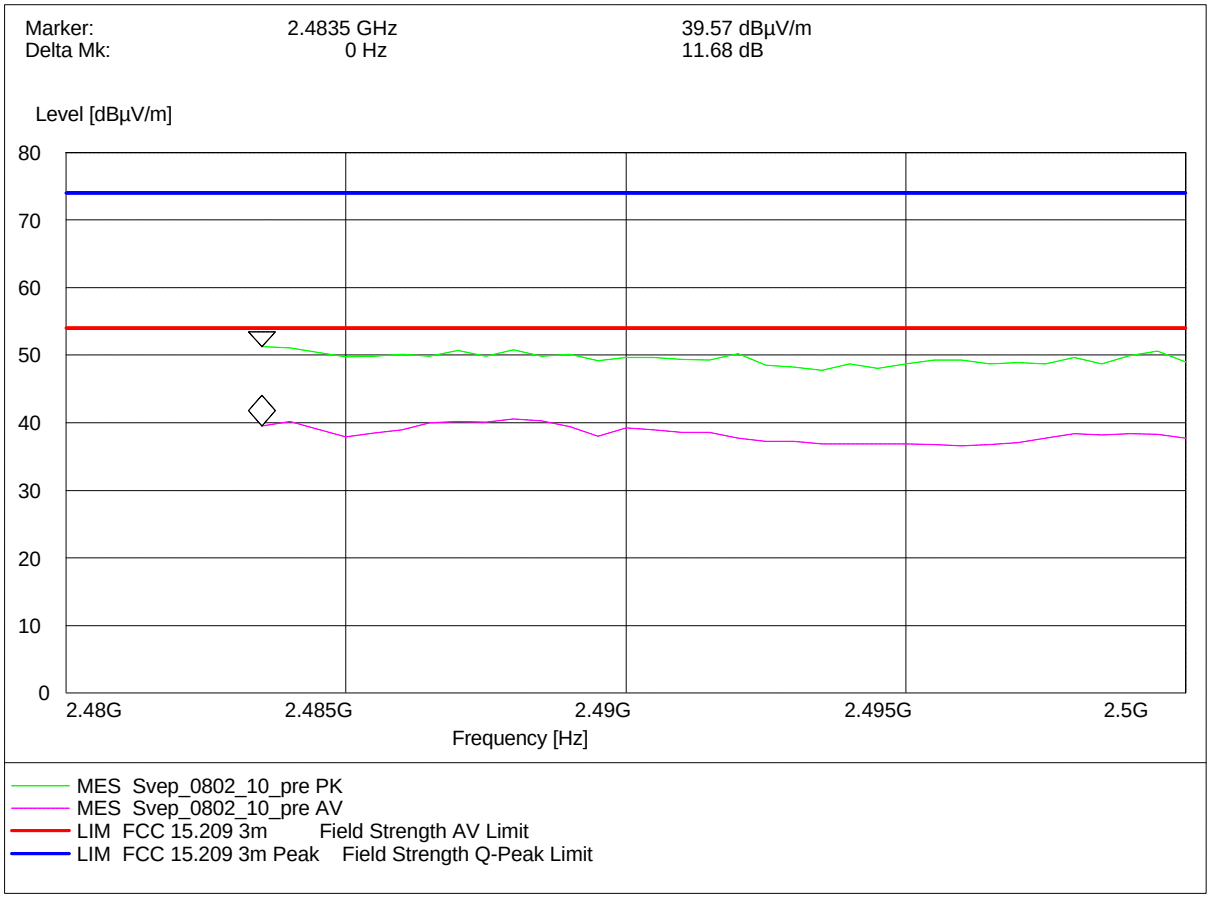


Date: 3.JUN.2008 13:15:41

8.1.2 Upper band edge

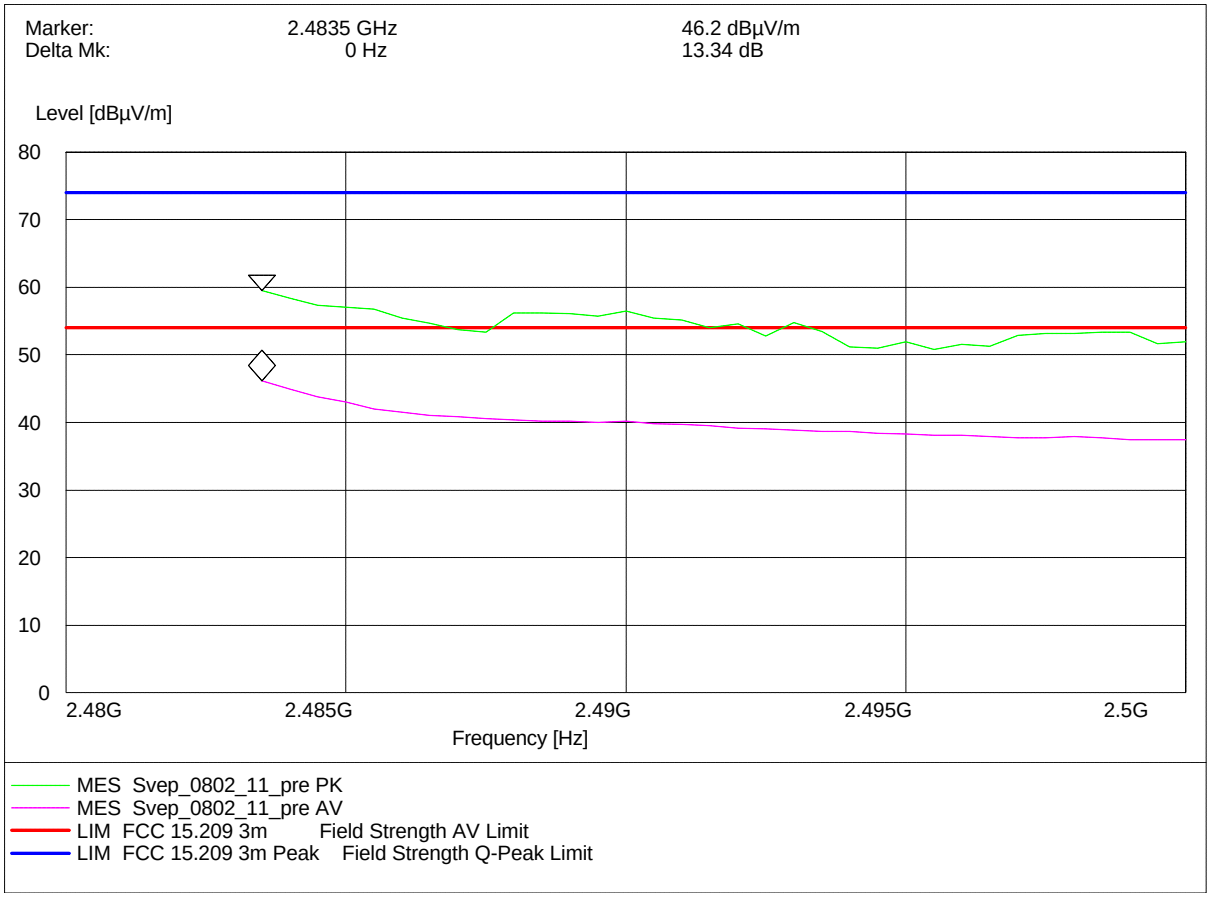
Op. Mode

op-mode 4



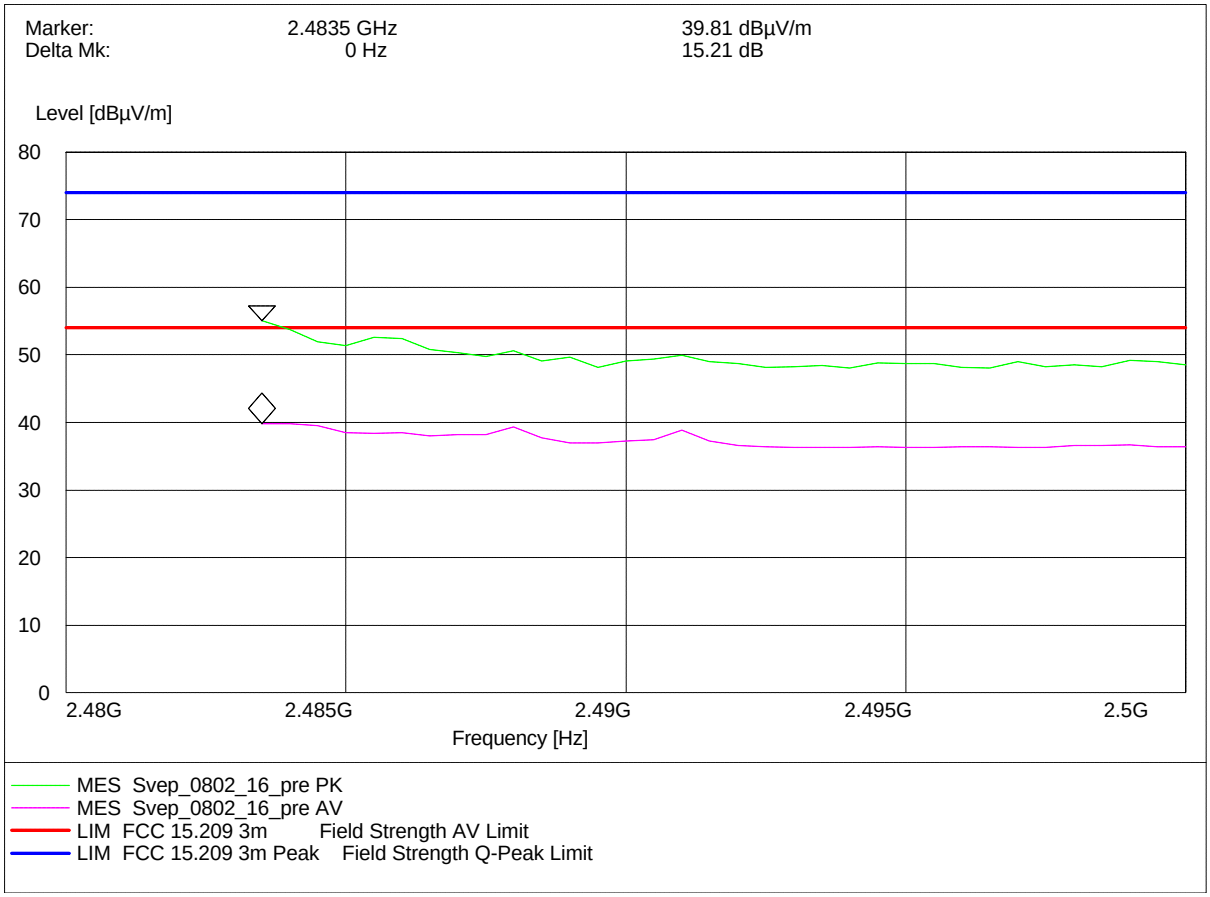
Op. Mode

op-mode 5



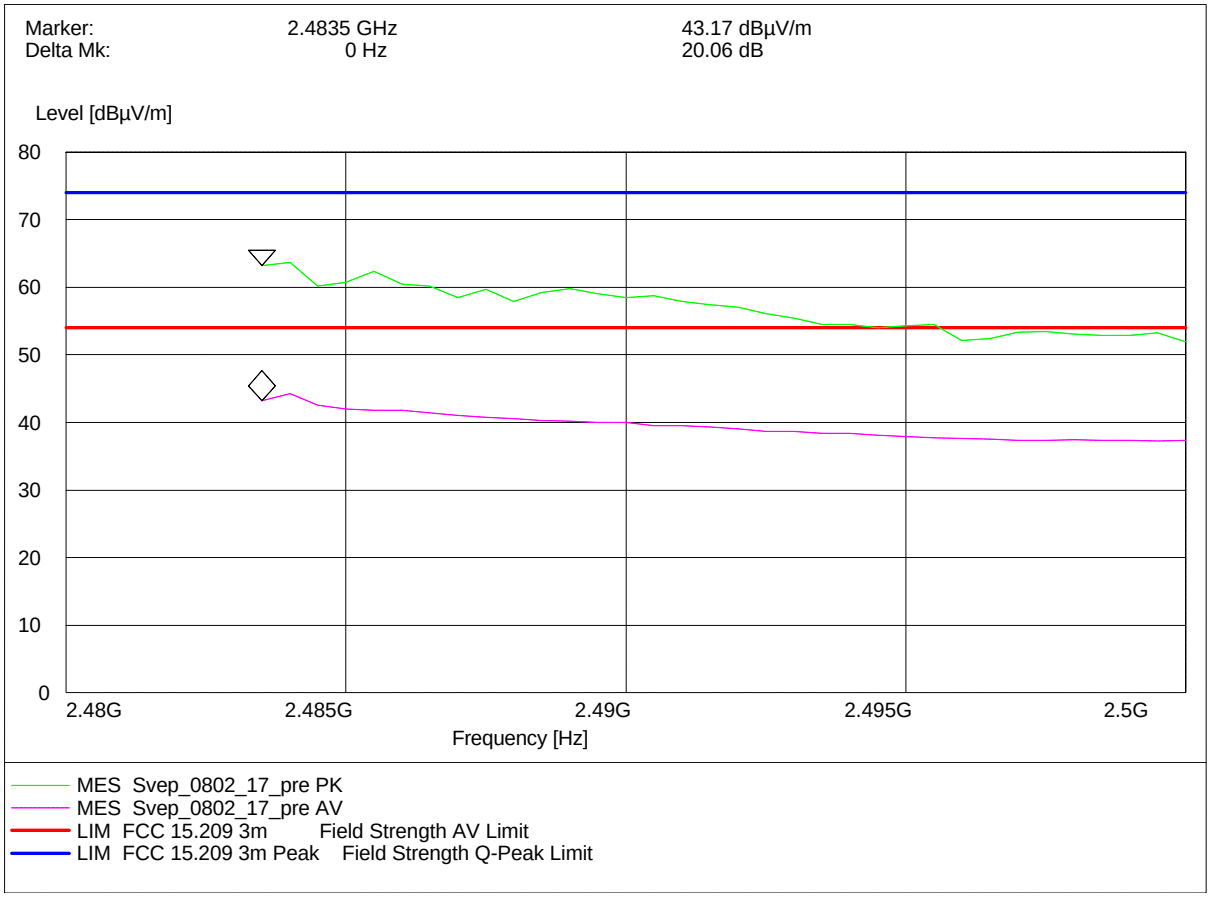
Op. Mode

op-mode 13



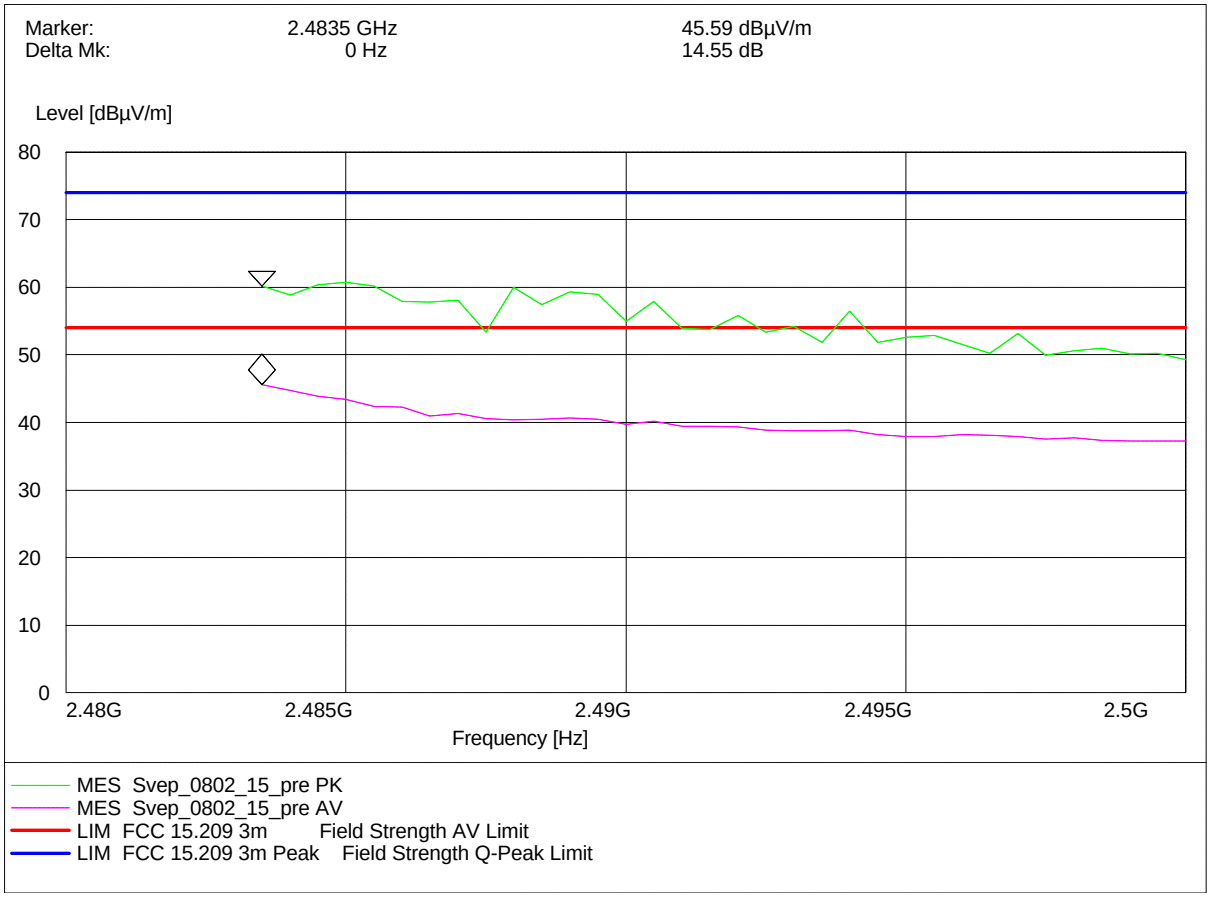
Op. Mode

op-mode 14



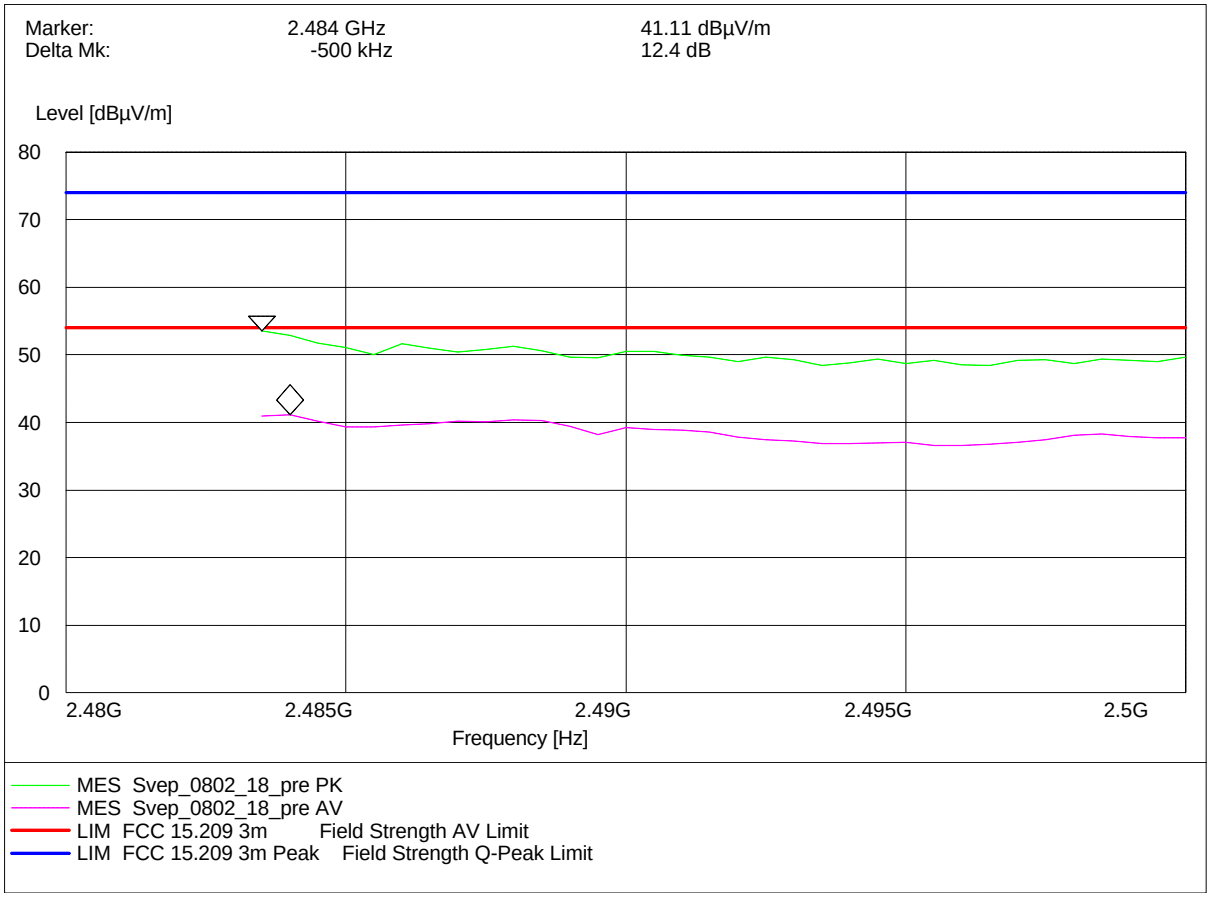
Op. Mode

op-mode 11



Op. Mode

op-mode 16



Op. Mode

op-mode 17