

## ELECTROMAGNETIC COMPATIBILITY TEST REPORT

PREPARED FOR TANTALUS SYSTEMS CORP.  
BY QAI LABORATORIES



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**Laboratory Accreditations (per ISO/IEC 17025:2005):**



**American Association for Laboratory Accreditation Certificate Number: 3657.02**

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**Applicable Test Standards:** FCC Title 47 CFR Part 15: Subpart B  
FCC Title 47 CFR Part 15: Subpart C  
ICES-003 Issue 6  
RSS-247 Issue 2  
RSS-Gen Issue 4

**Equipment Tested** SC-5421  
**Model Number:** SC-5421  
**FCC ID:** OZFSC5420B  
**IC Certification Number:** 3669A-SC5420B  
**Manufacturer:** Tantalus Systems Corp.



## REVISION HISTORY

Date	Report Number	Rev #	Details	Author's Initials
Mar 21, 2017	E10402-1701_SC-5420B	0.0	Draft Test Report	HZ
April 3, 2017	E10402-1701_SC-5421	1.0	Final Issue	HZ
June 23, 2017	E10402-1701_SC-5421	2.0	Report update as per TCB review	HZ

*All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.*

## REPORT AUTHORIZATION

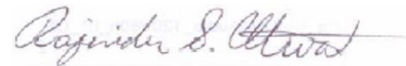
The data documented in this report is for the test equipment provided by Tantalus Systems Corp. Tests were conducted on the sample equipment as requested by Tantalus Systems Corp. for the purpose of demonstrating compliance with FCC Title 47 CFR Part 15: Subpart B, FCC Title 47 CFR Part 15: Subpart C, ICES-003 Issue 6, RSS-247 Issue 2, and RSS-Gen Issue 4 as agreed upon by Tantalus Systems Corp. as per Quote 17SH02066R1.

Tantalus Systems Corp. is responsible for the tested product configuration, continued product compliance, and for the appropriate auditing of subsequent products as required. This report may comprise partial list of tests that are required for FCC Declaration of Conformity and can only be produced by the manufacturer.

This is to certify that the following report is true and correct to the best of our knowledge.



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## QAI FACILITIES

Founded in 1994 by a group of experienced certification and testing experts, QAI is an independent third-party testing, inspection and certification organization which serves the building industry, government and individuals with cost effective solutions through our in-house capabilities / services, and an established world-wide network of qualified affiliates. To help get your product to market, trust the provider that many leading global manufacturers do: QAI.

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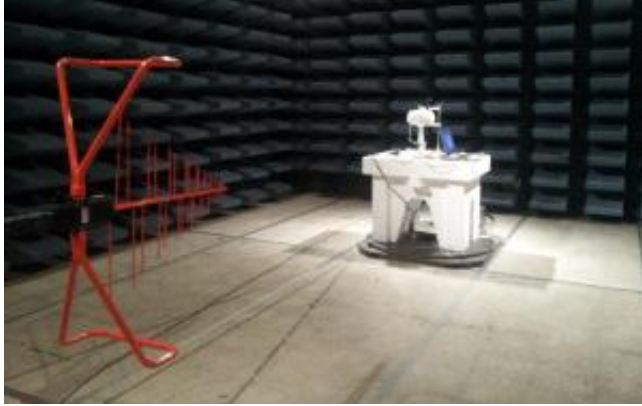
## QAI EMC ACCREDITATION

QAI EMC is your one-stop regulatory compliance partner for electromagnetic compatibility (EMC) and electromagnetic interference (EMI). Products are tested to the latest and applicable EMC/EMI requirements for domestic and international markets. QAI EMC goes above and beyond being a testing facility—we are your regulatory compliance partner. QAI EMC has the capability to perform RF Emissions and Immunity for all types of electronics manufacturing including Industrial, Scientific, Medical, Information Technology, Telecom, Wireless, Automotive, Marine and Avionics.

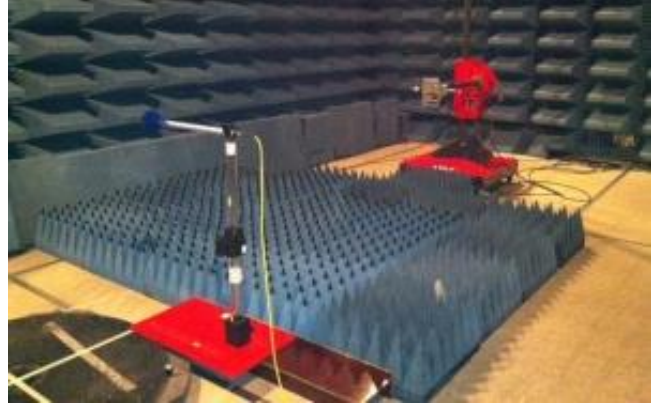
EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
Burnaby, BC Canada	CA9543	21146-1	3657.02



**Headquarters & EMC Laboratory in Burnaby, BC**



**Chamber 1- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC**



**Chamber 1- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC**



**Chamber 2- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC**



**Chamber 2- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC**



**10m Open Area Test Site (OATS) in British Columbia, Canada**

## TABLE OF CONTENTS

REVISION HISTORY .....	2
REPORT AUTHORIZATION .....	2
QAI FACILITIES .....	3
QAI EMC ACCREDITATION .....	3
TABLE OF CONTENTS .....	5
Section I: EXECUTIVE SUMMARY .....	6
1.1 Purpose .....	6
1.2 Scope .....	6
1.3 Summary of Results .....	7
Section II: GENERAL INFORMATION .....	8
2.1 Product Description .....	8
2.2 Environmental Conditions .....	9
2.3 Measurement Uncertainty .....	9
2.4 Worst Test Case .....	9
2.5 Sample Calculations of Emissions Data .....	10
2.6 Test Equipment List .....	11
Section III: Unintentional Radiated Emissions Test Result .....	12
3.1 AC Mains Conducted Emissions .....	12
3.2 Unintentional Radiated Emissions .....	21
Section IV: RF Devices Intentional Radiators Test Result .....	23
4.1 Antenna Requirements .....	23
4.2 RF Peak Power Output .....	24
4.3 20dB Occupied Bandwidth .....	27
4.4 Out of Band Emissions (Band Edge) .....	34
4.5 Channel Separation .....	38
4.6 Number of Hopping Channels .....	42
4.7 Dwell Time and Time Occupancy Per Frequency .....	60
4.8 Radiated Spurious Emissions Transmit Mode .....	64
Appendix A: TEST SETUP PICTURES .....	70
Appendix B: ABBREVIATIONS .....	73

## Section I: EXECUTIVE SUMMARY

### 1.1 Purpose

The purpose of this report is to demonstrate and document the compliance of “SC-5421” as per Sections 1.2 & 1.3 of this report.

### 1.2 Scope

The information documented in this report is based on the test methods and levels as per Quote 17SH02066R1:

- **FCC CFR 47 Part 15** – Radio Frequency Devices, Subpart B – Unintentional Radiators
- **FCC CFR 47 Part 15** – Radio Frequency Devices, Subpart C – Intentional Radiators
  - o 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5875 MHz
- **ICES-003 Issue 6** – Information Technology Equipment (Including Digital Apparatus) - Limits and Methods of Measurement
- **RSS-247 Issue 2** – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
- **RSS-Gen Issue 4** – General Requirements and Information for the Certification of Radio Apparatus

The tests documented in this report were performed in accordance with ANSI C63.4-2014, ANSI C63.10-2013, RSS-Gen Issue 4 and FCC KDB 558074 D01 DTS Meas Guidance v04.

### 1.3 Summary of Results

The following tests demonstrate the testimony to “FCC and IC” Mark Electromagnetic compatibility testing for “SC-5421” manufactured by Tantalus Systems Corp.

The following testing was performed pursuant to the FCC and IC Radio and RF Emissions Standards:

Test or Measurement	Applicable FCC and IC Standard	Performance Criteria
AC Mains Conducted Emissions	FCC CFR 47 Part 15.107	Complies
	ICES-003 Issue 6 RSS-Gen Issue 4	
Unintentional Radiated Spurious Emissions	FCC CFR 47 Part 15.109	Complies
	ICES-003 Issue 6 RSS-Gen Issue 4	
Intentional Radiated Spurious Emissions	FCC CFR 47 Part 15.247 FCC CFR 47 Part 15.209 FCC CFR 47 Part 15.205	Complies
	RSS-247 Issue 2 RSS-Gen Issue 4	
Antenna Requirement	FCC CFR 47 Part 15.203	Complies
	RSS-Gen Issue 4	
RF Peak Power Output	FCC CFR 47 Part 15.247	Complies
	RSS-247 Issue 2	
20dB Occupied Bandwidth	FCC CFR 47 Part 15.247	Complies
	RSS-247 Issue 2 RSS-Gen Issue 4	
Out-of-Band Emissions (Band Edge)	FCC CFR 47 Part 15.247	Complies
	RSS-247 Issue 2	
Channel Separation	FCC CFR 47 Part 15.247	Complies
	RSS-247 Issue 2	
Number of Hopping Channels	FCC CFR 47 Part 15.247	Complies
	RSS-247 Issue 2	
Dwell Time	FCC CFR 47 Part 15.247	Complies
	RSS-247 Issue 2	
Time Occupancy	FCC CFR 47 Part 15.247	Complies
	RSS-247 Issue 2	

## Section II: GENERAL INFORMATION

### 2.1 Product Description

The information provided in this section is for the Equipment Under Test (EUT) and the corresponding Auxiliary Equipment needed to perform the tests as complete system.

#### Equipment Under Test (EUT) Information

<b>EUT</b>	SC-5421
<b>Functional Description</b>	Streetlight Controller
<b>FRN</b>	0007474851
<b>FCC ID</b>	OZFSC5420B
<b>IC Certification Number</b>	3669A-SC5420B
<b>Manufacturer</b>	Tantalus Systems Corp.
<b>Model No.</b>	SC-5421
<b>Serial No.</b>	5000055 1216 (Streetlight Controller) 0024CDBA86 (Communication Module)

#### Antenna Information

No.	Qty	Description	Manufacturer	Manufacturer's Part #	Value	Type	Rating
1		Integrated Antenna					

#### Ancillary Equipment Information

No.	Item/Description	Manufacturer	Model No.	Serial No.
1	Streetlight Controller	Tantalus Systems Corp.		5000055 1216



## 2.2 Environmental Conditions

The equipment under test was operated and tested under the following environmental conditions:

Parameter	Conditions
Location	Indoors
Temperature	22-28°C
Relative Humidity	39.7 - 54.4%

## 2.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz-1GHz	± 2.40 dB
Radiated Emissions, 1GHz-40GHz	± 2.48 dB
Radio Frequency	±1,5 x 10 <sup>-5</sup> MHz
Total RF Power Conducted	±1.36 dB
Spurious Emissions, Conducted	±1.36 dB
RF Power Density, Conducted	±1.36 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±3 %

## 2.4 Worst Test Case

Worst-case orientation was determined during the preliminary testing. The final radiated emissions were performed in the worst-case orientation.

## 2.5 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohdes & Schwarz. Transducer factors like Antenna factors, Cable Losses and Amplifier gains were stored in the test templates which are used to perform the emissions measurements. After test is finished, data is generated from the EMC32 consisting of product details, emission plots and final data tables as shown below.

Frequency (MHz)	Quasi-Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
42.663900	33.0	1000.000	120.000	100.0	H	70.0	13.2	7.5	40.5

Quasi Peak reading shown in the table above is already corrected by the software using correction factor shown in column “Corr.” The correction factor listed under “Corr.” table calculated as:

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable loss}$$

Or

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable Loss} - \text{Amp gain (if pre-amplifier was used)}$$

The final Quasi peak reading shown in the data is calculated by the software using following equation:

$$\text{Corrected Quasi Peak (dBµV/m)} = \text{Raw Quasi Peak Reading} + \text{Antenna factor} + \text{Cable loss}$$

To obtain the final Quasi-Peak or Average reading during power line conducted emissions, transducer factors are included in the final measurement as shown below.

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	44.3	1000.000	9.000	0.6	21.7	66.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	27.2	1000.000	9.000	0.6	28.8	56.0

*Note: Data shown above are sample data and are not relevant to the EUT's actual data.*

Quasi Peak or Average reading shown in above table is already corrected by the software using the correction factor shown in column “Corr.” The correction factor listed under “Corr.” table calculated as:

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable loss}$$

The final Quasi peak or Average reading shown in the data is calculated by the software using following equation:

$$\text{Corr. Quasi Peak/Average Reading (dBµV)} = \text{Raw Quasi Peak/Average Reading} + \text{Antenna factor} + \text{Cable loss}$$

The allowable margin from the limits, as per the standards, were calculated for both radiated and conducted emissions:

$$\text{Margin (dB)} = \text{Limit} - \text{Quasi-Peak or Average reading}$$

## 2.6 Test Equipment List

The tables below contain all the equipment used by QAI Laboratories in conducting all tests on the Equipment Under Test (EUT) as per Section 1.3.

### Emissions Test Equipment

Manufacturer	Model	Description	Serial No.	Calibration Due Date
Sunol Sciences	SM46C	Turntable	051204-2	N/A
Sunol Sciences	TWR95	Mast	TREML0001	N/A
Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A120106	24-Sep-2017
Sunol Sciences	DRH-118	Horn Antenna 1GHz-18GHz	A050905	10-Mar-2019
ETS Lindgren	3160-09	Horn Antenna 18GHz-26.5GHz	9701-1071	30-Aug-2017
ETS Lindgren	3160-10	Horn Antenna 26.5GHz-40.0GHz	9708-1075	30-Aug-2017
ETS Lindgren	6502	Active Loop Antenna 10kHz – 30MHz	2178	21-Aug-2017
ETS Lindgren	2165	Turntable	00043677	N/A
ETS Lindgren	2125	Mast	00077487	N/A
Rohde & Schwarz	ESU40	EMI Receiver	100011	20-Nov-2017
Fischer	FCC-LISN-50-25-2-08	LISN (150kHz-30MHz)	2041	19-Nov-2018
ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A
AH Systems	PAM118	Amplifier 10KHz-18GHz	189	Conditional Use
California Instruments	PACS-1	Harmonics and flicker analyzer	72569	18 July 2018
California Instruments	OMNI 1-18 I	Programmable Impedance Flicker test	-	18 July 2018
California Instruments	3001ix	Power supply	HK52117	18 July 2018

*Note: Equipment listed above have a 3 years calibration interval.*

### Measurement Software List

Manufacturer	Model	Version	Description
Rhode & Schwarz	EMC 32	6.20.0	Emissions Test Software
ETS-Lindgren	Tile7	7.3.15	Emissions Test Software

## Section III: Unintentional Radiated Emissions Test Result

### 3.1 AC Mains Conducted Emissions

**Date Performed:**

March 3, 2017

**Test Standard:**

- FCC CFR 47 Part 15.107
- ICES-003 Issue 6
- RSS-Gen Issue 4

**Test Method:**

- ANSI C63.4-2014

**Test Requirement:**

FCC/IC Class B Limit:

Frequency (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.50	66 to 56	56 to 46
0.50 – 5	56	46
5 – 30	60	50

*Note 1: The lower limit shall apply at the transition frequencies.*  
*Note 2: The limit decreases linearly with the logarithm of the frequency in the 0.15 to 0.50 MHz.*

**Method of Measurement:**

Measurements were made using a test receiver with 9kHz bandwidth, CISPR Quasi-Peak and Average detector.

**Modifications:**

No modification was required to comply for this test.

**Result:**

The EUT complies with the applicable standard.

**Measurement Data and Plot:**

EUT Test Mode:

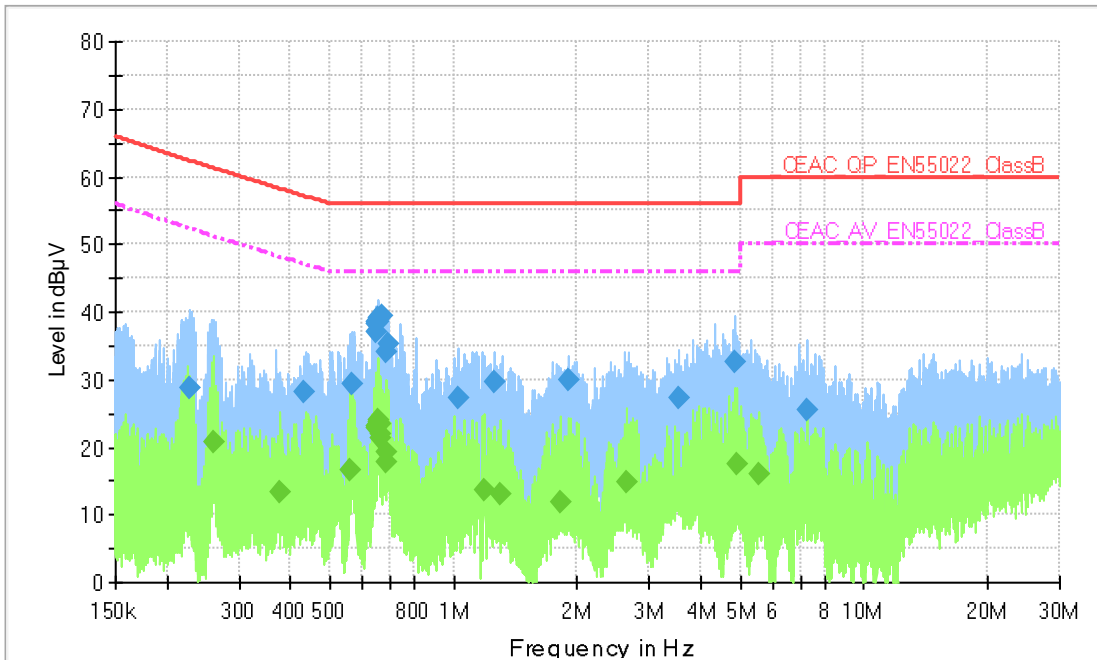
- Idle Mode

Test Mains Voltage Used:

- Line 1, 120Vac/60Hz

Frequency Range:

- 150kHz to 30MHz



**Plot 1: Conducted Emissions – Line 1, 120Vac/60Hz**

**Table 1: QPeak Data of Conducted Emissions – Line 1, 120Vac/60Hz**

Frequency (MHz)	QPeak (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.227336	28.9	1000.000	9.000	GND	10.4	33.5	62.4
0.429709	28.0	1000.000	9.000	GND	10.2	29.2	57.2
0.567347	29.3	1000.000	9.000	GND	10.2	26.7	56.0
0.646714	37.1	1000.000	9.000	GND	10.2	18.9	56.0
0.648656	38.4	1000.000	9.000	GND	10.2	17.6	56.0
0.650604	38.6	1000.000	9.000	GND	10.2	17.4	56.0
0.652558	38.4	1000.000	9.000	GND	10.2	17.6	56.0
0.654518	38.7	1000.000	9.000	GND	10.2	17.3	56.0
0.656483	39.0	1000.000	9.000	GND	10.2	17.0	56.0
0.668401	39.5	1000.000	9.000	GND	10.2	16.5	56.0
0.683945	34.2	1000.000	9.000	GND	10.2	21.8	56.0
0.694276	35.3	1000.000	9.000	GND	10.2	20.7	56.0
1.021142	27.2	1000.000	9.000	GND	10.1	28.8	56.0
1.257112	29.5	1000.000	9.000	GND	10.1	26.5	56.0
1.909055	30.0	1000.000	9.000	GND	10.1	26.0	56.0
3.549691	27.3	1000.000	9.000	GND	10.3	28.7	56.0
4.838988	32.7	1000.000	9.000	GND	10.3	23.3	56.0
7.289979	25.5	1000.000	9.000	GND	10.3	34.5	60.0

**Table 2: Average Data of Conducted Emissions – Line 1, 120Vac/60Hz**

Frequency (MHz)	Average (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.259397	20.7	1000.000	9.000	GND	10.4	30.5	51.2
0.376597	13.2	1000.000	9.000	GND	10.2	35.0	48.2
0.560582	16.6	1000.000	9.000	GND	10.2	29.4	46.0
0.648656	22.7	1000.000	9.000	GND	10.2	23.3	46.0
0.650604	23.2	1000.000	9.000	GND	10.2	22.8	46.0
0.652558	23.4	1000.000	9.000	GND	10.2	22.6	46.0
0.654518	23.6	1000.000	9.000	GND	10.2	22.4	46.0
0.656483	23.9	1000.000	9.000	GND	10.2	22.1	46.0
0.658455	23.3	1000.000	9.000	GND	10.2	22.7	46.0
0.660432	22.1	1000.000	9.000	GND	10.2	23.9	46.0
0.662415	21.5	1000.000	9.000	GND	10.2	24.5	46.0
0.683945	17.7	1000.000	9.000	GND	10.2	28.3	46.0
0.688058	19.2	1000.000	9.000	GND	10.2	26.8	46.0
1.193444	13.5	1000.000	9.000	GND	10.1	32.5	46.0
1.303169	13.1	1000.000	9.000	GND	10.1	32.9	46.0
1.812368	11.9	1000.000	9.000	GND	10.1	34.1	46.0
2.651184	14.8	1000.000	9.000	GND	10.2	31.2	46.0
4.921912	17.6	1000.000	9.000	GND	10.3	28.4	46.0
5.554656	16.0	1000.000	9.000	GND	10.3	34.0	50.0

EUT Test Mode:

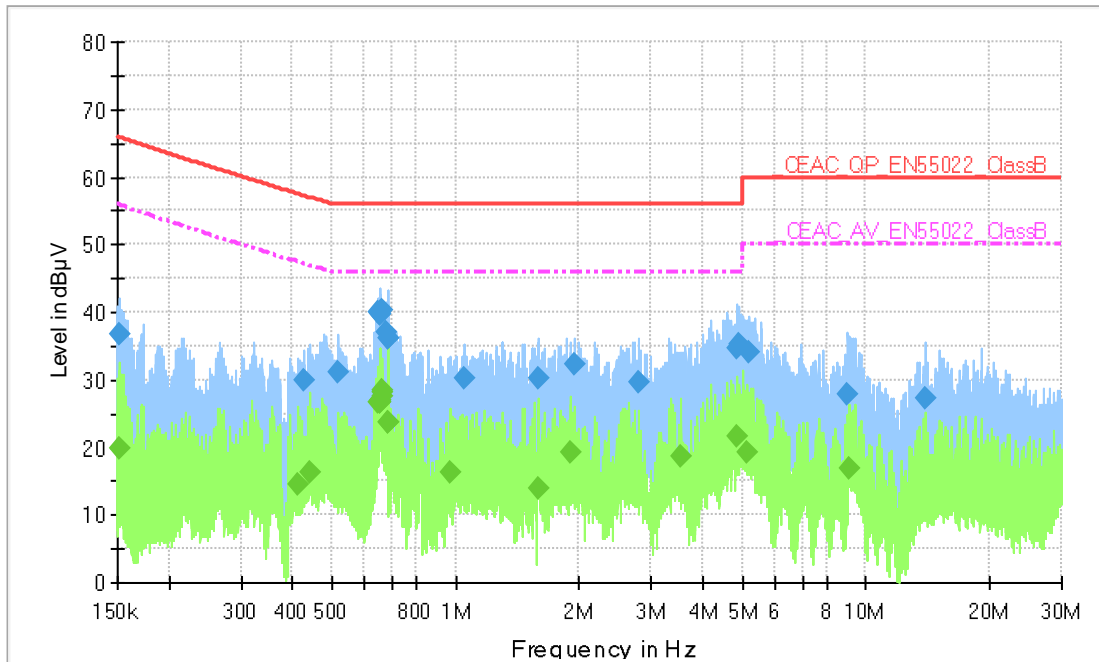
- Idle Mode

Test Mains Voltage Used:

- Line 2, 120Vac/60Hz

Frequency Range:

- 150kHz to 30MHz



**Plot 2: Conducted Emissions – Line 2, 120Vac/60Hz**

**Table 3: QPeak Data of Conducted Emissions – Line 2, 120Vac/60Hz**

Frequency (MHz)	QPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.151962	36.8	1000.000	9.000	GND	10.5	29.1	65.9
0.425436	29.8	1000.000	9.000	GND	10.2	27.4	57.2
0.519577	31.2	1000.000	9.000	GND	10.2	24.8	56.0
0.649954	39.9	1000.000	9.000	GND	10.2	16.1	56.0
0.651906	40.1	1000.000	9.000	GND	10.2	15.9	56.0
0.653864	39.8	1000.000	9.000	GND	10.2	16.2	56.0
0.655827	39.7	1000.000	9.000	GND	10.2	16.3	56.0
0.665734	40.3	1000.000	9.000	GND	10.2	15.7	56.0
0.675115	37.1	1000.000	9.000	GND	10.2	18.9	56.0
0.681216	36.1	1000.000	9.000	GND	10.2	19.9	56.0
0.683261	36.1	1000.000	9.000	GND	10.2	19.9	56.0
1.045933	30.1	1000.000	9.000	GND	10.1	25.9	56.0
1.588357	30.3	1000.000	9.000	GND	10.1	25.7	56.0
1.955403	32.4	1000.000	9.000	GND	10.1	23.6	56.0
2.787043	29.6	1000.000	9.000	GND	10.2	26.4	56.0
4.848670	34.6	1000.000	9.000	GND	10.3	21.4	56.0
4.877835	35.3	1000.000	9.000	GND	10.3	20.7	56.0
5.215673	34.2	1000.000	9.000	GND	10.3	25.8	60.0
9.046634	27.7	1000.000	9.000	GND	10.3	32.3	60.0
13.921295	27.4	1000.000	9.000	GND	10.3	32.6	60.0

**Table 4: Average Data of Conducted Emissions – Line 2, 120Vac/60Hz**

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.151507	19.7	1000.000	9.000	GND	10.5	36.2	55.9
0.412456	14.6	1000.000	9.000	GND	10.2	32.9	47.5
0.441023	16.3	1000.000	9.000	GND	10.2	30.7	47.0
0.649954	26.6	1000.000	9.000	GND	10.2	19.4	46.0
0.651906	26.8	1000.000	9.000	GND	10.2	19.2	46.0
0.653864	26.8	1000.000	9.000	GND	10.2	19.2	46.0
0.655827	26.9	1000.000	9.000	GND	10.2	19.1	46.0
0.657797	26.9	1000.000	9.000	GND	10.2	19.1	46.0
0.659772	27.5	1000.000	9.000	GND	10.2	18.5	46.0
0.661754	28.2	1000.000	9.000	GND	10.2	17.8	46.0
0.663741	28.5	1000.000	9.000	GND	10.2	17.5	46.0
0.681216	23.7	1000.000	9.000	GND	10.2	22.3	46.0
0.683261	23.8	1000.000	9.000	GND	10.2	22.2	46.0
0.969424	16.4	1000.000	9.000	GND	10.0	29.6	46.0
1.588357	13.8	1000.000	9.000	GND	10.1	32.2	46.0
1.910964	19.4	1000.000	9.000	GND	10.1	26.6	46.0
3.524942	18.8	1000.000	9.000	GND	10.3	27.2	46.0
4.848670	21.7	1000.000	9.000	GND	10.3	24.3	46.0
5.158643	19.4	1000.000	9.000	GND	10.3	30.6	50.0
9.110151	16.8	1000.000	9.000	GND	10.3	33.2	50.0



EUT Test Mode:

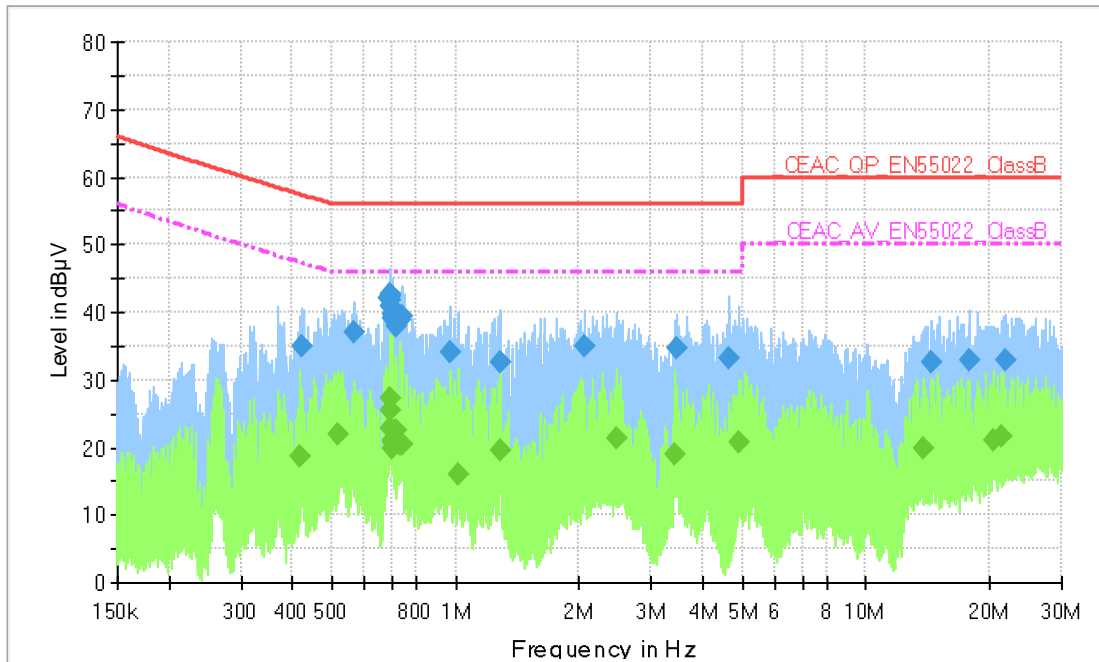
- Idle Mode

Test Mains Voltage Used:

- Line 1, 240Vac/60Hz

Frequency Range:

- 150kHz to 30MHz



**Plot 3: Conducted Emissions – Line 1, 240Vac/60Hz**

**Table 5: QPeak Data of Conducted Emissions – Line 1, 240Vac/60Hz**

Frequency (MHz)	QPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.424162	35.0	1000.000	9.000	GND	10.2	22.3	57.3
0.563391	37.2	1000.000	9.000	GND	10.2	18.8	56.0
0.687371	42.1	1000.000	9.000	GND	10.2	13.9	56.0
0.689435	42.6	1000.000	9.000	GND	10.2	13.4	56.0
0.691506	42.5	1000.000	9.000	GND	10.2	13.5	56.0
0.693582	41.9	1000.000	9.000	GND	10.2	14.1	56.0
0.695665	40.8	1000.000	9.000	GND	10.2	15.2	56.0
0.697754	39.7	1000.000	9.000	GND	10.2	16.3	56.0
0.701951	39.0	1000.000	9.000	GND	10.1	17.0	56.0
0.712554	37.9	1000.000	9.000	GND	10.1	18.1	56.0
0.733510	38.9	1000.000	9.000	GND	10.1	17.1	56.0
0.737923	39.4	1000.000	9.000	GND	10.1	16.6	56.0
0.967488	34.0	1000.000	9.000	GND	10.0	22.0	56.0
1.282495	32.5	1000.000	9.000	GND	10.1	23.5	56.0
2.071203	35.0	1000.000	9.000	GND	10.1	21.0	56.0
3.465554	34.8	1000.000	9.000	GND	10.3	21.2	56.0
4.635421	33.0	1000.000	9.000	GND	10.3	23.0	56.0
14.359392	32.5	1000.000	9.000	GND	10.3	27.5	60.0
17.956645	33.0	1000.000	9.000	GND	10.4	27.0	60.0
22.014125	33.0	1000.000	9.000	GND	10.5	27.0	60.0

**Table 6: Average Data of Conducted Emissions – Line 1, 240Vac/60Hz**

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.419105	18.8	1000.000	9.000	GND	10.2	28.5	47.3
0.516470	21.9	1000.000	9.000	GND	10.2	24.1	46.0
0.691506	27.2	1000.000	9.000	GND	10.2	18.8	46.0
0.693582	25.5	1000.000	9.000	GND	10.2	20.5	46.0
0.695665	22.8	1000.000	9.000	GND	10.2	23.2	46.0
0.697754	21.0	1000.000	9.000	GND	10.2	25.0	46.0
0.699849	20.6	1000.000	9.000	GND	10.1	25.4	46.0
0.701951	19.9	1000.000	9.000	GND	10.1	26.1	46.0
0.712554	22.4	1000.000	9.000	GND	10.1	23.6	46.0
0.733510	20.4	1000.000	9.000	GND	10.1	25.6	46.0
0.737923	20.6	1000.000	9.000	GND	10.1	25.4	46.0
0.742361	20.5	1000.000	9.000	GND	10.1	25.5	46.0
1.011997	16.1	1000.000	9.000	GND	10.0	29.9	46.0
1.288920	19.6	1000.000	9.000	GND	10.1	26.4	46.0
2.457254	21.3	1000.000	9.000	GND	10.2	24.7	46.0
3.424236	18.9	1000.000	9.000	GND	10.3	27.1	46.0
4.877835	20.7	1000.000	9.000	GND	10.3	25.3	46.0
13.851897	19.9	1000.000	9.000	GND	10.3	30.1	50.0
20.465096	21.0	1000.000	9.000	GND	10.4	29.0	50.0
21.299866	21.7	1000.000	9.000	GND	10.5	28.3	50.0

EUT Test Mode:

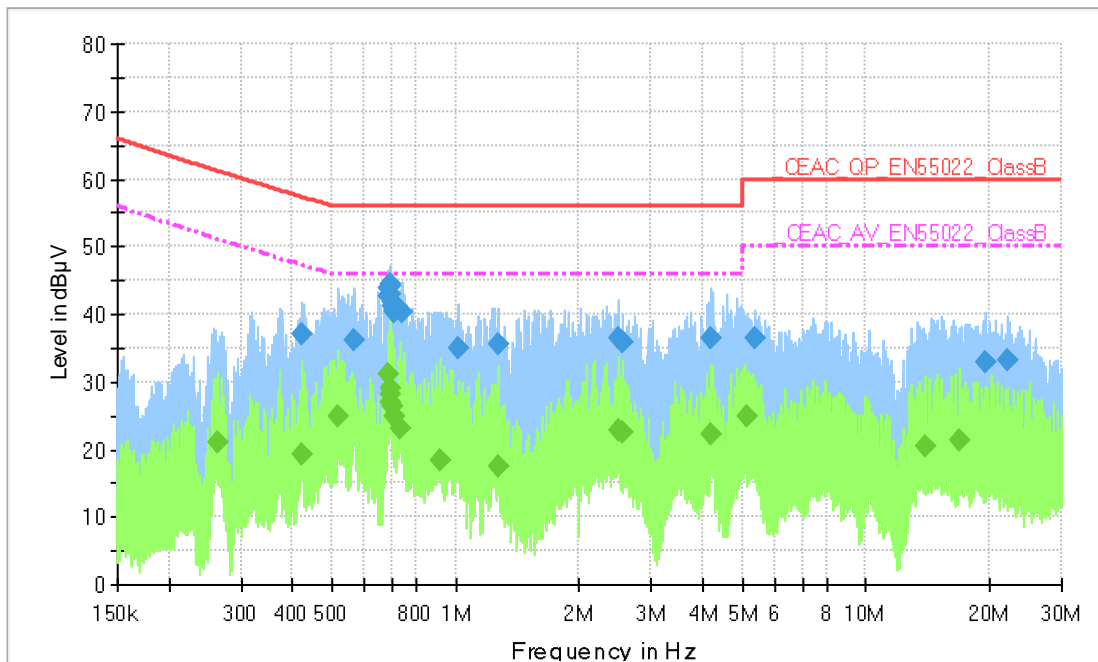
- Idle Mode

Test Mains Voltage Used:

- Line 2, 240Vac/60Hz

Frequency Range:

- 150kHz to 30MHz



**Plot 4: Conducted Emissions – Line 2, 240Vac/60Hz**

**Table 7: QPeak Data of Conducted Emissions – Line 2, 240Vac/60Hz**

Frequency (MHz)	QPeak (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.422470	37.1	1000.000	9.000	GND	10.2	20.2	57.3
0.564518	36.2	1000.000	9.000	GND	10.2	19.8	56.0
0.684628	42.8	1000.000	9.000	GND	10.2	13.2	56.0
0.688747	43.9	1000.000	9.000	GND	10.2	12.1	56.0
0.690815	44.5	1000.000	9.000	GND	10.2	11.5	56.0
0.692889	44.0	1000.000	9.000	GND	10.2	12.0	56.0
0.694970	43.1	1000.000	9.000	GND	10.2	12.9	56.0
0.697057	41.9	1000.000	9.000	GND	10.2	14.1	56.0
0.699150	41.1	1000.000	9.000	GND	10.2	14.9	56.0
0.705468	40.6	1000.000	9.000	GND	10.1	15.4	56.0
0.709711	40.3	1000.000	9.000	GND	10.1	15.7	56.0
0.743103	40.3	1000.000	9.000	GND	10.1	15.7	56.0
1.016051	34.9	1000.000	9.000	GND	10.0	21.1	56.0
1.269740	35.4	1000.000	9.000	GND	10.1	20.6	56.0
2.491880	36.6	1000.000	9.000	GND	10.2	19.4	56.0
2.552378	35.8	1000.000	9.000	GND	10.2	20.2	56.0
4.181953	36.5	1000.000	9.000	GND	10.3	19.5	56.0
5.363700	36.3	1000.000	9.000	GND	10.3	23.7	60.0
19.470876	32.8	1000.000	9.000	GND	10.4	27.2	60.0
22.080234	33.1	1000.000	9.000	GND	10.5	26.9	60.0

**Table 8: Average Data of Conducted Emissions – Line 2, 240Vac/60Hz**

Frequency (MHz)	Average (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.263053	20.9	1000.000	9.000	GND	10.4	30.2	51.1
0.422470	19.3	1000.000	9.000	GND	10.2	28.0	47.3
0.517503	24.8	1000.000	9.000	GND	10.2	21.2	46.0
0.688747	31.1	1000.000	9.000	GND	10.2	14.9	46.0
0.690815	27.0	1000.000	9.000	GND	10.2	19.0	46.0
0.692889	28.9	1000.000	9.000	GND	10.2	17.1	46.0
0.694970	28.2	1000.000	9.000	GND	10.2	17.8	46.0
0.697057	26.5	1000.000	9.000	GND	10.2	19.5	46.0
0.699150	26.4	1000.000	9.000	GND	10.2	19.6	46.0
0.705468	24.9	1000.000	9.000	GND	10.1	21.1	46.0
0.709711	25.0	1000.000	9.000	GND	10.1	21.0	46.0
0.730584	23.2	1000.000	9.000	GND	10.1	22.8	46.0
0.917571	18.4	1000.000	9.000	GND	10.0	27.6	46.0
1.276102	17.4	1000.000	9.000	GND	10.1	28.6	46.0
2.506868	22.9	1000.000	9.000	GND	10.2	23.1	46.0
2.552378	22.6	1000.000	9.000	GND	10.2	23.4	46.0
4.169433	22.1	1000.000	9.000	GND	10.3	23.9	46.0
5.153489	24.7	1000.000	9.000	GND	10.3	25.3	50.0
13.963101	20.5	1000.000	9.000	GND	10.3	29.5	50.0
16.827135	21.2	1000.000	9.000	GND	10.4	28.8	50.0

## 3.2 Unintentional Radiated Emissions

### Date Performed:

March 3, 2017

### Test Standard:

- FCC CFR 47 Part 15.109
- ICES-003 Issue 6
- RSS-Gen Issue 4

### Test Method:

- ANSI C63.4-2014

### Test Requirement:

#### FCC/IC Class B Limit:

Frequency (MHz)	Field Strength Quasi Peak dB $\mu$ V/m @ 3m
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
Above 960	54.0

### Method of Measurement:

The EUT was positioned in the center of the turntable in the SAC. The EUT was then measured for all the radiated emissions in the frequency range of 30MHz – 1GHz. Measurements were made using the spectrum analyzer and receiver using the appropriate antennas, amplifiers, attenuators, and filters.

The required Quasi-Peak CISPR bandwidth shall be 120 kHz for the range 30 – 1000 MHz. A 1 MHz Resolution Bandwidth (RBW, CISPR Band E) shall be used and a 10 Hz Video Bandwidth (VBW). The ANSI C63.4:2014 requirement for the placement of RF Absorber on the turntable Ground Plane shall be satisfied.

Emissions in both horizontal and vertical polarizations were measured while rotating the Equipment Under Test (EUT) on the turntable to maximize signal strength. In the case of high ambient noises, the measurements are performed at a closer distance and the limit is adjusted per the equation below. The result is added or subtracted to the required emission level to ensure compliance at the new distance.

$$20 \log \left( \frac{D1}{D2} \right); \quad \text{Where } \begin{array}{l} D1 = \text{Current Distance} \\ D2 = \text{Required Distance} \end{array}$$

### Modifications:

No modification was required to comply for this test.

### Result:

The EUT complies with the applicable standard.

**Measurement Data and Plot:**

EUT Test Mode:

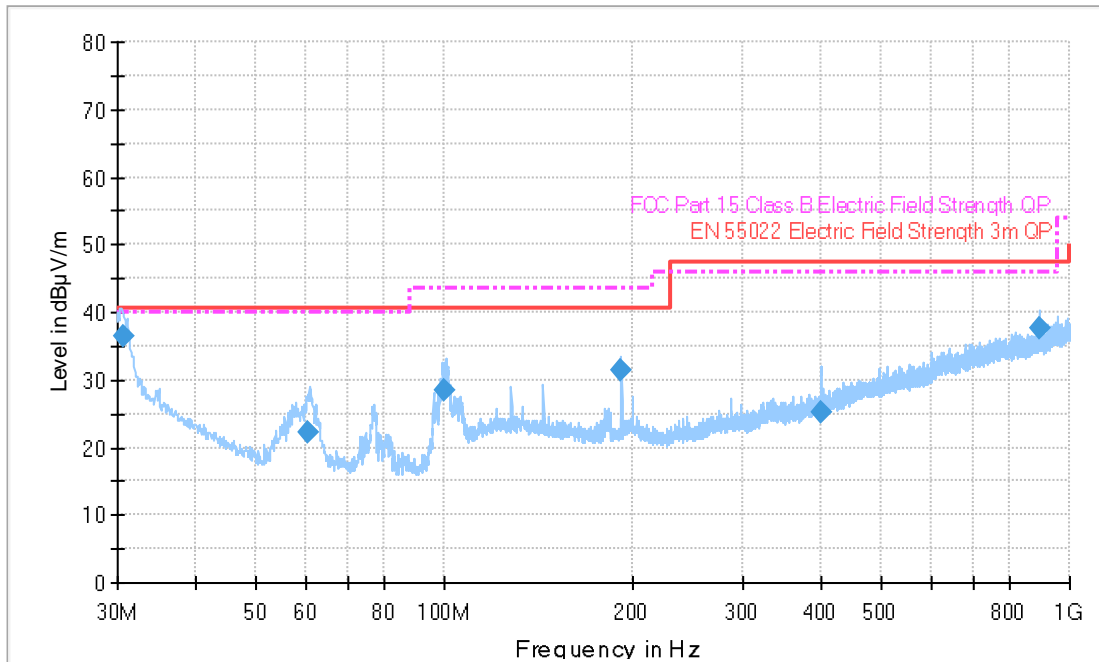
- Idle Mode

Test Mains Voltage Used:

- 120Vac/60Hz

Frequency Range:

- 30MHz to 1GHz



**Plot 5: Radiated Emissions scanned at 3m SAC**

**Table 9: QPeak Data of Radiated Emissions measured 3m SAC – FCC/IC Class B Limit**

Freq. (MHz)	QPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Ant. Ht. (cm)	Pol	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.580651	36.3	1000.000	120.000	122.0	V	117.0	26.5	3.7	40.0
60.405800	22.3	1000.000	120.000	123.0	V	0.0	14.0	17.7	40.0
99.824840	28.6	1000.000	120.000	100.0	V	67.0	16.8	14.9	43.5
192.014000	31.3	1000.000	120.000	161.0	H	1.0	18.7	12.2	43.5
399.932000	25.2	1000.000	120.000	123.0	H	121.0	23.4	20.8	46.0
896.001600	37.5	1000.000	120.000	232.0	V	199.0	30.5	8.5	46.0

## Section IV: RF Devices Intentional Radiators Test Result

### 4.1 Antenna Requirements

**Date Performed:**

March 6, 2017

**Test Standard:**

- FCC CFR 47 Part 15.203
- RSS-Gen Issue 4

**Applicable Regulation:**

The purpose of this requirement is to make certain that no other antenna, except for that provided by the responsible party, shall be used with the Equipment-Under-Test (EUT) as defined in FCC CFR 47 Part 15.203 & RSS-Gen Issue 4:

“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 the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.” ... “the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.”

**Modifications:**

No modification was required to comply for this test.

**Result:**

An integrated antenna is used on this product and it is not field replaceable.

## 4.2 RF Peak Power Output

**Date Performed:**

March 6, 2017

**Test Standard:**

- FCC CFR 47 Part 15.247
- RSS-247 Issue 2

**Test Method:**

- ANSI C63.10:2013
- RSS-Gen Issue 4

**Test Requirement:**

For systems employing digital modulation techniques operating in the bands 902-928 MHz the maximum peak conducted output power shall not exceed 1 W (30dBm). Except as provided in RSS 210 Section A8.4 (5), the e.i.r.p. shall not exceed 4 W (36dBm).

**Test Setup:**

The antenna port of EUT was directly connected to a spectrum analyzer.

**Measurement Method:**

Power meter was used for this radio therefore there was no plots generated.

**Modifications:**

No modification was required to comply for this test.

**Result:**

The EUT complies with the applicable standard.



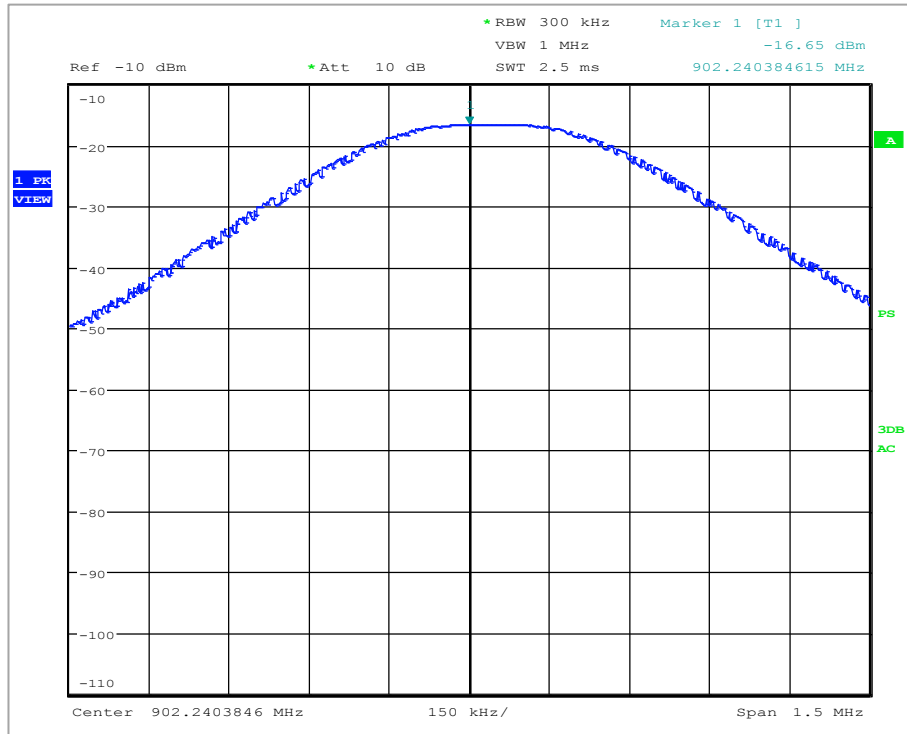
**Measurement Data and Plot:**

**Table 10: E.I.R.P measurements**

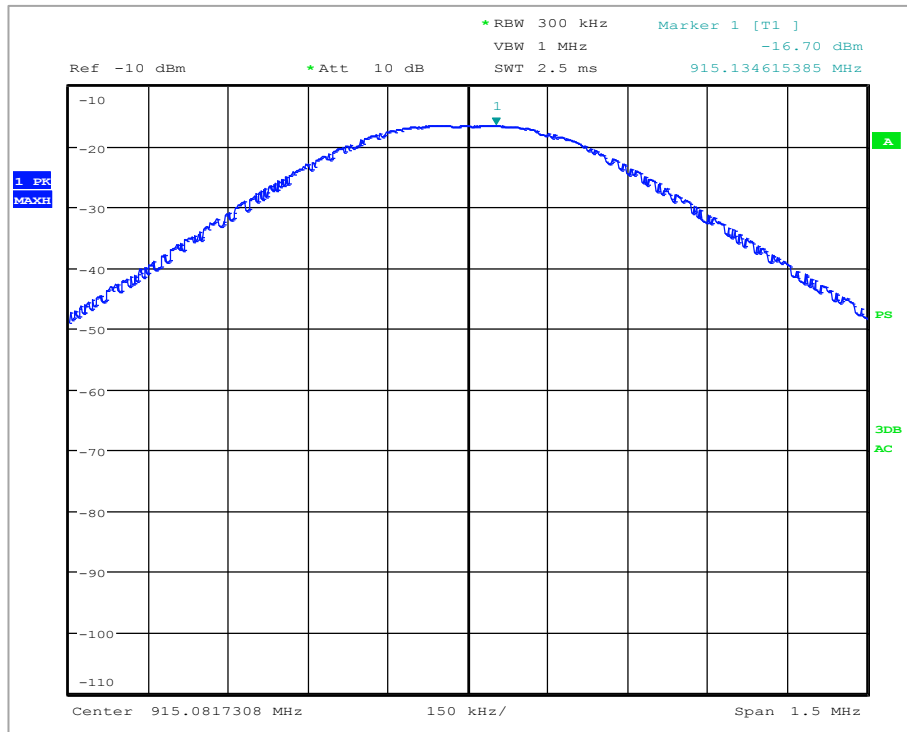
Channel	Freq. (MHz)	Raw Peak (dBμV)	Pol (V or H)	Turn Table (deg)	Ant. Ht. (cm)	Ant. Factors (dBμV)	Cable Loss (dB)	Atten. (dB)	Corr. Peak (dBμV)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Low	902.2	75.9	V	281.3	100.0	22.2	3.3	16.0	117.4	22.1	36	13.9
	902.2	76.4	H	108.8	217.5	22.2	3.3	16.0	117.9	22.6	36	13.4
Middle	915.1	74.7	V	287.0	100.0	22.4	3.3	16.0	116.4	21.1	36	14.9
	915.1	76.9	H	282.3	116.4	22.4	3.3	16.0	118.6	23.3	36	12.7
High	927.7	73.5	V	43.6	100.0	22.5	3.3	16.0	115.3	20.1	36	15.9
	927.7	75.7	H	282.6	112.4	22.5	3.3	16.0	117.5	22.3	36	13.7

**Table 11: Conducted output power measurements**

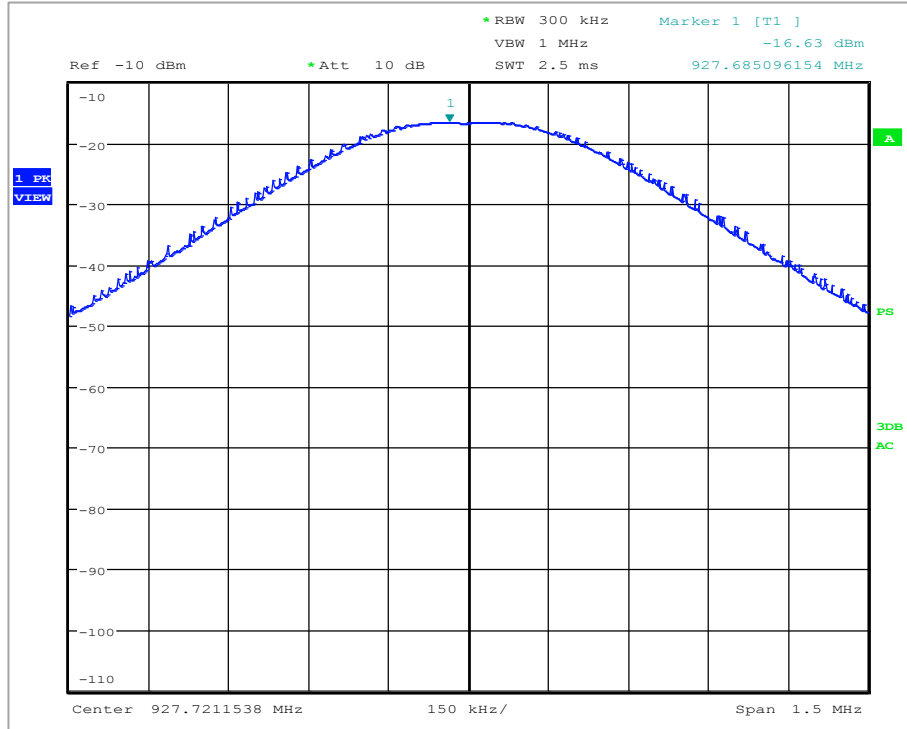
Channel	Freq. (MHz)	Measured Output Power (dBm)	Correction Factor (dB)	Corrected Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	902.2	-16.65	41	24.35	30	5.65
Middle	915.1	-16.70	41	24.30	30	5.70
High	927.7	-16.63	41	24.37	30	5.63



**Plot 6: RF Peak Conducted Power Output (Low Channel ~902.2MHz)**



**Plot 7: RF Peak Conducted Power Output (Mid Channel ~915.1MHz)**



**Plot 8: RF Peak Conducted Power Output (High Channel ~927.7MHz)**

## 4.3 20dB Occupied Bandwidth

### **Date Performed:**

March 7, 2017

### **Test Standard:**

- FCC CFR 47 Part 15.247
- RSS-247 Issue 2
- RSS-Gen Issue 4

### **Test Method:**

- ANSI C63.10:2013
- RSS-Gen Issue 4

### **Test Requirement:**

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

### **Test Setup:**

The antenna port of EUT was directly connected to a spectrum analyzer.

### **Measurement Method:**

As called in ANSI C63.10-2013.

### **Modifications:**

No modification was required to comply for this test.

### **Result:**

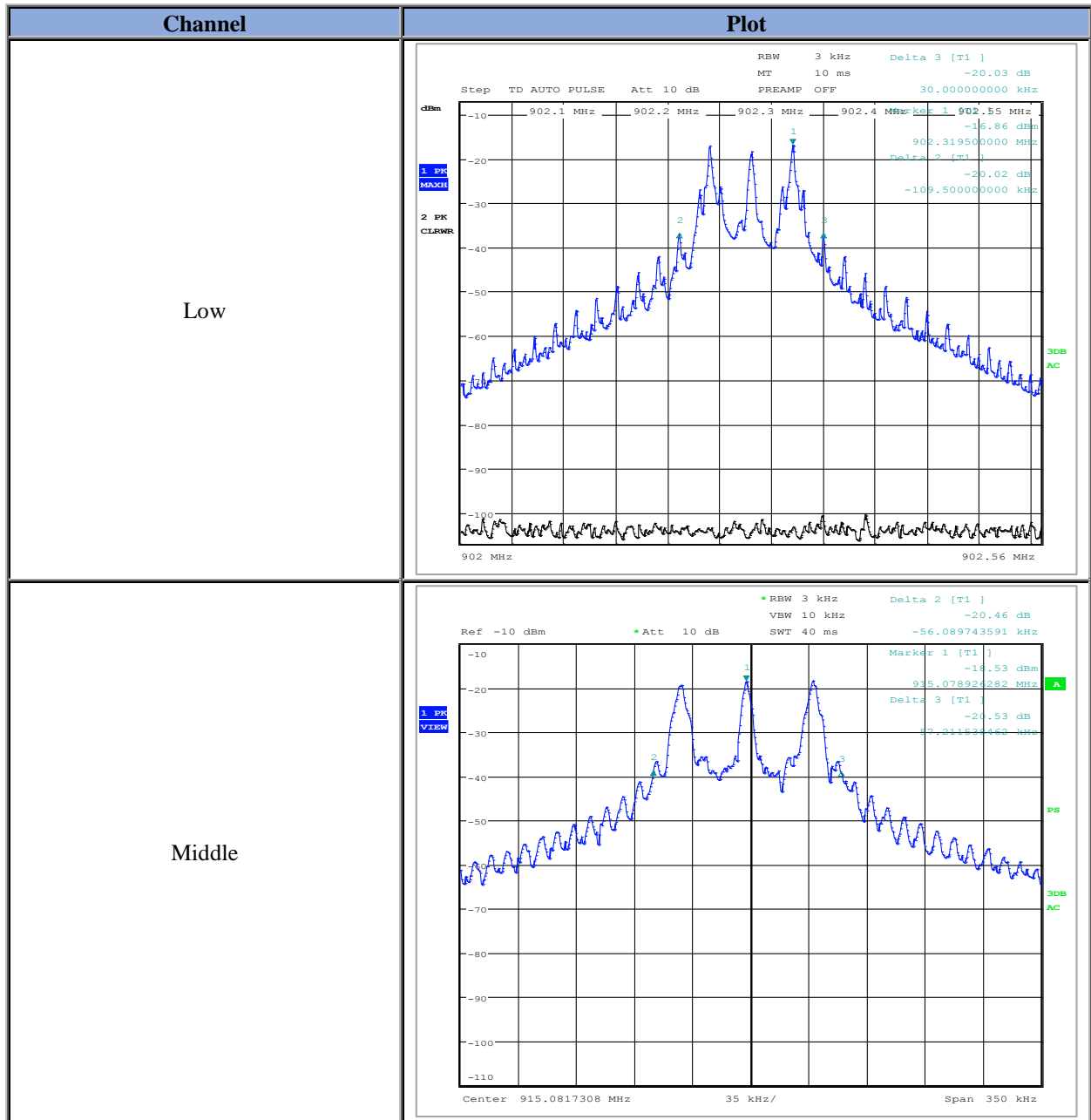
The EUT complies with the applicable standard.

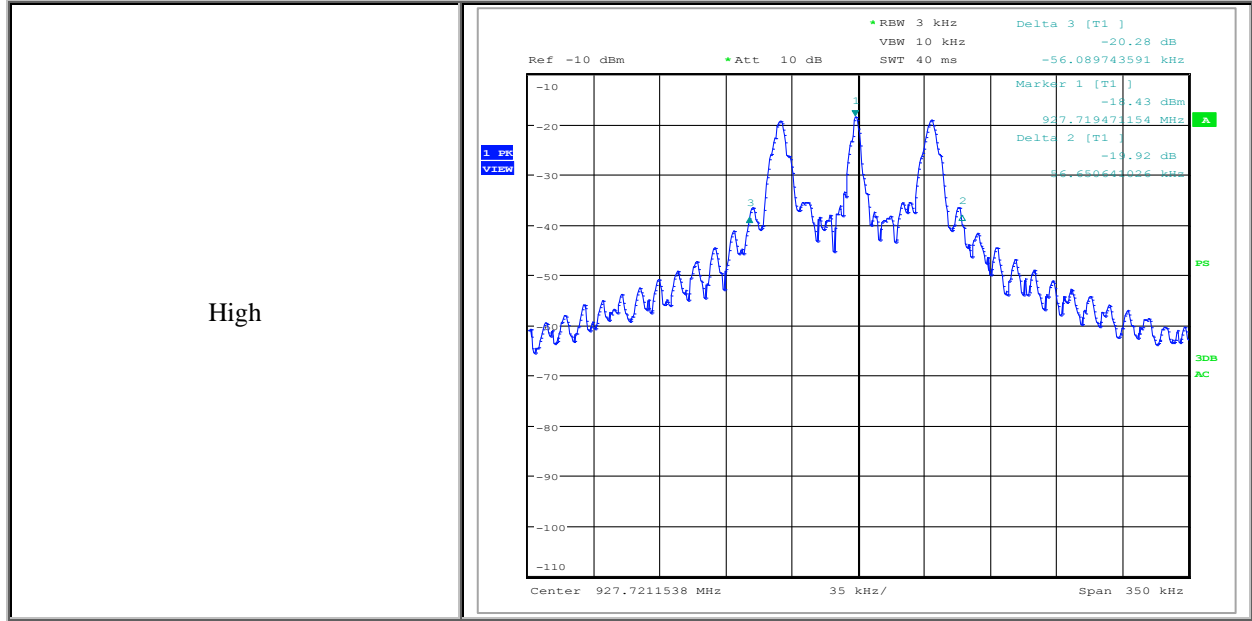
**Measurement Data and Plot:**

Low Data Rate

**Table 12: 20dB Occupied Bandwidth Data on Low Data Rate**

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	902.32	139.50
Middle	915.08	153.30
High	927.72	112.74



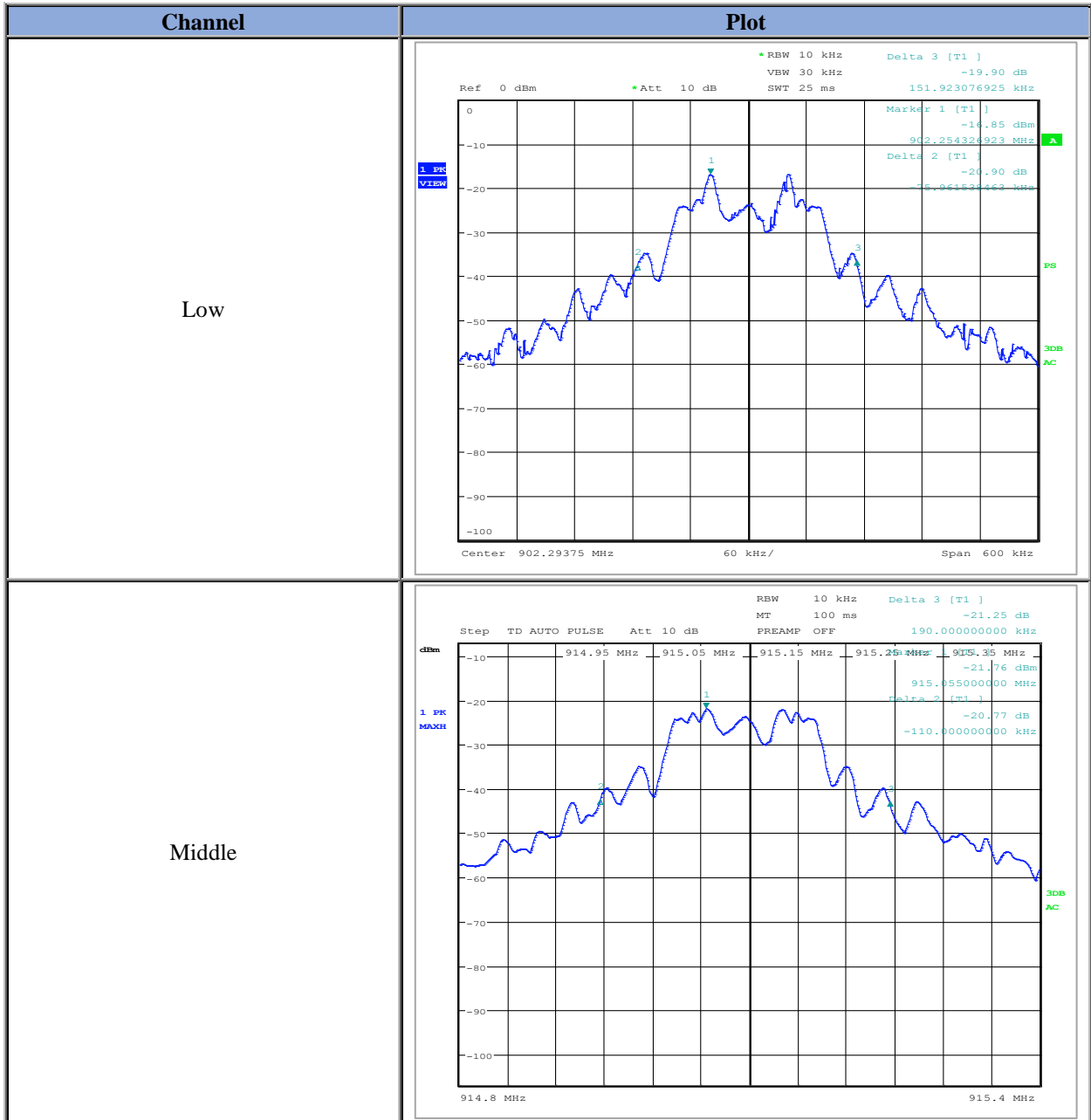


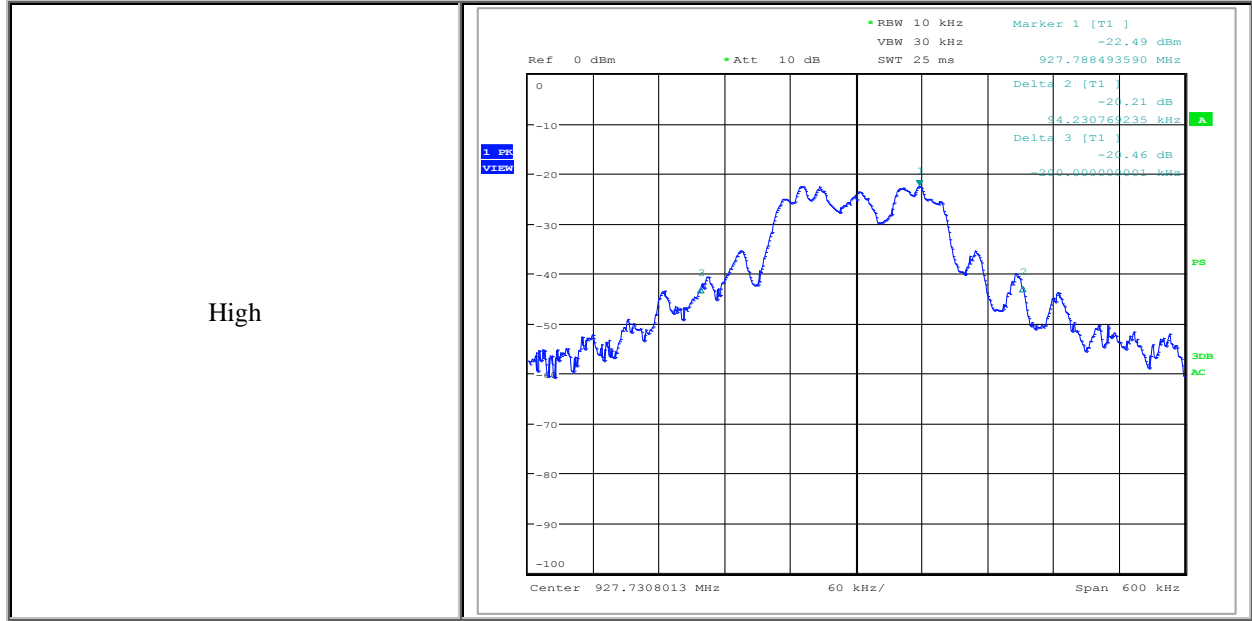
**Plot 9: 20dB Occupied Bandwidth Plot (Low Data Rate)**

High Data Rate

**Table 13: 20dB Occupied Bandwidth Data on High Data Rate**

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	902.25	227.88
Middle	915.06	300.00
High	927.79	254.23



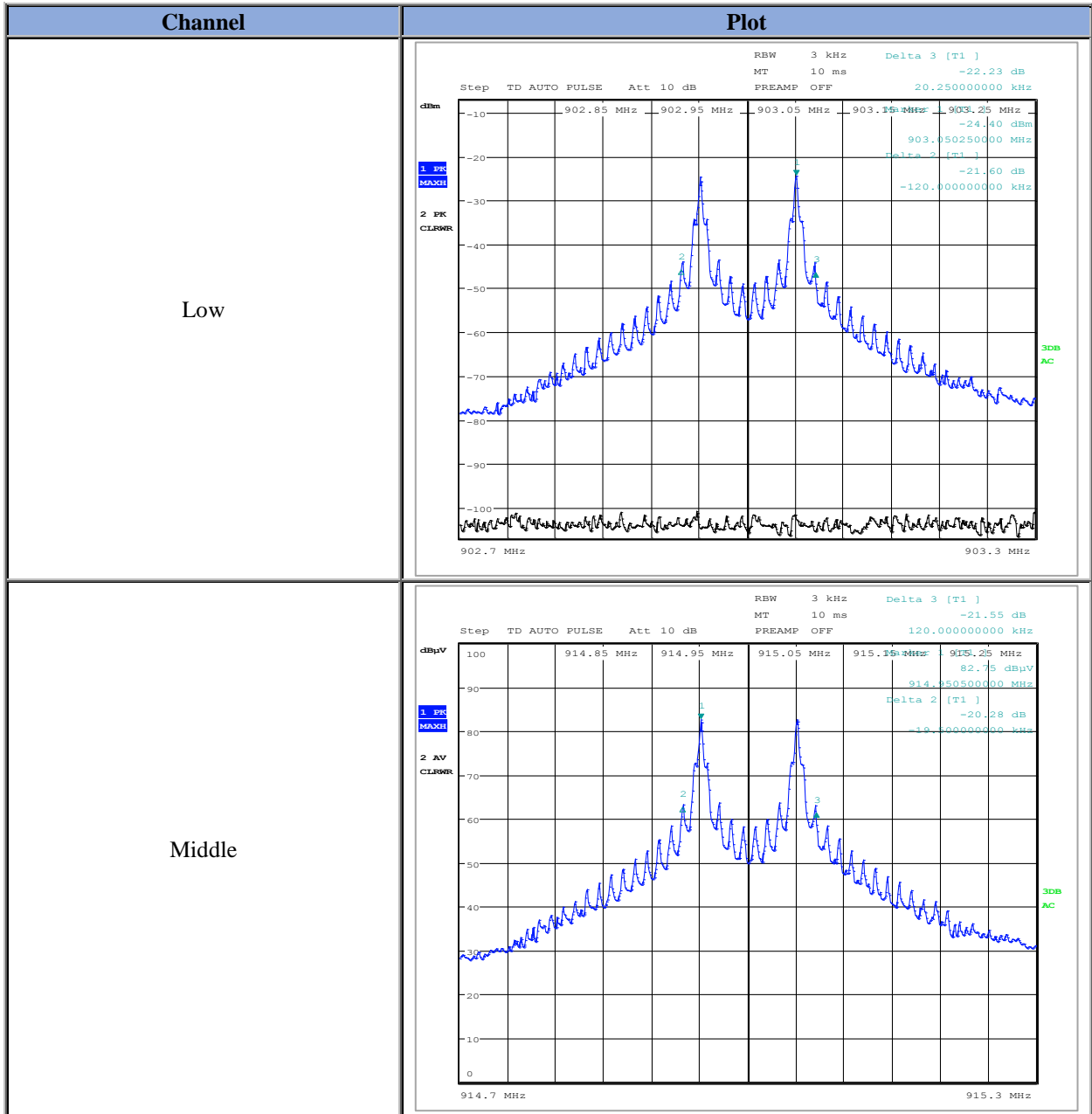


**Plot 10: 20dB Occupied Bandwidth Plot (High Data Rate)**

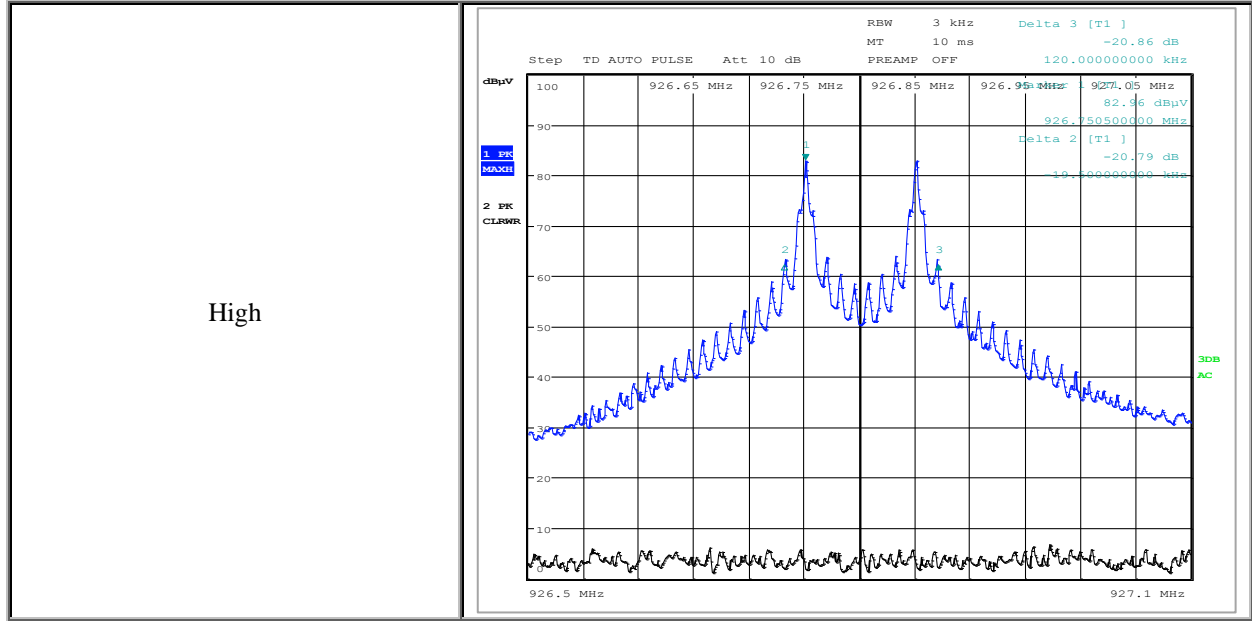
Unit Communicating to OEM Part 15 Approved Device

**Table 14: 20dB Occupied Bandwidth Data on Unit Communicating to OEM Part 15 Approved Device**

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	903.05	140.25
Middle	914.95	139.50
High	926.75	139.50







High

**Plot 11: 20dB Occupied Bandwidth Plot (Unit Communicating to OEM Part 15 Approved Device)**

## 4.4 Out of Band Emissions (Band Edge)

**Date Performed:**

March 7, 2017

**Test Standard:**

- FCC CFR 47 Part 15.247
- RSS-247 Issue 2

**Test Method:**

- ANSI C63.10:2013

**Test Requirement:**

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20dB. Attenuation below the general field strength limits specified in RSS-Gen Issue 4 is not required.

**Test Setup:**

The antenna port of EUT was directly connected to a spectrum analyzer.

**Measurement Method:**

The measurement method used for both radios was Section 6.10.6.2 Marker-delta Method of ANSI C63.10-2013 standard.

**Modifications:**

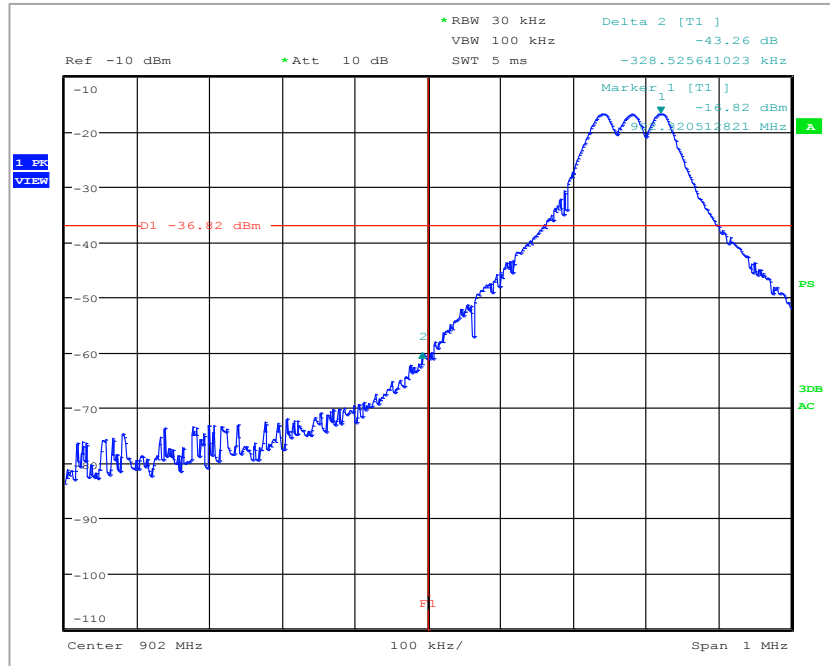
No modification was required to comply for this test.

**Result:**

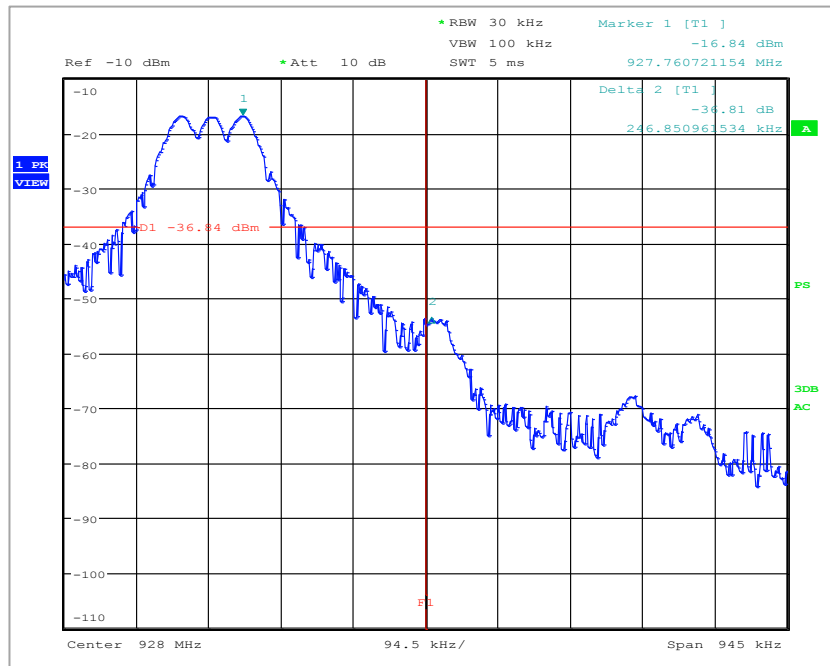
The EUT complies with the applicable standard.

**Measurement Data and Plot:**

Low Data Rate

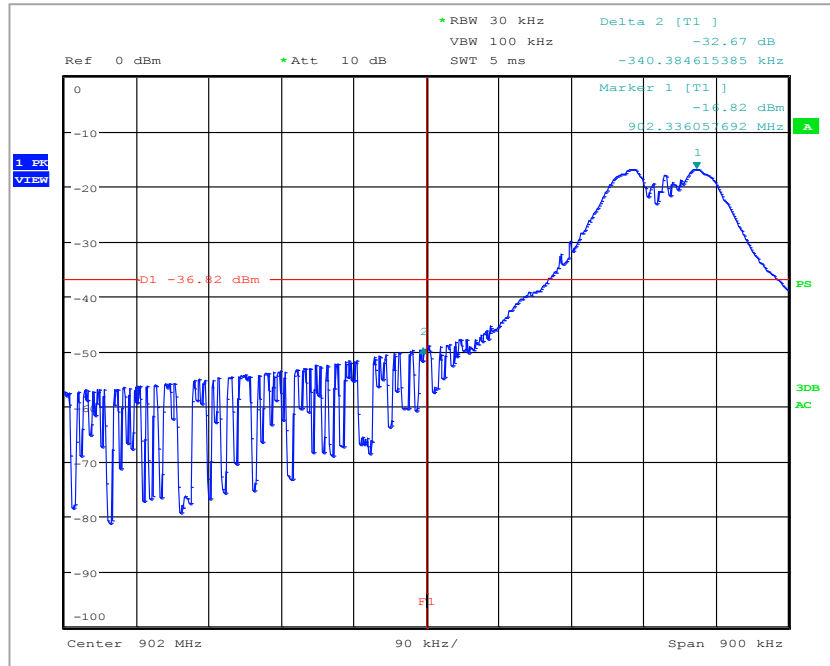


**Plot 12: Band Edge Plot (Low Channel ~902MHz)**

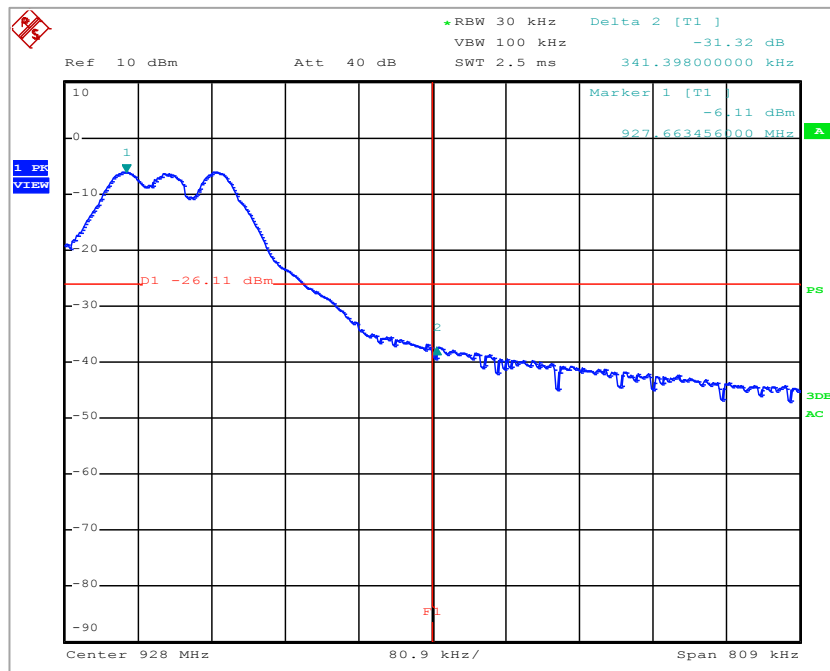


**Plot 13: Band Edge Plot (High Channel ~927.5MHz)**

**High Data Rate**

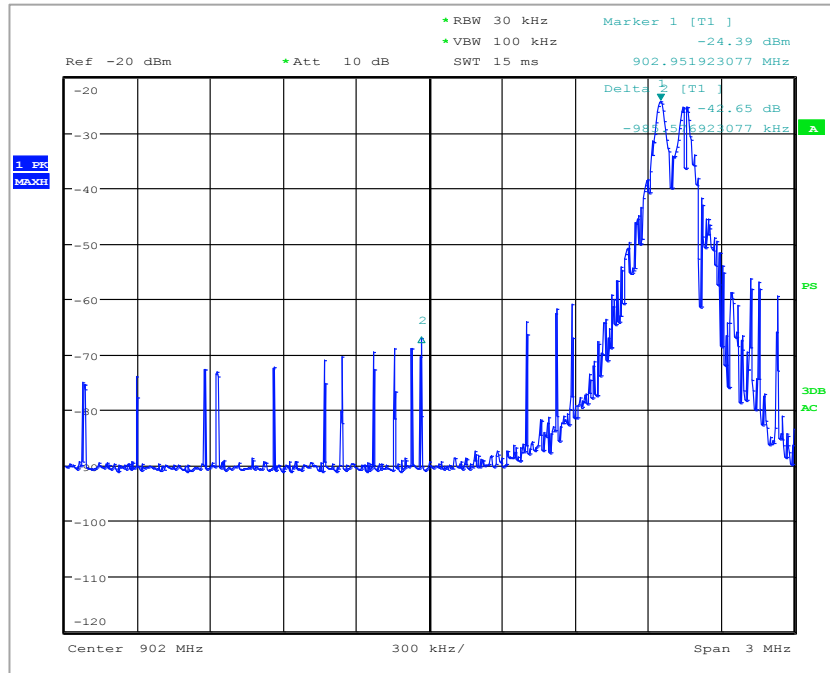


**Plot 14: Band Edge Plot (Low Channel ~902MHz)**

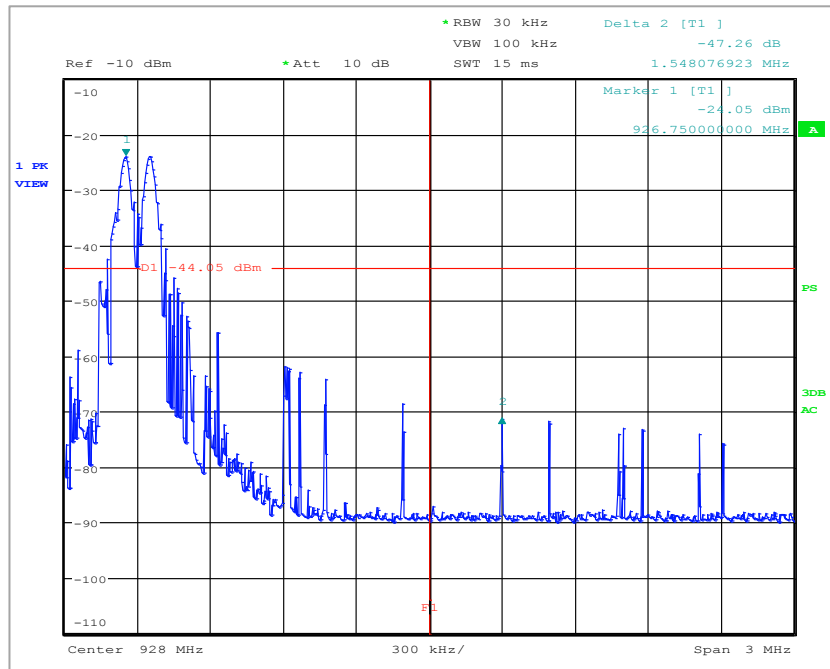


**Plot 15: Band Edge Plot (High Channel ~927.5MHz)**

Unit Communicating to OEM Part 15 Approved Device



**Plot 16: Band Edge Plot (Low Channel ~902MHz)**



**Plot 17: Band Edge Plot (High Channel ~927.5MHz)**

## 4.5 Channel Separation

**Date Performed:**

March 7, 2017

**Test Standard:**

- FCC CFR 47 Part 15.247
- RSS-247 Issue 2

**Test Method:**

- ANSI C63.10:2013

**Test Requirement:**

FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20dB bandwidth of the hopping channel, whichever is greater. 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 Setup:**

The antenna port of EUT was directly connected to a spectrum analyzer.

**Measurement Method:**

As called in ANSI C63.10-2013.

**Modifications:**

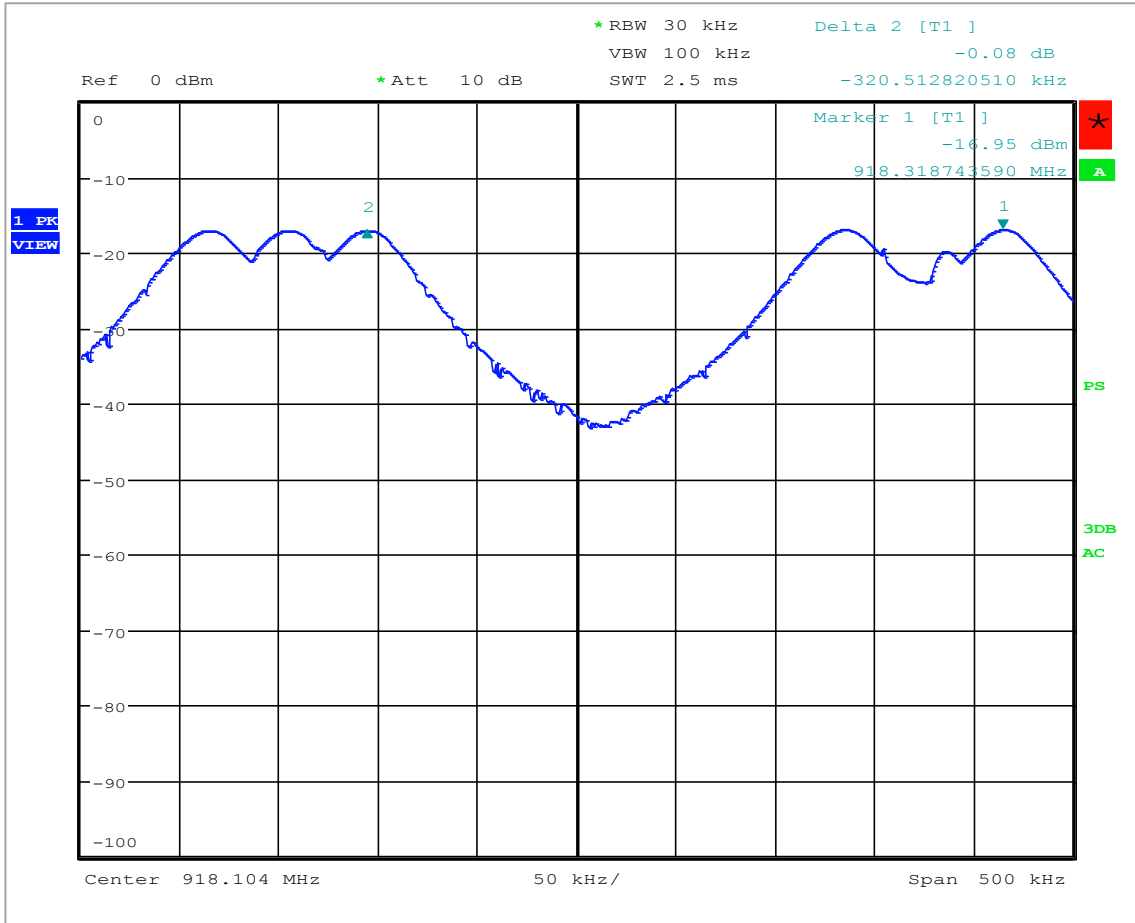
No modification was required to comply for this test.

**Result:**

The EUT complies with the applicable standard.

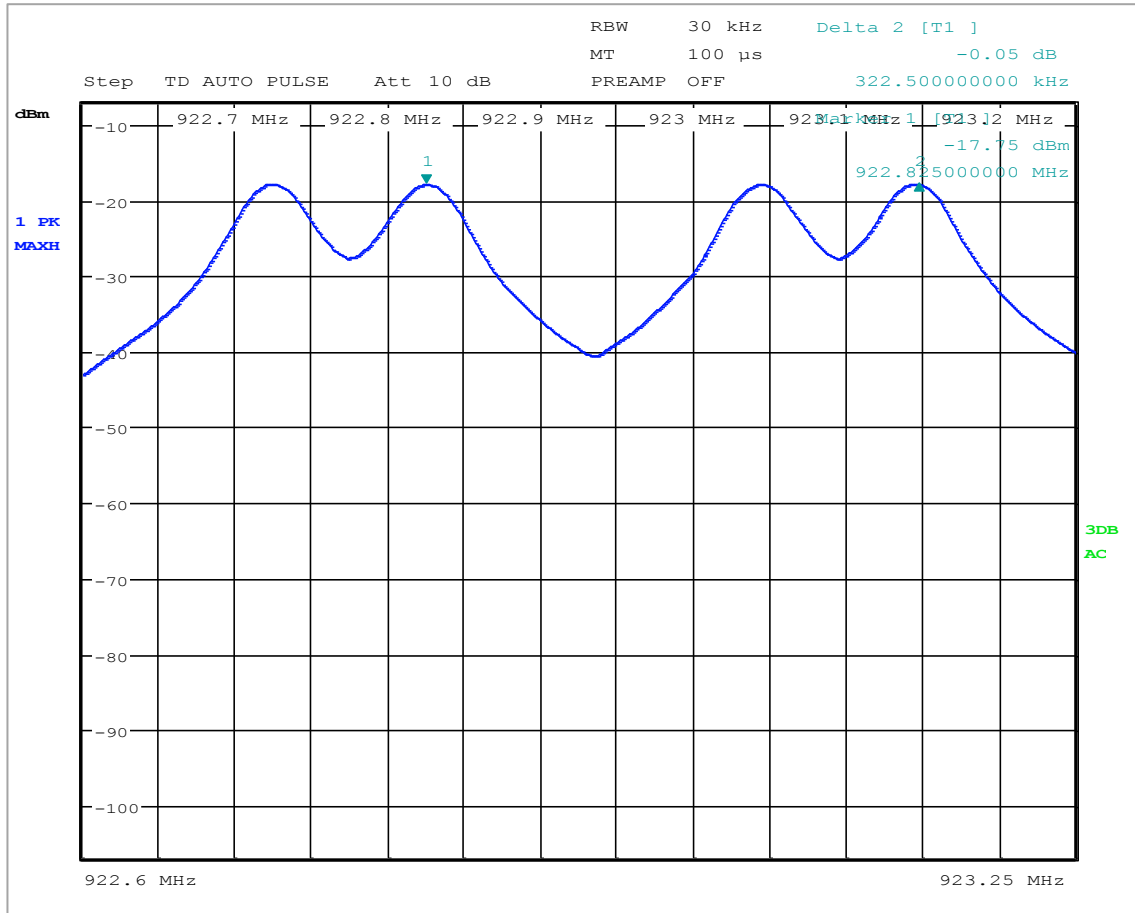
**Measurement Data and Plot:**

Low Data Rate



**Plot 18: Channel Separation → 320.51 kHz**

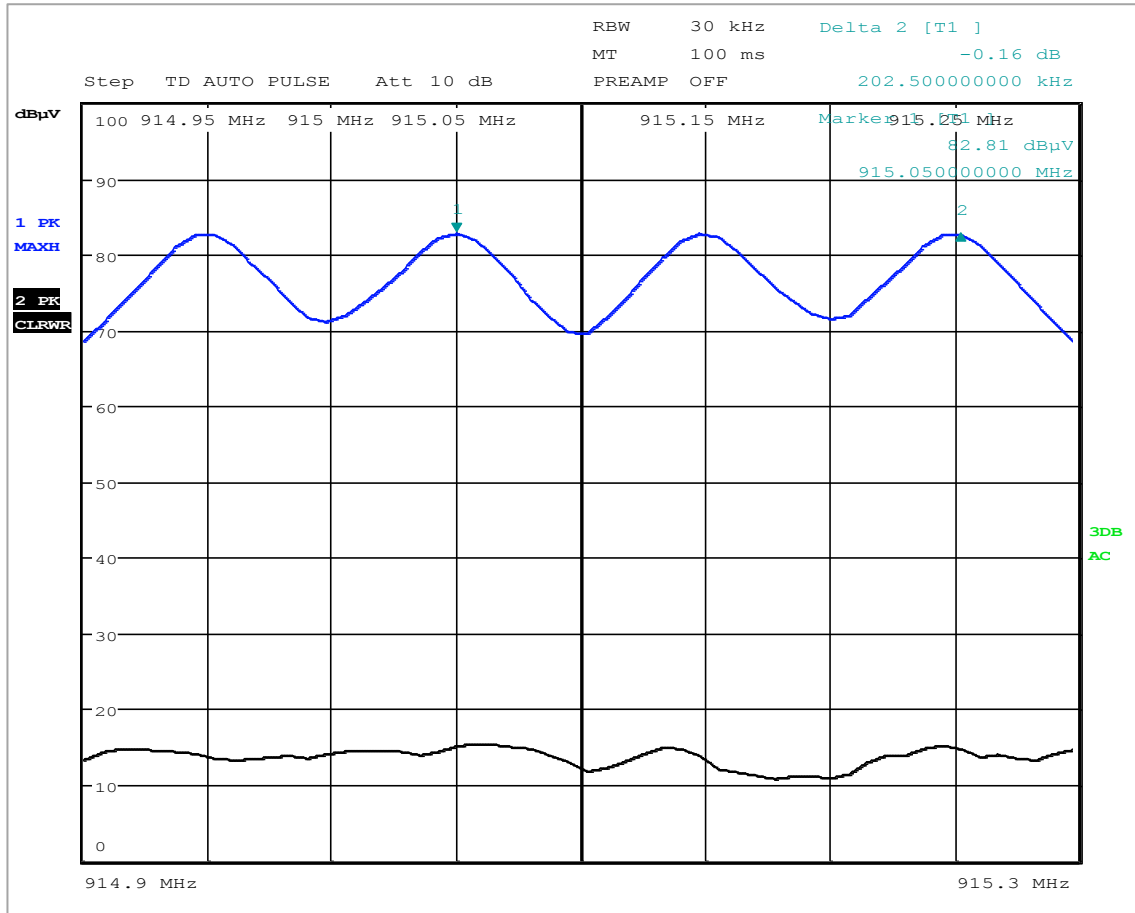
**High Data Rate**



**Plot 19: Channel Separation → 322.50 kHz**



Unit Communicating to OEM Part 15 Approved Device



**Plot 20: Channel Separation → 202.50 kHz**

## 4.6 Number of Hopping Channels

### Date Performed:

March 7, 2017

### Test Standard:

- FCC CFR 47 Part 15.247
- RSS-247 Issue 2

### Test Method:

- ANSI C63.10:2013

### Test Requirement:

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

### Test Setup:

The antenna port of EUT was directly connected to a spectrum analyzer.

### Measurement Method:

As called in ANSI C63.10-2013.

### Modifications:

No modification was required to comply for this test.

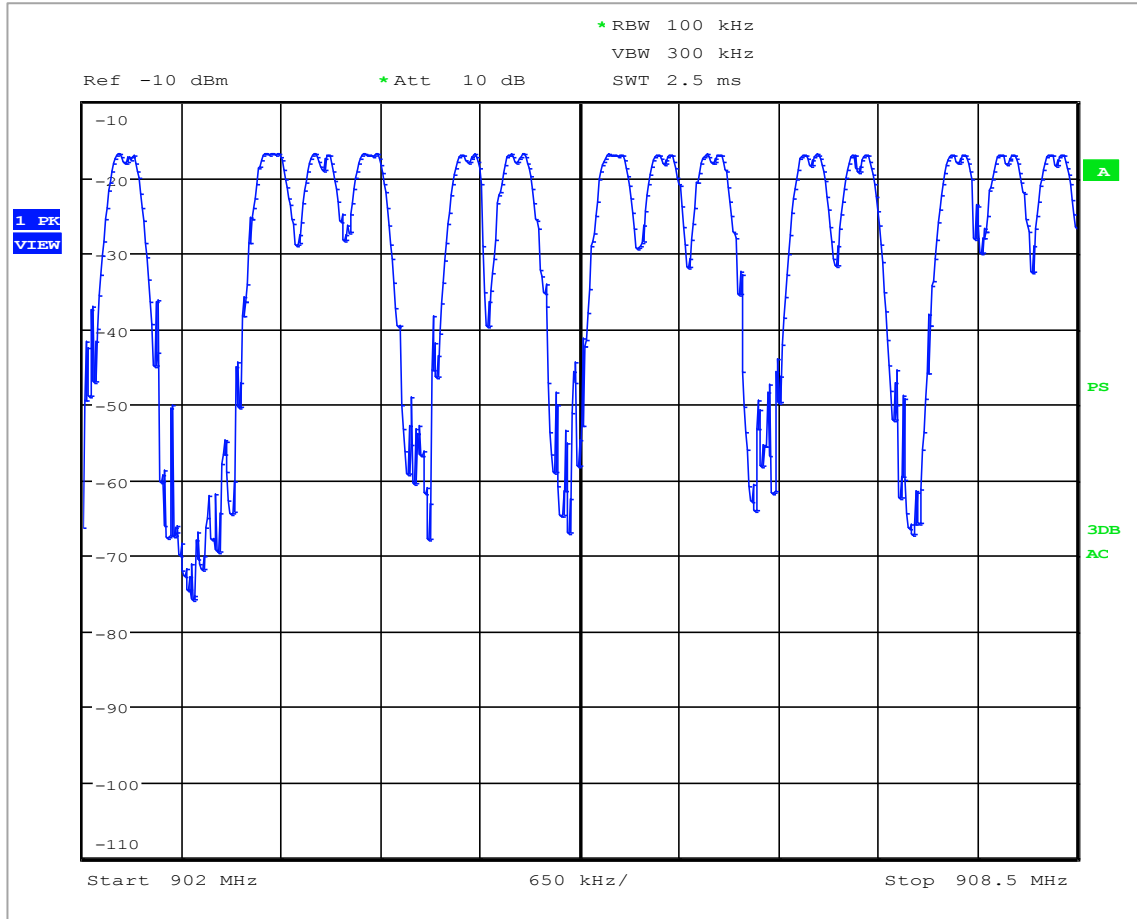
### Result:

The EUT complies with the applicable standard.

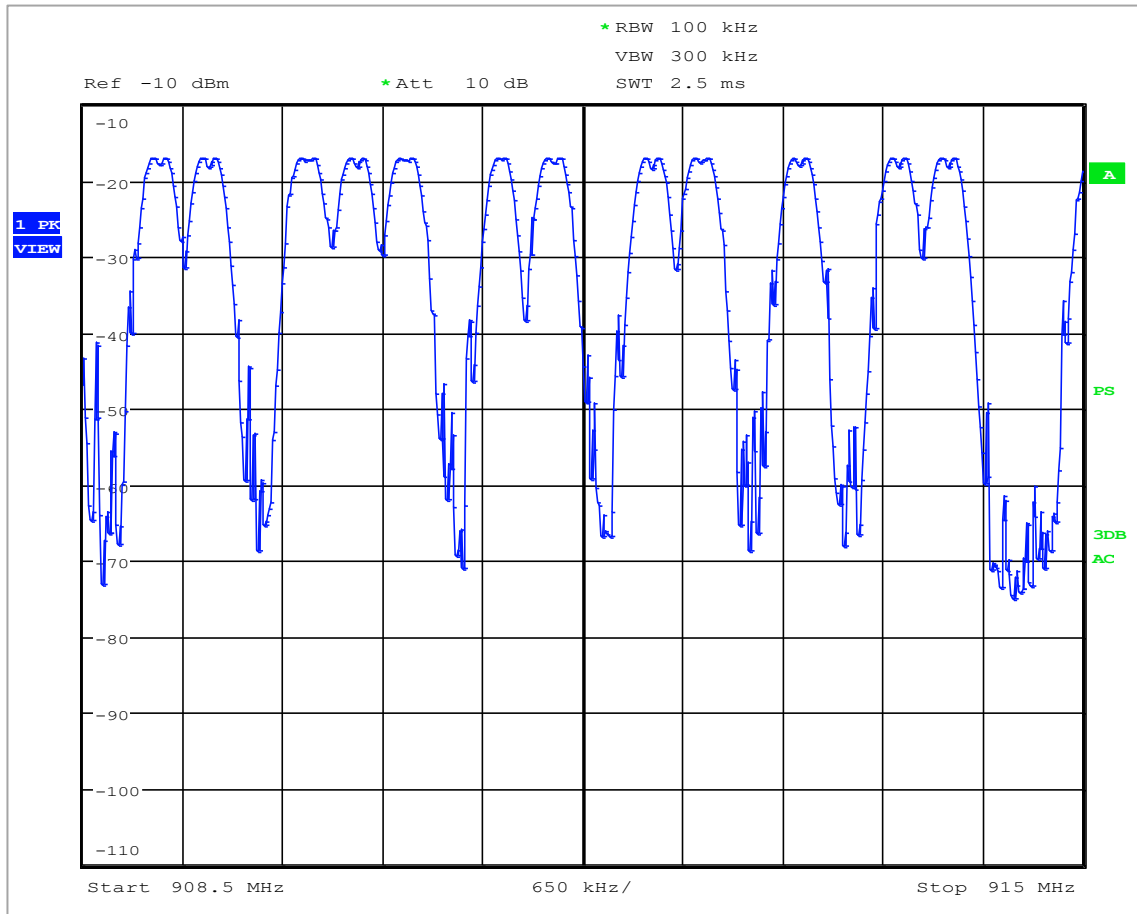
Data Rate	Frequency Range	Number of Hopping Frequencies
Low Data Rate & High Data Rate	902MHz to 908MHz	14
	908MHz to 915MHz	12
	915MHz to 921MHz	13
	921MHz to 928MHz	11
Unit Communicating to OEM Part 15 Approved Device	902MHz to 905MHz	10
	905MHz to 908MHz	15
	908MHz to 911MHz	15
	911MHz to 914MHz	15
	914MHz to 917MHz	15
	917MHz to 920MHz	15
	920MHz to 923MHz	15
	923MHz to 926MHz	15
	926MHz to 928MHz	5

**Measurement Data and Plot:**

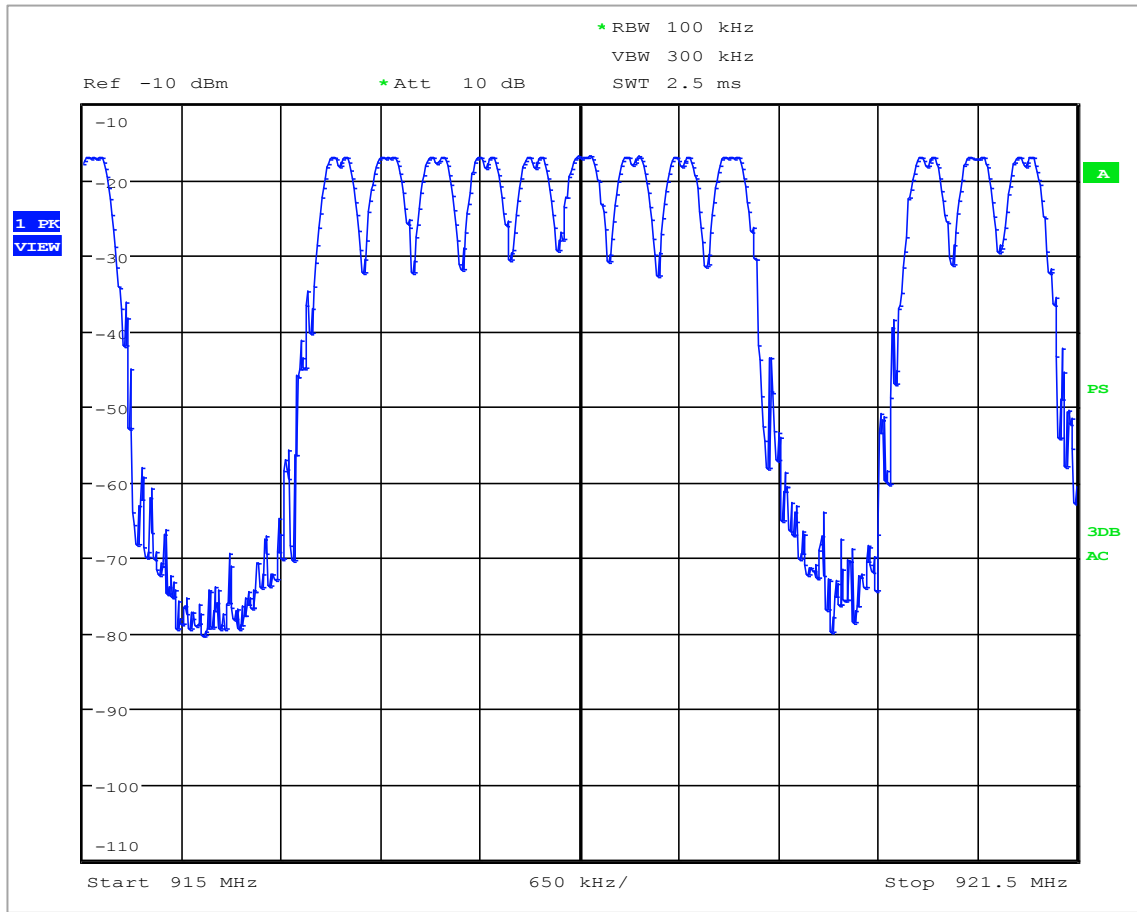
Low Data Rate



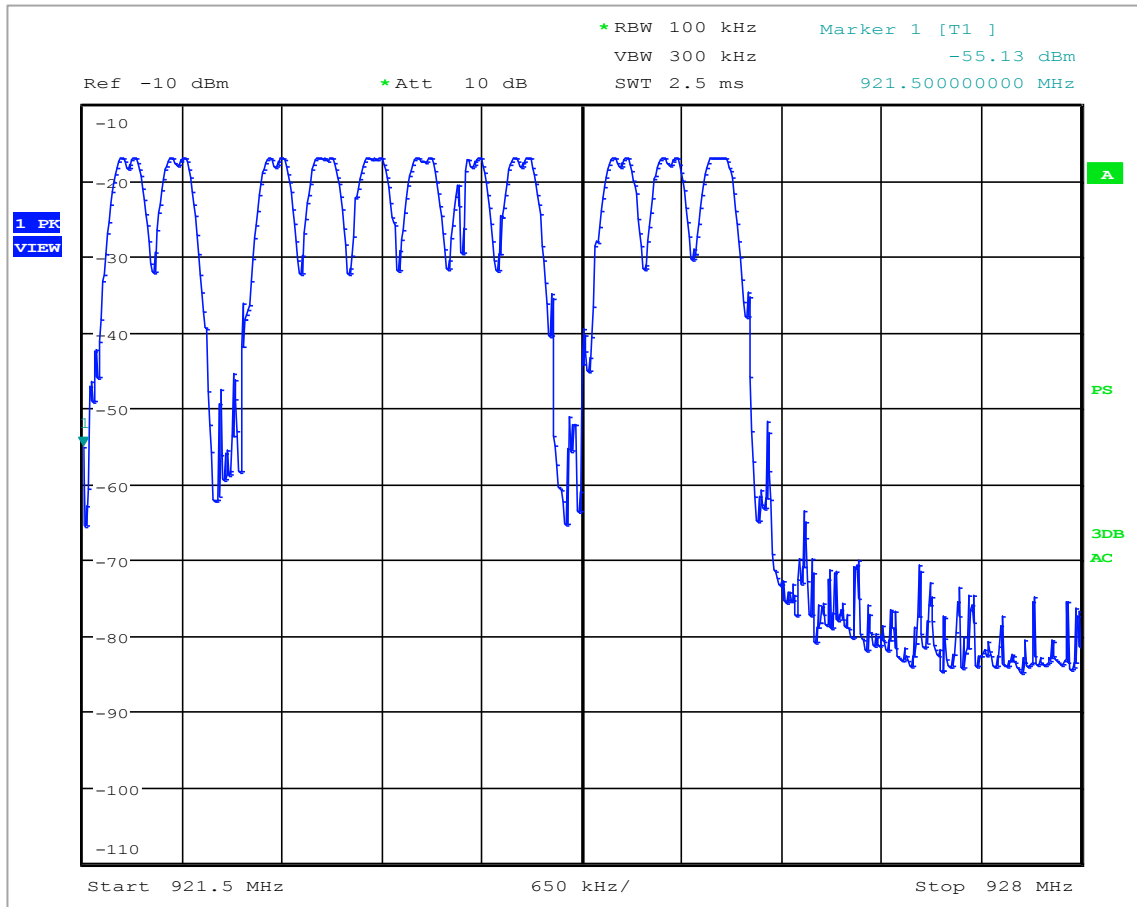
**Plot 21: Number of Hopping Channels → 902MHz to 908MHz ~14 frequencies**



**Plot 22: Number of Hopping Channels → 908MHz to 915MHz ~12 frequencies**

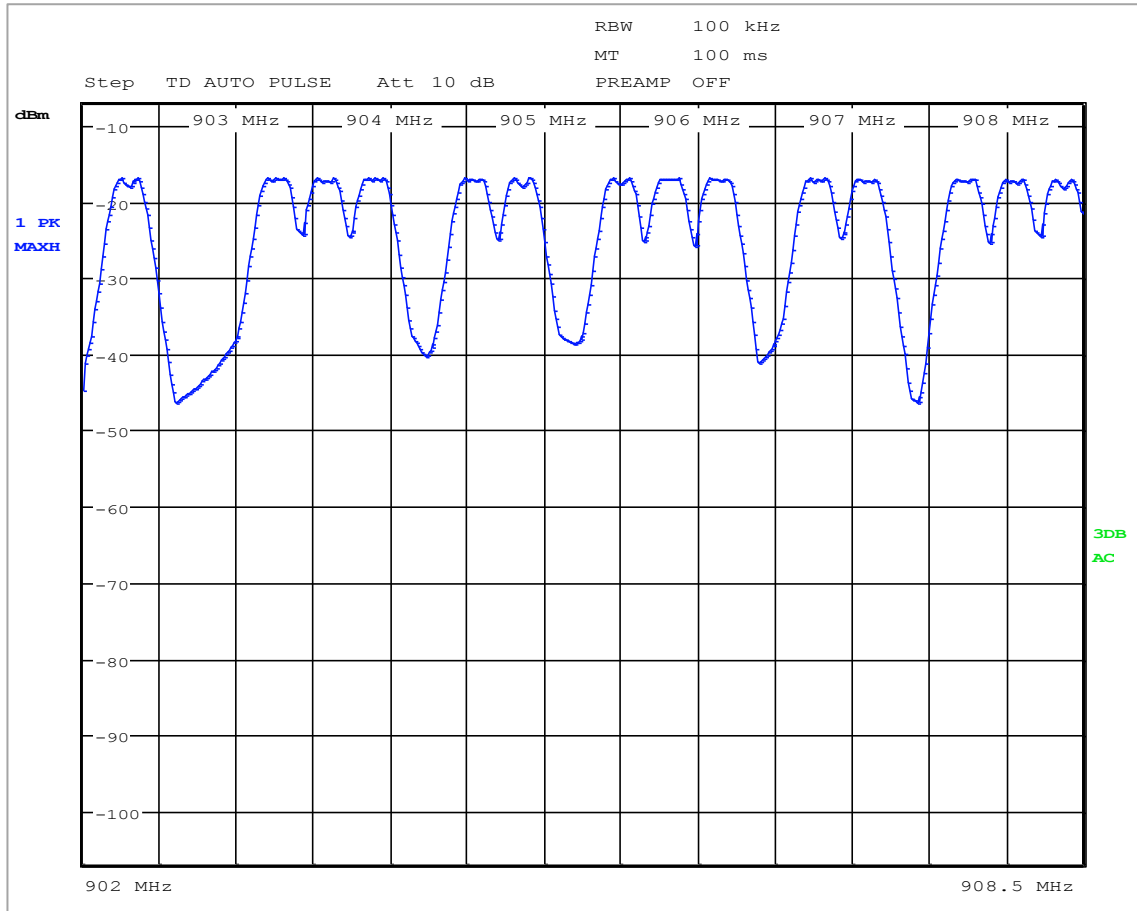


**Plot 23: Number of Hopping Channels → 915MHz to 921MHz ~13 frequencies**

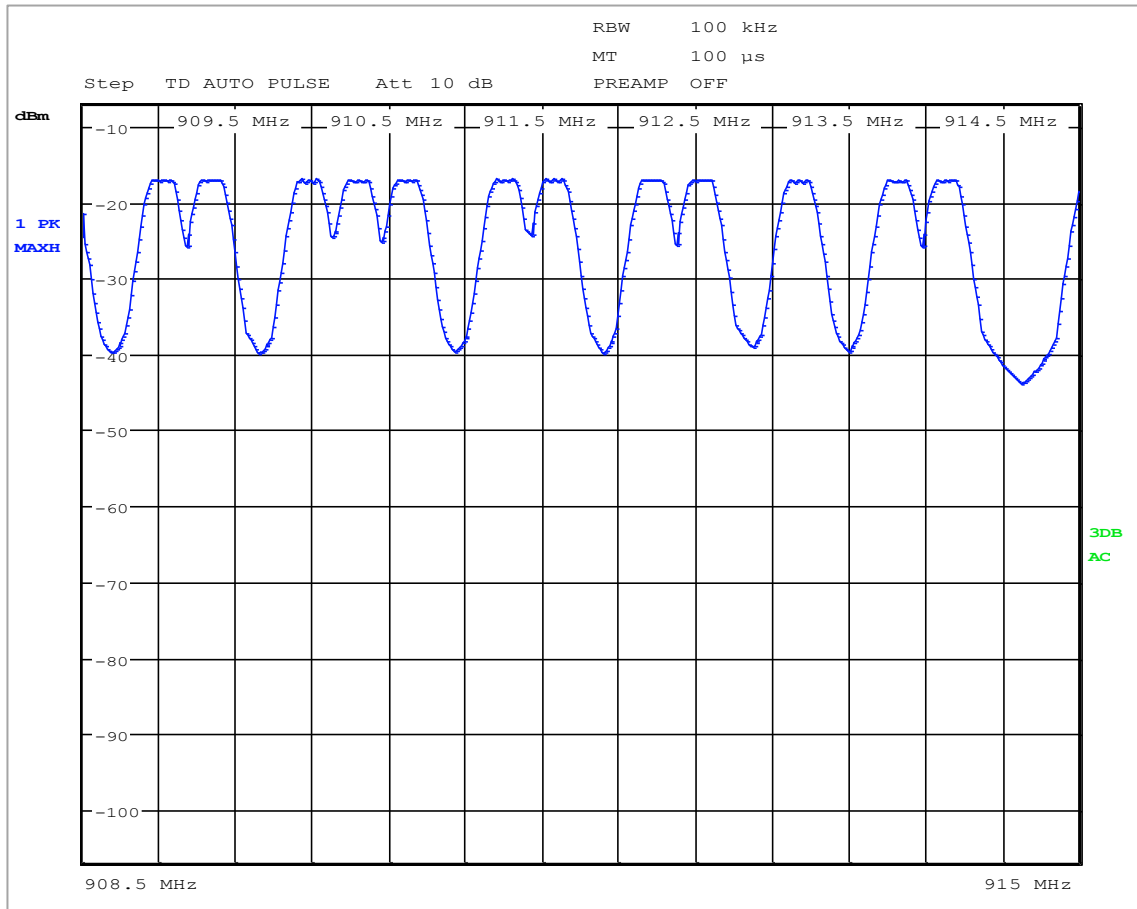


**Plot 24: Number of Hopping Channels → 921MHz to 928MHz ~11 frequencies**

**High Data Rate**

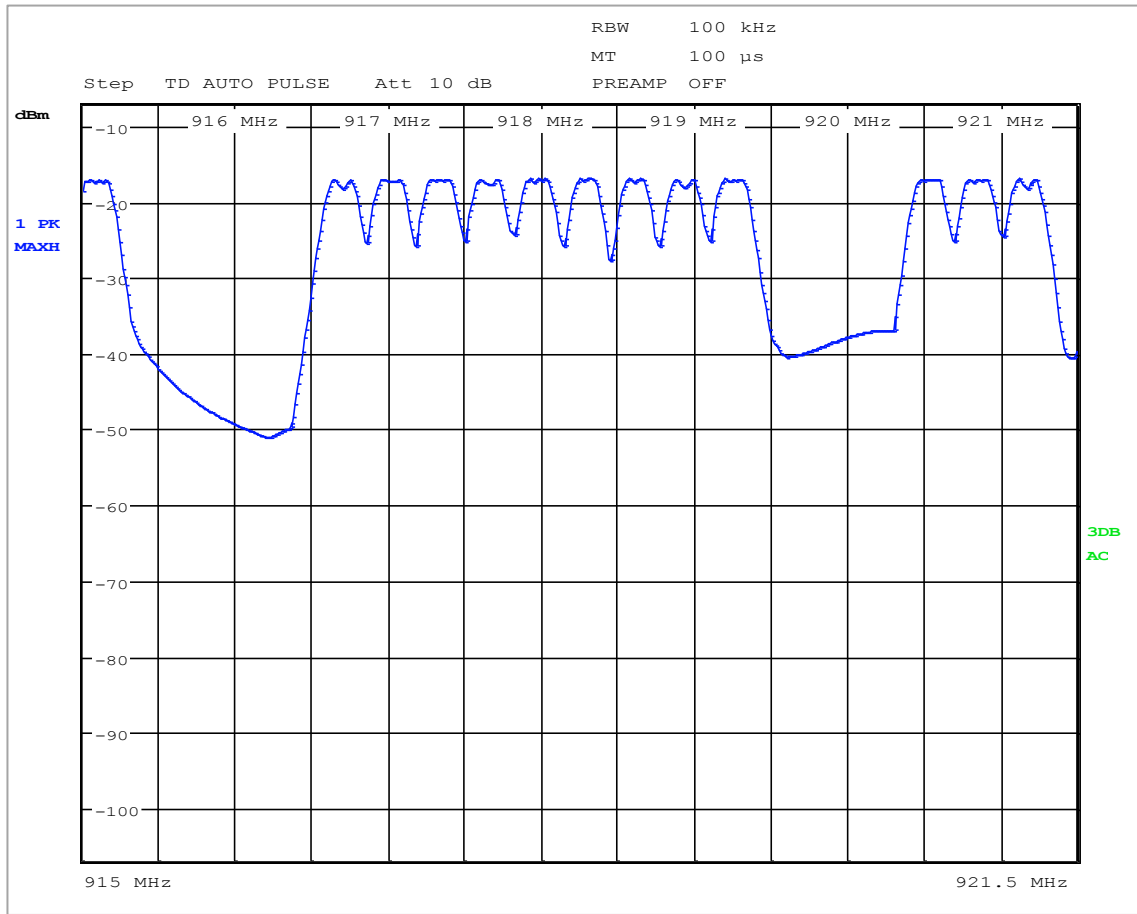


**Plot 25: Number of Hopping Channels → 902MHz to 908MHz ~14 frequencies**

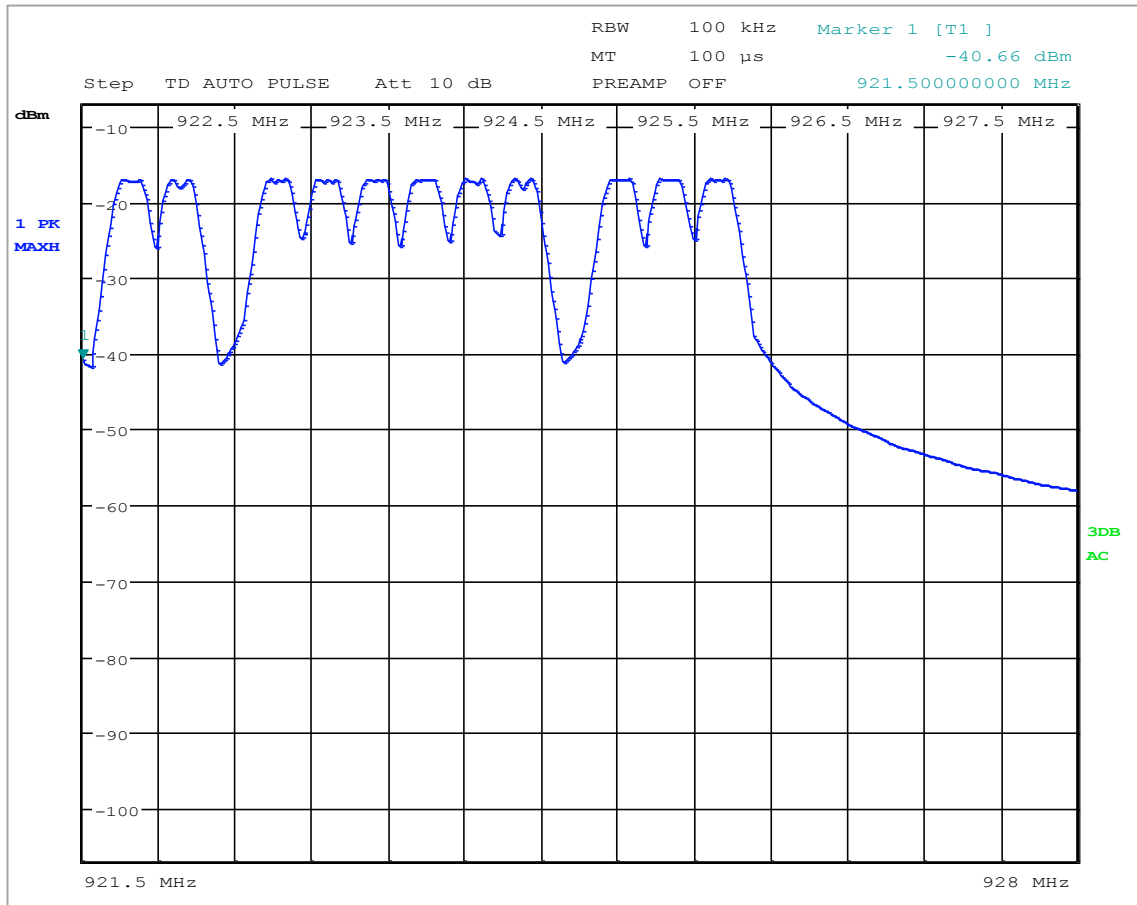


**Plot 26: Number of Hopping Channels → 908MHz to 915MHz ~12 frequencies**



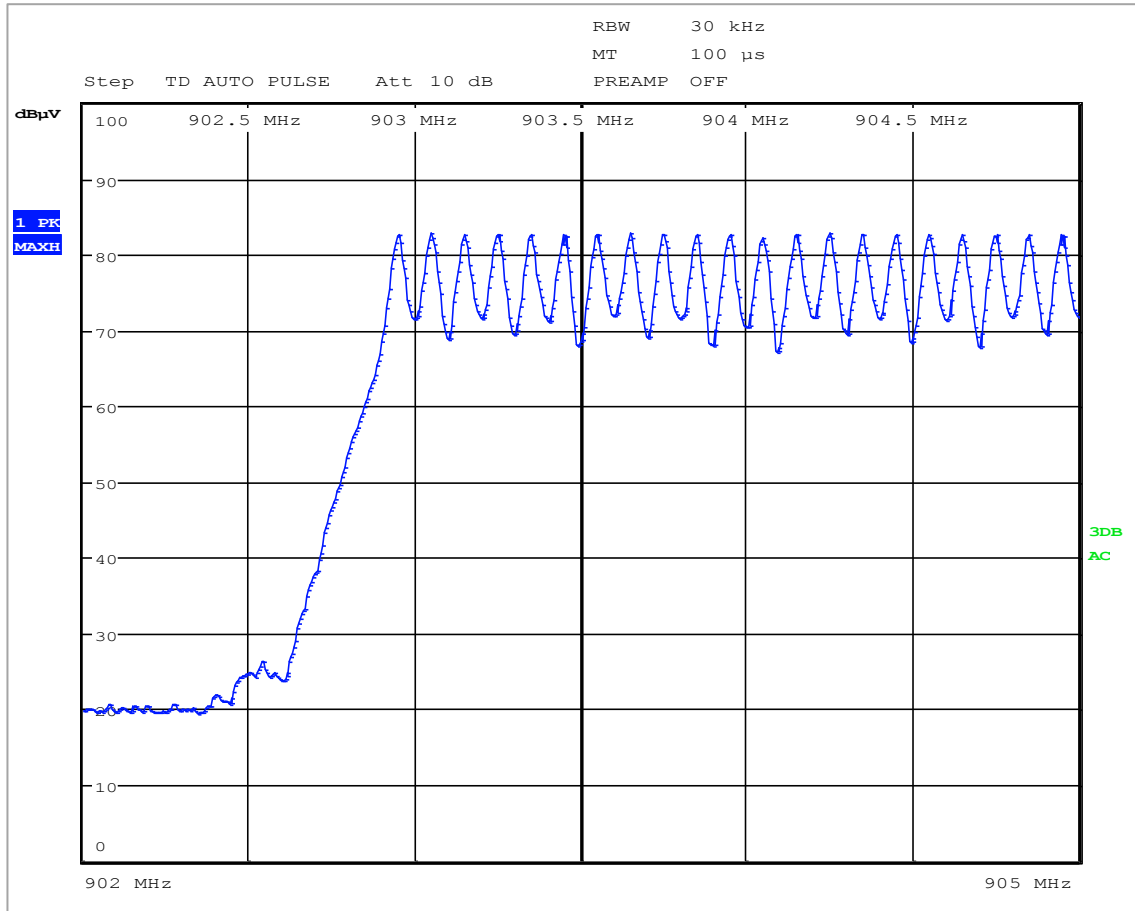


**Plot 27: Number of Hopping Channels → 915MHz to 921MHz ~13 frequencies**

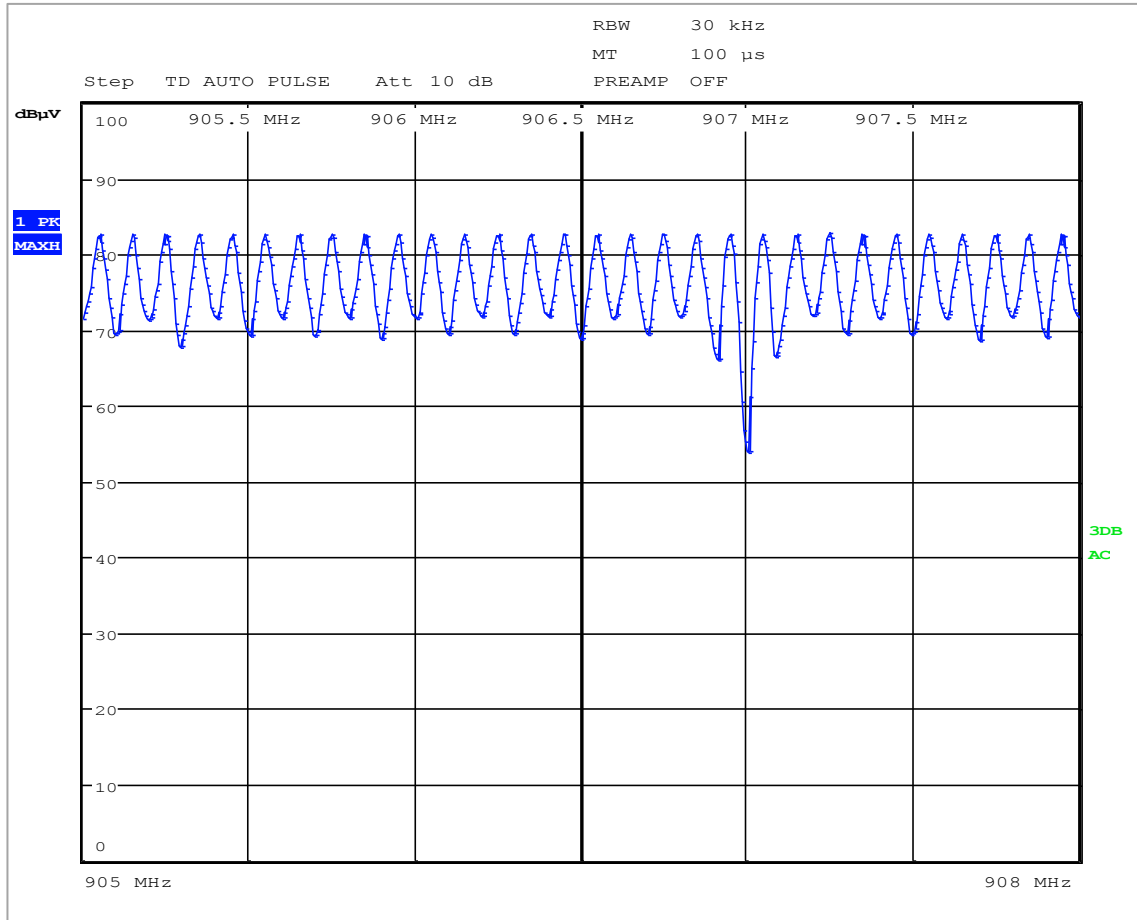


**Plot 28: Number of Hopping Channels → 921MHz to 928MHz ~11 frequencies**

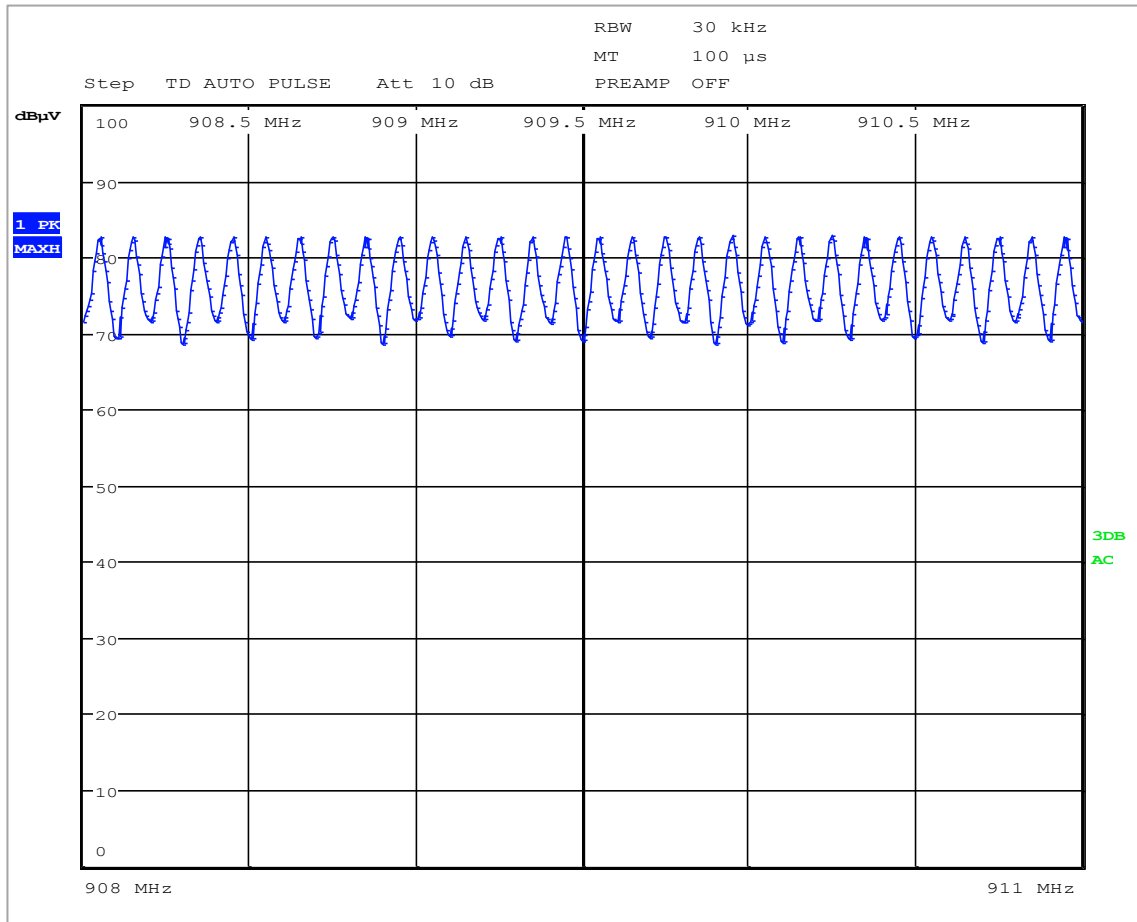
Unit Communicating to OEM Part 15 Approved Device



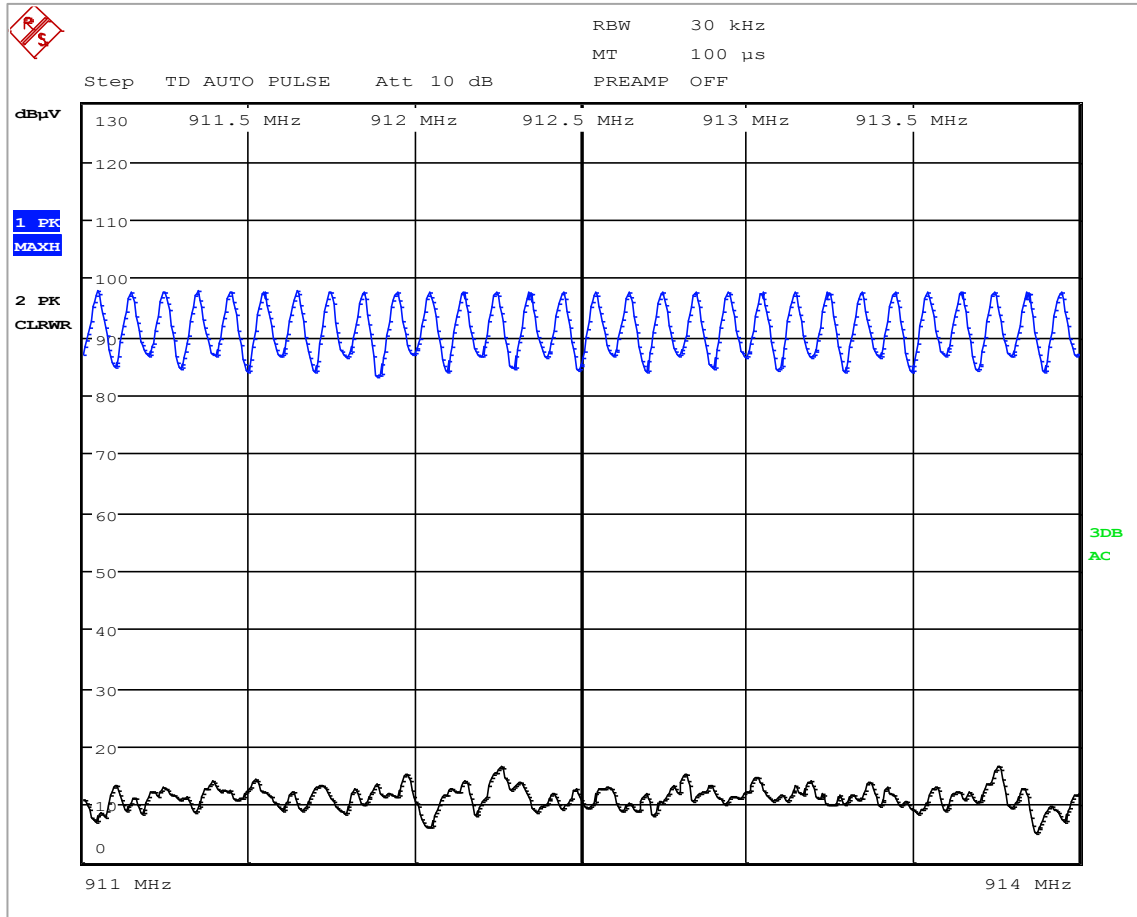
**Plot 29: Number of Hopping Channels → 902MHz to 905MHz ~10 frequencies**



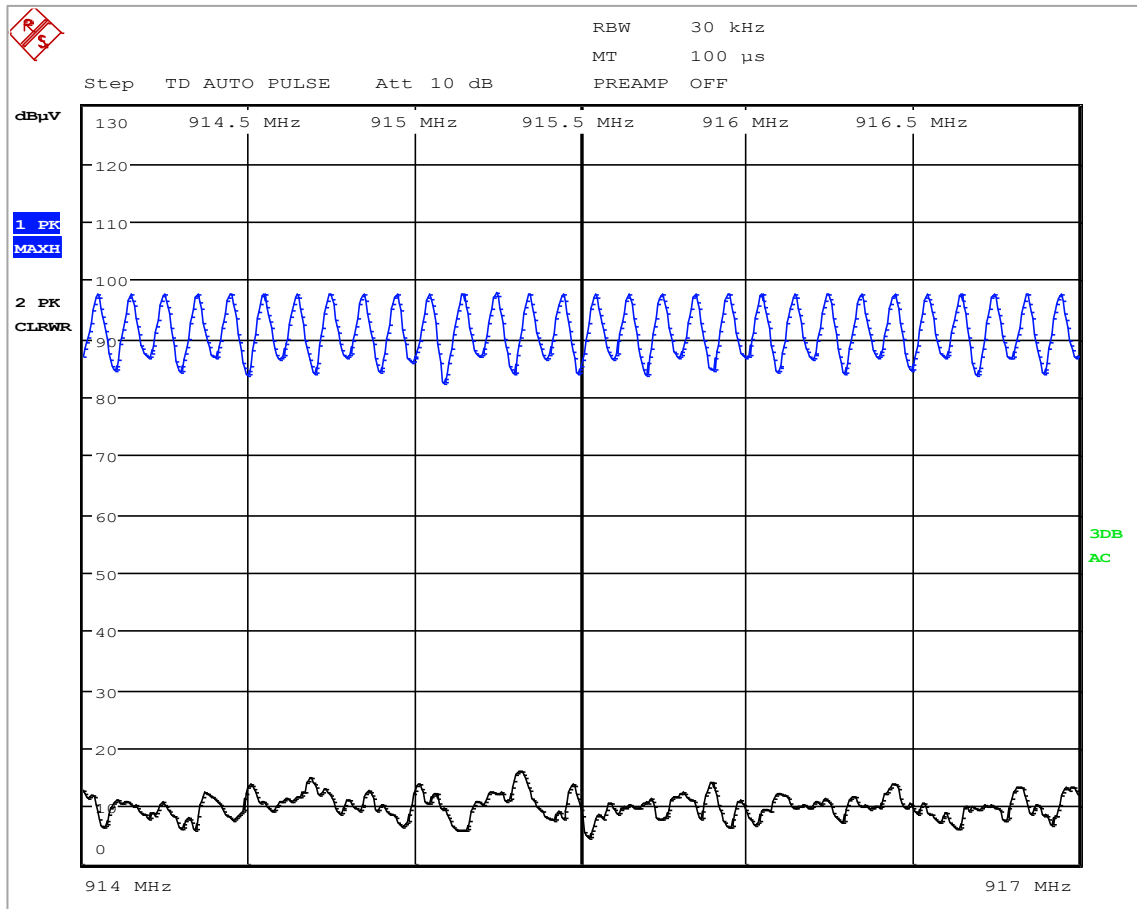
**Plot 30: Number of Hopping Channels → 905MHz to 908MHz ~15 frequencies**



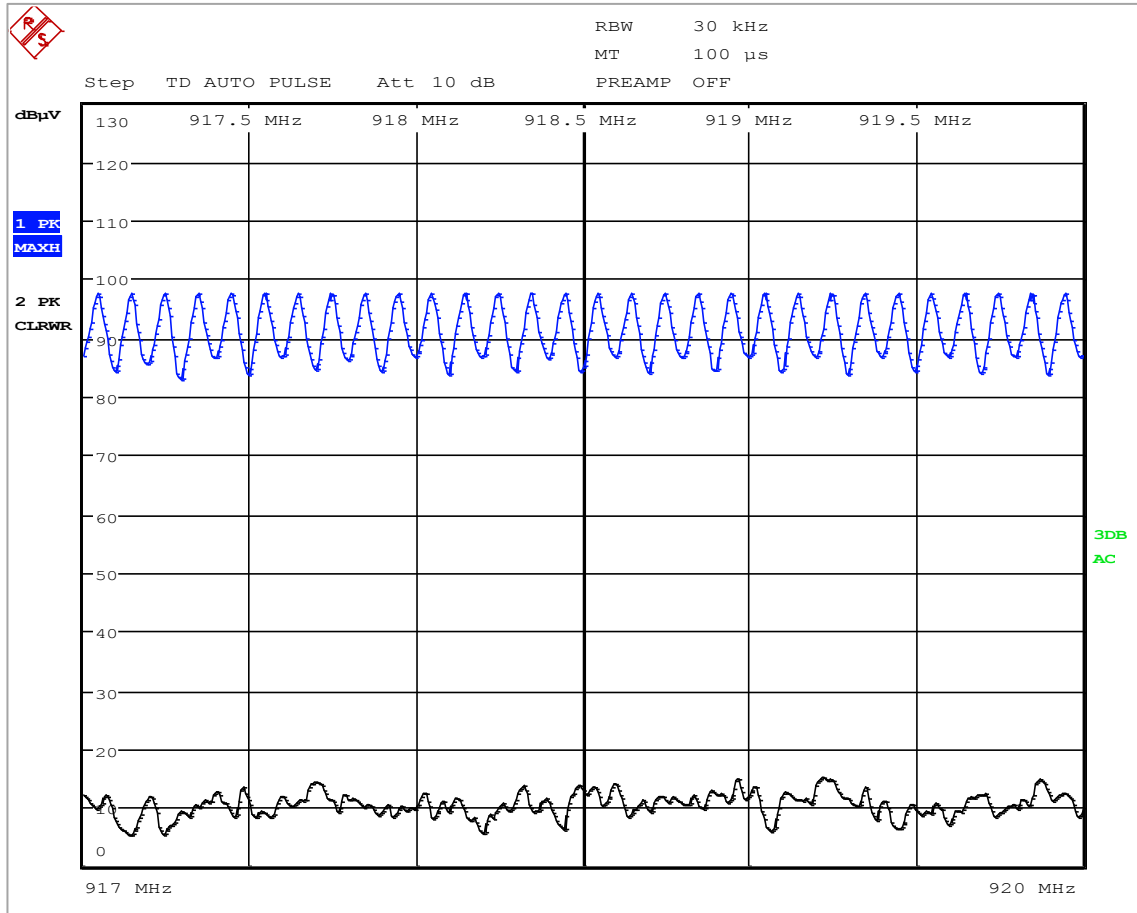
**Plot 31: Number of Hopping Channels → 908MHz to 911MHz ~15 frequencies**



**Plot 32: Number of Hopping Channels → 911MHz to 914MHz ~15 frequencies**

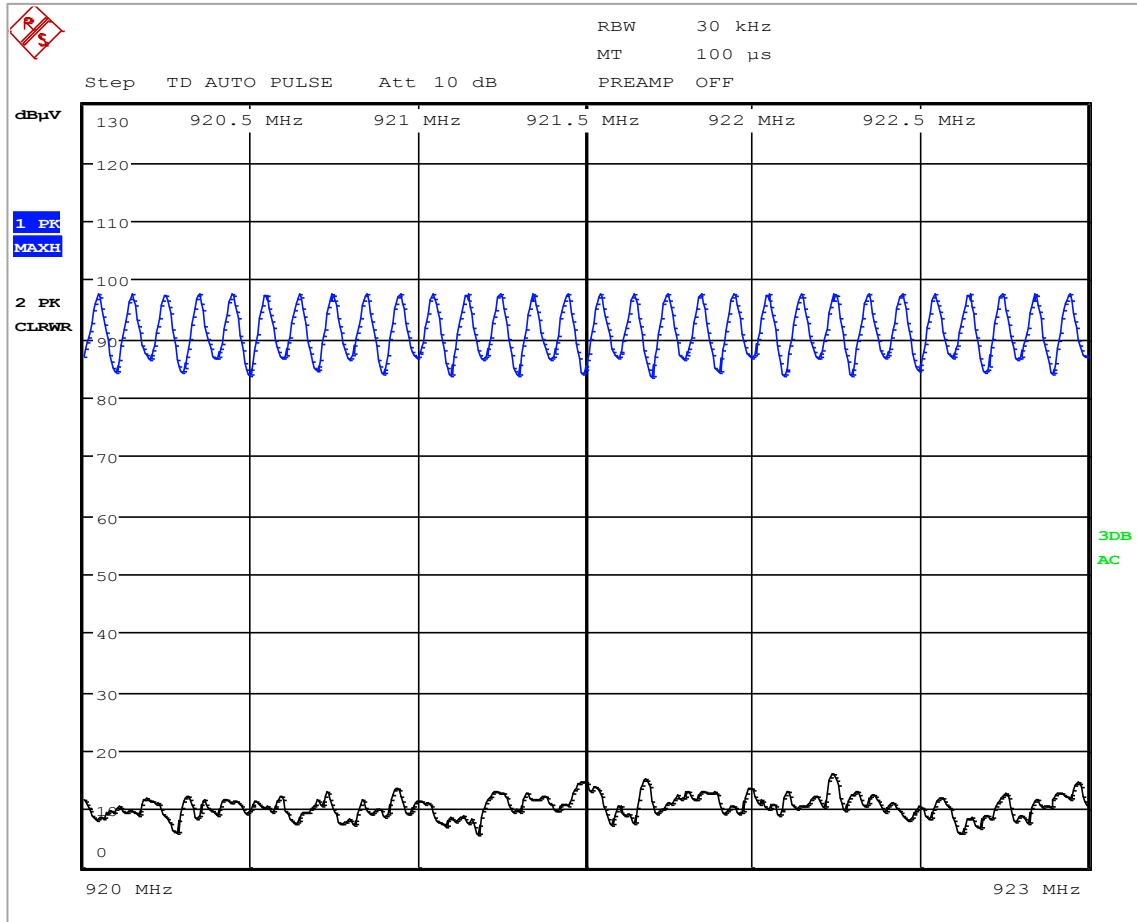


**Plot 33: Number of Hopping Channels → 914MHz to 917MHz ~15 frequencies**

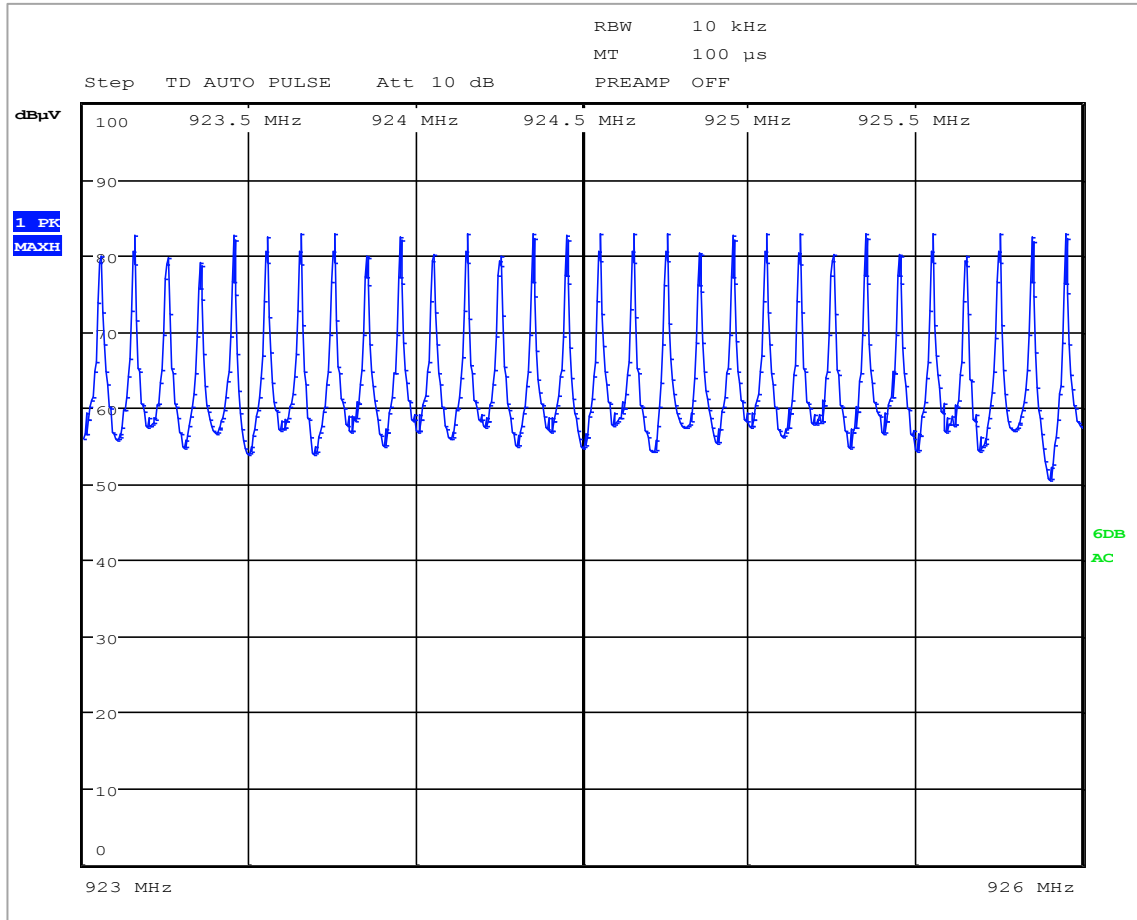


**Plot 34: Number of Hopping Channels → 917MHz to 920MHz ~15 frequencies**

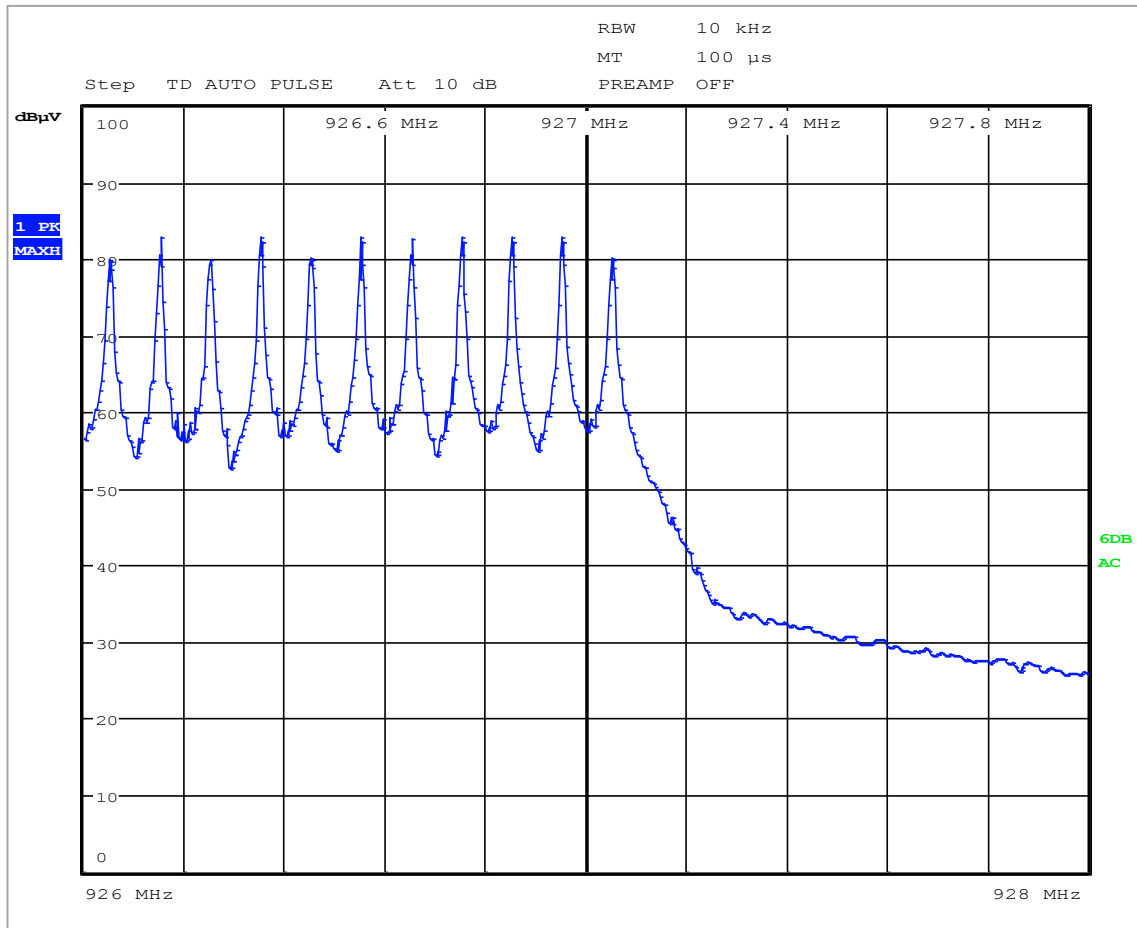




**Plot 35: Number of Hopping Channels → 920MHz to 923MHz ~15 frequencies**



**Plot 36: Number of Hopping Channels → 923MHz to 926MHz ~15 frequencies**



**Plot 37: Number of Hopping Channels → 926MHz to 928MHz ~5 frequencies**

## 4.7 Dwell Time and Time Occupancy Per Frequency

**Date Performed:**

March 7, 2017

**Test Standard:**

- FCC CFR 47 Part 15.247
- RSS-247 Issue 2

**Test Method:**

- ANSI C63.10:2013

**Test Requirement:**

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

**Test Setup:**

The antenna port of EUT was directly connected to a spectrum analyzer.

**Measurement Method:**

As called in ANSI C63.10-2013.

**Modifications:**

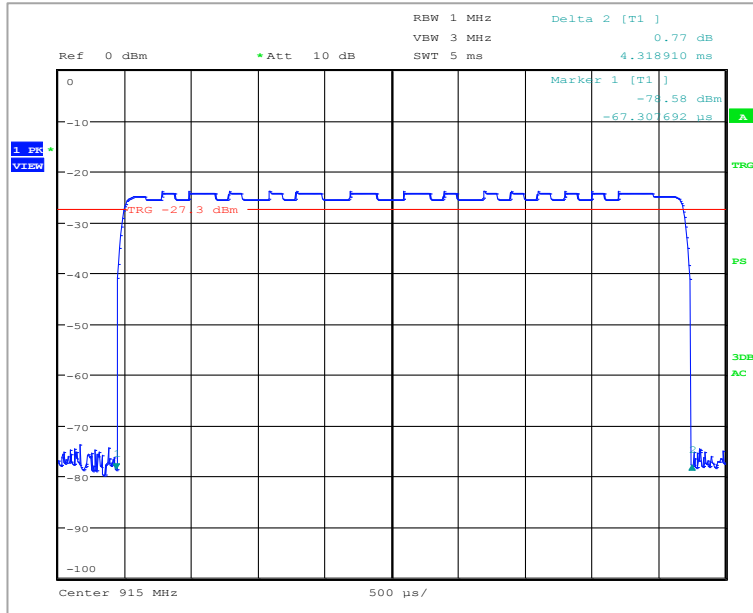
No modification was required to comply for this test.

**Result:**

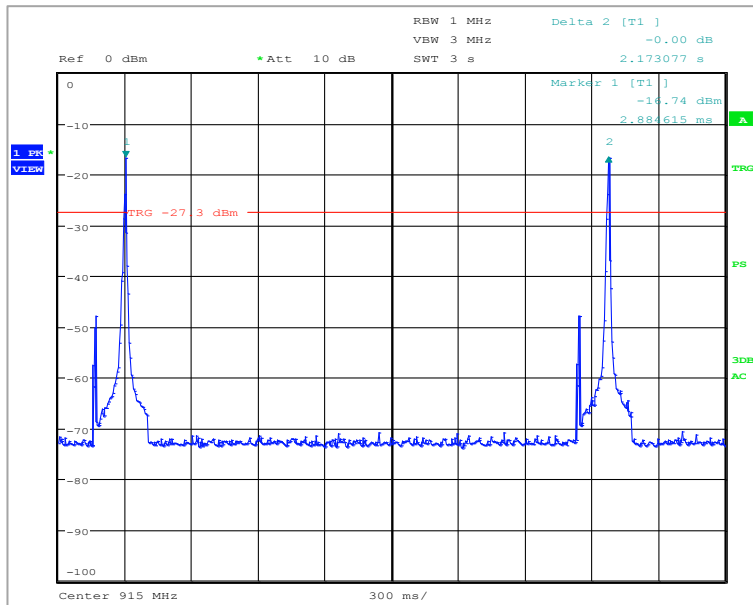
The EUT complies with the applicable standard.

**Measurement Data and Plot:**

Low Data Rate



**Plot 38: Dwell Time → 4.319ms**



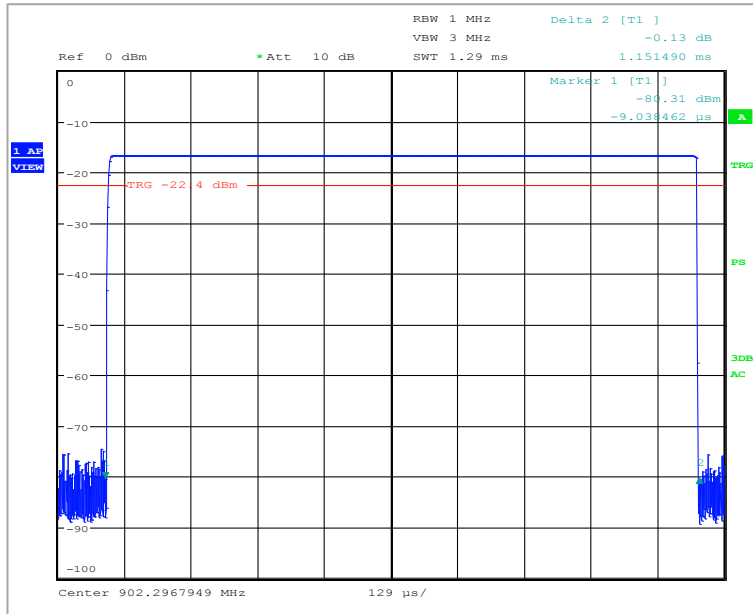
**Plot 39: Time Occupancy Per Frequency → 39.75ms**

Time between 2 consecutive transmissions on the same frequency is 2.173s

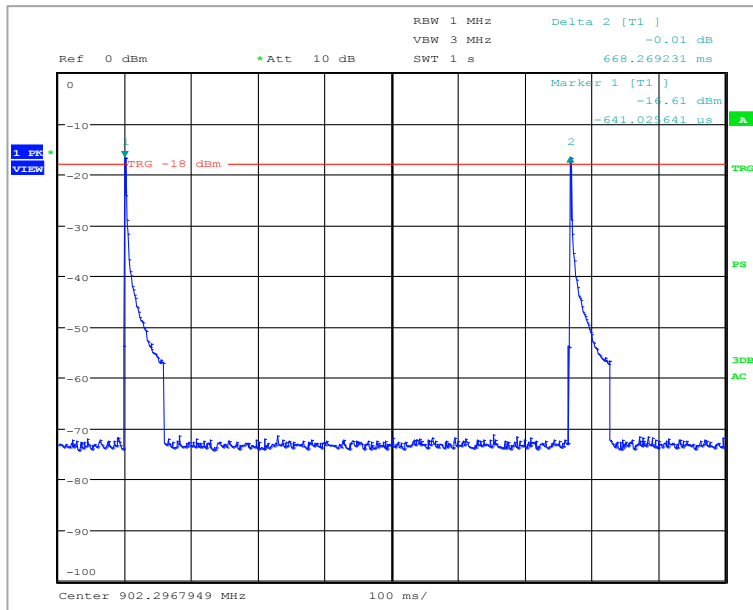
Dwell time per frequency is 4.319ms

Therefore, occupancy time per frequency within 20 seconds' period is  $\frac{0.004319s \times 20s}{2.173s} = 39.75ms$

High Data Rate



**Plot 40: Dwell Time → 1.151ms**



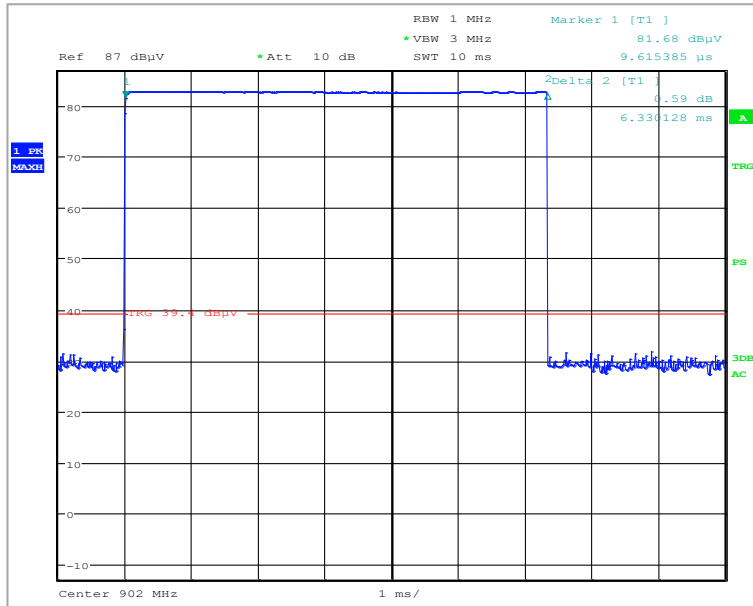
**Plot 41: Time Occupancy Per Frequency → 34.46ms**

Time between 2 consecutive transmissions on the same frequency is 0.668s

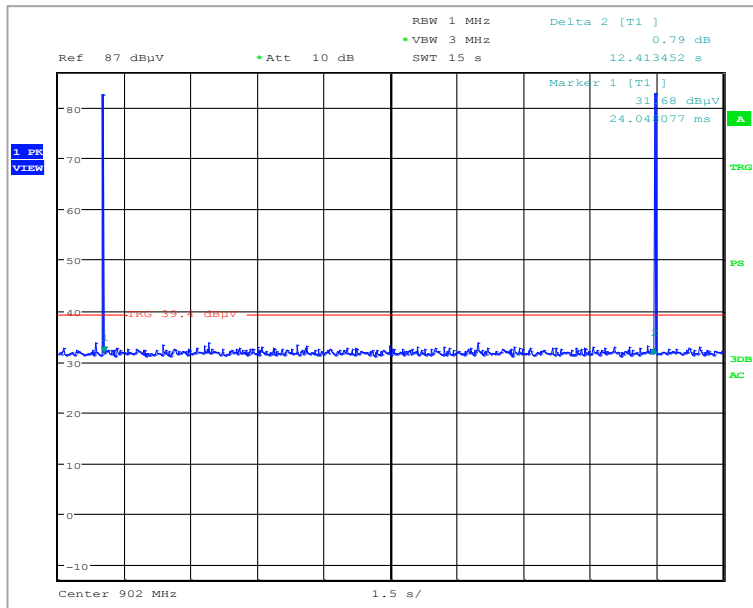
Dwell time per frequency is 1.151ms

Therefore, occupancy time per frequency within 20 seconds' period is  $\frac{0.001151s \times 20s}{0.668s} = 34.46ms$

Unit Communicating to OEM Part 15 Approved Device



**Plot 42: Dwell Time → 6.33ms**



**Plot 43: Time Occupancy Per Frequency → 1.055ms**

There are 120 channels in the pseudo random sequence when EUT is communicating to OEM Part 15 approved device, therefore, next same channel will be used is in 120s

Dwell time per frequency is 6.33ms

Therefore, occupancy time per frequency within 20 seconds' period is  $\frac{0.00633s \times 20s}{120s} = 1.055ms$

## 4.8 Radiated Spurious Emissions Transmit Mode

### Date Performed:

March 6, 2017

### Test Standard:

- FCC CFR 47 Part 15.247
- FCC CFR 47 Part 15.209
- FCC CFR 47 Part 15.205
- RSS-247 Issue 2
- RSS-Gen Issue 4

### Test Method:

- ANSI C63.10:2013
- RSS-Gen Issue 4

### Test Requirement:

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general field strength limits listed in Rss-Gen Issue 4, whichever is less stringent.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

**Unwanted emissions falling into restricted bands of shall comply with the limits specified below**

Frequency (MHz)	Field Strength (dB $\mu$ V/m) at 3m
0.009 – 0.490	128.5 – 93.8
0.490 – 1.705	73.8 – 63.0
1.705 – 30.0	69.5

Frequency (MHz)	Field Strength Quasi Peak dB $\mu$ V/m @ 3m
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
Above 960	54.0



**FCC PART 15.205-RESTRICTED BANDS OF OPERATION**

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
<sup>1</sup> 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	( <sup>2</sup> )
13.36-13.41			

\* - note FCC-specific .

Canada-specific frequency ranges in MHz – 3.020-3.026, 5.677–5.683, 121.94-123.0. 149.9-150.05, 162.0125-167.17, 167.72-173.2, 1300-1427, 2483.5-2500, 3500-3600,

**(2) Above 38,6 GHz**

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

**RESTRICTED FREQUENCY BANDS (RSS-GEN ISSUE 4)**

MHz	MHz	GHz
0.090-0.110	240-285	9.0-9.2
2.1735-2.1905	322-335.4	9.3-9.5
3.020-3.026	399.9-410	10.6-12.7
4.125-4.128	608-614	13.25-13.4
4.17725-4.17775	960-1427	14.47-14.5
4.20725-4.20775	1435-1626.5	15.35-16.2
5.677-5.683	1645.5-1646.5	17.7-21.4
6.215-6.218	1660-1710	22.01-23.12
6.26775-6.26825	1718.8-1722.2	23.6-24.0
6.31175-6.31225	2200-2300	31.2-31.8
8.291-8.294	2310-2390	36.43-36.5
8.362-8.366	2655-2900	Above 38.6
8.37625-8.38675	3260-3267	
8.41425-8.41475	3332-3339	
12.29-12.293	3345.8-3358	
12.51975-12.52025	3500-4400	
12.57675-12.57725	4500-5150	
13.36-13.41	5350-5460	
16.42-16.423	7250-7750	
16.69475-16.69525	8025-8500	
16.80425-16.80475		
25.5-25.67		
37.5-38.25		
73-74.6		
74.8-75.2		
108-138		
156.52475-156.52525		
156.7-156.9		

Note: Certain frequency bands listed in Table 3 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in the 200- and 300- series RSSs, such as RSS-210 and RSS-310, which contain the requirements that apply to licence-exempt radio apparatus.

**Test Setup:**

The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The lowest, middle and highest channels in the 902-928 MHz bands were measured for all radiated emissions 10kHz to 18 GHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

**Measurement Method:**

ANSI C63.10:2013 radiated emissions procedure was followed to demonstrate the compliance of EUT.

**Modifications:**

No modification was required to comply for this test.

**Result:**

QPeak data at frequency range 9kHz – 30MHz were 20dB and greater below the limit line and need not to be reported.  
-FCC Part 15.31 (o)

The EUT complies with the applicable standard.

### Measurement Data and Plot:

EUT Test Mode:

- Low Channel ~902.2MHz

Test Mains Voltage Used:

- 120Vac/60Hz

Frequency Range:

- 1GHz to 18GHz

**Table 15: Average and Peak Data of Radiated Emissions measured 3m SAC – FCC/IC Class B Limit**

Freq.	Pol	Corrected Peak	Peak Limit	Peak Margin	Duty Cycle Correction	Corrected Average	Average Limit	Average Margin
MHz	V or H	dB $\mu$ V/m	dB $\mu$ V/m	dB	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
2706.9	V	61.6	74	12.4	23.97	37.63	54	16.37
2706.6	H	60.1	74	13.9	23.97	36.13	54	17.87
3608.6	V	53.93	74	20.07	23.97	29.96	54	24.04
3608.6	H	57.13	74	16.87	23.97	33.16	54	20.84
4511.3	V	55.3	74	18.7	23.97	31.33	54	22.67
4511.3	H	60.2	74	13.8	23.97	36.23	54	17.77
5413.7	V	53.6	74	20.4	23.97	29.63	54	24.37
5413.7	H	56.3	74	17.7	23.97	32.33	54	21.67
8120.5	V	59.34	74	14.66	23.97	35.37	54	18.63
8120.5	H	60.04	74	13.96	23.97	36.07	54	17.93

**Remark:**

- Correction factor includes antenna factor, cable loss, and pre-amp gain (if used).
- The EUT's longest dwell time per frequency was measured to be 6.33ms per 100ms. This equates to a duty cycle correction factor of -23.97dB that has been applied to the measured average values in accordance with Part 15.35(c). In accordance with 15.31(o) emissions that are 20dB below the permissible value have not been reported.

EUT Test Mode:

- Mid Channel ~915.1MHz

Test Mains Voltage Used:

- 120Vac/60Hz

Frequency Range:

- 1GHz to 18GHz

**Table 16: Average and Peak Data of Radiated Emissions measured 3m SAC – FCC/IC Class B Limit**

Freq.	Pol	Corrected Peak	Peak Limit	Peak Margin	Duty Cycle Correction	Corrected Average	Average Limit	Average Margin
MHz	V or H	dB $\mu$ V/m	dB $\mu$ V/m	dB	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
2745.4	V	57.7	74	16.3	23.97	33.73	54	20.27
2745.4	H	62.5	74	11.5	23.97	38.53	54	15.47
3660.1	V	52.8	74	21.2	23.97	28.83	54	25.17
3660.1	H	55	74	19	23.97	31.03	54	22.97
4575.3	V	54.46	74	19.54	23.97	30.49	54	23.51
4575.3	H	61.26	74	12.74	23.97	37.29	54	16.71
7320.6	V	62.4	74	11.6	23.97	38.43	54	15.57
7320.6	H	60.3	74	13.7	23.97	36.33	54	17.67
8235.7	V	58.79	74	15.21	23.97	34.82	54	19.18
8235.7	H	59.69	74	14.31	23.97	35.72	54	18.28

**Remark:**

- Correction factor includes antenna factor, cable loss, and pre-amp gain (if used).
- The EUT's longest dwell time per frequency was measured to be 6.33ms per 100ms. This equates to a duty cycle correction factor of -23.97dB that has been applied to the measured average values in accordance with Part 15.35(c). In accordance with 15.31(o) emissions that are 20dB below the permissible value have not been reported.

EUT Test Mode:

- High Channel ~927.7MHz

Test Mains Voltage Used:

- 120Vac/60Hz

Frequency Range:

- 1GHz to 18GHz

**Table 17: Average and Peak Data of Radiated Emissions measured 3m SAC – FCC/IC Class B Limit**

Freq.	Pol	Corrected Peak	Peak Limit	Peak Margin	Duty Cycle Correction	Corrected Average	Average Limit	Average Margin
MHz	V or H	dBµV/m	dBµV/m	dB	dB	dBµV/m	dBµV/m	dB
2783.15	V	63.2	74	10.8	23.97	39.23	54	14.77
2783.15	H	64.9	74	9.1	23.97	40.93	54	13.07
3711.5	V	55.5	74	18.5	23.97	31.53	54	22.47
3711.4	H	57.5	74	16.5	23.97	33.53	54	20.47
4638.5	V	55.71	74	18.29	23.97	31.74	54	22.26
4638.7	H	63.91	74	10.09	23.97	39.94	54	14.06
7421.7	V	63.5	74	10.5	23.97	39.53	54	14.47
7421.7	H	61.2	74	12.8	23.97	37.23	54	16.77
8349.5	V	58.8	74	15.2	23.97	34.83	54	19.17
8349.5	H	59.5	74	14.5	23.97	35.53	54	18.47

**Remark:**

- Correction factor includes antenna factor, cable loss, and pre-amp gain (if used).
- The EUT's longest dwell time per frequency was measured to be 6.33ms per 100ms. This equates to a duty cycle correction factor of -23.97dB that has been applied to the measured average values in accordance with Part 15.35(c). In accordance with 15.31(o) emissions that are 20dB below the permissible value have not been reported.

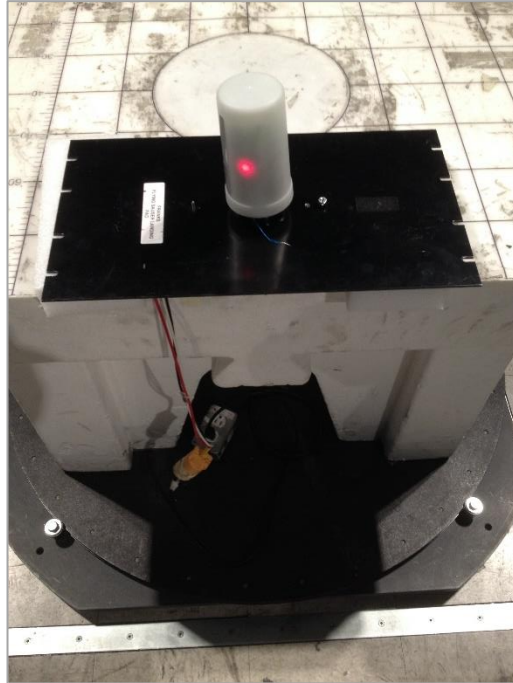
## Appendix A: TEST SETUP PICTURES



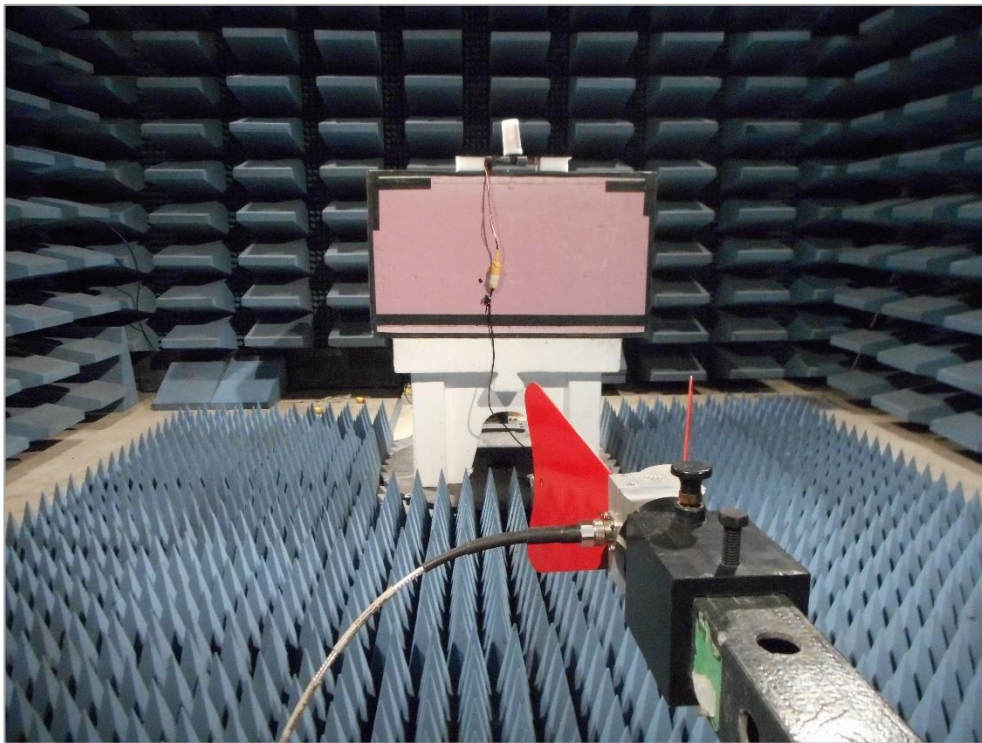
**Figure 1: Radiated Emissions (below 1GHz) Test Setup**



**Figure 2: Radiated Emissions (below 30MHz) Test Setup**



**Figure 3: Radiated Emissions (close-up view) Test Setup**



**Figure 4: Radiated Emissions (above 1GHz) Test Setup**



**Figure 5: Conducted Emissions Test Setup**



## Appendix B: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
DC	Direct Current
E.I.R.P.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EUT	Equipment Under Test
FCC	Federal Communications Commission
IC	Industry Canada
ICES	Interference-Causing Equipment Standard
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RF	Radio Frequency
RMS	Root-Mean-Square
RSS	Radio Standards Specifications
SAC	Semi-Anechoic Chamber



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**END OF REPORT**