

# HBflex™

## mmWave and sub-6 GHz Network Testing

Scanning Receiver | 10 MHz – 6 GHz | 24 – 40 GHz



The PCTEL® HBflex is a highly flexible scanner designed for testing 5G NR, LTE, 2G/3G cellular across mmWave (FR2) and sub-6 GHz (FR1) bands. It features Dynamic Spectrum Sharing (DSS) and simultaneous mmWave and sub-6 GHz measurements to help operators efficiently utilize all their spectrum and make a smooth transition to 5G.

### Bands

- 5G: 3GPP FR1
- mmWave 3GPP FR2
- All existing 2G, 3G, and 4G
- CBRS
- Public safety
- WiFi (2.4 and 5 GHz)
- Other bands currently deployed around the world

### Technologies

- 5G NR
- LTE FDD
- TD-LTE
- NB-IoT
- UMTS
- GSM
- CDMA
- WiFi
- LAA
- P25
- DMR
- TETRA
- Analog FM

Custom Channel Power Measurements for additional technologies

### Features

- 4G/5G Dynamic Spectrum Sharing (DSS)
- Non-Terrestrial Network (NTN) measurements
- Dual polarization beamforming measurements
- 2x2 and 4x2 LTE MIMO measurements
- Hot-swap battery system
- Windows® laptop and Android™ tablet support
- Connect with Bluetooth® or USB
- Blind Scan for automatic channel detection
- LMR active channel scan



# HBflex™ Specifications

## 5G New Radio (NR)

Measurement modes	NR TopN Signal: Synchronization channels (P-SS/S-SS) & PBCH; Layer 3 Reporting: MIB (FR1 and FR2), SIBs 1-9 (FR1); Dual polarization beamforming measurements (FR1); Blind Scan; Mobile Blind Scan
Data modes	PCI, Beam Index, PSS-RP [dBm], SSS-RP [dBm], PSS-RQ [dB], SSS-RQ [dB], PSS-CINR [dB], SSS-CINR [dB], RSPBCH-RP [dBm], RSPBCH-RQ [dB], RSPBCH-CINR [dB], SSB-RP [dBm], SSB-RQ [dB], SSB-CINR [dB], SSB-idx, SSB-RSSI, SSS-Delay-Spread, Time Offset
Sub carrier spacing	15/30/120/240 kHz
Max. number of channels	24 FR1 and 8 FR 2
Max. number of PCIs	8 (sub-6 GHz), 8 (mmWave)
Max. number of beams/PCI	8 (sub-6 GHz), 64 (mmWave)
Measurement rate (typical)	30/sec (sub-6 GHz), 20/sec (mmWave, 2 RF ports), 6/sec (mmWave, 1 RF port)
Dynamic range (CINR)	PSS/SSS CINR: -10 to +33 dB (sub-6 GHz), -10 to +23 dB (mmWave) PBCH DMRS CINR: -8 to +40 dB
Min. detection level	RP SCS @15 kHz: -135 dBm, SCS @30 kHz: -132 dBm, SCS @120 kHz: -128 dBm, SCS @240 kHz: -128 dBm
Accuracy (CINR)	PSS/SSS, PBCH DMRS ±2 dB

## LTE FDD and TD-LTE

Measurement modes	Top N Synchronization Channel Reference Signal (P-SCH/S-SCH) and Resource Block (Wideband, Subband), Dynamic Spectrum Sharing (DSS), Layer 3 Reporting, Blind Scan, Mobile Blind Scan, Non-Terrestrial Networks (NTN)
Data modes	PCI, RP, RQ, CINR, Cyclic Prefix, Time Offsets, Delay Spread; RF Path Measurements (4x1, 4x2); MIMO: Condition Number, ECQI, EPUT; NTN: Frequency Offset
Channel bandwidths	1.4 / 3 / 5 / 10 / 15 / 20 MHz
Max. number of channels	24
Receive modes	SISO; MIMO (2x2, 4x2)
Transmit antenna configurations	1, 2, 4 (with path measurement)
Measurement rates	Sync Channel RS LTE FDD: 50/sec; TD-LTE: 25/sec
Dynamic range (CINR) @ 10/15/20 MHz	RS -26 to +40 dB P-SCH/S-SCH -10 to +18 dB
Min. detection level	P-SCH/S-SCH & RS -140 dBm (RSRP @ 15 kHz)
Accuracy (CINR)	P-SCH/S-SCH & RS ±1 dB
Max. number of PCIs	16

## NB-IoT

Measurement modes	Top N NRS (Narrowband Reference Signal), NPSS (Narrowband Primary Synchronization Signal), and NSSS (Narrowband Secondary Synchronization Signal), Layer 3 Reporting, Blind Scan
Data modes	NRS: RP, RQ, RSSI, CINR, Time Offset; NPSS: RP, RQ, RSSI, CINR; NSSS: RP, RQ, RSSI, CINR, Time Offset
Operation mode	In-Band, Guard Band, Stand-alone (eTopN mode only)
Channel bandwidths	180 kHz
Measurement rates	5/sec
Dynamic range (CINR)	NRS -15 to +40 dB
Min. detection level	NRS RP -138 dBm
Accuracy (CINR)	NRS ±2 dB
Max. number of PCIs	16

## UMTS [WCDMA/HSPA(+)]

Measurement modes	Top N Pilot, Layer 3 Reporting, Blind Scan, Mobile Blind Scan
Data modes	Io, Ec/Io, Aggregate Ec/Io, SIR, Rake Finger Count, Time Offset, Delay Spread
Channel bandwidths	200 kHz / 3.84 MHz
Max. number of channels	24
Measurement rate	100/sec (high speed mode); 50/sec (high dynamic range mode)
Top N CPICH dynamic range (Ec/Io)	-26 dB
Min. detection level	-120 dBm (high dynamic range mode)
Accuracy	±1 dB
Max. number of Pilots	32

## GSM

Measurement modes	Color Code, Layer 3 Reporting, Blind Scan, Mobile Blind Scan
Data modes	BSIC, C/I, RSSI
Channel bandwidths	30 kHz / 200 kHz
Measurement rates	Up to 200 BSIC Decodes/sec
Dynamic range	+2 dB C/I
Min. BSIC detection level	-110 dBm
Accuracy	±1 dB

## CDMA

Measurement modes	Top N PN, CDMA Layer 3 Reporting, Blind Scan, Mobile Blind Scan
Data modes	Ec, Io, Ec/Io, Aggregate Ec/Io, Pilot Delay, Delay Spread
Channel bandwidths	30 kHz / 1.25 MHz
Max. number of channels	24
Measurement rates	CDMA: 25/sec
Top N PN dynamic range, Ec/Io	CDMA: -28 dB
Min. PN detection level	CDMA: -130 dBm
Accuracy (CINR)	±1 dB
Max. number of Pilots	32

## WiFi

Wireless adapter	D-Link Wi-Fi Adapter AC1200 Mini (Only D1 version is supported); Linksys WUSB6300 v2 Dual-Band WiFi 5 USB Adapter
Radio configuration	802.11a/g/n/ac (Note: Linksys also supports 802.11b)
Data modes	Signal Strength, Noise Level, Channel Number, Channel Bandwidth, BSSID, Device Name, SSID, Security Protocol, 802.11 Media, Beacon Interval, Channel Utilization
Frequency range	2.4 - 2.483 GHz; 5.15 - 5.85 GHz (subject to country regulations)
Measurement rates	4 sec/measurement (typical)

## LAA

Measurement modes	QTopN
Data modes	RSRP, RSRQ, RS-CINR, PSS-RQ, PSS-RP, PSS-CINR, SSS-RP, SSS-RQ, SSS-CINR
Channel bandwidth	20 MHz
Max. number of channels	24
Measurement rate (20MHz, 1 Sig)	6.25/sec
Dynamic range (CINR)	-12 dB
Minimum detection level	RSRP -130 dBm
Accuracy (CINR)	RS-CINR ±1 dB (Input CINR 0 dB to +15 dB)

## P25 (Phase 1 and Phase 2)

Measurement modes	DL, UL*, RSSI, DL Active Channel Scan
Data modes	DL SINR, RSSI, OOS-BER, Frame BER, Network ID, Auto Classification of Phase and Modulation Type UL SINR, RSSI, Frame BER, Network ID, Mobile ID, Auto Classification of Phase and Modulation Type, Frequency Offset, Symbol Deviation (Phase 1 UL only)
Channel bandwidths	DL & UL 12.5 kHz
Measurement rate	DL 5.4 Decodes/sec (maximum); 2.7 Decodes/sec (typical); 100 RSSI/sec UL 2.4 Decodes/sec (typical), 100 RSSI/sec
Dynamic range (SINR)	DL & UL +1 dB minimum detection
RSSI Accuracy	DL (Phase 1 C4FM & Phase 2 HDQPSK) ±1 dB over -105 to -10 dBm UL ±1 dB over -105 to -10 dBm
SINR Accuracy	DL (Phase 1 C4FM & Phase 2 HDQPSK) ±1 dB over +10 to +25 dB; ±2 dB over +7 to +10 dB, 25 to 30dB UL ±1 dB over +10 to +25 dB; ±2 dB over +7 to +10 dB, 25 to 30dB
Adjacent channel rejection	DL & UL 49 dB
UL frequency offset	Detection range -780 to +780 Hz Granularity +/- 10 Hz Accuracy +/- 10 Hz over RSSI > -105dBm, SINR > 20 dB
UL radio ID detection rate	Control Channel 95% detection RSSI > -110 dBm and SNR > 18 dB Traffic Channel 95% detection for RSSI > -95 dBm and SNR > 30 dB
Rejection of strong wideband (10 MHz LTE) signal 1 MHz from P25 channel	High rejection when the RSSI of the Wideband signal < -60 dBm

## Analog FM

Measurement modes	Decode, RSSI, Squelch Type, MDC-1200
Data modes	SINR, RSSI, Frequency Offset
Channel bandwidths	12.5 KHz; 25 KHz
Measurement rate	2.7 Decodes/sec (4 frequencies)
Dynamic range (SINR)	1.5 dB minimum detection for PL (> 90% detection) 2 dB minimum detection for DPL (> 90% detection)
Accuracy	SINR ±1 dB over +5 to +40 dB; ±2 dB over +1 to +5 dB and +41 to +45db; ±3 dB over -3 to 0 db and +45 to +50 db RSSI ±1 dB over -118 to -35 dBm

## Mixed Analog/P25

P25 specifications	See P25 Phase 1 specifications above
Analog FM specifications	See Analog FM specifications above

## DMR

Measurement modes	Decode, RSSI, DL Active Channel Scan
Data modes	SINR, OOS-BER, RSSI, Frame BER, cSysCode, CSBKO (Tier 2 or 3)
Channel bandwidths	12.5 kHz
Measurement rate	5.4 Decodes/sec (maximum); 2.7 Decodes/sec (typical); 100 RSSI/sec
Dynamic range (SINR)	-1 dB minimum detection
Accuracy	SINR ±1 dB over 6 to 40 dB; ±2 dB over 3 to 6 dB RSSI ±1 dB over -118 to -10 dBm
Adjacent channel rejection	49 dB
Rejection of strong wideband (10 MHz LTE) signal 1 MHz from DMR channel	High rejection when the RSSI of the Wideband signal < -60 dBm

\*UL measured on one out-of-service traffic channel

## TETRA

Measurement modes	Decode, RSSI, DL Active Channel Scan
Data modes	SINR, RSSI, Frame BER, Color Code, cSysCode, MCC, MNC, Location Area Code (LAC)
Channel bandwidths	25 kHz
Measurement rate	6.5 Decodes/sec (maximum); 3.5 Decodes/sec (typical); 100 RSSI/sec
Dynamic range (SINR)	+2 dB minimum detection
Accuracy	SINR ±2 dB over +8 to +20 dB; ±3 dB over +4 to +8 dB RSSI ±1 dB over -118 to -10 dBm
Adjacent channel rejection	20 dB
Rejection of strong wideband (10 MHz LTE) signal 1 MHz from TETRA channel	High rejection when the RSSI of the Wideband signal < -60 dBm

## GPS/GNSS

Supported navigation systems	Galileo, GPS, GLONASS, SBAS, QZSS
Type	56 channel internal receiver
Position accuracy	2.5 meters
Acquisition time	Cold start: <30 sec; Hot start: <2 sec
Sensitivity (tracking)	>-150 dBm

## Power Measurements

Accuracy	±1 dB (across basic RF input power range)
Dynamic range	-120 to -20 dBm @ 30 kHz
RSSI	5G NR, LTE 11,050 ch/sec (maximum, contiguous channels) NB-IoT, UMTS, GSM 4,250 ch/sec (maximum, contiguous channels) CDMA 8,500 ch/sec (maximum, contiguous channels)
Custom channel power (examples)	12.5 kHz (P25, DMR, EDACS, Analog LMR) 25,500 ch/sec (maximum, contiguous channels) 25 kHz (TETRA, EDACS, Analog LMR) 14,025 ch/sec (maximum, contiguous channels) 125 kHz (LoRa) 10,710 ch/sec (maximum, contiguous channels) 250 kHz (LoRa) 8,925 ch/sec (maximum, contiguous channels) 500 kHz (LoRa) 6,885 ch/sec (maximum, contiguous channels)
Enhanced Power Scan (EPS)	5 kHz to 20 MHz in 2.5 kHz increments 1,000 MHz/sec @ 5 MHz (typical)
Spectrum analysis	Range: >90 dB >270 MHz/sec (single sweep)
LTE power analysis	1.3 / 3/ 5 / 10 / 15 / 20 MHz TD-LTE only 20 msec @ 5 MHz

## Physical

Maximum power (+9 to +17 VDC)	25W max.
Size	10.10" D x 6.50" W x 4.40" H (255.3 mm D x 165.1 mm W x 111.5 mm H)
Weight	7.26 lbs (3.3kg)
Temperature range	Operating: 0°C to +50°C; Storage: -30°C to +80°C
Humidity	5% to 95% relative humidity, non-condensing
Host data communications interface	USB 2.0, Ethernet, Bluetooth®
Data storage	SD (32 GB)
Antenna ports	RF (sub 6 GHz, Bluetooth): SMA Female (50 Ω); GPS: Male (50 Ω) SMB, RF (mmWave): 2.92 mm Female
Safety	EN 62368-1
EMC	EN 301 489 -1
Shock and vibration	MIL-STD-810G, SAE J1455
RoHS	Directive 2011/65/EU and amendment 2015/863 (RoHS 3)

## RF Characteristics

Frequency range	Sub 6 GHz: 10 MHz – 6 GHz mmWave: N257 (26.5-29.5 GHz), N258 (24.25-27.5 GHz), N260 (37-40 GHz), N261 (27.5-28.35 GHz)
Internally generated spurious response	-105 dBm (typical)
RF operating range	In-Band -20 dBm max.
Desensitization	Adjacent channel >50 dB (20MHz RBW)
Safe RF input range	≤ +0 dBm
Frequency accuracy	±0.05 ppm (GPS Locked); ± 0.1 ppm (GPS unlocked)
Conducted local oscillator	-55 dBm (typical)

Supported bands, technologies, data modes, software features, and frequency ranges vary by scanning receiver configuration. Upgrades may be available for previously purchased scanning receivers. Please contact a sales representative for more information.



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