TR05 RF Exposure Exemption Analysis

Product: 2,4 GHz Radio module TR05, TR05-2, TR05-3, TR05-4, TR05-5, TR05-6, TR05-7, TR05-8

Company: Scanreco Industrielektronik AB, Box 47144/Årsta Skolgränd 22, S-10074, Stockholm, Sweden

The radio module is designed for use in Scanreco industrial remote controls that are permanently installed to provide a separation distance of at least 20 cm from the user and in hand-held / hand-operated remote control devices.

MPE for permanently installed equipment

For permanently installed equipment with a separation distance of at least 20 cm the max duty cycle is 72,36%.

From the pictures below the duty cycle is :

(4,32ms/95,5ms)*16channels = 72,36%.

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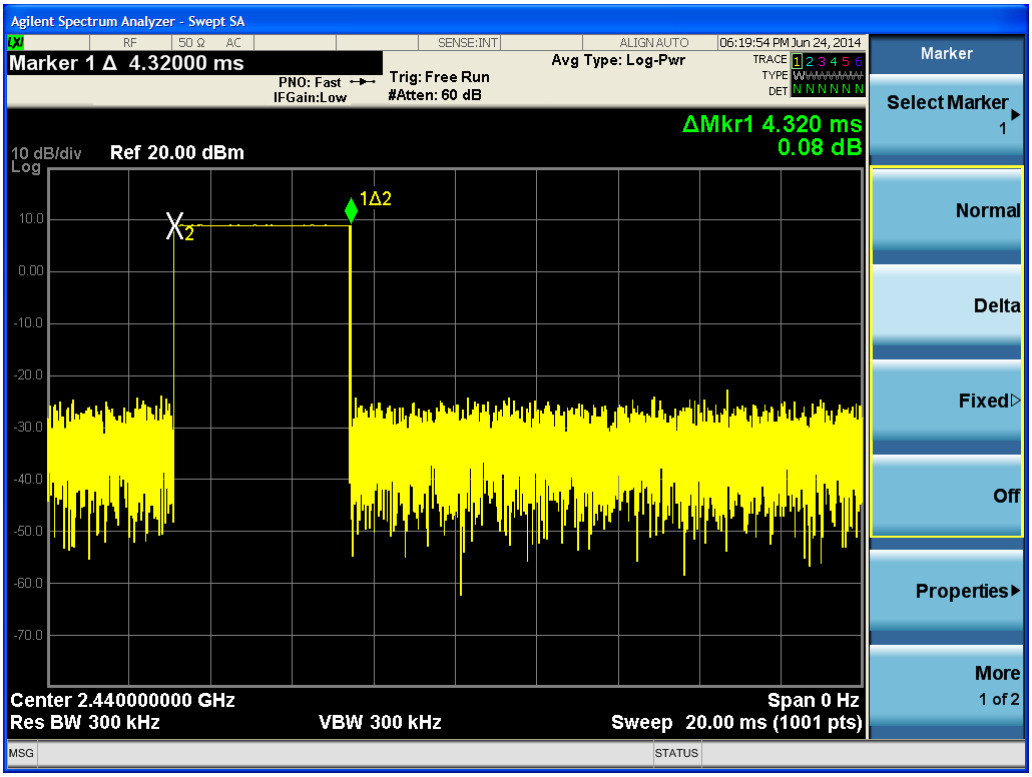

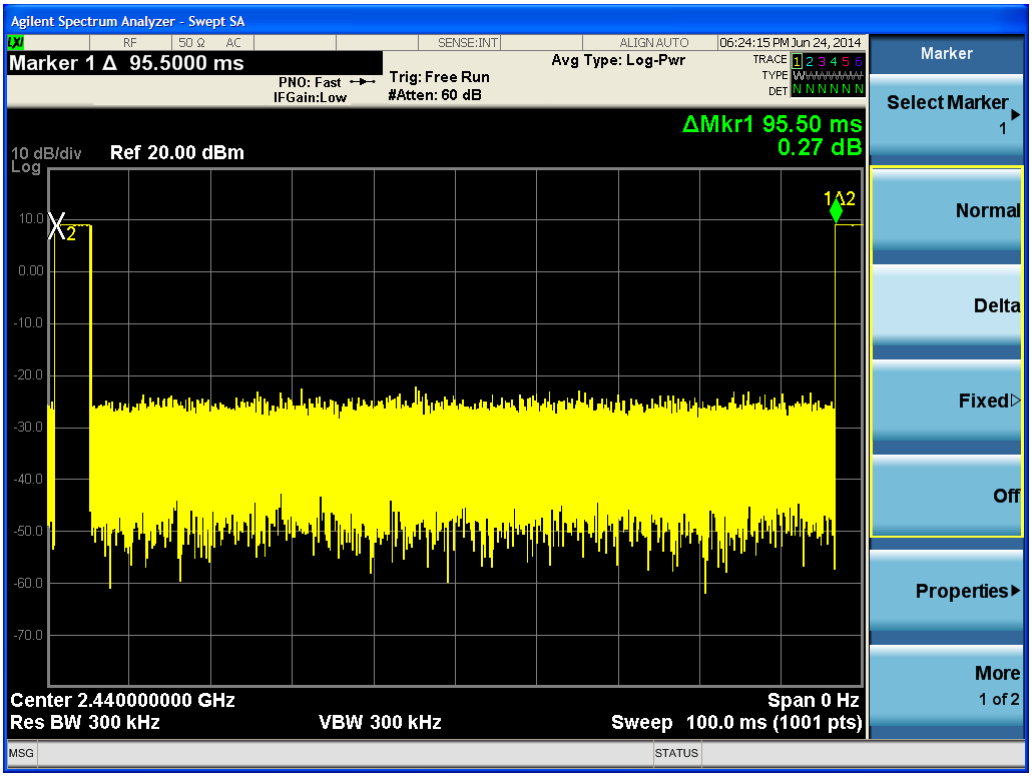

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Prediction of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density
P = power input to the antenna
G = antenna gain
R = distance

Conducted output power:	18.04	(dBm)
Tune up tolerance	0.5	(dB)
Number of carriers	1	(N)
	71.4	(mW)
	0.0714	(W)
P Average	0.0517	(W)
Antenna gain:	4.0	(dBi)
Maximum antenna gain:	2.51	(numeric)
EIRP Average	0.130	(W)
ERP Average	0.0794	(W)
Distance:	20	(cm)
Duty Cycle:	72.36	(%)
Frequency:	2400	(MHz)
MPE Limit:	1	(mW/cm^2)
Power density:	0.0258	(mW/cm^2)
	0.258	(W/m^2)
Margin	15.9	(dB)

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SAR Exclusion Analyses for use in Hand Held / Hand Operated Devices

In hand-held / hand-operated devices the distance from the user to the antenna is at least 20 cm. Therefore body SAR is not required.

For hand-held/hand operated radio remote controls the max duty cycle is 10%. The duty cycle is hard coded in the firmware under production and cannot be changed by the user.

From the pictures below:

(0,73ms/117ms)*16channels = 10%.

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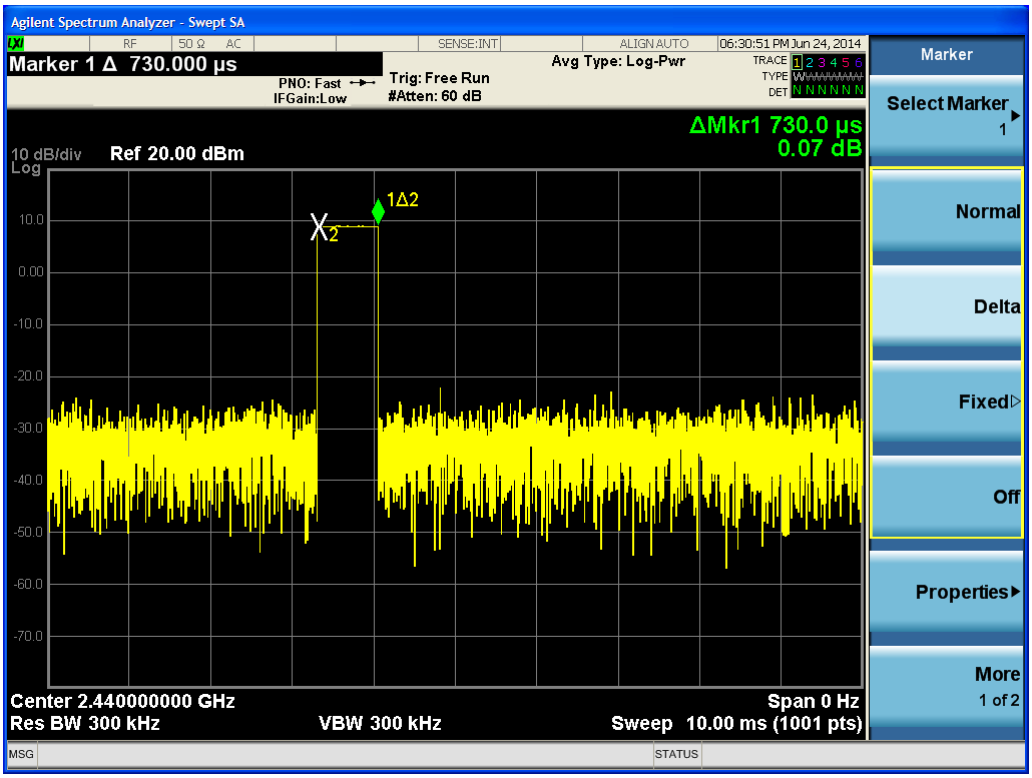

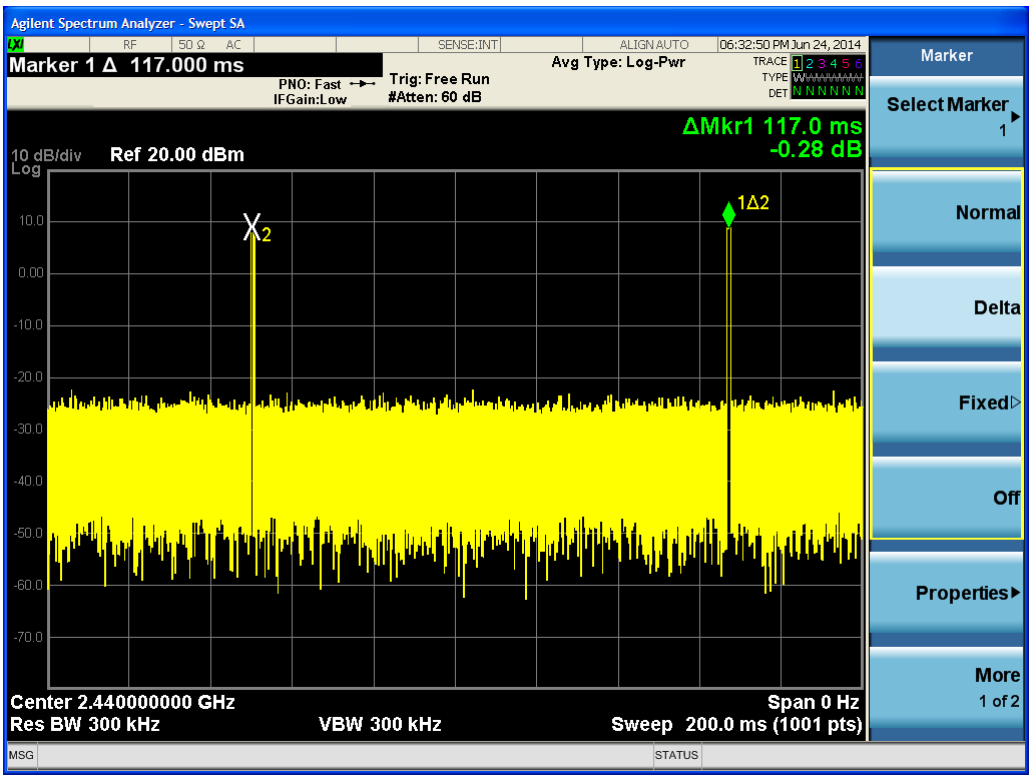

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Radio Remote Control

FCC SAR Exclusion Analysis for use in hand-held / hand-operated industrial remote controls

Section 4.3.1 of 447498 D01 General RF Exposure Guidance v05r02
Extremity SAR exclusion based on 5 mm separation distance and 10%maximum duty cycle for this hand-hand operated device is documented below.

P	18.00	dBm
Tune-up tolerance	0.50	dB
Duty Cycle	10.00	%
P average	7.08	mW
d	5	mm
f	2480	MHz
x	7.5	for 1-g SAR
SAR exclusion*	2.23	<7.5
Limit	7.5	
Pmax	24	mW

* calculated using 447498 D01 General RF Exposure Guidance v05r02 section 4.3.1 1) [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)

5.5.2
1) of 447498 D01 General RF Exposure Guidance v05r02
"When the standalone SAR test Exclusion of section 4.3.1 applies and no SAR test is required or highest *reported* 1-g SAR is ≤ 0.4 W/kg, modules and peripheral transmitters may be approved to operate in qualified portable host exposure conditions with no restriction for most host platform configurations. [44] This applies to both OEM installed and user accessible external peripheral transmitters. A *test separation distance* of 5 mm must be applied to determine test exclusion according to the *SAR Test Exclusion Threshold* requirements. "

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Industry Canada SAR Exclusion Analysis for use in hand-held / hand-operated industrial remote controls

RSS-102 Issue 4

2.5.1 Exemption from Routine Evaluation Limits – SAR Evaluation

SAR evaluation is required if the separation distance between the user and the radiating element of the device is less than or equal to 20 cm, except when the device operates as follows:

- above 2.2 GHz and up to 3 GHz inclusively, and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 20 mW for general public use and 100 mW for controlled use;

The maximum radiated (e.i.r.p) source-based time averaged output power is 7.08 x 2.14 = 15.2 mW. This is based on 10% duty cycle and 3.3 dBi max gain Pcb Inverted F Antenna.

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