

Setup for Country or Regulatory Domain on AR6002-Based Target Firmware

Introduction

This document describes programming country/regulatory configuration data on the AR6002-based target firmware, which is necessary for each intended SKU to insure that radio operation characteristics comply with regulatory requirements of the intended country or regulatory domain that the product ships to. This document applies to AR6002 target firmware version 2.0 and above.

The target firmware supports three supported SKU strategies:

- Worldwide SKU
- Regulatory domain
- Country-specific EEPROM

AR6002 target firmware saves country and regulatory information at location EEPROM offset 0x8, a 16-bit field located in the AR6002 EEPROM subsystem-specific information section. [Table 1](#) details the data fields for location EEPROM offset 0x8.

Table 1. AR6002 EEPROM Layout for Regulatory Code

EEPROM Location	15 ^[1]	14 ^[2]	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Offset 0x08	CCS	WWR	X	X	Country/Regulatory Domain/Worldwide Roaming Code											

[Table 2](#) shows the interpretation for regulatory code depending on the country code selector (CCS) flag and worldwide roaming code.

Table 2. Interpretation for Regulatory Code

EEPROM Location	15 ^[1]	14 ^[2]	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Offset 0x08	0	0	X	X	Regulatory Domain Code											
Offset 0x08	0	1	X	X	Worldwide RoamingCode											
Offset 0x08	1	0	X	X	Country Code											

[1]The value of the country code selector (CCS) flag [15] determines how the data stored in the country or regulatory domain code [11:0] is interpreted:

0 = Country or regulatory domain code field is to be interpreted as a regulatory domain;

see [Table 3, "Regulatory Domains,"](#) on page 2.

1 = Country or domain code field is interpreted as a country code;

see [Table 6, "Mapping of Countries in Specific Regulatory Domains,"](#) on page 5.

[2]If the world wide roaming (WWR) field [14] is set, bits [11:0] are interpreted as worldwide roaming code.

Regulatory Domain

A regulatory domain is used to configure a SKU intended to ship to a set of countries that share similar radio operation requirements. The target firmware supports setting the soft country configuration to a value supported by the regulatory domain. If no regulatory domain is specified, the AR6002 defaults to world mode behavior (regulatory code = 0x60).

Table 3 shows supported regulatory domain code used to program the EEPROM offset 0x8. Each regulatory domain defines specific 5- and 2.4-GHz operational parameters to ensure proper operation within the rules defined by the regional regulatory bodies.

Table 3. Regulatory Domains

Regulatory Domain	Regulatory Domain Code	5-GHz Regulatory Domain Definition	2.4-GHz Regulatory Domain Definition
NO_ENUMRD	0x0000	DEBUG_REG_DMN	DEBUG_REG_DMN
NULL1_WORLD	0x0003	NULL1	WORLD
NULL1_ETSIB	0x0007	NULL1	ETSIB
NULL1_ETSIC	0x0008	NULL1	ETSIC
FCC1_FCCA	0x0010	FCC1	FCCA
FCC1_WORLD	0x0011	FCC1	WORLD
FCC2_FCCA	0x0020	FCC2	FCCA
FCC2_WORLD	0x0021	FCC2	WORLD
FCC2_ETSIC	0x0022	FCC2	ETSIC
FCC3_FCCA	0x003A	FCC3	FCCA
FCC3_WORLD	0x003B	FCC3	WORLD
FCC5_FCCA	0x0013	FCC5	FCCA
ETSI1_WORLD	0x0037	ETSI1	WORLD
ETSI2_WORLD	0x0035	ETSI2	WORLD
ETSI3_WORLD	0x0036	ETSI3	WORLD
ETSI4_WORLD	0x0030	ETSI4	WORLD
ETSI5_WORLD	0x0039	ETSI5	WORLD
ETSI6_WORLD	0x0034	ETSI6	WORLD
FRANCE_RES1	0x0031	ETSI3	WORLD
APL2_APLC	0x0046	APL2	APLC
APL3_WORLD	0x0047	APL3	WORLD
APL2_APLD	0x0049	APL2	APLD
APL1_WORLD	0x0052	APL1	WORLD
APL2_WORLD	0x0045	APL2	WORLD
APL3_FCCA	0x0050	APL3	FCCA
APL4_WORLD	0x0042	APL4	WORLD
APL1_ETSIC	0x0055	APL1	ETSIC

Table 3. Regulatory Domains (continued)

Regulatory Domain	Regulatory Domain Code	5-GHz Regulatory Domain Definition	2.4-GHz Regulatory Domain Definition
APL5_WORLD	0x0058	APL5	WORLD
APL6_WORLD	0x005B	APL6	WORLD
APL8_WORLD	0x005D	APL8	WORLD
APL9_WORLD	0x005E	APL9	WORLD
APL1_ETSIC	0x0055	APL1	ETSIC
APL2_ETSIC	0x0056	APL2	ETSIC
APL2_APLD	0x0049	APL2	APLD
MKK5_MKKA	0x0099	MKK5	MKKA
MKK5_FCCA	0x009A	MKK5	FCCA
MKK5_MKCC	0x0088	MKK5	MKCC
MKK11_MKKA	0x00D4	MKK11	MKKA
MKK11_FCCA	0x00D5	MKK11	FCCA
MKK11_MKCC	0x00D7	MKK11	MKCC
WOR0_WORLD	0x0060 (World SKU)	WOR0_WORLD	WOR0_WORLD
WOR1_WORLD	0x0061 (World SKU)	WOR1_WORLD	WOR1_WORLD
WOR2_WORLD	0x0062 (World SKU)	WOR2_WORLD	WOR2_WORLD
WOR3_WORLD	0x0063 (World SKU)	WOR3_WORLD	WOR3_WORLD
WOR4_WORLD	0x0064 (World SKU)	WOR4_WORLD	WOR4_WORLD
WOR5_ETSIC	0x0065 (World SKU)	WOR5_ETSIC	WOR5_ETSIC
WOR01_WORLD	0x0066 (World SKU)	WOR01_WORLD	WOR01_WORLD
WOR02_WORLD	0x0067 (World SKU)	WOR02_WORLD	WOR02_WORLD
EU1_WORLD	0x0068 (World SKU)	EU1_WORLD	EU1_WORLD
WOR9_WORLD	0x0069 (World SKU)	WOR9_WORLD	WOR9_WORLD
WORA_WORLD	0x006A (World SKU)	WORA_WORLD	WORA_WORLD

Table 4 and Table 5 outline 2.4- and 5-GHz bands regulatory characteristics, including available channels, transmit (Tx) power allowed, and the set of conformance test limits (CTL) assigned to each regulatory domain. CTL values are used to back off Tx power to meet band edge requirements.

Tx power levels in Table 4 and Table 5 represent theoretical maximums allowed by

regulatory standards. Actual Tx power levels are board-specific and often limited to lower levels than those shown in these tables, and defined by values determined in conformance testing or calibration target powers. 2.4- and 5-GHz operation antenna gain values must be entered during EEPROM programming and reduce resulting Tx powers as required.

Table 4 shows the 5-GHz domains.

Table 4. 5-GHz Regulatory Domains

RD	CTL	Frequencies/Channels	DFS Support
FCC1 ^[1]	FCC	5180–5240, 5260–5320, 5745–5825	No
FCC2 ^[1]	FCC	5180–5240, 5260–5320, 5745–5825	No
FCC3 ^[1]	FCC	5180–5240, 5260–5320, 5500–5700, 5745–5825	Yes (5260–5320, 5500–5700)
FCC5 ^[1]	FCC	5180–5240	No
MKK5	MKK	5180–5240, 5260–5320, 5500–5700	Yes (5260–5320, 5500–5700)
MKK11	MKK	4920–4980, 5040–5080, 5180–5240, 5260–5320, 5500–5700	Yes (5260–5320, 5500–5700)
ETSI1	ETSI	5180–5240, 5260–5320, 5500–5700	Yes (5260–5320, 5500–5700)
ETSI2	ETSI	5180–5240	Yes (5180–5240)
ETSI3	ETSI	5180–5240, 5260–5320	Yes (5260–5320)
ETSI4	ETSI	5180–5240, 5260–5320	Yes (5180–5240, 5260–5320)
ETSI5	ETSI	5180–5240	No
ETSI6	ETSI	5180–5240, 5260–5280, 5500–5700	Yes (5260–5280, 5500–5700)
APL1	FCC	5745–5825	No
APL2	FCC	5745–5805	No
APL3	FCC	5280–5320, 5745–5825	No
APL4	FCC	5180–5240, 5745–5825	No
APL5	FCC	5745–5825	No
APL6	ETSI	5180–5240, 5260–5320, 5745–5825	Yes (5260–5320)
APL7	ETSI	5280–5320, 5500–5700, 5745–5805	Yes (5280–5320, 5500–5700)
APL8	ETSI	5260–5320, 5745–5825	Yes (5260–5320)
APL9	ETSI	5180–5240, 5260–5320, 5500–5620, 5745–5805	Yes (5260–5320, 5500–5620)

[1]These domains apply FCC part 15 rules for backing off Tx power for each dB that the antenna gain exceeds 6 dBi.

Table 5 shows the 2.4-GHz domains. When programming a regulatory domain, the CCS field and WWR field must be clear (set to 0).

Table 5. 2.4-GHz Regulatory Domains

RD	CTL	Channels
WORLD	(ETSI CTL_11B)	2412–2472
FCCA ^[1]	(FCC CTL_11B)	2412–2462
MKKA	(MKK CTL_11B)	2412–2462, 2467–2472, 2484
MKKC	(MKK CTL_11B)	2412–2472
APLD	NO_CTL	2412–2472, 2312–2372
ETSIB	(ETSI CTL_11B)	2432–2442 (5–7)
ETSIC	(ETSI CTL_11B)	2412–2472

[1]These domains apply FCC part 15 rules for backing off Tx power for each dB that the antenna gain exceeds 6 dBi.

Table 6 shows countries supported within particular regulatory domains. If a SKU strategy ships to a specific country, EEPROM

offset 0x8 must be programmed with a country code. When programming a country code value, set the CCS field to 1.

Table 6. Mapping of Countries in Specific Regulatory Domains [1]

Domain Code	Country	Country Code	Countries in Specific Domain	802.11g Allowed
NULL1_WORLD	AL	0x8008	ALBANIA	Yes
NULL1_WORLD	DZ	0x800C	ALGERIA	Yes
APL3_WORLD	AR	0x8020	ARGENTINA	Yes
ETSI4_WORLD	AM	0x8033	ARMENIA	Yes
FCC2_WORLD	AU	0x8024	AUSTRALIA	Yes
ETSI1_WORLD	AT	0x8028	AUSTRIA	Yes
ETSI4_WORLD	AZ	0x801F	AZERBAIJAN	Yes
APL6_WORLD	BH	0x8030	BAHRAIN	Yes
ETSI1_WORLD	BY	0x8070	BELARUS	Yes
ETSI1_WORLD	BE	0x8038	BELGIUM	Yes
APL1_ETSIC	BZ	0x8054	BELIZE	Yes
APL1_ETSIC	BO	0x8044	BOLIVIA	Yes
ETSI1_WORLD	BA	0x8046	BOSNIA AND HERZEGOVINA	Yes
FCC3_WORLD	BR	0x804C	BRAZIL	Yes
APL1_WORLD	BN	0x8060	BRUNEI DARUSSALAM	Yes
ETSI1_WORLD	BG	0x8064	BULGARIA	Yes
FCC2_FCCA	CA	0x807C	CANADA	Yes
APL6_WORLD	CL	0x8098	CHILE	No
APL1_WORLD	CN	0x809C	CHINA	Yes
FCC1_FCCA	CO	0x80AA	COLOMBIA	Yes
FCC1_WORLD	CR	0x80BC	COSTA RICA	Yes
ETSI3_WORLD	HR	0x80BF	CROATIA	Yes
ETSI3_WORLD	CY	0x80C4	CYPRUS	Yes
ETSI1_WORLD	CZ	0x80CB	CZECH REPUBLIC	Yes
ETSI1_WORLD	DK	0x80D0	DENMARK	Yes
FCC1_FCCA	DO	0x80D6	DOMINICAN REPUBLIC	Yes
FCC1_WORLD	EC	0x80DA	ECUADOR	Yes
ETSI3_WORLD	EG	0x8332	EGYPT	Yes
FCC1_WORLD	SV	0x80DE	EL SALVADOR	Yes
ETSI1_WORLD	EE	0x80E9	ESTONIA	Yes
ETSI1_WORLD	FI	0x80F6	FINLAND	Yes
ETSI1_WORLD	FR	0x80FA	FRANCE	Yes
ETSI3_WORLD4	F2	0x80FF	FRANCE RESERVED	Yes
ETSI4_WORLD	GE	0x810C	GEORGIA	Yes
ETSI1_WORLD	DE	0x8114	GERMANY	Yes
ETSI1_WORLD	GR	0x812C	GREECE	Yes
FCC1_FCCA	GT	0x8140	GUATEMALA	Yes
NULL1_WORLD	HN	0x8154	HONDURAS	Yes
FCC2_WORLD	HK	0x8158	HONG KONG	Yes
ETSI1_WORLD	HU	0x815C	HUNGARY	Yes
ETSI1_WORLD	IS	0x8160	ICELAND	Yes
APL6_WORLD	IN	0x8164	INDIA	Yes

Table 6. Mapping of Countries in Specific Regulatory Domains (continued)^[1]

Domain Code	Country	Country Code	Countries in Specific Domain	802.11g Allowed
APL1_WORLD	ID	0x8168	INDONESIA	Yes
APL1_WORLD	IR	0x816C	IRAN	Yes
ETSI1_WORLD	IE	0x8174	IRELAND	Yes
ETSI3_WORLD	IL	0x8178	ISRAEL	Yes
ETSI1_WORLD	IT	0x817C	ITALY	Yes
ETSI1_WORLD	JM	0x8184	JAMAICA	Yes
MKK5_MKCC	JP	0x8188	JAPAN	Yes
ETSI2_WORLD	JO	0x8190	JORDAN	Yes
NULL1_WORLD	KZ	0x818E	KAZAKHSTAN	Yes
NULL1_WORLD	KE	0x8198	KENYA	Yes
APL9_WORLD	KP	0x8198	NORTH KOREA	Yes
APL9_WORLD	KR	0x819A	KOREA_ROK	Yes
APL2_APLD	K2	0x819B	KOREA_ROC2	Yes
APL9_WORLD	K3	0x819C	KOREA_ROC3	Yes
NULL1_WORLD	KW	0x819E	KUWAIT	Yes
ETSI1_WORLD	LV	0x81AC	LATVIA	Yes
NULL1_WORLD	LB	0x81A6	LEBANON	Yes
ETSI1_WORLD	LI	0x81B6	LIECHTENSTEIN	Yes
ETSI1_WORLD	LT	0x81B8	LITHUANIA	Yes
ETSI1_WORLD	LU	0x81BA	LUXEMBOURG	Yes
FCC2_WORLD	MO	0x81BE	MACAU	Yes
NULL1_WORLD	MK	0x8327	MACEDONIA	Yes
APL8_WORLD	MY	0x81CA	MALAYSIA	No
ETSI1_WORLD	MT	0x81D6	MALTA	Yes
FCC1_FCCA	MX	0x81E4	MEXICO	Yes
ETSI4_WORLD	MC	0x81EC	MONACO	Yes
NULL1_WORLD	MA	0x81F8	MOROCCO	Yes
ETSI1_WORLD	NL	0x8210	NETHERLANDS	Yes
FCC2_ETSIC	NZ	0x822A	NEW_ZEALAND	Yes
ETSI1_WORLD	AN	0x822C	NEW_ZEALAND_ANTILLES	Yes
ETSI1_WORLD	NO	0x8242	NORWAY	Yes
APL6_WORLD	OM	0x8200	OMAN	Yes
NULL1_WORLD	PK	0x824A	PAKISTAN	Yes
FCC1_FCCA	PA	0x824F	PANAMA	Yes
APL1_WORLD	PE	0x825C	PERU	Yes
FCC3_WORLD	PH	0x8260	PHILIPPINES	Yes
ETSI1_WORLD	PL	0x8268	POLAND	Yes
ETSI1_WORLD	PT	0x826C	PORTUGAL	Yes
FCC1_FCCA	PR	0x8276	PUERTO_RICO	Yes
NULL1_WORLD	QA	0x827A	QATAR	Yes
NULL1_WORLD	RO	0x8282	ROMANIA	Yes
NULL1_WORLD	RU	0x8283	RUSSIA	Yes
FCC2_WORLD	SA	0x82AA	SAUDIA ARABIA	Yes
ETSI1_WORLD	CS	0x837B	MONTENEGRO	Yes
APL6_WORLD	SG	0x82BE	SINGAPORE	Yes

Table 6. Mapping of Countries in Specific Regulatory Domains (continued)^[1]

Domain Code	Country	Country Code	Countries in Specific Domain	802.11g Allowed
ETSI1_WORLD	SK	0x82BF	SLOVAK REPUBLIC	Yes
ETSI1_WORLD	SI	0x82C1	SLOVENIA	Yes
FCC3_WORLD	ZA	0x82C6	SOUTH AFRICA	Yes
ETSI1_WORLD	ES	0x82D4	SPAIN	Yes
FCC3_WORLD	LK	0x8090	SRI LANKA	Yes
ETSI1_WORLD	SE	0x82F0	SWEDEN	Yes
ETSI1_WORLD	CH	0x82F4	SWITZERLAND	Yes
NULL1_WORLD	SY	0x82F8	SYRIA	Yes
APL3_FCCA	TW	0x809E	TAIWAN	Yes
NULL1_WORLD	TH	0x82FC	THAILAND	Yes
ETSI4_WORLD	TT	0x830C	TRINIDAD AND TOBAGO	Yes
ETSI3_WORLD	TN	0x8314	TUNISIA	Yes
ETSI3_WORLD	TR	0x8318	TURKEY	Yes
NULL1_WORLD	UA	0x8324	UKRAINE	Yes
NULL1_WORLD	AE	0x8310	UNITED ARAB EMIRATES	Yes
ETSI1_WORLD	GB	0x833A	UNITED KINGDOM	Yes
FCC3_FCCA	US	0x8348	UNITED STATES	Yes
FCC1_WORLD	UY	0x835A	URUGUAY	Yes
FCC3_FCCA	UZ	0x835C	UZBEKISTAN	Yes
APL2_ETSIC	VE	0x835E	VENEZUELA	Yes
NULL1_WORLD	VN	0x82C0	VIETNAM	Yes
NULL1_WORLD	YE	0x8377	YEMEN	Yes
NULL1_WORLD	ZW	0x82CC	ZIMBABWE	Yes

[1] Table 6 indicates the country coding conventions of ISO 3166, as indicated by the IEEE 802.11d standard.

Worldwide SKU

Worldwide SKU options allow devices to roam across regulatory domains by adjusting the client operational parameters to conform to regional requirements, facilitated by using the country information data collected from probe responses and AP beacons discovered during a channel scan. Table 7 shows details on commonly used SKUs (see Table 3 for a complete list of supported SKUs). For more information, contact an Atheros FAE for assistance in planning SKUs.

NOTE: For Table 7 and Table 8:

- Common mode Tx powers are used on WW SKUs when no 802.11d beacon is present. If one is present, the driver maps the country code to power tables stored in the driver.
- Blocks shaded in blue indicate frequencies subject to active scan.
- Blocks shaded in green indicate frequencies subject to passive scan (no transmissions) only. In passive scan mode, transmissions begin on reception of beacon that indicates the presence of a WLAN. If an 802.11d beacon is found and regulatory laws of the country allows active scan, the client may assume active scan.
- OFDM (802.11g) operation is not permitted on channel 14. Product operation is restricted to 802.11b mode.
- All world modes active scan 802.11b channels 1–11, and passive scan 12–14 if supported.
- 2.4-GHz power level applies to 802.11b (CCK) across all channels except band edge channels. Power levels for 802.11g (OFDM) are lower due to a wider mask; check with the ODM/board manufacturer for actual power levels calibrated on the design.

Table 7. Most Commonly Used Worldwide SKUs

Freq. (GHz)	WOR0 WORLD	WOR01 WORLD	WOR02 WORLD	EU1 WORLD	WOR1 WORLD	WOR2 WORLD	WOR3 WORLD	WOR4 WORLD	WOR5 WORLD	WOR9 WORLD	WORA WORLD	WORB WORLD
EEPROM Hex	0x60	0x66	0x67	0x68	0x61	0x62	0x63	0x64	0x65	0x69	0x6A	0x6B
5.150–5.250												
5.250–5.350												
5.470–5.725												
5.725–5.825												
5.825–5.850												
2.412–2.452 (Ch. 1–9)												
2.457–2.462 (Ch. 10–11)												
2.467–2.472 (Ch. 12–13)												
2.467–2.497 (Ch. 14)												
WW Roaming Enabled	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ad Hoc Support for 802.11a	Per 802.11d	Per 802.11d	Per 802.11d	Per 802.11d	No	No	Per 802.11d	No	No	No	Per 802.11d	
Ad Hoc Support for 802.11b/g	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11
TPC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 8. Summary of Recommended Japan SKUs and New US SKU

Freq. (GHz)	US	Japan 7	Japan 8	Japan 9	Japan 10	Japan 11	Japan 12	Japan 13	Japan 14	Japan 15
SKUs	FCC3_ FCCA	MKK3_ MKKB	MKK3_ MKKA2	MKK3_ MKKC	MKK4_ MKKB	MKK4_ MKKA2	MKK4_ MKKC	MKK5_ MKKB	MKK5_ MKKA2	MKK5_ MKKC
EEPROM Hex	0x3A	0x80	0x81	0x82	0x83	0x84	0x85	0x86	0x87	0x88
4.900-5.000										
5.030-5.090										
5.180-5.240										
5.170-5.230										
5.250-5.350										
5.470-5.725										
5.725-5.825										
5.825-5.850										
2.412-2.452 (Ch. 1-9)										
2.457-2.462 (Ch. 10-11)										
2.467-2.472 (Ch. 12-13)										
2.467-2.497 (Ch. 14)										
WW Roaming Enabled	No	No	No	No	No	No	No	No	No	No
Ad Hoc Support for 802.11a	36, 40, 44, 48, 149, 153, 157, 161, 165	36, 40, 44, 48	36, 40, 44, 48	36, 40, 44, 48	36, 40, 44, 48	36, 40, 44, 48	36, 40, 44, 48	36, 40, 44, 48	36, 40, 44, 48	36, 40, 44, 48
Ad Hoc Support for 802.11b/g	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11	10, 11
DFS/TPC	Yes	No	No	No	No	No	No	Yes	Yes	Yes

Driver

Upon initial AR6002 bootup, the AR6002 indicates the regulatory code (regCode) to the host using the event

WMI_REGDOMAIN_EVENTID. The parameter in **WMI_REG_DOMAIN_EVENT** contains the encoded regulatory code. See [Table 9](#).

Table 9. regCode Interpretation

31	30	29:12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	X	Regulatory domain code (see Table 3)											
0	1	X	Worldwide roaming code											
1	X	X	Country code (see Table 6)											

While scanning, the station (STA) can see various access point (APs). The AP's beacon may contain the country IE. The STA keeps a note of all country IEs and selects the country based on maximum cumulative signal strength of a country-specific APs. If the current EEPROM regCode is a WWR code, the STA switches to the new country channel properties. The Tx power upper limit for a channel in a regulatory code is specified in regulatory database. If the AP has country IE info with max power, then STA applies the lower of the two values: one in the regulatory database and one in the AP country IE info.

The regulatory database, ROMed in the AR6002, is an encoded representation of this information. Atheros has tools to generate, modify, and apply a new regulatory database in the AR6002. The database can be generated by tools in the directory **host/tools/regDbGen**. Users can modify table info and generate a new database (whose schema is presented in **include/regulatory/reg_dbschema.h**); this schema is common to the generators that encode the data and to the parser in the AR6002 firmware that decodes the data. More information can be found in the *AR6000 Chipset Family Wireless Module Programmer's Guide*, in the **Readme.txt** file, and in header files in the directory **include/regulatory/**.



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