

Radio Equipment Directive

General Introduction



READY
FOR
RED

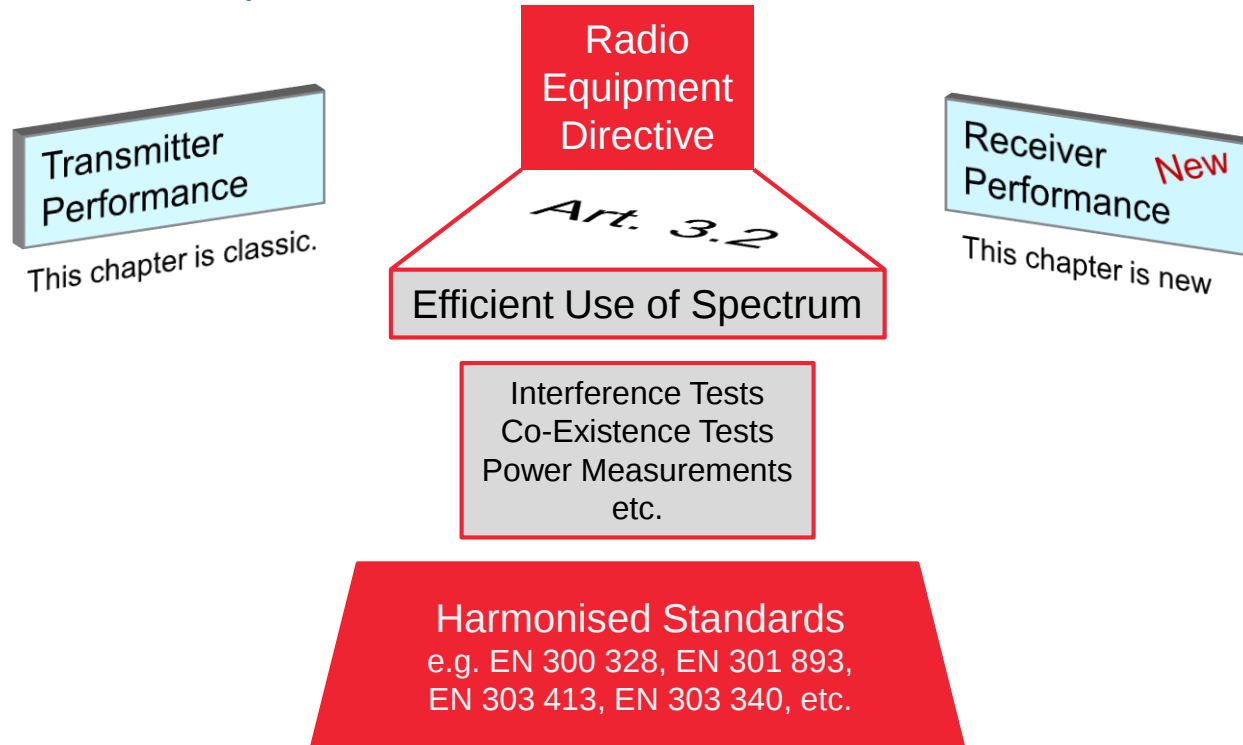
www.rohde-schwarz.com / RED

Christian Reimer

RED: Radio Equipment Directive

2014/53/EU: mandatory since June 2017

Keyword: Regulatory Testing



EN 302 567 under Directive 1999/5/EC (R&TTE)

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EN 302 567 under Directive 2014/53/EU (RED)

Example

Indication of higher
test effort

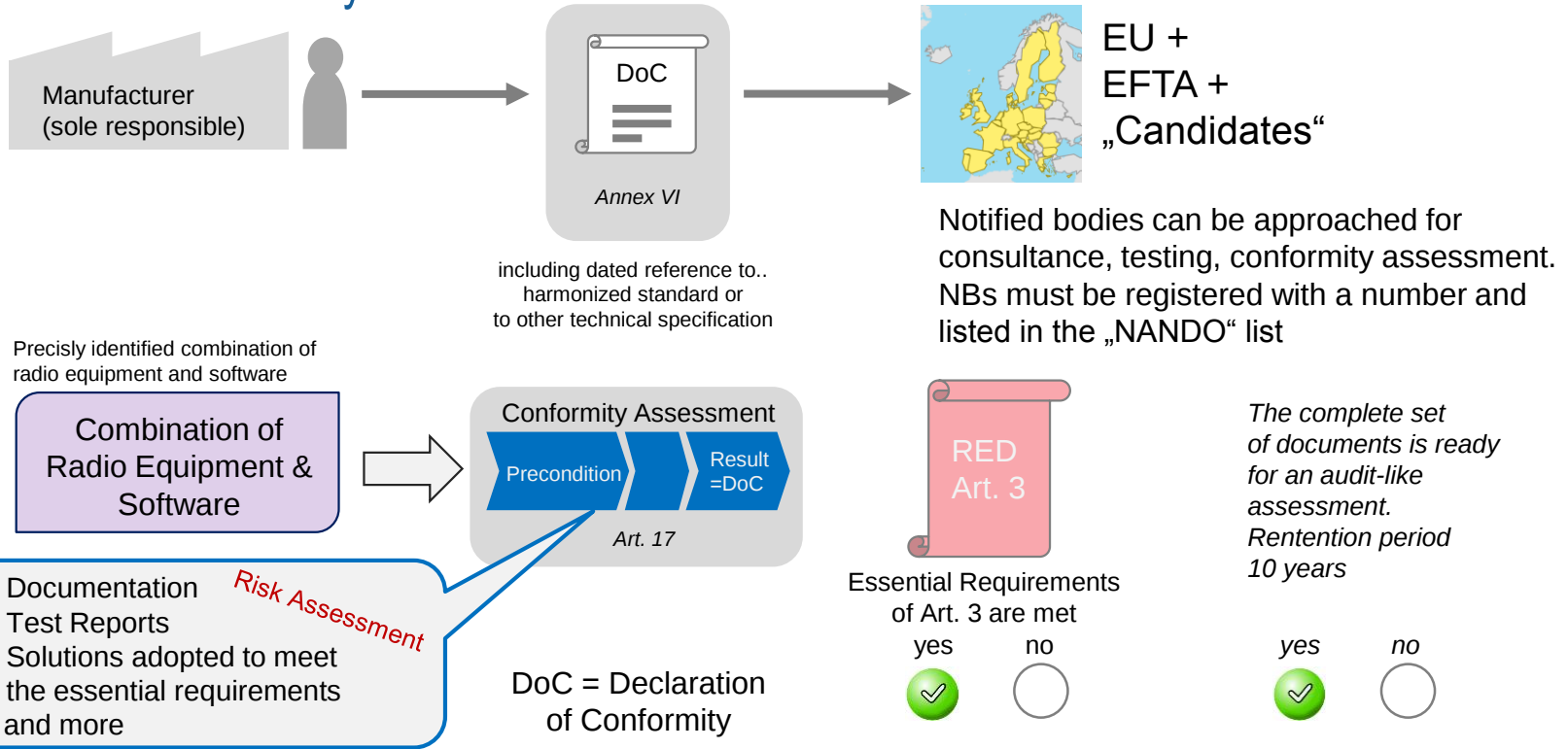
Extended table
of contents in the
standard

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More
requirements

Manufacturer's Homework according RED

Declaration of Conformity



Declaration of Conformity

Manufacturer Name
and address

Reference Number

EU Declaration of Conformity

This declaration is issued under the
sole responsibility of the manufacturer

We declare, that the product
<xyz>
is in conformity with the essential
requirements of EU directive(s)

by applying the following standards	
EU Directive(s) and Regulation(s)	Reference of standard(s) and amendment(s)
2014/53/EU	EN 300 328 V2.1.1
	EN 301 489-1 V2.1.1
	EN 301 489-17 V3.1.1
	EN 301 489-3 V2.1.1
	EN 60950-1:2006 with the following amendment(s) to this standard
	A11:2009, A1:2010, A12:2011, A2:2013
	EN 62311:2008
	EN 55032:2012 (Class B)
	EN 55024:2010
2011/65/EU	EN 50581:2012
2009/125/EC, (EU) No1194/2012	—

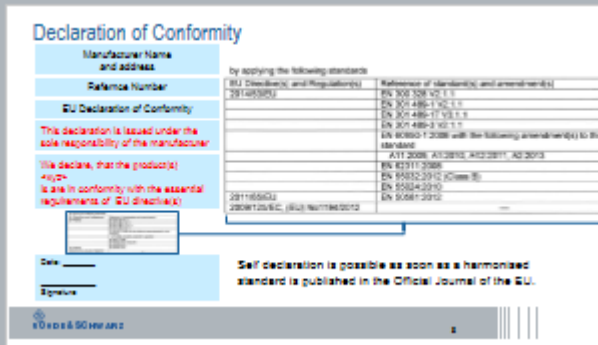
by applying the following standards

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	EN 62311:2008
	EN 55032:2012 (Class B)
	EN 55024:2010
2011/65/EU	EN 50581:2012
2009/125/EC, (EU) No1194/2012	—

Date: _____

Signature _____

Self declaration is possible as soon as a harmonised
standard is published in the Official Journal of the EU.



Notified Bodies...

Country	Amount of NBs
United States	10
United Kingdom	9
Germany	8
Italy	4
Poland	4
Spain	3
Austria	2
Bulgaria	2
France	2
Norway	2
Sweden	2
Canada	1
Croatia	1
Denmark	1
Finland	1
Japan	1
Netherlands	1
Slovakia	1
Slovenia	1

Notified bodies....

- qualify (alternative) test methods
- support risk assessments
- can perform tests
- can do the paperwork
but do not sign the declaration of conformity
- can sub-contract with test houses (incl. 3rd parties)
which do not have NB status.

In context with the RED, the use of a draft standard is regarded as a use of alternative test methods. Thus a NB has to be involved.

List of Notified Bodies

Country	Amount of NBs
United States	10
United Kingdom	9
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Finland	1
Japan	1
Netherlands	1
Slovakia	1
Slovenia	1

Nando list RED

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News
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About 1.470.000 results (0,39 seconds)

Information on Notified Bodies relating to RED - EUROPA - European ...

ec.europa.eu/growth/tools-databases/nando/index.cfm?fuseaction=directive...id...

Withdrawn/Expired/Suspended Notifications/NBs are not displayed in this list, you can find them in the Body module under the hyperlink ...

Legal notice | Contact | Search | English (en)

GROWTH
Internal Market, Industry, Entrepreneurship and SMEs

European Commission > Growth > Single Market and Standards > Tools and Databases > Notified bodies Nando > Legislation

Single Market and Standards
Industry
Entrepreneurship and SMEs
Access to finance for SMEs
Sectors

Notified bodies Nando

Country
Legislation
Body
Construction products
Free search
Mutual Recognition Agreements
Notifying Authority - Notification procedures
Accreditation Body
Glossary
Single Market and Standards - links

Bodies
Found : 56

Search criteria :

Legislation : 2014/53/EU Radio equipment

Procedure / ALL

Article or annex : ALL

Products : ALL

Search

Withdrawn/Expired/Suspended Notifications/NBs are not displayed in this list, you can find them in the Body module under the hyperlink "Withdrawn/Expired/Suspended Notifications/NBs".

Body type	Name	Country
• NB 0051	IMQ ISTITUTO ITALIANO DEL MARCHIO DI QUALITÀ S.P.A.	Italy
• NB 0081	LABORATOIRE CENTRAL DES INDUSTRIES ELECTRIQUES	France
• NB 0086	BSI	United Kingdom
• NB 0168	TUV SÜD BABT	United Kingdom
• NB 0197	TÜV Rheinland LGA Products GmbH	Germany
• NB 0199	DELTA DANSK ELEKTRONIK LYS OG AKUSTIK	Denmark



2017-05-08-
Downloaded-List-of-
NBs-index.pdf
External file

Be aware of Market Surveillance by TCAM / ADCO

Telecommunication Conformity Assessment and Market Surveillance

TCAM

Regulators of...
EU states +
EFTA states +
„candidates“

Each regulator can
decide on random checks up to
10 years after market placement
and may ask for

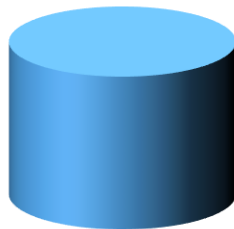
- Test reports
- Declaration of Conformity
- Purchase of radio equipment
- Test of radio equipment
- Notes and calculations done
during the risk assessment

Is there a mismatch?

Is there something strange?

Joint Actions

Committee work,
around 3 meetings
per year.



Common Data
including black-list

Administrative Cooperation - RED



- Trials
- Cross-border surveillance
Campaigns
- Conformity assessment
cooperation

Extra:

Administrative
Cooperation - EMC

Does R&S have solutions?

>140 standards with reference to
RED article 3.2 (= radio part)

Additional standards with reference to
RED article 3.1b (= EMC part incl. immunity)

There is a common set of test
approaches in the standards
that allow a general approach

2nd channel e.g. for blocking,
adjacent channel selectivity
→ additional SMBV, variable attenuators
General monitoring of the signals
(offset, level, OBW) → Analyzer

BTC → 3 standards

4th standard under discussion

CMW + CMW run + SMBV → sub-chapters of standards

TS8997 → 2 standards

TS8980 → conducted for LTE-, 3G-, 2G-
related regulatory tests.

GNSS solution → 1 standard

Radiated spurious emission setups → RS-Asia

Radiated power measurements

ITS100 → R&D stopped (1 standard)

R&D work on ATS1000 + 5G test solution
→ we will see what can be re-used
e.g. for automotive RADAR
(1 standard + 3 more)

CMA under preparation → various standards
for „analog hand-helds“

EN 391 908-2 → UTRA FDD UE

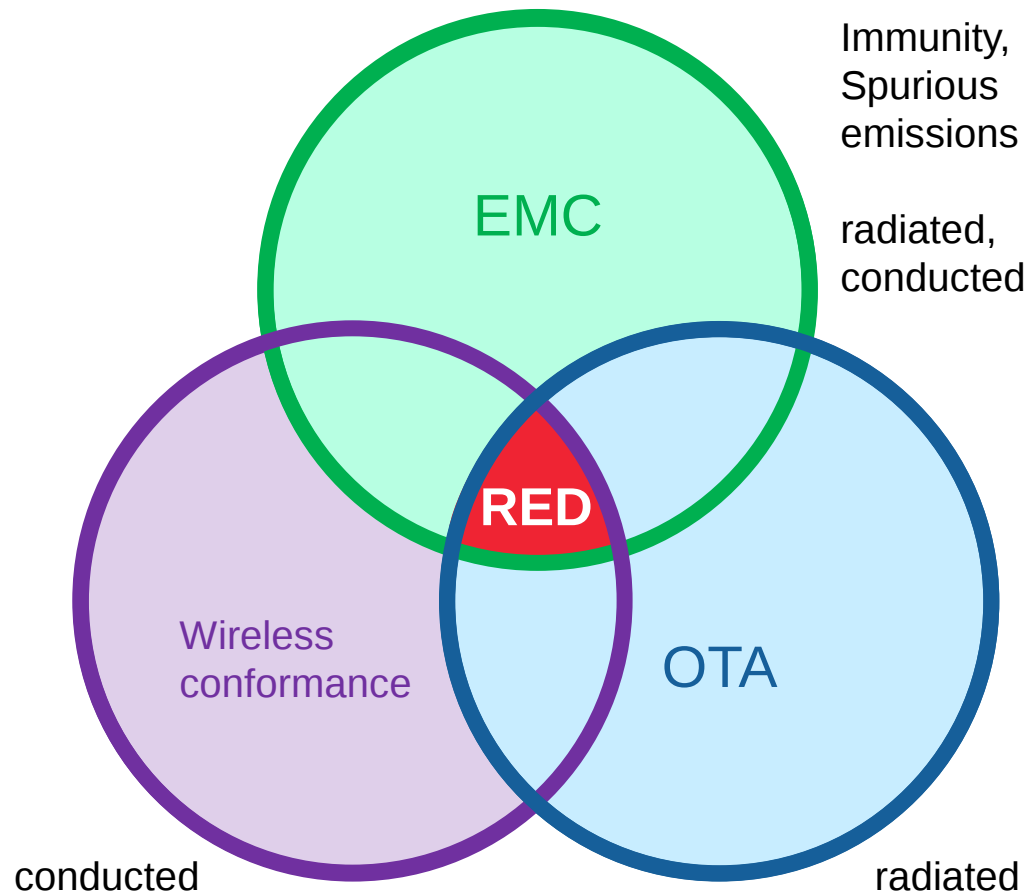
R&S® TS8997

Also interesting: TS8980 PRE



RED combines different technical fields

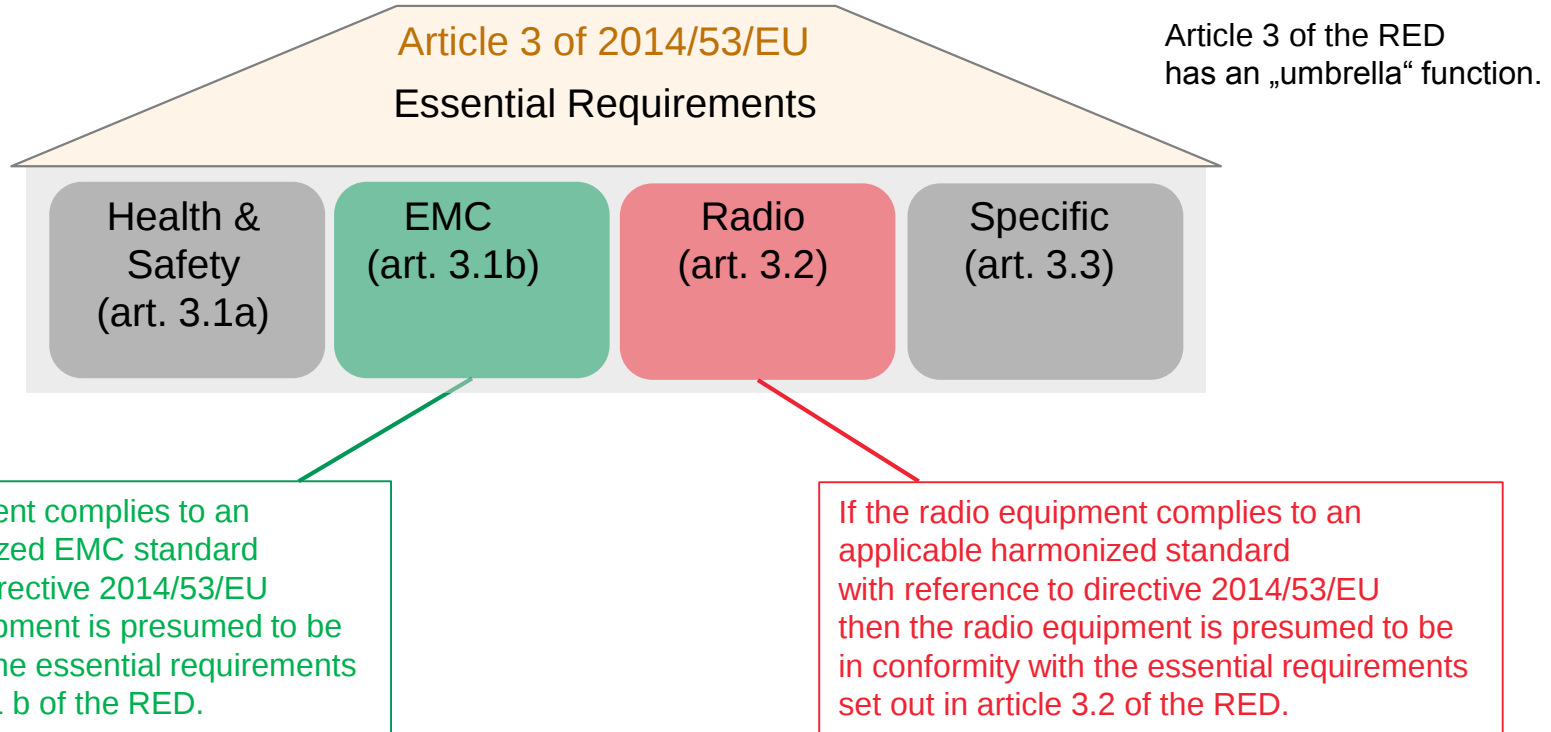
RED combines testing requirements derived from EMC, OTA and wireless conformance testing procedures



EMC experts play an important role in the discussion about RED.

Essential Requirements:

How the Harmonized Standards refer to RED articles 3.x



Up-to-date Harmonised Standards refer to 2014/53/EU

Reference on title page of standard

Old versions of Harmonised Standards refer to Directive 1999/5/EC

Up-to-date Harmonised Standards refer to Directive 2014/53/EU.

EN 3xx xxx Version Number (Date)



Chapter / Title / EUT Type

**Harmonised Standard covering the essential requirements
of article 3.2 of Directive 2014/53/EU**

Task Sharing within the „Cooperation Triangle“

Legal frame work.
Directives.
Publishing standards
in the
Official Journal



Member states +
MRA states
+ EFTA states:
Market surveillance



Committee with deliverables
helpful for the technical bodies:
spectrum engineering handbook,
studies, link scenarios,
interferer scenarios,
basic test methods,
etc.

Technical Bodies (work groups) including members of the industry, test houses and regulators are responsible for the definition, the maintenance of harmonised standards and the selection of test methods incl. parameters.

Radio Equipment Directive Technical Introduction



READY
FOR
RED

www.rohde-schwarz.com / RED

Christian Reimer

Essential Requirements of Radio Equipment Directive

“Radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference.”

Art. 3.2 of Radio Equipment Directive

RED demands the efficient use of spectrum, ... no harmful interference

RED requires, that receivers support an efficient use of spectrum.
The new harmonized standard versions deal with the receiver's capability to cope with interferers.

R&TTE Directive repealed by Radio Equipment Directive

- Frequency accuracy and stability
- Transmit power *)
- Adjacent-channel power
- Spurious emissions
- Intermodulation attenuation
- Transient behavior
- Modulation accuracy
- Duty cycle

* e.g. Transmit Emission Mask

R&TTE

Directive 1999/5/EC

Classic Tx Tests

Classic
Tx Tests...

and...

- Intermodulation response rejection
- Blocking / desensitization
- Spurious emissions
- Multipath sensitivity

Typical Receiver Tests

- Dynamic range and sensitivity
- Co-channel rejection
- Adjacent-channel selectivity
- Spurious response rejection

RED

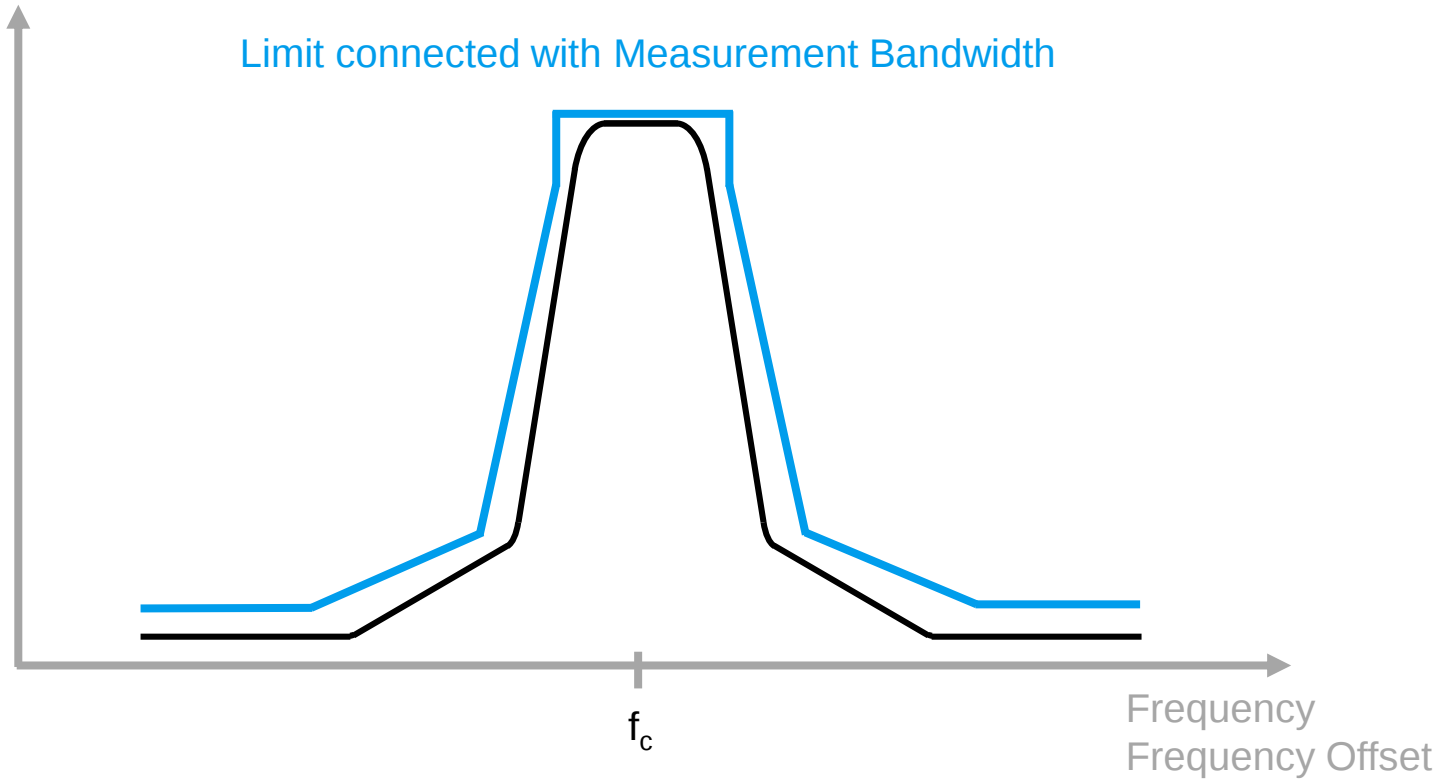
Directive 2014/53/EU

On Top: Receiver Tests

Example Scheme of Transmitter Spectrum Mask

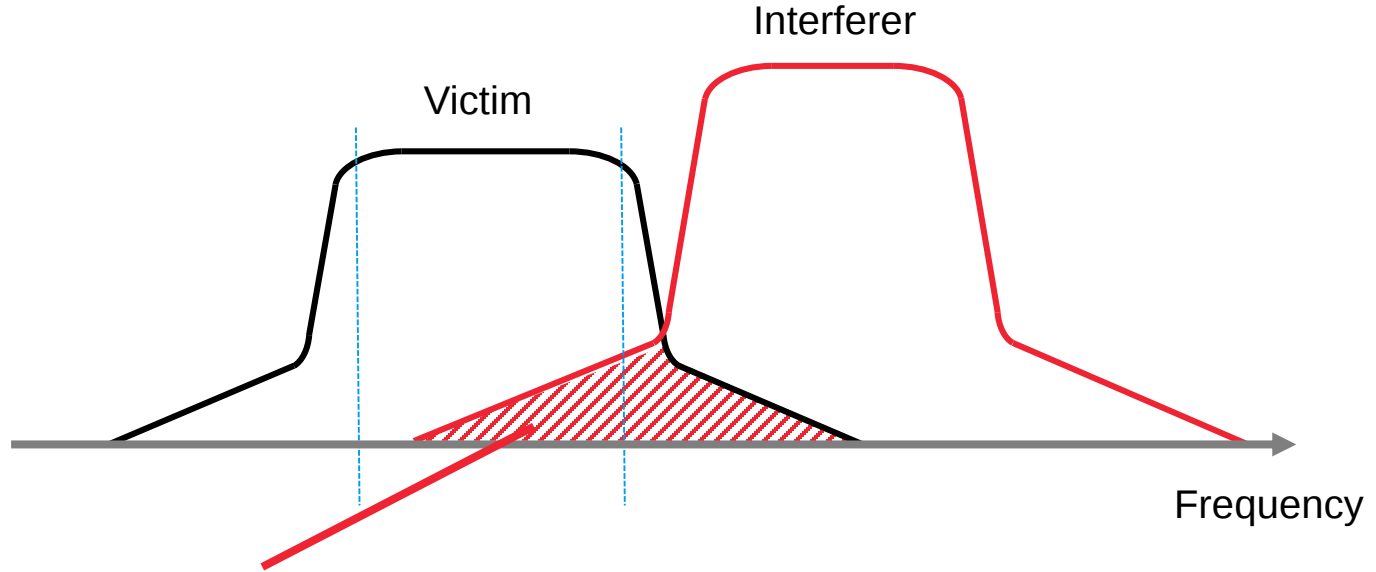
Level
Spectral
Power Density

Limit connected with Measurement Bandwidth



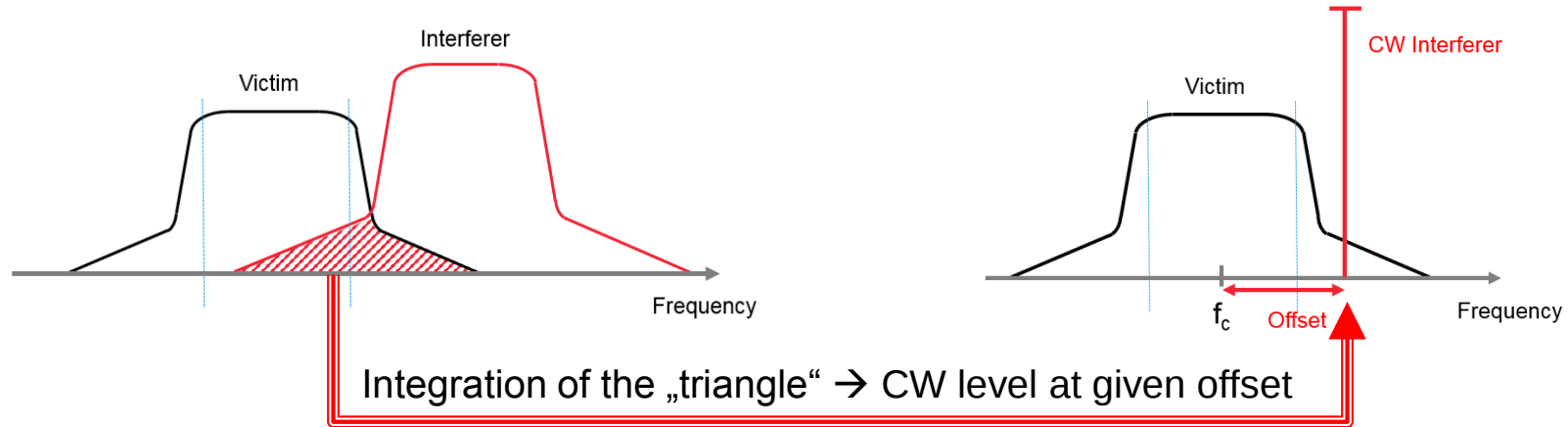
Classic Test

Interference Mechanism



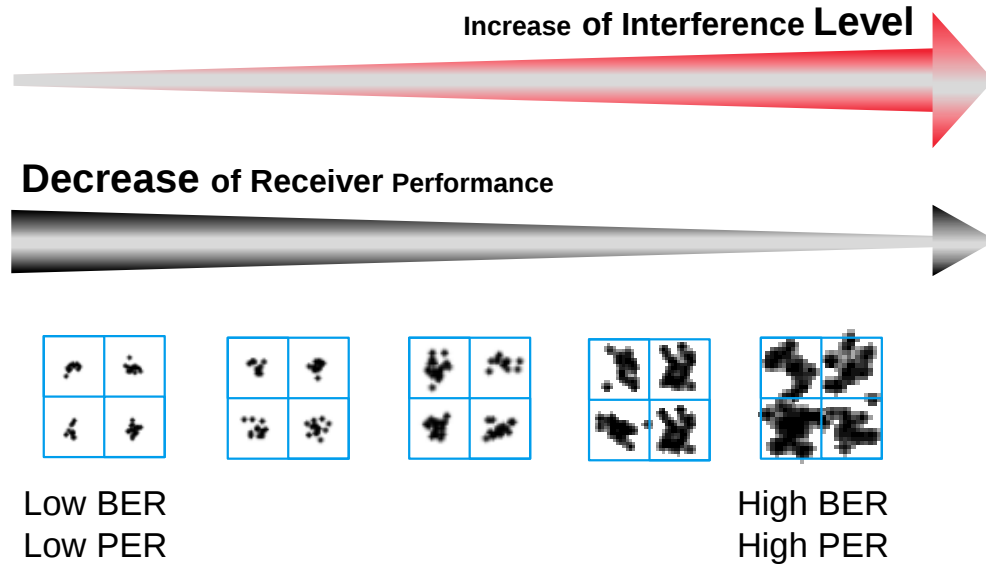
Such area can for example be pre-estimated by standardization work groups for typical scenarios. In some standards, this contribution is translated into a level of a single CW interferer signal with a dedicated offset.

Translation of Interfering Power into a CW Signal



This basic approach has been recommended to the standard work groups (technical bodies).

Receiver under Interference Condition



Victim Receiver

= receiver under interference conditions:

Can the receiver handle the interference and provide with a good performance?

Does the receiver ask for retransmission again and again while the already transmitted data is wasted (pure design)?

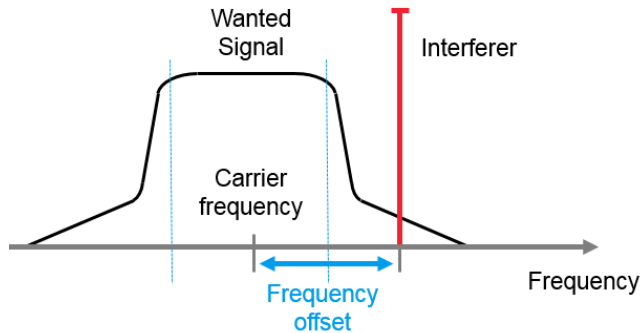
Does the receiver support for example a HARQ process and therefore asks for re-transmissions only when necessary (advanced design)?

RED demands the efficient use of spectrum.
RED requires, that receivers support an efficient use of spectrum.
The new harmonized standard versions deal with the receiver's capability to cope with interferers.

Coexistence Tests

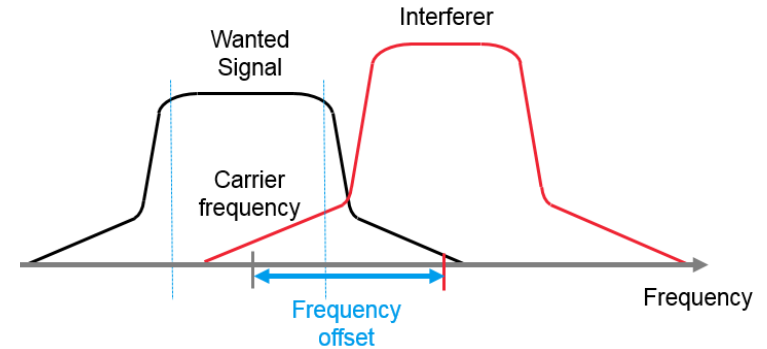
Test Type	Interferer Position
Blocking	anywhere, but not on the channel grid
Adjacent Channel Selectivity	exact neighbor position on the channel grid
Signal Handling	similar to blocking; no channel grid involved

Interferer Types, basic Procedure



Interferer type:
CW signal with constant level.

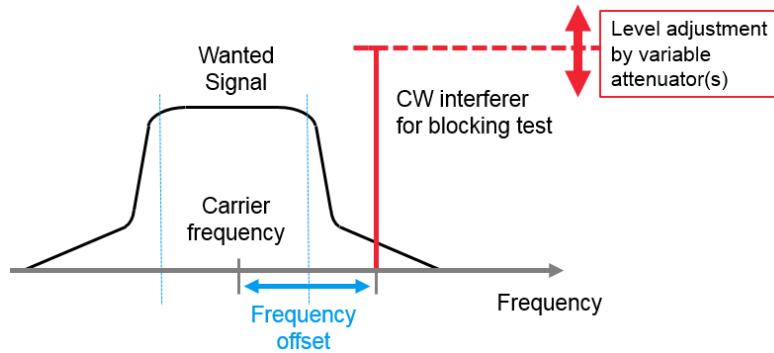
Procedure:
Step 1, Step 2 and
Step 3 version A.



Interferer type:
Modulated signal with fixed level.
AWGN signal with fixed level.

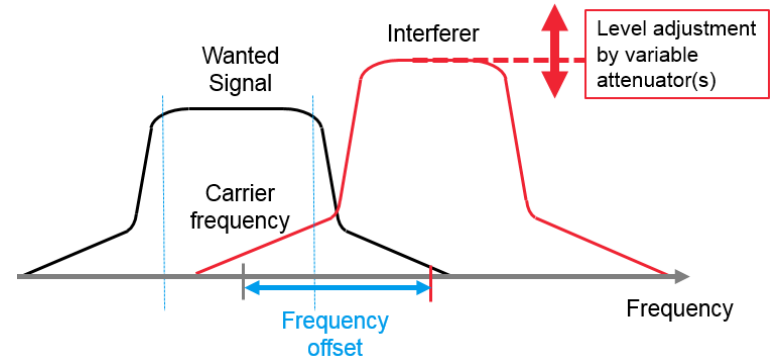
Procedure:
Step 1, Step 2 and
Step 3 version A.

Störsignal-Typen, grundsätzliche Vorgehensweise



Interferer type:
CW signal with level adjustment.

Procedure:
Step 1, Step 2 and
Step 3 version B.



Interferer type:
Modulated signal with level adjustment.
AWGN signal with level adjustment.

Procedure:
Step 1, Step 2 and
Step 3 version B.

Störsignal-Typen, grundsätzliche Vorgehensweise

Test step	Step 1	Step 2	Step 3
Motto	Sensitivity test	Comfort zone	Coexistence with one interferer signal
Level of the wanted signal	$P_{\min}$	$P_{\min} + 6 \text{ dB}$ or 3 dB or + x dB (x in standard)	$P_{\min} + 6 \text{ dB}$ or 3 dB or + x dB same as in step 2
Interferer signal (version A)	"off"	"off"	"on": The level stays constant.
Interferer signal (version B)	"off"	"off"	"on": Level to be increased in steps..
Receiver behaviour (version A)	just sufficient	good reception	reduced reception quality to be compared with a limit, e.g. $\text{PER} \leq 10\%$
Receiver behaviour (version B)	just sufficient e.g. $\text{PER} = 10\%$	good reception	just sufficient e.g. $\text{PER} = 10\%$

Interferer Types, basic Procedure

Step 1:

Up front testing the receiver's robustness its sensitivity has to be evaluated.

The result of the sensitivity test is the level of the wanted signal where the receiver shows just sufficient performance. This level of the wanted signal is the reference for step 2.

Step 2:

The receiver is operated in the comfort zone by a significant increase of the wanted signal level. For example the increase is 6 dB in blocking tests of 5 GHz wifi items.

Signale gegenüber Schritt 1 deutlich erhöht wird, beispielsweise um 6 dB (Wifi).

The exact increase value is given by the harmonised standard. 6 dB appear very often.

Step 3:

Up to now, no interferer signal has been involved. With step 3 the receiver is provided Not only with the wanted signal but also with the interferer signal simultaneously.

The interferer signal type, its level, the frequency offset or even an explicit frequency is stated in the corresponding standard.

Interferer Types, basic Procedure

Procedure at step 3:

Version A: Interferer signal level stays constant

Receiver: The reduced reception quality has to be compared with a limit given by the standard.

Version B: Interferer signal level to be adjusted

The interferer level is low at the beginning and to be increased in defined increments.

Receiver: The receiver reacts on the interferer signal level adjustments. With this step 3 it should be found out at which interferer level the receiver can provide with just sufficient reception quality.

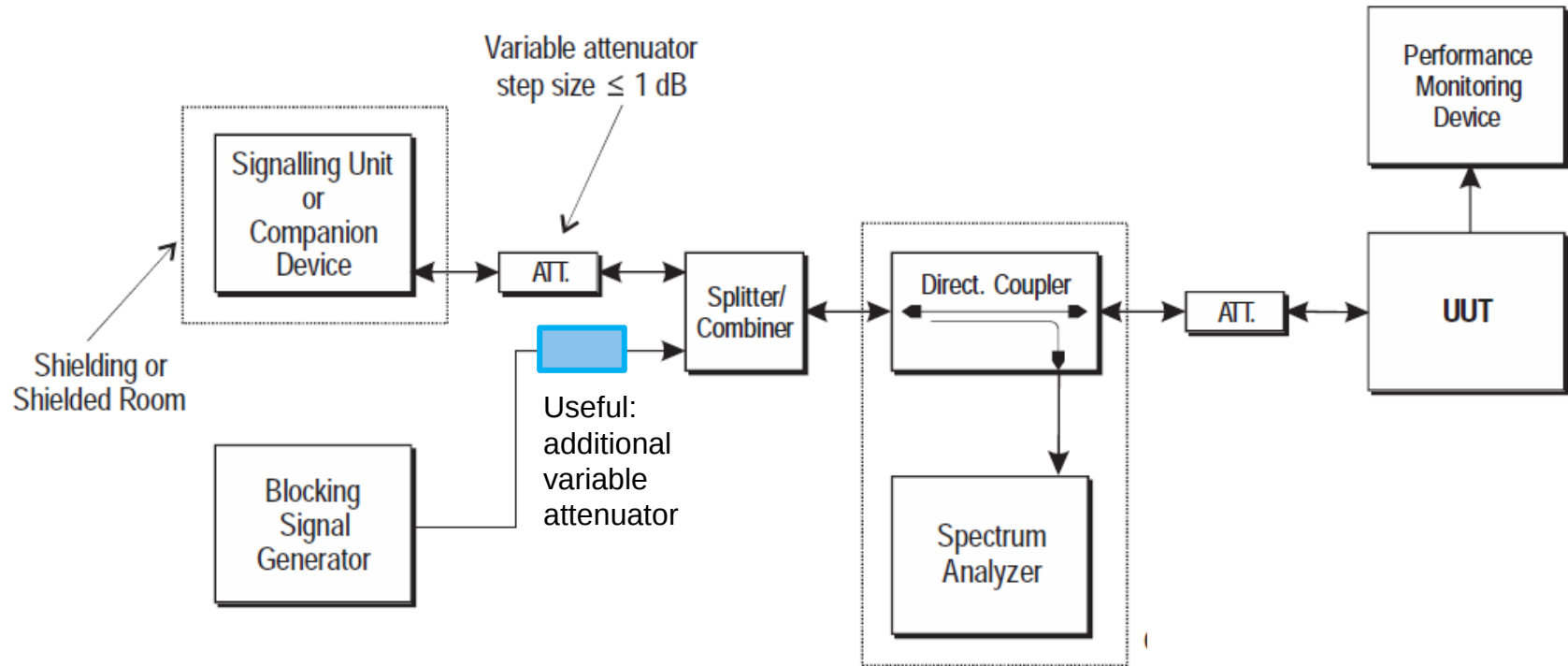


Interferer Types, basic Procedure

Interferer Type	Level Adjustment	Receiver Performance	Example
CW signal	Constant level	Comparison with performance limit (Degradation check)	Radar
CW signal	Level adjustment	Receiver arrives finally at minimum performance level (known from sensitivity test)	5 GHz Wifi, SRD 25 MHz to 40 GHz
Modulated signal	Constant level	Comparison with performance limit (Degradation check)	LTE
Modulated signal	Level adjustment	Receiver arrives finally at minimum performance level (known from sensitivity test)	Digital TV
AWGN signal	Constant level	Comparison with performance limit (Degradation check)	GNSS
AWGN signal	Level adjustment	Receiver arrives finally at minimum performance level (known from sensitivity test)	

Receiver Blocking Test Example by ETSI BRAN

Setup can be optimized.

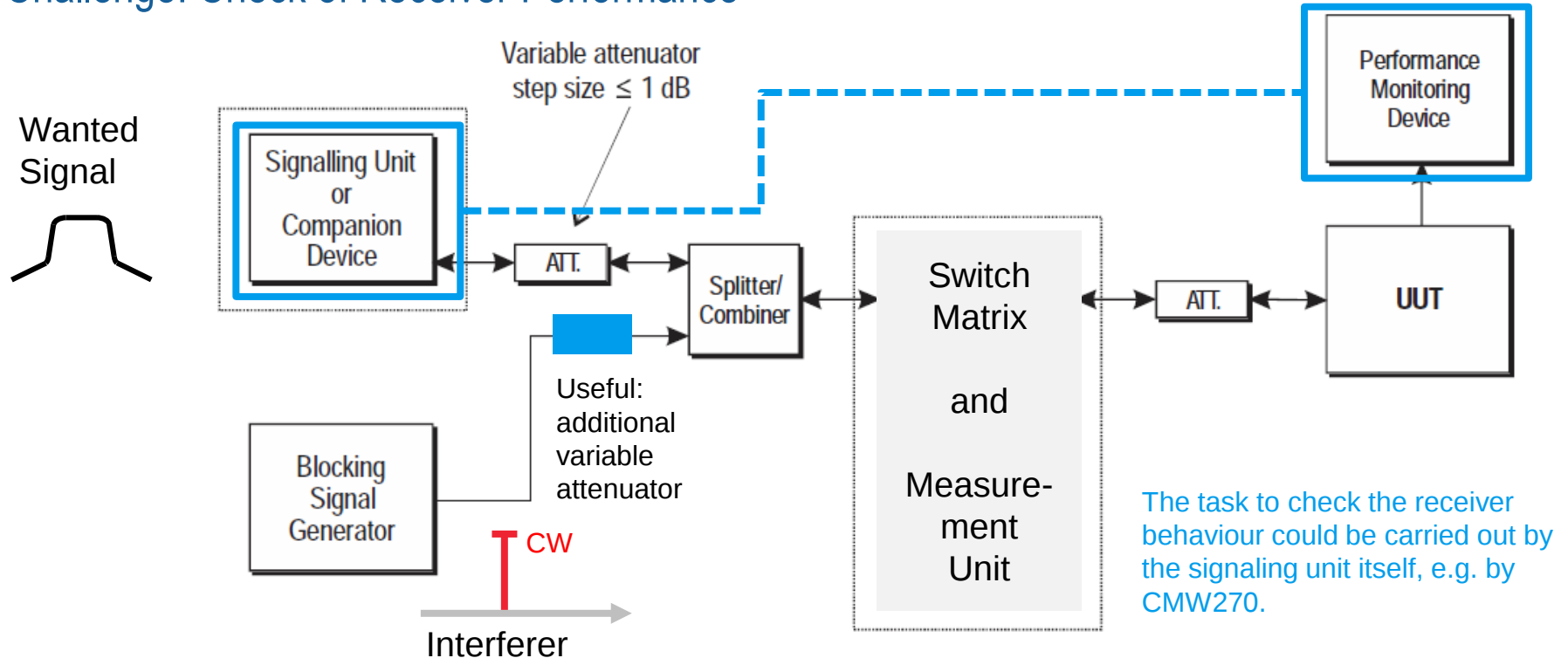


ETSI TS 103 521 v 1.1.1 with modification

Blocking Test in EN 301 893:

Challenge: Check of Receiver Performance

Tasks handled by signaling unit
e.g. by CMW270

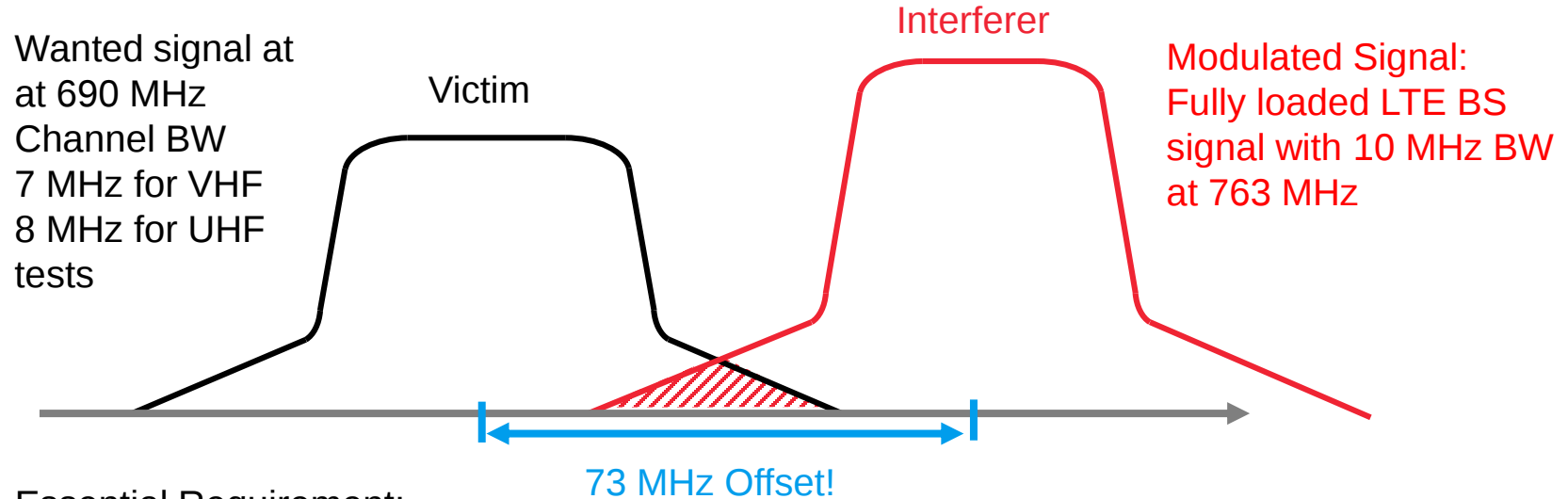


The task to check the receiver behaviour could be carried out by the signaling unit itself, e.g. by CMW270.

Example for modulated Interferer: Blocking Test in EN 303 340

Digital Terrestrial TV Broadcast Receivers

Example for DVB-T

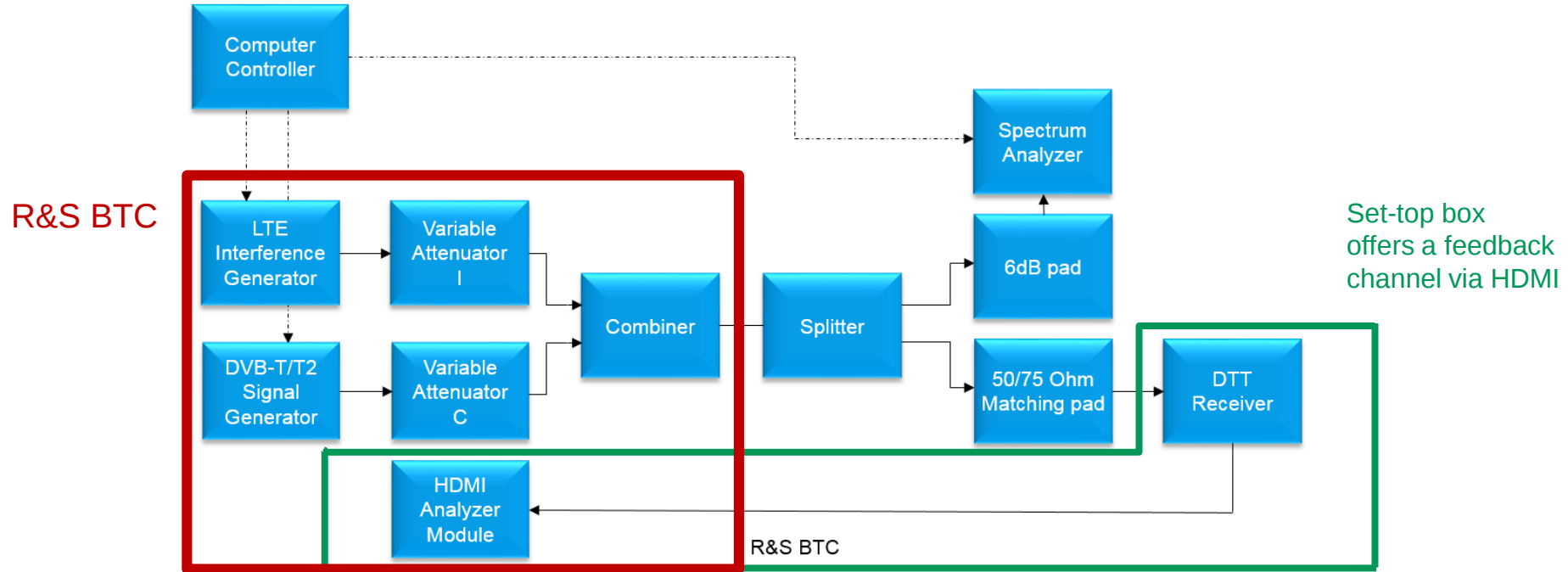


Essential Requirement:
Check of Receiver Performance.

Blocking Test in EN 303 340:

Challenge: Check of Receiver Performance

Interferer Scednario +
Check of Receiver Performance
provided by R&S BTC



Blocking Test in EN 303 340:

Challenge: Check of Receiver Performance



Set-top box
offers a feedback
channel via HDMI

Working with Save-and-Recall Files (.savrcf Files)

Standard	Scenario	Interferer type	Type of wanted signal
----------	----------	-----------------	-----------------------

For Digital TV the interferer signal level has to be increased until the receiver provides with just sufficient performance.

The standard prescribes a minimum period of 15 seconds for the interval between two errors.

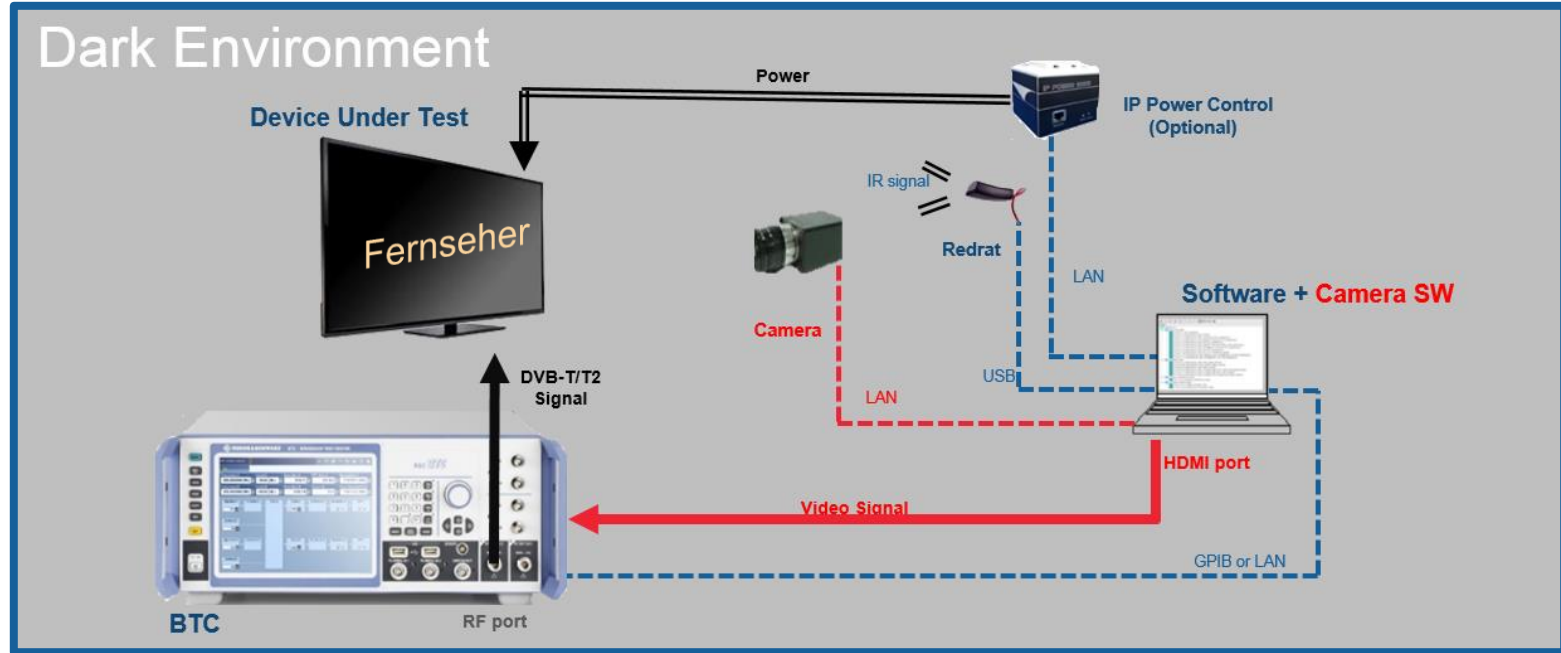
This leads to observation times of 30 seconds per interferer level value. The video must be seamless to avoid synchronisation errors of the device under test.

rcf
A.savrcf
hA.savrcf
athA.savrcf
PathA.savrcf
PathA.savrcf
hA.savrcf
rcf
rcf

- EN303340 Blocking DVBT2 7Mhz BTC PathA.savrcf
- EN303340 Blocking DVBT2 8Mhz BTC PathA.savrcf
- EN303340 Overloading1 DVBT 7Mhz BTC PathA.savrcf
- EN303340 Overloading1 DVBT 8Mhz BTC PathA.savrcf
- EN303340 Overloading1 DVBT2 7Mhz BTC PathA.savrcf
- EN303340 Overloading1 DVBT2 8Mhz BTC PathA.savrcf
- EN303340 Overloading2&3 DVBT 7Mhz BTC PathA.savrcf
- EN303340 Overloading2&3 DVBT 8Mhz BTC PathA.savrcf
- EN303340 Overloading2&3 DVBT2 7Mhz BTC PathA.savrcf
- EN303340 Overloading2&3 DVBT2 8Mhz BTC PathA.savrcf
- EN303340 Sensitivity DVBT BW7Mhz 198_5MHz
- EN303340 Sensitivity DVBT BW7Mhz 198_5MHz

Blocking Test in EN 303 340:

Challenge: Check of Receiver Performance



The prokect department of R&S Asia in Singapur has developed a system solution for the test of TV sets.

Adjacent Frequency Band Selectivity for GNSS User Equipment

Check of Receiver Performance

Step 1 without interferer: C/N_0 is reported by the GNSS UE

Step2 with interferer: C/N_0 maximum degrading by 1 dB

Interferer offsets, levels, bandwidth defined by standard

Interferer Example for GPS L1:

Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	Comments
1 518 to 1 525	1 524	-65	MSS (space-to-Earth) band
1 525 to 1 549	1 548	-95	MSS (space-to-Earth) band
1 549 to 1 559	1 554	-105	MSS (space-to-Earth) band
1 559 to 1 610	GUE RNSS band under test		
1 610 to 1 626	1 615	-105	MSS (Earth-to-space) band
1 626 to 1 640	1 627	-85	MSS (Earth-to-space) band

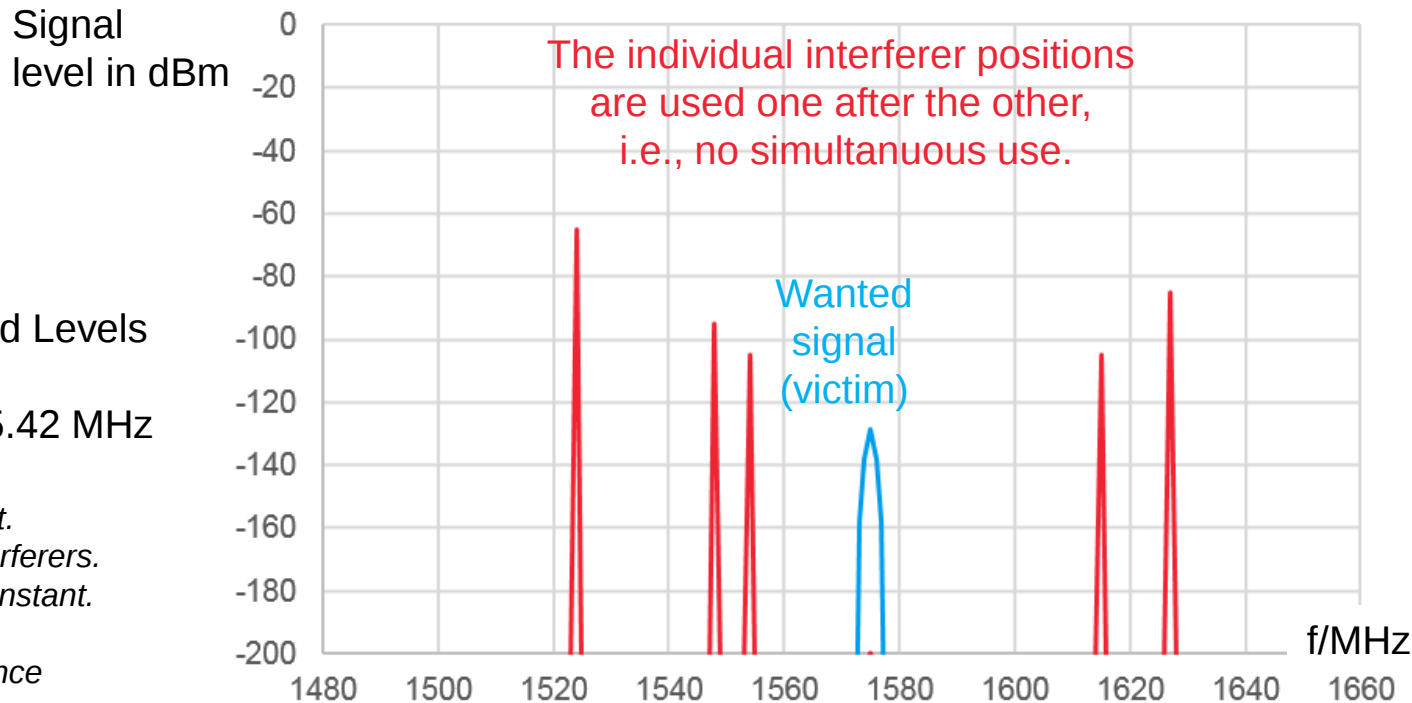
Source: table 4-2 in EN 303 413.

Adjacent Frequency Band Selectivity for GNSS User Equipment

Check of Receiver Performance

Interferer Positions and Levels
Example for GPS L1.
Wanted signal at 1575.42 MHz

*One interferer per test result.
No simultaneous use of interferers.
The interferer levels stay constant.
No level adjustment.
Check of receiver performance
degradation.*



Adjacent Frequency Band Selectivity for GNSS User Equipment

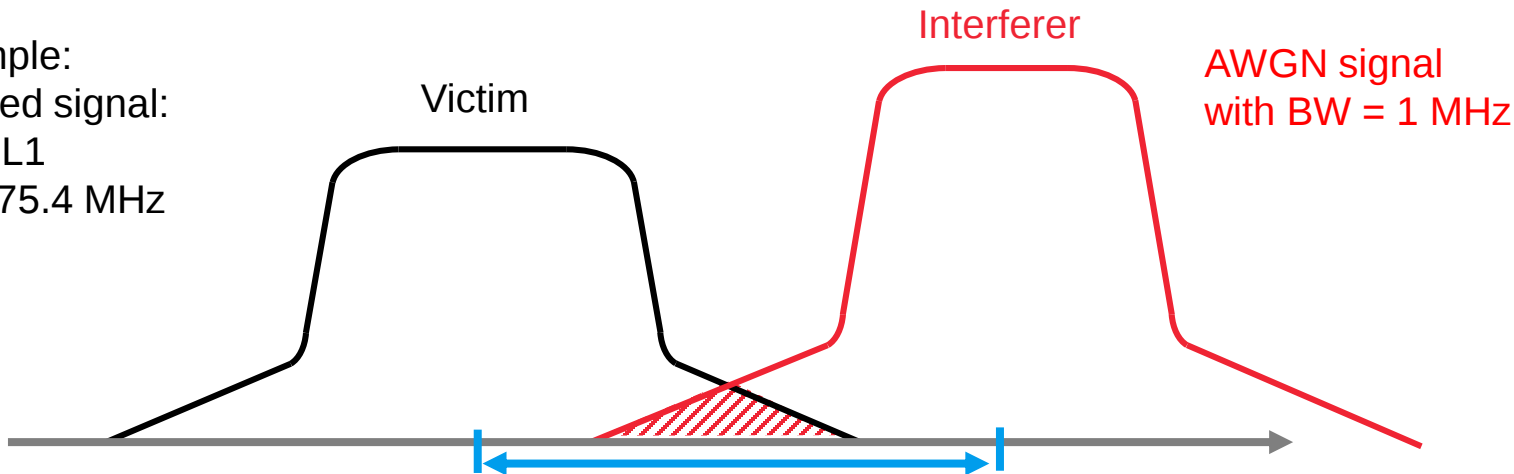
Check of Receiver Performance

Example:
Wanted signal:
GPS L1
at 1575.4 MHz

Victim

Interferer

AWGN signal
with BW = 1 MHz

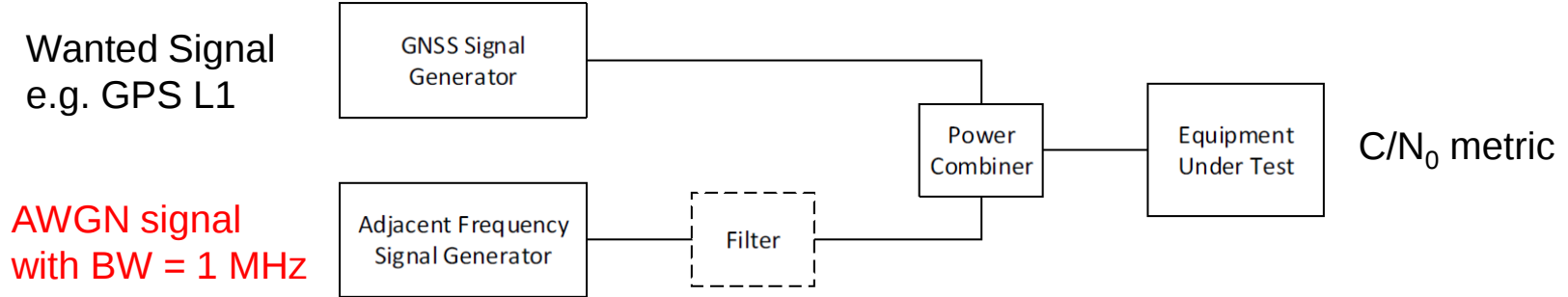


Degradation of reported
 $C/N_0 < 1$ dB

Around 27 MHz offset and more depending
on test point acc. to table 4-x in EN 303 413

Adjacent Frequency Band Selectivity for GNSS User Equipment

Check of Receiver Performance



Setup in EN 303 413 for conducted measurement

Adjacent Frequency Band Selectivity for GNSS User Equipment

Check of Receiver Performance

Wanted Signal
e.g. GPS L1

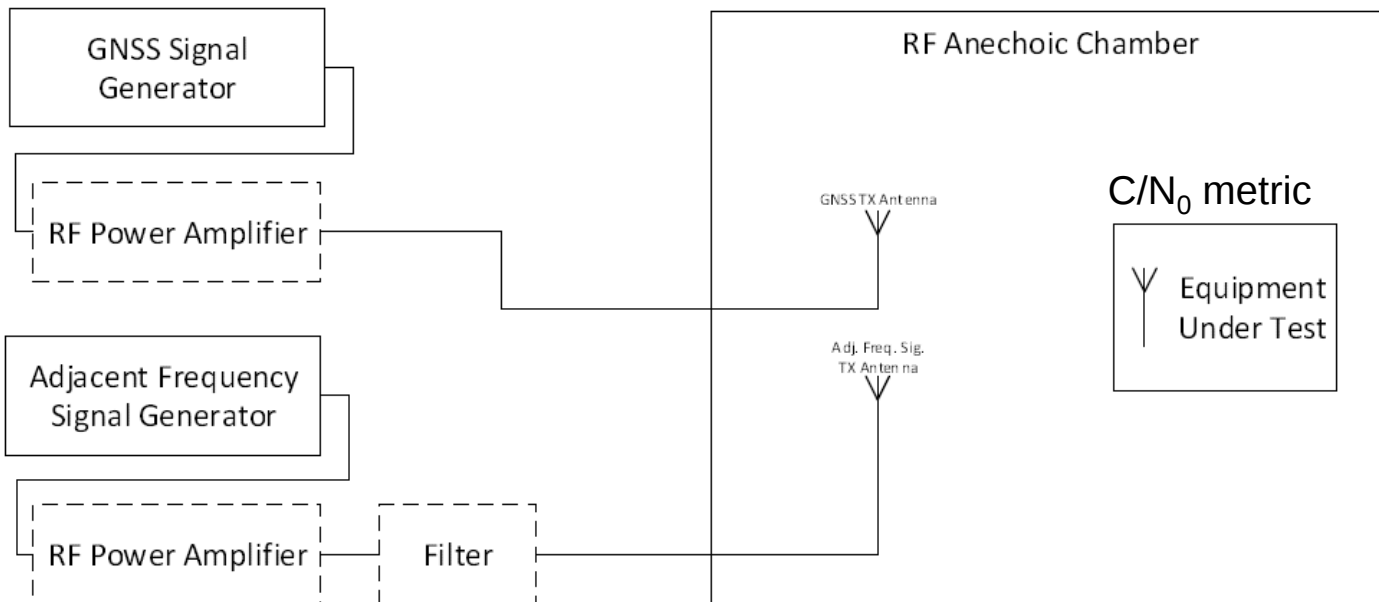
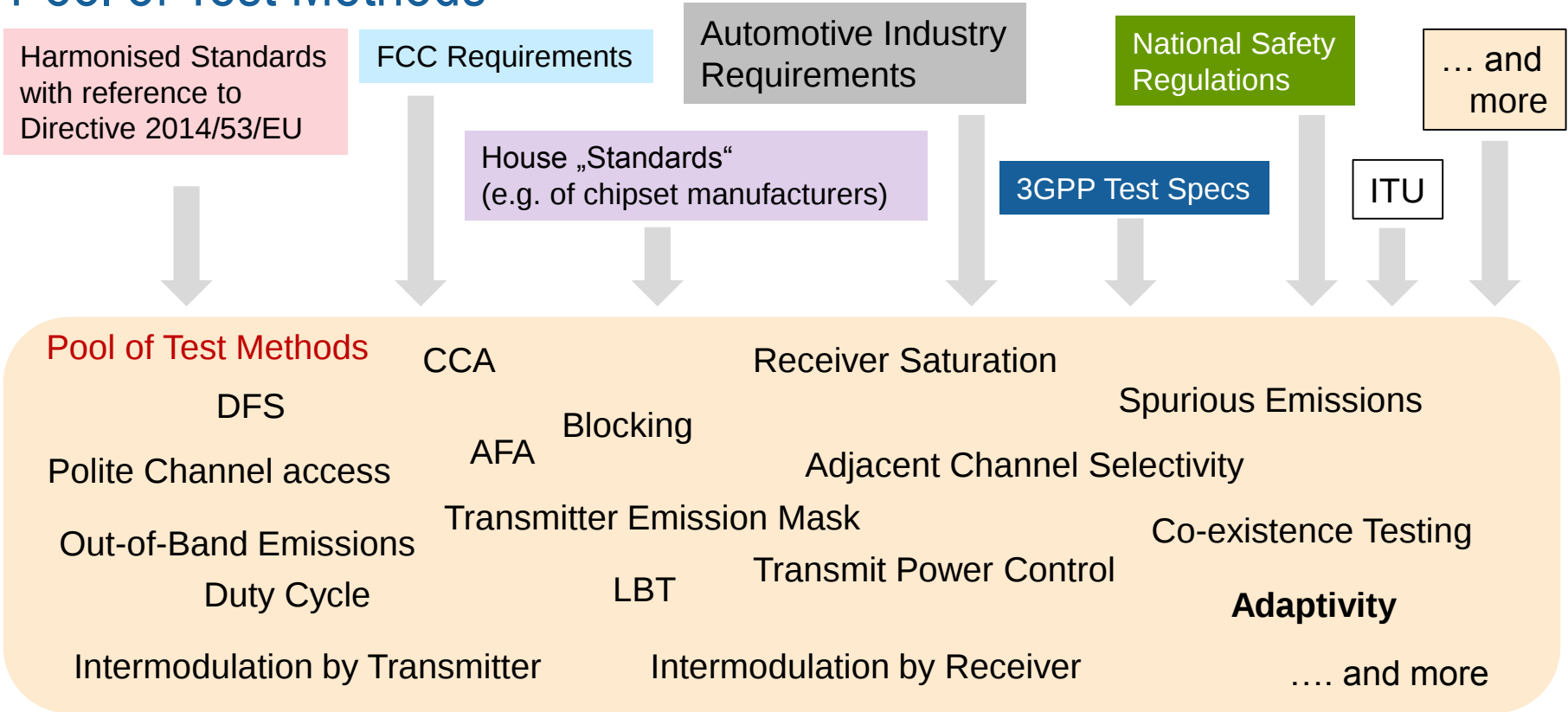


Figure 5-2: Radiated measurement setup for EUT adjacent frequency band selectivity performance

Setup in EN 303 413 for radiated measurement

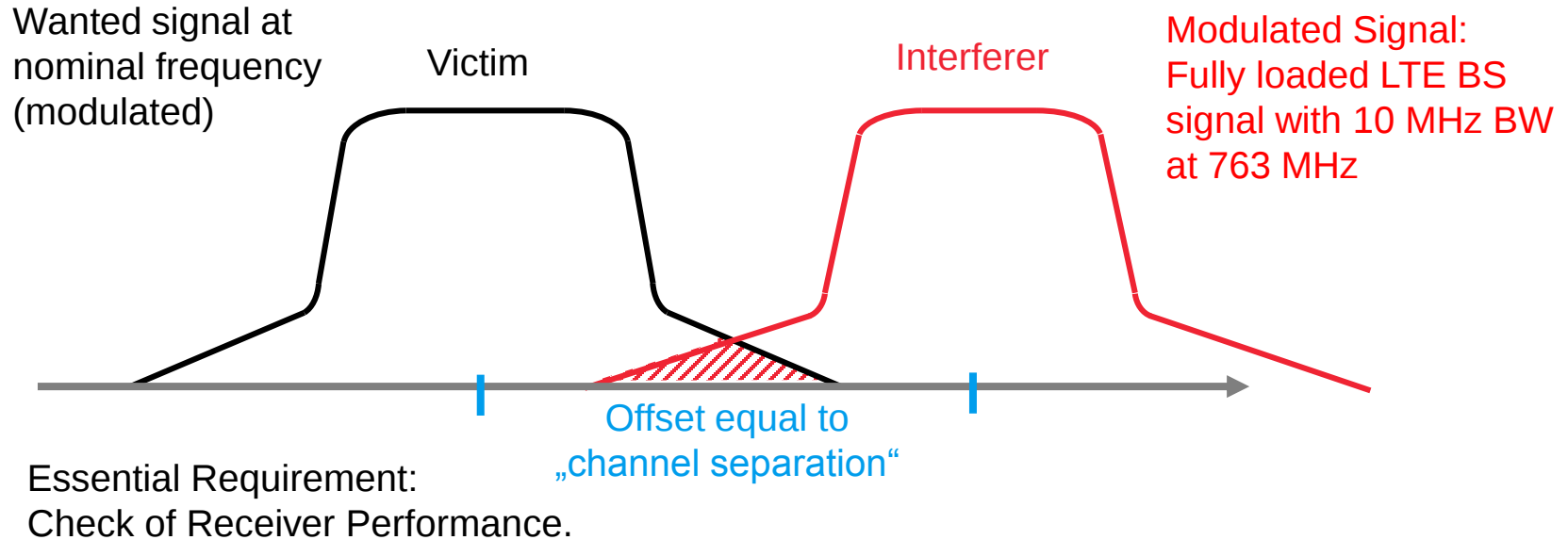
Collecting the C/N₀ data can be a challenge

Pool of Test Methods



Adjacent Channel Selectivity

Example for DVB-T



Adaptivity with “Interferer On” + “Blocker On”

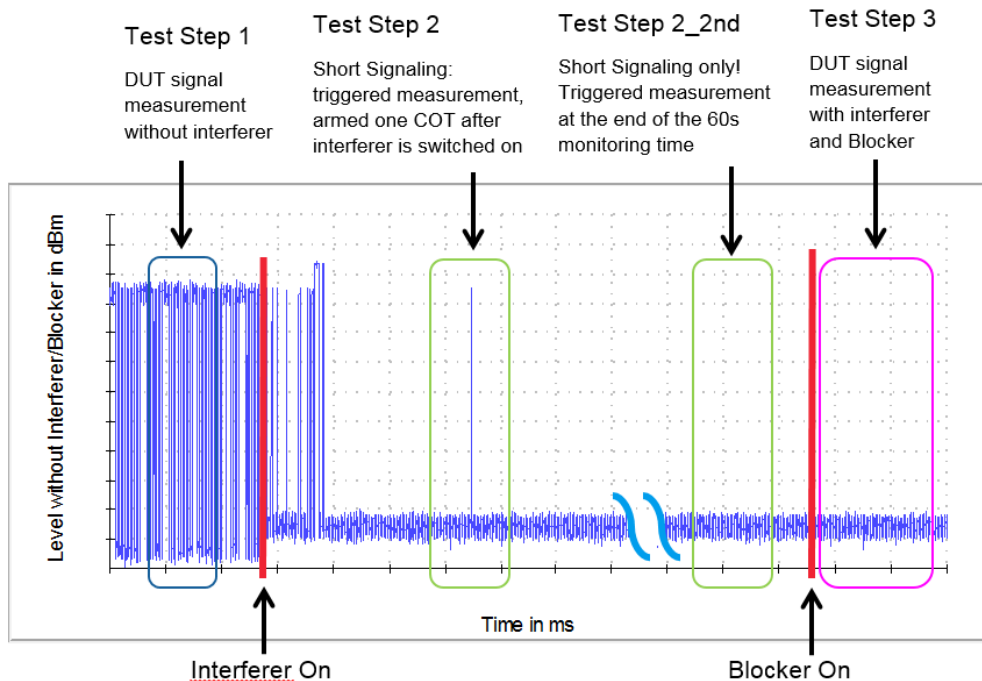
The interferer uses the same frequency (i.e. the same channel).

The blocker uses a different frequency (i.e. a different channel)

The DUT may transmit until the Channel Occupancy Time COT is over.

After the COT has elapsed a new Clear Channel Assessment CCA has to be performed. No further transmission is allowed as long as the wanted channel is occupied by the interferer. Only short signaling messages are allowed.

Interesting effect in this example with „Interferer On“: the DUT has increased the noise level.



Test Methods

In order to show conformity with the essential requirements set out in the radio part (in art. 3.2) of the Directive 2014/53/EU (RED) typically following test methods can be applied. The individual harmonized standard specifies technical parameters, limits, etc. where applicable.

Transmitters

(in line with previous (R&TTE) and new (RED) directive)

- ▮ Frequency accuracy and stability
- ▮ Transmit power
- ▮ Adjacent-channel power
- ▮ Spurious emissions
- ▮ Intermodulation attenuation
- ▮ Transient behavior
- ▮ Modulation accuracy
- ▮ Duty cycle

Receivers

(in line with new directive (RED))

- ▮ Dynamic range and sensitivity
- ▮ Co-channel rejection
- ▮ Adjacent-channel selectivity
- ▮ Spurious response rejection
- ▮ Intermodulation response rejection
- ▮ Blocking / desensitization
- ▮ Spurious emissions
- ▮ Multipath sensitivity

Summary from H. Mellein, R&S News 215

Non-exhaustive list. There can be more test methods.

Key Words in Relation with Channel Access Mechanisms

DFS Dynamic Frequency Selection

Capability of EUT (UUT) to detect radar systems and to avoid co-channel operation with such radar systems (typically applicable for 5250 to 5350 MHz and 5470 to 5725 MHz) Channel Availability Check (CAC).

Adaptivity (Channel Access Mechanism)

Capability to detect the transmissions of other users (not radar systems) operating in the same band.
Clear Channel Assessment (CCA)

Spectrum access techniques

Applicability

Listen Before Talk (LBT)

Detect And Avoid techniques (DAA)

Adaptive Frequency Agility (AFA)

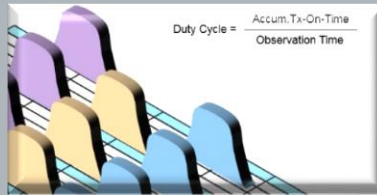
Listen Before Talk

„Listening Receiver checks channel occupancy“
If the channel is available → Tx On

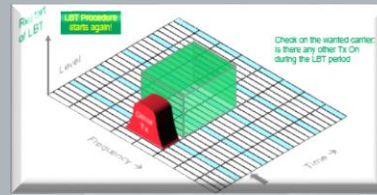
Polite Spectrum Access



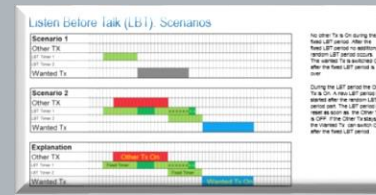
Adaptivity Discussion



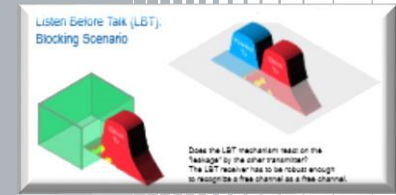
Duty Cycle



Listen Before Talk Scenario



Listen Before Talk Scenario Discussion



Listen Before Talk Blocking Scenario

Use the external file

How to find an example of a Declaration of Conformity?

Search: <manufacturer name> + 2014/53/EU + Declaration of Conformity

Autoliv

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[\[PDF\] EU Declaration of Conformity EC Directive\(s\) 2014/53/EU ... - Autoliv](#)

https://www.autoliv.com/.../DoC-RED-Autoliv-NB24G175V1_PK%20signed%20201...
Jun 8, 2017 - EU Declaration of Conformity. EC Directive(s). 2014/53/EU. Manufacturer. Autoliv ASP, Inc. 26545 American Drive. Southfield, Michigan 48034.

[\[PDF\] DoC 6234734 - Autoliv](#)

<https://www.autoliv.com/regulatory/EU%20RED%20DoC/DoC%206234734.pdf>
Jun 29, 2017 - EU Declaration of Conformity. 2014/53/EU. Autoliv ASP, Inc. 26545 American Drive. Southfield, Michigan 48034. United States of America.

EU Radio Directive Equipment (RED) : Declaration of Conformity (DoC)

<https://www.autoliv.com/regulatory/Pages/EURED-DoC.aspx>
Hereby, Autoliv ASP, Inc. declares that the radio equipment for the Autoliv Radar Sensors is in compliance with Radio Equipment Directive 2014/53/EU. ...

[\[PDF\] Page 1 EU Declaration of Conformity EC Directive\(s\) 2014/53/EU ...](#)

https://www.autoliv.com/.../EU%20%20DoC%20-RED%20Autoliv%206234734_...
Jun 8, 2017 - EU Declaration of Conformity. EC Directive(s) 2014/53/EU. Manufacturer Autoliv ASP, Inc. 26.545 American Drive. Southfield, Michigan 48034.

EU Declaration of Conformity	
EC Directive(s)	2014/53/EU
Manufacturer	Autoliv ASP, Inc. 26545 American Drive Southfield, Michigan 48034 United States of America
Radio Equipment	Type Designation: NB24G175V1
Description / Intended Use	Narrow Band 1.75 / vehicular radar utilized for object detection applications
Article 3.2: Applied Radio Spectrum Standard(s)	EN 302 858 v2.1.1 (2016-12)
Article 3.1(b): Applied EMC Standard(s)	EN 301 489-1 v1.9.2 (2011-09), EN 301 489-1 v2.1.1 (2017-03), EN 301 489-3 v2.1.0 (2017-03)
Article 3.1(a): Applied Health and Safety Standard(s)	EN 60950-1: 2006 / A2:2013, EN 62479:2010, EN 62311:2008
Frequency band(s) in which the radio equipment operates	Transceive: 24.05 – 24.25 GHz
Maximum radio-frequency power transmitted	Category D – < 20 dBm peak EIRP
Hereby, Autoliv ASP, Inc. declares that the object of the declaration described above is in conformity with the relevant Union harmonisation legislation (Directive 2014/53/EU).	
This declaration is issued under the sole responsibility of the manufacturer.	

Wich standards are listed under „Article 3.2“?

In this example:
EN 302 858 V 2.1.1

How to find an example of a Declaration of Conformity?

Search: <manufacturer name> + 2014/53/EU + Declaration of Conformity

TORICA Tokai Rika Create Corporation

HEAD OFFICE: 2-3-10 Aoi, HIGASHI-KU, NAGOYA 461-0004 JAPAN TEL: 81-52-934-2111 FAX: 81-52-934-2101

EU DECLARATION of CONFORMITY (DoC)

(No. 11604303-A)

This declaration of conformity is issued under the sole responsibility of the manufacturer:

Name: Tokai Rika Create Corporation

Address: 2-3-10 Aoi, Higashi-ku, Nagoya, Aichi 461-0004, Japan

We declare that the DoC is issued under our sole responsibility and belongs to the following product.

Object of the declaration:

Product Name Car audio with DAB radio,
DABTK1

Model Name 347-2021-000
347-2027-000

Software Ver. FM: 1.0
AM: 1.0
DAB: 1.1.14.0



Accessories N/A

The object of the declaration described above is in conformity with the relevant Union harmonization legislation:

Radio Equipment (RE) Directive (2014/53/EU)

The following harmonized standards and technical specifications have been applied:

Health & Safety
(Article 3.1(a)): EN 60065:2014

EMC
(Article 3.1(b)): EN 301 489-1 V2.1.1
EN 301 489-3 V2.1.0 (Draft)

Radio Spectrum
(Article 3.2): EN 303 345 V1.1.1 (Draft)

Notified Body performed an EU-type examination in accordance with the requirements of Annex III of RE Directive and issued the EU-type examination certificate.

Notified Body:

UL Japan, Inc. (No. 1731)

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021, Japan

Certificate No.: ULAR1703004

Signed for and on behalf of:

Place of Issue:

March 13, 2017

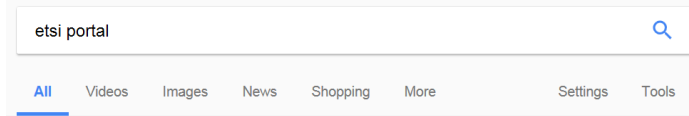
Date of Issue:

General Manager
Engineering Div.

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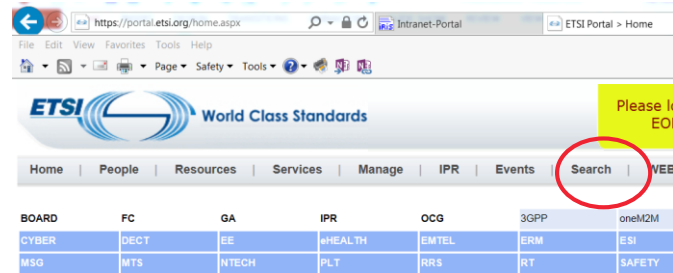
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<https://portal.etsi.org/>

ETSI releases test methods to improve QoS in the presence of background noise · ETSI Multi-access Edge Computing group releases a first package of APIs.

2



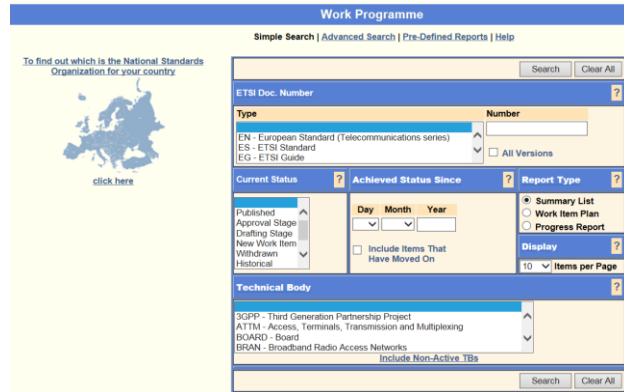
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EG - ETSI Guide

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Achieved Status Since

Report Type

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Items per Page

Technical Body

3GPP - Third Generation Partnership Project

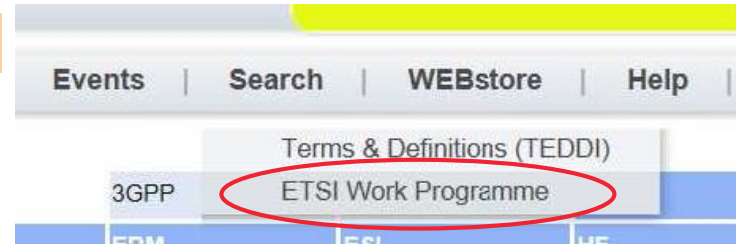
ATM - Access, Terminals, Transmission and Multiplexing

BOARD - Board

BRAN - Broadband Radio Access Networks

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3



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Terms & Definitions (TEDDI)

3GPP

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Type Number

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ES - ETSI Standard
EG - ETSI Guide

302 858

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Day Month Year

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	IDENTIFICATION	TITLE	STATUS
1	Doc. Nb. EN 302 858-2 Ver. 1.3.1 Ref. REN/ERM-TGSRR-061-2 Technical Body: ERM TGSRR Directives: 2014/53/EU Details and Download	Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Automotive radar equipment operating in the 24,05 GHz up to 24,25 GHz or 24,50 GHz frequency range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive EN for NB SRR @ 24GHz	Published Current Status: Citation in the OJ (2017-06-08)
2	Doc. Nb. EN 302 858-2 Ver. 1.3.1 Ref. REN/ERM-TGSRR-061-2_R&TTE Technical Body: ERM TGSRR Directives: 99/5/EC Details and Download	Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Automotive radar equipment operating in the 24,05 GHz up to 24,25 GHz or 24,50 GHz frequency range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive EN for NB SRR @ 24GHz	Published Current Status: No more cited in the OJ (2017-06-13)
3	Doc. Nb. EN 302 858-1 Ver. 1.3.1 Ref. REN/ERM-TGSRR-061-1 Technical Body: ERM TGSRR Details and Download	Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Automotive radar equipment operating in the 24,05 GHz up to 24,25 GHz or 24,50 GHz frequency range; Part 1: Technical characteristics and test methods EN for NB and WLAM SRR @ 24GHz	Published Current Status: Publication (2013-11-22)
4	Doc. Nb. EN 302 858 Ver. 2.1.1 Ref. REN/ERM-TGSRR-77 Technical Body: ERM TGSRR Directives: 2014/53/EU Details and Download	Short Range Devices; Transport and Traffic Telematics (TTT); Radar equipment operating in the 24,05 GHz to 24,25 GHz or 24,05 GHz to 24,50 GHz range; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU vehicular radar operating in 24 GHz NB range	Published Current Status: Delivery to the EC (2016-12-12) Next Status: Citation in the OJ (2017-03-06)

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Details of 'REN/ERM-TGSRR-77' Work Item

	Work Item Reference	ETSI Doc. Number	STF	Technical Body in Charge	Download Standard
	REN/ERM-TGSRR-77	EN 302 858		ERM TGSRR	
	Current Status (Click to View Full Schedule)	Latest Version	Cover Date	Standstill	Creation Date
	Delivery to the EC (2016-12-12)	2.1.1	2016-12-12	View Standstill Information	2015-02-19
	Rapporteur	Technical Officer	Harmonized Standard		
	Andreas John 	Igor Minaev 	Yes		View Transposition Data

Title

Short Range Devices; Transport and Traffic Telematics (TTT); Radar equipment operating in the 24,05 GHz to 24,25 GHz or 24,05 GHz to 24,50 GHz range; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU
vehicular radar operating in 24 GHz NB range

Scope and Field of Application

HEN covering the technical requirements and measurement procedures for short range vehicular radar operating in the 24,05 GHz to 24,25 GHz or 24,05 GHz to 24,50 GHz range; Revision and merging of current standard parts (EN 302 858-1 and 302 858-2) to cover the essential requirements of article 3.2 of the RE-D.

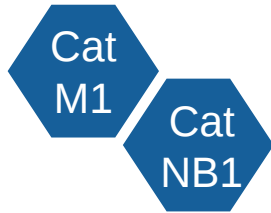
Supporting Organizations

JSConsulting, Continental Automotive GmbH, Valeo Radar Systems Inc., Hella

	Keywords	Projects	Clusters	Frequencies	Mandates	Directives
	Harmonised standard RADAR RADIO RTTT SRD TESTING		Transportation		M/536	2014/53/EU
Official Journal						
	2016-07-25 butscheidt Draft contributed - V 1.0.1 contributed for Decision in ERM(16)59b012 as Draft Review after PE 2016-07-25 butscheidt A new draft is uploaded - V 1.0.1 with status: Draft Review after PE - with comment: The results of the resolution meeting: successful. The resolution meeting was during TG SRR_25.					

Under hot discussion:

Cellular



NB-IOT
on cellular
follows the
frame-based
structure of
LTE signaling

LP WAN

Examples



The individual specifications
do not replace local regulatory
requirements.

Example:
SRD below 1 GHz
need to comply with EN 300 220
under RED.
This translates into
Duty Cycle or
LBT + AFA requirements

Local Area



Adaptivity

frame based
load based

Clear Channel Assessment
Channel Occupancy Time
Detect And Avoid
Listen Before Talk LBT

Dwell time requirements
Medium Utilization Factor

Conclusion: Everybody has to follow timing rules.

Regulatory Test Requirements for SRD below 1 GHz

Europe

Duty Cycle or LBT + AFA

Operational Frequency Band		Maximum effective radiated power, e.r.p.	Channel access and occupation rules (e.g. Duty cycle or LBT + AFA)	Maximum occupied bandwidth	Other usage restrictions	Band number from EC Decision 2013/752/EU [i.3]	Class 1 sub-class number according Commission Decision 2000/299/EU [i.7]
K	863 MHz to 865 MHz	25 mW e.r.p.	$\leq 0,1 \%$ duty cycle or polite spectrum access	The whole band except for audio & video applications limited to 300 kHz		46a	66
L	865 MHz to 868 MHz	25 mW e.r.p. Power density: -4,5 dBm/100 kHz The power density can be increased to +6,2 dBm/100 kHz if the band of operation is limited to 865 MHz to 868 MHz	$\leq 1 \%$ duty cycle or polite spectrum access	The whole band except for audio & video applications limited to 300 kHz	DSSS and any techniques other than FHSS.	47	67

EN 300 220 Annex B; EU-wide harmonised National Radio Interfaces

Regulatory Test Requirements for SRD below 1 GHz

Europe

Duty Cycle or LBT + AFA

	Operational Frequency Band	Maximum effective radiated power, e.r.p.	Channel access and occupation rules (e.g. Duty cycle or LBT + AFA)	Maximum occupied bandwidth	Other usage restrictions	Band number from EC Decision 2013/752/EU [i.3]	Class 1 sub-class number according Commission Decision 2000/299/EU [i.7]
M	868,000 MHz to 868,600 MHz	25 mW e.r.p.	≤ 1 % duty cycle or polite spectrum access	The whole band except for audio & video applications limited to 300 kHz		48	28
N	868,700 MHz to 869,200 MHz	25 mW e.r.p.	≤ 0,1% duty cycle or polite spectrum access	The whole sub-band except for audio & video applications limited to 300 kHz		50	29
O	869,400 MHz to 869,650 MHz	25 mW e.r.p.	≤ 0.1% duty cycle or polite spectrum access	The whole band		54a	130
P	869,400 MHz to 869,650 MHz	500 mW e.r.p.	≤ 10 % duty cycle or polite spectrum access	The whole band		54b	30
Q	869,700 MHz to 870,000 MHz	5 mW e.r.p.	No requirement	The whole band	Audio and video applications are excluded.	56a	31
R	869,700 MHz to 870,000 MHz	25 mW e.r.p.	≤ 1% duty cycle or polite spectrum access	The whole band	Analogue audio applications are excluded. Analogue video applications are excluded.	56b	69

This is the only exception



EN 300 220 Annex B; EU-wide harmonised National Radio Interfaces

Regulatory Test Requirements for SRD below 1 GHz

Duty Cycle or LBT + AFA

Operational Frequency Band		Maximum Effective Radiated Power	Channel access and occupation rules	Additional/other spectrum access parameters	Maximum occupied bandwidth	Other usage restriction	Notes	CEPT/ERC/REC 70-03 [i.1] implementation status
X	863 MHz to 870 MHz	25 mW e.r.p.	≤ 0,1 % duty cycle or polite spectrum access	≤ 1 % Duty Cycle if the band is limited to 865 MHz to 868 MHz	100 kHz for 47 or more channels	FHSS	Sub-bands for alarms [868,6 MHz to 868,7 MHz], [869,250 - 869,4 MHz], [869,650 MHz to 869,700 MHz] are excluded.	90 %
		25 mW e.r.p. Power density: -4,5 dBm/100 kHz. The power density can be increased to +6,2 dBm/100 kHz if the band of operation is limited to 865 MHz to 868 MHz. The power density can be increased to -0,8 dBm/100 kHz, if the band of operation is limited 865 MHz to 870 MHz.	≤ 0,1 % duty cycle or polite spectrum access	Duty cycle may be increased to 1 % if the band is limited to 865 MHz to 868 MHz and power limited to 10 mW e.r.p.	The whole band except for audio & video limited to 300 kHz and voice limited to 25 kHz		DSSS and any techniques other than FHSS Sub-bands [868,6 MHz to 868,7 MHz], [869,250 MHz to 869,4 MHz], [869,650 MHz to 869,700 MHz] for alarms are excluded.	90 %
		25 mW e.r.p.	≤ 0,1 % duty cycle or polite spectrum access		300 kHz except for voice limited to 25 kHz		Sub-bands [868,6 MHz to 868,7 MHz], [869,250 - 869,4 MHz], [869,650 MHz to 869,700 MHz] for alarms are excluded.	90 %

EN 300 220 Annex C; not EU-wide harmonised National Radio Interfaces

Measurement Uncertainty EN 300 220-1, SRD 25 MHz to 1000 MHz

EN 300 220-1

Table 5: Measurement uncertainty

Radio frequency	$\pm 0,5$ ppm
RF power, conducted	$\pm 1,5$ dB
Conducted spurious emission of transmitter, valid up to 6 GHz	± 3 dB
Conducted emission of receivers	± 3 dB
Radiated emission of transmitter, valid up to 6 GHz	± 6 dB
Radiated emission of receiver, valid up to 6 GHz	± 6 dB
RF level uncertainty for a given BER	$\pm 1,5$ dB
Occupied BandWidth	± 5 %
Temperature	$\pm 2,5$ °C
Humidity	± 10 %

Backup and Highlights

Spurious Emission Highlights



Spurious Emission Highlights

EN 302 567 requirements for Tx
e.g. WIGIG 60 GHz

30 MHz to **132 GHz**

Table 4: Transmitter spurious emissions

Frequency range	Emission Limit ERP (≤ 1 GHz) EIRP (> 1 GHz)	Measurement Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 790 MHz	-54 dBm	100 kHz
790 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 132 GHz	-30 dBm	1 MHz

Spurious Emission Highlights

EN 302 567 requirements for Rx
e.g. WIGIG 60 GHz

30 MHz to **132 GHz**

Table 5: Receiver spurious emissions

Frequency band	Emission Limit ERP (≤ 1 GHz) EIRP (> 1 GHz)	Measurement Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 132 GHz	-47 dBm	1 MHz

-30 dBm for Tx vs. -47 dBm for Rx

Spurious Emission Highlights

30 MHz to **154 GHz**

EN 301 091-2 requirements for Tx

e.g. Automotive Radar

@ fundamental = 77 GHz

Table 5: Limits of radiated spurious emissions [i.3]

Frequency range (MHz)	Limit values for spurious radiation	Detector type
47 to 74	-54 dBm e.r.p.	Quasi-Peak
87,5 to 118	-54 dBm e.r.p.	Quasi-Peak
174 to 230	-54 dBm e.r.p.	Quasi-Peak
470 to 790	-54 dBm e.r.p.	Quasi-Peak
otherwise in band 30 to 1 000	-36 dBm e.r.p.	Quasi-Peak
f > 1 000 to 300 000 (see note)	-30 dBm e.i.r.p.	RMS
NOTE: Measurement is only required up to the 2 nd harmonic of the fundamental frequency (as defined in CEPT/ERC/REC 74-01 [i.3]). In this case, the upper frequency limit up to which measurements are performed is 154 GHz.		

Spurious Emission Highlights

30 MHz to **154 GHz**

EN 301 091-2 requirements for Rx

e.g. Automotive Radar

@ fundamental = 77 GHz

Table 6: Narrowband spurious emission limits for receivers [i.3]

Frequency range	Limit	Detector type
30 MHz to 1 GHz	-57 dBm (e.r.p.)	Quasi-Peak
above 1 GHz to 300 GHz (see note)	-47 dBm (e.i.r.p.)	RMS
NOTE: Measurement is only required up to the 2 nd harmonic of the fundamental frequency (as defined in CEPT/ERC/REC 74-01 [i.3]). In this case, the upper frequency limit up to which measurements are performed is 154 GHz.		

Table 7: Wideband spurious emission limits for receivers [i.3]

Frequency range	Limit	Detector type
30 MHz to 1 GHz	-47 dBm/MHz (e.r.p.)	Quasi-Peak
above 1 GHz to 300 GHz (see note)	-37 dBm/MHz (e.i.r.p.)	RMS
NOTE: Measurement is only required up to the 2 nd harmonic of the fundamental frequency (as defined in CEPT/ERC/REC 74-01 [i.3]). In this case, the upper frequency limit up to which measurements are performed is 154 GHz.		

Spurious Emission Highlights

EN 303 413 requirements for Rx
GNSS User Equipment (GUE)

30 MHz to **8.3 GHz**

The spurious emissions of the GUE shall not exceed the values given in table 4-5.

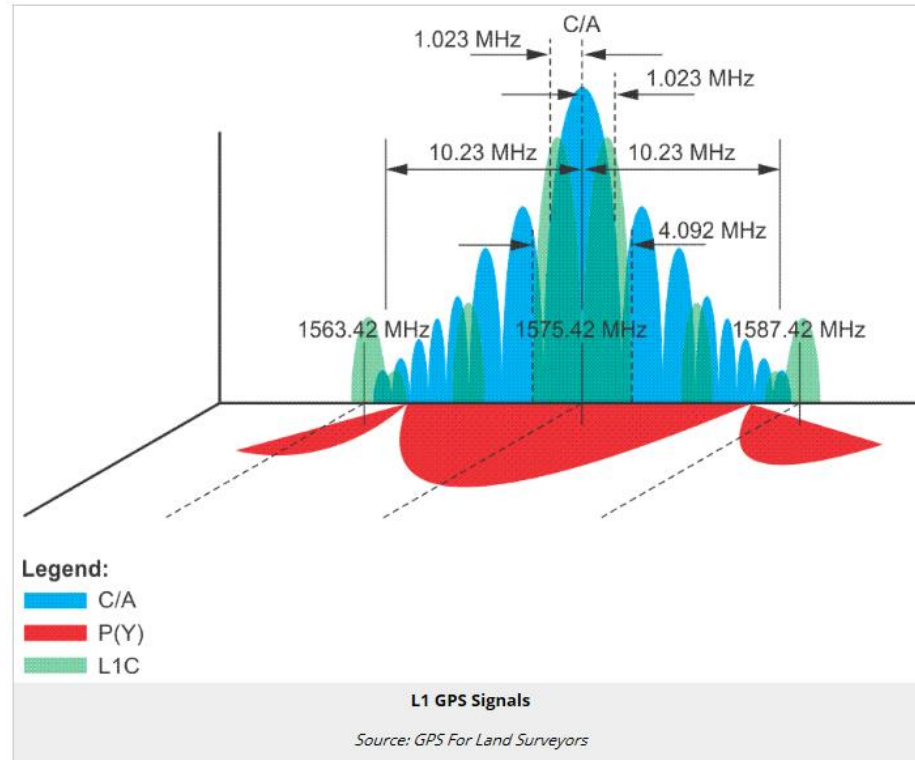
In case of a GUE with an external antenna connector, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or for emissions radiated by a GUE with an integral antenna (without an antenna connector), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Table 4-5: Spurious emission limits

Frequency range	Maximum power	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 8,3 GHz	-47 dBm	1 MHz

GNSS Signal Details

GPS L1 Carrier Modulation



<https://www.e-education.psu.edu/geog862/node/1753>

GNSS Signals listed in EN 303 413

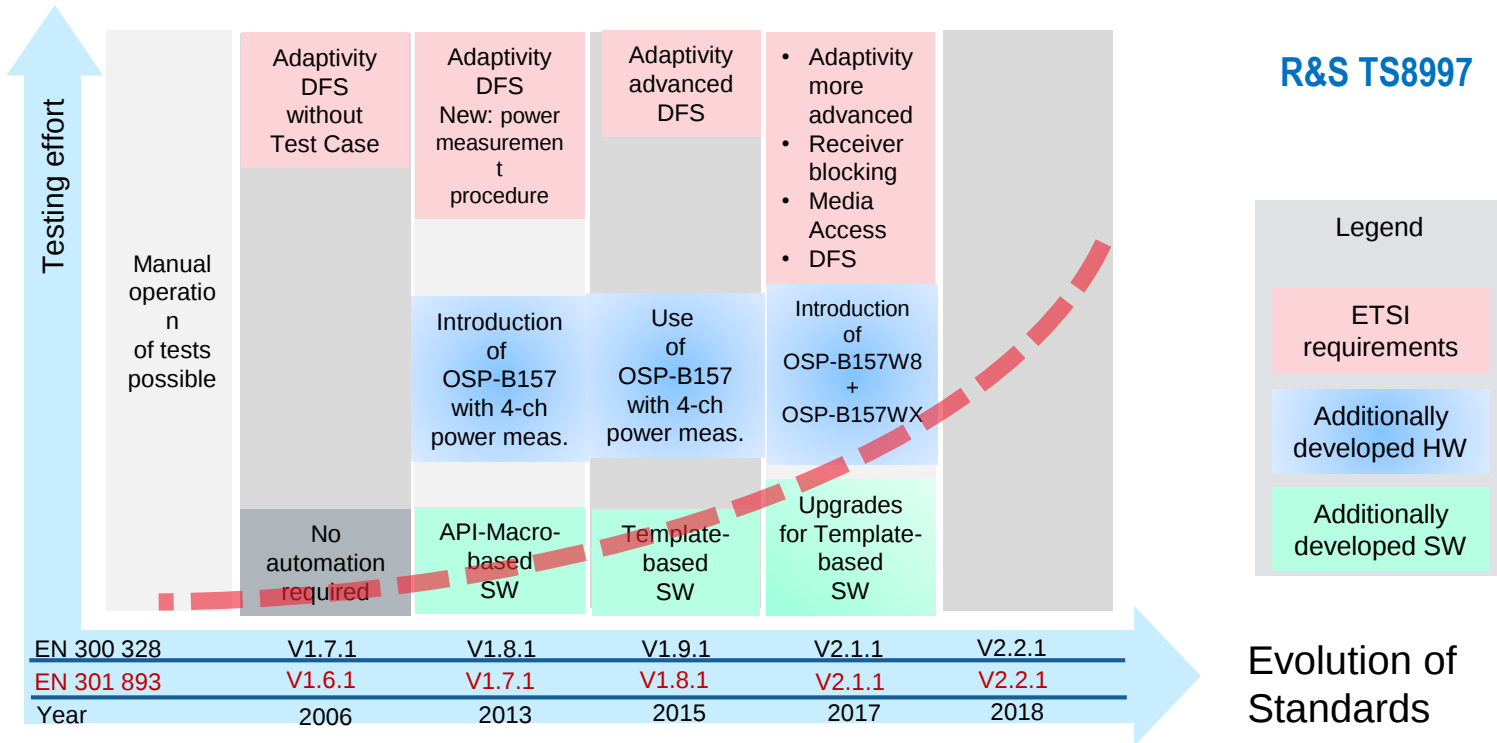
Check availability
of signal source!

Table 4-1: GNSS, GNSS signals and RNSS frequency bands

GNSS	GNSS Signal Designations	RNSS Frequency Band (MHz)
BDS	B1I	1 559 to 1 610
Galileo	E1	1 559 to 1 610
	E5a	1 164 to 1 215
	E5b	1 164 to 1 215
	E6	1 215 to 1 300
GLONASS	G1	1 559 to 1 610
	G2	1 215 to 1 300
GPS	L1	1 559 to 1 610
	L2	1 215 to 1 300
	L5	1 164 to 1 215
SBAS	L1	1 559 to 1 610
	L5	1 164 to 1 215

Information on Solution for EN 300 328 + 301 893

System complexity vs. Standard evaluation



ETSI EN 300 328 - Test Cases

RF output power

Duty cycle, Tx-sequence, Tx-gap

Accumulated Transit Time, Frequency Occupation and Hopping Sequence

Hopping Frequency Separation

Medium Utilization (MU) factor

Adaptivity

Occupied Channel Bandwidth

Transmitter unwanted emissions in the out-of-band domain

Transmitter unwanted emissions in the spurious domain

Receiver spurious emissions

Receiver Blocking

Geo-location capacity



ETSI EN 301 893 - Test Cases

Center Frequencies

Nominal Channel Bandwidth and occupied Channel Bandwidth

RF output power, Transit Power Control (TPC) and power density

Transmitter unwanted transmissions

Receiver spurious transmissions

Dynamic Frequency Selection (DFS)

Adaptivity

Receiver Blocking

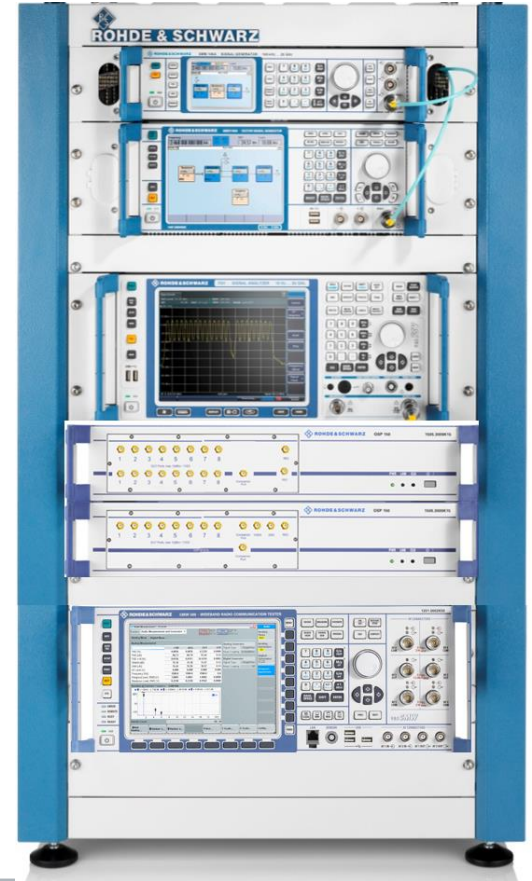
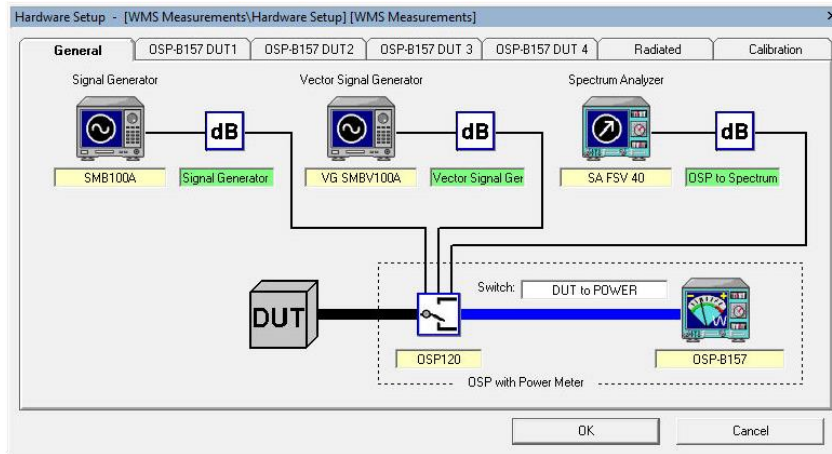
User Access Restriction

Geo-location capacity



Solution

- Special power measurement implemented
- Covers up to 8 channel MIMO
- Test software



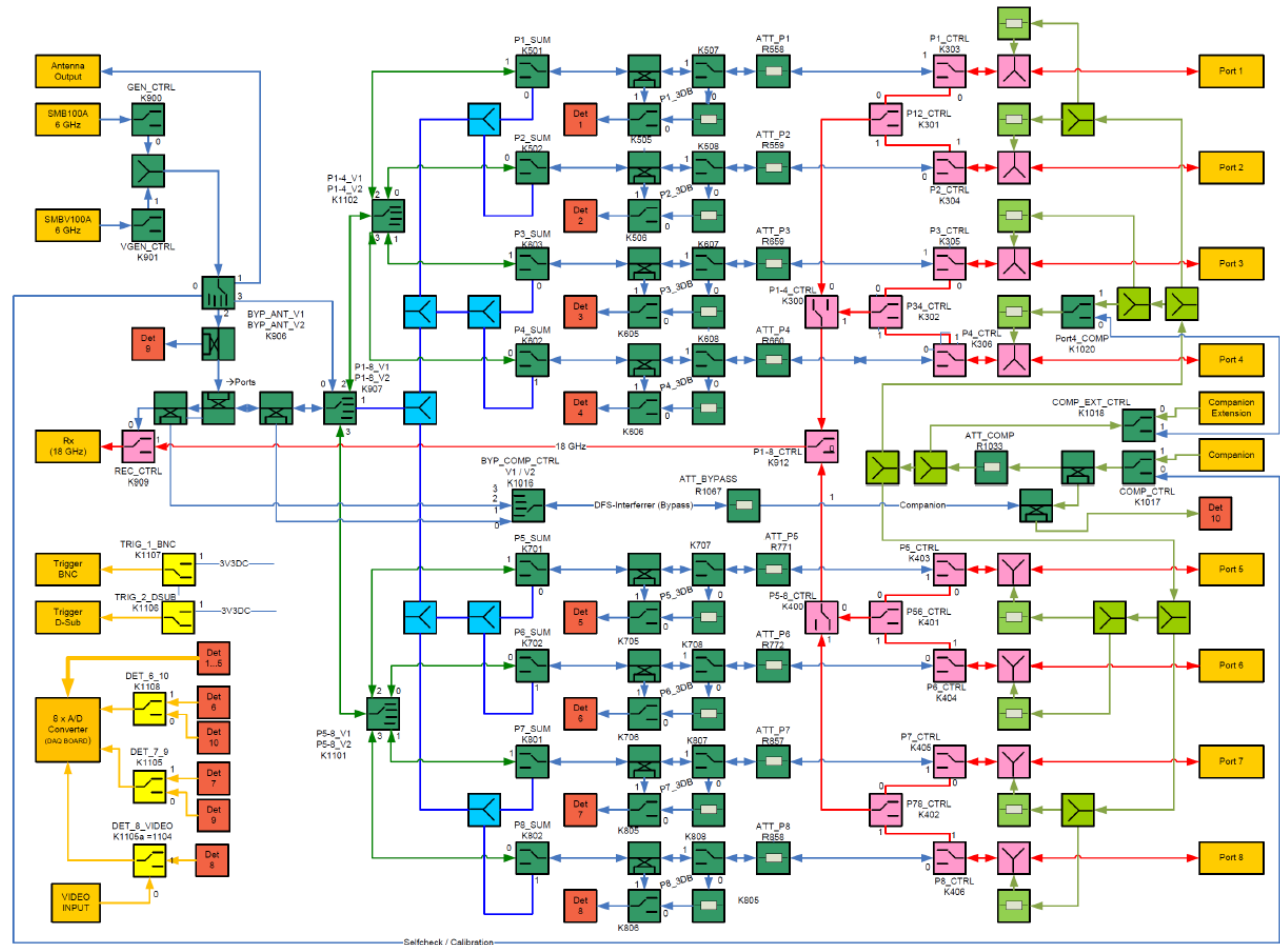
Solution Details

- 8 × 8 MIMO support
 - ETSI standard requires simultaneous measurement
 - Up to 8 ports can be measured simultaneously
- High resolution measurements (380 Mio sweep points)
 - Full support even beyond the standard's requirements
- higher RF power meter sampling rates (up to 10 MS)
 - Full support of FCC standard
 - More efficient and faster measurement times
- 40GHz extension available (OSP-B157WX)
 - Fully automated out-of-band test cases
 - Required for RED receiver test (§15.407)
 - Required for EN 301 893
- Integrated step attenuators (DUT & companion port)
 - 10 automated step attenuators integrated
 - 0,5 dB step resolution
 - Compact design, fits into OSP120 housing
- Measurement comfort
 - All required accessories integrated
 - Power meter and analyzer can run simultaneously
 - Time saving and high comfort
- Solid state technology on PCB
 - Good value for money
 - Small dimensions





Solution Details



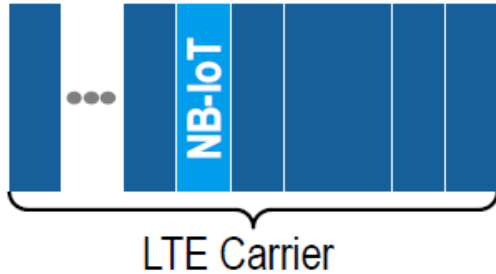
Backup for Cat NB1 (NB-IoT)

NB-IoT Operation Modes

The test requirements e.g. for ACS have to reflect different RF environment conditions of the potential victim signal depending on the operation mode of the device under test.

Which offset shall be selected for the interferer?

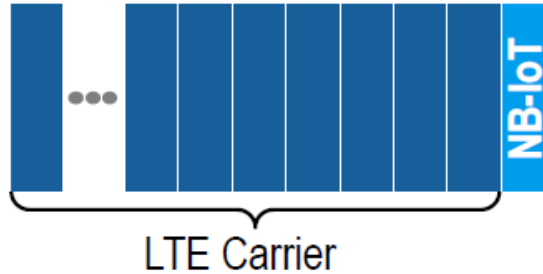
In-band operation



In-band operation

utilizing a resource block within a normal LTE carrier

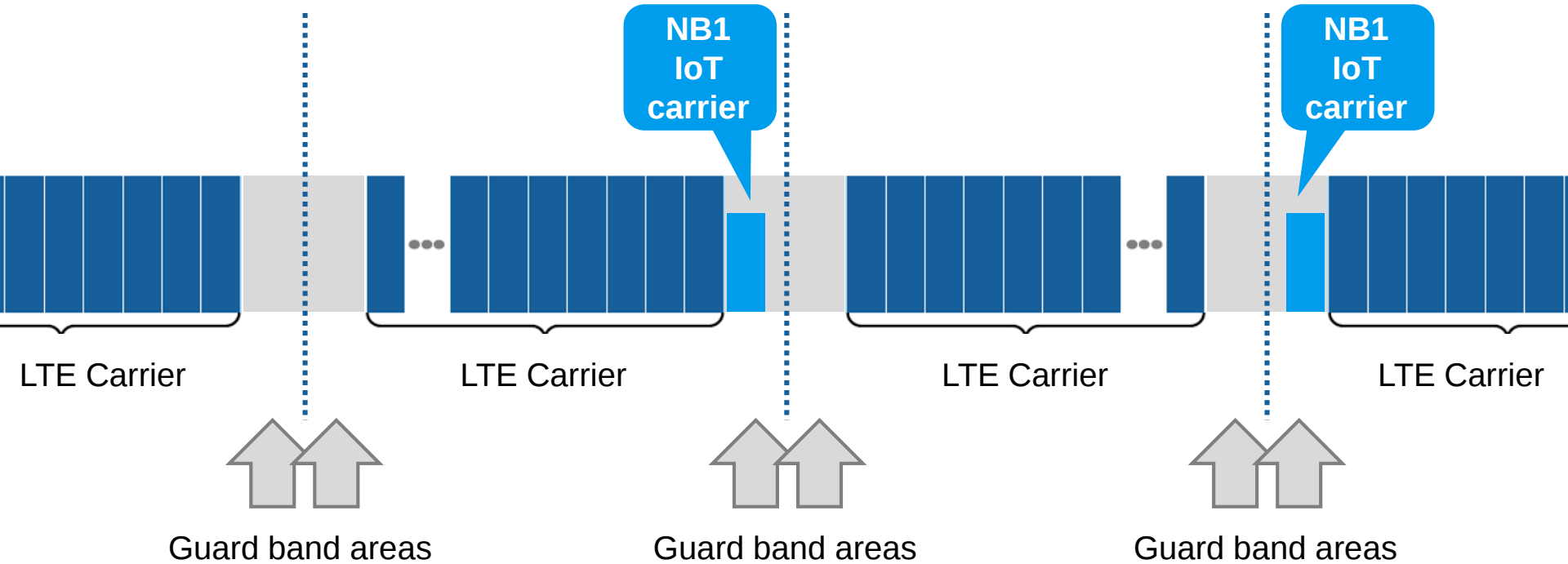
Guard operation



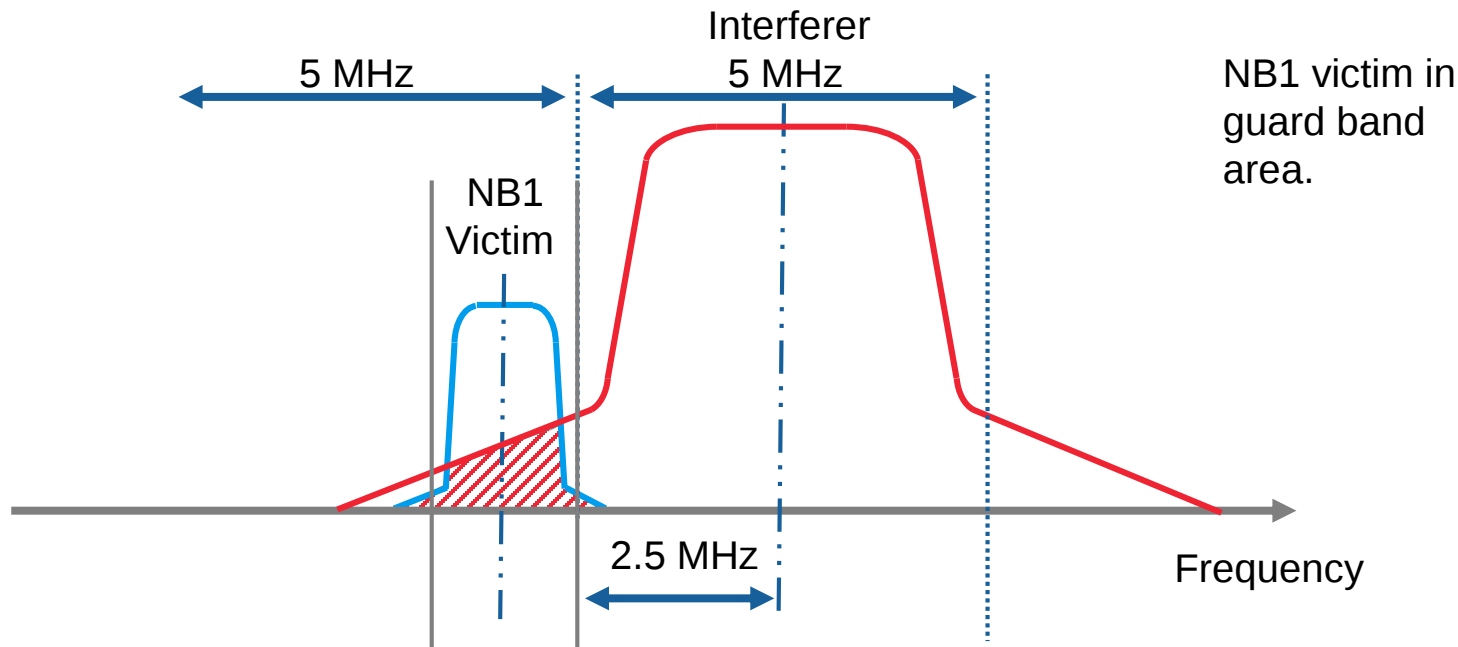
Guard operation

utilizing an unused resource block within a LTE carrier's guard-band

Guard Operation: NB-IoT Carrier on Guard Band Position



Adjacent Channel Selectivity ACS: Simulation of Worst Case Situation



The NB1 channel could be located at the edge of the LTE carrier.
The next LTE carrier would appear as interferer to the NB1 channel.

3GPP Scheme of Receiver Performance Tests for Cat NB1

Sensitivity test

In 3GPP the wanted signal level is pre-defined: REFSENS
The receiver must achieve $\geq 95\%$ of the maximum throughput

Receiver without interferer

- reuse of the signal level REFSENS from the prior sensitivity test
- wanted signal level must be set to REFSENS + 14 dB.

- target: receiver achieves a proper work condition

Interferer On

- for tests with constant interferer level:
the receiver must perform on a performance level, that is equal or better
to the receiver performance achieved during the sensitivity test. $\rightarrow \geq 95\%$ of max TP.

- no interferer level adjustment according to 3GPP.

7.5F Adjacent Channel Selectivity (ACS) for UE category NB1

ACS1 test Parameters		
Interferer		E-UTRA
Wanted signal	Category NB1 signal power (P_{wanted}) / dBm	approx. -94 dBm REFSENS + 14 dB
Interferer signal	interferer signal power ($P_{\text{Interferer}}$) / dBm	approx. -61 dBm REFSENS + 47 dB
Interferer bandwidth		5 MHz
Interferer offset from category NB1 channel edge		± 2.5 MHz

From table 7.5F5-1

$\geq 95\%$ of maximum throughput

→ Test result under 7.3F

Adjacent Channel Selectivity ACS

3GPP specification per technology

The basic part of the test case numbers stay the same. Suffix part refers to new technology or UE category.

