SAR ATTESTATION

KDB 447498 D01 General RF Exposure Guidance v05r02 (February 7, 2014)

1. Declaration of RF exposure compliance for exemption from routine evaluation limits

Applicant:	Hella Gutmann Solutions GmbH Am Krebsbach 2 79241 Ihringen Germany	
Nemko ident. no.:	315495	
Number of pages:	9	
Name of host device:	mega macs 56	
Transmitter #:	1 (Bluetooth)	2 (w-lan)
FCC ID:	2AEOK-HGS3	2AEOK-HGS3
Model number:	ELLA-W133-A	ELLA-W133-A
Manufacturer of the radio module:	u-blox AG Thalwil Ch-8800 Switzerland	u-blox AG Thalwil Ch-8800 Switzerland
Exposure Conditions:	The mega macs 56 is a communication interface between a vehicle and a mechanic working in a garage. It is designed and intended for use on extremities or mainly operated in extremity only. A body-worn use is not intended. There are no accessories such as shoulder bags or carrying straps. A typical use case is shown in Annex B. Therefore the product is considered to require *extremity SAR evaluation*.	
4.3.1. Standalone SAR test exclusion considerations:	The 1-g and 10-g SAR exclusion thresholds for 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following: [(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] x [√f(GHz)] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where f(GHz) is the RF channel transmit frequency in GHz Power and distance are rounded to the nearest mW and mm before calculation The result is rounded to one decimal place for comparison The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz.	
	Calculation based on the above formula: Separation Distance = 20.8 mm; Frequency = 2.480 GHz Conducted Output Power = 8 mW Tune-up tolerance = 2dB (factor 1.6) Calculation: $\frac{8 * 1.6}{20.8} * \sqrt{2.480} \approx 1.0 \leq 7.5$	Calculation based on the above formula: Separation Distance = 26.1 mm; Frequency = 2.437 GHz Conducted Output Power = 22.1 mW Tune-up tolerance = 2dB (factor 1.6) Calculation: $\frac{22.1 * 1.6}{26.1} * \sqrt{2.437} \approx 2.1 \leq 7.5$
	The corresponding SAR Test Exclusion Threshold conditions, listed above, are satisfied, therefore the standalone SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required.	

	The standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion: • [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm; where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR, where f(GHz) is the RF channel transmit frequency in GHz Power and distance are rounded to the nearest mW and mm before calculation The result is rounded to two decimal place for comparison The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz.	
4.3.2. Simultaneous transmission SAR test exclusion considerations:	Calculation based on the above formula: Separation Distance = 20.8 mm; Frequency = 2.480 GHz Conducted Output Power = 8 mW Tune-up tolerance = 2dB (factor 1.6) Calculation: $\frac{8*1.6}{20.8}*\frac{\sqrt{2.480}}{18.75}\approx 0.05\frac{W}{kg}$	Calculation based on the above formula: Separation Distance = 26.1 mm; Frequency = 2.437 GHz Conducted Output Power = 22.1 mW Tune-up tolerance = 2dB (factor 1.6) Calculation: $\frac{22.1*1.6}{26.1}*\frac{\sqrt{2.437}}{18.75}\approx 0.11\frac{W}{kg}$
	Sum of all simultaneously transmitting antennas: $0.05\frac{W}{kg}+0.11\frac{W}{kg}=0.16\frac{W}{kg}\leq 4.0\frac{W}{kg}$ Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneously transmitting antenna. The sum of 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, therefore SAR test exclusion applies to that simultaneous transmission configuration.	

2. Attestation

ATTESTATION: I attest that the testing was performed by a FCC listed test laboratory, that the test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

Signature:	
Date:	October 2, 2016
Name:	Markus Korny, EMC Specialist

Annex A

The physical dimensions of the mega macs 56 are 103 x 310 x 263 mm (H x W x L).
Test separation distances of antennas are determined by the closest separation between the antennas and the user.
The host device will be held as shown in Figure 2. The separation distance is calculated to the top outside (touchscreen) of the enclosure.
The distance is 26.1mm for the w-lan antenna and 20.8mm for the Bluetooth antenna as shown in Figure 3 and 4.
The distance between the antennas is 153mm, shown in Figure 5.

Figure 1

Figure 2

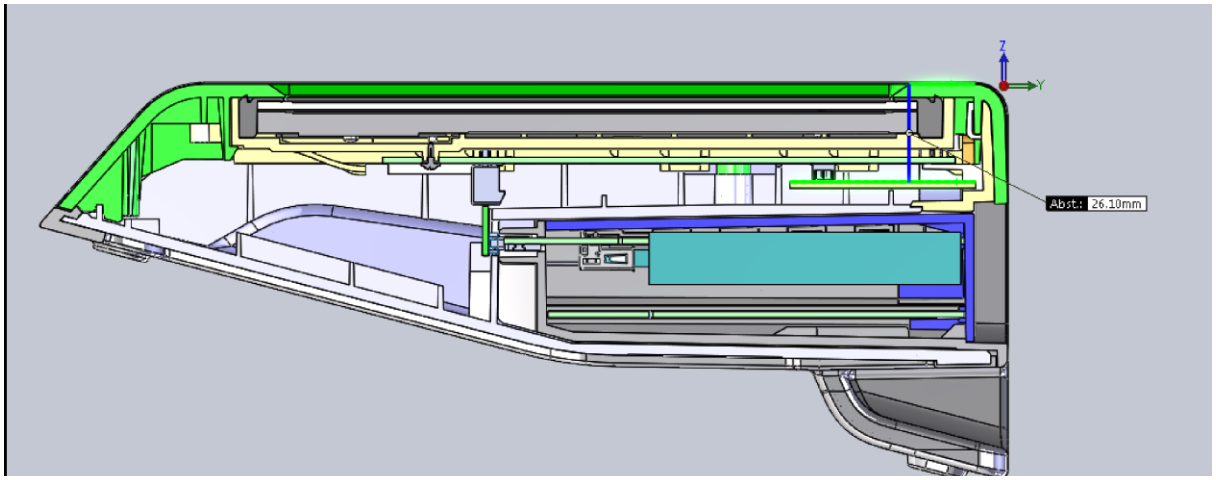


Figure 3 shows the closest distance of the w-lan antenna and the user (touchscreen) with 26.1 mm

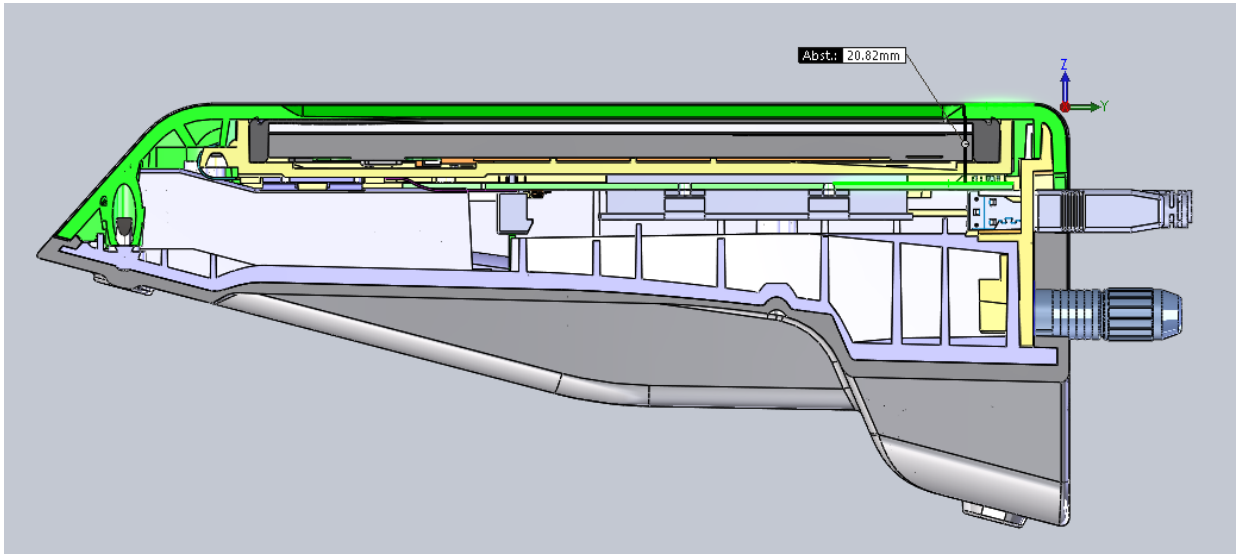


Figure 4 shows the closest distance of the Bluetooth antenna and the user (touchscreen) with 20.82 mm

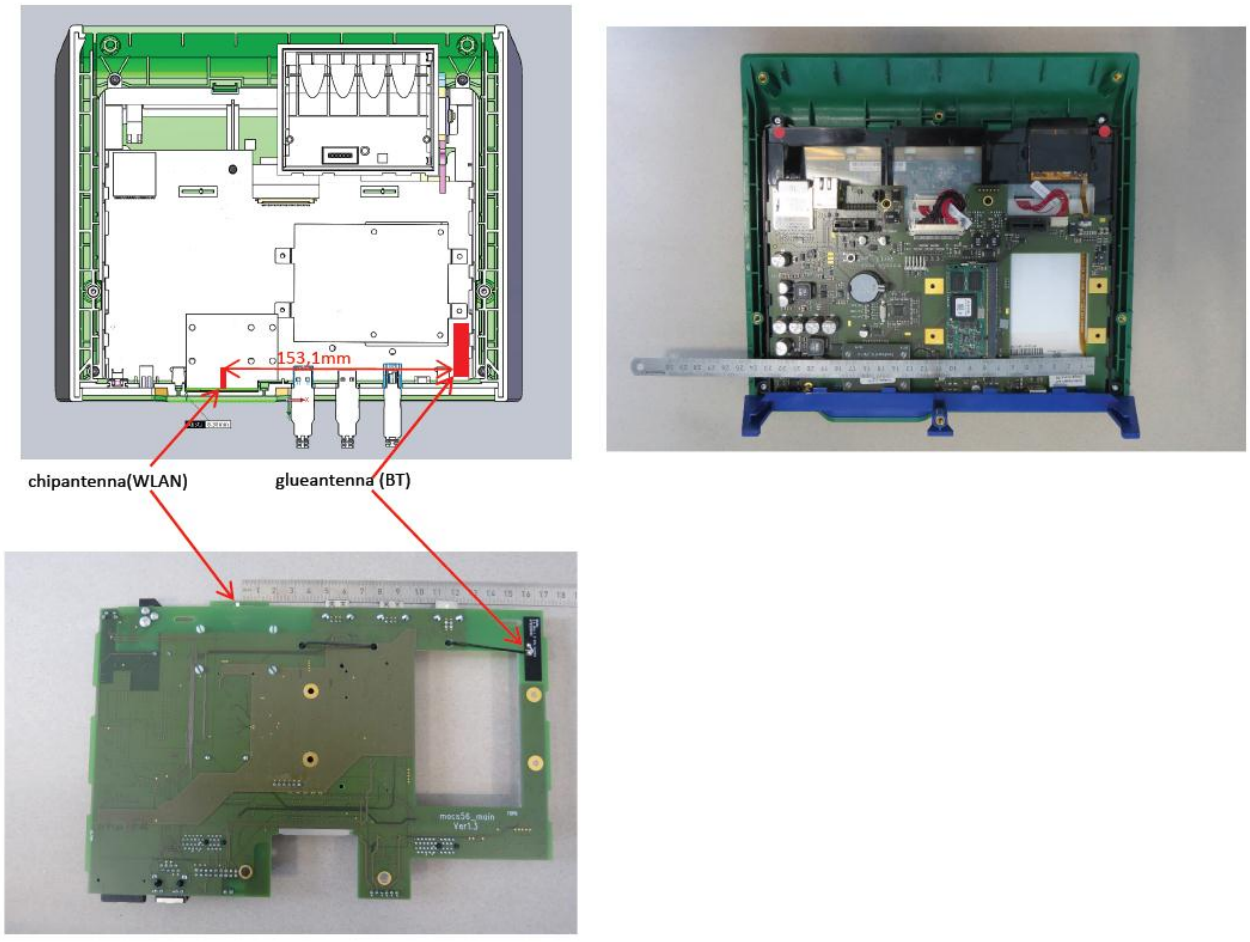


Figure 5 shows the distance between the antennas (153 mm).

Annex B

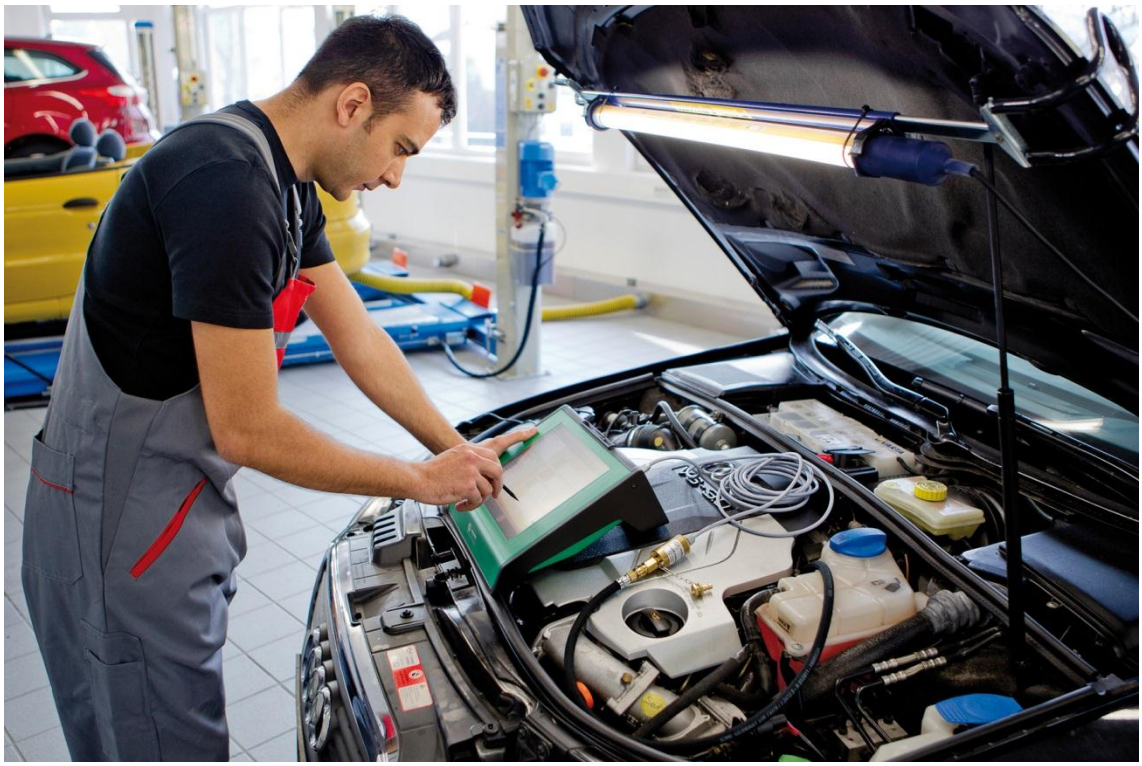


Figure 6 shows a typical use case.

Annex C

Nemko GmbH & Co. KG
Test and Certification Institute
Reetzstraße 58
D-76327 Pfinztal
Germany
Tel.: + 49 (0) 7240 – 63 - 0
Fax: + 49 (0) 7240 – 63 - 11

EMV
Testzentrum

315495 Hella Gutmann mm56
Determination of TX power for SAR purposes
Test method AVGSA-1 according to 558074 D01
EuT was operated in test mode with duty cycle > 98%

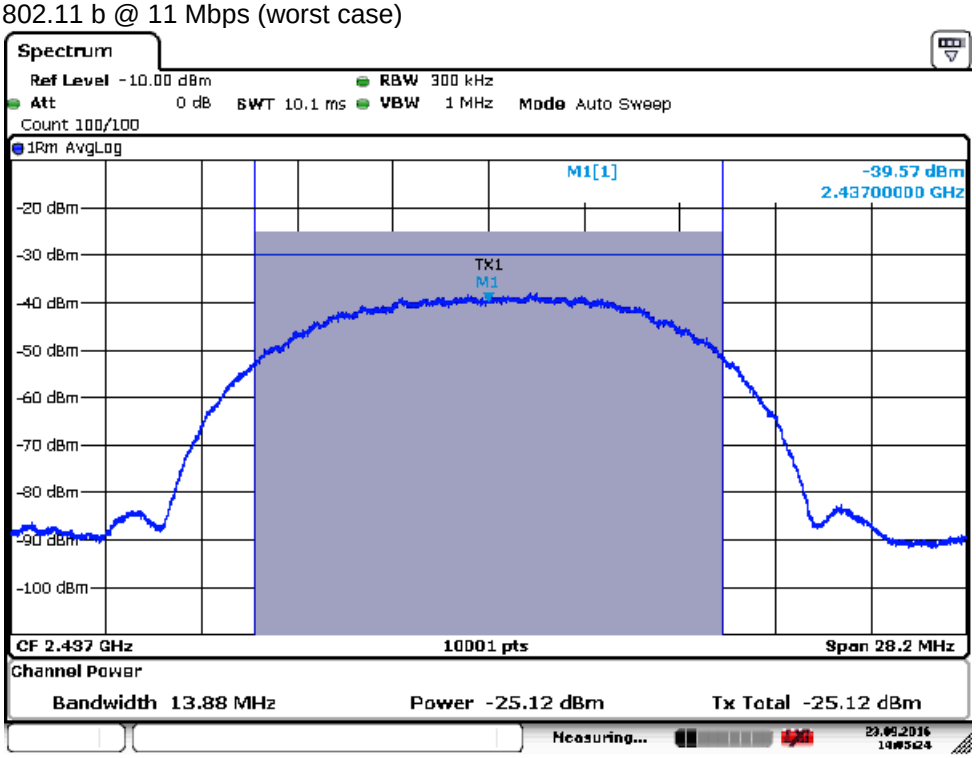
measured occupied bandwidth (using OBW function of Rohde & Schwarz FSV40)
802.11 b (DSSS) @ 1 Mbps: 13.88 MHz
802.11 b (DSSS) @ 11 Mbps: 13.88 MHz
802.11 g (OFDM) @ 6 Mbps: 16.80 MHz
802.11 g (OFDM) @ 54 Mbps: 16.80 MHz
802.11 n-20 @ MCS0: 18.12 MHz
802.11 n-20 @ MCS7: 17.96 MHz
802.11 n-40 @ MCS0: 36.38 MHz
802.11 n-40 @ MCS7: 36.7 MHz
Bandwidths above were used for band power measurements.

Test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the test house.

No.	Instrument/ ancillary	Type of instrument/ ancillary	Manufacturer	Ref. no.	Cal. Date	Cal. Due
1	-	Semi anechoic chamber	R&M München	1-0361	2014-10	2017-10
2	STLP9148	Log.-per. antenna	Schwarzbeck	1-0614	2013-07-23	2016-11
3	FSV40	Signal analyzer	Rohde & Schwarz	1-0611	2015-08	2016-09

802.11 b @ 11Mbps													
F	PMeas	GR	LC	GAmp	d	Lp	EIRP	EIRP	EIRP	GT	PT	PT	PT
MHz	dBm	dBi	dB	dB	m	dB	dBm	mW	W	dBi	dBm	mW	W
2412	-25,7	8,67	0,53	0	3	49,7	16	38,46	0,03846	3	12,8	19,275	0,019275
2437	-25,1	8,76	0,53	0	3	49,8	16,4	44,152	0,044152	3	13,4	22,129	0,022129
2462	-26,5	8,83	0,53	0	3	49,9	15,1	32,123	0,032123	3	12,1	16,1	0,0161
802.11 g @ 6Mbps													
F	PMeas	GR	LC	GAmp	d	Lp	EIRP	EIRP	EIRP	GT	PT	PT	PT
MHz	dBm	dBi	dB	dB	m	dB	dBm	mW	W	dBi	dBm	mW	W
2412	-28,4	8,67	0,53	0	3	49,7	13	20,65	0,02065	3	10,1	10,351	0,010351
2437	-28	8,76	0,53	0	3	49,8	13,5	22,644	0,022644	3	10,5	11,349	0,011349
2462	-29	8,83	0,53	0	3	49,9	12,6	18,064	0,018064	3	9,6	9,054	0,009054
802.11 n-20 @ MCS7													
F	PMeas	GR	LC	GAmp	d	Lp	EIRP	EIRP	EIRP	GT	PT	PT	PT
MHz	dBm	dBi	dB	dB	m	dB	dBm	mW	W	dBi	dBm	mW	W
2422	-28,5	8,71	0,53	0	3	49,7	13	20,16	0,02016	3	10	10,106	0,010106
2437	-28,7	8,76	0,53	0	3	49,8	12,8	19,273	0,019273	3	9,8	9,659	0,009659
2452	-28,2	8,81	0,53	0	3	49,8	13,4	21,641	0,021641	3	10,4	10,846	0,010846
802.11 n-40 @ MCS7													
F	PMeas	GR	LC	GAmp	d	Lp	EIRP	EIRP	EIRP	GT	PT	PT	PT
MHz	dBm	dBi	dB	dB	m	dB	dBm	mW	W	dBi	dBm	mW	W
2422	-28,8	8,71	0,53	0	3	49,7	13	18,82	0,01882	3	9,7	9,432	0,009432
2437	-28,8	8,76	0,53	0	3	49,8	12,7	18,834	0,018834	3	9,7	9,44	0,00944
2452	-28,3	8,81	0,53	0	3	49,8	13,3	21,149	0,021149	3	10,3	10,599	0,010599
F	is the center frequency of radiated DUT signal, in MHz												
PMeas	is the measured power level, in dBm												
GR	is the gain of the receive (measurement) antenna, in dBi												
LC	is the signal loss in the measurement cable, in dB												
GAmp	is the value of external amplification (if used), in dB												
d	is the measurement distance, in meters												
Lp	is the basic free space propagation path loss, in dB												
GT	is the gain of the transmitting antenna, in dBi												
PT	is the transmitter output power, in dBm (power over a specified reference bandwidth)												

spectral plots:
303851-802: 802.11 b @ 11 Mbps (worst case)



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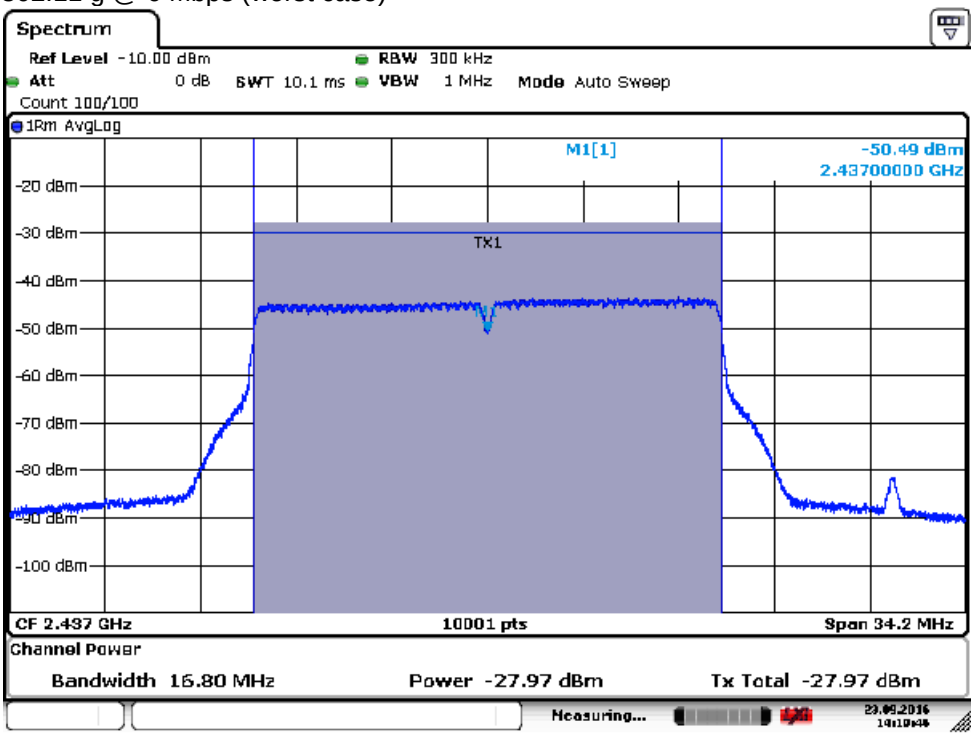
303851-805: 802.11 g @ 6 Mbps (worst case)



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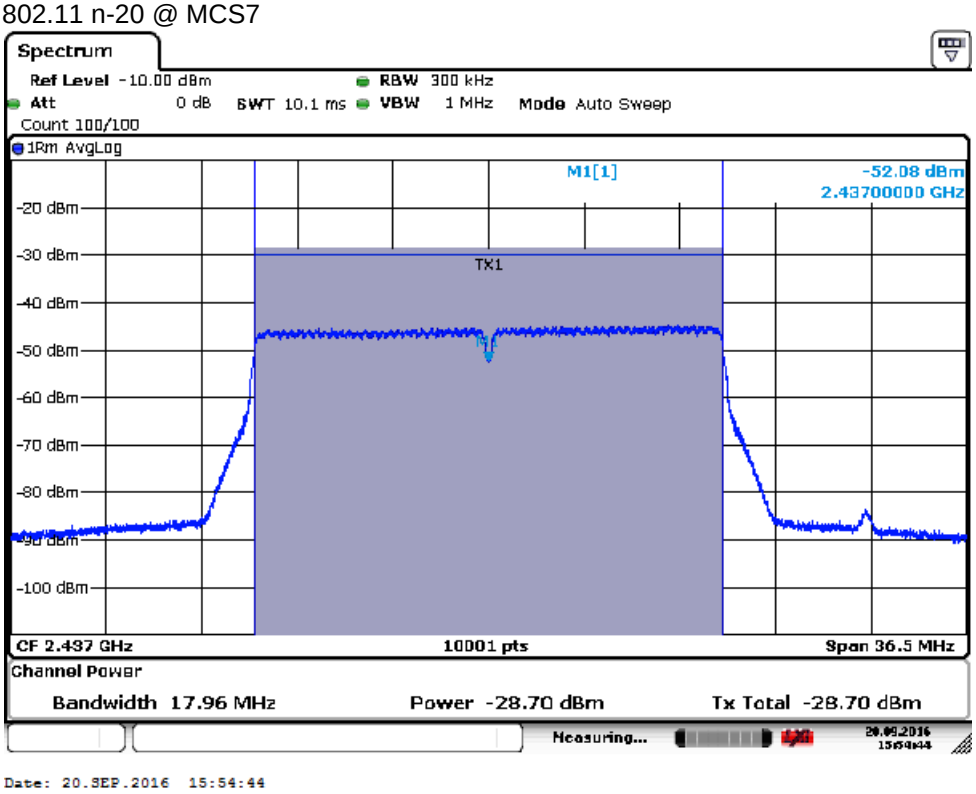
303851-906: 802.11 n-20 @ MCS7



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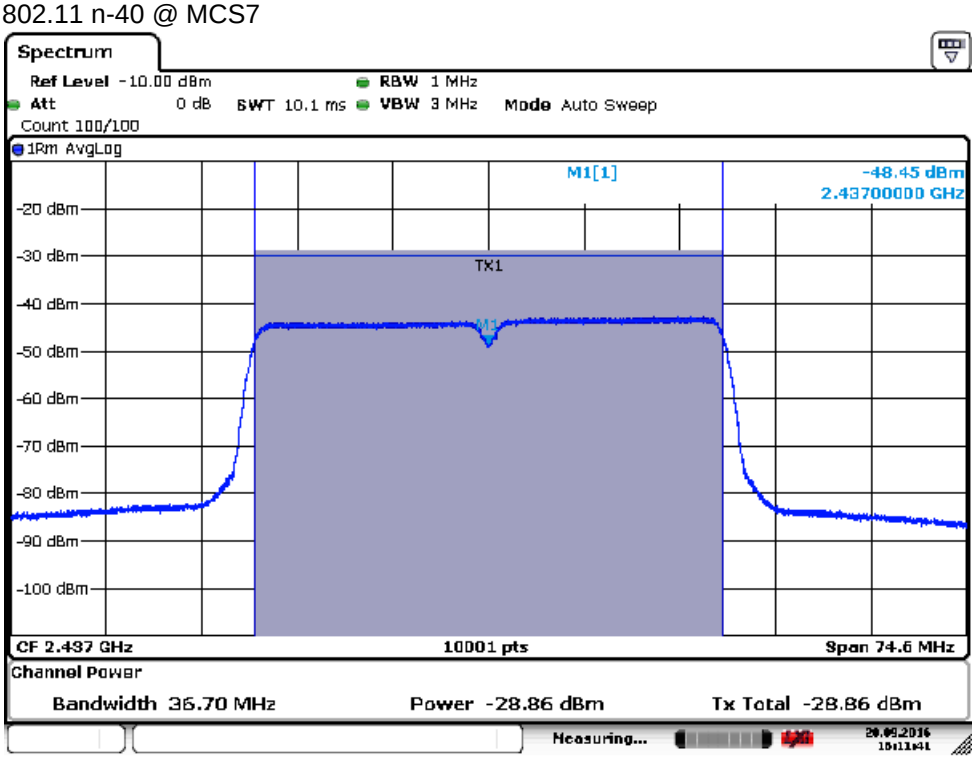
303851-910: 802.11 n-40 @ MCS7



Date: 20.SEP.2016 16:11:41