



Engineering and Testing for EMC and Safety Compliance



Accredited under A2LA Testing Certificate # 2653.01

**Certification Application Report
(Limited Modular Approval)
FCC Part 15.231 & Industry Canada RSS-210**

Test Lab: Rhein Tech Laboratories, Inc. Phone:703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 Email: atcbinfo@rheintech.com		Applicant: EnOcean GmbH Phone: 49 89 67 34 689 - 33 Kolpingring 18a Fax: 49 89 67 34 689 - 55 D-82041 Oberhaching www.enocean.com Germany Contact: Armin Anders	
FCC ID	SZV-TCM2XXC	Test Report Date	May 30, 2008
IC	5713A-TCM2XXC		
Platform	N/A	RTL Work Order Number	2008102
Model #s	TCM200C & TCM220C	RTL Quote Number	QRTL08-204A
FCC Classification	DSC – Part 15 Security/Remote Control Transmitter		
FCC Rule Part(s)	Part 15.231: Periodic operation in the band 40.66 – 40.70 MHz and above 70 MHz (10-01-07)		
Industry Canada Standard	RSS-210 Issue 7 June 2007: Low Power License-Exempt Radio Communication Devices (All Frequency Bands)		
Digital Interface Information	Digital Interface was found to be compliant		
Receiver Information	Receiver was found to be compliant		
Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
315	N/A	N/A	389KF1D

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. Modifications made to the equipment during testing in order to achieve compliance with these standards are listed in the report.

Furthermore, there was no deviation from, additions to, or exclusions from the applicable parts of FCC Part 2, FCC Part 15, Industry Canada RSS-210, and ANSI C63.4.

Signature: 

Date: May 30, 2008

Typed/Printed Name: Desmond A. Fraser

Position: President

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Table of Contents

1	General Information	4
1.1	Scope	4
1.2	Modifications	4
1.3	Test Facility	4
1.4	Related Submittal(s)/Grant(s)	4
2	Test Information	5
2.1	Test Justification	5
2.2	Exercising the EUT	5
2.3	Test Result Summary	5
2.4	Test System Details	5
2.5	Configuration of Tested System	6
3	Duty Cycle Calculation - FCC §15.35(c), RSS-Gen 4.5	7
4	Transmitter Deactivation - FCC §15.231(a)(1)/(2), RSS-210 A1.1.1(a)/(b)	8
5	Modulated Bandwidth – FCC §15.231(c) & IC RSS-210 §A1.1.3	9
5.1	Modulated Bandwidth Test Procedure	9
5.2	FCC §15.231(c) Limits	9
5.3	Modulated Bandwidth Test Data	9
6	Radiated Emissions – FCC §15.109, §15.231 & IC RSS-210 §A1.1.2	11
6.1	Radiated Fundamental Emissions Test Procedure	11
6.1.1	Radiated Fundamental Emissions Limits Test Data	11
6.2	Radiated Harmonics/Spurious Emissions – FCC §15.231 & IC RSS-210 §A1.1.2	11
6.2.1	Radiated Emissions Harmonics/Spurious Test Procedure	11
6.2.2	Radiated Harmonics/Spurious Emissions Test Data	11
7	Conducted Limits – FCC §15.207 & IC RSS-Gen	13
7.1	Site and Test Description	13
7.2	Test Limits	13
7.3	Conducted Emissions Test Data	14
8	Conclusion	15

Table Index

Table 2-1:	Test Result Summary with FCC Rules and Regulations	5
Table 2-2:	Equipment Under Test (EUT).....	5
Table 3-1:	Duty Cycle Test Equipment	7
Table 4-1:	Transmitter Deactivation Test Equipment	8
Table 5-1:	20 dB Modulated Bandwidths	9
Table 5-2:	Modulated Bandwidth Test Equipment	10
Table 6-1:	Radiated Fundamental Emissions (Stand-alone).....	11
Table 6-2:	Radiated Harmonics/Spurious Emissions without Carrier Board (Stand-alone).....	11
Table 6-3:	Radiated Emissions Test Equipment	12
Table 7-1:	Conducted Emissions Test Data - Neutral Side – Line 1	14
Table 7-2:	Conducted Emissions Test Data – Hot Side – Line 2	14
Table 7-3:	Conducted Emissions Test Equipment	14

Figure Index

Figure 2-1:	Worst Case Configuration of System under Test.....	6
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Plot Index

Plot 3-1:	Pulse Width	7
Plot 4-1:	Transmitter Deactivation	8
Plot 5-1:	Modulated Bandwidth.....	10

Appendix Index

Appendix A:	FCC/TCB Agency Authorization Letter	16
Appendix B:	FCC Confidentiality Request Letter	17
Appendix C:	FCC Modular Approval DA00-1407	18
Appendix D:	IC Agent Authority and Listing Requirements Letters	19
Appendix E:	IC Confidentiality Request Letter	20
Appendix F:	IC Modular Approval RSS-Gen.....	21
Appendix G:	ID Label and Label Location	22
Appendix H:	Operational Description	23
Appendix I:	Schematics	24
Appendix J:	Block Diagram	25
Appendix K:	Manual.....	26
Appendix L:	Test Photographs	27
Appendix M:	External Photographs	29

Photograph Index

Photograph 1:	ID Label Samples.....	22
Photograph 2:	ID Label Location on Modules.....	22
Photograph 3:	Radiated Emissions Front View	27
Photograph 4:	Radiated Emissions Back View	28
Photograph 5:	Top View	29
Photograph 6:	Bottom View	30

1 General Information

1.1 Scope

FCC Rules Part 15.231: Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

IC RSS-210 Section A1.1: Momentarily Operated Devices

1.2 Modifications

N/A.

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Rhein Tech Laboratories, Inc. (RTL), 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.4 Related Submittal(s)/Grant(s)

This is an original certification application for **Limited Modular Approval** for EnOcean GmbH Models TCM200C & TCM220C, FCC ID: SZV-TCM2XXC, IC: 5713A-TCM2XXC. A Family Certification is being requested for Industry Canada.

2 Test Information

2.1 Test Justification

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. 315 MHz was tested and investigated from 9 kHz to the 10th harmonic. The test results relate only to the item that was tested.

The antenna transmits, receives, and is externally attached. The IF, LO, and up to the 2nd LO, were investigated and tested, and found to be compliant for unintentional emissions compliance.

2.2 Exercising the EUT

The EUT was adapted to continuously transmit with a 30 ms long train of pulses within 100 ms for testing purposes. The carrier was also checked to verify that the information was being transmitted. There were no deviations from the test standard(s) and/or methods.

2.3 Test Result Summary

Table 2-1: Test Result Summary with FCC Rules and Regulations

Standard	Test	Pass/Fail Or N/A
FCC 15.207	AC Line Conducted Emissions	Pass
FCC 15.231(a)	Radiated Emissions	Pass
FCC 15.231(c)	20 dB Bandwidth	Pass

2.4 Test System Details

The test sample was received by RTL on May 16, 2008. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are shown in the following table.

Note that two models are covered under this report: TCM200C and TCM220C. The TCM200C is a 5 V version, and the TCM220C is a 3 V version. Both versions were investigated and the worst-case data is presented in this report.

Table 2-2: Equipment Under Test (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Transmitter	EnOcean GmbH	TCM200C	SN4	SZV-TCM2XXC	N/A	18473
Transmitter	EnOcean GmbH	TCM220C	SN10	SZV-TCM2XXC	N/A	18476

2.5 Configuration of Tested System

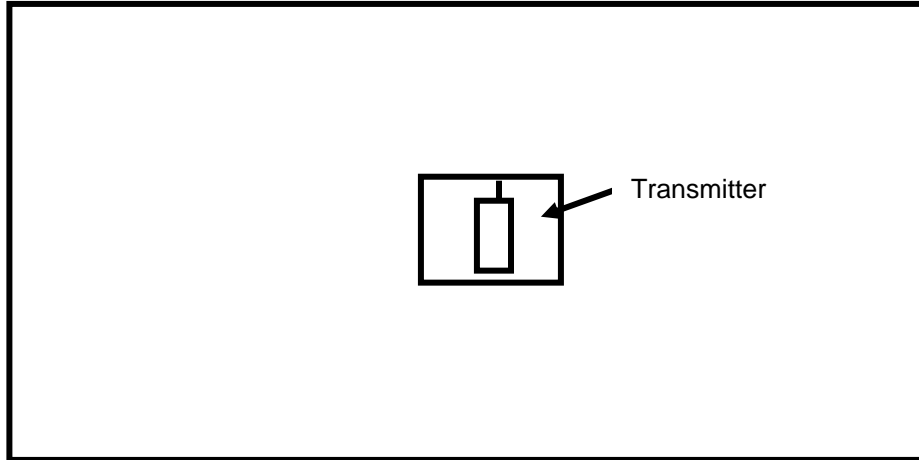


Figure 2-1: Worst Case Configuration of System under Test

3 Duty Cycle Calculation - FCC §15.35(c), RSS-Gen 4.5

Manufacturer's attestation of duty cycle:

A standard transmission consists of 3 ASK (OOK) data packets. Each one lasts 1.208 ms with ~50% on/off duty cycle. Thus, the transmitter is transmitting 0.6 ms during each of the three data packets, for a total of 1.8 ms for each standard transmission. Because the standard transmission occurs at a period longer than 100 ms, section 15.35(c) limits the period (for calculating the average) to 100 ms.

The duty cycle correction factor is $-20 \log (3 * 0.6 \text{ ms} / 100 \text{ ms}) = -34.9 \text{ dB}$

Plot 3-1: Pulse Width

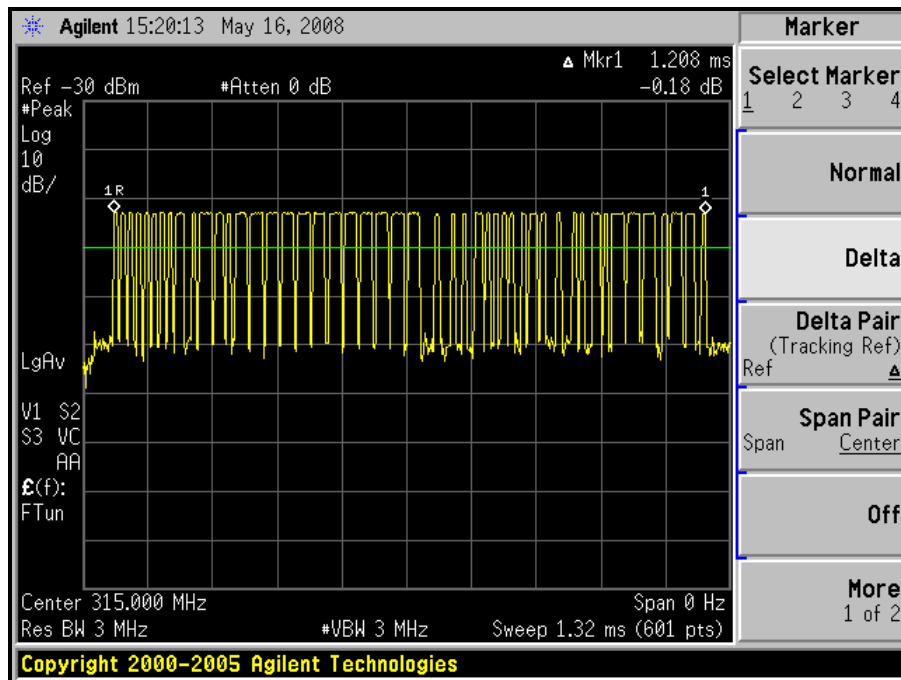


Table 3-1: Duty Cycle Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	6/13/08

Test Personnel:

Richard B. McMurray, P.E.
 EMC Test Engineer

Richard B. McMurray
 Signature

May 16, 2008
 Date of Test

4 Transmitter Deactivation - FCC §15.231(a)(1)/(2), RSS-210 A1.1.1(a)/(b)

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Manufacturer's attestation: The EUT can be activated manually or automatically, and the requirements above are fulfilled inherently. The transmitter sends only a short packet which lasts for only a few tens of milliseconds. Thus, it deactivates itself within the 5 second limit.

Plot 4-1: Transmitter Deactivation

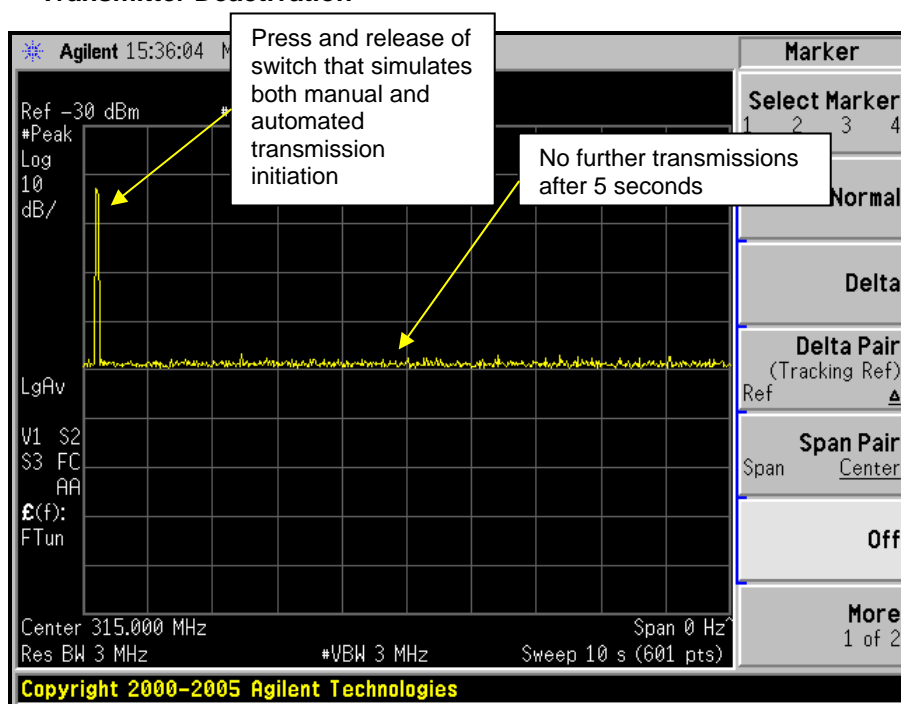


Table 4-1: Transmitter Deactivation Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	6/13/08

Test Personnel:

Richard B. McMurray, P.E. EMC Test Engineer	<i>Richard B. McMurray</i> Signature	May 16, 2008 Date of Test
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5 Modulated Bandwidth – FCC §15.231(c) & IC RSS-210 §A1.1.3

5.1 Modulated Bandwidth Test Procedure

The minimum 20 dB bandwidth was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 10 kHz, and the video bandwidth set at 30 kHz. The 20 dB bandwidth was measured using the delta marker function.

5.2 FCC §15.231(c) Limits

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.3 Modulated Bandwidth Test Data

Table 5-1: 20 dB Modulated Bandwidths

20 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
389	0.25% of 315000 = 787.5	-398.5

Plot 5-1: Modulated Bandwidth

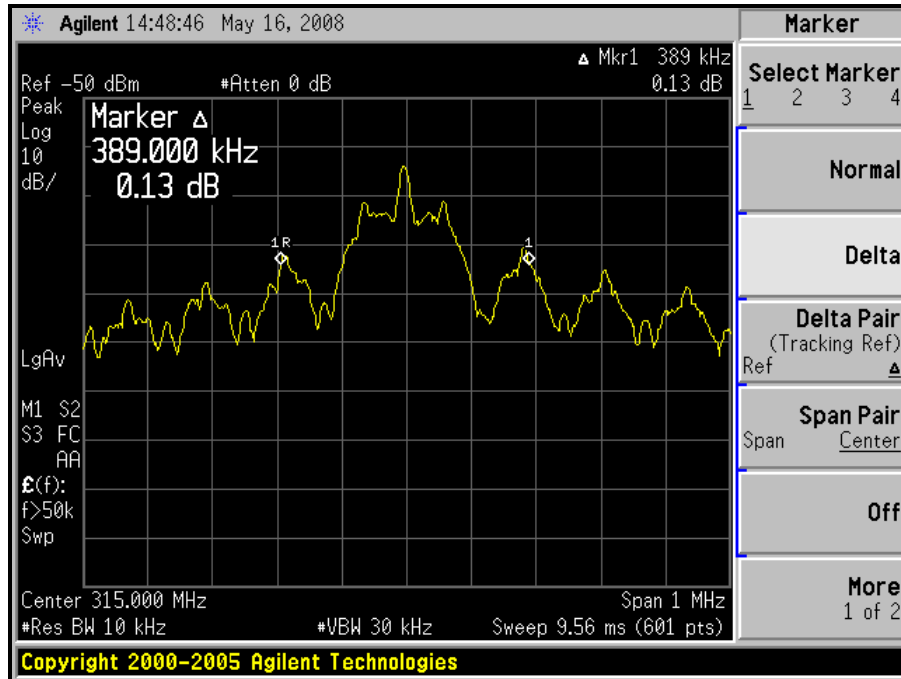


Table 5-2: Modulated Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	6/13/08

Test Personnel:

Richard B. McMurray, P.E.
 EMC Test Engineer

Richard B. McMurray
 Signature

May 16, 2008
 Date of Test

6 Radiated Emissions – FCC §15.109, §15.231 & IC RSS-210 §A1.1.2

6.1 Radiated Fundamental Emissions Test Procedure

Radiated Emissions of the Fundamentals were tested at three meters, and meet the requirements of 6,042 uV/m in average mode, and 20 dB higher in peak mode. The limit is calculated from a linear interpolation between 3,750 and 12,500 uV/m, and from 260 - 470 MHz. The EUT was tested in all three orthogonal planes. Measurement was based on a peak detector, and an average value was calculated based on the duty cycle.

6.1.1 Radiated Fundamental Emissions Limits Test Data

Table 6-1: Radiated Fundamental Emissions (Stand-alone)

Emission Frequency (MHz)	Analyzer Reading (dBuV)	Detector	Pol	Site Correction Factor (dB)	Duty Cycle Correction (dB)	Corrected Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
315	103.7	peak	H	-10.7	N/A	93.0	95.6	-2.6
315	103.7	average	H	-10.7	-34.9	58.1	75.6	-17.5

6.2 Radiated Harmonics/Spurious Emissions – FCC §15.231 & IC RSS-210 §A1.1.2

6.2.1 Radiated Emissions Harmonics/Spurious Test Procedure

Radiated emissions of the harmonics were tested at three meters. The EUT was tested in the 3 orthogonal planes with the receive antenna in both polarities.

6.2.2 Radiated Harmonics/Spurious Emissions Test Data

Table 6-2: Radiated Harmonics/Spurious Emissions without Carrier Board (Stand-alone)


Emission Frequency (MHz)	Analyzer Reading (dBuV)	Detector	Pol	Site Correction Factor (dB)	Duty Cycle Correction (dB)	Corrected Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
630	76.1	peak	H	-3.8	N/A	72.3	75.6	-3.3
630	76.1	average	H	-3.8	-34.9	37.4	55.6	-18.2
945	59.9	peak	H	0.6	N/A	60.5	75.6	-15.1

All other emissions were more than 20 dB below the limit; per 15.31(o) no other data is being reported.

Table 6-3: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
900905	Rhein Tech Laboratories	PR-1040	Amplifier	900905	5/16/2009
900791	Schaffner Chase	CBL6112	Bi-Log Antenna (20 MHz – 2 GHz)	2099	9/21/2008
900913	Hewlett Packard	85462A	EMI Receiver RF Section, (9 KHz - 6.5 GHz)	3325A00159	4/15/2009
900914	Hewlett Packard	85460A	RF Filter Section, (100 KHz - 6.5 GHz)	3330A00107	4/15/2009
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/13/2010
901364	MITEQ	JS4- 01002600- 36-5P	Amplifier (0.1 - 26 GHz)	849863	10/5/2008

Test Personnel:

Jon Wilson Test Engineer	 Signature	May 27, 2008 Date of Test
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7 Conducted Limits – FCC §15.207 & IC RSS-Gen

7.1 Site and Test Description

The power line conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm/50 microhenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable).

The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded.

An off-the-shelf Radio Shack AC Adapter PN 273-1667 was used to supply 3 VDC for this test.

7.2 Test Limits

Line-Conducted Emissions		
Limit (dBµV)		
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

7.3 Conducted Emissions Test Data

Table 7-1: Conducted Emissions Test Data - Neutral Side – Line 1

Temperature: 75°F Humidity: 30%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	CISPR B QP Limit (dBuV)	CISPR B QP Margin (dBuV)	CISPR B AV Limit (dBuV)	CISPR B AV Margin (dBuV)	Pass/Fail
0.151	Pk	35.7	0.2	35.9	65.9	-30.0	55.9	-20.0	Pass
0.223	Pk	35.0	0.2	35.2	62.7	-27.5	52.7	-17.5	Pass
0.307	Pk	35.6	0.2	35.8	60.1	-24.3	50.1	-14.3	Pass

Table 7-2: Conducted Emissions Test Data – Hot Side – Line 2


Temperature: 75°F Humidity: 30%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	CISPR B QP Limit (dBuV)	CISPR B QP Margin (dBuV)	CISPR B AV Limit (dBuV)	CISPR B AV Margin (dBuV)	Pass/Fail
0.155	Pk	36.7	0.2	36.9	65.7	-28.8	55.7	-18.8	Pass
0.191	Pk	36.1	0.2	36.3	64.0	-27.7	54.0	-17.7	Pass
0.323	Pk	35.7	0.2	35.9	59.6	-23.7	49.6	-13.7	Pass

Table 7-3: Conducted Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
900897	Hewlett Packard	8567A	Spectrum Analyzer (100 Hz - .15 GHz)	2727A00535	4/2/2009
900896	Hewlett Packard	85662A	Spectrum Analyzer Display Section	2816A16471	4/2/2009
900901	Hewlett Packard	85650A	Quasi-Peak Adapter	3145A01599	4/2/2009
901082	AFJ International	LS16/110VAC	16A LISN	16010020081	2/4/2009

Test Personnel:

Jon Wilson
 Test Engineer


 Signature

May 29, 2008
 Date of Test

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: EnOcean GmbH
Models: TCM200C & TCM220C
Standards: FCC 15.231/IC RSS-210
ID's: SZV-TCM2XXC/5713A-TCM2XXC
Report #: 2008102

8 Conclusion

The data in this measurement report shows that EnOcean GmbH Models TCM200C & TCM220C; FCC ID: SZV-TCM2XXC, IC: 5713A-TCM2XXC, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules, and Industry Canada RSS-210 for limited modular approval.