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EDVT Protocol and Report

MICS LBT Compliance

Jaguar S-ICD Implementation

Model 6290

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**Responsible Department: CRM R&D Hardware
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1 ABOUT THIS DOCUMENT

1.1 *Scope*

A firmware update to the existing LATITUDE Jaguar MICS Communicator, Model 6290, will provide support for BSC EMBLEM S-ICD implantable devices. MICS band telemetry for the EMBLEM S-ICD system is changed from the previously verified and approved legacy MICS telemetry system. Once the Model 6290 is paired in the field with an implantable device it will perform either legacy MICS band telemetry (10-channel) or S-ICD MICS band telemetry (2-channel). The device behavior for legacy MICS band telemetry is exactly the same as in the previous device verifications. Therefore testing for legacy MICS telemetry will not be repeated in this EDVT.

This document describes the test protocol and report for the electrical design verification testing (EDVT) performed to demonstrate the S-ICD implementation on the LATITUDE Jaguar MICS Communicator, Model 6290, complies with MICS Listen Before Talk (LBT) Requirements. The electrical design verification testing is part of a total system test plan that typically includes electromagnetic compatibility, modem and radio compliance, electrical safety, and various functional tests.

This EDVT provides compliance verification for the Jaguar MICS S-ICD implementation.

1.2 *Objective*

This testing is intended to ensure that the Jaguar MICS Model 6290 complies with the LBT requirements outlined in the various radio regulatory standards. Successful completion of this EDVT will be used to support Jaguar MICS radio compliance.

1.3 *Device Description*

The Jaguar MICS Communicator, Model 6290, is an externally powered device that communicates with implantable devices via an RF link and transmits information back to a central database. The device has a programmable RF section to support telemetry with the implantable device in the global MICS RF band (402-405 MHz).

2 TEST APPROACH

2.1 *Sample Size*

Sample size for this entire protocol is one (1) as defined by the external standards.

2.2 **Test Equipment**

A partial list of the test equipment needed to perform this testing is listed here:

- Model A209 S-ICD (or equivalent) – FW version 3.0.479
- Communicator Power Supply 5V/3A, 350118-001 (or equivalent)
- RF Test Equipment (spectrum analyzer and signal generators)

Details of the test equipment information will be included Section 6.

2.3 *Test Configuration*

2.3.1 Test Configuration for LBT Compliance Testing

The DUT to PG test setup will be configured per Section 7 for this protocol.

2.3.2 Signal Level Calibrations

All signal levels referenced in this protocol will be calibrated to the RF input of the DUT.

2.4 *Configuring the DUT for Test*

The following is a description of how to configure the DUT for test.

2.4.1 Initial Setup

2.4.1.1 Serial Port Setup

1. If not already installed, download the FTDI driver for the custom USB-serial converter from:
<http://www.ftdichip.com/Products/Cables/USBTTLSerial.htm>



Figure 1 FTDI BSC Custom Cable (for reference only)

2. Connect the FTDI cable directly from the USB port of a PC to the serial port connector on the DUT (J8).

3. Determine the PC serial COM port number assigned to the serial port used for the Communicator and use Hyperterminal or TeraTerm to configure the serial port as follows:
 - Baud Rate: 115200
 - Data: 8 bit
 - Parity: none
 - Stop: 1 bit
 - Flow Control: HW

2.4.1.2 Linux Read/Write Environment

For the read/write Linux environment, perform the following actions to access the interface upon power up:

1. Log in when prompted using the following values:
 - a. Login: <*login name*> where *login name* is controlled for security reasons and must be obtained directly from the appropriate personnel.
 - b. Password: <*password*> where *password* is controlled for security reasons and must be obtained directly from the appropriate personnel.

This will bring up a read-write Linux shell.

2.4.2 DUT Pre-Configuration

Prior to performing a PG interrogation with the Communicator, several PG parameters must be stored in the Communicator configuration files. Perform the following steps prior to the initial PG interrogation. The information is stored in non-volatile memory, so once a PG's parameters are loaded, this procedure does not need to be repeated unless a new PG will be used.

1. Connect the Communicator per the test set up of Section 2.4.1.1.
2. Apply power to the Communicator and boot to a Linux Read/Write environment per Section 2.4.1.2.
3. Connect the USB memory stick (provided by BSC) to either of the communicator USB ports. In the terminal program log, USB enumeration messages will be output. If failure messages are output, repeat the power on sequence. Ignore warning messages concerning toolstick and rootfs versions out of sync.
4. Setup the communicator for the PG
 - a. At the Linux prompt (#) type “reconfig” <ENTER>. A configuration menu will be output. The settings for the S-ICD PG used for test need to be configured: Model ID and Serial ID.
 - b. At the “Enter Item Number” prompt, press 25 <ENTER>. Input the Device S/N provided by BSC.
 - c. At the “Enter Item Number” prompt, press 6 <ENTER>. Input the Device Model Number provided by BSC.
 - d. At the “Enter Item Number” prompt, press 0 <ENTER> then 1<ENTER> to exit and save changes.
5. Load the PG interrogation definition files
 - a. At the Linux prompt (#) type “cd /mnt/usb” <ENTER> to access the USB memory stick files.
 - b. Copy the BSC provided interrogation definition files using the Linux cp command format:
`cp sicd2-model-independent-interrogation.def /Applications/data/pgif/interrogations/`

Where sicd2-model-independent-interrogation.def is the BSC provided file name.

6. After the “reconfig” command is run and the interrogation files are loaded. Remove the USB memory stick.

2.4.3 Communicator - PG Telemetry Session Start

Use the following to start a Communicator – PG telemetry session. The test command used is the same command implemented by the device during normal operation.

1. Perform the interrogation command from the Linux command line using the following command:

```
#interrogatepg /Applications/data/pgif/interrogations/sicd2-model-independent-interrogation.def
```

Where the “.def” file is the same file loaded onto the Communicator in Section 2.4.2.

The LBT algorithm status can be monitored in the terminal window as part of the device logging information. Included in the log is the measured signal level for each of the available wake-up channels.

2.5 *Standard Test Conditions and Configurations*

2.5.1 Mains Voltage

The Jaguar MICS Communicator is powered by an AC/DC Power Adapter. Various models of this power adapter are required to support the AC mains plug configurations for the Jaguar MICS distribution plans. However, the power adapter models are equivalent with the only difference being the plug configuration. Therefore testing per this protocol will be performed at only one mains voltage combination (110 VAC/ 60 Hz) using the 350118-001 (or equivalent) power adapter.

2.5.2 Temperature and Humidity

All tests are performed at an ambient room temperature of typically $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ with uncontrolled humidity unless specified in the protocol sections below.

2.6 *MICS S-ICD Channelization*

The device has a programmable RF section to support telemetry with the implanted device in the worldwide MICS RF band. The BSC MICS band telemetry system for S-ICD consists of 2 channels Refer to Table 1 for a list of channels and frequencies used in the BSC MICS S-ICD telemetry system. For the testing in this EDVT protocol, a blocking band will be set up using RF test equipment to apply RF energy in the MICS band (402-405 MHz) except for Channel 10. The selection of the unblocked channel for testing is arbitrary. Using Channel 11 as the unblocked channel will provide similar results.

Table 1 BSC MICS Band S-ICD Channelization

Channel	Frequency (MHz)
10	403.5108
11	402.8183

2.7 PG Emissions Bandwidth

The maximum emissions bandwidth for the PG is listed in the NWEMC report BSTN0488.2 as 126 kHz.

2.8 Mode 6290 Emissions Bandwidth

The maximum emissions bandwidth for the Model 6290 is listed in the NWEMC report BSTN0527.3 as a180 kHz.

3 SUMMARY

3.1 *Devices Under Test*

A summary of the DUT serial numbers and configurations used for testing is shown in Table 2.

Table 2 Configuration of Devices used for Testing

Assembly Number	Serial Number (S/N)	Software Version
400374-010	0000600	CommSW_Jaguar_Engineering-JAG2_2015.01.18_rc3

3.2 Results Summary

A summary of the tests to be completed is shown in Table 3.

Table 3 Test Summary

Protocol/ Report Section	Description	Protocol/Report Specification, Method, and Acceptance Criteria	Pass / Fail
4.1	LBT Threshold Power Level	FCC CFR Title 47 Part 95.627(a)(3) ETSI EN 301 839-1 V1.3.1 Clause 10.1 ETSI EN 301 839-2 V1.3.1 Clause 4.2.8.1 RSS-243 Clause 3.6 RSS-243 Clause 5.7.1 MIC 040527 Article 49.14.2d(1)	PASS
4.2	Monitoring System Bandwidth	FCC CFR Title 47 Part 95.627(a)(1) ETSI EN 301 839-1 V1.3.1 Clause 10.2 ETSI EN 301 839-2 V1.3.1 Clause 4.2.8.1 RSS-243 Clause 3.6 RSS-243 Clause 5.7.2 MIC 040527 Article 49.14.2d(2)	PASS
4.3	Monitoring System Scan Cycle Time	FCC CFR Title 47 Part 95.627(a)(2) ETSI EN 301 839-1 V1.3.1 Clause 10.3 ETSI EN 301 839-2 V1.3.1 Clause 4.2.8.1 RSS-243 Clause 3.6 RSS-243 Clause 5.7.3 MIC 040527 Article 49.14.2d(3)	PASS
4.4	Monitoring System minimum channel monitoring period	FCC CFR Title 47 Part 95.627(a)(2) ETSI EN 301 839-1 V1.3.1 Clause 10.3 ETSI EN 301 839-2 V1.3.1 Clause 4.2.8.1 RSS-243 Clause 3.6 RSS-243 Clause 5.7.4 MIC 040527 Article 49.14.2d(3)	PASS
4.5	Channel access based on Least Interfered Channel	FCC CFR Title 47 Part 95.627(a)(4) ETSI EN 301 839-1 V1.3.1 Clause 10.4 ETSI EN 301 839-2 V1.3.1 Clause 4.2.8.1 RSS-243 Clause 3.6 RSS-243 Clause 5.7.5 MIC 040527 Article 49.14.2d(1)	PASS
4.6	Discontinuation of MICS session	FCC CFR Title 47 Part 95.627(a)(4) ETSI EN 301 839-1 V1.3.1 Clause 10.5 ETSI EN 301 839-2 V1.3.1 Clause 4.2.8.1 RSS-243 Clause 3.6 RSS-243 Clause 5.7.6 MIC 040527 Article 49.14.2e	PASS
4.7	Use of pre-scanned alternative channel	FCC CFR Title 47 Part 95.627(a)(5) ETSI EN 301 839-1 V1.3.1 Clause 10.6 ETSI EN 301 839-2 V1.3.1 Clause 4.2.8.1 RSS-243 Clause 3.6 RSS-243 Clause 5.7.7 MIC 040527 Article 49.14.2d(4)	N/A The Model 6290 does not utilize the pre-scanned alternative channel option.

4 TESTS PERFORMED

The following sections describe the MICS LBT Compliance testing to be performed on the Jaguar MICS Communicator S-ICD implementation.

4.1 *LBT Threshold Power Level*

OBJECTIVE:

This test shows the system has sufficient sensitivity to recognize and accurately compare the ambient signals to the calculated threshold power level.

This test will be executed at BSC.

METHOD:

1. Configure the test setup as defined in Section 7.
2. Setup the blocking band signal generator to output the signal defined in Section 8.1. Adjust the blocking band power level to 3 dB above the calculated threshold power level.
3. Setup the on channel signal generator for continuous wave output, 6 dB below the calculated threshold power level, at the center frequency of the open channel in the blocking band. The signal waveform for the blocking band and on channel interferer is defined in Section 8.2.
4. Configure the device for testing per Section 2.4.1.1 and Section 2.4.1.2.
5. Start an RF telemetry session per Section 2.4.3. Verify that the session starts on the blocking band open channel (Channel 10).
6. Wait for the telemetry session to end.
7. Increase the on channel interferer signal level 1 dB from the following test and repeat Steps 5 and 6.
8. Repeat Step 7 until the session starts on Channel 11. Record the on channel signal generator level.
9. Subtract 4 dB from the on channel signal level recorded in Step 8 to calculate the measured threshold power level.

ACCEPTANCE CRITERIA:

As specified in SyRS017851, the calculated monitoring threshold power level shall be no greater than:

$$10 * \log B \text{ (Hz)} - 150 + G \text{ (dBi)}$$

Where B is the emission bandwidth of the widest MICS communication session transmitter (in this case the PG), and G is the monitoring system antenna gain.

As defined in Section 2.7 and Section 2.8, S-ICD system widest emission bandwidth is 180 kHz (See 2.8 Model 6290 Emissions Bandwidth). The minimum antenna gain is -0.45 dBi. The minimum communicator antenna gain is used for the threshold power level calculation because it will result in the minimum calculated value.

The calculated threshold power level is -98 dBm.

The requirement is met if the measured threshold power level is less than or equal to the calculated threshold power level.

RESULTS: **PASS**

Blocking band signal level = -95 dBm (3 dB above the calculated threshold)

Blocking Band Power (dBm)	CH10 Interferer Power (dBm)	LBT Result
-95	Off	Channel 10
-95	-104 through -97	Channel 10
-95	-96	Channel 11

Table 4 LBT Threshold Power Results

Measured Threshold Power Level	-100 dBm
--------------------------------	----------

4.2 Monitoring System Bandwidth

OBJECTIVE:

The intent of this requirement is to ensure that the DUT measures the power in a bandwidth that is equal to or greater than the emission bandwidth of the transmitter with the widest emission that it will participate with in a MICS communications session.

For the BSC telemetry system, the widest bandwidth emitter is the Communicator (bandwidth as defined in Section 2.8). For the purpose of this EDVT, the monitoring system bandwidth will be tested based on a 180 kHz transmit bandwidth from the channel center frequency as defined in Table 1. This test condition is greater than or equal to the widest emission bandwidth.

This test will be executed at BSC.

METHOD:

1. Configure the test setup as defined in Section 7.
2. Setup the blocking band signal generator to output the signal defined in Section 8.1. Adjust the blocking band power level to 3 dB above the calculated threshold power level.
3. Setup the on channel signal generator for continuous wave output, 6 dB above the calculated threshold power level, at the center frequency of the open channel in the blocking band. The signal waveform for the blocking band and on channel interferer is defined in Section 8.2.
4. Configure the device for testing per Section 2.4.1.1 and Section 2.4.1.2.
5. Start an RF telemetry session per Section 2.4.3.
6. Verify that the device starts a telemetry session on Channel 11.
7. Decrease the on channel interferer signal level 1 dB from the following test and repeat Steps 5 and 6.
8. Repeat Step 7 until the session is started on Channel 10. Record the on channel signal generator level as P_a . Wait for the telemetry session to end

9. Set the on channel signal generator frequency bandwidth/2 kHz lower than the value set in Step 3 to simulate the TX emissions bandwidth low frequency (Refer to Section 2.8).
10. Start an RF telemetry session per Section 2.4.3. Verify that the session starts on the blocking band open channel (Channel 10).
11. Wait for the telemetry session to end.
12. Increase the on channel interferer signal level 1 dB from the following test and repeat Steps 10 and 11.
13. Repeat Step 12 until the device starts a telemetry session on Channel 11. Record the on channel signal generator level as P_b .
14. Set the on channel signal generator frequency bandwidth/2 kHz higher than the value set in Step 3 to simulate the PG TX emissions bandwidth high frequency (Refer to Section 2.8) with signal level of P_a .
15. Start an RF telemetry session per Section 2.4.3. Verify that the session starts on the blocking band open channel (Channel 10).
16. Wait for the telemetry session to end.
17. Increase the on channel interferer signal level 1 dB from the following test and repeat Steps 15 and 16.
18. Repeat Step 17 until the device starts a telemetry session on Channel 11. Record the on channel signal generator level as P_c .
19. Subtract P_a from P_b and record the difference as D1.
20. Subtract P_a from P_c and record the difference as D2

EXPECTED RESULTS:

The monitoring system bandwidth measured at its 20 dB down points shall be equal to or greater than the widest emission bandwidth of the intended transmission.

This requirement is met if the calculated values D1 and D2 are less than or equal to 20 dB.

RESULTS: **PASS**

Maximum Emissions Bandwidth = 180 kHz

F_{low} = 403.4208 MHz

F_{high} = 403.6008MHz

CH 10 Interferer Frequency = 403.5108 MHz

Blocking Band Power (dBm)	CH10 Interferer Power (dBm)	LBT Result
-95	-92 through -96	CH 11
-95	-97	CH 10

F_{low} Test: CH 10 Interferer Frequency = 403.4208 MHz

Blocking Band Power (dBm)	CH10 Interferer Power (dBm)	LBT Result
-95	-97 through -95	CH 10
-95	-94	CH 11

F_{high} Test: CH 10 Interferer Frequency = 403.6008 MHz

Blocking Band Power (dBm)	CH10 Interferer Power (dBm)	LBT Result
-95	-97 through -96	CH 10
-95	-95	CH 11

Table 5 Monitoring System Bandwidth Results

Low Frequency Power Delta (D1)	3 dB
High Frequency Power Delta (D2)	2 dB

4.3 Monitoring System Scan Cycle Time

OBJECTIVE:

The intent of this requirement is to ensure that when the monitoring system updates the detected power levels, it scans the band within 5 seconds.

This test will be executed at BSC.

METHOD:

1. Configure the test setup as defined in Section 7.
2. Setup the blocking band signal generator to output the signal defined in Section 8.1. Adjust the blocking band power level to 3 dB above the calculated threshold power level.
3. Setup the on channel signal generator for continuous wave output, 6 dB above the calculated threshold power level, at the center frequency of the open channel in the blocking band. The signal waveform for the blocking band and on channel interferer is defined in Section 8.2.
4. Configure the device for testing per Section 2.4.1.1 and Section 2.4.1.2.
5. Start an RF telemetry session per Section 2.4.3.
6. Verify that the device starts and completes a telemetry session on Channel 11.
7. Set the spectrum analyzer as follows
 - a. Span: zero span
 - b. Frequency: Channel 10 frequency (403.51 MHz)
 - c. Sweep time: 10 seconds
 - d. Sweep: Single

8. Trigger a spectrum analyzer sweep. When the sweep has hit ~ 5seconds, remove the on channel generator signal (RF off) and start an RF telemetry session per Section 2.4.3.
9. Verify that the session starts on Channel 10 and measure the time from when the session was requested and the DUT TX starts.
10. Repeat Steps 8 and 9 four additional times (for a total of five) to show repeatability.

EXPECTED RESULTS:

Within 5 seconds prior to initiating a communications session, the device shall monitor all of the channels in the 402 MHz to 405 MHz band.

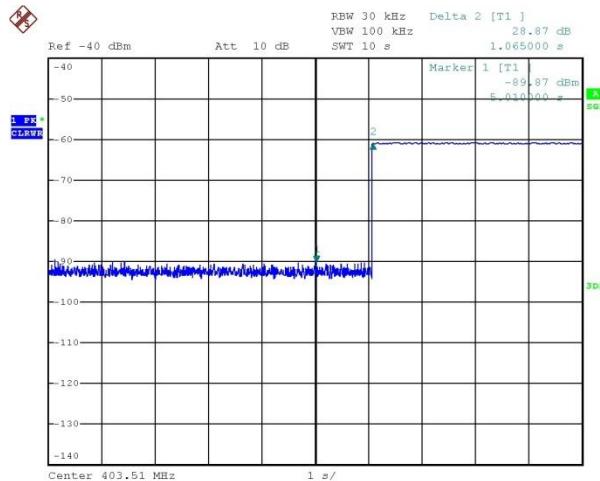
This requirement is met if each of the measured delay times is less than 5 seconds.

RESULTS: **PASS**

Table 6 Monitoring Scan Cycle Time Results

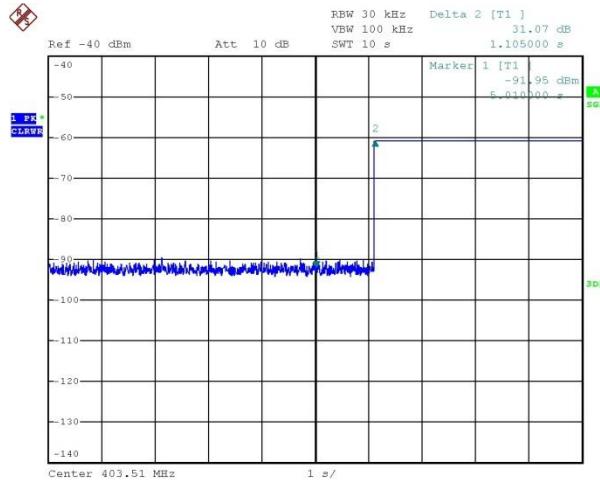
Scan Cycle time run 1 (s)	1.065
Scan Cycle time run 2 (s)	1.105
Scan Cycle time run 3 (s)	1.105
Scan Cycle time run 4 (s)	0.985
Scan Cycle time run 5 (s)	1.085

Run 1:



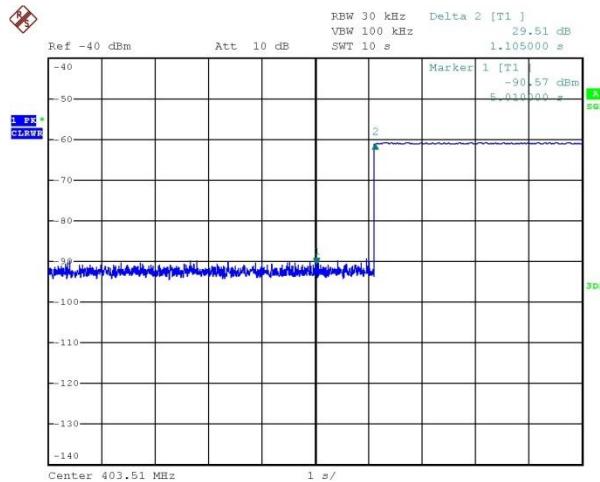
Date: 19.JAN.2015 15:24:11

Run 2:



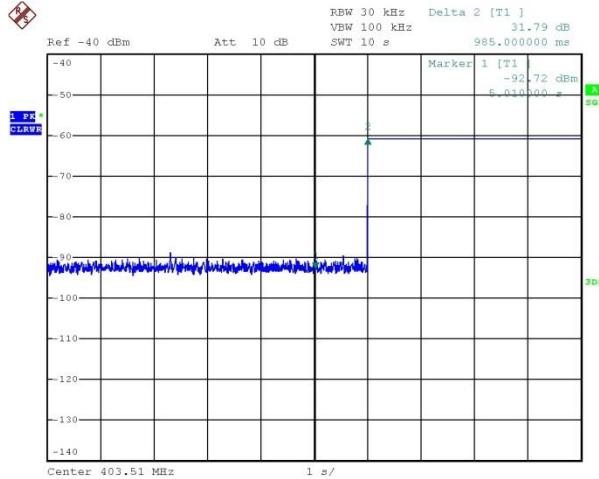
Date: 19.JAN.2015 15:26:24

Run 3:



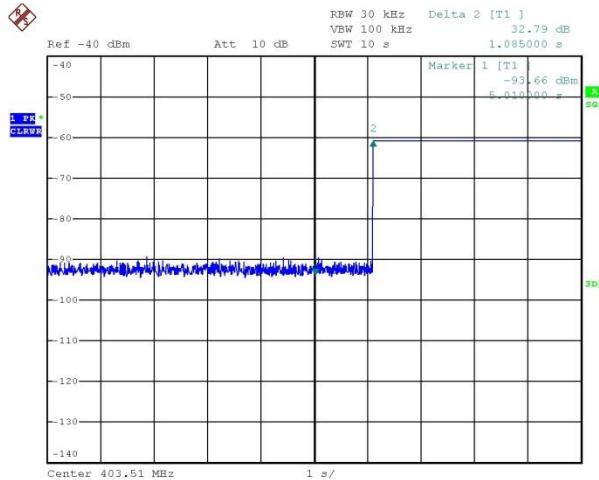
Date: 19.JAN.2015 15:27:19

Run 4:



Date: 19.JAN.2015 15:29:16

Run 5:



Date: 19.JAN.2015 15:30:42

4.4 Monitoring System Minimum Channel Monitoring Period

OBJECTIVE:

The intent of this requirement is to ensure that when the monitoring system updates the detected power levels that the monitoring period on each channel is 10 ms or longer in order to detect transmissions that may have silent periods that are less than 10 ms in duration.

This test will be executed at BSC.

METHOD:

1. Configure the test setup as defined in Section 7.
2. Setup the blocking band signal generator to output the signal defined in Section 8.1. Adjust the blocking band power level to 3 dB above the calculated threshold power level.
3. Configure the device for testing per Section 2.4.1.1 and Section 2.4.1.2.
4. Start an RF telemetry session per Section 2.4.3. Verify that the session starts on the blocking band open channel (Channel 10).
5. Wait for the telemetry session to end.
6. Setup the on channel signal generator for continuous wave output, 3 dB above the calculated threshold power level, at the center frequency of the open channel in the blocking band. The signal waveform for the blocking band and on channel interferer is defined in Section 8.2.
7. Remove the blocking band generator signal (RF off).
8. Start an RF telemetry session per Section 2.4.3. Verify that the session starts on Channel 11.
9. Wait for the telemetry session to end.
10. Turn the blocking band generator signal on (RF on) at a power level 6 dB above the calculated threshold power level. The on channel signal generator should still be on, with signal level 3 dB above the calculated threshold power level.
11. Start an RF telemetry session per Section 2.4.3.
12. Verify that the session starts on the blocking band open channel (Channel 10).
13. Repeat steps 11 and 12 four additional times (for a total of five).
14. Modulate the blocking band generator output so that it is on for 0.1 ms during a 10 ms period as defined in Section 8.4.
15. Start an RF telemetry session per Section 2.4.3.
16. Verify that the session starts on the blocking band open channel (Channel 10).
17. Repeat steps 15 and 16 nine additional times (for a total of ten).

EXPECTED RESULTS:

Each MICS channel shall be monitored for a minimum of 10 ms during each scan cycle of 5 seconds or less duration.

This requirement is met if the device does starts a telemetry session on Channel 10 (Steps 15-17).

RESULTS: PASS

Step 4 (Blocking Band 3 dB above threshold, on channel interferer OFF): CH 10 selected.

Step 8 (Blocking Band OFF, on channel interferer 3 dB above threshold): CH 11 selected.

Step 12/13 (Blocking Band 6 dB above threshold, on channel interferer 3 dB above threshold): CH 10 selected.

Step 16/17 (Blocking Band 6 dB above threshold modulated per Step 14, on channel interferer 3 dB above threshold): CH 10 selected.

4.5 *Channel access based on Least Interfered Channel*

OBJECTIVE:

MICS programmer/control transmitters are permitted to initiate a MICS communications session immediately on any channel where the ambient signal level is below the maximum permitted LBT threshold power level, P_{Th} . If no channel is available with an ambient power level at or below the maximum permitted P_{Th} , spectrum access is permitted based on the channel with the lowest ambient power level referred to as the LIC or "least interfered channel".

This test will be executed at BSC.

METHOD:

1. Configure the test setup as defined in Section 7.
2. Setup the blocking band signal generator to output the signal defined in Section 8.3. Adjust the blocking band power level to 10 dB above the calculated threshold power level and the LIC (Channel 11) to 3 dB above the calculated threshold power level.
3. Configure the device for testing per Section 2.4.1.1 and Section 2.4.1.2.
4. Start an RF telemetry session per Section 2.4.3. Verify that the session starts on the blocking band open channel (Channel 10)
5. Wait for the telemetry session to end.
6. Setup the on channel signal generator for continuous wave output, 3 dB below the calculated threshold power level, at the center frequency of the open channel in the blocking band. The signal waveform for the blocking band and on channel interferer is defined in Section 8.2.
7. Start an RF telemetry session per Section 2.4.3. Verify that the session starts on the blocking band open channel (Channel 10).
8. Wait for the telemetry session to end.
9. Increase the on channel interferer signal level 9 dB from the following test (6 dB above the calculated threshold power level).
10. Start an RF telemetry session per Section 2.4.3. Verify that the session starts on the LIC (Channel 11).

EXPECTED RESULTS:

The DUT shall access and transmit on the Least Interfered Channel (LIC) when no channel is available with an ambient power level at or below the maximum permitted P_{Th} .

This requirement is met if the DUT selects the LIC (Channel 11) in Step 10.

RESULTS: **PASS**

With the blocking band configured per the test method, the DUT selected Channel 11 when it was configured as the LIC (Step 10).

4.6 *Discontinuation of MICS Session*

OBJECTIVE:

MICS systems shall cease transmission in the event the communications session is interrupted for a period of 5 seconds or more. Once a MICS session is established, it may continue as long as the silent period in two-way communication between co-operating devices does not exceed 5 seconds.

This test will be executed at BSC.

METHOD:

1. Configure the test setup as defined in Section 7.
2. Setup the blocking band signal generator to output the signal defined in Section 8.1. Adjust the blocking band power level to 10 dB above the calculated threshold power level.
3. Setup the on channel signal generator for continuous wave output, 3 dB below the calculated threshold power level, at the center frequency of the open channel in the blocking band. The signal waveform for the blocking band and on channel interferer is defined in Section 8.2.
4. Configure the device for testing per Section 2.4.1.1 and Section 2.4.1.2.
5. Start an RF telemetry session per Section 2.4.3. Verify that the session starts on the blocking band open channel (Channel 10).
6. Set the spectrum analyzer as follows
 - a. Span: zero span
 - b. Frequency: Channel 10 frequency (403.51 MHz)
 - c. Sweep time: 10 seconds
 - d. Sweep: Single
7. Trigger a spectrum analyzer sweep. Adjust the attenuation in the telemetry link in order to stop communications.
8. Record the session stop time on Channel 10. The session stop time is defined as the time period from when link is broken due to increased attenuation to when the device TX stops.
9. Reduce the link attenuation to the previous value.
10. Verify that the session starts on the blocking band open channel (Channel 10).

EXPECTED RESULTS:

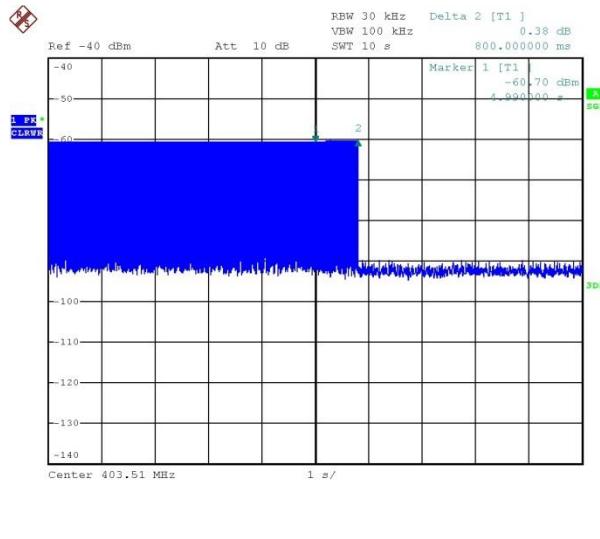
Emission from the programmer/control transmitter shall cease in an amount of time less than or equal to 5 seconds after the implanted device telemetry becomes inactive.

This requirement is met if the session stop time is less than 5 seconds after attenuation is added and if the session restarts on Channel 10 after the attenuation is removed.

RESULTS: **PASS**

Table 7 Discontinuation of MICS Session Results

Session Stop Time (s)	0.800
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The session restarted on Channel 10 after the attenuation was removed.

4.7 Use of Pre-scanned Alternative Channel

OBJECTIVE:

At the time a channel for operation is initially selected and accessed, it is permissible for the monitoring system to select one additional channel for alternate operation for use if the initially selected channel becomes unavailable due to blockage of the channel from unknown disturbing ambient signals.

The feature is not implemented for this device. Since the RF telemetry system only has two possible channels, the pre-scanned alternate channel test is not applicable. Testing is not required.

RESULTS: N/A

5 CONCLUSION

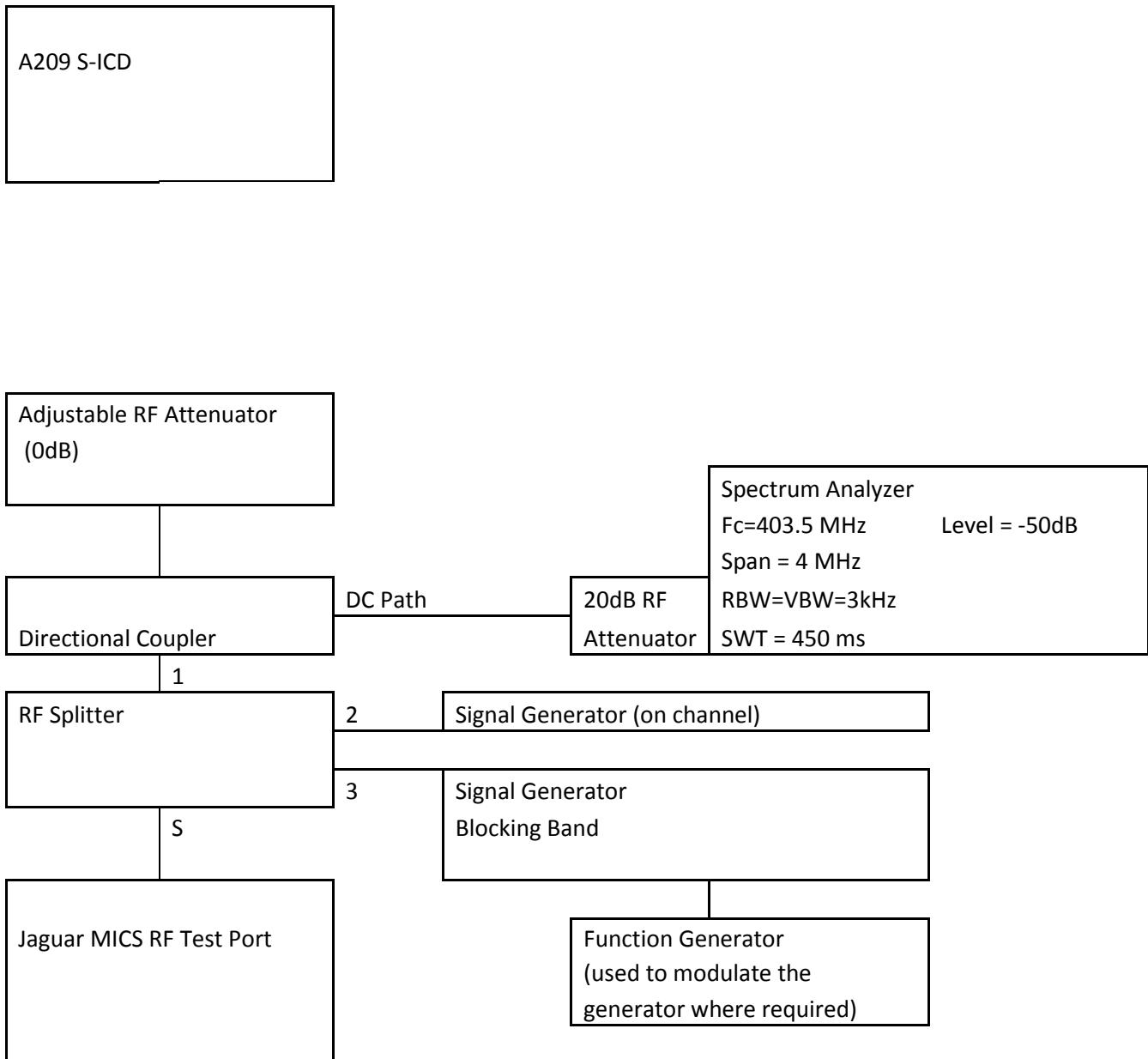
The Jaguar MICS Communicator **PASSED** all of the testing covered in this protocol/report. The Model 6290 updates to support S-ICD devices meet the LBT requirements for the 402-405 MHz band.

6 APPENDIX A - MICS LBT COMPLIANCE TEST EQUIPMENT

Description	Quantity	Manufacturer	Model	ESN/SN	Cal Date	Cal Due	Notes
Jaguar MICS Communicator (Model 6290)	1	BSC	400374-010	0000600	N/A	N/A	FW version: CommSW_Jaguar_Engineering-JAG2_2015.01.18_rc3
AC/DC Power Adapter (5V/3A)	1	GlobTek	GTM41061-1512-7.0	N/A	N/A	N/A	
A209 S-ICD	1	BSC	A209	100619	N/A	N/A	FW version: 3.0.479
Blocking Band Sig Gen	1	Rohde & Schwarz	SMBV100A	25026579	24-Oct-14	24-Oct-15	
Channel Blocker Sig Gen	1	Agilent	E4438C	10060926	12-Feb-14	12-Feb-15	
Spectrum Analyzer	1	Rohde & Schwarz	FSP	10074269	16-Jul-14	16-Jul-15	
Function Generator	1	Stanford Research Systems	DS345	0420-271	N/A	N/A	Output calibrated during test
Variable Attenuator	1	JFW Industries	50BR-008	441882 0640	N/A	N/A	
Fixed Attenuator (20 dB)	2	Mini-Circuits	VAT-20+	N/A	N/A	N/A	
RF Power Splitter (3 to 1)	1	Mini-Circuits	ZA3PD-1-S	040400640	N/A	N/A	
Directional Coupler	1	Pasternack	PE 2213-10	N/A	N/A	N/A	
Coax Cables	As Required	N/A	N/A	N/A	N/A	N/A	

7 APPENDIX B - MICS LBT COMPLIANCE TEST SETUP

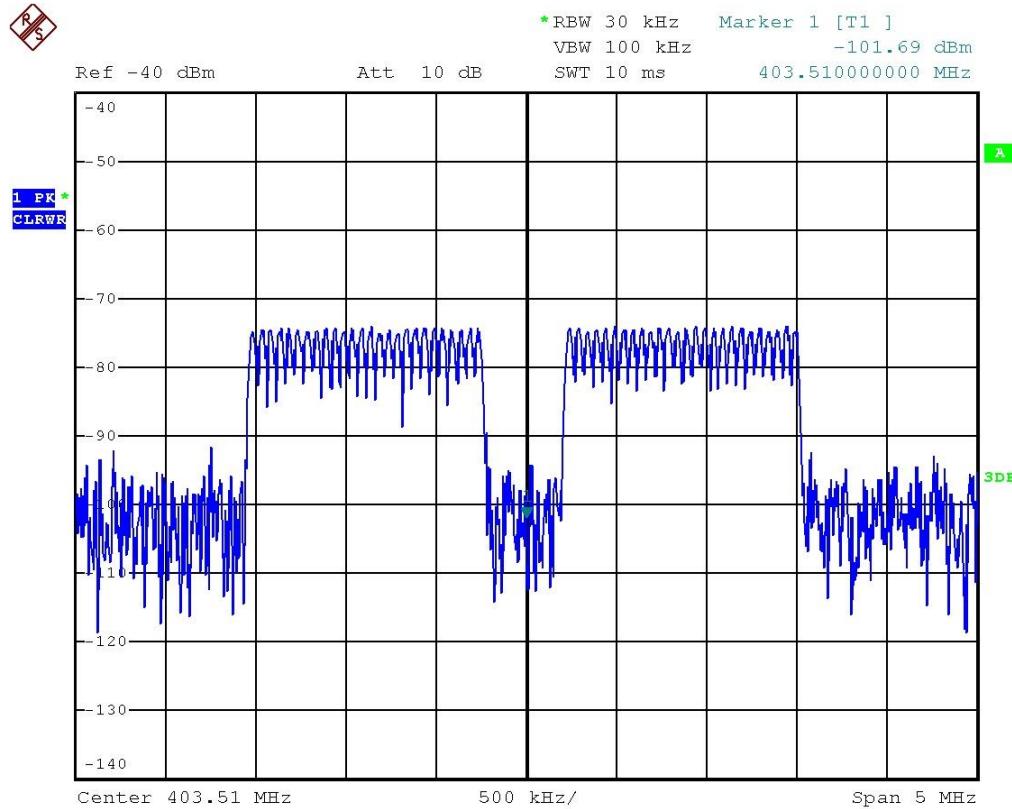
The following defines the test setup used in this protocol/report. The connection from the test setup RF output to the A209 S-ICD can be either wireless (using a lab antenna connected to the Adjustable RF Attenuator) or conducted (using a coax cable) depending on the A209 test article type (PG or System Board).



8 APPENDIX C - MICS LBT COMPLIANCE BLOCKING SIGNALS

8.1 Blocking band

The signal shown in Figure 2 was used as the blocking band for LBT testing. The notch is centered at 403.5108 MHz (Channel 10). The figure is for reference only. Actual signal levels and channels are set by the test method.

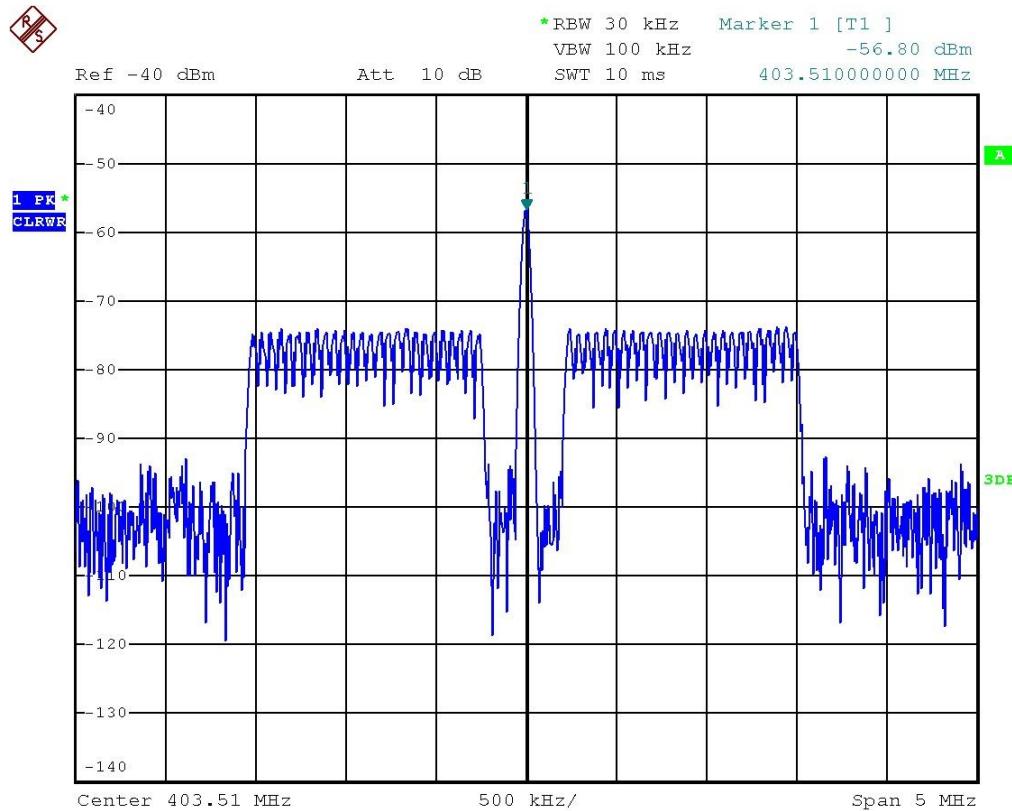


Date: 20.JAN.2015 09:11:21

Figure 2 LBT Blocking Band Signal

8.2 Blocking band with on-channel interferer

The signal shown in Figure 3 was used as the blocking band and on-channel interferer for LBT testing. The on-channel interferer is centered at 403.5108 MHz (Channel 10). The figure is for reference only. Actual signal levels and channels are set by the test method.

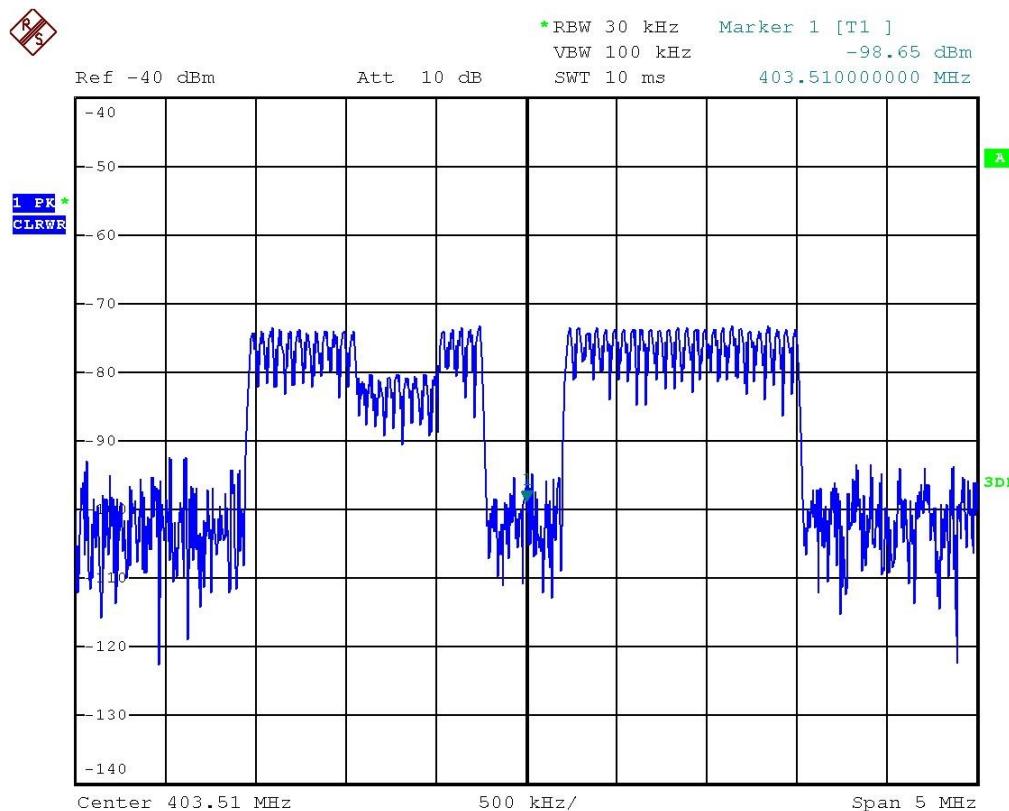


Date: 20.JAN.2015 09:10:50

Figure 3 LBT Blocking Band with On-channel Interferer Signal

8.3 Blocking band with Least Interfered Channel

The signal shown in Figure 4 was used as the blocking band with Least Interfered Channel (LIC) for LBT testing. The notch is centered at 403.5108 MHz (Channel 10). The LIC is centered at 402.818308 MHz (Channel 11) and has lower amplitude than the remainder of the blocking band. The figure is for reference only. Actual signal levels and channels are set by the test method.



Date: 20.JAN.2015 09:13:13

Figure 4 LBT Blocking Band with Least Interfered Channel Signal

8.4 Modulated Blocking Band for the Channel Monitoring Period Test

The signal shown in Figure 5 is the modulated blocking band waveform used for the Channel Monitoring Period test. The figure is a spectrum analyzer zero span measurement for a 10 ms period. The blocking signal is on for 100 us during the 10 ms shown.

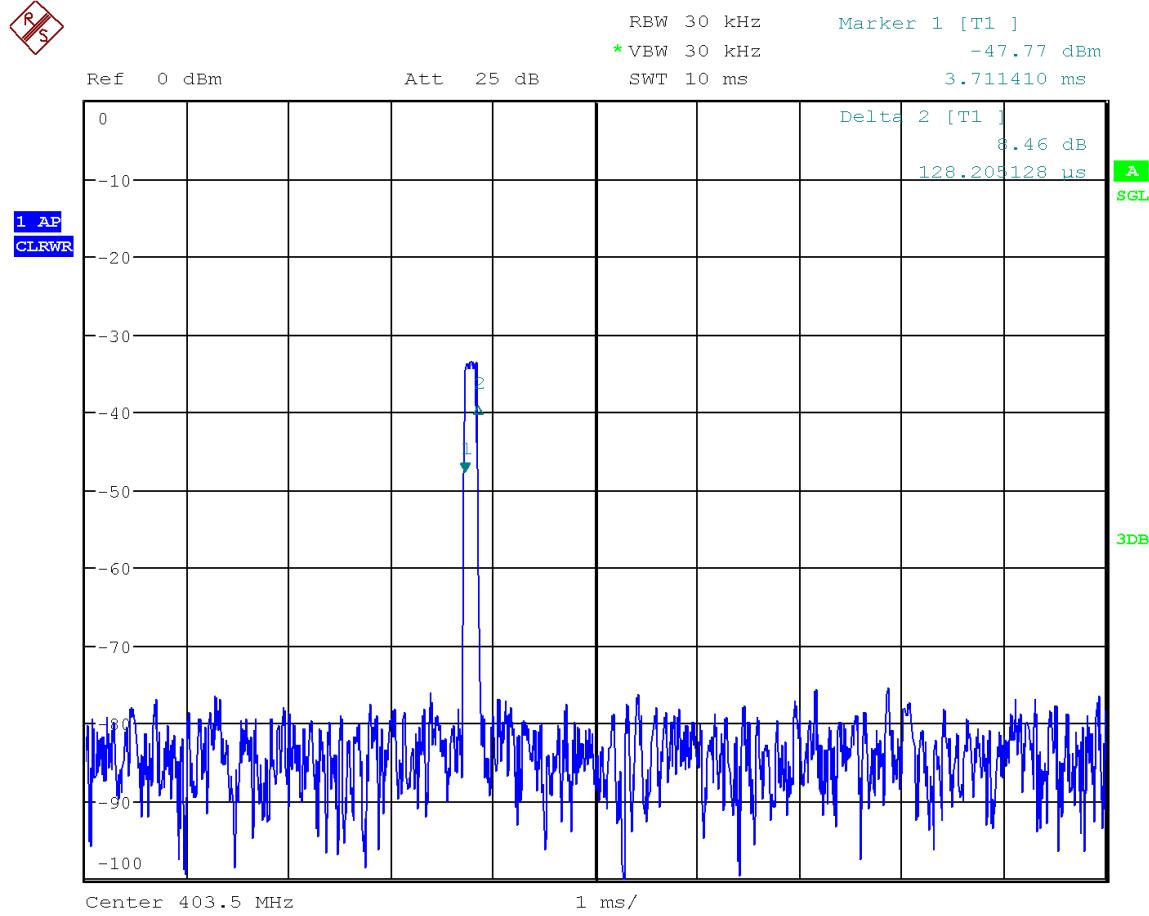


Figure 5 Modulated Blocking Band for the Channel Monitoring Period Test

9 APPENDIX E – TEST PHOTOS

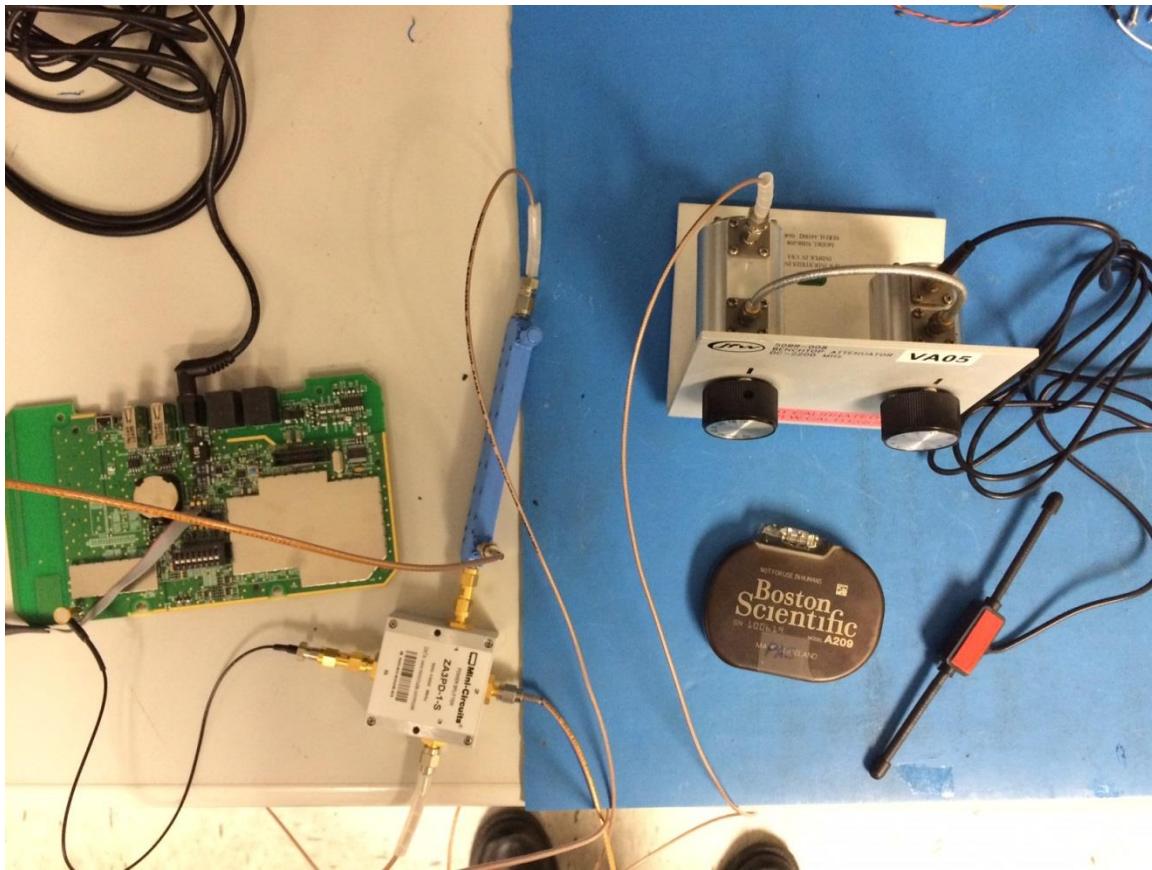


Figure 6 Model 6290 LBT Test Setup