平成 18 年 1 月
社団法人　ビジネス機械・情報システム産業協会
技術委員会 安全小委員会・電磁環境小委員会 合同
EN50371 対応 WG

電磁界人体ばく露制限規格(EN50371)対応方法の検討結果報告

１．はじめに

EU において、低電圧指令（LVD）と通信端末指令（R&TTED）適合評価対象規格として 2004 年に EN50371:2002（Generic standard to demonstrate the compliance of low power electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (10 MHz - 300 GHz) - General public）が発効し、当該製品においては従来規格に加え EN50371 が適合評価対象規格となった。

しかし、EN50371 では、機器からの無線周波放射電力の評価を行なうことを規定しているが、非意図的放射機器（JBMIA 対象品目）に関しては、具体的な放射電力の測定・評価方法の規定はなく、評価者による“放射電力を決定した方法と根拠”を記録に残すとの規定しかない。

この状況を踏まえ、低電圧指令（LVD）の JBMIA 対象品目（非意図的放射機器）の要求範囲に限定し、当該規格の適切な適合確認手法を見出す為、当 WG を設立し調査研究を行ない、EMI の測定結果を用いて放射電力推定方法を検討したので、ここに審議結果を報告する。

本報告書により、EN50371 対応を理解する一助にしていただきたい。

２．WG メンバー（敬称略）

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事務局：　漆田(JBMIA)

３．活動期間

平成 17 年 4 月～平成 18 年 1 月

4．調査項目

(1) EN50371 の検討

EN50371 は、意図的放射、非意図的放射にかかわらず機器からの放射電力等が次の条件を満たしていれば、公衆への電磁界ばく露に関する基本制限を満足すると規定されているが、非意図的機器に関しては、放射電力の評価法について、具体的な記載は何もない。

＜放射電力等の条件＞

平均放射電力：20mW 以下
20×prf mW未満（300MHz から 10GHz で 30μs 未満のパルス）
prf（パルスの繰返し周波数）：単位時間あたりの発振数

(2) EN50371 の適合確認方法（技術ガイドライン）の検討

ドイツから適合確認方法に関する技術ガイドライン ”Technical guideline on the assessment of the Human exposure to electromagnetic fields for Low power electronic and electrical apparatus according to the Standard EN50371:2002”（EN50371 に基づく人体の電磁波ばく露に関する低出力電子電気機器の評価についての技術ガイドライン）が CENELEC/TC106X 委員会に提案されたが、近磁界および垂直方向に対する測定方法の不備等の理由で否決された。本 WG は否決されたことを理解した上で、当該ガイドラインを調査した。

CENELEC/TC106X：EN 規格の制定機関である欧州電気標準化委員会の傘下にある技術委員会で、電磁界の人体ばく露を扱っている。

(3) 関連規格の検討

EN50392:2004(Generic standard to demonstrate the compliance of electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (0 Hz - 300 GHz))、等

5．検討結果

(1) EN50371 の検討結果

EN50371 で宣言するための適用可否判定フローを図１に示す。

＜図１の内容＞

① 放出電力測定は可能か？
② ①の測定が可能な場合は EN50371 に適合しているか？
③ EN50371 で評価し、調和規格として適合宣言書に EN50371 を記載する。
④ ①の測定が不可能な場合または EN50371 に不適合の場合は、適合宣言をしない。

(2) 技術ガイドラインの検討結果

1) 技術ガイドラインに従って測定する場合のフローを図２に示す。

＜図２の内容＞

① 次の規格で、EUT のエミッション測定を行ない、適合しているか？

10MHz－30MHz ：EN55011

30MHz－1GHz ：EN55022

1GHz 以上 ：FCC Part15, Subpart B（上限は、EUT のクロックに依存）

② EN50371 の対象製品である。

③ 置換法もしくは簡易置換法による放射電力の計算値の合計が 20mW 未満であるか？

置換法： EUT を利得の既知なアンテナに置換え、測定値と同レベルになるよう信号発生器の出力レベル調整し、その出力レベルから計算により求める。

簡易置換法：試験環境が自由空間の条件を満たす場合は測定値から計算によって求める。

④ ③で 20mW 未満であれば、②と同様。

⑤ ③で 20mW 以上の場合、EN50371 の適合宣言をしない。

2) EN50371 の測定方法の制限事項

技術ガイドライン検討の結果、下記のような測定手法の制限事項を定めないと適合確認が出来ないということが判明した。

＜制限事項＞

① 10MHz～300GHz の全周波数範囲の測定が必要。

② 周波数によって電界強度の測定限界（暗ノイズレベル等）があるので、暗ノイズレベルの規定が必要（これ以下は測定しないというレベル）。

③ 全方位測定（上下方向等）は EMI 試験では実施していないので、真の最大値測定が必要。

(3) EN50392 について

EN50371 に非対象の場合は、EN50392 で評価することになるが、まだ欧州官報に公告されていない。EN50392 でも EN50371 と同様に、非意図的放射機器に対して具体的な評価法の規定はない。

６．結　論

EN50371 による適合宣言について

EN50371 で適合宣言するために、当該規格の対象/非対象の判定法として、上記の制限事項があるなど課題は残っているが、現時点では、技術ガイドラインを用いることはできる。ただし、EN50371 は低出力電子電気機器であれば、公衆への電磁界ばく露に関する基本制限を満足すると規定しているだけで、適合を強制しているわけではない。

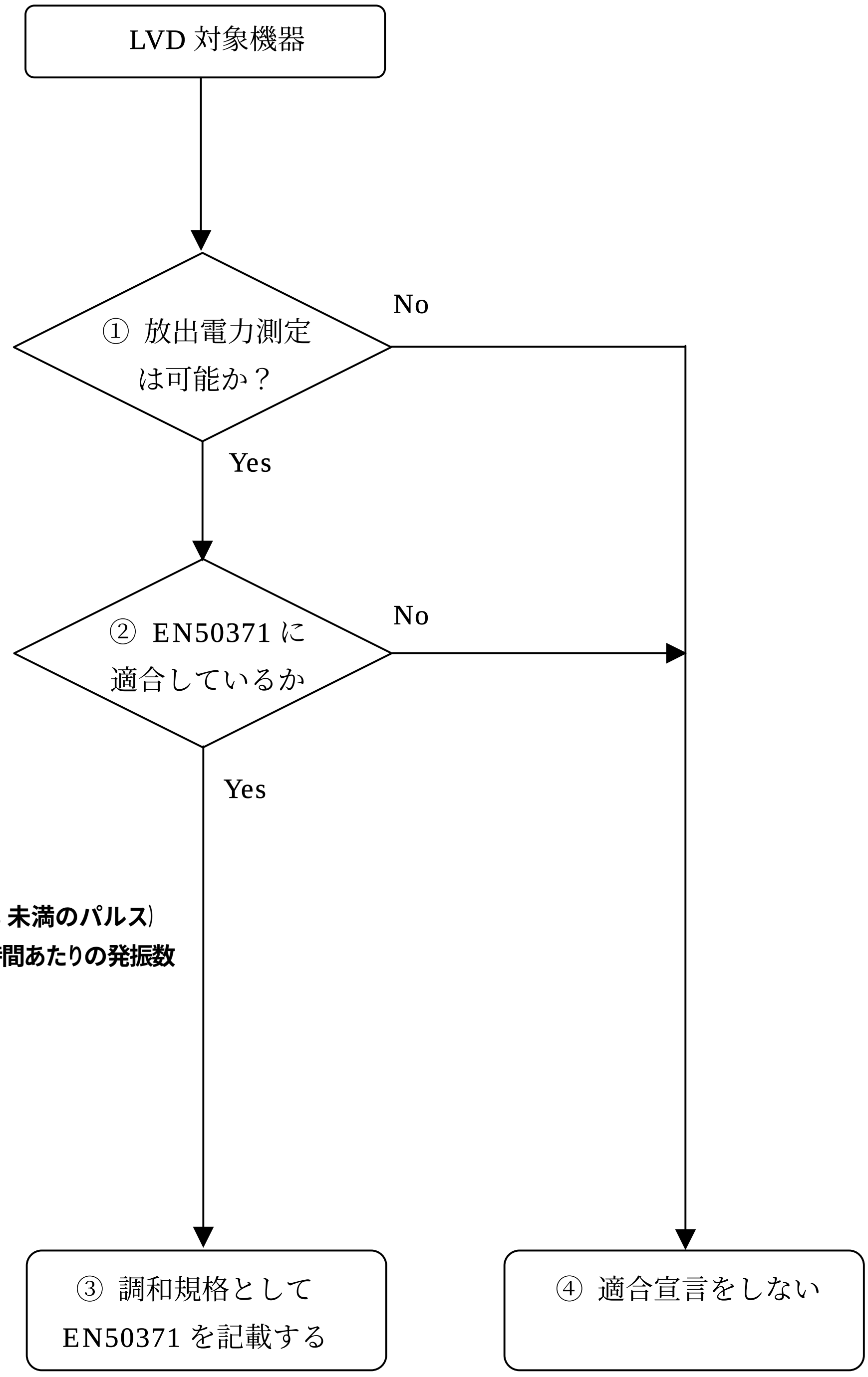
したがって、EN50371 における低出力電子電気機器かどうかが不明である場合は、当該規格の適合を宣言しないことで対応すれば、現時点では妥当であると考える。

７．おわりに

本活動のなかで、技術ガイドライン中の式および数値に関しては精査せず、基本的な考え方を引用した。

今後、EN50392 の官報公告日などの欧州動向を注視しながら、必要に応じて JBMIA ガイドラインを提案したい。

IEC TC106 の NP（New Work Item Proposal）である 106/106/NP も EN50371 と同じ内容で規格化が検討されはじめたので、規格審議過程での意見提案ができるようになった。



***1 判定条件**
放出ピーク電力：
20W 未満
平均放出電力：
20mW 以下
20×prf mW 未満
（300MHz から 10GHz で 30μs 未満のパルス）
prf（パルスの繰り返し周波数）：単位時間あたりの発振数

図１．EN50371 適用可否判定フロー

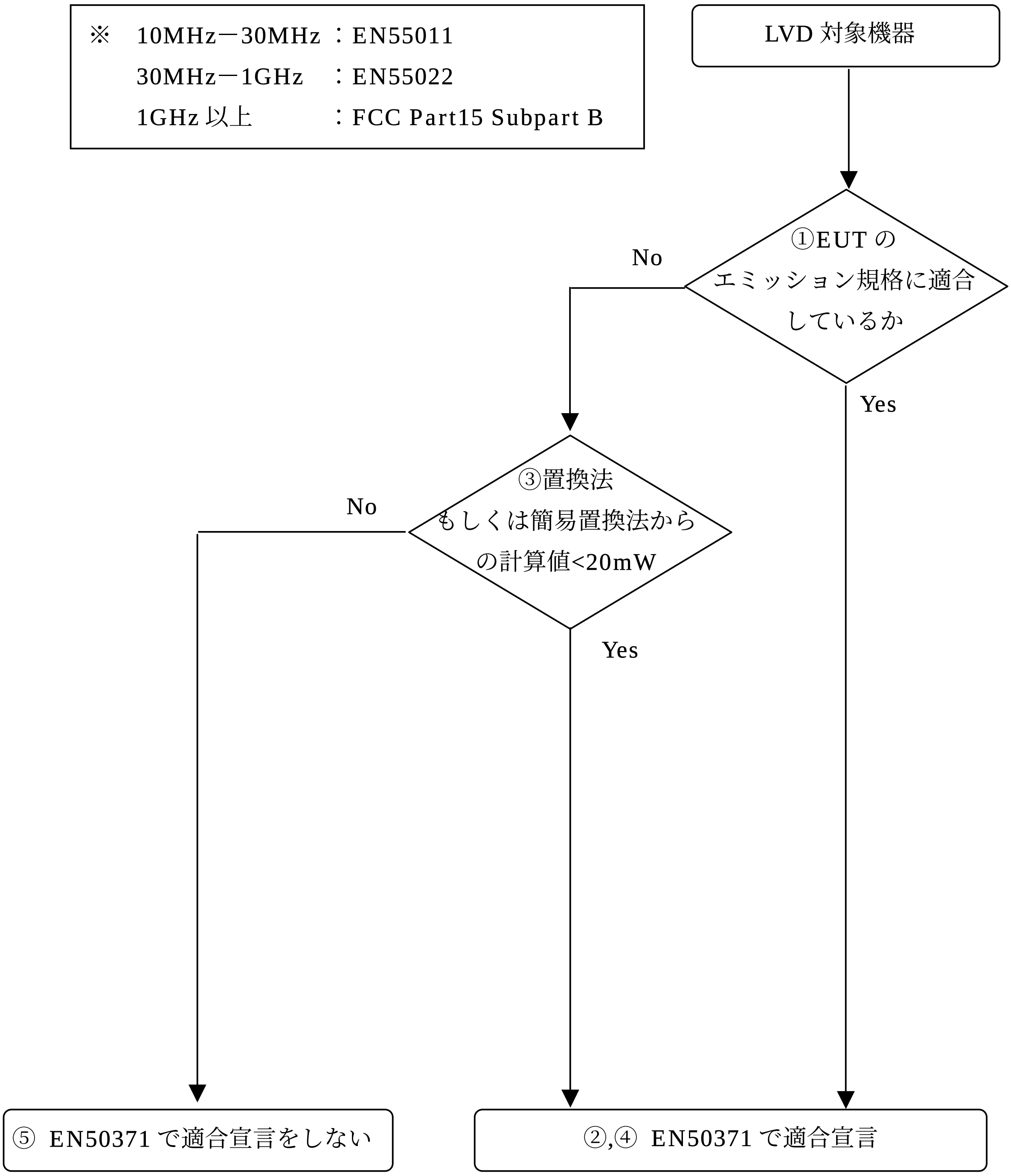


図２．技術ガイドライン適用フロー

Technical Guideline No.: 2005002

Standard / Regulation:	Subject:	Status:	Final of 2005-05-11
EN 50371:2002	**Assessment method for EN 50371**	Revision:	1.0
Sub-clause / Issue:	**Key words:**		
EMF	EMF, Class A, Substitution Method, 20mW		

CONTENT

Technical guideline on the assessment of the Human exposure to electromagnetic fields for Low power electronic and electrical apparatus according to the Standard EN 50371:2002

1 Introduction

With the publication of the Council recommendation 1999/519/EC, aiming to attain a high level of health protection, basic restrictions and reference levels for electric, magnetic and electromagnetic fields are proposed which are based on the internationally recognized ICNIRP recommendations.
In the subsequent standardisation mandate M/305 Sept. 2000 addressed to CEN, CENELEC and ETSI, the development for adequate harmonised standards for purpose of presumption of conformity was initiated. This mandate stipulates : "in case of Products likely to emit very weak EMF, a description of simpler and less accurate measurement methods and/or measurement equipment can be made providing the uncertainties by using such equipment or measurement method are fully taken into account.
Based on above principles the Generic standard EN 50371:2002 addresses such products.
This document is intended to provide adequate guidance for product design, manufacturing and test-laboratories for practical assessment methods to demonstrate the compliance and evaluation of uncertainties.

2 Scope of the guideline

the Guideline is addressing the technical assessment for EMF according to the CENELCE standard EN 50371 for Low power emitting devices with a total of max 20mW radiated power.
For technical reasons, the measurement methods are divided in 3 groups:

a) 10 MHz – 30 MHz
b) 30 MHz – 1 GHZ
c) > 1 GHz

3 Assessment methods

3. 1 Assessment of total input power

= to be amended =

3.2 Assessment of average power of pulses

= to be amended =

3.3 Assessment of Peak power (to be < 20 W)

= to be amended =

3.4 Assessment of emitted power through reference to other product standards

= to be amended =

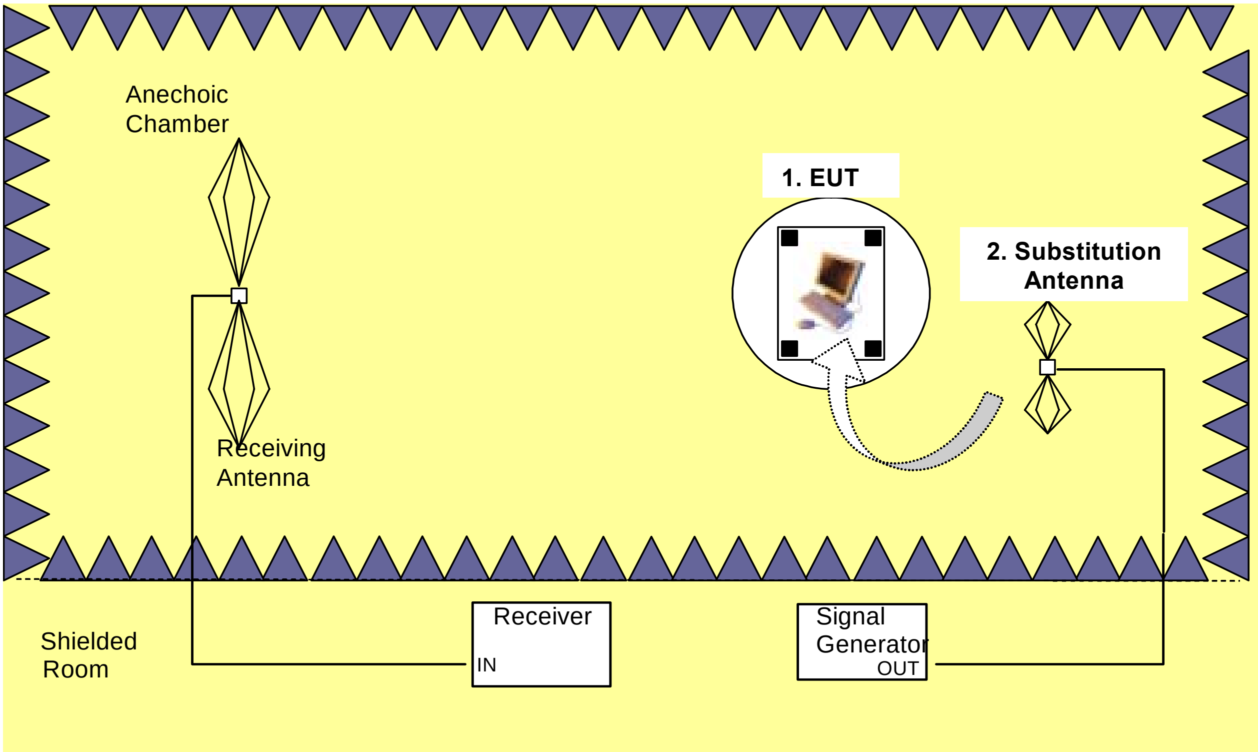
3.5 Assessment of the total of emitted power in the form of Electromagnetic fields (to be < 20 mW)

The following chapter 4 details the assessment method which will provide evidence that the apparatus under evaluation will not emit a total of radiated power above 20 mW.

The practical assessment of an low power apparatus will include 2 steps, where in the 1st step the radiated Power will be evaluated by a field strength measured followed in a 2nd step by the application of the substitution method where necessary.

4 Determination of the radiated power of the EUT by using the Substitution Method

4.1 Principle of setup



4.2 Principle of substitution measurement

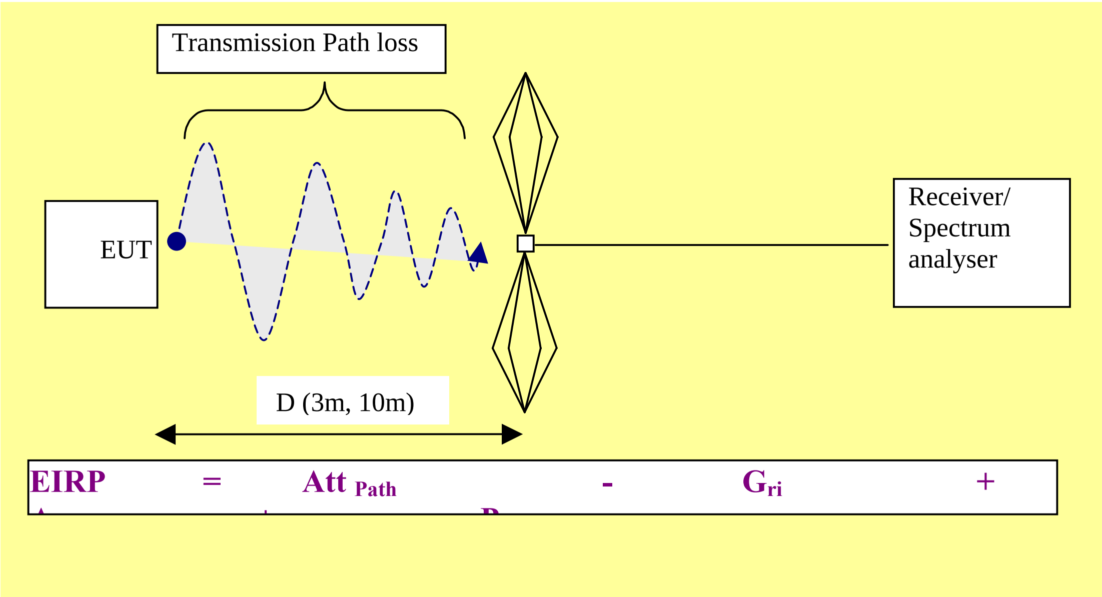
a) Measure each significant emission (maximising emission level by rotating turntable, moving receiving antenna 1m -4m in height (where applicable) of the EUT and record the receiver reading. An Emission is classified as "significant" taking into account the following criteria:

quantity and amplitude of Emissions is assessed against the values in table 1 and leads to the conclusion that the total radiated power may exceed 10 mW

b) Replace the EUT by an antenna with known gain and adjust the signal generator output level to the same receiver level for each emission as previously determined in a)

c) The radiated power of the EUT is then determined by the formulas in c1) and c2):

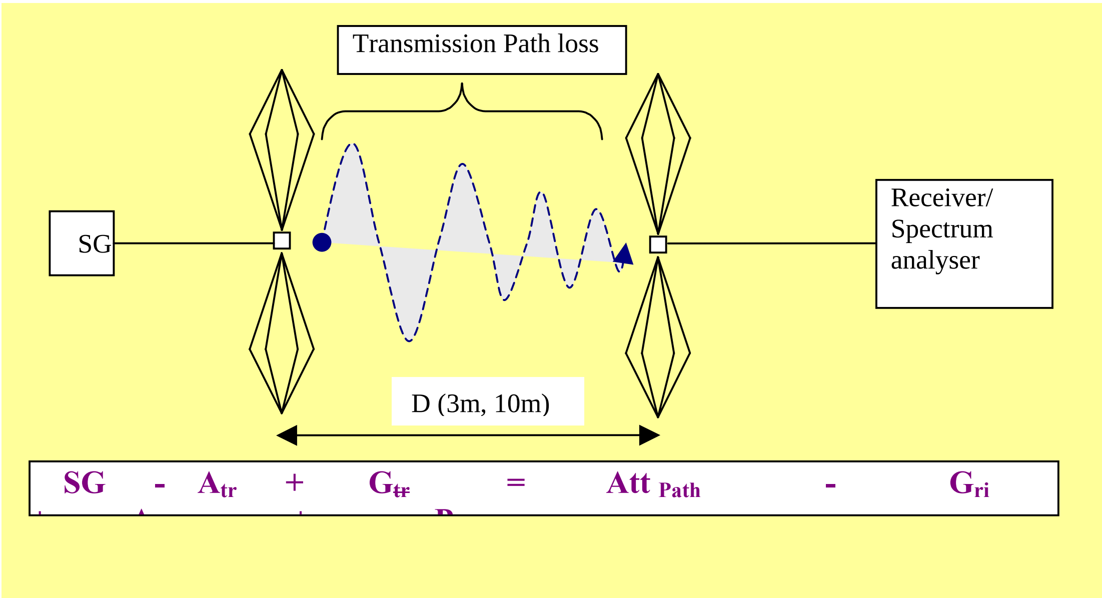
c1) Measurement of EUT



EIRP	:	Effective Isotropic Radiated Power of the EUT
Att_{Path}	:	Path loss of the transmission distance (3m or 10m)
G_{ri}	:	Gain of the receiving antenna (calibrated as isotropic gain)
A_{cr}	:	Attenuation of coaxial receiving signal cable
P_r	:	Received power at the input of the Receiver/Spectrum Analyser

c2) Substitution of the EUT

After measuring the emissions of the EUT, the EUT is removed and a substitute antenna is placed instead of the EUT at the same height and same distance from receiving antenna. For each frequency under measurement the signal Generator level is adjusted to obtain the same reading level as recorded before as EUT emission level.



SG	**:**	**Signal Generator output level**
A_{tr}	**:**	**Attenuation of the cable between SG and transmit antenna**
G_{tr}	**:**	**Gain of the transmitting antenna (calibrated as isotropic gain)**
Att_{Path}	**:**	**Path attenuation of the transmission distance (3m or 10m)**

G_{ri}	:	Gain of the receiving antenna (calibrated as isotropic gain)
A_{cr}	:	Attenuation of coaxial receiving signal cable
P_r	:	received power at the input of the Receiver/Spectrum Analyser

The resulting value for the EIRP for each individual emitted frequency can be calculated by the following formula:

$$EIRP = SG - A_{tr} + G_{tr} \quad [\text{ Eq 1}]$$

If ERP (Reference is λ/2 dipol as transmit antenna) is being used as reference:

$$ERP = EIRP - 2.15\ dB. \quad [\text{ Eq 2}]$$

Further details on the substitution method can be found in 7.2.3 of ETSI TR 102273-2 V1.2.1 (2001-12) and ETSI TR 102273-3 V1.2.1 (2001-12)

4.3 Determination of the radiated power of the EUT by using the simplified substitution method

Note: The simplified substitution method can only be applied, when the following conditions are fulfilled:

- The measurement environment (Fully Anechoic Chamber) must provide free space environment in terms of electromagnetic radio wave propagation
- The measurement distance d must meet far field conditions: $d \geq \lambda/2\pi$

When the simplified substitution method is applied, the EIRP can be determined by calculation only , when path loss, gain of the receiving antenna, and cable loss of the Coaxial cable between receiving antenna and Receiver /Spectrum Analyser are known.

The EIRP can then be calculated as follows:

$$EIRP = Att_{Path} - G_{ri} +$$ [Eq 3]

4.3.1 Determination of free space path attenuation (Att_{Path})

The free space path attenuation is defined at the ratio between the transmitted power and the power received at a distance (d):

$$\frac{P_t}{P_r} = \frac{(4\pi df)^2}{(C_0)^2} \Rightarrow 10\log\frac{P_t}{P_r} = 20\log(\frac{4\pi}{C_0}) + 20\log d + 20\log f$$ [Eq 4]

this equals if distance d is in [m] and frequency f is in [MHz] :

$$Att_{path} = -27{,}56 + 20\log d + 20\log f$$ [Eq 5]

and if distance is in [m] and frequency f is in [GHz]

$$Att_{path} = 32{,}44 + 20\log d + 20\log f$$ [Eq 6]

For a measurement distances of 3 m and 10 m the resulting path attenuation is:

Frequency/GHz	Path attenuation/ dB distance d = 3m	Path attenuation/dB Distance d = 10m
0.03	11.52	21.98
0.05	15.96	26.42
0.1	21.98	32.44

0.2	28.00	38.46
0.3	31.52	41,98
0.6	37.54	48,00
0.8	40.04	50.50
1.0	41.98	52,44
2.0	48.00	58,46
3.0	51.52	61.98
4.0	54.02	64,48
6.0	57.54	68.00
8.0	60.04	70.50
10.0	61.98	72,44
12.0	63.56	74,02
15.0	65.50	75,96
20.0	68.00	78.46
25.0	69.94	80.40
30.0	71.52	81.98

Example:

The EUT emission is measured at 200 MHz, the Receiver input signal is indicated as -57 dBm, the measurement distance is 3 m.

P_r : - 57 dBm

A_{cr}: 2.5 dB

G_{ri}: 3.5 dB

Att_{Path}: 28 dB

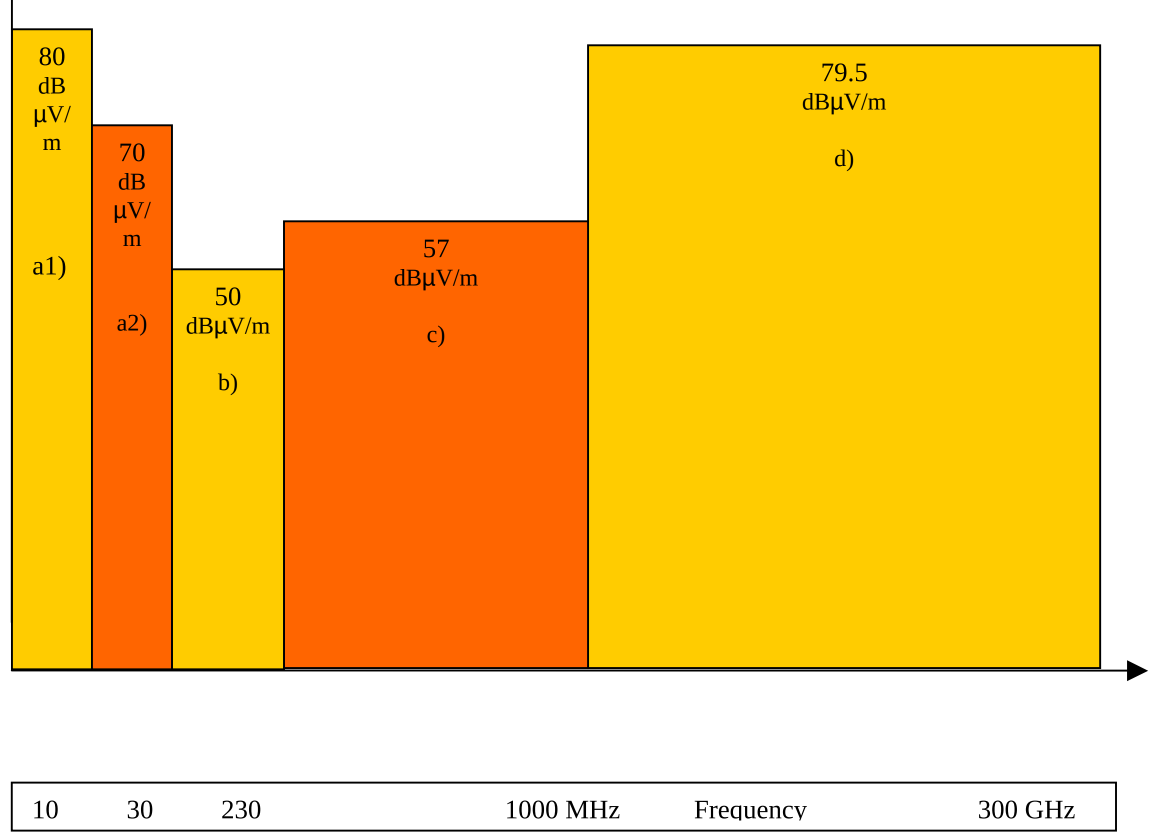
$$EIRP = Att_{Path} - G_{ri} + \ldots$$

EIRP = -30dBm

5 Application of the substitution method to determine the total emitted power

As worst case condition it is assumed that the EUT is emitting it's radiated power throughout the frequency range as considered in EN 50371 between 10 MHz and 300 GHz as broadband spectrum continuous wave exactly on the limits (Class A) as given in the relevant EMC standards :

Fieldstength [dBµV/m] limits for the assessment of Radiated Interference Emissions according to commonly used EMC standards Class A limits



The frequency band to be considered in EN 50371 is not covered by the radiated emission requirement of a single EMC standard. The above limits are a combination of the following commonly applied EMC standards:

a) EN 55011:2003 +A1:2004 Table 5a : measurement distance: 3m;

10 MHz to 20 MHz	**limit:**	**⇨ 80 [dbµV/m]**	**(a1)**
20 MHz to 30 MHz	**limit:**	**⇨ 70 [dbµV/m]**	**(a2)**

b) and c) EN 55022:1998 Table 5: measurement distance: 3m;

30 MHz to 230 MHz	**limit:**	**⇨ 50 [dbµV/m]**	**(b)**
230 MHz to 1000 MHZ	**limit:**	**⇨ 57[dbµV/m]**	**(c)**

d) FCC Part 15 Subpart B (2003) measurement distance 3m class A limits

> 1000 MHz:	**limit:**	**⇨79,5 [dbµV/m]**	**(d)**

Then the total of radiated power is assessed under the following theoretical assumptions: The EUT radiates equally distant spectral lines as follows:

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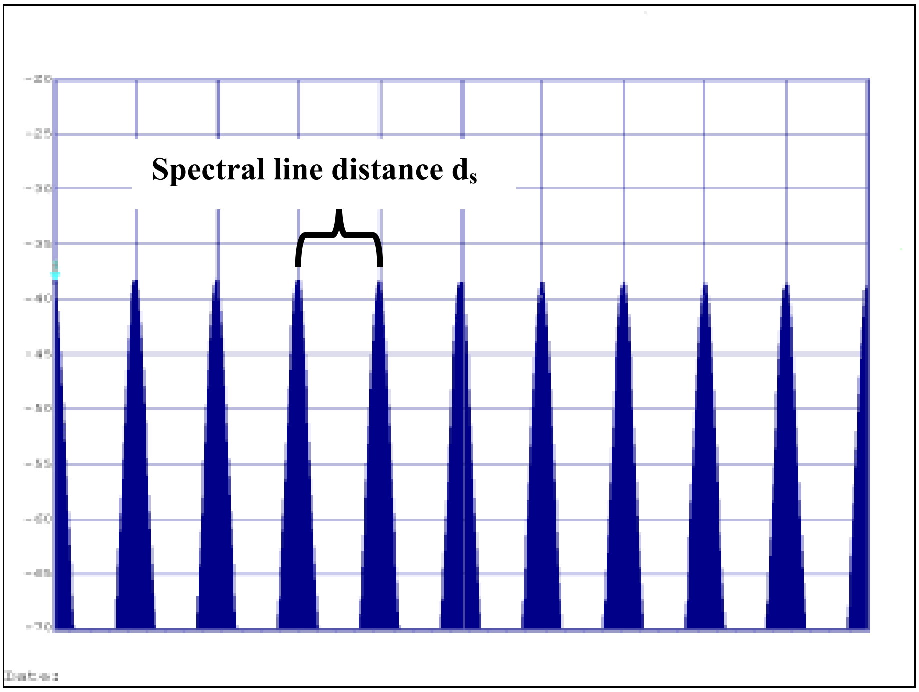


In Band a1) 10 MHz to 20 MHz the Receiver (CISPR) Resolution bandwidth of 9kHz and the spectral line distance d_s = 6 kHz leads to a the following maximum number of spectral lines:

$$\frac{20MHz - 10MHz}{6kHz} = 1667[Spectral\_Lines]$$

In Band a2) 20 MHz to 30 MHz the Receiver (CISPR) Resolution bandwidth of 9kHz and the spectral line distance d_s = 6 kHz leads to a the following maximum number of spectral lines:

$$\frac{30MHz - 20MHz}{6kHz} = 1667[Spectral\_Lines]$$

in the Bands b) and c) 30 MHz to 230 MHz and 230 MHz to 1000 MHz measured with a Receiver (CISPR) Resolution bandwidth of 120kHz a spectral line distance d_s =100 kHz
which results in a total of :

$$\frac{230MHz - 30MHz}{100kHz} = 2000[Spectral\_Lines]$$

and

$$\frac{1000MHz - 230MHz}{100kHz} = 7700[Spectral\_Lines]$$

in the Bands d) 1GHz to 300 GHz measured with a Receiver (CISPR) Resolution bandwidth of 1MHz a spectral line distance d_s =700 kHz which results in a total of :

$$\frac{300GHz - 1GHz}{700kHz} = 427143[Spectral\_Lines]$$

Under this assumption, over the whole frequency band from 10 MHz to 300 GHz the total power of 440377 Spectral lines has to be determined.

The radiated power is to be determined as follows:

$$P_{Total} = \sum_{1}^{n} P_{SL} \qquad \text{[Eq 7]}$$

P_{SL} = EIRP of a single Spectral line n = total No of Spectral lines

EMC measurements provide electrical field strength measured at a given distance from the source of radiation. The relationship between Field strength and Source power is as follows:

$$E = \frac{1}{2r}\sqrt{\frac{Ps \times Z_0 \times 1.64}{\pi}} \qquad \text{[Eq 8]}$$

The above equation is valid for far field free space conditions . The electrical field strength E_r is the field strength present in a distance r from a RF power source.
Here the RF power is given as ERP through dissipation by a λ/2 Dipole which has a numeric gain of 1.64.
When radiated EMC measurements are performed above a metallic ground plane, both direct and reflected RF wave reach the receiving antenna. By 360 deg. rotation of the EUT and positioning the Receiving antenna between 1m and 4 m height, attempt is made to maximise field strength. In Phase adding of both waves can lead to an increase of Field strength of up to 6 dB compared to free space conditions.

For the further analysis this is neglected, which results in a positive uncertainty margin.
Then the logarithmic equation for the determination of the substituted ERP is:

$$P_{ERP} = E_r - 7.4 - 20 \times \log\left(\frac{3}{r}\right) \qquad \text{[Eq 9]}$$

P_{ERP} as [dBpW], Er as [dBµV/m], distance r in [m]

And if reference is EIRP:

[Eq 2] in [Eq 9]

$$P_{EIRP} = E_r - 5.25 - 20 \times \log\left(\frac{3}{r}\right) \qquad [\text{ Eq } 10]$$

The following table 1 shows the result at a given distance r of 3 m.

Table 1

	Band a1) 10 – 20 MHz	Band a2) 20 –30 MHz	Band b) 30 – 230 MHz	Band c) 230-1000 MHz	Band d) 1 – 300 GHz
EMC limit (dBµV/m)	80	70	50	57	79.5
PEIRP per Spectral line (dBpW)	74.25	64,75	44.75	51.750	74,25
PEIRP per Spectral line (mW)	0.0266	0.00299	0.0000299	0.0001496	0.0266
number of spectral lines	1666	1667	2000	7700	427143
Total Power inside Band (mW)	44,32	4.977	0.0597	1.152	11365
Total Power inside Band (dBm)	16.47	6.97	-12.24	0.615	40.556

With [Eq 7] the maximum total radiated power(P $_{EIRP}$) is:

$$P_{Total} = \sum_{1}^{440177} P_{SL} = \sum P_{a)} + P_{b)} + P_{c)} + P_{d)}$$ **= 11415.5 mW**

This is approximately 500 times the 20 mW limit. At first it seems not possible to confirm that the ICNRP limits are met if the unintentional radiation of an electronic apparatus meets the class A limit.

However the total Radiated power of approx 12 W is only reached under the assumption that the Apparatus would emit 440177 Frequencies exactly on the Class A Limit, which is a huge over estimation.

A more realistic approach would be as the worst-case assumption follows:

In each of the 5 bands (a1, a2, b,c,d) there are 5 frequencies emitted which would reach the Class A Limit:

The total emitted power would then sum up as shown in table 2

Table 2

	Band a1) 10 – 20 MHz	Band a2) 20 –30 MHz	Band b) 30 – 230 MHz	Band c) 230-1000 MHz	Band d) 1 – 300 GHz
EMC limit (dBµV/m)	80	70	50	57	79.5
PEIRP per Spectral line (dBpW)	74.25	64,75	44.75	51.750	74,25
PEIRP per Spectral line (mW)	0.0266	0.00299	0.0000299	0.0001496	0.0266
number of spectral lines	20	20	20	20	20
Total Power inside Band (mW)	0,532	0.0598	0.000598	0.00299	0.532
Total Power inside Band (dBm)	-2.74	-12.323	-32.24	-25.243	-2.74

With [Eq 7] the maximum total radiated power(P_{EIRP}) is:

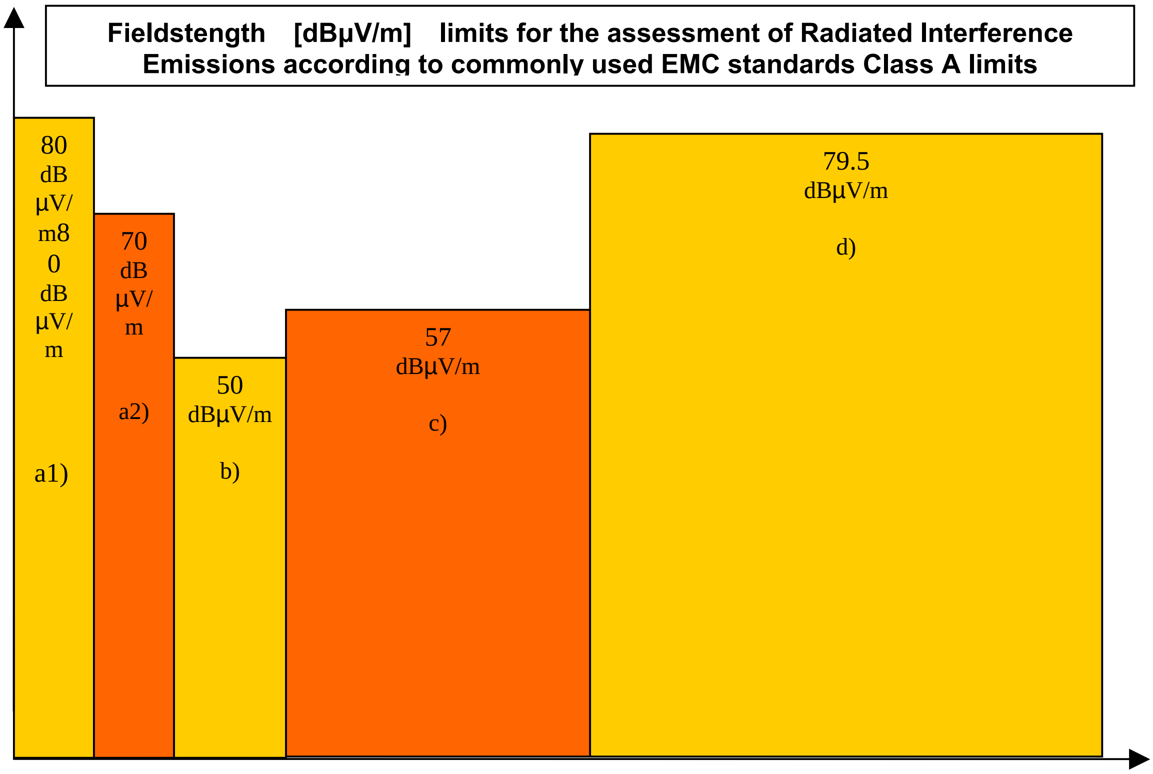
$$P_{Total} = \sum_{1}^{440177} P_{SL} = \sum P_{a)} + P_{b)} + P_{c)} + P_{d)}$$ **= 1.127 mW**

Under this more realistic Emission assumption the total radiated Power would decrease to 1/20 of the EMF limit. Even this assumption is an overestimation as all the frequencies are radiated in different directions and will never reach at the same time any 10 g of human tissue.

<u>Conclusion:</u> for the demonstration of Compliance with EN 50371 it is necessary to measure the Radiated Electromagnetic Emissions in the frequency range between 10 MHz to 40 (300 at later stage) GHz and make an assessment to demonstrate that the total radiated power fulfils the 20 mW limits.

Based on above results a practical product assessment can be performed in the following steps:

1) Assess the EUT radiated emissions by electric field strength measurements and compare with the limits:



If all the frequencies measured are within the limits and an engineering analysis according to the number of measured emissions shows that the total of radiated power is clearly below the 20 mW limit, compliance with EN 50371 can be concluded without the need of substitution measurements.

2) If the limits as shown above are exceeded, for these frequencies the radiated power has to be evaluated by the substitution (simplified substitution, if the site fulfils free space conditions). Then the total power of theses frequencies has to be determined. If result shows total radiated Power is less than 20 mW taking into account measurement uncertainties, compliance with EN 50371 can be concluded.

3) If the total of radiated power is ≥ 20 mW the product has to be assessed according to EN 50392.

Details for the measurement method as applicable for the respective frequency bands are as follows:

5.1 Measurement method for the determination of the emitted power between 10 MHz and 30 MHz (band a1, a2)

- **The Measurement distance d must meet far field conditions:**

$$d \geq \frac{\lambda}{2 \times \pi} = \frac{c_0}{f \times 2 \times \pi} \quad \text{[Eq 11]}$$

as the lowest frequency is 10 MHz, the corresponding minimum distance is: d ≥ 4.77 m (if level of emission is very low, a shorter distance e.g. 3 m may be used to make the EUT emissions visible out of the intrinsic system noise level)

Then the limit for each spectral line in this band has to be adjusted according to the distance of 4.77m:

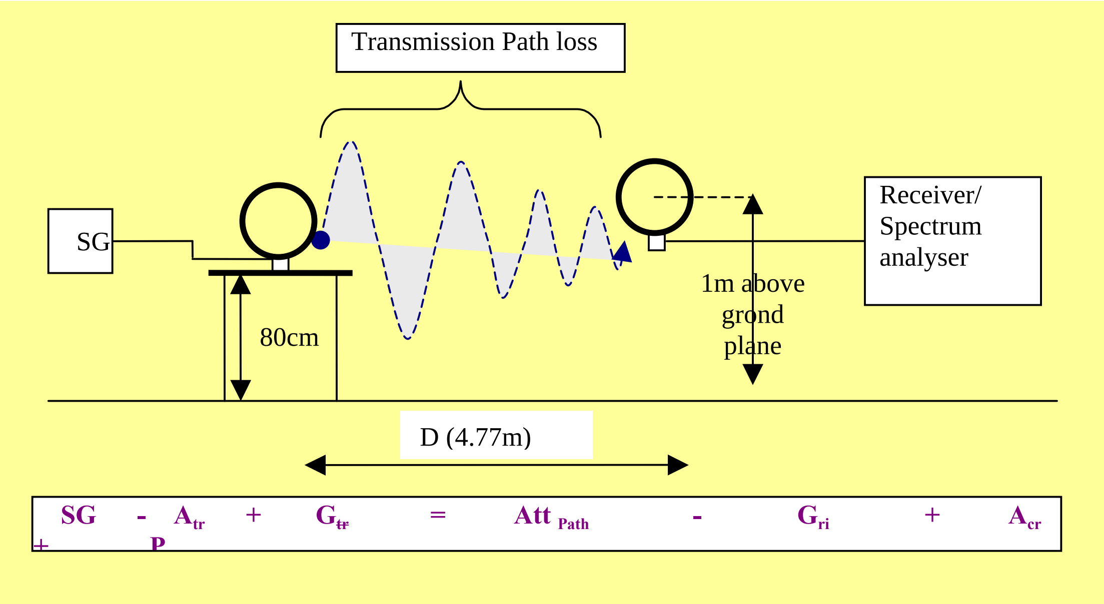
$$E_{(d)} = E_{(3m)} + 20 \times \log \frac{3m}{d}$$ [Eq 12]

Limit (4.77m) = 50.47 dBµV/m

- The Receiver Bandwidth is 9 kHz (acc. To CISPR 16, using peak detector)
- The EUT has to be set up for table top equipment, floor standing equipment and combinations of table top and floor standing equipment according to the appropriate applicable product standards e.g. EN 55022, EN 55013.
- The maximum emission has to be detected by rotating the table with the EUT or the floor standing equipment by 360 degrees. The receiving loop antenna has to be

rotated as well to maximise the measured field strength for each measured frequency respectively.

- In order to determine the substituted power according to the procedure described in 4.1, the EUT has to be replaced by a transmitting loop antenna at the same distance d.
- The same procedure (field measurement and Substitution) has to be repeated vertical polarised radiation (transmitting and receiving loop antenna are positioned parallel to the ground plane)



The EIRP can then be determined using [Eq 1]:

EIRP = SG - A_{tr} + G_{tr}

The isotropic gain G_{tri} of the transmitting antenna can be determined from its E-field antenna factor by the following formula:

$$AF_E = 20 \times \log f - G_{tri} - 29.78 \qquad \text{[Eq 13]}$$

if the H-Field antenna factor is provided, the E-Field antenna factor can be determined by:

$$AF_E = AF_H + 20 \times \log(120\pi) = AF_H + 51.5dB \qquad \text{[Eq 14]}$$

5.2 Measurement method for the determination of the emitted power between 30 MHz and 1GHz (band b, c):

- The measurement distance is 3 m. If larger distances are used, the E-Field limit has to be adjusted by using [Eq 12]
- The receiver bandwidth is 120 kHz (acc. to CISPR 16, using Peak detector)
- The EUT has to be set up for table top equipment, floor standing equipment and combinations of table top and floor standing equipment according to the appropriate applicable product standards e.g. EN 55022, EN 55013.
- The procedure to determine maximum of emission is to rotate turntable be 360 deg and moving receiving antenna between 1m and 4 m (horizontal and vertical polarisation)
- The determination of the Substitution power is done following the procedures of 4.1

- Usually EMC product standards require the assessment of the radiated emissions between 30 and 1000 MHz . And compliance with these limits has been demonstrated by measurements. These results can be used also for EMF assessment according to EN 50371 without the need to repeat the measurements.

5.3 Measurement method for the determination of the emitted power for frequencies above 1 GHz (band d):

- **The measurement distance is 3 m. If larger distances are used, the E-Field limit has to be adjusted by using** [Eq 11]
- **The receiver bandwidth is 1 MHz (acc. to CISPR 16, using peak detector)**
- **The EUT has to be set up for table top equipment, floor standing equipment and combinations of table top and floor standing equipment according to the appropriate applicable product standards e.g. EN 55022, EN 55013.**

- **The procedure to determine maximum of emission is to rotate turntable be 360 deg and moving receiving antenna between 1m and 4 m (horizontal and vertical polarisation).**
- **The determination of the Substitution power is done following the procedures of 4.2**

6 Consideration of measurement uncertainties

6.1 Uncertainties for field strength measurements using (broadband) receiving antennas and Spectrum Analyser/Receiver:

Component	Influence factor	Specified uncertainty [dB]	Distribution	Division factor	Standard uncertainty [dB]
Analyzer	Frequency response	0,5	Normal (K = 2)	2	0,25
Analyzer	Input attenuation	0,1	Normal (K = 2)	2	0,05
Analyzer	Resolution bandwith	0,05	Normal (K = 2)	2	0,03
Analyzer	IF-amplifier	0,5	Normal (K = 2)	2	0,25
Analyzer	Temperature response	1,0	Rectangular	1,73	0,58
Analyzer	Modulation response	0,5	Rectangular	1,73	0,29
Analyzer	Display reading uncertainty	0,05	Rectangular	1,73	0,03
Antenna cable	Calibration uncertainty	0,2	Normal (K = 2)	2	0,10
Antenna cable	Cable attenuation frequency interpolation	0,1	Rectangular	1,73	0,06
Antenna	Calibration uncertainty	1,0	Normal (K = 2)	2	0,50
Antenna	Antenna factor frequency interpolation	0,1	Rectangular	1,73	0,06
Mismatch	Uncertainty caused by reflections	0,8	U-shaped	1,41	0,57
Repeatibility	Limited Repeatibility	2,3	Normal (K = 2)	2	1,15
	Combined standard uncertainty:				1,57
	Expansion factor:				2,00
	Expanded uncertainty [dB]:				**3,14**
	Expanded uncertainty [%]:				**43,5**

The above table is an example only and needs to be modified according to the actual testing environment being used to perform the EMF measurements.

6.2 Uncertainties for the substitution measurement where EUT is replaced by calibrated transmit antenna

=== to be amended===

7 Annex: example assessment

=== to be amended ===