Group of Administrative Co-operation
Under the R&TTE Directive

7th R&TTE Market Surveillance Campaign
on Remotely Piloted Aircraft System

REPORT

ON THE 7TH JOINT CROSS-BORDER

R&TTE MARKET SURVEILLANCE CAMPAIGN

(2015)

REMOTELY PILOTED AIRCRAFT SYSTEM

Adopted by ADCO R&TTE 51
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A. EXECUTIVE SUMMARY

The 47th R&TTE Administration and Cooperation Group ('ADCO R&TTE') agreed that remotely piloted aircraft systems would be the target of the seventh joint cross-border market surveillance campaign. Sixteen European countries participated in the campaign and sampled 79 products over the whole price range (up and down the market), from all origins (national, EEA, EFTA, and imported from third countries).

Within the planned timeframe of six months, the market surveillance authorities found that ninety two percent (92%) of the devices did not fulfil all of the requirements. Half (51%) of assessed RPAS were found to be non-compliant in relation to the effective use of spectrum. Four out of five (82%) had administrative non-compliances within the meaning of the R&TTE Directive.

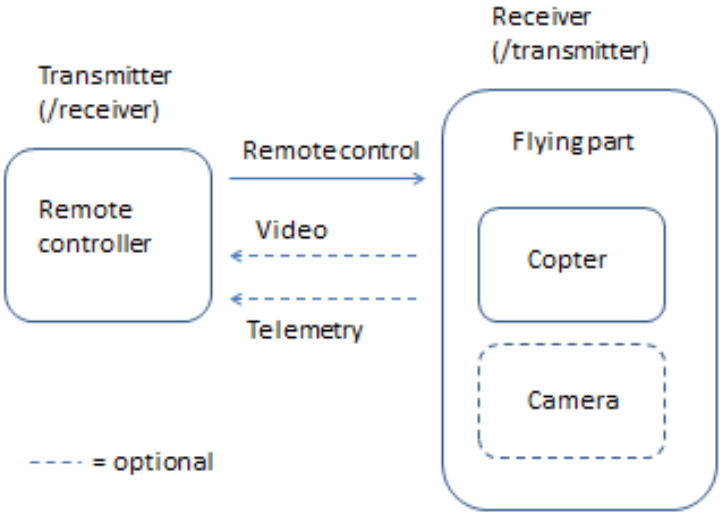
The campaign showed that the main reasons for non-compliances with the effective use of spectrum were spurious emissions (70%) and radiated power/power density (23%). Furthermore, the figures show that the remote controls on the ground tend to have a higher non-compliance rate than the aircraft systems.

The market surveillance authorities consider the rate of non-compliances too high. The growing market of remotely piloted aircraft systems combined with a low compliance rate could lead to an increase of interferences to the radio spectrum. Market surveillance authorities should therefore continue to check at national level such products and take all appropriate measures to ban non-compliant products from the market. Regular reporting in ADCO R&TTE is recommended.

B. ELEMENTS OF THE CAMPAIGN

1. Reasons for the campaign

The market for remotely piloted aircraft systems (RPAS) is growing very fast. At first, radio controlled toys were the biggest part of this market but gradually the market has moved in the direction of more professional systems. RPAS were mostly used in the past for military actions, but the fall in prices now permits the use of the technology for civil usages. One of the major differences between radio controlled toys and RPAS, is the fact that RPAS are sending information back to the user, e.g. video signal, telemetry. This means that there is a first radio link between the ground station (GS) and the RPA, mostly in the 2.4 GHz band and a second link between the RPA and the GS, typically in the 5.8 GHz band. RPAS are typically operating on unlicensed frequency bands, which are in parallel use by many other license-free applications. Signals transmitted from the air to the ground have a significantly bigger coverage area than from the ground. Therefore, interferences generated from RPAS could have a major impact on radio communication. This means that there is a higher risk of harmful interference if RPAS systems do not meet the essential requirements. Block diagram of RPAS set is presented below.



The 47th meeting of the R&TTE Administration and Cooperation Group ('ADCO R&TTE') agreed that remotely piloted aircraft systems would be the target of the seventh joint cross-border market surveillance campaign in 2015. The campaign mainly focused on products that operate in the 2.4GHz ISM frequency band and may include the on-board video and telemetry links that work on other frequency bands (e.g. video transmission in the 5.8 GHz frequency band).

2. Scope of the campaign

The essential requirements for radio equipment are defined in Article 3 of the R&TTE Directive (Directive 1999/5/EC of the European Parliament and the Council), which is applicable until 12 June 2016. If radio equipment is in conformity with harmonised standards, the references of which have been published in the Official Journal of the European Union, they are presumed to be in conformity with the essential requirements covered by those standards.

Furthermore, radio equipment shall meet the administrative requirements under the R&TTE Directive.

The primary purpose of the campaign was to determine the compliance level of RPAS available on the European Market. Market Surveillance Authorities (MSA) have assessed products against all administrative requirements and carried out a conformity assessment with the essential requirement of the effective use of the spectrum (article 3.2 R&TTED). Measurements against the requirements of the electrical health and safety (article 3.1.a R&TTED) and electromagnetic compatibility (article 3.1.b R&TTED) were carried out on a voluntary basis.

The campaign was also intended to provide MSAs with the opportunity to participate in R&TTE market surveillance and to improve the exchange of information between them.

It was agreed that TCAM, TCAM WG, ECC, R&TTE CA and ETSI would be informed of this campaign and its results.

3. Participation in the campaign

Participation in the campaign was voluntary, and was open to all members of ADCO R&TTE. Sixteen European countries participated in the campaign: Austria, Estonia, Finland, France, Germany, Greece, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

4. Timing

The campaign commenced on the 1st January 2015. The information gathering, testing and data reporting phases of the campaign ended on the 31st May 2015. Within that period, MSAs carried out their operations to their own timescales. A further 30 days, ending on the 30th June 2015, were allowed for results to be uploaded to ICSMS.

5. Sampling

Participating MSAs took 1 to 11 RPAS (complete sets: controller and the flying object), working mainly in the 2.4 GHz ISM frequency band for the remote control and may also include on-board video and telemetry links that are working on other frequency bands. Participating MSA were free to select professional products (such as professional RPAS) and mass-market products (such as radio controlled toys). Selection may include ecommerce investigations (like eBay, Amazon etc.)

The aim of selecting apparatus for testing provided the campaign with the broadest possible selection of RPAS products on the EU market. Therefore, samples were taken over the whole price range (up and down the market) and from all origins (national, EEA, EFTA, and imported from third countries), if available.

To avoid double sampling, participating MSAs were encouraged to register details of their selections to ICSMS as early in the campaign as possible.

6. Documents

A Code of Practice was drawn up to provide guidance and a common understanding of the purpose of the campaign and to ensure, as far as possible, the adoption of harmonised practices during the operational phase of the campaign. The results of each assessment were recorded on a common electronic data input form for R&TTE (R&TTE DIF). Complementary technical data input forms were also used (Annex C and Annex D).

7. Assessment procedure

Participating MSAs had to assess the product against all administrative requirements paying attention to:

- product identification (name of the manufacturer or the party responsible for placing on the market, type designation, batch and serial number),
- CE marking (CE mark layout and height) on equipment, its packaging and on the accompanying documents,
- involvement of Notified Bodies in the conformity assessment process,
- description of intended use and information on restriction of use for radio equipment,
- obligatory elements of DoC or it's short form,
- information on standards applied by the manufacturer to show compliance with article 3.1.a (electrical health and safety), article 3.1.b (electromagnetic compatibility) and article 3.2 (effective use of the spectrum).

If the DoC was not provided with the product, the participating MSA had to request it from the person responsible for placing the item on the market.

The participating MSAs had to request, as a minimum, the following elements of the technical documentation from the party responsible for placing on the market:

- test reports to demonstrate compliance with the requirement on effective use of spectrum (article 3.2 R&TTED),
- descriptions and explanation of the solutions adopted by the manufacturer to meet the essential requirements of the Directive where Harmonised Standards have not been or only partly used.

Participants of the campaign carried out measurements against the requirement in relation to the essential requirements as defined in the R&TTE Directive, in particular effective use of spectrum (article 3.2 R&TTED) by assessing the conformity with the applicable relevant Harmonised Standard. Both the transmitter and receiver of the RPAS were measured to cover the worst case scenario. The results were compared directly with the limits of the Harmonised Standard, taking into account the measurement uncertainty defined within it.

Measurements were carried out on the basis of harmonised standards which have been indicated by the manufacturer, reflecting the moment the product became available on the market as per the table below.

Table 1 : List of harmonised standards

2.4 GHz	EN 300 440-2 V1.4.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
2.4 GHz	EN 300 328 V1.7.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive
2.4 GHz	EN 300 328 V1.8.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide

		band modulation techniques; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
5.8 GHz	EN 300 440-2 V1.4.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
5 GHz	EN 301 893 V1.7.1	Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

In cases where a previous version of the current harmonised standard was available at the moment of placing on the market, then the measurements were carried out against the previous version. In cases where two (or more) harmonised standards could be applicable at the point of placing on the market, the measurements were carried out against the least stringent.

Results of the assessment were recorded on special forms dedicated for the campaign and analyzed from a statistical point of view.

C. RESULTS

Initially, participating MSAs registered one hundred and fifteen (115) RPAS for the purpose of the campaign activities onto the ICSMS server. Due to the fact that some of the products were unavailable on the national market and some MSAs were unable to complete the technical checks of all chosen products before the deadline, the number of analysed cases was reduced to seventy nine (79).

All qualified products were assessed against administrative requirements and the technical compliance of all products were checked in test laboratories.

The majority of tested RPAS were manufactured in countries of the Far East (92%), remotely controlled on 2,4 GHz (84%), the mean price was between 100 and 200 euro, one out of four samples was a toy (according to manufacturer's declaration), one of two (44%) had a video transmission link to the ground receiver.

Table 1: RPAS' information

Price range [EUR]	Quantity	Toy	Auto landing function	Remote control freq. [GHz]		Video & audio link freq. [GHz]		Telemetry link freq. [GHz]	
				2,4	5,8	2,4	5,8	2,4	5,8
0-50	10	2	2	10					
50-100	15	4	1	15		1			
100-200	18	6	3	18		5	4	5	
200-500	13	5	3	12	1	2	5	1	
500-1000	11	1	7	8	3	3	6	6	
1000+	12	1	8	9	3	5	5	3	
Overall	**79**	**19**	**24**	**72**	**7**	**16**	**20**	**15**	**0**

1. Administrative compliance

All 79 samples were checked against administrative requirements including: CE marking, content of Declaration of Conformity, notification obligation, and obligatory elements of technical documentation. Approximately one out of five products had no administrative non compliances within the meaning of R&TTE Directive.

1.1. Markings (including CE marking)

The level of compliance of RPAS with the marking requirements is approximately 37%. The table below presents the number of non-compliant products within the scope of the listed requirements and the overall level of compliance with the marking requirements.

Table 2 : Reasons of markings non-compliance

Detailed requirement	on product	on packaging	on documents
Missing name of the manufacturer	11		
Incorrect type designation	12		
Missing batch and/or serial number	23		
Missing, incorrect CE mark layout or height	19	4	25
Not compliant class identifier, it's layout or height	13	12	14

1.2. EC Declaration of Conformity (DoC)

Sixty two (62) products had complete or short forms of the DoC. From those, thirty four (34) were found to be compliant. The overall level of compliance is about 55%.

Table 3 : Compliance with DoC requirements				
DoC form	DoC available	DoC available [%]	DoC compliant	Compliance level of available DoC [%]
Short form	25	32%	12	48%
Complete form	37	47%	22	59%
Overall	**62**	**78%**	**34**	**55%**

Detailed information of the non-compliances of the short and complete form of the Declaration of Conformity is presented in table 4.

Table 4: Reason of DoC non-compliance			
	Requirement	Requirement not fulfilled	Requirement not fulfilled [%]
Short form	Statement: "Hereby, [Name of manufacturer], declares that this [type of equipment] is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC."	6	24%
	Information about location of complete form	4	16%
	Complete form available at the location indicated in short form of DoC	7	28%
Complete form	Name and address of manufacturer	2	5%
	Description of the equipment	6	16%
	Reference to R&TTED 1999/5/EC	2	5%
	Applied standards (including date/version)	7	19%
	Date of issue	4	11%
	Identity of author	3	8%
	Signature of author	2	5%

1.3. Technical documentation (TD)

Forty eight (48) RPAS have been assessed against some TD requirements (test reports to demonstrate compliance with article 3.2 R&TTED and explanation on solutions adopted by the manufacturer if Harmonised Standards have not been or only partly used). In thirty two (32) cases, the requested elements of the TD were made available. In ten (10) cases the requested elements of the TD have been found compliant. Overall level of compliance of the checked elements of the TD is approximately 21%.

Table 4 : Compliance with assessed TD requirements				
Number assessed	TD available	TD available [%]	TD compliant	TD compliance level [%]
48	32	67%	10	21%

2. Technical compliance

Participating MSAs conducted a technical assessment of chosen RPAS. All products were checked against the requirement of the effective use of the spectrum (article 3.2 R&TTED). On a voluntary basis, fourteen (14) RPAS were verified with the requirements of electrical health and safety (article 3.1.a R&TTED). The electromagnetic compatibility (article 3.1.b R&TTED) requirement was checked in thirty (30) cases but due to insufficient data these results were excluded from the report's analysis.

2.1. Technical compliance of the whole product (remote control + flying part)

Forty (40) products were found with technical non-compliances in relation to the effective use of the spectrum requirement (article 3.2 R&TTED). The overall level of non-compliance in that scope is about 51%. Statistical information on non-compliances in relation to the product price is presented in table 5.

Table 5: Compliance with art. 3.2 essential requirements

Price range [EUR]	Quantity	Not compliant	Non compliance level [%]
0-50	10	4	40%
50-100	15	5	33%
100-200	18	10	56%
200-500	13	6	46%
500-1000	11	8	73%
1000+	12	7	58%
Overall	**79**	**40**	**51%**

2.2. Technical compliance of the remote control

Test measurements were performed on the radio control part (base station) and on the flying vehicle independently. That verification procedure revealed that spurious emissions and radiated power/power density are the main reasons for non-compliance.

Technical assessment has proved that thirty (30) remote controllers (38%) are not compliant with the essential requirement of effectively using the spectrum. In twenty three cases (23) (29%) the level of spurious emissions exceeded limits of applicable relevant harmonised standards. In fourteen cases (14) (18%) the level of radiated power/power density also exceeded limits of applicable relevant harmonised standards. Detailed statistical information concerning the radio control part is presented in table 6.

Table 6: Remote control non-compliances against art. 3.2						
Frequency band	Quantity	Non-compliant	Spurious emissions	Radiated power / Power density	Used frequency range	Other
2,4GHz	72	25	20	12	1	1
5,8GHz	7	5	3	2	1	1
Overall	**79**	**30**	**23**	**14**	**2**	**1**

2.3. Technical compliance of the flying part

Appropriate technical assessment was applied to flying part (e.g. the drone or similar, which may include an in-built or attached video camera) of the RPAS. All seventy nine (79) devices were tested despite the fact RPAS has no transmitting feature of video, audio or telemetry data. Eighteen (18) devices (23%) were found to be not compliant against the applied harmonised standard. In twelve cases (12) (15%) the level of spurious emissions exceeded limits of applicable relevant harmonised standards. In six cases (6) (8%), the level of radiated power/power density also exceeded limits of applicable relevant harmonised standards. Detailed statistical information concerning flying part of RPAS is presented in table 7.

Table 7: Flying part non-compliances against art. 3.2						
Frequency band	Quantity	Non-compliant	Spurious emissions	Radiated power / Power density	Used frequency range	Other
Tx 2,4GHz	19	3	3	1	1	
Tx 5,8GHz	14	6	2	3	2	1
Tx 2,4 & 5,8GHz	6	4	2	2		
Receiver only	40	5	5			
Overall	**79**	**18**	**12**	**6**	**3**	**1**

3. Overall non-compliance

From the group of seventy nine (79) samples of RPAS assessed by participating MSAs, seventy three (73) RPAS (92%) were found non-compliant with the requirements of the R&TTE Directive. Detailed statistical information is presented in tables 8a and 8b.

Table 8a: Overall non-compliance					
Price range [EUR]	Quantity	Administratively non-compliant	Art. 3.2 non-compliant	Overall non-compliant	Overall non - compliance [%]
0-50	10	7	4	9	**90%**
50-100	15	13	5	14	**93%**
100-200	18	14	10	18	**100%**
200-500	13	11	6	11	**85%**
500-1000	11	11	8	11	**100%**
1000+	12	9	7	10	**83%**
Overall	**79**	**65**	**40**	**73**	**92%**

Table 8b: Overall non-compliance					
Frequency band	Quantity	Administratively non-compliant	Art. 3.2 non-compliant	Overall non-compliant	Overall non - compliance [%]
2,4GHz	53	42	25	48	**91%**
5,8GHz	3	3	3	3	**100%**
2,4 & 5,8GHz	23	20	12	22	**96%**
Overall	**79**	**65**	**40**	**73**	**92%**

4. Other observations

Several RPAS checked during this campaign were not intended for the European market even though they were marked with a CE marking. For example, a remote control had a declared radiated power of 100 mW, whereas the applicable EU decision on short range devices only allows 10 mW. In this case, the manufacturer admitted that the devices were FCC approved versions - US standard allows 10 times higher power. In some cases, where the same product is intended for several regions around the world, the firmware in the RPAS was not for the European version.

Some market surveillance authorities observed that the combination of different radio devices (sometimes from different subcontractors) in the RPAS tends to be very challenging for the manufacturers. A reason for this seems to be that each single product within the set influences the overall compliance of the RPAS.

D. CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

- The majority of tested RPAS were manufactured in countries of the Far East (92%), remotely controlled on 2,4 GHz (84%), the mean price was between 100 and 200 euro, one out of four samples was a toy (according manufacturers' declaration), and 44% had a video transmission link to the ground receiver.
- One third (30%) of devices have implemented the auto landing function or other features which prevents radio device from uncontrollably falling down in case of low battery state.
- Four out of five (82%) products had administrative non-compliances within the meaning of R&TTE Directive; this non-compliance level is extremely high.
- During the campaign, it was difficult for MSA to obtain DoC and TCF from importers.
- Half (51%) of all assessed RPAS were found to be non-compliant in relation to the effective use of spectrum.
- Due to the low compliance with administrative requirements, the overall non-compliance is approximately 92%.
- The compliance level of the short form of the DoC is lower (11%) in comparison to the complete form. This is because the complete form of the DoC is not available at the location indicated in its short form.
- 23 samples (29%) were selected from the price categories 500-1000 € or over 1.000 €. Those more expensive devices had a higher technical non compliance rate than the cheaper ones.
- Laboratory tests revealed that remote controllers are frequently less compliant than the flying part of the RPAS.
- Spurious emissions (70%) and radiated power/power density (23%) are the main reasons for non-compliance.

2. Recommendations

- Market surveillance authorities should continue to check at national level RPAS, including remote controls and take all appropriate measures to ban non-compliant products from the market. Regular reporting in ADCO R&TTE should be guaranteed.
- The results of the campaign should be publicized widely throughout Europe and to the other countries of origin of the products.
- The report should be presented and discussed in TCAM WG.
- Economic operators should be identified and possible solutions should be discussed with them.
- Civil aviation authorities should also be informed of the results of this campaign.
- Customs should be informed of the special attention to be given to the import checks of RPAS at the borders.

- All national MSA should participate in future market surveillance campaigns to fulfil the requirement of market surveillance obligations included in the New Legislative Framework (NLF).
- In order to inform the other market surveillances authorities on the non-compliant products within one RPAS set,it is recommended to add each single non-compliant product within a set to ICSMS.

E. References

EN 300 440-2 V1.4.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
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EN 301 893 V1.7.1	Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

F. Abbreviations

ADCO R&TTE	Group of Administrative Cooperation for the sector of radio equipment and telecommunications terminal equipment
CIRCABC	Communication and Information Resource Centre for Administrations, Businesses and Citizens
DIF	Data Input Form
DoC	Declaration of Conformity
ECC	The Electronic Communications Committee
EEA	The European Economic Area
ETSI	European Telecommunications Standards Institute
ICSMS	Internet-based Information and Communication System for Europe wide cross-border Market Surveillance of technical products
MSA	Market Surveillance Authority
Rx	Receiver
RPAS	Remotely Piloted Aircraft System
R&TTE CA	The Radio and Telecommunications Terminal Equipment Compliance Association
TCAM	The Telecommunication Conformity Assessment and Market Surveillance Committee
TD	Technical documentation
Tx	Transmitter