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Spec No: 001-15085

Spec Title: WIRELESSUSB(TM) LS RADIO MODULE ETSI TESTING AND VERIFICATION - AN4001

Replaced by: NONE

AN4001

WirelessUSB™ LS Radio Module ETSI Testing and Verification

Author: Sai Prashanth Chinnapalli
Associated Project: No
Associated Part Family: CYWUSB6934
Software Version: N/A
Related Application Notes: None

This application note provides a brief overview of the legal issues governing the manufacture and sale of wireless products intended for unlicensed operation in the European Union (EU).

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Introduction

One of the bottlenecks that many product developers encounter in incorporating any radio communication device is facing the legal aspect of qualifying the products and going to market without encountering legal problems. The EU/Radio Equipment and Telecommunication Terminal Equipment (R&TTE) verification process certifies devices in accordance with the European Telecommunication Standards Institute (ETSI) rules and policies. The performance of WirelessUSB™ LS is measured with a reference radio module according to the requirements of ETSI rules. The major applicable ETSI regulations are described in ETSI EN301 489–1 and ETSI EN300 328–1.

Although the operation of wireless radio devices in the industrial, scientific and medical (ISM) band is license free, a product incorporating WirelessUSB™ LS radio IC must be type approved or meet certain requirements. In the European Union, the ETSI is responsible for the regulation of all wireless radio devices. The European Union regulates the use of radio equipment through the R&TTE directive. Any device that radiates RF energy must be tested for compliance with Conference of European Post and Telecommunications (CEPT) and ETSI rules.

ETSI Authorization Process

The actual standards to follow are written by standardization bodies like CEPT and ETSI. The CEPT is an organization for the Post Telephone Telegraph (PTT) authorities in the European Countries and is responsible for the use of radio frequencies and the output power.

EU Compliance Process—R&TTE Directive

On April 1, 2000, R&TTE Directive 1999/5/EC (also known as the R&TTE Directive) went into effect. The Directive 1999/5/EEC allows the manufacturers to adopt self-declaration. In addition, it makes the conformity assessment process quicker and more flexible, and takes radio and telecommunication equipment to the same level as other product types. It dramatically changed the way manufacturers achieved compliance for their wireless devices in the EU. Compliance is presumed when the manufacturer issues a Declaration of Conformity (DoC) and marks the product with the CE logo.

Previously, approval was obtained from the spectrum authority in each country. Because few Mutual Recognition Arrangements (MRAs) existed, it was an arduous country-by-country process. The notified body in each country played a primary role in the approvals process. Now, under the R&TTE Directive, compliance is based on a manufacturer's DoC. The role of a notified body is greatly diminished. Their expertise is required when harmonized standards do not exist; otherwise, manufacturers can voluntarily elect to use their services. A guiding principle of the directive is that manufacturers take full responsibility for their products and should test to verify compliance. Unlike FCC rules, the R&TTE Directive requires no certification prior to marketing. In the absence of tight premarket controls, postmarket surveillance is the primary enforcement strategy. Several member states have comprehensive surveillance and testing programs. Not only is compliance with the applicable technical standards randomly checked, but labeling and user information are thoroughly reviewed as well.

The R&TTE directive applies throughout the European Union (EU) and the European Economic Area (EEA). The Directive itself can be found in the European Law section of the European Union's Web site: (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0005:EN:HTML).

The requirements of the R&TTE Directive are legal rather than technical and are designed to safeguard the RF spectrum. ETSI and the European Committee for Electrotechnical Standardization (CENELEC) provide the technical requirements in the form of harmonized standards. An ETSI standard (http://www.etsi.org) is considered harmonized once it is published in the *Official Journal of the European Union* (http://publications.europa.eu/official/index_en.htm).

Although harmonized standards are voluntary, compliance with them provides a presumption of conformity with the directive. Testing to verify compliance with harmonized standards is the easiest route for manufacturers. In the absence of harmonized standards, manufacturers can use other methods (developed either in-house or under the guidance of a notified body). It is important not to confuse harmonized standards with harmonized spectrum. Although there are many harmonized standards, very few portions of the EU radio spectrum are completely harmonized. Compliance with the applicable harmonized standards is sufficient to apply the CE mark, but notification to the spectrum authority in each member state is still required prior to marketing a device. The notification process is relatively simple and can be accomplished online or via email. If no reply is received within 30 days of notification, then the manufacturer is free to market its device. The R&TTE Directive provides free movement of radios within the EU, unless the spectrum authority in a member state has good reasons to bar products (usually due to spectrum allocation issues).

The DoC declares that the essential requirements of the directive are met. The essential requirements of the directive are outlined in Article 3 as:

- Electrical safety and health (for example, Low Voltage Directive 73/23/EEC, RF Safety)
- Electromagnetic compatibility (as in EMC Directive 89/336/EEC)
- No harmful interference to the spectrum (as in compliance with harmonized ETSI standards).

Another important requirement, specified in Article 4, is to operate in accordance with national frequency plans. A useful database containing the spectrum allocation of EU member states can be found online (see EFIS at http://www.ero.dk/).

The conformity assessment process is outlined in Article 10 of the directive. Again, the main principle is that manufacturers take full responsibility and should test to verify compliance. The procedures described in Annex III or Annex IV are the most common compliance routes. The following section provides a brief description of each procedure.

Conformity Assessment

Annex II—Internal Production Control per Article 10(3)

This procedure is available only to telecommunications terminal equipment and receivers, not to transmitters. It involved assembling technical documentation to demonstrate conformity with the essential requirements of Article 3. This documentation covers design, manufacture, and operation of the product, and may include test reports. Either the manufacturer or its representative in the EU must keep the documentation on file. In either case, it should be readily available in case surveillance authorities request evidence of compliance.

Annex III—Internal Production Control Plus Specific Apparatus Tests

The requirements of Annex II, plus all of the essential radio test suites, must be performed. In the absence of harmonized standards, a notified body identifies the essential radio test suites in the form of a test plan. Otherwise, manufacturers may test to the applicable harmonized standards. Finally, the manufacturer or its EU representative must declare that the tests have been carried out, declare that the apparatus complies with the essential requirements of the R&TTE Directive, and apply the CE mark. If a notified body has been involved, its number must accompany the CE mark.

Annex IV—Technical Construction File (TCF)

This process includes the requirements of Annex III, plus a Technical Construction File (TCF) that contains a DoC to specific radio test suites. A notified body reviews the TCF and issues an opinion within four weeks. This is not a certification. Notified bodies do not issue certifications under the R&TTE Directive. If no opinion is received within four weeks, the manufacturer may place the product on the market. The manufacturer must keep the TCF ready for inspection or its EU representative for at least ten years after the last product of that type has been manufactured.

Annex V—Full Quality Assurance

This process is more complex than those previously discussed. Not all notified bodies are approved to perform this process. The manufacturer must operate an approved quality system for design, manufacture, and final product inspection. A notified body must assess whether the quality control system ensures conformity with the requirements of the directive. Manufacturing facilities are then subject to on-site surveillance by a notified body. The manufacturer must keep a number of documents ready for inspection for at least ten years after the last product of that type has been manufactured.

European Perspective

The European Commission reports a positive experience with the R&TTE Directive for wireless devices. Manufacturers are particularly pleased with the new streamlined process, and spectrum authorities report that there has been no visible increase in radio interference.

Equipment Marking

The Directive Annex VII specifies the marking requirements. They include CE marking, notified body number (if used) equipment class identifier, manufacturer's name, type, and batch and/or serial number.

ETSI: The following documents can be obtained from the ETSI web site (http://www.etsi.org).

- ETSI EN 300 328-1 V1.3.1 (2001-12)
- ETSI EN 301 489-1 V1.4.1 (2002-08)

Table 1. ETSI Documents

Document	Topics
ETSI EN 300 328-1 V1.3.1 (2001-12)	Electromagnetic compatibility and radio spectrum matters (ERM) Wideband transmission systems Data transmission equipment operating in the 2.4-GHz ISM band and using spread spectrum modulation techniques Technical characteristics and test conditions.
ETSI EN 300 489-1 V1.4.1 (2002-08)	Electromagnetic compatibility and radio spectrum matters (ERM) Electromagnetic compatibility (EMC) standard for radio equipment and services Common technical requirements

Global Regulatory Standards for the ISM Band in Major Market Segments

In EN 301 489–1, Section 7, Table 2 and Table 3 outlines the required tests for portable, mobile, and base station equipment. For Europe, mobile equipment is used in vehicles and powered from the vehicle battery, portable equipment is battery operated only, and base station equipment connects to the AC mains (see EN 301 489–1, subclauses 3.1 and 5.5). The ETSI tests performed at NWEMC were limited to portable equipment. The other tests, such as surge, Electrical Fast Transient (EFT), conducted immunity, VDI, telecom ports conducted emissions, AC mains conducted emissions, and flicker and harmonics, depend almost entirely on the host device and were not tested.

Here is a brief overview of the required tests for portable equipment applications:

- Spurious radiated emissions of transmitter and receiver
- Conducted spurious emissions of transmitter and receiver
- Frequency range of modulation at extreme and normal test conditions
- Effective radiated power at extreme and normal test conditions
- Peak power density
- Radiated immunity
- ESD

Table 2. Global Regulatory Standards for ISM Band

Region or Territory	Frequency Allocation	Output Power	Relevant Documents	Regulatory Body
USA/ Canada	2.400–2.4835 GHz	10 dBm	FCC Part 15 Part B and Part C	http://wireless.fcc.gov/
Europe	2.400–2.4835 GHz	55 mV/m	ERC 70–03 EN300–400	http://www.etsi.org
Japan	2.400–2.4835 GHz	10 dBm	ARIB STD–T66	http://www.arib.or.jp/english/index.html

European Union

There are 27 EU member countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

There are four candidate member countries (Croatia, The Former Yugoslav Republic of Macedonia, Turkey, and Iceland) and four potential candidates (Albania, Bosnia and Herzegovina, Serbia, and Kosovo (under UN Security Council Resolution 1244)).

Measurement Details

This section documents the measurements and data collected on a PDC–9163 radio module using a WirelessUSB LS to verify that the radio module meets the ETSI– Unintentional radiators and Intentional radiators specification.

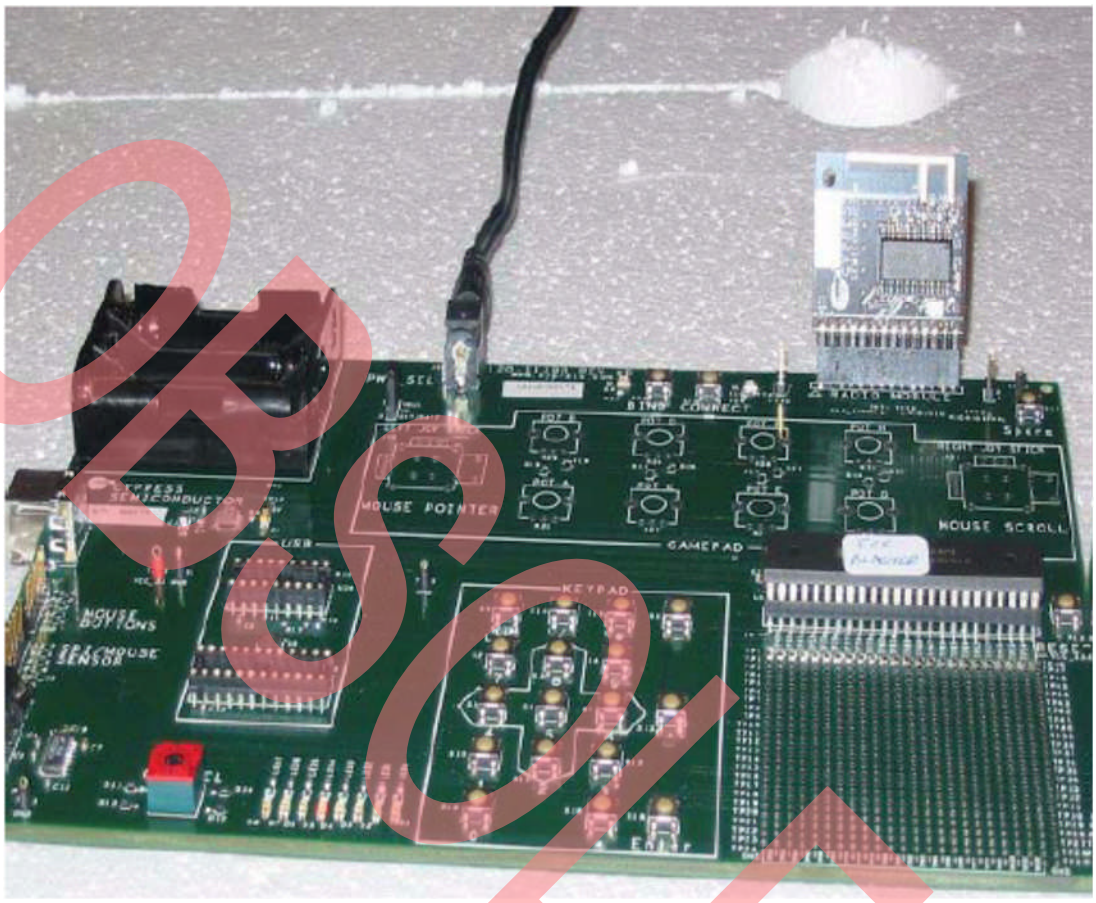
The ETSI testing was performed at NW EMC test facility on our PDC–9163 radio module.

- The testing is done on standalone configuration.
- There is no PC attached to the PDC–9075 Rev*B (121–07701 *E).
- The radio module PDC–9163 is mounted on to the PDC–9075 platform board.
- The platform board PDC–9075 is AC powered with a power brick
- The platform board PDC–9075 is installed with:
  - Blaster Code Test utility to exercise the radio module in single-frequency transmit mode
  - Listener Code Test Utility to exercise the radio module in single-frequency receive mode
  - PERT Code Test Utility to exercise the radio module in transmit and receive mode.

  The radio module PDC–9163 was set up to transmit or receive continuously at lowest and highest frequency channels.
- Performed all the tests required by ETSI (European Union) at lowest channel = 2401 MHz, mid channel = 2442 MHz and highest channel = 2481 MHz. All measurements are taken with power level set = 7.

The platform board is connected initially to the PC with RS232 cable and communicated through the “Hyper terminal” to program the channel, power level, PN code. The PN code was not changed during testing. After testing, the PC was removed from the anechoic test chamber.

Figure 1. FCC Measurement Test Setup



ETSI Test Details

The following represents the various measurements taken on the PDC–9163 RF radio module.

Table 3. Testing on PDC-9163 RF Radio Module

Test	Testing Parameter: Spurious Radiated Emission of Transmitter and Receiver	Single Frequency with FSK Modulation in Transmit Mode and Receive Mode (PDC–9075 Mounted with Single-Frequency Blaster Code)	
	Frequency range	Low Band Channel 2402 MHz	High Band Channel 2481 MHz
1	10 MHz to 1 GHz	X	X
	1 GHz to 4 GHz	X	X
	4 GHz o 12.75 GHz	X	X

Test	Testing Parameter	Single Frequency with FSK Modulation. Radio in Transmit Mode (PDC–9075 Mounted with Single-Frequency Blaster Code)	
		Low Band Channel 2402 MHz	High Band Channel 2481 MHz
2	Frequency range of modulation	X	X
3	Effective radiated power	X	X
4	Conducted spurious emissions of transmitter and receiver	X	X
5	Peak power density	X	X
6	Radiated immunity	X	
7	ESD	X	

Measurement Results

The tables in this section can be interpreted as follows: Red = Failure, Green = Passing, Yellow = Marginal. The plus sign indicates that the unit is failing by that amount and minus sign indicates the unit is passing with margin by that amount.

Spurious Radiated Emission of Receiver

The spurious radiated emission of receiver measurement should not exceed –47 dBm in narrowband and –57 dBm in peak measurement method over the frequency band 30 MHz to 12.5 GHz.

Table 4. Spurious Radiated Emission of Receiver

Test/Measurement Spurious Radiated Emission in Single-Frequency Receive Mode	Channels Frequency in MHz	Antenna Polarity	ETSI Requirement/ Limits	PDC–9163 Radio Module		Test Condition (PA = 7 for all)
		Antenna = Horn/Bilog		EIRP Reading in dBm	Compared to the Spec. Limit in dB	
Peak	2481 MHz	Horizontal–Horn	–47 dBm	–55.9 @ 4962 MHz	**–8.9**	Narrowband
Peak	2481 MHz	Vertical–Horn	–47 dBm	–56.5 @ 4962 MHz	**–9.5**	Narrowband
Peak	2481 MHz	Vertical–Bilog	–57 dBm	–62.2 @ 35.735 MHz	**–5.2**	Narrowband
Peak	2481 MHz	Horizontal–Bilog	–57 dBm	–77.4 @ 35.735 MHz	**–20.4**	Narrowband
Peak	2402 MHz	Vertical–Bilog	–57 dBm	–62.5 @ 35.715 MHz	**–5.5**	Narrowband
Peak	2402 MHz	Horizontal–Bilog	–57 dBm	–77.8 @ 35.715 MHz	**–20.8**	Narrowband
Peak	2402 MHz	Vertical–Horn	–47 dBm	–61.1 @ 4804 MHz	**–14.1**	Narrowband
Peak	2402 MHz	Horizontal–Horn	–47 dBm	–61.3 @ 4804 MHz	**–14.3**	Narrowband

Spurious Radiated Emission of Transmitter

The spurious radiated emission of transmitter measurement should not exceed –97 dBm/MHz in wideband and –30/–36 dBm in narrowband and in peak measurement method over the frequency band 30 MHz to 12.5 GHz.

Table 5. Spurious Radiated Emission of Transmitter

Test/Measurement Spurious Radiated Emission in Single-Frequency Transmit Mode	Channels Frequency in MHz	Antenna Polarity	ETSI Requirement/ Limits	PDC–9163 Radio Module		Test Condition (PA = 7 for all)
		Antenna = Horn/Bilog		EIRP Reading in dBm	Compared to the Spec. Limit in dB	
Peak	2402 MHz	Vertical–Horn	–97 dBm/MHz	–103.1 @ 1895 MHz	**–6.1**	Wideband
Peak	2402 MHz	Horizontal–Horn	–97 dBm/MHz	–105.8 @ 1895 MHz	**–8.8**	Wideband
Peak	2402 MHz	Vertical–Horn	–30 dBm	–51.8 @ 7206 MHz	**–21.8**	Narrowband
Peak	2402 MHz	Horizontal–Horn	–30 dBm	–53.2 @ 7206 MHz	**–23.2**	Narrowband
Peak	2402 MHz	Horizontal–Horn	–30 dBm	–61.0 @ 4804 MHz	**–31.0**	Narrowband
Peak	2402 MHz	Vertical–Horn	–30 dBm	–61.1 @ 4804 MHz	**–31.1**	Narrowband
Peak	2402 MHz	Horizontal–Bilog	–36 dBm	–76.8 @ 36 MHz	**–40.8**	Narrowband
Peak	2402 MHz	Horizontal–Bilog	–36 dBm	–77.0 @ 36 MHz	**–41.0**	Narrowband
Peak	2481 MHz	Horizontal–Bilog	–36 dBm	–77.8@ 37MHz	**–41.8**	Narrowband
Peak	2481 MHz	Horizontal–Bilog	–36 dBm	–78.5 @ 37 MHz	**–42.5**	Narrowband
Peak	2481 MHz	Vertical–Horn	–30 dBm	–54.2 @ 4962 MHz	**–24.2**	Narrowband
Peak	2481 MHz	Horizontal–Horn	–30 dBm	–54.3 @ 4962 MHz	**–24.3**	Narrowband
Peak	2481 MHz	Horizontal–Horn	–30 dBm	–55.0 @ 7443 MHz	**–25.0**	Narrowband
Peak	2481 MHz	Vertical–Horn	–30 dBm	–55.9@ 7443 MHz	**–25.9**	Narrowband
Peak	2481 MHz	Vertical–Horn	–97 dBm/MHz	–103.8 @ 1841 MHz	**–6.8**	Wideband
Peak	2481 MHz	Horizontal–Horn	–97 dBm/MHz	–105.9 @ 1841 MHz	**–8.9**	Wideband

Spurious Conducted Emissions of Transmitter and Receiver

ETSI Requirements

While receiving, the maximum level of any spurious conducted emission must not exceed the following values.

- Narrowband limits: 30 MHz o 1 GHz (–57 dBm), 1 to 12.75 GHz (–47 dBm)
- Wideband limits: 30 MHz to 1 GHz (–107 dBm/Hz), 1 to 12.75 GHz (–97 dBm/Hz)

While transmitting, the maximum level of any spurious conducted emission must not exceed the following values.

- Narrowband limits: 30 MHz to 1 GHz (–36 dBm), 1 to 12.75 GHz (–30 dBm), 1.8 to 1.9 GHz and 5.15 to 5.3 GHz (–47 dBm)
- Wideband limits: 30 MHz to 1 GHz (–86 dBm/Hz), 1 to 12.75 GHz (–80 dBm/Hz), 1.8 to 1.9 GHz and 5.15 to 5.3 GHz (–97 dBm/Hz)

Note. It has been determined that the Conducted Spurious Emissions of Transmitter and Receiver testing is not required, based on the fact that the emission was narrowband. The following graphical data proves that the emission was indeed narrowband and presents a detailed explanation of how this is determined.

EN 300 328–1 states:

5.2.4 Spurious emissions

Spurious emissions are emissions outside the frequency range(s) of the equipment as defined in clause 5.2.3.

The level of spurious emissions shall be measured as:

Either:

- p Their power in a specified load (conducted spurious emissions); and
- p Their effective radiated power when radiated by the cabinet or structure of the equipment (cabinet radiation); or:
- p Their effective radiated power when radiated by cabinet and antenna.

1. Peak Measurements only: 100 kHz = RBW = VBW
2. Investigate emissions with <6 dB margin.
3. If emissions < 6dB, remeasure Peak:
   30 kHz = RBW = VBW
   - p If level reduces >2 dB, it is wideband.
     If level reduces <2 dB, it is narrowband (label as narrowband).
   - p If wideband, overwrite 100-kHz measurement w/PK: 1 MHz = VBW = RBW
     Subtract 60 dB from dBm to convert to dBm/Hz.
     Label as wideband.
   - p If fails, try 3 MHz = VBW = RBW with 64.8-dB bandwidth correction factor.

Bandwidth Correction Factor = 10log (RBW/1Hz)

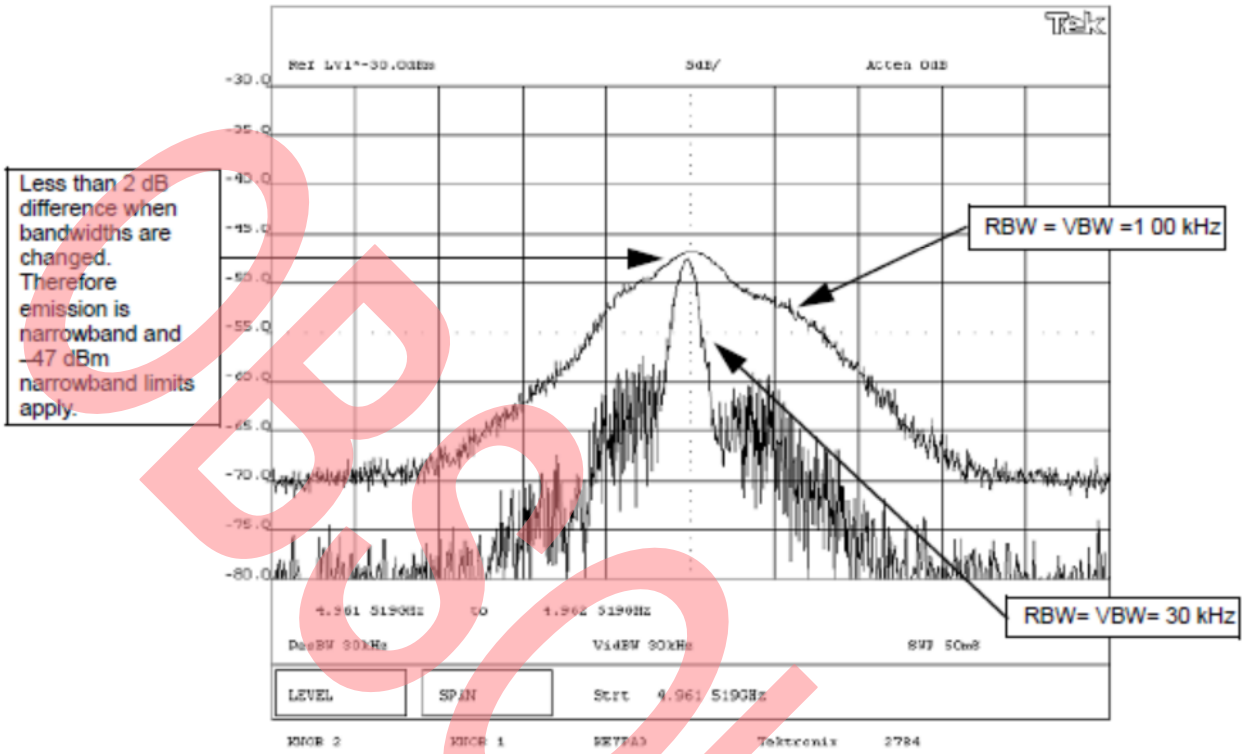
The radiated spurious emissions testing with antenna attached (per sub clause 5.2.4(c) above) was performed. The unit passed radiated spurious emissions and therefore meets the requirement of sub clause 5.2.4.

EN 300–328 Conducted Spurious Emissions

High Channel (Ch. 79) Receive Mode

11–11–2003

Figure 2. Spurious Emissions



Frequency Range of Modulation

The frequency range must lie within the band of 2.4 GHz to 2.483 GHz over the temperature range and power supply voltage range.

Table 6. Spurious Radiated Emission of Transmitter

Test/Measurement Frequency Range of Modulation	Channels Frequency in MHz	ETSI Requirement /Limits	PDC–9163 Radio Module		Test Condition
			Reading in dBm	Compared to the Spec. Limit in dB	
Peak	2402	2.4–2.4835 GHz	–30.40 dBm @ 2401.56 MHz	1.56	+25 °C
Peak	2481	2.4–2.4835 GHz	–30.1 dBm @ 2481.52 MHz	1.98	+25 °C
Peak	2402	2.4–2.4835 GHz	–30.30 dBm @ 2401.55 MHz	1.55	Supply voltage = 2.7 V
Peak	2481	2.4–2.4835 GHz	–30.30 dBm @ 2481.61 MHz	1.89	Supply voltage = 2.7 V
Peak	2402	2.4–2.4835 GHz	–30.00 dBm @ 2401.62 MHz	1.62	Supply voltage = 3.6 V
Peak	2481	2.4–2.4835 GHz	–30.00 dBm @ 2481.55 MHz	1.95	Supply voltage = 3.6 V
Peak	2402	2.4–2.4835 GHz	–30.70 dBm @ 2401.63 MHz	1.63	+55 °C
Peak	2481	2.4–2.4835 GHz	–30.5 dBm @ 2481.50 MHz	2.0	+55 °C
Peak	2402	2.4–2.4835 GHz	–30.50 dBm @ 2401.53 MHz	1.53	–20 °C
Peak	2481	2.4–2.4835 GHz	–30.8 dBm @ 2481.505 MHz	1.995	–20 °C

Effective Radiated Power

At ambient temperature, the maximum effective radiated power must be less than or equal to +20 dBm (average), or +23 dBm (peak).

Table 7. Effective Radiated Power

Test/Measurement Effective Radiated Power	Channels Frequency in MHz	ETSI Requirement/ Limits	PDC–9163 Radio Module		Test Condition
			Reading in dBm	Compared to the Spec. Limit in dB	
Average power with thermocouple detector	2402	≤20 dBm	–2.7	**–17.3**	+25 °C
Average power with thermocouple detector	2481	≤20 dBm	–3.1	**–16.9**	+25 °C
Peak power with diode detector	2402	≤23 dBm	–0.4	**–22.6**	+25 °C
Peak power with diode detector	2481	≤23 dBm	–1.0	**–22.0**	+25 °C
Average power with thermocouple detector	2402	≤20 dBm	–2.6	**–17.4**	Supply voltage = 2.7 V
Average power with thermocouple detector	2481	≤20 dBm	–3.1	**–16.9**	Supply voltage = 2.7 V
Peak power with diode detector	2402	≤23 dBm	–0.5	**–22.5**	Supply voltage = 2.7 V
Peak power with diode detector	2481	≤23 dBm	–1.2	**–21.8**	Supply voltage = 2.7 V
Average power with thermocouple detector	2402	≤20 dBm	–2.7	**–17.3**	Supply voltage = 3.6 V
Average power with thermocouple detector	2481	≤20 dBm	–3.1	**–16.9**	Supply voltage = 3.6 V
Peak power with diode detector	2402	≤23 dBm	–0.4	**–22.6**	Supply voltage = 3.6 V
Peak power with diode detector	2481	≤23 dBm	–1.0	**–22.0**	Supply voltage = 3.6 V
Average power with thermocouple detector	2402	≤20 dBm	–2.6	**–17.4**	–20 °C
Average power with thermocouple detector	2481	≤20 dBm	–2.9	**–17.1**	–20 °C
Peak power with diode detector	2402	≤23 dBm	–1.0	**–22.0**	–20 °C
Peak power with diode detector	2481	≤23 dBm	–1.4	**–21.6**	–20 °C
Average power with thermocouple detector	2402	≤20 dBm	–2.8	**–17.2**	+55 °C
Average power with thermocouple detector	2481	≤20 dBm	–3.0	**–17.0**	+55 °C
Peak power with diode detector	2402	≤23 dBm	–0.5	**–22.5**	+55 °C
Peak power with diode detector	2481	≤23 dBm	–1.0	**–22.0**	+55 °C

Peak Power Density

Maximum peak power density (EIRP) must be less than or equal to +10 dBm/MHz.

Table 8. Peak Power Density

Test/Measurement Peak Power Density in Single-Frequency Transmit Mode	Channels Frequency in MHz	ETSI Requirement/ Limits	PDC–9163 radio Module		Test Condition
			Reading in dBm/MHz	Compared to the Spec. Limit in dB	
Peak	2402	≤ +10 dBm/MHz	–0.9	**–9.1**	Peak
Peak	2481	≤ +10 dBm/MHz	–1.3	**–8.7**	Peak

Radiated Immunity

The Equipment Under Test (EUT) is placed in transmit and receive mode using Program Evaluation and Review Technique (PERT) Code Test utility.

Table 9. Radiated Immunity

Test/Measurement Radiated Immunity	Channels Frequency in MHz	Frequency Range	ETSI Requirement/ Limits	PDC–9163 Radio Module Result	Test Condition
Monitoring performance with PERT software	2442	80 MHz– GHz	The EUT should not fail during the test	**No Anomalies observed during the test**	Transmit and Receive
Monitoring performance with PERT software	2442	1400 MHz–2 GHz	The EUT should not fail during the test	**No Anomalies observed during the test**	Transmit and Receive

ESD

The EUT is subjected to air discharge and contact discharge with 4 kV on vertical and horizontal coupling planes.

No anomalies were observed during the test.

The EUT failed the 4-kV contact discharge applied to the RS232 connector shell. This is not a failure of our radio module. This result can be interpreted as a failure of the whole test platform. The test platform consists of the PDC–9075 platform board mounted with a PDC–9163 radio module.

Summary

This application note provides an overview of the wireless-product compliance process for electromagnetic compatibility (EMC) in the European Union (EU). It also serves as a guideline for selecting the Cypress's WirelessUSB™ LS radio system IC to wireless application solutions. The ETSI EMC testing on the reference radio module PDC–9163 was tested and verified. The equipment under test (EUT) passed all of the tests required by the EU to meet ETSI certification requirements.

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Document History

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Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	1013621	SFV	4/24/2007	Existing Application Note in the web - Added Spec No. and new disclaimer and also updated the copyright date
*A	1767565	CSAI	11/23/2007	Old App Note - Applied new template, Copyright updated, Revision Disclaimer added. No technical updates made.
*B	3184078	CSAI	2/28/2011	Applied new template. Performed copy edit. No technical updates.
*C	4390011	CSAI	05/26/2014	Updated in new template. Completing Sunset Review.
*D	5740123	ANKC	05/23/2017	Obsoleting the AN

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