

**Agenda item:** 7.1  
**Source:** Motorola Mobility, Huawei, Sony Mobile, Intel  
**Title:** Framework analysis of TRP and TRS data for multi-band mobile devices  
**Document for:** Approval

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## 1. Introduction

During the last 3GPP RAN4 #76-bis meeting in Sophia-Antipolis (France). The handset manufacturers presented their consolidated the position, where the pass/fail criteria associated with TRP/TRS certification values should be defined based on the complete set of frequency bands available in the EUT rather than a single band radiated performance as currently defined. As stated during the meeting we, the manufactures, understands that the pass/fail criteria definition based on multi-band radiated performance is an improvement in the framework agreed in [1], and not an replacement on the agreed framework.

The objective of this contribution is to demonstrate how such refinement can provide a better perspective about this issue, and propose alternatives to improve the current framework in how to post-process the available data based on multi-band rather than single band EUT radiated performance.

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## 2. Discussion

As discussed on [2] clause 4 proposal 3:

“TRP (TRS) be selected at 10(90) % points such that both TRP and TRS for ALL the bands meet the 10(90) % points, rather than meeting the requirement on a per band basis for TRP and TRS individually.”

Following such proposal the authors defined a set of TRP/TRS values on Table 1 [2] which enables a fair compromise between the current state-of-the-art radiated performance of Multi-Band handsets and adequate requirements of radiated performance to guarantee the proper operation of mobile devices in current network deployments.

Table 1, BHH TRP/TRS minimum average requirements derived from “RAN 4 pool” CDF’s at 10(90) %.

Band	TRP, dBm	TRS, dBm
I	13	-99.5
II	8	-99.5
V	7	-95.5
VIII	9	-95.5

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### 3. Proposal

Adopting the minimum average requirements defined on [2], the available data was post-processed as follows:

- i. Single band pass/fail criteria, based on all data points available;
- ii. Single band pass/fail criteria, based on all data points minus Vodafone data (larger population);
- iii. Dual band pass/fail criteria, at this moment based only on Motorola, Intel and Huawei<sup>1</sup> data;
- iv. Tri band pass/fail criteria, at this moment based only on Motorola, Intel and Huawei<sup>1</sup> data;
- v. Quad band pass/fail criteria, at this moment based only on Motorola, Intel and Huawei<sup>1</sup> data;

The results on Table 2 clearly indicated that the manufacturers proposed BHH TRP/TRS minimum average requirements derived from “RAN 4 pool” CDF’s at 10(90)% in fact is already largely compromised. While there are no indications that pass rate larger than 82.5% can be reached, the limited data set indicates that adopting these minimum values 66.7% of Quad-Band devices will fail.

Table 2, Pass/Fail results based on devices number of frequency bands

SINGLE BAND	total fail:	64	366	<- total devices
	pass rate	82.5		
	fail rate	17.5		
SINGLE BAND EXCLUDING VODAFONE:	total fail:	54	169	<- total devices
	pass rate	68.0		
	fail rate	32.0		
DUAL BAND DEVICES:	total fail:	5	14	<- total devices
	pass rate	64.3		
	fail rate	35.7		
TRI BAND DEVICES:	total fail:	3	7	<- total devices
	pass rate	57.1		
	fail rate	42.9		
QUAD BAND DEVICES:	total fail:	8	12	<- total devices
	pass rate	33.3		
	fail rate	66.7		

Based on this results which are limited by the number of devices where the banding is declared. We propose to further evaluate the available data following this refinement in the agreed framework. To do so, the companies that shared the available data-points need to provide the information referent to available band in each device measured.

The limited amount of available data points described a very pessimistic perspective for devices with four or more bands, very common nowadays, where 66.7% fails to comply even with minimum average requirements proposed by manufacturers. This is a clear indication in how much those limits were already compromised.

<sup>1</sup> The Huawei Quad-band devices TRP/TRS data is available in the annex A

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#### 4. References

- [1] R4-75AH-TRPS-0018, “Way Forward on TRP/TRS framework discussion”, July 2013
- [2] R4-155859, “TRP/TRS requirements proposal”, October 2015

#### Annex A

Table A1. Huawei Quad-band devices TRP/TRS data.

handset 1	BHH	
	TRP	TRS
WCDMA I	16.74	-104.3
WCDMA II	15.8	-103.43
WCDMA V	8.9	-97.29
WCDMA VIII	10.22	-96.63
handset 2	BHH	
	TRP	TRS
WCDMA I	14.8	-103.3
WCDMA II	13.4	-100.1
WCDMA V	8.6	-91.5
WCDMA VIII	6.6	-95.4