



# FCC PART 15.247

## TEST REPORT

For

### Rosslare Enterprises Ltd

Room 905, 12 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong

**FCC ID: GCD-DRU955BT**

<b>Report Type:</b> Original Report	<b>Product Name:</b> Desktop Reader & Programmer for UHF / MIFARE / BLE
<b>Report Number:</b>	RDG180420003-00B
<b>Report Date:</b>	2018-05-21
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

<b>EUT Name:</b>	Desktop Reader & Programmer for UHF / MIFARE / BLE
<b>EUT Model:</b>	DR-U955BT
<b>FCC ID:</b>	GCD-DRU955BT
<b>Rated Input Voltage:</b>	DC 5V from USB Port
<b>External Dimension:</b>	Length (123 mm)*Width (70 mm)*High (16.2 mm)
<b>Serial Number:</b>	180420003
<b>EUT Received Date:</b>	2018.04.24

The device contains a certified Bluetooth module, the Bluetooth module FCC ID:S9NSPBTLERF

### Objective

This report is prepared on behalf of *Rosslare Enterprises Ltd* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules

The tests were performed in order to determine the EUT compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

### Related Submittal(s)/Grant(s)

FCC Part 15C DXX submissions with FCC ID: GCD-DRU955BT.

### Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices".

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

### Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61 dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	30M~200MHz: 4.55 dB, 200M~1GHz: 5.92 dB, 1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB, 18G~26.5G: 5.47 dB, 26.5G~40G: 5.63 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

### **Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218,the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in an engineering mode. 50 hopping channels are provided:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	903.24	14	909.48	27	915.72	40	921.96
2	903.72	15	909.96	28	916.20	41	922.44
3	904.20	16	910.44	29	916.68	42	922.92
4	904.68	17	910.92	30	917.16	43	923.40
5	905.16	18	911.40	31	917.64	44	923.88
6	905.64	19	911.88	32	918.12	45	924.36
7	906.12	20	912.36	33	918.60	46	924.84
8	906.60	21	912.84	34	919.08	47	925.32
9	907.08	22	913.32	35	919.56	48	925.80
10	907.56	23	913.80	36	920.04	49	926.28
11	908.04	24	914.28	37	920.52	50	926.76
12	908.52	25	914.76	38	921.00	/	/
13	909.00	26	915.24	39	921.48	/	/

Channel 1, 26, 50 were selected to test.

### EUT Exercise Software

The software “Docklight Scripting.exe” was used during test. The system configured the maximum power level as default setting.

Test Software Version	Docklight Scripting.exe		
Test Frequency	903.24MHz	915.24MHz	926.76MHz
Power Level	18	18	18

### Equipment Modifications

No modification was made to the EUT.

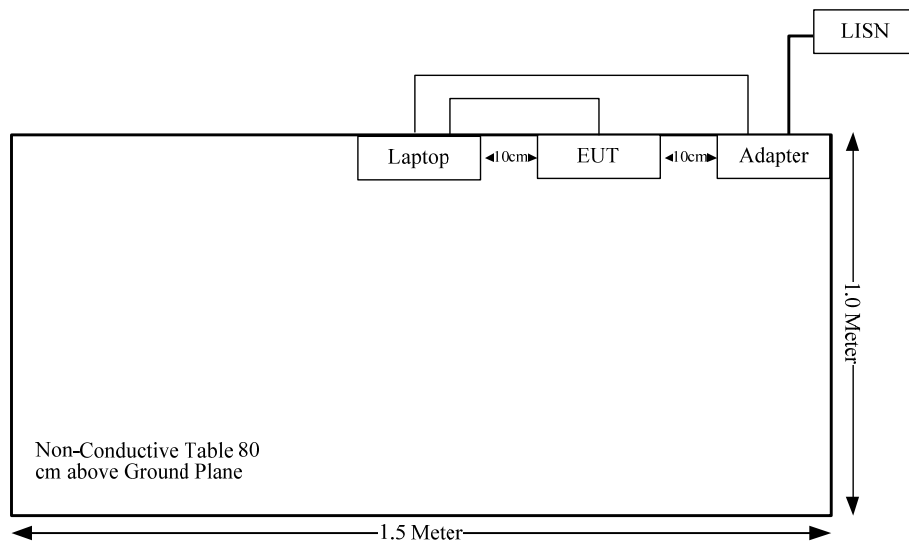
### Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017

**Support Cable List and Details**

Cable Description	Shielding Type	Ferrite Core	Length (m)	From	To
USB Cable	Yes	No	2.0	Laptop	EUT
DC Cable	Yes	No	1.2	Adapter	Laptop

**Block Diagram of Test Setup**



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(1)	20 dB Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(i)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(i)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band Edges	Compliance



**FCC §15.247 (i) , §1.1310 , §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

**Applicable Standard**

According to subpart 15.247(i) and subpart §1.1310, 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 Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
<b>Frequency Range (MHz)</b>	<b>Electric Field Strength (V/m)</b>	<b>Magnetic Field Strength (A/m)</b>	<b>Power Density (mW/cm<sup>2</sup>)</b>	<b>Averaging Time (minutes)</b>
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	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;

According to §1.1310 and §2.1091 RF exposure is calculated.

**Calculation Formula:**

Prediction of power density at the distance of the applicable MPE limit:

S = PG/4πR<sup>2</sup> = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

**Calculated Data:**

Mode	Frequency (MHz)	EIRP		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBm)	(mW)			
915MHz Radio	903.24-926.76	24	251.19	20.00	0.05	0.6
Bluetooth	2402-2480	4.2	2.63	20.00	0.0005	1.0

Note: the conducted output power including turn up tolerance for 915MHz radio is 18dBm, antenna gain is 6 dBi, that declared by manufacturer.

The 915MHz radio and Bluetooth can transmit simultaneously:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$$= S_{915}/Limit_{915} + S_{BT}/Limit_{BT}$$

$$= 0.05/0.6 + 0.0005/1.0$$

$$= 0.08$$

**Result: Compliance,** The device meets MPE requirement for Devices Used by the General Public (Uncontrolled Environment) at distance  $\geq 20$  cm.

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## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

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.

### **Antenna Connector Construction**

The EUT has one internal antenna arrangement, and the antenna gain is 6 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

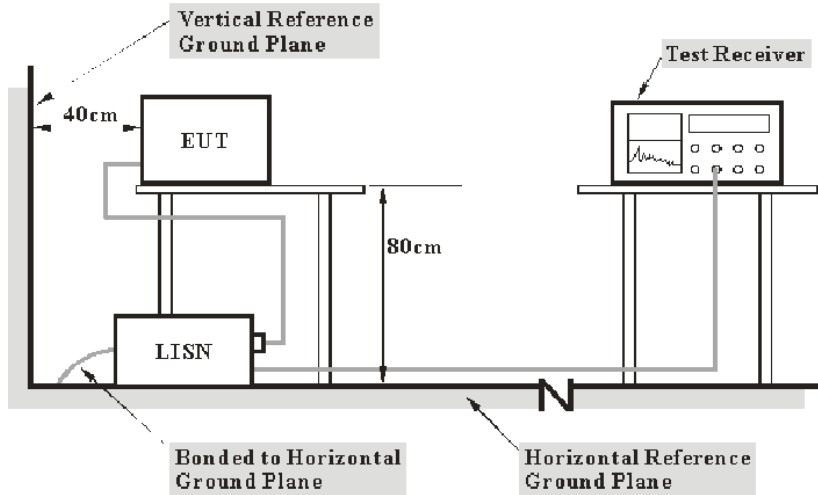
**Result:** Compliance.

## FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC§15.207(a)

### EUT Setup



- Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main LISN with a 120 V/60 Hz AC power source.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

### Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

## Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

Herein,

$V_C$ : corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

$VDF$ : voltage division factor of AMN or ISN

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

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2017-12-11	2018-12-11
R&S	Two-line V-network	ENV 216	101614	2017-12-08	2018-12-08
R&S	L.I.S.N	ESH2-Z5	892107/021	2017-09-25	2018-09-25
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2017-09-05	2018-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Data

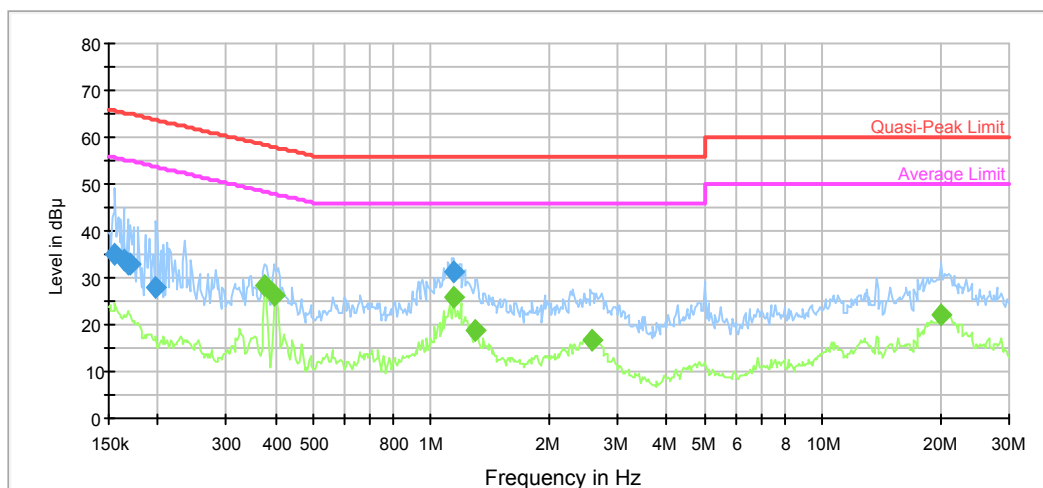
### Environmental Conditions

<b>Temperature:</b>	26.6 °C
<b>Relative Humidity:</b>	57 %
<b>ATM Pressure:</b>	100.5 kPa

*The testing was performed by Sider Huang on 2018-05-17.*

**Test Mode: Transmitting**

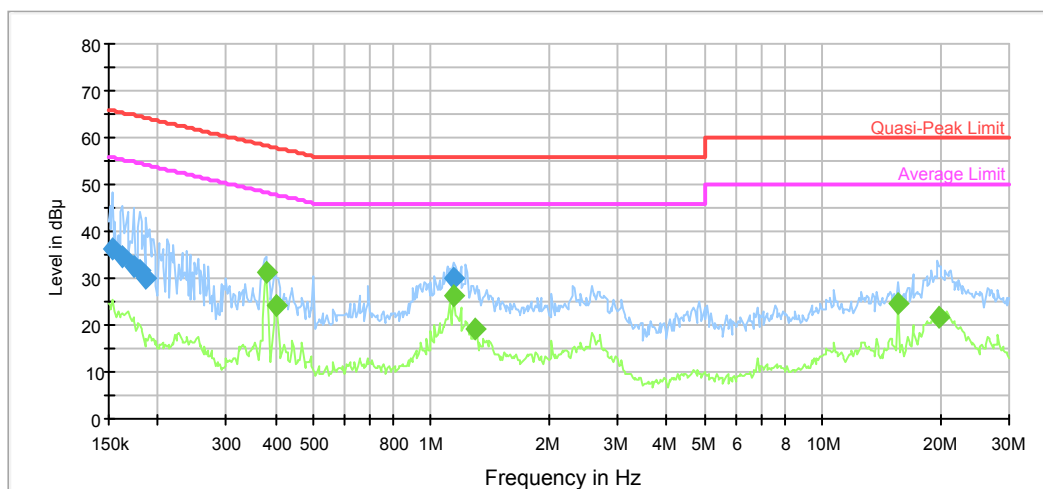
**AC120V, 60 Hz, Line:**



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.156097	35.2	9.000	L1	11.1	30.5	65.7	Compliance
0.163741	33.7	9.000	L1	11.0	31.6	65.3	Compliance
0.167702	32.9	9.000	L1	10.9	32.2	65.1	Compliance
0.170396	32.9	9.000	L1	10.9	32.1	64.9	Compliance
0.198249	27.7	9.000	L1	10.6	36.0	63.7	Compliance
1.144267	31.2	9.000	L1	9.8	24.8	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.375019	28.1	9.000	L1	10.0	20.3	48.4	Compliance
0.399703	26.1	9.000	L1	10.0	21.8	47.9	Compliance
1.144267	25.7	9.000	L1	9.8	20.3	46.0	Compliance
1.289541	18.8	9.000	L1	9.8	27.2	46.0	Compliance
2.579298	16.5	9.000	L1	9.8	29.5	46.0	Compliance
20.152030	22.0	9.000	L1	10.1	28.0	50.0	Compliance

**AC120V, 60 Hz, Neutral:**



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.153629	36.1	9.000	N	11.1	29.7	65.8	Compliance
0.162441	34.5	9.000	N	11.0	30.8	65.3	Compliance
0.173134	32.6	9.000	N	10.9	32.2	64.8	Compliance
0.180171	31.6	9.000	N	10.8	32.9	64.5	Compliance
0.187494	29.8	9.000	N	10.7	34.3	64.1	Compliance
1.144267	30.0	9.000	N	9.8	26.0	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.378019	31.1	9.000	N	10.0	17.2	48.3	Compliance
0.402900	24.2	9.000	N	10.0	23.6	47.8	Compliance
1.144267	26.1	9.000	N	9.8	19.9	46.0	Compliance
1.289541	19.1	9.000	N	9.8	26.9	46.0	Compliance
15.616430	24.5	9.000	N	10.0	25.5	50.0	Compliance
19.833426	21.7	9.000	N	10.0	28.3	50.0	Compliance

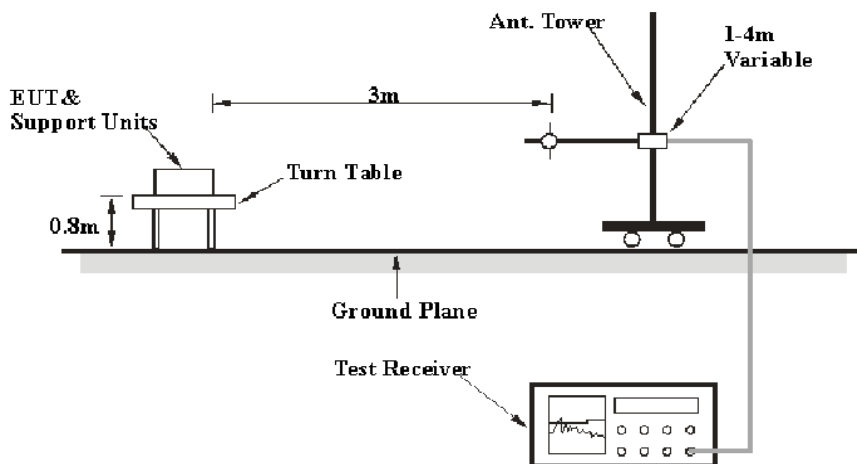
## FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

### Applicable Standard

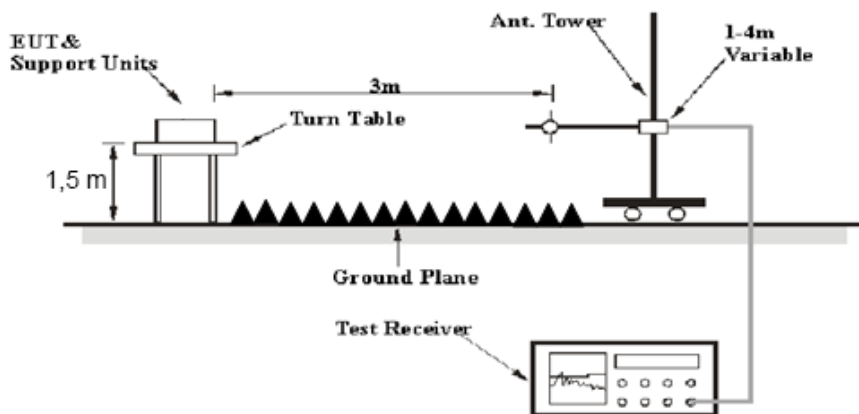
FCC §15.247 (d); §15.209; §15.205;

### EUT Setup

#### Below 1GHz:



#### Above 1GHz:



The radiated emission Below 1GHz tests were performed in the 3 meters chamber A, above 1GHz tests were performed in the 3 meters chamber B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.



## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 10 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

*Note: If the maximized peak measured value complies with the limit, then it is unnecessary to perform an QP measurement*

## Test Procedure

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

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and average detection modes for frequencies above 1 GHz.

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
R&S	EMI Test Receiver	ESCI	100224	2017-12-11	2018-12-11
HP	Amplifier	8447D	2727A05902	2017-09-05	2018-09-05
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Agilent	Spectrum Analyzer	E4440A	SG43360054	2018-01-04	2019-01-04
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2017-09-05	2018-09-05
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Data

### Environmental Conditions

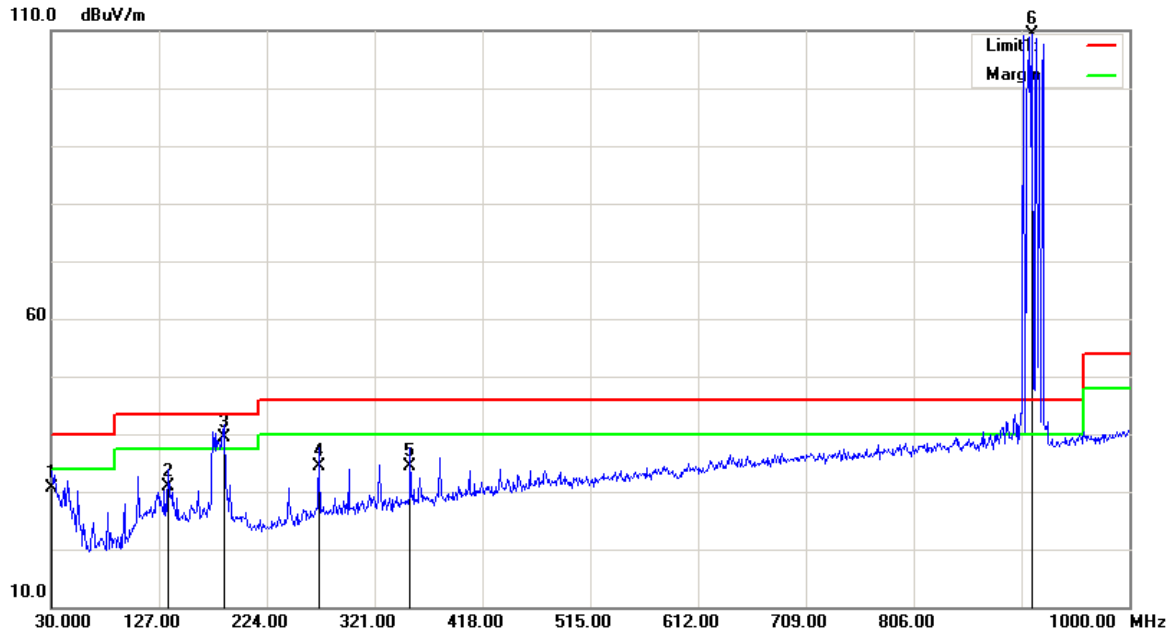
<b>Temperature:</b>	23.6~24.5 °C
<b>Relative Humidity:</b>	39~50 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Blake Yang & Sunny Cen on 2018-04-28.*

*Test Mode: Transmitting*

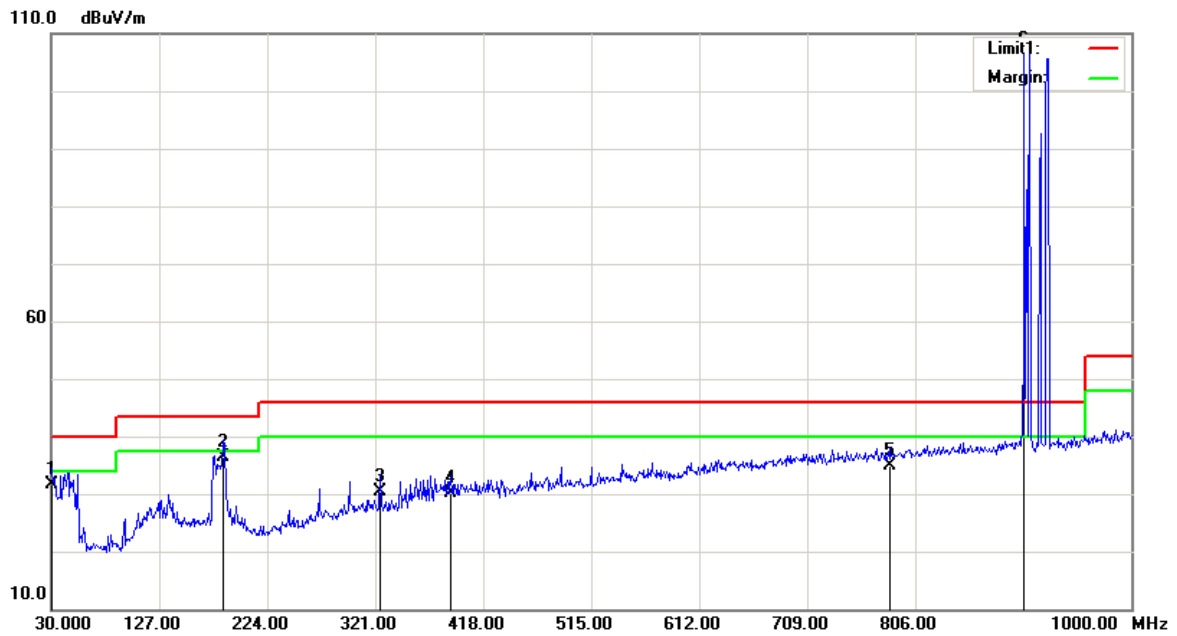
1) 30MHz-1GHz(Hopping mode is the worst)

Horizontal:



Frequency (MHz)	Receiver Reading (dBμV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
30.0000	2.73	QP	27.87	30.60	40.00	9.40
134.7600	10.23	QP	20.67	30.90	43.50	12.60
186.1700	21.22	QP	18.28	39.50	43.50	4.00
270.5600	13.38	QP	21.12	34.50	46.00	11.50
353.0100	11.66	QP	22.84	34.50	46.00	11.50

**Vertical:**

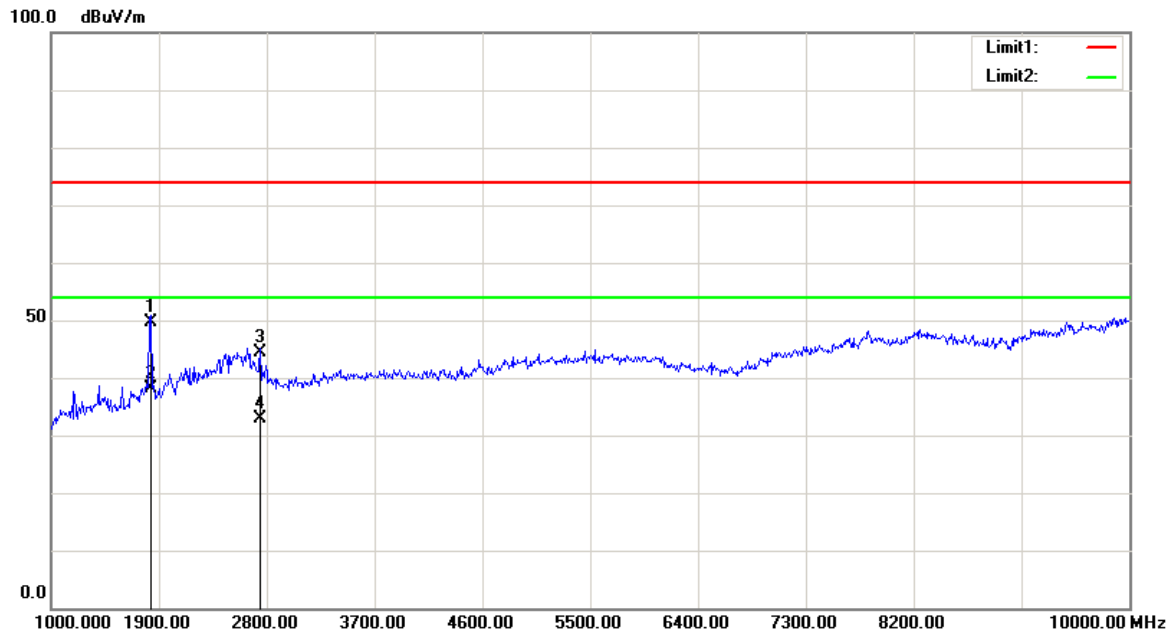


Frequency (MHz)	Receiver Reading (dBμV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
30.0000	3.73	QP	27.87	31.60	40.00	8.40
184.2300	18.18	QP	18.22	36.40	43.50	7.10
324.8800	8.15	QP	22.15	30.30	46.00	15.70
388.9000	6.33	QP	23.77	30.10	46.00	15.90
782.7200	3.79	QP	31.21	35.00	46.00	11.00

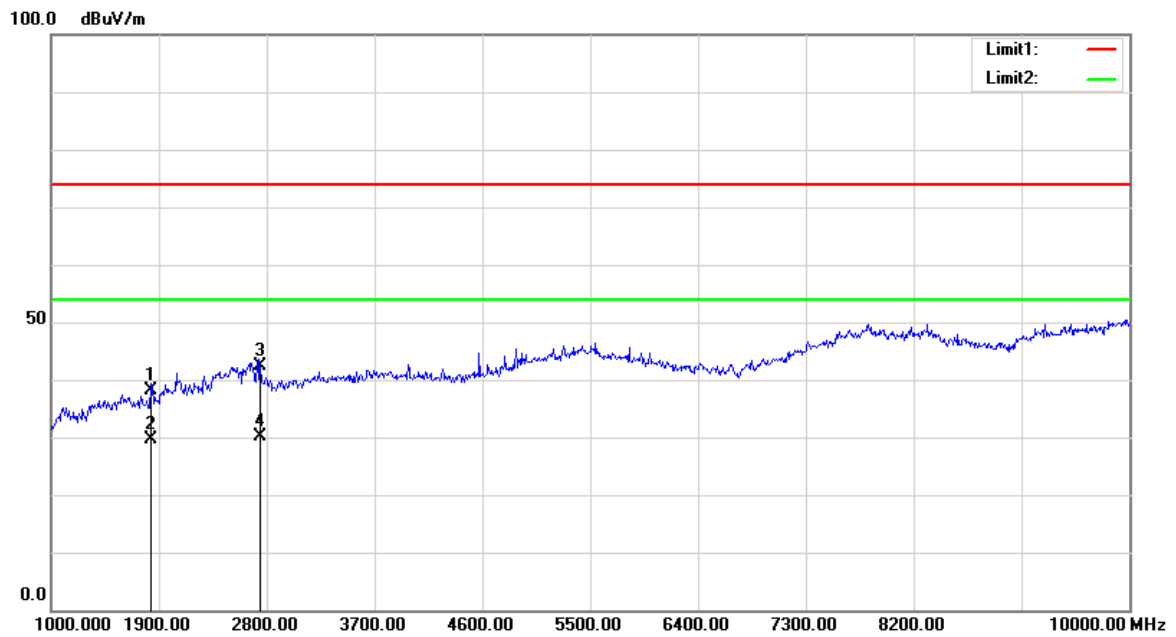
**2) Bandedge and above 1GHz:**

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (Db)	Amplifier Gain (Db)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (Db)
	Reading (dBµV)	Detector	Polar (H/V)	Factor (Db/m)					
Low Channel: 903.24 MHz									
903.24	80.40	QP	H	22.36	4.28	0.00	107.04	N/A	N/A
903.24	79.30	QP	V	22.36	4.28	0.00	105.94	N/A	N/A
902.00	15.80	QP	H	22.34	4.29	0.00	42.43	46.00	3.57
1806.48	50.76	PK	H	26.49	1.66	35.90	43.01	74.00	30.99
1806.48	41.42	AV	H	26.49	1.66	35.90	33.67	54.00	20.33
2709.72	50.23	PK	H	29.05	1.88	36.47	44.69	74.00	29.31
2709.72	40.87	AV	H	29.05	1.88	36.47	35.33	54.00	18.67
Middle Channel: 915.24 MHz									
915.24	80.65	QP	H	22.40	4.21	0.00	107.26	N/A	N/A
915.24	79.84	QP	V	22.40	4.21	0.00	106.45	N/A	N/A
1830.48	57.28	PK	H	26.59	1.66	35.95	49.58	74.00	24.42
1830.48	45.87	AV	H	26.59	1.66	35.95	38.17	54.00	15.83
2745.72	49.85	PK	H	29.18	1.91	36.51	44.43	74.00	29.57
2745.72	38.34	AV	H	29.18	1.91	36.51	32.92	54.00	21.08
High Channel: 926.76 MHz									
926.76	81.30	QP	H	22.54	4.35	0.00	108.19	N/A	N/A
926.76	77.60	QP	V	22.54	4.35	0.00	104.49	N/A	N/A
928.00	15.40	QP	H	22.56	4.34	0.00	42.30	46.00	3.70
1853.52	54.24	PK	H	26.68	1.66	35.99	46.59	74.00	27.41
1853.52	43.69	AV	H	26.68	1.66	35.99	36.04	54.00	17.96
2780.28	50.48	PK	H	29.31	1.93	36.55	45.17	74.00	28.83
2780.28	41.01	AV	H	29.31	1.93	36.55	35.70	54.00	18.30

### Worst plots(High channel) Horizontal



### Vertical



## FCC §15.247(a) (1) – CHANNEL SEPARATION TEST

### Applicable Standard

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2017-12-11	2018-12-11
E-Microwave	Coaxial Attenuators	EMCA10-5RN-6	OE01203239	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 10 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25.9 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	100.9 kPa

\* The testing was performed by Kami Zhou on 2018-04-26.

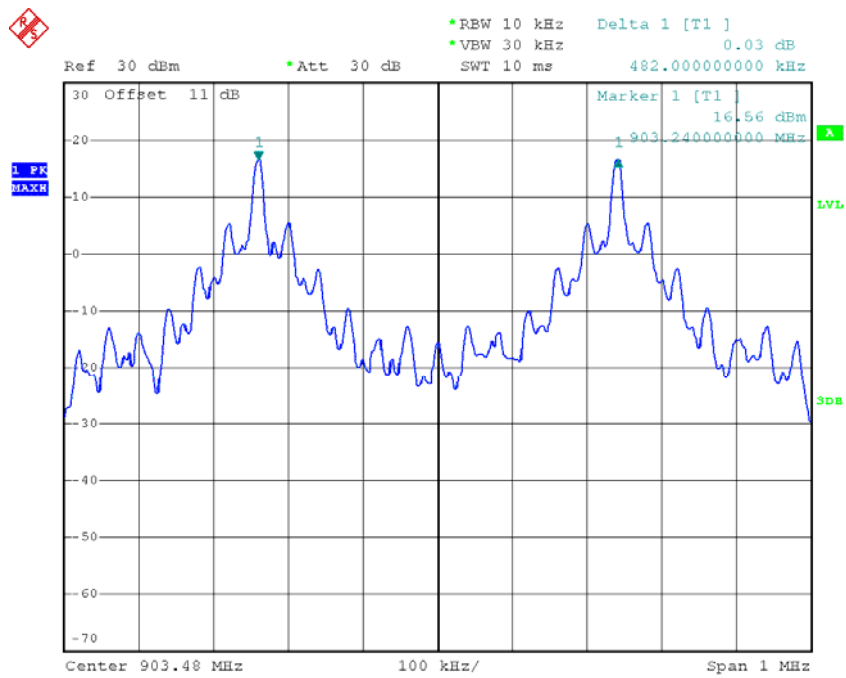
**Test Result:** Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
Low	903.24	0.482	0.166
Middle	915.24	0.482	0.167
High	926.76	0.480	0.163

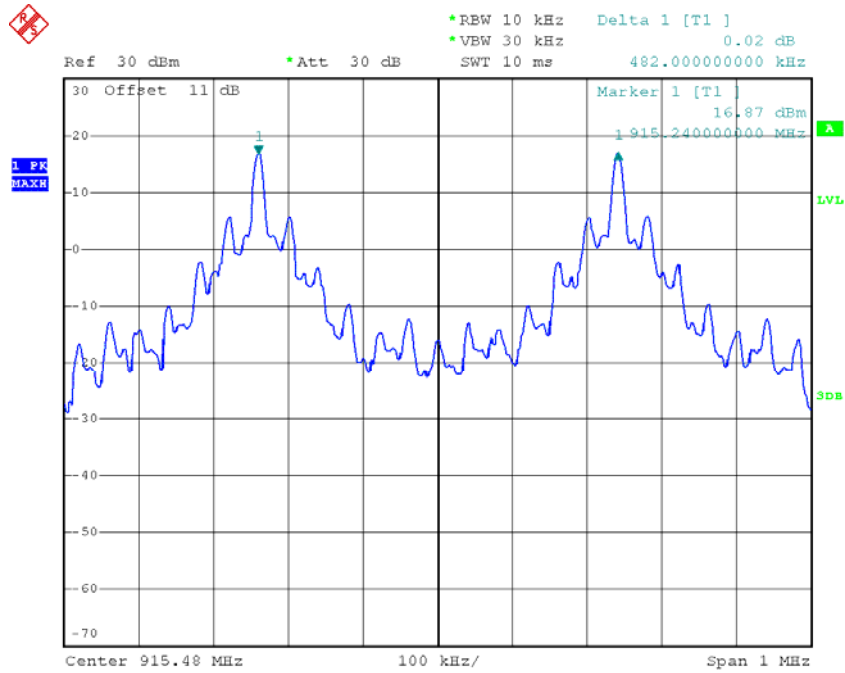
Low Channel



Date: 26.APR.2018 15:14:22

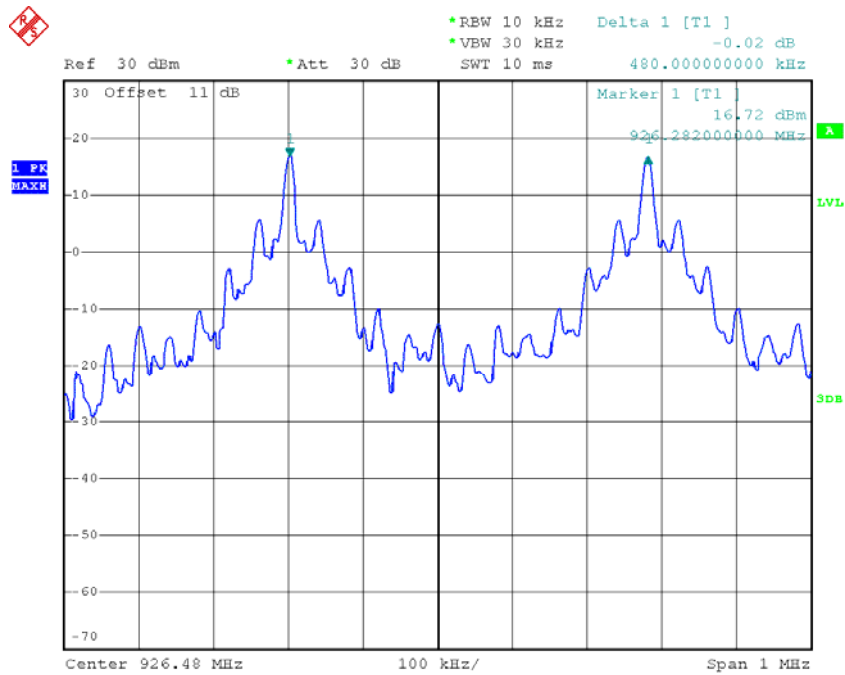


### Middle Channel



Date: 26.APR.2018 15:15:14

### High Channel



Date: 26.APR.2018 15:16:18

## FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING

### Applicable Standard

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2017-12-11	2018-12-11
E-Microwave	Coaxial Attenuators	EMCA10-5RN-6	OE01203239	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25.9 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	100.9 kPa

\* The testing was performed by Kami Zhou on 2018-04-26.

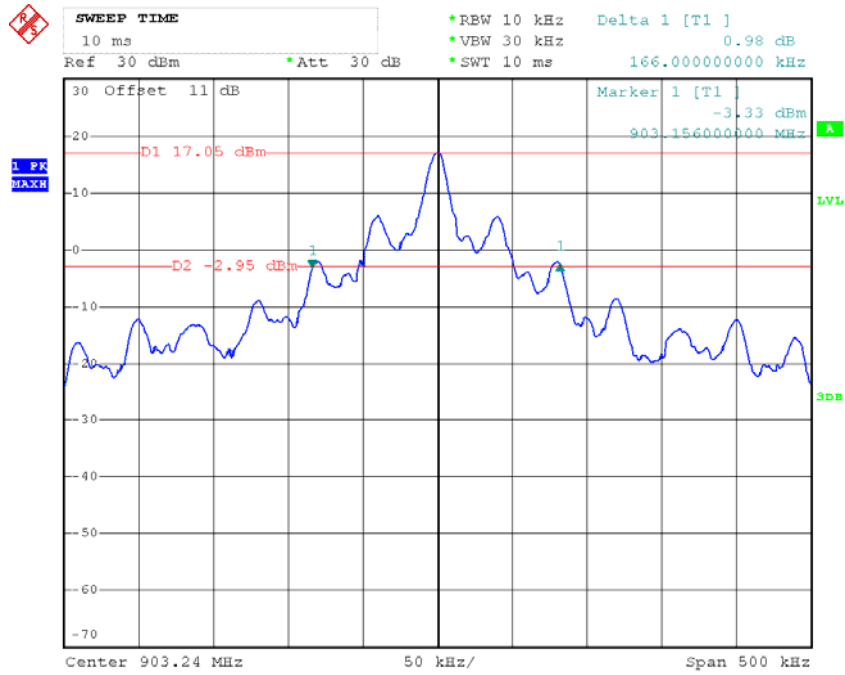
**Test Result:** Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

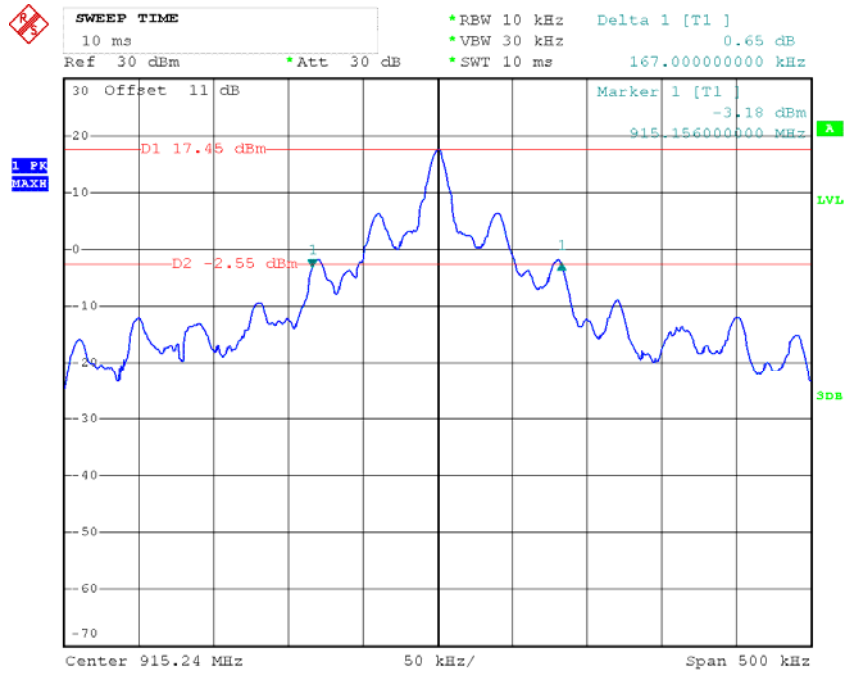
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	Limits (MHz)
Low	903.24	0.166	0.5
Middle	915.24	0.167	0.5
High	926.76	0.163	0.5

Low Channel



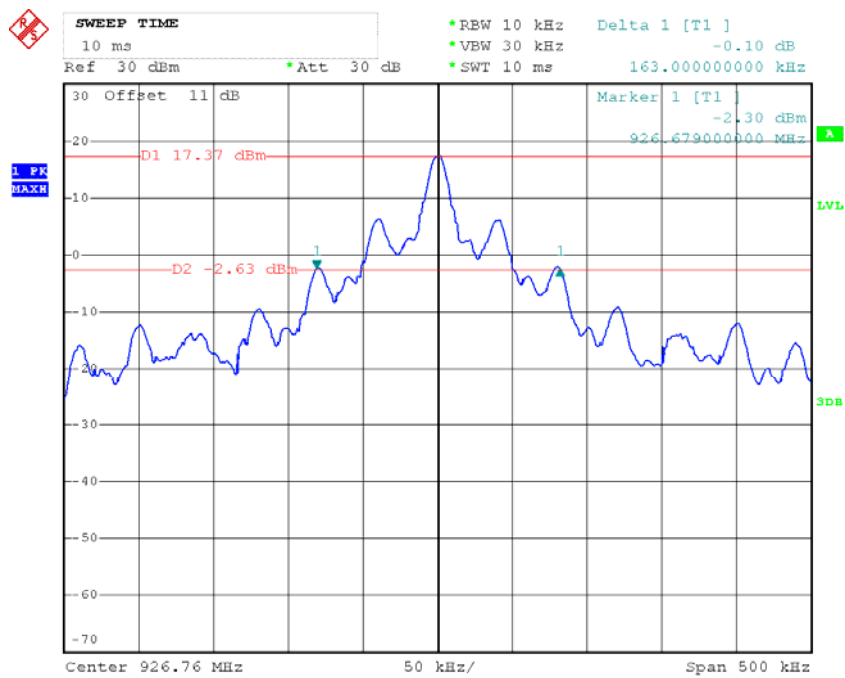
Date: 26.APR.2018 14:35:14

### Middle Channel



Date: 26.APR.2018 14:36:03

### High Channel



Date: 26.APR.2018 14:36:50

## FCC §15.247(a) (1) (i) - QUANTITY OF HOPPING CHANNEL TEST

### Applicable Standard

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

### Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2017-12-11	2018-12-11
E-Microwave	Coaxial Attenuators	EMCA10-5RN-6	OE01203239	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25.9 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	100.9 kPa

\* The testing was performed by Kami Zhou on 2018-04-26.

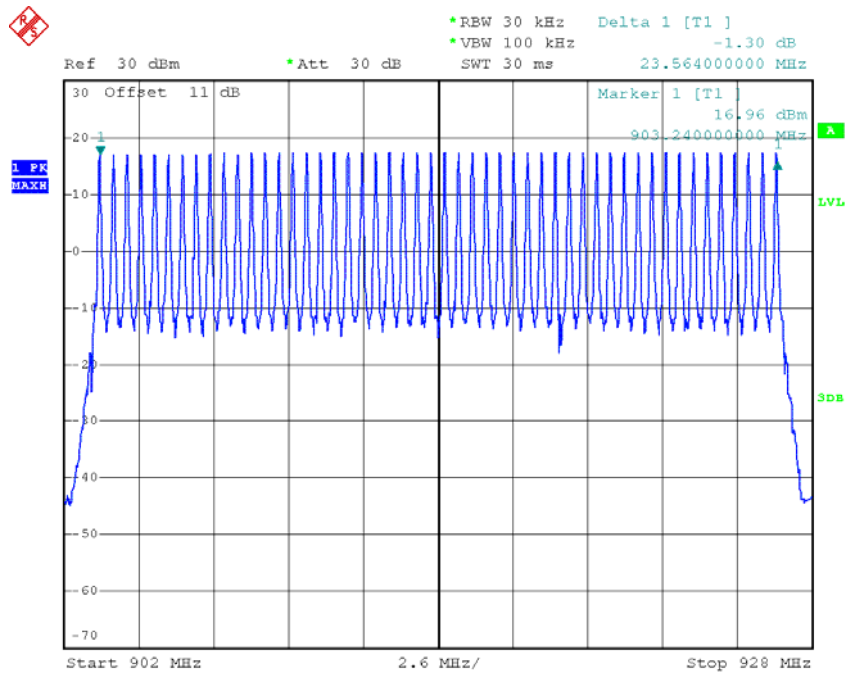
**Test Result:** Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

Frequency Range (MHz)	Number of Hopping Channel	Limit
902-928	50	50

### Number of Hopping Channels



Date: 26.APR.2018 15:30:23

**FCC §15.247(a) (1) (i) - TIME OF OCCUPANCY (DWELL TIME)****Applicable Standard**

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

**Test Procedure**

The EUT was worked in channel hopping; the time of single pulses was tested.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2017-12-11	2018-12-11
E-Microwave	Coaxial Attenuators	EMCA10-5RN-6	OE01203239	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

**Test Data****Environmental Conditions**

<b>Temperature:</b>	25.9 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	100.9 kPa

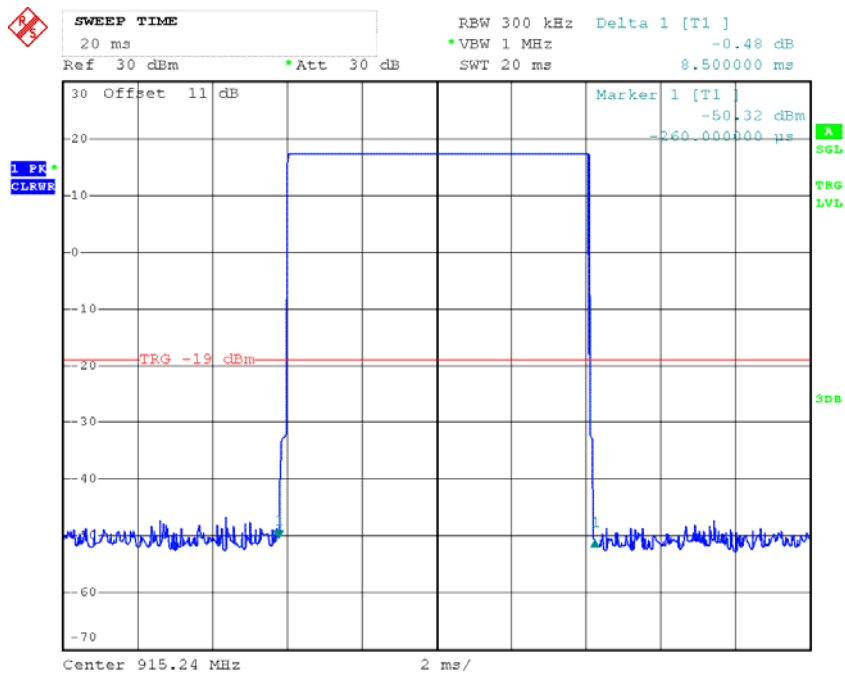
\* The testing was performed by Kami Zhou on 2018-04-26.

**Test Result:** Compliance. Please refer to following tables and plots

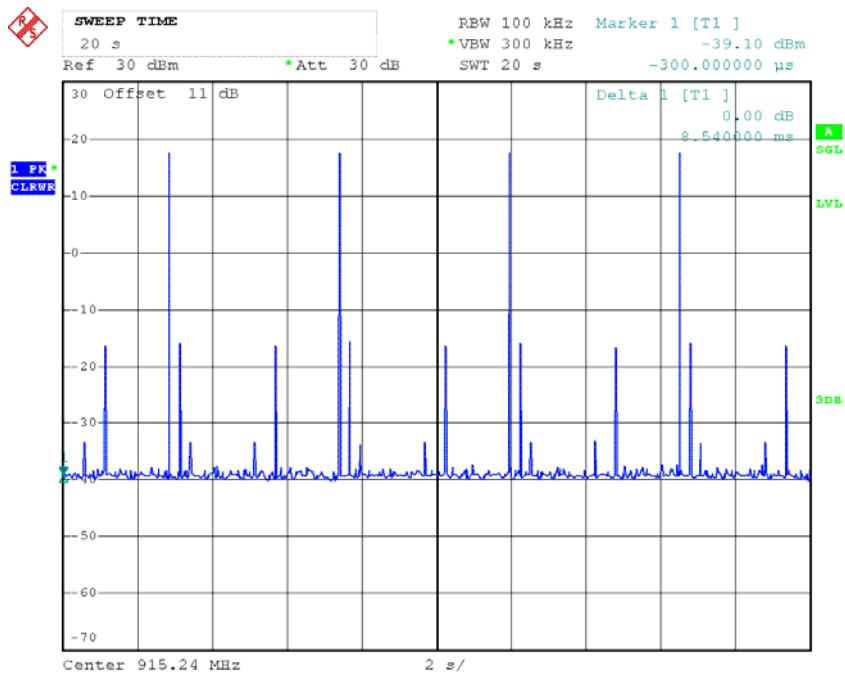
*Test Mode: Transmitting*

Channel	Occupancy Time For Single Hop (ms)	Hops in Observed Period (20s)	Dwell time (s)	Limit (s)	Result
Middle	8.50	4	0.034	0.4	Compliance
Dwell time=Pulse time (ms) × hopping number per channel in Observed Period Observed Period=20S					

### Middle Channel



Date: 26.APR.2018 15:01:35



Date: 26.APR.2018 15:06:03



**FCC §15.247(b) (2) - PEAK OUTPUT POWER MEASUREMENT**

**Applicable Standard**

According to §15.247(b) (2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

**Test Procedure**

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54170013	2017-11-03	2018-11-03
Agilent	P-Series Power Meter	N1912A	MY5000448	2017-11-03	2018-11-03
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25.9 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	100.9 kPa

\* *The testing was performed by Kami Zhou on 2018-04-26.*

**Test Result:** Compliance.

*Test Mode: Transmitting*

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Conducted Output power (dBm)</b>	<b>Limit (dBm)</b>
Low	903.24	16.99	30
Middle	915.24	17.36	30
High	926.76	17.30	30

Note: The data above was tested in conducted mode.

## FCC §15.247(d) - BAND EDGES TESTING

### Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW/ VBW of spectrum analyzer to 100/300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2017-12-11	2018-12-11
E-Microwave	Coaxial Attenuators	EMCA10-5RN-6	OE01203239	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

**Test Data**

**Environmental Conditions**

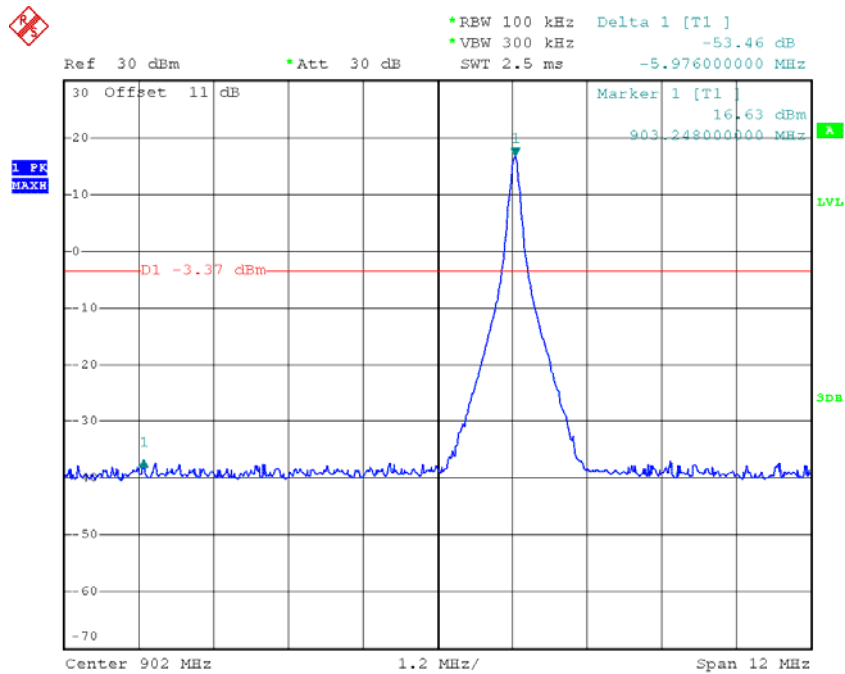
<b>Temperature:</b>	25.9 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	100.9 kPa

\* The testing was performed by Kami Zhou on 2018-04-26.

**Test Result:** Compliance

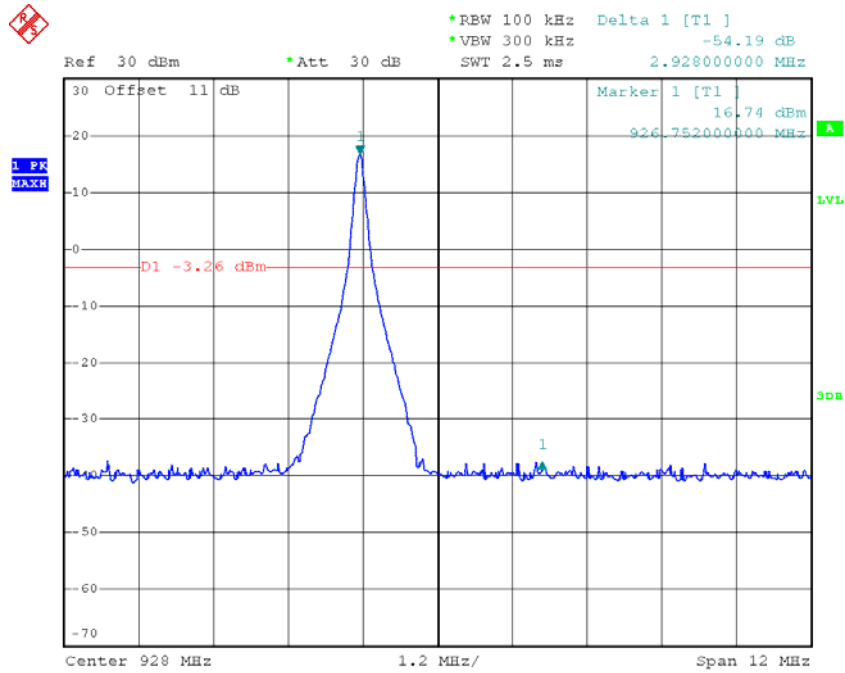
Single Channel Mode,

**Band Edge, Left Side**



Date: 26.APR.2018 15:10:52

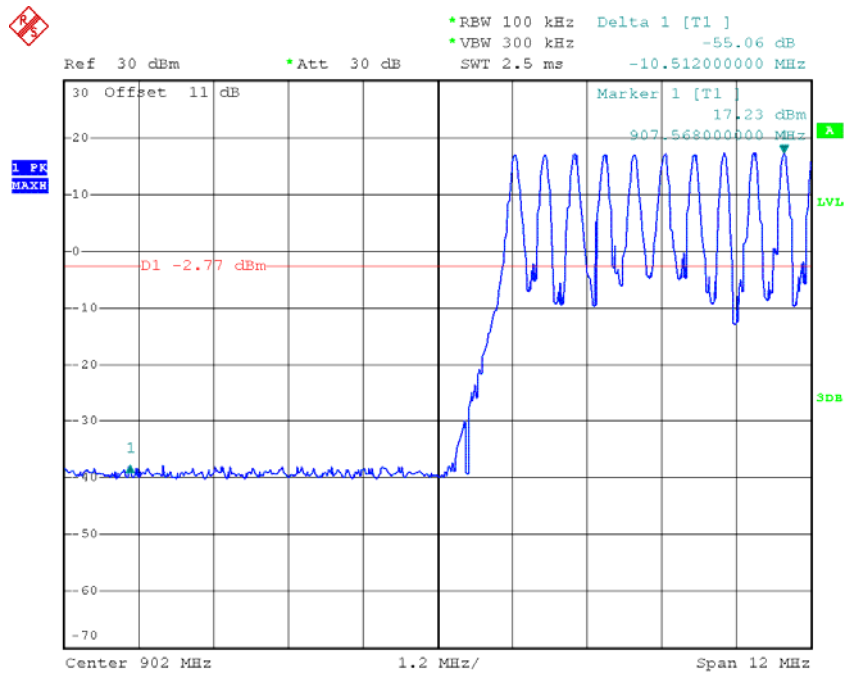
### Band Edge, Right Side



Date: 26.APR.2018 15:11:50

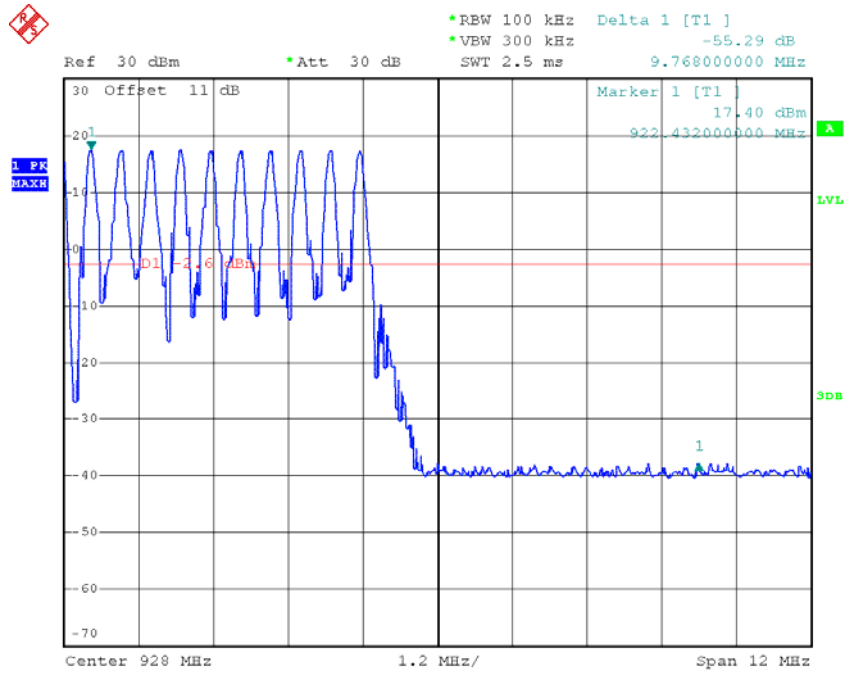
### Hopping Mode

### Band Edge, Left Side



Date: 26.APR.2018 14:55:12

### Band Edge, Right Side



Date: 26.APR.2018 14:57:21

\*\*\*\*\* END OF REPORT \*\*\*\*\*