Release Notes

ART2 Version 2.27.3

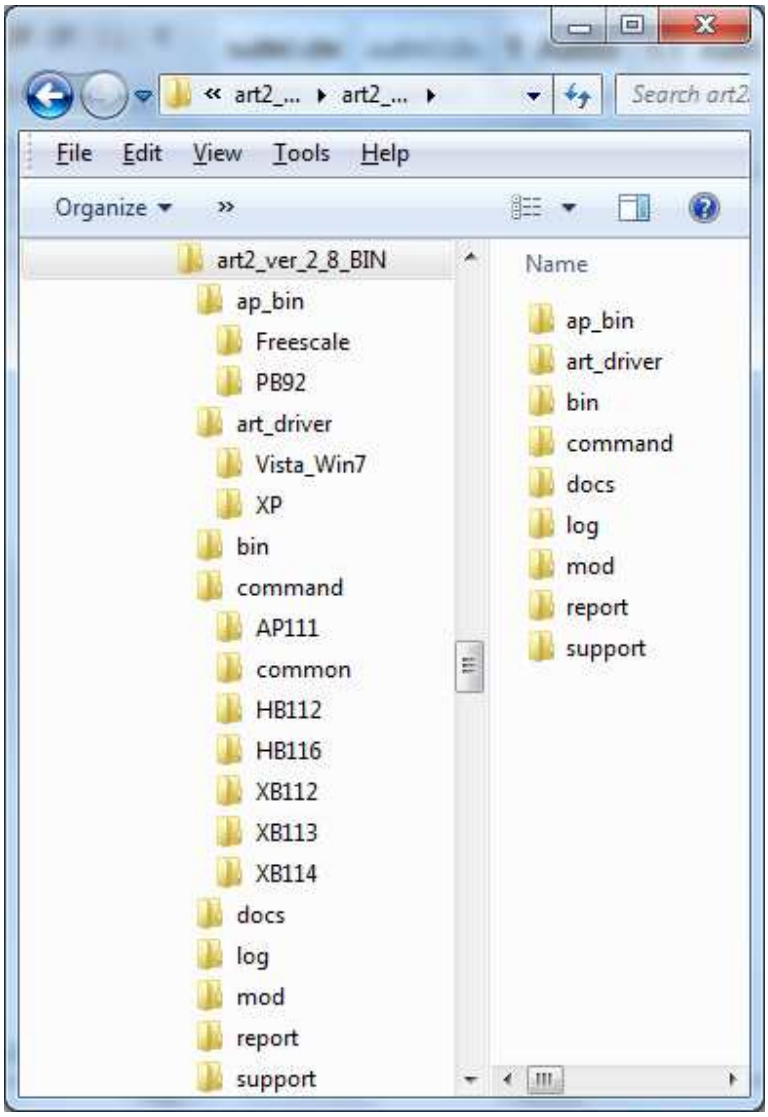
March 15, 2012

1 Purpose

ART2 is the next generation version of Atheros Radio Test (ART). ART2 supports all the same capabilities of ART with regards to the ability to test and calibrate Atheros radio cards, but in addition provides more flexibility and options for how these tests can be run. For example tests can be created that run receive sensitivity sweeps on the radio or comprehensive transmit power accuracy tests can be performed in an automatic flow. While ART2 provides more testing capabilities and flexibility than ART, it does make it more complicated and as a result may require a longer time to learn how to use all its features. In order to accommodate a broad spectrum of users, ie from those who need to run a limited number of features quickly, to users who want to customize a manufacturing, ART2 has both a command line interface and a Graphical User Interface (GUI). ART2 is still under development and as a result the GUI supports a subset of the features that are available via the command line. Further improvements to both the command line interface and the GUI will be added through time. Currently the documentation for ART2 is under development and will be following in subsequent releases. In the meantime these release notes provide a brief overview to getting started with ART2.

2 Brief Description of ART2 Software package

ART2 runs on the same 3 chain calibration setups as ART, consisting of DUT, Golden Radio, power meter, spectrum analyzer and 3 chain variable attenuators. It can also be used with one box testers, once the appropriate software has been obtained from the manufacturer of the one box tester. The following is structure of the ART2 package.

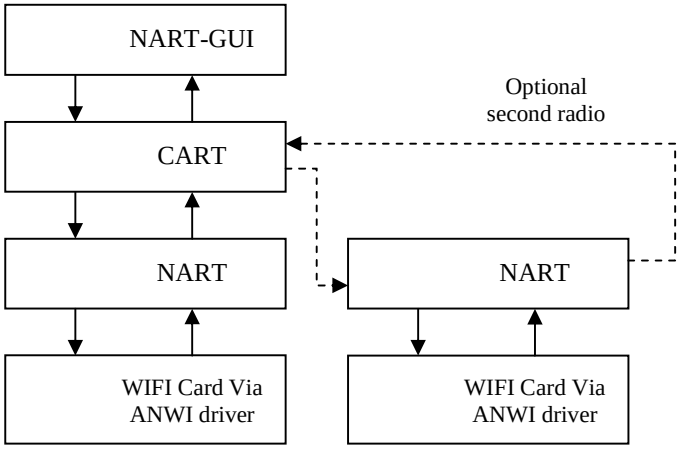


1. The “ap_bin” directory contains the components that should be run when the radio being tested is an Access Point.
2. The “art_driver” contains the Windows driver files needed when the radio being tested is a station card within a PC.
3. The “bin” directory contains the ART executables and is the directory where art2 software should be run from.
4. The “command” directory contains test flow files and reference design specific files needed for testing Atheros Radios.
5. The “docs” directory contains this release note as well as the eeprom support documents.
6. The “log” and “report” directories are empty directories that will be used to store log and report files generated from ART2.

7. The “mod” directory is an additional download which is only needed if running calibration with Litepoint one box tester.

8. The “support” directory contains the Microsoft Framework .NET Version 2 needed for the ART2 GUI. Some systems have this installed already and are not needed. If executing the artgui.bat and an error message pops up, then this framework needs to be installed into your system before running ART2 GUI.

- As shown below, the ART2 software consists of several components:



9. CART contains the control software which runs all the test loops and controls the test instrumentation. It also sends radio specific information over a TCP/IP socket to NART.

10. NART contains the hardware specific code needed to control the Atheros radio.

11. The GUI is runs on top of NART and CART and provides a graphical, easier to use interface to CART.

12. The ANWI driver is the same driver as was used by ART when the radio under test is a station card inserted into a PC.

13. If the radio under test is an AP then NART and the Linux version of the anwi driver (called art.ko) runs on the AP. In this scenario CART and the GUI will run on a host PC.

3 Installing and Running ART2 for a Station Card

1. Install the anwi driver, by running the OS specific version of the inst_new_drv_xxx.bat

2. Insert the Atheros reference design into the host PC and allow the OS to install the card automatically

3.1 To run using the ART2 GUI:

Refer to the GUI Guide in the “doc” directory. “Currently being Updated”

3.2 To run the command line version of ART2

1. In one command window, run
   nart.exe

2. In a second command window run
   cart.exe –local localhost

3. Use the ‘help’ command for a list of available commands and use ‘help <command name>’ for command specific help.

4 Installing and Running ART2 for an Access point

1. Place art2_ver_2_18\art_driver\Linux\art.ko and art2_ver_2_18\ap_bin\nart.out on your tftp server

2. Log into the Atheros based AP and set the Ethernet IP address with the command:
   ifconfig br0 <ip_addrs>

3. Change to the tmp directory with the command:
   cd /tmp

4. tftp art.ko to the /tmp dir with the command:
   tftp -r art.ko -g <tftp_server_ip_address>

5. start the driver with the command:
   insmod art.ko

6. tftp the nart.out file with the command:
   tftp -r nart.out -g <server_ip>

7. Change the mode of the file to be executable:
   chmod +x nart.out

8. Create a device handler for the radio
   mknod /dev/dk0 c 63 0

9. For a 2 radio solution, also create a handler for the second radio
   mknod /dev/dk1 c 63 1

10. Start nart.out
    ./nart.out

11. For a 2 radio solution, also start nart for the second radio
    ./nart.out –instance 1

12. On the host PC, run cart with the command
    cart –local <ip_address> of AP assigned in step 2

13. If running a 2 radio based AP, start cart with the command:
    cart
    Then run:
    db120\connectradios.art
    See section 8 for more information.

5 Installing and Running ART2 for a Link Test with 2 Radio Cards

In this setup a single cart communicates with nart running on the local machine and a nart running on the remote machine. Both machines should be connected via a tapir Ethernet network connection.

1. Start nart.exe in one command window on the local PC
2. Start nart.exe on one command window of the remote PC (alternatively this could be an AP running nart)
3. On the local PC, in a second command window, start
   cart –local localhost –remote<ip address of second PC or AP>
4. Use the link command for link based tests

6 Running Sample Manufacturing Flow

A sample test flow has been created which can perform calibration and testing of AR93xx based radios. Available tests include calibration, target power testing, spectral mask, channel accuracy, sensitivity sweeping, and throughput testing. Most tests are on by default and, will require a dut and a golden radio as well as the standard ART based calibration setup. Tests can be turned on and off by the flags in art2_ver_2_8\command\ test_flow_flags.art. To run the test flow:

1. start nart and cart as for “ART2 for a Link Test with 2 Radio Cards” as described above
2. In the cart window, run the command
   test_flow
3. At the “Please supply a value for BoardIDType:” prompt, enter 0 to indentify the card via subsystemID or enter 1 to enter it by refID.
4. Currently since 2 designs are using the same subsystemID, select 1 to enter via refID. Note that cus152 will not be a supported reference design after the ar93xx revision 2.2 is released.
5. Enter the refID at the next prompt – for example ‘xb112’
6. Enter mac address when prompted at the next prompt – for example 11:22:33:44:55:66

7 Using ART2 with One-box Testers

One Box testers are supported with ART2 in one of 2 ways:

1. With a CART based dll that allows CART to control the one box tester and the DUT. The testers currently supported in this mode include:
   a. Litepoint’s IQ2010, IQView and IQFlex
      For installation instructions refer to the instructions provided with the release at:
      support\litepoint\cartWithLitepoint.txt
2. Software released from the One Box Tester vendors will control the tester and connect directly to NART to control the DUT. The testers currently supported in this way includes, but is not limited to:

a. Agilent's N4010/11A using the N7311A-2 software
b. Litepoint's IQ2010, IQView and IQFlex

Please contact the One Box Tester vendors, directly for the software required to run in the mode.

8 Sample Manufacturing Flow for 2 Radio Based DUTs

Launch either cart or artgui on your host machine:

To use cart:

1. Launch a dos prompt window, and `cd` to your `art2_ver_x_y\bin` folder. From here you can `enter .\cart -start my-start.art`, where `my-start.art` is your customized start script.
2. You will need to modify the `db120\connectradios.art` script to use the correct IP addresses for your DUT and golden system. Note that the connect command for the second radio on the DUT will use the same address as the first radio, but with :2391 appended, e.g. 192.168.1.2 for the first radio and 192.168.1.2:2391 for the second radio.
3. When cart prompts you for commands, first enter `db120\connectradios`, then enter `test_flow`, and provide the fields that you are prompted for.

To use artgui:

1. Got to `your art2_ver_x_y\bin` folder and click on the artgui executable.
2. You will need to connect to the three systems via the three load buttons on the gui. Ignore the labels on these buttons (DUT, golden, etc.). For the first one (instance 0) enter the IP address of the DUT (e.g. 192.168.1.2). For the second (instance 1), enter the IP of the DUT followed by :2391 (e.g. 192.168.1.2:2391). For the third, enter the IP address of the golden system (e.g. 192.168.1.3).
3. Now you can go to the system tab and select your customized `start.art` script.
4. Now go to `Tools->Run script->Start`, and select `commands\db120\test_flow_flags_DB120.art`.
5. When this is complete, go to `Tools->Run script->Start` and select `commands\test_flow`, and provide the fields that you are prompted for.

9 Useful Files, Controlling Manufacturing Flow

9.1 Start.art

1. In \bin directory
2. parsed at cart startup time
3. contains path loss of the manufacturing setup. Path loss for frequency ranges of chain 0, chain 1 and chain2 can be specified, ie
   path d=<golden|pm|sa>;f=<frequency1>,<frequency2>;loss=<ch0>,<ch1>,<ch2>;
   multiple frequency ranges can be used, for example, to span the 5GHz band.

4. Can also specify the directory for where command files can be found and where log and report files should be saved. The default start.art points to the appropriate paths within the art2 package.

9.2 ProductList.ref

1. In \bin directory
2. Parsed at cart startup time
3. Contains lookup table for reference design specific files. Indentify a reference by subsystem ID (SSID) or by a descriptive reference design specific name (refID). refName is the name of the directory of where the reference design specific files are.

9.3 Test_flow_flags.art

1. In \command directory
2. Called from start.art so will be called at cart startup time
3. Contains the flags to disable tests within manufacturing test flow.

10 Limitations and Known Issues with Release 2.21

1. An extra space at the end of the cart command line, or any of the cart command files, will result in an error message "Unknown parameter." To avoid this error message make sure to <enter> at the end of the last non-space character typed on the command line.
2. ANWI driver in Windows 7 is unstable when switching cards
3. Sometimes the first load of the DUT via the GUI does not load. This is because the background nart has not finished starting. A second press of the load button will work.
4. If running the manufacturing flow for a 2 radio based DUT via the GUI, the first radio IP address info should be entered in the DUT field of the main window, the IP address info for the second radio of the DUT should be entered in the Golden field and finally the info for the golden should be entered in the blocker field. See xxx for further information
5. Specifying rate "all" in cart will miss rate t0 and f0. Use the workaround "rate=all,t0,f0; for now.
6. Occasionally, when running db120 calibration, loading the second radio's ref file will cause cart to crash. This does not happen on the first board run with cart, so the workaround for this issue is to stop cart and restart it.
7. It has been found that after running multiple calibration runs on the same db120 without restarting nart on the AP, will eventually result in a crash of nart on the AP. Restart nart to work-around this issue.
8. The eeprom reads/writes in the artgui are not reliable. This functionality should only be used for setting the MAC address and the regDomain. For anything else, cart.exe should be used as it is reliable.
9. AP123 has too good throughput results in the rx throughput test. This is believed to be an issue with nart's calculation of test duration. For now the test is being disabled.

11 Differences Between art2 v2.27.3 and v2.25

1. Updated APH126 power accuracy measurement.
2. Removed HT rates when testing 4.9GHz.
3. Fixed a bug which could cause an incorrect PER to be reported.
4. Noise floor histogram support added.
5. Fixed bug which could cause incorrect values of Reg Domain or Tuning Caps to be reported.
6. Updated AP113 ref file and tgt power file.
7. Fixed bug which could cause nart to crash when multiple applications try to connect.
8. Updated AP113 test_flow_flags.
9. Updated gain tables for AR934x, and AR935x, and AR938x.
10. Fixed bug which could cause errors in writing to OTP on Freescale boards.
11. Fixed bug in artgui which could cause non-functional buttons to appear functional.
12. Updated ref files for XB116, DB120-030, DB120-640, DB120-730 and MI124-020.
13. Updated XB116 ref file.
14. Improved support for Japanese regulatory domains.
15. Updated gain tables for AR958x family.
16. Fixed bugs in 4.9GHz testing – invalid rates were being tested.

12 Differences Between art2 v2.25 and v2.23

1. Updated CUS191 ref file.
2. Fixed bug that prevented the artgui from prompting for the second radio id for DBDC designs.
3. Fixed bug that caused the AP123 to report incorrect throughput values.
4. Added tx gain table index 4 for AR958x family.
5. Updated the AR934x and AR958x gain tables.
6. Increased the maximum tx gain to 120.
7. Increased the speed of writing data to the OTP.
8. Updated the AR938/9x gain tables.
9. Added support for DB120-640, DB120-840 and DB120-940.

13 Differences Between art2 v2.23 and v2.21

1. Updated gain tables for AR934x and AR958x families to reduce spurs.
2. Fix for Litepoint – occasionally incorrect packet counts were being reported.
3. Fixed “get AntCtrlChain2g” command – it was reporting incorrect settings.
4. Updated XB116 ref file.
5. Updated MI124 ref file and target power file.
6. Updated APH128 ref files.
7. Updated CUS191 ref file.
8. Updated APH126 ref file and target power file.
9. Fixed bug in EEPROM write – sometimes write would fail after rx calibration.
10. Disabled rx calibration for CUS191 since it is not supported in software. Note, this does not mean rx sensitivity is not tested, it is still tested.

11. Updated Win7 driver to fix some stability issue with systems with updated service packs.

14 Differences Between art2 v2.21 and v2.20

1. Support for Litepoint model IQ2010 has been added. Note that the installation instructions for running Litepoint testers with CART has also changed. Refer to section 7 above for more details.
2. Support for the R&S power meter with the most recent driver has been added.
3. Additional information regarding One Box Tester support in ART2 has been added to this document. See section 7 above.
4. Two new gain tables have been added for the AR934x family – one "mixed mode", which is for systems with an XPA on the 5Ghz but not on the 2.4GHz, and one that provides enhanced regulatory compliance in the 5GHz band. *Note: These gain tables are in addition to the old ones, and are only available for systems running software version 9.2.0.728 (U7) or later.*
5. Initial support for XB116, APH126, and APH128.

15 Differences Between art2 v2.19.1 and v2.20

1. Fix for OTP writing:
    a. Sometimes OTP was not written due to timing issue
    b. OTP contents after a commit command would be written to the wrong place if the adapter also had an EEPROM with a populated calibration structure
2. New ap123-030 ref file due to a change in the 030 antenna switch table
3. MI124 target powers are updated
4. New spur channel 2475 added in AP123-030.ref file
5. Sticky writes are added in AP123 sens_2g file to address the sensitivity failures at higher frequencies – this simulates the Automatic Noise Immunity algorithm that is performed by the production software.
6. Disable Rx throughput test for AP123 and disable EVM test by default to match the default of the other reference designs.
7. Fix for pcie reset issue found on specific motherboards.
8. Fix for DB120 AR9380 pci config space registers are not written to AR938x/AR939x onboard, therefore LSDK software will not enable second radio using AR938x/939x.

16 Differences Between art2 v2.19 and v2.19.1

1. Added missing AP113 directory.
2. Updated AP123 temperature slope.

17 Differences Between art2 v2.18 and v2.19

3. Fix for PA pre-distortion when running a single chain. This should improve evm when testing single chains other than chain0.
4. The tx99/tx100 buttons on the artgui had interchanged functionality in the last version. This has been fixed.
5. For legacy rates, the default evm analysis of channel estimation has been changed to full packet.
6. Fixed bug causing MCS2 to use MCS6 target power.
7. Fixed bug in Litepoint mask report causing it to report a pass when it received no data.
8. Support for AP113 has been added.
9. AP123 target powers have been updated.

10. DB120 support has been updated, with new temp slope values and reg domain data for both AR9344 and AR9380.
11. Fixed bug in DB120 flow – previous versions did not enable the XLNA for the AR9380.
12. Numerous fixes in the MI124 flow, for tx/rx throughput, target power measurement and evm measurement.
13. Target powers for DB120-730 have been updated, and support for 4.9GHz has been added to the DB120-730 calibration flow.
14. Target powers for CUS191 have been updated.
15. Spur mitigation has been disabled for the AP113, CUS113, XB113, XB113B and CUS191.
16. Fixed bug setting the xpabiaslevel for AR934x.

18 Differences Between art2 v2.18.2 and v2.18.3

1. Updated crystal calibration scripts for DB120

19 Differences Between art2 v2.18 and v2.18.2

2. Added Nart.out and art.ko for Freescale base platform
3. Updated temp curve for DB120 designs

20 Differences Between art2 v2.14 and v2.18

4. Fixed GUI backup/Restore feature – now does backup/restore to/from a field name based file
5. 4.9GHz half and quarter rate support has been added for AR9390/92 only
6. Ref file updates including fixing bug that required a new line be at the end of the file
7. Add ability to “ping-pong” between 2 DUT’s against one Litepoint box
8. 2GHz HT40 power accuracy issue of previous release has been fixed
9. Added support for HP power meter 436A
10. If not power is detected during calibration the flow will stop immediately and report fail
11. Changing SSID and SVID via GUI will now be committed to EEPROM/OTP
12. Fixed CART issue where a crash would happen with the command reset on a 5GHz only board
13. Cart command “pcie memory=eeprom” should now work
14. Calibration and target power piers have been changed to align with piers used in CTLs
15. Added support for AR9580
16. Added support for AR934x
17. DB120 DBDC manufacturing flow can be run from cart or the GUI. See section 8.
18. Addition of FSL spectrum analyzer.
19. Optimized manufacturing flow for appropriate channels and rates
20. Continuous transmit “forever” should now work via the GUI.
21. Updated CTL for HB112.

21 Differences Between art2 v2.13.1 and v2.14

1. Added aspm.art file in common directory to support PC base designs for HB116/HB112 to allow PC system bios to automatically read the link and device capability register and set aspm control register.
2. Fixed HW RFsilent not getting set for PC base designs for HB112/HB116
3. Nart.exe revision changed to 2.14 and card.exe and ART GUI remains the same as before.

22 Differences Between art2 v2.13 and v2.13.1

4. xb112, xb114, cus152: Updated quick drop for strong signal improvement
5. Updated HB115 CTL file. Text changes to state Korea uses same power as Europe.
6. Added Windows 64bit driver support.

23 Differences Between art2 v2.8 and v2.13

1. xb112, xb114, cus152: implemented quick drop for strong signal improvement
2. xb113, xb113b: fixed gain table. Changed temperature slope.
3. commit: added error messages. Dynamic computation of lower limit to avoid pcie initialization space.
4. pcie: added error messages. Dynamic computation of upper limit to avoid calibration structure. fixed ability to overwrite exisiting value if possible.
5. carrier: implemented improved single carrier as option to tx command. please use "tx carrier=yes;" instead of "carrier" command.
6. check: added current in-memory state as last column in returned data.
7. 44416a: restored fixes for improved power accuracy.
8. hb112, hb116: fixed interaction of pa predistortion and CTLs for rate t15. (issue showed as worse EVM when CTL was installed for hb116
9. xb112, xb114, cus152: fixed 5GHz spurs issues

10. xb112, xb114, cus152: implemented quick drop for strong signal improvement
11. xb113, xb113b: fixed gain table. Changed temperature slope.
12. commit: added error messages. Dynamic computation of lower limit to avoid pcie initialization space.
13. pcie: added error messages. Dynamic computation of upper limit to avoid calibration structure. fixed ability to overwrite exisiting value if possible.
14. carrier: implemented improved single carrier as option to tx command. please use "tx carrier=yes;" instead of "carrier" command.
15. check: added current in-memory state as last column in returned data.
16. 44416a: restored fixes for improved power accuracy.
17. hb112, hb116: fixed interaction of pa predistortion and CTLs for rate t15. (issue showed as worse EVM when CTL was installed for hb116
18. xb112, xb114, cus152: fixed 5GHz spurs issues

24 Differences Between art2 v1.8 and v2.8

1. 2x2 support (AR9382)
2. bad noise floor detection after reset and retry fix
3. fix error from reset detection and retry
4. update tx iq calibration algorithm
5. Sync with LSDK9.2 base HAL
6. “cart –port xxxx” fixed to allow opening gui listen port
7. fixed parsing of mactx and macrx in cart link command
8. introduced dynamic 2x3 mode
9. transmit power minimum lowered to –100 in link command
10. check for 5GHz band before enabling dynamic 2x3 mode
11. correct computation of blocker frequency when more than one frequency is specified
12. raised target powers for hb112-241
13. rfsilent is fixed (for hardware mechanism)
14. set regdmn clears the second 0x1f field bug fixed
15. pa pre distortion algorithm updates
16. f7 rx throughput bug is fixed (actually first receive operation after reset on pa pre distortion)
17. no commit to otp/eeprom if any errors on pt or ft tests
18. add hello synch in pt.art so that mac address is fetched before it is reset (intermittent problem)
19. Redo the eeprom get/set parameters, now cover all eeprom fields.
20. You can access individual elements with array indexes, parameter[i][j].

21. new , more descriptive names for parameters (old names still work).
22. Eeprom backup/restore feature using the new get/set commands (added at command line only)
23. Add quickDrop parameters to eeprom, required for rx strong signal tuning
24. Add xpa timing parameters into eeprom
25. Adjusted xpa timing to resolve 11b spurs.
26. Support for Litepoint tester from Cart – Use flags in test_flow_flags to enable
27. tx pc=infinite[-1] and duration=forever[-1] work.
28. fl name=pattern, where pattern uses * to equal any characters works to look up field names
29. removed unused parameters ob, db_stage2, db_stage3, and db_stage4
30. Changed printed references to “osprey” to “ar938x”, etc.
31. shows amount of free memory after load, check, commit, and pcie commands
32. standard formatted error messages for commit and pcie commands
33. Allows entry of integer formats other than the expected one for parameters: xNNNN is always hex, +/-NNNN is always signed decimal, and uNNNN is always unsigned decimal.
34. Applies tuning caps
35. New options on pcie command allow you to view, modify, delete, or add (register, value) pairs to this space
36. Added CTLs for HB116, all other reference designs now point to a generic CTL file that customers can update
37. Update to the PA Pre-distortion algorithm, issues were uncovered with the addition of CTL limited power
38. Cleanup of all ref files for consistency
39. Rfkill and WOW can be enabled on cards by un-commenting the call to rfkill and WOW configuration files within the ref file

24.1 GUI Differences From ART2 Version 1.8 to Version 2.8

GUI version Change from 1.0 -> 1.5:

1. Added raw eeprom backup and restore capability.
2. Changed buttons to read "storage device" instead of eeprom.
3. Added Registers->Utilities page where user can read/write registers & fields to the extent that cart allows.
4. Added DevID box on the "Load Cards".
5. Fixed bug where could not enter mac address
6. Fixed bug in Error display.
7. Remove password requirement from Beam Forming feature.
8. Cleanup.

25 Differences Between art2 v1.7 and v1.8

1. Fixed bug where first boards being calibrated would be configured wrongly, while subsequent boards would be configured correctly. HB116 also had an issue where the “correct” configuration was not correct. Both these issues have been resolved.
2. Xb114 was using the wrong template version and so was not updating eeprom on calibration. This issue has been resolved.
3. Strong signal rx configuration has been enabled for hb116

26 Differences Between art2 v1.0 and v1.7

1. Enable PA-Predistortion for the FEM-less reference designs. This improves EVM for these designs
2. Minor rf tuning updates were made

3. Target powers for most reference designs have been changed
4. Manufacturing test flow can now be run from with the GUI as overall test result is now displayed.
5. The GUI is now started by selecting artgui.exe rather than artgui.bat
6. Link test is now available via the GUI, although refer to known issues below.
7. In test_flow_flags.art, add flag manufAuto:
    a. For manufacture test with user selection refID and SSID will be entered by user
    b. For manufacure auto test, no user enter required refID need to be setup correctly by assigning refID, BoardIDType=1
8. In test_flow_flags.art, add flag noEEPSaveOnFail:
    a. saveEEP based on enable/disable noEEPSaveOnFail flag
    b. saveEEP based on enable/disable noEEPSaveOnFail flag and only when all pass
9. SaveEEP will be only performed once at the end of test.
    a. If PT/FT are all enabled, saveEEP will only be performed once after FT and based on noEEPSaveOnFail flag setting.
    b. If PT enabled and FT disabled, saveEEP will be performed after PT and based on noEEPSaveOnFail flag setting.
    c. If PT disabled and FT enabled, saveEEP will be performed after PT and based on noEEPSaveOnFail flag setting.
10. Adding error check during PT/FT, if fails skip rest of test flow and stop test flow.
11. Updates to Message and error handling between nart and cart and cart and the GUI
12. Interface between cart and GUI is now TCP/IP socket based
13. Improvements to transmit power accuracy. All reference designs are now being test to +/- 2.0 dbm, although many boards will be pass to +/- 1.5 dbm.
14. OTP programming is now being supported. If no EEPROM is present on the reference design, OTP will automatically be selected