

Electromagnetic Compatibility Test Report

Prepared in accordance with

CFR47 part 15B

On

Qolsys Zigbee Radio Card

Prepared for:




Qolsys Inc.
1900 The Alameda
San Jose, CA 95126
U.S.A

Prepared by:

TUV Rheinland of North America, Inc.
1279 Quarry Lane, Ste. A
Pleasanton, CA 94566 U.S.A.

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ATTESTATION OF TEST RESULTS

Client:	Qolsys Inc. 1900 The Alameda San Jose, CA 95126 U.S.A		Walt Wallach Tel. +1 855-476-5797 Walt.Wallach@qolsys.com	
Model Name:	Qolsys Zigbee Radio Card	Serial Number:	N/A	
Model Numbers:	QS-ZB	Date(s) Tested:	21st May 2019 to May 30th, 2019	
Test Location:	TUV Rheinland of North America 1279 Quarry Lane, Ste. A Pleasanton, CA 94566 U.S.A. Tel. (925) 249-9123			
Test Specifications:	Emissions:	CFR47 part 15B		
	Immunity:	N/A		
Test Result:	The above product was found to be Compliant to the above test standard(s)			
Prepared by: Bernd Jungbluth		Reviewed by: Josie Sabado		
<u>May 30, 2019</u> <i>Date</i> <i>Name</i> <i>Signature</i>		<u>May 30, 2019</u> <i>Date</i> <i>Name</i> <i>Signature</i>		
Other aspects:	None			
PLEASANTON				
 US1131	 Testing Cert #3331.02	INDUSTRY CANADA 2932M-1	 1097 (A-0268)	

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the listed standards based on the results of testing performed on 21st May 2019 to May 30th, 2019 on Qolsys Zigbee Radio Card, model number QS-ZB, manufactured by Qolsys Inc.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Applicant	Qolsys Inc. 1900 The Alameda San Jose, CA 95126 U.S.A
Contact	Walt Wallach
Tel.	+1 855-476-5797
E-mail	Walt.Wallach@qolsys.com
Description	ZigBee Module
Model Name	Qolsys Zigbee Radio Card
Model Number	QS-ZB
Input Power	N/A – Not specified – EUT powered via battery powered host
Test Date(s)	21st May 2019 to May 30th 2019

Standards	Description	Severity Level or Limit	Criteria	Test Result
CFR47 part 15B Product Family Standard Emissions	Emissions	See called out basic standards below	See Below	Complies
CFR47 part 15B	Radiated Emissions	CLASS B 30M-18GHZ	Limit	Complies

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2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission



TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 is recognized by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Pleasanton Registration No. US1131). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / A2LA



TUV Rheinland of North America EMC test facilities are accredited by the American Association for Laboratory Accreditation (A2LA). The laboratories have been assessed and accredited by A2LA in accordance with ISO Standard 17025:2005 (Testing Certificate #3331.02). The Scope of Laboratory Accreditation includes emission and immunity testing. The accreditations are updated annually.

2.1.3 Canada – Industry Canada



The Pleasanton 5-meter Semi-Anechoic Chamber, Registration No. 2932M-1, has been accepted by Industry Canada to perform testing to 3 and 5 meters based on the test procedures described in ANSI C63.4-2014. The Fremont 10-meter Semi-Anechoic Chamber, Registration No. 2932D-1, has been accepted by Industry Canada to perform testing to 3 and 10 meters based on the test procedures described in ANSI C63.4-2014.

2.1.4 Acceptance by Mutual Recognition Arrangement



The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / A2LA accreditation will be accepted by each member country.

2.1 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, Pleasanton, California 94566, USA.

2.1.1 Emission Test Facility

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 and 5 meters. The site is listed with the FCC and accredited by A2LA (Testing Certificate #3331.02). The 3/5-meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meter and 5 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.1.2 EMC Software - Pleasanton

Manufacturer	Name	Version	Test Type
ETS-Lindgren	TILE	3.4.K.14 @ 4.0.A.5	Radiated & Conducted Emissions
EMISoft	Vasona	5.0	Radiated & Conducted Emissions
Rohde & Schwarz	EMC32	10.40.10	Radiated Emissions
Agilent	Agilent MXE	A.11.02	Radiated & Conducted Emissions
ETS-Lindgren	TILE	3.4.K.14	Radiated & Conducted Immunity
Thermo Electron - Keytek	CEWare32	4.00	EFT/Surge/Voltage Dips & Interrupt
Voltech	IEC61000-3	1.21.07RC2	Harmonic & Flicker

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2.2 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

2.2.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{RAW} - \text{AMP} + \text{CBL} + \text{ACF}$$

Where: RAW = Measured level before correction (dB μ V)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu\text{V/m} = 10^{\frac{\text{dB}\mu\text{V/m}}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

$$25 \text{ dBuV/m} + 17.5 \text{ dB} - 20 \text{ dB} + 1.0 \text{ dB} = 23.5 \text{ dBuV/m}$$

2.2.2 Measurement Uncertainty Emissions

Per CISPR 16-4-2	U_{lab}	U_{cispr}
Radiated Disturbance @ 10 meters		
30 – 1,000 MHz	2.25 dB	4.51 dB
Radiated Disturbance @ 3 meters		
30 – 1,000 MHz	2.26 dB	4.52 dB
1 – 6 GHz	2.12 dB	4.25 dB
6 – 18 GHz	2.47 dB	4.93 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.09 dB	2.18 dB
Disturbance Power		

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Measurement Equipment Used

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yy	Next Cal mm/dd/yy	Test
Bilog Antenna	Sunol Sciences	JB3	A102606	08/01/2018	08/01/2020	RE
Horn Antenna	EMCO	3115	9211-3969	05/16/2017	05/16/2019*	RE
Spectrum Analyzer	Rohde & Schwarz	FSW67	104088	06/11/2018	06/11/2019	RE
EMI Receiver	Rohde & Schwarz	ESIB40	5000-3090823415	09/20/2018	09/20/2019	RE
Spectrum Analyzer	Agilent	N9038A	MY52260210	1/16/2019	1/16/2020	RE
Preamplifier	Miteq	AMF-7D-01001800-30-10p-L	2074297	N/A – (See Note 1)		RE
DC Block	Mini-Circuits	UNAT-1+	VUU83701027	N/A (See Note 1)		RE
Preamplifier	Sonoma Instruments	310N	185516	01/16/2019	01/16/2020	RE

Note 1: No calibration required. Path loss correction characterized internal.

*Note 2: Horn antenna SN 9211-3969 utilized for radiated Band Edge and RSE measurements under laboratory declared 3 month extended calibration.

Note: CE=Conducted Emissions, CI=Conducted Immunity, DP=Disturbance Power, EFT=Electrical Fast Transients, ESD=Electrostatic Discharge, FLI=Flicker, HAR=Harmonics, MF=Magnetic Field Immunity, NCR=No Calibration Required, RE=Radiated Emissions, RI=Radiated Immunity, SI=Surge Immunity, VDSI=Voltage Dips and Short Interruptions

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3 Product Information

3.1 Product Description

See Section 5.4.

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

3.3 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in Appendix A of this report.

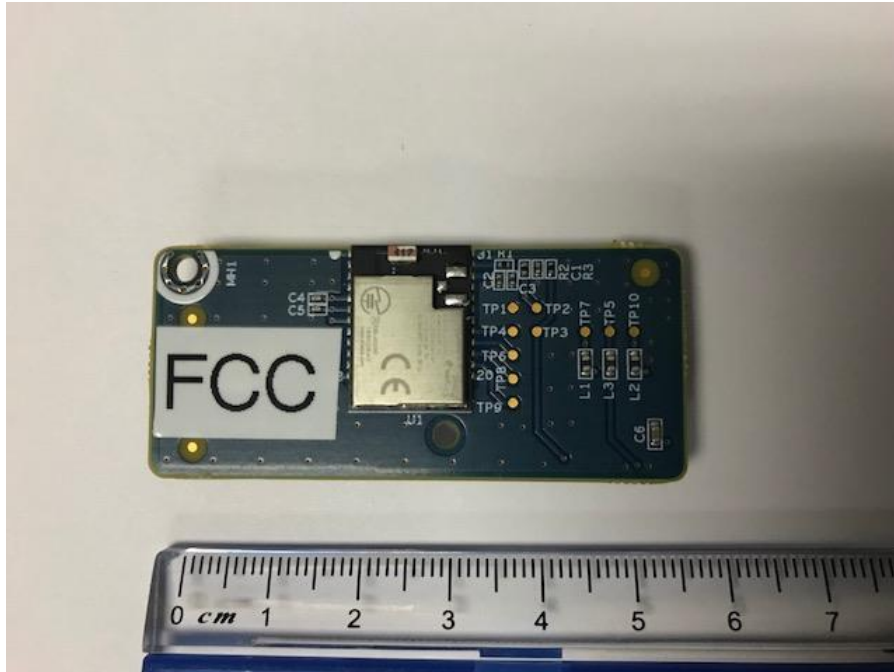


Figure 1: External Photo of Qolsys Zigbee Radio Card – Top



Figure 2: External Photo of Qolsys Zigbee Radio Card - Rear

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Figure 3: External Photo Qolsys Zigbee Radio Card QS-ZB– Host Unit



Figure 4: External Photo Qolsys Zigbee Radio Card QS-ZB– Host Unit – Detail –
EUT module separation > 10cm

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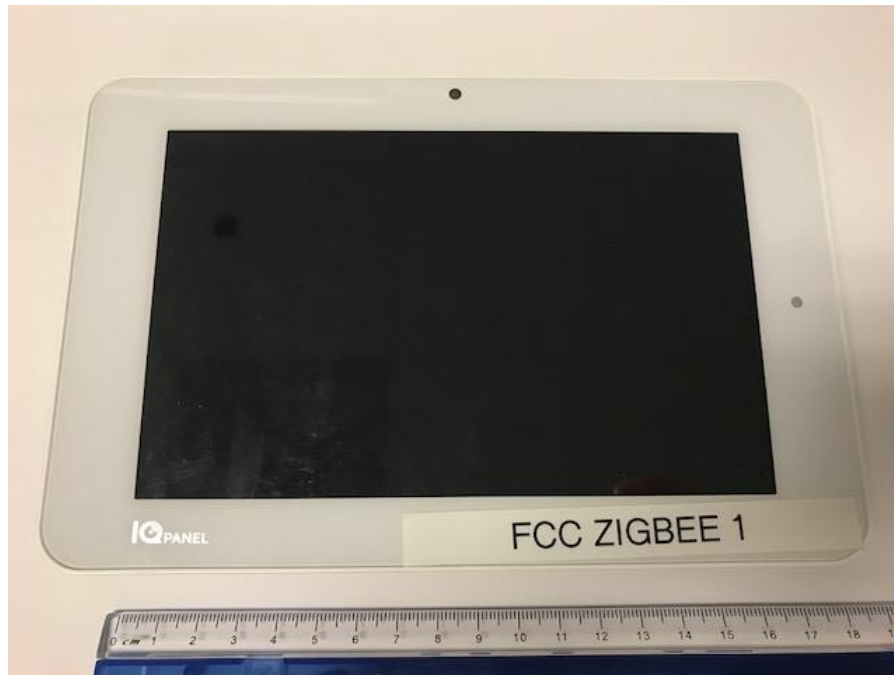


Figure 5: External Photo Qolsys Zigbee Radio Card QS-ZB- Host Unit – Detail – EUT Top view



Figure 6: External Photo Qolsys Zigbee Radio Card QS-ZB- Host Unit – Detail – EUT Top Rear

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4 Emissions

4.1 Radiated Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

4.1.1 Overview of Test

Results	Complies (as tested per this report)			Test Date(s)	22 nd May 2019 to 30 rd May, 2019		
Standard	CFR47 part 15B						
Model Number	Qolsys Zigbee Radio Card			Serial #	N/A		
Configuration	See test plan for details.						
Test Setup	Tested in the 5-meter chamber, placed on turntable: see test plan for details.						
EUT Powered By	Not declared - Powered by host equipment						
Environmental Conditions	22 nd May, 2019	Temp	20° C	Humidity	34%	Pressure	1013 mbar
	30 rd May, 2019	Temp	21° C	Humidity	36%	Pressure	1016mbar
Frequency Range	30 MHz to 18 GHz						
Perf. Criteria	Class B			Perf. Verification	Readings Under Limit		
Mod. to EUT	None			Test Performed By	Abraham Avalos & Bernd Jungbluth		

4.1.2 Test Procedure

Radiated emissions tests were performed using the procedures of ANSI C63.4:2014:A 2017 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range according Class **B**

limits was investigated for radiated emissions.

4.1.2.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emissions test procedure. The frequency range of interest was divided into sub-ranges. For each sub-range peak emission data was continuously recorded and plotted while the turntable was rotated 360° steps and the measurement antenna was rotated in horizontal and vertical antenna polarization.

Preliminary emission profile testing was performed inside a semi-anechoic chamber. The EUT was placed on a non-conductive table 80 cm above the floor. The EUT was positioned as shown in the setup photographs. The measurement antenna was placed at a distance of 3m.

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4.1.2.2 Final Test

Final testing was performed on an NSA compliant test site.

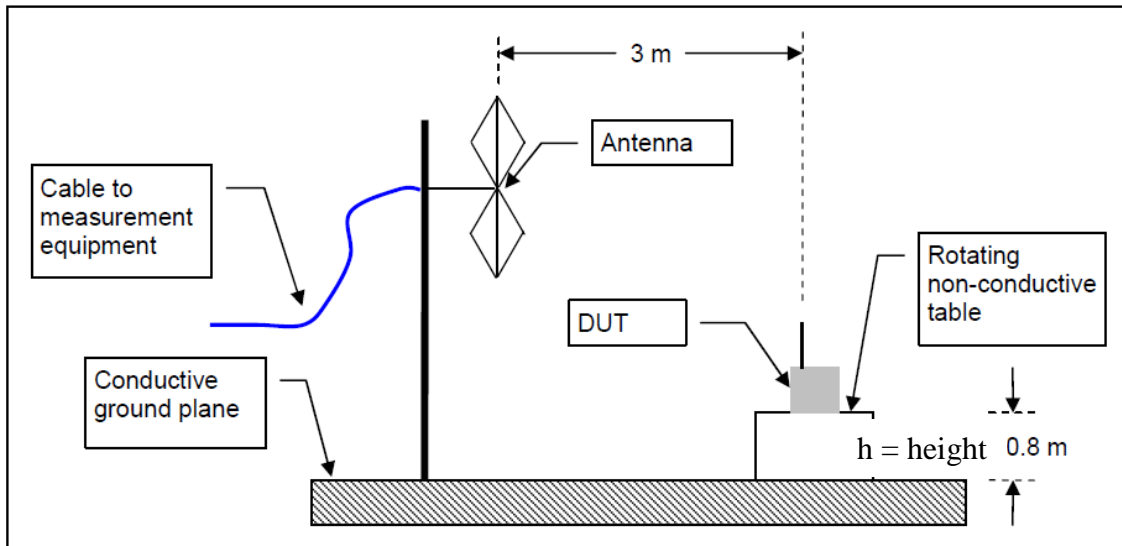
For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. Preliminary emissions within 10 dB of the limit were measured.

The final scans were performed on the worst EUT axis for three operating channels in the operating mode with the highest power.

4.1.2.3 Deviations

None.

Test Setup:



$h = 80\text{cm}$

4.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the radiated emission test.

4.1.4 Final Test

All final radiated emissions measurements were below the specification limits.

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4.1.5 Plots

Radiated spurious emissions - FCC 15 B Unintentional emissions:

Radiated Emissions - 30MHz- 1 GHz – Rx – Idle mode								
EUT Name			Qolsys Zigbee Radio Card			Temp / Hum in		20° C / 34%rh
EUT Model			QS-ZB			Line AC / Freq		N/A – Battery operated
EUT Config.			Rx – Idle mode			RBW / VBW		100KHz/ 300KHz
Standard			FCC 15 B			Performed by		Abraham Avalos
						Dist/Ant Used		3m/ JB3
Frequency	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	Result
MHz	dBuV/m		H/V	cm	deg	dBuV/m	dB	
34.19	16.65	QP	H	135	189	40.00	-23.35	Pass
230.86	7.73	QP	H	329	360	46.00	-38.27	Pass
393.69	12.39	QP	H	128	320	46.00	-33.61	Pass
506.27	16.16	QP	H	400	252	46.00	-29.84	Pass
618.70	21.16	QP	H	110	262	46.00	-24.84	Pass
751.88	18.74	QP	H	345	174	46.00	-27.26	Pass

dBuV/m TUV Rheinland of North America

Qolsys
 Filename: c:\program files (x86)\emisoft - vasonal\results\Qolsys_FCC_15B_30-1GHz_emi

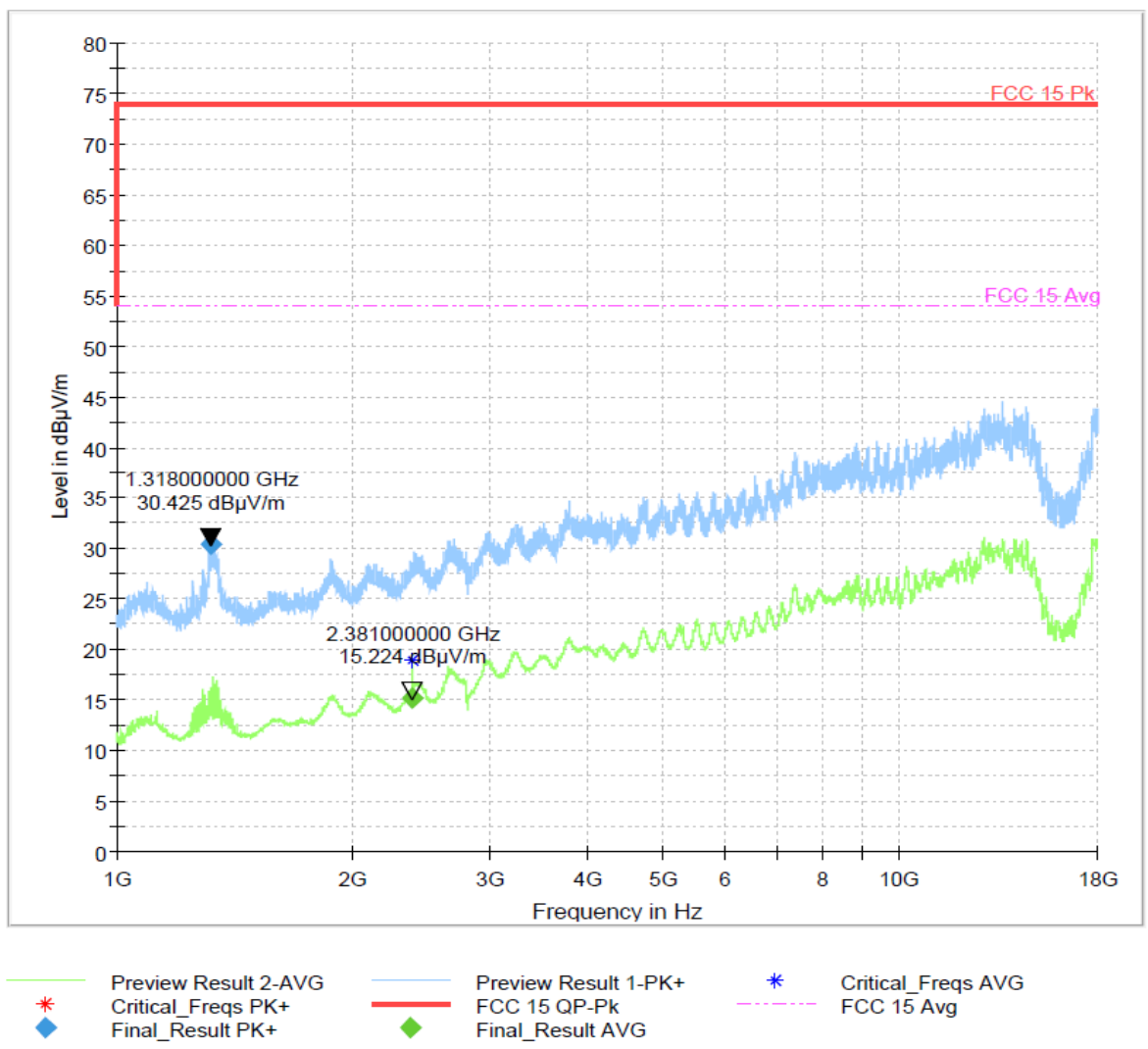
Note: -

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Radiated Emissions – 1GHz– 18 GHz – Rx – Idle mode			
EUT Name	Qolsys Zigbee Radio Card	Temp / Hum in	21° C / 36%rh
EUT Model	QS-ZB	Line AC / Freq	N/A – Battery operated
EUT Config.	Rx – Idle mode	RBW / VBW	1 MHz/ 3 MHz
Standard	FCC 15 B	Performed by	Abraham Avalos
		Dist/Ant Used	3m – AHA-840

Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1320.000000	30.39	---	74.00	43.61	2.0	1000.000	118.0	H	21.0
2381.000000	---	15.22	54.00	38.78	2.0	1000.000	359.0	V	107.0



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4.1.6 Photos



Figure 7 - Radiated Emissions Test Setup 30 - 1000 MHz - Front



Figure 8 - Radiated Emissions 30MHz - 1 GHz rear - EUT Horizontal

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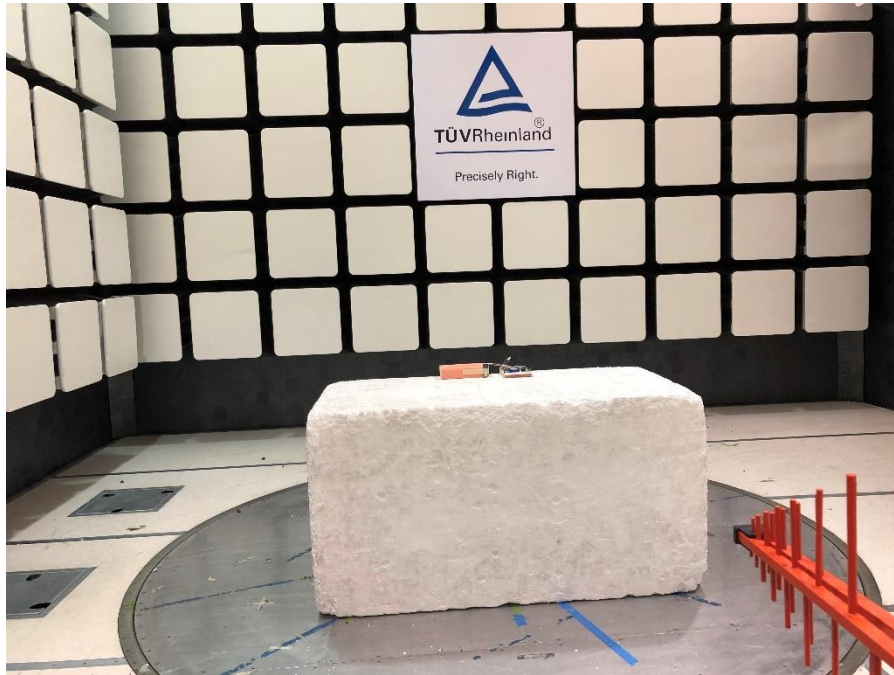


Figure 9 - Radiated Emissions 30MHz – 1 GHz rear – EUT Vertical

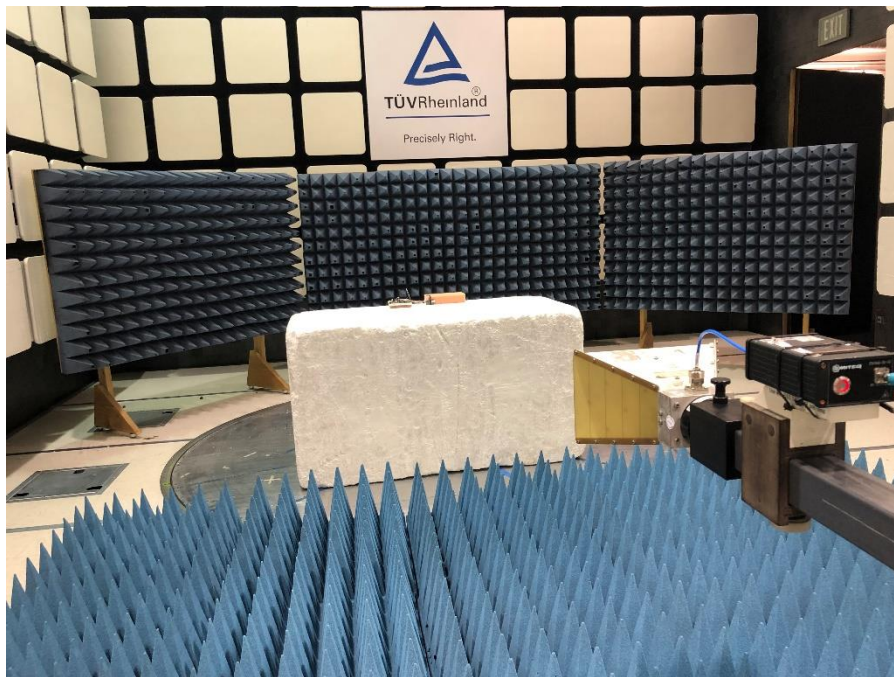


Figure 10 - Radiated Emissions 1-18 GHz front

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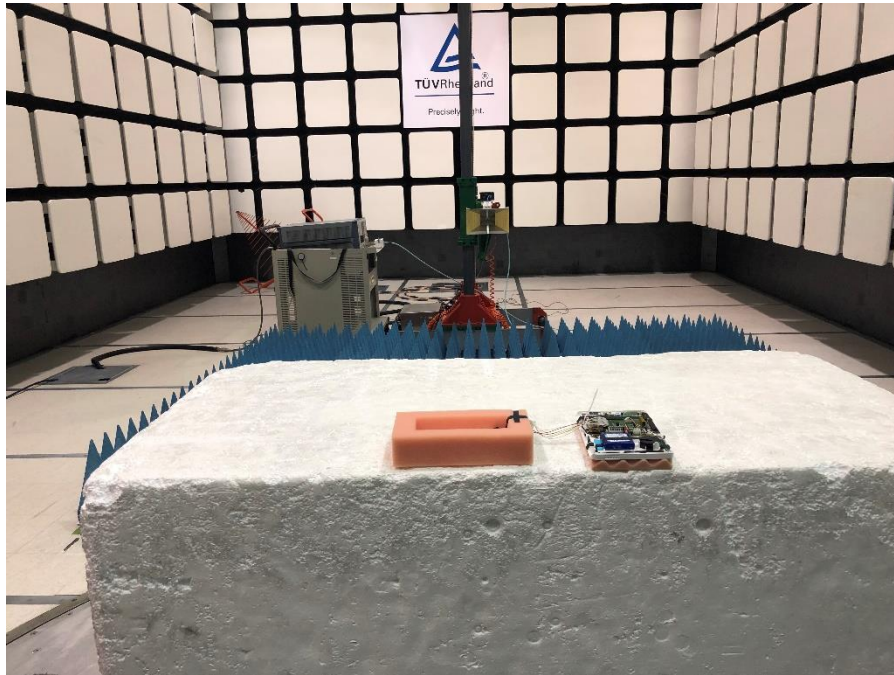


Figure 11 - Radiated Emissions 1 to 18GHz rear

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Appendix A

5 Test Plan

This test report is intended to follow this test plan outlined here in unless otherwise stated in this here report. The following test plan will give details on product information, standards to be used, test set ups and refer to TUV test procedures. The test procedures will give the steps to be taken when performing the stated test. The product information below came via client, product manual, product itself and or the internet.

5.1 General Information

Client	Qolsys Inc.
Address	1900 The Alameda
	San Jose, CA 95126
Contact Person	Walt Wallach
Telephone	+1 855-476-5797
e-mail	Walt.Wallach@qolsys.com

5.2 EUT Designation

Model Name	Qolsys Zigbee Radio Card
Model Number(s)	QS-ZB

5.3 Test configurations

The Module is tested in active mode under continuous Rx\Idle mode configuration.

5.3.1 Equipment Under Test (EUT) Description

The Qolsys Zigbee Radio Card Model nr. QS-ZB is a ZigBee Module. The Module was connected to a IQ Panel 2 host device via a serial wire connection cable.

Table 5: EUT Specifications

EUT Specifications	
Dimensions	5.6cm x 2.5cm x 0.3 cm
DC Input	3.7 VDC, 15 mA (Battery operated)
Environment	Indoor/Outdoor
Multiple Feeds:	<input type="checkbox"/> Yes and how many <input checked="" type="checkbox"/> No
Product Marketing Name (PMN)	Qolsys Zigbee Radio Card
Modle Number	QS-ZB
ZigBee Radio	
Operating Mode	ZigBee CH11-CH26
Transmitter Frequency Band	2402 MHz to 2480 MHz
Operating Bandwidth	2.2 MHz
Max. Power Output	10.98 dBm
Power Setting @ Operating Channel	Power Setting: FW default: Powerlevel 97; power: 104
Antenna Type	Internal embedded chip antenna
Antenna Gain	1 dBi
Modulation Type	O-QPSK
Data Rate	250 kb/s

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Table 1: Antenna Information

Number	Antenna Type	Description	Max Gain (dBi)
1	Internal	Embedded chip antenna	1

Table 2: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
USB	USB	No	3m	Not Applicable

Note: USB cable connected to auxiliary host.
 Removed after configuration before radiated testing.

Table 3: Support Equipment

Equipment	Manufacturer	Model	Used for
Laptop	Lenovo	T480 Thinkpad	EUT configuration via Putty serial\USB interface connection for module operational mode configuration.
Host Auxiliary IQ Panel 2	Qolsys Inc.	QS-IQPANEL2 FW Version: 2.3.0 HW Version: REV H	Host device for EUT - Module

Note: None.

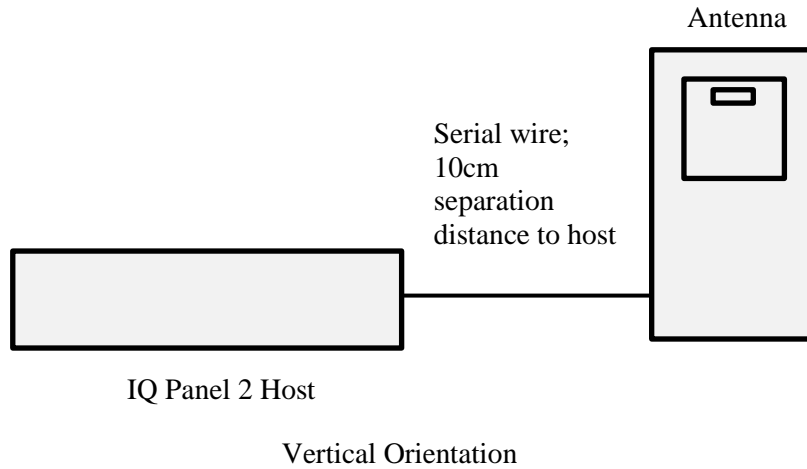
Table 4: Description of Sample used for Testing

Device	Serial	RF Connection	Comment
Qolsys Zigbee Radio Card	N/A	Temporary u.fl	Conducted testing
Qolsys Zigbee Radio Card	N/A	Intended embedded chip antenna	Radiated testing

Table 5: Accessory Equipment

Equipment	Manufacturer	Model	Serial	Comment
-	-	-	-	-

5.3.2 Block Diagram



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5.4 Emissions

5.4.1 Radiated Emissions

5.4.1.1 Preliminary Radiated Emissions Test Setup

Standard	CFR47 part 15B			Procedure	ANSI C63.4: 2017
Limit	Class B	Emissions Verification	Emissions Under Limit		
Frequency Range	30 MHz – 26 GHz				
Scan #1	Pre-scan 30 – 1000 MHz	Antenna Distance	3m	Detector	Peak
Scan #2	Pre-scan 1 – 18 GHz	Antenna Distance	3m	Detector	Peak
Antenna Height	1 – 4 meter	EUT height	80 cm		
Configuration	See Section 5.3				
Notes	None				

5.4.1.2 Final Radiated Emissions Test Setup

Standard	FR47 part 15B			Procedure	ANSI C63.4: 2017
Limit	Class B	Emissions Verification	Emissions Under Limit		
Frequency Range	30 MHz – 18 GHz				
Scan #1	Final Scan 30 – 1000 MHz	Antenna Distance	3m	Detector	Quasi Peak
Scan #2	Final Scan 1 – 18 GHz	Antenna Distance	3m	Detector	Average
Antenna Height	1 – 4 meter	EUT height	80 cm		
Configuration	See Section 5.3				
Notes	None				

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END OF REPORT

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