

Test Report



Emission tests to FCC and IC requirements of HA03

Performed for Intermatic Inc.

DANAK-197369

Project no.: E501839-1

Page 1 of 13

4 annexes

5 March 2004

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Title Emission tests to FCC and IC requirements of HA03

Test object HA03

FCC ID DGZH0003

IC ID 4898A-H0003

Report no. DANAK-197369

Project no. E501839-1

Test period 12 February 2004 to 1 March 2004

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Specifications FCC: 47 CFR Part 15, Subpart C - Intentional Radiators
47 CFR Part 15, Subpart B class B verification
IC: RSS-210 LPD Category I equipment
ICES-003 class B verification

Results The equipment under test was in compliance with the requirements.

Test personnel Henrik Nielsen
Karsten Kruse Jensen

Date 5 March 2004

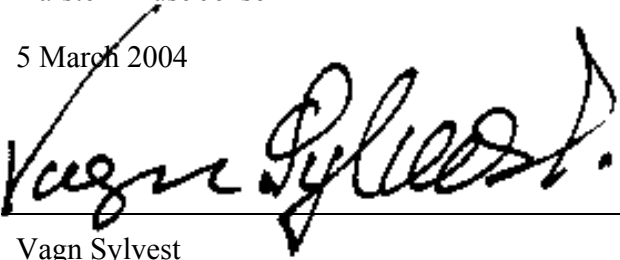
Responsible 
Vagn Sylvest
Project Manager - EMC
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1. Summaries

1.1 Technical report summary

This report contains measurement data from tests performed at DELTA, Hørsholm, Denmark, authorized as DANAK accredited test laboratory. The laboratory is listed at FCC under registration number 90529 and by Industry Canada under file IC 41875-5.

USA

The tests reported in this document have been performed to demonstrate compliance with the requirements of FCC Part 15C, Section 15.249 "Rules for transmitters in band 902 - 928 MHz (and more bands)".

Furthermore, during the tests it was verified that the receiver, and control logic of the unit, was in compliance with the requirements of FCC Part 15B, Section 15.109 Class B.

Canada

Also, the tests reported in this document have been performed to demonstrate compliance with the requirements of RSS-210 covering LPD Class I equipment.

Furthermore, during the tests it was verified that the control logic of the unit, was in compliance with the requirements of ICES-003, Section 5.5, Class B.

1.1.1 Applicable FCC rules for test

47 CFR Part 15, Subpart C - Intentional Radiators

- §15.207 Conducted limits
- §15.209 Radiated emission limits, general requirements
- §15.215 Additional provisions to the general radiated emission limitations
- §15.249 Operation within the bands 902 - 928 MHz, (and more bands).

The methods and procedures have been applied as specified in:

- §15.31 Measurements standards.

This point to the following procedure, used during the measurements in this report:

ANSI C63.4:2001 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

Furthermore, the requirements of the following have been applied:

- § 15.33 Frequency range of radiated measurements
- § 15.35 Measurement detector functions and bandwidths.

1.1.2 **Applicable Industry Canada rules for test**

RSS-210 LPD Class I equipment.

The methods and procedures have been applied as specified in:

5.3 Testing methods

6.2.1 General field strength limits

6.2.2 (m2) 902 - 928 MHz, (and more bands)

5.17 Digital circuits.

RSS-212 Test Facilities and Test Methods for Radio Equipment.

This point to the following procedure, used during the measurements in this report:

ANSI C63.4:1992 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.2 Summary of tests

The results of the emission tests can be summarised as follows:

Tests of Intentional Radiator	FCC Part 15 Subpart C	IC RSS-210
Conducted emission, AC mains	Passed	Passed
Radiated electromagnetic field emission	Passed	Passed
Radiated emission limits, additional provisions	Passed	N/A
Emission in restricted bands	Passed	Passed

Abbreviations

Passed	:	The requirements are met.
Failed	:	The requirements are not met.
Not done	:	No test was performed.
N/A	:	Not applicable.
Not relevant	:	The test was not relevant for the test object.

The test results relate only to the object tested.

2. Test specimen

The EUT is part of a control system.

HA03 Plug-In Indoor Lamp Dimmer Module - 300W

300W triac-type plug-in module utilizing RF signals to communicate control and status information to and from a primary controller and/or other secondary controllers. Device is used to control the ON & OFF switching & dimming of loads for incandescent lamps plugged into the module.

2.1 Test object - HA03

Category	SRD
Manufacturer	Intermatic Inc.
Model / type	HA03
Part no.	Tx Car – Rx - TxMod
Serial no.	-
FCC ID	DGZH0003
IC ID	4898A-H0003
Supply voltage	120 VAC 60 Hz
Operational mode	TX/RX Load commanded OFF.

Photo of EUT:



3. General test conditions

3.1 Test set-up

The antenna of the EUT module is an internal wire antenna.

The EUT is configured to transmit un-modulated carrier during spurious emission tests and carrier level tests.

The module was also tested in receive-only mode to verify compliance with CFR47 Part 15 and RSS-210. The test record sheets are included in this report.

In this way, three modules were used. One module was in Tx-only mode with constant un-modulated carrier. One module in Rx-only mode and a third programmed to constant transmission at maximum data rate of 9.6 kbits using frequency shift keying with a separation of 40 kHz. This was used to test occupied bandwidth.

In some cases more modules were tested at the same time. This was done where the set-up would give worst-case measurement data.

4. Test and results

4.1 Conducted emission, AC mains (FCC Part 15, Subpart C)

	Requirements	
Specification	FCC Rules and Regulations Part 15, Subpart C	
Test set-up	ANSI C63.4:1992	
Frequency range	0.15-30 MHz	
Limit: (quasi-peak)	Quasi-peak	Average
0.15-0.5 MHz	66-56 Decreases with log of freq.	56-46 Decreases with log of freq.
0.5-5 MHz	56	46
5-30 MHz	60	50
Test set-up	<i>Annex 2</i>	
Test record sheets	<i>Annex 3</i>	

Results

The module in Rx mode and in Tx mode is in compliance with the requirements.

Comments

The module was supplied from 120 VAC 60 Hz. Load was commanded OFF.

4.2 Radiated electromagnetic field (FCC Part 15, Subpart C)

	Requirements	
Specification	FCC Rules and Regulations Part 15, Subpart C IC Radio Standard Specification RSS-210, Class I equipment	
Test set-up	ANSI C63.4:1992/2001	
Measuring distance	3 m	
Frequency range	30-10.000 MHz	
Limits: As specified in 15.209(a)	30-88 MHz: 88-216 MHz: 216-960 MHz: Above 960 MHz:	40 dB μ V/m 43.5 dB μ V/m 46 dB μ V/m 54 dB μ V/m
Measurement uncertainty (2 σ) <1 GHz	2.6 dB	
Measurement uncertainty (2 σ) >1 GHz	4.9 dB	
Below 1 GHz the limits apply to measurements performed using a quasi-peak detector. Above 1 GHz the limits apply to measurements of spurious emission performed with an average detector. Furthermore, the peak level must be no higher than 20 dB above the average limit.		
Test set-up	<i>Annex 2</i>	
Test record sheets	<i>Annex 3</i>	

During exploratory radiated emission measurements all three orthogonal planes - X, Y and Z - are investigated. The final measurements are performed in worst-case position.

The module was also tested in receive-only mode to verify compliance with CFR47 Part 15 and RSS-210. The test record sheets are included in this report.

If for a frequency band only plots from one polarisation have been included, this will be the worst case plot.

On plots from the R&S receiver, found as A4-portrait plots, statements like "Ant 1 m vertical" or "4 m horizontal" indicate the elevation of the antenna during exploratory measurements. Scans are performed at both heights, but both are possibly not included.

Measurements 1 - 2.75 GHz were performed using an R&S test receiver. The tabulated values on the plot are the measured average values using a resolution bandwidth of 1 MHz.

Plots from 2.75 - 10 GHz are spectrum analyser plots in peak-hold mode. Peak-to-Average factor is established to be 0 dB, because un-modulated carrier is transmitted. Therefore, AVG emission values are 0 dB lower than the values indicated on the spectrum analyser plots.

Results: The emission was within the specified limits.

Spurious emission 30-1000 MHz in tabular form: (For spectral plots see *Annex 3*)

Spurious freq. MHz	Polarisation	QPeak dB μ V/m	dB below QP limit	Note
169.67	V	28.1	15.4	R-FCC
199.18	H	30.5	13.0	-
287.7	H	33.8	12.2	-
449.98	V	37.5	8.5	-
479.49	V	38.8	7.2	-
908.27	V	43.0	3.0	Rx LO

(R-FCC) means frequency in restricted band as defined in §15.205.

(R-IC) means frequency in restricted band as defined in RSS-210, 6.3.

Spurious emission 1 GHz to 10 GHz in tabular form: (For spectral plots see *Annex 3*).

Spurious freq. MHz	Polarisation	Peak dB μ V/m	Average dB μ V/m	dB below peak limit	dB below average limit	Note
1816.54	V	41.6	41.6	32.3	12.3	Rx LO 2 nd harm.
1816.84	V	49.1	49.1	24.8	4.8	Sheet 39 *) Tx 2 nd harm.
2725.26	V	40.9	40.9	33.0	13.0	R-FCC R-IC Rx LO 3 rd harm.
2725.81	H	40.5	40.5	33.4	13.4	R-FCC R-IC Tx 3 rd harm.
3620.4	H+V	42.5	42.5	31.4	11.4	R-FCC R-IC 4 th harm.

*) On sheet 37 another HA09 transmitter was active at the same frequency. This is rectified on sheet 39.

(R-FCC) means frequency in restricted band as defined in §15.205.

(R-IC) means frequency in restricted band as defined in RSS-210, 6.3.

Average limit is 500 $\mu\text{V}/\text{m}$ or 54 $\text{dB}\mu\text{V}/\text{m}$.

Peak limit is 20 dB above average limit or 74 $\text{dB}\mu\text{V}/\text{m}$.

Comments

Measurements of spurious emission performed with CW carrier.

Measurements 30 - 1000 MHz are performed using a test receiver with quasi peak detector.

Measurements 1 GHz to 2.75 GHz are performed using a test receiver with average detector and 1 MHz bandwidth.

Measurements above 2.75 GHz are performed using a spectrum analyser in peak hold mode. Average measurements are performed on spurious emission exceeding the average limit, when measured in peak hold mode.

The average level is determined using one of the following procedures:

- a) R&S Receiver 1000 – 2750 MHz. An average detector is applied.
- a) Spectrum analyser 2.75 – 10 GHz. Measuring the signal using RBW 1 MHz and VBW 10 Hz, and using linear level axis.

4.3 Peak output field strength

The peak output field strength of the unit is limited to 50 mV/m , or 94 $\text{dB}\mu\text{V}/\text{m}$, following §15.249(a) and RSS-210 6.2.2(m2). Measurements show:

Peak output field strength: 92.5 $\text{dB}\mu\text{V}/\text{m}$ at the frequency 908.42 MHz.

The carrier frequency cannot be tuned.

See plot Sheet 19 in *Annex 4*.

The EUT is in compliance with the requirement with a margin of 1.5 dB.

4.4 Occupied bandwidth

The lower band limit is 902 MHz and the upper band limit is 928 MHz.

The nominal carrier frequency of the module is 908.42 MHz

The occupied bandwidth expressed as the bandwidth at -20 dBc.

The limits of the transmission band are reached, when only spurious emission can be measured.

In *Annex 4* the occupied bandwidth is obtained, using 10 kHz resolution bandwidth.

Occupied bandwidth:

At -20 dBc: 0.171 MHz measured in 10 kHz bandwidth.

At spurious limit: The carrier is well below spurious level at the band edges of 902 MHz and 928 MHz as shown by plot 19 in *Annex 4*.

The EUT is in compliance with the requirement(s).

Annex 1

List of instruments

(1 page)

NO.	DESCRIPTION	MANUFACTURER	TYPE NO.	CAL. EXPIRES
29337	ARTIFICIAL MAINS NETWORK	ROHDE & SCHWARZ	ESH2-Z5	2004-10-02
29680	IMPULSE VOLTAGE LIMITER	ROHDE & SCHWARZ	ESH3/Z2	2004-12-30
29797	BILOG ANTENNA, 30-1000 MHz	CHASE ELECTRICS LTD	CBL 6111A	2005-11-20
29861	EMI-SOFTWARE Ver. 1.60	ROHDE & SCHWARZ	ES-K1, PART: 1026.6790.02	ONLY CAL. IF REQUIRED
29876	RIDGED GUIDE HORN ANTENNA, 1-12.75 (18) GHz	EMCO	3115	2005-02-11
29916	AUTOMATIC TEST RECEIVER, 9 kHz - 2.75 GHz	ROHDE & SCHWARZ	ESCS 30 1102.4500.30	2005-01-02
49037	BROADBAND MICROWAVE PREAMPLIFIER, 1-12.8 GHz	MITEQ / DELTA	AMF-5D-001128-35- 11P	2004-11-04
49097	MICROWAVE HP FILTER 2.75-12.75 GHz, MAX. 2 W	MICRO-TRONICS	HPM13106	2004-10-30
49306	"CABLE#52", LOW-LOSS uWAVE CABLE, N-N, 8.0 m "EMI"	SUHNER	SUCOFLEX 104 PB	2004-09-10
49307	"CABLE#53", LOW-LOSS uWAVE CABLE, N-N, 7.0 m "EMI"	SUHNER	SUCOFLEX 104 PB	2004-09-10
49321	SPECTRUM ANALYZER, 50GHz	HEWLETT-PACKARD	8565E	2004-12-29

Annex 2
Photos
(2 pages)



Photo 1 Set-up for conducted emission measurements.
The LISN is bonded to the vertical ground plane (wall) of the screened room.

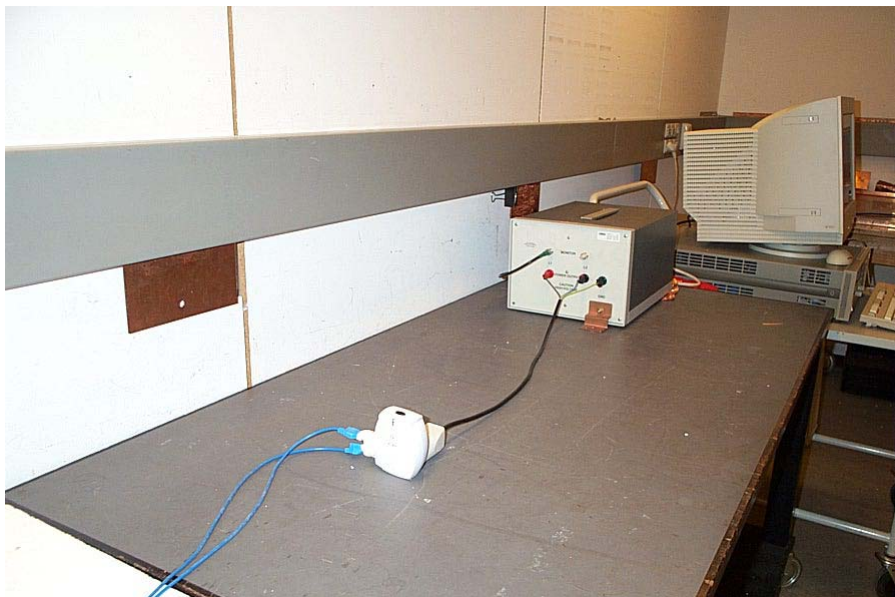


Photo 2 Set-up for conducted emission measurements.
The LISN is bonded to the vertical ground plane (wall) of the screened room.

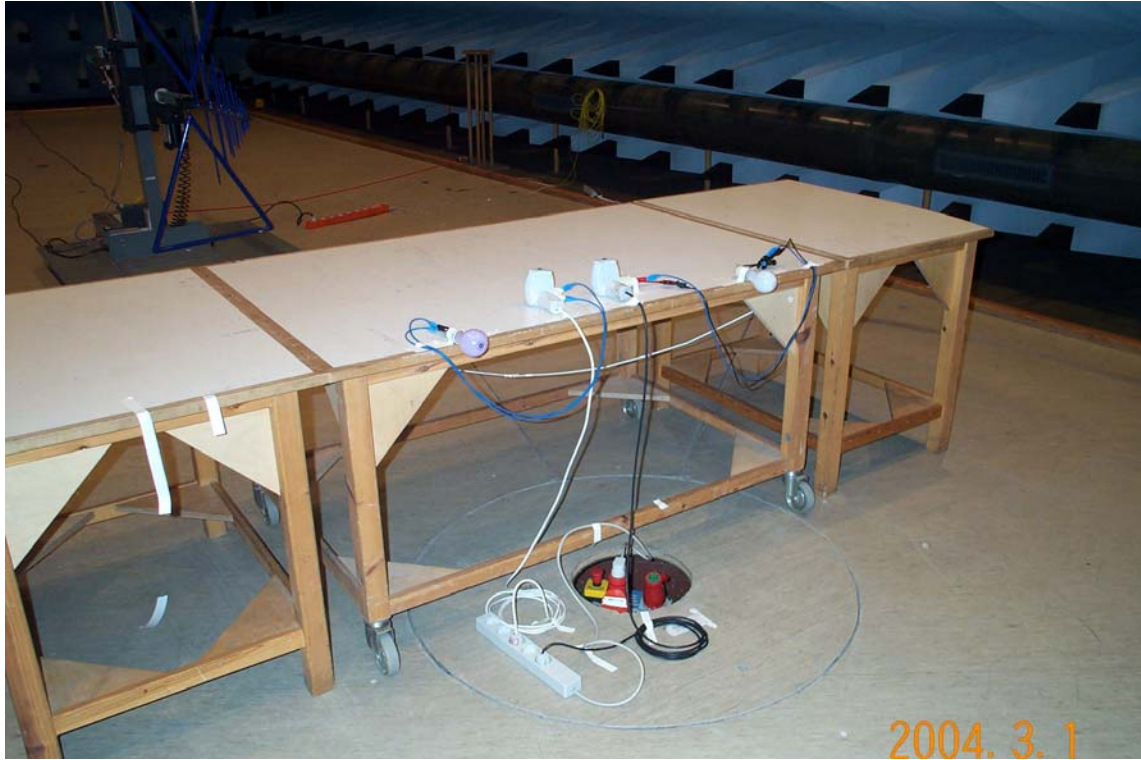


Photo 3 Set-up for measurements 30 – 1000 MHz. Date is 2004-02-12. Camera time is faulty.

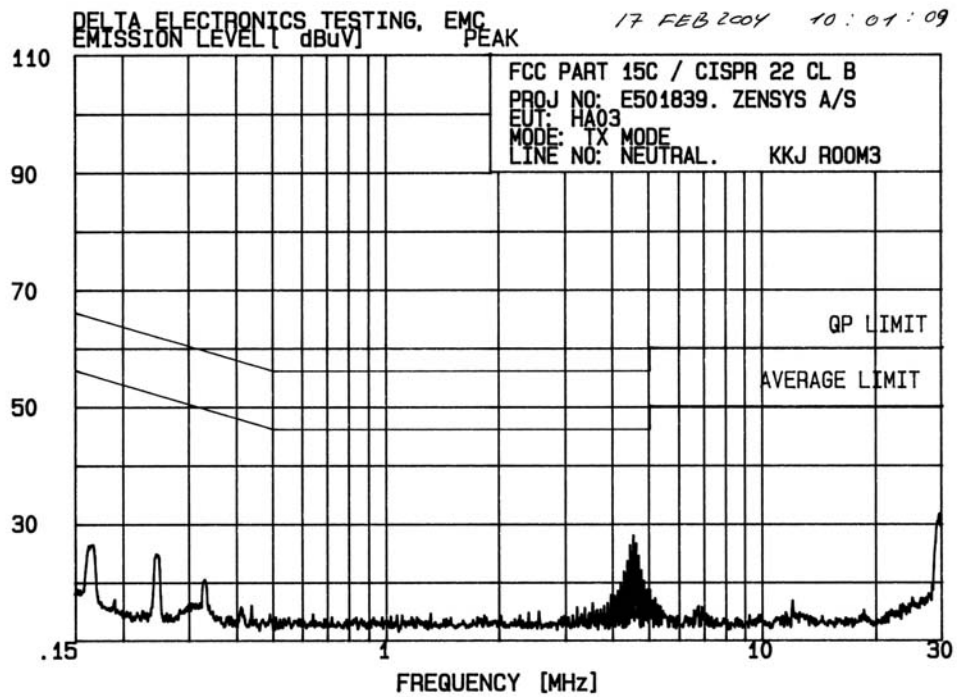
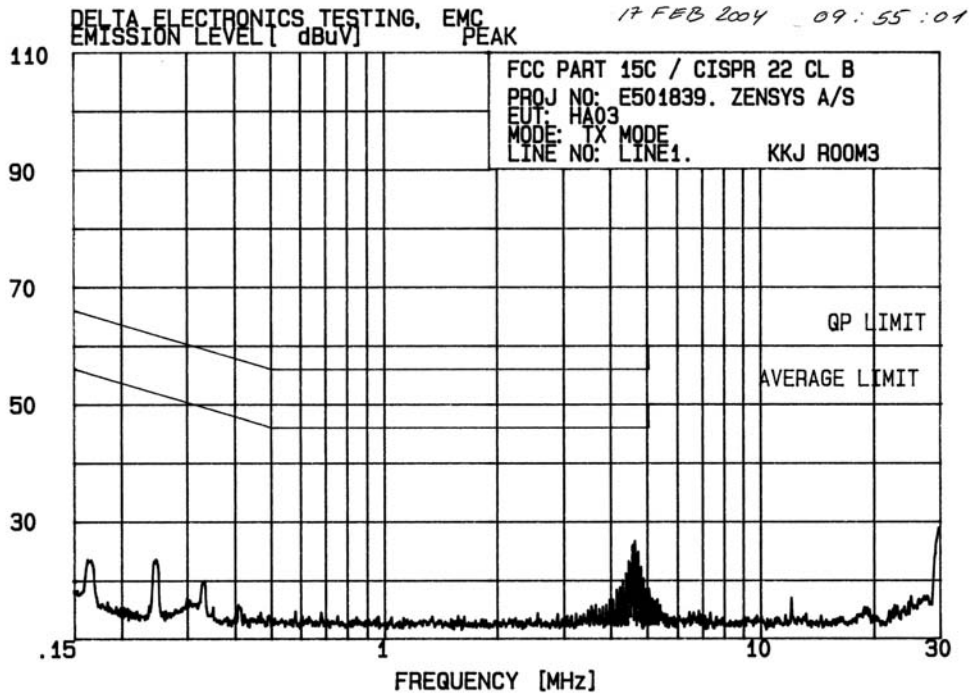


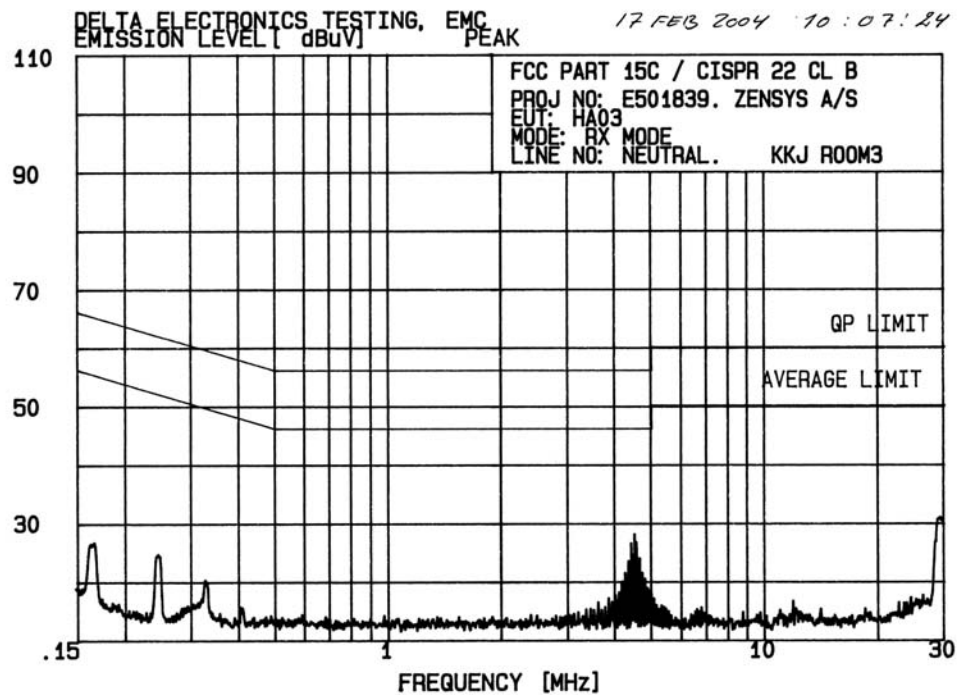
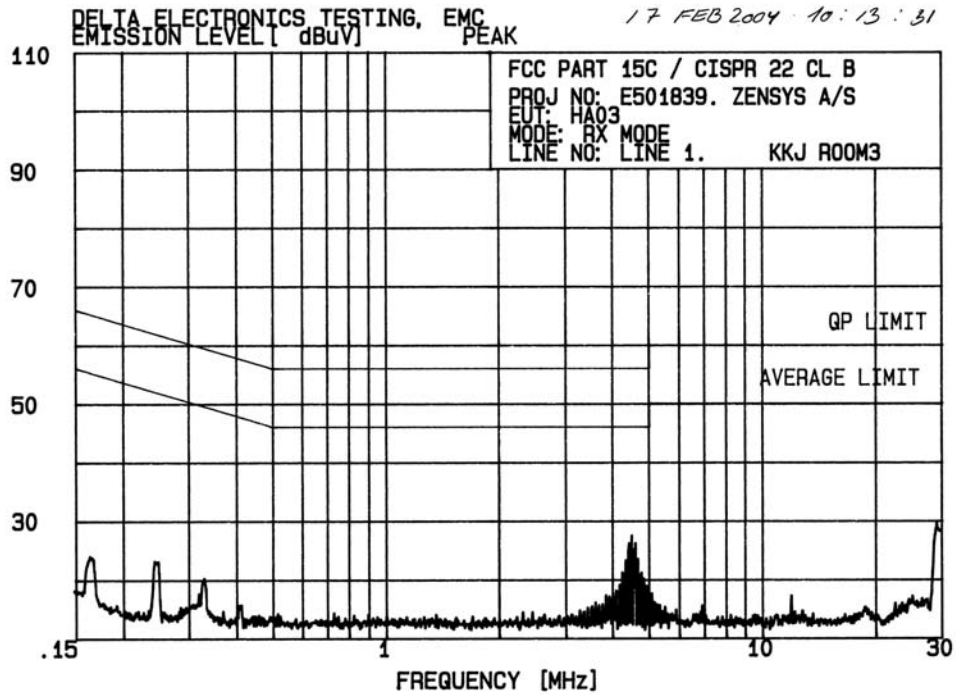
Photo 4 Measurement set-up > 1 GHz.

Annex 3

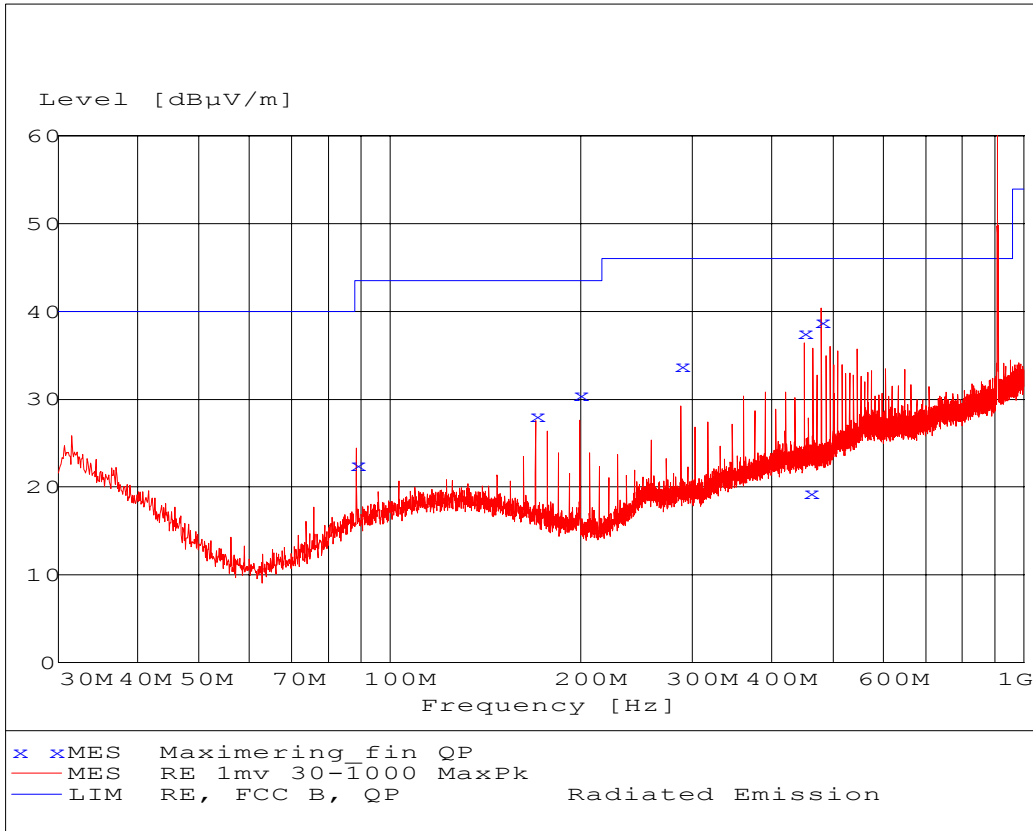
Test record sheets regarding conducted and radiated emission

(7 pages)





EUT: HA03. TX mode and HA03 RX mode
 Manufacturer: Zensys
 Operating Condition: Ant. 1 vertical
 Test Site: EMC-5
 Operator: KKJ - E501839
 Test Specification: FCC 15 B. FCC 15 C. RSS 210
 Comment: Sheet 20
 Start of Test: 2004-02-12

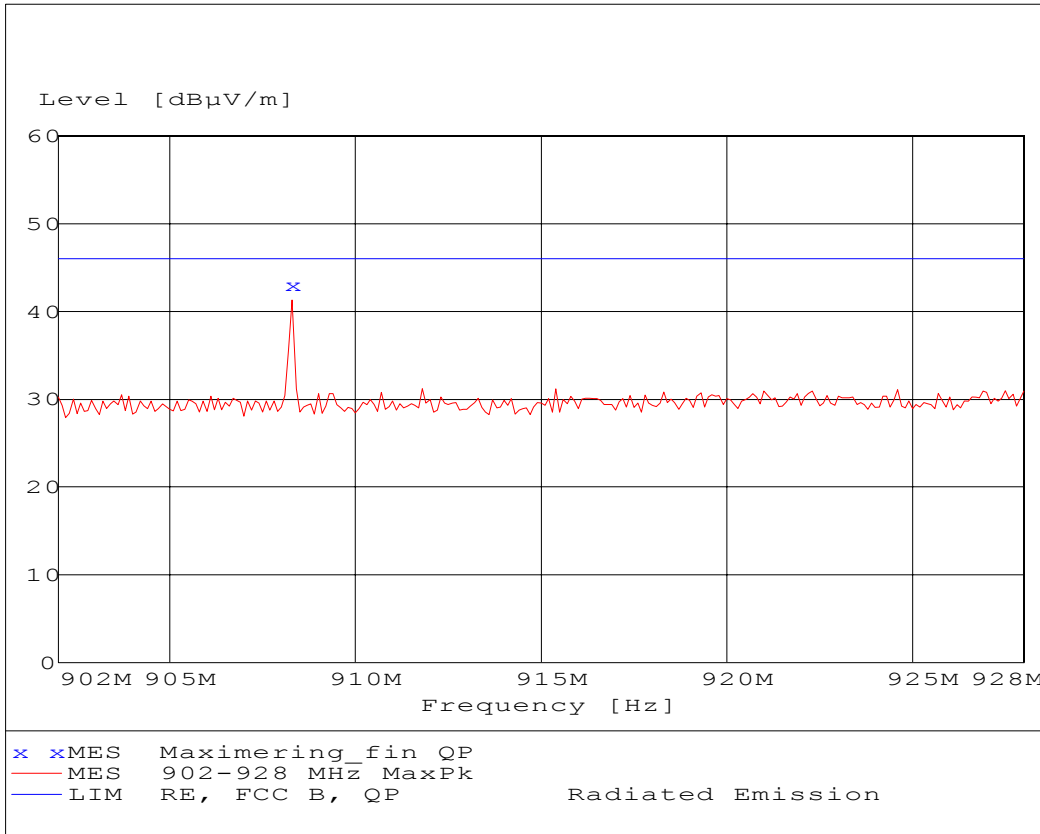


MEASUREMENT RESULT: "Maximizing_fin QP"

2004 02 12 16:14

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
88.510000	22.50	11.9	43.5	21.0	111.0	86.00	VERTICAL
169.670000	28.10	12.5	43.5	15.4	101.0	308.00	VERTICAL
199.180000	30.50	12.0	43.5	13.0	162.0	288.00	HORIZONTAL
287.700000	33.80	16.2	46.0	12.2	101.0	351.00	HORIZONTAL
449.980000	37.50	20.7	46.0	8.5	123.0	338.00	VERTICAL
459.490000	19.30	20.9	46.0	26.7	279.0	119.00	HORIZONTAL
479.490000	38.80	21.0	46.0	7.2	101.0	347.00	VERTICAL

EUT: HA03 RX mode
 Manufacturer: Zensys
 Operating Condition: Ant. 1 vertical
 Test Site: EMC-5
 Operator: HEN - E501839
 Test Specification: FCC 15 B. FCC 15 C. RSS 210
 Comment: Sheet 13
 Start of Test: 2004-02-12

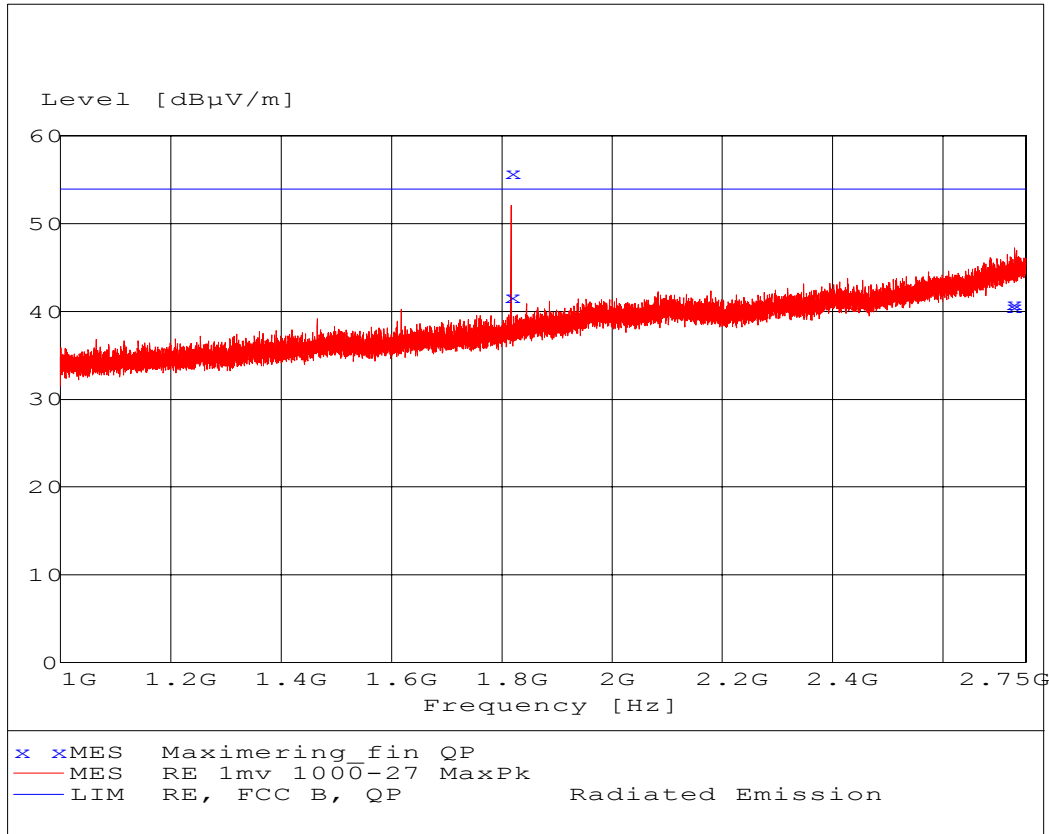


MEASUREMENT RESULT: "Maximering_fin QP"

2004 02 12 12:05

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
908.270000	43.00	28.0	46.0	3.0	114.0	4.00	VERTICAL

EUT: HA03 and HA09. TX mode and RX mode
 Manufacturer: Zensys
 Operating Condition: Ant. 1 meter vertical.
 Test Site: EMC-5
 Operator: HEN - E501839
 Test Specification: FCC 15 B. FCC 15 C. RSS 210
 Comment: Sheet 37
 Start of Test: 2004-02-13



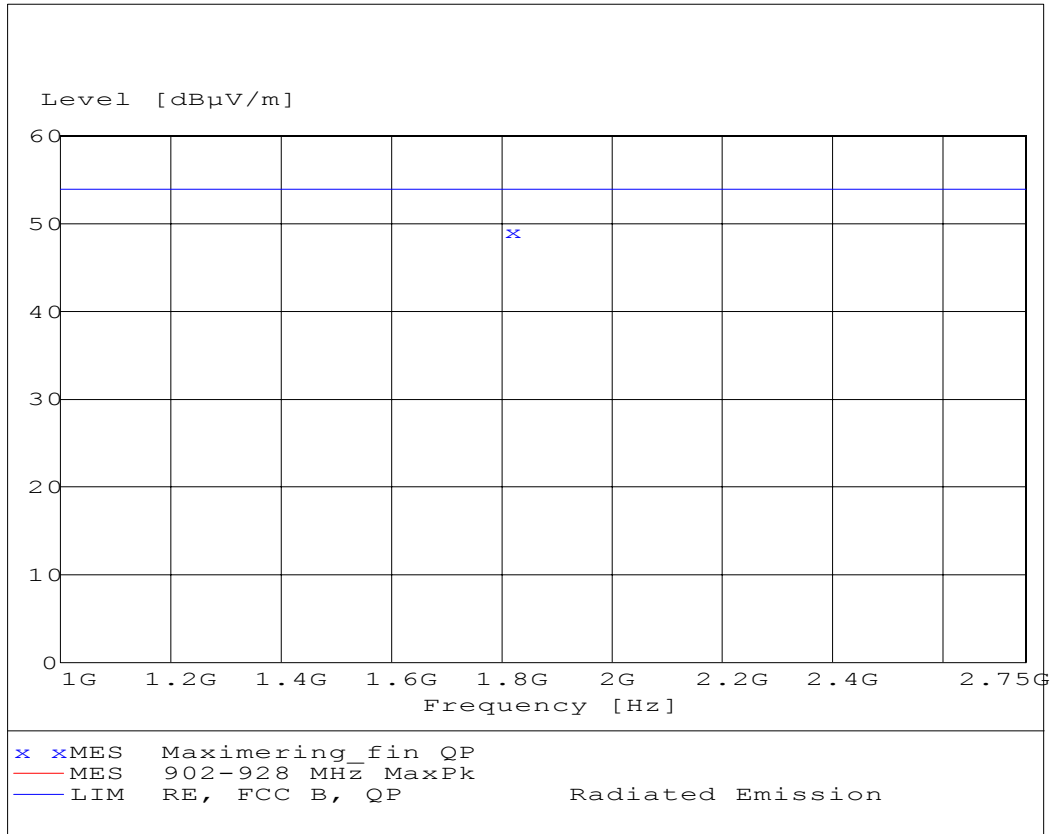
MEASUREMENT RESULT: "Maximizing_fin QP"

2004 02 13 14:02

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
1816.540000	41.60	33.9	53.9	12.3	101.0	0.00	VERTICAL
1816.840000	55.70	33.9	53.9	-1.8	101.0	321.00	VERTICAL
2725.260000	40.90	37.5	53.9	13.0	104.0	64.00	VERTICAL
2725.810000	40.50	37.5	53.9	13.4	214.0	0.00	HORIZONTAL

Note: On 816.54 MHz two transmitters are active. See sheet 39, where only one HA03 transmitter is active.

EUT: HA03 TX mode and TX mode. HA09 in RX mode
 Manufacturer: Zensys
 Operating Condition: Ant. 1 meter vertical.
 Test Site: EMC-5
 Operator: HEN - E501839
 Test Specification: FCC 15 B. FCC 15 C. RSS 210
 Comment: Sheet 39
 Start of Test: 2004-02-13

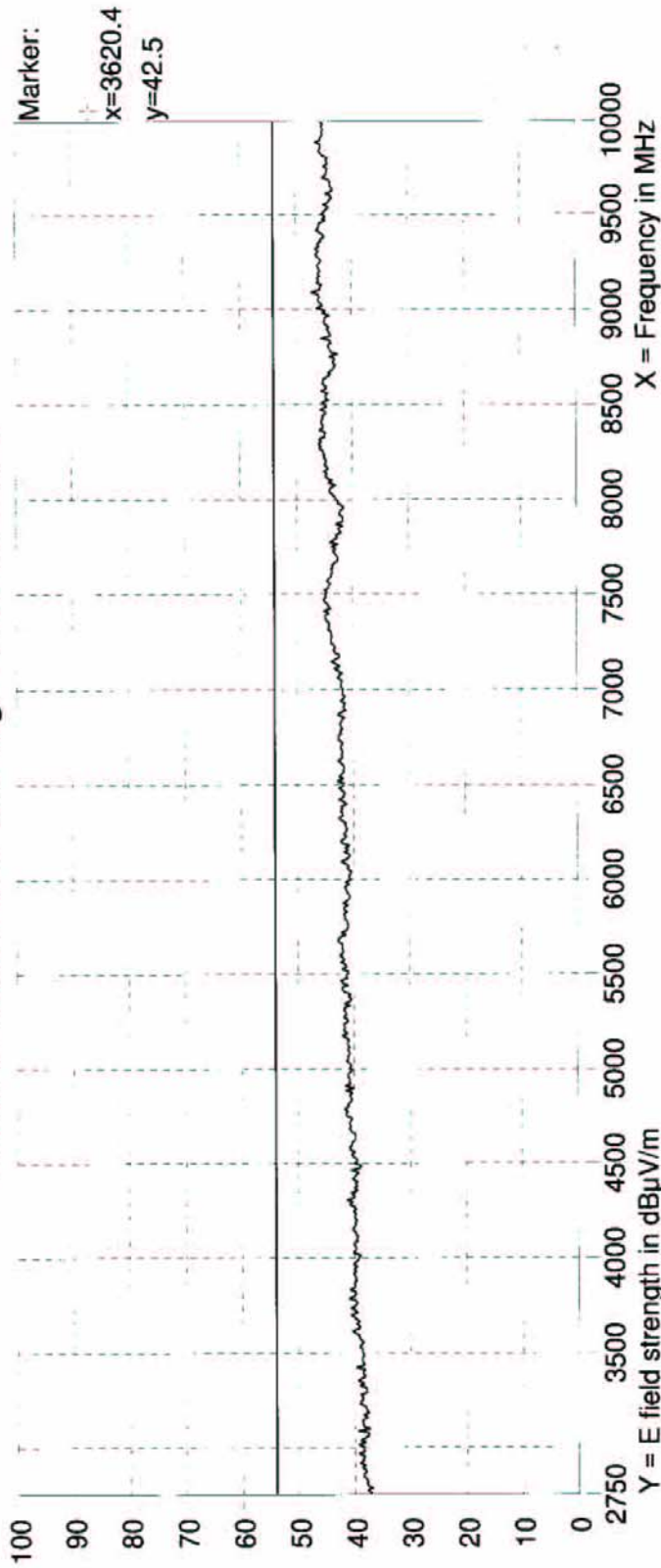


MEASUREMENT RESULT: "Maximering_fin QP"

2004 02 13 14:26

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
1816.840000	49.10	33.9	53.9	4.8	101.0	343.00	VERTICAL

DELTA Electronics Testing, EMC Section.



Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E

2004 03 01 15:38:37 File: FCC.TO1, EUT 1

2004 03 01 13:26:12 File: FCC.LM1, Limit 1, FCC15.109(part B) unintentional rad. and FCC 15.209(Part C) intentional rad. Both Rx

HA03 TX and RX

Zensys

Proj. no.: E501839-HEN

ant 1-3 meter horizontal and vertical. T.T. 0-360 deg.

Project no: E501839 - HEN

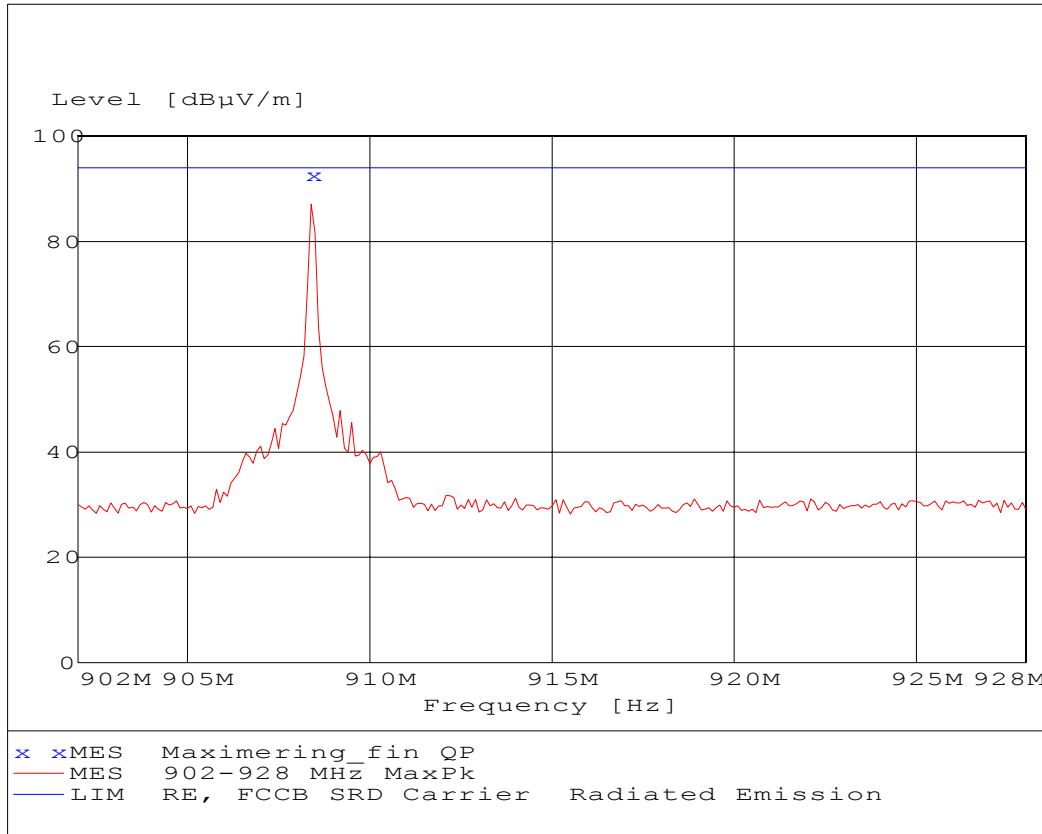
Sheet 56

Annex 4

Peak output power / Occupied bandwidth

(2 pages)

EUT: HA03. TX mode
 Manufacturer: Zensys
 Operating Condition: Ant. 1 vertical
 Test Site: EMC-5
 Operator: HEN - E501839
 Test Specification: FCC 15 B. FCC 15 C. RSS 210
 Comment: Sheet 19
 Start of Test: 2004-02-12



MEASUREMENT RESULT: "Maximering_fin QP"

2004 02 12 14:38

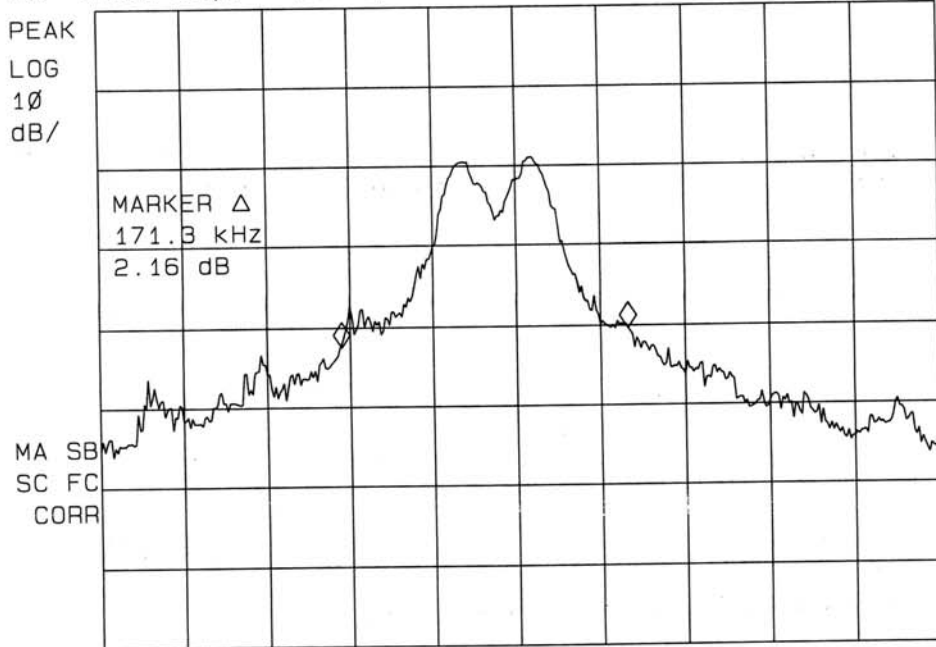
Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
908.420000	92.50	28.0	94.0	1.5	132.0	180.00	VERTICAL

#A04
15
20

11:20:12 17 FEB 2004

MKR 171.3 KHz
2.16 dB

REF 103.0 dBμV #AT 10 dB



CENTER 908.4210 MHz
#RES BW 10 KHz

VBW 10 KHz

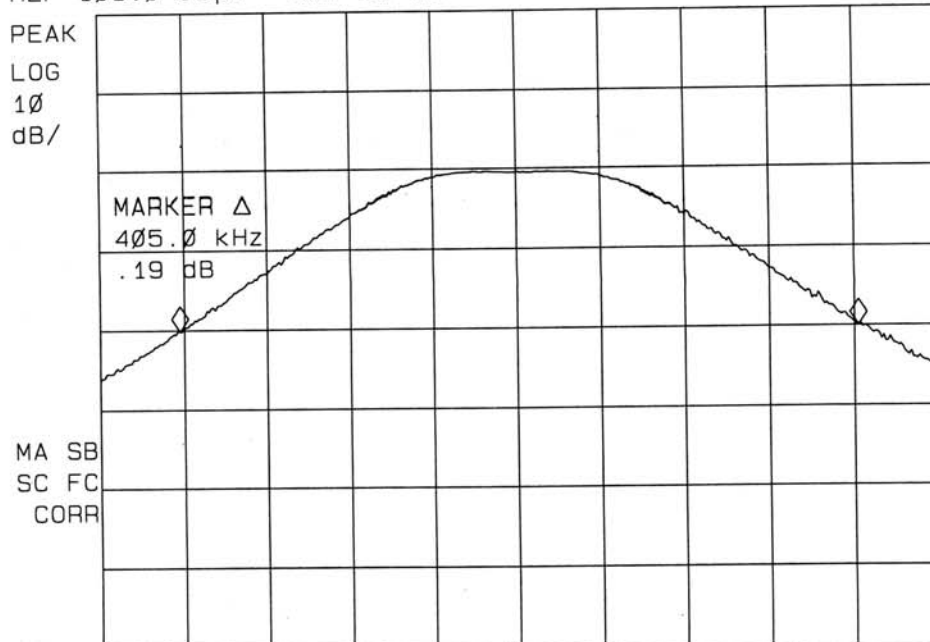
SPAN 500.0 KHz
SWP 30.0 msec

#A03
15
20

11:21:43 17 FEB 2004

MKR 405.0 KHz
.19 dB

REF 105.0 dBμV #AT 10 dB



CENTER 908.4210 MHz
#RES BW 100 KHz

VBW 30 KHz

SPAN 500.0 KHz
SWP 20.0 msec