JANUS REMOTE COMMUNICATIONS

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Antenna Recommendations
HSPA910CF Based Applications

Overview

One of the frequently asked questions for engineers that are designing m2m applications for the first time is, "What antennas do you suggest for this application?"

In addition to the application specific requirements, antenna and cable combination selection is governed by two sets of requirements: carrier based minimum transmitted ERP/minimum receiver sensitivity and FCC maximum antenna gain for a given band.

In the case of the HSPA910CF those requirements and limits are as follows:

Telit:

The Telit HE910 performance basis per class and band [1]

Output power

- Class 4	(2 W, 33 dBm)	@ GSM 850 / 900
- Class 1	(1 W, 30 dBm)	@ GSM 1800 / 1900
- Class 3	(0.25 W, 24 dBm)	@ UMTS
- Class E2	(0.5 W, 27 dBm)	@ EDGE 850 / 900
- Class E2	(0.4 W, 26 dBm)	@ EDGE 1800 / 1900

Sensitivity

-108 dBm	@ UMTS
-107 dBm	@ GSM 850 / 900 MHz
-106 dBm	@ DCS1800 / PCS1900 MHz

FCC

FCC emission limit requirements [2]

Section	Band	Power(w)
22H	824.2 – 824.2	1.995
22H	824.2 – 848.8	0.997
22H	826.4 – 846.4	0.446
27	1712.4 – 1752.6	0.226
24E	1850.2 – 1909.8	0.993
24E	1850.2 – 1909.8	0.38
24E	1852.4 – 1907.6	0.243

Requirements of 2.1091 (maximum permissible antenna gain) are: *5.22 dBi for part 22H, 3.31 dBi for part 27 6.45 dBi for part 24E.*

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operated in conjunction with any antenna or transmitter not described under this FCC id, except in accordance with FCC multi-transmitter product procedures.

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AT&T

AT&T requirements for performance [3]

The cable loss shall be such that the total radiate power at the antenna shall be no less than +22/24.5 dBm for 850/1900 MHz respectively, and the total isotropic sensitivity at the antenna shall be no less than -99/101.5 dBm for 850/1900 MHz respectively

So the easy "first" answer is from the FCC grant for the HE910. For most standard installations this answer is correct and sufficient. An antenna that is has no more gain than that listed – per band – meets the requirements. However, some would like to know how low they can go for a given antenna installation. This then requires a fuller examination of the cable and antenna characteristics with respect to how well they meet the minimum performance requirements for the carrier – in this case AT&T.

For Transmissions:

Band	AT&T Requirement	Telit Output	Combined Cable Loss & Antenna Loss (neg gain or -X dBi)
850/900	22 dBm	33 dBm (GSM)	11 dB
		27 dBm (EDGE)	5 dB
1800/1900	24.5 dBm	30 dBm (GSM)	5.5
		26 dBm (EDGE)	1.5

For Reception:

Band	AT&T Requirement	Telit Sensitivity	Combined Cable Loss & Antenna Loss (neg gain or -X dBi)
850/900	-99 dBm	-107 dBm	8 dB
1800/1900	-101 dBm	-106 dBm	5

So look down the far right hand column and we see that for a 0 dBi antenna @1800/1900 the maximum cable loss acceptable is 1.5 dB. On the other hand for a 3 dBi gain antenna the cable loss increases to 4.5 dB.

AT&T continued

AT&T requirements for performance [3] continued

Following are example antennas and calculations:

Example 1 surface mount antenna [4]

Example 2 low-gain monopole [5]

Example 3 peta-band surface mount [6]

Example 1: Surface Mount Antenna

Band	Antenna Mfr Gain Spec (dBi)	FCC Spec (dBi)	Gain less than FCC Max	Telit xmit Power (dBm)	AT&T R'qed Min Power (dBm)	Ant & Cable Loss	Net ERP (dBm)	OK to use
850/900	-2.4/-1.6	5.22	Yes	33/27 dBm	22	-6.7/-5.9	26.3/21.1	No
1800/1900	1.9/0	6.45	Yes	30/26 dBm	24.5	-3.6/-5.4	26.4/20.6	No

Example 2: Low-Gain Monopole

Band	Antenna Mfr Gain Spec (dBi)	FCC Spec (dBi)	Gain less than FCC Max	Telit xmit Power (dBm)	AT&T R'qed Min Power (dBm)	Ant & Cable Loss	Net ERP (dBm)	OK to use
850/900	3 dBi	5.22	Yes	33/27 dBm	22	3 dB*	36/30	Yes
1800/1900	3 dBi	6.45	Yes	30/26 dBm	24.5	3 dB*	33/29	Yes

* No cable specified – zero cable loss

Example 3: Peta-Band Surface Mount

Band	Antenna Mfr Gain Spec (dBi)	FCC Spec (dBi)	Gain less than FCC Max	Telit xmit Power (dBm)	AT&T R'qed Min Power (dBm)	Ant & Cable Loss	Net ERP (dBm)	OK to use
850/900	-2.54/-1.37	5.22	Yes	33/27 dBm	22	-2.54/-1.37	30.53/25.5	Yes
1800/1900	-1.97/-2.53	6.45	Yes	30/26 dBm	24.5	-1.97/-2.53	28/23.5	No

1 Telit_HE910)Family_Datasheet.pdf
2. USA_HE910_FCC_(PCB)_Grant.pdf
3. Notice of Network Caompatibility
4. PC27.09.0100A
5. PSKN3
6. PC29.07.0100A

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