FCC PART 15, SUBPART F
IC RSS-220, ISSUE 1, MARCH 2009

TEST AND MEASUREMENT REPORT

For

Siemens Medical Solution USA Inc.

5168 Campus Drive,
Plymouth Meeting, PA 19462, USA

FCC ID: XSB2300B
IC: 267FA-2300B

Report Type:	**Product Type:**
Original Report	Diagnostic Ultrasound System

Prepared By:	Jason Qian Test Engineer
Report Number:	R1602221-519
Report Date:	2016-08-09
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1602221-519	Original Report	2016-06-22
1	R1602221-519	Revised Radiated Spurious Emissions data in Section 8.7	2016-07-21
2	R1602221-519	Updated Radiated Spurious Emissions data on P25. Added measurement plots on P26.	2016-08-09

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been compiled on behalf of *Siemens Medical Solution USA, Inc*., and their product: *ACUSON Freestyle Ultrasound System*. Console Model number: ACUSON Freestyle, Handheld probe model: L8-3 (11001401), L13-5(11001402 and C5-2 (11001403) or *FCC ID: XSB2300B; IC: 267FA-2300,* which henceforth is referred to as the EUT (Equipment Under Test.). The EUT is handheld probe, a UWB 7.8 GHz radio transmitter.

1.2 Mechanical Description of EUT

The EUT measures approximately 38mm (L) x 36.3 mm (W) x 38 mm (H) and weighs approximately 100 g with battery.

The data gathered are from a typical production sample provided by the manufacturer with serial number: PP2069 and PP2074, assigned by Client.

1.3 Objective

This report is prepared on behalf of *Siemens Medical Solution USA, Inc.,* in accordance with Part 15, Subparts F and C of the Federal Communication Commission's rules and IC RSS-220 Issue 1, March 2009.

The objective is to determine compliance with FCC Part 15.519 and ICRSS-220 rules for Peak Power, Antenna Requirements, Radiated Spurious Emissions, UWB Bandwidth, Operational Bandwidth, GPS Bands and Turn off Time.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.6 Measurement Uncertainties

All measurements involve uncertainties. In the case of EMC Emissions tests, the influence quantities (factors) that make a significant contribution to the measurement uncertainties are detailed in the latest version of CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty" (i.e., CISPR 16-4-2:2011-06 + C1:2013-04 +A1:2014-02).

Based on the uncertainty models given in the latest version of CISPR 16-4-2, and, based on the calibration uncertainties of the specific instruments and facilities used at BACL to perform the measurements documented in this Test Report, the following estimates have been made of BACL's Measurement Uncertainties for the measurements documented in this Test Report.

Type of Measurement	**BACL Typical U_{LAB} Value (for a k=2 Coverage Factor, equivalent to ~ 95% level of confidence)**	**U_{CISPR} Value worst-allowable values, per Table 1 of the latest version of CISPR 16-4-2 (for a k=2 Coverage Factor, equivalent to ~ 95% level of confidence)**
Conducted Disturbance (Mains Port) 150 kHz to 30 MHz (i.e., AC/DC Line Conducted Emissions measurements made with an LISN)	3.3 dB	3.4 dB
Radiated Disturbance on an OATS 30 MHz – 1000 MHz (i.e., Radiated Emissions measured in a SAC at 10 metres distance)	5.8 dB	6.3 dB
Radiated Disturbance on an OATS 1 GHz – 6 GHz (i.e., Radiated Emissions measured in a FAR at 3 metres distance)	5.1 dB	5.2 dB
Radiated Disturbance on an OATS 6 GHz – 18 GHz (i.e., Radiated Emissions measured in a FAR at 3 metres distance)	5.4 dB	5.5 dB

1.7 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.8 Test Facility

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3279.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.03)*** to certify

- For the USA (Federal Communications Commission):
  - 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  - 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  - 3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  - 1 All Scope 1-Licence-Exempt Radio Frequency Devices;
  - 2 All Scope 2-Licensed Personal Mobile Radio Services;
  - 3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime & Aviation Radio Services;
  - 5 All Scope 5-Licensed Fixed Microwave Radio Services
  - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D- ***A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:***

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - EMC Directive 2004/108/EC US-EU EMC & Telecom MRA CAB
  - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC
    US -EU EMC & Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA)
  APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

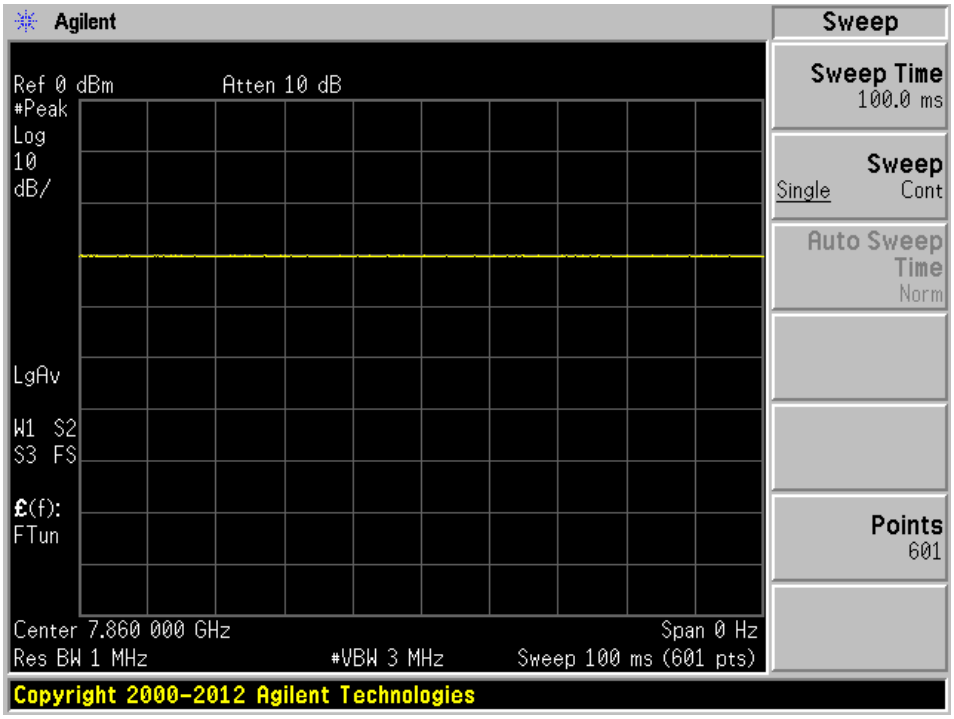
2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2014 and ANSI C63.10-2013.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

Duty Cycle: 100%

7.86 GHz



2.2 EUT Exercise Software

N/A

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Local Support Equipment

N/A

2.5 EUT Internal Configuration Details

Manufacturer	Description	Type	Serial Number
Siemens	Base Unit/Display	Freestyle S/N 000111	-
Siemens	L13-5 probe	L13-5 S/N PP2069	-
Siemens	L8-3 probe	L8-3 S/N PP2061	-
Siemens	C5-2 probe	C5-2 S/N PP2072	-

2.6 Power Supply and Line Filters

N/A

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
RF Cable	< 1 m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §2.1093 IC RSS-102	RF Exposure	Compliant
FCC §15.203, §15.519(a)(2) RSS-Gen §8.3	Antenna Requirement	Compliant
FCC §15.503(d), §15.519(b) RSS-220 §6.5.1(a)	UWB Operation Bandwidth	Compliant
FCC §15.519(a)(1) RSS-220 §6.5.1(b)	Turn off Time	Compliant
FCC §15.519(c)(d)(e) FCC §15.209 RSS-220 §6.5.1(c)(d)	Radiated Emissions	Compliant
FCC §15.519(e) RSS-220 §6.5.1(g)	Peak Output Power	Compliant

4 FCC §15.247(i), §2.1093 & IC RSS-102 – RF Exposure

4.1 Applicable Standards

According to FCC KDB 447498 D01 General RF Exposure Guidance: §4.3.1. Standalone SAR test exclusion considerations.

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

§4.3.2. Simultaneous transmission SAR test exclusion considerations

(Max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm; where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR

According to IC RSS-102 §2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- Below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- At or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 4.49/f0.5 W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 f0.6834 W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

4.2 Evaluation Result

For FCC:

UWB:

Maximum output power is -25.85 dBm/50 MHz (0.0026mW)

Based on below equation

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

(0.0026/5)*(√7.8) =0.00145 which is less than 7.5

Bluetooth (from FCC ID: ED9LMX9838)

Maximum output power is -2.11 dBm (1.626 mW)

Based on below equation

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

(1.626/5)*(√2.48) =0.512 which is less than 7.5

So this device meets the SAR exclusion condition.

For IC:

This device operates at 7.8 GHz and the EIRP less than 5W, so this device meets the exemption limits for SAR evaluation.

This device operates at 2.4GHz and the EIRP less than 1.31 x 10-2 f 0.6834=5.47 Watt, so this device meets the exemption limits for SAR evaluation.

5 FCC §15.203, §15.519(a)(2) & IC RSS-Gen §8.3 – Antenna Requirements

5.1 Applicable Standards

According to FCC §15.203, 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.

According to FCC §15.519 (a) (2):

The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device.

According to IC RSS-Gen §8.3: Transmitter Antenna

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. 9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi)

5.2 Antenna Description

Antenna Location	Antenna Gain (dBi)
Internal X 6	-4.37

The Highest Gain is -4.37 dBi, and the antenna consists of non-standard (UFL) connectors; Antenna gain that exceeds 6 dBi was added to RF measurement therefore, it complies with the antenna requirement. Please refer to the internal photos.

The Antenna is only use on the hand held UWB device. Total 6 antennas are inside the unit.

6 FCC §15.503(d), §15.519(b) & IC RSS-220 §6.5.1(a) - UWB Bandwidth

6.1 Applicable Standards

For FCC §15.503, UWB bandwidth. For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M.

Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

For FCC §15.519(b), The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz
For IC RSS-220 §6.5.1(a), The -10 dB UWB bandwidth of a medical radar imaging device shall be totally contained in the band 3.1-10.6 GHz.

6.2 Measurement Procedure

The frequency at which the maximum power level is measured with the peak detector is designated f_M. The peak power measurements shall be made using a spectrum analyzer or EMI receiver with a 1 MHz resolution bandwidth and a video bandwidth of 1 MHz or greater. The instrument shall be set to peak detection using the maximum-hold trace mode. The outermost 1 MHz segments above and below f_M, where the peak power falls by 10 dB relative to the level at f_M, are designated as f_H and f_L, respectively:
a) For the lowest frequency bound f_L, the emission is searched from a frequency lower than f_M that has, by inspection, a peak power much lower than 10 dB less than the power at f_M and increased toward f_M until the peak power indicates 10 dB less than the power at f_M. The frequency of that segment is recorded.
b) This process is repeated for the highest frequency bound f_H, beginning at a frequency higher than f_M that has, by inspection, a peak power much lower than 10 dB below the power at f_M. The frequency of that segment is recorded.
c) The two recorded frequencies represent the highest fH and lowest fL bounds of the UWB transmission, and the −10 dB bandwidth (B − 10) is defined as $(f_H - f_L)$. The center frequency (f_c) is mathematically determined from $(f_H - f_L) / 2$.
d) The fractional bandwidth is defined as $2(f_H - f_L) / (f_H + f_L)$.
e) Determine whether the −10 dB bandwidth $(f_H - f_L)$ is ≥500 MHz, or whether the fractional bandwidth $2(f_H - f_L) / (f_H + f_L)$ is ≥0.2.

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2015-06-23	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

6.4 Test Environmental Conditions

Temperature:	22º C
Relative Humidity:	35%
ATM Pressure:	101.5 KPa

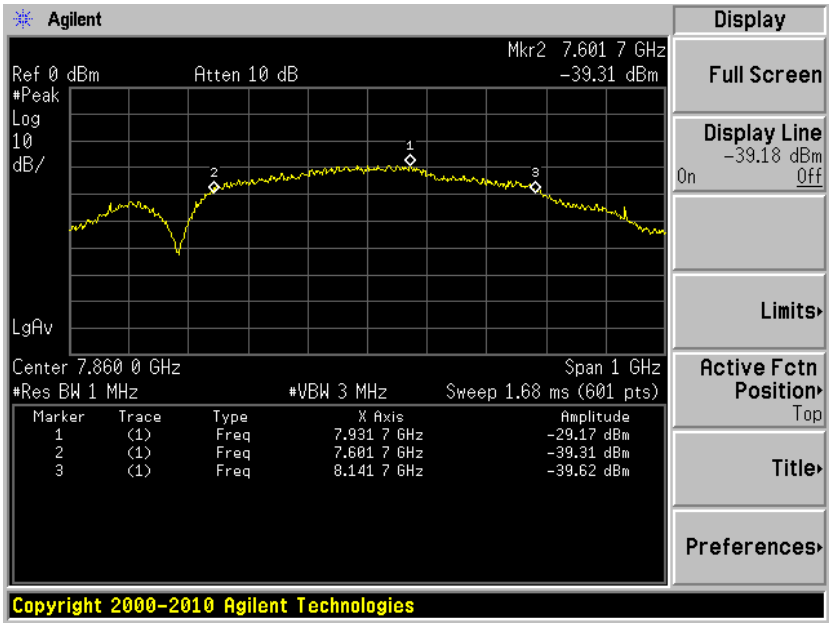
The testing was performed by Jason Qian on 2015-06-2 at RF site.

6.5 Test Results

The bandwidth of the EUT was found to comply with the requirement of 15.519(b) and the minimum bandwidth as defined in 15.503.

Please refer to following table and plot of Bandwidth.

Measurement	Frequency (MHz)	Result
f_L	7601.7	Compliant
f_H	8141.7	Compliant
f_M	7931.7	Compliant
Measured Bandwidth $=f_H-f_L$	540.0	Compliant
Center Frequency $=(f_H+f_L)/2$	7871.7	Compliant
Fractional Bandwidth $=2(f_H-f_L)/(f_H+f_L)$	0.0686	Compliant



7 FCC §15.519(c) & IC RSS-220 §6.5.1(b) - Turn off Time

7.1 Applicable Standards

As per FCC §15.519(a)(1): a UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

As per IC RSS-220 §6.5.1(b): A medical radar imaging device shall contain a manually operated switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. It is permissible to operate an imaging device by remote control provided that the imaging device ceases transmission within 10 seconds of the remote switch being released by the operator.

7.2 Measurement Procedure

The UWB transmitter is controlled via a Bluetooth link to the base station. Transmission will cease within 10 seconds of a loss of control from the base station.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2015-06-23	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

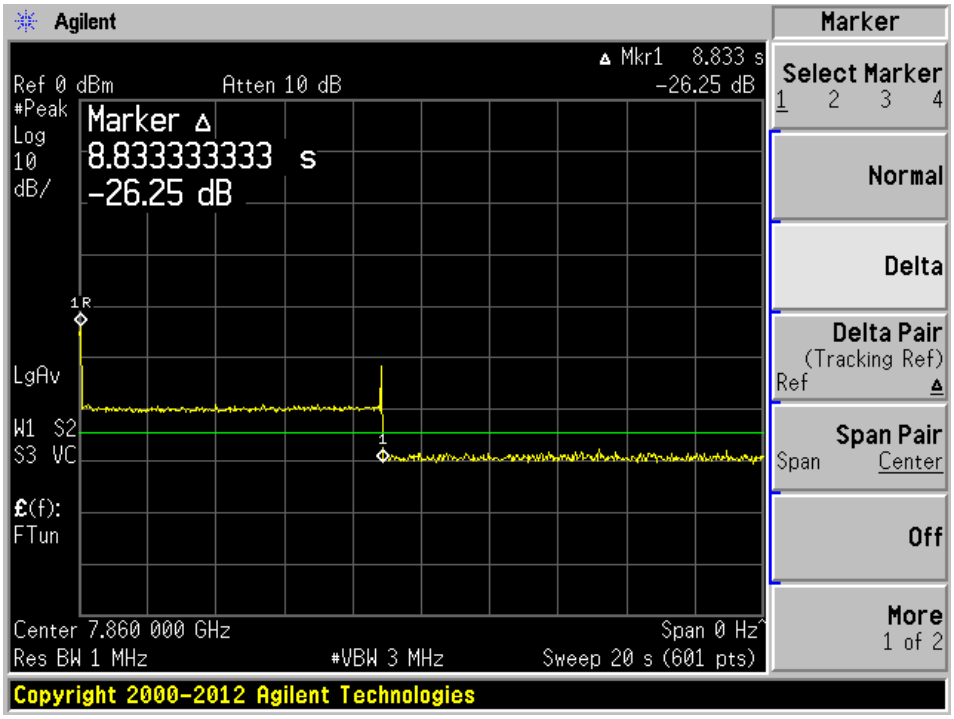
7.4 Test Environmental Conditions

Temperature:	22º C
Relative Humidity:	35%
ATM Pressure:	101.5 KPa

The testing was performed by Jason Qian on 2016-03-02 at RF site.

7.5 Test Results

The following plot shows the time to turn off is 8.83 seconds once the UWB transmitter lost control from the base station.



8 FCC §15.519(c)(d)(e) & IC RSS-220 §6.5.1(c)(d)(e) - Radiated Emissions

8.1 Applicable Standards

As per FCC §15.519(e): There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521.

As per FCC §15.519(c): The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP in dBm
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

As per FCC §15.209: the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph 15.209(g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §15.231 and §15.241.

As per RSS-220 §6.5.1(d): Radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz.

Frequency (MHz)	EIRP in dBm
960-1610	-65.3
1610-1990	-53.3
1990-3100	-51.3
3100-10600	-41.3
Above 10600	-51.3

As per RSS Radiated emissions at or below 960 MHz for all subclasses of UWB device shall not exceed the following limits. Measurements of radiated emissions at and below 960 MHz are to be made using a CISPR quasi-peak detector. CISPR measurement bandwidth specifications are to be used.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	EIRP (dBmW)
0.009-0.490	2400/F(kHz)	300	10 log (17.28 / F2)
0.490-1.705	24000/F(kHz)	30	10 log (17.28 / F2)
1.705-30.0	30	30	-45.7
30-88	100	3	-55.2
88-216	150	3	-51.7
216-960	200	3	-49.2

Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average emissions detector.

As per FCC §15.519(d): in addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164-1240	−85.3
1559-1610	−85.3

As per RSS-220.6.5.1(e): In addition to the limits specified in paragraph (d) of this section, radiated emissions shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz. The measurements shall demonstrate compliance with the stated limits at whatever resolution bandwidth is used.

Frequency in MHz	EIRP in dBm
1164-1240	−75.3
1559-1610	−75.3

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart F and IC RSS-220 limits.

The spacing between the peripherals was 10 centimeters.
External I/O cables were draped along the edge of the test table and bundle when necessary.

8.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane for below 1GHz and 1.5 meter above ground plane for above 1GHz, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz

Above 1000 MHz:

RBW = 1MHz / VBW = 1MHz

For radiated emissions fall in 1164-1240 MHz and 1559-1610 MHz bands, the spectrum analyzer or receiver is set as: RBW = 1 kHz

8.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBm = Indicated Reading (32.5 dBm) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

8.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2016-01-20	2 year
Agilent	Spectrum Analyzer	E4440A	MY44303352	2015-06-22	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2015-07-11	2 year
A.R.A	Antenna, Horn	DRG-118/A	1132	2015-09-21	2 year
HP	Pre-Amplifier	8447D	2944A06639	2015-06-08	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	2015-11-05	1 year
-	SMA cable	-	C0001	Each time[1]	N/A
IW Microwave	High Frequency Cable	DC-1531	KPS-1501A3960KPS	2015-08-10	1 year
Agilent	Pre-Amplifier	8449B	3008A01978	2015-09-02	1 year
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2015-10-22	2 year
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2013-09-20	3 year
Wisewave	Antenna, Horn	ARH-2823-02	10555-01	2015-09-01	2 year

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL *attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.*

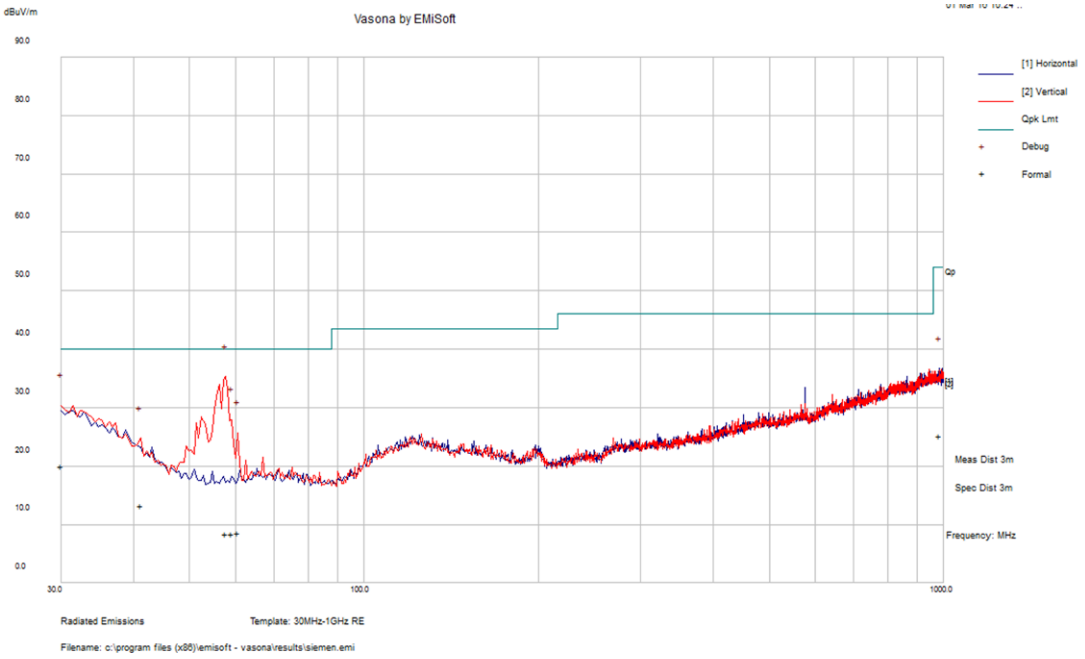
8.6 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	33 %
ATM Pressure:	102.1 kPa

The testing was performed by Jason Qian on 2016-03-03 in 5m chamber3.

8.7 Radiated Emissions Test Data and Plots

1) 30 MHz - 1 GHz



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
57.80925	8.47	294	V	18	40	-31.53	QP
30.00059	20.04	297	V	100	40	-19.96	QP
59.27775	8.41	154	V	171	40	-31.59	QP
60.55975	8.6	266	V	202	40	-31.4	QP
41.194	13.33	137	V	87	40	-26.67	QP
983.1338	25.16	290	H	168	54	-28.84	QP

2) 960 MHz - 40 GHz

Frequency (MHz)	S.A. Reading (dBuv/m)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Reading (dBuv/m)	EIRP (dBm)	FCC/IC	
			Height (cm)	Pol. (H/V)	Factor (dB)					Limit (dBm)	Margin (dB)
1253.6	0.94	0	150	V	25.362	3.74	17.838	12.204	-83.096	-75.3	-7.796
1270.9	0.48	0	150	H	25.324	3.71	17.838	11.676	-83.624	-75.3	-8.324
1651.1	35.78	0	150	V	25.214	4.071	34.16	30.905	-64.395	-63.3	-1.095
1630.9	35.41	0	150	H	25.214	4.071	34.16	30.535	-64.765	-63.3	-1.465
2204.6	34.39	0	150	V	27.714	4.673	33.66	33.117	-62.183	-61.3	-0.883
2021.44	34.56	0	150	H	27.8	4.943	33.67	33.633	-61.667	-61.3	-0.367
3100	33.9	0	150	V	30.345	5.947	33.59	36.602	-58.698	-41.3	-17.398
3100	33.87	0	150	H	30.345	5.947	33.59	36.572	-58.728	-41.3	-17.428
8306	32.44	0	150	V	37.622	10.486	34.05	46.498	-48.802	-41.3	-7.502
8141	32.79	0	150	H	37.041	10.31	34.05	46.091	-49.209	-41.3	-7.909

Note1: FCC limit is lower than IC limit, therefore, the FCC limit was applied to the result table above.
Note2: Based on ANSI 63.10 and FCC 15.519 (e), the limit for fundamental signal is 0dBm EIRP, with 1MHz RBW convert to 50MHz RBW, the factor is -34 dBm, therefore, the limit for fundamental signal is -34dBm.
Note3: According to ANSI 63.10 section 10.3.9, Field strength convert to EIRP at 3 meter distance, the equation is listed below.

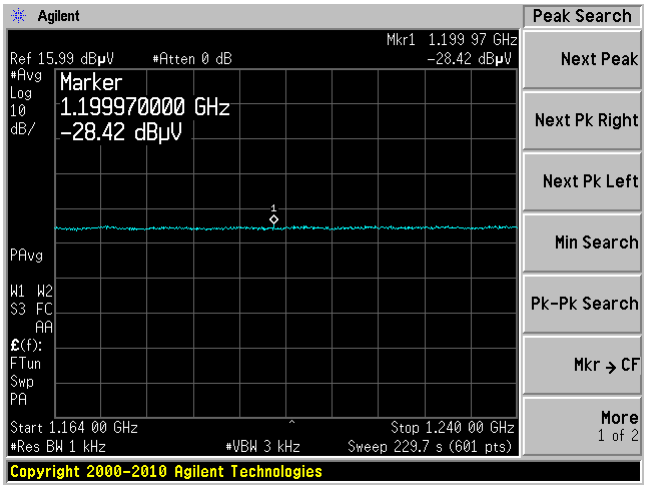
EIRP (dBm) = E (dBμV/m) - 95.3 dB

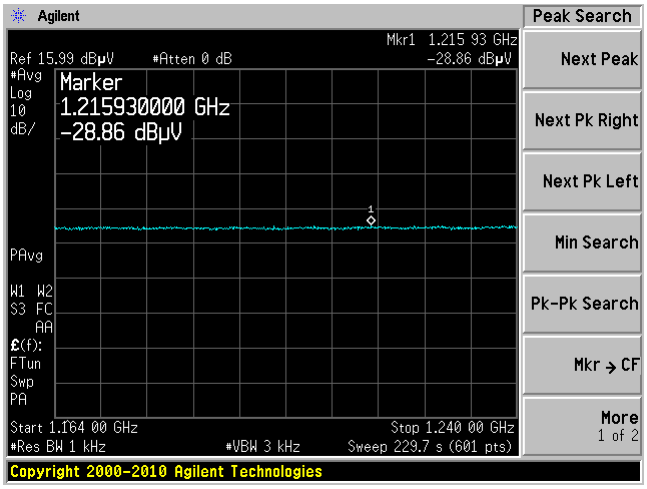
3) Radiated Emission fall in 1164-1240 MHz and 1559-1610 MHz

Frequency (MHz)	S.A. Reading (dBuv/m)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBuv/m)	EIRP value (dBm)	FCC	
			Height (cm)	Polarity (H/V)	Factor (dB)					Limit (dBm)	Margin (dB)
1199.97	-28.42	180	150	H	24.74	3.74	0	0.06	-95.14	-85.3	-9.84
1215.93	-28.86	180	150	V	24.78	3.74	0	-0.34	-95.54	-85.3	-10.24
1583.99	-27.56	180	150	H	25.47	4.05	0	1.96	-93.24	-85.3	-7.94
1583.99	-28.23	180	150	V	25.47	4.05	0	1.29	-93.91	-85.3	-8.61

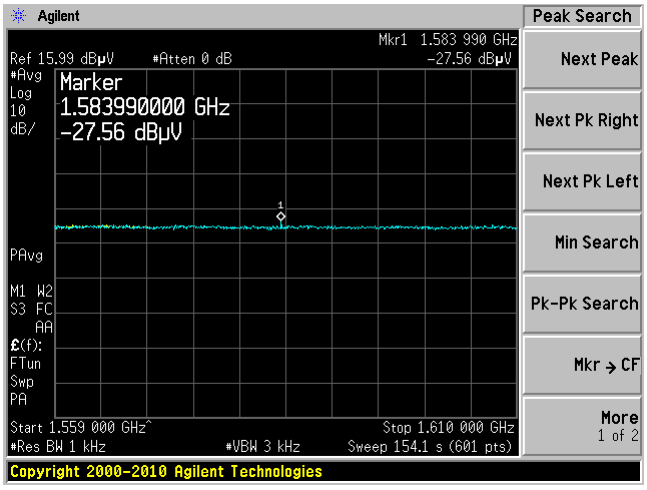
Frequency (MHz)	S.A. Reading (dBuv/m)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp (dB)	Cord. Reading (dBuv/m)	EIRP value (dBm)	IC	
			Height (cm)	Polarity (H/V)	Factor (dB)					Limit (dBm)	Margin (dB)
1199.97	-28.42	180	150	H	24.74	3.74	0	0.06	-95.14	-75.3	-19.84
1215.93	-28.86	180	150	V	24.78	3.74	0	-0.34	-95.54	-75.3	-20.24
1583.99	-27.56	180	150	H	25.47	4.05	0	1.96	-93.24	-75.3	-17.94
1583.99	-28.23	180	150	V	25.47	4.05	0	1.29	-93.91	-75.3	-18.61

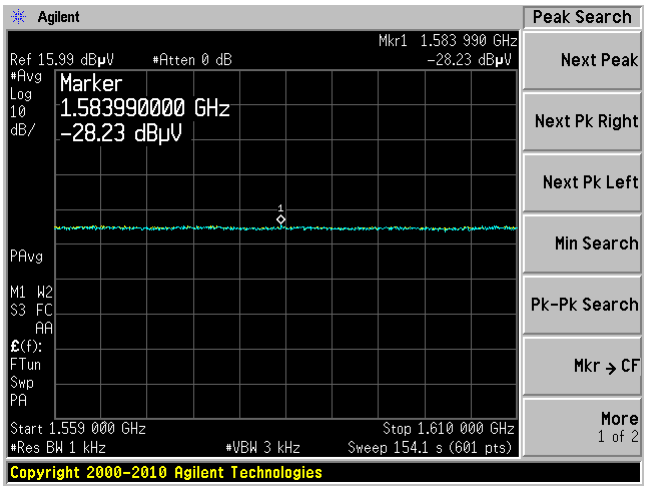
1160-1240MHz





1559-1610MHz





9 FCC§15.519(e) & RSS-220 §6.5.1 (g) - Peak Output Power

9.1 Applicable Standards

According to FCC §15.519(e): There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521.

According to RSS-220 §6.5.1(g): The peak level of the transmissions shall not exceed the peak equivalent of the average limit contained within any 50 MHz bandwidth, as defined in section 4 of the Annex.

9.2 Measurement Procedure

According to ANSI C63.10 the spectral characterization of a UWB device shall begin with a peak-detected radiated measurement because the results obtained from this measurement could preclude the need for subsequent average measurements. For example, if the data collected from the peak-power measurement show that the radiated emissions levels are equal to, or less than, the applicable emissions limit, then these data are adequate to determine compliance. This is predicated on the fact that the average levels are always less than, or equal to, the peak signal level.

The peak detector of the instrument is selected and the maximum hold feature activated. The RBW is set to 1 MHz and the VBW is set to at least 1 MHz (3 MHz is recommended).
It is acceptable to employ an RBW of less than 50 MHz (but no less than 1 MHz) when performing the required peak power measurements. When this approach is employed, the peak emissions EIRP limit (0 dBm / 50 MHz) is converted to a limit commensurate with the RBW by employing a [20 log (RBW/50 MHz)] relationship. For example, the peak power limit could be expressed in a 1 MHz bandwidth as follows in Equation:
$EIRP_{1MHz} = EIRP_{50MHz} + 20\log(1MHz/50\ MHz) = 0\ dBm + (-34\ dB) = -34\ dBm$
When a resolution bandwidth of less than 50 MHz is used, this measurement shall be performed over a 50 MHz span centered on the frequency associated with the highest detected average emission level.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
R & S	Spectrum Analyzer	FSQ	1155.5001.26	2015-03-09	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

9.4 Test Environmental Conditions

Temperature:	22 ºC
Relative Humidity:	35%
ATM Pressure:	101.5 KPa

The testing was performed by Jason Qian on 2016-03-04 at RF site.

9.5 Test Result

Frequency (MHz)	Reading Level (dBm/8 MHz)	Corrected Level (dBm/50 MHz)	Antenna Gain (dBi)	EIRP (dBm/50 MHz)	Limit (dBm/50 MHz)	Margin (dB)	Results
7860	-17.89	-25.85	-4.37	-30.22	0	-30.22	Pass

Note: Based on ANSI 63.10 and FCC 15.519 (e), with 8MHz RBW convert to 50MHz RBW, the factor is -7.96 dBm

Please refer to the following plots for detailed test results