



849 NW STATE ROAD 45  
NEWBERRY, FL 32669 USA  
PH: 888.472.2424 OR 352.472.5500  
FAX: 352.472.2030  
EMAIL: [INFO@TIMCOENGR.COM](mailto:INFO@TIMCOENGR.COM)  
[HTTP://WWW.TIMCOENGR.COM](http://WWW.TIMCOENGR.COM)

## FCC PART 90 Addendum Report

<b>APPLICANT</b>	DAMM CELLULAR SYSTEMS A/S
	MOLLEGADE 68 6400 SONDERBORG DENMARK
<b>FCC ID</b>	Z5W-104028
<b>IC CERTIFICATION</b>	10159A-104028
<b>MODEL NUMBER</b>	TR412H TRANSCEIVER 805-825/851-869 MHz
<b>PRODUCT DESCRIPTION</b>	800 MHz Transceiver
<b>TESTED BY</b>	Mario de Aranzeta
<b>APPROVED BY</b>	Mario R. de Aranzeta
<b>TIMCO REPORT NO.</b>	1130UT12TestReport.doc
<b>TEST RESULTS</b>	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL  
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**



Testing Certificate #0955-01



## TABLE OF CONTENTS

GENERAL REMARKS.....	3
GENERAL INFORMATION.....	4
GENERAL INFORMATION (cont'd).....	5
GENERAL INFORMATION (cont'd).....	6
TEST PROCEDURES .....	7
MODULATION CHARACTERISTICS.....	8
OCCUPIED BANDWIDTH.....	9
EMC EQUIPMENT LIST .....	11

Applicant: DAMM CELLULAR SYSTEMS A/S  
FCC ID: Z5W-104028  
IC CERT #: 10159A-104028  
Report: D\DAMM\1130UT12\1130UT12TestReport.doc

**GENERAL REMARKS**

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

**Attestations**

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025: 2005 requirements.



Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.  
849 NW State Road 45  
Newberry, Fl 32669



**Authorized Signatory Name:**

Mario de Aranzeta C.E.T.  
Compliance Engineer/ Lab. Supervisor

**Date:** May 4, 2012

Applicant: DAMM CELLULAR SYSTEMS A/S  
FCC ID: Z5W-104028  
IC CERT #: 10159A-104028  
Report: D\DAMM\1130UT12\1130UT12TestReport.doc

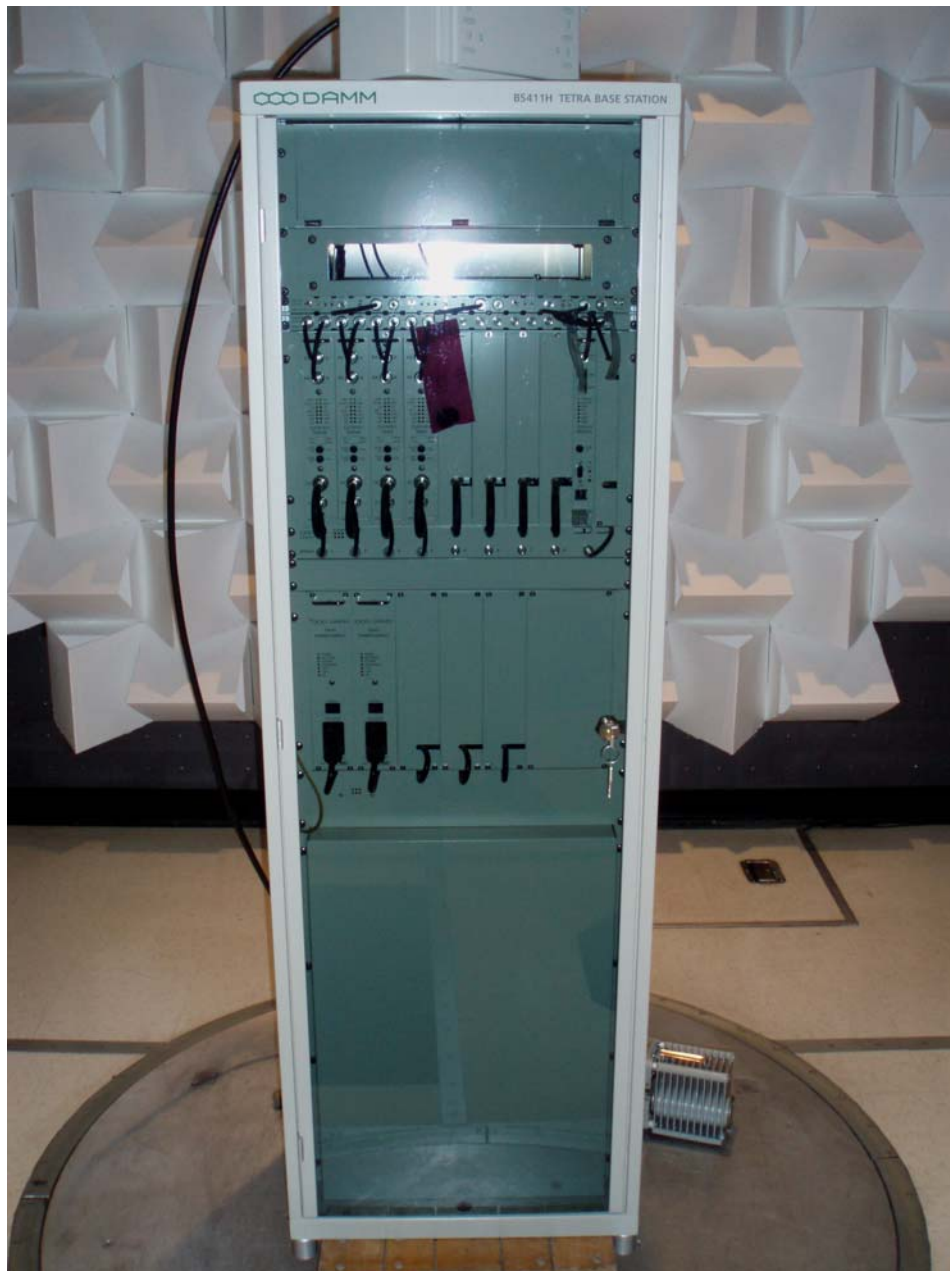
**GENERAL INFORMATION**  
**DUT Specification**

<b>DUT Description</b>	Transceiver 0.2(modified) and 0.35 TETRA
<b>FCC ID</b>	Z5W-104028
<b>IC Certification</b>	10159A-104028
<b>Model Number</b>	TR412H transceiver 800 MHz
<b>Serial Number</b>	N/A
<b>Operating Frequency</b>	RX = 805 – 825 TX = 851 – 869
<b>Test Frequencies</b>	856 MHz, 863 MHz, 869 MHz
<b>Type of Emission</b>	21K0D1W, 21K0D1D, 21K0D1E, & 21K0D7W 20K0D1W, 20K0D1D, 20K0D1E, & 20K0D7W
<b>Modulation</b>	0.35 TETRA, 0.20 modified TETRA
<b>DUT Power Source</b>	<input checked="" type="checkbox"/> 110-120Vac/50- 60Hz
	<input type="checkbox"/> DC Power 12V
	<input type="checkbox"/> Battery Operated Exclusively
<b>Test Item</b>	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
<b>Type of Equipment</b>	<input checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
<b>Test Conditions</b>	Temperature was 26°C Relative humidity of 50%.
<b>Modification to the DUT</b>	None
<b>Test Exercise</b>	The DUT was placed in continuous transmit mode.
<b>Applicable Standards</b>	ANSI/TIA 603-C:2004, FCC CFR 47 Part 90, IC RSS-119, RSS-GEN
<b>Test Facility</b>	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

Applicant: DAMM CELLULAR SYSTEMS A/S  
 FCC ID: Z5W-104028  
 IC CERT #: 10159A-104028  
 Report: D\DAMM\1130UT12\1130UT12TestReport.doc

**GENERAL INFORMATION (cont'd)**  
**DUT Specification**

The system as tested consists of the transceiver module combined with a power supply module, CPU module, and broadband filter assembly. This is combined in a single 19inch rack assembly. The unit is detailed in the user's manual.



Applicant: DAMM CELLULAR SYSTEMS A/S  
FCC ID: Z5W-104028  
IC CERT #: 10159A-104028  
Report: D\DAMM\1130UT12\1130UT12TestReport.doc

**GENERAL INFORMATION (cont'd)**  
**DUT Specification**

TR-412H Transceiver



Applicant: DAMM CELLULAR SYSTEMS A/S  
FCC ID: Z5W-104028  
IC CERT #: 10159A-104028  
Report: D\DAMM\1130UT12\1130UT12TestReport.doc

## TEST PROCEDURES

**Power Line Conducted Interference:** The procedure used was ANSI/TIA 603-C: 2004 using a 50uH LISN. Both lines were observed with the DUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

**Bandwidth 20 dB:** The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

**Power Output:** The RF power output was measured at the antenna feed point using a peak power meter.

**Antenna Conducted Emissions:** The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10<sup>th</sup> harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

**Radiation Interference:** The test procedure used was ANSI/TIA 603-C: 2004 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a micro volt at the output of the antenna.

Applicant: DAMM CELLULAR SYSTEMS A/S  
FCC ID: Z5W-104028  
IC CERT #: 10159A-104028  
Report: D\DAMM\1130UT12\1130UT12TestReport.doc

**MODULATION CHARACTERISTICS**

**Part 2.1033(c)**

**Part 2.1033(c) (4)**

**FCC Part 90.209, IC RSS-119 5.5**

**FCC Part 90.207**

Type of Emission:  $\pi/4$ DQPSK TETRA as defined in EN 300 392-2.

TETRA is a digital, trunked radio technology that operates with Time Division Multiple Access (TDMA) in four-slot channels within a twenty-five kilohertz bandwidth.

This unit has two distinct and different but similar modulation schemes. One being as defined above and the second mode which is similar and implemented through a software change only where:

**Description of the modified modulation:**

From ETSI EN 300 392-2 part 5.5 the requirement for the output spectrum of a TETRA signal  $G(f)$  is:

$$\begin{array}{ll}
 G(f) = 1 & \text{for } |f| \leq (1 - \alpha)/2T \\
 G(f) = \sqrt{0.5(1 - \sin(\pi(2|f|T - 1)/2\alpha))} & \text{for } (1 - \alpha)/2T \leq |f| \leq (1 + \alpha)/2T \\
 G(f) = 0 & \text{for } |f| \geq (1 + \alpha)/2T
 \end{array}$$

Where  $\alpha$  is the roll-off factor, which determines the width of the transmission band at a given symbol rate. For TETRA the value of  $\alpha$  shall be 0.35.

This spectrum can't fulfill the requirement of the FCC. Therefore the shape of the output spectrum has been modified by changing  $\alpha$  from 0.35 to 0.20. This gives a narrowed spectrum that meets the FCC requirements for the 20 kHz bandwidth.

The TETRA and modified modulation meets the spectrum efficiency requirements of Part 90.



**OCCUPIED BANDWIDTH**

**FCC Part 2.1049(c), RSS-GEN 4.6 EMISSION BANDWIDTH  
FCC Part 90.210(b) RSS-119 4.2 25 kHz Channel Spacing**

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least 43 + 10log(P)dB.

**Part 90.210(c) 25 kHz Channel Spacing Not Equipped with a Low Pass Filter**

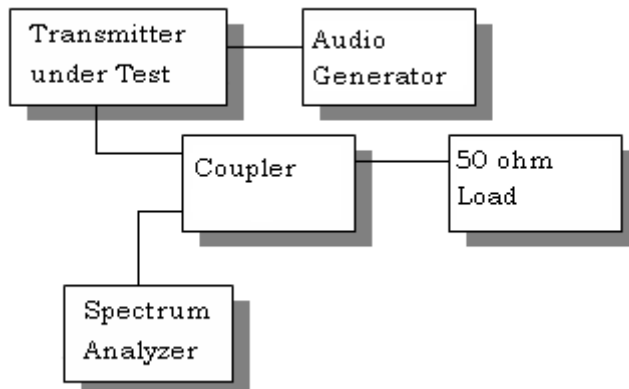
For transmitters that are not equipped with an audio low pass filter pursuant to S90.211 (b), the power of any emission must be attenuated below the un-modulated carrier output power as follows; (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz but not more than 10 kHz: At least 83 log (fd/5) dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least 29 log(fd2/11)dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least 43+10 log(Po)dB.

**OCCUPIED BANDWIDTH MEASUREMENT**

**Test procedure:** ANSI/TIA-603-C:2004 para 2.2.11.

**Test Setup Diagram:**

OCCUPIED BANDWIDTH MEASUREMENT



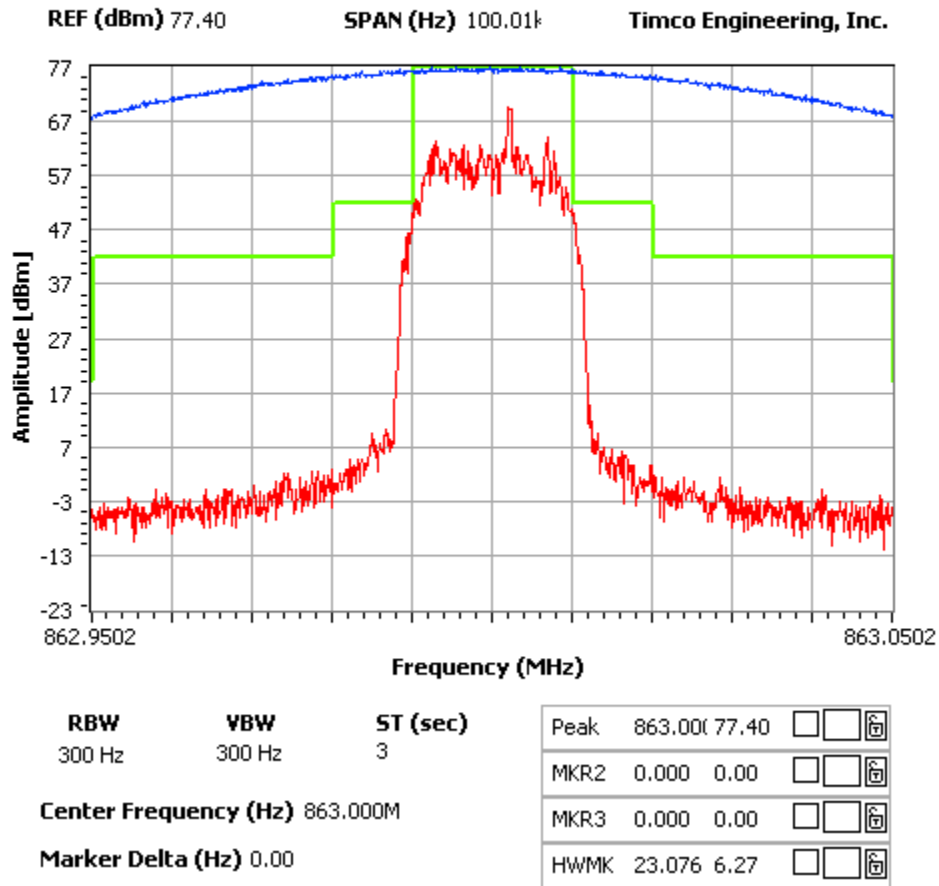
**Test Data:** See the plots below

Applicant: DAMM CELLULAR SYSTEMS A/S  
 FCC ID: Z5W-104028  
 IC CERT #: 10159A-104028  
 Report: D\DAMM\1130UT12\1130UT12TestReport.doc

**25.0 kHz – DIGITAL  
0.2 modified**

NOTES:

FCC 90.210 Mask B



Applicant: DAMM CELLULAR SYSTEMS A/S  
 FCC ID: Z5W-104028  
 IC CERT #: 10159A-104028  
 Report: D\DAMM\1130UT12\1130UT12TestReport.doc

## EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 5/10/10	5/10/12
AC Voltmeter	HP	400FL	2213A14499	CAL 6/12/11	6/12/13
Antenna: Active Loop	ETS-Lindgren	6502	00062529	CAL 9/23/10	9/23/12
Frequency Counter	HP	5385A	2730A03025	CAL 8/17/11	8/17/13
Hygro-Thermometer	Extech	445703	0602	CAL 6/15/11	6/15/13
Modulation Analyzer	HP	8901A	3435A06868	CAL 7/18/11	7/18/13
Digital Multimeter	Fluke	FLUKE-77	35053830	CAL 9/9/11	9/9/13
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 10/28/11	10/28/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 10/28/11	10/28/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 10/28/11	10/28/13
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 10/28/11	10/28/13
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/10	4/25/12
Antenna	ETS	3117	41534	9/22/2010	9/22/2012
Antenna	Electro metrics	LPA-25	1122	5/04/2011	5/04/2013
Antenna	Electro metrics	94455-1	1096	5/4/2011	5/4/2013

Applicant: DAMM CELLULAR SYSTEMS A/S  
 FCC ID: Z5W-104028  
 IC CERT #: 10159A-104028  
 Report: D\DAMM\1130UT12\1130UT12TestReport.doc