MT7986 Power Consumption and Thermal Report v1.3

01/21/2022

ICB_RSD_SA3

Jimmy Wu/Arvin Wang

Document History

Version	Date	Description	Editor
1.0	2021.08.26	First formal release	Arvin Wang
1.1	2021.11.02	Add MT7986B AX6000 ePA	Rey/Jimmy/Arvin Wang
1.2	2021.11.26	a. MT7986A power consumption b. AX4200 power consumption c. Chip Part number update	Jimmy Wu/Arvin Wang
1.3	2022.01.21	a. A-die high-rate power consumption b. AX4200 iPA T-put power consumption	Jimmy Wu/Arvin Wang

Contents

D-die (MT7986) Package Configurations

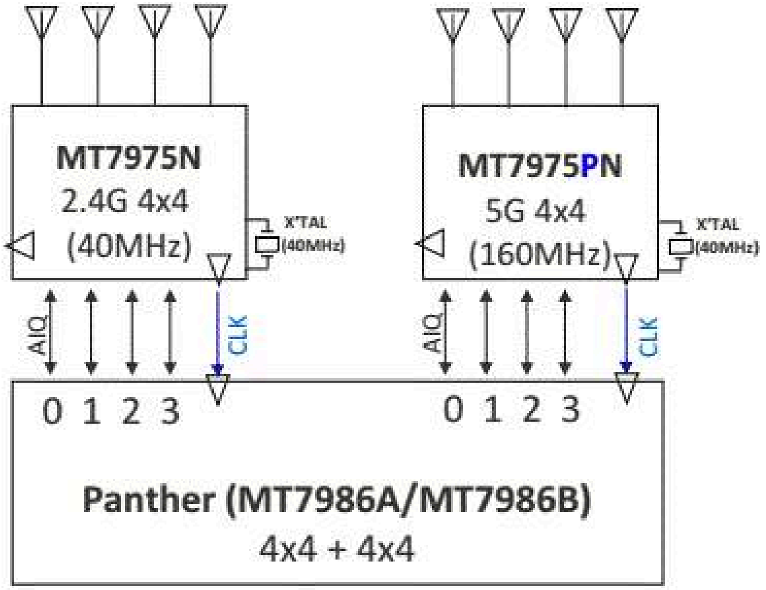
Panther	MT7986A	MT7986B	MT7986C	Note
Package configuration	(Wi-Fi 4+4) AX6000 Support AX4200	(Wi-Fi 4+4) AX6000	(Wi-Fi 2+3) AX4200	
PCB	4 Layer	4 Layer	4 Layer	
RF	2 A-die	2 A-die	1 A-die	
CPU	CA53x4@ 2 GHz_1.023V CA53x4@ 1.6GHz_0.85V	CA53x4@ 1.6GHz_0.85V	CA53x4@ 1.6GHz_0.85V	
UART	Fx2, Lx1 (IDC, PTA share)	SPI share	SPI share	KGD: SPI share
I2C (I3C)	x1	SPI share	SPI share	KGD: SPI share
EMMC	V5.1	V4.5	V4.5	KGD: SPI share
SPI NOR/ NAND / SPI	x3	x3	x3	KGD: UART/ I2C/eMMC share
PCM	x1	NA	NA	
2.5G HSGMII	x2	x2	x2	
2L_ PCIe2.0	X1	NA	NA	
USB3.0	x1	x1	x1	
USB2.0	x1	NA	NA	
DRAM	DDR3-2133/ DDR4-3200 16bit	KGD DDR3-2133-512/256MB	KGD DDR3-2133-512/256MB	
Wi-Fi AIQ	4x4+4x4	4x4+4x4	2x2+3x3	

RF Configurations

SKUs	AX6000 (4x4+4x4)		AX4200 (2x2+3x3)	
	iPAiLNA	ePAeLNA	iPAiLNA	ePAeLNA
D-die(Panther)	MT7986A/MT7986B		MT7986A/C	
A-die1(2G)	MT7975N	MT7976GN	MT7976CN	MT7976DAN
A-die2(5G)	MT7975PN	MT7976AN		

Note1: Both 2G and 5G should be iPAiLNA or ePAeLNA. Didn't support 2G(i)+5G(e) or 2G(e)+5(i).
Note2: MT7976 support multi-rail PA voltage. 3.3V for iPA and 1.8V for ePA.
Note3: MT7976A and MT7976DA support 5G and 6G band.
Note4: A-die, N= package type， N= QFN

AX6000 (2i+5i) (4x4+ 4x4) Configurations

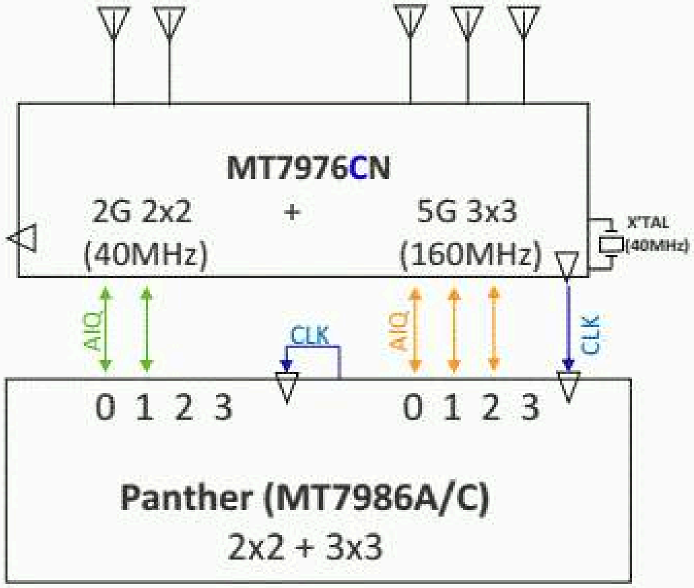


MT7975N
2.4G 4x4
(40MHz)

MT7975PN
5G 4x4
(160MHz)

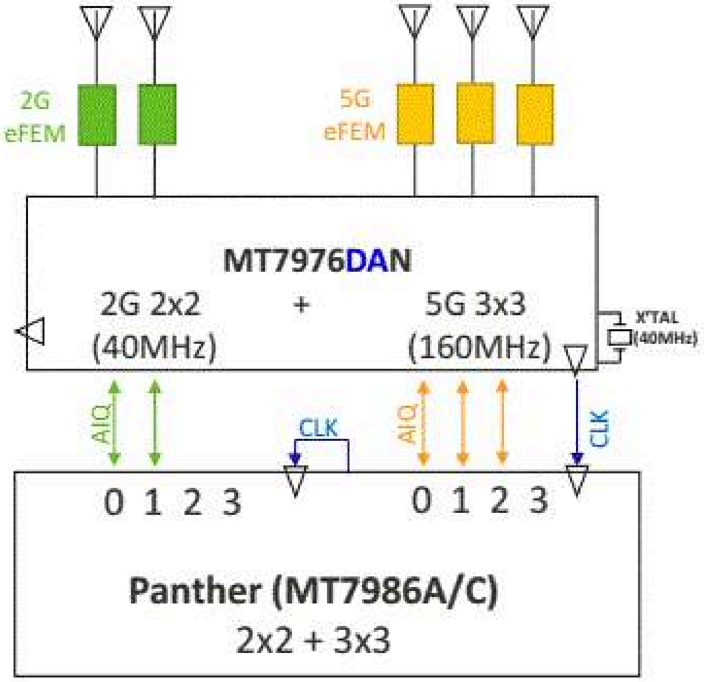
Panther (MT7986A/MT7986B)
4x4 + 4x4

AX4200 (2i+5i) (2x2+ 3x3) Configurations



*PCB Connection:
B16: AFE1_XIN_WBG
A16: AFE0_XIN_WBG

AX4200 (2e+5e) (2x2+ 3x3) Configurations



2G
eFEM

5G
eFEM

MT7976DAN

2G 2x2 + 5G 3x3
(40MHz) (160MHz)

X'TAL
(40MHz)

AIQ

CLK

AIQ

CLK

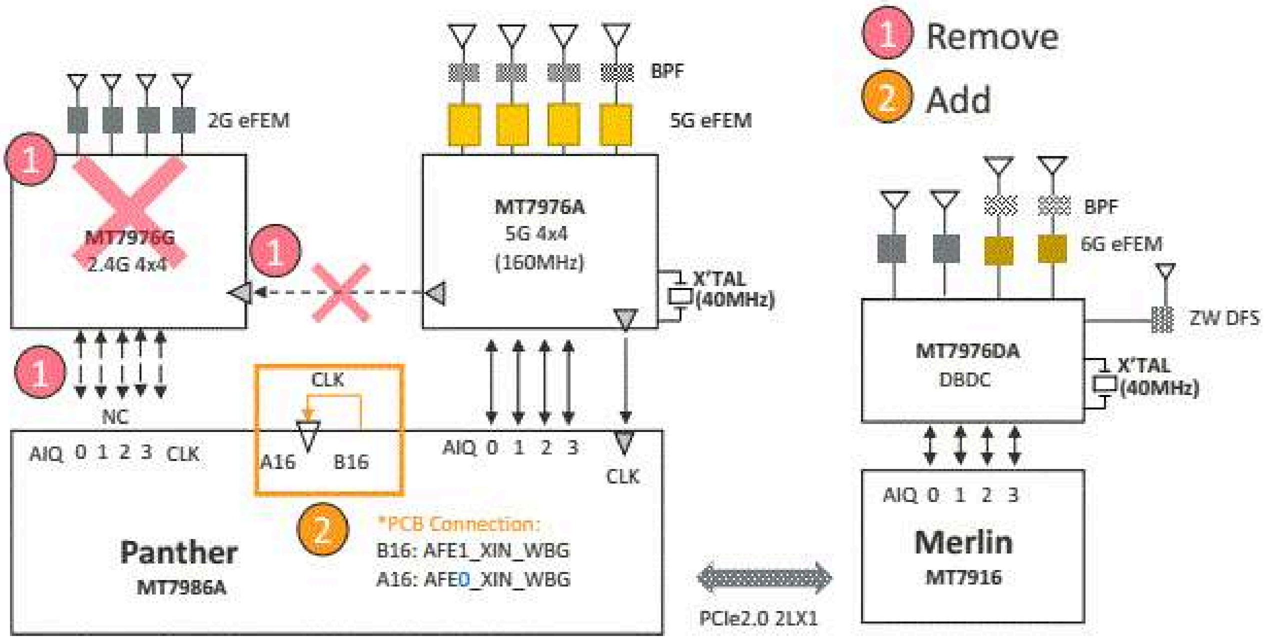
0 1 2 3

0 1 2 3

Panther (MT7986A/C)
2x2 + 3x3

*PCB Connection:
B16: AFE1_XIN_WBG
A16: AFE0_XIN_WBG

AX7800 Panther + Merlin Config.

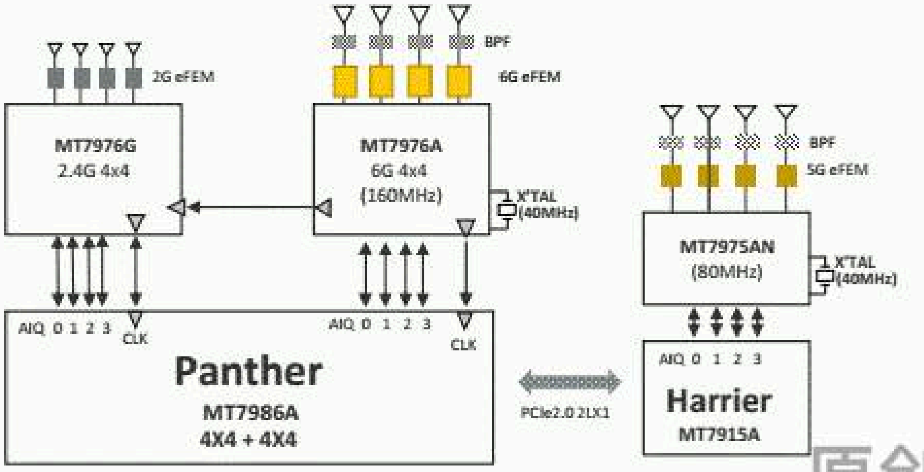


① Remove

② Add

*PCB Connection:
B16: AFE1_XIN_WBG
A16: AFE0_XIN_WBG

AX8400 Panther + Harrier Config.



Contents

MT7986 Thermal Characteristics

MT7986A modeling

Thermal characteristics when stationary, without an external heat sink in an air-conditioned environment:
Thermal Resistance θ JA (°C/W) for JEDEC 4L system PCB ………………. 10.6 ˚C /W
Thermal Resistance θ JC (°C/W) for JEDEC system PCB …………………. 3.4 ˚C /W
Thermal Resistance θ JB (°C/W) for JEDEC system PCB …………………. 4.57 ˚C /W
Thermal Characterization parameter ΨJt (°C/W) for JEDEC 4L system PCB ………0.45 ˚C /W
NOTE: JEDEC 51-9 system FR4 PCB size: 101.5x114.5mm (4"x4.5")

MT7986B/C modeling

Thermal characteristics when stationary, without an external heat sink in an air-conditioned environment:
Thermal Resistance θ JA (°C/W) for JEDEC 4L system PCB ………………. 14 ˚C /W
Thermal Resistance θ JC (°C/W) for JEDEC system PCB …………………. 5.1 ˚C /W
Thermal Resistance θ JB (°C/W) for JEDEC system PCB …………………. 6.75 ˚C /W
Thermal Characterization parameter ΨJt (°C/W) for JEDEC 4L system PCB ………0.65 ˚C /W
NOTE: JEDEC 51-9 system FR4 PCB size: 101.5x114.5mm (4"x4.5")

MT7975 Thermal Characteristics

MT7975 modeling

Thermal characteristics without external heat sink in still air condition

Thermal Resistance θJA (˚C /W) for JEDEC 4L system PCB……………………………………………………17.56˚C/W
Thermal Resistance θJC (˚C /W) for JEDEC system PCB…………………………………………………………5.67 ˚C/W
Thermal Resistance θJB (˚C /W) for JEDEC system PCB…………………………………………………………2.57 ˚C/W
Thermal Characterization parameter ΨJt (˚C /W) for JEDEC 4L system PCB……………………………….1.2 ˚C/W
NOTE: JEDEC 51-7 system FR4 PCB size: 76.2x114.3mm (3”x4.5”)

MT7976G/A/DA/C Thermal Characteristics

MT7976G/A/DA modeling

Thermal characteristics when stationary, without an external heat sink in an air-conditioned environment:
Thermal Resistance θ JA (°C/W) for JEDEC 4L system PCB .... 10.6 ˚C /W
Thermal Resistance θ JC (°C/W) for JEDEC system PCB .... 3.4 ˚C /W
Thermal Resistance θ JB (°C/W) for JEDEC system PCB .... 4.57 ˚C /W
Thermal Characterization parameter ΨJt (°C/W) for JEDEC 4L system PCB ....0.45 ˚C /W
NOTE: JEDEC 51-9 system FR4 PCB size: 101.5x114.5mm (4"x4.5")

MT7976C modeling

Thermal characteristics without external heat sink in still air condition
Thermal Resistance θJA (˚C /W) for JEDEC 4L system PCB...18.51˚C/W
Thermal Resistance θJC (˚C /W) for JEDEC system PCB...2.94 ˚C/W
Thermal Resistance θJB (˚C /W) for JEDEC system PCB...2.68 ˚C/W
Thermal Characterization parameter ΨJt (˚C /W) for JEDEC 4L system PCB..1.48 ˚C/W
NOTE: JEDEC 51-7 system FR4 PCB size: 76.2x114.3mm (3"x4.5")

MT7531A Thermal Characteristics

Symbol	Description	Performance	
		Typ	Unit
T_J	Maximum Junction Temperature (Plastic Package)	125	°C
θ_{JA}	Thermal resistance for JEDEC 2L system PCB	58.2	°C/W
θ_{JA}	Thermal resistance for JEDEC 4L system PCB	54.5	°C/W
θ_{JC}	Thermal resistance for JEDEC 4L system PCB	17.2	°C/W
θ_{JB}	Thermal resistance for JEDEC 4L system PCB	45.41	°C/W
ψ_{Jt}	Thermal characterization parameter for JEDEC 2L system PCB	0.9	°C/W
ψ_{Jt}	Thermal characterization parameter for JEDEC 4L system PCB	0.84	°C/W

Note: JEDEC 51-7 system FR4 PCB size: 76.2x114.3mm (3"x4.5")

Contents

D-die (MT7986) Die Power

- Pls follow project user scenario (power/duty/loading) to choose suitable condition
- MT7986 supports WIFI TX/RX offload, and default setting is offload enabled

Power (W) Mesurement		**MT7986A AX6000 (4+4) CPU 2GHz**	**MT7986A AX7800 (5G only) CPU 2GHz**	**MT7986A AX4200 (2+3) CPU 2GHz**	**MT7986 AX6000 (4+4) CPU 1.6GHz**	**MT7986 AX7800 (5G only) CPU 1.6GHz**	**MT7986 AX4200 (2+3) CPU 1.6GHz**
D-Die (85'C)	CPU Full Loading	**4.13**	**3.38**	**3.50**	**3.44**	**3.15**	**3.28**
	Offload (Default)	**3.14**	**2.78**	**2.90**	**2.86**	**2.55**	**2.68**
D-Die (125'C)	CPU Full Loading	**5.58**	**4.56**	**4.72**	**4.72**	**4.26**	**4.43**
	Offload (Default)	**3.93**	**3.47**	**3.62**	**3.52**	**3.19**	**3.35**

NT(Normal temperature): Tj ~ 85'C
HT(High temperature): Chip Tj~125'C

MT7986 supports WIFI TX/RX offload, and default setting is offload enable
Full loading: to use memtest to run CPU stress 100% loading

A-die (MT7976) Die Power

- Pls follow project user scenario (power/duty/loading) to choose suitable condition

Condition		Mean (Tj=125°C)	Mean (Tj=85°C)
TX Low Rate	MT7975N 2G 4SS iPA (21dBm, 6M, 90%)	5.2	4.84
TX High Rate	MT7975N 2G 4SS iPA (16.5dBm, HE40 MCS11, 90%)	4.1	3.8
TX Low Rate	MT7975PN 5G 4SS iPA (21dBm, 6M, 90%)	6.2	5.77
TX High Rate	MT7975PN 5G 4SS iPA (15dBm, HE160 MCS11, 90%)	4.7	4.3
TX Low Rate	MT7976C 2+3 iPA (21dBm, 6M, 90%)	7.65	7.12
TX High Rate	MT7976C 2+3 iPA (16.5dBm, HE40 MCS11, 90%) (15.5dBm, HE160 MCS11, 90%)	5.6	5.2

Condition	Mean (Tj=125°C)	Mean (Tj=85°C)
MT7976GN_2G 4SS ePA mode	1.87	1.74
MT7976AN_5G 4SS ePA mode	2.69	2.50
MT7976DA (2+3) ePA mode	2.92	2.72

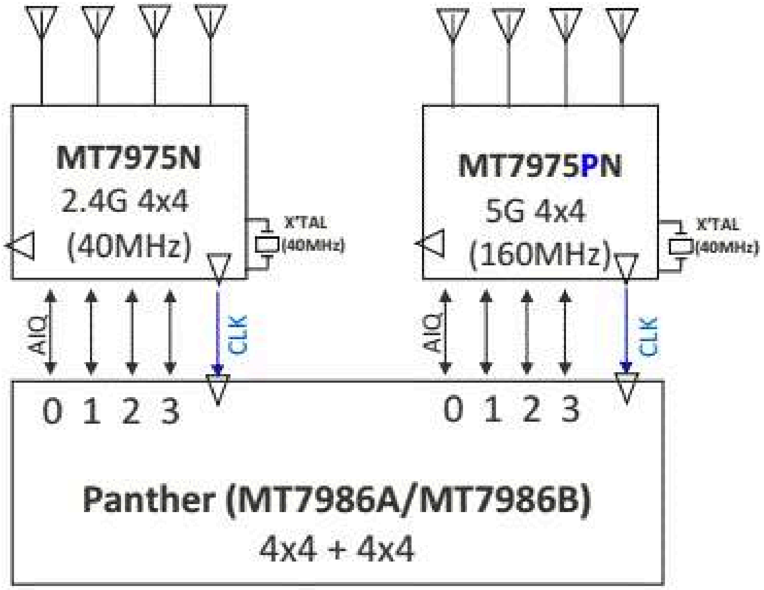
NT(Normal temperature): Tj ~ 85'C

HT(High temperature): Chip Tj~125'C

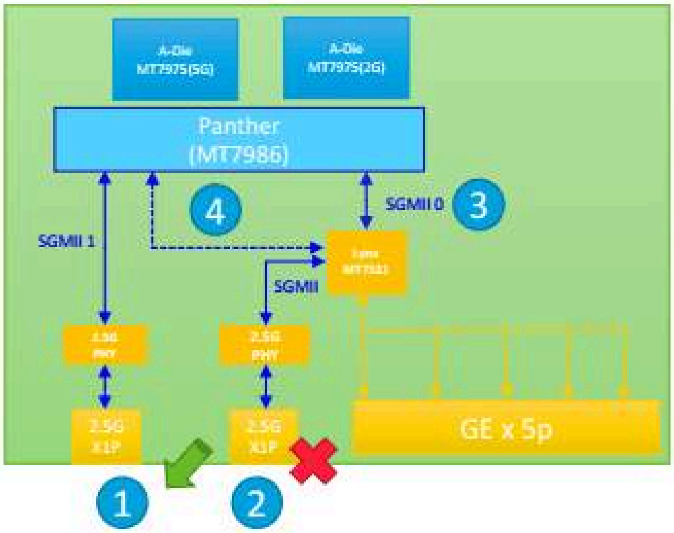
Contents

CONFIDENTIAL C

AX6000 (2i+5i) (4x4+ 4x4) Configurations



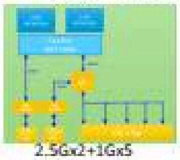
AX6000 RFB Scenarios



Scenarios	HW Configuration
1	2.5GPHYx2 + Lynx 5GEb
2	2.5GPHYx1 + Lynx 5GEb
3	SGMIIx1_Lynx 5GEb
4	SGMIIx2_Lynx 5GEb

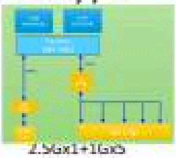
AX6000 RFB Type

1



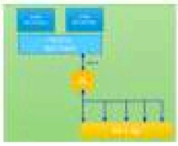
2.5Gx2+1Gx5

2

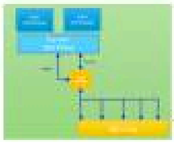


2.5Gx1+1Gx5

3



4



AX6000 iPA Power Consumption(CPU 1.6GHz)

- AX6000: MT7986B+7975N(2G)+7975PN(5G)
- Ethernet: 5GEb
- Pls follow project user scenario (power/duty/loading) to choose suitable condition

CPU Offload (Default)

Model AX6000(4+4)	Panther MTK 4+4 @ HT	Panther MTK 4+4 @NT
Panther MT7986B (CA53x4@1.6GHz) CPU Offload	3.52	2.86
MT7975N_2G 4SS iPA (21dBm, 6M, 90%)	5.2	4.84
MT7975P_5G 4SS iPA (21dBm, 6M, 90%)	6.2	5.77
MT7531(Lynx) 5ports	2.03	1.67
DRAM(KGD)	0.36	0.3
Total	16.95	15.1
DC BUCK 85% Eff.	**20.36**	**18.16**

CPU Full Loading 100%

Model AX6000(4+4)	Panther MTK 4+4 @ HT	Panther MTK 4+4 @NT
Panther MT7986B (CA53x4@1.6GHz) CPU Full Load 100%	4.72	3.44
MT7975N_2G 4SS iPA (21dBm, 6M, 90%)	5.2	4.84
MT7975P_5G 4SS iPA (21dBm, 6M, 90%)	6.2	5.77
MT7531(Lynx) 5ports	2.03	1.67
DRAM(KGD)	0.36	0.3
Total	18.51	16.02
DC BUCK 85% Eff.	**21.77**	**18.85**

* Assure BUCK eff. 85%

NT(Normal temperature): Tj ~ 85'C
HT(High temperature): Chip Tj~125'C

Full loading: to use memtest to run CPU stress 100% loading

AX5400 iPA Power Consumption

- AX6000: MT7986B+7975N(2G) 2SS+7975PN(5G) 4SS
- Ethernet: 5GEb
- Pls follow project user scenario (power/duty/loading) to choose suitable condition

CONFIDENTIAL C

CPU Offload (Default)

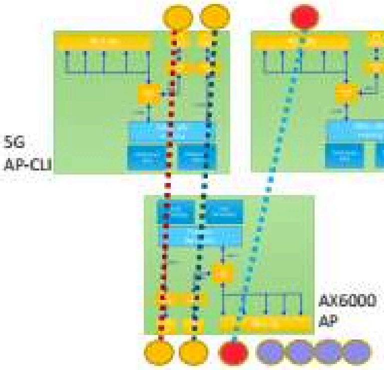
Model AX5400(2+4)	Panther MTK 2+4 @ HT	Panther MTK 2+4 @NT
Panther MT7986B (CA53x4@1.6GHz) CPU Offload	3.4	2.75
MT7975G_2G 2SS iPA (21dBm, 6M, 90%)	3.1	2.9
MT7975A_5G 4SS iPA (21dBm, 6M, 90%)	6.2	5.77
MT7531(Lynx) 5ports	2.03	1.67
DRAM(KGD)	0.36	0.3
Total	15.15	13.4
DC BUCK 85% Eff.	**17.8**	**15.8**

MT7531 power consumption

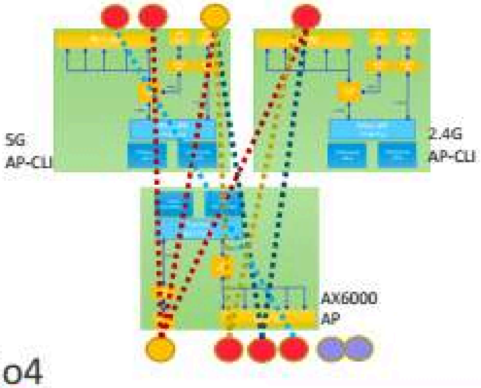
MT7531 ports number	0	1	2	3	4	5
NT(W)	0.42	0.67	0.91	1.17	1.39	1.67
HT(W)	0.42	0.74	1.06	1.38	1.68	2.03

AX6000 RFB Power Consumption Measurement (T-put)

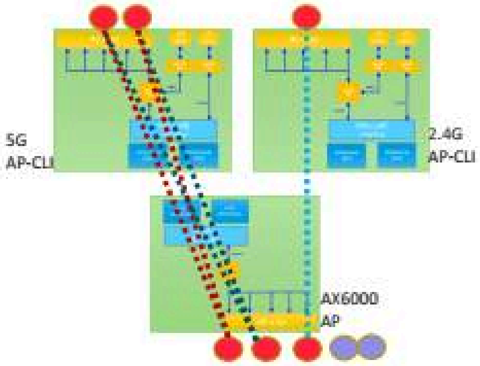
Scenario1



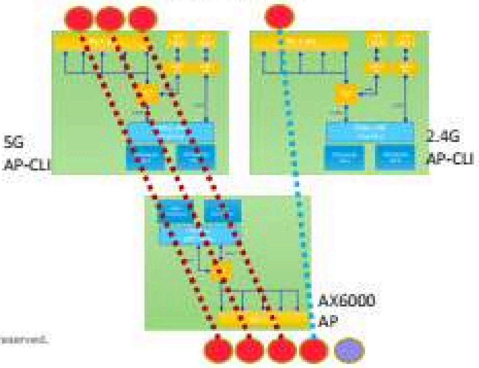
Scenario2



Scenario3



Scenario4



Scenarios	HW Configuration
1	2.5GPHYx2 + Lynx 5GEb
2	2.5GPHYx1 + Lynx 5GEb
3	SGMIIx1_Lynx 5GEb
4	SGMIIx2_Lynx 5GEb

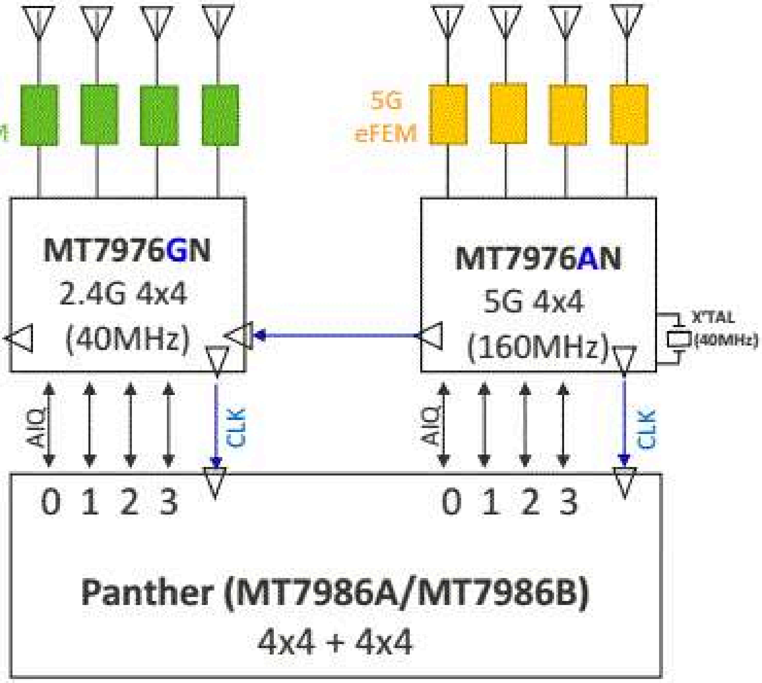
🟡	PC with 2.5G Ethernet
🔴	PC with 1G Ethernet
🟣	1G Link only, no traffic

AX6000/AX5400 T-put/Power Consumption)

AX6000 Router	DL T-put	DL Power consumption (Mean/Max)	UL T-put	UL Power consumption (Mean/Max)	BiDi T-put	BiDi Power consumption (Mean/Max)	2G 6M 5G 6M DL T-put	Power consumption (Mean/Max)	2G CCK 5G 6M DL T-put	Power consumption (Mean/Max)	MT7975 RF TX Power
Scenario1 2.5GX2 Lynx GEbx5	4.12Gbps	14.4/16.3W	3.64Gbps	9.3/12.5W	4.35Gbps	12.0/14.4W	8.3Mbps	17.5/19.3W	5.4Mbps	18.0/19.8W	**2G:** HE40MCS11,15dBm OFDM 6M, 21dBm CCK-1M, 22dBm **5G:** HE 40MCS11, 4SS, 15dBm OFDM 6M, 4SS, 20dBm
Scenario2 2.5GX1 Lynx GEbx5	3.6Gbps	13.2/15.1W	3.0Gbps	9.2/12.3W	4.35Gbps	10.2/13.5W	8.2Mbps	16.6/18.7W	5.4Mbps	17.3/19.1W	
Scenario3 Lynx GEbx5 HSGMIIx1	2.2Gbps	11.8/14.8W	1.95Gbps	8.1/12.1W	2.7Gbps	9.4/12.8W	8.0Mbps	15.7/18.1W	5.4Mbps	16.5/18.5W	
Scenario4 Lynx GEbx5 HSGMIIx2	2.98Gbps	12.0/14.8W	2.56Gbps	8.6/12.5W	3.2Gbps	10.4/13.2W	8.6Mbps	16.0/18.4W	5.4Mbps	16.8/18.7W	
Scenario2 AX5400 (2-4) 2.5GX1 Lynx GEbx5	3.2Gbps	11.1/12.8	3.0Gbps	7.8/9.9W	4.1Gbps	9.4/11.2W	8.1Mbps	13.9/15.1W	5.4Mbps	14.1/15.4W	

* NT(Normal temperature) measurement: Ta=25℃, Tj ~ 85℃

AX6000 (2e+5e) (4x4+ 4x4) Configurations



2G eFEM

5G eFEM

MT7976GN
2.4G 4x4
(40MHz)

MT7976AN
5G 4x4
(160MHz)

X'TAL (40MHz)

AIQ

CLK

AIQ

CLK

0 1 2 3

0 1 2 3

Panther (MT7986A/MT7986B)
4x4 + 4x4

AX6000 ePA Power Consumption

- AX6000: MT7986B+7976G(2G)+7976A(5G)
- Pls follow project user scenario (power/duty/loading) to choose suitable condition

CPU Offload (Default)

Model AX6000(4+4) ePA	Panther MTK 4+4 @ HT	Panther MTK 4+4 @NT
Panther MT7986B (CA53x4@1.6GHz) CPU Offload	3.52	2.86
MT7976G_2G 4SS ePA mode	1.87	1.74
2G FEM X4 QPF4206 (24dBm, 6M, 90%)	5.90	5.71
MT7976A_5G 4SS ePA mode	2.69	2.50
5G FEM X4 QPF4526 (24dBm, 6M, 90%)	6.93	6.55
MT7531(Lynx) 5ports	2.03	1.67
DRAM(KGD)	0.36	0.3
Total	23.30	21.33
DC BUCK 85% Eff.	**27.42**	**25.09**

CPU Full Loading 100%

Model AX6000(4+4) ePA	Panther MTK 4+4 @ HT	Panther MTK 4+4 @NT
Panther MT7986B (CA53x4@1.6GHz) CPU Full Load 100%	4.72	3.44
MT7976G_2G 4SS ePA mode	1.87	1.74
2G FEM X4 QPF4206 (24dBm, 6M, 90%)	5.90	5.71
MT7976A_5G 4SS ePA mode	2.69	2.50
5G FEM X4 QPF4526 (24dBm, 6M, 90%)	6.93	6.55
MT7531(Lynx) 5ports	2.03	1.67
DRAM(KGD)	0.36	0.3
Total	24.50	21.91
DC BUCK 85% Eff.	**28.83**	**25.78**

* Assure BUCK eff. 85%

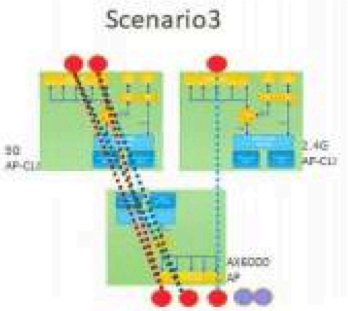
NT(Normal temperature): Tj ~ 85'C
HT(High temperature): Chip Tj~125'C

Full loading: to use memtest to run CPU stress 100% loading

AX6000 ePA T-put Power Consumption

AX6000 Router	**DL T-put**	**DL Power consumption (Mean/Max)**	**UL T-put**	**UL Power consumption (Mean/Max)**	**BiDi T-put**	**BiDi Power consumption (Mean/Max)**	**2G 6M 5G 6M DL T-put**	**Power consumption (Mean/Max)**	**2G CCK 5G 6M DL T-put**	**Power consumption (Mean/Max)**	**MT7976 RF TX Power**
Scenario3 GEbx5 HSGMIIx1	2.2Gbps	16.6/21.8W	1.9Gbps	11.9/18.6W	2.95Gbps	14.8/22.5W	9.8Mbps	24.9/29.5W	5.4Mbps	25.8/30.8W	**2G:** HE40MCS11,20dBm OFDM 6M, 24dBm CCK-1M, 24dBm **5G:** HE 40MCS11, 4SS, 19.5dBm OFDM 6M, 4SS, 24dBm

* NT(Normal temperature) measurement: Ta=25℃, Tj ~ 85℃



Scenario3

AX6000 ePA Power Consumption (CPU 2GHz)

- AX6000: MT7986A iPA/ePA
- Ethernet: 5GEb
- Pls follow project user scenario (power/duty/loading) to choose suitable condition

CPU Offload (Default)

Model AX6000(4+4)	Panther MTK 4+4 @ HT	Panther MTK 4+4 @NT
Panther MT7986A (CA53x4@2GHz) CPU Offload	3.93	3.14
MT7975N_2G 4SS iPA (21dBm, 6M, 90%)	5.2	4.84
MT7975P_5G 4SS iPA (21dBm, 6M, 90%)	6.2	5.77
MT7531(Lynx) Sports	2.03	1.67
DRAM(KGD)	0.36	0.3
Total	17.72	15.72
DC BUCK 85% Eff.	**20.85**	**18.49**

CPU Offload (Default)

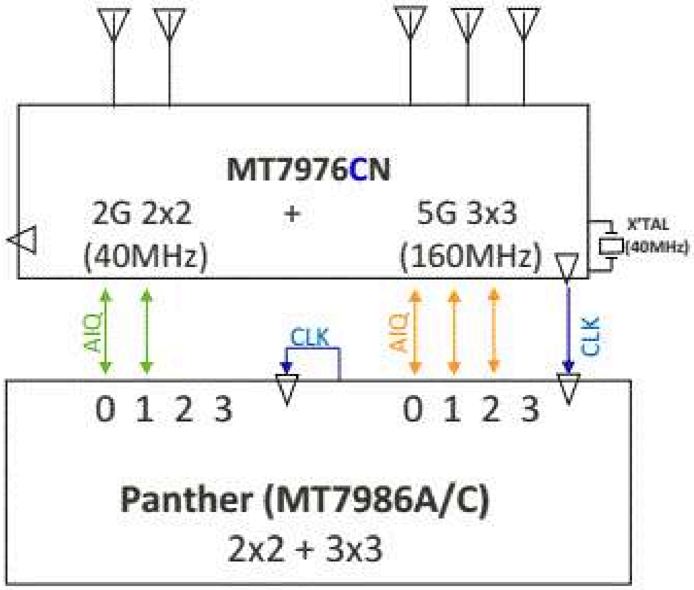
Model AX6000(4+4) ePA	Panther MTK 4+4 @ HT	Panther MTK 4+4 @NT
Panther MT7986A (CA53x4@2GHz) CPU Offload	3.93	3.14
MT7976G_2G 4SS ePA mode	1.87	1.74
2G FEM x4 QPF4206 (24dBm, 6M, 90%)	5.90	5.71
MT7976A_5G 4SS ePA mode	2.69	2.50
5G FEM x4 QPF4526 (24dBm, 6M, 90%)	6.93	6.55
MT7531(Lynx) Sports	2.03	1.67
DRAM(KGD)	0.36	0.3
Total	23.71	21.61
DC BUCK 85% Eff.	**27.90**	**25.42**

NT(Normal temperature): Tj ~ 85'C
HT(High temperature): Chip Tj~125'C

Full loading: to use memtest to run CPU stress 100% loading

Contents

AX4200 (2i+5i) (2x2+ 3x3) Configurations



*PCB Connection:
B16: AFE1_XIN_WBG
A16: AFE0_XIN_WBG

AX4200 iPA Power Consumption

- AX4200: MT7986A/C+7976C
- Ethernet: 5GEb+2.5GPHYx1
- Pls follow project user scenario (power/duty/loading) to choose suitable condition

CPU Offload (Default)

Model AX4200 (2+3)	Panther Est. MTK 2+3 @ HT	Panther Est. MTK 2+3 @NT
Panther MT7986C (CA53x4@1.6GHz) CPU Offload	3.35	2.68
MT7976C 2+3 iPA (21dBm, 6M, 90%)	7.65	7.12
MT7531(Lynx) TPlink 4ports	1.68	1.39
DRAM(KGD)	0.36	0.3
2.5G PHY	1.51	1.41
Total	14.55	12.9
DC BUCK 85% Eff.	**17.11**	**15.1**

CPU Offload (Default)

Model AX4200 (2+3)	Panther Est. MTK 2+3 @ HT	Panther Est. MTK 2+3 @NT
Panther MT7986C (CA53x4@1.6GHz) CPU Offload	3.35	2.68
MT7976C 2+3 iPA (16.5dBm, HE40 MCS11, 90%) (15.5dBm, HE160 MCS11, 90%)	5.6	5.2
MT7531(Lynx) TPlink 4ports	1.68	1.39
DRAM(KGD)	0.36	0.3
2.5G PHY	1.51	1.41
Total	12.5	10.98
DC BUCK 85% Eff.	**14.7**	**12.92**

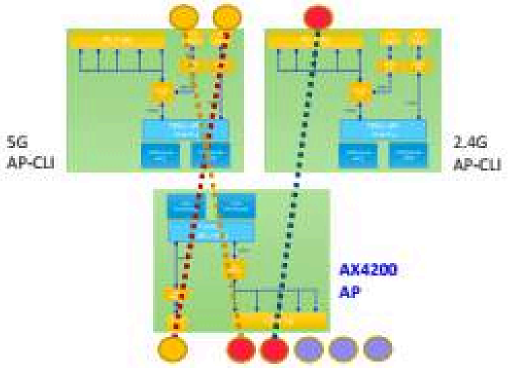
NT(Normal temperature): Tj ~ 85'C
HT(High temperature): Chip Tj~125'C

AX4200 iPA T-put Power Consumption

AX4200 Router	DL T-put	DL Power consumption (Mean/Max)	UL T-put	UL Power consumption (Mean/Max)	BiDi T-put	BiDi Power consumption (Mean/Max)	2G 6M 5G 6M DL T-put	Power consumption (Mean/Max)	2G CCK 5G 6M DL T-put	Power Consumption (Mean/Max)	MT7976C RF TX Power
Scenario2 **2.5GX1** **Lynx** **GEbx5** **WiFi** **2G+5G**	3.25Gbps	10.7/13.4W	3.15Gbps	8.2/12.8W	3.28Gbps	10.7/12.9W	8.1Mbps	12.8/15.0W	5.1Mbps	13.1/15.3W	**2G:** HE40 MCS11,16.5 dBm OFDM 6M, 21dBm CCK-1M, 22dBm **5G:** HE160 MCS11,3SS, 15.5dBm OFDM 6M, 3SS, 21dBm

* NT(Normal temperature) measurement: Ta=25℃, Tj ~ 85℃

Scenario2



AX4200 ePA Power Consumption

- AX4200: MT7986+7976DA + FEM
- Ethernet: 5GEb
- Pls follow on project user scenario (power/duty/loading) to choose suitable condition

CPU Offload (Default)

Model AX4200 (2+3)	Panther Est. MTK 2+3 @ HT	Panther Est. MTK 2+3 @NT
Panther MT7986C (CA53x4@1.6GHz) CPU Offload	3.35	2.68
MT7976DA (2+3) ePA mode	2.92	2.72
2G FEM X2 QPF4206 (24dBm, 6M, 90%)	2.95	2.85
5G FEM X3 QPF4526 (24dBm, 6M, 90%)	5.20	4.91
MT7531(Lynx) 5ports	2.03	1.67
DRAM(KGD)	0.36	0.3
Total	16.81	15.13
DC BUCK 85% Eff.	**19.78**	**17.80**

CPU Offload (Default)

Model AX4200 (2+3)	Panther Est. MTK 2+3 @ HT	Panther Est. MTK 2+3 @NT
Panther MT7986A (CA53x4@2GHz) CPU Offload	3.62	2.90
MT7976DA (2+3) ePA mode	2.92	2.72
2G FEM X2 QPF4206 (24dBm, 6M, 90%)	2.95	2.85
5G FEM X3 QPF4526 (24dBm, 6M, 90%)	5.20	4.91
MT7531(Lynx) 5ports	2.03	1.67
DRAM(KGD)	0.36	0.3
Total	17.08	15.35
DC BUCK 85% Eff.	**20.09**	**18.06**

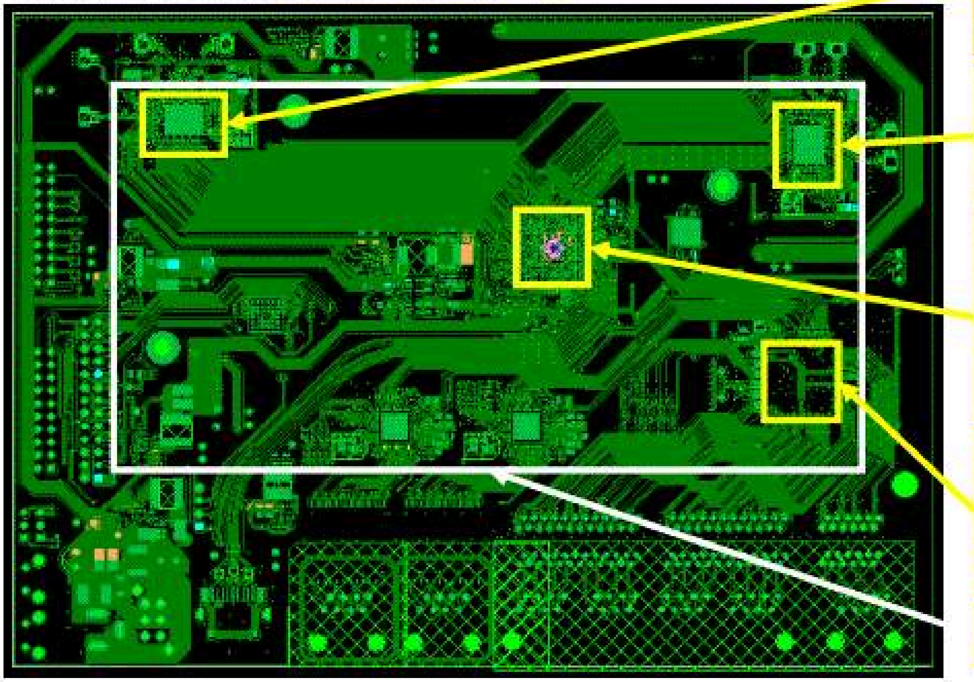
NT(Normal temperature): Tj ~ 85'C
HT(High temperature): Chip Tj~125'C

Full loading: to use memtest to run CPU stress 100% loading

Contents

AX6000 MT7986B+7975 RFB

RFB PCB size: 180x128x1.6 mm



MT7975N_2G:
DRQFN 10.5x9mm
5.2 W

MT7975P_5G:
DRQFN 10.5x9mm
6.2 W

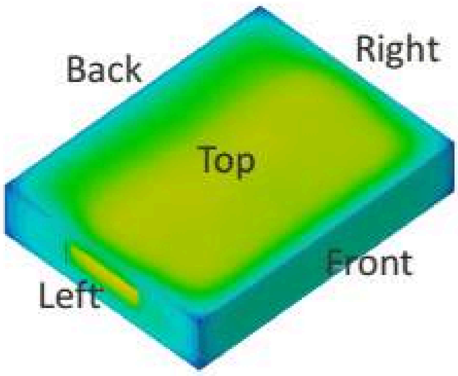
MT7986B: FCCSP KGD
13.6x13.6mm
4.72 W

MT7531:
LQFP 14x14mm
2.03 W

Heat Sink

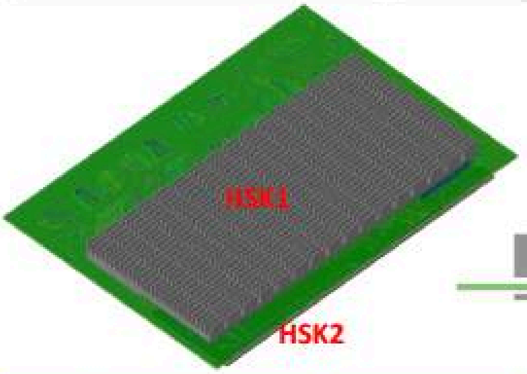
MT7986B+7975 Thermal Sim

SKU	AX6000
Chipsets	MT7986B+MT7975x2
MT7986 Package	FCCSP (13.6x13.6mm) +DRAM KGD
MT7975 Package	DRQFN (10.5x 9mm)
CPU	CPU 1.6GHz (0.85V), CA53x4: active
Ambient	42°C
PCB Layer	4L
PCB Dimension	180x128x1.6 mm
Housing	254x 188.5x 37.6 mm
Panther D-die TX	4.72 +0.36(DRAM)
MT7975_2G TX (6M_21dBm,Duty 90%)	5.2
MT7975_5G TX (6M_21dBm,Duty 90%)	6.2
MT7531	2.03
Thermal result	
MT7986 TJ ('C)	123.6
MT7975 2G TJ ('C)	116.6
MT7975 5G TJ ('C)	123.9
MT7531 TJ ('C)	124.1



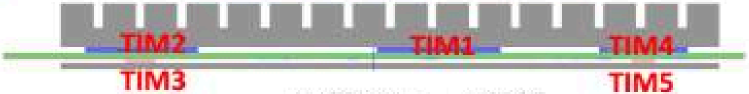
Top('C)	67.7
Front('C)	59.33
Right('C)	59.21
Left('C)	59.32
Back('C)	56.89
BTM('C)	66.78

Thermal solution information



Heat Sink Dimension

- Heat Sink Dimension: 160X64x9mm ([illegible]), 123X64x9 ([illegible])
- Height: 6mm
- Length: 6mm
- Gap: 2mm



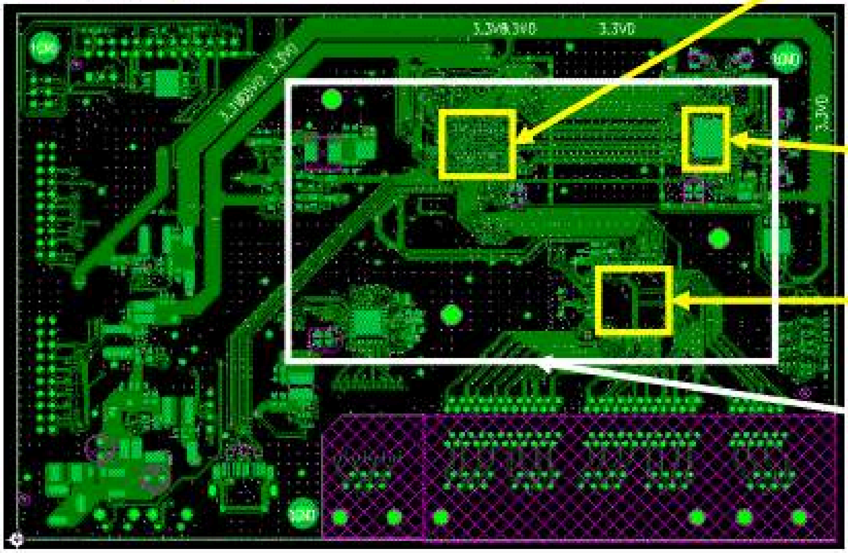
MATERIAL : A 6063
FINISH : BLACK ANODIZE

	L x L (mm)	H : Height (mm)	B.H: base height (mm)	Fin number	F.P.: fin pitch (mm)	Fin thickness (mm)	Fixed
HSK1	160x64	9	3	--	--	0.95	Screw or others
Plate	160X44.5	2	--	--	--	--	Screw or others

System solution	L x L (mm)	H : Height (mm)	Quantity	Material
TIM1 (between MT7986 and shielding) TOP side	13.6x13.6	2	1	Thermal pad (conductivity = 6 W/m-K)
TIM2 (between MT7976 2G and shielding) TOP side	12.5x10	2	1	Thermal pad (conductivity = 6 W/m-K)
TIM3 (between MT7976 2G and heat-plate) BTM side	7.4x5.6	2	1	Thermal pad (conductivity = 6 W/m-K
TIM4 (between MT7976 5G and shielding) TOP side	12.5x10	2	1	Thermal pad (conductivity = 6 W/m-K)
TIM5 (between MT7976 5G and heat-plate) BTM side	7.4x5.6	2	1	Thermal pad (conductivity = 6 W/m-K

AX4200(2+3) MT7986C+7976C RFB

PCB size: 171x110x1.6 mm
Housing: 254x 188.5x 37.6 mm
Heat Sink: 123X64x9 mm(AX5430)
*PCB: 4L



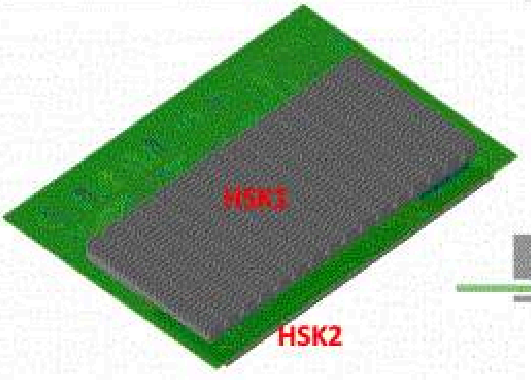
MT7986C KGD:
FCCSP 13.6x13.6mm
4.43 W

MT7976C(2+3):
DRQFN
12x10mm
7.6 W

MT7531:
LQFP 14x14mm
2.025 W

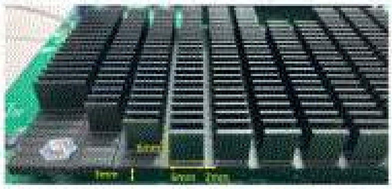
Heat Sink
123X64x**9mm**

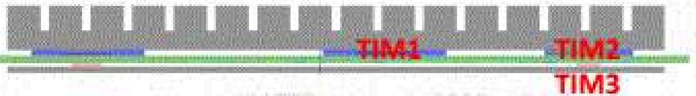
Thermal solution information



Heat Sink Dimension

- Heat Sink Dimension: 160X64x9mm (AX6000), 123X64x9 (AX5400)
- Height: 6mm
- Length: 6mm
- Gap: 2mm





MATERIAL : A 6063
FINISH : BLACK ANODIZE

	L x L (mm)	H : Height (mm)	B.H: base height (mm)	Fin number	F.P.: fin pitch (mm)	Fin thickness (mm)	Fixed
HSK1	123x64	9	3	--	--	0.95	Screw or others
Plate	123X50	5	--	--	--	--	Screw or others

System solution	L x L (mm)	H : Height (mm)	Quantity	Material
TIM1 (between MT7986 and shielding) TOP side	13.6x13.6	2	1	Thermal pad (conductivity = 6 W/m-K)
TIM2 (between MT7976 5G and shielding) TOP side	12.5x10	2	1	Thermal pad (conductivity = 6 W/m-K)
TIM3 (between MT7976 5G and heat-plate) BTM side	7.4x5.6	2	1	Thermal pad (conductivity = 6 W/m-K

AX4200 Thermal Sim

SKU	AX4200 (2+3)	AX4200 (2+3)
Chipsets	MT7986C+MT7976C One A-die	MT7986C+MT7976C One A-die
MT7986 Package	**FCCSP** (13.6x13.6mm) **+DRAM KGD**	**FCCSP** (13.6x13.6mm) **+DRAM KGD**
MT7975 Package	**DRQFN** (12.5x 10**mm**) ePAD: 7.4x5.6mm	**DRQFN** (12.5x 10**mm**) ePAD: 7.4x5.6mm
CPU	CPU 1.6GHz (0.85V) CA53x4: active	CPU 1.6GHz (0.85V) CA53x4: active
Ambient	**42°C**	**50°C**
PCB Layer	**4L**	**4L**
PCB Dimension	**171x110x1.6 mm**	**171x110x1.6 mm**
Housing	**254x 188.5x 37.6 mm**	**w/o Housing** *** w/o bottom plane**
Panther D-die TX	**4.43**+0.36(DRAM)	**4.43**+0.36(DRAM)
MT7976C_2G TX **Est.** (6M_21dBm,Duty 90%)	**7.6**	**7.6**
DRAM	KGD	KGD
MT7531	2.025	2.025
Thermal result		
MT7986 TJ ('C)	**115**	**115.5**
MT7975 5G TJ ('C)	**112.3**	**119.8**
MT7531 TJ ('C)	**114.1**	**114.4**

Contents

MT7986A POD

- PKG : 16.85 mm x 16.85 mm

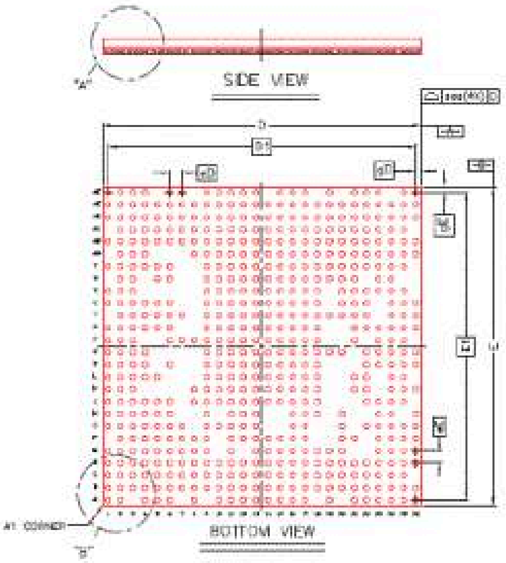
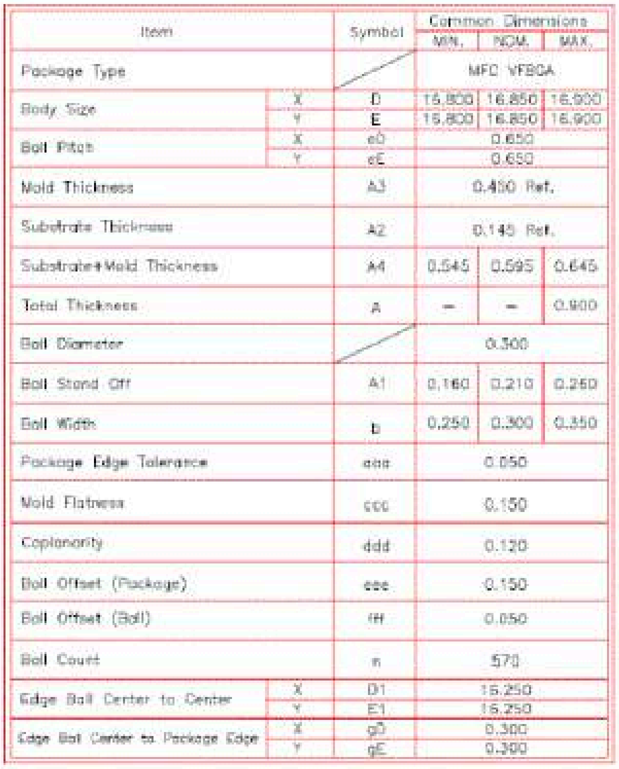


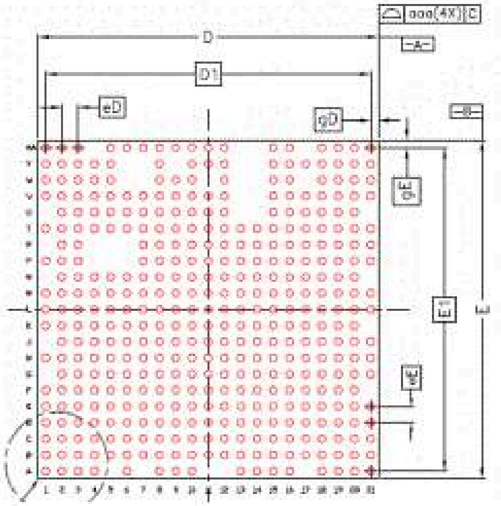
Table 4-1 Package Diagram Key

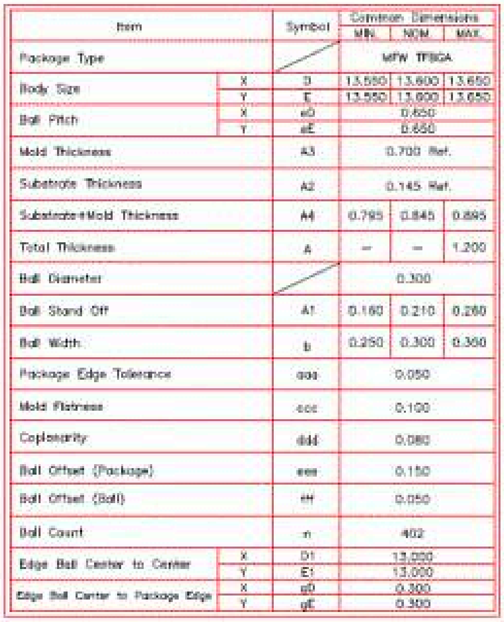


Item		Symbol	Common Dimensions MIN.	NOM.	MAX.
Package Type			MFC VFBGA		
Body Size	X	D	15.800	16.850	16.900
	Y	E	15.800	16.850	16.900
Ball Pitch	X	eD	0.650		
	Y	eE	0.650		
Mold Thickness		A3	0.450 Ref.		
Substrate Thickness		A2	0.145 Ref.		
Substrate+Mold Thickness		A4	0.545	0.595	0.645
Total Thickness		A	–	–	0.900
Ball Diameter			0.300		
Ball Stand Off		A1	0.160	0.210	0.260
Ball Width		b	0.250	0.300	0.350
Package Edge Tolerance		aaa	0.050		
Mold Flatness		ccc	0.150		
Coplanarity		ddd	0.120		
Ball Offset (Package)		eee	0.150		
Ball Offset (Ball)		fff	0.050		
Ball Count		n	570		
Edge Ball Center to Center	X	D1	16.250		
	Y	E1	16.250		
Edge Ball Center to Package Edge	X	gD	0.300		
	Y	gE	0.300		

MT7986B/C POD

- PKG : 13.86 mm x 13.6mm

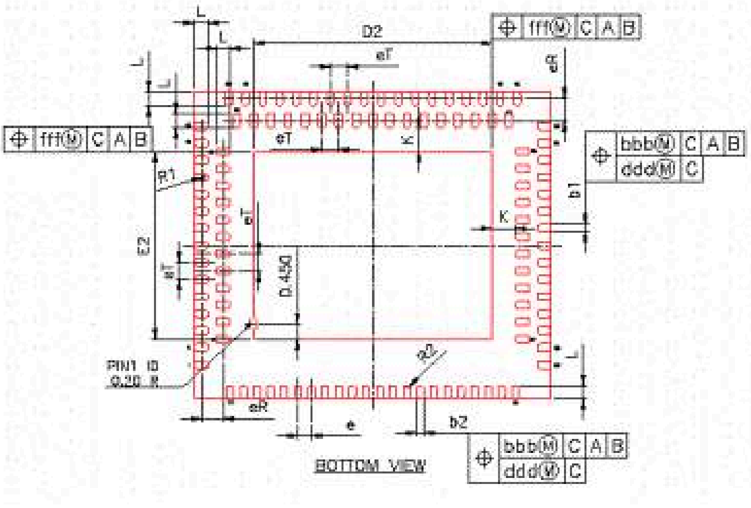


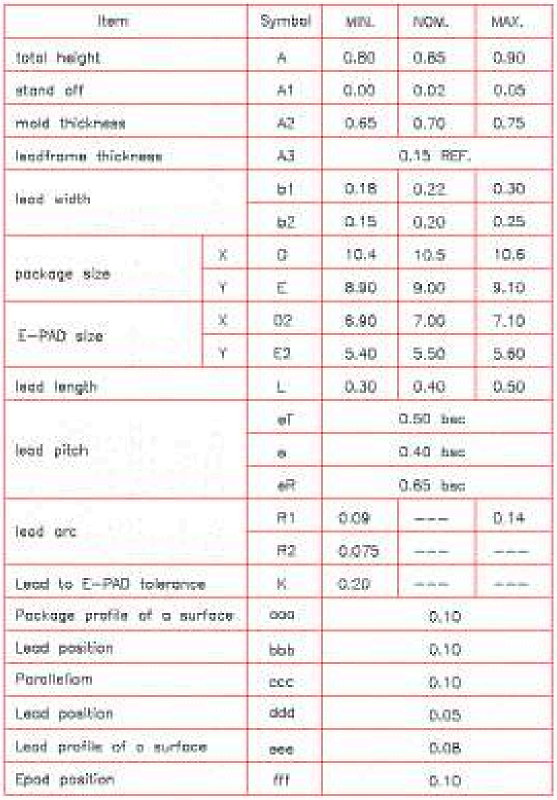


Item		Symbol	Common Dimensions		
			MIN.	NOM.	MAX.
Package Type			MFW TFBGA		
Body Size	X	D	13.550	13.600	13.650
	Y	E	13.550	13.600	13.650
Ball Pitch	X	eD	0.650		
	Y	eE	0.650		
Mold Thickness		A3	0.700 Ref.		
Substrate Thickness		A2	0.145 Ref.		
Substrate+Mold Thickness		A4	0.795	0.845	0.895
Total Thickness		A	—	—	1.200
Ball Diameter			0.300		
Ball Stand Off		A1	0.160	0.210	0.260
Ball Width		b	0.250	0.300	0.350
Package Edge Tolerance		aaa	0.050		
Mold Flatness		ccc	0.100		
Coplanarity		ddd	0.080		
Ball Offset (Package)		eee	0.150		
Ball Offset (Ball)		fff	0.050		
Ball Count		n	402		
Edge Ball Center to Center	X	D1	13.000		
	Y	E1	13.000		
Edge Ball Center to Package Edge	X	gD	0.300		
	Y	gE	0.300		

MT7975 POD

- PKG : 10.5 mm x 9 mm
- E-PAD : 7.0 mm x 5.5mm

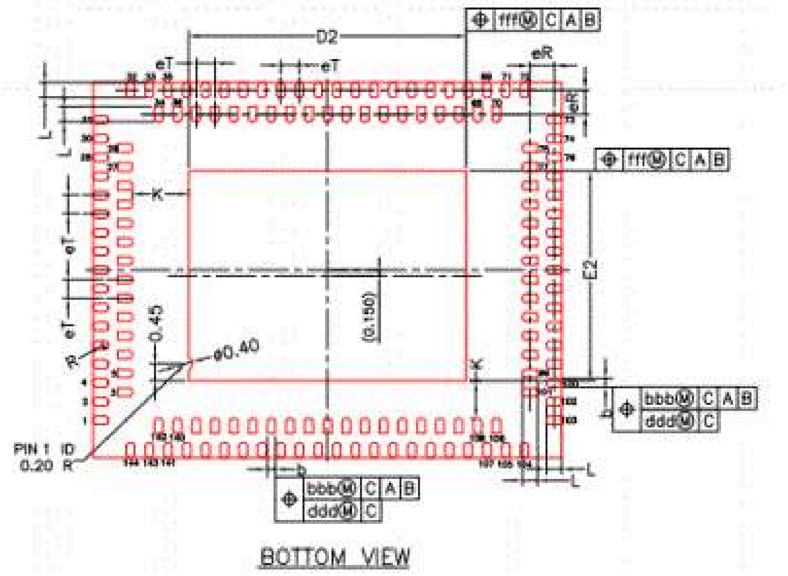




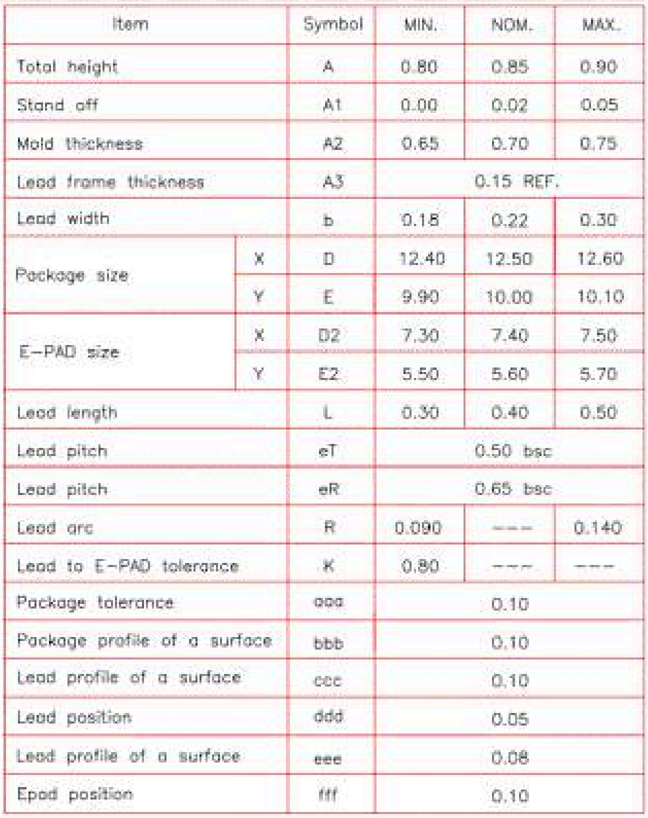
Item		Symbol	MIN.	NOM.	MAX.
total height		A	0.80	0.85	0.90
stand off		A1	0.00	0.02	0.05
mold thickness		A2	0.65	0.70	0.75
leadframe thickness		A3	0.15 REF.		
lead width		b1	0.18	0.22	0.30
		b2	0.15	0.20	0.25
package size	X	D	10.4	10.5	10.6
	Y	E	8.90	9.00	9.10
E-PAD size	X	D2	6.90	7.00	7.10
	Y	E2	5.40	5.50	5.60
lead length		L	0.30	0.40	0.50
lead pitch		eT	0.50 bsc		
		e	0.40 bsc		
		eR	0.65 bsc		
lead arc		R1	0.09	---	0.14
		R2	0.075	---	---
Lead to E-PAD tolerance		K	0.20	---	---
Package profile of a surface		aaa	0.10		
Lead position		bbb	0.10		
Parallelism		ccc	0.10		
Lead position		ddd	0.05		
Lead profile of a surface		eee	0.08		
Epad position		fff	0.10		

MT7976 POD

- PKG : 12.5 mm x 10 mm
- E-PAD : 7.4 mm x 5.6mm



BOTTOM VIEW

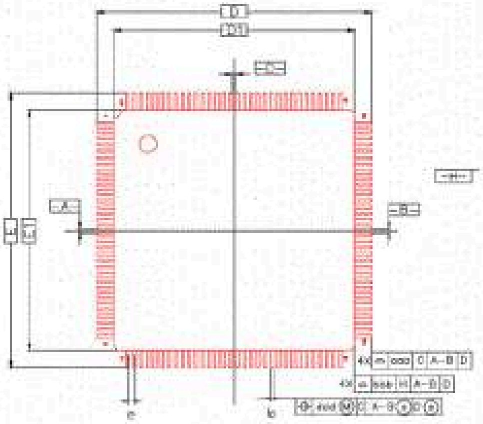


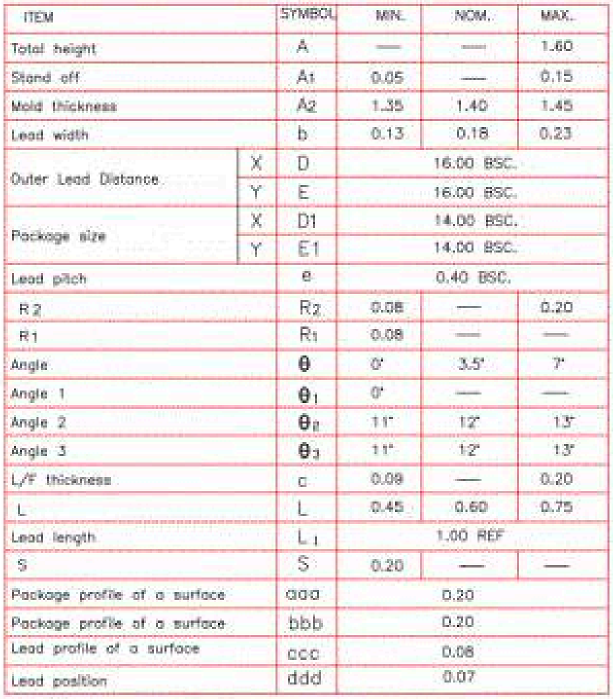
Item		Symbol	MIN.	NOM.	MAX.
Total height		A	0.80	0.85	0.90
Stand off		A1	0.00	0.02	0.05
Mold thickness		A2	0.65	0.70	0.75
Lead frame thickness		A3	0.15 REF.		
Lead width		b	0.18	0.22	0.30
Package size	X	D	12.40	12.50	12.60
	Y	E	9.90	10.00	10.10
E-PAD size	X	D2	7.30	7.40	7.50
	Y	E2	5.50	5.60	5.70
Lead length		L	0.30	0.40	0.50
Lead pitch		eT	0.50 bsc		
Lead pitch		eR	0.65 bsc		
Lead arc		R	0.090	---	0.140
Lead to E-PAD tolerance		K	0.80	---	---
Package tolerance		aaa	0.10		
Package profile of a surface		bbb	0.10		
Lead profile of a surface		ccc	0.10		
Lead position		ddd	0.05		
Lead profile of a surface		eee	0.08		
Epad position		fff	0.10		

MT7531 POD

4.1 Dimensions - LQFP (14 x 14mm)

Figure 4-1 Package Dimension





ITEM		SYMBOL	MIN.	NOM.	MAX.
Total height		A	—	—	1.60
Stand off		A_1	0.05	—	0.15
Mold thickness		A_2	1.35	1.40	1.45
Lead width		b	0.13	0.18	0.23
Outer Lead Distance	X	D	16.00 BSC.		
	Y	E	16.00 BSC.		
Package size	X	D1	14.00 BSC.		
	Y	E1	14.00 BSC.		
Lead pitch		e	0.40 BSC.		
R 2		R_2	0.08	—	0.20
R 1		R_1	0.08	—	—
Angle		θ	0°	3.5°	7°
Angle 1		θ_1	0°	—	—
Angle 2		θ_2	11°	12°	13°
Angle 3		θ_3	11°	12°	13°
L/F thickness		c	0.09	—	0.20
L		L	0.45	0.60	0.75
Lead length		L_1	1.00 REF		
S		S	0.20	—	—
Package profile of a surface		aaa	0.20		
Package profile of a surface		bbb	0.20		
Lead profile of a surface		ccc	0.08		
Lead position		ddd	0.07		

Appendix

WiFi Fixed Rate Commands

```
iwpriv ra0 set FixedRate
[WCID]-[Mode]-[BW]-[MCS]-[VhtNss]-[SGI]-[Preamble]-[STBC]-[LDPC]-[SPE_EN]
```

2G CCK:

```
iwpriv ra0 set FixedRate=1-0-0-0-0-0-0-0-0-1
```

2G 6M:

```
iwpriv ra0 set FixedRate=1-1-0-0-1-0-0-0-0-1
```

5G 6M:

```
iwpriv rax0 set FixedRate=2-1-0-0-1-0-0-0-0-1
```

MEDIATEK

everyday genius