

Test Report



INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C

Equipment Under Test: Remote Control

Model: 9101A


Manufacturer: Cenelec Oy
Olvitie 5
FI-74100 Iisalmi
FINLAND

Customer: Cenelec Oy
Olvitie 5
FI-74100 Iisalmi
FINLAND

FCC Rule Part: §15.249:2010

Date: 16.11.2011

Issued by:


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Date: 16.11.2011

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Table of Contents

PRODUCT DESCRIPTION	3
Equipment Under Test (EUT)	3
Description of the EUT	3
Classification of the Device	3
Ratings and Declarations	3
Power Supply	3
Mechanical Size of the EUT	4
Samples	4
GENERAL REMARKS	5
Disclaimer	5
SUMMARY OF TESTING	6
EUT Test Conditions During Testing	6
Photographs of the EUT	7
TEST RESULTS	9
20 dB Bandwidth	9
Field Strength of Fundamental	10
Transmitter Spurious Radiated Emissions 30 – 24 500 MHz	11
Receiver Radiated Emissions 30 – 24 500 MHz	16
TEST EQUIPMENT	19
List of Test Equipment	19

Equipment Under Test (EUT)

Remote Control
 Model: 9101A
 Type: -
 Serial no: -
 HW version: Rev C
 SW version: 1.0
 FCC ID number: Z3I9101A

Description of the EUT

The EUT is a remote control that controls different functions of audio amplifiers. It has three buttons, volume up (+), volume down (-), and mute/standby.

Classification of the Device

Fixed device	<input type="checkbox"/>
Mobile Device (Human body distance > 20cm)	<input type="checkbox"/>
Portable Device (Human body distance < 20cm)	<input checked="" type="checkbox"/>

Modifications Incorporated in the EUT

No modifications were applied to the EUT during radiated testing. In conducted tests 50 Ω SMA connector was soldered to PCB and integral antenna was disconnected.

Ratings and Declarations

Operating Frequency Range (OFR): 2 440 MHz
 Channels: 1
 Modulation: GFSK
 Data rate: 250 kb/s
 Antenna connector type: Integrated on PCB
 Antenna gain: 3.0 dBi
 Radiated power: -18,9 dBm (12,88 μ W)

Power Supply

Battery operated
 Voltage: 3.0 V (CR2032 battery)
 (tested by using 2 x AA size battery (1.5 V) and 3.0 V voltage level)

Mechanical Size of the EUT

Height: 7.6 mm	Width:4.1 mm	Depth: 0.9mm
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Samples

Sample No. 1: The EUT uses its PCB antenna.

Sample No. 2: The EUT was fitted with temporally 50Ω SMA connector and its PCB antenna was disconnected.

Disclaimer

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SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.215(c)	20 Bandwidth	PASS
§15.249(a)	Field Strength of Fundamental	PASS
§15.249(a)(d)(e)	Transmitter Spurious Radiated Emissions	PASS
§15.109	Receiver Radiated Emissions	PASS

EUT Test Conditions During Testing

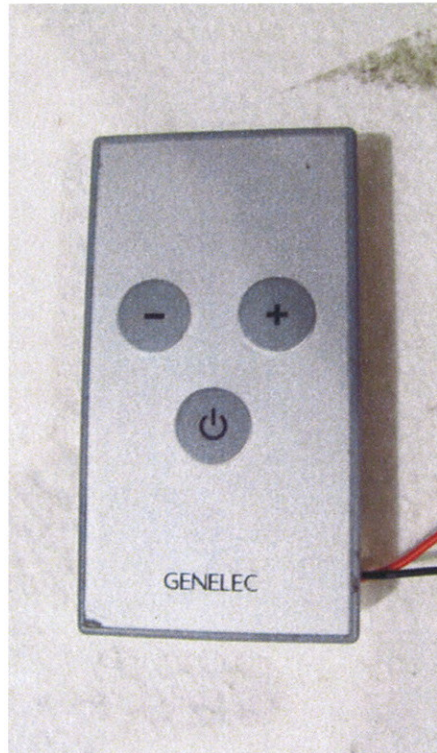
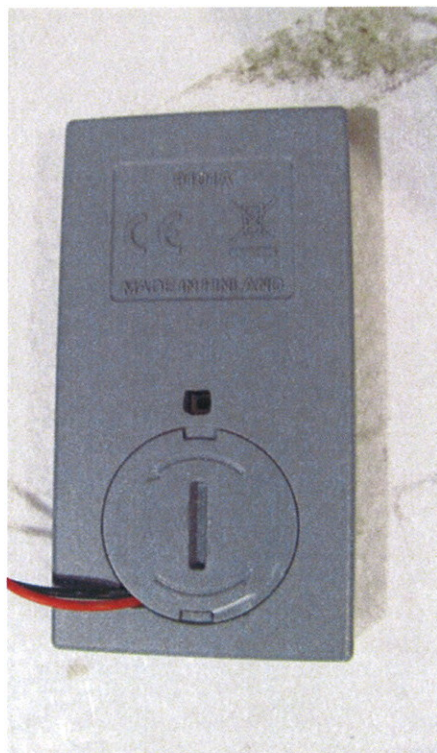
The EUT was in transmitting with maximum duty cycle during all the tests. Used duty cycle during tests was 55 % and period time 749.519 μ s. Normal modulation was applied with maximum transmitting power in all the tests. In tests the EUT was powered from external batteries (2 x 1,5 V AA size). Radiated tests were done with sample no 1. and conducted tests with sample no 2.

Following channel was used during the tests:

Channel = 2440 MHz

Test Facility

<input type="checkbox"/> Testing Location / address: FCC registration number: 90598	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
<input checked="" type="checkbox"/> Testing Location / address: FCC registration number: 178986 Industry Canada registration number: 8708A-2	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

Photographs of the EUT**Figure 1.** The EUT (sample 1.)**Figure 2.** The EUT (sample 1.)

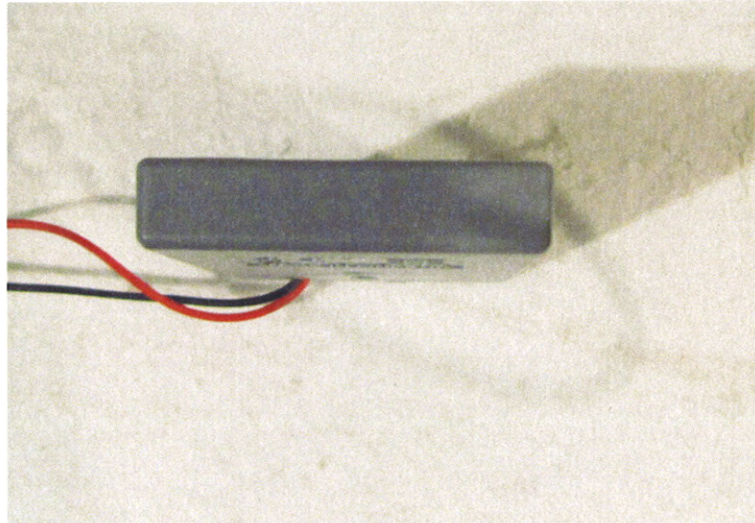


Figure 3. The EUT (sample 1.)

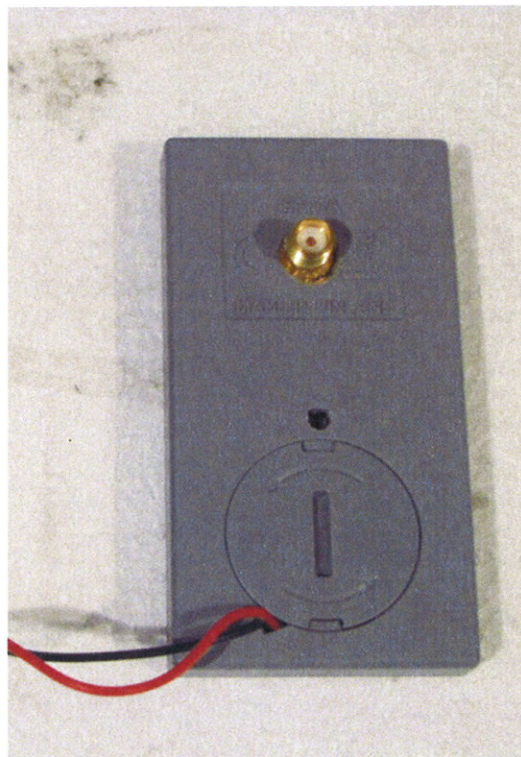


Figure 4. The EUT (sample 2.) with temporary SMA connector

TEST RESULTS

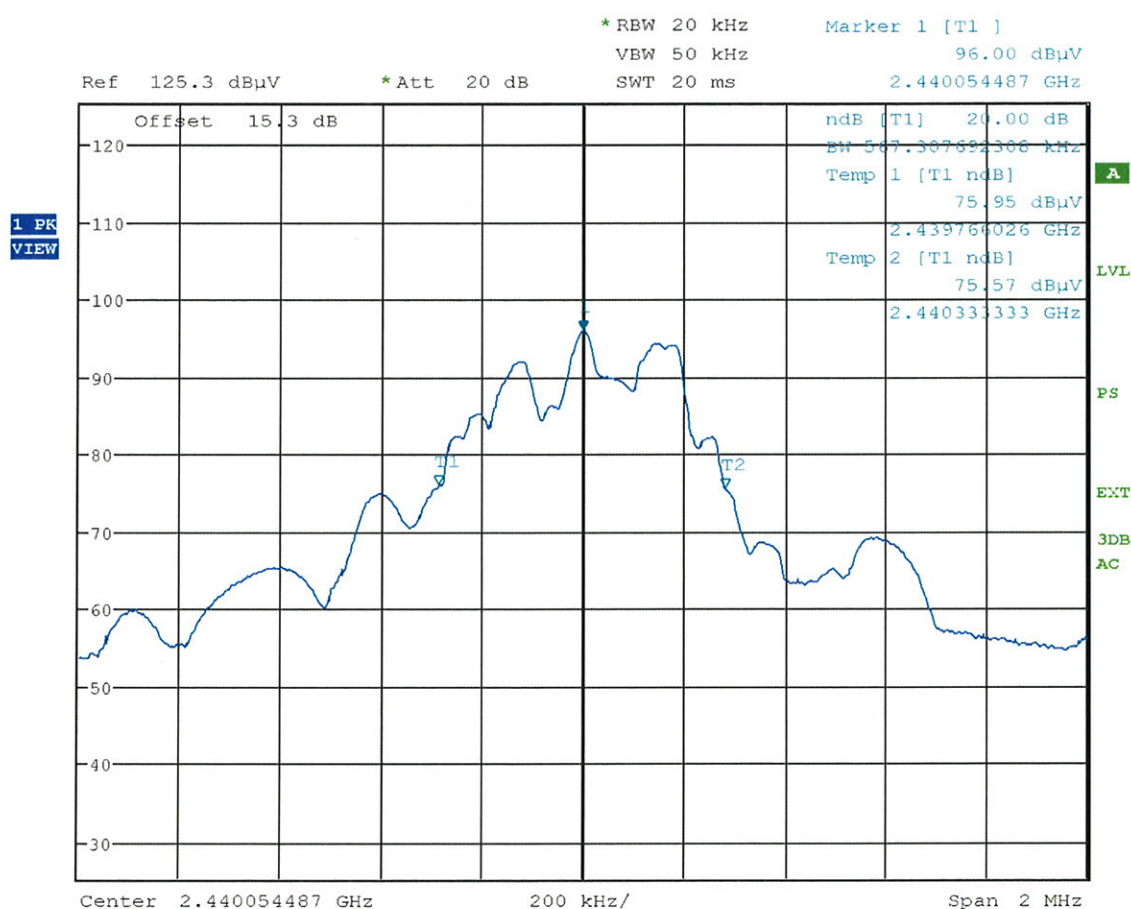
20 dB Bandwidth

Standard: ANSI C63.10 (2009)
Tested by: NTO
Date: 6.10.2011
Relative humidity: 53 %
Temperature: 20 °C

FCC Rule: 15.215(c)

Table 1. 20 dB bandwidth results.

Channel Frequency (MHz)	20 dB Bandwidth (kHz)	Margin (kHz)	Limit (kHz)	Result
2 440	567.307	-	-	PASS



Date: 6.OCT.2011 12:17:54

Figure 5. Measured curve with MaxPeak detector.

Transmitter Radiated Emission Test

Field Strength of Fundamental

Standard: ANSI C63.10 (2009)
Tested by: NTO
Date: 5.10.2011
Relative humidity: 52 %
Temperature: 19 °C
Measurement uncertainty ± 4.51 dB Level of confidence 95 % (k = 2)

FCC Rule: 15.249(a)

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables) for. The final Average results are calculated from the MaxPeak final results with duty cycle correction factor $20 \cdot \text{LOG}(x/100)$. The MaxPeak values are the measured values corrected with the correction factor.

Field Strength of Fundamental

Figure 6. Measured curve with MaxPeak detector.

Table 2. MaxPeak final results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2440.175000	88.1	1000.0	1000.000	127.0	V	315.0	4.4	25.9	114.0	
2440.175000	83.7	1000.0	1000.000	216.0	H	25.0	4.4	30.3	114.0	

Table 3. Average final results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2440.175000	82.9	1000.0	1000.000	127.0	V	315.0	4.4	11.1	94.0	**
2440.175000	78.5	1000.0	1000.000	216.0	H	25.0	4.4	15.5	94.0	**

** Duty cycle correction for average results: $20 \cdot \text{LOG}(55\%/100\%) = -5.2 \text{ dB}$

Transmitter Spurious Radiated Emissions 30 – 24 500 MHz

Standard: ANSI C63.10 (2009)
Tested by: NTO
Date: 5. - 6.10.2011
Relative humidity: 52 – 53 %
Temperature: 19 – 20 °C
Measurement uncertainty ± 4.51 dB Level of confidence 95 % (k = 2)

FCC Rule: 15.249(a)(d)(e), 15.209(a)

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + filter + cables). The final Average results are calculated from the MaxPeak final results with duty cycle correction factor $20 \cdot \text{LOG}(x/100)$. The QuasiPeak and MaxPeak values are the measured values corrected with the correction factor.

The Frequency Range 30 – 1 000 MHz

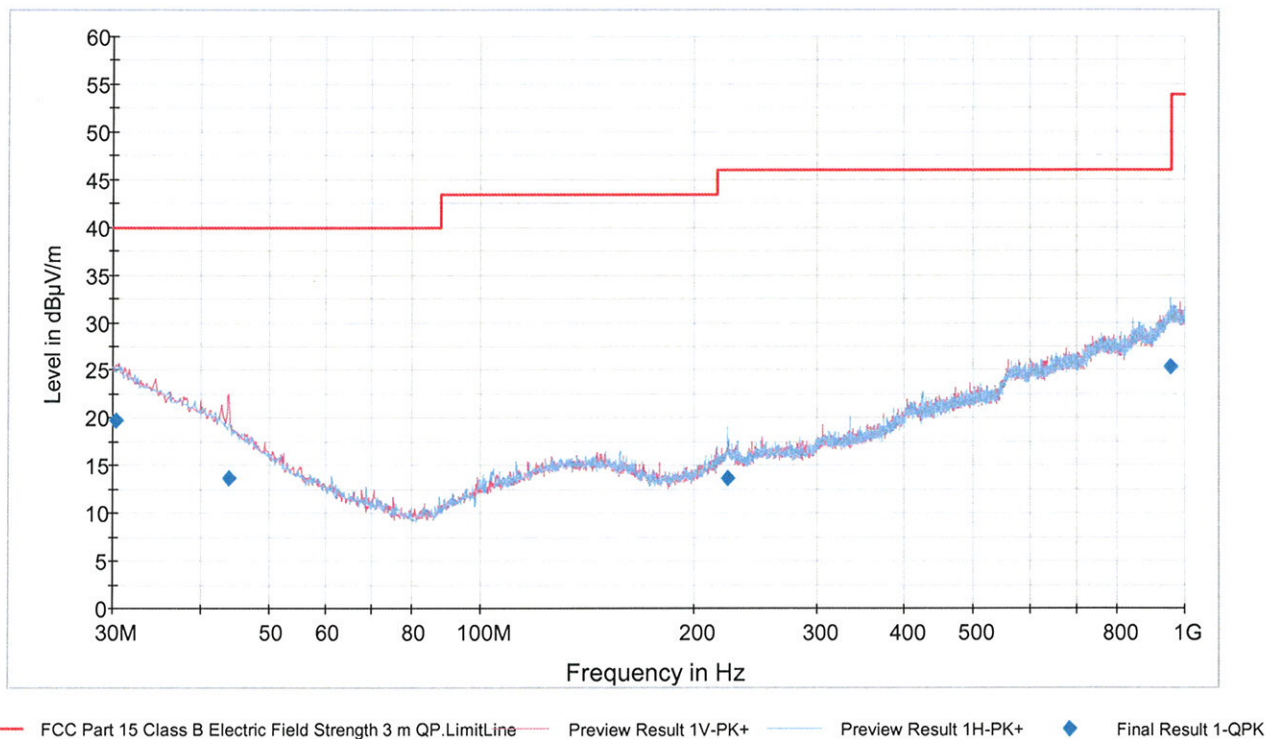


Figure 7. Measured curves with MaxPeak detector.

Table 4. QuasiPeak final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
30.340000	19.8	1000.0	120.000	185.0	V	300.0	-1.0	20.2	40.0	
43.595000	13.7	1000.0	120.000	261.0	V	150.0	-6.9	26.3	40.0	
223.335000	13.6	1000.0	120.000	117.0	H	89.0	-8.2	32.4	46.0	
954.125000	25.4	1000.0	120.000	268.0	H	351.0	6.4	20.6	46.0	

Transmitter Radiated Emission Test

The Frequency Range 1 000 – 4 000 MHz and Band Edges

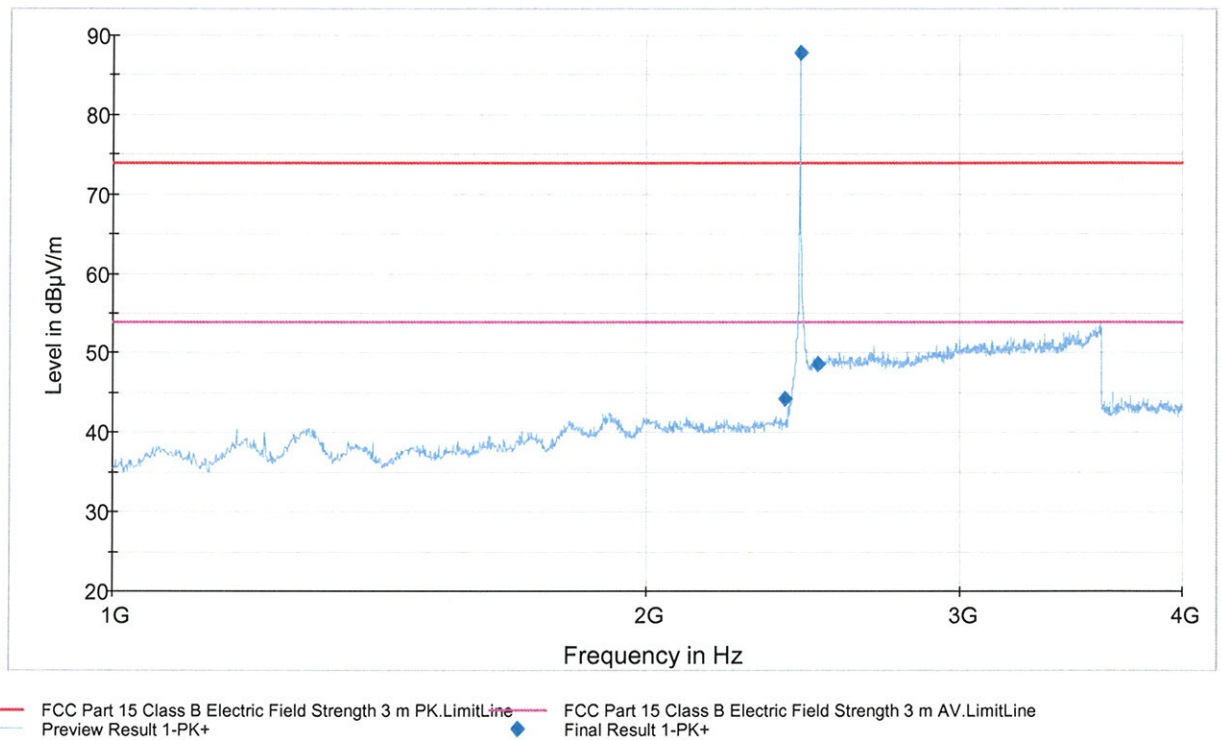


Figure 8. Measured curve with MaxPeak detector.

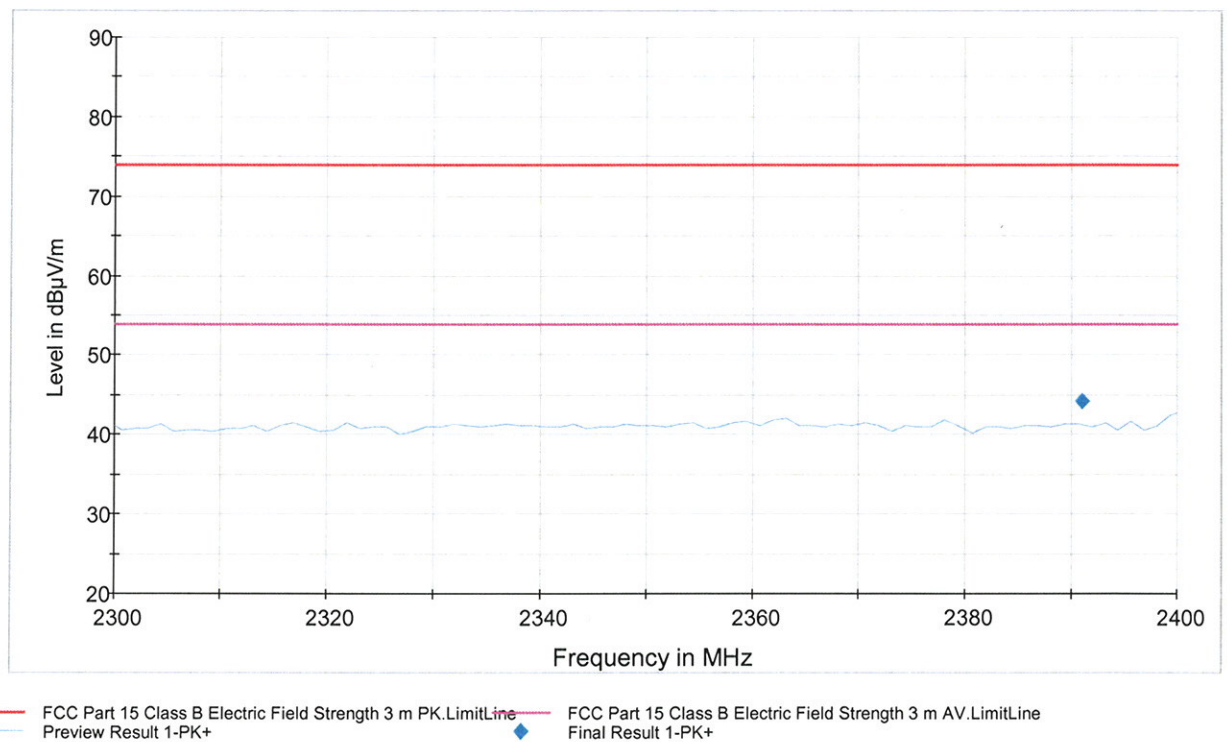


Figure 9. Measured curve with MaxPeak detector.

Transmitter Radiated Emission Test

Copy of Copy of Copy of Radiated Emission FCC Part 15 Class B 1-18GHz 3m

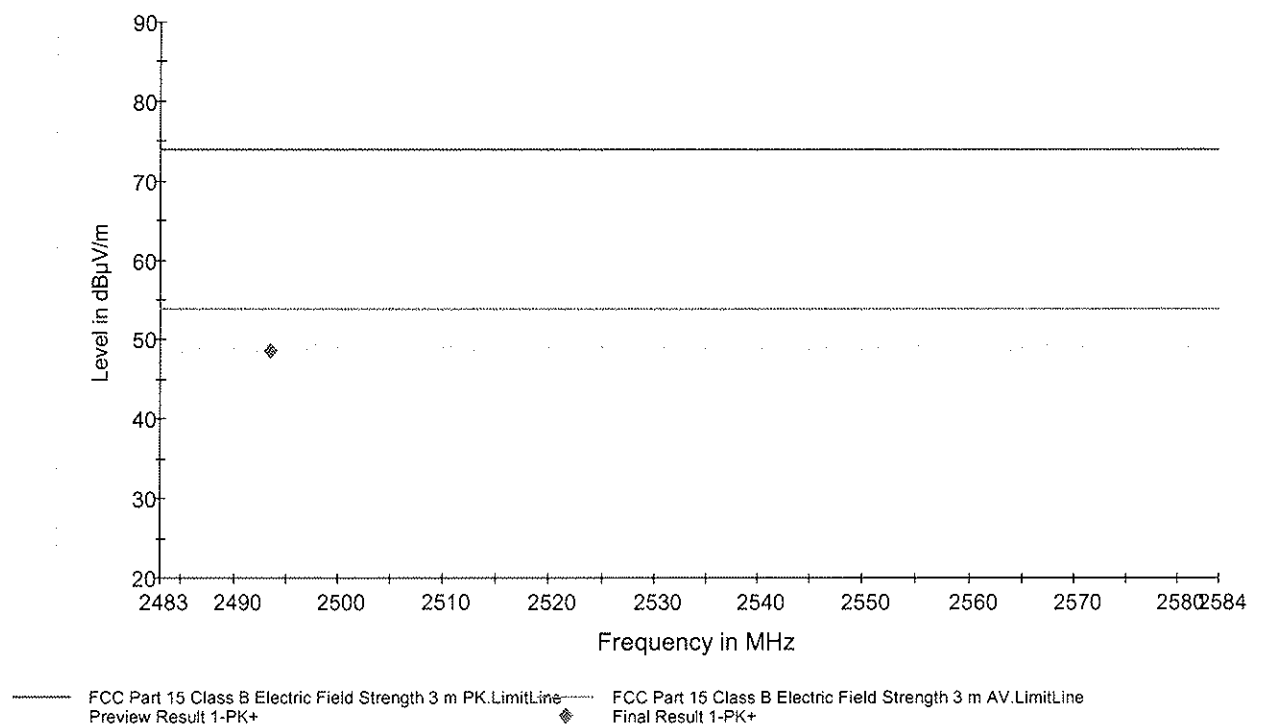


Figure 10. Measured curve with MaxPeak detector.

Table 5. MaxPeak final results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2391.000000	44.3	1000.0	1000.000	100.0	V	233.0	4.6	29.6	73.9	
2439.975000	87.8	1000.0	1000.000	195.0	V	222.0	4.4	-	-	*
2493.500000	48.6	1000.0	1000.000	188.0	V	223.0	4.8	25.3	73.9	

* The fundamental frequency of the carrier

Table 6. Average final results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2391.000000	39.1	1000.0	1000.000	100.0	V	233.0	4.6	14.8	53.9	**
2439.975000	82.6	1000.0	1000.000	195.0	V	222.0	4.4	-	-	* **
2493.500000	43.4	1000.0	1000.000	188.0	V	223.0	4.8	10.5	53.9	**

* The fundamental frequency of the carrier

** Duty cycle correction for average results: $20 * \text{LOG} (55\%/100\%) = -5.2 \text{ dB}$

The Frequency Range 4 000 – 18 000 MHz

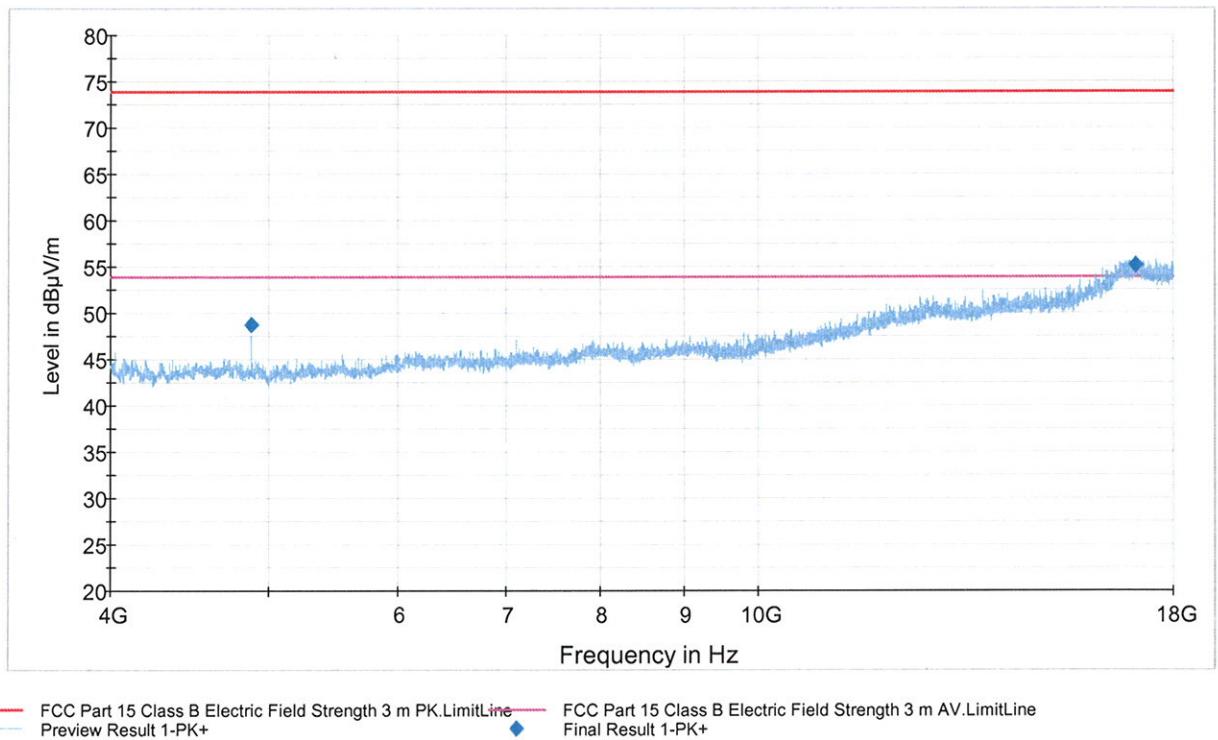


Figure 11. Measured curve with MaxPeak detector.

Table 7. MaxPeak final results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4879.975000	48.8	1000.0	1000.000	127.0	H	328.0	10.6	25.1	73.9	
17080.775000	55.2	1000.0	1000.000	100.0	H	258.0	25.8	18.7	73.9	

Table 8. Average final results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4879.975000	43.6	1000.0	1000.000	127.0	H	328.0	10.6	10.3	53.9	**
17080.775000	50.0	1000.0	1000.000	100.0	H	258.0	25.8	3.9	53.9	**

** Duty cycle correction for average results: $20 * \text{LOG} (55\%/100\%) = -5.2 \text{ dB}$

Transmitter Radiated Emission Test

The Frequency Range 18 000 – 24 500 MHz

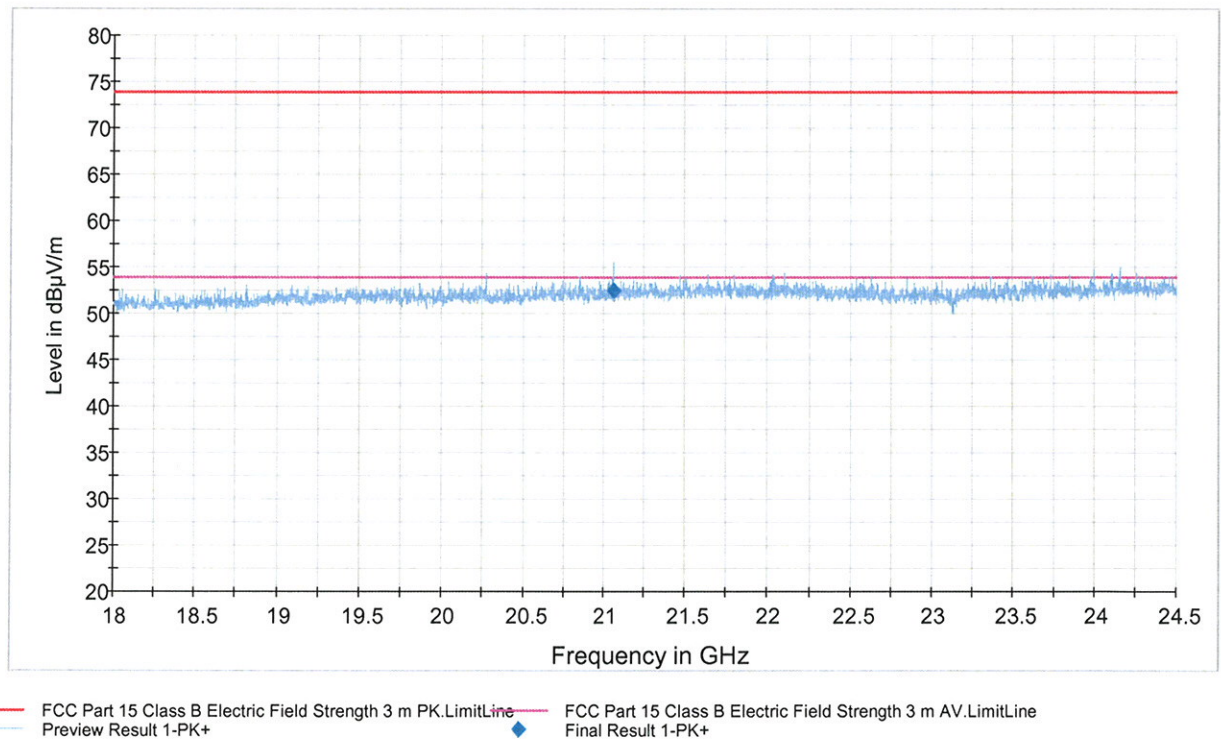


Figure 12. Measured curve with MaxPeak detector.

Table 9. MaxPeak final results.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
21063.675000	52.5	1000.0	1000.000	243.0	V	161.0	25.6	21.4	73.9	

Table 10. Average final results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
21063.675000	47.5	1000.0	1000.000	243.0	V	161.0	25.6	6.4	53.9	**

** Duty cycle correction for average results: $20 * \text{LOG} (55\%/100\%) = -5.2 \text{ dB}$

Receiver Radiated Emissions 30 – 24 500 MHz

Standard: ANSI C63.10 (2009)

Tested by: NTO

Date: 5. - 6.10.2011

Relative humidity: 52 – 53 %

Temperature: 19 – 20 °C

Measurement uncertainty ± 4.51 dB

Level of confidence 95 % (k = 2)

FCC Rule: 15.109

The EUT was in a receiving mode.

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables). The final Average results are calculated from the MaxPeak final results with duty cycle correction factor $20 \cdot \log(x/100)$. The QuasiPeak and MaxPeak values are the measured values corrected with the correction factor.

The Frequency Range 30 – 1 000 MHz

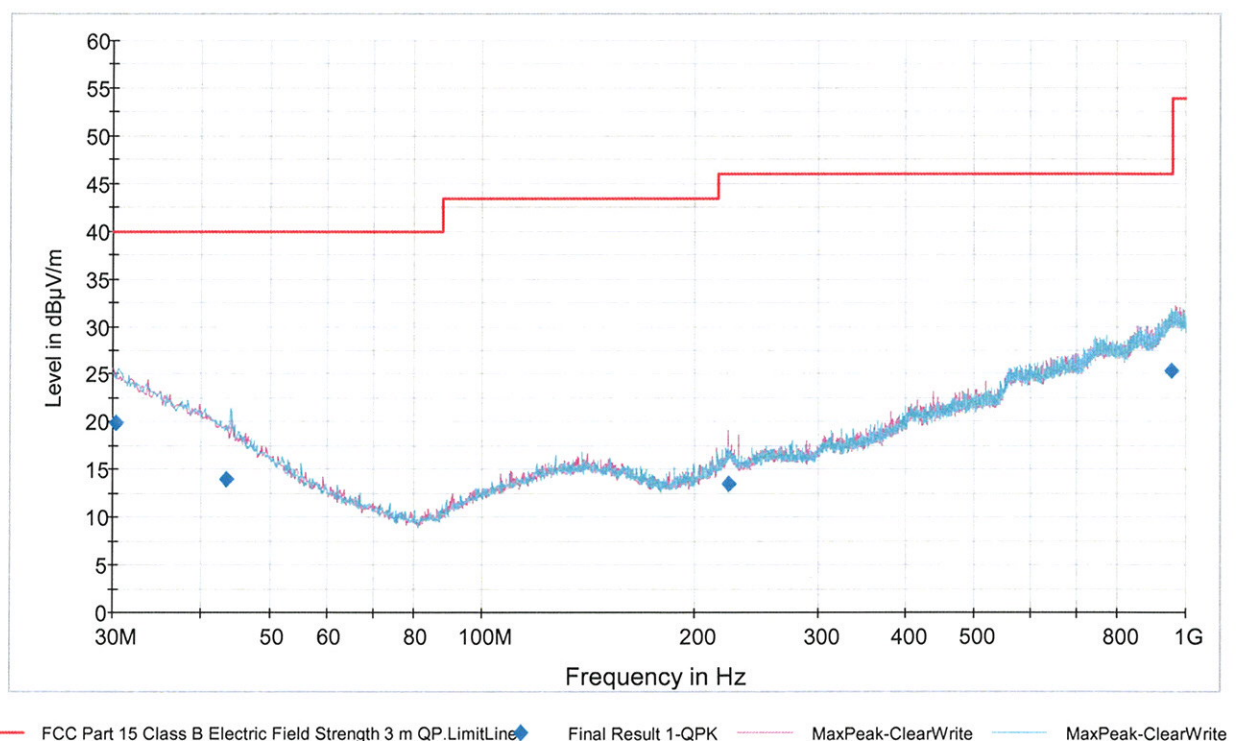


Figure 13. Measured curves with MaxPeak detector.

Table 11. QuasiPeak final results.

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
30.280000	19.8	1000.0	120.000	102.0	H	60.0	-1.0	20.2	40.0	
43.275000	13.9	1000.0	120.000	225.0	V	113.0	-6.6	26.1	40.0	
223.075000	13.5	1000.0	120.000	135.0	H	210.0	-8.3	32.5	46.0	
954.505000	25.4	1000.0	120.000	193.0	V	103.0	6.4	20.6	46.0	

The Frequency Range 1000 – 18 000 MHz

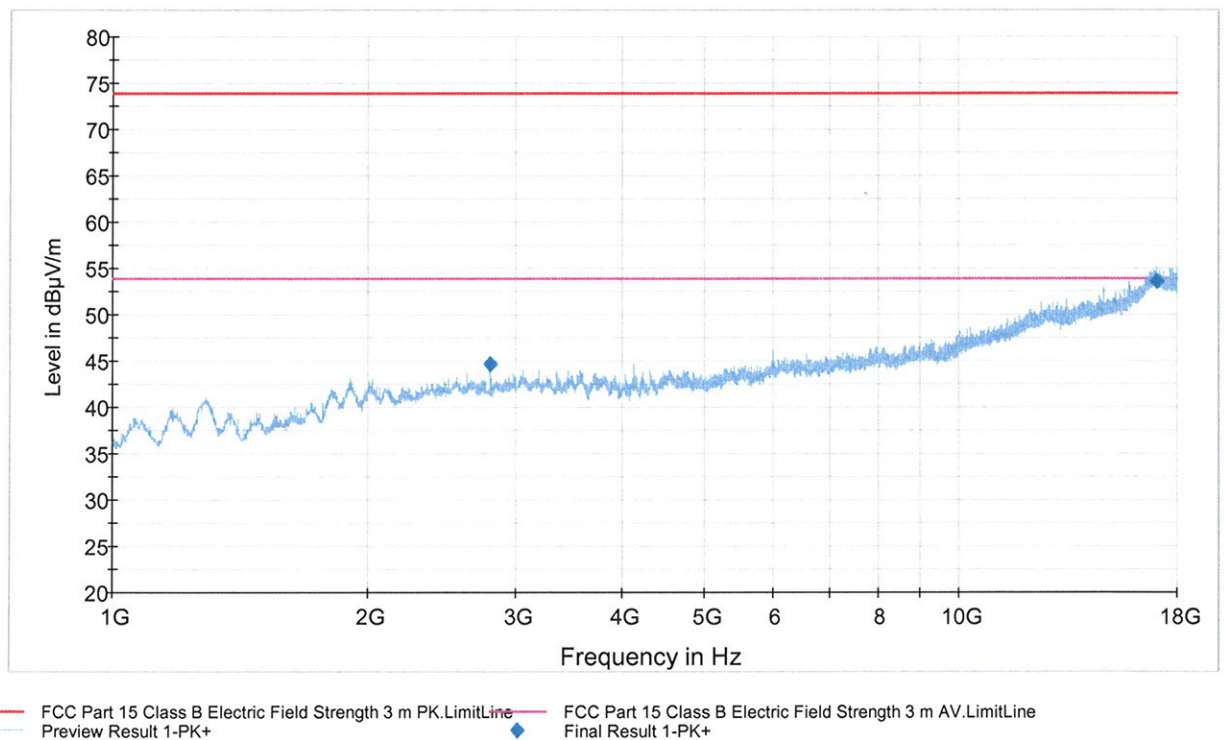


Figure 14. Measured curve with MaxPeak detector.

Table 12. MaxPeak final results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2791.025000	44.6	1000.0	1000.000	100.0	H	135.0	5.3	29.3	73.9	
17018.525000	53.5	1000.0	1000.000	204.0	V	256.0	25.2	20.4	73.9	

Table 13. Average final results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2791.025000	39.4	1000.0	1000.000	100.0	H	135.0	5.3	14.5	53.9	**
17018.525000	48.3	1000.0	1000.000	204.0	V	256.0	25.2	5.6	53.9	**

** Duty cycle correction for average results: $20 * \text{LOG} (55\%/100\%) = -5.2 \text{ dB}$

The Frequency Range 18 000 – 24 500 MHz

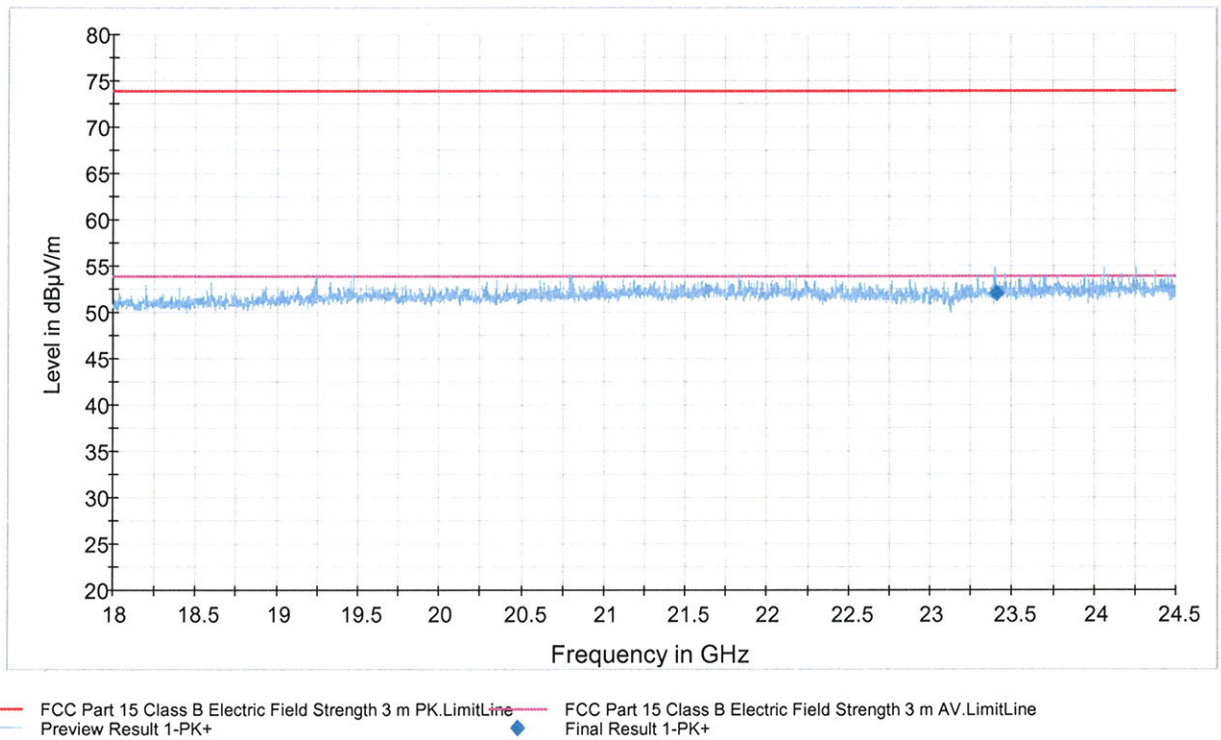


Figure 15. Measured curve with MaxPeak detector.

Table 14. MaxPeak final results.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
23407.525000	52.0	1000.0	1000.000	182.0	V	0.0	26.9	21.9	73.9	

Table 15. Average final results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
23407.525000	46.8	1000.0	1000.000	182.0	V	0.0	26.9	6.7	53.9	**

** Duty cycle correction for average results: $20 * \text{LOG} (55\%/100\%) = -5.2 \text{ dB}$

TEST EQUIPMENT

List of Test Equipment

Manufacturer	Type	Serial no	Inv. no
ROHDE & SCHWARZ			
EMI Test receiver	ESU 26	100185	8453
Test software	EMC32	-	-
EMCO			
Antenna (1 - 18 GHz)	3117	29617	7293
CHASE			
Antenna (30 MHz - 1 GHz)	6141	4004	7943
HEWLETT- PACKARD			
Microwave amplifier	83017A	3950M00102	5226
Amplifier	8447F opt H64	3113A04851	8366
DEISEL			
Antenna mast	MA 240 T	240/394/96	5017
Tilt option	KE 220	220/307/96	-
Controller	HD 100	100/413/96	5018
Turntable	DS 420	420/420/96	5015
WAINWRIGHT			
High Pass Filter (4 GHz)	WHKX	10	8267