Test Report

DANAK
Reg. no. 19

Emission tests to FCC and IC requirements of HA07

Performed for Intermatic Inc.

DANAK-197371
Project no.: E501839-3
Page 1 of 12
4 annexes

5 March 2004

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Title	Emission tests to FCC and IC requirements of HA07
Test object	HA07
FCC ID	DGZH0007
IC ID	4898A-H0007
Report no.	DANAK-197371
Project no.	E501839-3
Test period	18 February 2004 to 1 March 2004
Client	Intermatic Inc. Intermatic Plaza Spring Grove, IL 60081 Tel. 815.675.7786 Fax 815.675.7785
Contact person	Mr. Patrick J. Alog
Manufacturer	Intermatic Inc.
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 DELTA

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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, were 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	N/A	N/A
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.

HA07 Master Controller

A hand-held or wall-mountable 21 button remote control unit capable of controlling 12 groups of modules with up to 16 modules per group for a total capacity of 192 modules. The controller utilizes RF signals to communicate control and status information to and from various slave-modules. The controller has numerous functions such as automated remote control, dimming capability, astronomic timer function, and ALL ON / ALL OFF function.

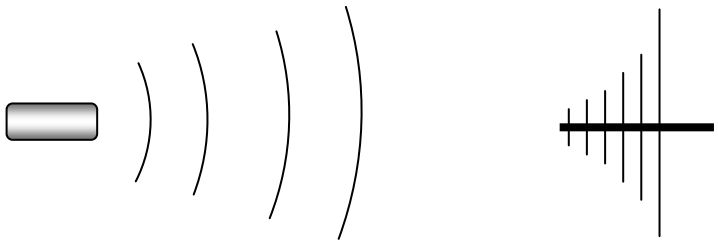
2.1 Test object - HA07

Category	SRD
Manufacturer	Intermatic Inc.
Model / type	HA07
Part no.	Tx – Rx - TxMod
Serial no.	-
FCC ID	DGZH0007
IC ID	4898A-H0007
Supply voltage	4 AA Alkaline cells
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 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 dBµV/m 43.5 dBµV/m 46 dBµV/m 54 dBµV/m
Measurement uncertainty (2 σ) <1 GHz Measurement uncertainty (2 σ) >1 GHz		2.6 dB 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 Test record sheets		*Annex 2* *Annex 3*

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
31.8	V	18.1	21.9	-
95.12	V	11.7	31.8	-
132.3	V	12.9	30.6	R-FCC R-IC
401.2	H	16.7	29.3	R-FCC R-IC
600.561	V	21.2	24.8	-
908.27	H	36.7	9.3	Rx-LO Leakage

(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 dBµV/m	Average dBµV/m	dB below peak limit	dB below average limit	Note
1816.85	H	41.1	41.1	32.8	12.8	Tx 2nd harm.
1816.54	H	34.7	34.7	32.2	19.2	Rx 2nd harm.
2725.81	H	40.5	40.5	33.4	13.4	R-FCC R-IC Tx 3rd harm.
2725.26	H	40.8	40.8	33.1	13.1	R-FCC R-IC Rx-LO 3rd harm.
3620.3	H+V	49.7	49.7	24.3	4.3	R-FCC R-IC 4th 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.

Rx refer to emission from the local oscillator or LO leakage.

Average limit is 500 µV/m or 54 dBµV/m.
Peak limit is 20 dB above average limit or 74 dBµV/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.

4.2 Peak output field strength

The peak output field strength of the unit is limited to 50 mV/m, or 94 dBµV/m, following §15.249(a) and RSS-210 6.2.2(m2). Measurements show:

Peak output field strength: 93.4 dBµV/m at the frequency 908.42 MHz.

The carrier frequency cannot be tuned.

See plot Sheet 46 in *Annex 4*.

The EUT is in compliance with the requirement with a margin of 0.6 dB.

4.3 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: 0.125 MHz measured in 10 kHz bandwidth.

At spurious limit: The carrier is well below the spurious 53.8 dBµV/m limit at the band edges of 902 MHz and 928 MHz as shown by plot 46 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 ANALYSER, 50 GHz	HEWLETT-PACKARD	8565E	2004-12-29

Annex 2

Photos

(1 page)

Photo 1 Set-up for emission measurements. Constant TX CW unit and constant Rx unit.

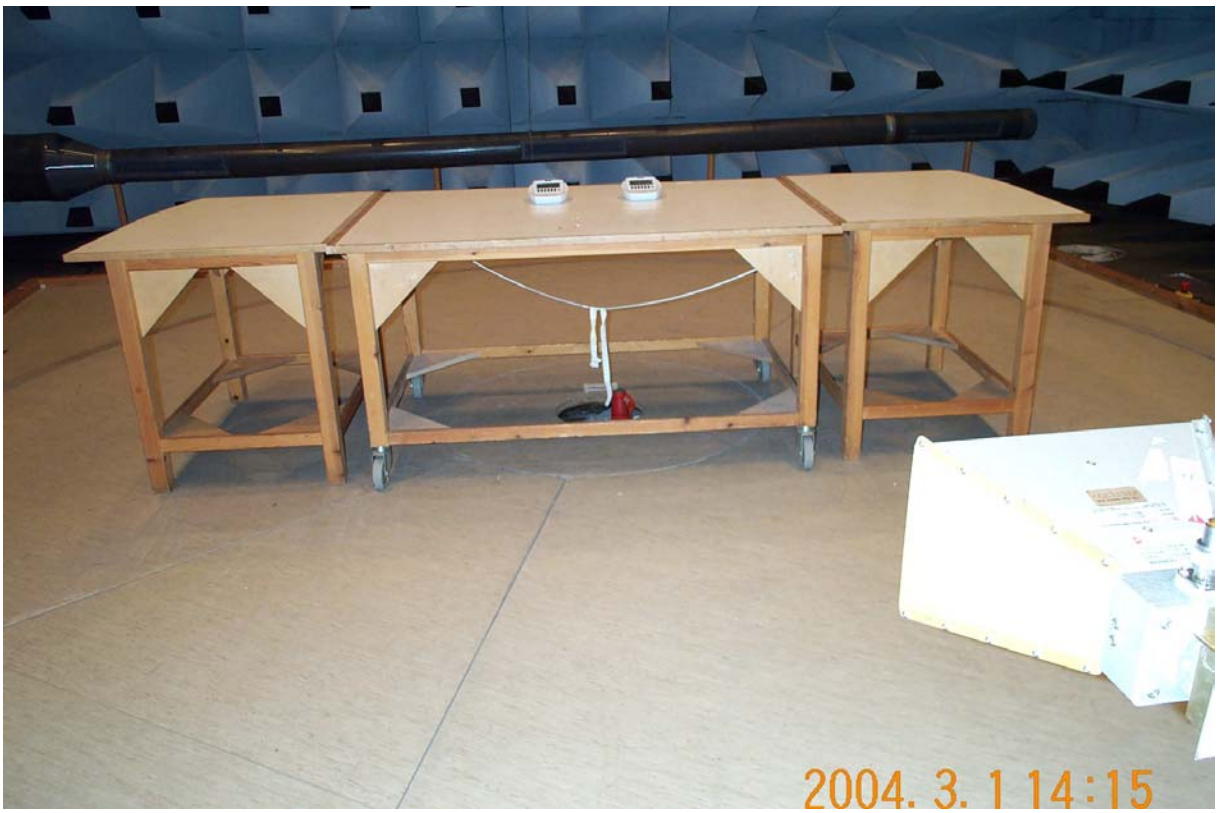


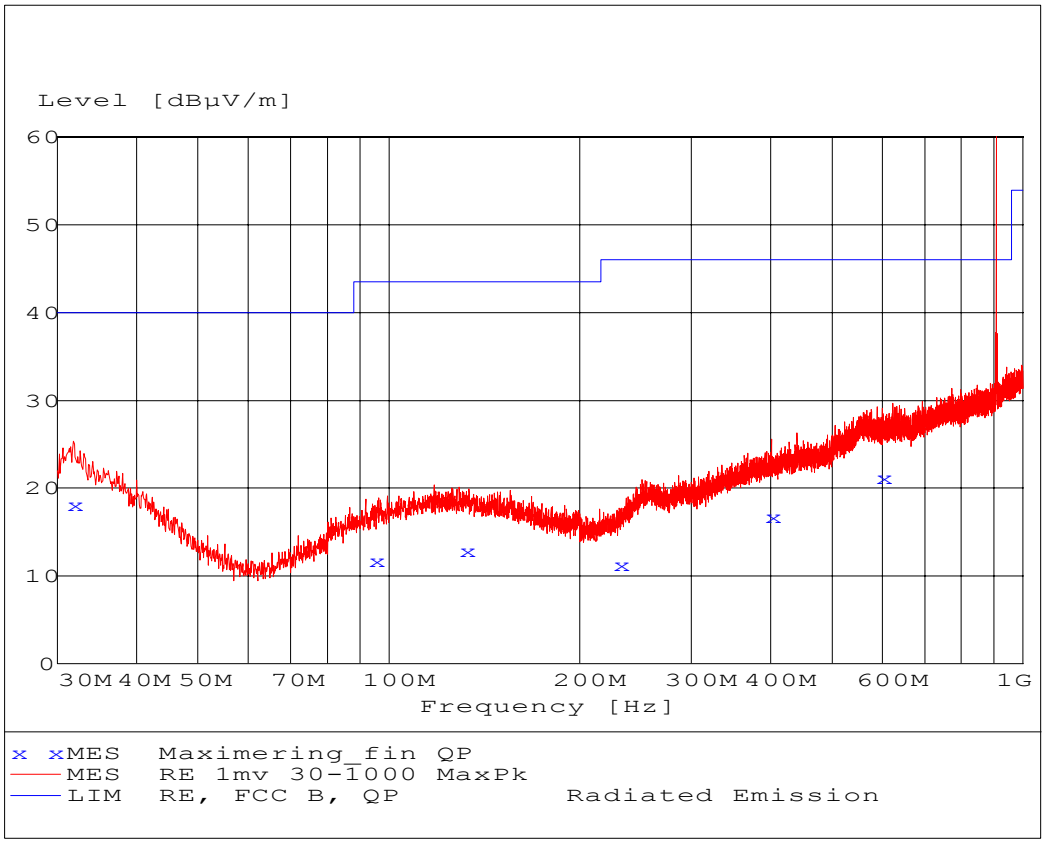
Photo 2 Set-up for measurements 1 - 10 GHz.

Annex 3

Test record sheets regarding radiated emission

(3 pages)

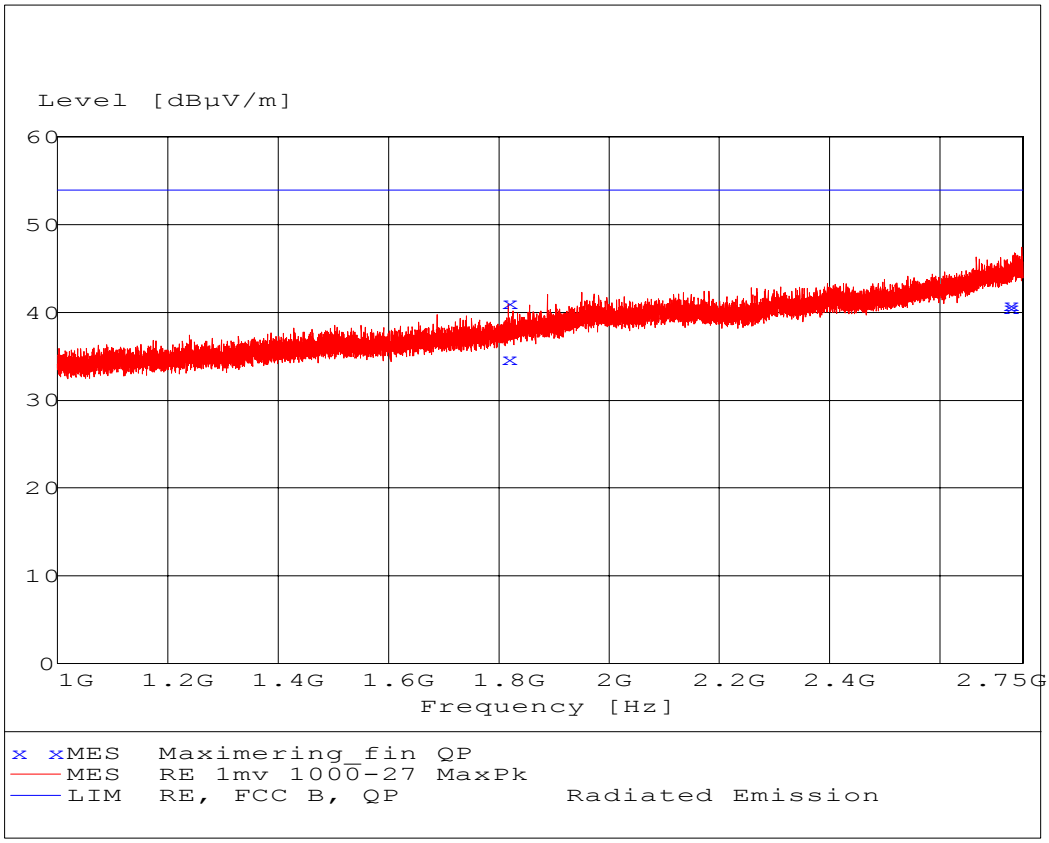
EUT: HA07 TX mode and RX mode
Manufacturer: Zensys
Operating Condition: Ant. 1 m vertical.
Test Site: EMC-5
Operator: KKJ - E501839
Test Specification: FCC 15 B. FCC 15 C. RSS 210
Comment: Sheet 52
Start of Test: 2004-02-18



MEASUREMENT RESULT: "Maximering_fin QP"
2004 02 18 21:08

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
31.800000	18.10	18.7	40.0	21.9	169.0	307.00	VERTICAL
95.120000	11.70	11.5	43.5	31.8	398.0	316.00	VERTICAL
132.300000	12.90	12.9	43.5	30.6	112.0	329.00	VERTICAL
231.200000	11.20	12.0	46.0	34.8	101.0	0.00	HORIZONTAL
401.200000	16.70	17.9	46.0	29.3	246.0	133.00	HORIZONTAL
600.561000	21.20	22.3	46.0	24.8	181.0	2.00	VERTICAL

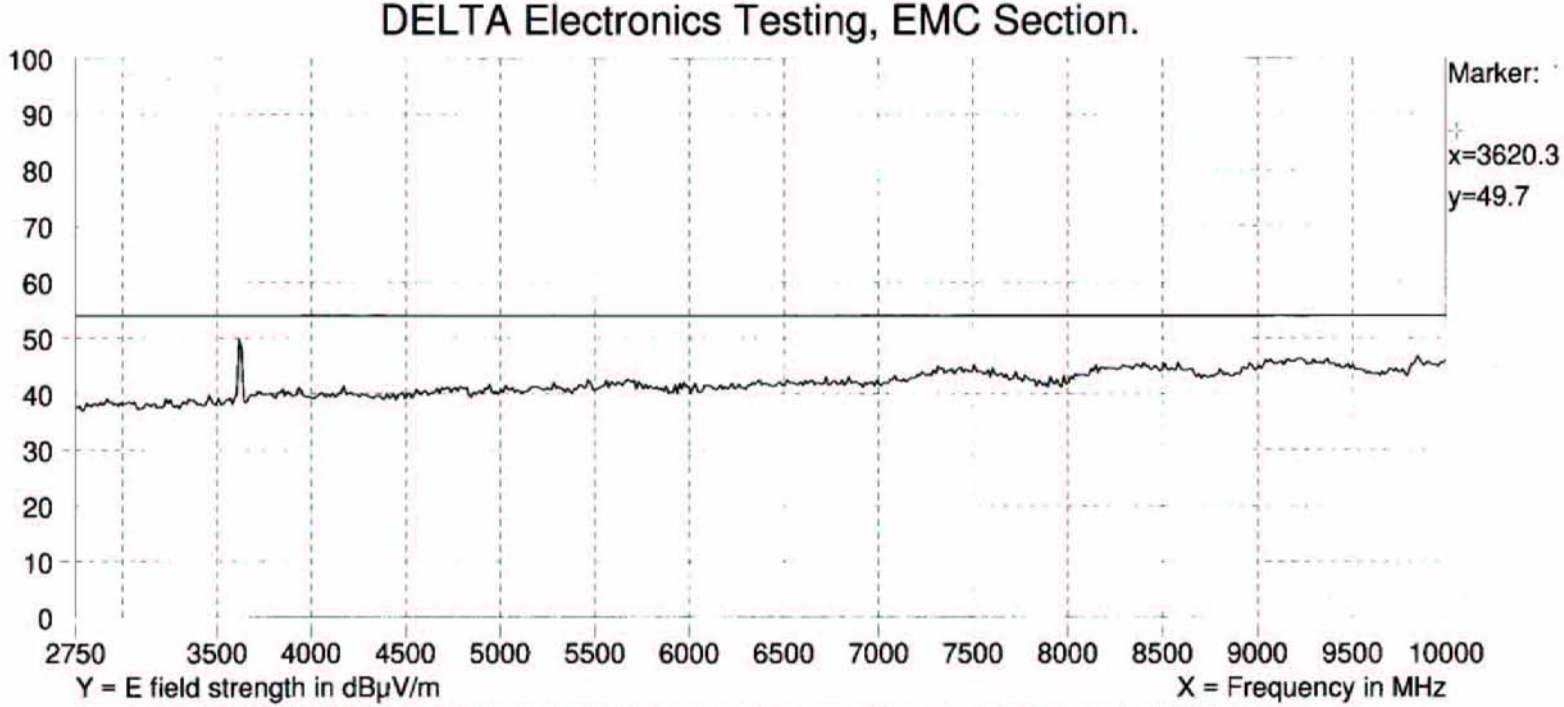
EUT: HA07 TX mode and RX mode
Manufacturer: Zensys
Operating Condition: Ant. 1 m vertical.
Test Site: EMC-5
Operator: KKJ - E501839
Test Specification: FCC 15 B. FCC 15 C. RSS 210
Comment: Sheet 47
Start of Test: 2004-02-18



MEASUREMENT RESULT: "Maximering_fin QP"
2004 02 18 18:45

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
1816.540000	34.70	33.9	53.9	19.2	177.0	117.00	HORIZONTAL
1816.850000	41.10	33.9	53.9	12.8	101.0	1.00	HORIZONTAL
2725.260000	40.80	37.5	53.9	13.1	179.0	231.00	HORIZONTAL
2725.810000	40.50	37.5	53.9	13.4	244.0	32.00	HORIZONTAL

VS/BLJ



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 14:08:53 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

HA07 TX and RX
Zensys
Proj. no.: E501839-HEN

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

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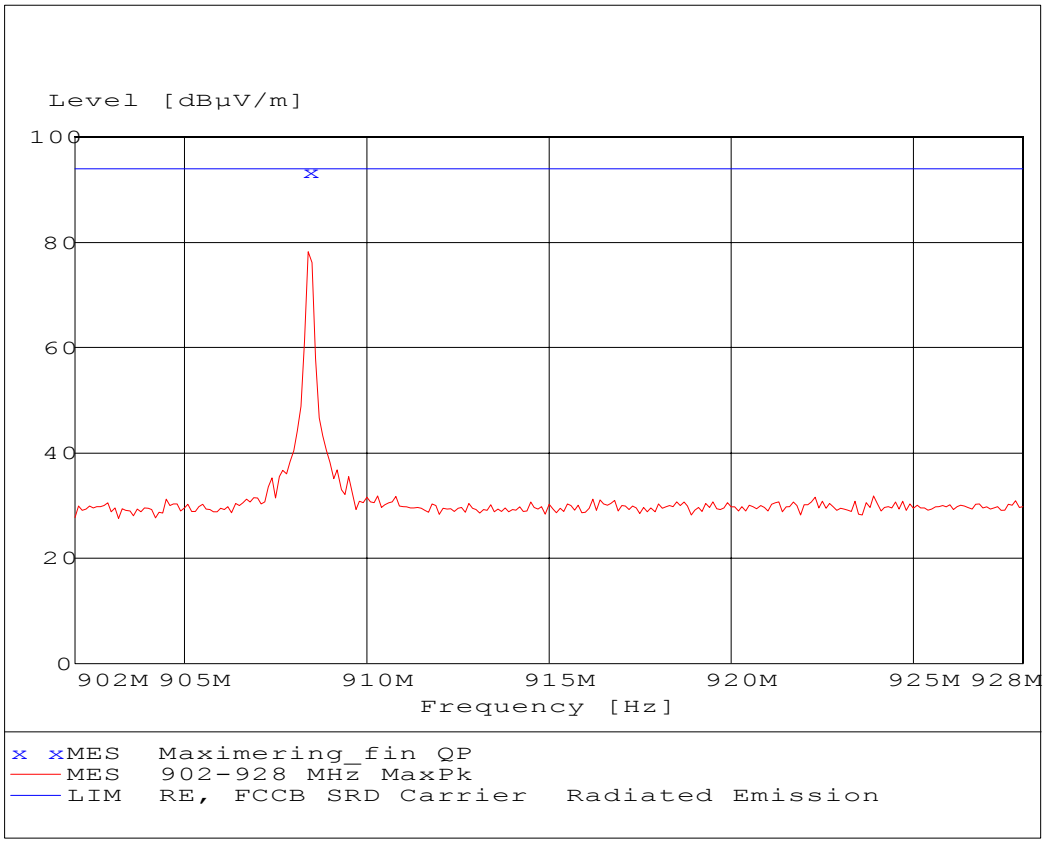
DELTA-E501839-3

Annex 4

Occupied bandwidth / Peak output power

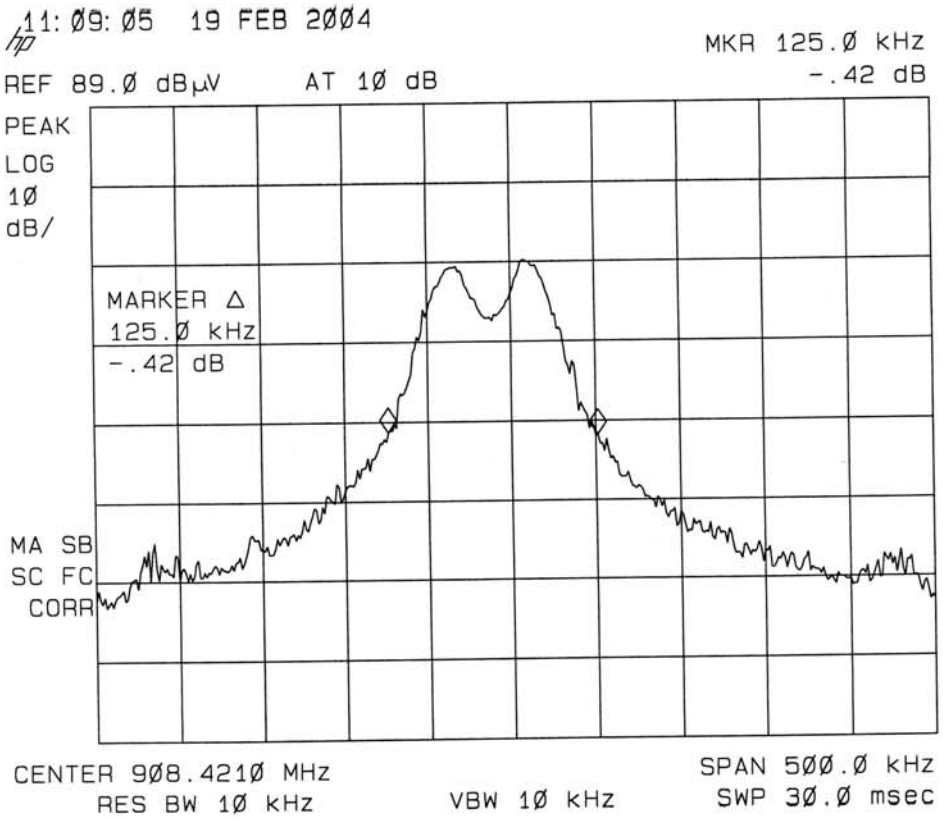
(2 pages)

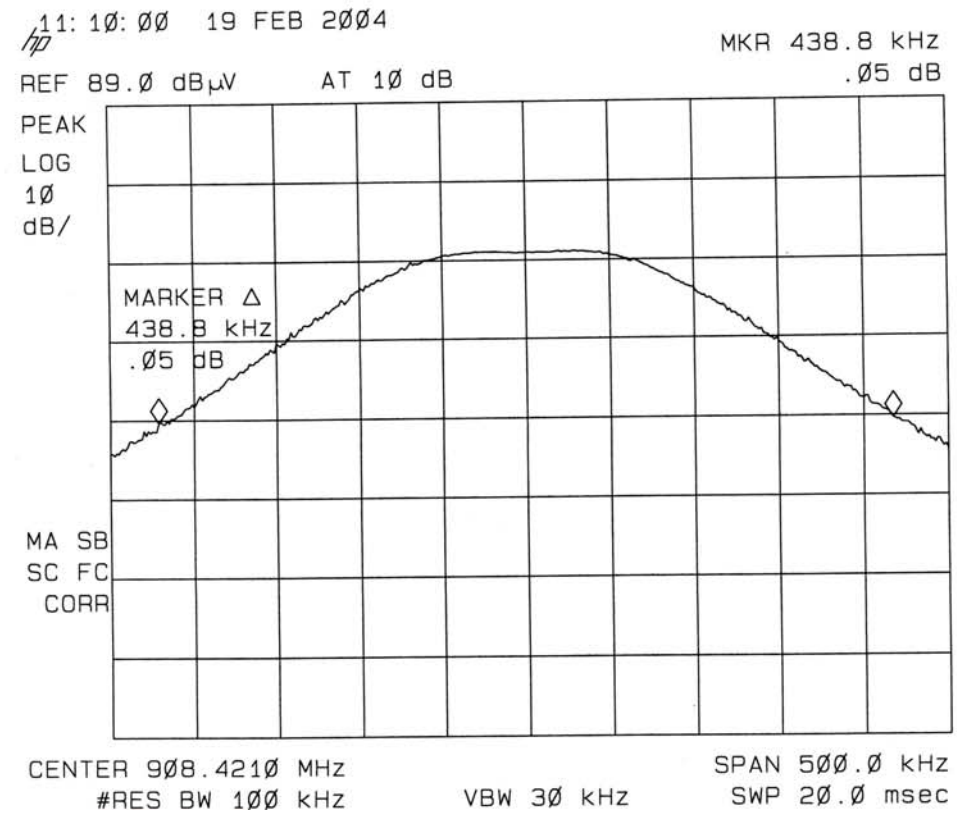
EUT: HA07 TX mode
Manufacturer: Zensys
Operating Condition: Ant. 1 m vertical.
Test Site: EMC-5
Operator: KKJ - E501839
Test Specification: FCC 15 B. FCC 15 C. RSS 210
Comment: Sheet 46
Start of Test: 2004-02-18



MEASUREMENT RESULT: "Maximering_fin QP"
2004 02 18 17:34

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
908.420000	93.40	28.0	94.0	0.6	101.0	193.00	HORIZONTAL


11: Ø9: Ø5 19 FEB 2ØØ4
MKR 125.Ø kHz
-.42 dB
REF 89.Ø dBµV
AT 1Ø dB
PEAK
LOG
1Ø
dB/
MARKER Δ
125.Ø kHz
-.42 dB
MA SB
SC FC
CORR
CENTER 9Ø8.421Ø MHz
RES BW 1Ø kHz
VBW 1Ø kHz
SPAN 5ØØ.Ø kHz
SWP 3Ø.Ø msec


11: 1Ø: ØØ 19 FEB 2ØØ4
MKR 438.8 kHz
.Ø5 dB
REF 89.Ø dBµV
AT 1Ø dB
PEAK
LOG
1Ø
dB/
MARKER Δ
438.8 kHz
.Ø5 dB
MA SB
SC FC
CORR
CENTER 9Ø8.421Ø MHz
#RES BW 1ØØ kHz
VBW 3Ø kHz
SPAN 5ØØ.Ø kHz
SWP 2Ø.Ø msec