Application Note

# INDY MODULE ETSI RED ADJACENT INTERFERER TEST PROCEDURE

## APPLICATION NOTE

Version 1.0



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# 1 ABSTRACT


The new ETSI Radio Equipment Directive (RED) test applies additional requirements for interferer immunity to UHF RFID reader products. Impinj has performed tests of our reader modules to ensure that they can be built into readers that meet these requirements, and the setup and results from these tests are detailed in this document.

Impinj performed the connectorized version of the tests, not the over the air version.

This version of the document is preliminary. These tests will be performed again with the release of the RS1000 Module, and the document will be updated.


# 2 HARDWARE PREREQUISITES

1) RFID Reader DUTs
    a) RS500 on development board
    b) RS2000 on development board
2) Test equipment
    a) Electrical test equipment
        i) Signal Generator
            (1) Agilent E4432B SN US40052652
        ii) Attenuators
            (1) JFW JBR-017 SN 396504 0518
            (2) JFW JBR-022 447006 0644
        iii) Isolators
            (1) Ditom D3I0810S SN 200
            (2) Ditom D3I0810S SN 113
        iv) Circulators
            (1) JQL JCCC0800T0960-S10 SN 70739809
            (2) JQL JCCC0800T0960-S10 SN 70739809
        v) Power Splitter
            (1) Mini-Circuits ZFSC-2-4 SN SF343200 514

vi) Network Analyzer

(1) Planar TR1300/1 SN 0280514

b) Windows 7 PC

i) Running Indy demo tool GUI 1.6.7.240

c) Connectorized tag

i) Monza X 8K board HN1

# 3 TESTED MODULES

RS500 module configuration

- SKU: IPJ-RS500-EU
- Serial number: 020150130103
- Running application image version 1.6.8.7
- Mounted on a pogo-pin RS500 development board

RS2000 module configuration

- SKU: IPJ-RS2000-1
- Serial number: 010000030255
- Running application image version 1.6.8.12
- Mounted on an RS2000 development board

# 4 TEST HARDWARE OVERVIEW

A block diagram of the test hardware is shown in Figure 1, with photos following.

**Figure 1 – Adjacent Interferer Test RF Hardware and Connections**

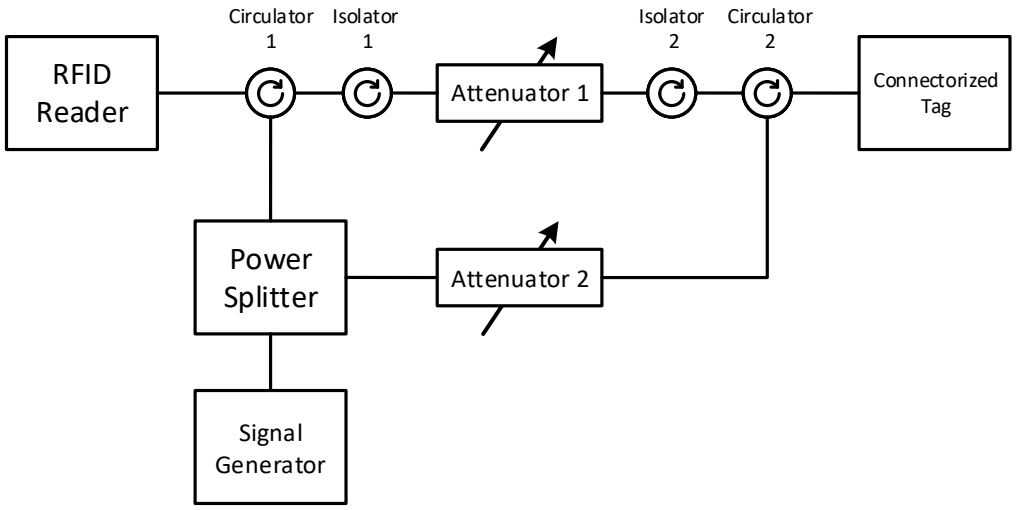


Figure 2 – Overall Adjacent Interferer Test Setup

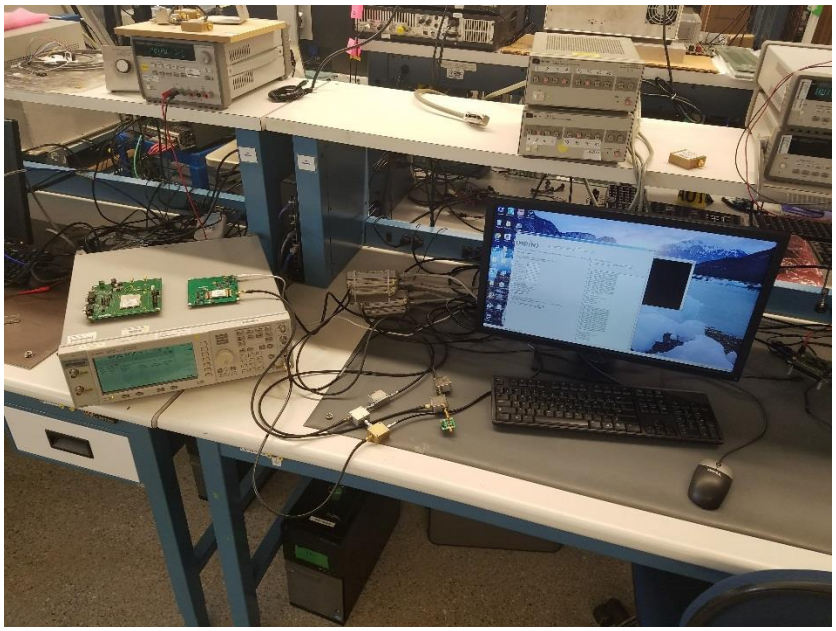
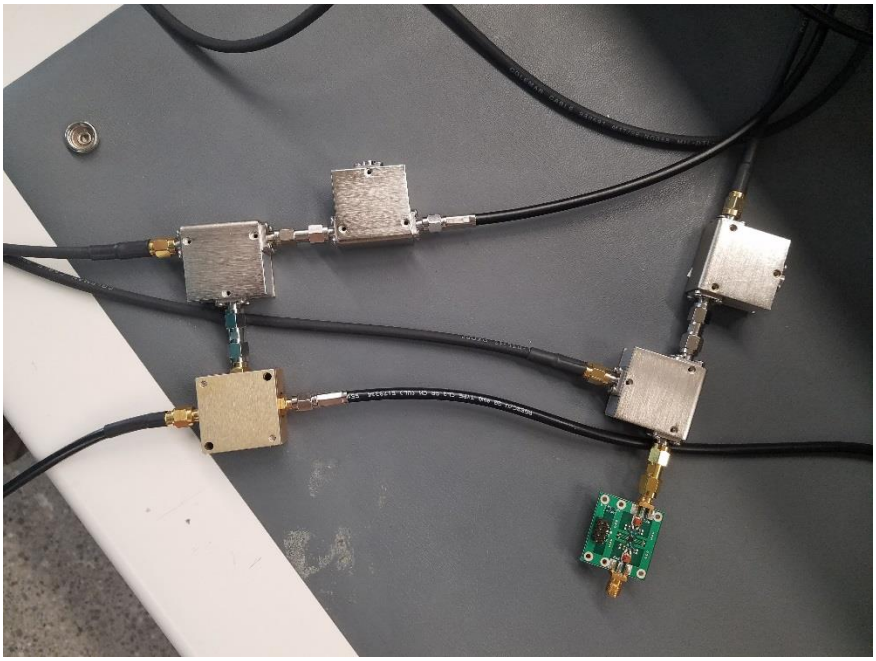


Figure 3 – Circulators, Isolators, Power Splitter, and Connectorized Tag



# 5 TEST PROCEDURE

1. Connect hardware as shown in Figure 1 above
   1.1. Attenuation should be 0 dB initially, Signal Generator should be disabled
2. Measure and record losses in path from signal generator to RFID reader, make note of it for use in further steps
   2.1. Used a Planar TR1300/1 Network Analyzer (Serial Number 0280514)
   2.2. Note: Impinj's total measured path loss was 5.5 dB
   2.3. Note: Other cable losses in the test setup don't matter because attenuation setting is arbitrary

3. Configure reader using Indy Demo Tool GUI
    3.1. On the Tx Control tab:
        3.1.1. Set transmit power to maximum
        3.1.2. Set the reader to operate at fixed frequency, 866.3 MHz
            3.1.2.1. Use the “Set Frequency” control
        3.1.3. Cycle carrier wave (CW) on and off to enable RF
    3.2. On the Inventory Tab
        3.2.1. Set Link profile to 2
        3.2.2. Set tag population to 0 (q=0)
            3.2.2.1. Note: this makes the difference between reading and not reading tags very obvious
        3.2.3. Start reading tags with the “Start” button
            3.2.3.1. Tag reads should begin to appear in the log
4. Set forward path attenuation using the forward path attenuator
    4.1. Start with forward path attenuator at -0 dB
    4.2. Increase forward link attenuation until tag reads become marginal (<1 tag read per second)
    4.3. Decrease the attenuation by 10 dB from that value
    4.4. Record this attenuation value
5. Set reverse path attenuation using the reverse path attenuator
    5.1. Start with reverse path attenuation at -0 dB
    5.2. increase reverse link attenuation until tag reads become marginal (<1 tag read per second)
    5.3. Decrease the attenuation by 3 dB from that value
    5.4. Record this attenuation value
6. Configure the interferer (signal generator)
    6.1. 80% AM modulation
    6.2. Note: photo shown in Figure 4
7. Determine marginal interferer power level on the lower adjacent channel
    7.1. Set the interferer frequency to the channel below the reader frequency
    7.2. Adjust marginal interferer power level until reading becomes marginal (<1 tag read per second)
    7.3. The measurement result is the amplitude of the interfering signal at the signal generator, minus the loss in the path from the signal generator to the reader.
    7.4. Record the test result
8. Determine marginal interferer power level on the higher adjacent channel
    8.1. Set the interferer frequency to the channel above the reader frequency
    8.2. Adjust marginal interferer power level until reading becomes marginal (<1 tag read per second)
    8.3. The measurement result is the amplitude of the interfering signal at the signal generator, minus the loss in the path from the signal generator to the reader.
    8.4. Record the test result
9. Repeat marginal interferer power level tests for channel 866.9 MHz
    9.1. Configure the reader for 866.9 MHz fixed frequency operation as per step 3 above

9.2. Repeat upper and lower interferer tests, recording results, as per steps 7 and 8 above

**Figure 4 – Interferer (Signal Generator) Configuration**


# 6 TEST RESULTS

Impinj's adjacent channel selectivity test results for each reader module are described below.

These results should be compared with the ETSI adjacent channel selectivity minimum of -26 dBm. All of Impinj's results are greater than this value, and thus meet the requirement.

## 6.1 RS2000

RS2000's test results are shown below in Table 1.

When operating at 866.3 MHz, the forward attenuation value was set to 26 dB, and the reverse attenuation value was set to 49 dB.

When operating at 866.9 MHz, the forward attenuation value was set to 27 dB, and the reverse attenuation value was set to 47 dB.

**Table 1: Adjacent Channel Selectivity Test Results, RS2000**

| Reader Frequency | Interferer Frequency | | | |
|---|---|---|---|---|
| | 865.7 MHz | 866.3 MHz | 866.9 MHz | 867.5 MHz |
| 866.3 MHz | -22.5 dBm | N/A | -21.5 dBm | N/A |
| 866.9 MHz | N/A | -22.5 dBm | N/A | -21.5 dBm |

## 6.2 RS500

RS500's test results are shown below in Table 2.

When operating at 866.3 MHz, the forward attenuation value was set to 22 dB, and the reverse attenuation value was set to 27 dB.

When operating at 866.9 MHz, the forward attenuation value was set to 22 dB, and the reverse attenuation value was set to 26 dB.

**Table 2: Adjacent Channel Selectivity Test Results, RS500**

| Reader Frequency | Interferer Frequency | | | |
|---|---|---|---|---|
| | 865.7 MHz | 866.3 MHz | 866.9 MHz | 867.5 MHz |
| 866.3 MHz | -12.5 dBm | N/A | -11.5 dBm | N/A |
| 866.9 MHz | N/A | -11.5 dBm | N/A | -11.5 dBm |

Note: RS500 has higher "better" adjacent interferer insensitivity measurements because it can accommodate much less reverse channel attenuation due to its inherent insensitivity. This reflects RS2000's superior sensitivity performance.

# 7 APPENDICES

## 7.1 References

EN 302 208 V3.1.1 (2016-11)

# 8 DOCUMENT CHANGE LOG

**Table 3: Document Change Log**

| Version | Date | Description |
|---|---|---|
| **1.0** | 2019-05-01 | • Initial version |

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