Helsinki Tune-Up Procedure and Target Powers for WWAN, WLAN, BT
Revised 9-28-18

Tune-Up Procedure:

Normal Operation and Testing Modes:

This is an LTE/WCDMA/EDGE device, and as such provides cellular access using both LTE/WCDMA/HSPA technology, and GSM/GPRS/EDGE technology. LTE and WCDMA utilize FDD and GSM/GPRS/EDGE utilizes TDD. The radio is normally in receive mode listening to all network activity. When a data packet or voice call is received that is explicitly addressed to the radio it then transmits a short acknowledgement packet. For GSM/GPRS/EDGE mode, when data is to be transmitted, the radio first receives system information from the network to determine when to transmit and then the data is transmitted in packets. When operating in LTE/WCDMA/HSPA mode, when data is to be transmitted, the radio negotiates a connection with the network, a connection is established, a code channel is assigned, and data transferred. As this device is capable of multislot Class 12 operation in GSM/GPRS/EDGE mode, the transmit packet timing for data and circuit switched timing for voice is based on a deterministic pattern with a duty factor of 12.5% (1 timeslot per frame) for voice, and up to 50% (4 timeslots per frame) for data. For LTE/WCDMA/HSPA, transmission is continuous when alternate channel measurements are not being made. Transmission and reception occur simultaneously when transmission is required. To facilitate testing, the radio specification allows several test modes for transmitting continuous carrier without modulation or with modulation generated from scrambler sequence or fixed sequence test pattern.

Tuning Operations:

All functions of the radio are either fixed in nature or are electronically tuned. There are no manually tunable components. Tuning is accomplished by automated software using RF test equipment and the testing modes of the radio.

WWAN target power info:

WWAN Band	Target (dBm)	Tolerance (dB)
WCDMA B1	23.5	+0.5~-1.5
WCDMA B2	23.5	+0.5~-1.5
WCDMA B5	24	+0.5~-1.5
WCDMA B8	24	+0.5~-1.5
CDMA/1xRTT/EVDO BC0	24	+0.5~-2
CDMA/1xRTT/EVDO BC1	23.5	+0.5~-2
HSDPA/HSUPA B1	22.5	+0.5~-2

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HSDPA/HSUPA B2	22.5	+0.5~-2
HSDPA/HSUPA B5	23	+0.5~-2
HSDPA/HSUPA B8	23	+0.5~-2
LTE B2	23	+0.5~-1.5
LTE B4	23	+0.5~-1.5
LTE B5	23	+0.5~-1.5
LTE B17	23	+0.5~-1.5
LTE B3	23	+0.5~-1.5
LTE B7	22.5	+0.5~-1.5
LTE B20	23	+0.5~-1.5
GSM850	33	+1.0~-1.5
EDGE 850	27	+1.0~-1.5
GSM900	33	+1.0~-1.5
EDGE900	27	+1.0~-1.5
GSM1800	30	+1.0~-1.5
EDGE1800	25	+1.0~-1.5
GSM1900	30	+1.0~-1.5
EDGE1900	25	+1.0~-1.5

WWAN Band	Target (dBm)	Tolerance (dB)
GPRS 850 class 12 (2slot)	30.5	+1.0~-1.5
GPRS 850 class 12 (3slot)	28.5	+1.0~-1.5
GPRS 850 class 12 (4slot)	27	+1.0~-1.5

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EDGE 850 class 12 (2slot)	25	+1.0~-1.5
EDGE 850 class 12 (3slot)	22.5	+1.0~-1.5
EDGE 850 class 12 (4slot)	20.5	+1.0~-1.5
GPRS 900 class 12 (2slot)	30.5	+1.0~-1.5
GPRS 900 class 12 (3slot)	28.5	+1.0~-1.5
GPRS 900 class 12 (4slot)	27	+1.0~-1.5
EDGE 900 class 12 (2slot)	25	+1.0~-1.5
EDGE 900 class 12 (3slot)	22.5	+1.0~-1.5
EDGE900 class 12 (4slot)	20.5	+1.0~-1.5
GPRS 1800 class 12 (2slot)	27.5	+1.0~-1.5
GPRS 1800 class 12 (3slot)	25.5	+1.0~-1.5
GPRS 1800 class 12 (4slot)	24.5	+1.0~-1.5
EDGE 1800 class 12 (2slot)	22.5	+1.0~-1.5
EDGE 1800 class 12 (3slot)	20.5	+1.0~-1.5
EDGE 1800 class 12 (4slot)	18.5	+1.0~-1.5
GPRS 1900 class 12 (2slot)	27.5	+1.0~-1.5
GPRS 1900 class 12 (3slot)	25.5	+1.0~-1.5
GPRS 1900 class 12 (4slot)	24.5	+1.0~-1.5
EDGE 1900 class 12 (2slot)	22.5	+1.0~-1.5
EDGE 1900 class 12 (3slot)	20.5	+1.0~-1.5
EDGE 1900 class 12 (4slot)	18.5	+1.0~-1.5

BT and WLAN Target Powers

IEEE 802.11(in dBm)						
Mode	**Protocol**	**a**	**b**	**g**	**n**	**ac**
2.4 GHz Wi-Fi	2450MHz	NA	15	11.5	9.5	NA
5GHz Wi-Fi	5200MHz	14	NA	NA	14	14

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(20MHz BW)	5300MHz	14	NA	NA	14	14
	5500MHz	14	NA	NA	14	14
	5800MHz	11.5	NA	NA	11.5	11.5
5 GHz Wi-Fi **(40MHz BW)**	5200MHz	NA	NA	NA	14	14
	5300MHz	NA	NA	NA	14	14
	5500MHz	NA	NA	NA	14	14
	5800MHz	NA	NA	NA	14	11.5
5GHz Wi-Fi **(80MHz BW)**	5200MHz	NA	NA	NA	14	14
	5300MHz	NA	NA	NA	NA	14
	5500MHz	NA	NA	NA	NA	14
	5800MHz	NA	NA	NA	NA	11.5

(Tolerance is Target +0.5/-2dB)

Bluetooth	Target (dBm)	Tolerance (dB)
2.4GHz	6	+-2

Bluetooth LE	Target (dBm)	Tolerance (dB)
2.4GHz	1	+-2