

Amended Test Report

Includes NCEE Labs Report R20120824-20-01 and its amendment in full

Company: Johnson Outdoors
1531 E. Madison Ave.
Mankato, MN 56001

Product: Talon Foot Remote

FCC ID: T62-TALONFS
IC ID: 4397A-TALONFS

Test Report No: R20120824-20-01A

APPROVED BY:



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1.0 Summary of test results**1.1 Test Results**

The EUT has been tested according to the following specifications:

APPLIED STANDARDS: 47 CFR Part 15 & RSS-210			
Standard Section	Test Type and Limit	Result	Remark
15.207 RSS-Gen	Conducted AC Mains Emissions	Pass	Meets the requirement of the limit.
15.209, 15.231 RSS-Gen	Radiated Emissions Peak Output Field Strength Limit: 80.83dBµV/m	Pass	Meets the requirement of the limit.
15.231 RSS-210 Issue 8	Bandwidth	Pass	Meets the requirement of the limit.

1.2 Reason for amendment

The report was amended to provided correct duty cycle correction.

“Receive” mode was changed to “Standby mode”, as the equipment does not contain a receiver.

2.0 Description

2.1 Equipment under test

The equipment under test was a wireless foot remote for the wirelss control of the Talon anchor system from Johnson Outdoors. The remote only operates on one frequency and runs off of a non-rechargeable 3.0 VDC battery. The Talon is capable of transmitting only and the Talon anchor is capable of receiving only. Pushing any of the button one time will send one packet of data.

EUT Received Date: 2012 SEPT 17

EUT Tested Date: 2012 SEPT 21, OCT 19

PRODUCT	Talon Remote Foot Control
SERIAL NUMBER	Cont. transmit – NCEE Test 1 (assigned) Normal – NCEE Test 2 (assigned)
POWER SUPPLY	3.0 VDC internal battery, non-rechargeable
MODULATION TYPE	FSK
FREQUENCY RANGE	433.9MHz
NUMBER OF CHANNELS	1
ANTENNA TYPE	PCB trace
I/O PORTS	None
ASSOCIATED DEVICES	Talon wireless anchor (receiver only)

NOTE:

1. For more detailed features description, please refer to the manufacturer's specifications or User's Manual.

2.2 Laboratory description

All testing was performed at the NCEE Lincoln facility, which is a FCC and IC registered lab. This site has been fully described in previously submitted reports. Laboratory environmental conditions varied slightly throughout the tests:

Relative humidity of $45 \pm 4\%$

Temperature of $20 \pm 3^\circ$ Celsius

2.3 *Description of test modes*

The EUT was modified by the manufacturer to transmit continuously for testing purposes. It was set to transmit one packet after another with 20ms in between transmissions

2.4 *Applied standards*

The EUT is a low-power transmitter device operating on one frequency at 433.9MHz. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**Standby mode;
FCC Part 15.109 using ANSI/IEEE C63.4: 2009**

**Transmit mode;
FCC Part 15.209 and 15.231 using ANSI/IEEE C63.4: 2009
Industry Canada, RSS 210, Issue 8, Category I Equipment**

All test items have been performed and recorded as per the above standards.

2.5 *Configuration of system under test*

The EUT was set to transmit a continuous carrier signal at the lowest possible frequency, highest possible frequency, and on in the middle of the operating range. The EUT was also tested in a mode of operation in which it ran in its normal operating condition, waiting to receive data.

2.6 *Requirements of FCC Part 15.231(a)*

The EUT meets the requirements of FCC Part 15.231(a) because it is manually operated and will only transmit one packet when the push buttons are held down. There are no periodic transmissions.

2.7 Duty Cycle Calculation

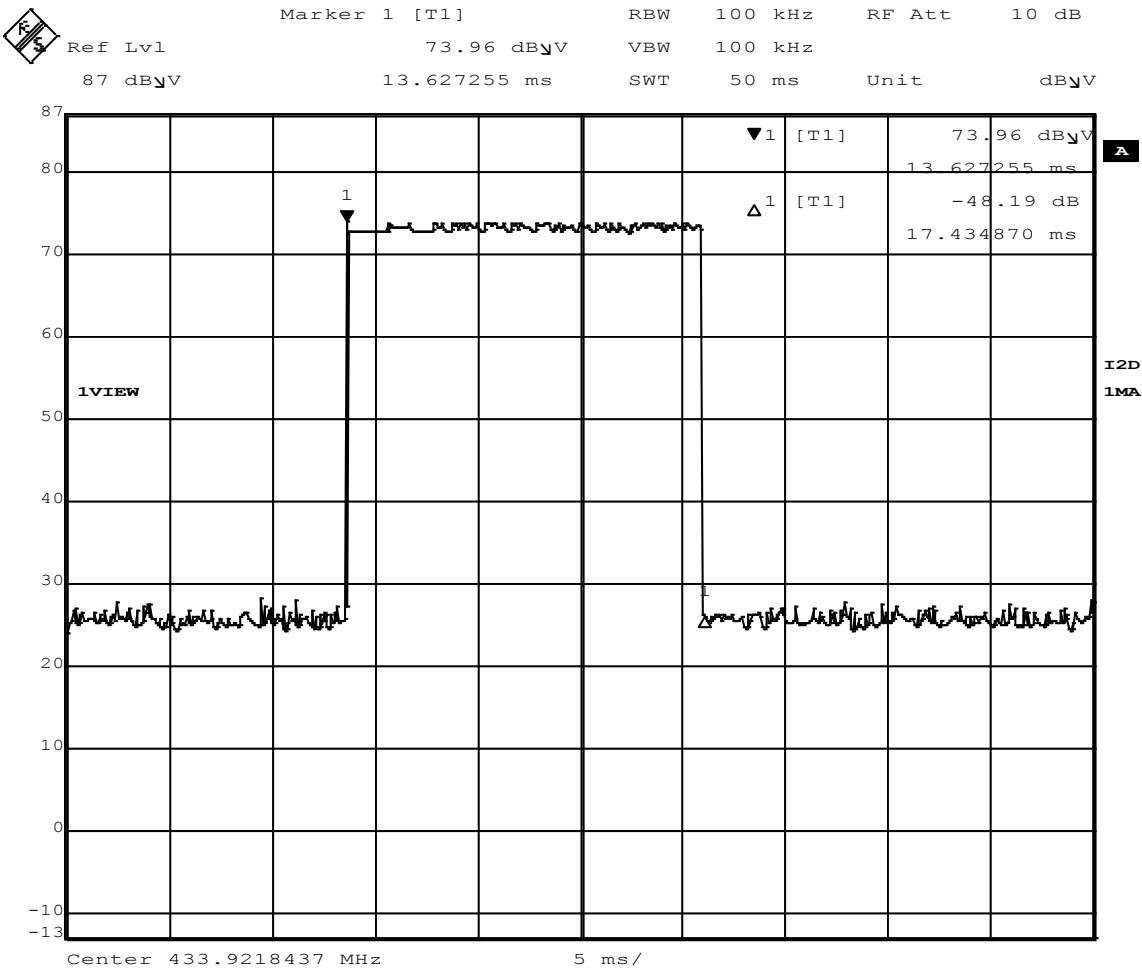


Figure 1 - Transmission Length Plot, 17.43 ms

3.0 Test equipment used

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Rohde & Schwarz Test Receiver	ESI7	100007	2012 JULY 19	2013 JULY 19
EMCO Biconilog Antenna	3142B	1654	2012 JAN 6	2013 JAN 6
EMCO Horn Antenna	3115	6416	2011 SEPT 29	2013 SEPT 29
Rohde & Schwarz Preamplifier	TS-PR18	082001/003	2011 DEC 15*	2012 DEC 15*
Rohde & Schwarz Test Software	ES-K1	2575	Not required	Not required

*Internal characterization

4.0 Detailed results

4.1 15.209, 15.231 Radiated emissions

4.1.1 Limits for radiated emissions measurements

Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

FREQUENCIES (MHz)	FIELD STRENGTH ($\mu\text{V/m}$)	MEASUREMENT DISTANCE (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 * log * Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.
4. The radiated emissions limit according to FCC Part 15.231(b) for a transmitter operating at 433.02MHz is 80.84dB $\mu\text{V/m}$ at a 3m test distance.

4.1.2 Test procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The receive antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.
- d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.
- e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for peak and average detectors at frequencies above 1GHz.

4.1.3 Deviations from test standard

No deviation.

4.1.4 EUT operating conditions

See section 2.5 for details.

4.1.5 Test results

EUT	Talon Remote Foot Control	DATE	2013 SEP 21
MODE	Cont. transmit	FREQUENCY RANGE	30MHz – 5GHz
INPUT POWER (SYSTEM)	3.0 VDC battery	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C	TECHNICIAN	KVepuri

REMARKS:

1. Emission level (dB μ V/m) = Raw Value (dB μ V) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The radiated emissions limit according to FCC Part 15.231(a) is 80.83dB μ V/m for 433.92MHz at a 3m test distance. This applies to an average measurement. See calculations after the chart.

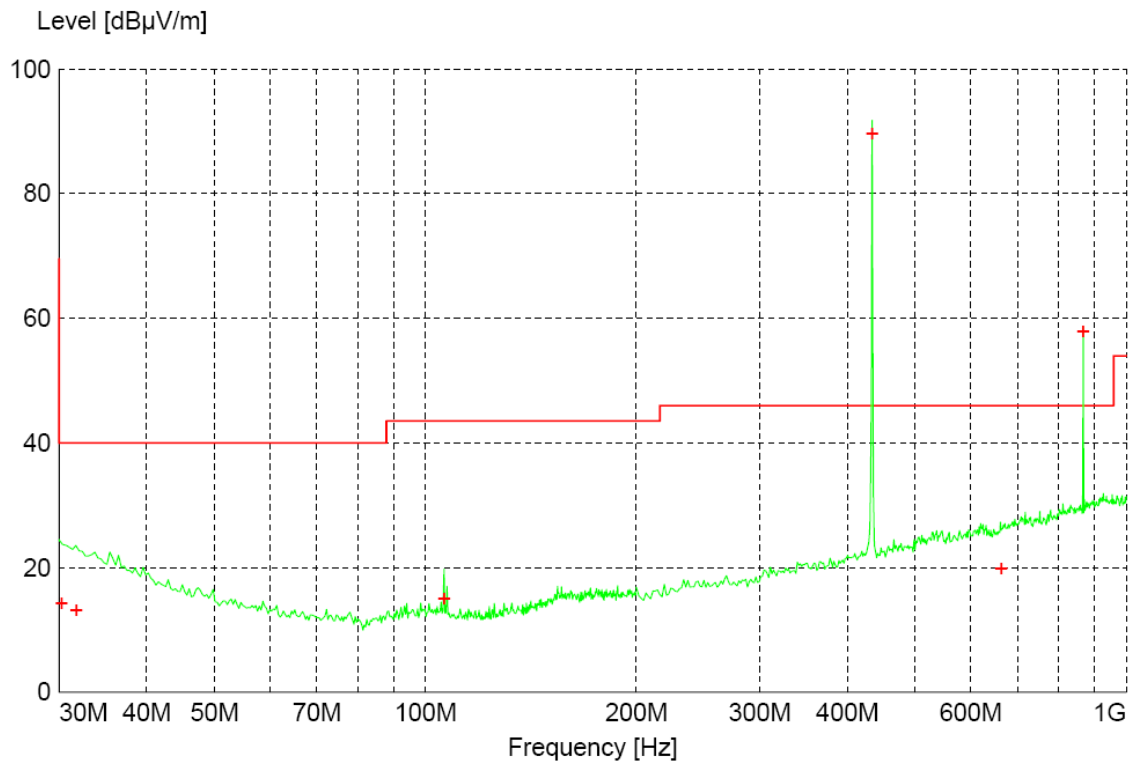


Figure 2 - Radiated Emissions Plot, EUT Orientation 1

Table 1 - Radiated Emissions Quasi-peak Measurements, Transmit Mode

Frequency	Level	Limit	Margin	Height	Angle	Pol	EUT Orientation
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
30.2400	14.07	40.00	25.90	375	274	HORI	EUT Flat
31.7400	13.11	40.00	26.90	394	121	HORI	EUT Flat
106.3200	14.93	43.50	28.60	385	241	VERT	EUT Flat
433.9000	89.47 ₁	100.82	11.35	100	9	HORI	EUT Flat
433.9000	74.30 ₂	80.82	6.50	100	9	HORI	EUT Flat
662.8200	19.79	46.00	26.20	387	0	HORI	EUT Flat
867.7200	57.85	60.82 ₃	-11.80	106	92	HORI	EUT Flat

Note₁: Peak Measurement

Note₂: Average measurement, calculated using peak measurement and duty cycle correction

Averaging factor of -15.17dB was applied to peak field strength measurement. Averaging factor is calculated over a 100ms period per FCC Part 15.35, this is based on the duty cycle as measured in Section 2.6.

$$(20 \times \text{Log}(17.43\text{ms}/100\text{ms})) = \mathbf{-15.17\text{dB}} \text{ (Duty Cycle Correction Factor)}$$

Note₃: Spurious limit from FCC Part 15.231 for frequencies not listed in restricted frequencies from FCC Part 15.205.

Measurements of the fundamental were performed with the EUT in each of three axis. The worse-case orientation was tested also with the EUT powered by its internal 3.0 VDC battery.

Table 2 – Radiated Emissions Average Measurements, 1-5GHz, Transmit Mode

Frequency	Level	Limit	Margin	Height	Angle	Pol	EUT
MHz	dBìV/m	dBìV/m	dB	cm.	deg.		Orientation
1735.5000	35.49	54.00	18.51	163	175	HORI	EUT Flat
2603.5000	40.31	54.00	13.69	100	114	HORI	EUT Flat
3037.0000	42.89	54.00	11.11	99	132	HORI	EUT Flat
3471.0000	44.62	54.00	9.38	200	296	VERT	EUT Flat
3905.0000	47.35	54.00	6.65	153	297	VERT	EUT Flat
4338.5000	44.10	54.00	9.9	128	236	HORI	EUT Flat

Based off of peak measurements with 1517 dB duty cycle factor applied as specified in Note 2 above.

Table 3 – Radiated Emissions Peak Measurements, 1-5GHz, Transmit Mode

Frequency	Level	Limit	Margin	Height	Angle	Pol	EUT
MHz	dBìV/m	dBìV/m	dB	cm.	deg.		Orientation
1735.5000	50.66	74.00	23.30	163	175	HORI	EUT Flat
2603.5000	55.48	74.00	18.50	100	114	HORI	EUT Flat
3037.0000	58.06	74.00	15.90	99	132	HORI	EUT Flat
3471.0000	59.79	74.00	14.20	200	296	VERT	EUT Flat
3905.0000	62.52	74.00	11.50	153	297	VERT	EUT Flat
4338.5000	59.27	74.00	14.70	128	236	HORI	EUT Flat

EUT	Talon Remote Foot Control	DATE	2013 SEP 21
MODE	Stand-by	FREQUENCY RANGE	30MHz – 5GHz
INPUT POWER (SYSTEM)	3.0 VDC battery	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% $\pm$ 5% RH 20 $\pm$ 3°C	TECHNICIAN	KVepuri

REMARKS:

1. Emission level (dB μ V/m) = Raw Value (dB μ V) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The limits shown are from FCC Part 15.109.

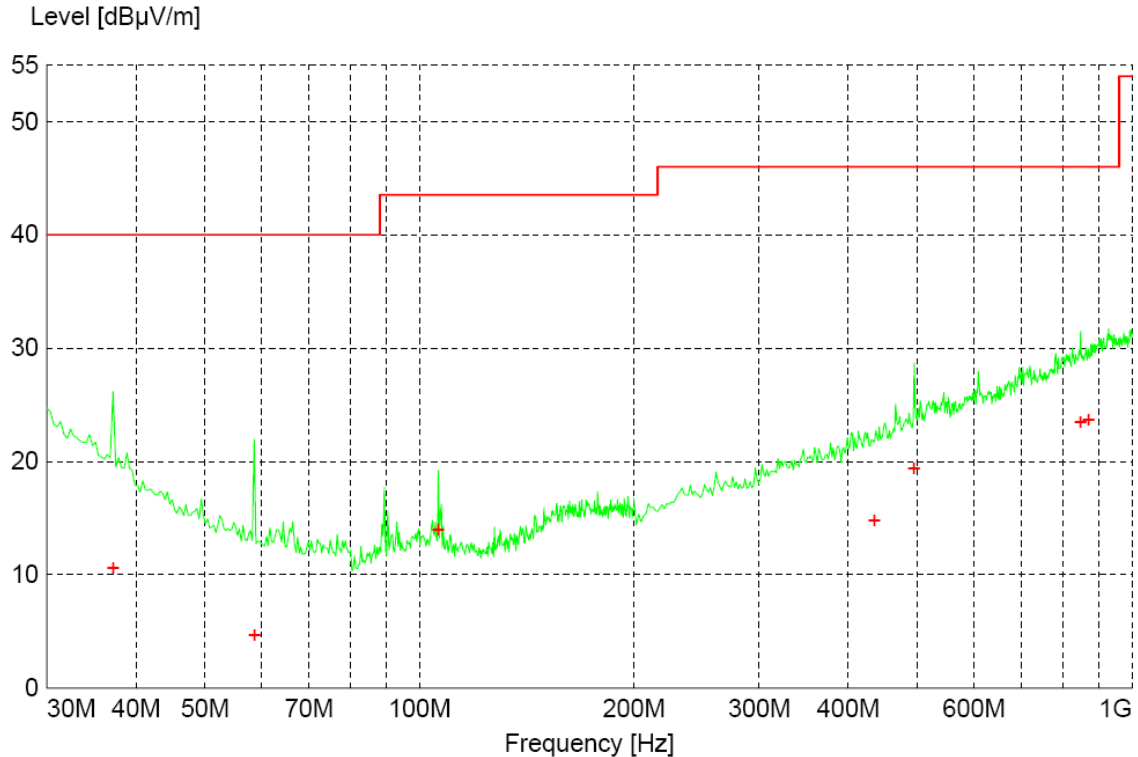
**Figure 3 - Radiated Emissions Plot, Stand-by Mode**

Table 4 - Radiated Emissions Quasi-peak Data, 30MHz - 1GHz, Receive Mode

Frequency	Level	Limit	Margin	Height	Angle	Pol	EUT
MHz	dBiV/m	dBiV/m	dB	cm.	deg.		Orientation
37.1400	10.52	40.00	29.50	397	292	VERT	EUT Flat
58.6800	4.64	40.00	35.40	182	355	HORI	EUT Flat
106.2600	13.92	43.50	29.60	100	253	VERT	EUT Flat
435.0600	14.72	46.00	31.30	281	212	HORI	EUT Flat
494.2800	19.34	46.00	26.70	100	9	VERT	EUT Flat
846.7800	23.37	46.00	22.60	349	236	HORI	EUT Flat
869.1600	23.58	46.00	22.40	332	351	VERT	EUT Flat

Table 5 – Radiated Emissions Peak Measurements, 1-5GHz Stand-by Mode

Frequency	Level	Limit	Margin	Height	Angle	Pol	EUT
MHz	dBiV/m	dBiV/m	dB	cm.	deg.		Orientation
1301.5000	41.20	54.00	12.80	98	208	HORI	EUT Flat
1735.5000	44.60	54.00	9.40	99	322	HORI	EUT Flat
2169.5000	44.80	54.00	9.20	101	130	HORI	EUT Flat

Peak Measurements listed above comply with the average limits, so average measurements were not taken. Peak measurements were also found to comply with the peak field strength limit of 74.00dB μ V/m.

4.2 15.231, Bandwidth

4.2.1 *Limits of bandwidth measurements*

FCC Part 15.231 (c):

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

4.2.2 *Test procedures*

Bandwidth was made as a radiated measurement as specified in Section 4.1. Screen capture was taken at angle/pol/height of maximum emission.

4.2.3 *Deviations from test standard*

No deviation.

4.2.4 *EUT operating conditions*

The EUT was operating in continuous transmit mode.

4.2.5 Test results

EUT	Talon Remote Foot Control	DATE	2012 OCT 19
MODE	Cont. transmit	INPUT POWER (SYSTEM)	3.0 VDC
ENVIRONMENTAL CONDITIONS	45% $\pm$ 5% RH 20 $\pm$ 3°C	TECHNICIAN	KVepuri

Bandwidth

CHANNEL	Bandwidth (kHz)	Limit (kHz) $=0.0025 \times 433.9 \text{ MHz}$
1	432.86	1335.0

NOTE:

The plot does not include transducer factor from receiving antenna or cables. Measurement is relative, so they are not necessary.

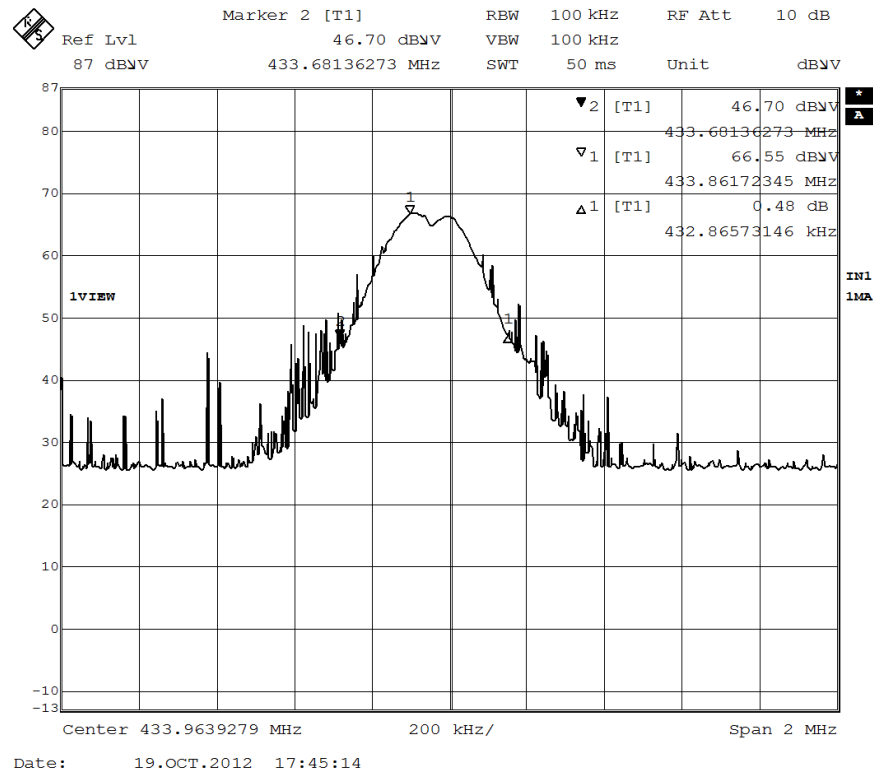


Figure 4 - Bandwidth Measurement

Annex A: Sample Calculations

Radiated Emissions

The field strength is calculated in decibels (dB) by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = R + AF - (-CF + AG)$$

where FS = Field Strength

R = Receiver Amplitude Receiver reading in dB μ V

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Preamplifier Amplifier Gain

Assume a receiver reading of 55.00 dB μ V is obtained. The Antenna Factor of 12.00 and a Cable Factor of 1.10 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.10 dB μ V/m.

$$FS = 55.00 + 12.00 - (-1.10 + 20.00) = 48.10 \text{ dB}\mu\text{V/m}$$

The 48.1 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

Level in μ V/m = Common Antilogarithm [(48.10 dB μ V/m)/20]= 254.1 μ V/m