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	Deliverable	Technical Construction/Documentation File Element	
	Title	24967 CareLink SmartSync™ Device Manager Patient Connector BT/BLE Radio Antenna Gain calculation	

The gain for the BT/BLE antenna p/n 511185-00 used in the 24967 Patient connector is shown below by comparing a representative measure of the transmitter conducted output level against the highest measured radiated EIRP power level and calculating the antenna gain.

Direct Measurement Confirmation (Excerpt from Medtronic radio design verification report DSN021467)

To confirm the datasheet inspection, a manufacturing equivalent Pilot base station (serial number SPM000113A, firmware HEAD_BS_TRR4(20160707) was modified by removing the chip antenna from the Bluetooth module and soldering a SMA socket in its place. This was connected through a 20 dB Agilent attenuator (no calibration required) and a 1 meter length of coaxial cable (measured loss of 1.02 dB) to an Agilent model E4404B spectrum analyzer (ID#145092, calibration due 21Oct2016) with a 1 MHz resolution bandwidth (the same bandwidth as the Bluetooth classic channel). There was enough “leakage” power to successfully allow two-way communication with a nearby tablet computer (Android Google Pixel C, 6.0.1 running CareLink SmartSync application ID 0000-881D-7104-8604) and measure the transmit power.

Agilent datasheet 5589-9815EN published August 4, 2014, page 13, shows the absolute frequency response of the E4404B from 9 kHz to 3 GHz is +/-0.46 dB. Overall amplitude accuracy is the absolute frequency response +/-0.54 dB, so the overall amplitude accuracy is +/-0.46 +/- 0.54 = +/- 1.00 dB. That is, a “true” power of 4 dBm might be measured anywhere from 3 to 5 dBm, so the “pass” criterion is a measured power of 5 dBm or less.

Operator and Date	Thomas Kelly 03August2016					
Parameter	Measured Power. Max. (raw)	Add: 20 dB Attenuator	Add: 1.02 dB Cable Loss	Transmit Power (adjusted)	Transmit Power Limit	Pass/Fail
Value	-16.76 dBm	+ 20 dB	+ 1.02 dB	4.26 dBm	5 dBm	Pass

EIRP Radiated Measurement (pulled from NWEMC OTA Radio Characterization report MDTR0473)

The 4.26 dBm was used in the NWEMC report for the highest measured EIRP value of 8.46dBm. The resulting antenna gain is shown in the table below to be 4.2dBi.

3D PATTERN DATA

Frequency (MHz)	2440
Ant. Port Input Pwr. (dBm)	4.26
Tot. Rad. Pwr. (dBm)	1.74
Peak EIRP (dBm)	8.46
Directivity (dBi)	6.71
Gain (dBi)	4.20

