

Test Report



DANAK
Reg. no. 19

Emission tests to FCC and IC requirements of HA04

Performed for Intermatic Inc.

DANAK-197370

Project no.: E501839-2

Page 1 of 13

4 annexes

5 March 2004

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Title Emission tests to FCC and IC requirements of HA04

Test object HA04

FCC ID DGZH0004

IC ID 4898A-H0004

Report no. DANAK-197370

Project no. E501839-2

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

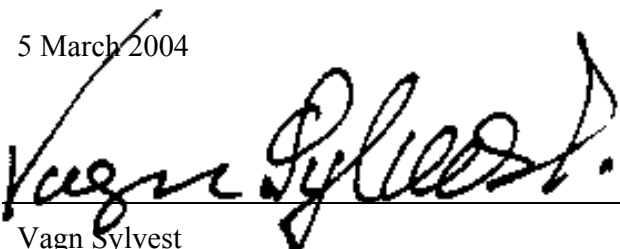
Responsible 
Vagn Sylvest
Project Manager - EMC
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1. Summaries

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.

HA04 Outdoor Module - 15A

15A electromechanical relay-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 of loads for outdoor de-

vices

2.1 Test object – HA04

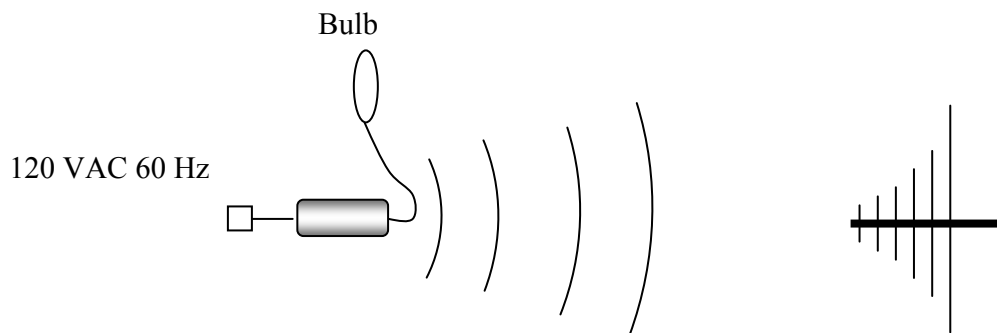
Category	SRD
Manufacturer	Intermatic Inc.
Model / type	HA04
Part no.	Tx Car – Rx - TxMod
Serial no.	-
FCC ID	DGZH0004
IC ID	4898A-H0004
Supply voltage	120 VAC 60 Hz
Operational mode	TX/RX
	Load commanded OFF.

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	Annex 2	
Test record sheets	Annex 3	

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: 40 dB μ V/m 88-216 MHz: 43.5 dB μ V/m 216-960 MHz: 46 dB μ V/m Above 960 MHz: 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 dBμV/m	dB below QP limit	Note
132.78	V	27.1	16.4	R-FCC R-IC
162.29	V	28.2	15.3	R-FCC
191.8	V	30.4	13.1	-
236.06	H	27.8	18.2	-
553.26	H	30.4	15.6	-
908.27	V	44.1	1.9	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	Polarisa- tion	Peak dBμV/m	Average dBμV/m	dB below peak limit	dB below average limit	Note
1816.54	V	40.6	40.6	33.3	13.3	Rx LO 2 nd harm.
1816.84	V	46.1	46.1	27.8	7.8	Tx 2 nd harm
2725.26	V	40.4	40.4	33.5	13.5	R-FCC R-IC Rx LO 3 rd harm.
2725.81	H	40.4	40.4	33.5	13.5	R-FCC E-IC Tx 3 rd harm.
3620.4	H+V	42.5	42.5	31.4	11.4	R-FCC R-IC Tx 4 th harm.

(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 $\mu\text{V/m}$ or 54 $\text{dB}\mu\text{V/m}$.

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

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 $\text{dB}\mu\text{V/m}$, following §15.249(a) and RSS-210 6.2.2(m2). Measurements show:

Peak output field strength: 90.2 $\text{dB}\mu\text{V/m}$ at the frequency 908.42 MHz.

The carrier frequency cannot be tuned.

See plot Sheet 18 in *Annex 4*.

The EUT is in compliance with the requirement with a margin of 3.8 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: 0,098 MHz measured in 10 kHz bandwidth.

At spurious limit: The carrier is well below the spurious 53.8 dB μ V/m limit at the band edges of 902 MHz and 928 MHz as shown by plot 18 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)

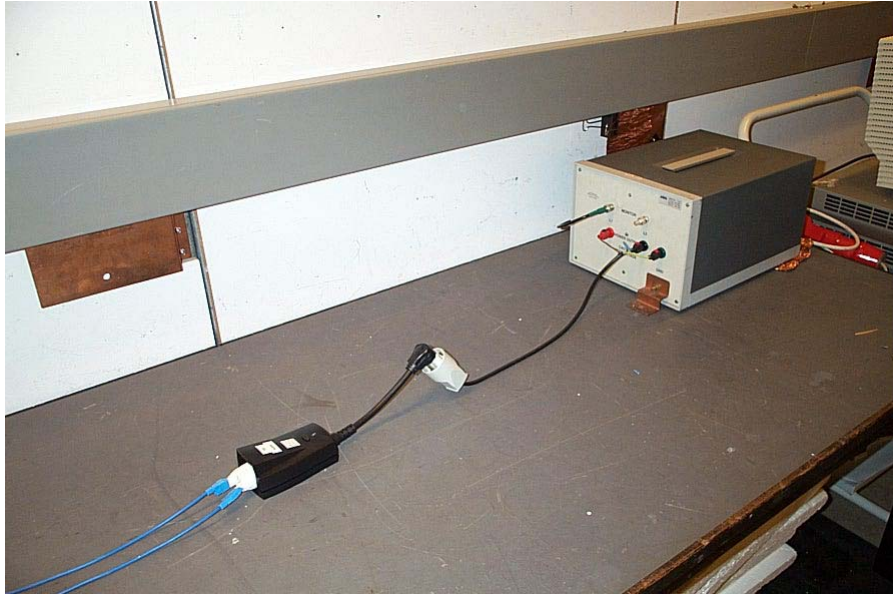


Photo 1 Set-up for conducted emission.
Measurements performed in screened room. LISN bonded to vertical ground plane (wall).



Photo 2 Set-up for conducted emission.
Measurements performed in screened room. LISN bonded to vertical ground plane (wall).

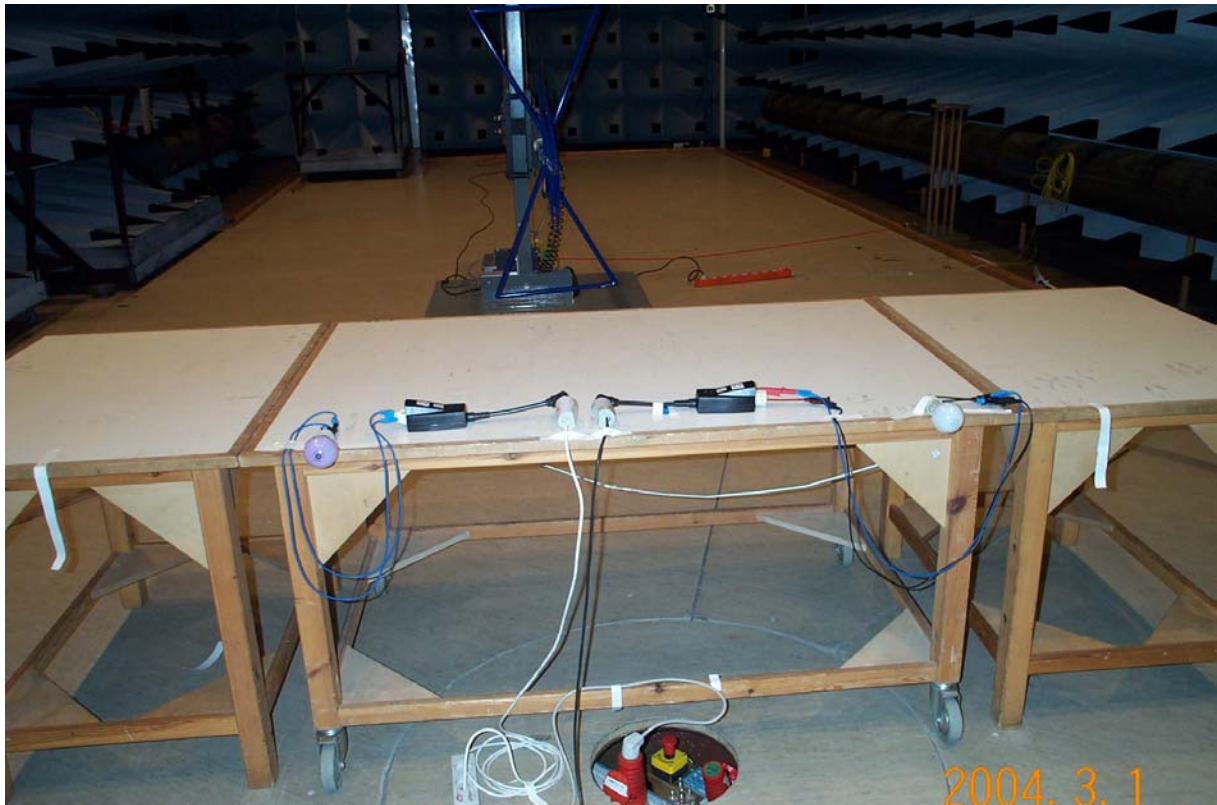


Photo 3 Set-up for measurements 30 – 1000 MHz. Date is 2004-02-12 Camera wrongly set.

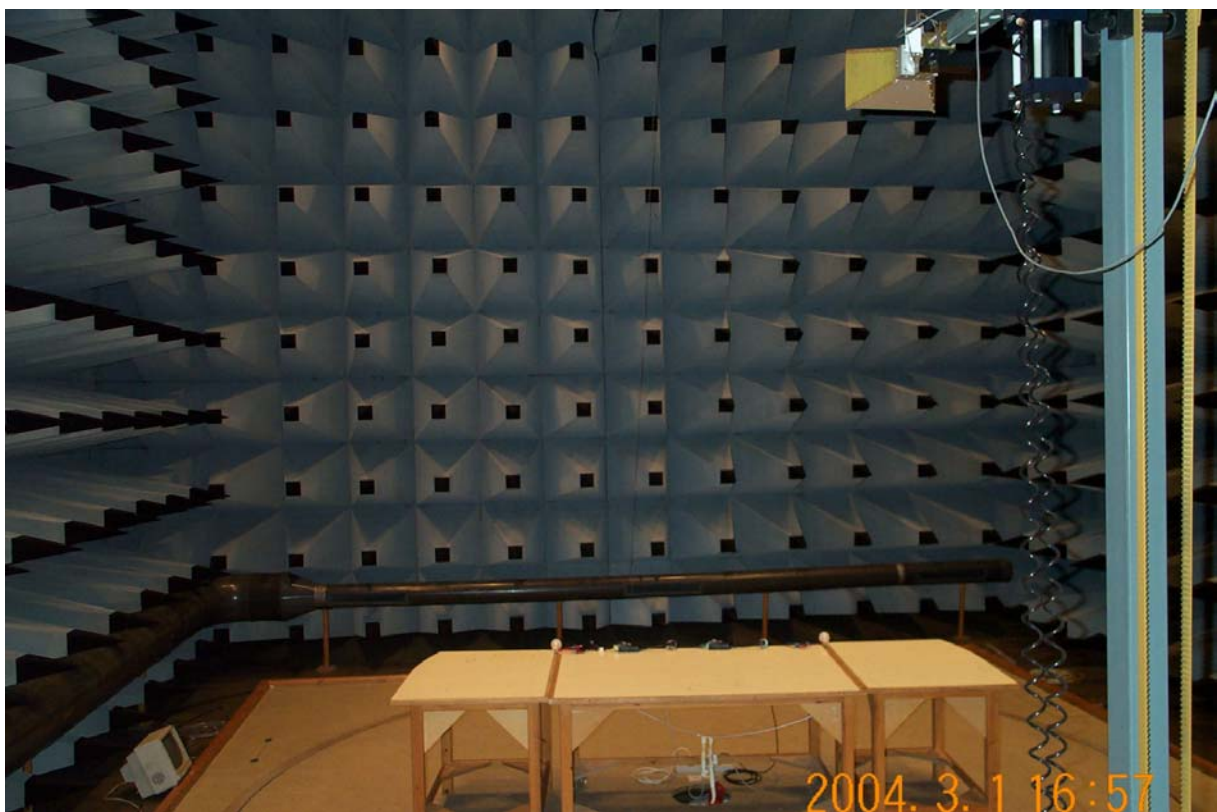
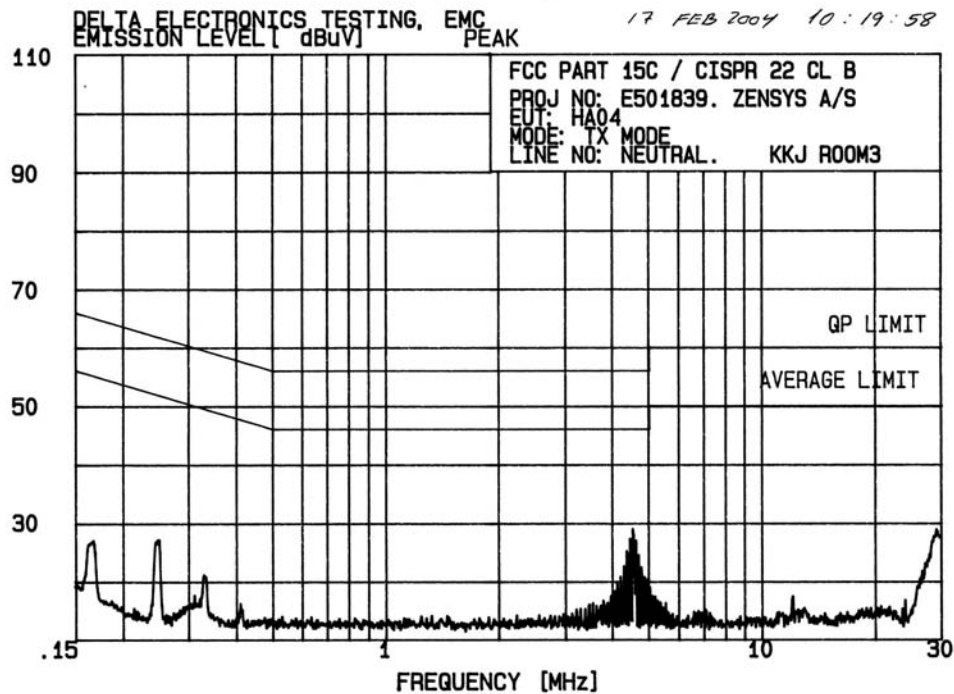
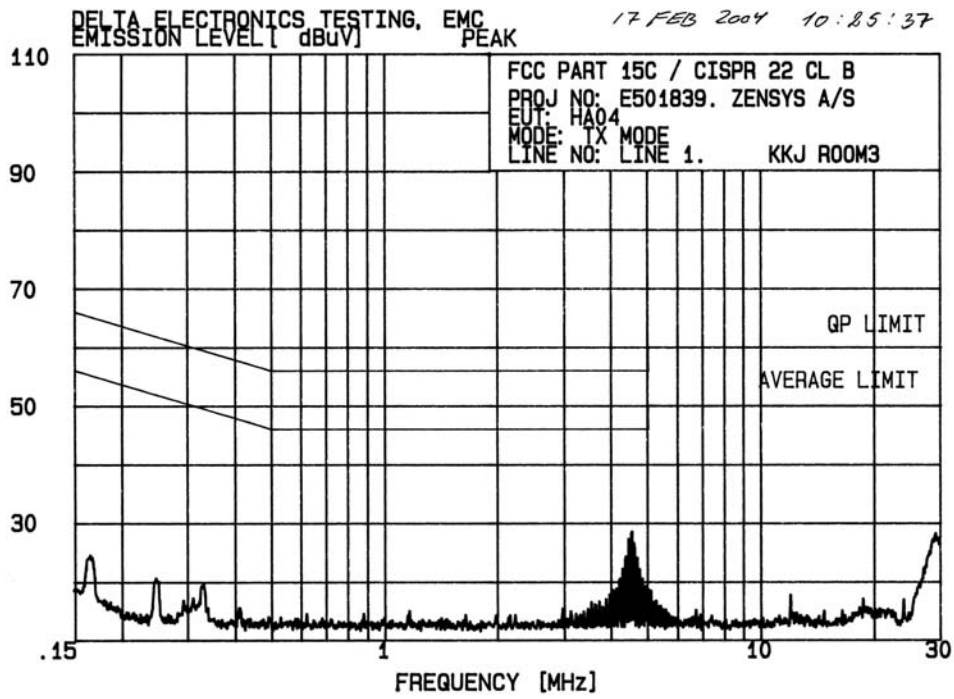


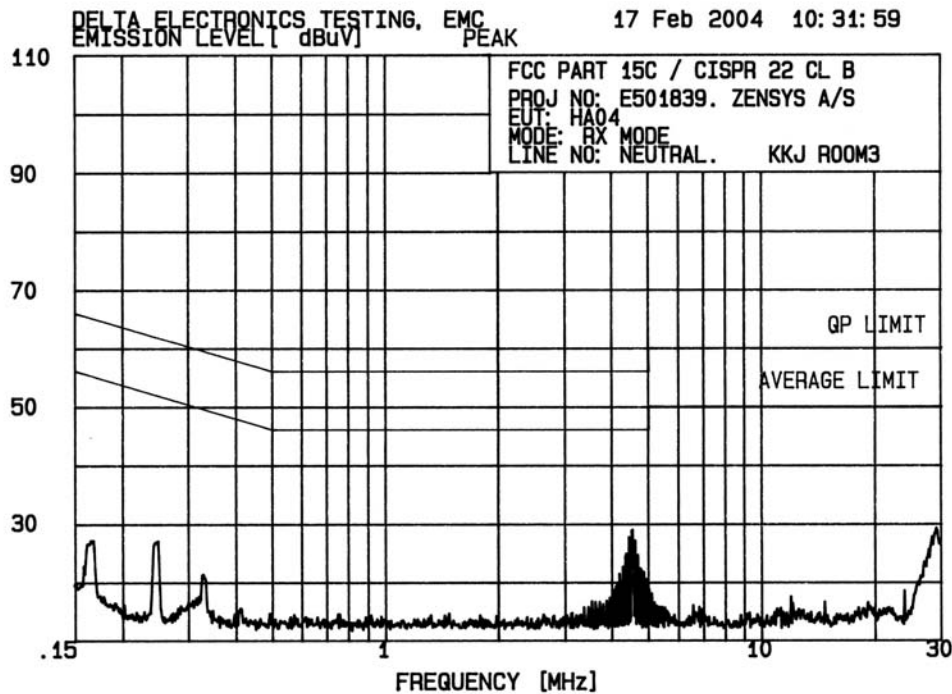
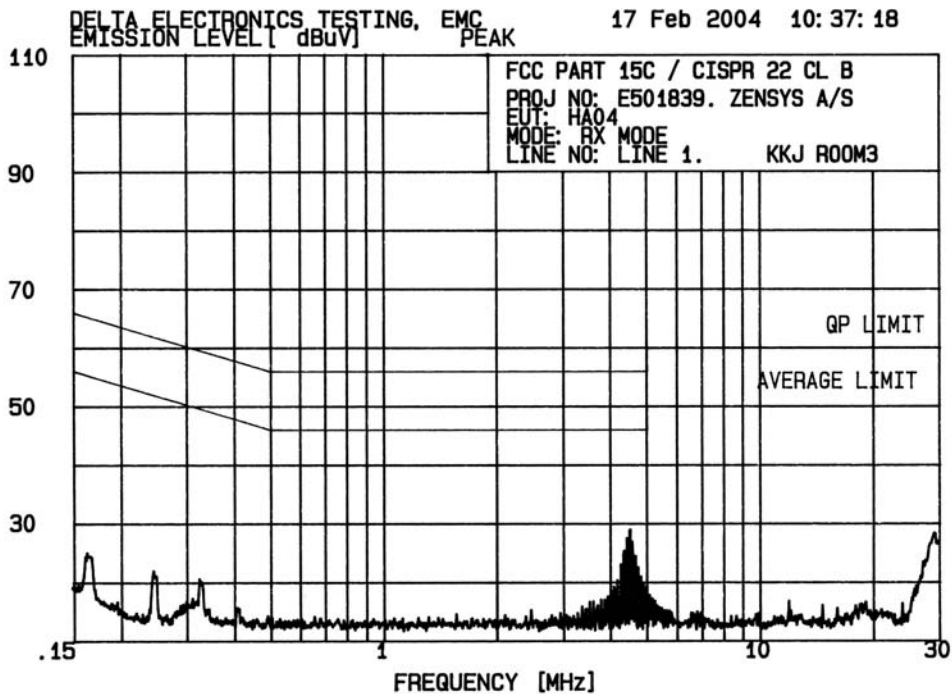
Photo 4 Set-up for measurements > 1 GHz.

Annex 3

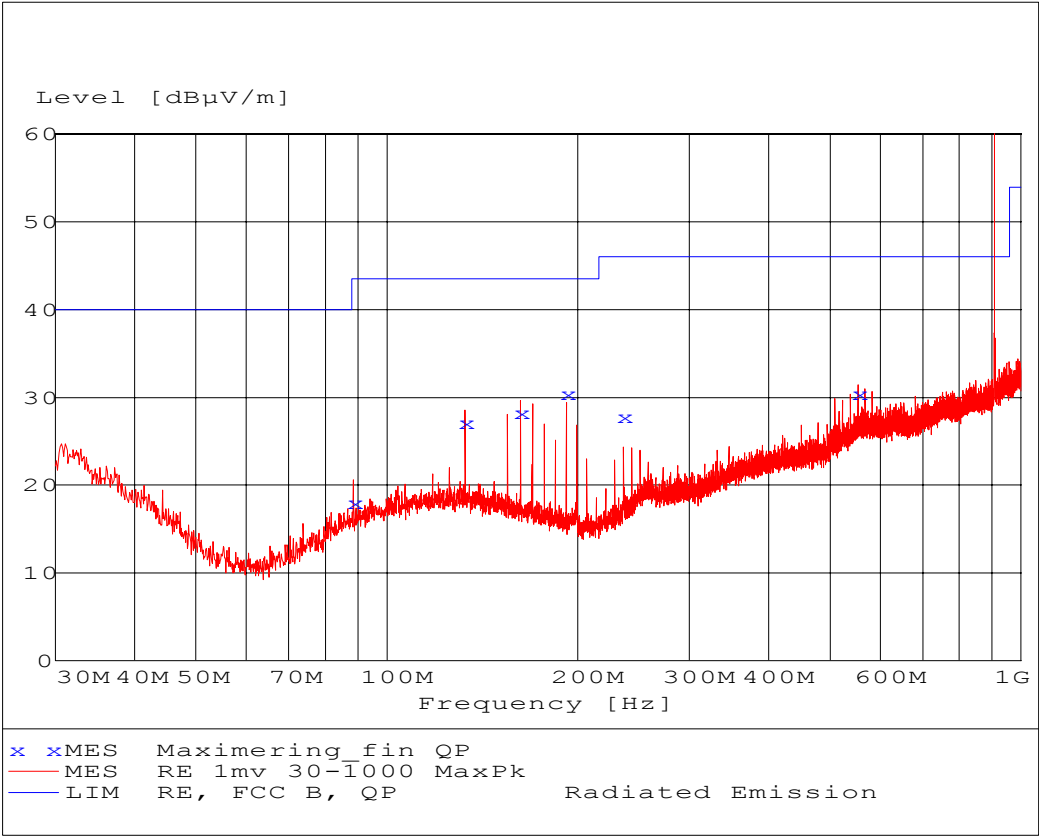
Test record sheets regarding conducted and radiated emission

(6 pages)





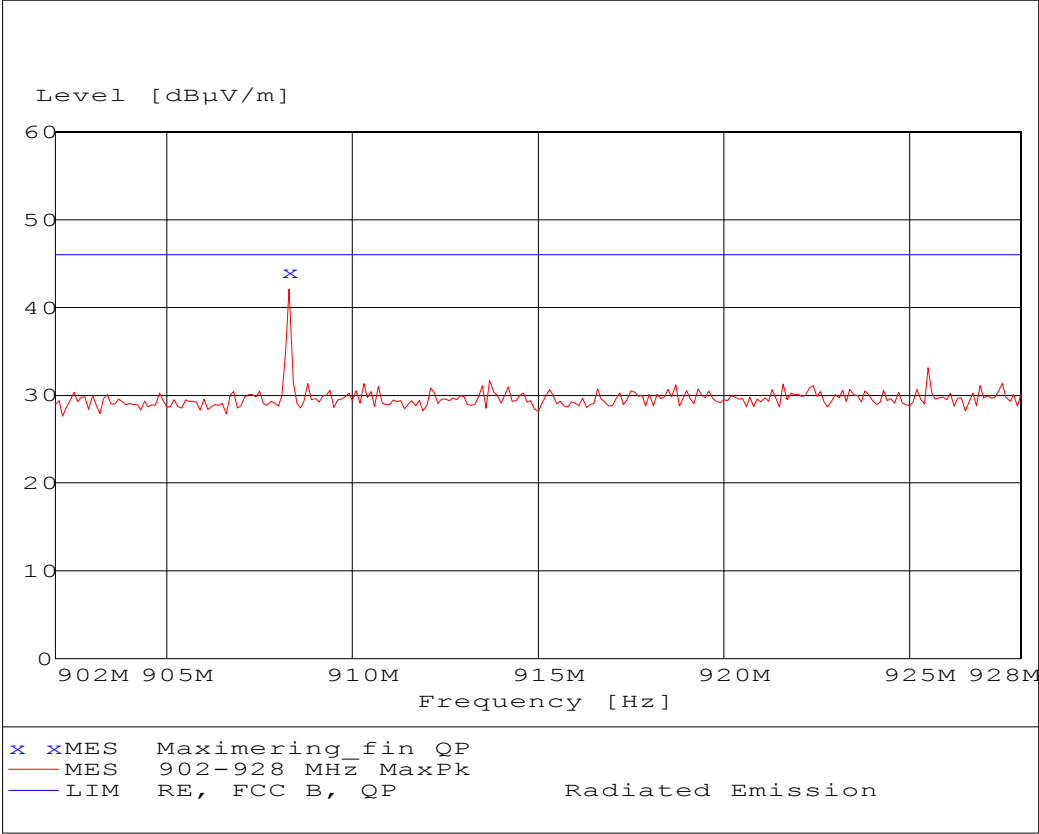
EUT: HA04. TX mode and HA04 RX mode
Manufacturer: Zensys
Operating Condition: Ant. 1 meter vertical.
Test Site: EMC-5
Operator: KKJ - E501839
Test Specification: FCC 15 B. FCC 15 C. RSS 210
Comment: Sheet 22
Start of Test: 2004-02-12



MEASUREMENT RESULT: "Maximizing_fin QP"
2004 02 12 17:26

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
88.520000	18.00	11.9	43.5	25.5	112.0	75.00	VERTICAL
132.780000	27.10	14.3	43.5	16.4	110.0	16.00	VERTICAL
162.290000	28.20	13.0	43.5	15.3	101.0	182.00	VERTICAL
191.800000	30.40	11.6	43.5	13.1	101.0	153.00	VERTICAL
236.060000	27.80	13.8	46.0	18.2	136.0	1.00	HORIZONTAL
553.260000	30.40	23.4	46.0	15.6	166.0	335.00	HORIZONTAL

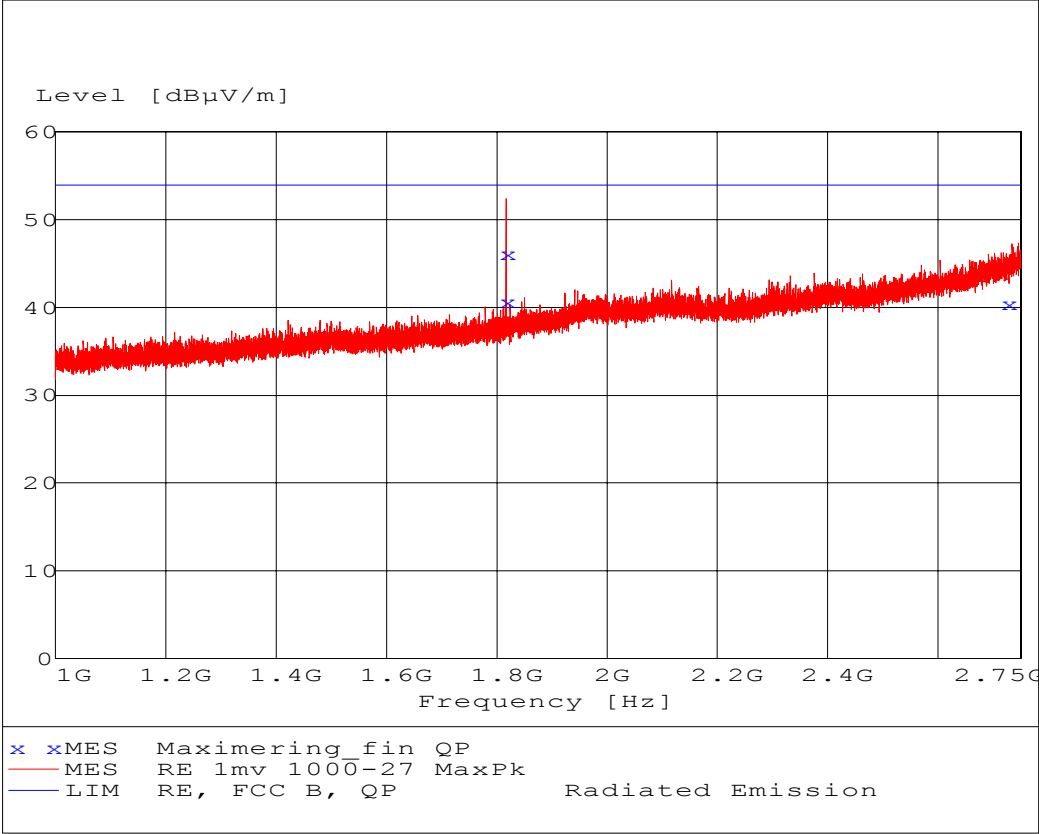
EUT: HA04 RX mode
Manufacturer: Zensys
Operating Condition: Ant. 1 vertical
Test Site: EMC-5
Operator: HEN - E501839
Test Specification: FCC 15 B. FCC 15 C. RSS 210
Comment: Sheet 14
Start of Test: 2004-02-12



MEASUREMENT RESULT: "Maximizing_fin QP"
2004 02 12 12:17

Frequency	Level	Transd	Limit	Margin	Height	Azimuth	Polarisation
MHz	dBµV/m	dB	dBµV/m	dB	cm	deg	
908.270000	44.10	28.0	46.0	1.9	120.0	0.00	VERTICAL

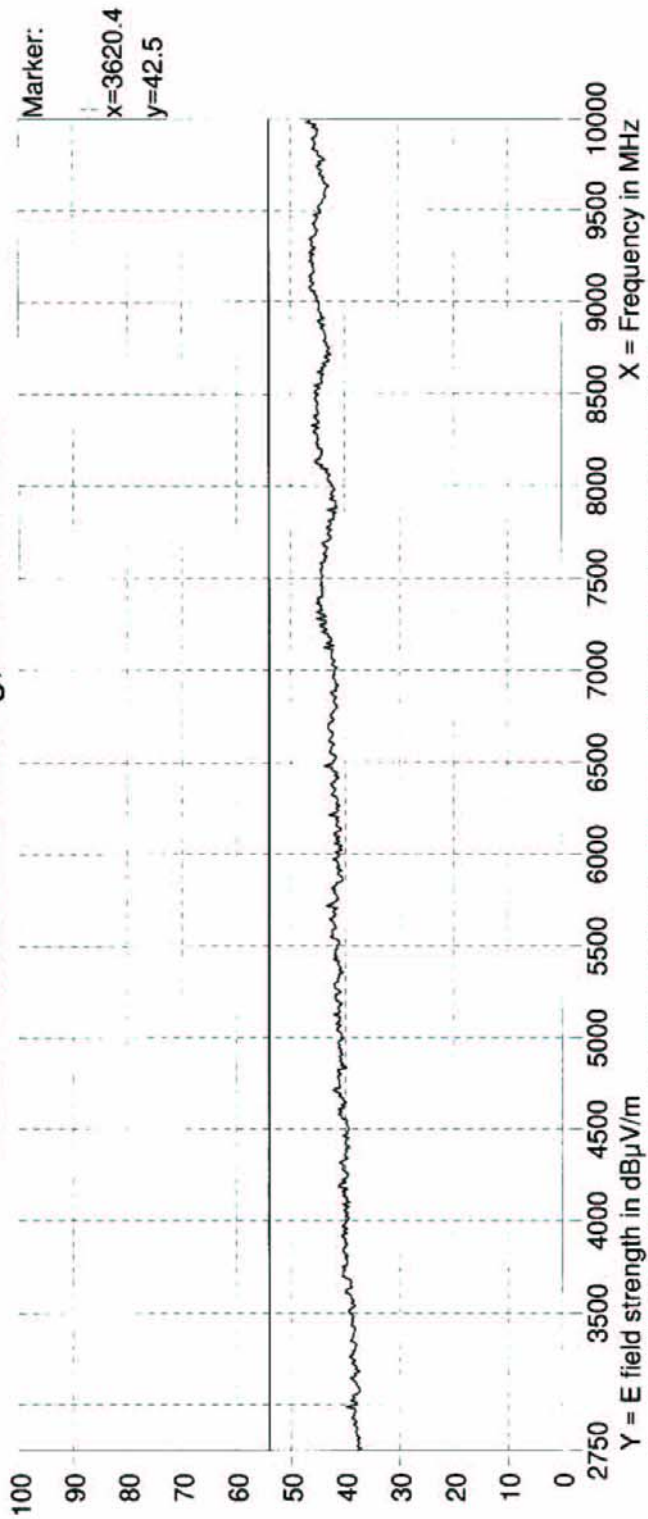
EUT: HA04 TX mode and RX mode. HA07 in RX mode
Manufacturer: Zensys
Operating Condition: Ant. 1 meter vertical.
Test Site: EMC-5
Operator: HEN - E501839
Test Specification: FCC 15 B. FCC 15 C. RSS 210
Comment: Sheet 42
Start of Test: 2004-02-13



MEASUREMENT RESULT: "Maximizing_fin QP"
2004 02 13 15:45

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
1816.540000	40.60	33.9	53.9	13.3	143.0	239.00	VERTICAL
1816.840000	46.10	33.9	53.9	7.8	104.0	8.00	VERTICAL
2725.260000	40.40	37.5	53.9	13.5	300.0	0.00	VERTICAL
2725.810000	40.40	37.5	53.9	13.5	254.0	329.00	HORIZONTAL

DELTA Electronics Testing, EMC Section.



2004 03 01 16:17:05 File: FCC.T01, 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

HA04 TX and RX
Zensys
Proj. no.: E501839-HEN

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

Project no: E501839 - HEN

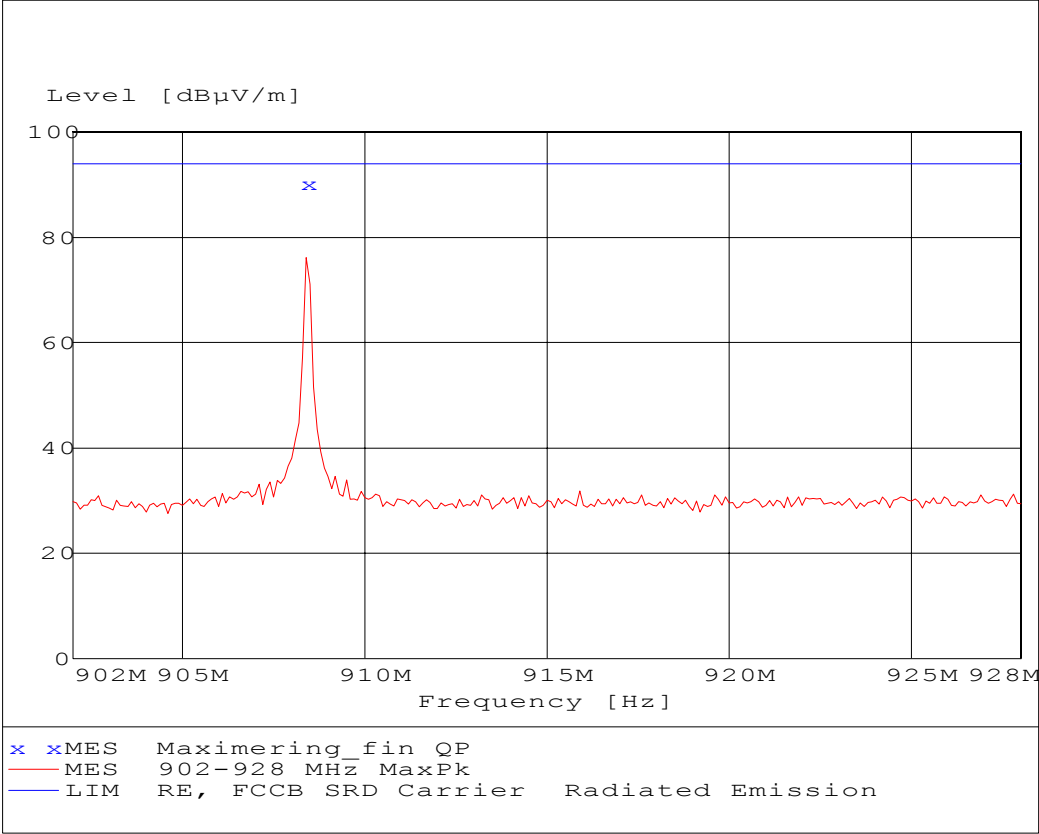
Sheet 57

Annex 4

Peak output power / Occupied bandwidth

(2 pages)

EUT: HA04. 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 18
Start of Test: 2004-02-12



MEASUREMENT RESULT: "Maximering_fin QP"
2004 02 12 14:29

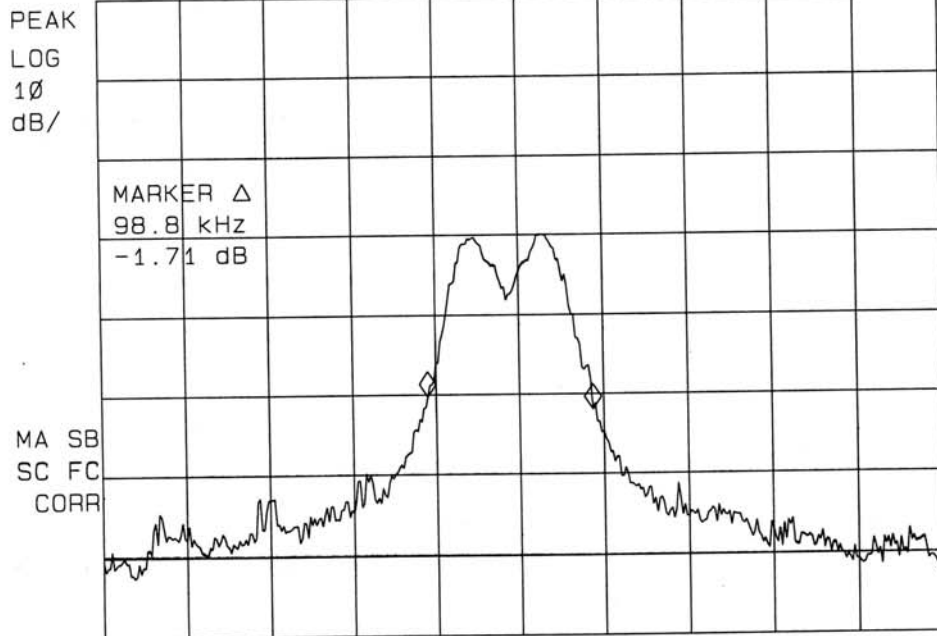
Frequency	Level	Transd	Limit	Margin	Height	Azimuth	Polarisation
MHz	dBµV/m	dB	dBµV/m	dB	cm	deg	
908.420000	90.20	28.0	94.0	3.8	101.0	314.00	HORIZONTAL

1702
16
23

11: 12: 55 17 FEB 2004

MKR 98.8 kHz
-1.71 dB

REF 100.0 dBμV #AT 10 dB



CENTER 908.4210 MHz
#RES BW 10 kHz

VBW 10 kHz

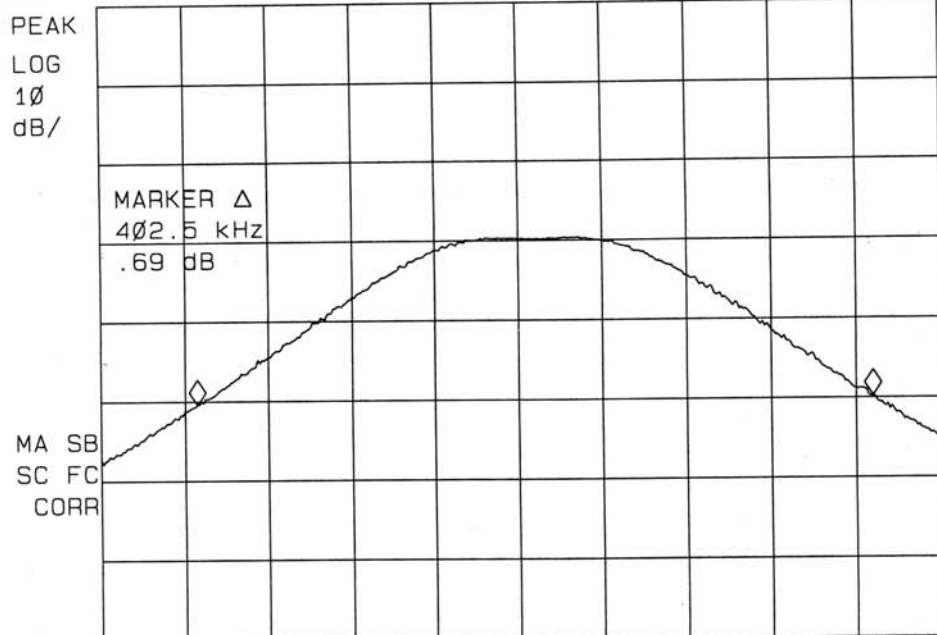
SPAN 500.0 kHz
SWP 30.0 msec

1704
V5
23

11: 14: 25 17 FEB 2004

MKR 402.5 kHz
.69 dB

REF 100.0 dBμV #AT 10 dB



CENTER 908.4210 MHz
#RES BW 100 kHz

VBW 30 kHz

SPAN 500.0 kHz
SWP 20.0 msec