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Report Reference ID:	168216-1TRFWL
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Test specification:	Title 47 - Telecommunication Chapter I - Federal Communications Commission Subchapter A - General Part 15 - Radio Frequency Devices Subpart C - Intentional Radiators – §15.249 - Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz and 24.0–24.25 GHz
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Applicant:	Autec s.r.l. Via Pomaroli, 65 Caldogno VI, 36030 Italy
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Apparatus:	Transmitter module
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FCC ID:	OQA-E16STXUS1
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Model:	E16STXUS1
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Testing laboratory:	Nemko Canada Inc. 303 River Road Ottawa, ON, Canada K1V 1H2 Telephone: (613) 737-9680 Facsimile: (613) 737-9691
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	Name and title	Date
Tested by:	Andrey Adelberg, Wireless/EMC Specialist	March 16, 2011
Reviewed by:	 _____ David Duchesne, Wireless/EMC Specialist	March 31, 2011



Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada.
The tests included in this report are within the scope of this accreditation.



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303 River Rd, Ottawa, ON, Canada, K1V 1H2

Product: Transmitter module

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Section 1: Report summary

1.1 Test specification

Specifications	FCC Part 15 Subpart C, 15.249 Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz and 24.0–24.25 GHz
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1.2 Statement of compliance

Compliance	In the configuration tested the EUT was found compliant Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Canada Inc. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003.
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1.3 Exclusions

Exclusions	None
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1.4 Registration number

Test site FCC ID number	176392 (3 m Semi anechoic chamber)
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1.5 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

1.6 Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 2: Summary of test results

2.1 FCC Part 15 Subpart C – Intentional Radiators, test results

General requirements for FCC Part 15

Part	Test description	Verdict
§15.31(e)	Variation of power source	N/A*
§15.31(m)	Number of operating frequencies	Pass
§15.203	Antenna requirement	Pass
§15.207(a)	Conducted limits	N/A*
§15.215(c)	20 dB bandwidth	Pass

Specific requirements for FCC Part 15 Subpart C, 15.249

Part	Test description	Verdict
§15.249(a)	Radiated emissions not in restricted bands	Pass
§15.249(b)	Fixed Point-to-Point operation in the 24.0–24.25 GHz band	N/A**
§15.249(d)	Spurious emissions (except harmonics)	Pass

Notes: * The EUT is a battery operated device

** The EUT operated within 902–928 MHz frequency range

Section 3: Equipment under test (EUT) and application details

3.1 Applicant details

Applicant complete business name	Name:	Autec s.r.l.
Mailing address	Address: City: Province/State: Post code: Country:	Via Pomaroli, 65 Caldogno VI 36030 Italy

3.2 Sample information

Receipt date:	February 11, 2011
Serial number	R258406
FCC ID:	OQA-E16STXUS1
Nemko sample ID #:	13

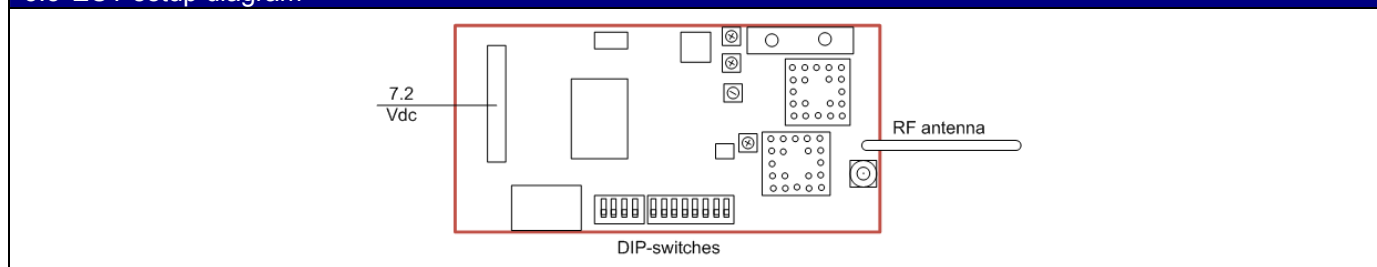
3.3 EUT technical specifications

Operating band:	902–928 MHz
Operating frequency:	902.15–927.725 MHz
Modulation type:	GFSK
Occupied bandwidth:	12.98 kHz (99 % BW)
Emission designator:	12K9F1D
Antenna type:	Integral wire antenna
Power source:	7.2 VDC from battery

3.4 Operation of the EUT during testing

Details:	The EUT is a transmitter module operates inside 902–928 MHz ISM band, which is going to be implemented within numerous Autec hand-held remote controllers. The EUT was set to transmit continuously on the chosen channels by selecting proper sequence on the DIP-switches.
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3.5 EUT setup diagram



Section 4: Engineering considerations

4.1 Modifications incorporated in the EUT

Modifications

Modifications performed to the EUT during this assessment
 None Yes , performed by Client or Nemko
 Details:

4.2 Deviations from laboratory tests procedures

Deviations

Deviations from laboratory test procedures
 None Yes - details are listed below:

4.3 Technical judgment

Judgment

None

Section 5: Test conditions

5.1 Power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions

Temperature: 15–30 °C
Relative humidity: 20–75 %
Air pressure: 86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

Power supply range:

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed.

Section 6: Measurement uncertainty

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95 % and can be found in Nemko Canada document MU-003.

Section 7: Test equipment

7.1 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	April 14/11
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	Jan. 04/12
50 coax cable	Huber + Suhner	NONE	FA002013	1 year	Sept. 01/11
50 coax cable	Huber + Suhner	NONE	FA002074	1 year	July 13/11
Biconical antenna	Sunol	BC2	FA002078	1 year	Dec. 08/11
Log periodic antenna	Sunol	LP5	FA002077	1 year	Dec. 10/11
Temperature chamber	Thermotron	SM-16C	FA001030	1 year	NCR
Horn antenna #2	Emco	3115	FA000825	1 year	Feb. 04/12
1–18 GHz pre-amplifier	JCA	JCA118-503	FA002091	1 year	Sept. 23/11

Note: NCR = No cal required



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Section 8: Testing data		Product: Transmitter module	
Test name: Clause 15.31(e) Variation of power source			
Test date: March 8, 2011		Test engineer: Andrey Adelberg	Verdict: Pass
Specification: FCC Part 15 Subpart A			

Section 8: Testing data

8.1 Clause 15.31(e) Variation of power source

§ 15.31 Measurement standards.

- (e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.

Special notes

None

Test data

- All tests were performed with fully charged battery.



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Section 8: Testing data		Product: Transmitter module	
Test name: Clause 15.31(m) Number of operating frequencies			
Test date: February 28, 2011	Test engineer: Andrey Adelberg	Verdict: Pass	
Specification: FCC Part 15 Subpart A			

8.2 Clause 15.31(m) Number of operating frequencies

§ 15.31 Measurement standards.

(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz and less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom


Special notes

None

Test data

The frequency band is 26 MHz therefore number of operating frequencies for test is 3:

Low frequency / channel	902.150 MHz
Mid frequency / channel	915.350 MHz
High frequency / channel	927.725 MHz

 Nemko Canada Inc., 303 River Rd, Ottawa, ON, Canada, K1V 1H2	Section 8: Testing data	Product: Transmitter module	
	Test name: Clause 15.203 Antenna requirement		
	Test date: March 8, 2011	Test engineer: Andrey Adelberg	Verdict: Pass
	Specification: FCC Part 15 Subpart C		

8.3 Clause 15.203 Antenna requirement

§ 15.203 Antenna requirement.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

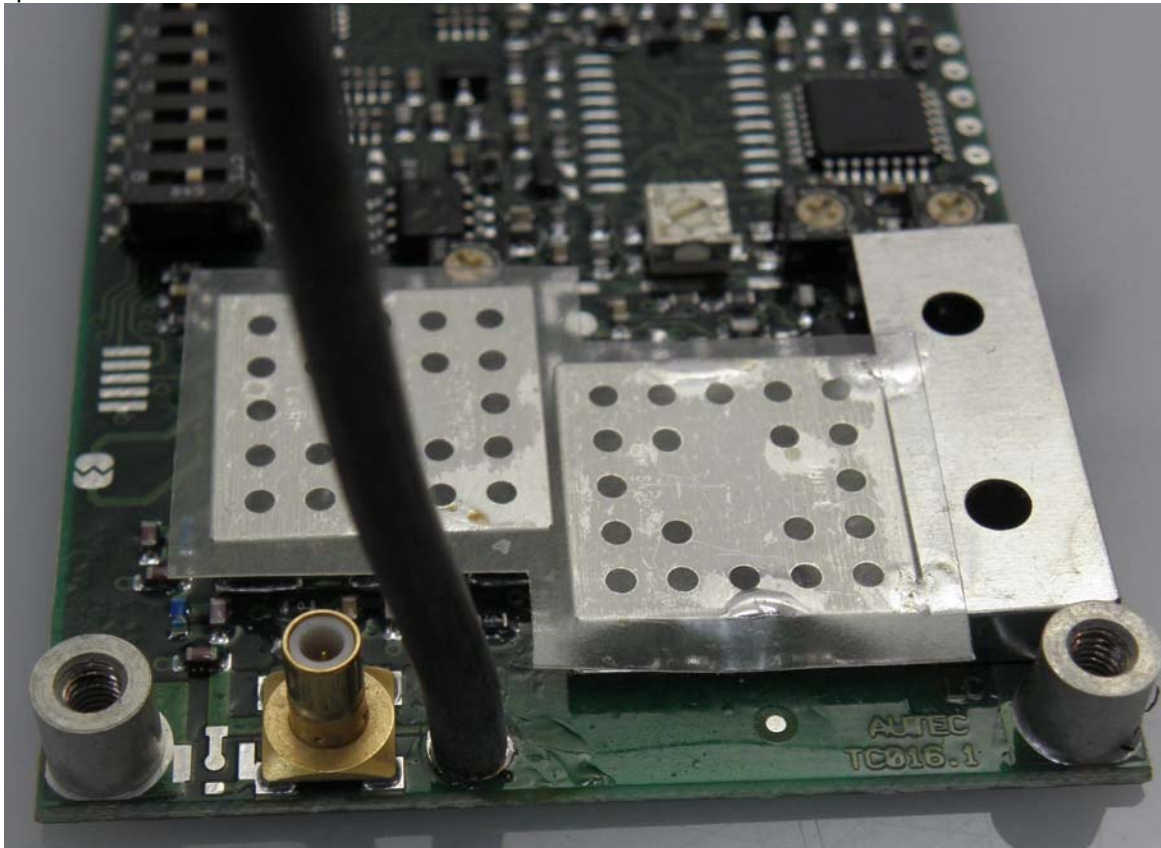
Special notes


None

Test data

The EUT uses a non-detachable antenna to the intentional radiator.

Detailed photo of RF connector:



 Nemko Canada Inc., 303 River Rd, Ottawa, ON, Canada, K1V 1H2	Section 8: Testing data		Product: Transmitter module	
	Test name: Clause 15.215(c) Emission bandwidth			
	Test date: March 10, 2011		Test engineer: Andrey	
	Verdict: Pass		Supply input: 7.2 VDC	
	Temperature: 21 °C	Air pressure: 1003 mbar	Relative humidity: 31 %	
Specification: FCC Part 15 Subpart C				

8.4 Clause 15.215(c) Emission bandwidth

§ 15.215 Additional provisions to the general radiated emission limitations

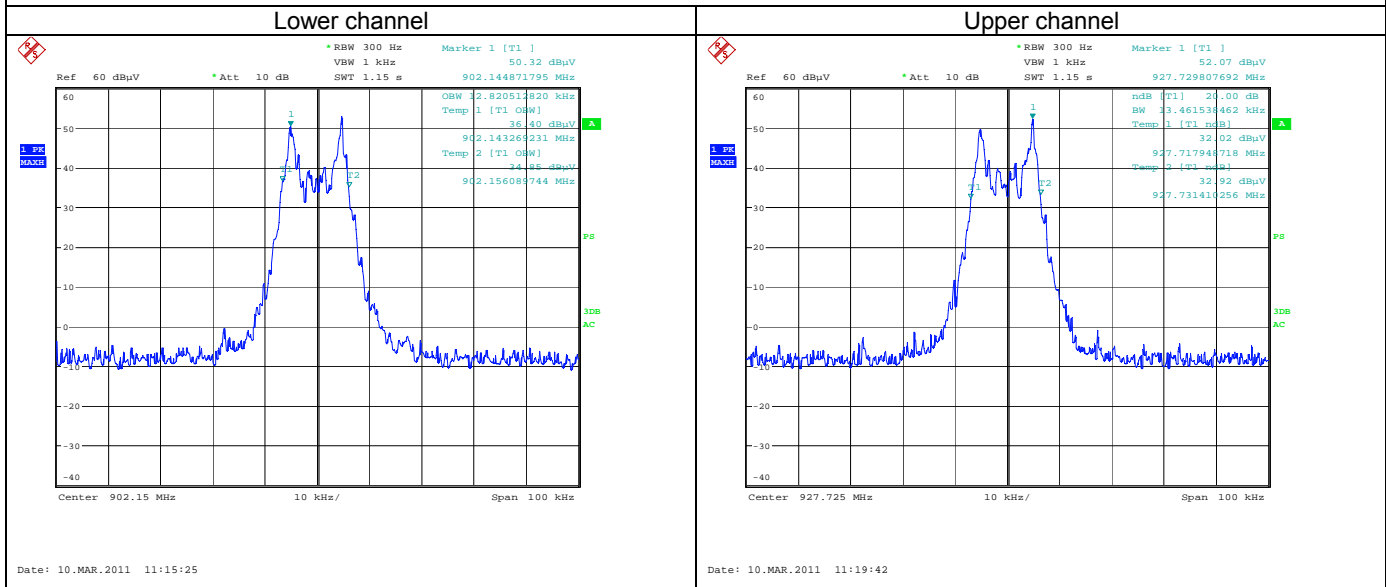
(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

Special notes

The test was performed using peak detector of the spectrum analyzer with RBW no narrower than 1 % of the emission bandwidth.

Test data

Measured results



Lower band edge (MHz)	Lower Limit (MHz)	Lower margin (MHz)	Upper band edge (MHz)	Upper Limit (MHz)	Upper margin (MHz)
902.143	902.000	0.143	927.731	928.000	0.269

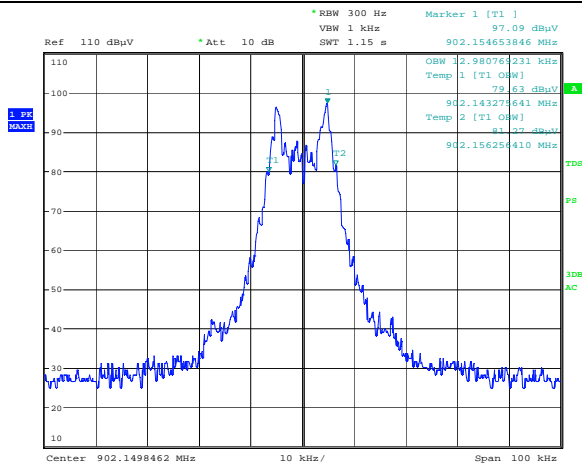


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Section 8: Testing data		Product: Transmitter module	
Test name: Clause 15.215(c) Emission bandwidth			
Test date: March 10, 2011		Test engineer: Andrey	
Verdict: Pass		Supply input: 7.2 VDC	
Temperature: 21 °C	Air pressure: 1003 mbar	Relative humidity: 31 %	
Specification: FCC Part 15 Subpart C			

Test data

99 % occupied bandwidth



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 Nemko Canada Inc., 303 River Rd, Ottawa, ON, Canada, K1V 1H2	Section 8: Testing data		Product: Transmitter module	
	Test name: Clause 15.249(a) Field strength of radiated emissions not in restricted bands			
	Test date: March 8, 2011		Test engineer: Andrey Adelberg	
	Verdict: Pass		Supply input: 7.2 VDC	
	Temperature: 21 °C	Air pressure: 1003 mbar	Relative humidity: 31 %	
Specification: FCC Part 15 Subpart C				

8.5 Clause 15.249(a) Field strength of radiated emissions not in restricted bands

§ 15.249 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental		Field strength of spurious emissions	
	(mV/m)	(dBµV/m)	(µV/m)	(dBµV/m)
902–928	50	94	500	54
2400–2483.5	50	94	500	54
5725–5875	50	94	500	54
24.0–24.25	250	108	2500	68

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter (128 dBµV/m) at 3 meters along the antenna azimuth.

Special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
 - within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
 - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
 - and using average detector with 1 MHz/3 MHz RBW/VBW for average results

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators) for determination of compliance. Limits have been adjusted to reflect 3 m requirements.

A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission.

There were no emissions detected within 6 dB or above limit.

Preview measurements	Final measurement
30–1000 MHz range	
Receiver: 120 kHz RBW, Peak detector, max hold	Receiver: 120 kHz RBW, Quasi-peak detector
Measurement time 100 ms	
1000–9300 MHz range	
Receiver: 1 MHz RBW, Peak detector, max hold	Receiver: 1 MHz RBW, Peak and Average detector
Measurement time 100 ms	



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Section 8: Testing data

Product: Transmitter module

Test name: Clause 15.249(a) Field strength of radiated emissions not in restricted bands

Test date: March 8, 2011

Test engineer: Andrey Adelberg

Verdict: Pass

Supply input: 7.2 VDC

Temperature: 21 °C

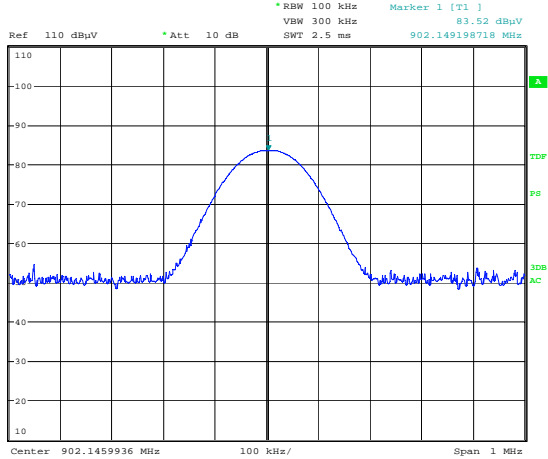
Air pressure: 1003 mbar

Relative humidity: 31 %

Specification: FCC Part 15 Subpart C

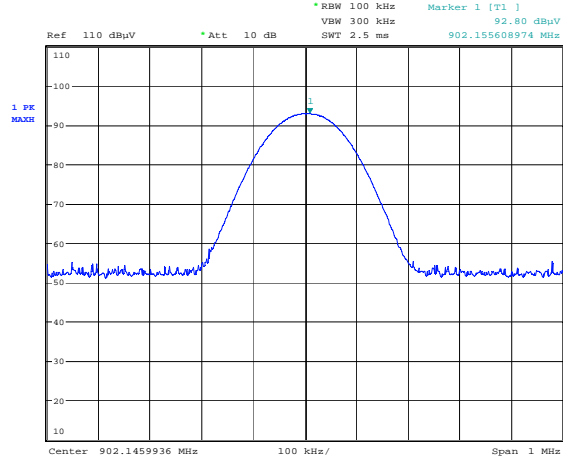
Test data

Low channel, vertical antenna polarization



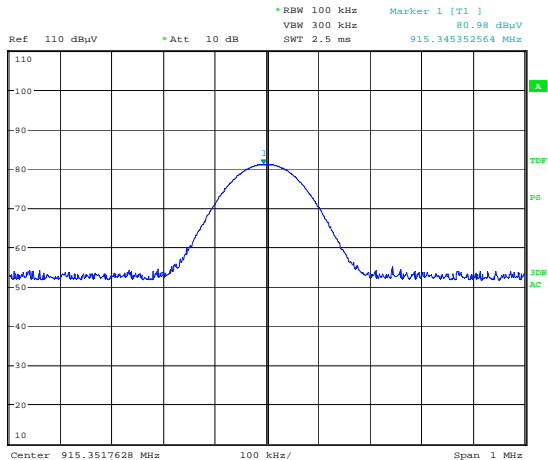
Date: 8.MAR.2011 17:27:14

Low channel, horizontal antenna polarization



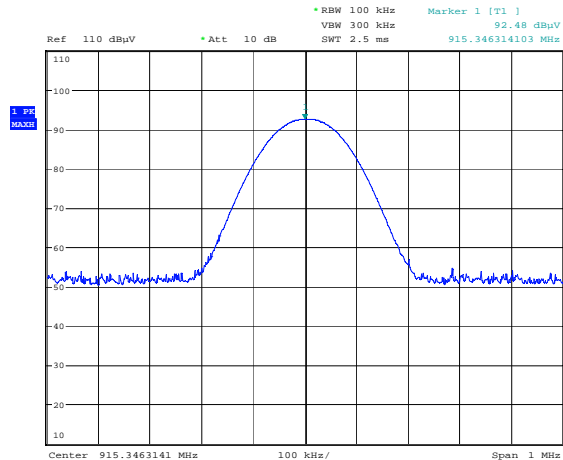
Date: 8.MAR.2011 17:28:53

Mid channel, vertical antenna polarization



Date: 8.MAR.2011 17:41:08

Mid channel, horizontal antenna polarization



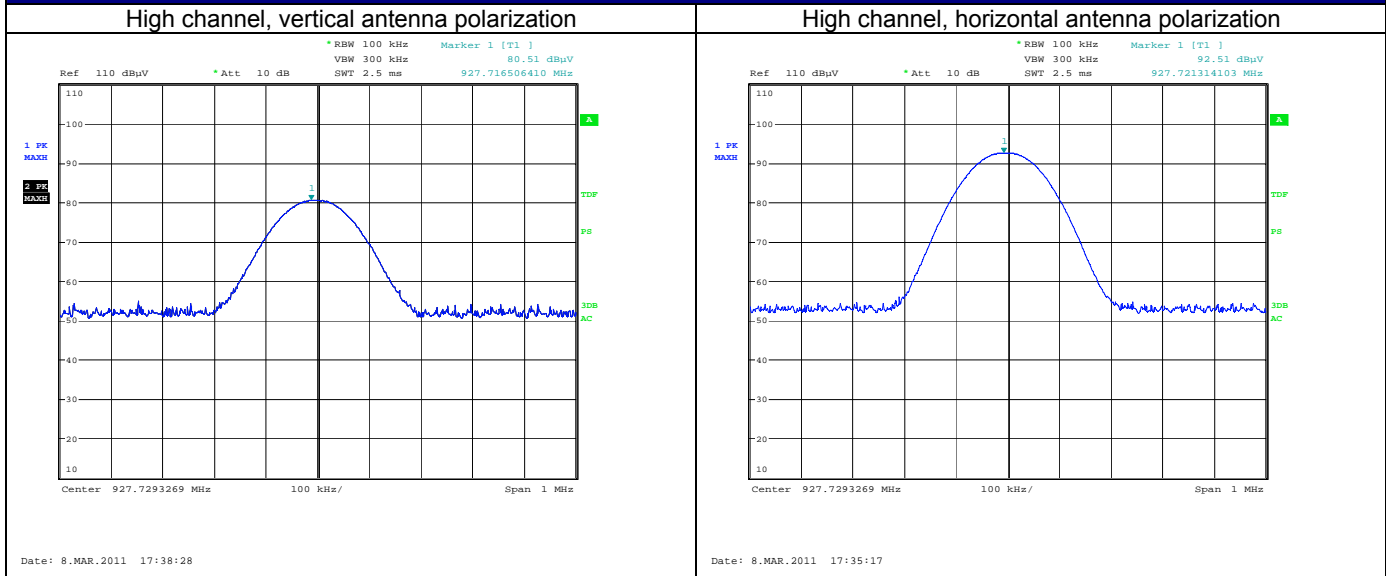
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Section 8: Testing data		Product: Transmitter module	
Test name: Clause 15.249(a) Field strength of radiated emissions not in restricted bands			
Test date: March 8, 2011		Test engineer: Andrey Adelberg	
Verdict: Pass		Supply input: 7.2 VDC	
Temperature: 21 °C	Air pressure: 1003 mbar	Relative humidity: 31 %	
Specification: FCC Part 15 Subpart C			

Test data, continued



Frequency (MHz)	Polarization. Vertical/Horizontal	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
902.15	Vertical	83.52	94.00	10.48
	Horizontal	92.80	94.00	1.20
915.35	Vertical	80.98	94.00	13.02
	Horizontal	92.48	94.00	1.52
927.73	Vertical	80.51	94.00	13.49
	Horizontal	92.51	94.00	1.49

Note: Field strength includes correction factor of antenna and cable losses.

 Nemko Canada Inc., 303 River Rd, Ottawa, ON, Canada, K1V 1H2	Section 8: Testing data		Product: Transmitter module	
	Test name: Clause 15.249(d) Spurious emissions (except for harmonics)			
	Test date: March 8, 2011		Test engineer: Andrey Adelberg	
	Verdict: Pass		Supply input: 7.2 VDC	
	Temperature: 21 °C		Air pressure: 1003 mbar	Relative humidity: 31 %
	Specification: FCC Part 15 Subpart C			

8.6 Clause 15.249(d) Spurious emissions (except for harmonics)

§ 15.249 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

- (d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Special notes

§15.209 – Radiated emission limits

Frequency (MHz)	Field strength		Measurement distance (m)
	($\mu\text{V}/\text{m}$)	($\text{dB}\mu\text{V}/\text{m}$)	
0.009–0.490	2400/F	67.6–20log(F)	300
0.490–1.705	24000/F	87.6–20log(F)	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes:

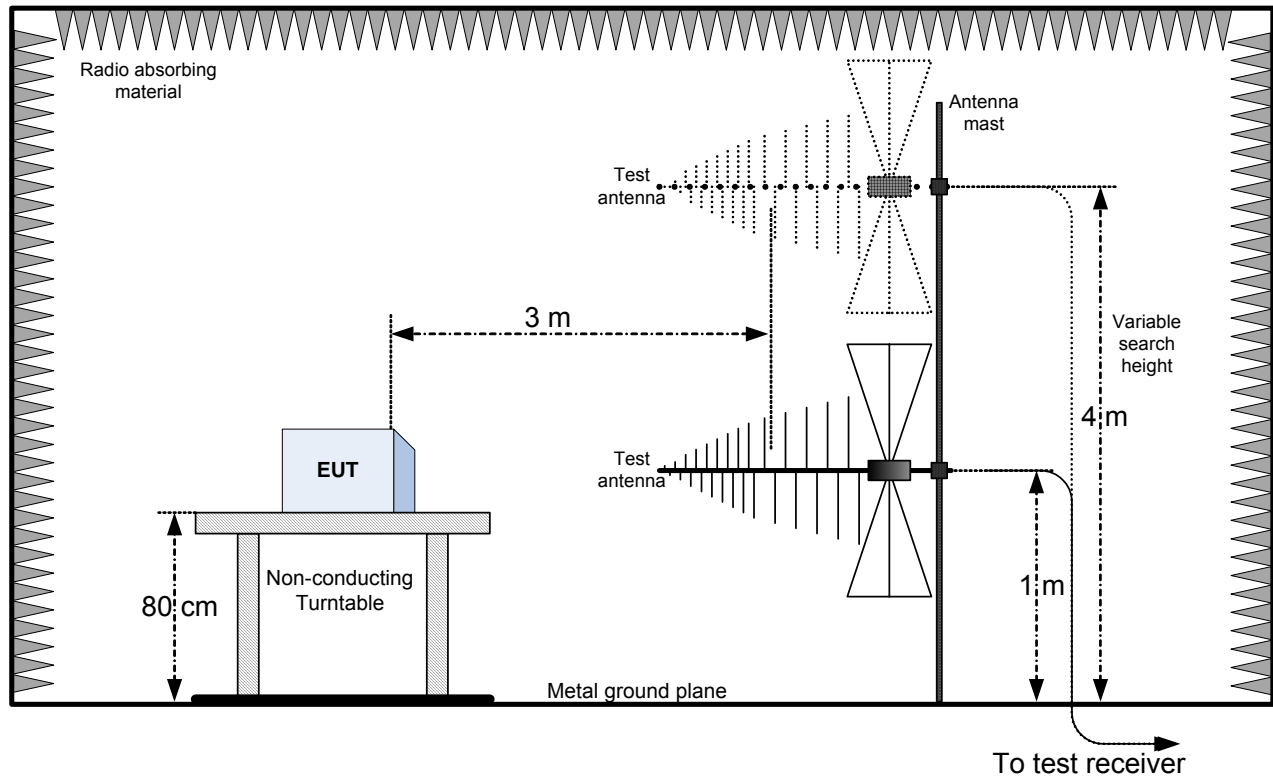
- F = fundamental frequency in kHz
- In the emission table above, the tighter limit applies at the band edges.
- For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

- The spectrum was searched from 30 MHz to the 10th harmonic.
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
 - within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
 - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results and using average detector with 1 MHz/3 MHz RBW/VBW for average results

No emissions were found within 10 dB below the limit.

Section 9: Block diagrams of test set-ups

Radiated emissions set-up

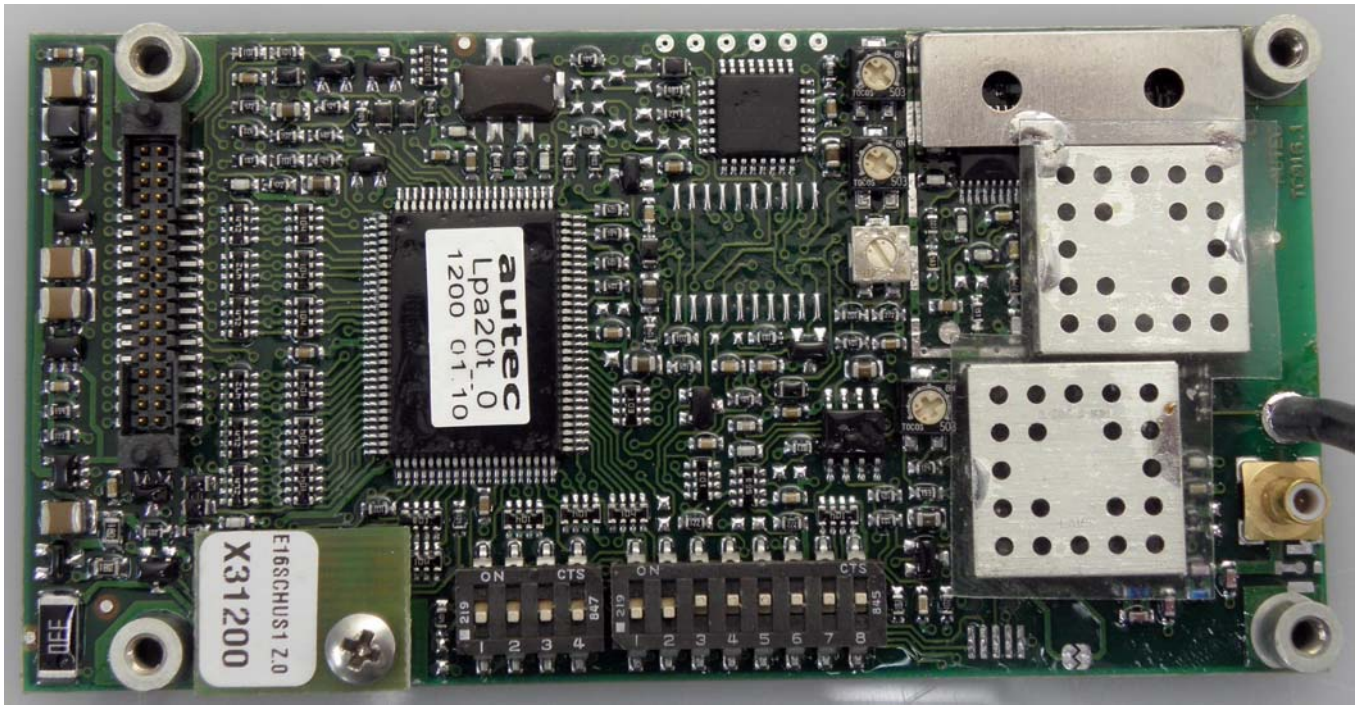


Section 10: EUT photos

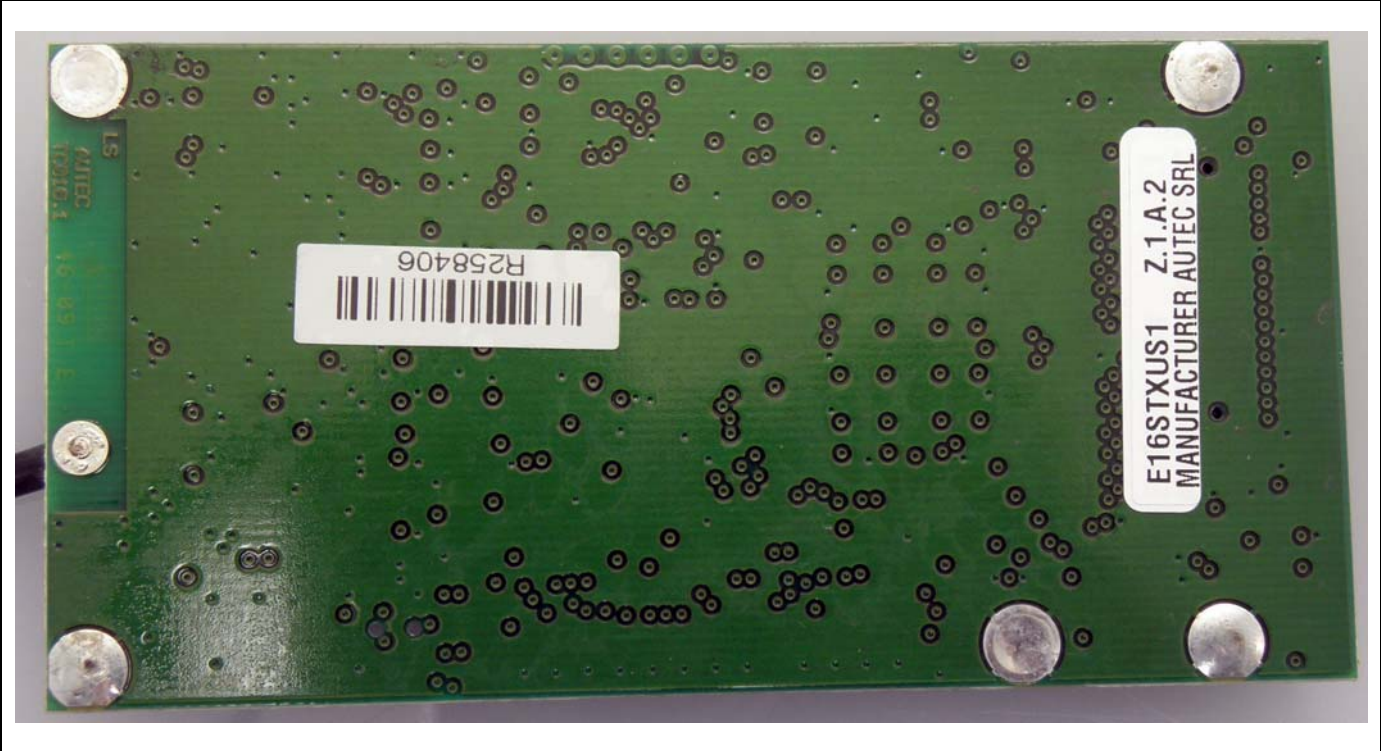
EUT



EUT, continued



EUT, continued



EUT, continued

