



**DATE: 23 June 2016**

**I.T.L. (PRODUCT TESTING) LTD.**  
**FCC/IC Radio Test Report**  
**For**

**Orpak Systems Ltd.**

**Equipment under test:**

**Fuel Pump Nozzle Reader NNR  
Back**

**NNR-T + Coil #7; NNR-B + Coil # 7\*;**  
**NNR-T + Coil #6\*; NNR-B + Coil #6\*;**  
**NNR-T + Coil #5\*; NNR-B + Coil #5\*;**  
**NNR-T + Coil #4\*; NNR-B + Coil #4\*;**  
**NNR-T + Coil #3\*; NNR-B + Coil #3\*;**  
**NNR-T + Coil #2\*; NNR-B + Coil #2\*;**  
**NNR-T + Coil #1\*; NNR-B + Coil #1\***

\*See customer's Declaration on page 5

Tested by:

N. Levi

Approved by:

D. Shidowsky

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This report relates only to items tested.



## Measurement/Technical Report for Orpak Systems Ltd.

Fuel Pump Nozzle Reader NNR Back

NNR-T + Coil #7

**FCC ID: W8F800960060**

**IC: 8264A-800960000**

This report concerns:

Original Grant:

Class I Change:

Class II Change:

Equipment type:

FCC: Part 15 Low Power Transmitter Below 1705 kHz

IC: Low Power Transmitter General Field Strength  
Limits (9kHz-30MHz)

Limits used:

47CFR15 Section 15.209

RSS-Gen, Issue 4, 2014

RSS-210, Issue 8, 2010

Measurement procedure used is ANSI C63.4: 2010.

Application for Certification

Applicant for this device:

prepared by:

(different from "prepared by")

R. Pinchuck

Yair Elul

ITL (Product Testing) Ltd.

Orpak Systems Ltd.

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## 1. General Information

### 1.1 Administrative Information

Manufacturer: Orpak Systems Ltd.

Manufacturer's Address: 31 Lechi St.  
P.O.B. 1461  
Bnei-Brak, 51114  
Israel  
Tel: +972-3-577-6868  
Fax: +972-3-579-6310

Manufacturer's Representative: Yair Elul

Equipment Under Test (E.U.T): Fuel Pump Nozzle Reader NNR Back

Equipment Model No.: NNR-T + Coil #7; NNR-B + Coil # 7\*;  
NNR-T + Coil #6\*; NNR-B + Coil #6\*;  
NNR-T + Coil #5\*; NNR-B + Coil #5\*;  
NNR-T + Coil #4\*; NNR-B + Coil #4\*;  
NNR-T + Coil #3\*; NNR-B + Coil #3\*;  
NNR-T + Coil #2\*; NNR-B + Coil #2\*;  
NNR-T + Coil #1\*; NNR-B + Coil #1\*

Equipment Part No.: Not designated

Date of Receipt of E.U.T: 08.03.16

Start of Test: 08.03.16

End of Test: 22.03.16

Test Laboratory Location: I.T.L (Product Testing) Ltd.  
1 Batsheva St.,  
Lod  
ISRAEL 7120101

Test Specifications: FCC Part 15, Subpart C  
RSS-210 Issue 8, 2010  
RSS Gen, Issue 4, 2014

\*See customer's Declaration on following page.



## DECLARATION

Date: June 23, 2016

### I HEREBY DECLARE THE FOLLOWING REGARDING THE BELOW MODELS:

NNR-T + Coil #7; NNR-B + Coil #7;  
NNR-T + Coil #6; NNR-B + Coil #6;  
NNR-T + Coil #5; NNR-B + Coil #5;  
NNR-T + Coil #4; NNR-B + Coil #4;  
NNR-T + Coil #3; NNR-B + Coil #3;  
NNR-T + Coil #2; NNR-B + Coil #2;  
NNR-T + Coil #1; NNR-B + Coil #1

1. All the above models contain the identical 125.00 kHz radio transmitter which is found in the NNR Extra Large+Switch.
2. All the above models contain the identical 2.4 GHz radio transmitter and have the same RF circuitry as the NNR Extra Large+ Switch.
3. The difference between the above models and the NNR Extra Large + Switch is that the 125 kHz coil antenna has been changed and is now connected externally to the device.
4. The NNR-T models are identical to the NNR-B models except for a mechanical switch and the 125kHz coil antenna that is assembled with each model.
5. The differences between the 125kHz coil antennas are as follows:

	Coil type	Coil Diameter	Housing type (according to the fueling nozzle)
1	COIL#1	35x58mm (Rectangular)	Rectangular
2	COIL#2	70mm	70mm
3	COIL#3	90mm	90mm WIGGINS
4	COIL#4	90mm	90mm OPW1290
5	COIL#5	90mm	90mm CT5000
6	COIL#6	90mm	90mm POSILOCK
7	COIL#7	80mm	WIGGINS

Please relate to them (from an EMC/RADIO point of view) as the same product.

Thank you.

Yair Elul  
Engineering Manager  
OrPAK Systems LTD.



## 1.2 *List of Accreditations*

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T1877, G-245
5. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.



### **1.3    *Product Description***

The NNR Back is an add-on device designed to be installed on the dispenser's nozzle. It is a self-powered device that does not require any connections to any other existing components of the dispenser due to its wireless nature. The NNR has only mechanical interface to the nozzle without any wires or electronic interface to the nozzle, dispenser or any other station equipment.

The NNR reads (Frequency: 108 – 131 kHz) the vehicle information from the RFID FuelOpass and after that transmits (Frequency: 2.405-2.480 GHz) it to the WGT over wireless channel.

### **1.4    *Test Methodology***

Radiated testing was performed according to the procedures in RSS Gen, Issue 4, RSS 210, Issue 8, 2010 and ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### **1.5    *Test Facility***

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

### **1.6    *Measurement Uncertainty***

#### **Radiated Emission**

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):  
± 4.98 dB



## 2. System Test Configuration

### 2.1 Justification

The product was originally certified under FCC ID: W8F800960060 issued on 12/30/2015 and under IC: 8264A-800960000 issued on 12/24/2014.

There was no change to the 2.4 GHz transmitter/antenna.

The C2PC change to the original device is that the original LF 125 kHz antenna which had been located in the body of the E.U.T. has been replaced with 7 different coil antennas which are now connected externally.

A FCC C2PC is being requested based on this change.

An IC C2PC is also being requested to add the 14 models listed in Figure 1 below to the existing family certification based on the above change.

The E.U.T. transmits at Low (108.1 kHz), Mid (125.0 kHz) and High (131.1 kHz).

Exploratory radiated emission testing was performed to determine the worst case between the 14 models. According to the results below the worst case was NNR-T + COIL#7, on which full testing was performed.

Unit #	P/N	Description	Result [dBuV]		
			X	Y	Z
1	819260227	NNR-T + COIL#1	76.3	63.6	NA
2	819260220	NNR-B + COIL#1	76.5	76.4	NA
3	819260228	NNT-T + COIL#2	80.3	67.8	NA
4	819260221	NNR-B + COIL#2	81.3	67.8	NA
5	819260231	NNR-T + COIL#5	74.4	65.4	NA
6	819260224	NNR-B + COIL#5	81.6	71.7	NA
7	819260232	NNR-T + COIL#6	84.9	74.9	NA
8	819260225	NNR-B + COIL#6	81.8	70.2	NA
9	819260230	NNR-T + COIL#4	85.7	73	NA
10	819260223	NNR-B + COIL#4	83.4	69.4	NA
11	819260229	NNR-T + COIL#3	78.5	65	NA
12	819260222	NNR-B + COIL#3	82.4	72.3	NA
13	<b>819260233</b>	<b>NNR-T + COIL#7</b>	<b>85.8</b>	72.2	NA
14	819260226	NNR-B + COIL#7	85.3	70.5	NA

Figure 1. Screening Results

### 2.2 EUT Exercise Software

Commands were sent via hyper terminal to the WGT tester to operate the E.U.T.

### 2.3 Special Accessories

No accessories were used.

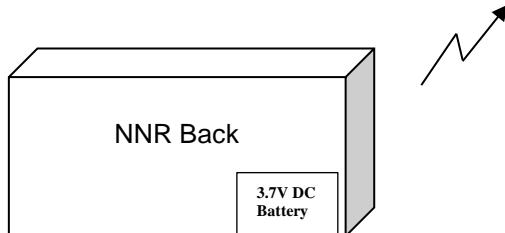


## 2.4 ***Equipment Modifications***

No modifications were needed in order to achieve compliance.

## 2.5 ***Configuration of Tested System***

108.1 kHz, 125.0 kHz, 131.1 kHz



**Figure 2. Configuration of Tested System**

### 3. Test Setup Photos



**Figure 1. Fundamental and Radiated Emission Test Setup**



## 4. Field Strength of Fundamental (125 kHz Transmitter)

### 4.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.209  
RSS Gen, Issue 4, November 2014, Clause 8.9  
RSS 210 Issue 8 Clause 2.5

### 4.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. was placed in a chamber on a table, 1.5 meters above the ground. The EMI receiver was set to the E.U.T. Fundamental Frequency and Peak Detection.

The distance between the E.U.T. and test antenna was 3 meters.

The turntable and antenna were adjusted for maximum level reading on the EMI receiver. The loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.

### 4.3 Test Results

Frequency (kHz)	Reading (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
108.1	84.4	106.1	-21.7
125.0	83.7	105.6	-21.9
131.1	84.2	105.2	-21.0

**Figure 3. Field Strength of Fundamental 125 KHz Transmitter Test Results**

The EUT met the FCC Part 15, Subpart C, Section 15.209, RSS 210 Issue 8 Clause 2.5 and RSS Gen, Issue 4, Clause 8.9 requirements.

JUDGEMENT: Passed by 21.0dB

The details of the highest emissions are given in *Figure 4* to *Figure 6*.



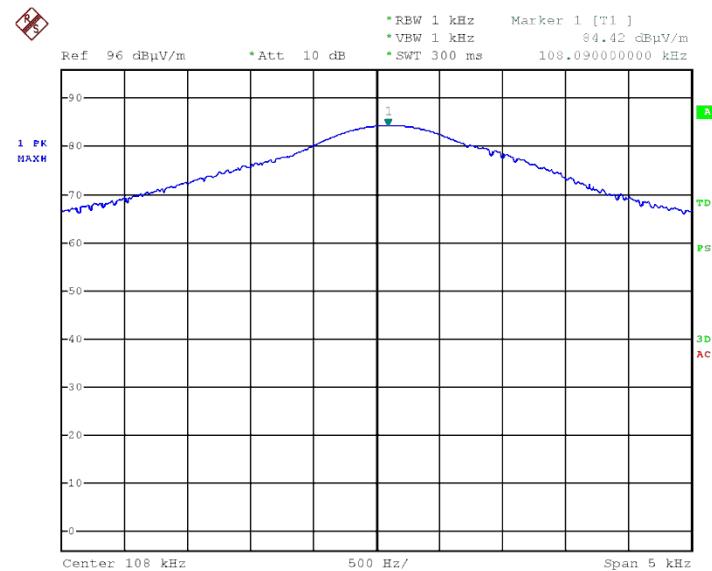
## Field Strength of Fundamental

E.U.T Description      Fuel Pump Nozzle Reader

NNR Back

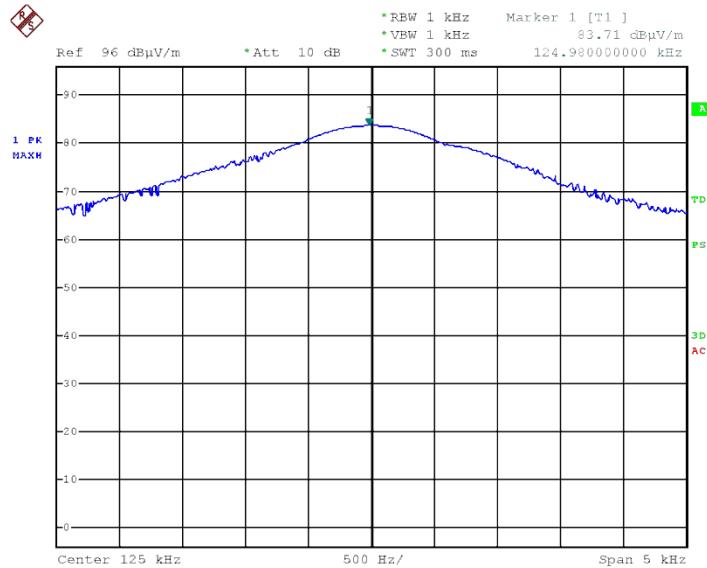
Model Number      NNR-T + Coil #7

Part Number:      Not designated



Date: 8.MAR.2016 10:23:54

**Figure 4. Field Strength of Fundamental, Low, Detector: Peak**



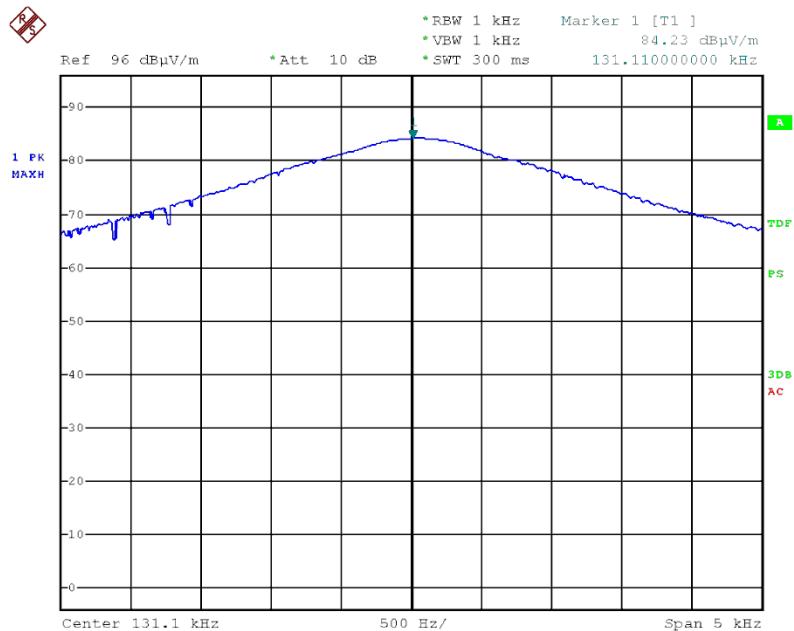
Date: 8.MAR.2016 10:07:36

**Figure 5. Field Strength of Fundamental, Mid, Detector: Peak**



## Field Strength of Fundamental

E.U.T Description      Fuel Pump Nozzle Reader  
                            NNR Back  
Model Number              NNR-T + Coil #7  
Part Number:              Not designated



Date: 8.MAR.2016 10:31:28

**Figure 6. Field Strength of Fundamental, High, Detector: Peak**



#### **4.4 Test Instrumentation Used; Field Strength of Fundamental**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Next Calibration Due</b>
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Loop Antenna	EMCO	6502	9506-2950	November 5, 2015	November 30, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

**Figure 7. Test Equipment Used**



## 5. Radiated Emission, 9 kHz – 30 MHz (125 kHz Transmitter)

### 5.1 Test Specification

FCC, Part 15, Subpart C, Section 209

RSS 210, Issue 8, Clause 2.5

RSS Gen, Issue 4, Clause 8.9

### 5.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

The measurement was performed inside the shielded room at a distance of 3 meters, using peak detection mode and loop antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was placed on a remote-controlled turntable on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in Figure 2.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1.5 meter at a distance of 3 meters.

The E.U.T. was operated at the frequency of 108.1 kHz, 125.0 kHz and 131.1 kHz. These frequencies were measured using a peak detector.

### 5.3 Test Results

JUDGEMENT: Passed by 16.7 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209, RSS 210, Issue 8, Clause 2.5 and RSS Gen, Issue 4, Clause 8.9 specification.

See additional information in *Figure 8*.



## Radiated Emission 9 kHz – 30 MHz, (125 kHz Transmitter)

E.U.T Description      Fuel Pump Nozzle Reader  
                            NNR Back  
Model Number              NNR-T + Coil #7  
Part Number:              Not designated

Specification: FCC, Subpart C, Part 15.209  
RSS 210 Issue 8 Clause 2.5; RSS Gen, Issue 4, Clause 8.9

Antenna Polarization: Horizontal/Vertical      Frequency range: 9 kHz to 30.0 MHz  
Test Distance: 3 meters                              Detector: Peak  
Operation Frequency: 108.1 kHz, 125.0 kHz, 131.1 kHz

Operation Frequency (kHz)	Frequency (kHz)	Peak Reading (dB $\mu$ V/m)	Specification (dB $\mu$ V/m)	Margin (dB)
108.1	324.4	64.2	97.4	-33.2
108.1	536.0	56.3	73.0	-16.7
125.0	374.5	62.7	96.1	-33.4
125.0	626.0	53.3	71.6	-18.3
131.1	393.5	57.3	95.7	-38.4
131.1	655.7	49.6	71.2	-21.6

**Figure 8. Radiated Emission**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.



#### 5.4 **Test Instrumentation Used; Radiated Measurements**

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Loop Antenna	EMCO	6502	9506-2950	November 5, 2015	November 30, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

**Figure 9. Test Equipment Used**

#### 5.5 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dB $\mu$ V/m]  
RA: Receiver Amplitude [dB $\mu$ V]  
AF: Receiving Antenna Correction Factor [dB/m]  
CF: Cable Attenuation Factor [dB]

Example:  $FS = 30.7 \text{ dB}\mu\text{V (RA)} + 14.0 \text{ dB (AF)} + 0.9 \text{ dB (CF)} = 45.6 \text{ dB}\mu\text{V}$

No external pre-amplifiers are used.



## 6. Bandwidth for 125 kHz Transmitter

### 6.1 Test Specification

RSS-Gen Issue 4, Section 6.6, November 2014  
FCC, Subpart C, Part 2.1049

### 6.2 Test Procedure

The transmitter unit was operated with normal modulation. The spectrum analyzer was set to 1 kHz resolution BW and center frequency of the transmitter fundamental. The spectrum bandwidth of the transmitter unit was measured and recorded. The BW was measured at 26dBc (99%) points.

The EUT was set up as shown in *Figure 2*, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on the modulation envelope. The E.U.T was tested in 3 operating frequencies: 108.1 kHz, 125.0 kHz and 131.1 kHz.

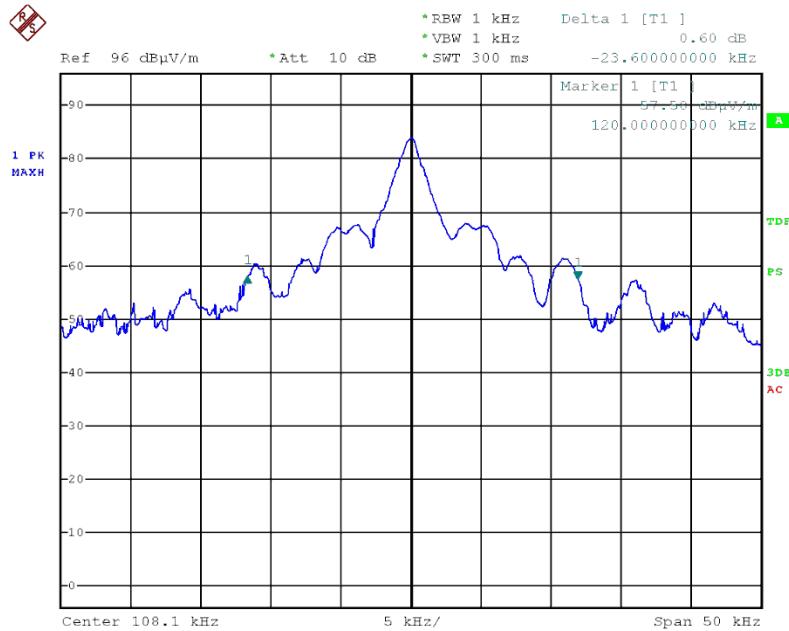
### 6.3 Test Results

FREQUENCY (kHz)	READING (kHz)
108.1	23.6
125.0	26.3
131.1	27.4

**Figure 10. Bandwidth Test Results**

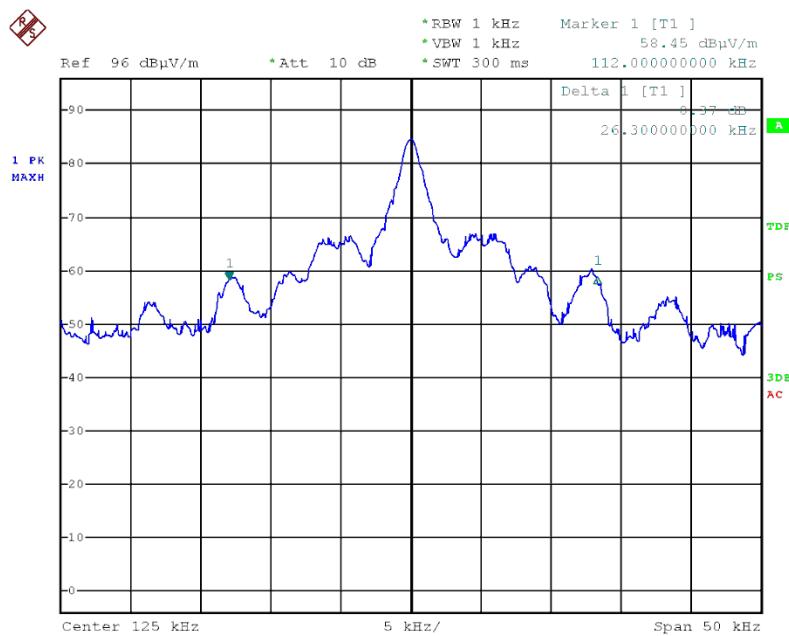
JUDGEMENT: Passed

See additional information in *Figure 11* to *Figure 13*.



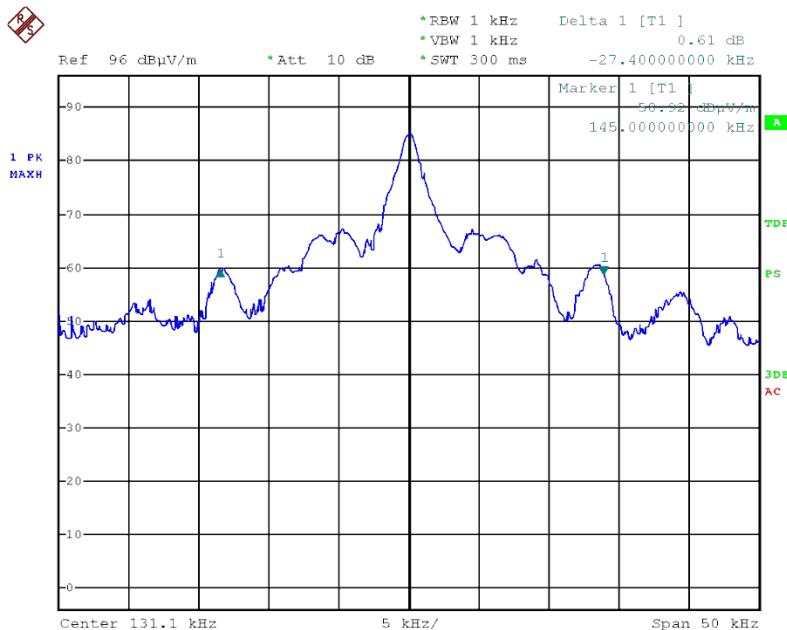
Date: 8.MAR.2016 13:44:26

**Figure 11 Bandwidth – Low Frequency**



Date: 8.MAR.2016 13:51:59

**Figure 12 Bandwidth – Mid Frequency**



Date: 8.MAR.2016 14:17:24

**Figure 13 Bandwidth – High Frequency**



#### 6.4 **Test Equipment Used; Bandwidth**

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Loop Antenna	EMCO	6502	9506-2950	November 5, 2015	November 30, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

**Figure 14 Test Equipment Used**



## 7. APPENDIX A - CORRECTION FACTORS

### 7.1 Correction factor for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
0.010	0.4	50.00	1.2
0.015	0.2	100.00	0.7
0.020	0.2	150.00	2.1
0.030	0.3	200.00	2.3
0.050	0.3	300.00	2.9
0.075	0.3	500.00	3.8
0.100	0.2	750.00	4.8
0.150	0.2	1000.00	5.4
0.200	0.3	1500.00	6.7
0.500	0.4	2000.00	9.0
1.00	0.4	2500.00	9.4
1.50	0.5	3000.00	9.9
2.00	0.5	3500.00	10.2
5.00	0.6	4000.00	11.2
10.00	0.8	4500.00	12.1
15.00	0.9	5000.00	13.1
20.00	0.8	5500.00	13.5
		6000.00	14.5

#### NOTES:

1. The cable type is SPUMA400 RF-11N(X2) and 39m long
2. The cable is manufactured by Huber + Suhner



**7.2 Correction factors for ACTIVE LOOP ANTENNA**  
**Model 6502**  
**S/N 9506-2950**

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2