

Company: Iotera

Test of: Home Base

To: FCC CFR 47 Part 15 Subpart C 15.247 (DTS)

Report No.: IOTA01-U3a 900 MHz Rev A





TEST OF: Home Base

to

TO: FCC CFR 47 Part 15 Subpart C 15.247 (DTS)

Test Report Serial No.: IOTA01-U3a 900 MHz Rev A

This report supersedes: NONE

Applicant: Iotera  
370 Convention Way # 220  
Redwood City, California 94063  
USA

Product Function: GPS tracker

Issue Date: 8<sup>th</sup> April 2015

**This Test Report is Issued Under the Authority of:**

**MiCOM Labs, Inc.**  
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**MiCOM Labs is an ISO 17025 Accredited Testing Laboratory**



**Title:** Iotera - Home Base  
**To:** FCC CFR 47 Part 15 Subpart C 15.247 (DTS)  
**Serial #:** IOTA01-U3a 900 MHz Rev A  
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## 1. ACCREDITATION, LISTINGS & RECOGNITION

### 1.1. TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2005. The company is accredited by the American Association for Laboratory Accreditation (A2LA) [www.a2la.org](http://www.a2la.org) test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



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## 1.2. RECOGNITION

MiCOM Labs, Inc has widely recognized wireless testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA countries. MiCOM Labs test reports are accepted globally.

| Country   | Recognition Body                                                                                 | Status | Phase      | Identification No.                      |
|-----------|--------------------------------------------------------------------------------------------------|--------|------------|-----------------------------------------|
| USA       | Federal Communications Commission (FCC)                                                          | TCB    | -          | US0159<br>Listing #: 102167             |
| Canada    | Industry Canada (IC)                                                                             | FCB    | APEC MRA 2 | US0159<br>Listing #: 4143A-2<br>4143A-3 |
| Japan     | MIC (Ministry of Internal Affairs and Communication)                                             | CAB    | APEC MRA 2 | RCB 210                                 |
|           | VCCI                                                                                             | --     | --         | A-0012                                  |
| Europe    | European Commission                                                                              | NB     | EU MRA     | NB 2280                                 |
| Australia | Australian Communications and Media Authority (ACMA)                                             | CAB    | APEC MRA 1 | US0159                                  |
| Hong Kong | Office of the Telecommunication Authority (OFTA)                                                 | CAB    | APEC MRA 1 |                                         |
| Korea     | Ministry of Information and Communication Radio Research Laboratory (RRL)                        | CAB    | APEC MRA 1 |                                         |
| Singapore | Infocomm Development Authority (IDA)                                                             | CAB    | APEC MRA 1 |                                         |
| Taiwan    | National Communications Commission (NCC)<br>Bureau of Standards, Metrology and Inspection (BSMI) | CAB    | APEC MRA 1 |                                         |
| Vietnam   | Ministry of Communication (MIC)                                                                  | CAB    | APEC MRA 1 |                                         |

EU MRA – European Union Mutual Recognition Agreement.

NB – Notified Body

APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. Recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.

Phase I - recognition for product testing

Phase II – recognition for both product testing and certification

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### 1.3. PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) [www.a2la.org](http://www.a2la.org) test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



United States of America – Telecommunication Certification Body (TCB)  
Industry Canada – Certification Body, CAB Identifier – US0159  
Europe – Notified Body (NB), NB Identifier - 2280  
Japan – Recognized Certification Body (RCB), RCB Identifier - 210



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## 2. DOCUMENT HISTORY

| Document History |                            |                 |
|------------------|----------------------------|-----------------|
| Revision         | Date                       | Comments        |
| Draft            | 25th Mar 2015              |                 |
| Rev A            | 8 <sup>th</sup> April 2015 | Initial Release |
| .                |                            |                 |
| .                |                            |                 |
| .                |                            |                 |
| .                |                            |                 |
| .                |                            |                 |

In the above table the latest report revision will replace all earlier versions.

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### 3. TEST RESULT CERTIFICATE

|                                                                                                    |                                                                                                  |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| <b>Manufacturer:</b> Iotera<br>370 Convention Way # 220<br>Redwood City<br>California 94063<br>USA | <b>Tested By:</b> MiCOM Labs, Inc.<br>575 Boulder Court<br>Pleasanton<br>California 94566<br>USA |
| <b>Model:</b> Home Base                                                                            | <b>Telephone:</b> +1 925 462 0304<br><b>Fax:</b> +1 925 462 0306                                 |
| <b>Type Of Equipment:</b> GPS Tracker (900 MHz)                                                    |                                                                                                  |
| <b>S/N's:</b> Not Available                                                                        |                                                                                                  |
| <b>Test Date(s):</b> 25 - 25 March 2015                                                            | <b>Website:</b> www.micomlabs.com                                                                |

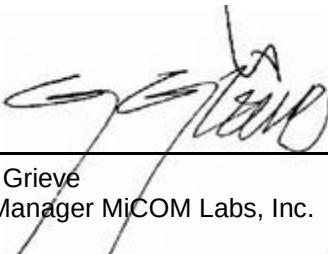
| STANDARD(S)                                                                        | TEST RESULTS       |
|------------------------------------------------------------------------------------|--------------------|
| FCC CFR 47 Part 15 Subpart C 15.247 (DTS)<br><br>Limited to 900 MHz Operation Only | EQUIPMENT COMPLIES |

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

#### Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

**Approved & Released for MiCOM Labs, Inc. by:**

  
\_\_\_\_\_  
Graeme Grieve  
Quality Manager MiCOM Labs, Inc.

  
\_\_\_\_\_  
Gordon Hurst  
President & CEO MiCOM Labs, Inc.



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## 4. REFERENCES AND MEASUREMENT UNCERTAINTY

### 4.1. Normative References

| REF. | PUBLICATION            | YEAR                | TITLE                                                                                                                                                                                                 |
|------|------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I    | KDB 644545 D01 v01r02  | Oct 31 2013         | Guidance for IEEE 802.11ac Old rules.                                                                                                                                                                 |
| II   | 662911                 | Oct 31 2013         | Guidance for measurement of output emission of devices that employ single transmitter with multiple outputs or systems with multiple transmitters operating simultaneously in the same frequency band |
| III  | 558074 D01             | June 6,2014         | DTS Meas Guidance v03r02 Guidance for performing compliance measurements on Digital Transmission Systems (DTS) operating under section 15.247.                                                        |
| IV   | 558074 D02             | June 5,2014         | DTS Part 15.247 Old Rule. Guidance for performing compliance measurements on Digital Transmission Systems (DTS) operating under section 15.247.                                                       |
| V    | A2LA                   | April 2014          | Reference to A2LA Accreditation Status – A2LA Advertising Policy                                                                                                                                      |
| VI   | ANSI C63.10            | 2013                | American National Standard for Testing Unlicensed Wireless Devices                                                                                                                                    |
| VII  | ANSI C63.4             | 2014                | American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz                                  |
| VIII | CISPR 22               | 2008                | Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement                                                                                              |
| IX   | ETSI TR 100 028        | 2001-12             | Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics                                              |
| X    | FCC 47 CFR Part 15.247 | 2014                | CFR Title 47 Part 15.247 – Radio Frequency Devices; Subpart C – Intentional Radiators                                                                                                                 |
| XI   | ICES-003               | Issue 5 2012        | Spectrum Management and Telecommunications; Interference-Causing Equipment Standard. Information Technology Equipment (ITE) – Limits and methods of measurement.                                      |
| XII  | M 3003                 | Edition 3 Nov. 2012 | Expression of Uncertainty and Confidence in Measurements                                                                                                                                              |
| XIII | RSS-210 Annex 8        | 2010                | Radio Standards Specification 210; License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment                                                                                         |
| XIV  | RSS-Gen                | 2010                | General Requirements and Information for the Certification of Radio communication Equipment                                                                                                           |
| XV   | KDB 644545 D02 v01     | June 7th 2012       | Alternative Guidance for IEEE 802.11ac and pre-ac Device emissions testing, old rules.                                                                                                                |
| XVI  | KDB 644545 D03         | August 14th 2014    | Guidance for IEEE 802.11ac New Rules v01                                                                                                                                                              |
| XVII | FCC 47 CFR Part 2.1033 | 2014                | FCC requirements and rules regarding photographs and test setup diagrams.                                                                                                                             |



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#### **4.2. Test and Uncertainty Procedure**

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

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## 5. PRODUCT DETAILS AND TEST CONFIGURATIONS

### 5.1. Technical Details

| Details                              | Description                                                                  |
|--------------------------------------|------------------------------------------------------------------------------|
| Purpose:                             | Test of the Iotera Home Base to FCC CFR 47 Part 15 Subpart C 15.247 (DTS).   |
| Applicant:                           | Iotera<br>370 Convention Way # 220<br>Redwood City<br>California 94063 USA   |
| Manufacturer:                        | As Applicant                                                                 |
| Laboratory performing the tests:     | MiCOM Labs, Inc.<br>575 Boulder Court<br>Pleasanton California 94566 USA     |
| Test report reference number:        | IOTA01-U3a 900 MHz                                                           |
| Date EUT received:                   | 5 <sup>th</sup> March 2015                                                   |
| Standard(s) applied:                 | FCC CFR 47 Part 15 Subpart C 15.247 (DTS)                                    |
| Dates of test (from - to):           | 25 - 25 March 2015                                                           |
| No of Units Tested:                  | 4                                                                            |
| Type of Equipment:                   | GPS Tracker                                                                  |
| Product Family Name:                 | Home Base and Iota                                                           |
| Model(s):                            | Home Base                                                                    |
| Location for use:                    | Indoor                                                                       |
| Declared Frequency Range(s):         | 902 - 928 MHz; 2400 - 2483.5 MHz;                                            |
| Primary function of equipment:       | GPS Tracker                                                                  |
| Secondary function of equipment:     | None provided                                                                |
| Type of Modulation:                  | Chirp Spread Spectrum                                                        |
| EUT Modes of Operation:              | 902 - 928 MHz:<br>FH: 125 kHz; 250 kHz (FH – Frequency Hopper)<br>500kHz DSS |
| Declared Nominal Output Power (Ave): | 902 - 928 MHz:<br>30.00 dBm: 125FH; 250FH; 500DSS;                           |
| Transmit/Receive Operation:          | Transceiver - Simplex                                                        |
| System Beam Forming:                 | This device has no beam-forming capability                                   |
| Rated Input Voltage and Current:     | ac/dc Adapter 120 Vac 60 Hz / 6 Vdc                                          |
| Operating Temperature Range:         | Declared Range -20°C to 50°C                                                 |
| Equipment Dimensions:                | 6" x 1.5" x 0.5"                                                             |
| Weight:                              | 200 grams                                                                    |
| Hardware Rev:                        | V1.0                                                                         |
| Software Rev:                        | V1.0                                                                         |

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## **5.2. Scope Of Test Program**

### **Iotera Home Base**

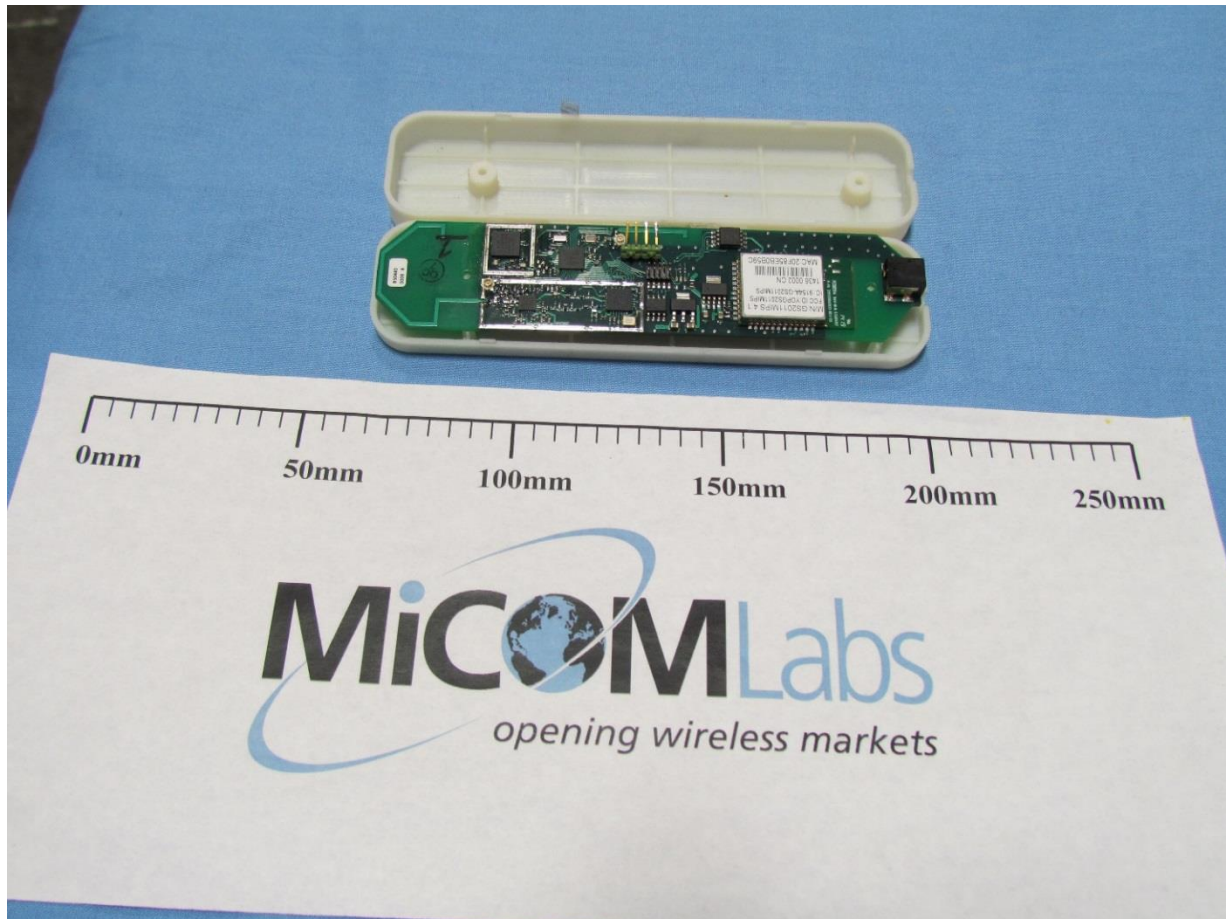
The scope of the test program was to test the Iotera Home Base, GPS Tracker configurations in the frequency ranges 902 - 928 MHz; 2400 - 2483.5 MHz; for compliance against the following specification:

### **FCC CFR 47 Part 15 Subpart C 15.247 (DTS)**

Although the device has three bandwidths 125 kHz, 250 kHz and 500 kHz with two operational modes;

- 1) Frequency Hopping – 125 kHz and 250 kHz
- 2) DSS – 500 kHz

### **Iotera Home Base**



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### **FCC OET KDB Implementation**

This test program implements the following FCC KDB – 662911 31<sup>st</sup> October 2013;

#### **Emissions Testing of Transmitters with Multiple Outputs in the Same Band**

The KDB document provides guidance for measurements of conducted output emissions of devices that employ a single transmitter with multiple outputs in the same band, with the outputs occupying the same or overlapping frequency ranges. It applies to EMC compliance measurements on devices that transmit on multiple antennas simultaneously in the same or overlapping frequency ranges through a coordinated process. Examples include, but are not limited to, devices employing beam forming or multiple-input and multiple-output (MIMO.) This guidance applies to both licensed and unlicensed devices wherever the FCC rules call for conducted output measurements. Guidance is provided for in-band, out-of-band and spurious emission measurements.

This guidance does not apply to the multiple transmitters included in a composite device, such as a device that combines an 802.11 modem with a cell phone in one enclosure with each driving its own antenna.

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### 5.3. Equipment Model(s) and Serial Number(s)

| Type | Description    | Manufacturer | Model     | Serial no. | Delivery Data               |
|------|----------------|--------------|-----------|------------|-----------------------------|
| EUT  | Radiated Unit  | Iotera       | Home Base | Unknown    | 5 <sup>th</sup> March 2015  |
| EUT  | Conducted Unit | Iotera       | Home Base | Unknown    | 25 <sup>th</sup> March 2015 |
| EUT  | ac/dc Adapter  | V-INFINITY   | Unknown   | EPS060100  | 25th March 2015             |

### 5.4. Antenna Details

| Type     | Manufacturer | Model     | Family | Gain (dBi) | BF Gain | Dir BW | X-Pol | Frequency Band (MHz) |
|----------|--------------|-----------|--------|------------|---------|--------|-------|----------------------|
| Integral | Iotera       | PCB Trace | PCB    | 3.0        | -       | 360    | -     | 902 - 928            |
| Integral | Iotera       | PCB Trace | PCB    | 3.0        | -       | 360    | -     | 2400 - 2483.5        |

BF Gain - Beamforming Gain  
Dir BW - Directional BeamWidth  
X-Pol - Cross Polarization

### 5.5. Cabling and I/O Ports

| Port Type | Max Cable Length | # Of Ports | Screened | Conn Type | Data Type |
|-----------|------------------|------------|----------|-----------|-----------|
| None      | --               | --         | --       | --        | --        |

There are no I/O ports on the Home Base



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## 5.6. Test Configurations

Testing was performed to determine the highest power level versus bit rate. The variant with the highest power was used to exercise the product.

| Operational Mode(s) | Data Rate with Highest Power Bit/s | Channel Frequency (MHz) |        |        |
|---------------------|------------------------------------|-------------------------|--------|--------|
|                     |                                    | Low                     | Mid    | High   |
| 902 - 928 MHz       |                                    |                         |        |        |
| 125FH               | 300                                | 902.56                  | 915.00 | 926.94 |
| 250FH               | 600                                | 902.56                  | 915.00 | 926.94 |
| 500DSS              | 1200                               | 902.56                  | 915.00 | 926.94 |

Results for the above configurations are provided in this report

## 5.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

## 5.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

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## 6. TEST SUMMARY

### List of Measurements

| Test Header                                | Result   | Data Link                 |
|--------------------------------------------|----------|---------------------------|
| 15.247(a)(2) 20 dB & 99% Bandwidth         | Complies | <a href="#">View Data</a> |
| 15.247(a)(2) 6 dB & 99% Bandwidth          | Complies | <a href="#">View Data</a> |
| 15.247 Number of Channels                  | Complies | <a href="#">View Data</a> |
| 15.247 Channel Spacing                     | Complies | <a href="#">View Data</a> |
| 15.247 Dwell Time & Channel Occupancy      | Complies | <a href="#">View Data</a> |
| 15.247(b), 15.31(e) Conducted Output Power | Complies | <a href="#">View Data</a> |
| 15.247(d) Emissions                        | -        | -                         |
| (1) Conducted Emissions                    | -        | -                         |
| (i) Conducted Spurious Emissions           | Complies | <a href="#">View Data</a> |
| (ii) Conducted Band-Edge Emissions         | Complies | <a href="#">View Data</a> |
| 15.247(e) Power Spectral Density           | Complies | <a href="#">View Data</a> |
| 15.207 ac Wireline Emissions               | Complies | <a href="#">View Data</a> |

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## **7. TEST EQUIPMENT CONFIGURATION(S)**

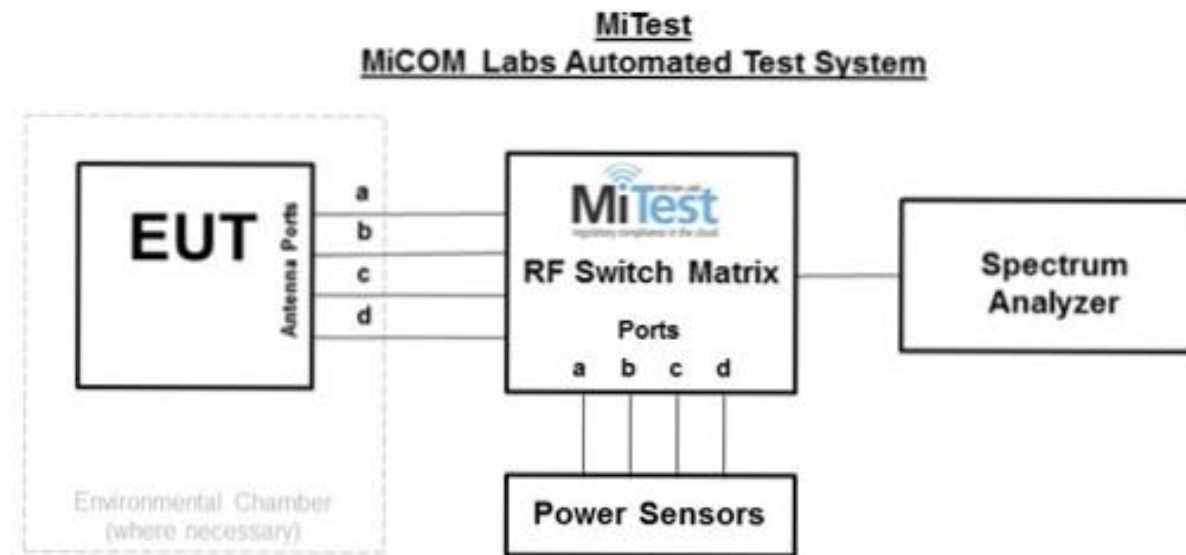
Conducted

Conducted RF Emission Test Set-up(s) with Environmental Chamber

The following tests were performed using the conducted test set-up shown in the diagram below.

- 9.1 20 dB & 99% Bandwidth
- 9.2 6 dB & 99% Bandwidth
- 9.3 Number of Channels
- 9.4 Channel Spacing
- 9.5 Dwell Time & Channel Occupancy
- 9.6 Output Power
- 9.7 Transmitter Spurious Emissions (Conducted)
- 9.8 Power Spectral Density

\*environmental chamber utilized



### **Conducted Test Measurement Setup**

A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.



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#### Assets Utilized for Conducted Testing

| Asset#      | Description                                           | Manufacturer         | Model#               | Serial#       | Calibration Due Date |
|-------------|-------------------------------------------------------|----------------------|----------------------|---------------|----------------------|
| 127         | Power Supply                                          | HP                   | 6674A                | US36370530    | Cal when used        |
| 158         | Barometer/Thermometer                                 | Control Company      | 4196                 | E2846         | 04 Dec 2015          |
| 193         | Receiver 20 Hz to 7 GHz                               | Rhode & Schwarz      | ESI 7                | 838496/007    | 14 Jan 2016          |
| 248         | Resistance Thermometer                                | Thermotronics        | GR2105-02            | 9340 #1       | 30 Oct 2015          |
| 287         | Rohde & Schwarz 40 GHz Receiver                       | Rhode & Schwarz      | ESIB40               | 100201        | 31 Jul 2015          |
| 376         | USB 10MHz - 18GHz Average Power Sensor                | Agilent              | U2000A               | MY51440005    | 28 Oct 2015          |
| 378         | Rohde & Schwarz 40 GHz Receiver with Generator        | Rhode & Schwarz      | ESIB40               | 100107/040    | 17 Jul 2015          |
| 381         | 4x4 RF Switch Box                                     | MiCOM Labs           | MiTest RF Switch Box | MIC002        | 30 Jun 2015          |
| 419         | Laptop with Labview Software                          | Lenova               | W520                 | TS02          | Not Required         |
| 420         | USB to GPIB Interface                                 | National Instruments | GPIB-USB HS          | 1346738       | Not Required         |
| 435         | USB Wideband Power Sensor                             | Boonton              | 55006                | 8730          | 31 Jul 2015          |
| 436         | USB Wideband Power Sensor                             | Boonton              | 55006                | 8731          | 31 Jul 2015          |
| 437         | USB Wideband Power Sensor                             | Boonton              | 55006                | 8759          | 31 Jul 2015          |
| 445         | PoE Injector                                          | D-Link               | DPE-101GL            | QTAH1E2000625 | Not Required         |
| 460         | Dell Computer with installation of MiTest executable. | Dell                 | Optiplex330          | BC944G1       | Not Required         |
| 74          | Environmental Chamber Chamber 3                       | Tenney               | TTC                  | 12808-1       | 30 Sep 2015          |
| RF#2 GPIB#1 | GPIB cable to Power Supply                            | HP                   | GPIB                 | None          | Not Required         |
| RF#2 SMA#1  | EUT to Mitest box port 1                              | Flexco               | SMA Cable port1      | None          | 30 Jun 2015          |
| RF#2 SMA#2  | EUT to Mitest box port 2                              | Flexco               | SMA Cable port2      | None          | 30 Jun 2015          |
| RF#2 SMA#3  | EUT to Mitest box port 3                              | Flexco               | SMA Cable port3      | None          | 30 Jun 2015          |
| RF#2 SMA#4  | EUT to Mitest box port 3                              | Flexco               | SMA Cable port4      | None          | 30 Jun 2015          |
| RF#2 SMA#SA | Mitest box to SA                                      | Flexco               | SMA Cable SA         | None          | 30 Jun 2015          |
| RF#2 USB#1  | USB Cable to Mitest Box                               | Dynex                | USB Cable            | None          | Not Required         |

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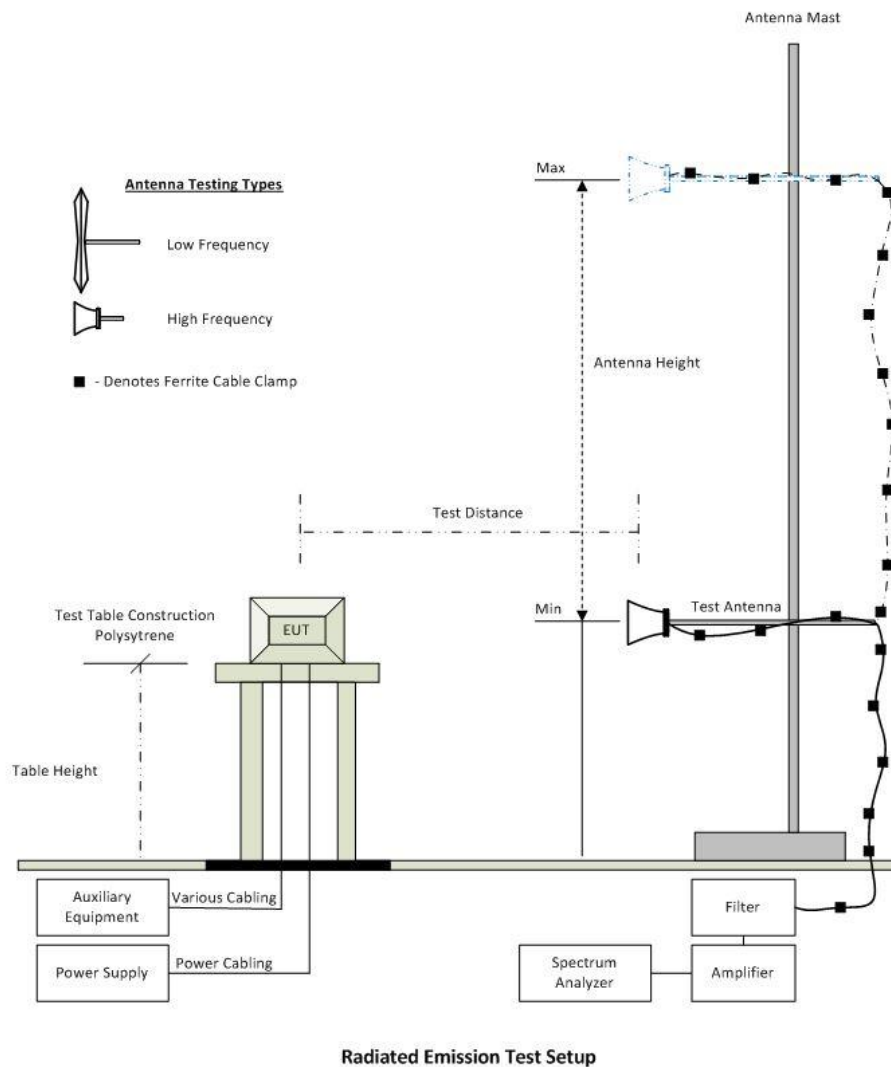
## Radiated Testing

The following tests were performed using the radiated test set-up shown in the diagram below.

9.9.1 Radiated Spurious Emissions (1 – 10 GHz)

9.9.2 Radiated Digital Emissions (0.03 – 1 GHz)

### Radiated Emission Measurement Setup



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#### Assets Utilized for Radiated Emission Testing

| Asset# | Description                                       | Manufacturer         | Model#                | Serial#            | Calibration Due Date |
|--------|---------------------------------------------------|----------------------|-----------------------|--------------------|----------------------|
| 158    | Barometer/Thermometer                             | Control Company      | 4196                  | E2846              | 04 Dec 2015          |
| 170    | Video System Controller for Semi Anechoic Chamber | Panasonic            | WV-CY101              | 04R08507           | Not Required         |
| 287    | Rohde & Schwarz 40 GHz Receiver                   | Rhode & Schwarz      | ESIB40                | 100201             | 31 Jul 2015          |
| 301    | 5470 to 5725 MHz Notch Filter                     | Microtronics         | RBC50704              | 001                | 08 Oct 2015          |
| 302    | 5150 to 5350 MHz Notch Filter                     | Microtronics         | BRC50703              | 002                | 08 Oct 2015          |
| 303    | 5725 to 5875 MHz Notch filter                     | Microtronics         | BRC50705              | 003                | 08 Oct 2015          |
| 310    | SMA Cable                                         | Micro-Coax           | UFA210A-0-0787-3G03G0 | 209089-001         | 30 Oct 2015          |
| 338    | Sunol 30 to 3000 MHz Antenna                      | Sunol                | JB3                   | A052907            | 14 Aug 2015          |
| 342    | 2.4 GHz Notch Filter                              | EWT                  | EWT-14-0203           | H1                 | 08 Oct 2015          |
| 343    | 5.15 GHz Notch Filter                             | EWT                  | EWT-14-0200           | H1                 | 08 Oct 2015          |
| 344    | 5.35 GHz Notch Filter                             | EWT                  | EWT-14-0201           | H1                 | 08 Oct 2015          |
| 345    | 5.46 GHz Notch Filter                             | EWT                  | EWT-14-0202           | H1                 | 08 Oct 2015          |
| 377    | Band Rejection Filter 5150 to 5880MHz             | Microtronics         | BRM50716              | 034                | 08 Oct 2015          |
| 396    | 2.4 GHz Notch Filter                              | Microtronics         | BRM50701              | 001                | 07 Oct 2015          |
| 397    | Amp 10 - 2500MHz                                  | MiCOM Labs           | Amp 10 - 2500 MHz     | NA                 | 23 Oct 2015          |
| 399    | ETS 1-18 GHz Horn Antenna                         | ETS                  | 3117                  | 00154575           | 10 Oct 2015          |
| 406    | Amplifier for Radiated Emissions                  | MiCOM Labs           | 40dB 1 to 18GHz Amp   | 0406               | 30 May 2015          |
| 410    | Desktop Computer                                  | Dell                 | Inspiron 620          | WS38               | Not Required         |
| 411    | Mast/Turntable Controller                         | Sunol Sciences       | SC98V                 | 060199-1D          | Not Required         |
| 412    | USB to GPIB Interface                             | National Instruments | GPIB-USB HS           | 11B8DC2            | Not Required         |
| 413    | Mast Controller                                   | Sunol Science        | TWR95-4               | 030801-3           | Not Required         |
| 414    | DC Power Supply 0-60V                             | HP                   | 6274                  | 1029A01285         | Cal when used        |
| 415    | Turntable Controller                              | Sunol Sciences       | Turntable Controller  | None               | Not Required         |
| 416    | Gigabit ethernet filter                           | ETS-Lingren          | Gigafoil 260366       | None               | Not Required         |
| 502    | Test Software for Radiated Emissions              | EMISoft              | Vasona                | Version 5 Build 59 | Not Required         |
| 87     | Uninterruptible Power Supply                      | Falcon Electric      | ED2000-1/2LC          | F3471 02/01        | Cal when used        |

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## 8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

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## 9. TEST RESULTS

### 9.1. 20 dB & 99% Bandwidth

| Conducted Test Conditions for 20 dB and 99% Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                          |                     |             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------|-------------|
| Standard:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | FCC CFR 47:15.247        | Ambient Temp. (°C): | 24.0 - 27.5 |
| Test Heading:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 20 dB and 99 % Bandwidth | Rel. Humidity (%):  | 32 - 45     |
| Standard Section(s):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 15.247 (a)(2)            | Pressure (mBars):   | 999 - 1001  |
| Reference Document(s):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | See Normative References |                     |             |
| <p>Test Procedure for 20 dB and 99% Bandwidth Measurement</p> <p>The bandwidth at 20 dB and 99 % was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.</p> <p>Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.</p> <p>Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.</p> <p><b>Limits for 20 dB and 99% Bandwidth</b></p> <p>(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:</p> <p>(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz bands. The minimum 20 dB bandwidth shall not exceed 500 kHz.</p> |                          |                     |             |

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#### Equipment Configuration for 20 dB & 99% Bandwidth

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 125FH          | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 300 Bit/s      | <b>Antenna Gain (dBi):</b>        | 3              |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured 20 dB Bandwidth (MHz) |    |    |    | 6 dB Bandwidth (MHz) |        | Limit  | Lowest Margin |
|----------------|--------------------------------|----|----|----|----------------------|--------|--------|---------------|
|                | Port(s)                        |    |    |    | Highest              | Lowest |        |               |
| MHz            | a                              | b  | c  | d  |                      |        | KHz    | MHz           |
| 902.6          | <a href="#">0.164</a>          | -- | -- | -- | 0.164                | 0.164  | ≥250.0 | -0.86         |
| 915.1          | <a href="#">0.164</a>          | -- | -- | -- | 0.164                | 0.164  | ≥250.0 | -0.86         |
| 926.9          | <a href="#">0.163</a>          | -- | -- | -- | 0.163                | 0.163  | ≥250.0 | -0.87         |

| Test Frequency | Measured 99% Bandwidth (MHz) |    |    |    | Maximum 99% Bandwidth (MHz) |  |  |
|----------------|------------------------------|----|----|----|-----------------------------|--|--|
|                | Port(s)                      |    |    |    |                             |  |  |
| MHz            | a                            | b  | c  | d  |                             |  |  |
| 902.6          | <a href="#">0.142</a>        | -- | -- | -- | 0.142                       |  |  |
| 915.1          | <a href="#">0.140</a>        | -- | -- | -- | 0.140                       |  |  |
| 926.9          | <a href="#">0.142</a>        | -- | -- | -- | 0.142                       |  |  |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                  |
|--------------------------|----------------------------------|
| Work Instruction:        | WI-03 MEASURING RF SPECTRUM MASK |
| Measurement Uncertainty: | ±2.81 dB                         |

Note: click the links in the above matrix to view the graphical image (plot).

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#### Equipment Configuration for 20 dB & 99% Bandwidth

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 250FH          | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 600 Bit/s      | <b>Antenna Gain (dBi):</b>        | 3              |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured 20 dB Bandwidth (MHz) |    |    |    | 20 dB Bandwidth (MHz) |        | Limit  | Lowest Margin |
|----------------|--------------------------------|----|----|----|-----------------------|--------|--------|---------------|
|                | Port(s)                        |    |    |    | Highest               | Lowest | KHz    | MHz           |
| MHz            | a                              | b  | c  | d  |                       |        |        |               |
| 902.6          | <a href="#">0.306</a>          | -- | -- | -- | 0.306                 | 0.306  | ≤500.0 | -0.19         |
| 915.1          | <a href="#">0.300</a>          | -- | -- | -- | 0.300                 | 0.300  | ≤500.0 | -0.20         |
| 926.9          | <a href="#">0.307</a>          | -- | -- | -- | 0.307                 | 0.307  | ≤500.0 | -0.19         |

| Test Frequency | Measured 99% Bandwidth (MHz) |    |    |    | Maximum 99% Bandwidth (MHz) |  |  |
|----------------|------------------------------|----|----|----|-----------------------------|--|--|
|                | Port(s)                      |    |    |    |                             |  |  |
| MHz            | a                            | b  | c  | d  |                             |  |  |
| 902.6          | <a href="#">0.268</a>        | -- | -- | -- | 0.268                       |  |  |
| 915.1          | <a href="#">0.267</a>        | -- | -- | -- | 0.267                       |  |  |
| 926.9          | <a href="#">0.267</a>        | -- | -- | -- | 0.267                       |  |  |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                  |
|--------------------------|----------------------------------|
| Work Instruction:        | WI-03 MEASURING RF SPECTRUM MASK |
| Measurement Uncertainty: | ±2.81 dB                         |

Note: click the links in the above matrix to view the graphical image (plot).

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## 9.2. 6 dB & 99% Bandwidth

| Conducted Test Conditions for 6 dB and 99% Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                          |                     |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------|-------------|
| Standard:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | FCC CFR 47:15.247        | Ambient Temp. (°C): | 24.0 - 27.5 |
| Test Heading:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6 dB and 99 % Bandwidth  | Rel. Humidity (%):  | 32 - 45     |
| Standard Section(s):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 15.247 (a)(2)            | Pressure (mBars):   | 999 - 1001  |
| Reference Document(s):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | See Normative References |                     |             |
| <p>Test Procedure for 6 dB and 99% Bandwidth Measurement</p> <p>The bandwidth at 6 dB and 99 % was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.</p> <p>Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.</p> <p>Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.</p> <p><b>Limits for 6 dB and 99% Bandwidth</b></p> <p>(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:</p> <p>(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.</p> |                          |                     |             |

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#### Equipment Configuration for 6 dB & 99% Bandwidth

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 500DSS         | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 1.2 KBit/s     | <b>Antenna Gain (dBi):</b>        | 3              |
| <b>Modulation:</b>             | DSS            | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured 6 dB Bandwidth (MHz) |    |    |    | 6 dB Bandwidth (MHz) |        | Limit  | Lowest Margin |
|----------------|-------------------------------|----|----|----|----------------------|--------|--------|---------------|
|                | Port(s)                       |    |    |    | Highest              | Lowest | KHz    | MHz           |
| MHz            | a                             | b  | c  | d  |                      |        |        |               |
| 902.6          | <a href="#">0.764</a>         | -- | -- | -- | 0.764                | 0.764  | ≥500.0 | -0.26         |
| 915.1          | <a href="#">0.758</a>         | -- | -- | -- | 0.758                | 0.758  | ≥500.0 | -0.26         |
| 926.9          | <a href="#">0.756</a>         | -- | -- | -- | 0.756                | 0.756  | ≥500.0 | -0.26         |

| Test Frequency | Measured 99% Bandwidth (MHz) |    |    |    | Maximum 99% Bandwidth (MHz) |  |  |
|----------------|------------------------------|----|----|----|-----------------------------|--|--|
|                | Port(s)                      |    |    |    |                             |  |  |
| MHz            | a                            | b  | c  | d  |                             |  |  |
| 902.6          | <a href="#">0.826</a>        | -- | -- | -- | 0.826                       |  |  |
| 915.1          | <a href="#">0.830</a>        | -- | -- | -- | 0.830                       |  |  |
| 926.9          | <a href="#">0.822</a>        | -- | -- | -- | 0.822                       |  |  |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                  |
|--------------------------|----------------------------------|
| Work Instruction:        | WI-03 MEASURING RF SPECTRUM MASK |
| Measurement Uncertainty: | ±2.81 dB                         |

Note: click the links in the above matrix to view the graphical image (plot).

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### 9.3. Number Of Channels

| Conducted Test Conditions for Number Of Channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                          |                     |             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------|-------------|
| Standard:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | FCC CFR 47:15.247        | Ambient Temp. (°C): | 24.0 - 27.5 |
| Test Heading:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Number of Channels       | Rel. Humidity (%):  | 32 - 45     |
| Standard Section(s):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 15.247 (a)(2)            | Pressure (mBars):   | 999 - 1001  |
| Reference Document(s):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | See Normative References |                     |             |
| <p>Test Procedure</p> <p>The number of channels and channel occupancy is measured with a spectrum analyzer connected to the antenna terminal, while the EUT is operating in transmission mode at the appropriate center frequency and modulation.</p> <p>Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.</p> <p>Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.</p> <p>Limit</p> <p>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; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.</p> |                          |                     |             |

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#### Equipment Configuration for Hopping Sequence

|                                |                      |                                   |                |
|--------------------------------|----------------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 125FH, 250FH         | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 300 Bit/s, 600 Bit/s | <b>Antenna Gain (dBi):</b>        | 3.0            |
| <b>Modulation:</b>             | FHSS                 | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable       | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                      |                                   |                |

#### Test Measurement Results

| Modulation | Frequency Range (MHz) | Number of Hopping Channels | Limit                  | Total Number of Hops | Results |
|------------|-----------------------|----------------------------|------------------------|----------------------|---------|
|            |                       |                            | No of Hopping Channels |                      |         |
| 125FH      | 900.00 – 912.00       | <a href="#">33</a>         | > 50                   | 89                   | Pass    |
| 125FH      | 912.00 – 920.00       | <a href="#">28</a>         | > 50                   | 89                   | Pass    |
| 125FH      | 920.00 – 928.00       | <a href="#">28</a>         | > 50                   | 89                   | Pass    |
| 250FH      | 900.00 – 912.00       | <a href="#">17</a>         | > 25                   | 46                   | Pass    |
| 250FH      | 912.00 – 920.00       | <a href="#">13</a>         | > 25                   | 46                   | Pass    |
| 250FH      | 920.00 – 928.00       | <a href="#">16</a>         | > 25                   | 46                   | Pass    |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                  |
|--------------------------|----------------------------------|
| Work Instruction:        | WI-03 MEASURING RF SPECTRUM MASK |
| Measurement Uncertainty: | ±2.81 dB                         |

Note: click the links in the above matrix to view the graphical image (plot).

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#### 9.4. Channel Spacing

| Conducted Test Conditions for 6 dB and 99% Bandwidth |                          |                     |             |
|------------------------------------------------------|--------------------------|---------------------|-------------|
| Standard:                                            | FCC CFR 47:15.247        | Ambient Temp. (°C): | 24.0 - 27.5 |
| Test Heading:                                        | Channel Spacing          | Rel. Humidity (%):  | 32 - 45     |
| Standard Section(s):                                 | 15.247 (a)(2)            | Pressure (mBars):   | 999 - 1001  |
| Reference Document(s):                               | See Normative References |                     |             |

Test Procedure

The number of channels and channel occupancy is measured with a spectrum analyzer connected to the antenna terminal, while the EUT is operating in transmission mode at the appropriate center frequency and modulation.

Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limit

(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.

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#### Equipment Configuration for Channel Separation

|                                |                      |                                   |                |
|--------------------------------|----------------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 125FH, 250FH         | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 300 Bit/s, 600 Bit/s | <b>Antenna Gain (dBi):</b>        | 3.0            |
| <b>Modulation:</b>             | FHSS                 | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable       | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                      |                                   |                |

#### Test Measurement Results

| Center Frequency | Packet Type | Chan Separation       | Limit   | Result |
|------------------|-------------|-----------------------|---------|--------|
| MHz              |             | MHz                   | MHz     |        |
| 902.125          | 125FH       | <a href="#">0.251</a> | > 0.162 | Pass   |
| 902.25           | 250FH       | <a href="#">0.515</a> | > 0.306 | Pass   |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                                      |
|--------------------------|------------------------------------------------------|
| Measurement Uncertainty: | ±2.81 dB (Spectrum/Amplitude), ±0.86 ppm (Frequency) |
|--------------------------|------------------------------------------------------|

Note: click the links in the above matrix to view the graphical image (plot).

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## 9.5. Dwell Time & Channel Occupancy

| Conducted Test Conditions for 6 dB and 99% Bandwidth |                                |                            |             |
|------------------------------------------------------|--------------------------------|----------------------------|-------------|
| <b>Standard:</b>                                     | FCC CFR 47:15.247              | <b>Ambient Temp. (°C):</b> | 24.0 - 27.5 |
| <b>Test Heading:</b>                                 | Dwell Time & Channel Occupancy | <b>Rel. Humidity (%):</b>  | 32 - 45     |
| <b>Standard Section(s):</b>                          | 15.247 (a)(2)                  | <b>Pressure (mBars):</b>   | 999 - 1001  |
| <b>Reference Document(s):</b>                        | See Normative References       |                            |             |

### Test Procedure

The number of channels and channel occupancy is measured with a spectrum analyzer connected to the antenna terminal, while the EUT is operating in transmission mode at the appropriate center frequency and modulation.

Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

### Limit

(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 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 average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

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#### Equipment Configuration for Dwell Time & Channel Occupancy

|                                |                      |                                   |                |
|--------------------------------|----------------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 125FH, 250FH         | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 300 Bit/s, 600 Bit/s | <b>Antenna Gain (dBi):</b>        | 3.0            |
| <b>Modulation:</b>             | FHSS                 | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable       | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                      |                                   |                |

#### Test Measurement Results

| Center Frequency | Packet Type | Dwell Time (Single Channel) | Limit (Single Channel) | Channel Occupancy Limit | Result |
|------------------|-------------|-----------------------------|------------------------|-------------------------|--------|
| MHz              |             | mS                          | mS                     | S                       |        |
| 902.125          | 125FH       | <a href="#">365</a>         | 400                    | <a href="#">20</a>      | Pass   |
| 902.25           | 250FH       | <a href="#">398</a>         | 400                    | <a href="#">10</a>      | Pass   |

#### Traceability to Industry Recognized Test Methodologies

Measurement Uncertainty:  $\pm 2.81$  dB (Spectrum/Amplitude),  $\pm 0.86$  ppm (Frequency)

Note: click the links in the above matrix to

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## 9.6. Conducted Output Power

| Conducted Test Conditions for Fundamental Emission Output Power |                          |                            |             |
|-----------------------------------------------------------------|--------------------------|----------------------------|-------------|
| <b>Standard:</b>                                                | FCC CFR 47:15.247        | <b>Ambient Temp. (°C):</b> | 24.0 - 27.5 |
| <b>Test Heading:</b>                                            | Output Power             | <b>Rel. Humidity (%):</b>  | 32 - 45     |
| <b>Standard Section(s):</b>                                     | 15.247 (b) & (c)         | <b>Pressure (mBars):</b>   | 999 - 1001  |
| <b>Reference Document(s):</b>                                   | See Normative References |                            |             |

Test Procedure for Fundamental Emission Output Power Measurement  
In the case of average power measurements an average power sensor was utilized.

For peak power measurements the spectrum analyzer built-in power function was used to integrate peak power over the 20 dB bandwidth.

Testing was performed under ambient conditions at nominal voltage only. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured, summed (Σ) and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Supporting Information  
Calculated Power = A + G + Y+ 10 log (1/x) dBm

A = Total Power [10\*Log10 (10<sup>a/10</sup> + 10<sup>b/10</sup> + 10<sup>c/10</sup> + 10<sup>d/10</sup>)]  
G = Antenna Gain  
Y = Beamforming Gain  
x = Duty Cycle (average power measurements only)

**Limits for Fundamental Emission Output Power**  
(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following for non-frequency hopping systems:

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(1)(i) and (c)(1)(ii) of this section, excludes the use of point-to-

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multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.



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#### Equipment Configuration for Average Output Power

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 125FH          | <b>Duty Cycle (%):</b>            | 100.0          |
| <b>Data Rate:</b>              | 300 Bit/s      | <b>Antenna Gain (dBi):</b>        | 3.0            |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured Output Power (dBm) |    |    |    | Calculated Total Power<br>Σ Port(s) + DCCF (+0 dB) | Limit | Margin | EUT Power Setting |
|----------------|-----------------------------|----|----|----|----------------------------------------------------|-------|--------|-------------------|
|                | Port(s)                     |    |    |    |                                                    |       |        |                   |
| MHz            | a                           | b  | c  | d  | dBm                                                | dBm   | dB     |                   |
| 902.6          | 29.10                       | -- | -- | -- | 29.10                                              | 30.00 | -0.90  |                   |
| 915.1          | 28.48                       | -- | -- | -- | 28.48                                              | 30.00 | -1.52  |                   |
| 926.9          | 28.78                       | -- | -- | -- | 28.78                                              | 30.00 | -1.22  |                   |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                 |
|--------------------------|---------------------------------|
| Work Instruction:        | WI-01 MEASURING RF OUTPUT POWER |
| Measurement Uncertainty: | $\pm 1.33$ dB                   |

DCCF - Duty Cycle Correction Factor

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#### Equipment Configuration for Average Output Power

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 250FH          | <b>Duty Cycle (%):</b>            | 100.0          |
| <b>Data Rate:</b>              | 600 Bit/s      | <b>Antenna Gain (dBi):</b>        | 3.0            |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured Output Power (dBm) |    |    |    | Calculated Total Power<br>Σ Port(s) + DCCF (+0 dB) | Limit | Margin | EUT Power Setting |
|----------------|-----------------------------|----|----|----|----------------------------------------------------|-------|--------|-------------------|
|                | Port(s)                     |    |    |    |                                                    |       |        |                   |
| MHz            | a                           | b  | c  | d  | dBm                                                | dBm   | dB     |                   |
| 902.6          | 29.02                       | -- | -- | -- | 29.02                                              | 30.00 | -0.98  | 13.00             |
| 915.1          | 29.14                       | -- | -- | -- | 29.14                                              | 30.00 | -0.86  | 13.00             |
| 926.9          | 28.92                       | -- | -- | -- | 28.92                                              | 30.00 | -1.08  | 13.00             |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                 |
|--------------------------|---------------------------------|
| Work Instruction:        | WI-01 MEASURING RF OUTPUT POWER |
| Measurement Uncertainty: | $\pm 1.33$ dB                   |

DCCF - Duty Cycle Correction Factor

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#### Equipment Configuration for Average Output Power

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 500DSS         | <b>Duty Cycle (%):</b>            | 100.0          |
| <b>Data Rate:</b>              | 1.2 KBit/s     | <b>Antenna Gain (dBi):</b>        | 3.0            |
| <b>Modulation:</b>             | DSS            | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured Output Power (dBm) |    |    |    | Calculated Total Power $\Sigma$ Port(s) + DCCF (+0 dB) | Limit | Margin | EUT Power Setting |
|----------------|-----------------------------|----|----|----|--------------------------------------------------------|-------|--------|-------------------|
|                | Port(s)                     |    |    |    |                                                        |       |        |                   |
| MHz            | a                           | b  | c  | d  | dBm                                                    | dBm   | dB     |                   |
| 902.6          | 29.05                       | -- | -- | -- | 29.05                                                  | 30.00 | -0.95  |                   |
| 915.1          | 28.81                       | -- | -- | -- | 28.81                                                  | 30.00 | -1.19  |                   |
| 926.9          | 28.71                       | -- | -- | -- | 28.71                                                  | 30.00 | -1.29  |                   |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                 |
|--------------------------|---------------------------------|
| Work Instruction:        | WI-01 MEASURING RF OUTPUT POWER |
| Measurement Uncertainty: | $\pm 1.33$ dB                   |

DCCF - Duty Cycle Correction Factor

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## **9.7. Conducted Spurious Emissions**

### **9.7.1. Conducted Emissions**

#### **9.7.1.1. Conducted Spurious Emissions**

| Conducted Test Conditions for Transmitter Conducted Spurious and Band-Edge Emissions |                              |                     |             |
|--------------------------------------------------------------------------------------|------------------------------|---------------------|-------------|
| Standard:                                                                            | FCC CFR 47:15.247            | Ambient Temp. (°C): | 24.0 - 27.5 |
| Test Heading:                                                                        | Max Unwanted Emission Levels | Rel. Humidity (%):  | 32 - 45     |
| Standard Section(s):                                                                 | 15.247 (d)                   | Pressure (mBars):   | 999 - 1001  |
| Reference Document(s):                                                               | See Normative References     |                     |             |

**Test Procedure for Transmitter Conducted Spurious and Band-Edge Emissions Measurement**  
Transmitter Conducted Spurious and Band-Edge emissions were measured at a limit of 30 dBc (average detector) or 20 dBc (peak detector) below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Measurements were made while EUT was operating in transmit mode of operation at the appropriate centre frequency closest to the band-edge. Emissions were maximized during the measurement and limits derived from the peak spectral power and drawn on each plot.

Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. Testing was performed under ambient conditions at nominal voltage only.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

**Limits Transmitter Conducted Spurious and Band-Edge Emissions**  
(d) 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)).

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#### Equipment Configuration for Transmitter Conducted Spurious Emissions

|                                |                |                               |                |
|--------------------------------|----------------|-------------------------------|----------------|
| <b>Variant:</b>                | 125FH          | <b>Duty Cycle (%):</b>        | 100            |
| <b>Data Rate:</b>              | 300 Bit/s      | <b>Antenna Gain (dBi):</b>    | Not Applicable |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>             | CC             |
| <b>Engineering Test Notes:</b> |                |                               |                |

#### Test Measurement Results

| Test Frequency | Frequency Range | Transmitter Conducted Spurious Emissions (dBm) |        |        |       |        |       |        |       |
|----------------|-----------------|------------------------------------------------|--------|--------|-------|--------|-------|--------|-------|
|                |                 | Port a                                         |        | Port b |       | Port c |       | Port d |       |
| MHz            | MHz             | SE                                             | Limit  | SE     | Limit | SE     | Limit | SE     | Limit |
| 902.6          | 30.0 - 26000.0  | <a href="#">-49.249</a>                        | -26.59 | --     | --    | --     | --    | --     | --    |
| 915.1          | 30.0 - 26000.0  | <a href="#">-49.109</a>                        | -26.69 | --     | --    | --     | --    | --     | --    |
| 926.9          | 30.0 - 26000.0  | <a href="#">-49.222</a>                        | -27.51 | --     | --    | --     | --    | --     | --    |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                               |
|--------------------------|-----------------------------------------------|
| Work Instruction:        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| Measurement Uncertainty: | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

Note: click the links in the above matrix to view the graphical image (plot).

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#### Equipment Configuration for Transmitter Conducted Spurious Emissions

|                                |                |                               |                |
|--------------------------------|----------------|-------------------------------|----------------|
| <b>Variant:</b>                | 250FH          | <b>Duty Cycle (%):</b>        | 100            |
| <b>Data Rate:</b>              | 600 Bit/s      | <b>Antenna Gain (dBi):</b>    | Not Applicable |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>             | CC             |
| <b>Engineering Test Notes:</b> |                |                               |                |

#### Test Measurement Results

| Test Frequency | Frequency Range | Transmitter Conducted Spurious Emissions (dBm) |        |        |       |        |       |        |       |
|----------------|-----------------|------------------------------------------------|--------|--------|-------|--------|-------|--------|-------|
|                |                 | Port a                                         |        | Port b |       | Port c |       | Port d |       |
| MHz            | MHz             | SE                                             | Limit  | SE     | Limit | SE     | Limit | SE     | Limit |
| 902.6          | 30.0 - 26000.0  | <a href="#">-49.810</a>                        | -26.47 | --     | --    | --     | --    | --     | --    |
| 915.1          | 30.0 - 26000.0  | <a href="#">-49.712</a>                        | -26.70 | --     | --    | --     | --    | --     | --    |
| 926.9          | 30.0 - 26000.0  | <a href="#">-51.875</a>                        | -27.48 | --     | --    | --     | --    | --     | --    |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                               |
|--------------------------|-----------------------------------------------|
| Work Instruction:        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| Measurement Uncertainty: | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

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#### Equipment Configuration for Transmitter Conducted Spurious Emissions

|                                |                |                               |                |
|--------------------------------|----------------|-------------------------------|----------------|
| <b>Variant:</b>                | 500DSS         | <b>Duty Cycle (%):</b>        | 100            |
| <b>Data Rate:</b>              | 1.2 KBit/s     | <b>Antenna Gain (dBi):</b>    | Not Applicable |
| <b>Modulation:</b>             | DSS            | <b>Beam Forming Gain (Y):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>             | CC             |
| <b>Engineering Test Notes:</b> |                |                               |                |

#### Test Measurement Results

| Test Frequency | Frequency Range | Transmitter Conducted Spurious Emissions (dBm) |        |        |       |        |       |        |       |
|----------------|-----------------|------------------------------------------------|--------|--------|-------|--------|-------|--------|-------|
|                |                 | Port a                                         |        | Port b |       | Port c |       | Port d |       |
| MHz            | MHz             | SE                                             | Limit  | SE     | Limit | SE     | Limit | SE     | Limit |
| 902.6          | 30.0 - 26000.0  | <a href="#">-49.230</a>                        | -26.18 | --     | --    | --     | --    | --     | --    |
| 915.1          | 30.0 - 26000.0  | <a href="#">-49.241</a>                        | -26.88 | --     | --    | --     | --    | --     | --    |
| 926.9          | 30.0 - 26000.0  | <a href="#">-59.092</a>                        | -27.53 | --     | --    | --     | --    | --     | --    |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                               |
|--------------------------|-----------------------------------------------|
| Work Instruction:        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| Measurement Uncertainty: | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

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### 9.7.1.2. Conducted Band-Edge Emissions

#### Equipment Configuration for Conducted Low Band-Edge Emissions - Average

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 125FH          | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 300 Bit/s      | <b>Antenna Gain (dBi):</b>        | 3              |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| <b>Channel Frequency:</b>    | 902.6 MHz                   |                  |                    |                 |                     |        |
|------------------------------|-----------------------------|------------------|--------------------|-----------------|---------------------|--------|
| <b>Band-Edge Frequency:</b>  | 902.0 MHz                   |                  |                    |                 |                     |        |
| <b>Test Frequency Range:</b> | 850.0 - 915.0 MHz           |                  |                    |                 |                     |        |
| Port(s)                      | Band-Edge Markers and Limit |                  |                    | Revised Limit   |                     | Margin |
|                              | M1 Amplitude (dBm)          | Plot Limit (dBm) | M2 Frequency (MHz) | Amplitude (dBm) | M2A Frequency (MHz) | (MHz)  |
| a                            | <a href="#">-35.12</a>      | -7.27            | 902.40             | --              | --                  | -0.400 |

#### Traceability to Industry Recognized Test Methodologies

|                                 |                                               |
|---------------------------------|-----------------------------------------------|
| <b>Work Instruction:</b>        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| <b>Measurement Uncertainty:</b> | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

Note: click the links in the above matrix to view the graphical image (plot).

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#### Equipment Configuration for Conducted Low Band-Edge Emissions - Average

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 250FH          | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 600 Bit/s      | <b>Antenna Gain (dBi):</b>        | 3              |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| <b>Channel Frequency:</b>    | 902.6 MHz                   |                     |                       |                    |                        |                 |
|------------------------------|-----------------------------|---------------------|-----------------------|--------------------|------------------------|-----------------|
| <b>Band-Edge Frequency:</b>  | 902.0 MHz                   |                     |                       |                    |                        |                 |
| <b>Test Frequency Range:</b> | 850.0 - 915.0 MHz           |                     |                       |                    |                        |                 |
| Port(s)                      | Band-Edge Markers and Limit |                     |                       | Revised Limit      |                        | Margin<br>(MHz) |
|                              | M1 Amplitude<br>(dBm)       | Plot Limit<br>(dBm) | M2 Frequency<br>(MHz) | Amplitude<br>(dBm) | M2A Frequency<br>(MHz) |                 |
| a                            | <a href="#">-36.77</a>      | -13.00              | 902.20                | --                 | --                     | -0.200          |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                               |
|--------------------------|-----------------------------------------------|
| Work Instruction:        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| Measurement Uncertainty: | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

Note: click the links in the above matrix to view the graphical image (plot).

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#### Equipment Configuration for Conducted Low Band-Edge Emissions - Average

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 500DSS         | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 1.2 KBit/s     | <b>Antenna Gain (dBi):</b>        | 3              |
| <b>Modulation:</b>             | DSS            | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| <b>Channel Frequency:</b>    | 902.6 MHz                   |                  |                    |                 |                     |        |
|------------------------------|-----------------------------|------------------|--------------------|-----------------|---------------------|--------|
| <b>Band-Edge Frequency:</b>  | 902.0 MHz                   |                  |                    |                 |                     |        |
| <b>Test Frequency Range:</b> | 850.0 - 915.0 MHz           |                  |                    |                 |                     |        |
| Port(s)                      | Band-Edge Markers and Limit |                  |                    | Revised Limit   |                     | Margin |
|                              | M1 Amplitude (dBm)          | Plot Limit (dBm) | M2 Frequency (MHz) | Amplitude (dBm) | M2A Frequency (MHz) | (MHz)  |
| a                            | <a href="#">-30.71</a>      | -19.00           | 902.10             | --              | --                  | -0.100 |

#### Traceability to Industry Recognized Test Methodologies

|                                 |                                               |
|---------------------------------|-----------------------------------------------|
| <b>Work Instruction:</b>        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| <b>Measurement Uncertainty:</b> | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

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#### Equipment Configuration for Conducted High Band-Edge Emissions - Average

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 125FH          | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 300 Bit/s      | <b>Antenna Gain (dBi):</b>        | 3              |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| <b>Channel Frequency:</b>    | 926.9 MHz                   |                  |                    |                 |                     |              |
|------------------------------|-----------------------------|------------------|--------------------|-----------------|---------------------|--------------|
| <b>Band-Edge Frequency:</b>  | 928.0 MHz                   |                  |                    |                 |                     |              |
| <b>Test Frequency Range:</b> | 915.0 - 978.0 MHz           |                  |                    |                 |                     |              |
| Port(s)                      | Band-Edge Markers and Limit |                  |                    | Revised Limit   |                     | Margin (MHz) |
|                              | M3 Amplitude (dBm)          | Plot Limit (dBm) | M2 Frequency (MHz) | Amplitude (dBm) | M2A Frequency (MHz) |              |
| a                            | <a href="#">-39.68</a>      | -13.00           | 927.20             | --              | --                  | -0.800       |

#### Traceability to Industry Recognized Test Methodologies

|                                 |                                               |
|---------------------------------|-----------------------------------------------|
| <b>Work Instruction:</b>        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| <b>Measurement Uncertainty:</b> | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

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#### Equipment Configuration for Conducted High Band-Edge Emissions - Average

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 250FH          | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 600 Bit/s      | <b>Antenna Gain (dBi):</b>        | 3              |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| <b>Channel Frequency:</b>    | 926.9 MHz                   |                  |                    |                 |                     |        |
|------------------------------|-----------------------------|------------------|--------------------|-----------------|---------------------|--------|
| <b>Band-Edge Frequency:</b>  | 928.0 MHz                   |                  |                    |                 |                     |        |
| <b>Test Frequency Range:</b> | 915.0 - 978.0 MHz           |                  |                    |                 |                     |        |
| Port(s)                      | Band-Edge Markers and Limit |                  |                    | Revised Limit   |                     | Margin |
|                              | M3 Amplitude (dBm)          | Plot Limit (dBm) | M2 Frequency (MHz) | Amplitude (dBm) | M2A Frequency (MHz) | (MHz)  |
| a                            | <a href="#">-38.38</a>      | -13.00           | 927.20             | --              | --                  | -0.800 |

#### Traceability to Industry Recognized Test Methodologies

|                                 |                                               |
|---------------------------------|-----------------------------------------------|
| <b>Work Instruction:</b>        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| <b>Measurement Uncertainty:</b> | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

Note: click the links in the above matrix to view the graphical image (plot).

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#### Equipment Configuration for Conducted High Band-Edge Emissions - Average

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 500DSS         | <b>Duty Cycle (%):</b>            | 100            |
| <b>Data Rate:</b>              | 1.2 KBit/s     | <b>Antenna Gain (dBi):</b>        | 3              |
| <b>Modulation:</b>             | DSS            | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| <b>Channel Frequency:</b>    | 926.9 MHz                   |                     |                       |                    |                        |                 |
|------------------------------|-----------------------------|---------------------|-----------------------|--------------------|------------------------|-----------------|
| <b>Band-Edge Frequency:</b>  | 928.0 MHz                   |                     |                       |                    |                        |                 |
| <b>Test Frequency Range:</b> | 915.0 - 978.0 MHz           |                     |                       |                    |                        |                 |
| Port(s)                      | Band-Edge Markers and Limit |                     |                       | Revised Limit      |                        | Margin<br>(MHz) |
|                              | M3 Amplitude<br>(dBm)       | Plot Limit<br>(dBm) | M2 Frequency<br>(MHz) | Amplitude<br>(dBm) | M2A Frequency<br>(MHz) |                 |
| a                            | <a href="#">-38.64</a>      | -15.00              | 927.40                | --                 | --                     | -0.600          |

#### Traceability to Industry Recognized Test Methodologies

|                                 |                                               |
|---------------------------------|-----------------------------------------------|
| <b>Work Instruction:</b>        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| <b>Measurement Uncertainty:</b> | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

Note: click the links in the above matrix to view the graphical image (plot).

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## 9.8. Power Spectral Density

| Conducted Test Conditions for Power Spectral Density |                          |                            |             |
|------------------------------------------------------|--------------------------|----------------------------|-------------|
| <b>Standard:</b>                                     | FCC CFR 47:15.247        | <b>Ambient Temp. (°C):</b> | 24.0 - 27.5 |
| <b>Test Heading:</b>                                 | Power Spectral Density   | <b>Rel. Humidity (%):</b>  | 32 - 45     |
| <b>Standard Section(s):</b>                          | 15.247 (e)               | <b>Pressure (mBars):</b>   | 999 - 1001  |
| <b>Reference Document(s):</b>                        | See Normative References |                            |             |

### Test Procedure for Power Spectral Density

The transmitter output was connected to a spectrum analyzer and the measured made in a 3 kHz resolution bandwidth using the analyzer auto-coupled sweep-time. A peak value was found over the full emission bandwidth and the spectrum downloaded for post processing purposes.

Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. The Peak Power Spectral Density is the highest level found across the emission bandwidth. With multiple antenna port measurements the numerical analyzer data from each port is summed (Σ) and a link to this additional graphic is provided.

Testing was performed under ambient conditions at nominal voltage only.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Measure and sum the spectra across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The individual spectra are then summed mathematically in linear power units. Unlike in-band power measurements, in which the sum involves a single measured value (output power) from each output, measurements for compliance with PSD limits involve summing entire spectra across corresponding frequency bins on the various outputs. Consistency is maintained for any device with multiple transmitter outputs to be certain the individual outputs are all aligned with the same span and same number of points. In this instance, the linear power spectrum value within the first spectral bin of output 0 is summed with that in the first spectral bin of output 1, and the first spectral bin of output 2, and so on up to the Nth output to obtain the true value for the first frequency bin of the summed spectrum. The summed spectrum value for each frequency bin is computed in this fashion. These summed spectral values were post processed and the resulting numerical and graphical data presented.

### NOTE:

It may be observed that the spectrum in some antenna port plots break the limit line however this in itself does NOT constitute a failure. In all cases a spectrum summation plot is provided in order to prove compliance. A failure occurs only after the summation of all spectrum plots have been summed and are found to be greater than the limit line.

### Supporting Information

Calculated Power =  $A + 10 \log (1/x)$  dBm

$A$  = Total Power Spectral Density [ $10 \log_{10} (10^{a/10} + 10^{b/10} + 10^{c/10} + 10^{d/10})$ ]

$x$  = Duty Cycle

### Limits Power Spectral Density

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

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#### Equipment Configuration for Power Spectral Density - Average

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | 500DSS         | <b>Duty Cycle (%):</b>            | 100.0          |
| <b>Data Rate:</b>              | 1.2 KBit/s     | <b>Antenna Gain (dBi):</b>        | 3.00           |
| <b>Modulation:</b>             | DSS            | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured Power Spectral Density |    |    |    | Amplitude Summation + DCCF (+0 dB) | Limit    | Margin |
|----------------|---------------------------------|----|----|----|------------------------------------|----------|--------|
|                | Port(s) (dBm/3KHz)              |    |    |    |                                    |          |        |
| MHz            | a                               | b  | c  | d  | dBm/3KHz                           | dBm/3KHz | dB     |
| 902.6          | <a href="#">-2.800</a>          | -- | -- | -- | <a href="#">-2.800</a>             | 8.0      | -10.8  |
| 915.1          | <a href="#">-2.821</a>          | -- | -- | -- | <a href="#">-2.821</a>             | 8.0      | -10.8  |
| 926.9          | <a href="#">-2.747</a>          | -- | -- | -- | <a href="#">-2.747</a>             | 8.0      | -10.7  |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                  |
|--------------------------|----------------------------------|
| Work Instruction:        | WI-03 MEASURING RF SPECTRUM MASK |
| Measurement Uncertainty: | ±2.81 dB                         |

DCCF - Duty Cycle Correction Factor

Note: click the links in the above matrix to view the graphical image (plot).

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## **9.9. Radiated Emissions**

### **9.9.1. Radiated Spurious**

**Transmitter Radiated Spurious Emissions (above 1 GHz); Peak Field Strength Measurements; and Radiated Band Edge Measurements – Restricted Bands**

**FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209**

**Industry Canada RSS-210 §A8.5, §2.2, §2.6**

**Industry Canada RSS-Gen §4.7**

#### **Test Procedure**

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

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### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

where: FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss or Waveguide Loss

For example:

Given receiver input reading of 51.5 dB $\mu$ V; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dB}\mu\text{V/m}$$

Conversion between dB $\mu$ V/m (or dB $\mu$ V) and  $\mu$ V/m (or  $\mu$ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log (level (}\mu\text{V/m))}$$

$$40 \text{ dB}\mu\text{V/m} = 100 \mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$

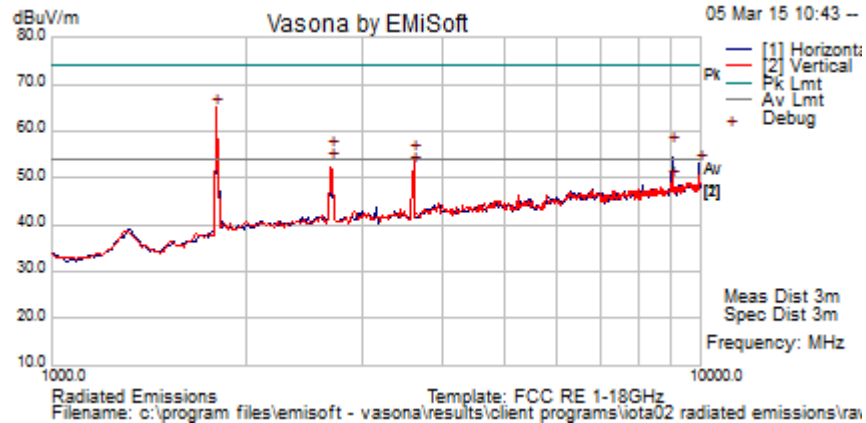
**NOTE: KDB 662911 was implemented for Out-of-Band measurements. Where necessary Option (2) Measure and add 10 log (N) dB was implemented**



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### Frequency Hopping Operation

|                      |                                                         |                       |      |
|----------------------|---------------------------------------------------------|-----------------------|------|
| <b>Test Freq.</b>    | 902.5 MHz 125 KHz                                       | <b>Engineer</b>       | JMH  |
| <b>Variant</b>       | Base Station                                            | <b>Temp (°C)</b>      | 14   |
| <b>Freq. Range</b>   | 1-10GHz                                                 | <b>Rel. Hum.(%)</b>   | 36   |
| <b>Power Setting</b> | PS 12                                                   | <b>Press. (mBars)</b> | 1005 |
| <b>Antenna</b>       | Integral                                                |                       |      |
| <b>Test Notes 1</b>  | Base Version 2, higher voltage on Amp, different filter |                       |      |
| <b>Test Notes 2</b>  |                                                         |                       |      |



### Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 2707.766      | 63.0     | 4.2        | -11.4 | 55.8         | Peak Max         | V   | 161    | 250     | 74.0         | -18.3     | Pass       | RB       |
| 2707.766      | 60.4     | 4.2        | -11.4 | 53.2         | Average Max      | V   | 161    | 250     | 54.0         | -0.8      | Pass       | RB       |
| 3610.333      | 58.8     | 4.9        | -11.1 | 52.5         | Average Max      | V   | 148    | 180     | 54           | -1.5      | Pass       | RB       |
| 3610.333      | 61.5     | 4.9        | -11.1 | 55.2         | Peak Max         | V   | 148    | 180     | 74           | -18.8     | Pass       | RB       |
| 9025.789      | 48.4     | 8.1        | -6.9  | 49.6         | Average Max      | H   | 146    | 337     | 54           | -4.4      | Pass       | RB       |
| 9025.789      | 55.7     | 8.1        | -6.9  | 56.9         | Peak Max         | H   | 146    | 337     | 74           | -17.1     | Pass       | RB       |
| 1793.587      | 75.4     | 3.4        | -13.8 | 65.0         | Peak [Scan]      | V   |        |         |              |           |            | NRB      |
| 9945.892      | 49.7     | 8.7        | -5.4  | 53.0         | Peak [Scan]      | H   |        |         |              |           |            | NRB      |

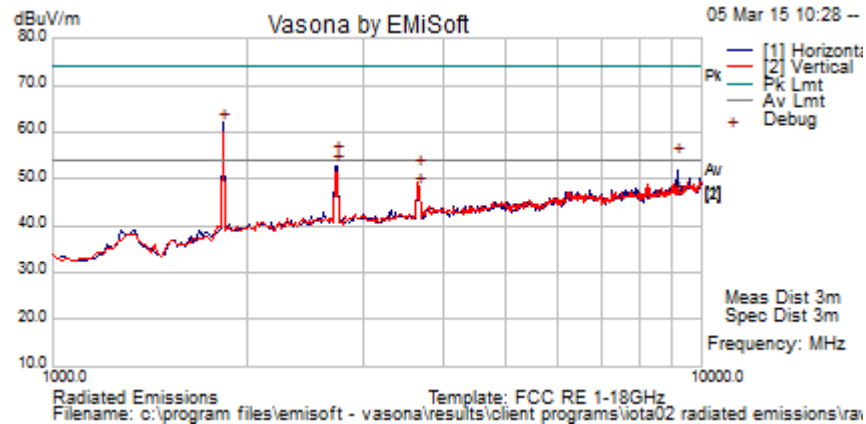
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission  
NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

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|               |                                                         |                |      |
|---------------|---------------------------------------------------------|----------------|------|
| Test Freq.    | 915 MHz, 125 KHz                                        | Engineer       | JMH  |
| Variant       | Base Station                                            | Temp (°C)      | 14   |
| Freq. Range   | 1-10GHz                                                 | Rel. Hum.(%)   | 36   |
| Power Setting | PS 12                                                   | Press. (mBars) | 1005 |
| Antenna       | Integral                                                |                |      |
| Test Notes 1  |                                                         |                |      |
| Test Notes 2  | Base Version 2, higher voltage on Amp, different filter |                |      |



#### Formally measured emission peaks

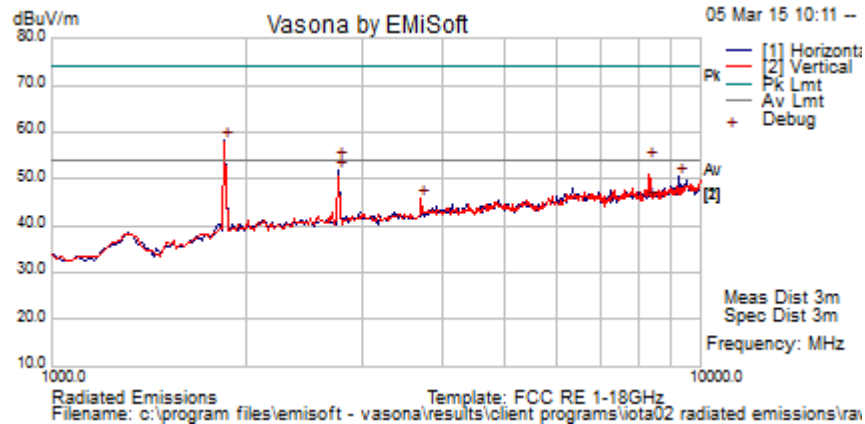
| Frequency MHz                                                                                           | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 2745.266                                                                                                | 62.3     | 4.2        | -11.4 | 55.1         | Peak Max         | H   | 101    | 151     | 74.0         | -18.9     | Pass       | RB       |
| 2745.266                                                                                                | 59.9     | 4.2        | -11.4 | 52.8         | Average Max      | H   | 101    | 151     | 54.0         | -1.2      | Pass       | RB       |
| 3660.371                                                                                                | 58.4     | 4.9        | -11.0 | 52.3         | Peak Max         | V   | 140    | 148     | 74           | -21.7     | Pass       | RB       |
| 3660.371                                                                                                | 54.5     | 4.9        | -11.0 | 48.3         | Average Max      | V   | 140    | 148     | 54           | -5.7      | Pass       | RB       |
| 9150.726                                                                                                | 53.7     | 8.2        | -7.2  | 54.7         | Peak Max         | H   | 126    | -1      | 74           | -19.3     | Pass       | RB       |
| 9150.726                                                                                                | 45.3     | 8.2        | -7.2  | 46.3         | Average Max      | H   | 126    | -1      | 54           | -7.7      | Pass       | RB       |
| 1829.659                                                                                                | 72.1     | 3.4        | -13.5 | 62.0         | Peak [Scan]      | H   | 200    |         |              |           |            | NRB      |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission |          |            |       |              |                  |     |        |         |              |           |            |          |
| NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205                |          |            |       |              |                  |     |        |         |              |           |            |          |

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|                      |                                                         |                       |      |
|----------------------|---------------------------------------------------------|-----------------------|------|
| <b>Test Freq.</b>    | 927 MHz 125 KHz                                         | <b>Engineer</b>       | JMH  |
| <b>Variant</b>       | TX Spur on Base Station                                 | <b>Temp (°C)</b>      | 14   |
| <b>Freq. Range</b>   | 1-10GHz                                                 | <b>Rel. Hum.(%)</b>   | 36   |
| <b>Power Setting</b> | PS 12                                                   | <b>Press. (mBars)</b> | 1005 |
| <b>Antenna</b>       | Integral                                                |                       |      |
| <b>Test Notes 1</b>  |                                                         |                       |      |
| <b>Test Notes 2</b>  | Base Version 2, higher voltage on Amp, different filter |                       |      |



#### Formally measured emission peaks

| Frequency MHz                                                                                                                                                                                       | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass/Fail | Comments |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|-----------|----------|
| 2780.912                                                                                                                                                                                            | 58.6     | 4.2        | -11.3 | 51.5         | Average Max      | H   | 172    | 164     | 54.0         | -2.5      | Pass      | RB       |
| 2780.912                                                                                                                                                                                            | 61.1     | 4.2        | -11.3 | 54.0         | Peak Max         | H   | 172    | 164     | 74           | -20.0     | Pass      | RB       |
| 8342.523                                                                                                                                                                                            | 44.4     | 7.8        | -7.1  | 45.1         | Average Max      | V   | 99     | -1      | 54           | -8.9      | Pass      | RB       |
| 8342.523                                                                                                                                                                                            | 52.9     | 7.8        | -7.1  | 53.6         | Peak Max         | V   | 99     | -1      | 74           | -20.4     | Pass      | RB       |
| 1847.695                                                                                                                                                                                            | 68.2     | 3.4        | -13.5 | 58.1         | Peak [Scan]      | H   |        |         |              |           |           | NRB      |
| 3706.575                                                                                                                                                                                            | 51.8     | 4.9        | -10.9 | 45.8         | Peak [Scan]      | H   | 98     | 361     | 54           | -8.2      | Pass      | RB       |
| 9277.780                                                                                                                                                                                            | 49.3     | 8.3        | -7.0  | 50.6         | Peak [Scan]      | H   |        |         |              |           |           | NRB      |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission<br>NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205 |          |            |       |              |                  |     |        |         |              |           |           |          |

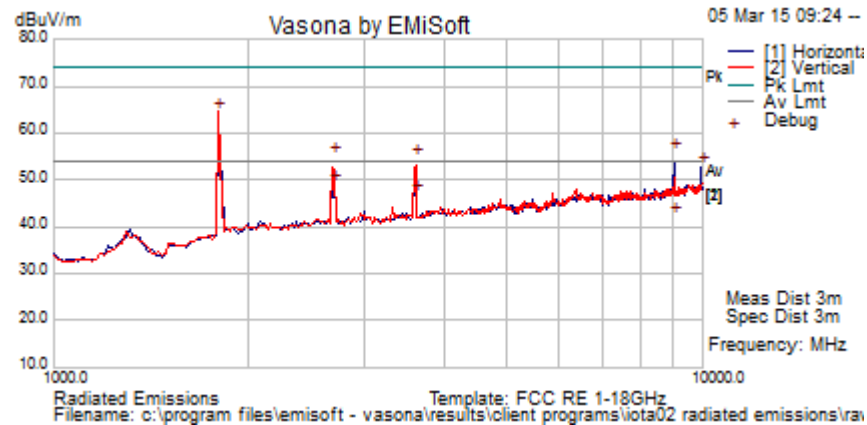
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## DSS Operation

|               |                                                         |                |      |
|---------------|---------------------------------------------------------|----------------|------|
| Test Freq.    | 902.5 MHz 500 KHz                                       | Engineer       | JMH  |
| Variant       | TX Spur on Base Station                                 | Temp (°C)      | 14   |
| Freq. Range   | 1-10GHz                                                 | Rel. Hum.(%)   | 36   |
| Power Setting | PS 12                                                   | Press. (mBars) | 1005 |
| Antenna       | Integral                                                |                |      |
| Test Notes 1  | Base Version 2, higher voltage on Amp, different filter |                |      |
| Test Notes 2  |                                                         |                |      |



## Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 2707.703      | 62.4     | 4.2        | -11.4 | 55.2         | Peak Max         | V   | 137    | 255     | 74.0         | -18.8     | Pass       | RB       |
| 2707.703      | 56.5     | 4.2        | -11.4 | 49.3         | Average Max      | V   | 137    | 255     | 54           | -4.7      | Pass       | RB       |
| 3610.346      | 53.3     | 4.9        | -11.1 | 47.0         | Average Max      | V   | 146    | 177     | 54           | -7.0      | Pass       | RB       |
| 3610.346      | 61.1     | 4.9        | -11.1 | 54.8         | Peak Max         | V   | 146    | 177     | 74           | -19.2     | Pass       | RB       |
| 9026.052      | 40.8     | 8.1        | -6.9  | 42.0         | Average Max      | H   | 156    | 334     | 54           | -12.0     | Pass       | RB       |
| 9026.052      | 54.7     | 8.1        | -6.9  | 55.9         | Peak Max         | H   | 156    | 334     | 74           | -18.1     | Pass       | RB       |
| 1793.587      | 75.1     | 3.4        | -13.8 | 64.7         | Peak [Scan]      | V   |        |         |              |           |            | NRB      |
| 9945.892      | 49.6     | 8.7        | -5.4  | 52.8         | Peak [Scan]      | H   |        |         |              |           |            | NRB      |

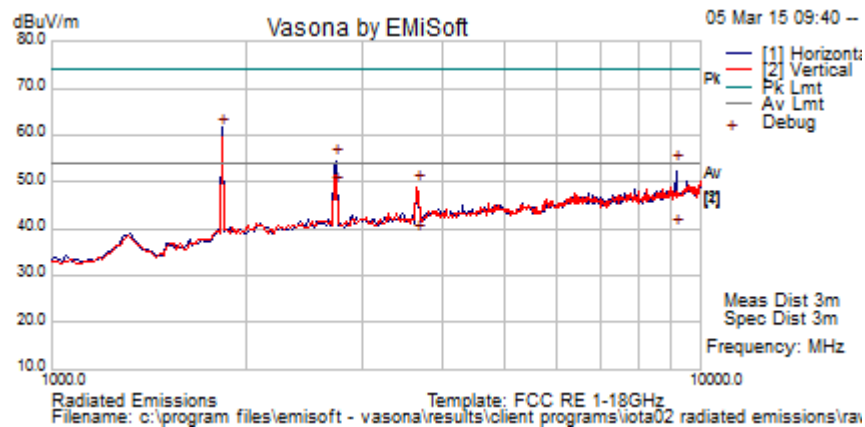
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission  
NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

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|                      |                                                         |                       |      |
|----------------------|---------------------------------------------------------|-----------------------|------|
| <b>Test Freq.</b>    | 915 MHz, 500 KHz                                        | <b>Engineer</b>       | JMH  |
| <b>Variant</b>       | TX Spur on Base Station                                 | <b>Temp (°C)</b>      | 14   |
| <b>Freq. Range</b>   | 1-10GHz                                                 | <b>Rel. Hum.(%)</b>   | 36   |
| <b>Power Setting</b> | PS 12                                                   | <b>Press. (mBars)</b> | 1005 |
| <b>Antenna</b>       | Integral                                                |                       |      |
| <b>Test Notes 1</b>  | Base Version 2, higher voltage on Amp, different filter |                       |      |
| <b>Test Notes 2</b>  |                                                         |                       |      |



#### Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 2745.128      | 56.3     | 4.2        | -11.4 | 49.2         | Average Max      | H   | 101    | 152     | 54.0         | -4.8      | Pass       | RB       |
| 2745.128      | 62.3     | 4.2        | -11.4 | 55.1         | Peak Max         | H   | 101    | 152     | 74.0         | -18.9     | Pass       | RB       |
| 3660.308      | 55.5     | 4.9        | -11.0 | 49.4         | Peak Max         | H   | 100    | 22      | 74           | -24.6     | Pass       | RB       |
| 3660.308      | 44.8     | 4.9        | -11.0 | 38.7         | Average Max      | H   | 100    | 22      | 54           | -15.3     | Pass       | RB       |
| 9150.451      | 39.0     | 8.2        | -7.2  | 40.0         | Average Max      | H   | 118    | -1      | 54           | -14.0     | Pass       | RB       |
| 9150.451      | 52.8     | 8.2        | -7.2  | 53.8         | Peak Max         | H   | 118    | -1      | 74           | -20.2     | Pass       | RB       |
| 1829.659      | 71.7     | 3.4        | -13.5 | 61.6         | Peak [Scan]      | H   |        |         |              |           |            | NRB      |

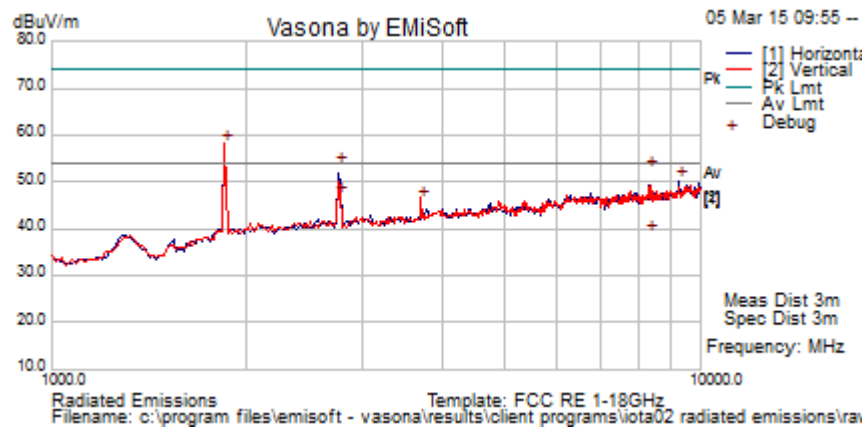
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission  
 NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

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|               |                                                         |                |      |
|---------------|---------------------------------------------------------|----------------|------|
| Test Freq.    | 927 MHz 500 KHz                                         | Engineer       | JMH  |
| Variant       | TX Spur on Base Station                                 | Temp (°C)      | 14   |
| Freq. Range   | 1-10GHz                                                 | Rel. Hum.(%)   | 36   |
| Power Setting | PS 12                                                   | Press. (mBars) | 1005 |
| Antenna       | Integral                                                |                |      |
| Test Notes 1  | Base Version 2, higher voltage on Amp, different filter |                |      |
| Test Notes 2  |                                                         |                |      |



#### Formally measured emission peaks

| Frequency MHz                                                                                           | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 2780.949                                                                                                | 54.2     | 4.2        | -11.3 | 47.1         | Average Max      | H   | 171    | 162     | 54.0         | -6.9      | Pass       | RB       |
| 2780.949                                                                                                | 60.3     | 4.2        | -11.3 | 53.2         | Peak Max         | H   | 171    | 162     | 74.0         | -20.8     | Pass       | RB       |
| 8342.624                                                                                                | 38.0     | 7.8        | -7.1  | 38.7         | Average Max      | H   | 101    | 182     | 54           | -15.3     | Pass       | RB       |
| 8342.624                                                                                                | 51.7     | 7.8        | -7.1  | 52.4         | Peak Max         | H   | 101    | 182     | 74           | -21.7     | Pass       | RB       |
| 1847.695                                                                                                | 68.3     | 3.4        | -13.5 | 58.2         | Peak [Scan]      | H   |        |         |              |           |            | NRB      |
| 9278.557                                                                                                | 48.9     | 8.3        | -7.0  | 50.2         | Peak [Scan]      | H   |        |         |              |           |            | NRB      |
| 3706.338                                                                                                | 52.3     | 4.9        | -10.9 | 46.3         | Peak [Scan]      | V   | 100    | -1      | 54           | -7.7      | Pass       | RB       |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission |          |            |       |              |                  |     |        |         |              |           |            |          |
| NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205                |          |            |       |              |                  |     |        |         |              |           |            |          |

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## Specification Limits

**FCC §15.247(d) and RSS-210 §A8.5** 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 radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

### **FCC §15.247(d)**

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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

**IC RSS-210 §A8.5** If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

### **IC RSS-Gen §4.7**

The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz, whichever is the lowest frequency, to the 5<sup>th</sup> harmonic of the highest frequency generated without exceeding 40 GHz.

**FCC §15.205 (a)** Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

**FCC §15.205 (a)** Except as shown 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 Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

**FCC §15.209 (a)** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.



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**§15.209 (a) Limit Matrix**

| Frequency(MHz) | Field Strength<br>( $\mu$ V/m) | Field Strength<br>(dB $\mu$ V/m) | Measurement Distance<br>(meters) |
|----------------|--------------------------------|----------------------------------|----------------------------------|
| 30-88          | 100                            | 40.0                             | 3                                |
| 88-216         | 150                            | 43.5                             | 3                                |
| 216-960        | 200                            | 46.0                             | 3                                |
| Above 960      | 500                            | 54.0                             | 3                                |

**Laboratory Measurement Uncertainty for Radiated Emissions**

|                         |               |
|-------------------------|---------------|
| Measurement uncertainty | +5.6/ -4.5 dB |
|-------------------------|---------------|

**Traceability**

| Method                                                                                | Test Equipment Used                            |
|---------------------------------------------------------------------------------------|------------------------------------------------|
| Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions' | 0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312 |

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### 9.9.2. Digital Emissions (0.03-1 GHz)

**FCC, Part 15 Subpart C §15.205/ §15.209**  
**Industry Canada RSS-210 §2.2**

#### **Test Procedure**

Testing 30M-1 GHz was performed in a 3-meter anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

The EUT had two methods of powering on ac/dc converter and Power over Ethernet (POE). Both modes were tested for emissions below 1GHz.

#### **Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength  
R = Measured Receiver Input Amplitude  
AF = Antenna Factor  
CORR = Correction Factor = CL – AG + NFL  
CL = Cable Loss  
AG = Amplifier Gain

For example:

Given a Receiver input reading of 51.5dBμV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3\text{dB}\mu\text{V/m}$$

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log (level (}\mu\text{V/m))}$$

$$40 \text{ dB}\mu\text{V/m} = 100\mu\text{V/m}$$

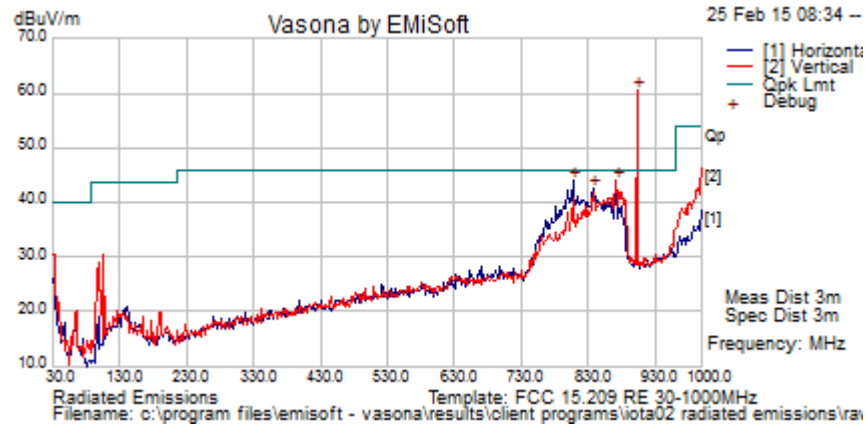
$$48 \text{ dB}\mu\text{V/m} = 250\mu\text{V/m}$$



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### Frequency Hopping Operation

|                      |                         |                       |      |
|----------------------|-------------------------|-----------------------|------|
| <b>Test Freq.</b>    | 902.5 MHz, 125 KHz BW   | <b>Engineer</b>       | JMH  |
| <b>Variant</b>       | TX Spur on Base Station | <b>Temp (°C)</b>      | 15   |
| <b>Freq. Range</b>   | 30 MHz - 1000 MHz       | <b>Rel. Hum.(%)</b>   | 36   |
| <b>Power Setting</b> | Maximum (+30 dBm)       | <b>Press. (mBars)</b> | 1013 |
| <b>Antenna</b>       | Integral                |                       |      |
| <b>Test Notes 1</b>  |                         |                       |      |
| <b>Test Notes 2</b>  | SN# PP01 AC 120V PS     |                       |      |



### Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 902.806       | 61.8     | 6.3        | -7.6  | 60.6         | Peak [Scan]      | V   |        |         |              |           |            | FUND     |
| 807.555       | 46.5     | 6.1        | -8.7  | 43.9         | Peak [Scan]      | H   | 100    | 0       | 46           | -2.1      | Pass       | NRB      |
| 838.504       | 44.6     | 6.2        | -8.3  | 42.6         | Peak [Scan]      | H   | 98     | -1      | 46           | -3.5      | Pass       | NRB      |
| 871.762       | 45.6     | 6.3        | -8.1  | 43.8         | Peak [Scan]      | H   | 98     | -1      | 46           | -2.2      | Pass       | NRB      |

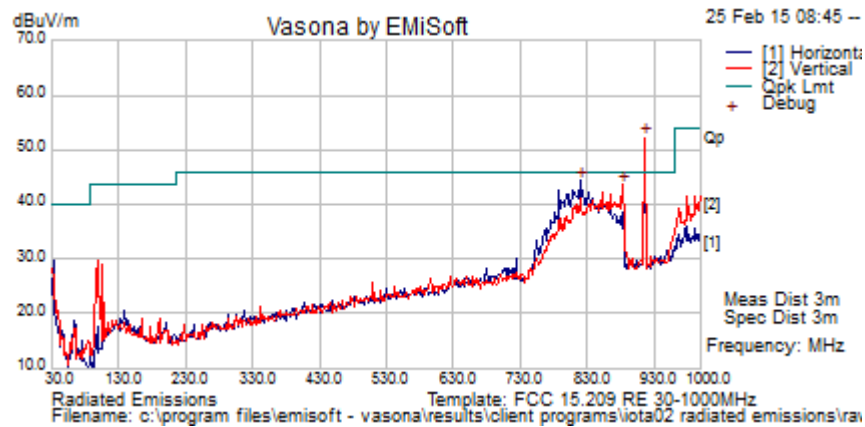
Legend: DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency  
NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

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|                      |                         |                       |      |
|----------------------|-------------------------|-----------------------|------|
| <b>Test Freq.</b>    | 915 MHz, 125 KHz BW     | <b>Engineer</b>       | JMH  |
| <b>Variant</b>       | Tx Spur on Base Station | <b>Temp (°C)</b>      | 15   |
| <b>Freq. Range</b>   | 30 MHz - 1000 MHz       | <b>Rel. Hum.(%)</b>   | 36   |
| <b>Power Setting</b> | Maximum (+30 dBm)       | <b>Press. (mBars)</b> | 1013 |
| <b>Antenna</b>       | Integral                |                       |      |
| <b>Test Notes 1</b>  |                         |                       |      |
| <b>Test Notes 2</b>  | SN# PP01 AC 120V PS     |                       |      |



#### Formally measured emission peaks

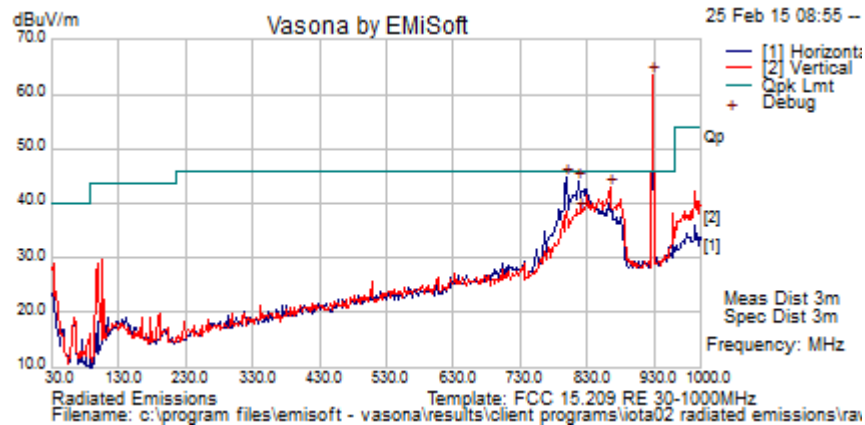
| Frequency MHz                                                                                  | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 916.413                                                                                        | 53.3     | 6.4        | -7.6  | 52.2         | Peak [Scan]      | V   |        |         |              |           |            | FUND     |
| 819.218                                                                                        | 46.5     | 6.1        | -8.3  | 44.4         | Peak [Scan]      | H   | 100    | 0       | 46.0         | -1.6      | Pass       | NRB      |
| 883.275                                                                                        | 45.0     | 6.3        | -8.0  | 43.3         | Peak [Scan]      | V   | 99     | -1      | 46.0         | -2.7      | Pass       | NRB      |
| Legend: DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency |          |            |       |              |                  |     |        |         |              |           |            |          |
| NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band              |          |            |       |              |                  |     |        |         |              |           |            |          |

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|                      |                         |                       |      |
|----------------------|-------------------------|-----------------------|------|
| <b>Test Freq.</b>    | 927 MHz, 125 KHz BW     | <b>Engineer</b>       | JMH  |
| <b>Variant</b>       | Tx Spur on Base Station | <b>Temp (°C)</b>      | 15   |
| <b>Freq. Range</b>   | 30 MHz - 1000 MHz       | <b>Rel. Hum.(%)</b>   | 36   |
| <b>Power Setting</b> | Maximum (+30 dBm)       | <b>Press. (mBars)</b> | 1013 |
| <b>Antenna</b>       | Integral                |                       |      |
| <b>Test Notes 1</b>  |                         |                       |      |
| <b>Test Notes 2</b>  | SN# PP01 AC 120V PS     |                       |      |



#### Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 928.076       | 64.3     | 6.4        | -7.3  | 63.4         | Peak [Scan]      | V   |        |         |              |           |            | FUND     |
| 799.780       | 47.5     | 6.1        | -8.8  | 44.8         | Peak [Scan]      | H   | 100    | 0       | 46.0         | -1.2      | Pass       | NRB      |
| 817.413       | 46.2     | 6.1        | -8.4  | 44.0         | Peak [Scan]      | H   | 99     | -1      | 46.0         | -2.0      | Pass       | NRB      |
| 863.677       | 44.7     | 6.3        | -8.1  | 42.9         | Peak [Scan]      | V   | 99     | -1      | 46.0         | -3.1      | Pass       | NRB      |

Legend: DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency  
NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

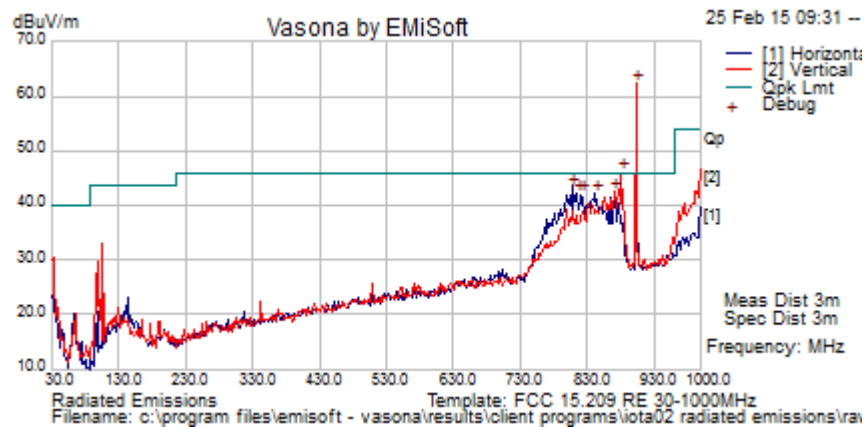
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**Title:** Iotera - Home Base  
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**Serial #:** IOTA01-U3a 900 MHz Rev A  
**Issue Date:** 8<sup>th</sup> April 2015  
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## DSS Operation

|               |                         |                |      |
|---------------|-------------------------|----------------|------|
| Test Freq.    | 902.5 MHz, 500 KHz BW   | Engineer       | JMH  |
| Variant       | TX Spur on Base Station | Temp (°C)      | 15   |
| Freq. Range   | 30 MHz - 1000 MHz       | Rel. Hum.(%)   | 36   |
| Power Setting | Maximum (+30 dBm)       | Press. (mBars) | 1013 |
| Antenna       | Integral                |                |      |
| Test Notes 1  | SN# PP01 AC 120V PS     |                |      |
| Test Notes 2  |                         |                |      |



## Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 902.806       | 63.5     | 6.3        | -7.6  | 62.3         | Peak [Scan]      | V   |        |         |              |           |            | FUND     |
| 881.423       | 47.7     | 6.3        | -8.0  | 46.0         | Peak [Scan]      | V   | 100    | 0       | 46           | -0.1      | Pass       | NRB      |
| 807.339       | 45.8     | 6.1        | -8.7  | 43.2         | Peak [Scan]      | H   | 98     | -1      | 46           | -2.8      | Pass       | NRB      |
| 871.615       | 44.2     | 6.3        | -8.1  | 42.4         | Peak [Scan]      | V   | 98     | -1      | 46           | -3.6      | Pass       | NRB      |
| 814.932       | 44.3     | 6.1        | -8.4  | 42.0         | Peak [Scan]      | V   | 98     | -1      | 46           | -4.0      | Pass       | NRB      |
| 842.214       | 43.9     | 6.3        | -8.3  | 41.9         | Peak [Scan]      | H   | 98     | -1      | 46           | -4.1      | Pass       | NRB      |
| 821.465       | 44.0     | 6.2        | -8.2  | 41.9         | Peak [Scan]      | V   | 98     | -1      | 46           | -4.1      | Pass       | NRB      |

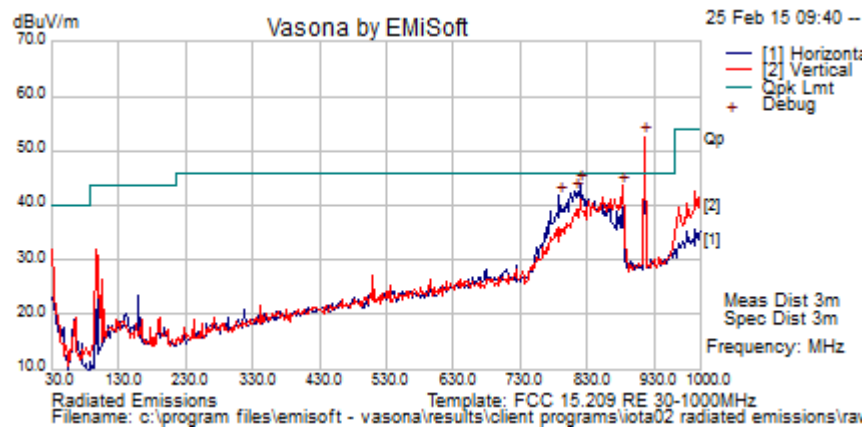
Legend: DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency  
NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

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|               |                         |                |      |
|---------------|-------------------------|----------------|------|
| Test Freq.    | 915 MHz, 500 KHz BW     | Engineer       | JMH  |
| Variant       | Tx Spur on Base Station | Temp (°C)      | 15   |
| Freq. Range   | 30 MHz - 1000 MHz       | Rel. Hum.(%)   | 36   |
| Power Setting | Maximum (+30 dBm)       | Press. (mBars) | 1013 |
| Antenna       | Integral                |                |      |
| Test Notes 1  | SN# PP01 AC 120V PS     |                |      |
| Test Notes 2  |                         |                |      |



#### Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 916.413       | 53.8     | 6.4        | -7.6  | 52.6         | Peak [Scan]      | V   |        |         |              |           |            | FUND     |
| 819.218       | 46.0     | 6.1        | -8.3  | 43.8         | Peak [Scan]      | H   | 100    | 0       | 46.0         | -2.2      | Pass       | NRB      |
| 883.441       | 45.2     | 6.3        | -8.0  | 43.5         | Peak [Scan]      | H   | 99     | -1      | 46.0         | -2.5      | Pass       | NRB      |
| 811.885       | 44.8     | 6.1        | -8.6  | 42.4         | Peak [Scan]      | H   | 99     | -1      | 46.0         | -3.6      | Pass       | NRB      |
| 788.033       | 44.6     | 6.1        | -8.9  | 41.7         | Peak [Scan]      | H   | 99     | -1      | 46.0         | -4.3      | Pass       | NRB      |

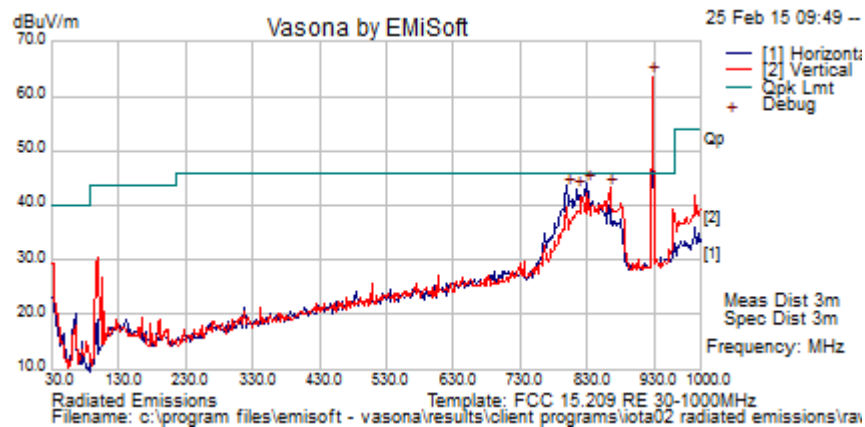
Legend: DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency  
NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

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|                      |                         |                       |      |
|----------------------|-------------------------|-----------------------|------|
| <b>Test Freq.</b>    | 927 MHz, 500 KHz BW     | <b>Engineer</b>       | JMH  |
| <b>Variant</b>       | Tx Spur on Base Station | <b>Temp (°C)</b>      | 15   |
| <b>Freq. Range</b>   | 30 MHz - 1000 MHz       | <b>Rel. Hum.(%)</b>   | 36   |
| <b>Power Setting</b> | Maximum (+30 dBm)       | <b>Press. (mBars)</b> | 1013 |
| <b>Antenna</b>       | Integral                |                       |      |
| <b>Test Notes 1</b>  | SN# PP01 AC 120V PS     |                       |      |
| <b>Test Notes 2</b>  |                         |                       |      |



#### Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 928.076       | 64.5     | 6.4        | -7.3  | 63.6         | Peak [Scan]      | V   |        |         |              |           |            | FUND     |
| 830.882       | 46.0     | 6.2        | -8.1  | 44.0         | Peak [Scan]      | H   | 100    | 0       | 46.0         | -2.0      | Pass       | NRB      |
| 800.072       | 45.8     | 6.1        | -8.8  | 43.1         | Peak [Scan]      | H   | 98     | -1      | 46.0         | -2.9      | Pass       | NRB      |
| 863.821       | 45.1     | 6.3        | -8.1  | 43.2         | Peak [Scan]      | V   | 98     | -1      | 46.0         | -2.8      | Pass       | NRB      |
| 815.336       | 45.1     | 6.1        | -8.4  | 42.8         | Peak [Scan]      | H   | 98     | -1      | 46.0         | -3.2      | Pass       | NRB      |

**Legend:** DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency  
 NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

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## Specification

### Limits

**§15.205 (a)** Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

**§15.205 (a)** Except as shown 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 Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

**§15.209 (a)** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

#### §15.209 (a) and RSS-Gen §2.2 Limit Matrix

| Frequency(MHz) | Field Strength<br>( $\mu\text{V/m}$ ) | Field Strength<br>(dB $\mu\text{V/m}$ ) | Measurement Distance<br>(meters) |
|----------------|---------------------------------------|-----------------------------------------|----------------------------------|
| 30-88          | 100                                   | 40.0                                    | 3                                |
| 88-216         | 150                                   | 43.5                                    | 3                                |
| 216-960        | 200                                   | 46.0                                    | 3                                |
| Above 960      | 500                                   | 54.0                                    | 3                                |

### Laboratory Measurement Uncertainty for Radiated Emissions

|                         |               |
|-------------------------|---------------|
| Measurement uncertainty | +5.6/ -4.5 dB |
|-------------------------|---------------|

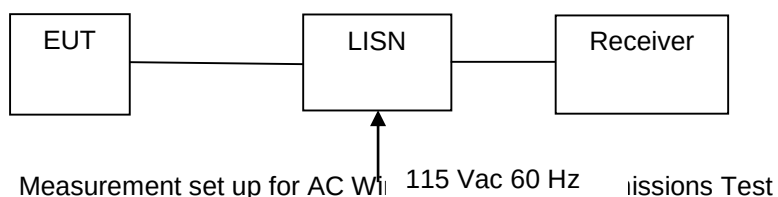
## 9.10. ac Wireline Emissions

**FCC, Part 15 Subpart C §15.207**  
**Industry Canada RSS-Gen §7.2.2**

### Test Procedure

The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

### Test Measurement Set up



### Measurement Results for AC Wireline Conducted Emissions (150 kHz – 30 MHz)

Ambient conditions.

Temperature: **Error! Reference source not found.** °C

**Reference source not found.** %  
**source not found.** mbar

Relative humidity: **Error!**

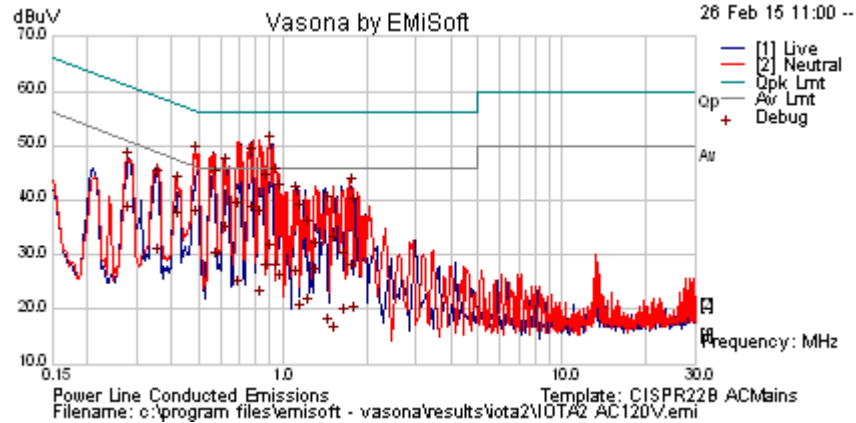
Pressure: **Error! Reference**



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#### ac Wireline Emissions

|               |                                       |                |      |
|---------------|---------------------------------------|----------------|------|
| Test Freq.    | 120V                                  | Engineer       | JMH  |
| Variant       | AC Line Emissions                     | Temp (°C)      | 16   |
| Freq. Range   | 0.150 MHz - 30 MHz                    | Rel. Hum.(%)   | 43   |
| Power Setting | NA                                    | Press. (mBars) | 1008 |
| Antenna       | NA                                    |                |      |
| Test Notes 1  | AC 120V PS V-INFINITY Model:EPS060100 |                |      |
| Test Notes 2  |                                       |                |      |



#### Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | Factors dB | Level dBuV | Measurement Type | Line    | Limit dBuV | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|------------|------------|------------------|---------|------------|-----------|------------|----------|
| 0.277         | 27.3     | 9.9        | 0.1        | 37.3       | Average          | Neutral | 50.91      | -13.6     | Pass       |          |
| 0.277         | 37.2     | 9.9        | 0.1        | 47.2       | Quasi Peak       | Neutral | 60.91      | -13.7     | Pass       |          |
| 0.356         | 19.5     | 9.9        | 0.1        | 29.5       | Average          | Live    | 48.82      | -19.3     | Pass       |          |
| 0.356         | 33.9     | 9.9        | 0.1        | 43.8       | Quasi Peak       | Live    | 58.82      | -15.0     | Pass       |          |
| 0.415         | 32.7     | 9.9        | 0.1        | 42.6       | Quasi Peak       | Neutral | 57.55      | -14.9     | Pass       |          |
| 0.415         | 26.3     | 9.9        | 0.1        | 36.3       | Average          | Neutral | 47.55      | -11.3     | Pass       |          |
| 0.482         | 26.5     | 9.9        | 0.1        | 36.5       | Average          | Neutral | 46.3       | -9.8      | Pass       |          |
| 0.482         | 38.2     | 9.9        | 0.1        | 48.2       | Quasi Peak       | Neutral | 56.3       | -8.1      | Pass       |          |
| 0.570         | 33.7     | 9.9        | 0.1        | 43.7       | Quasi Peak       | Live    | 56         | -12.3     | Pass       |          |
| 0.570         | 18.8     | 9.9        | 0.1        | 28.9       | Average          | Live    | 46         | -17.2     | Pass       |          |
| 0.620         | 36.2     | 10.0       | 0.1        | 46.2       | Quasi Peak       | Neutral | 56         | -9.8      | Pass       |          |
| 0.620         | 23.5     | 10.0       | 0.1        | 33.6       | Average          | Neutral | 46         | -12.4     | Pass       |          |
| 0.689         | 13.6     | 10.0       | 0.1        | 23.7       | Average          | Neutral | 46         | -22.4     | Pass       |          |
| 0.689         | 27.8     | 10.0       | 0.1        | 37.8       | Quasi Peak       | Neutral | 56         | -18.2     | Pass       |          |
| 0.763         | 37.9     | 10.0       | 0.1        | 47.9       | Quasi Peak       | Neutral | 56         | -8.1      | Pass       |          |
| 0.763         | 27.1     | 10.0       | 0.1        | 37.1       | Average          | Neutral | 46         | -8.9      | Pass       |          |
| 0.826         | 26.4     | 9.9        | 0.1        | 36.4       | Quasi Peak       | Neutral | 56         | -19.6     | Pass       |          |
| 0.826         | 11.7     | 9.9        | 0.1        | 21.7       | Average          | Neutral | 46         | -24.3     | Pass       |          |
| 0.855         | 33.3     | 9.9        | 0.1        | 43.3       | Quasi Peak       | Live    | 56         | -12.7     | Pass       |          |

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|         |                                                                                        |      |     |      |            |         |    |       |      |  |
|---------|----------------------------------------------------------------------------------------|------|-----|------|------------|---------|----|-------|------|--|
| 0.855   | 16.5                                                                                   | 9.9  | 0.1 | 26.5 | Average    | Live    | 46 | -19.5 | Pass |  |
| 0.897   | 40.2                                                                                   | 9.9  | 0.1 | 50.2 | Quasi Peak | Neutral | 56 | -5.8  | Pass |  |
| 0.897   | 20.3                                                                                   | 9.9  | 0.1 | 30.3 | Average    | Neutral | 46 | -15.7 | Pass |  |
| 0.929   | 34.2                                                                                   | 9.9  | 0.1 | 44.2 | Quasi Peak | Live    | 56 | -11.8 | Pass |  |
| 0.929   | 16.7                                                                                   | 9.9  | 0.1 | 26.7 | Average    | Live    | 46 | -19.3 | Pass |  |
| 0.962   | 14.8                                                                                   | 9.9  | 0.1 | 24.8 | Average    | Neutral | 46 | -21.2 | Pass |  |
| 0.962   | 31.3                                                                                   | 9.9  | 0.1 | 41.3 | Quasi Peak | Neutral | 56 | -14.7 | Pass |  |
| 1.106   | 30.8                                                                                   | 9.9  | 0.1 | 40.8 | Quasi Peak | Neutral | 56 | -15.2 | Pass |  |
| 1.106   | 15.6                                                                                   | 9.9  | 0.1 | 25.6 | Average    | Neutral | 46 | -20.4 | Pass |  |
| 1.138   | 27.7                                                                                   | 9.9  | 0.1 | 37.7 | Quasi Peak | Live    | 56 | -18.3 | Pass |  |
| 1.138   | 9.1                                                                                    | 9.9  | 0.1 | 19.1 | Average    | Live    | 46 | -26.9 | Pass |  |
| 1.213   | 24.7                                                                                   | 10.0 | 0.1 | 34.8 | Quasi Peak | Live    | 56 | -21.3 | Pass |  |
| 1.213   | 10.1                                                                                   | 10.0 | 0.1 | 20.2 | Average    | Live    | 46 | -25.8 | Pass |  |
| 1.311   | 15.9                                                                                   | 10.0 | 0.1 | 25.9 | Average    | Neutral | 46 | -20.1 | Pass |  |
| 1.311   | 20.4                                                                                   | 10.0 | 0.1 | 30.5 | Quasi Peak | Neutral | 56 | -25.5 | Pass |  |
| 1.427   | 28.9                                                                                   | 10.0 | 0.1 | 38.9 | Quasi Peak | Live    | 56 | -17.1 | Pass |  |
| 1.427   | 6.5                                                                                    | 10.0 | 0.1 | 16.6 | Average    | Live    | 46 | -29.4 | Pass |  |
| 1.519   | 21.7                                                                                   | 10.0 | 0.1 | 31.8 | Quasi Peak | Neutral | 56 | -24.2 | Pass |  |
| 1.519   | 5.1                                                                                    | 10.0 | 0.1 | 15.2 | Average    | Neutral | 46 | -30.8 | Pass |  |
| 1.631   | 18.8                                                                                   | 10.0 | 0.1 | 29.0 | Quasi Peak | Live    | 56 | -27.1 | Pass |  |
| 1.631   | 8.4                                                                                    | 10.0 | 0.1 | 18.5 | Average    | Live    | 46 | -27.5 | Pass |  |
| 1.745   | 16.6                                                                                   | 10.0 | 0.1 | 26.7 | Average    | Neutral | 46 | -19.3 | Pass |  |
| 1.745   | 32.2                                                                                   | 10.0 | 0.1 | 42.3 | Quasi Peak | Neutral | 56 | -13.7 | Pass |  |
| 1.781   | 28.6                                                                                   | 10.0 | 0.1 | 38.7 | Quasi Peak | Live    | 56 | -17.3 | Pass |  |
| 1.781   | 8.8                                                                                    | 10.0 | 0.1 | 18.9 | Average    | Live    | 46 | -27.1 | Pass |  |
|         |                                                                                        |      |     |      |            |         |    |       |      |  |
| Legend: | DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency |      |     |      |            |         |    |       |      |  |
|         | NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band      |      |     |      |            |         |    |       |      |  |

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## Specification

### Limit

**§15.207 (a)** Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu\Omega$  line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

### §15.207 (a) Limit Matrix

The lower limit applies at the boundary between frequency ranges

| Frequency of Emission (MHz) | Conducted Limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

\* Decreases with the logarithm of the frequency

### Laboratory Measurement Uncertainty for Conducted Emissions

|                         |               |
|-------------------------|---------------|
| Measurement uncertainty | $\pm 2.64$ dB |
|-------------------------|---------------|

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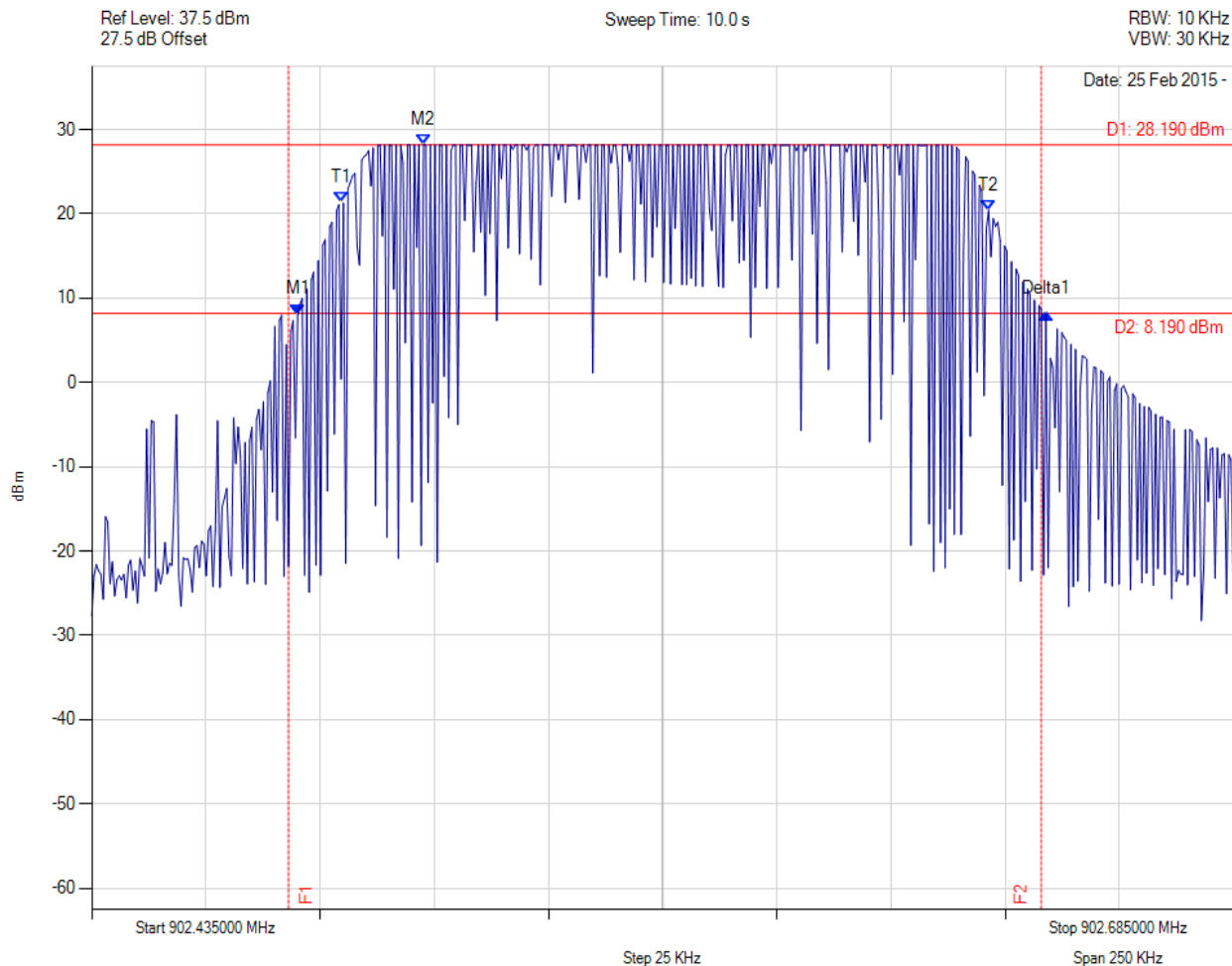
## 10. APPENDIX

### 10.1. 20 dB & 99% Bandwidth



20 dB & 99% BANDWIDTH

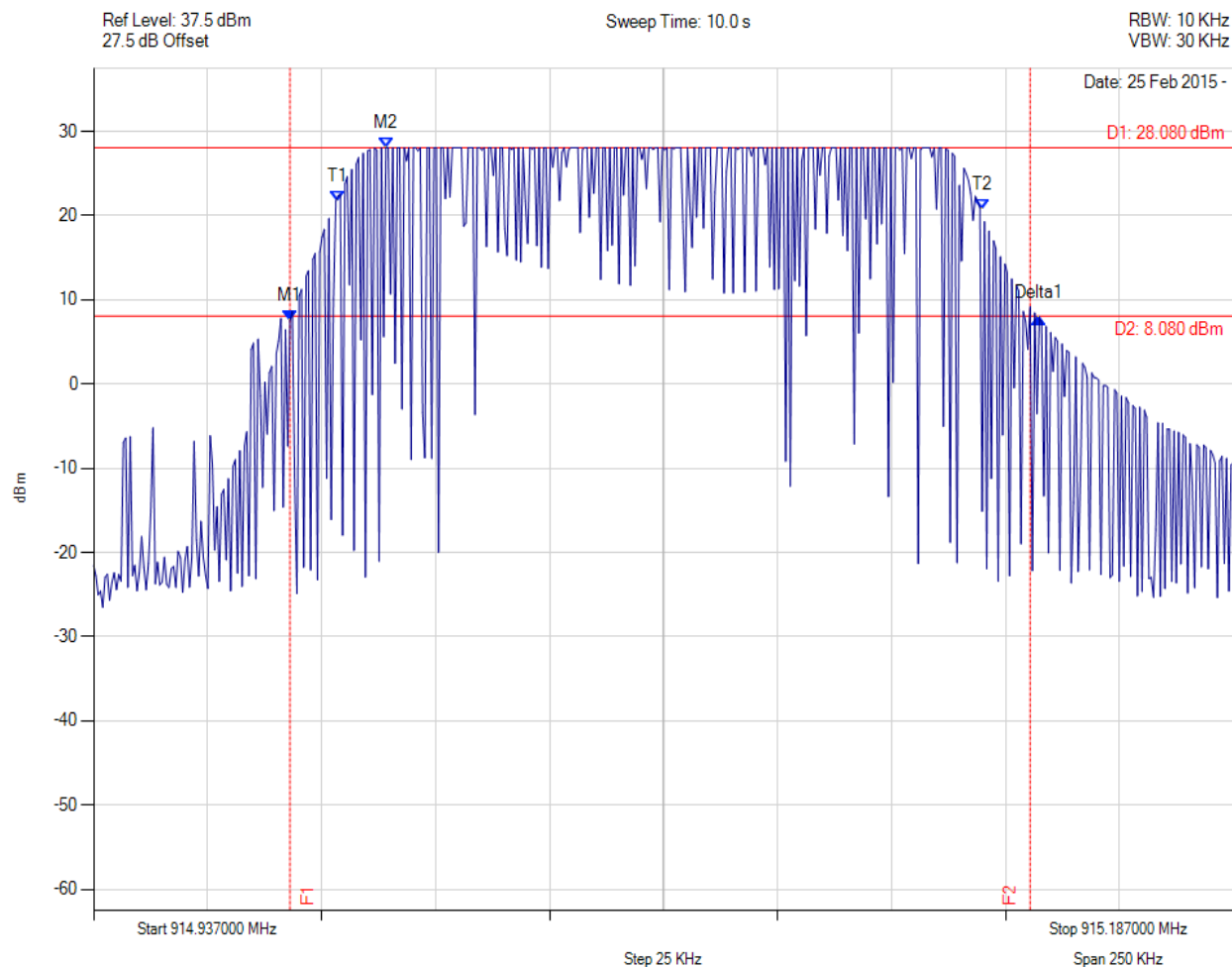
Variant: 125FH, Channel: 902.56 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc



| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                                                                                                                                      | Test Results                  |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 902.480 MHz : 8.086 dBm<br>M2 : 902.508 MHz : 28.187 dBm<br>Delta1 : 164 KHz : 0.006 dB<br>T1 : 902.490 MHz : 21.400 dBm<br>T2 : 902.631 MHz : 20.414 dBm<br>OBW : 142 KHz | Channel Frequency: 902.56 MHz |

[Back to Matrix](#)

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| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                                                                                                                                      | Test Results                  |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 914.980 MHz : 7.531 dBm<br>M2 : 915.001 MHz : 28.080 dBm<br>Delta1 : 164 KHz : 0.305 dB<br>T1 : 914.991 MHz : 21.707 dBm<br>T2 : 915.132 MHz : 20.638 dBm<br>OBW : 140 KHz | Channel Frequency: 915.06 MHz |

[Back to Matrix](#)

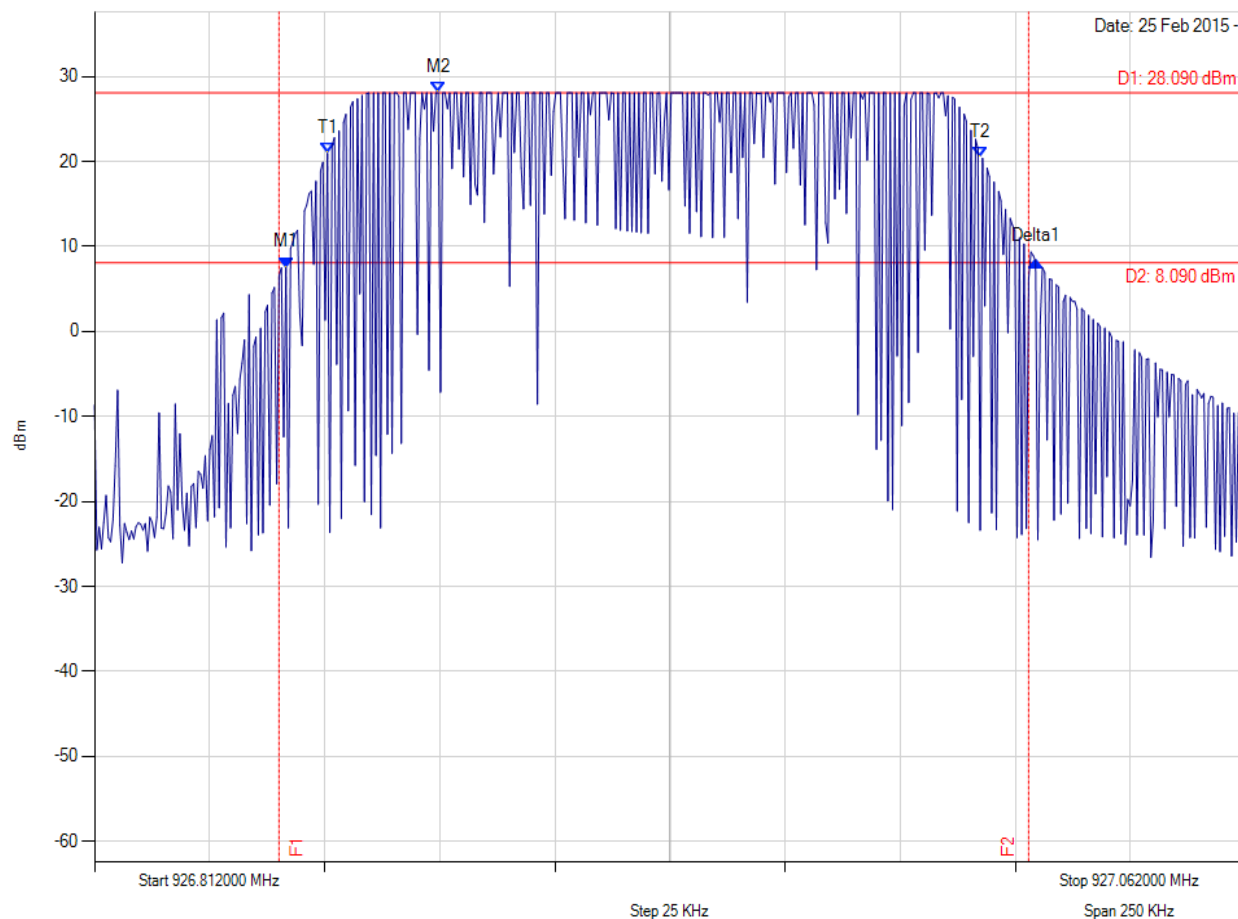
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Ref Level: 37.6 dBm  
27.6 dB Offset

Sweep Time: 10.0 s

RBW: 10 KHz  
VBW: 30 KHz

Date: 25 Feb 2015 -



| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                                                                                                                                      | Test Results                  |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 926.854 MHz : 7.519 dBm<br>M2 : 926.887 MHz : 28.088 dBm<br>Delta1 : 163 KHz : 0.783 dB<br>T1 : 926.863 MHz : 20.945 dBm<br>T2 : 927.004 MHz : 20.438 dBm<br>OBW : 142 KHz | Channel Frequency: 926.94 MHz |

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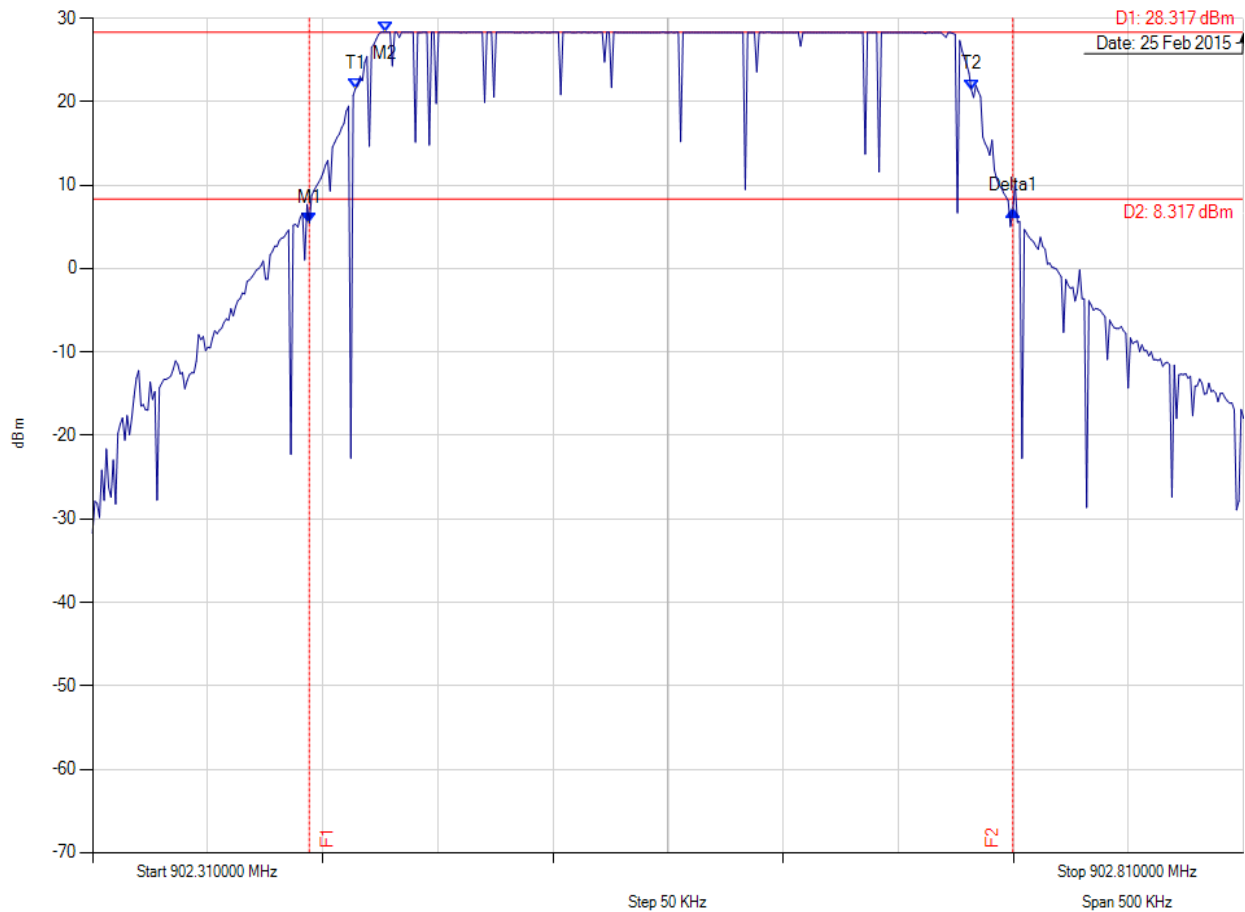
20 dB & 99% BANDWIDTH

Variant: 250FH, Channel: 902.56 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 30 dBm  
27.5 dB Offset

Sweep Time: 10.0 s

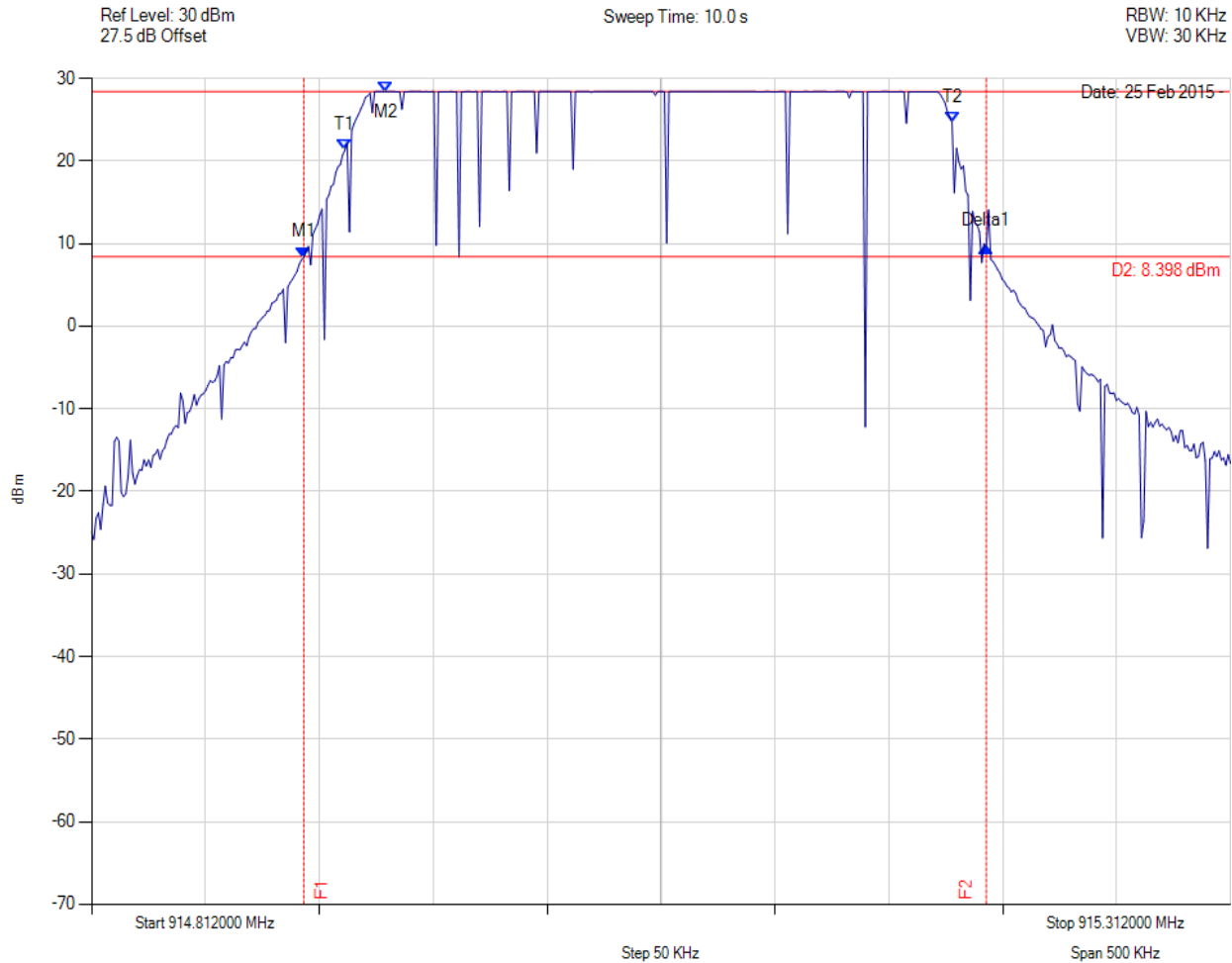
RBW: 10 KHz  
VBW: 30 KHz



| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                                                                                                                                      | Test Results                  |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 902.404 MHz : 5.441 dBm<br>M2 : 902.437 MHz : 28.317 dBm<br>Delta1 : 306 KHz : 1.527 dB<br>T1 : 902.424 MHz : 21.565 dBm<br>T2 : 902.692 MHz : 21.431 dBm<br>OBW : 268 KHz | Channel Frequency: 902.56 MHz |

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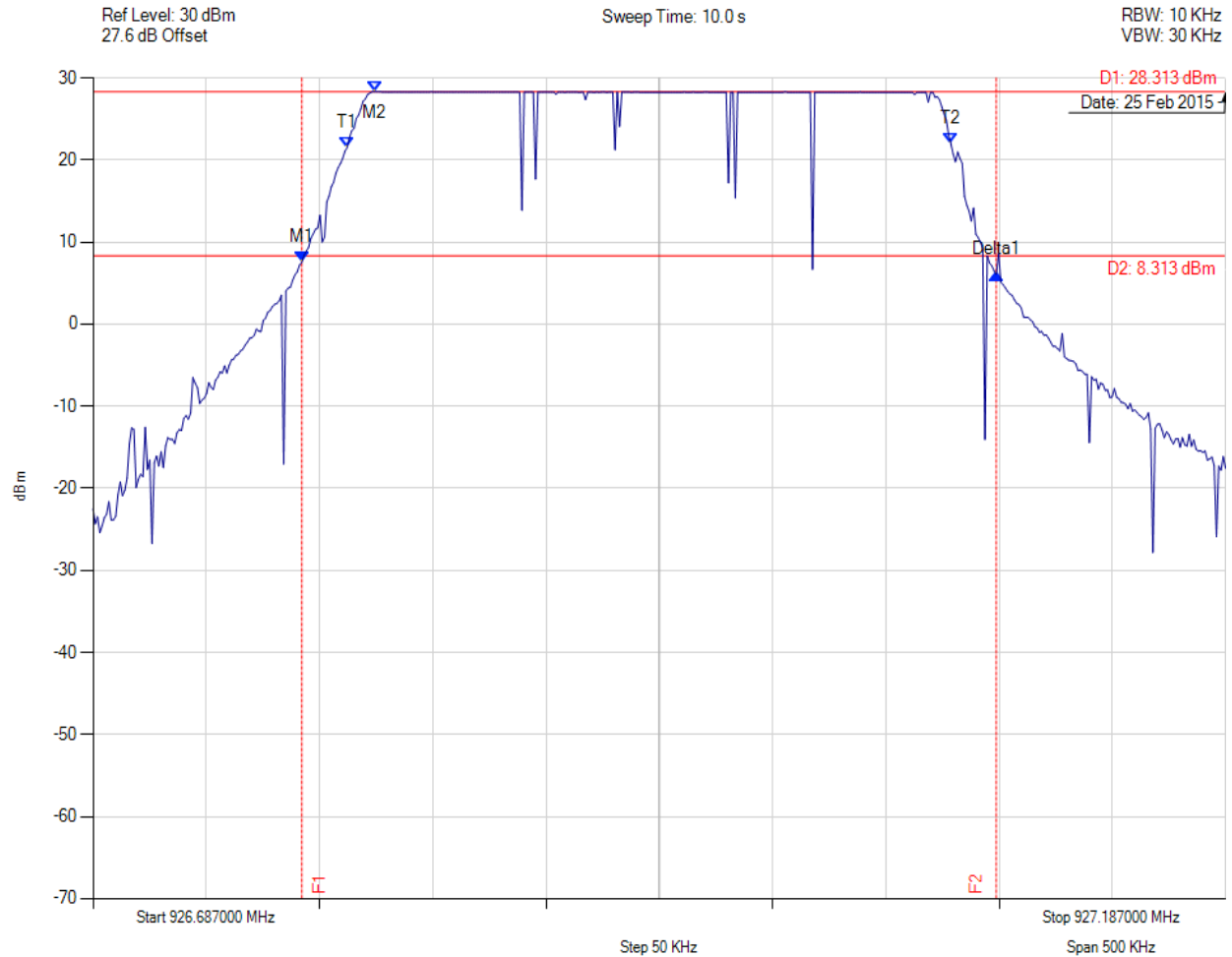
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| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                                                                                                                                      | Test Results                  |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 914.905 MHz : 8.333 dBm<br>M2 : 914.941 MHz : 28.398 dBm<br>Delta1 : 300 KHz : 1.324 dB<br>T1 : 914.923 MHz : 21.305 dBm<br>T2 : 915.190 MHz : 24.687 dBm<br>OBW : 267 KHz | Channel Frequency: 915.06 MHz |

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| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                                                                                                                                       | Test Results                  |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 926.779 MHz : 7.524 dBm<br>M2 : 926.811 MHz : 28.313 dBm<br>Delta1 : 307 KHz : -1.430 dB<br>T1 : 926.799 MHz : 21.502 dBm<br>T2 : 927.066 MHz : 21.960 dBm<br>OBW : 267 KHz | Channel Frequency: 926.94 MHz |

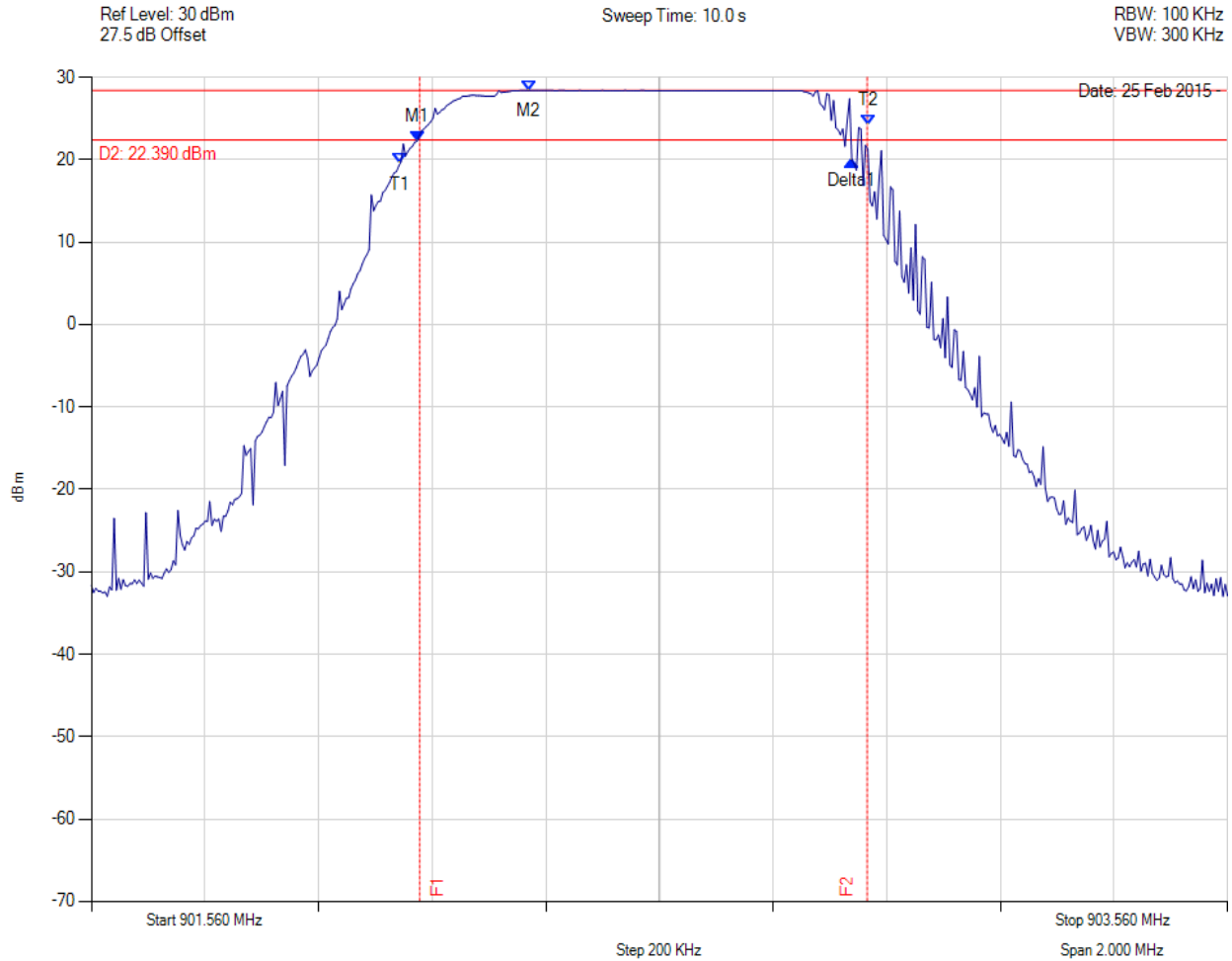
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## 10.2. 6 dB & 99% Bandwidth

6 dB & 99% BANDWIDTH



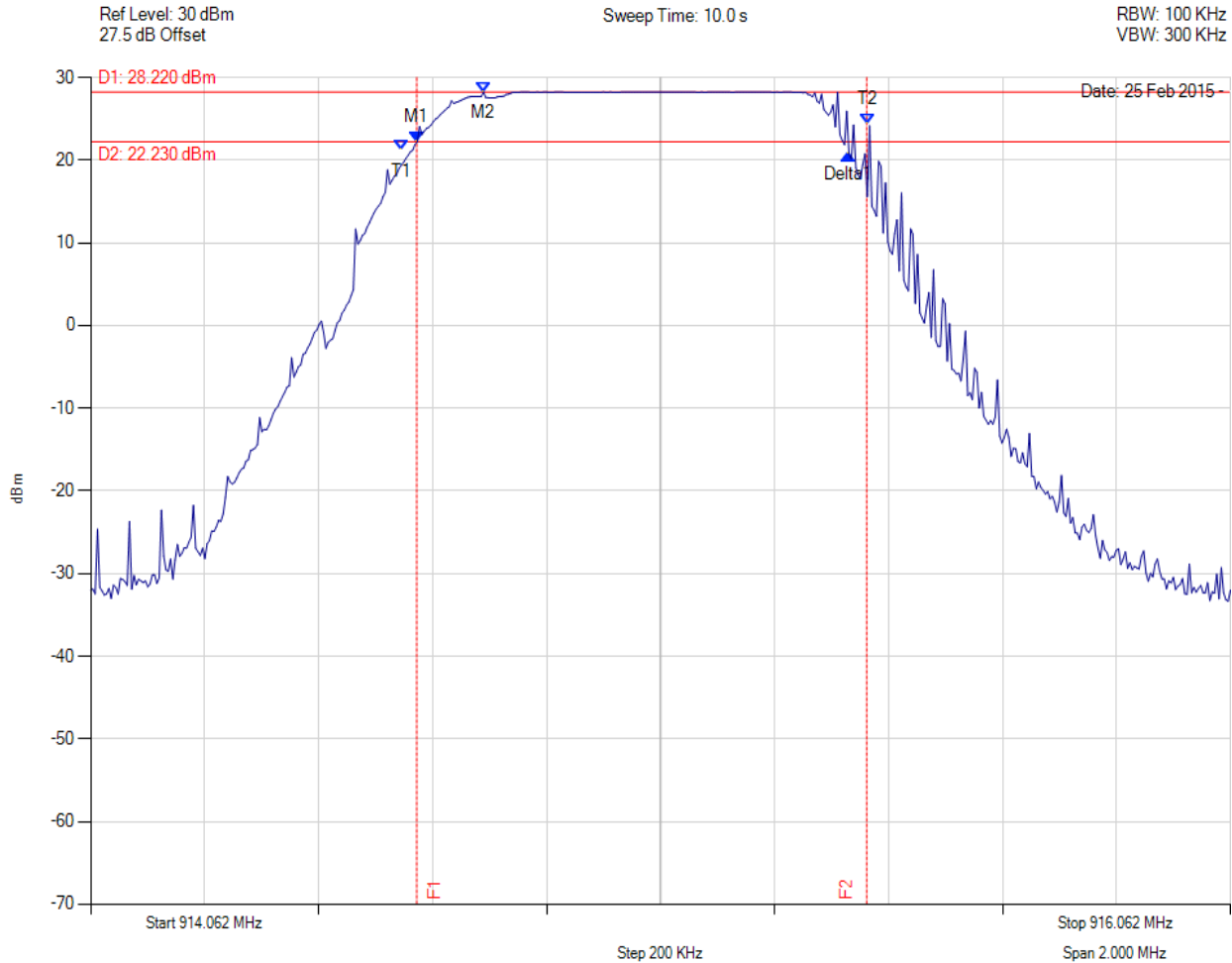
Variant: 500DSS, Channel: 902.56 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc



| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                                                                                                                                        | Test Results                  |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 902.134 MHz : 22.217 dBm<br>M2 : 902.330 MHz : 28.385 dBm<br>Delta1 : 764 KHz : -2.300 dB<br>T1 : 902.104 MHz : 19.460 dBm<br>T2 : 902.928 MHz : 24.205 dBm<br>OBW : 826 KHz | Channel Frequency: 902.56 MHz |

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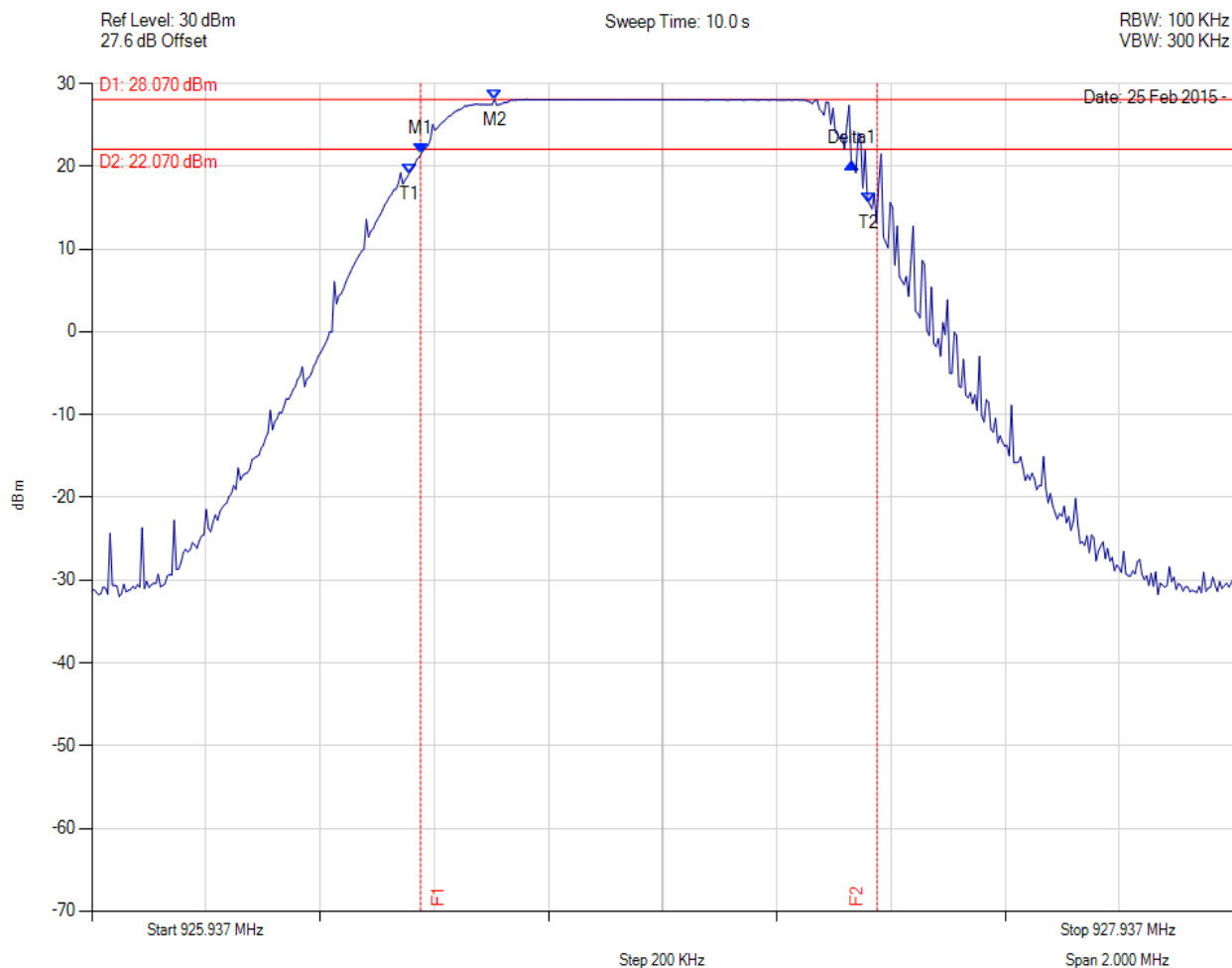
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| Analysers Setup                                                                   | Marker:Frequency:Amplitude                                                                                                                                                        | Test Results                  |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 914.634 MHz : 22.184 dBm<br>M2 : 914.751 MHz : 28.216 dBm<br>Delta1 : 758 KHz : -1.440 dB<br>T1 : 914.608 MHz : 21.183 dBm<br>T2 : 915.426 MHz : 24.311 dBm<br>OBW : 830 KHz | Channel Frequency: 915.06 MHz |

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| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                                                                                                                                        | Test Results                  |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 926.513 MHz : 21.534 dBm<br>M2 : 926.642 MHz : 28.070 dBm<br>Delta1 : 756 KHz : -1.230 dB<br>T1 : 926.493 MHz : 19.086 dBm<br>T2 : 927.299 MHz : 15.620 dBm<br>OBW : 822 KHz | Channel Frequency: 926.94 MHz |

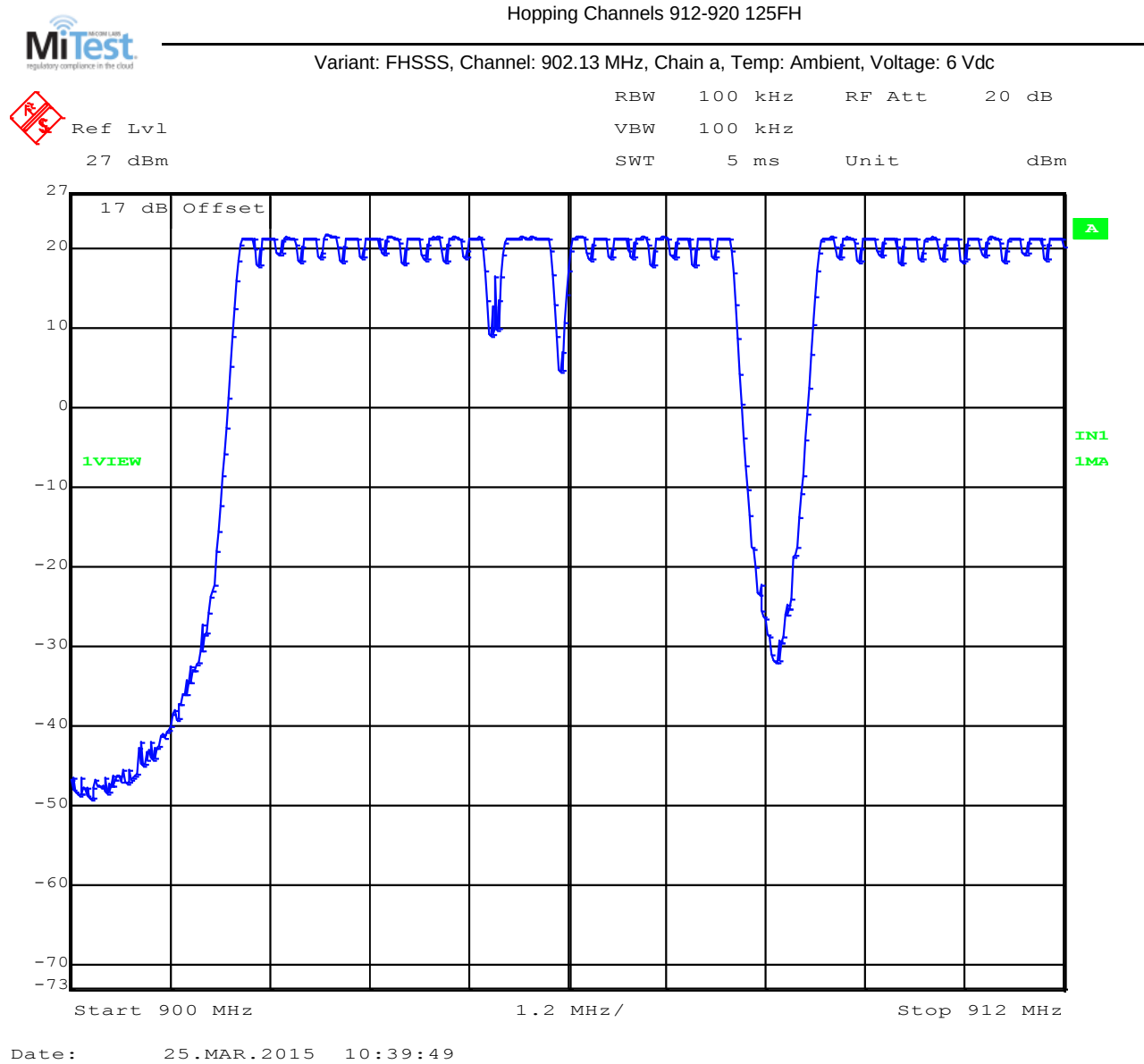
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### 10.3. Number of Channels



| Analyser Setup                                                                    | Marker:Frequency:Amplitude | Test Results    |
|-----------------------------------------------------------------------------------|----------------------------|-----------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW |                            | No. Of Hops: 33 |

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Hopping Channels 912-920 125FH

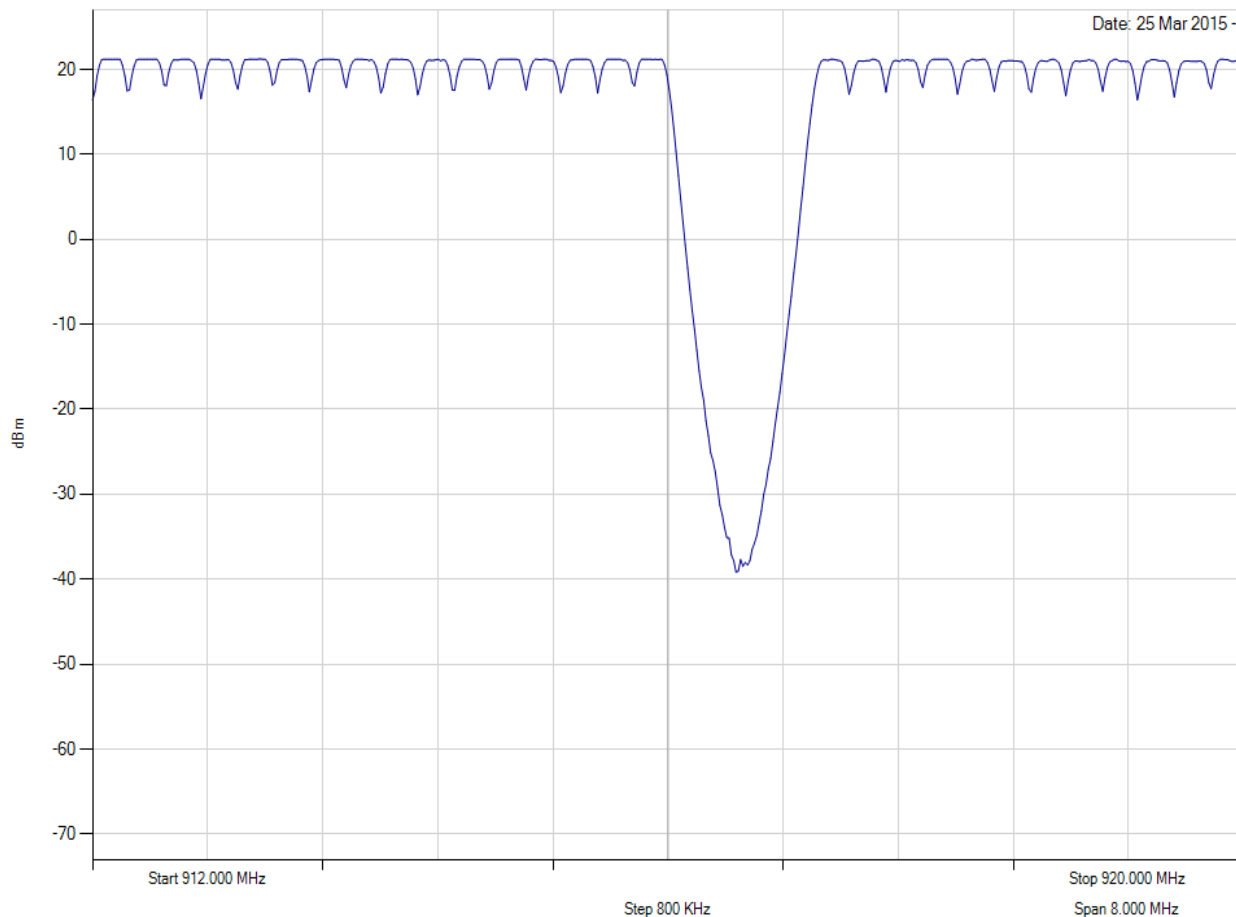
Variant: FHSSS, Channel: 902.13 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 5 ms

RBW: 100 KHz  
VBW: 100 KHz

Date: 25 Mar 2015 -



| Analyser Setup                                                                    | Marker:Frequency:Amplitude | Test Results    |
|-----------------------------------------------------------------------------------|----------------------------|-----------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW |                            | No. Of Hops: 28 |

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### Hopping Channels 920-928 125FH

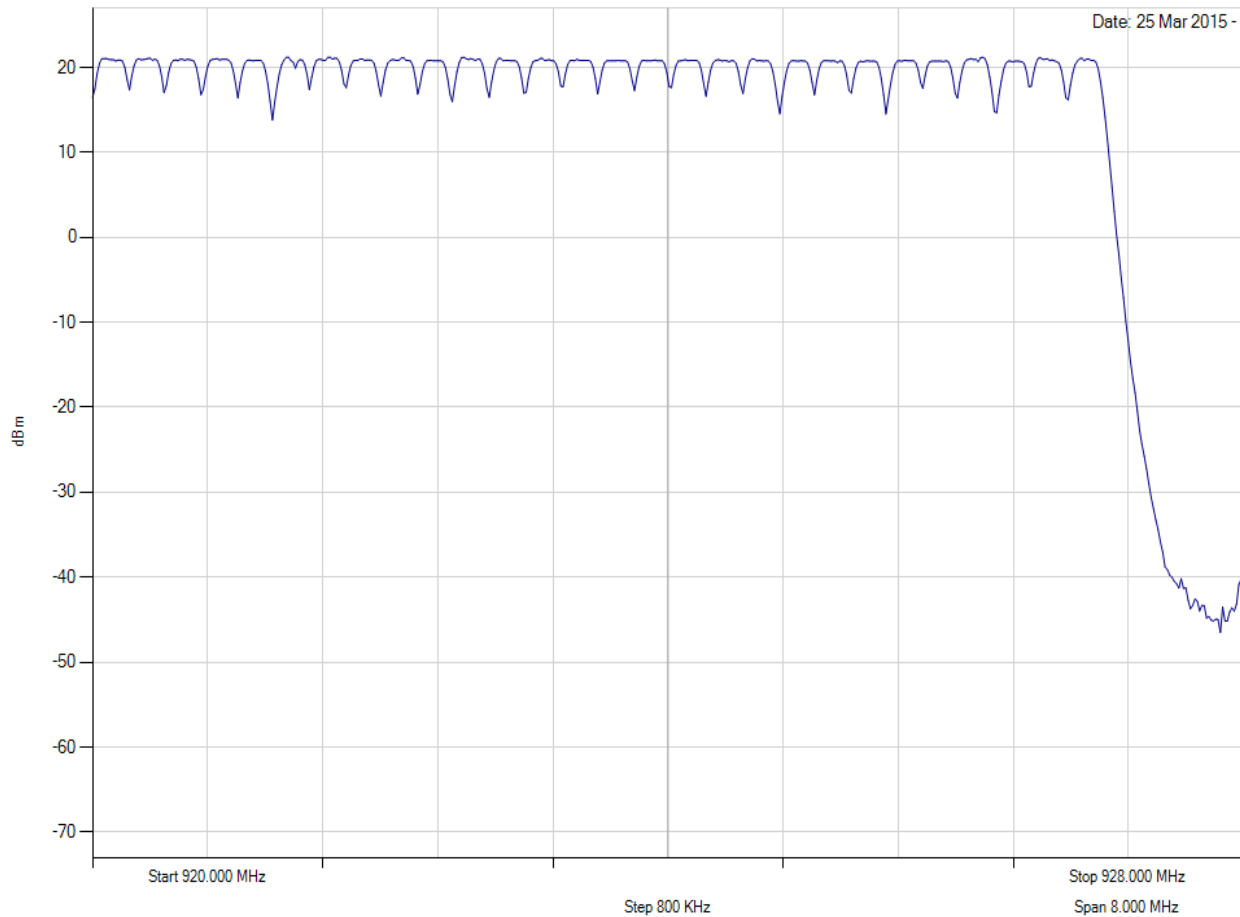
Variant: FHSSS, Channel: 902.13 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 5 ms

RBW: 100 KHz  
VBW: 100 KHz

Date: 25 Mar 2015 -



| Analyser Setup                                                                    | Marker:Frequency:Amplitude | Test Results    |
|-----------------------------------------------------------------------------------|----------------------------|-----------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW |                            | No. of Hops: 28 |

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### Hopping Channels 900-912 250FH

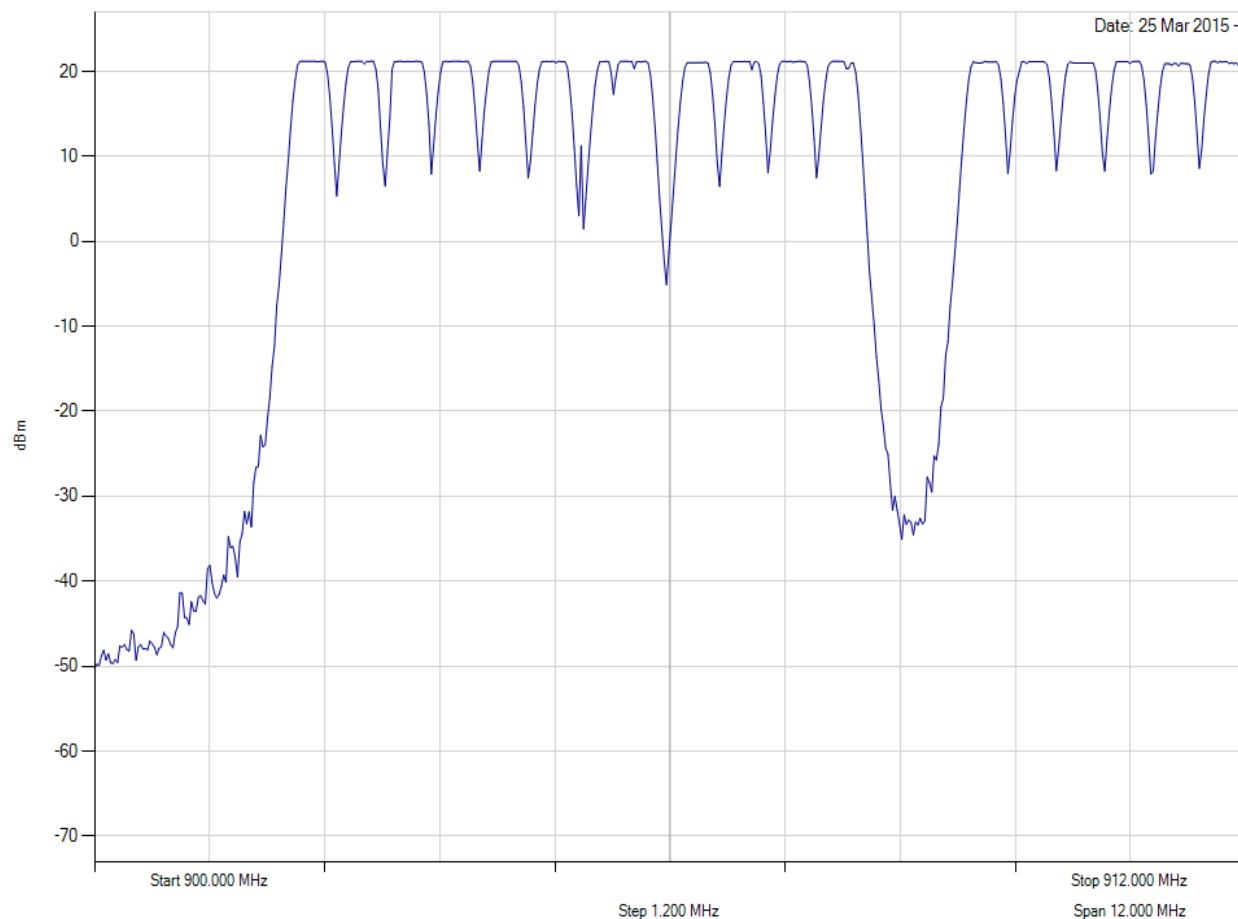
Variant: FHSSS, Channel: 902.25 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 5 ms

RBW: 100 KHz  
VBW: 100 KHz

Date: 25 Mar 2015 -



| Analyser Setup                                                                    | Marker:Frequency:Amplitude | Test Results    |
|-----------------------------------------------------------------------------------|----------------------------|-----------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW |                            | No. Of Hops: 17 |

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### Hopping Channels 912-920 250FH

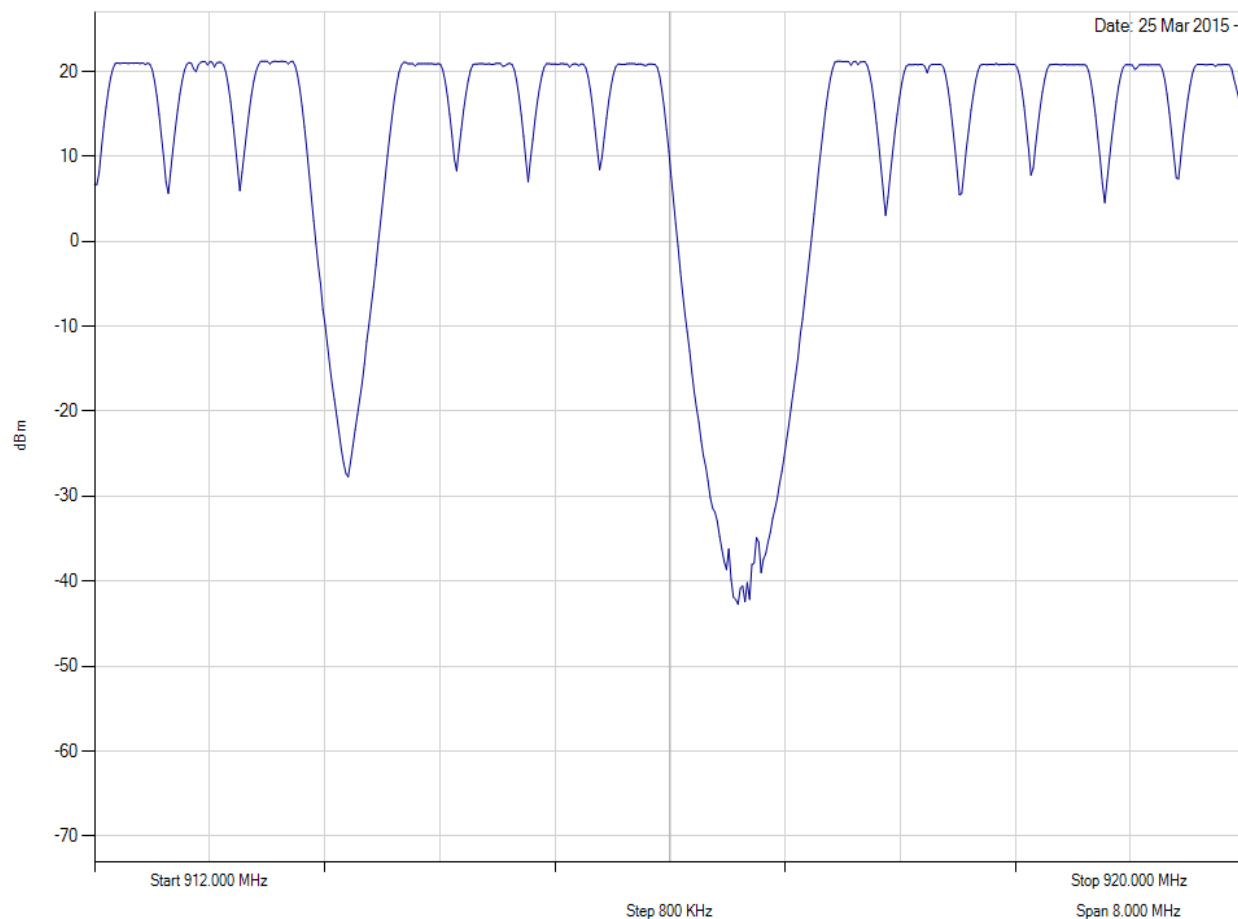
Variant: FHSSS, Channel: 902.25 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 5 ms

RBW: 100 KHz  
VBW: 100 KHz

Date: 25 Mar 2015 -



| Analyser Setup                                                                    | Marker:Frequency:Amplitude | Test Results  |
|-----------------------------------------------------------------------------------|----------------------------|---------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW |                            | No of Hops:13 |

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### Hopping Channels 920-928 250FH

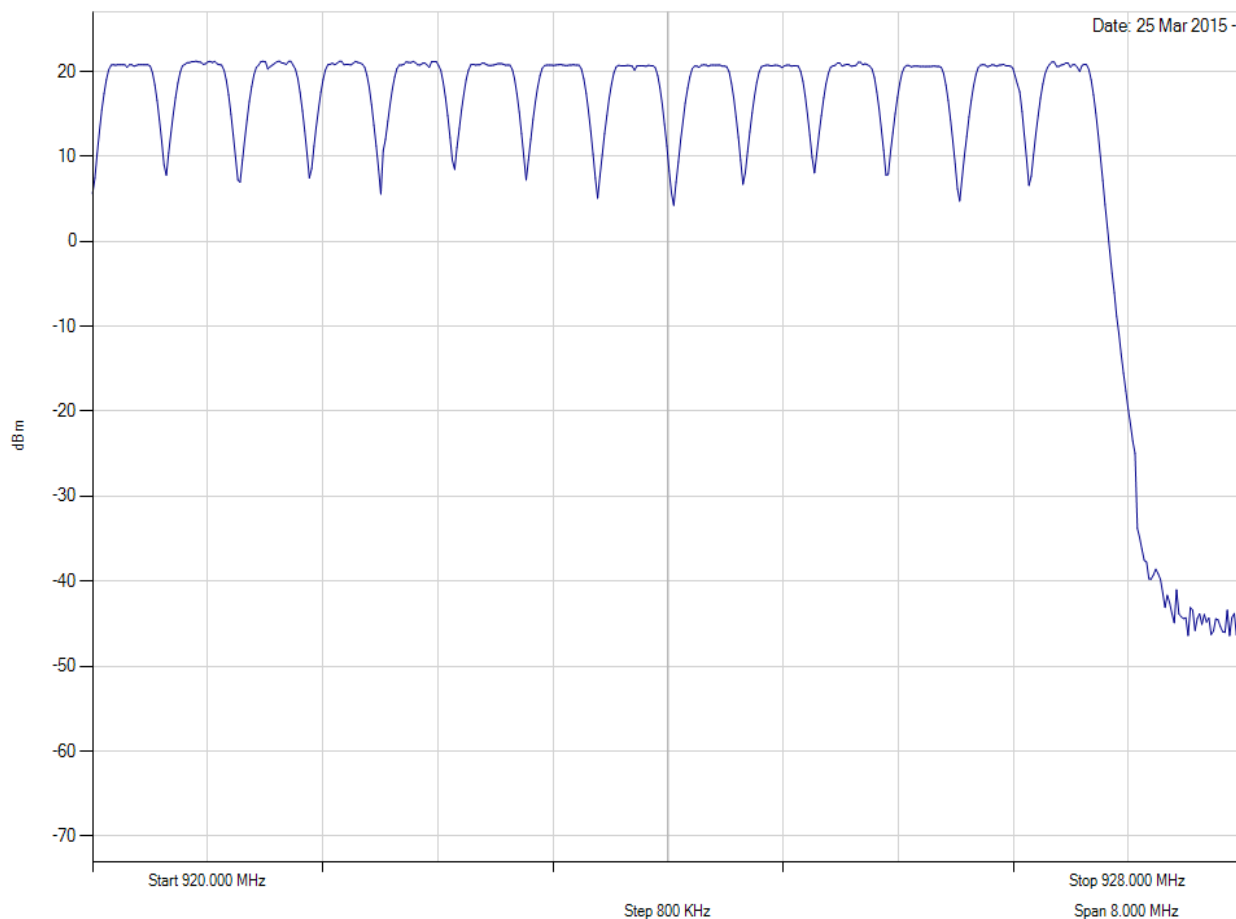
Variant: FHSSS, Channel: 902.25 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 5 ms

RBW: 100 KHz  
VBW: 100 KHz

Date: 25 Mar 2015 -



| Analyser Setup                                                                    | Marker:Frequency:Amplitude | Test Results    |
|-----------------------------------------------------------------------------------|----------------------------|-----------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW |                            | No. Of hops: 16 |

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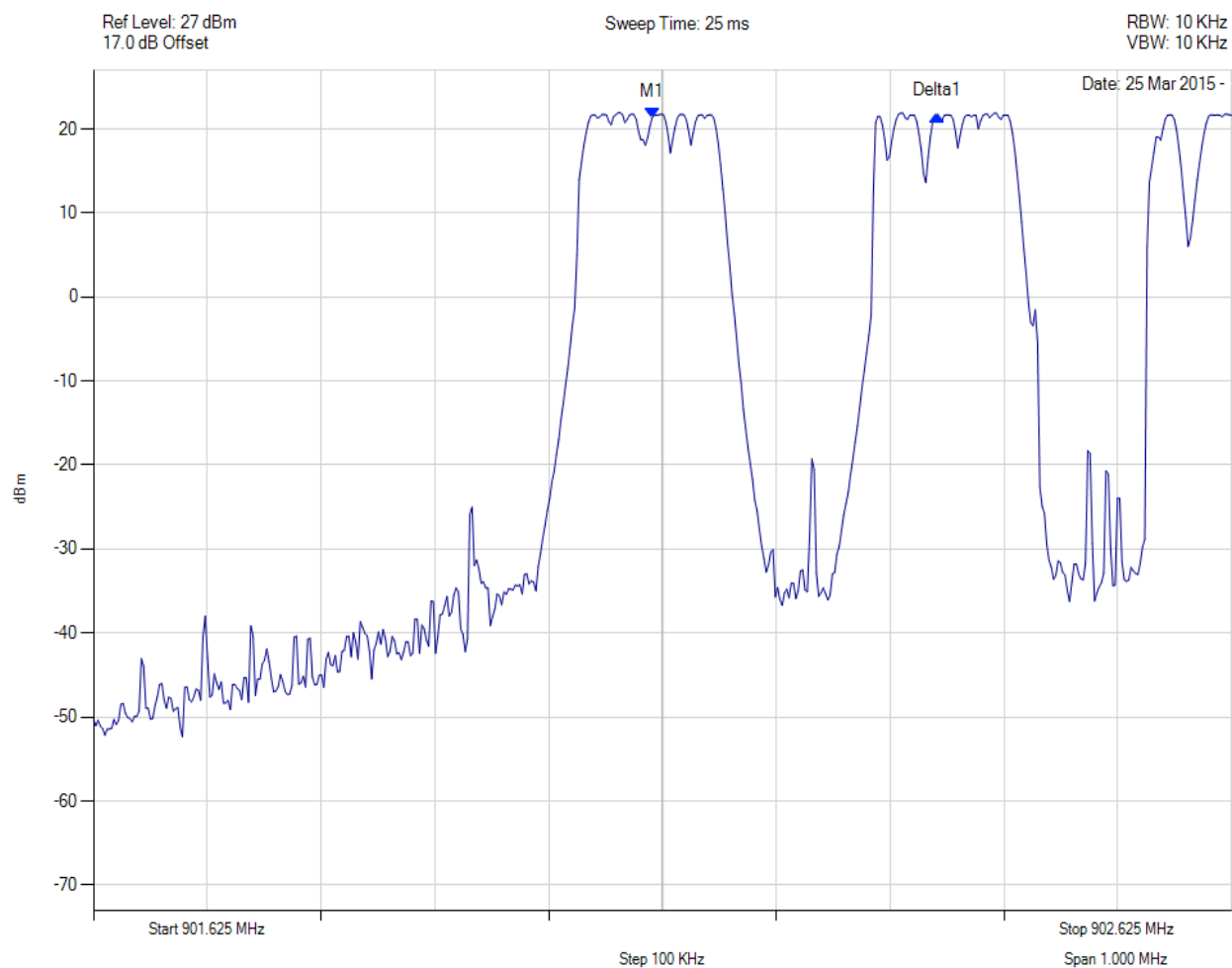
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## 10.4. Channel Spacing



### Frequency Separation

Variant: FHSSS, Channel: 902.25 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc



| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                   | Test Results                  |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 902.116 MHz : 21.356 dBm<br>Delta1 : 251 KHz : 0.277 dB | Channel Frequency: 902.25 MHz |

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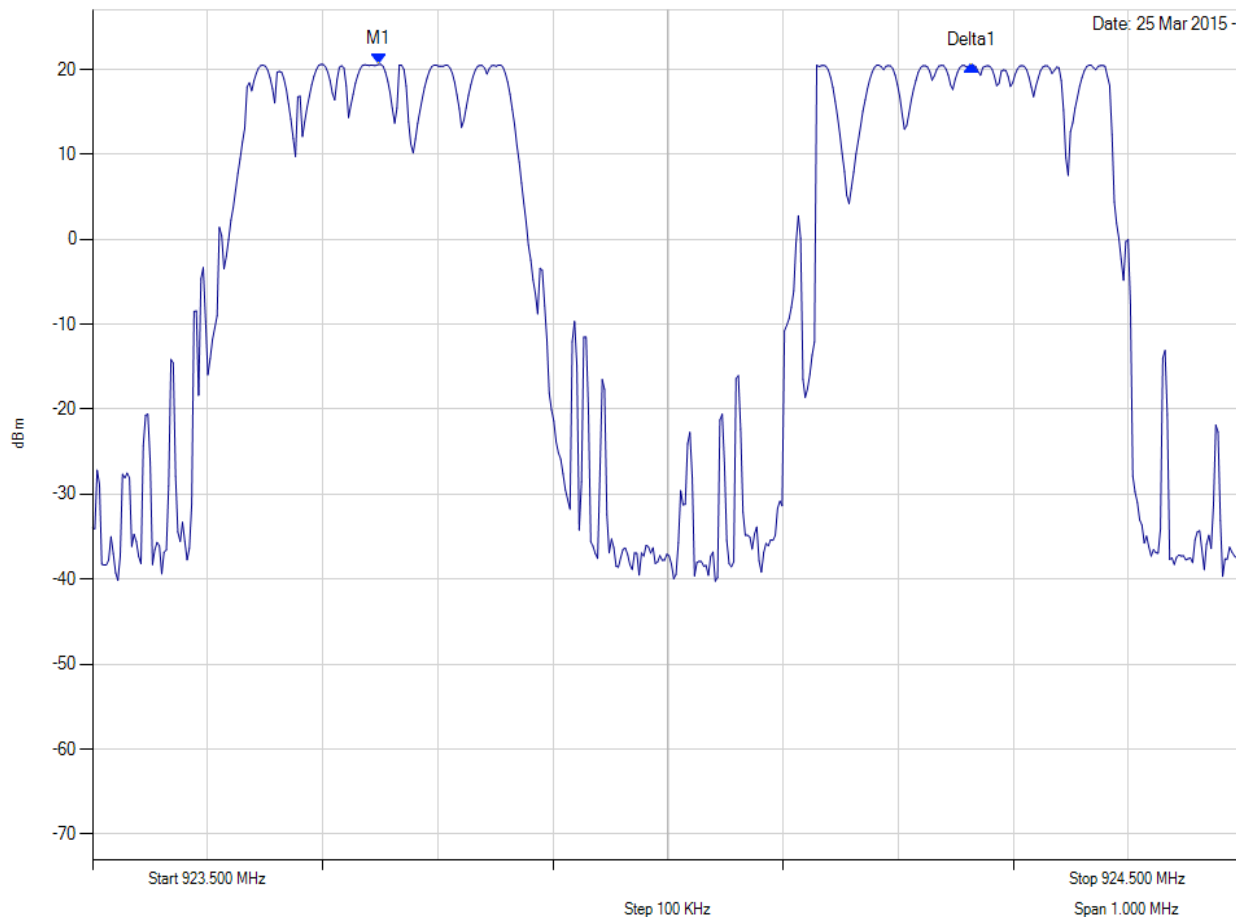
### Frequency Separation

Variant: FHSSS, Channel: 902.25 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 25 ms

RBW: 10 KHz  
VBW: 10 KHz



| Analyser Setup                                                                    | Marker:Frequency:Amplitude                                    | Test Results                  |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 923.748 MHz : 20.594 dBm<br>Delta1 : 515 KHz : -0.122 dB | Channel Frequency: 902.25 MHz |

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## 10.5. Dwell Time & Channel Occupancy



### Dwell Time

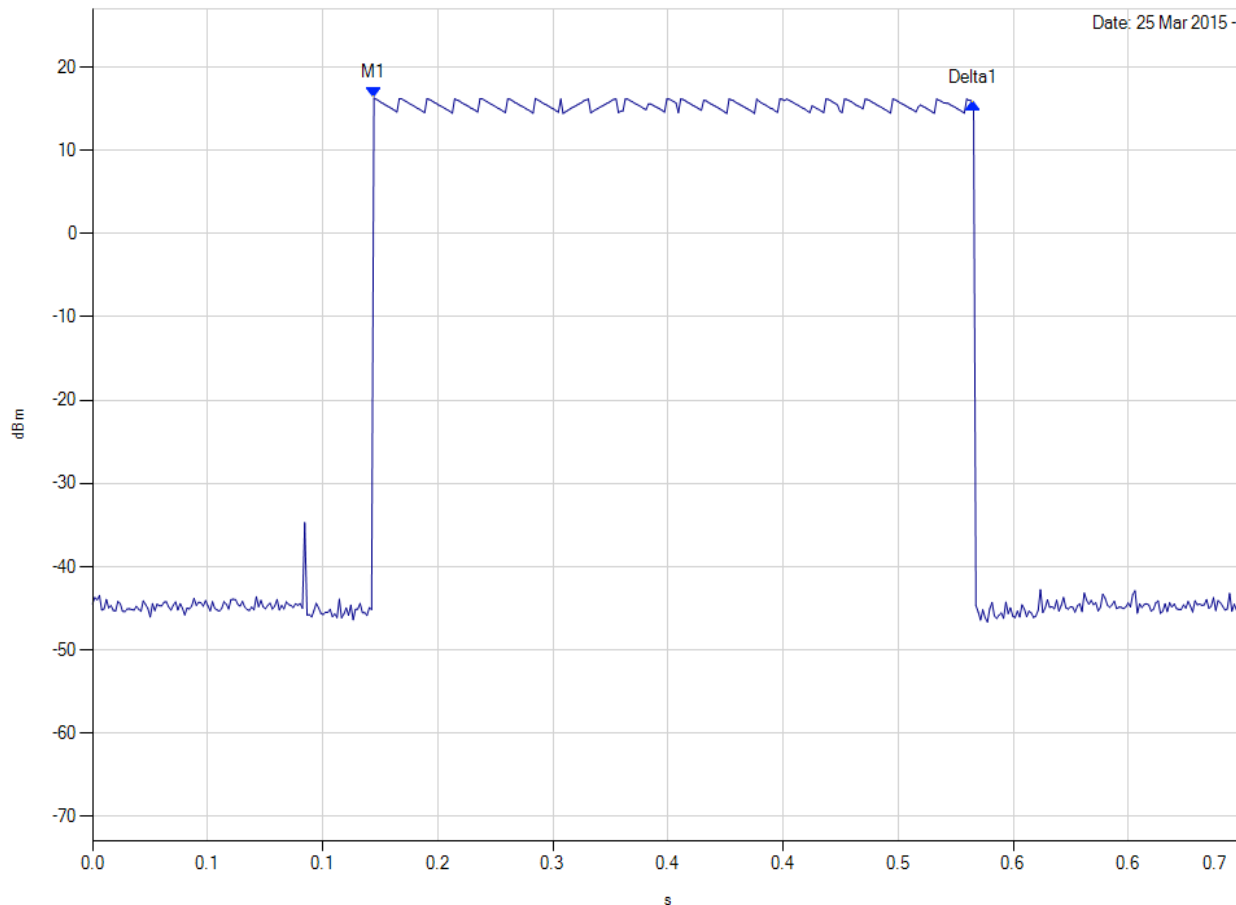
Variant: FHSSS, Channel: 902.13 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 700 ms

RBW: 1 MHz  
VBW: 1 MHz

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| Analyser Setup                                                                    | Marker:Time:Amplitude                                     | Test Results                  |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 0.171 s : 16.300 dBm<br>Delta1 : 0.365 s : -0.574 dB | Channel Frequency: 902.13 MHz |

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### Channel Occupancy

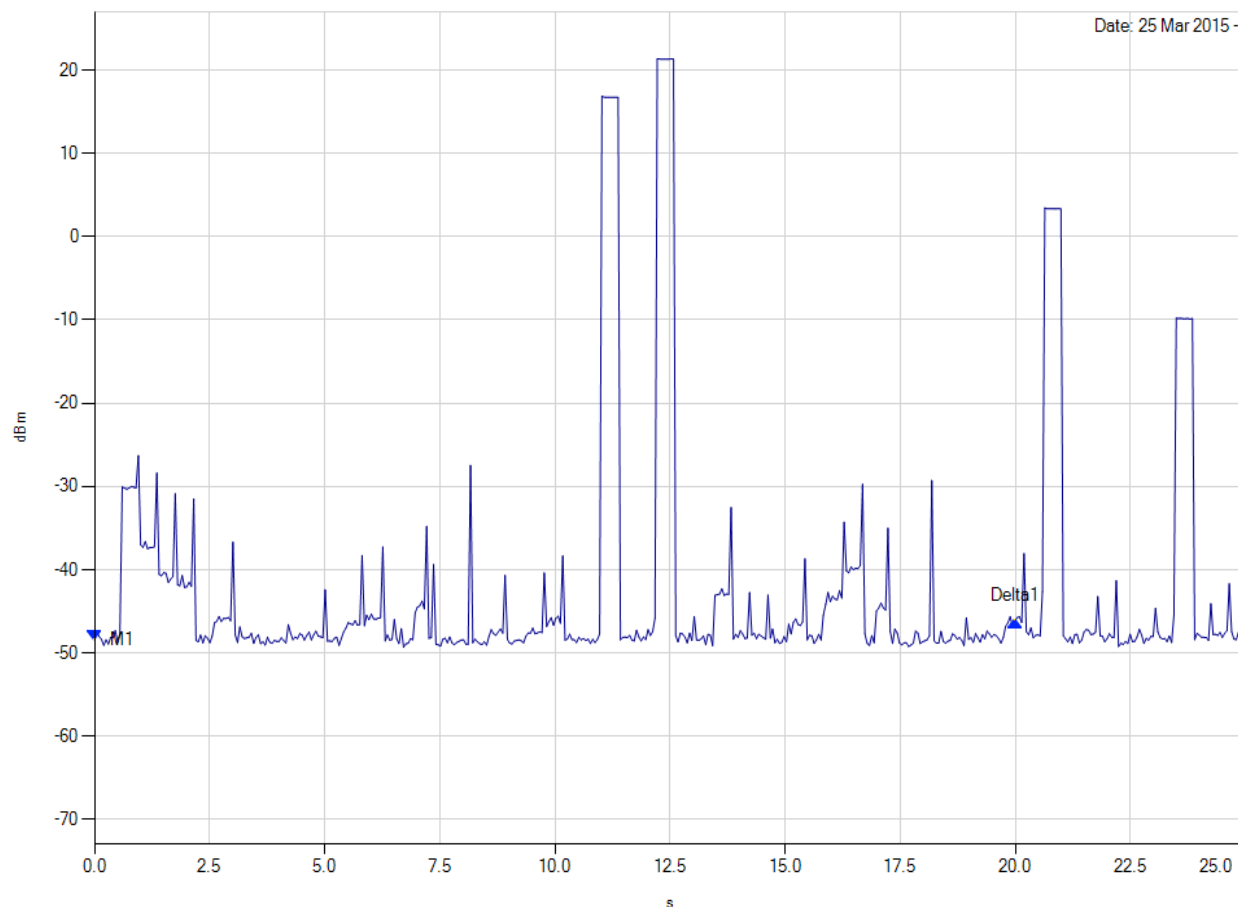
Variant: FHSSS, Channel: 902.13 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 25.0 s

RBW: 300 KHz  
VBW: 300 KHz

Date: 25 Mar 2015 -



| Analyser Setup                                                                    | Marker:Time:Amplitude                                      | Test Results                  |
|-----------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 0.000 s : -48.430 dBm<br>Delta1 : 20.000 s : 2.245 dB | Channel Frequency: 902.13 MHz |

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Dwell Time

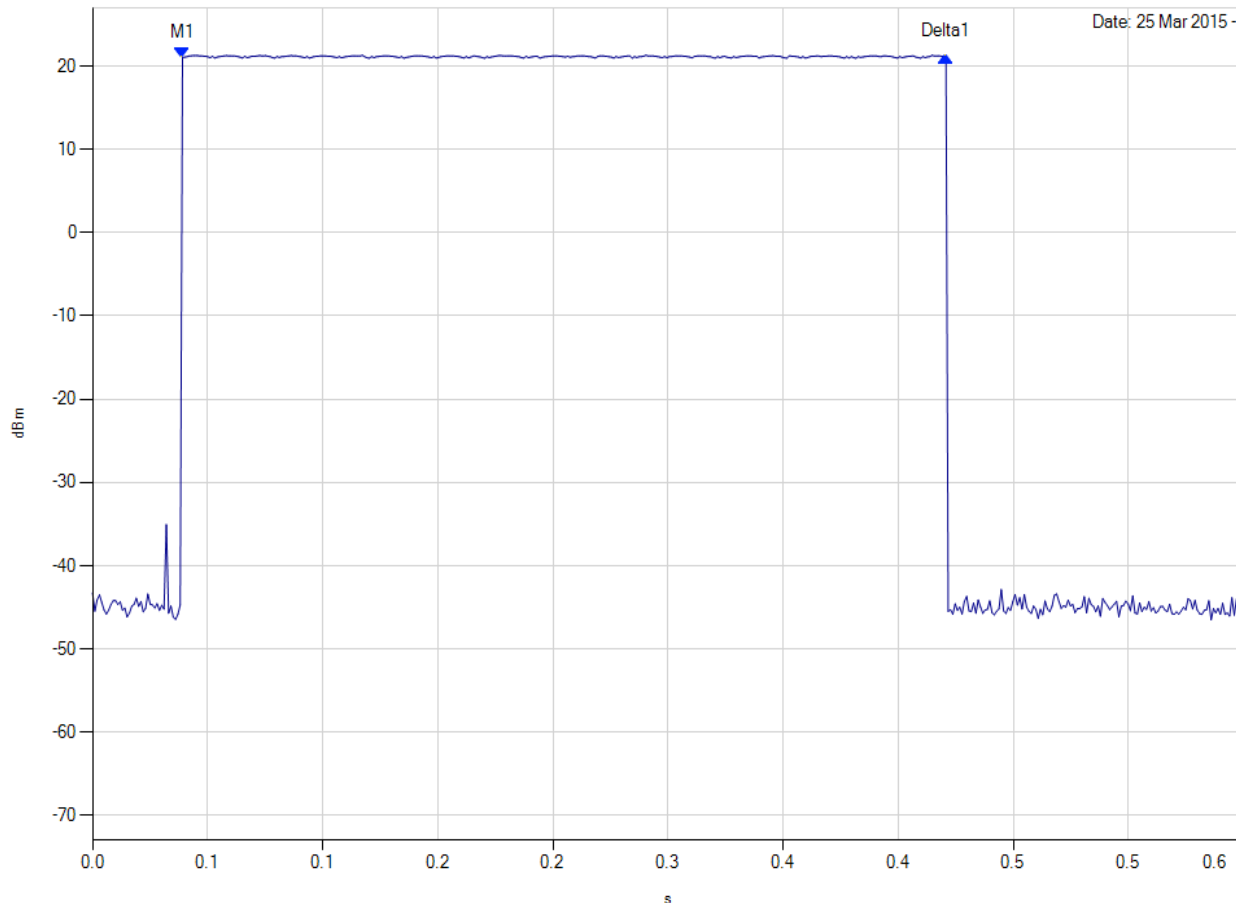
Variant: FHSSS, Channel: 902.25 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 600 ms

RBW: 1 MHz  
VBW: 1 MHz

Date: 25 Mar 2015 -



| Analysers Setup                                                                   | Marker:Time:Amplitude                                    | Test Results                  |
|-----------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 0.047 s : 21.059 dBm<br>Delta1 : 0.398 s : 0.094 dB | Channel Frequency: 902.25 MHz |

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### Channel Occupancy

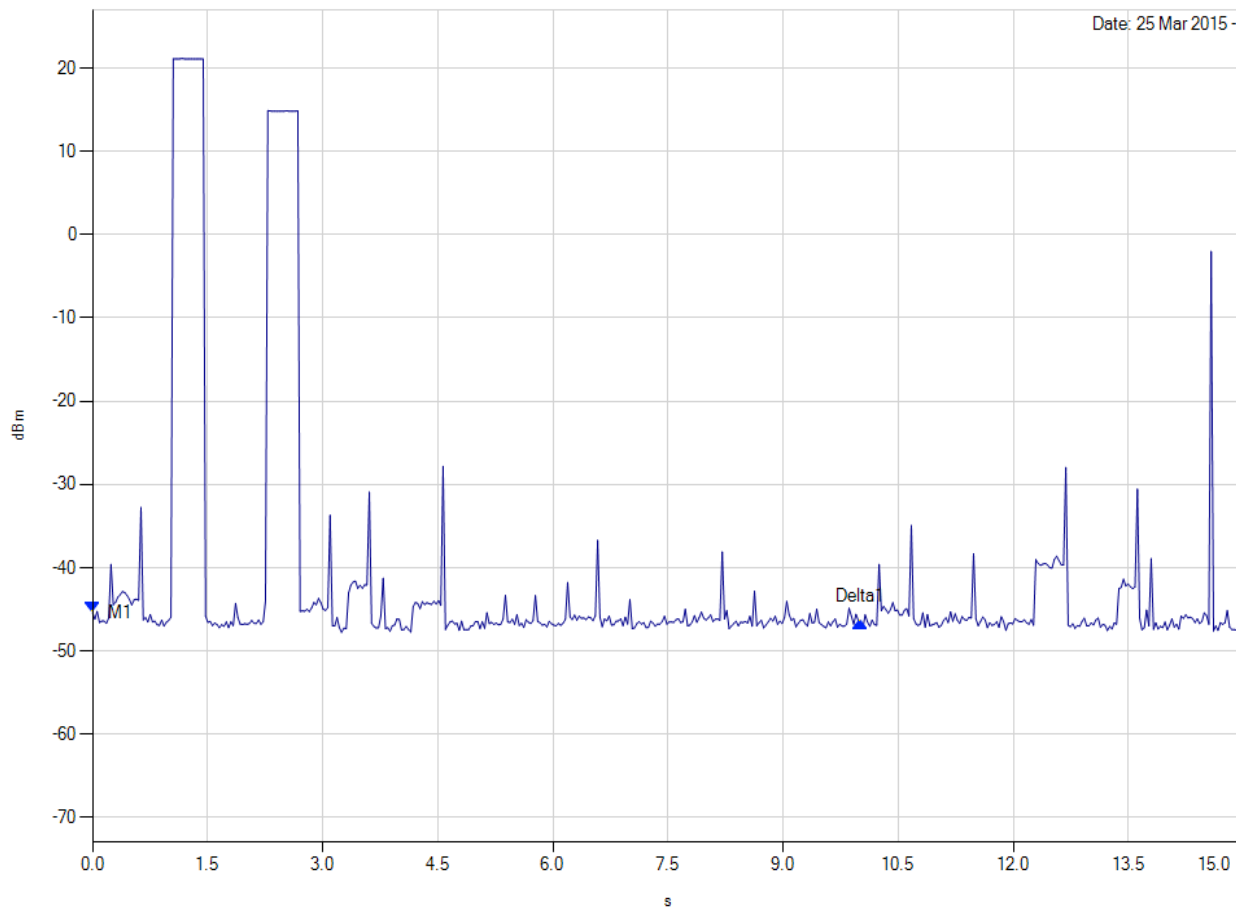
Variant: FHSSS, Channel: 902.25 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27 dBm  
17.0 dB Offset

Sweep Time: 15.0 s

RBW: 500 KHz  
VBW: 500 KHz

Date: 25 Mar 2015 -



| Analysers Setup                                                                   | Marker:Time:Amplitude                                       | Test Results                  |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 0.000 s : -45.379 dBm<br>Delta1 : 10.000 s : -1.100 dB | Channel Frequency: 902.25 MHz |

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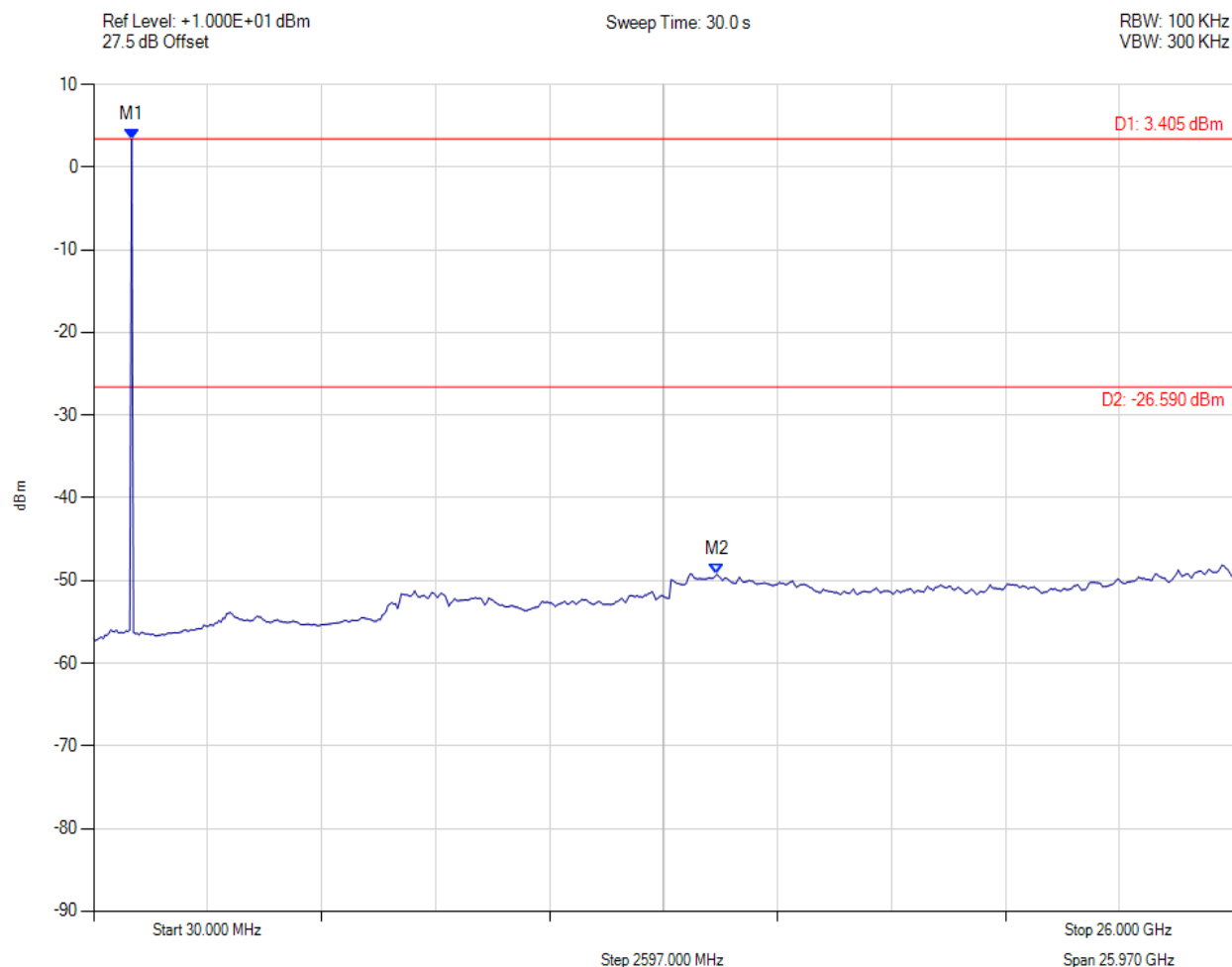
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## 10.6. Conducted Spurious Emissions

### 10.6.1. Conducted Emissions



#### CONDUCTED SPURIOUS EMISSIONS - AVERAGE



| Analysers Setup                                                               | Marker:Frequency:Amplitude                                    | Test Results                  |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = AVER<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = MAXH | M1 : 900.000 MHz : 3.405 dBm<br>M2 : 14.230 GHz : -49.249 dBm | Channel Frequency: 902.56 MHz |

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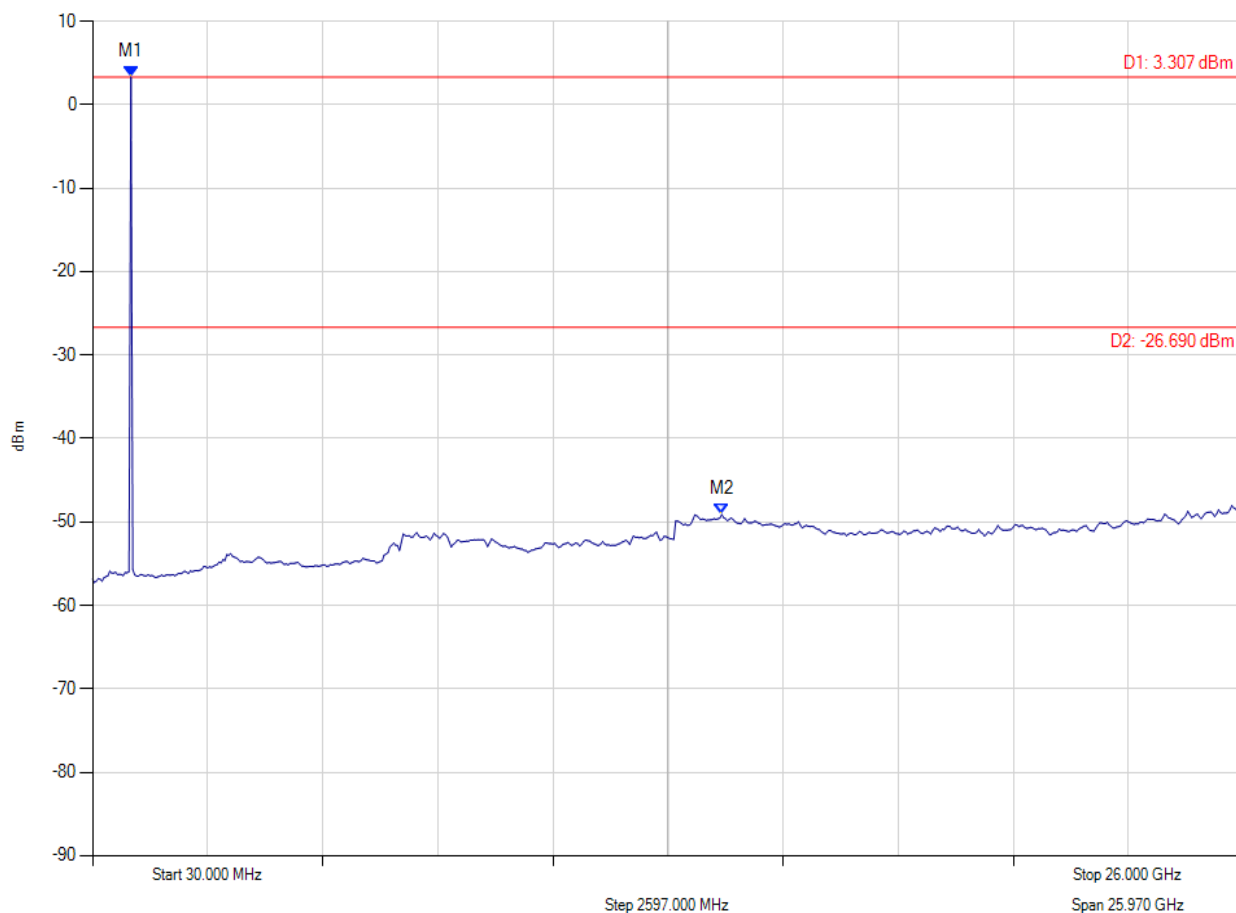
# CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 125FH, Channel: 915.06 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: +1.000E+01 dBm  
27.5 dB Offset

Sweep Time: 30.0 s

RBW: 100 KHz  
VBW: 300 KHz



| Analyser Setup                                                                | Marker:Frequency:Amplitude                                    | Test Results                  |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = AVER<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = MAXH | M1 : 900.000 MHz : 3.307 dBm<br>M2 : 14.230 GHz : -49.109 dBm | Channel Frequency: 915.06 MHz |

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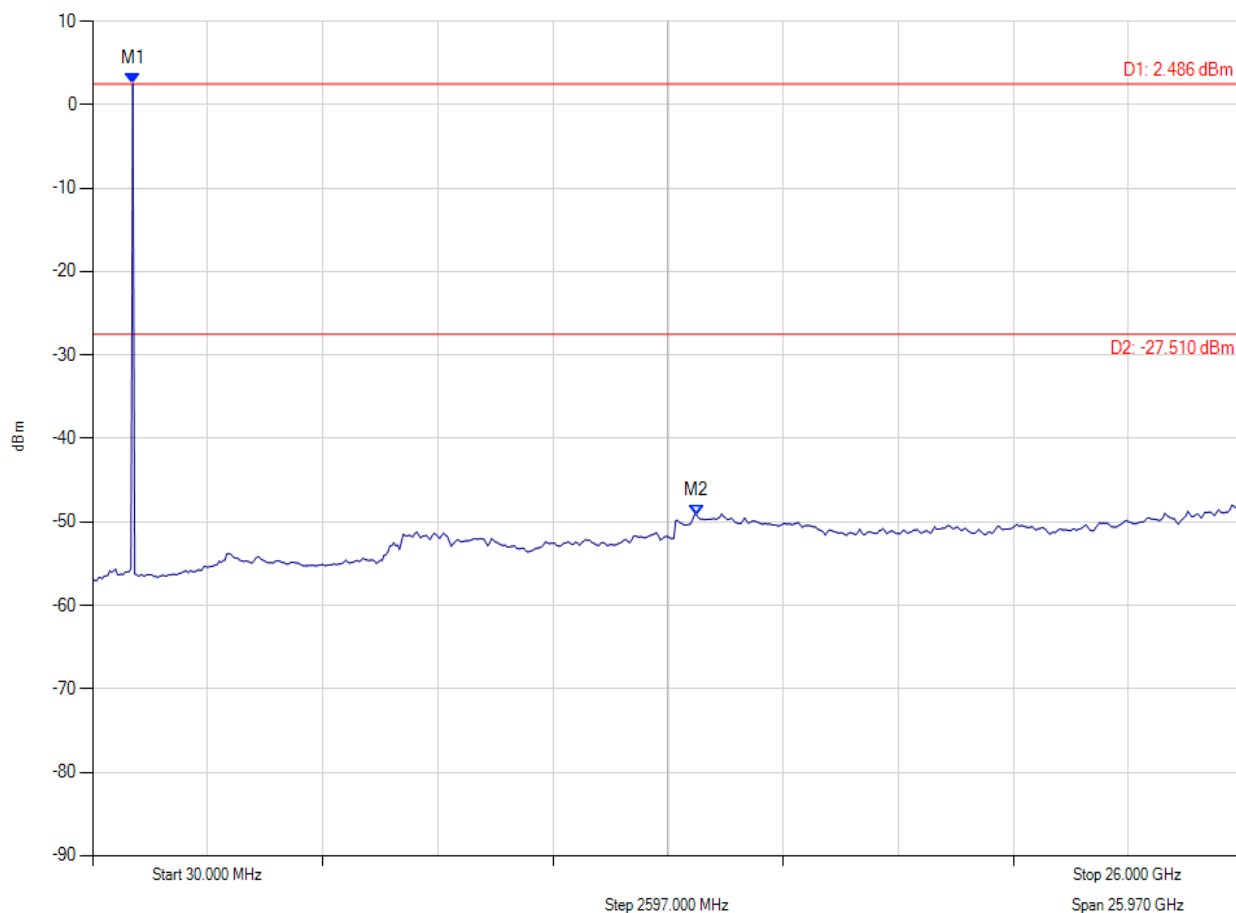
#### CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 125FH, Channel: 926.94 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: +1.000E+01 dBm  
27.6 dB Offset

Sweep Time: 30.0 s

RBW: 100 KHz  
VBW: 300 KHz



| Analyser Setup                                                                | Marker:Frequency:Amplitude                                    | Test Results                  |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = AVER<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 940.000 MHz : 2.486 dBm<br>M2 : 13.660 GHz : -49.222 dBm | Channel Frequency: 926.94 MHz |

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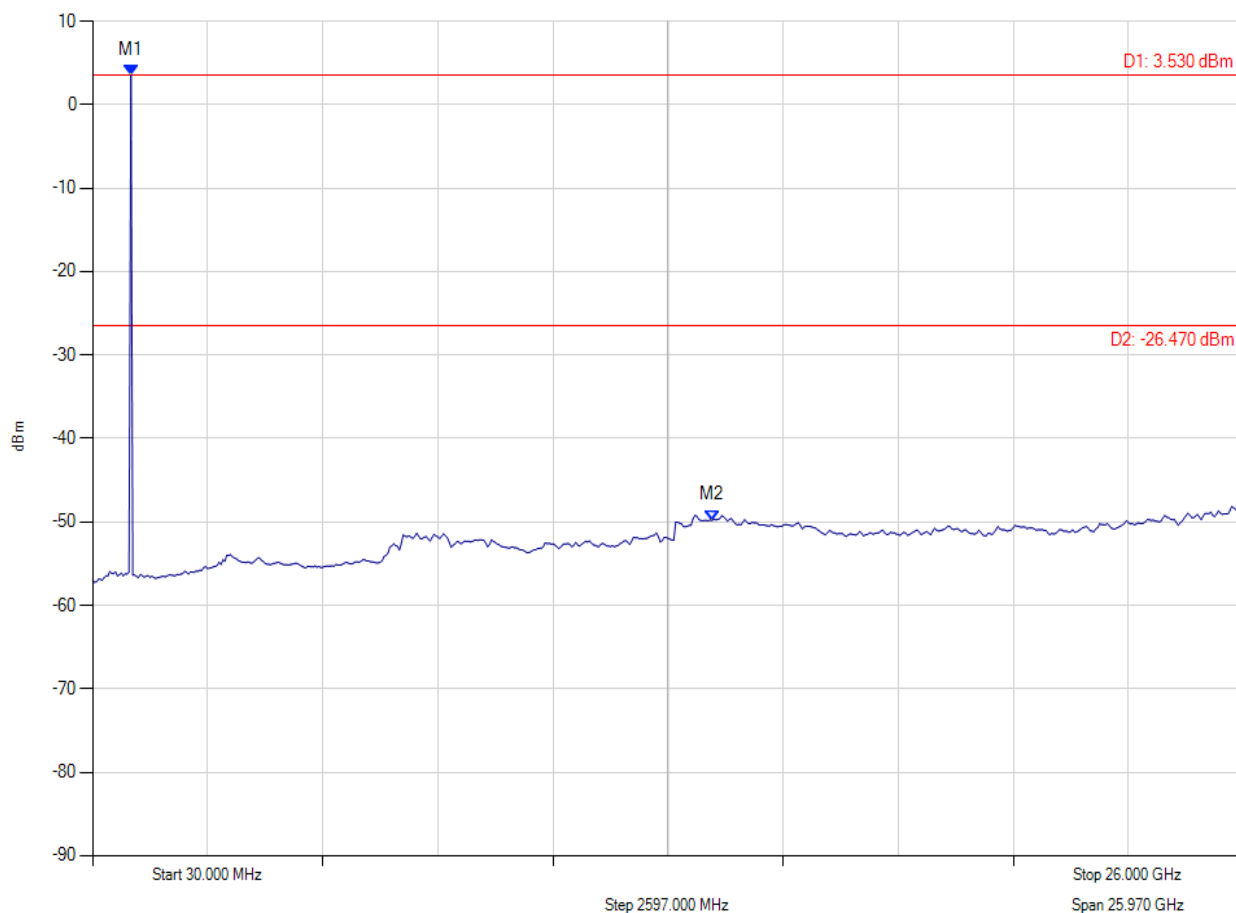
#### CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 250FH, Channel: 902.56 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: +1.000E+01 dBm  
27.5 dB Offset

Sweep Time: 30.0 s

RBW: 100 KHz  
VBW: 300 KHz



| Analyser Setup                                                                | Marker:Frequency:Amplitude                                    | Test Results                  |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = AVER<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 900.000 MHz : 3.530 dBm<br>M2 : 14.010 GHz : -49.810 dBm | Channel Frequency: 902.56 MHz |

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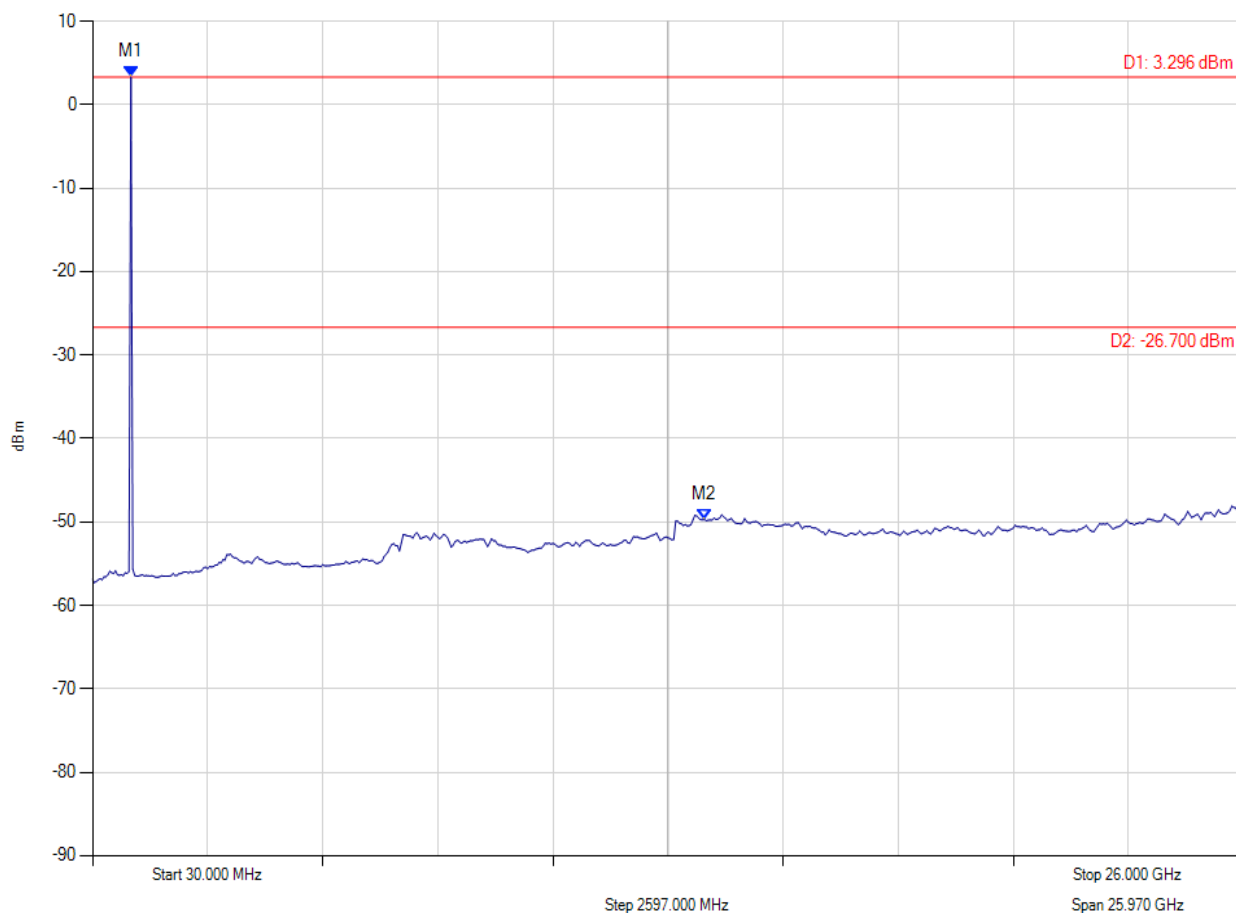
#### CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 250FH, Channel: 915.06 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: +1.000E+01 dBm  
27.5 dB Offset

Sweep Time: 30.0 s

RBW: 100 KHz  
VBW: 300 KHz



| Analyser Setup                                                                | Marker:Frequency:Amplitude                                    | Test Results                  |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = AVER<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 900.000 MHz : 3.296 dBm<br>M2 : 13.840 GHz : -49.712 dBm | Channel Frequency: 915.06 MHz |

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**Title:** Iotera - Home Base  
**To:** FCC CFR 47 Part 15 Subpart C 15.247 (DTS)  
**Serial #:** IOTA01-U3a 900 MHz Rev A  
**Issue Date:** 8<sup>th</sup> April 2015  
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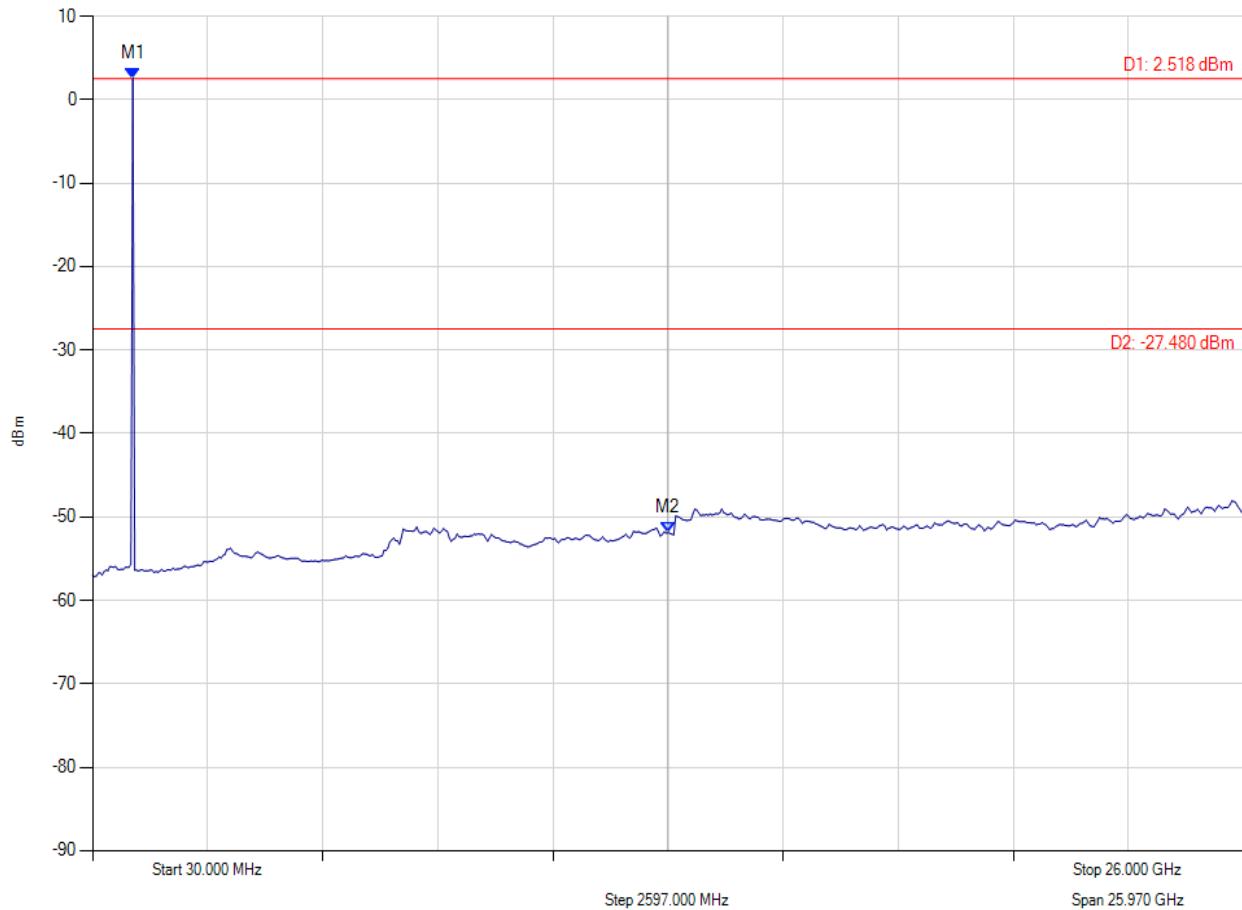
#### CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 250FH, Channel: 926.94 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: +1.000E+01 dBm  
27.6 dB Offset

Sweep Time: 30.0 s

RBW: 100 KHz  
VBW: 300 KHz



| Analyser Setup                                                                | Marker:Frequency:Amplitude                                    | Test Results                  |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = AVER<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 940.000 MHz : 2.518 dBm<br>M2 : 13.020 GHz : -51.875 dBm | Channel Frequency: 926.94 MHz |

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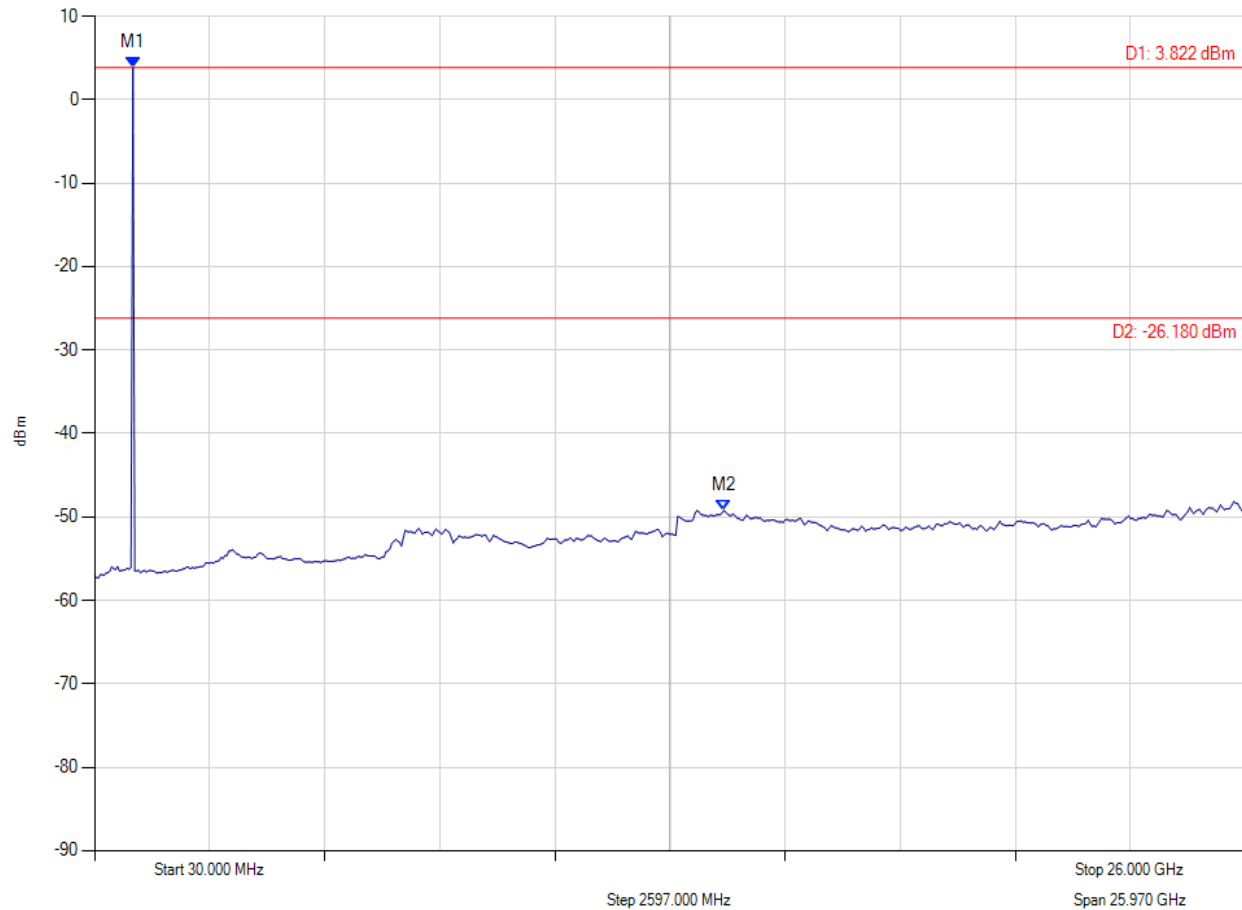
#### CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 500DSS, Channel: 902.56 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: +1.000E+01 dBm  
27.5 dB Offset

Sweep Time: 30.0 s

RBW: 100 KHz  
VBW: 300 KHz



| Analyser Setup                                                                | Marker:Frequency:Amplitude                                    | Test Results                  |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = AVER<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 900.000 MHz : 3.822 dBm<br>M2 : 14.230 GHz : -49.230 dBm | Channel Frequency: 902.56 MHz |

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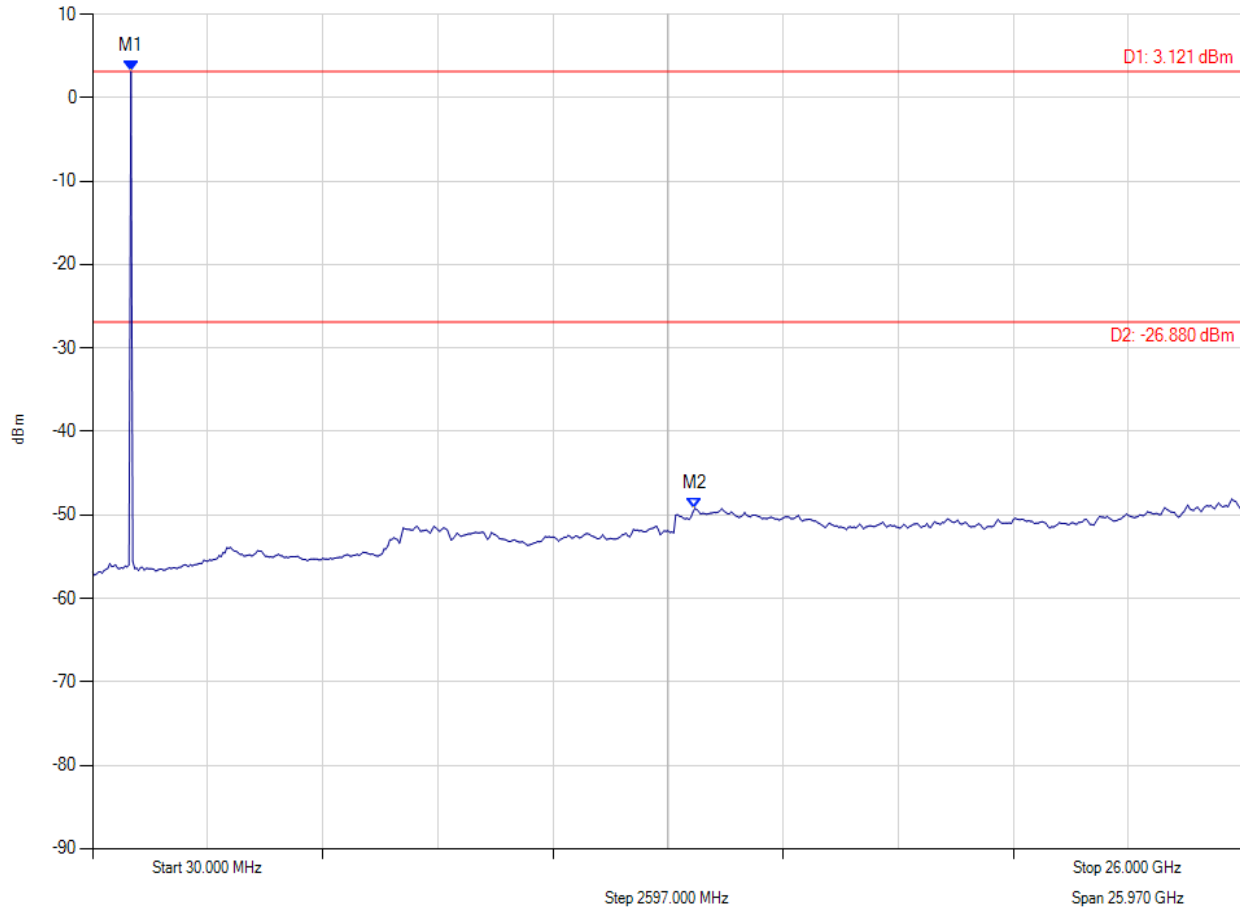
### CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 500DSS, Channel: 915.06 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: +1.000E+01 dBm  
27.5 dB Offset

Sweep Time: 30.0 s

RBW: 100 KHz  
VBW: 300 KHz



| Analyser Setup                                                                | Marker:Frequency:Amplitude                                    | Test Results                  |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = AVER<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 900.000 MHz : 3.121 dBm<br>M2 : 13.620 GHz : -49.241 dBm | Channel Frequency: 915.06 MHz |

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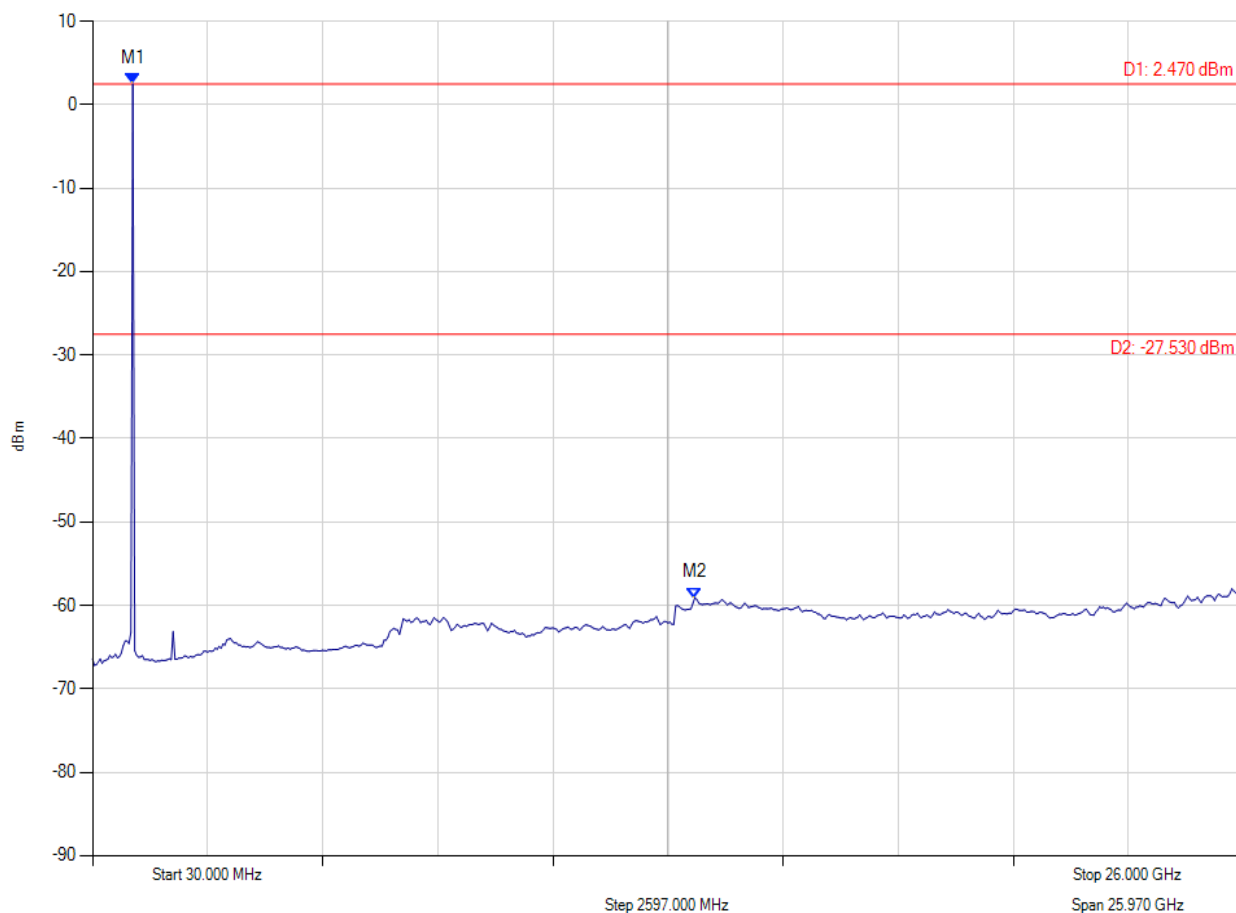
#### CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 500DSS, Channel: 926.94 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: +1.000E+01 dBm  
27.6 dB Offset

Sweep Time: 30.0 s

RBW: 100 KHz  
VBW: 300 KHz



| Analyser Setup                                                                | Marker:Frequency:Amplitude                                    | Test Results                  |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Detector = AVER<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 940.000 MHz : 2.470 dBm<br>M2 : 13.620 GHz : -59.092 dBm | Channel Frequency: 926.94 MHz |

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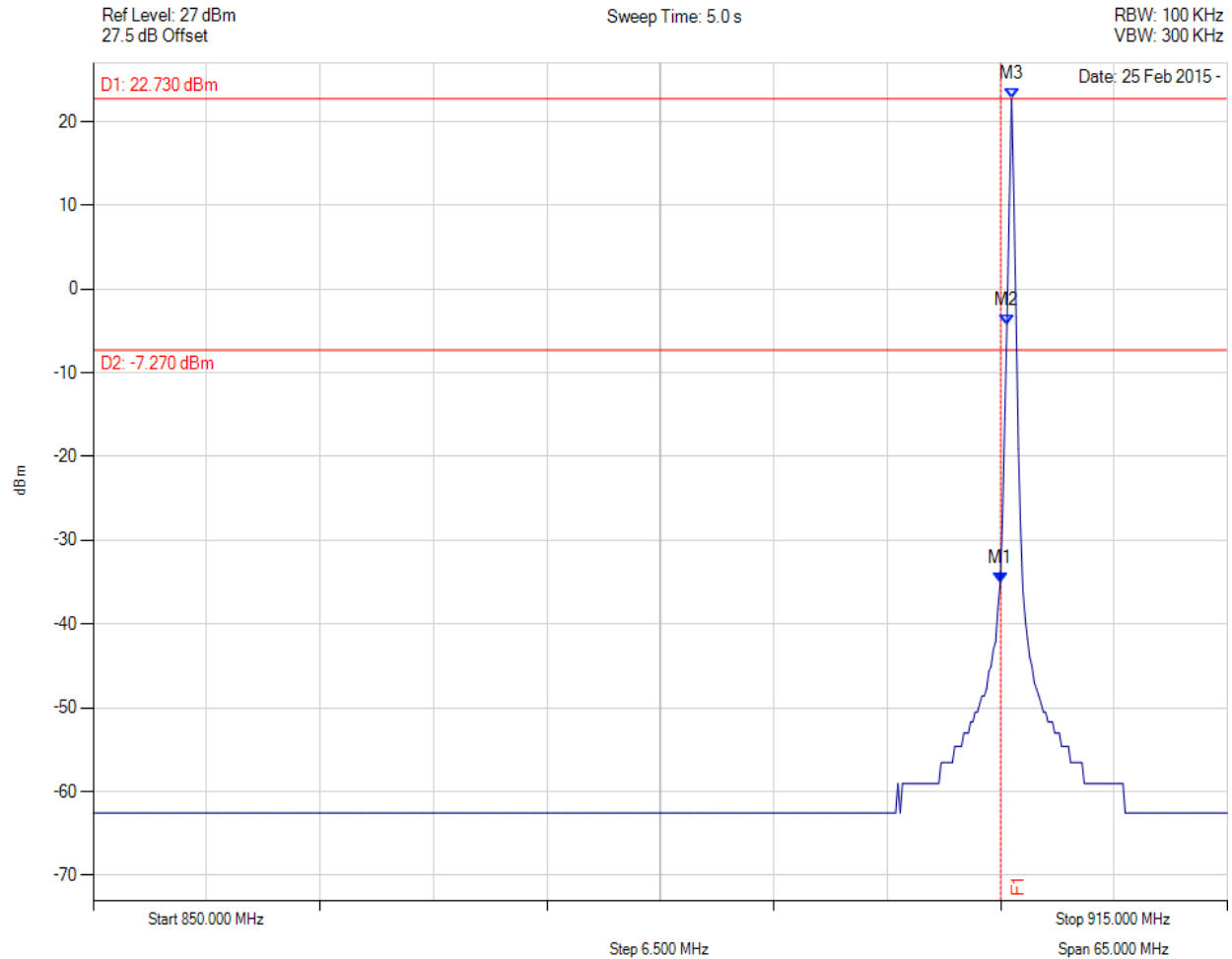
**Title:** Iotera - Home Base  
**To:** FCC CFR 47 Part 15 Subpart C 15.247 (DTS)  
**Serial #:** IOTA01-U3a 900 MHz Rev A  
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### 10.6.2. Conducted Band-Edge Emissions



#### CONDUCTED LOW BAND-EDGE EMISSIONS - AVERAGE

Variant: 125FH, Channel: 902.56 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc



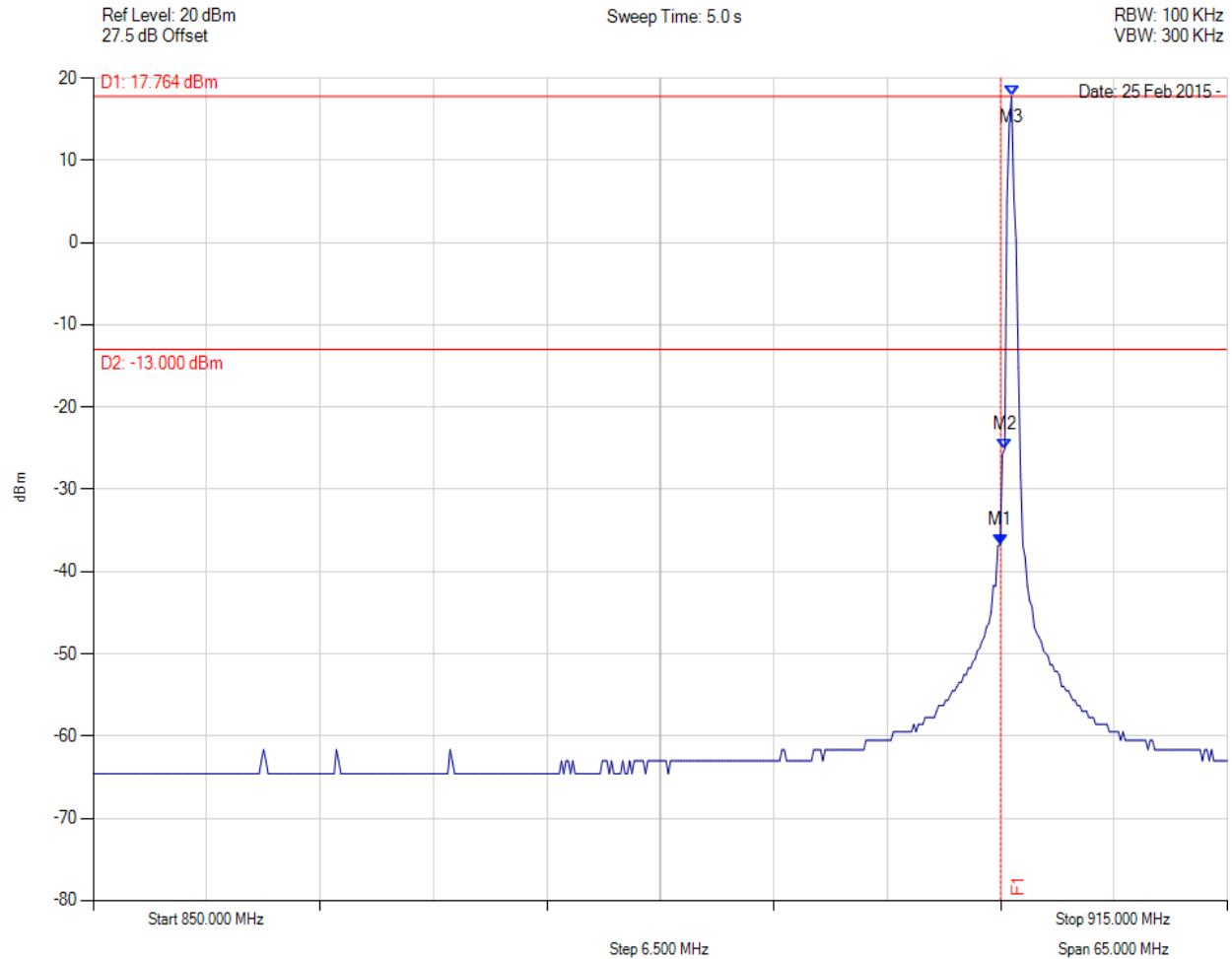
| Analyser Setup                                                                   | Marker:Frequency:Amplitude                                                                       | Test Results                  |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 902.000 MHz : -35.123 dBm<br>M2 : 902.365 MHz : -4.237 dBm<br>M3 : 902.625 MHz : 22.733 dBm | Channel Frequency: 902.56 MHz |

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### CONDUCTED LOW BAND-EDGE EMISSIONS - AVERAGE

Variant: 250FH, Channel: 902.56 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc



| Analyser Setup                                                                   | Marker:Frequency:Amplitude                                                                        | Test Results                  |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 902.000 MHz : -36.767 dBm<br>M2 : 902.234 MHz : -25.087 dBm<br>M3 : 902.625 MHz : 17.764 dBm | Channel Frequency: 902.56 MHz |

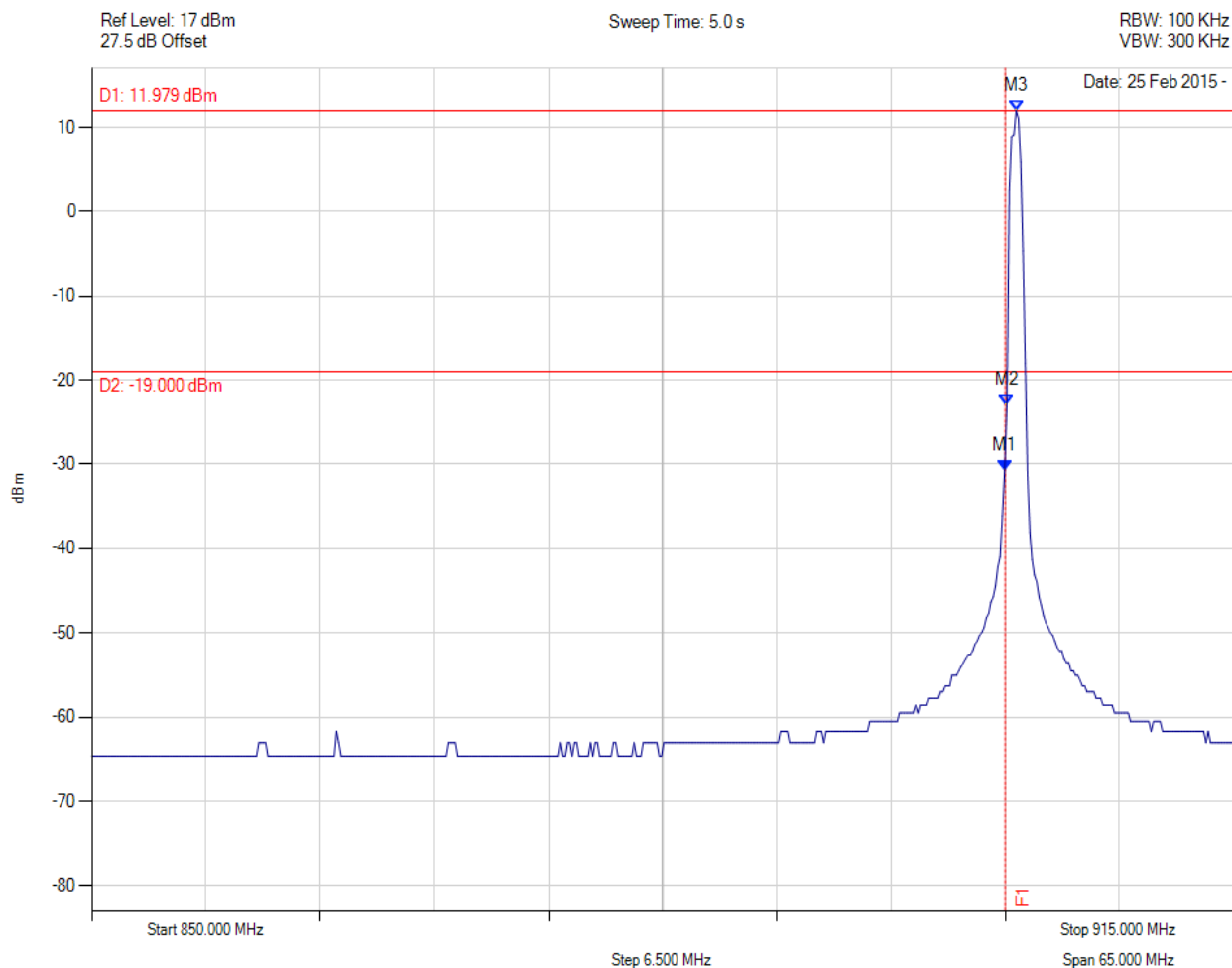
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# CONDUCTED LOW BAND-EDGE EMISSIONS - AVERAGE

Variant: 500DSS, Channel: 902.56 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc



| Analysers Setup                                                                  | Marker:Frequency:Amplitude                                                                        | Test Results                  |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 902.000 MHz : -30.711 dBm<br>M2 : 902.104 MHz : -22.887 dBm<br>M3 : 902.625 MHz : 11.979 dBm | Channel Frequency: 902.56 MHz |

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### CONDUCTED HIGH BAND-EDGE EMISSIONS - AVERAGE

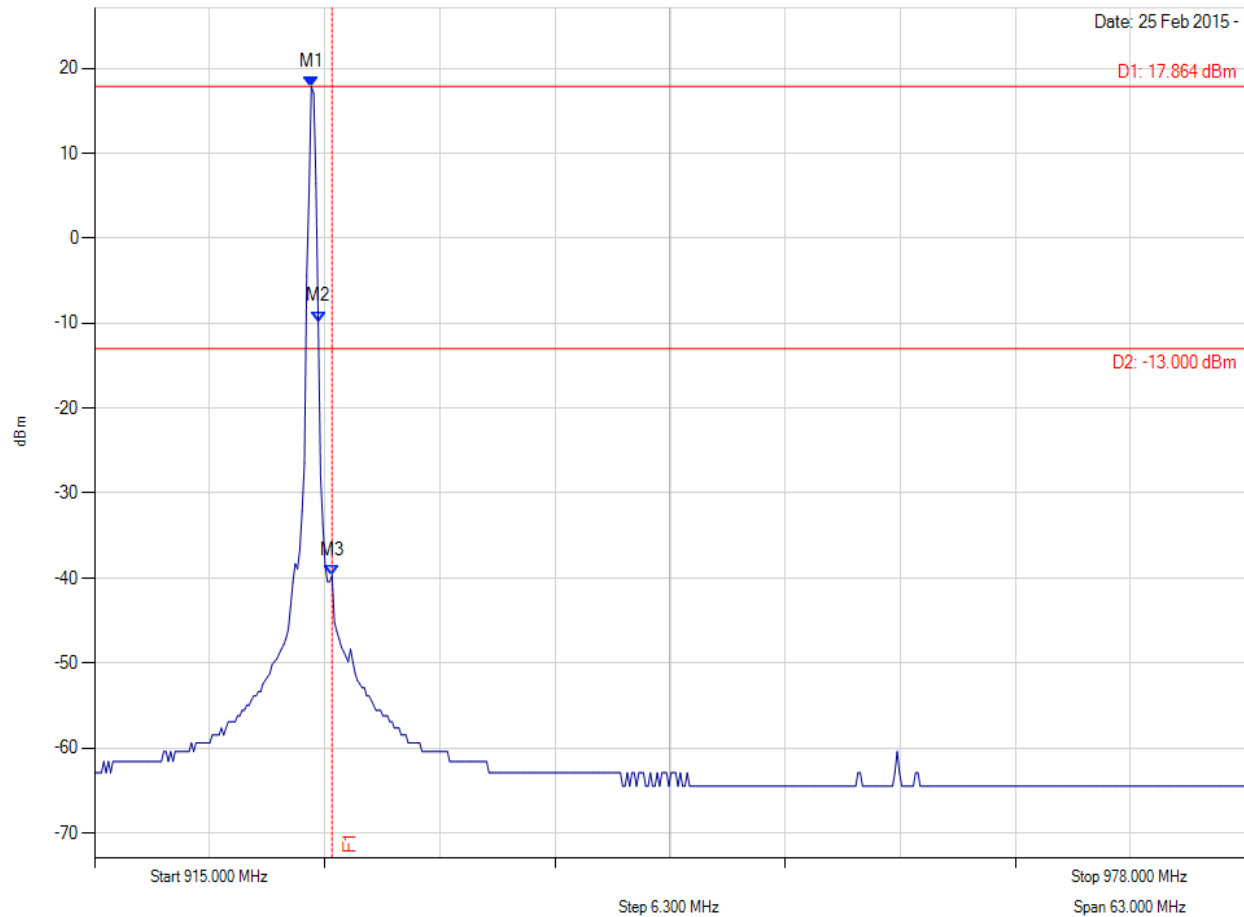
Variant: 125FH, Channel: 926.94 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 27.1 dBm  
27.6 dB Offset

Sweep Time: 5.0 s

RBW: 100 KHz  
VBW: 300 KHz

Date: 25 Feb 2015 -



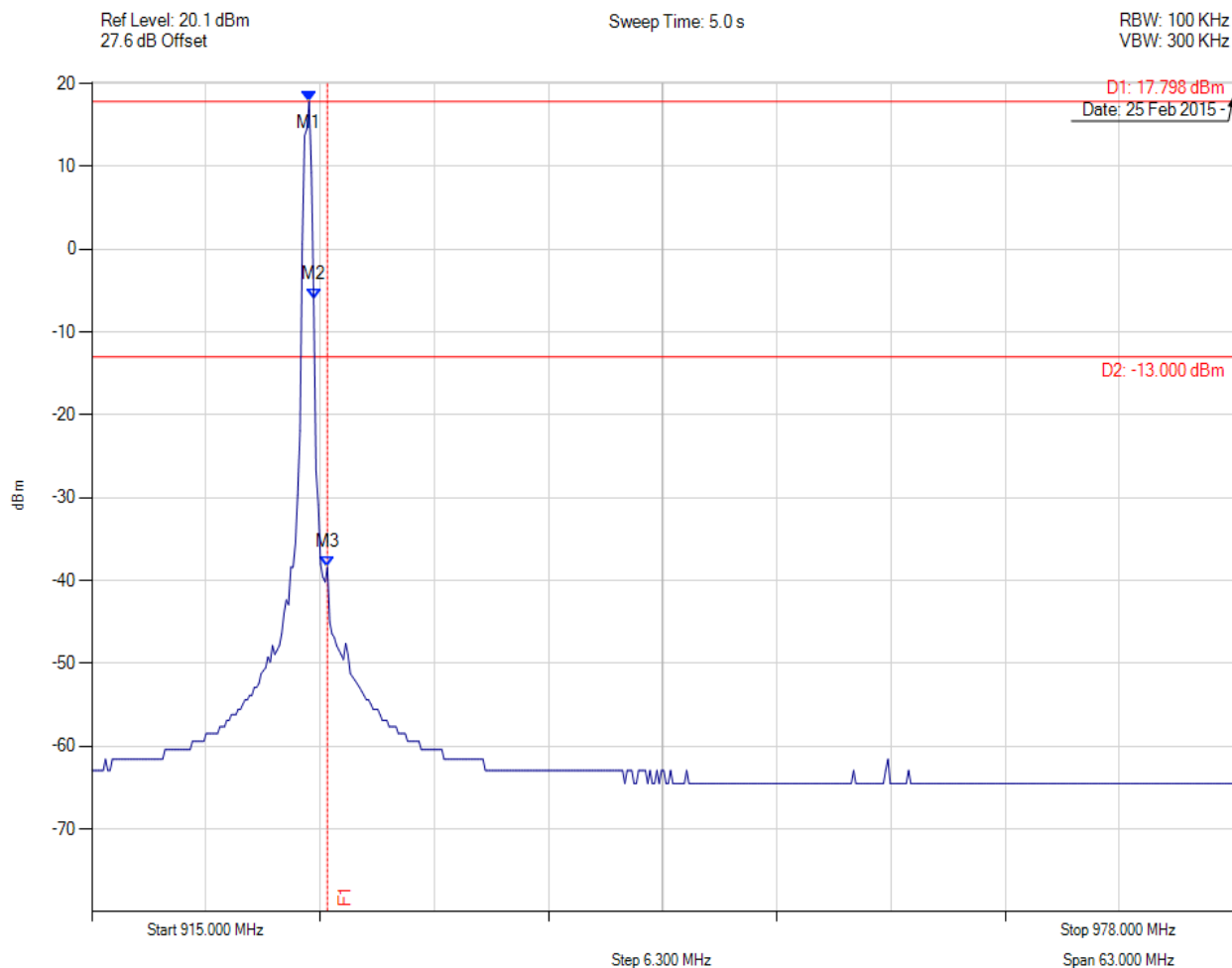
| Analyser Setup                                                                   | Marker:Frequency:Amplitude                                                                       | Test Results                  |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 926.868 MHz : 17.864 dBm<br>M2 : 927.246 MHz : -9.822 dBm<br>M3 : 928.000 MHz : -39.675 dBm | Channel Frequency: 926.94 MHz |

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# CONDUCTED HIGH BAND-EDGE EMISSIONS - AVERAGE

Variant: 250FH, Channel: 926.94 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc



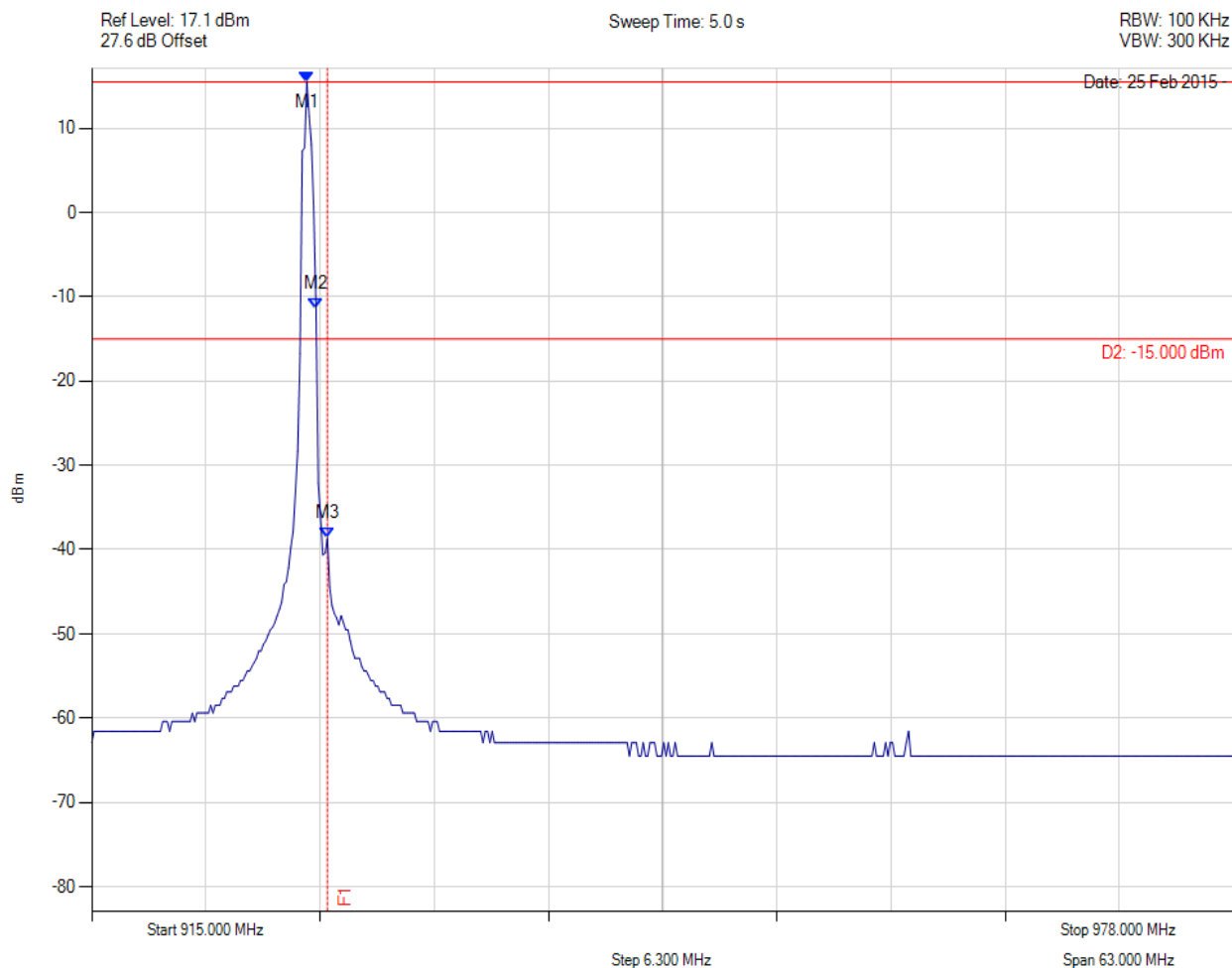
| Analyser Setup                                                                   | Marker:Frequency:Amplitude                                                                       | Test Results                  |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 926.994 MHz : 17.798 dBm<br>M2 : 927.246 MHz : -6.038 dBm<br>M3 : 928.000 MHz : -38.379 dBm | Channel Frequency: 926.94 MHz |

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# CONDUCTED HIGH BAND-EDGE EMISSIONS - AVERAGE

Variant: 500DSS, Channel: 926.94 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc



| Analyser Setup                                                                   | Marker:Frequency:Amplitude                                                                        | Test Results                  |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 926.868 MHz : 15.479 dBm<br>M2 : 927.373 MHz : -11.441 dBm<br>M3 : 928.000 MHz : -38.641 dBm | Channel Frequency: 926.94 MHz |

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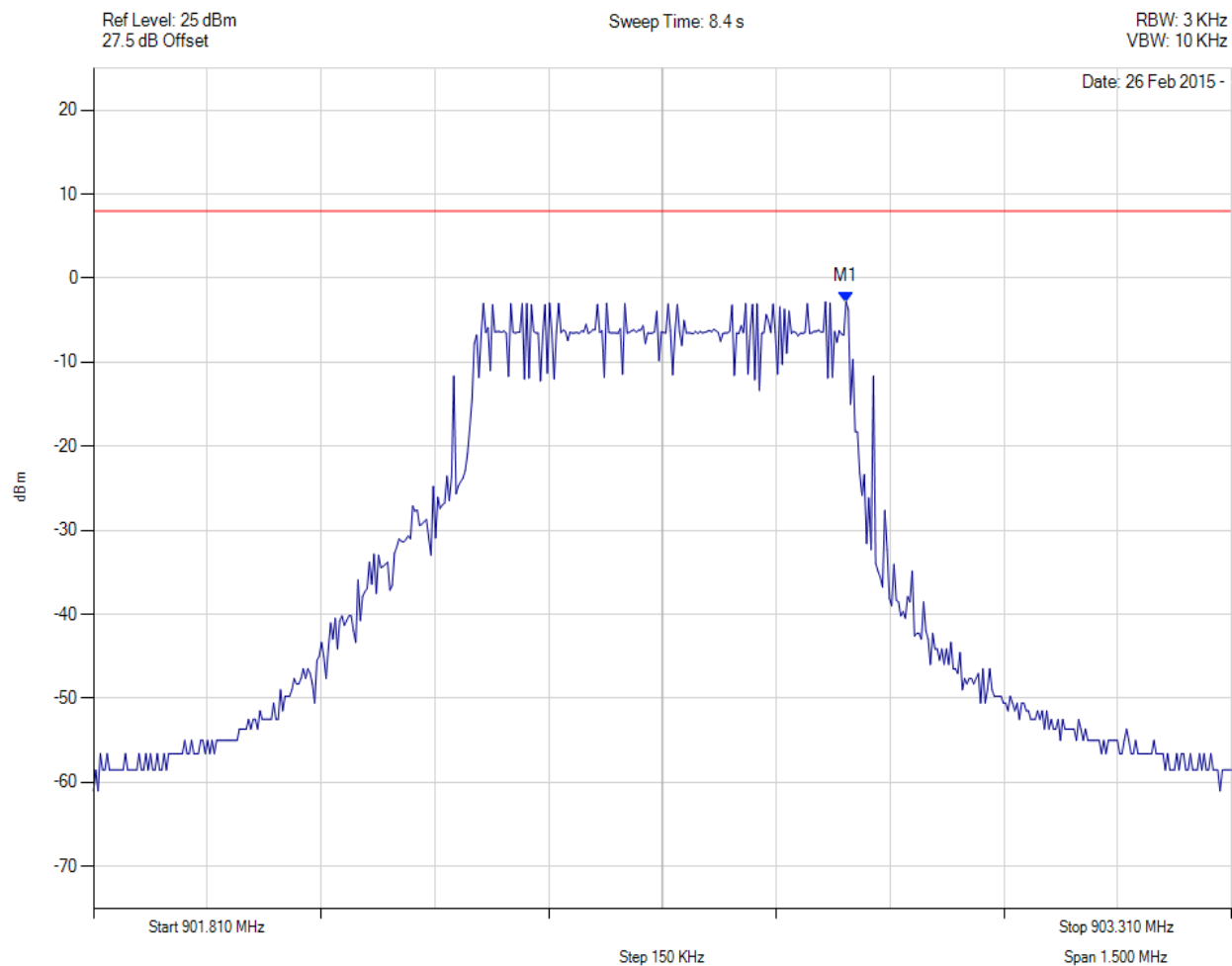
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## 10.7. Power Spectral Density



### POWER SPECTRAL DENSITY - AVERAGE

Variant: 500DSS, Channel: 902.56 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc



| Analyser Setup                                                                   | Marker:Frequency:Amplitude    | Test Results                  |
|----------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 902.802 MHz : -2.800 dBm | Channel Frequency: 902.56 MHz |

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POWER SPECTRAL DENSITY - AVERAGE

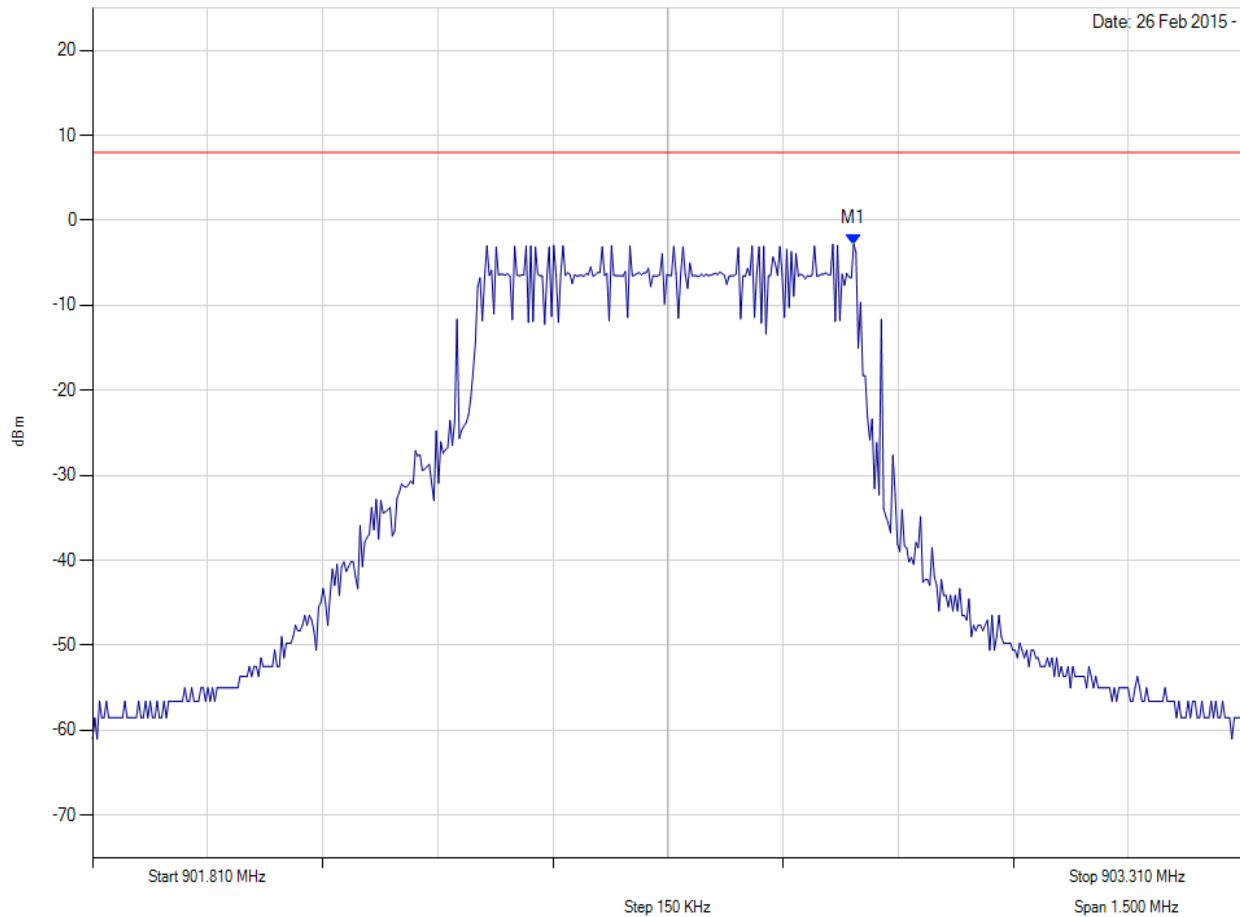
Variant: 500DSS, Channel: 902.56 MHz, SUM, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 25 dBm  
27.5 dB Offset

Sweep Time: 8.4 s

RBW: 3 KHz  
VBW: 10 KHz

Date: 26 Feb 2015 -



| Analyser Setup                                                                   | Marker:Frequency:Amplitude    | Test Results                  |
|----------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 902.802 MHz : -2.800 dBm | Channel Frequency: 902.56 MHz |

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POWER SPECTRAL DENSITY - AVERAGE

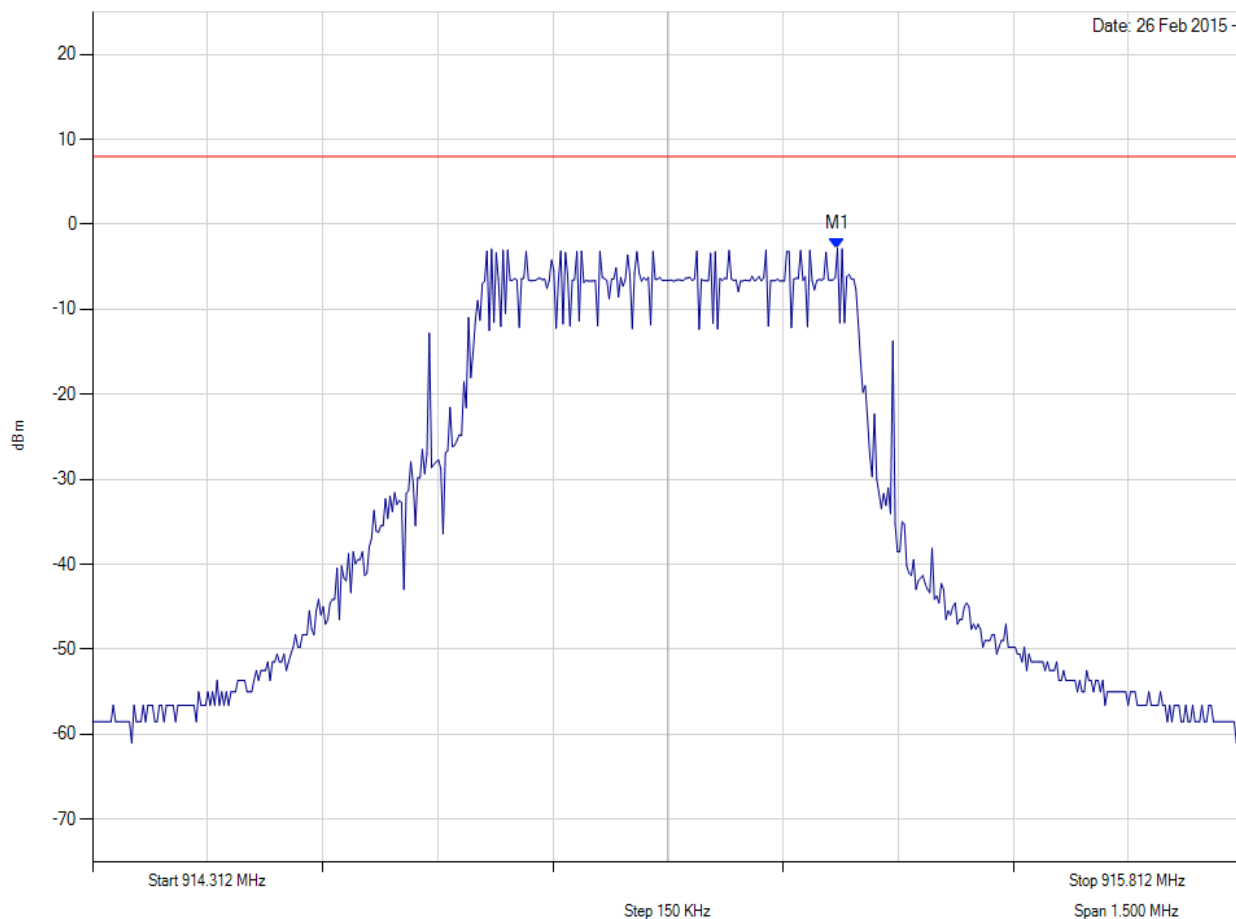
Variant: 500DSS, Channel: 915.06 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 25 dBm  
27.5 dB Offset

Sweep Time: 8.4 s

RBW: 3 KHz  
VBW: 10 KHz

Date: 26 Feb 2015 -



| Analyser Setup                                                                   | Marker:Frequency:Amplitude    | Test Results                  |
|----------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 915.283 MHz : -2.821 dBm | Channel Frequency: 915.06 MHz |

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POWER SPECTRAL DENSITY - AVERAGE

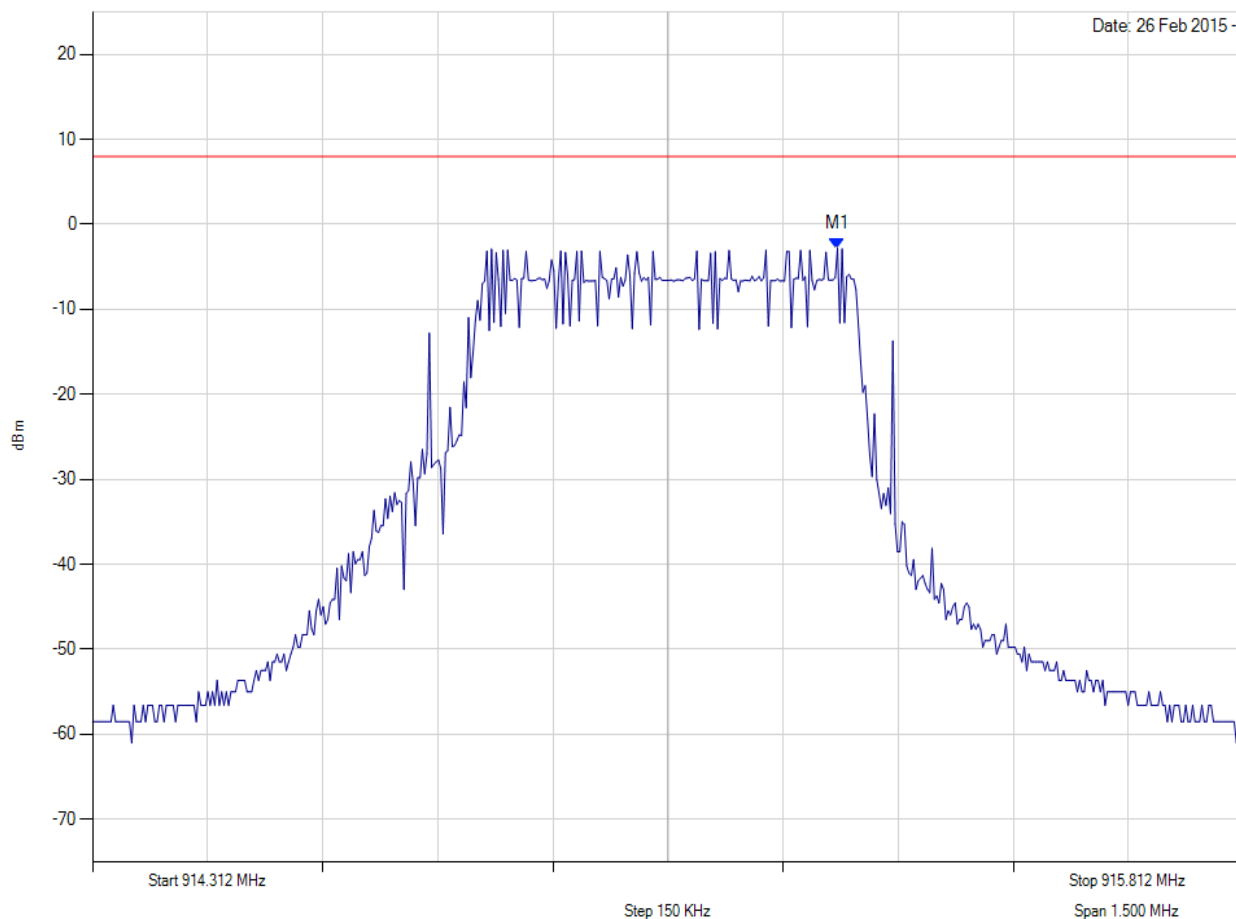
Variant: 500DSS, Channel: 915.06 MHz, SUM, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 25 dBm  
27.5 dB Offset

Sweep Time: 8.4 s

RBW: 3 KHz  
VBW: 10 KHz

Date: 26 Feb 2015 -



| Analyser Setup                                                                   | Marker:Frequency:Amplitude    | Test Results                  |
|----------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 915.283 MHz : -2.821 dBm | Channel Frequency: 915.06 MHz |

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POWER SPECTRAL DENSITY - AVERAGE

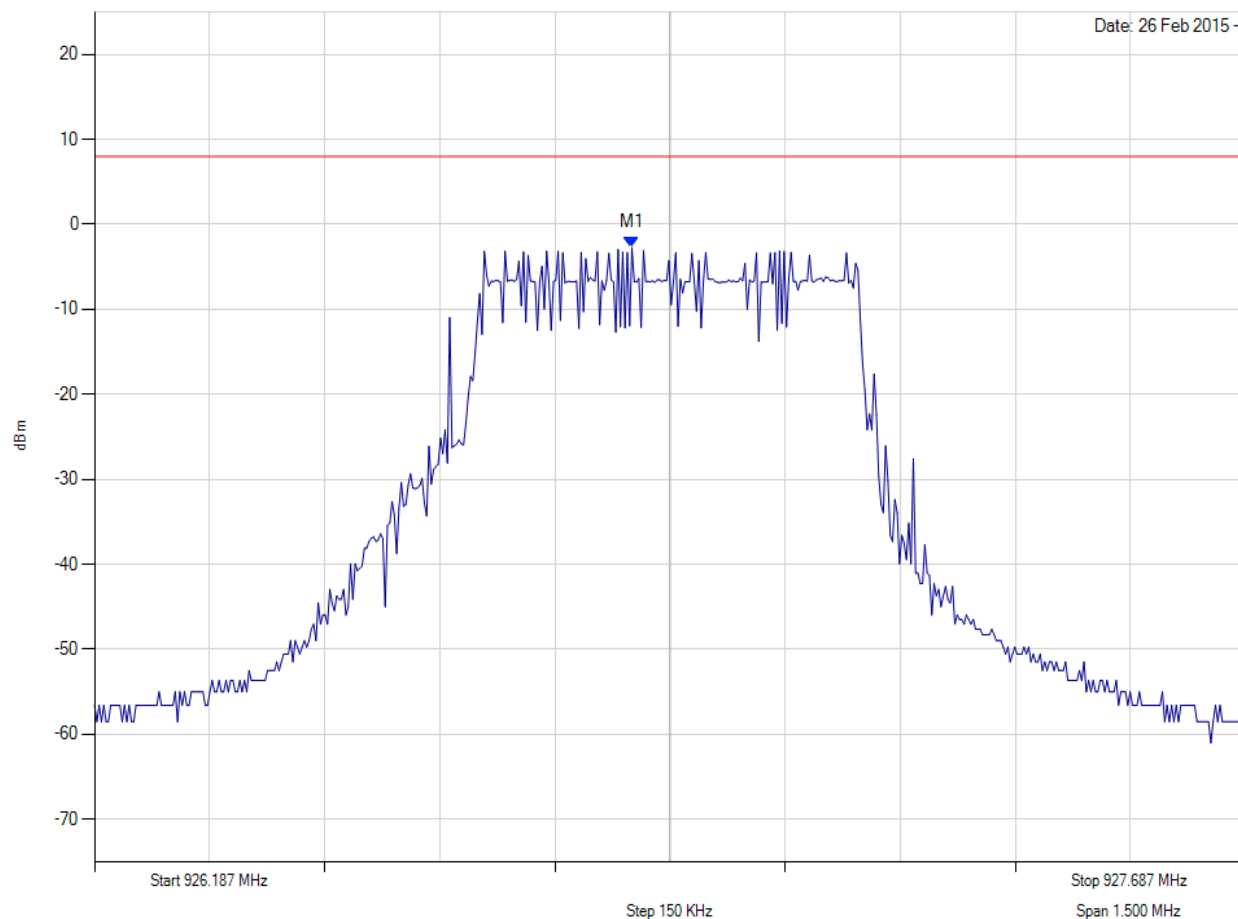
Variant: 500DSS, Channel: 926.94 MHz, Chain a, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 25 dBm  
27.6 dB Offset

Sweep Time: 8.4 s

RBW: 3 KHz  
VBW: 10 KHz

Date: 26 Feb 2015 -



| Analyser Setup                                                                   | Marker:Frequency:Amplitude    | Test Results                  |
|----------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 926.887 MHz : -2.747 dBm | Channel Frequency: 926.94 MHz |

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POWER SPECTRAL DENSITY - AVERAGE

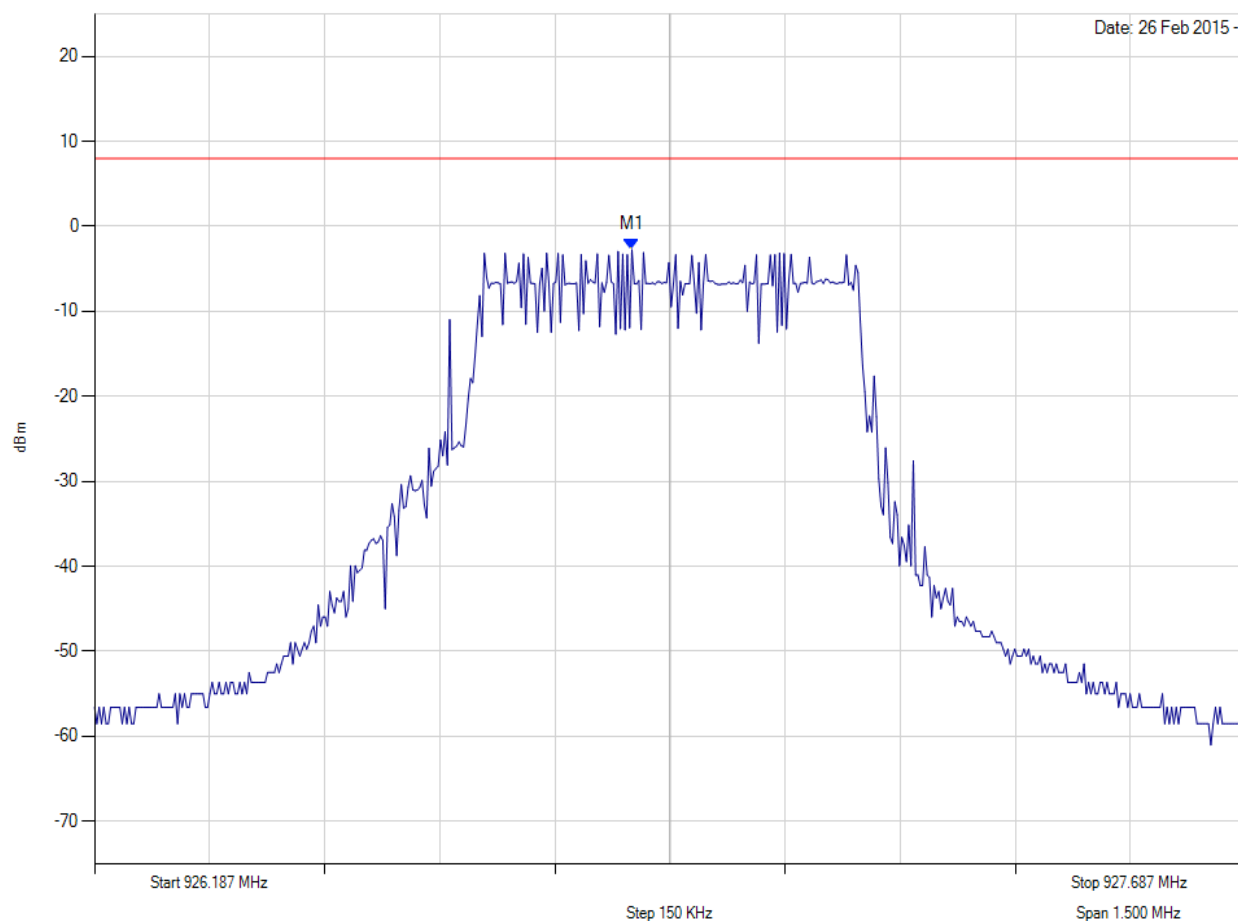
Variant: 500DSS, Channel: 926.94 MHz, SUM, Temp: Ambient, Voltage: 6 Vdc

Ref Level: 25 dBm  
27.6 dB Offset

Sweep Time: 8.4 s

RBW: 3 KHz  
VBW: 10 KHz

Date: 26 Feb 2015 -



| Analyser Setup                                                                   | Marker:Frequency:Amplitude    | Test Results                  |
|----------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| Detector = AVERAGE<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 926.887 MHz : -2.747 dBm | Channel Frequency: 926.94 MHz |

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