



Report ITU-R BT.2215
(05/2011)

**Measurements of protection ratios and
overload thresholds for broadcast
TV receivers**

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***Note:** This ITU-R Report was approved in English by the Study Group under the procedure detailed in Resolution ITU-R 1.*

Electronic Publication
Geneva, 2011

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TABLE OF CONTENTS

	<i>Page</i>
1 Executive summary	2
2 Abbreviations	2
3 Useful definitions	3
3.1 Radio frequency signal-to-interference ratio (<i>C/I</i>)	3
3.2 Radio frequency protection ratio (PR).....	3
3.3 Receiver (front-end) overloading threshold.....	3
3.4 Adjacent channel leakage power ratio	3
3.5 “Can” tuners.....	3
3.6 “Silicon” tuners.....	3
4 References	4
4.1 Broadcasting technology characteristics.....	4
4.2 Mobile technology characteristics	4
5 Measurement methodology	4
5.1 Example test set-up.....	4
5.2 Wanted signal levels	7
5.3 Frequency offsets between interfering signal and wanted signal	7
5.4 Measurements in the presence of a time varying interfering signal	7
5.5 UMTS uplink	7
5.6 LTE – downlink.....	7
5.7 LTE – uplink.....	7
5.8 Interferer reference power level.....	8
5.9 Characterization of the interfering signal	8
5.10 Failure point assessment methods	8
5.11 Method for determining protection ratios and overloading thresholds.....	8

6	Conclusions and further work required	14
	Annex 1 – DVB-T receiver performance in the presence of interfering signals from DVB-T, UMTS and LTE	15

1 Executive summary

This Report documents measurements of protection ratio (PR) and overloading threshold (O_{th}) against interference from other broadcasts or mobile broadband services in the 800 MHz band.

The types of interference used in the tests and the actual tests themselves varies with the different broadcasting system and mobile technologies used around the world.

The aim of the Report is to establish test procedures together with measurement results to assist in network planning and sharing studies for the co-existence of TV broadcasting, with either mobile services, or other services and applications.

The original test details and measurement data, together with information on which particular Recommendation and its version number was updated with this data are contained in the individual annexes.

2 Abbreviations

BS	Base station
O_{th}	Overloading threshold
PR	Protection ratio
TPC	Transmit power control
UE	User equipment – the mobile handset
RB	Resource block – a unit of data transmission in LTE, represented by a certain number of carriers in a uplink or downlink symbol in the frequency domain.
FDMA	Orthogonal frequency-division multiplex access – a multi-carrier modulation system used for the LTE downlink.
SC-FDMA	Single carrier frequency division multiplex access – a multi-carrier modulation system used for the LTE uplink.

3 Useful definitions

3.1 Radio frequency signal-to-interference ratio (C/I)

It is the ratio, generally expressed in dB, of the power of the wanted signal to the total power of interfering signals and noise, evaluated at the receiver input (see Recommendation ITU-R V.573).

The power of the wanted signal is measured in a bandwidth equal to the wanted signal bandwidth, while the total power of interfering signal and noise is measured in a bandwidth equal to the interfering signal bandwidth.

3.2 Radio frequency protection ratio (PR)

It is the minimum value of the signal-to-interference ratio required to obtain a specified reception quality under specified conditions at the receiver input (note that this differs from the definition in Recommendation ITU-R V.573). In this Report, the “specified reception quality” and the “specified conditions” have been defined separately by each entity that has undertaken measurements.

Usually, PR is specified as a function of the frequency offset between the wanted and interfering signals over a wide frequency range. In this Report, PR specified in this way is referred to as “PR curve”. PR curves show the ability of a receiver to discriminate against interfering signals on frequencies differing from that of the wanted signal.

3.3 Receiver (front-end) overloading threshold

Overloading threshold (O_{th}) is the interfering signal level expressed in dBm, above which the receiver begins to lose its ability to discriminate against interfering signals at frequencies differing from that of the wanted signal (i.e., the onset of strong non-linear behaviour). Therefore, above the overloading threshold the receiver will behave in a non-linear way, but does not necessarily fail immediately depending on the receiver and interference characteristics.

3.4 Adjacent channel leakage power ratio

Adjacent channel leakage power ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency.

The requirements shall apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification. For a multi-carrier base station (BS), the requirement applies for the adjacent channel frequencies below the lowest carrier frequency transmitted by the BS and above the highest carrier frequency transmitted by the BS for each supported multi-carrier transmission configuration. The requirement applies during the transmitter ON period.

3.5 “Can” tuners

“Can” tuners are classical superheterodyne tuners housed in a metal enclosure containing discrete components. Classically, there are fixed and tunable circuits made up from discrete inductors and transistors usually with varactor diode frequency control. The metal enclosure should minimize RF interference and eliminate crosstalk and stray radiation.

3.6 “Silicon” tuners

“Silicon” tuners are IC-based tuners integrating all tuner circuitry into a small package directly to be fitted onto main boards. The tuned circuits may be completely absent or can be integrated onto the silicon. The silicon chip may be protected from external electromagnetic interference by a metallic cover. Silicon tuners have different characteristics to can tuners and their performance can be better and worse at some frequency offsets compared to can tuners. This technology is still developing.

4 References

4.1 Broadcasting technology characteristics

The following references explain the characteristics of the different broadcast systems including transmitter spectrum masks.

- DVB-T system characteristics: Recommendation ITU-R BT.1306, ETSI EN 300 744
- DVB-T2 system characteristics: Recommendation ITU-R BT.1877, ETSI EN 302 755
- ISDB-T system characteristics: Recommendation ITU-R BT.1306, ARIB STD-B31
- ATSC system characteristics: Recommendation ITU-R BT.1306, ATSC A/53
- DTMB system characteristics: Recommendation ITU-R BT.1306, GB20600-2006.

4.2 Mobile technology characteristics

The following references explain the characteristics of the different mobile broadband systems.

- UMTS system characteristics: ETSI TS 125.101, ETSI TS.125.104
- LTE system characteristics: ETSI TS 136.101, ETSI TS.136.104.

5 Measurement methodology

5.1 Example test set-up

An example basic test setup for protection ratio and overloading threshold measurements is depicted in Fig. 1.

FIGURE 1

