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Sony Mobile Communications, Inc.
4-12-3 Higashi-shinagawa, Shinagawa-ku, Tokyo, 140-0002, Japan

Remarks
This document is managed in Infodoc.

Date: December 14, 2018

PY7-50241M Technical description for FCC

1 Introduction

The scope of this document is to provide an overview and understanding of project PY7-50241M hardware.

2 Simultaneous transmission

PY7-50241M supports the following simultaneous transmissions.

Case	cellular	WLAN/BT Main	Note
1	GSM/GPRS/EDGE	BT/BLE	Support
2		WLAN 2.4G	Support
3		WLAN 5G	Support
4	UMTS/HSPA	BT/BLE	Support
5		WLAN 2.4G	Support
6		WLAN 5G	Support
7	LTE	BT/BLE	Support
8		WLAN 2.4G	Support
9		WLAN 5G	Support

Note: WLAN 2.4/5G and BT/BLE share the same antenna and cannot transmit simultaneously.

3 HW configuration

3.1 platform information

PY7-50241M uses MT6762V/WA and configuration is as below list

Feature	
process	Octa-core ARM Cortex-A53 MPCore™, up to 2.0GHz
package	TYPE: VFBGA 11.4mm*11mm Height:Max. 0.9mm 558 balls, ball pitch:0.4mm
processor	MT6762V/WA
MODEM	GSM/GPRS/EDGE Rel9 HSDPA 42.2Mbps/HSUPA 11.2Mbps, UMTS, LTE Rel10 Cat6 DL FDD
Modem Enhancements	NA
RF & PMC chipset	RF chipset: MT6177 PMC chipset: MT6357CRV
LCD Support	HD+(20:9)(1600*720)
Bluetooth	MT6631: 2.1,3.0,4.1,5.0
WLAN	MT6631: 802.11 a/b/g/n
NFC	PN553
Video Decode	HEVC decoder 1080p@30fps/40Mbps H.264 decoder: Baseline 1080p@30fps/40Mbps H.264 decoder: Main/high profile 1080p@30fps/40Mbps Sorenson H.263/H.263 decoder: 1080p@30fps/40Mbps MPEG-4 SP/ASP decoder: 1080p@30fps/40Mbps DIVX4/DIVX5/DIVX6/DIVX HD/XVID decoder: 1080p@30fps/40Mbps MPEG-2 decoder: 1080p@30fps/40Mbps
Video Encode	MPEG-4 encoder: Simple profile D1@30fps H.263 encoder: Simple profile D1@30fps H.264 encoder: High profile1080p@30fps
Qcamera	Integrated image signal processor supports 21MP @30fps

Audio	Audio content sampling rates supported:8kHz to 192kHz Audio content sample formats supported:8-bit/16-bit/24-bit,Mono/Stereo Interfaces supported:I2S,PCM External CODEC I2S interface supports:8-bit/16-bit/24-bit,Mono/Stereo,8kHz to 192kHz. 4-band IIR compensation filter to enhance loudspeaker responses Proprietary audio post-processingtcehnologies:BesLoufness(MB-DRC),BesSurround,Android built-in post processing Audio encoding: AMR-NB,AMR-WB,AAC,OGG,ADPCM Audio decoding:WAV,MP3,MP2,AAC,AMR-NB,AMR-WB,MIDI,Vorbis,APE,ACC-plus v1,AAC-plusv2,FLAC,WMA,ADPCM
Graphics	OpenGL ES 3.1/3.0/2.0/1.1 3D graphic accelerator capable of processing 140M tri/sec and 1400M pixel/sec @520MHz OpenGL ES 1.1 full profile
GPS	MT6631: A-GPS/Glonass/Beifou/Galileo
Security and DRM	Widevine L3/ DRM Level 1

3.2 Variant information and major chipset

FCC ID	PY7-50241M
BB Asic	MT6762V/WA
eMCP	KMGD6001BM-B421TSM H9TQ27ADFTMCUR-KUM Memory Size: 3GB RAM/32GB eMMC
RF Asic	MT6177
Wifi /BT Asic	MT6631
Felica/ NFC Asic	PN553
WLAN	MT6631
Bluetooth	MT6631

Category	GSM	850/900 Class4
		1800/1900 Class1
		GPRS/EGPRS Class12
	DTM	No
	HSUPA	Cat7
	HSDPA	Cat24
	LTE	Cat6
ANT	Main	Loop
	Sub	LMB: Loop HB: Monopole
	HoRxD	No
	4x4 MIMO	No
	Wifi/BT	IPA
	NFC	Loop
	GPS	IPA
Dual SIM		DS
Digital TV		NA

3.2.1 Band capability

LTE **Australia/NZ/Malaysia**

	1	2	3	4	5	5*	7	7	8	12	13	17	20	28	38	39	40	40	41M
PY7-50241M	X	X	X		X	X	X	X	X				X		X				

GSM

	850	900	1800	1900
PY7-50241M	X	X	X	X

UMTS **Australia**

1	2	4	5	5*	8
X	X		X	X	X

FCC

CE

FCC ID	PY7-50241M
GSM	850/1900
UMTS	2/5
LTE	2/5/7
LTE CA band(DL)	7C , 7A-7A

Non-CA LTE Bandwidth information

Band	Support Bandwidth					
	1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz
2	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	-	-
7	-	-	Yes	Yes	Yes	Yes

3.2.2 Carrier aggregation support bands

E-UTRA CA configuration/ Bandwidth combination set for inter-band CA

N/A

E-UTRA CA configuration/ Bandwidth combination set for intra-band CA RF

		E-UTRA CA configuration / Bandwidth combination set						
E-UTRA CA configuration	Uplink CA configurations (NOTE 3)	Component carriers in order of increasing carrier frequency					Maximum aggregated bandwidth [MHz]	Bandwidth combination set
		Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]		
CA_7C	CA_7C	15	15	-	-	-	40	0
		20	20	-	-	-		
		10	20	-	-	-	40	1
		15	15, 20	-	-	-		
		20	10, 15, 20	-	-	-		
		15	10, 15	-	-	-	40	2
		20	15, 20	-	-	-		

E-UTRA CA configurations and bandwidth combination sets defined for noncontiguous

intra-band CA

		E-UTRA CA configuration / Bandwidth combination set						
		Component carriers in order of increasing carrier frequency						
E-UTRACA configuration	Uplink CA configurations (NOTE 1)	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Maximum aggregated bandwidth [MHz]	Bandwidth combination set
CA_7A-7A	-	5	15	-			40	0
		10	10, 15	-				
		15	15, 20	-				
		20	20	-				
		5, 10, 15, 20	5, 10, 15, 20	-	-	-	40	1
		5, 10, 15, 20	5, 10	-	-	-	30	2
		10, 15, 20	10, 15, 20	-	-	-	40	3

4 RF

4.1 RF configuration

There are two main antennas at bottom of lower half. One is used for high band the other is used for low-middle band. The two antennas used for main transmission and reception, a diversity antenna is used for RX, located at the upper right corner.

The Front End block connects the proper block in the radio system to the antenna. The Front End has two inputs for EDGE/GSM/GPRS, one for low band(850/900Mhz) and one for high band(1800/1900Mhz). The EDGE/GSM/GPRS power amplifier output is connected to the antenna through a switch. In receive mode, the EDGE/GSM/GPRS signal form the antenna passes through the switch to corresponding duplexer.

In GSM/GPRS/EDGE systems, transmit and receive operations are divided in time and the switch connects the proper block in accordance with the mode of operation (that is transmit or receive, one at a time).

In WCDMA/LTE the transmit outputs the WCDMA transceiver are filtered by a SAW filter that cleans up the spectrum. The SAW filter output is connected to the power amplifier, one for each band. This signal is used to control the transmitter output power. The transmit signal passes through a duplexer. The duplexer output is selected by the switch in the Front End for connection to the antenna. In WCDMA receive mode the signal from the antenna is switched by the Front End to the correct duplexer. The output from the duplexer is connected to the LNA input in the WCDMA receiver.

4.2 Antenna combination:

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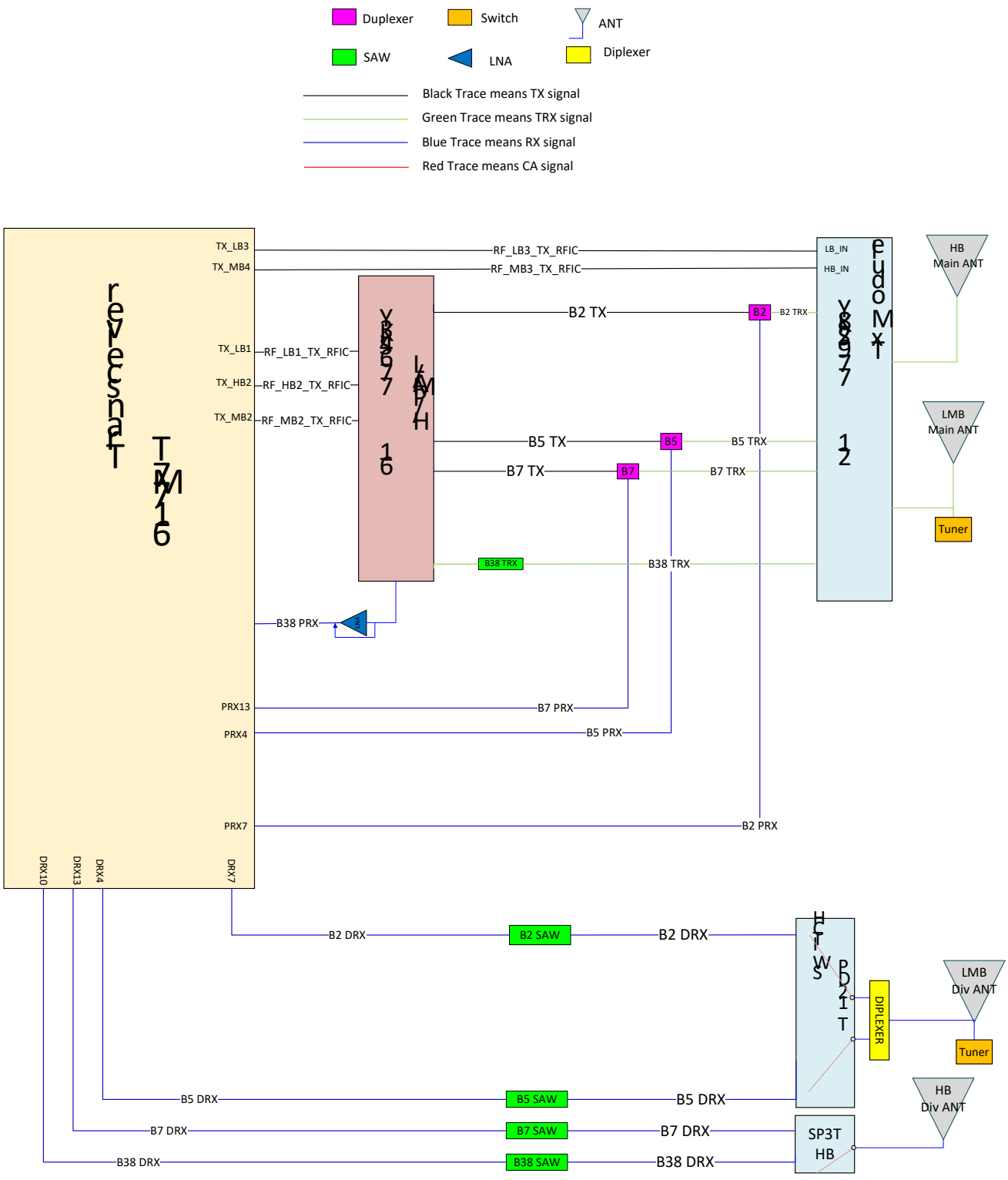
Block	Antenna	Support Bands
LTE	① TX/RX④RX	2/5
	② TX/RX③RX	7
UMTS	① TX/RX④RX	2/5
GSM	①TX/RX ④RX	850/1900
GPS	⑤RX	1575MHz
WLAN/BT	⑤TX/RX	a/b/g/n(2.4G+5G)
NFC	⑥TX/RX	13.56MHz

4.3Cellular block diagram



4.4Dual transfer mode

N/A

4.5 Devices using mobile country code

GSM1900/WCDMA B2/LTE B2/LTE B7 power is controlled by mobile county code. US MCC includes territories, such as Guam, or Puerto Rico, etc., and the default operation mode is for compliant in the US and its territories.

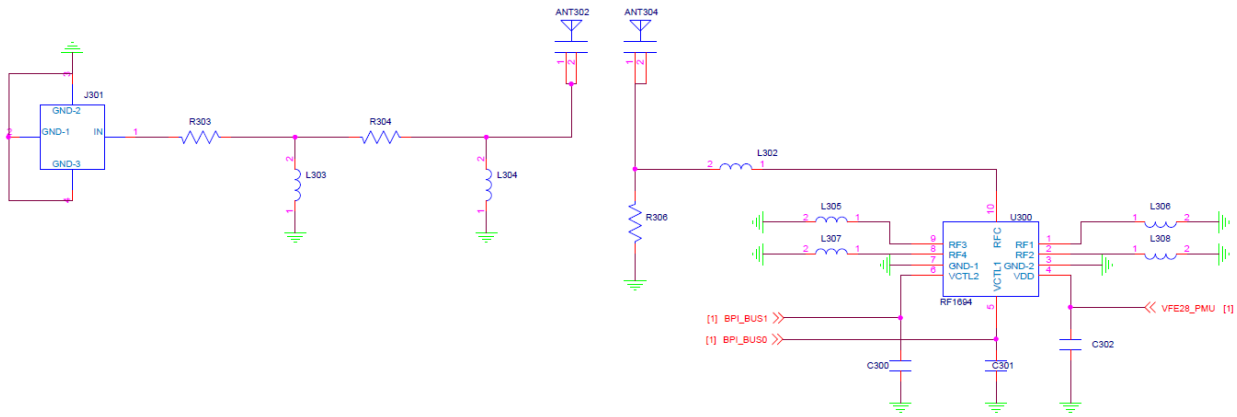
The mechanism meets the requirement from KDB 594280 D01 Software Configuration Control v02r01 to check MCC, because the phone is constantly receiving MCC and the network changes, such as handover to a new cell, loss of signal, etc., the phone will revert to the default mode and follow the decision process once MCC has been decoded.

If a valid code is not received, the device may not be reconfigured, and will search another base station with a valid code. Until a valid code is received, the device may not transmit any control signals or data. All these behaviors come with 3GPP/3GPP2 specification.

4.6 Antenna matching switch circuit

This device do not support antenna switch technology.

Low/Middle band Primary ANT Matching:



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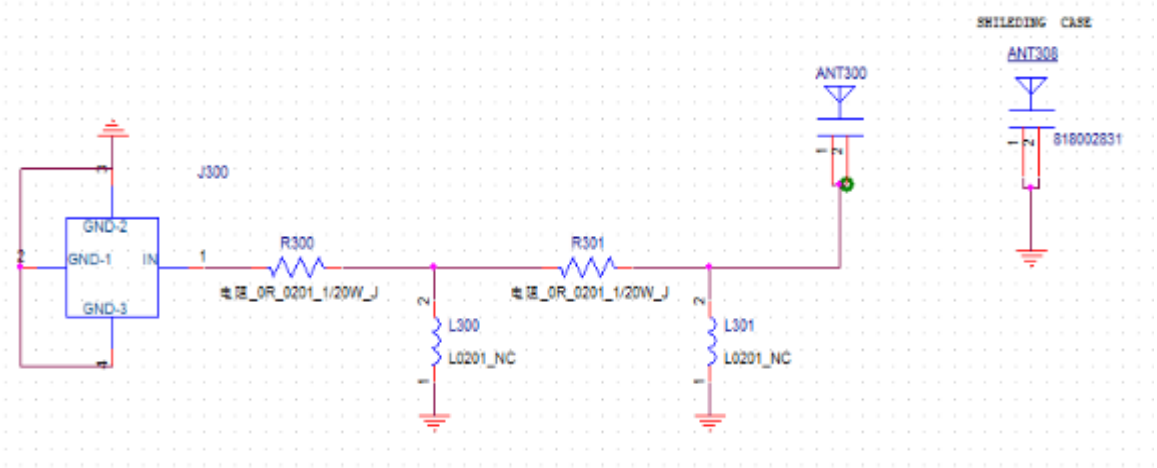
High band Primary ANT Matching:



5. Wi-Fi/BT

5.1 Configuration

The information of WLAN operation and Block diagram for MT6631 as follows. Regarding the power, please refer to each manufacturing tolerance. This device 2.4G WLAN support Hotspot operation and Bluetooth support tethering application.

Band [MHz]	BW [MHz]	DFS/TPC	Channel set
2412.000 - 2462.000	20	n/a	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
5180.000 - 5240.000	20	n/a	36, 40, 44, 48,
	40		38, 46
5260.000 - 5320.000	20	DFS	52, 56, 60, 64,
	40		54, 62
5500.000 - 5640.000	20	DFS	100, 104, 108, 112, 116, 120, 124, 128
	40		102, 110, 118, 126
5660.000 - 5700.000	20	DFS	132, 136, 140
	40		134
5745.000 - 5825.000	20	n/a	149, 153, 157, 161, 165
	40		151, 159

For Industry Canada(IC), 120, 124, 128 / 118, 126 channels are not supported

Channel	**Freq. (MHz)**	**DFS/TPC**	**Scanning**	**802.11 Mode**	**Wi-Fi direct support**
1	2412	-	Active	b/g/n	GC&GO
2	2417	-	Active	b/g/n	GC&GO
3	2422	-	Active	b/g/n	GC&GO
4	2427	-	Active	b/g/n	GC&GO
5	2432	-	Active	b/g/n	GC&GO
6	2437	-	Active	b/g/n	GC&GO
7	2442	-	Active	b/g/n	GC&GO
8	2447	-	Active	b/g/n	GC&GO
9	2452	-	Active	b/g/n	GC&GO
10	2457	-	Active	b/g/n	GC&GO
11	2462	-	Active	b/g/n	GC&GO

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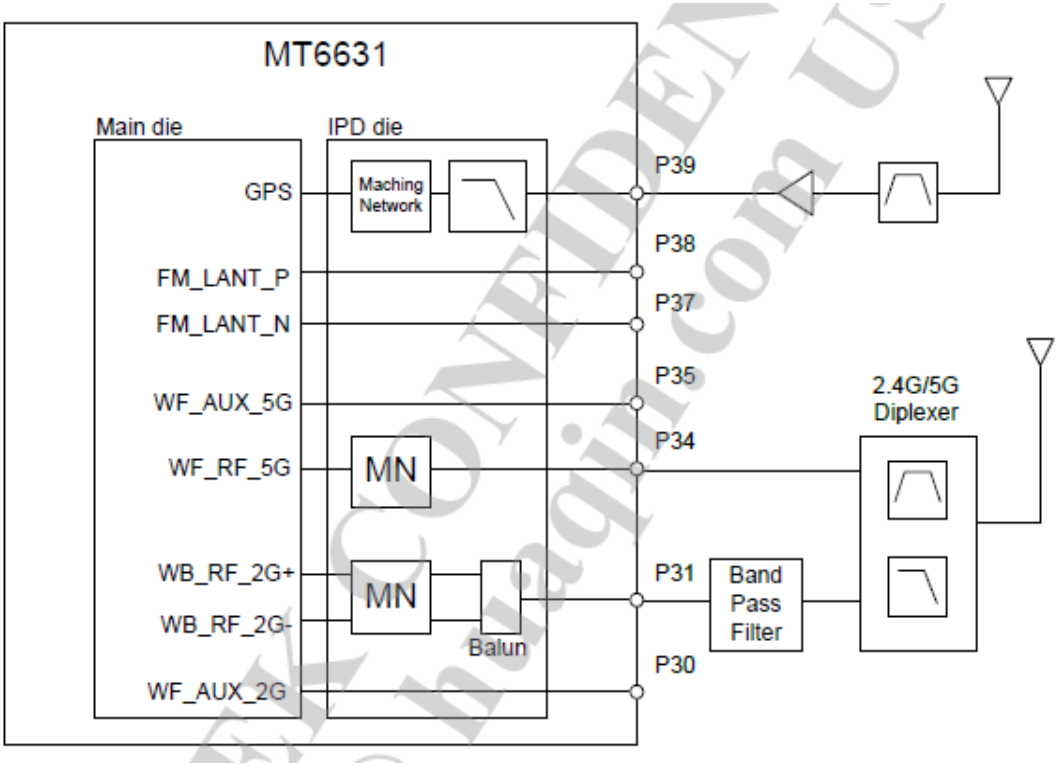
Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	DFS/TPC	Scanning	802.11 Mode	Wi-Fi direct support
UNII 1									
20MHz BW		**40MHz BW**		**80MHz BW**					
36	5180	38	5190	-	-	n/a	Active	a/n	GC&GO
40	5200					n/a	Active		GC&GO
44	5220	46	5230			n/a	Active		GC&GO
48	5240					n/a	Active		GC&GO
UNII 2-A									
20MHz BW		**40MHz BW**		**80MHz BW**					
52	5260	54	5270	-	-	DFS	Active	a/n	GC
56	5280					DFS	Active		GC
60	5300	62	5310			DFS	Active		GC
64	5320					DFS	Active		GC
UNII 2-C									
20MHz BW		**40MHz BW**		**80MHz BW**					
100	5500	102	5510	-	-	DFS	Active	a/n	GC
104	5520					DFS	Active		GC
108	5540	110	5550			DFS	Active		GC
112	5560					DFS	Active		GC
116	5580	118	5590	-	-	DFS	Active		GC
120	5600					DFS	Active		GC
124	5620	126	5630			DFS	Active		GC
128	5640					DFS	Active		GC
132	5660	134	5670	-	-	DFS	Active		GC
136	5680					DFS	Active		GC
140	5700					DFS	Active		GC
UNII 3									
20MHz BW		**40MHz BW**		**80MHz BW**					
149	5745	151	5755	-	-	n/a	Active	a/n	GC&GO
153	5765					n/a	Active		GC&GO
157	5785	159	5795			n/a	Active		GC&GO
161	5805					n/a	Active		GC&GO
165	5825			-		n/a	Active		GC&GO

MT6631 WIFI/BT is a high performance and highly-integrated dual-band RF transceiver fully compliant with IEEE 802.11 a/b/g/n and Bluetooth v2.1+EDR/v3.0+HS/v4.1+HS/v5.0 LE standards.

A novel RF front-end topology is implemented to achieve maximum hardware sharing between 2.4GHz/5GHz WIFI and Bluetooth with integrated TR-switches.MT6631 also features a self-calibration scheme to compensate the process and temperature variation to maintain high performance. The calibration is performed automatically right after the system boot-up.

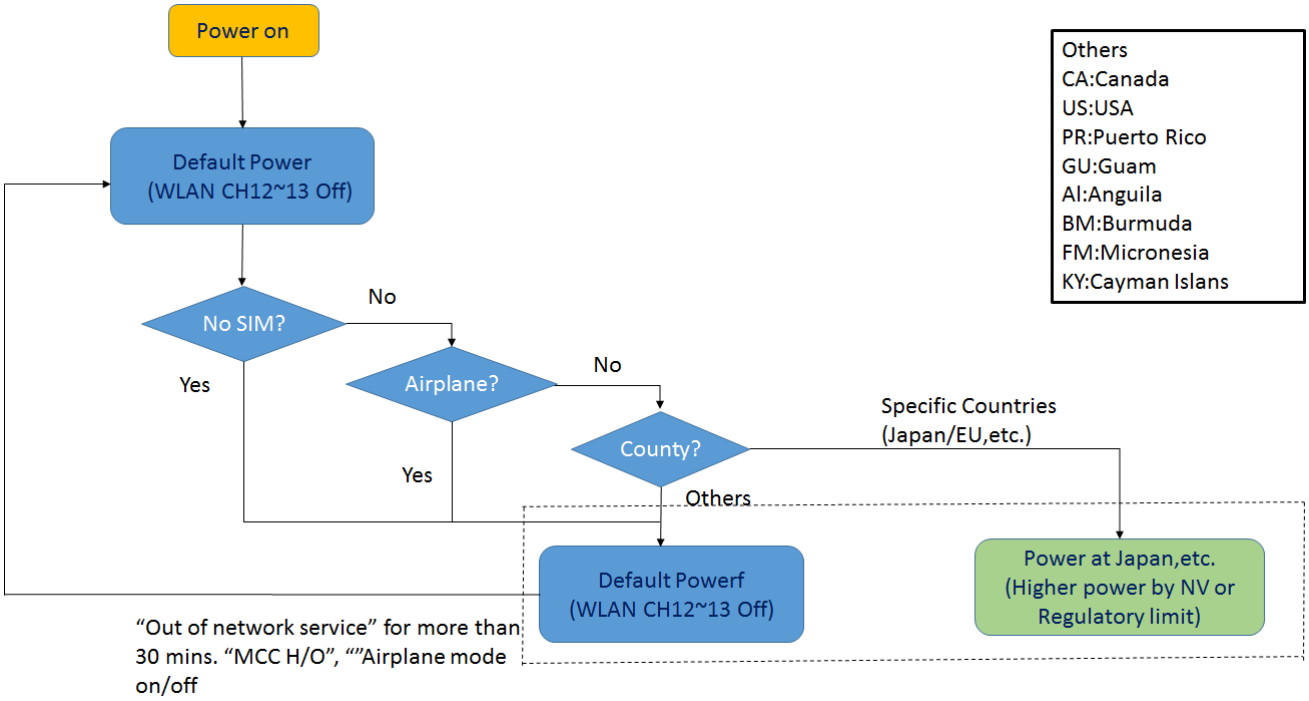


5.2 Power control by mobile country code

WLAN Power controlled by Mobile Country Code flow

The mobile phone, by default, operates in a mode that is compliant with the U.S. requirements, and regularly rechecks the geo-location information at least once hour when the phone is switched on and connections are established or changed.

If receiving MCC does not match with Japan or EU or others MCC which stores in the phone firmware, then the power will be set to the default mode which is complied with FCC regulation. If the MCC received is other countries, WIFI channel and power settings follows its mapping regulatory domain.



5.3 For geolocation mechanism test validation

Set up phone with Wi-Fi link in channel 12 and 13 and way to measure power (coupler or antenna).

Step1: Start with no cellular connection and then check power

Step2: Set county code to US

Measure power (should be off – no power)

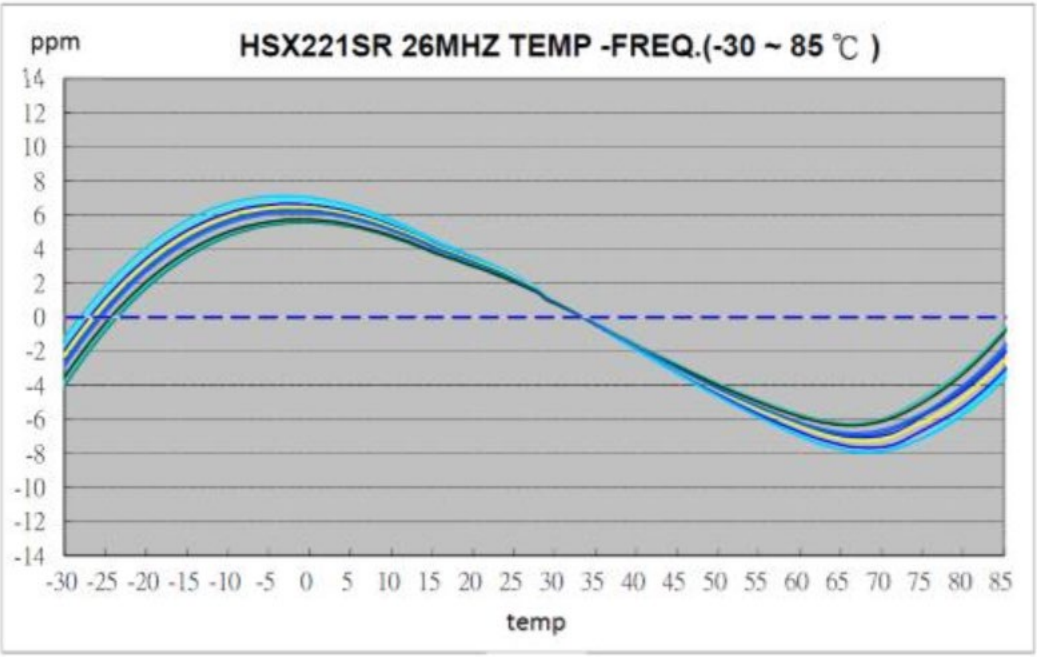
Step3: Set cellular connection with EU or Japan county code.

Measure power (should be high)

Step4: Set county code to other. (Ex: PR-Puerto Rico)

Measure power (should be off – no power)

5.4 WLAN frequency tolerance/stability



5.5 Bluetooth

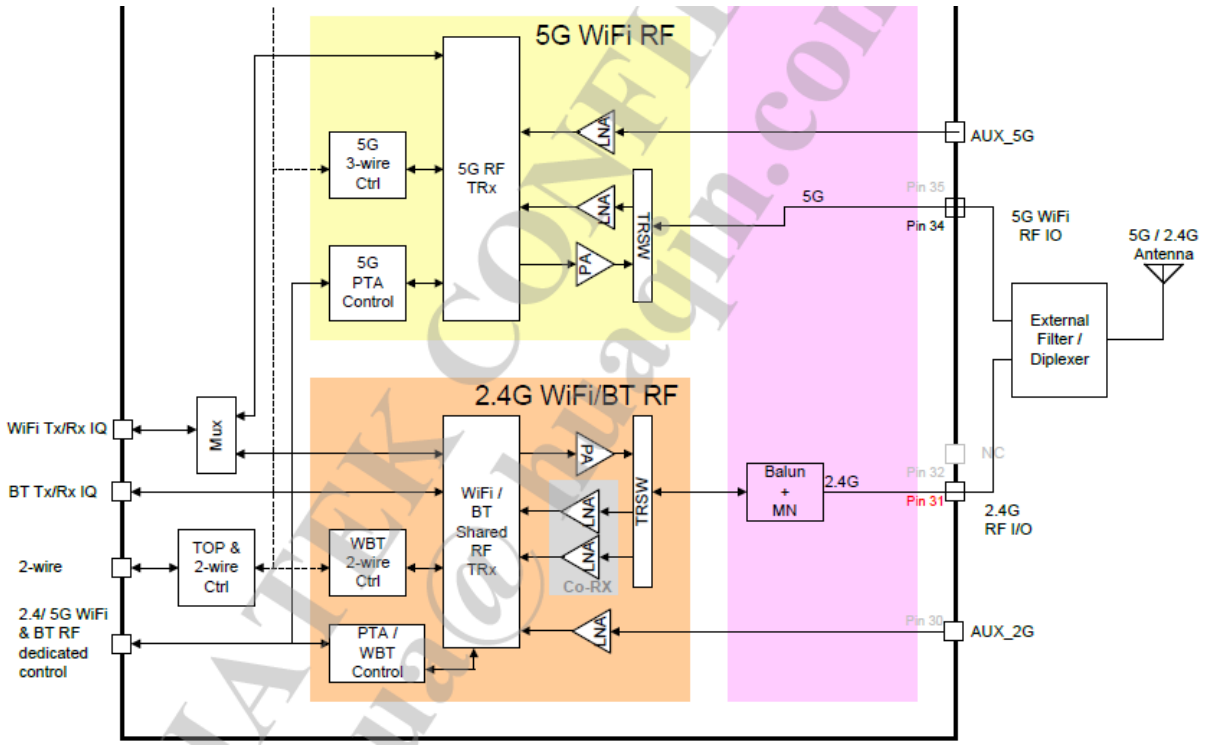
1、 Bluetooth specification v2.1+EDR, 3.0+HS、v4.1+HS and v5.0 LE compliant

2、Integrated PA with 8dBm (class 1) transmit power

3、Typical Rx sensitivity with companion chip modem: GFSK -94dBm, DQPSK -93dBm, 8-DPSK-87.5dBm

4、Low-power scan function to reduce power consumption in scan modes

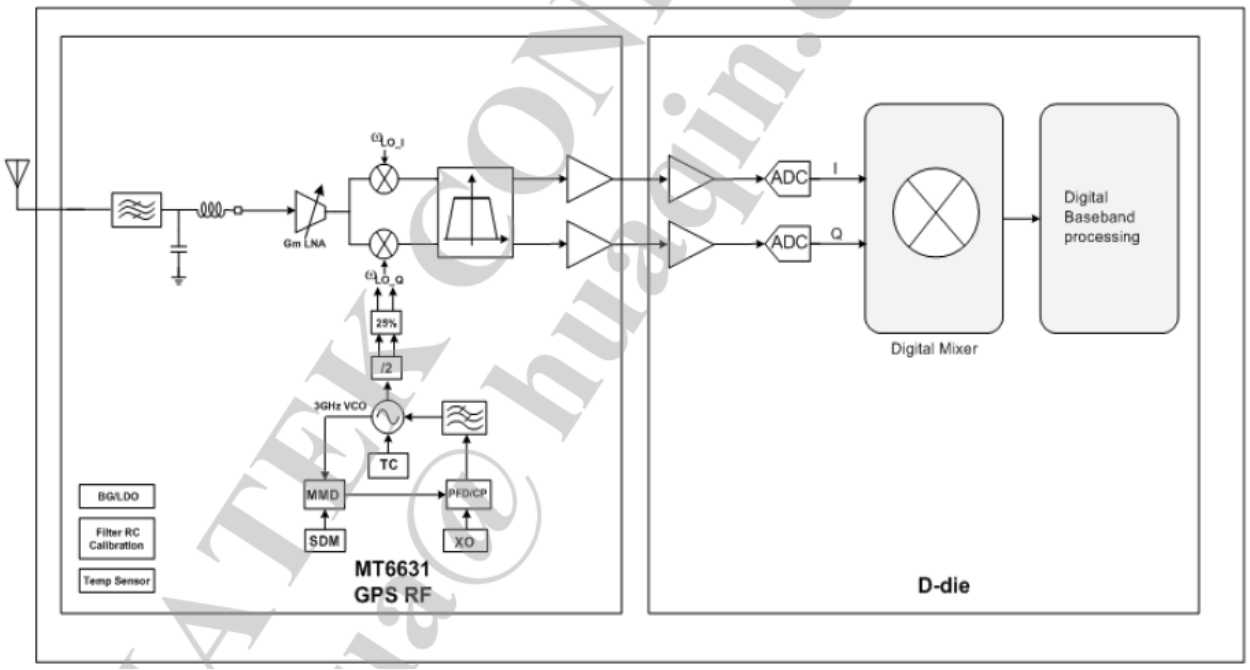
5.6 WLAN/BT block diagram



6 GNSS

The GPS RF consists of a low-IF receiver and a fractional-N frequency synthesizer. All RF/analog blocks operate under a 1.3V supply voltage. The radio architecture allows for configurations of GPS-only, Galileo-only, GPS/Galileo, GPS/Glonass, Galileo/Glonass, GPS/Beidou, Galileo/Beidou, GPS/Glonass/Beidou, and GPS/Glonass/Galileo modes, which are set by LO and baseband filter configurations.

Simultaneous reception of multiple satellite signals, i.e. GPS, Galileo, Glonass, and Beidou, allows a shorter time to first lock and higher location accuracy. Since different satellite signals are uncorrelated and are buried well below the noise floor, they can be amplified and down-converted by the same RF/analog chain as an image of one another and separated in the digital domain by the corresponding correlator and signal processor. In the case of GPS-only reception, LO (fLO_GPS) is set to 1571.328MHz resulting in an IF frequency of 4.092MHz, with the baseband filter configured as complex BPF. On the other hand, for simultaneous GPS/Glonass reception, LO (fLO_GG) is set to 1588.608MHz. As a result, the GPS signal becomes the image of the Glonass satellite signal with an IF frequency of 13.1MHz, and the baseband filter in this case is configured as real LPF. The Glonass signal is separated from the GPS image signal in digital baseband. Similarly, with LO (fLO_GB) set to 1568.256MHz, the resulting IF frequency is about 7.1MHz for simultaneous GPS/Beidou reception. Finally for the GPS/Glonass/Beidou mode, LO (fLO_G3B) is set to 1582.464MHz which will cause the IF frequency to fall on -7MHz, 19.2MHz and -21.36MHz respectively. Only one synthesizer is required to support this architecture.



7 NFC

PN553 is an NFC controller designed for integration in mobile devices and devices

compliant with NFC standards (NFC Forum, NCI, EMVCo, ETSISCP).

PN553 is designed based on learnings from previous NXP NFC device generation to ease the integration of NFC technology in mobile devices by providing:

A low PCB footprint and a reduced external Bill of Material

An optimized architecture for low-power consumption in different modes (Standby.

low-power polling loop)

A highly efficient integrated power management unit allowing direct supply from an

extended battery supply range (2.8 V to 5.5 V). Moreover, this power management

provides full flexibility to support the different configurations in the mobile devices

(screen ON, screen OFF, phone OFF)

Support of an external DC-to-DC like NXP PCA941xA (with x=0,1 and 2),to provide more output power.

2 SWP pads for UICC connections with dedicated power supply lines

PN553 embeds a new generation RF contactless front-end supporting various

transmission modes according to NFCIP-1 and NFCIP-2,ISO/IEC14443,ISOMEC 15693,

MIFARE and FeliCa specifications. This new contactless front-end design brings a major

performance step-up with on one hand a higher sensitivity and on the other hand the

capability to work in active load modulation communication enabling the support of small antenna form factor. It also allows to provide a higher output power by supplying the

transmitter output stage from 2.7 V to 5.25V.

Enhanced Dynamic LMA (DLMA)to optimize and to enhance load modulation

amplitude depending on external field strength. It allows higher range communication distance in card mode.

Independent LMA phase adjustment by step of 5 for type A, B and F

Dynamic Power control which allows to make use of the maximum power in reader

mode without exceeding the maximum power allowed by the standard in 0 distance.

Improved card mode receiver sensitivity down to 20 mV(p-p)

Support of single ended receiver

1.3 W output transmitter power

PN553 provides an architecture supporting several secure element interfaces (2 SWP)allowing a full flexibility for the support of SWP-based secure elements. It enables

dynamic multiple secure element management (AID routing table).

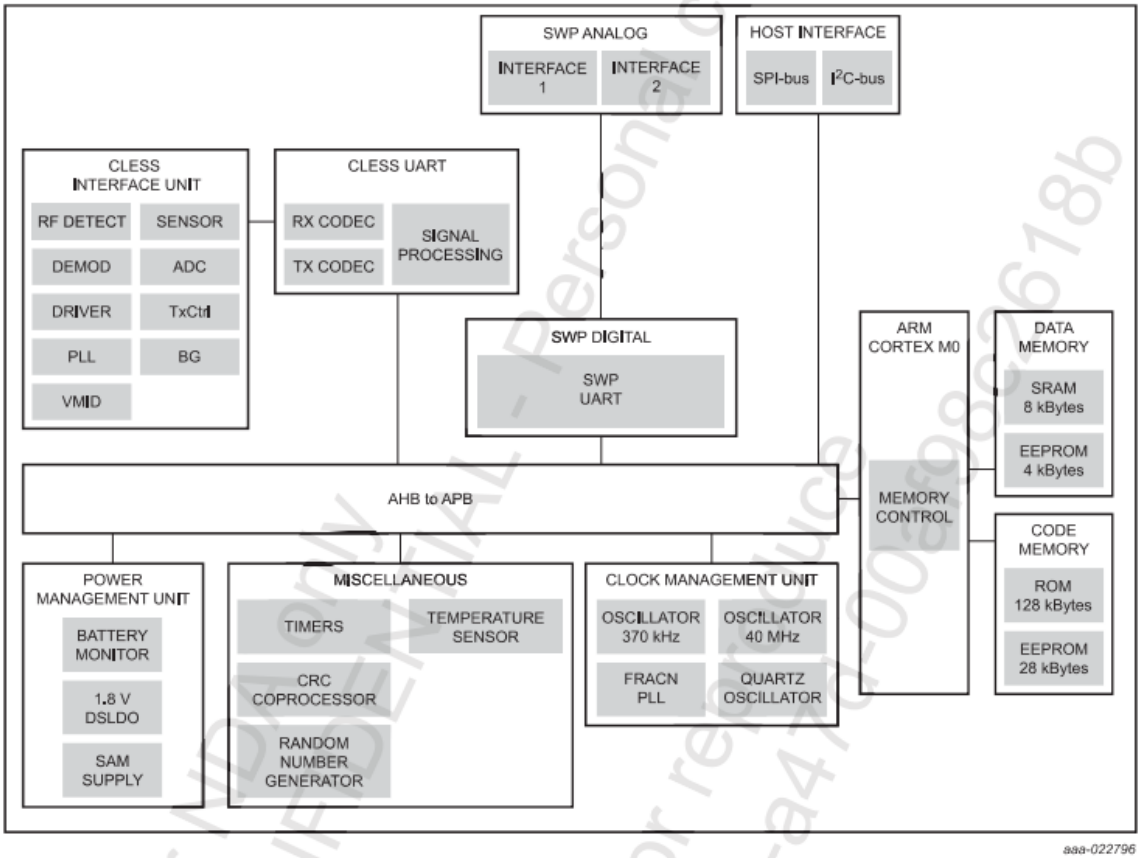


Fig 3. PN553 block diagram

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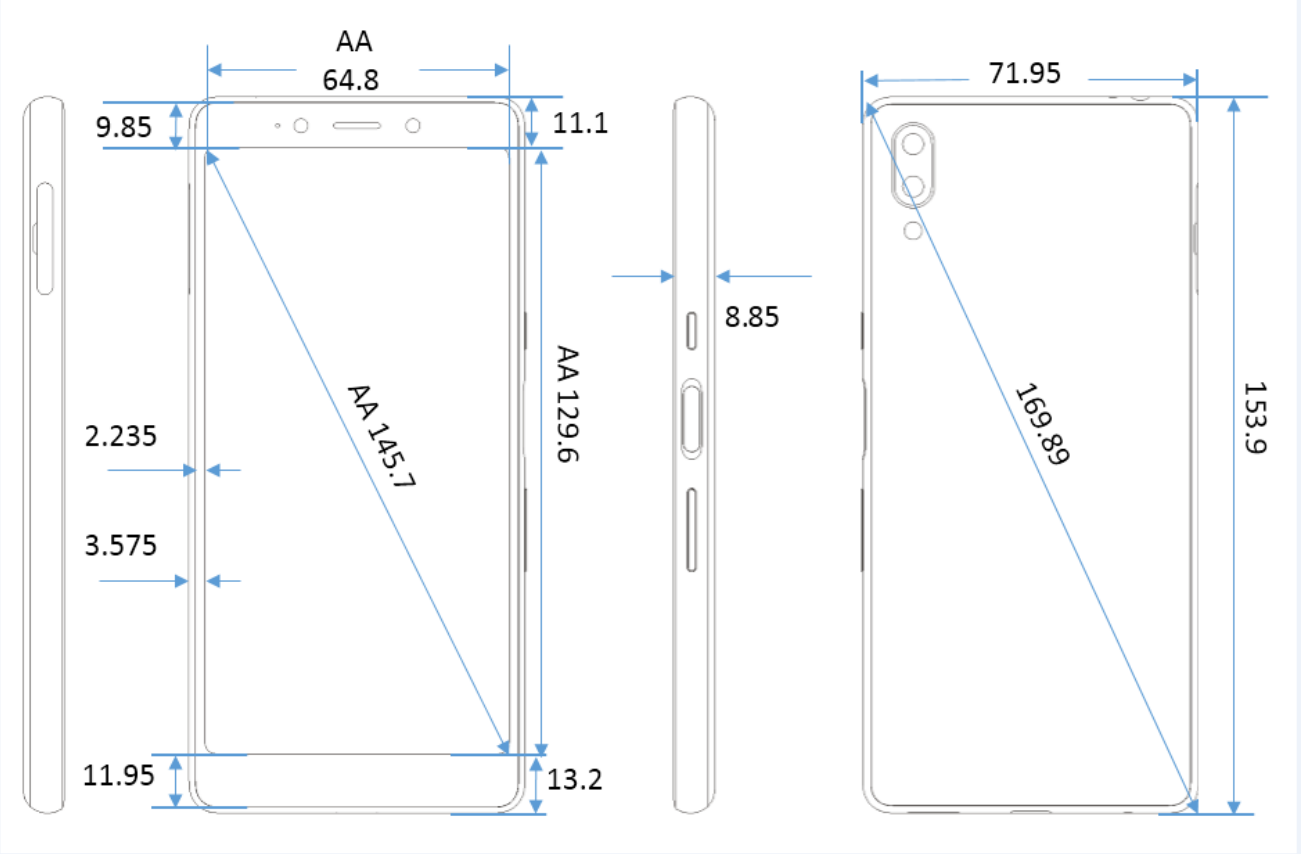
8 Size of the Phone



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9 Technical description for WLAN Security

The information within this section of the /12Description is to show compliance against the Software Security Requirements laid out within KDB 594280 D02 U-NII Security.

The information below describes how we maintain the overall security measures and systems so that only:

1. Authenticated software is loaded and operating on the device

2. The device is not easily modified to operate with RF parameters outside of the authorization

General Description	
1. Describe how any software/firmware updates for elements than can affect the device's RF parameters will be obtained, downloaded, validated and installed. For software that is accessed through manufacturer's website or device's management system, describe the different levels of security as appropriate.	There is no downloadable software provided by the manufacturer that can modify critical radio transmitter parameters. All critical parameters are programmed in OTP memory at the factory and cannot be modified or overridden by third parties.
2. Describe the RF parameters that are modified by any software/firmware without any hardware changes. Are these parameters in some way limited, such that any other software/firmware changes will not allow the device to exceed the authorized RF characteristics?	There are no RF parameters that can be modified. All RF parameters are programmed in OTP memory at the factory and cannot be modified or overridden by third parties
3. Describe in detail the authentication protocols that are in place to ensure that the source of the RF-related software/firmware is valid. Describe in detail how the RF-related software is protected against modification	The firmware is programmed at the factory and cannot be modified by third parties.
4. Describe in detail any encryption methods used to support the used of legitimate RF-related software/firmware.	The firmware is programmed at the factory and cannot be modified by third parties therefore no encryption is necessary.
5. For a device that can be configured as a master and client (with active or passive scanning), explain how the device ensures compliance for each mode? In particular if the device acts as master in some band of operation and client in another; how is compliance ensured in each band of operation?	It is a client module only.

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3rd Party Access Control	
1. Explain if any third parties have the capability to operate a U.S.-sold device on any other regulatory domain, frequencies, or in any manner that may allow the device to operate in violation of the device's authorization if activated in the U.S.	Third parties do not the capability to operate in any manner that is violation of the certification in the U.S.
2. Describe, if the device permits third-party software or firmware installation, what mechanisms are provided by the manufacturer to permit integration of such functions while ensuring that the RF parameters of the device cannot be operated outside its authorization for operation in the U.S. In the description include what control and/or agreements are in place with providers of third-party functionality to ensure the devices' underlying RF parameters are unchanged and how the manufacturer verifies the functionality.	RF parameters are programmed into OTP memory at the factory and cannot be reprogrammed or re-flashed by the third parties.
3. For Certified Transmitter modular devices, describe how the module grantee ensures that hosts manufactures fully comply with these software security requirements for U-NII devices. If the module is controlled through driver software loaded in the host, describe how the drivers are controlled and managed such that the modular transmitter RF parameters are not modified outside the grant of authorization.	There are no rf parameters that can be modified. All rf parameters are programmed in OTP memory at the factory and cannot be modified or overridden by third parties. The module is not controlled by driver software on the host and cannot override critical rf parameters stored in module OTP memory.

SOFTWARE CONFIGURATION DESCRIPTION GUIDE – USER CONFIGURATION GUIDE[1]	
1. Describe the user configurations permitted through the UI. If different levels of access are permitted for professional installers, system integrators or end-users, describe the differences.	No UI provided.
a) What parameters are viewable and configurable by different parties?	None

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Remarks

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SOFTWARE CONFIGURATION DESCRIPTION GUIDE – USER CONFIGURATION GUIDE[1]	
b) What parameters are accessible or modifiable by the professional installer or system integrators?	1. The module micro-code reads the parameters from the module OTP memory. These parameters cannot be modified or overridden by sw drivers. 2. Default mode is always FCC compliant. Other country modes cannot be activated without receiving three independent country codes from different APs, otherwise remains in FCC default mode (always FCC compliant)
1) Are the parameters in some way limited, so that the installers will not enter parameters that exceed those authorized?	
2) What controls exist that the user cannot operate the device outside its authorization in the U.S.?	
c) What parameters are accessible or modifiable to by the end-user?	1. The module micro-code reads the parameters from the module OTP memory. These parameters cannot be modified or overridden by sw drivers. 2. Default mode is always FCC compliant. Other country modes cannot be activated without receiving three independent country codes from different APs, otherwise remains in FCC default mode (always FCC compliant)
1) Are the parameters in some way limited, so that the user or installers will not enter parameters that exceed those authorized?	
2) What controls exist so that the user cannot operate the device outside its authorization in the U.S.?	
d) Is the country code factory set? Can it be changed in the UI?	Default country code is set in the factory and no UI is provided for modification. Programmed for default mode which is always FCC compliant. Always set for default for all start-ups, resets, timeouts or other host or network events.
1) If it can be changed, what controls exist to ensure that the device can only operate within its authorization in the U.S.?	
e) What are the default parameters when the device is restarted?	Always FCC compliant
2. Can the radio be configured in bridge or mesh mode? If yes, an attestation may be required. Further information is available in KDB Publication 905462 D02.	No
3. For a device that can be configured as a master and client (with active or passive scanning), if this is user configurable, describe what controls exist, within the UI, to ensure compliance for each mode. If the device acts as a master in some bands and client in others, how is this configured to ensure compliance?	This is a client device.
4. For a device that can be configured as different types of access points, such as point-to-point or point-to-multipoint, and use different types of antennas, describe what controls exist to ensure compliance with applicable limits and the proper antenna is used for each mode of operation. (See Section 15.407(a))	This device is not an access point.