FCC PART 95
ISEDC RSS-252, ISSUE 1, SEPTEMBER 2017
TEST AND MEASUREMENT REPORT

For

Delphi Electronics & Safety

2151 E. Lincoln Road, M/S C2E
Kokomo, IN 46902, USA

FCC ID: L2C0072TR
IC: 3432A-0072TR

Report Type:	**Product Type:**
Original Report	On-Board Unit

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Report Number:	R1711272-95
Report Date:	2018-01-24
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1711272-95	Original Report	2018-01-11
1	R1711272-95	Add ISEDC Rules	2018-01-24

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Delphi Electronics & Safety* and their product model Vehicle Awareness Device (VAD)*;* FCC ID: L2C0072TR, IC: 3432A-0072TR, or the "EUT" as referred to in this report. The EUT is a module with an On-Board-Unit function operates in 5850-5925 MHz.

1.2 Mechanical Description of EUT

The EUT measures 12.11 cm (L), 12.02 cm (W), 2.395 cm (H), and weighs 0.325 kg.

The data gathered are from a production sample provided by the manufacturer, serial number: R1711205-01*, assigned by BACL.*

1.3 Objective

This report is prepared on behalf of *Delphi Electronics & Safety* in accordance with Part 2 and Part 95 of the FCC guidelines. The objective is to ensure compliance with FCC Part 95 and ISEDC RSS-252 Issue 1, September 2017.

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 TIA-603-D and ASTM E2213-03

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 º C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

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 Annex 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 Accreditations

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: (Innovation, Science and Economic development Canada - ISEDC) 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 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC US -EU EMC & Telecom MRA CAB (NB)
  - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - Low Voltage Directive (LVD) 2014/35/EU
- 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 Media Development Authority - IMDA) 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;
  - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA-603-D and ASTM E2213-03.

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

2.2 EUT Exercise Software

The test utilities used were Saint Bus Engine and Saint Bus Monitor.

2.3 Special Equipment

N/A

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Latitude E6410	3CKR4Q1

2.6 Support Equipment

Manufacturer	Description	Model	Serial Number
CSI Electronics	CAN Transceiver	SAINT	1177

2.7 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
NPX	Microcontroller	i.MX6	N/A
u-blox	GNSS Receiver	UBX-M8030-KA	N/A
NXP	RF Transceiver	TEF5200EL/F1	N/A
NXP	SDR Processor	SAF5100	N/A
Renesas	Microcontroller	uPD78F1837	N/A
N/A	Switching Regulators	N/A	N/A

2.8 Interface Ports and Cabling

Cable Description	Length (m)	Qty.	To	From
RS232 Cable	1.5 m	1	RS232-to-USB adapter	SAINT
RS232-to-USB adapter	< 1 m	1	Laptop	RS232 Cable
Power/Bus Cable Harness	< 1 m	1	Power Supply	SAINT
SMA Cable	< 1 m	1	PSA	EUT

3 Summary of Test Results

Results reported relate only to the product tested.

FCC and ISEDC Rules	Description of Test	Results
FCC §2.1091 ISEDC RSS-102	RF Exposure	Compliant
FCC § 2.1049 ISEDC RSS-Gen §6.6	Emission Bandwidth	Compliant
ASTM E2213-03 8.9.1 & FCC § 95.3189 ISEDC RSS-252 §5.3	Maximum Transmitter Power (EIRP)	Compliant
ASTM E2213-03 8.9.2 & FCC §95.3189 ISEDC RSS-252 §5.4	Transmit Spectrum Mask	Compliant
ASTM E2213-03 8.9.2 & FCC § 2.1051 & § 95.3189 ISEDC RSS-252 §5.4	Transmitter Conducted Unwanted Emissions	Compliant
ASTM E2213-03 8.9.3 & FCC § 2.1053 & § 95.3189 ISEDC RSS-252 §5.4	Transmitter Radiated Unwanted Emissions	Compliant
ASTM E2213-03 8.9.4 & FCC § 2.1055 & § 95.3189 ISEDC RSS-252 §5.5	Frequency Tolerance	Compliant

4 FCC § 2.1091 & ISEDC RSS-102 – RF Exposure

4.1 Applicable Standard

According to FCC §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF field

According to ISED RSS-102 Issue 5:

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[6] 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 $4.49/f^{0.5}$ 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 $1.31 \times 10^{-2} f^{0.6834}$ 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 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.3 MPE Results

Maximum tuned output power at antenna input terminal (dBm):	20
Maximum tuned output power at antenna input terminal (mW):	100
Prediction distance (cm):	20
Prediction frequency (MHz):	5910
Maximum Antenna Gain, typical (dBi):	6
Maximum Antenna Gain (numeric):	3.98
Power density of prediction frequency at 20 cm (mW/cm^2):	0.08
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1

The device compliances with FCC MPE limit at 20 cm distance.

4.4 RF exposure evaluation exemption for IC

20 + 6.0 dBi = 26 dBm < $1.31\times10^{-2}f^{0.6834}$ = 4.952 W = 36.94 dBm

Therefore the RF exposure is not required.

5 FCC §2.1049 & ISEDC RSS-Gen §6.6 – Emission Bandwidth

5.1 Applicable Standard

According to FCC §2.1049 & ISEDC RSS-Gen §6.6

5.2 Test Procedure

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold my produce a wider bandwidth than actual.

The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between two recorded frequencies is the occupied bandwidth.

5.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2017-04-20	1 year

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

5.4 Test Environmental Conditions

Temperature:	22-26° C
Relative Humidity:	42-46 %
ATM Pressure:	101-102 kPa

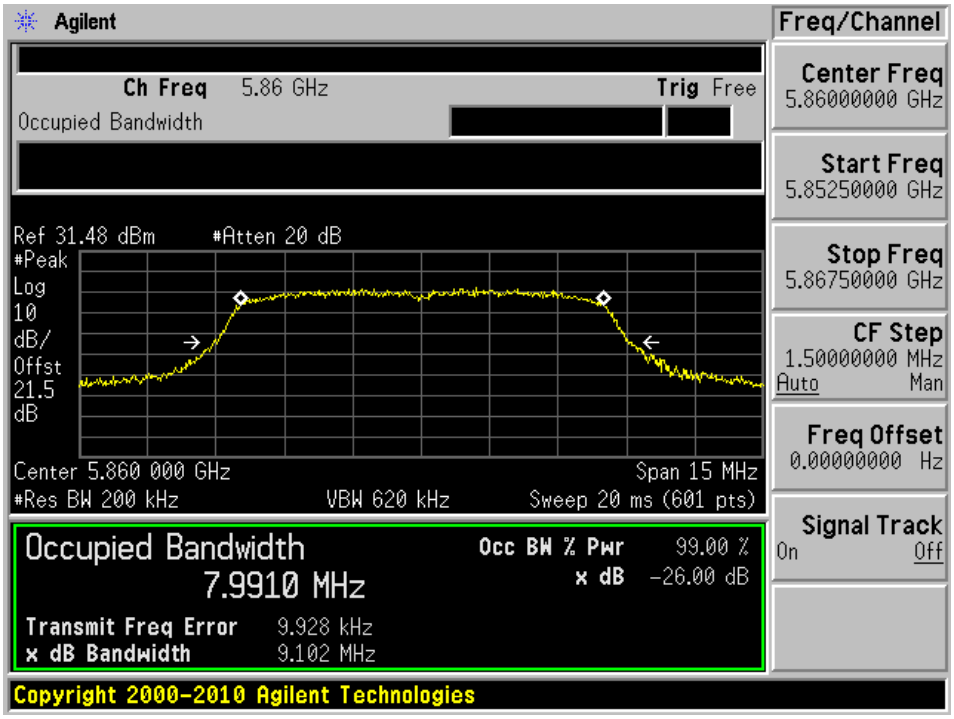
The testing was performed by Chin Ming Lui on 2017-12-21 at RF site.

5.5 Test Results

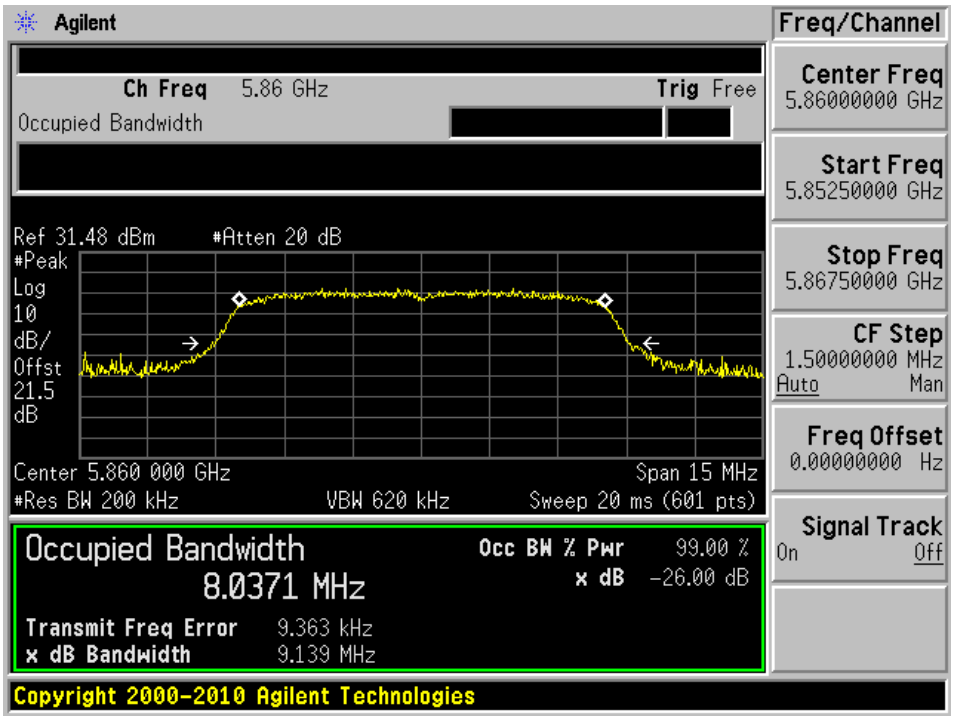
Channel	Frequency (MHz)	99% Bandwidth (MHz) Antenna 1	99% Bandwidth (MHz) Antenna 2
Low	5860	7.99	8.04
Middle	5890	7.98	8.04
High	5920	8.01	8.03

Please refer to the following plots for the test results

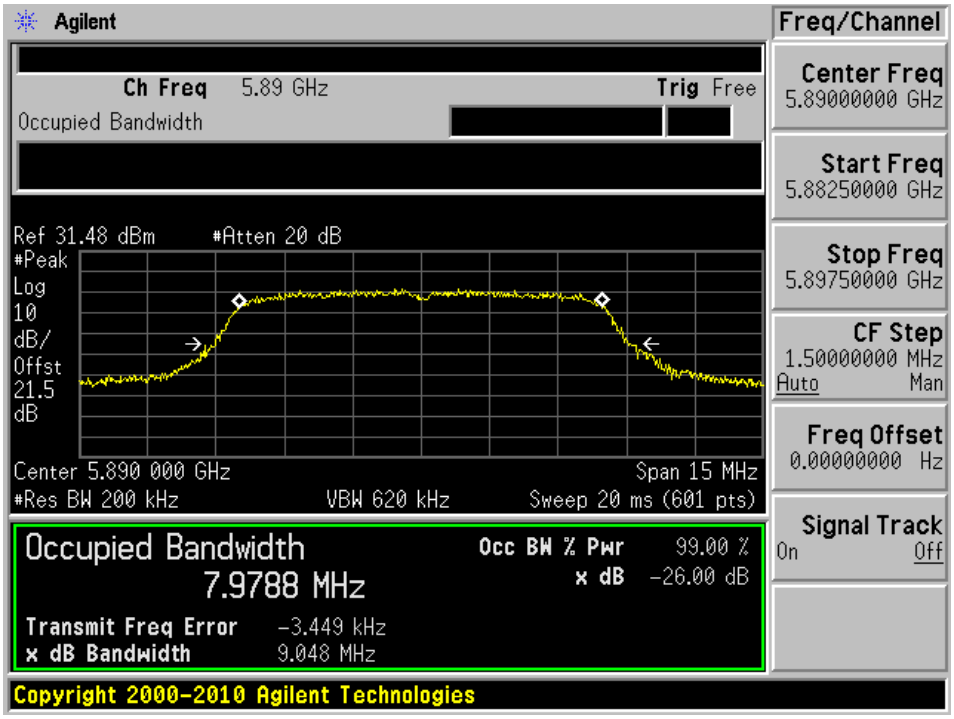
Low Channel, 5860 MHz Antenna 1



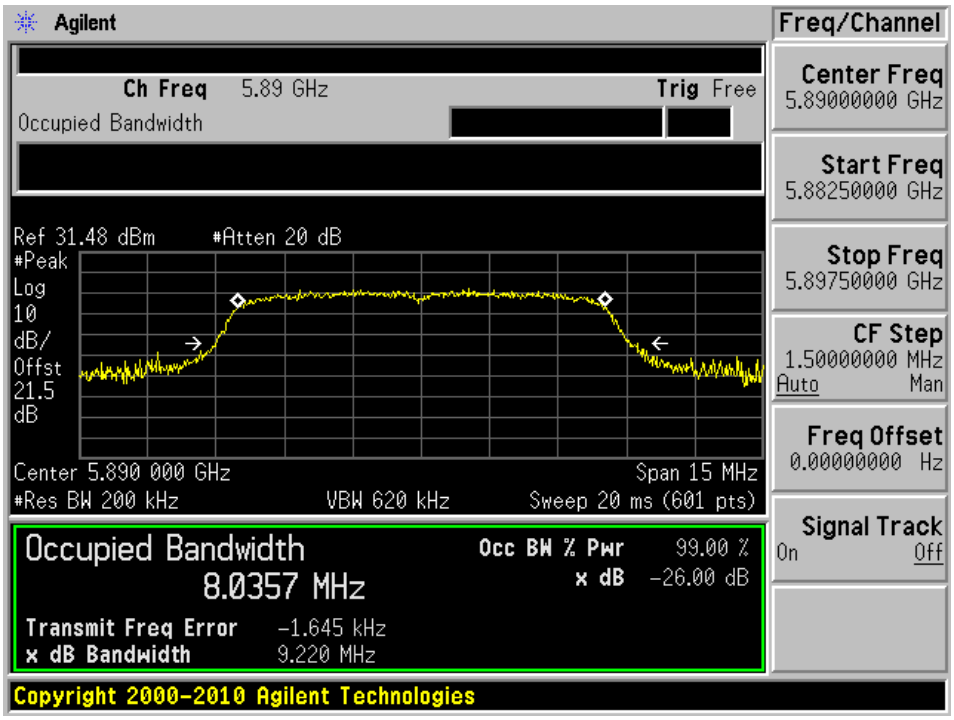
Low Channel, 5860 MHz Antenna 2



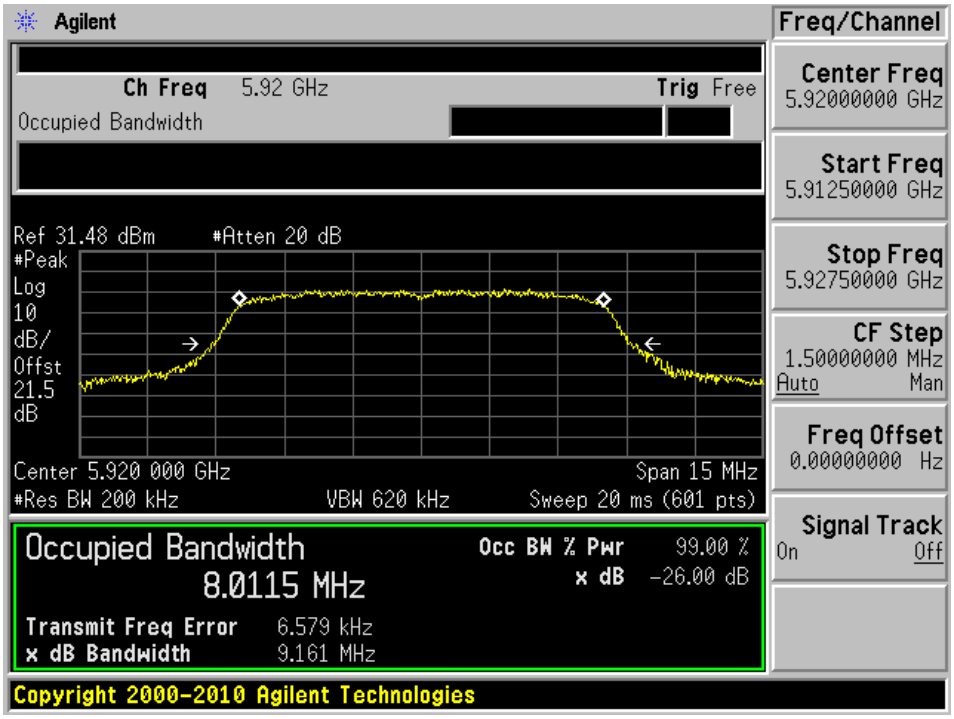
Middle Channel, 5890 MHz Antenna 1



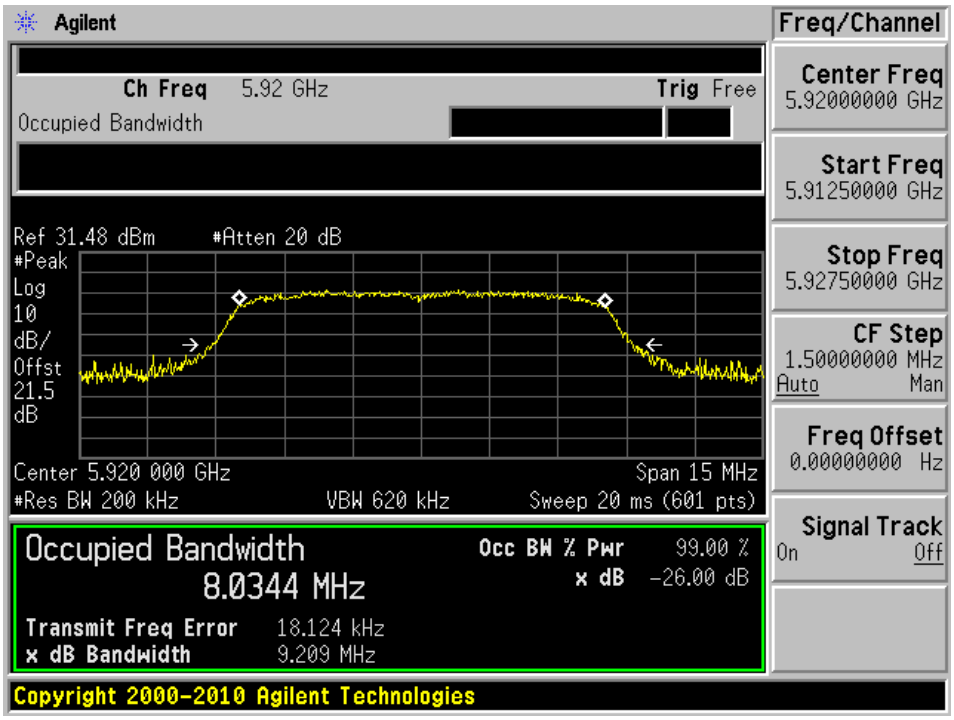
Middle Channel, 5890 MHz Antenna 2



High Channel, 5920 MHz Antenna 1



High Channel, 5920 MHz Antenna 2



6 ASTM E2213-03 8.9.1 & FCC §95.3189, ISEDC RSS-252 §5.3 – Maximum Transmitter Power (EIRP)

6.1 Applicable Standard

According to ASTM E2213-03 8.9.1:

Private OBU operations in Channels 172, 174, 176,178, and 184 shall not exceed 28.8 dBm antenna input power and 33 dBm EIRP. Private OBU operations in Channel 175 shall not exceed 10 dBm antenna input power and 23 dBm EIRP. Private OBU operations in Channels 180, 181, and 182 shall not exceed 20 dBm antenna input power and 23 dBm EIRP.

6.2 Test Procedure

According to TIA-603-D

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
ETS- Lingerin	Power Sensor	7002-006	160097	2016-12-05	25 months

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:	22-26° C
Relative Humidity:	42-46 %
ATM Pressure:	101-102 kPa

The testing was performed by Chin Ming Lui on 2017-12-13 at RF site.

6.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power			Antenna Gain[1] (dBi)	E.I.R.P		
		Chain 0 (dBm)	Chain 1 (dBm)	Limit (dBm)		Chain 0 (dBm)	Chain 1 (dBm)	Limit (dBm)
172	5860	18.63	18.62	28.8	3.05	21.68	21.67	33
174	5870	18.59	18.79	28.8	3.05	21.64	21.84	33
176	5880	18.36	18.55	28.8	3.05	21.41	21.60	33
178	5890	18.38	18.47	28.8	3.05	21.43	21.52	33
180	5900	18.48	18.78	20	3.05	21.53	21.83	23
182	5910	18.63	18.84	20	3.05	21.68	21.89	23
184	5920	18.73	18.83	28.8	3.05	21.78	21.88	33

Note[1]: the antenna will be installed with cable. The antenna gain is 6 dBi and the cable loss is 2.95 dB. Thus, the absolute antenna gain used in calculating e.i.r.p was 3.05 dBi.

7 ASTM E2213-03 8.9.2 & FCC §95.3189, ISEDC RSS-252 §5.4 – Transmit Spectrum Mask

7.1 Applicable Standard

TABLE 9 DSRC Device Classes and Transmit Power Levels[A]

Device Class	Maximum Device Output Power, dBm
A	0
B	10
C	20
D	28.8 or more

[A] From IEEE 802.11a. Copyright 1999 IEEE. All rights reserved.

TABLE 10 DSRC Spectrum Mask[A]

NOTE—Reduction in Power Spectral Density, dBr.

Class	± 4.5-MHz Offset	± 5.0-MHz Offset	± 5.5-MHz Offset	± 10-MHz Offset	± 15-MHz Offset
Class A	0	-10	-20	-28	-40
Class B	0	-16	-20	-28	-40
Class C	0	-26	-32	-40	-50
Class D	0	-35	-45	-55	-65

[A] From IEEE 802.11a. Copyright 1999 IEEE. All rights reserved.

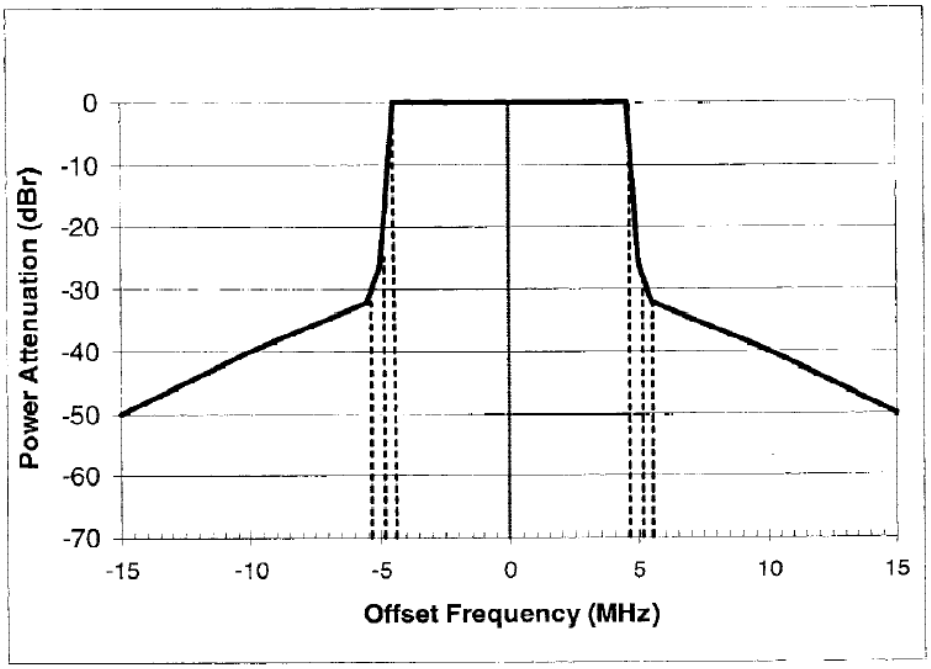


FIG. 14 Class C Transmit Spectrum Mask

7.2 Test Procedure

According to ASTM E2213-03 section 8.9.2, The DSRC transmitted spectrum mask is relative to the device class of operation. The power in the transmitted spectrum for all DSRC devices shall be −25 dBm or less within 100 kHz outside all channel and band edges. This will be accomplished by attenuating the transmitted signal 100 kHz outside the channel and band edges by 55 + 10log(*P*) dB, where *P* is the total transmitted power in watts. The transmitted spectral density of the transmitted signal for all devices shall fall within the spectral mask, as detailed in Table 10.5 The measurements shall be made using a 100 kHz resolution bandwidth and a 30 kHz video bandwidth.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2017-06-08	2 years

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

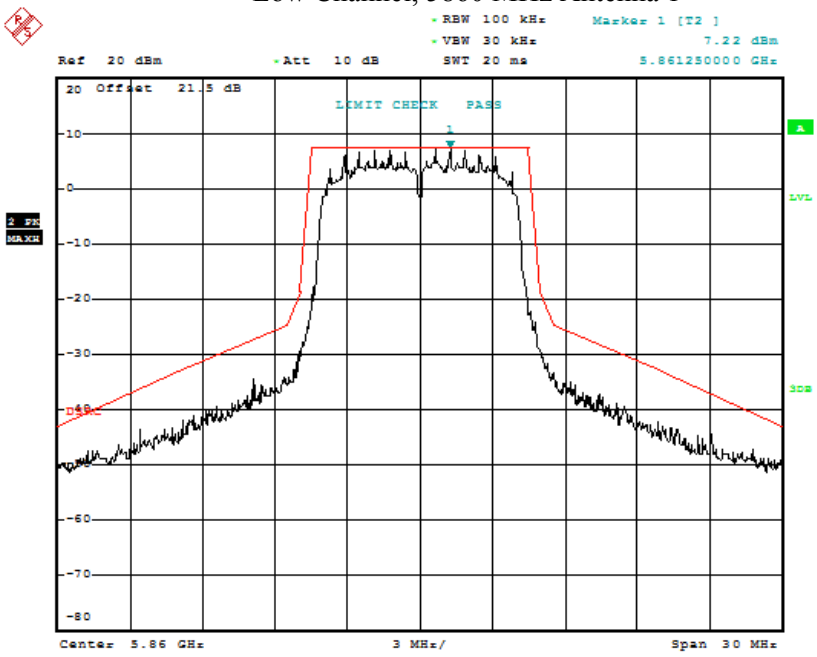
Temperature:	22-26° C
Relative Humidity:	42-46 %
ATM Pressure:	101-102 kPa

The testing was performed by Chin Ming Lui on 2017-12-21 at RF site.

7.5 Test Results

Class C mask is selected since the conducted output power from each chain was lower than 20 dBm.

Low Channel, 5860 MHz Antenna 1



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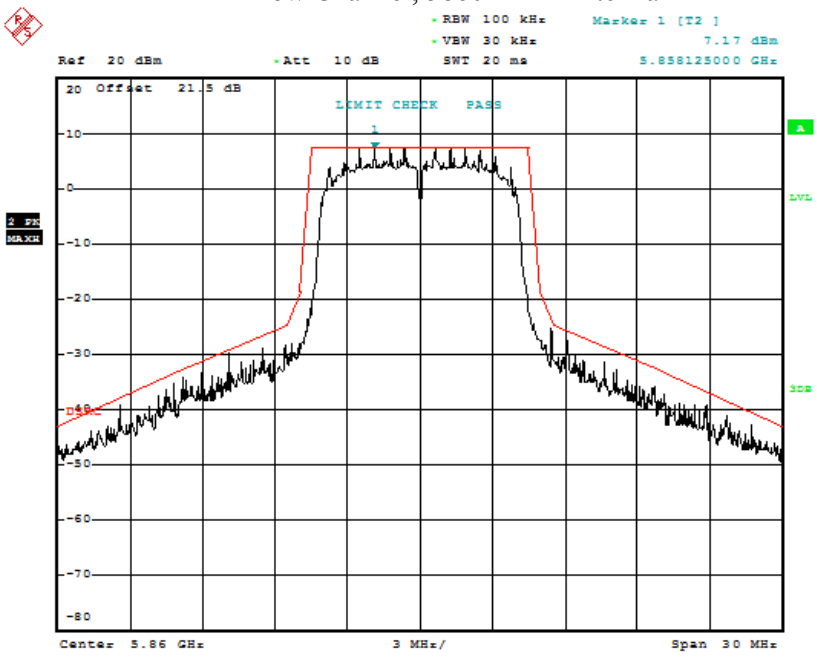
Low Channel, 5860 MHz Antenna 2



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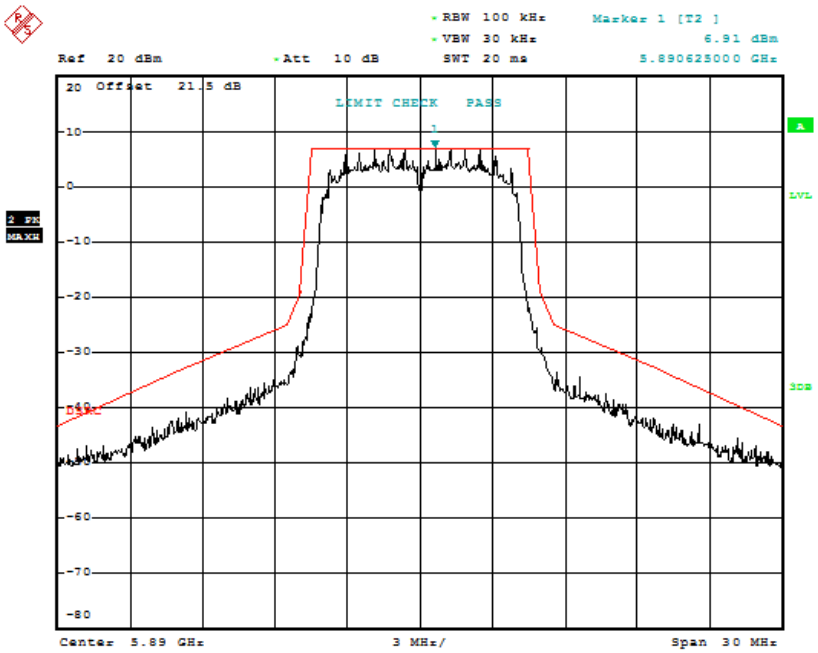
Middle Channel, 5890 MHz Antenna 1



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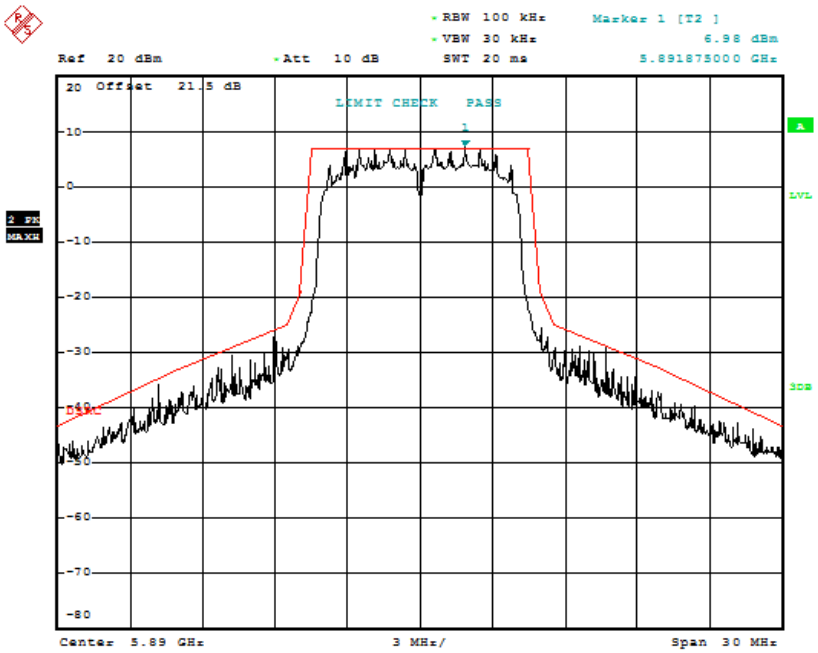
Middle Channel, 5890 MHz Antenna 2



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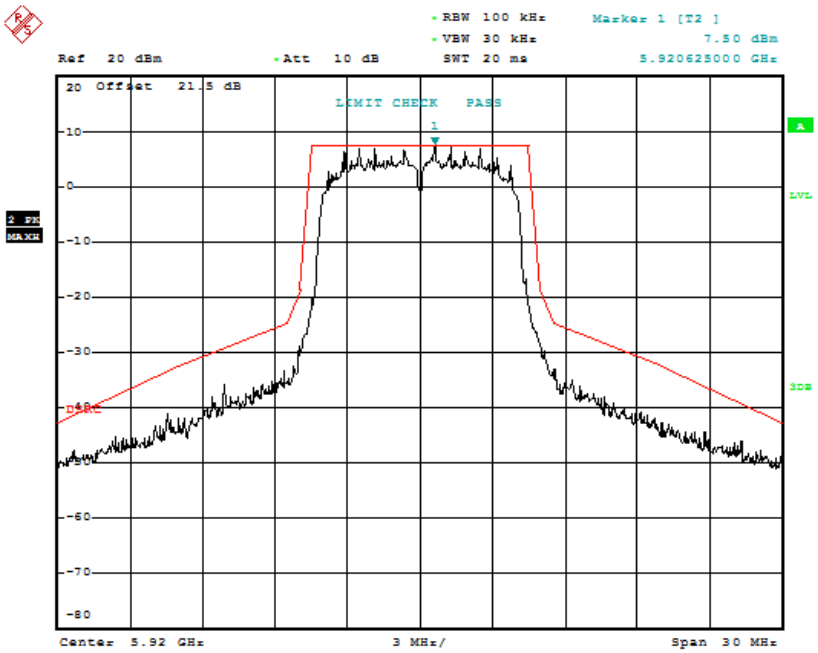
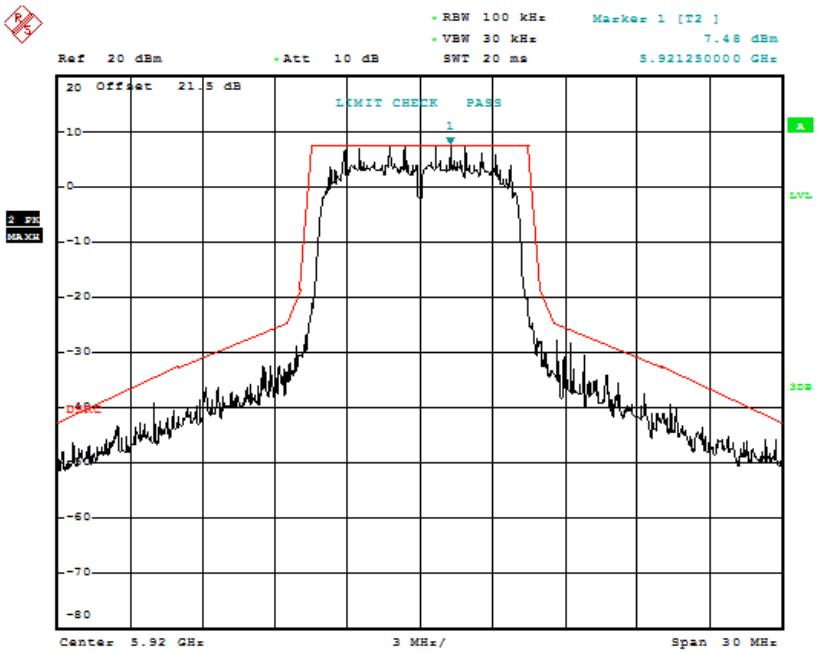
High Channel, 5920 MHz Antenna 1



High Channel, 5920 MHz Antenna 2



8 ASTM E2213-03 8.9.2 & FCC §2.1051, §95.3189, ISEDC RSS-252 §5.4 – Transmitter Conducted Unwanted Emissions

8.1 Applicable Standard

According to ASTM EN2213-03 8.9.2:

8.9.2.2 The transmitted spectral mask for class A, B, C, and D devices are shown in Figs. 12-15. In addition, all DSRC site installations shall limit the EIRP in the transmitted spectrum to −25 dBm or less in the 100 kHz at the channel edges and the band edges. Additional filtering that supplements the filtering provided by the transmitter may be needed for some antenna/transmitter combinations.

8.2 Measurement Procedure

The DSRC transmitted spectrum mask is relative to the device class of operation. The power in the transmitted spectrum for all DSRC devices shall be −25 dBm or less within 100 kHz outside all channel and band edges. This will be accomplished by attenuating the transmitted signal 100 kHz outside the channel and band edges by $55 + 10\log(P)$ dB, where P is the total transmitted power in watts. The transmitted spectral density of the transmitted signal for all devices shall fall within the spectral mask, as detailed in Table 10.5 The measurements shall be made using a 100 kHz resolution bandwidth and a 30 kHz video bandwidth.

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2017-04-20	1 year

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

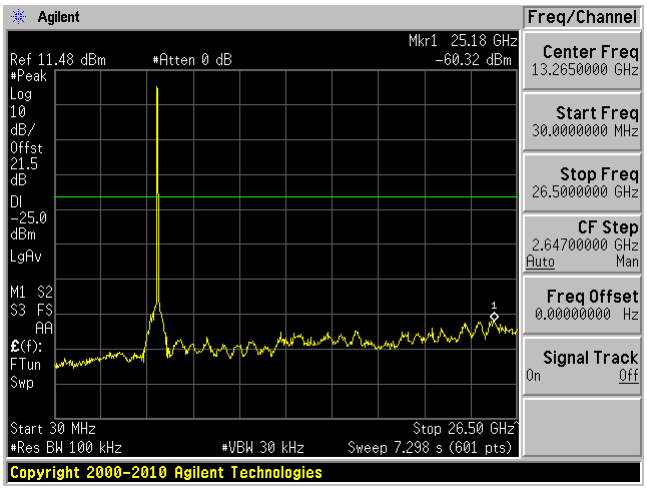
8.4 Test Environmental Conditions

Temperature:	22-26° C
Relative Humidity:	42-46 %
ATM Pressure:	101-102 kPa

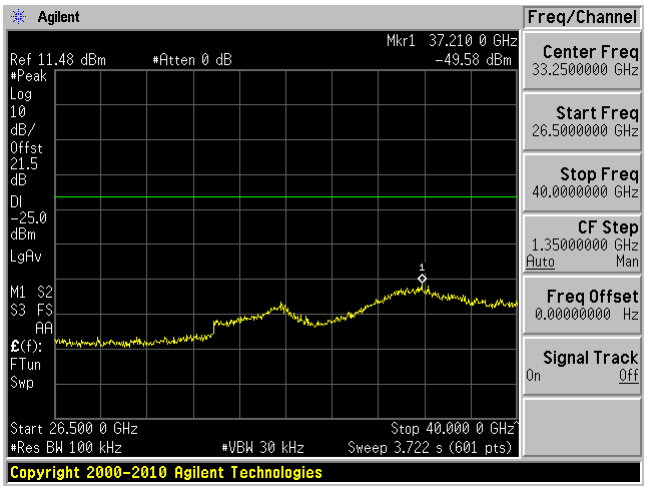
The testing was performed by Chin Ming Lui on 2017-12-21 at RF site.

8.5 Test Results

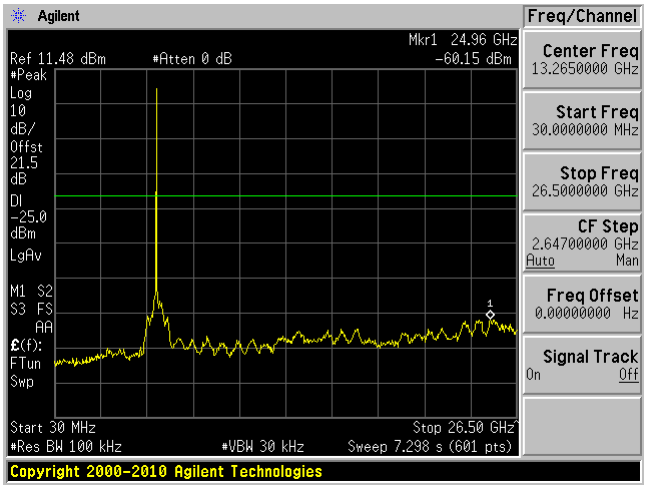
Low Channel 5860 MHz Ant 1, 30MHz – 26.5GHz



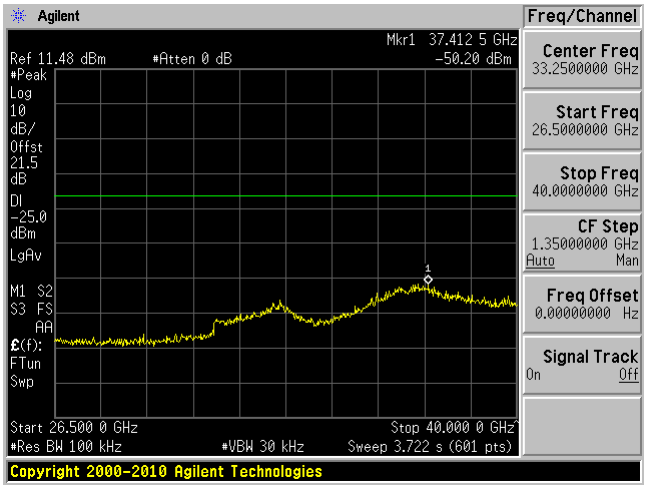
Low Channel 5860 MHz Ant 1, 26.5GHz – 40GHz



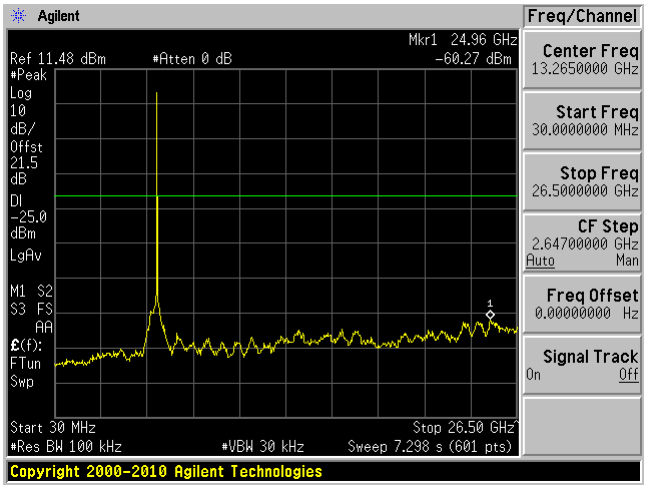
Low Channel 5860 MHz Ant 2, 30MHz – 26.5GHz



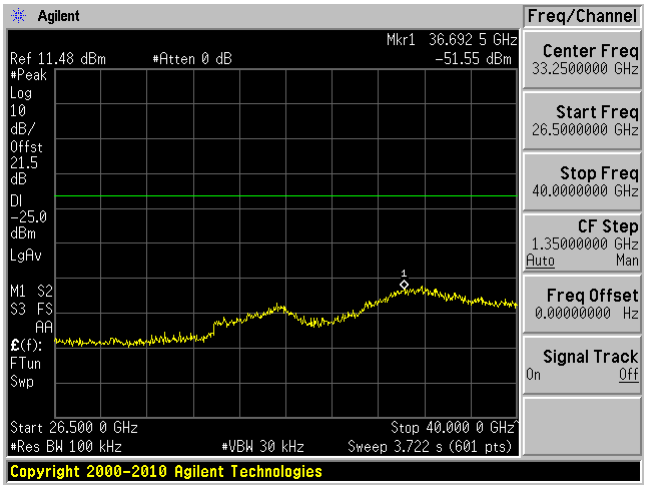
Low Channel 5860 MHz Ant 2, 26.5GHz – 40GHz



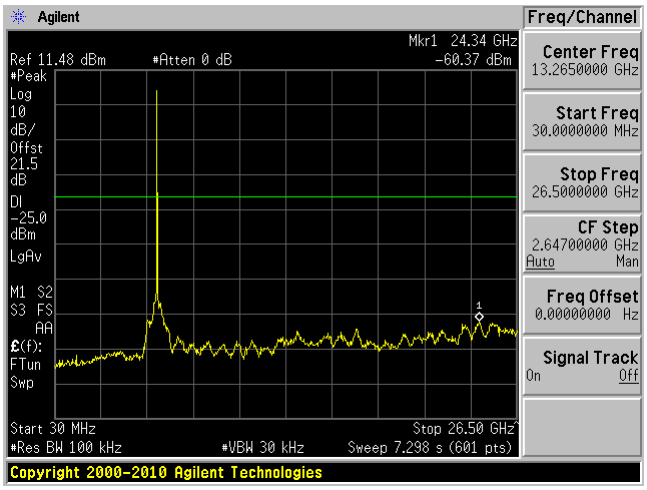
Middle Channel 5890 MHz Ant 1, 30MHz – 26.5GHz



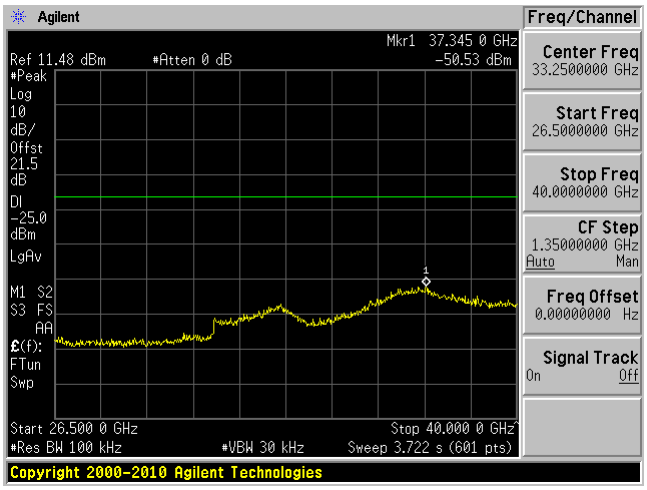
Middle Channel 5890 MHz Ant 1, 26.5GHz – 40GHz



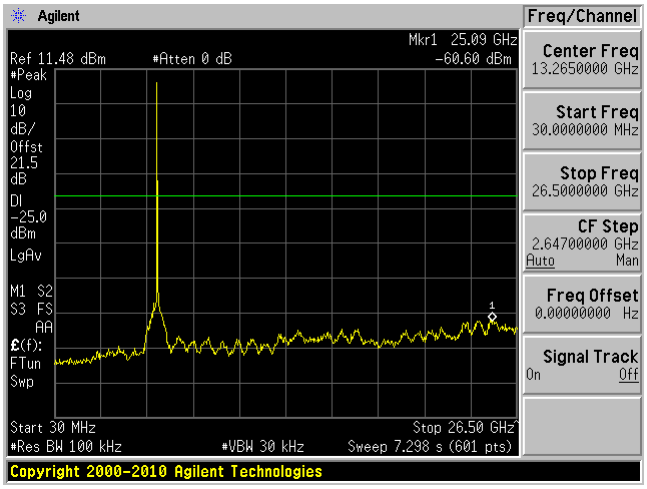
Middle Channel 5890 MHz Ant 2, 30MHz – 26.5GHz



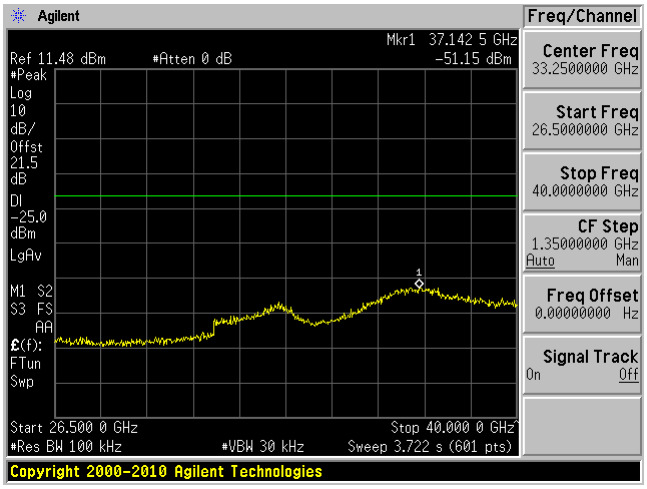
Middle Channel 5890 MHz Ant 2, 26.5GHz – 40GHz



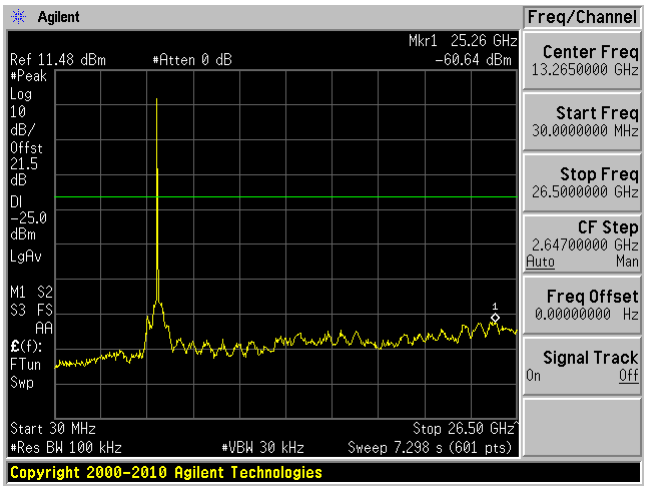
High Channel 5920 MHz Ant 1, 30MHz – 26.5GHz



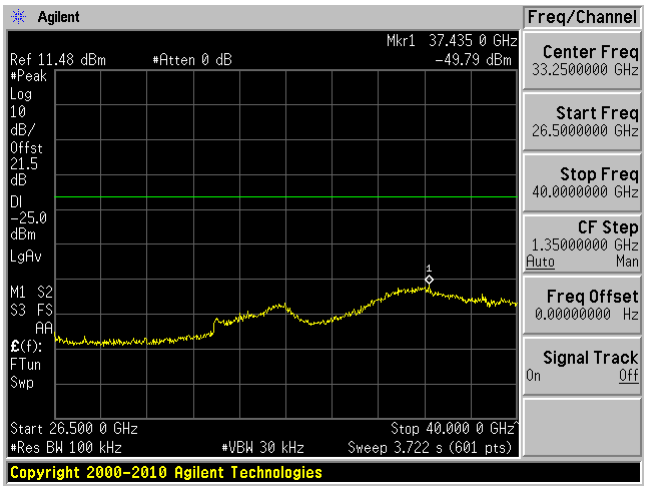
High Channel 5920 MHz Ant 1, 26.5GHz – 40GHz



High Channel 5920 MHz Ant 2, 30MHz – 26.5GHz



High Channel 5920 MHz Ant 2, 26.5GHz – 40GHz



9 ASTM E2213-03 8.9.3 & FCC §2.1053, §95.3189, ISEDC RSS-252 §5.4 – Transmitter Radiated Unwanted Emissions

9.1 Applicable Standard

According to ASTM EN2213-03 8.9.3:

8.9.3 Spurious Transmissions - Spurious transmissions from compliant devices shall comply with national regulations.

9.2 Measurement Procedure

The DSRC transmitted spectrum mask is relative to the device class of operation. The power in the transmitted spectrum for all DSRC devices shall be −25 dBm or less within 100 kHz outside all channel and band edges. This will be accomplished by attenuating the transmitted signal 100 kHz outside the channel and band edges by 55 + 10log(*P*) dB, where *P* is the total transmitted power in watts. The transmitted spectral density of the transmitted signal for all devices shall fall within the spectral mask, as detailed in Table 10.5 The measurements shall be made using a 100 kHz resolution bandwidth and a 30 kHz video bandwidth.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2017-02-24	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2015-07-11	31 months
Agilent	Pre-Amplifier	8449B	3147A00400	2017-06-15	1 year
Agilent	Amplifier, Pre	8447D	2944A10187	2017-05-17	1 year
A. H. Systems	Antenna, Horn	SAS-200/571	261	2017-05-16	2 years
EMCO	Antenna, Horn	3115	9511-4627	2016-01-28	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-01	2015-09-01	28 months
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2015-10-22	28 months
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2017-01-06	1 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1, 2, 3, 4	2017-02-13	2 years

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:	22-26° C
Relative Humidity:	42-46 %
ATM Pressure:	101-102 kPa

The testing was performed by Chin Ming Lui on 2017-12-22 and 2017-12-27 at 5 meter chamber 3.

9.5 Test Results

Low Channel Frequency: 5860 MHz

Freq. (MHz)	S.A. Amp. (dBµV)	Table Azimuth Degrees	Test Antenna		Substitution				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/ V)	S.G Freq. (MHz)	S.G Level (dBm)	Ant. Gain (dB)	Cable Loss (dB)			
239.8	50.01	333	100	H	239.8	-50.24	0	0.141	-50.381	-25	-25.38
239.8	47.22	235	100	V	239.8	-59.37	0	0.141	-59.511	-25	-34.51
400	50.15	195	140	H	400	-49.49	0	0.227	-49.717	-25	-24.72
600	45.5	198	100	V	600	-46.48	0	0.227	-46.707	-25	-21.71
1534.9	56.33	120	135	H	1534.9	-52.92	8.441	0.423	-44.902	-25	-19.90
1534.9	53.92	116	100	V	1534.9	-55.48	8.339	0.423	-47.564	-25	-22.56
3069.7	41.98	335	135	H	3069.7	-62.04	8.896	0.786	-53.93	-25	-28.93
3070	42.8	280	100	V	3070	-61.41	8.822	0.786	-53.374	-25	-28.37

Middle Channel Frequency: 5890 MHz

Freq. (MHz)	S.A. Amp. (dBµV)	Table Azimuth Degrees	Test Antenna		Substitution				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/ V)	S.G Freq. (MHz)	S.G Level (dBm)	Ant. Gain (dB)	Cable Loss (dB)			
239.8	49.55	240	100	H	239.8	-50.7	0	0.141	-50.841	-25	-25.84
239.8	47.32	235	100	V	239.8	-59.27	0	0.141	-59.411	-25	-34.41
400	49.94	205	133	H	400	-49.7	0	0.227	-49.927	-25	-24.93
600	45.12	212	107	V	600	-46.86	0	0.227	-47.087	-25	-22.09
1534.9	57.05	122	129	H	1534.9	-52.2	8.441	0.423	-44.182	-25	-19.18
1534.9	46.32	117	100	V	1534.9	-63.08	8.339	0.423	-55.164	-25	-30.16
3069.7	42.11	334	134	H	3069.7	-61.91	8.896	0.786	-53.8	-25	-28.80
3070	39.25	337	100	V	3070	-64.96	8.822	0.786	-56.924	-25	-31.92

High Channel Frequency: 5920 MHz

Freq. (MHz)	S.A. Amp. (dBµV)	Table Azimuth Degrees	Test Antenna		Substitution				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/ V)	S.G Freq. (MHz)	S.G Level (dBm)	Ant. Gain (dB)	Cable Loss (dB)			
239.8	49.41	230	100	H	239.8	-50.84	0	0.141	-50.981	-25	-25.98
239.8	46.36	230	100	V	239.8	-60.23	0	0.141	-60.371	-25	-35.37
400	50.23	205	135	H	400	-49.41	0	0.227	-49.637	-25	-24.64
600	46.03	210	110	V	600	-45.95	0	0.227	-46.177	-25	-21.18
1534.9	51.01	119	100	H	1534.9	-58.24	8.441	0.423	-50.222	-25	-25.22
1534.9	53.91	158	100	V	1534.9	-55.49	8.339	0.423	-47.574	-25	-22.57
3067	36.96	333	100	H	3067	-66.28	8.896	0.786	-58.17	-25	-33.17
3070	41.9	338	100	V	3070	-62.31	8.822	0.786	-54.274	-25	-29.27

10 ASTM E2213-03 8.9.4 & FCC §2.1055, §95.3189, ISEDC RSS-252 §5.5 – Frequency Tolerance

10.1 Applicable Standard

According to FCC §2.1055 and ASTM E2213-03 8.9.4

10.2 Measurement Procedure

According to ANSI/TIA-D 2010 section 2.2.2, the carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The measurement method is as following:

- Operate the equipment in standby conditions for 15 minutes before proceeding.
- Record the carrier frequency of the transmitter as MCF MHz.
- Calculate the ppm frequency error by the following:

  Ppm error = ((MCF/ACF) - 1) * 10^6

  Where

  MCF is the Measured Carrier Frequency in MHz
  ACF is the Assigned Carrier Frequency in MHz

- The value recorded above is the carrier frequency stability.

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2017-04-20	1 year
Tenney	Temperature Chamber	TUJR	27445-06	2017-10-02	1 year

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

10.4 Test Environmental Conditions

Temperature:	22-26° C
Relative Humidity:	42-46 %
ATM Pressure:	101-102 kPa

The testing was performed by Chin Ming Lui on 2017-12-21 at RF site.

10.5 Test Results

Antenna 1:

Low Channel, 5860 MHz:

Temperature (°C)	Frequency (MHz)	Result (ppm)	Limit (ppm)
-30	5859.95	-8.5324	±10
-20	5859.975	-4.2662	±10
-10	5860.025	4.2662	±10
0	5860.025	4.2662	±10
10	5860	0	±10
20	5860	0	±10
30	5860	0	±10
40	5860.025	4.2662	±10
50	5860.025	4.2662	±10

Middle Channel, 5890 MHz:

Temperature (°C)	Frequency (MHz)	Result (ppm)	Limit (ppm)
-30	5890.05	8.4890	±10
-20	5889.975	-4.2445	±10
-10	5890.05	8.4890	±10
0	5890.025	4.2445	±10
10	5890.025	4.2445	±10
20	5890	0	±10
30	5890	0	±10
40	5890	0	±10
50	5890.025	4.2445	±10

High Channel, 5920 MHz:

Temperature (°C)	Frequency (MHz)	Result (ppm)	Limit (ppm)
-30	5919.975	-4.2230	±10
-20	5920.05	8.4459	±10
-10	5920	0	±10
0	5920	0	±10
10	5919.975	-4.2230	±10
20	5919.975	-4.2230	±10
30	5920	0	±10
40	5919.95	-8.4459	±10
50	5919.975	-4.2230	±10

Antenna 2:

Low Channel, 5860 MHz:

Temperature (°C)	Frequency (MHz)	Result (ppm)	Limit (ppm)
-30	5860.05	8.5324	±10
-20	5860	0	±10
-10	5859.975	-4.2662	±10
0	5860.025	4.2662	±10
10	5860	0	±10
20	5860	0	±10
30	5860.025	4.2662	±10
40	5860.025	4.2662	±10
50	5860	0	±10

Middle Channel, 5890 MHz:

Temperature (°C)	Frequency (MHz)	Result (ppm)	Limit (ppm)
-30	5890.05	8.4890	±10
-20	5889.975	-4.2445	±10
-10	5890	0	±10
0	5890.025	4.2445	±10
10	5890	0	±10
20	5890	0	±10
30	5890	0	±10
40	5889.975	-4.2445	±10
50	5890	0	±10

High Channel, 5920 MHz:

Temperature (°C)	Frequency (MHz)	Result (ppm)	Limit (ppm)
-30	5919.975	-4.2230	±10
-20	5920.025	4.2230	±10
-10	5920.05	8.4459	±10
0	5920.05	8.4459	±10
10	5920.025	4.2230	±10
20	5919.975	-4.2230	±10
30	5920.025	4.2230	±10
40	5920.025	4.2230	±10
50	5920	0	±10

10 Exhibit A – FCC & IDESC Equipment Labeling Requirements

10.1 FCC ID Label Requirements

As per FCC §2.925,

(a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID: XXX123

Where: XXX—Grantee Code, 123—Equipment Product Code

As per FCC §15.19,

(a) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labeled as follows:

(3) All other devices shall bear the following statement in a conspicuous location on the device:
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified above is required to be affixed only to the main control unit. If the EUT is integrated within another device then a label affixed to the host shall also state, "Contains FCC ID: XXXXXX"

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

10.2 ISEDC Label Requirements

As per ISEDC RSP-100 Section3.1, the certification number shall appear as follows:

IC: XXXXXX-YYYYYYYY

Where:

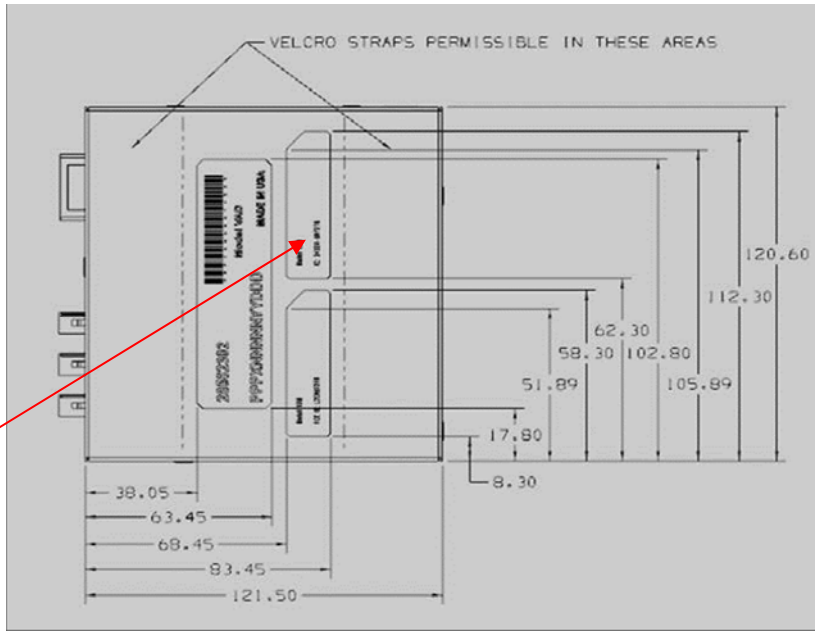
- The letters "IC:" indicate that this is an Innovation, Science and Economic Development Canada's certification number, but they are not part of the certification number. XXXXXXYYYYYYYYYY is the ISED certification number.
- XXXXXX is the CN assigned by Innovation, Science and Economic Development Canada. Newly assigned CNs will be made up of five numeric characters (e.g. "20001") whereas existing CNs may consist of up to five numeric characters followed by an alphabetic character (e.g. "21A" or "15589J").
- YYYYYYYYYY is the Unique Product Number (UPN) assigned by the applicant, made up of a maximum of 11 alphanumeric characters.
- The CN and UPN are limited to capital alphabetic characters (A-Z) and numerals (0-9) only. The use of punctuation marks or other symbols, including "wildcard" characters, is not permitted.

- The HVIN may contain punctuation marks or symbols but they shall not represent any indeterminate ("wildcard") characters.

As per RSS-Gen §2.1 Equipment Labeling:

The application for equipment certification shall be submitted in accordance with Industry Canada's Radio Standards Procedure RSP-100, Radio Equipment Certification Procedure which sets out the requirements for certification and labelling of radio apparatus. RSP-100 shall be used in conjunction with RSS-Gen and other Radio Standards Specifications (RSSs) specifically applicable to the type of radio apparatus for which certification is sought.

10.3 Label Contents & Location



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