Out of band emissions from BTS without TXBP

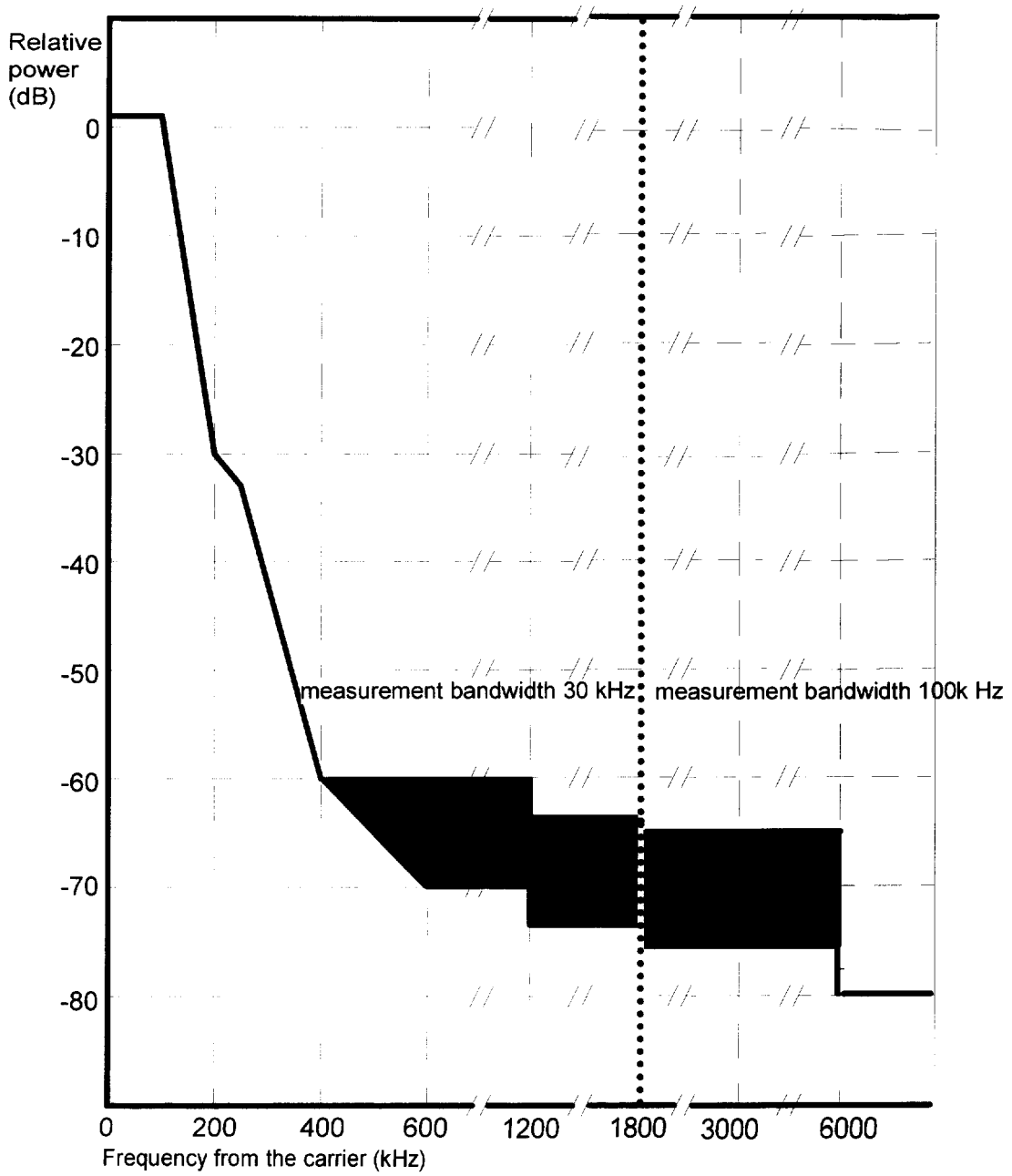


Figure 1: GSM 400, GSM 900, GSM 850, MXM 850, DCS 1800, PCS 1900 and MXM 1900 BTS spectrum due to GMSK modulation

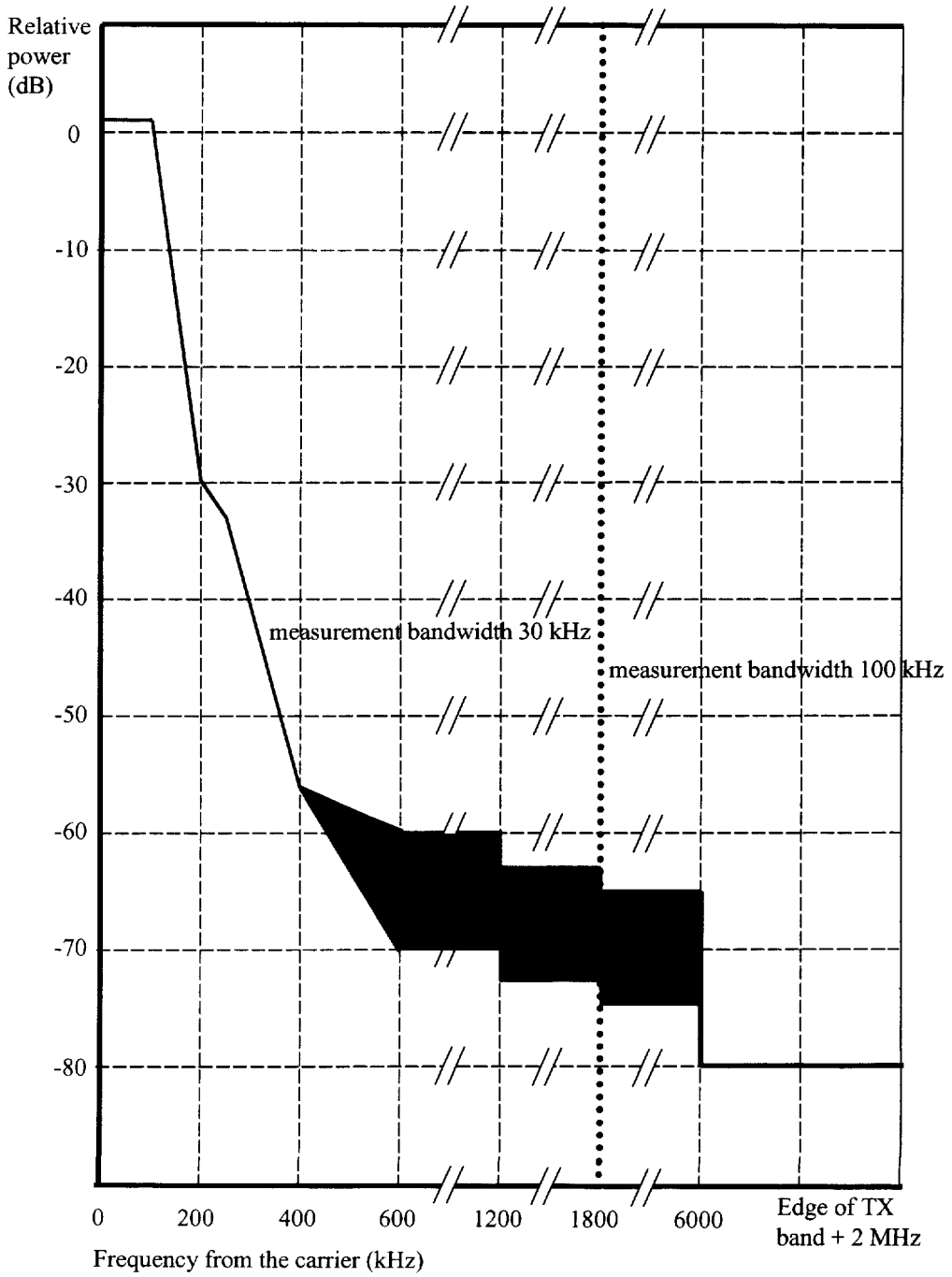
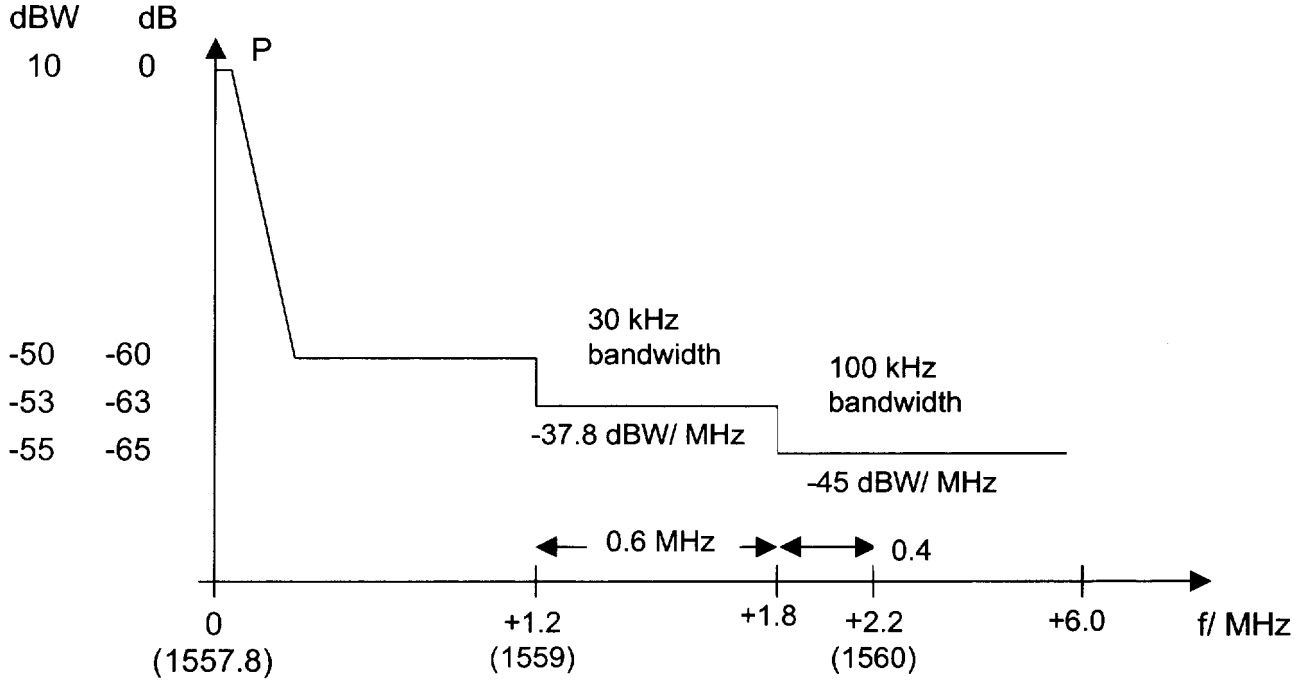


Figure 2: GSM 400, GSM 900, GSM 850, MXM 850, DCS 1800, PCS 1900 and MXM 1900 BTS spectrum due to 8-PSK modulation

3 CALCULATION OF THE REQUIREMENT FOR THE TXBP



Req 1: `-70 dBW/MHz EIRP from 1559 - 1606 MHz.`

Conversion factors:

30 kHz measurement bandwidth ⇒ +15.2 dB / MHz

100 kHz measurement bandwidth ⇒ +10 dB / MHz

Generated emissions:

Average level for 1559 to 1560 MHz ⇒ -40.7 dBW/ MHz (0.6x37.8+0.4x45)

Assume 3 dB feeder loss and 16 dBi Antenna gain ⇒ -27.7 dBW/ MHz (-40.7-3+16 =-27.7)

Filter requirement:

The filter requirement is therefore to attenuate an average of 42.3 dB over 1 MHz (-70 + 27.7=-42.3)

With the current chip-set for the GSM Transceiver the expected out of band emissions are –63 dB relative power from 1.2 to 1.8 MHz from the center frequency of the carrier, measured in 30kHz bandwidth. –65 dB from 1.8 to 6 MHz measured in 100 kHz bandwidth. This corresponds to an average of –40.7 dBW/MHz for the lowest MHz within the GPS band that is the most at risk.

Req 2: `-80 dBW discrete spurious, measured in a 1 kHz bandwidth.`

Conversion factors:

30 kHz measurement bandwidth ⇒ -15 dB / kHz

Generated emissions

With – 53 dBW/ 30 kHz ⇒ -68 dBW/ kHz

Assume 3 dB feeder loss and 16 dBi Antenna gain ⇒ -55 dBW/ kHz (-68-3+16 =-55)

Filter requirement:

The requirement on the filter is to attenuate 25 dB from 1559 to 1606MHz. (-80+55=-25)

4 TXBP WITH SOME ATTENUATION IN 1559 – 1606 MHZ

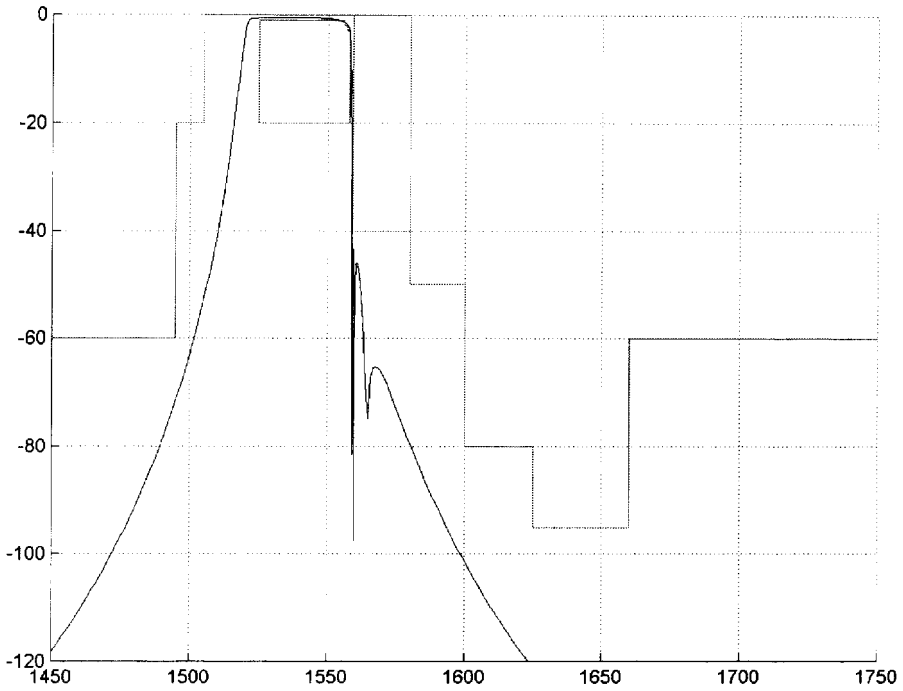
Below are simulations of TX-bandpassfilter as it could be designed with some attenuation in the GPS-band. The size of the filter is compliant with the GSM-products of today.

In blue are some general specifications in line with other GSM-products of today. In red is a 40dB attenuation reference line for the GPS-frequencies.

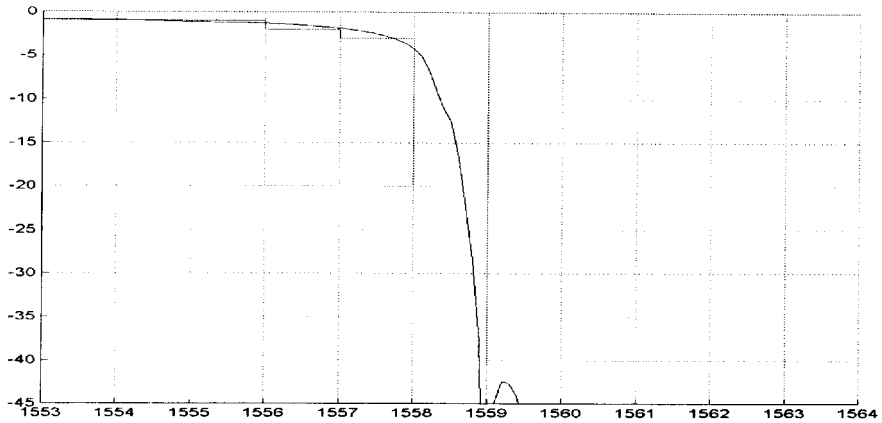
Note that the curves are from a perfect model. That's why there is some margin to suggested specs / performance.

The performance is based on conventional air/metal cavity's with high temperature stability. Performance could be somewhat improved by enforcing a high Q notchfilter for the GPS-attenuation (See section 4.4)

4.1 WIDEBAND PLOT



4.2 MAGNIFIED PLOT OF GUARDBAND AREA BETWEEN GSM TX AND GPS



4.3 PERFORMANCE OF CONVENTIONAL AIR CAVITY

If about 40 dB attenuation is required approx. performance is as follows:

Passband:	1525 – 1554 MHz	= normal insertion loss
	1554 – 1556 MHz	< 0.5 dB increase in insertion loss
	1556 – 1557 MHz	< 1 dB increase in insertion loss
	1557 – 1558 MHz	< 3.5 dB increase in insertion loss
Guardband:	1558 – 1559 MHz	
GPS-band:	1559 – 1606 MHz	> 40 dB attenuation

4.4 PERFORMANCE WITH HIGH-Q REJECTFILTER

Passband:	1525 – 1556 MHz	= normal insertion loss
	1556 – 1557 MHz	< 0.5 dB increase in insertion loss
	1557 – 1557.4 MHz	< 1 dB increase in insertion loss
	1557.4 – 1558 MHz	< 2 dB increase in insertion loss
Guardband:	1558 – 1559 MHz	
GPS-band:	1559 – 1506 MHz	> 40 dB attenuation

5 CONCLUSIONS

There will be little difficulties designing a TXBP filter in the current form factor for the GSM BTS that makes the BTS meet the listed requirements for usage with any normally used antennas. Even if a high gain antenna were to be used, filters can be made with an acceptable guardband that make the BTS meet the requirements.