Reference: 40107, EA430169

Dear FCC

In response to your questions:

1. The statement in the attestation letter that country code is stored in the EEPROM of the Atmel Mega8 uController and that EEPROM is "write once" are both incorrect. EEPROM is not a write-once component but re-writable by software after initial programming at time of production; and there is no Atmel micro-controller in the schematics, only a simple 8-pin AT24C32 EEPROM. Providing false/incorrect attestation statements is prohibited. Please rephrase.

The Atmel micro-controller is located on the Xirrus controller board, part number 100-0114-001, and has been upgraded to a Mega16 device. The country code is stored in the EEPROM of the micro-controller. While the EEPROM is not a write once memory, the firmware running in the micro-controller employs a write protection scheme once the value has been programmed.

Schematics for the Xirrus controller board have been uploaded to both DTS and NII applications.

2. Please describe the procedure that an "authorized service professional" or a "trained Xirrus service technician" (Country Code Attestation Letter) follows to change country code setting. This information will enable us to better assess the likelihood of unauthorized alteration. It is important to note that making frequency range and output power changes are not allowed by any 3rd party (user, installer, integrator, VAR, dealer, distributor); only Xirrus employees can perform such changes and for compliance purpose only. This should be made clear in the User's Guide.

The protection scheme employed for the country code setting involves a multi-step process in order to reset the country code and then program a new value. This procedure is not documented anywhere and is known only to select Xirrus employees. Xirrus would prefer not to document that procedure here but would be glad to walk FCC through the process of changing the country code if required.

Attestation – Country Code Protection.pdf has been uploaded to both DTS and NII applications as part of the operational description so that the procedures for setting country codes are not readily available.

3. If the above country code and other settings (e.g., output power, DFS enable/disable, etc.) are protected by special username/password, please attest that such information is never released to any 3rd party, including those 3rd party personnel in the sales channel. If the protection is more sophisticated than username/password, please describe.

The country code setting controls the output power, DFS settings, and all regulatory related parameters of the Xirrus radios. The protection scheme employed for the country code setting is described above.

Attestation – Country Code Protection.pdf has been uploaded to both DTS and NII applications as part of the operational description so that the procedures for setting country codes are not readily available.

4. In the output power attestation letter, Channel 132 is mentioned to be an available channel. This channel (5660 MHz) is not allowed because either 20 MHz or 40 MHz operation would overlap with the TDWR band (5600 - 5650 MHz). In addition, with a 30 MHz spacing requirement if located within 35 km of a TDWR operating (known center frequency ranges 5603 - 5647 MHz) Channel 116 (5580 MHz) could be off the available channel table too. Therefore, if the applicant does not prefer to bother its customers with detail instruction on avoiding TDWR interference, both Channels 116 and 132 should be removed from US channel table. The DFS (5250 - 5350, 5470 - 5725 MHz) and TDWR rules apply to all devices operating in those bands, regardless indoor or outdoor installation.

Test data in the report shows that the 20dB bandwidth of the 20 MHz channel at 5660MHz (channel 132) does not fall inside the 5600-5650MHz TDWR band. Our understanding was that the 30MHz spacing requirement only applied to outdoor systems (the requirement falls under the second bullet point in 443999 D01 Approval of DFS UNII Devices v01 DB 33781 – "*Devices intended for outdoor use will be further restricted, as follows:* …"

5. Although the cover letter, authorized by the test lab, intends to limit host devices to have up to 8 multiple modular transmitters only operating on non-overlapping channels, the company's product portfolio includes host products with up to 16 transmitter modules. Even with just 8 transmitter modules, each 802.11n 3x3 module can have up to 3 transmitters and all of them employ identical high power SST12LP15A (2.4 GHz) and LX5530 (5GHz) power amplifiers. In other words, an 8-module host would need 24 different channels when each channel is carrying different payload for maximum throughput (300 Mbps each module) as claimed. Since there not are that many non-overlapping channels, please explain the channel assignment in such a configuration (24 or more transmitters, maximum throughput). The XR48xx's 60 W power supply (Page 24 User's Guide) is an indicator of such maximum output power design intent.

The Xirrus Model XR4000 Array may contain up to 8 MIMO radio modules. The Xirrus Model XR6000 Array, in development, may contain up to 16 MIMO radio modules. A 3x3 802.11n radio module does not transmit on 3 separate channels. It can use one 20MHz channel occupying one available channel or one 40MHz channel occupying 2 available channels. The software employed on the Xirrus Arrays will not allow overlapping channels to be enabled. In the case of a 16 port Array, all radios could not be set to 40MHz mode because there are not 32 available channels. The software will limit the number of radios that can be enabled to insure that there are no overlapping channels.

AR9390DS.pdf has been uploaded. The AR9390 3x3 supports spatial diversity, cyclic-delay diversity and TX beamforming to support MIMO operation. They do not support frequency diversity (i.e. the three individual chains all operate on the same 20MHz or 40MHz channel).

6. The product concept, namely, employing multiple modules transmitting simultaneously on different channels, is probably a stretch of the uniform loading requirement, admittedly at the same time an engineering achievement. The intent of the uniform loading guideline was to not overburden a particular channel or to avoid constant collision with a transmitter having no channel switch-over capability (e.g., radar). It was not meant to encourage products that do not single out one channel but instead ALL channels. After all, ISM bands are supposed to be shared by all manufacturers. However, one can argue that if all channels are to be flooded, it is better to be monopolized by a coordinated group of transmitters than by a group of uncoordinated ones. Also, with sectorized antennas as in this case, one can further argue that in any particular direction, not all channels are occupied. We acknowledge both points and indeed there is currently no explicit rules prohibiting such products. In summary, we will review this collection of transmitters as a single transmitter and apply the same sets of rules as such.

Noted.

7. In an 8-module configuration, for example, the applicant states that the total output power will remain a constant, 17/24/30 dBm conducted and 23/30/36 dBm EIRP. However, the power allocation table and algorithm presented in the MPE report and Operational Description are purely theoretical. In reality, all power control schemes do so in discrete steps and accuracy is hard to maintain over a large dynamic range. There must be a balanced power setting table for various configurations, please provide such table(s). Furthermore, the rule requires that for every 1 dB exceeding 6 dBi of antenna gain, there should be 1 dB reduction in output power. When MIMO and/or 2 or more modules are used to send the same data to the same user (maximum power/range mode), antenna gains and output powers will all need to be combined, consequently the 6 dBi maximum antenna gain would be exceeded and output power back-off should take place. Please confirm and describe the detail.

No two modules can be set to the same channel, therefore there is no need to reduce output power based on multiple radios sending the same data to the same user. For MIMO modes of operation the maximum output power and antenna gain was taken into account during testing and the submitted powers comply with the FCC limits. Output power only has to be reduced when modules are co-located in a host system and operating in the same band to ensure that the total power and total eirp within a specific band does not exceed the allowed limits.

Attestation - Power reduction.pdf has been uploaded to both DTS and NII applications and shows the power settings used when multiple radios operate in the same band in the same host system.

8. The applicant should also note that with output power exceeding 500 mW EIRP, which is true in some modes of operation, TPC (Transmit Power Control) is also required for devices operating on DFS channels (5250 - 5350 and 5470 - 5725 MHz) per Part 15.407(h).

This is understood. The test report summary table indicates that TPC is employed through the 802.11h protocol.

9. It is not clear to this reviewer why power reduction is not required in the 2.4 GHz band if, take the smaller XR44xx for example, 4 modules all operate in the 2.4 GHz band (set aside for now the issue that there are only three non-overlapping channels), all 4 modules output maximum power from each of its 3 transmitters in MIMO mode. The Power Summary table seems to miss at least the factor of 3 for the number of transmitters per module carrying identical data, and the total antenna gain could be also underestimated in this condition.

The system only allows three radios to be operated in the 2.4GHz band. The output power and eirp values are correct in the table (they are the toal power per module, aggregated across all chains). The gain per chain is 2dBi, therefore the total effective gain for the MIMO modes using CDD is 6.8dBi. The maximum allowed total output power is, therefore, 29.8dBm. With three modules operational the maximum allowed output power per module would be 25.0dBm (they are operating on different channels, sending different data, so the effective antenna gain remains at 6.2dBi). The maximum rated power in the 2.4GHz band is 24.2dBm (802.11b mode), which is below the 25.0dBm maximum.

The total eirp with three modules operating at rated power is 24.2dBm + 6.8dBi = 35.8dBm.

10. Please describe the external antenna connectors discussed on Page 29 of the User's Guide. For unlicensed Part 15 products, all antennas to be used with the product should be listed and all antenna types tested at time of certification. The test reports currently do not include any data on external antennas.

This is an error in the manual. A revised draft manual (Host Manual (Draft) p1 to p170 rev 8-5-11.pdf) with the external antenna information struck-out will be provided. Also note the corrected antenna gain information on the same page.

The module covered under the scope of this application will not use external antennas. If host systems are developed that would enable use of external antennas the appropriate filings for C2PC would be made at that time.

11. The cover letter, authored by the test lab, indicates that a "depopulated" 2x2 MIMO version is currently under test and will be used along with 3x3 modules in various combinations. Please note that, as commonly the case and confirmed by the applicant in the Product Specifications, the 2x2 and 3x3 versions use different CPUs (Atheros AR9392 vs. AR9390). Although DFS expedite service probably may apply if the applicant and the chipset vendor can provide convincing information on the similarity and difference between 2 and 3 antenna DFS detections, the 2x2 version cannot be treated simply as a depopulated version of 3x3 when it comes to RF behavior because conducted power, radiated power, antenna pattern, spurs, harmonics all are different.

The 2x2 module uses the same base PCB as the 3x3 module. The difference is that the components for the third chain are not populated on the 2x2 module. The 2x2 module has been fully tested for EMC compliance. DFS testing on the 2x2 and 3x3 module was performed in full for detection probability tests. Channel availability check and channel move/close times were only performed on the 3x3 module as they share the same firmware implementation for DFS. This will be explained in the application for the 2x2 module.

12. Please explain the maximum of 36 antennas (instead of 24) for the 8-module host XR48xx, and 20 antennas (instead of 12) for XR44xx shown on Page 28 of the User's Guide.

This is leftover documentation from the old product line. An edited draft manual has been uploaded (Host Manual (Draft) p1 to p170 rev 8-5-11.pdf).

13. FCC label: please use the words "FCC ID" instead of "FCC REG ID". FCC Registration Number (FCC REG NO) is not applicable in this case.

Revised label document has been uploaded.

The following documents have been uploaded to support these responses:

1. Schematics for the Xirrus controller board *130-0114-001rc (Host System Schematic).pdf*
2. Country code explanation Attestation – Country Code Protection.pdf
3. Description/data sheet for Atheros 3x3 chipset AR9390DS.pdf
4. Attestation/explanation regarding power reduction when multiple modules are located in the same host system Attestation - Power reduction.pdf
5. Revised draft manual Host Manual (Draft) p1 to p170 rev 8-5-11.pdf
6. Revised label document 835-0289-002_A rev IC 2.pdf

If you have additional questions please do not hesitate to contact us.

Regards,

Mark Briggs
Staff Engineer
NTS

Steve Smith
VP Hardware Engineering
Xirrus Inc.