



Inter**Lab**[®]

FCC Measurement/Technical Report on
FM transmitter (low power device)
Jabra HFS100

Report Reference: MDE_GNNET_1003_FCCf

Test Laboratory:

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DGA-PL-192/99-02

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.

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 (10-1-09 Edition) and 15 (10-1-09 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J – Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

§ 15.239 Operation in the band 88–108 MHz

Note: –

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 § 15.207

Conducted emissions (AC power line)			
The measurement was performed according to ANSI C63.4			
OP-Mode	Setup	Port	Final Result
op-mode 2	Setup_c01	AC Port (power line)	2003 passed

FCC Part 15, Subpart C § 15.239

Occupied bandwidth			
The measurement was performed according to FCC § 15.31			
OP-Mode	Setup	Port	Final Result
op-mode 1	Setup_f01	Enclosure	10-1-09 Edition passed
op-mode 2	Setup_f01	Enclosure	passed
op-mode 3	Setup_f01	Enclosure	passed

FCC Part 15, Subpart C § 15.239

Peak power output			
The measurement was performed according to FCC § 15.31			
OP-Mode	Setup	Port	Final Result
op-mode 1	Setup_b01	Enclosure	10-1-09 Edition passed
op-mode 2	Setup_b01	Enclosure	passed
op-mode 3	Setup_b01	Enclosure	passed

FCC Part 15, Subpart C § 15.239, § 15.35 (b), § 15.209

Spurious radiated emissions			
The measurement was performed according to ANSI C63.4			
OP-Mode	Setup	Port	Final Result
op-mode 1	Setup_b01	Enclosure	2003 passed
op-mode 2	Setup_b01/_g01	Enclosure	passed
op-mode 3	Setup_b01	Enclosure	passed

FCC Part 15, Subpart C § 15.239

Band edge compliance			
The measurement was performed according to FCC § 15.31 / ANSI C63.4			
OP-Mode	Setup	Port	Final Result
op-mode 1	Setup_f01	Enclosure	10-1-09 Edition / 2003 passed
op-mode 3	Setup_f01	Enclosure	passed

FCC Part 15, Subpart C § 15.239

Tuning range of FM transmitter			
The measurement was performed according to FCC § 15.31			
OP-Mode	Setup	Port	Final Result
op-mode 4	Setup_f01	Enclosure	10-1-09 Edition passed



Notes:

This report replaces the test report referenced by: MDE_GNNET_1003_FCCc.



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Responsible for
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Madula

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A. Pelt



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. DGA-PL-192/99-02

Responsible for Accreditation Scope: Dipl.-Ing. Bernhard Retka
Dipl.-Ing. Robert Machulec
Dipl.-Ing. Thomas Hoell
Dipl.-Ing. Andreas Petz

Report Template Version: 2011-02-22

1.2 Project Data

Responsible for testing and report: Dipl.-Ing. Andreas Petz
Date of Test(s): 2010-10-19 to 2011-03-08
Date of Report: 2011-03-08

1.3 Applicant Data

Company Name: GN Netcom A/S
Address: Lautrupbjerg 7
DK-2750 Ballerup
Denmark
Contact Person: Mr. Tom Ringtved

1.4 Manufacturer Data

Company Name: please see applicant data
Address:
Contact Person:

2 Test object Data

2.1 General EUT Description

Equipment under Test	FM transmitter (low power device)
Type Designation:	Jabra HFS100
Kind of Device: (optional)	Bluetooth Handsfree, Mobile Phone Accessory
Voltage Type:	DC (DC cigar light charger)
Voltage level:	12V / 5V
Modulation type:	FM
Channel spacing:	200 kHz
Nominal frequency band:	88.1 MHz – 107.9 MHz

General product description:

Low power FM transmitter used for short range communication in the frequency band 88 MHz - 108 MHz using an integrated antenna.

Specific product description for the EUT:

The EUT is a Bluetooth in-car hands-free speakerphone equipped with a FM transmitter which allows to stream audio from e.g. a mobile phone to a car radio system. The FM transmitter can be only used in conjunction with an active Bluetooth connection. The EUT has an integrated battery.

The EUT provides the following ports:

Ports

Enclosure
DC Port (power line input, USB)

The main components of the EUT are listed and described in Chapter 2.2.



2.2 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: CJ110b01)	FM transmitter	Jabra HFS100	09	28-03161	23h	2010-10-18
Remark: EUT A is equipped with an integral FM antenna.						
EUT B (Code: CJ110f03)	FM transmitter	Jabra HFS100	34	28-03161	01-05-01	2011-02-02
Remark: EUT B is equipped with an integral FM antenna.						
EUT C (Code: CJ110c01)	FM transmitter	Jabra HFS100	22	28-03161	23h	2010-10-18
Remark: EUT C is equipped with an integral FM antenna.						
EUT D (Code: CJ110g01)	FM transmitter	Jabra HFS100	52	28-03161	23h	2010-10-18
Remark: EUT D is equipped with an integral FM antenna.						

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

2.3 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	Serial no.	HW Status	SW Status	FCC ID
AE 1	DC cigar light charger	Jabra ESC-003	-	-	-	-

2.4 Auxiliary Equipment

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	Serial no.	HW Status	SW Status	FCC ID
AUX 1	Mobile Phone	Nokia Model: N8-00	IMEI: 352684042945597	-	011.012	-
AUX 2	Switching adapter	SSA-4P 5050F	-	-	-	-



2.5 EUT Setups

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

Setup No.	Combination of EUTs	Description
Setup_b01	EUT A + AE 1	setup for Spurious radiated emissions (tests > 30 MHz) and Peak power output
Setup_f01	EUT B + AUX 1	setup for Band Edge Compliance and Occupied bandwidth
Setup_c01	EUT C + AUX 2	setup for conducted measurements at AC mains
Setup_g01	EUT D	setup for Spurious radiated emissions (tests < 30 MHz)

Note: AUX 1 is used to transfer stereo audio data to an EUT.

2.6 Operating Modes

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

Op. Mode	Description of Operating Modes	Remarks
op-mode 1	The EUT transmits on 88.1 MHz	lowest channel
op-mode 2	The EUT transmits on 98.1 MHz	mid channel
op-mode 3	The EUT transmits on 107.9 MHz	highest channel
op-mode 4	The EUT transmits in range 88–108 MHz	all available channels

For the tests Conducted emissions (AC power line), Spurious radiated emissions and Peak power output no audio data is used. In this mode, the transmitter is still modulated by the 19 kHz pilote-tone and the 38 kHz subcarrier.

The signal without audio data produces the highest output power.

For the tests Band Edge Compliance and Occupied bandwidth a mobile Phone was used to send audio data via Bluetooth to the tested device. The audio file generates frequencies from 20 Hz to 20 kHz (audio sweep time = 1 s) to produce the maximum bandwidth.

2.7 Product labelling

2.7.1 FCC ID label

Please refer to the documentation of the applicant.

2.7.2 Location of the label on the EUT

Please refer to the documentation of the applicant.



3 Test Results

3.1 Conducted emissions (AC power line)

Standard FCC Part 15, 10-1-09 Edition Subpart C

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

3.1.1 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 setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50 μ H || 50 Ohm Line Impedance Stabilization Network (LISN). The LISN's unused connections were terminated with 50 Ohm loads.

The measurement procedure consists of two steps. It is implemented into the EMI test software ES-K1 from R&S.

Step 1: Preliminary scan

Intention of this step is, to determine the conducted EMI-profile of the EUT.

EMI receiver settings:

- Detector: Peak - Maxhold
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 5 kHz
- IF-Bandwidth: 9 kHz
- Measuring time / Frequency step: 20 ms
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2: Final measurement

Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.

EMI receiver settings:

- Detector: Quasi-Peak
- IF - Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:

- 1) Neutral lead - reference ground (PE grounded)
- 2) Phase lead - reference ground (PE grounded)
- 3) Neutral lead - reference ground (PE floating)
- 4) Phase lead - reference ground (PE floating)

The highest value is reported.



3.1.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.207

Frequency Range (MHz)	QP Limit (dBµV)	AV Limit (dBµV)
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

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

3.1.3 Test Protocol

Temperature: 23 °C
 Air Pressure: 1008 hPa
 Humidity: 38 %

Op. Mode	Setup	Port
op-mode 2	Setup_c01	AC Port (power line)

Additional to the FM function the Bluetooth transceiver was activated (Tx on 2441 MHz; loopback mode; Packettype: 1-DH1).

Power line	Frequency MHz	Measured value QP dBµV	Measured value AV dBµV	QP Limit dBµV	AV Limit dBµV	Delta to QP limit dB	Delta to AV limit dB
N	-	-	-	-	-	-	-
L	-	-	-	-	-	-	-

Remark: No final measurement was performed because no frequencies (peaks) were found within the offset for acceptance analysis during the preliminary scan. Please see annex for the measurement plot.

3.1.4 Test result: Conducted emissions (AC power line)

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 2	passed



3.2 Occupied bandwidth

Standard FCC Part 15, 10-1-09 Edition Subpart C

The test was performed according to: FCC §15.31

3.2.1 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 set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The radiated emissions measurements were made in a typical installation configuration. The resolution bandwidth for measuring the occupied bandwidth was 10 kHz. Because this test is a relative measurement, the determined absolute power level need not to be the correct value due to using additional pre-amplifier(s) without applying path correction factors. This might become necessary if the signal-to-noise-ratio is not sufficient.

3.2.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.239

(a) Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88–108 MHz.



3.2.3 Test Protocol

Temperature: 24 °C
 Air Pressure: 1022 hPa
 Humidity: 35 %

Op. Mode	Setup	Port
op-mode 1	Setup_f01	Enclosure

20 dB bandwidth kHz	Remarks
195.99	-

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 2	Setup_f01	Enclosure

20 dB bandwidth kHz	Remarks
195.99	-

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 3	Setup_f01	Enclosure

20 dB bandwidth kHz	Remarks
195.79	-

Remark: Please see annex for the measurement plot.

3.2.4 Test result: Occupied bandwidth

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 1	passed
	op-mode 2	passed
	op-mode 3	passed



3.3 Peak power output

Standard FCC Part 15, 10-1-09 Edition Subpart C

The test was performed according to: FCC §15.31

3.3.1 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 set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

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.

3.3.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.239

(b) The field strength of any emissions within the permitted 200 kHz band shall not exceed 250 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

Used conversion factor: $\text{Limit (dB}\mu\text{V/m)} = 20 \log (\text{Limit } (\mu\text{V/m})/1\mu\text{V/m})$
(250 $\mu\text{V/m}$ are equal to 48 dB $\mu\text{V/m}$)

3.3.3 Test Protocol

Temperature: 21 °C
 Air Pressure: 1015 hPa
 Humidity: 38 %

Op. Mode	Setup	Port
op-mode 1	Setup_a01	Enclosure

Output power QP dBµV/m	Output power AV dBµV/m	Remarks
46.8	46.2	-

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 2	Setup_a01	Enclosure

Output power QP dBµV/m	Output power AV dBµV/m	Remarks
46.0	45.9	-

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 3	Setup_a01	Enclosure

Output power QP dBµV/m	Output power AV dBµV/m	Remarks
46.1	45.8	-

Remark: Please see annex for the measurement plot.

3.3.4 Test result: Peak power output

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 1	passed
	op-mode 2	passed
	op-mode 3	passed

3.4 Spurious radiated emissions

Standard FCC Part 15, 10-1-09 Edition Subpart C

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

3.4.1 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 set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

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.

1. 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: 10 m
- 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

2. Measurement above 30 MHz and up to 1 GHz

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: 1 ms
- 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 of 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 1 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 + 0.2 5m 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



3. 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) are used, the steps 2-4 are omitted. Step 1 was performed with one height of the receiving antenna only.

EMI receiver settings:

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

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.

3.4.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.239

(c) The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed the general radiated emission limits in § 15.209.

FCC Part 15, Subpart C, §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

§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)

3.4.3 Test Protocol

3.4.3.1 Measurement up to 30 MHz

Temperature: 24 °C
 Air Pressure: 1018 hPa
 Humidity: 36 %

Op. Mode	Setup	Port
op-mode 2	Setup_g01	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
0°	-	-	-	-	-	-	-	-	-
90°	-	-	-	-	-	-	-	-	-

Remark: No (further) spurious emissions in the range 20 dB below the limit found therefore step 2 was not performed. The found peak at 91.2 kHz is emission from loop antenna power supply.
 Please see annex for the measurement plots.

3.4.3.2 Measurement above 30 MHz

Temperature: 21 °C
 Air Pressure: 1015 hPa
 Humidity: 38 %

Op. Mode	Setup	Port
op-mode 1	Setup_b01	Enclosure

Polarisation	Frequency MHz	Corrected value dBµV/m	Limit dBµV/m	Delta to limit dB
		QP	QP	QP
Vertical + horizontal	213.30	34.7	43.5	8.8
	224.04	42.6	46.0	3.4
	231.96	37.4	46.0	8.6
	405.36	39.9	46.0	6.1
	415.98	41.0	46.0	5.0
	448.02	35.8	46.0	10.2
	469.32	36.4	46.0	9.6
	480.00	37.4	46.0	8.6
	511.98	38.0	46.0	8.0

Remark: No (further) spurious emissions in the range 20 dB below the limit found.
 Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 2	Setup_b01	Enclosure

Polarisation	Frequency MHz	Corrected value dB μ V/m	Limit dB μ V/m	Delta to limit dB
		QP	QP	QP
Vertical + horizontal	223.86	22.0	46.0	24.0

Remark: No (further) spurious emissions in the range 20 dB below the limit found.
Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 3	Setup_b01	Enclosure

Polarisation	Frequency MHz	Corrected value dB μ V/m	Limit dB μ V/m	Delta to limit dB
		QP	QP	QP
Vertical + horizontal	213.36	34.1	43.5	9.4
	223.98	30.9	46.0	15.1
	405.30	37.7	46.0	8.3
	415.98	40.7	46.0	5.3
	448.02	28.5	46.0	17.5
	469.32	29.5	46.0	16.5
	480.00	31.6	46.0	14.4
	511.98	32.4	46.0	13.6

Remark: No (further) spurious emissions in the range 20 dB below the limit found.
Please see annex for the measurement plot.

3.4.4 Test result: Spurious radiated emissions

FCC Part 15, Subpart C

Op. Mode	Result
op-mode 1	passed
op-mode 2	passed
op-mode 3	passed

3.5 Band edge compliance

Standard FCC Part 15, 10-1-09 Edition Subpart C

The test was performed according to: ANSI C 63.4, 2003; FCC §15.31

3.5.1 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 set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

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.

3.5.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.239

(c) The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed the general radiated emission limits in § 15.209.

3.5.3 Test Protocol

Temperature: 23 °C
 Air Pressure: 1012 hPa
 Humidity: 34 %

Op. Mode	Setup	Port
op-mode 1	Setup_f01	Enclosure

Frequency MHz	Polarisation	Corrected QP value dBµV/m	Limit QP dBµV/m	Delta to QP limit dB
88.0	Vertical + horizontal	30.3	40.0	9.7

Remark: Please see annex for the measurement plot.

Op. Mode	Setup	Port
op-mode 3	Setup_f01	Enclosure

Frequency MHz	Polarisation	Corrected QP value dBµV/m	Limit QP dBµV/m	Delta to QP limit dB
108.0	Vertical + horizontal	42.4	43.5	1.1

Remark: Please see annex for the measurement plot.

3.5.4 Test result: Band edge compliance

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 1	passed
	op-mode 3	passed



3.6 Tuning range of FM transmitter

Standard FCC Part 15, 10-1-09 Edition Subpart C

The test was performed according to: FCC §15.31

3.6.1 Test Description

The Equipment Under Test (EUT) was set up at a kind of test fixture. The test was performed in the nearfield of the EUT and the receiving antenna is used to detect the frequencies. No requirement applies to the absolute power level for this test therefore path correction is not needed.

The EUT is tuned to all consumer-accessible frequencies and the spectrum is traced using a spectrum analyser in maxhold mode in order to determine the covered frequency range.

3.6.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.239

(a) Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88–108 MHz.

3.6.3 Test Protocol

Temperature: 22 °C
 Air Pressure: 1014 hPa
 Humidity: 29 %

Op. Mode	Setup	Port
op-mode 4	Setup_f01	Enclosure

Covered Tuning Range	Limit	Remarks
88.1 – 107.9 MHz	88 – 108 MHz	The tuning range is inside the maximum range.

Remark: Please see annex for the measurement plot.

3.6.4 Test result: Band edge compliance

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 4	passed



4 Test Equipment

The calibration, hardware and software states are shown for the testing period.

Test Equipment Anechoic Chamber

Lab ID:	Lab 2		
Manufacturer:	Frankonia		
Description:	Anechoic Chamber for radiated testing		
Type:	10.58x6.38x6 m ³		
	<i>Calibration Details</i>	<i>Last Execution</i>	<i>Next Exec.</i>
	IC renewal	2009/01/21	2011/01/20
	FCC renewal	2009/01/07	2011/01/06

Single Devices for Anechoic Chamber

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>		
Air compressor	none	-	Atlas Copco		
Anechoic Chamber	10.58 x 6.38 x 6.00 m ³	none	Frankonia		
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>	
	FCC listing 96716 3m Part15/18		2009/01/07	2011/01/06	
	ANSI C64.3 NSA		2009/01/21	2011/01/20	
	FCC listing 96716 3m Part15/18		2011/01/11	2014/01/10	
Controller Maturo	MCU	961208	Maturo GmbH		
EMC camera	CE-CAM/1	-	CE-SYS		
EMC camera Nr.2	CCD-400E	0005033	Mitsubishi		
Filter ISDN	B84312-C110-E1		Siemens&Matsushita		
Filter Universal 1A	BB4312-C30-H3	-	Siemens&Matsushita		

Test Equipment Auxiliary Equipment for Conducted emissions

Lab ID: Lab 1
Manufacturer: Rohde & Schwarz GmbH & Co.KG
Description: EMI Conducted Auxiliary Equipment

Single Devices for Auxiliary Equipment for Conducted emissions

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>	
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber&Suhner	
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG	
One-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	DKD Calibration		2008/10/13	2010/10/12
	DKD Calibration		2011/01/20	2013/01/19

Test Equipment Auxiliary Equipment for Radiated emissions

Lab ID: Lab 2
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer		
Antenna mast	AS 620 P		HD GmbH		
Biconical dipole	VUBA 9117	9117-108	Schwarzbeck	<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2008/10/27	2013/10/26
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P	849785	Miteq	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Path Calibration			2010/05/10	2010/11/09
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4	-	Miteq	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Path Calibration			2010/05/10	2010/11/09
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P	896037	Miteq	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Path Calibration			2010/05/10	2010/11/09
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01- 2	Kabel Kusch	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Path Calibration			2010/05/10	2010/11/09
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02-2+W38.02- 2	Rosenberger Micro-Coax	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Path Calibration			2010/05/10	2010/11/09
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Standard Calibration			2009/04/16	2012/04/15
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Standard Calibration			2009/04/28	2012/04/27
Dreheinheit	DE 325		HD GmbH		
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Path Calibration			2010/05/10	2010/11/09
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Path Calibration			2010/05/10	2010/11/09
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic		

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Path Calibration		2010/05/10	2010/11/09
	Path Calibration		2010/11/06	2011/05/05
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Path Calibration		2010/05/11	2010/11/09
	Path Calibration		2010/11/06	2011/05/05
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration		2009/05/27	2012/05/26
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	DKD calibration		2008/10/07	2011/10/06
Network Analyzer	E5071B	MY42200813	Agilent	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Calibration		2008/11/06	2010/11/06
	Standard Calibration		2009/11/11	2010/11/11
	Standard Calibration		2010/11/09	2011/11/09
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH	
Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH	
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5- 10kg/024/3790709	Maturo GmbH	

Test Equipment Auxiliary Test Equipment

Lab ID: Lab 2
Manufacturer: see single devices
Description: Single Devices for various Test Equipment
Type: various
Serial Number: none

Single Devices for Auxiliary Test Equipment

Single Device Name	Type	Serial Number	Manufacturer	
AC Power Source	Chroma 6404	64040001304	Chroma ATE INC.	
Broadband Power Divider N (Aux)	1506A / 93459	LM390	Weinschel Associates	
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates	
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
	Standard calibration		2009/10/07	2011/10/06
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	Pontis	
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	Pontis	
Isolating Transformer	LTS 604	1888	Thalheimer Transformatorenwerke GmbH	
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright	
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG	

Test Equipment Digital Signalling Devices

Lab ID: Lab 1, Lab 2
Description: Signalling equipment for various wireless technologies.

Single Devices for Digital Signalling Devices

Single Device Name	Type	Serial Number	Manufacturer
Bluetooth Signalling Unit CBT CBT		100589	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2008/08/14 2011/08/13
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2009/02/16 2011/02/15
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	Hardware: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04 Software: K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22 Firmware: µP1 8v50 02.05.06 ---		2007/07/16

Test Equipment Emission measurement devices

Lab ID: Lab 1, Lab 2
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Emission measurement devices

Single Device Name	Type	Serial Number	Manufacturer
Personal Computer	Dell	30304832059	Dell
Power Sensor	NRV-Z1	836219/005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/10/20 2011/04/19
Powermeter	NRVS	836333/064	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2009/10/15 2011/10/14
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2009/12/03 2011/12/02

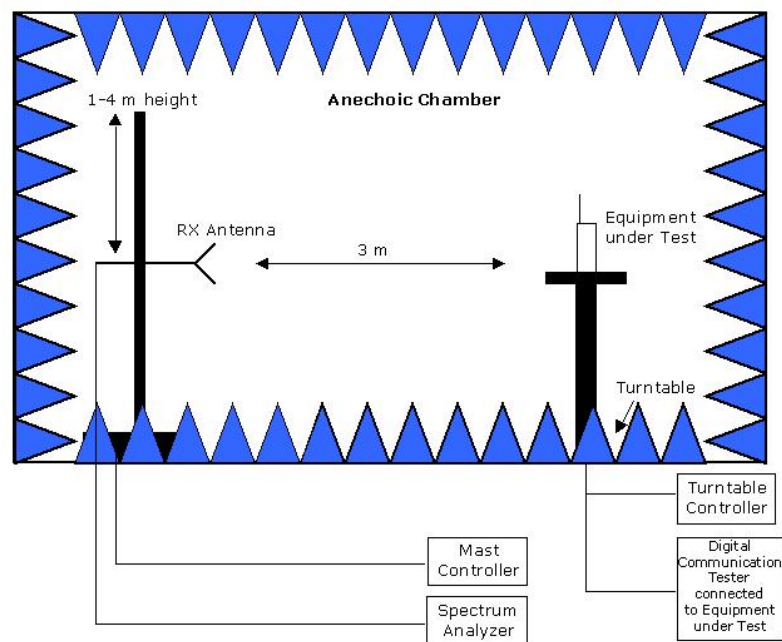
Test Equipment Shielded Room 02

Lab ID: Lab 1
Manufacturer: Frankonia
Description: Shielded Room for conducted testing
Type: 12 qm
Serial Number: none

5 Photo Report

Photos are included in an external report.

6 Setup Drawings



Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Drawing 1: Setup in the Anechoic chamber:
Measurements below 1 GHz: Semi-anechoic, conducting ground plane.
Measurements above 1 GHz: Fully-anechoic, absorbers on all surfaces

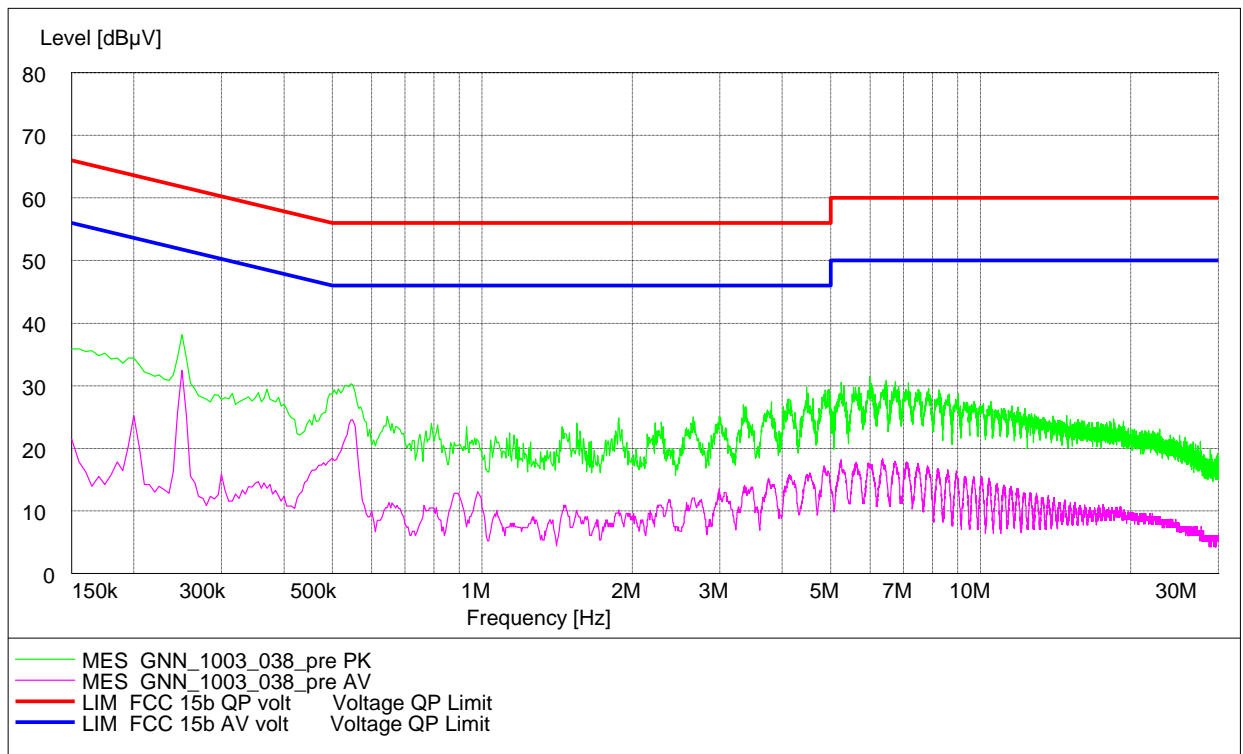
7 Annex measurement plots

7.1 AC Mains conducted

Op. Mode

op-mode 2

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 kHz	30.0 MHz	5.0 kHz	MaxPeak Average	20.0 ms	9 kHz	ESH3-Z5

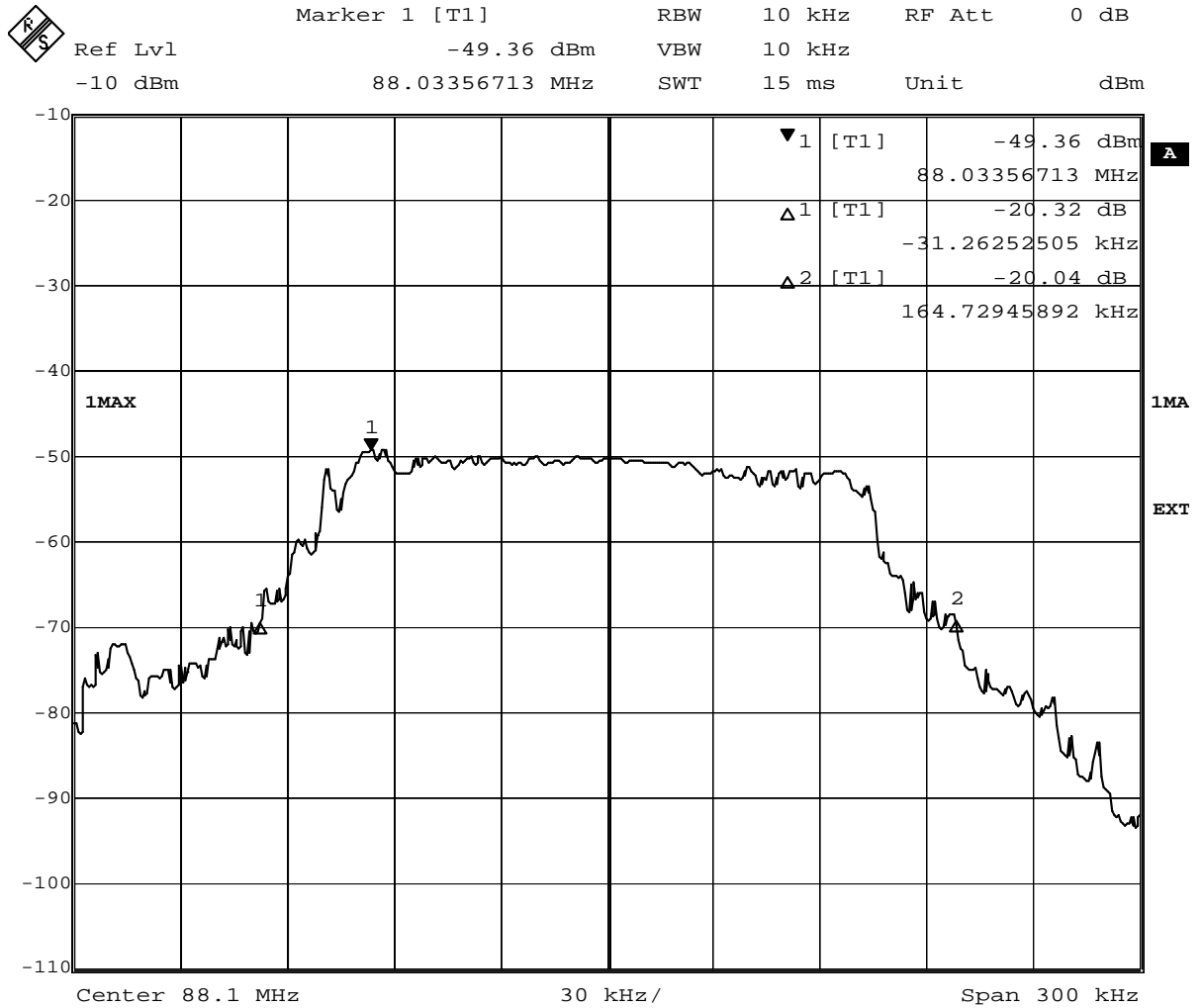


7.2 Occupied bandwidth

7.2.1 Occupied bandwidth operating mode 1

Op. Mode

op-mode 1




Date: 8.MAR.2011 10:25:13

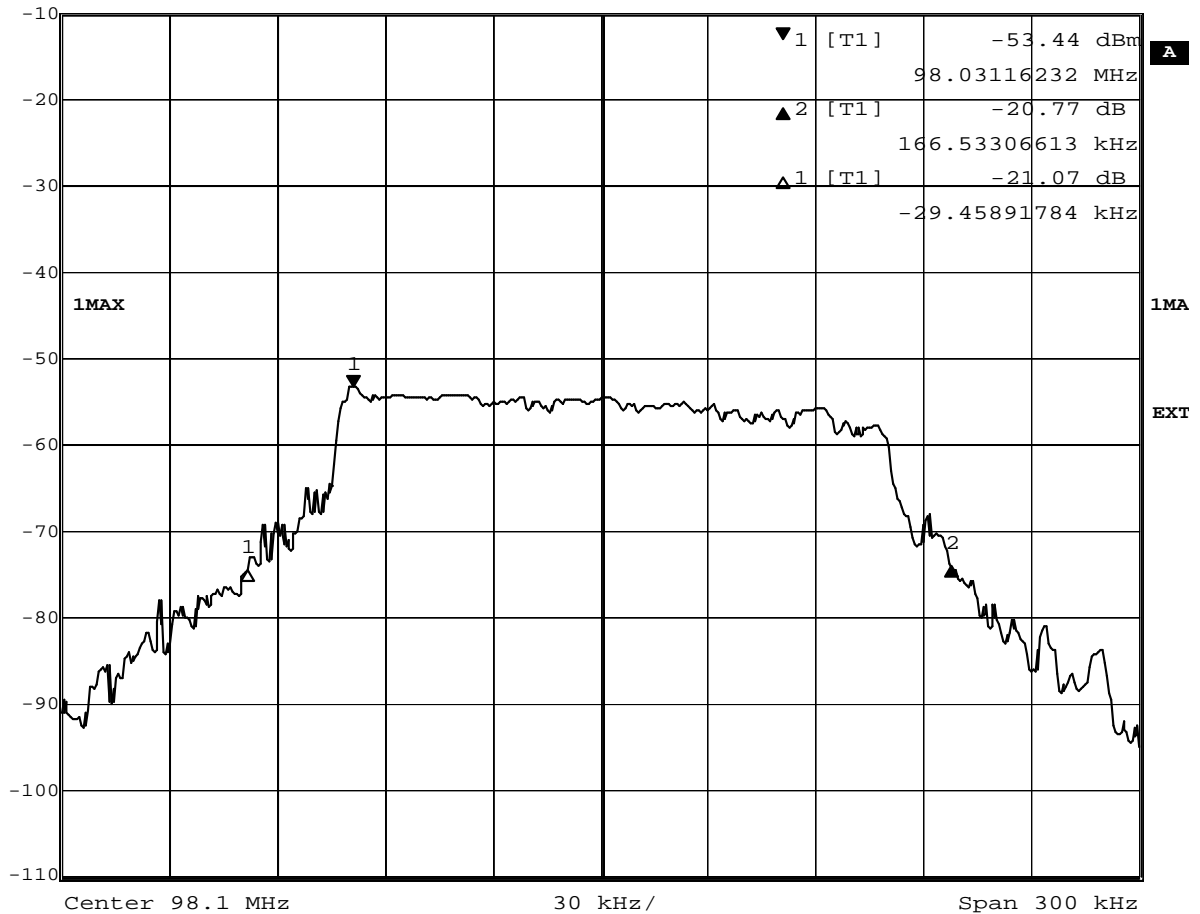
Note: This is a relative measurement and the power levels need not to represent correct values.

7.2.2 Occupied bandwidth operating mode 2

Op. Mode

op-mode 2

	Delta 2 [T1]	RBW	10 kHz	RF Att	0 dB
	Ref Lvl	-20.77 dB	VBW	10 kHz	
	-10 dBm	166.53306613 kHz	SWT	15 ms	Unit




Date: 8.MAR.2011 10:10:09

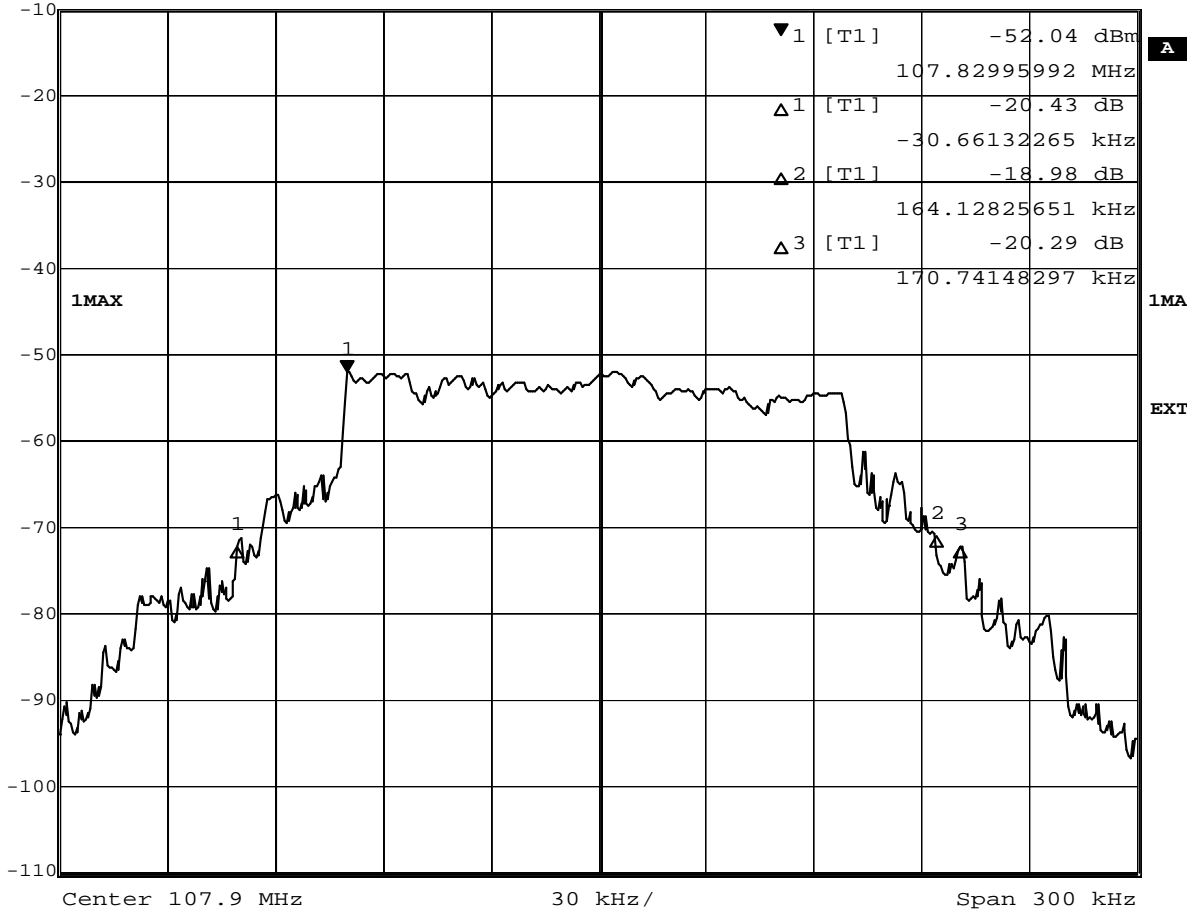
Note: This is a relative measurement and the power levels need not to represent correct values.

7.2.3 Occupied bandwidth operating mode 3

Op. Mode

op-mode 3

	Marker 1 [T1]	RBW	10 kHz	RF Att	0 dB
	Ref Lvl	-52.04 dBm	VBW	10 kHz	
	-10 dBm	107.82995992 MHz	SWT	15 ms	Unit



Date: 8.MAR.2011 10:29:55

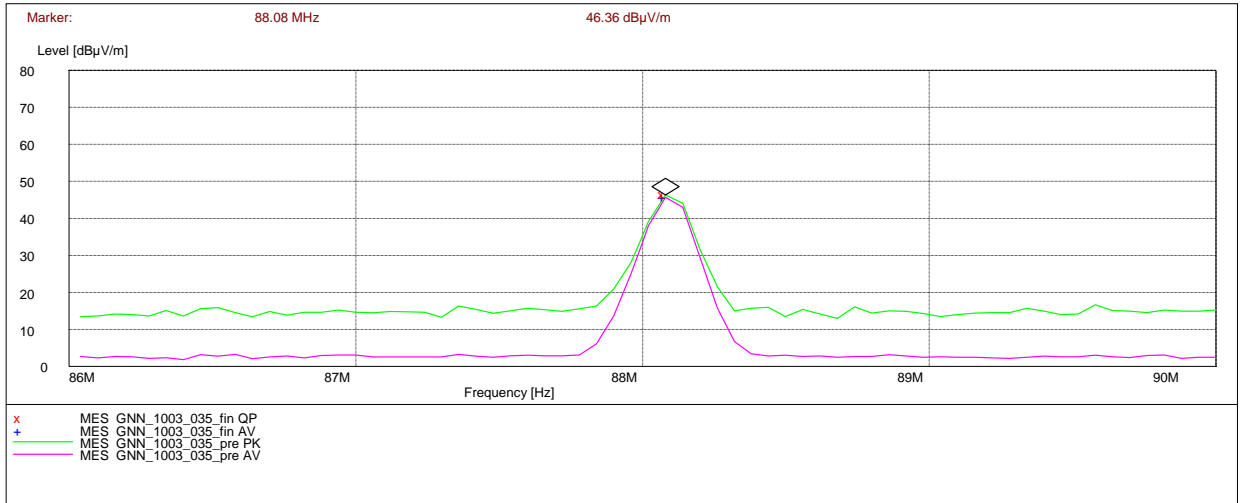
Note: This is a relative measurement and the power levels need not to represent correct values.

7.3 Peak power output

7.3.1 Peak power output operating mode 1

Op. Mode

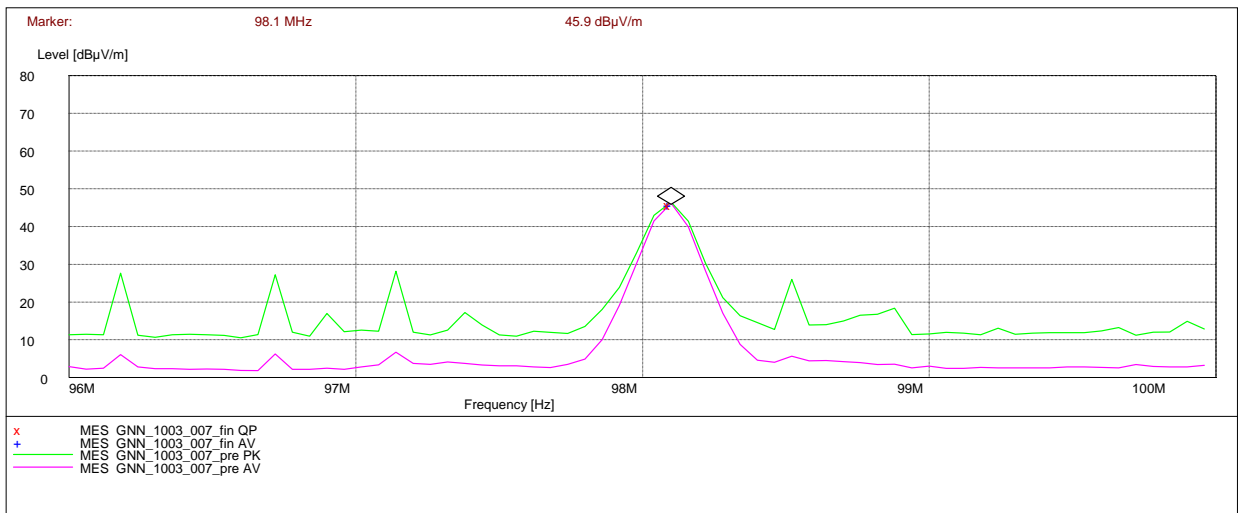
op-mode 1



7.3.2 Peak power output operating mode 2

Op. Mode

op-mode 2

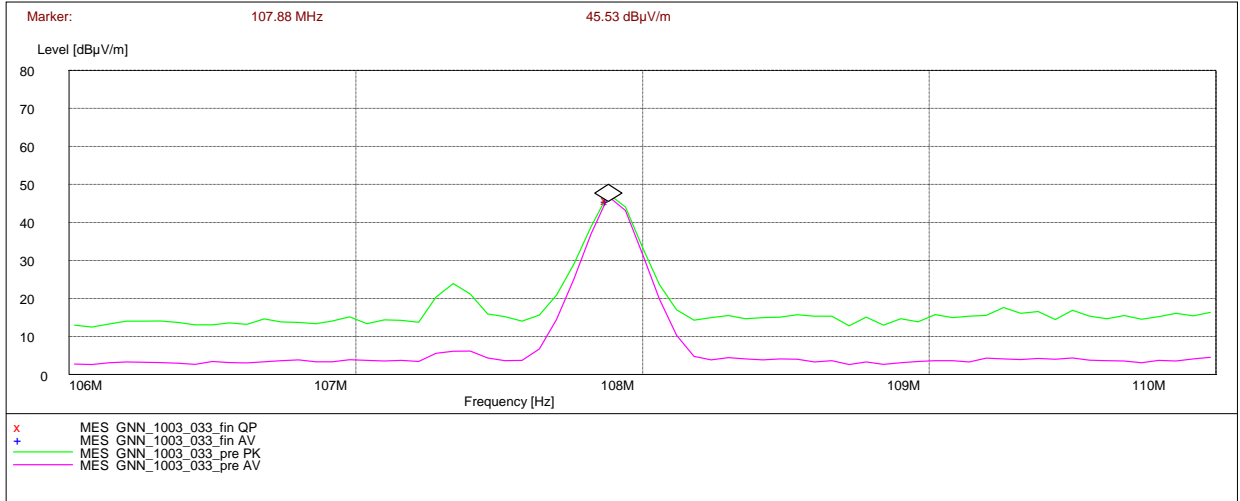




7.3.3 Peak power output operating mode 3

Op. Mode

op-mode 3

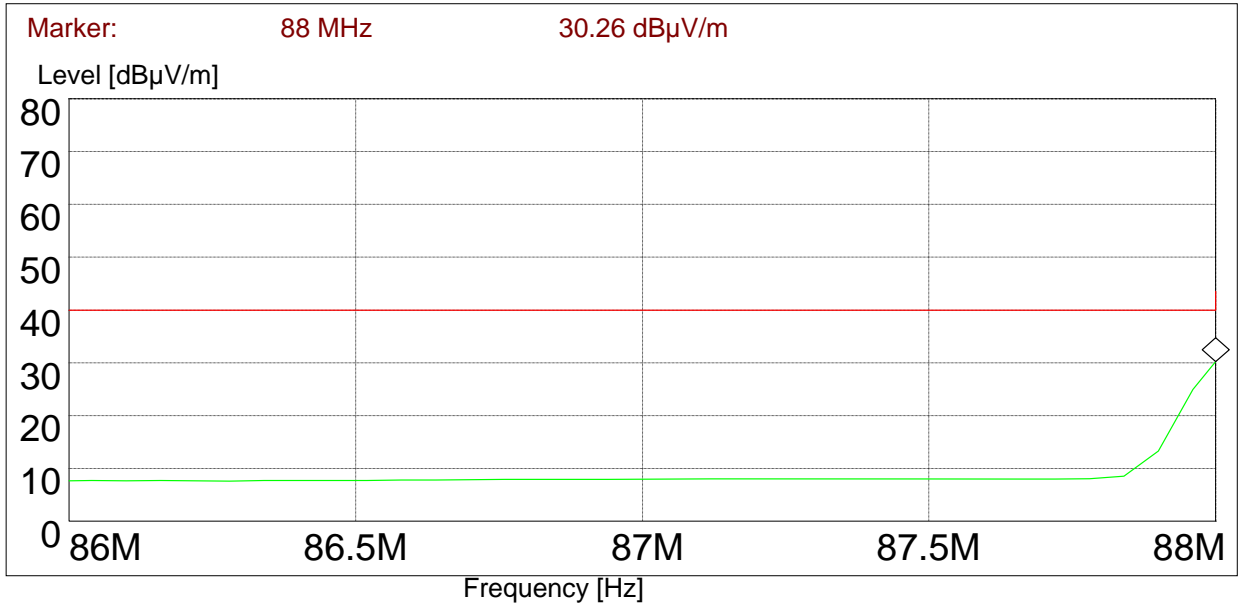


7.4 Band edge compliance

7.4.1 Band edge compliance operating mode 1

Op. Mode

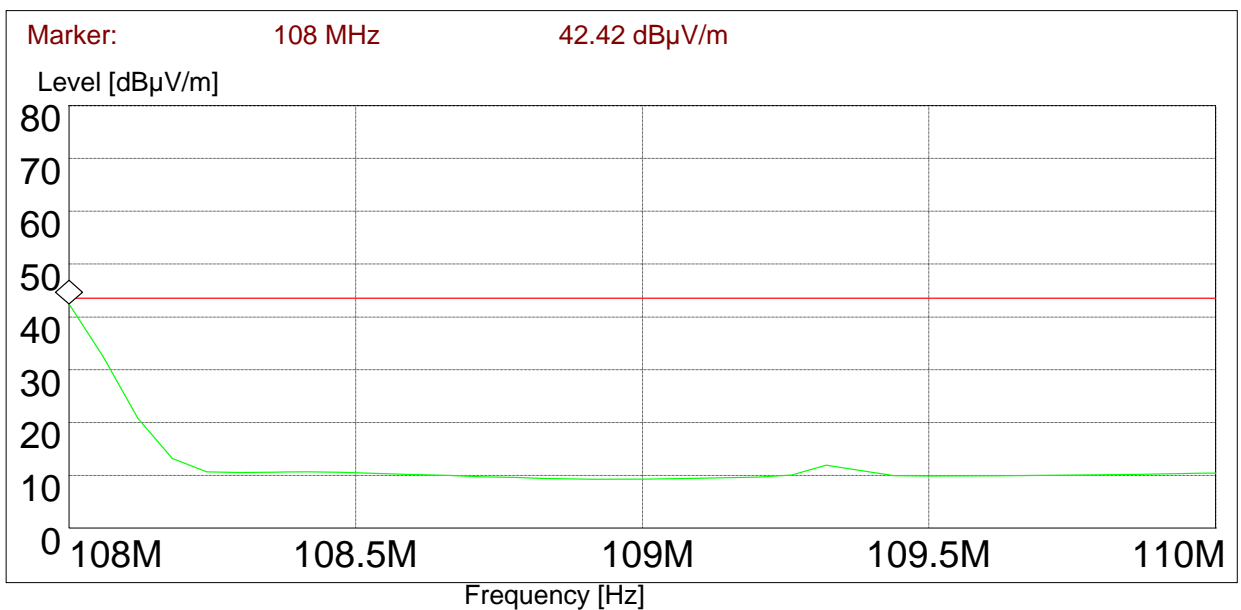
op-mode 1



7.4.2 Band edge compliance operating mode 3

Op. Mode

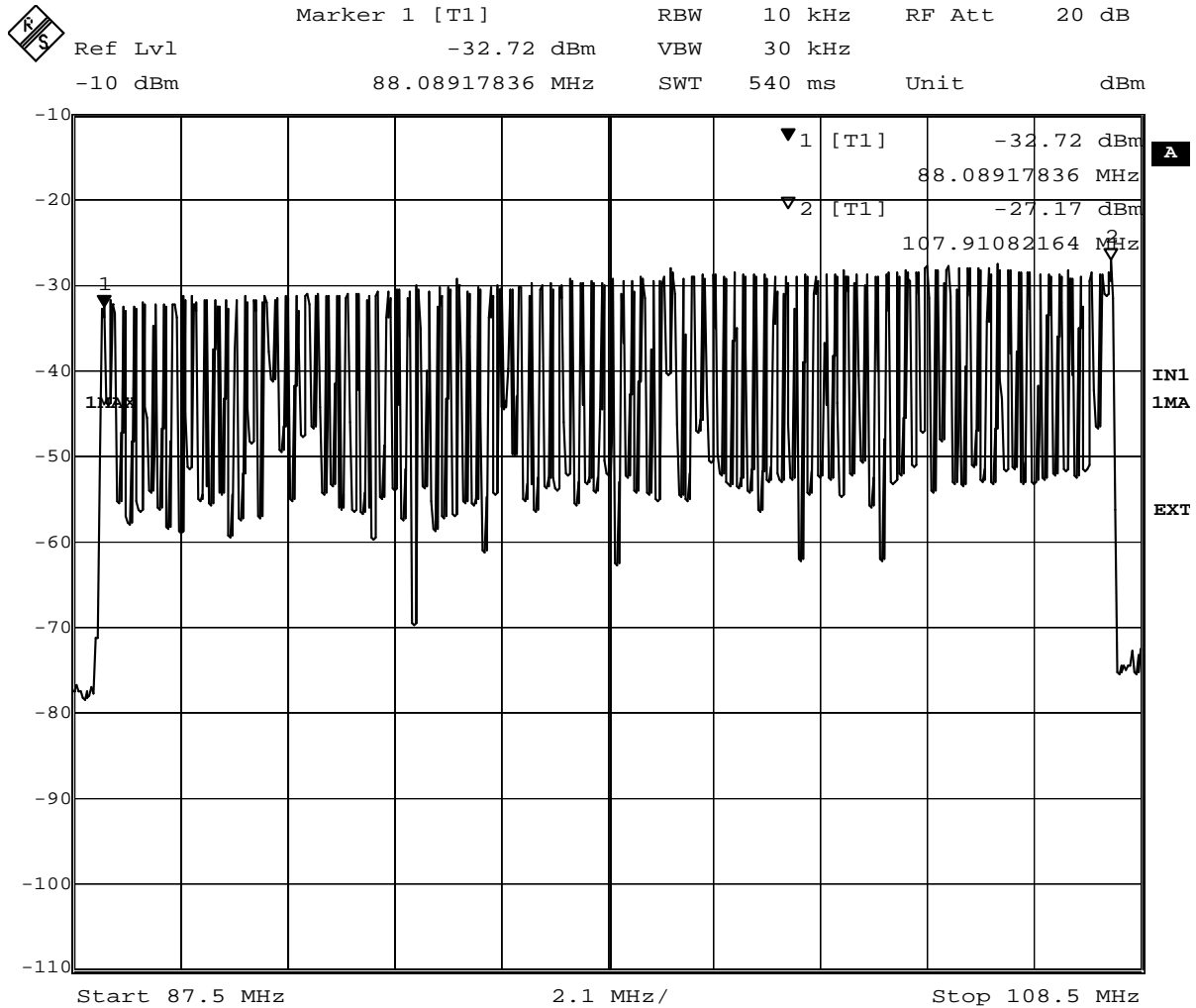
op-mode 3



7.5 Tuning range of FM transmitter

Op. Mode

op-mode 4



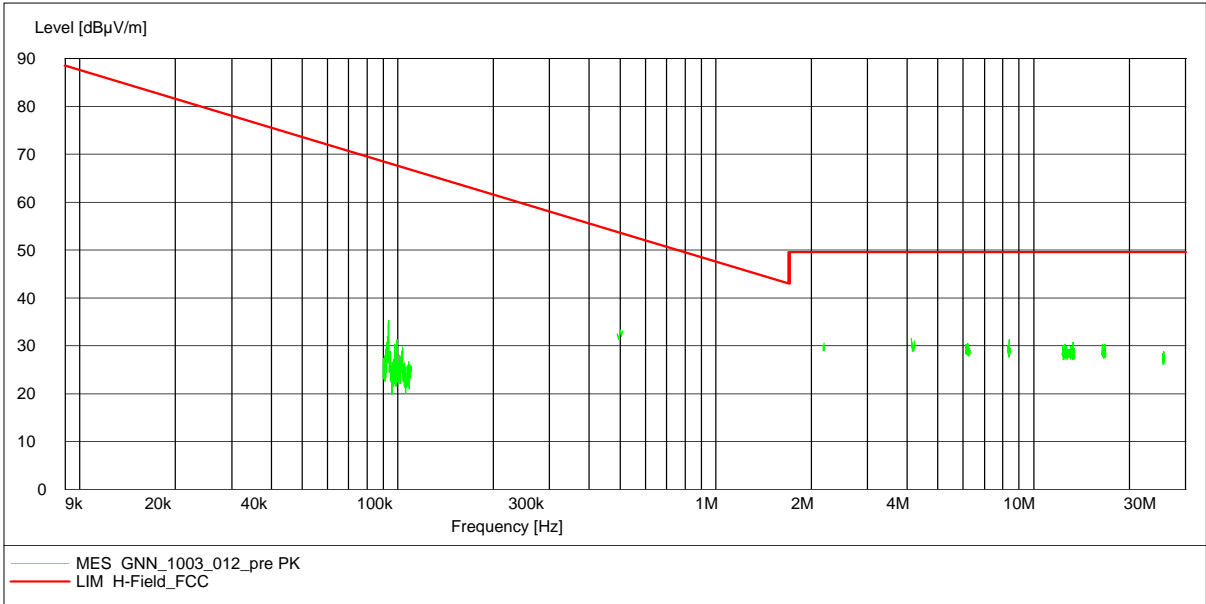
Date: 22.FEB.2011 16:49:42

Note: This is a relative measurement and the power levels need not to represent correct values.

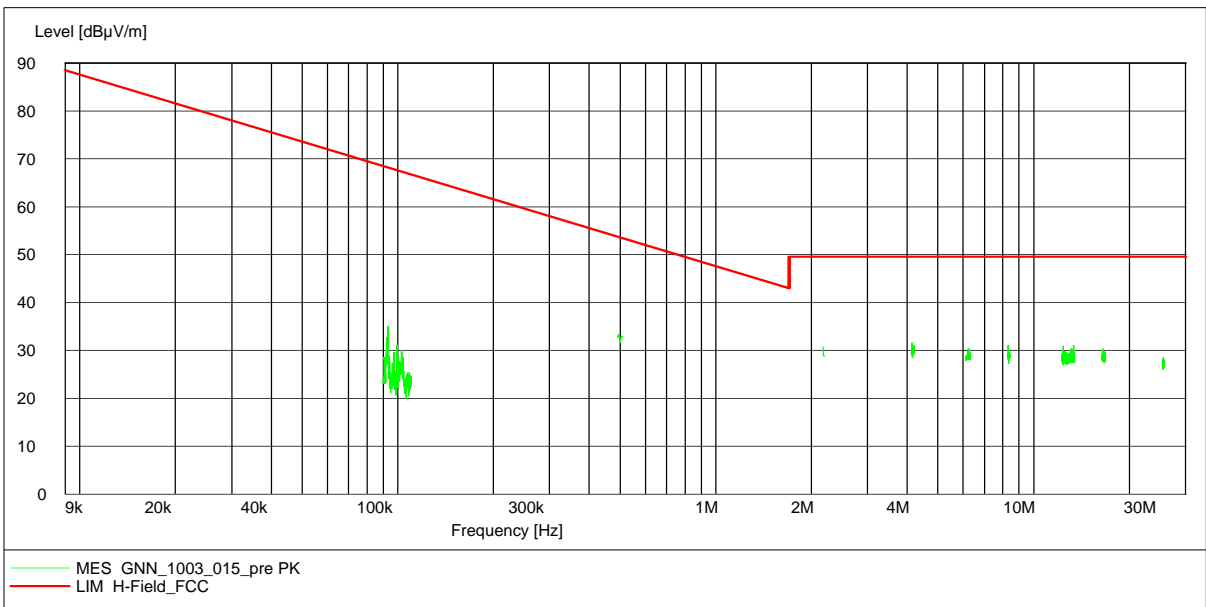
7.6 Radiated emissions (f < 30 MHz)

Op. Mode

op-mode 2



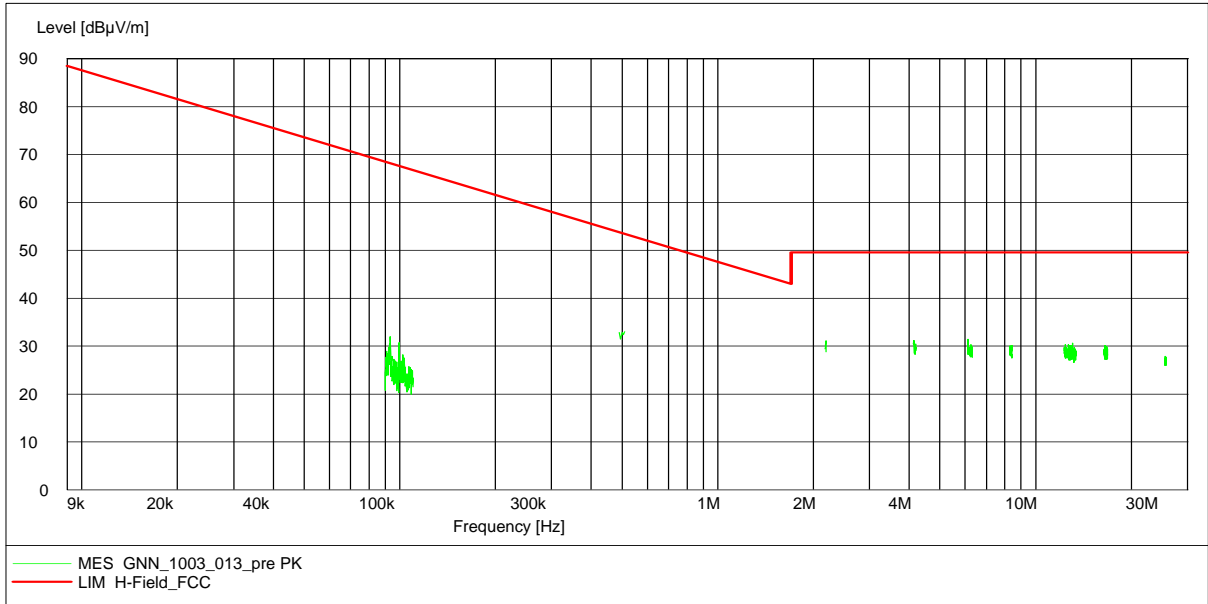
Antenna position 90°
EUT position front side



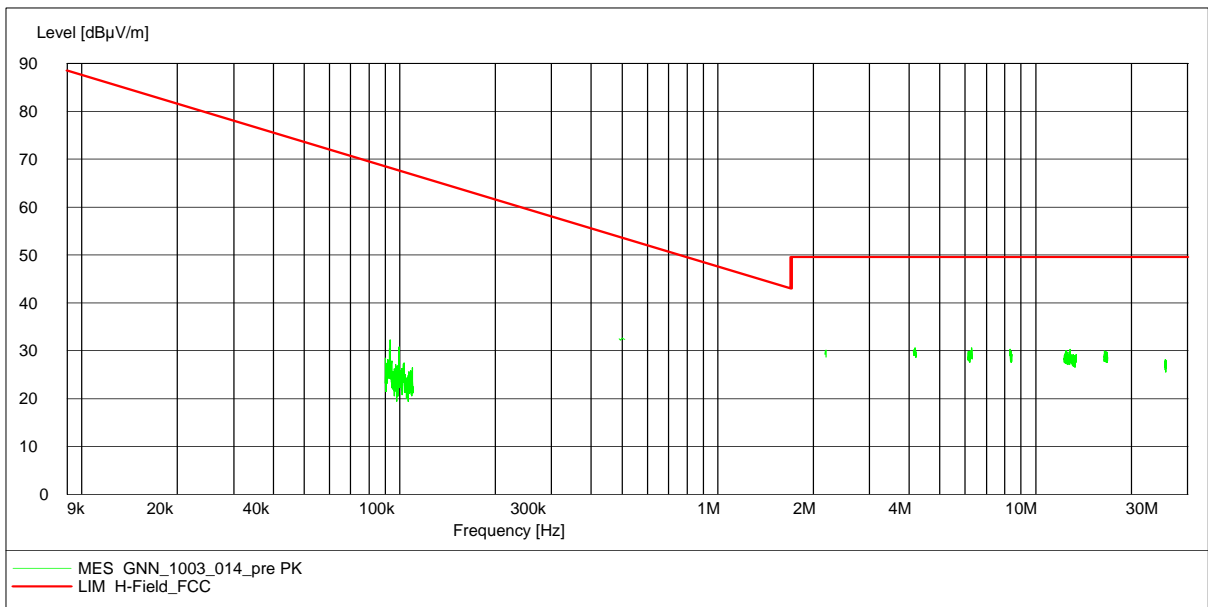
Antenna position 90°
EUT position right side

Op. Mode

op-mode 2



Antenna position 0°
EUT position front side

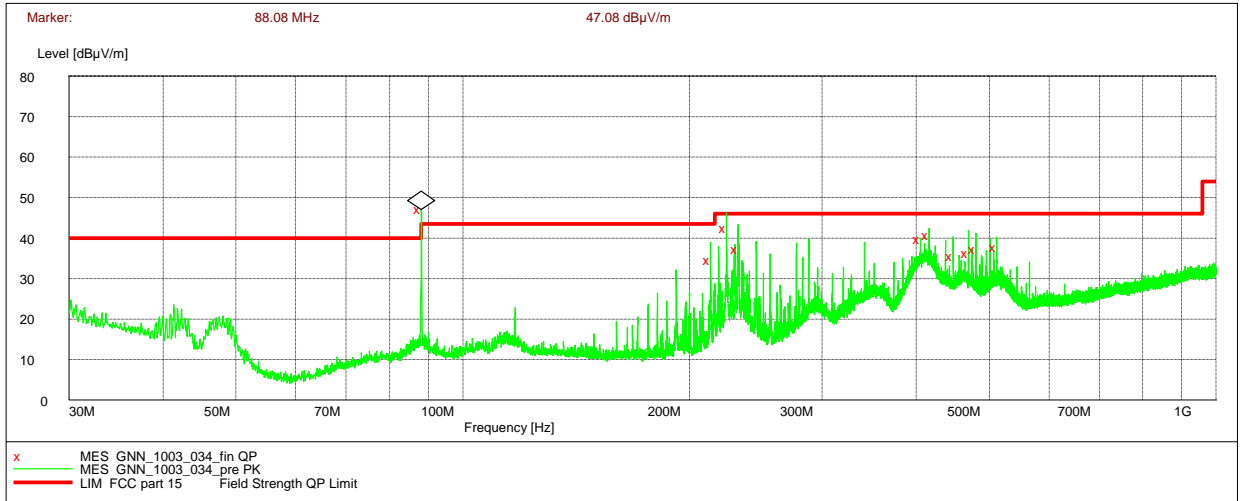


Antenna position 0°
EUT position right side

7.7 Radiated emissions (f > 30 MHz)

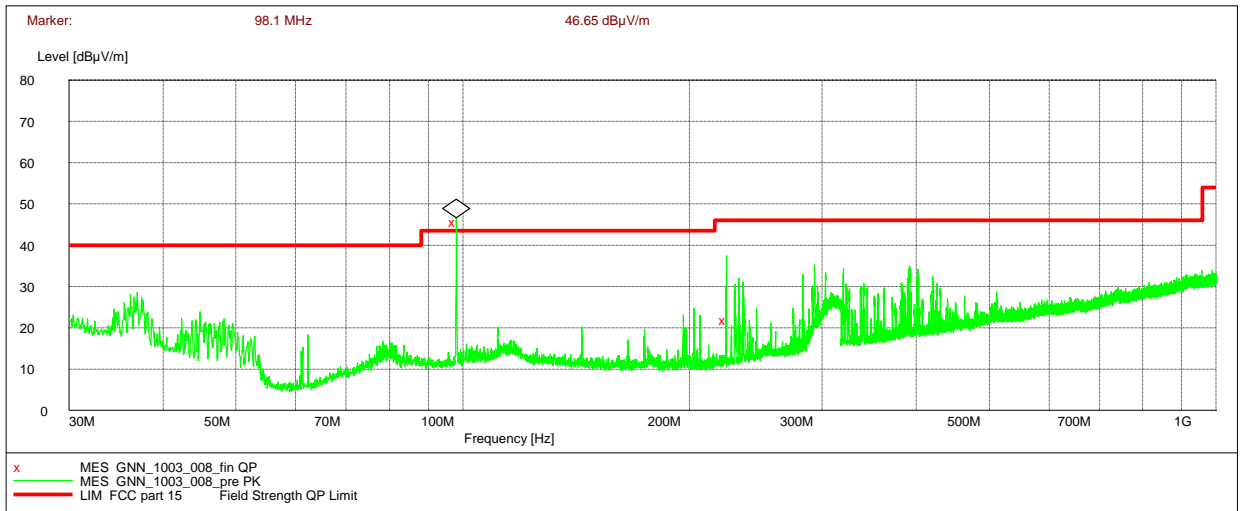
Op. Mode

op-mode 1



Op. Mode

op-mode 2



Op. Mode

op-mode 3

