

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

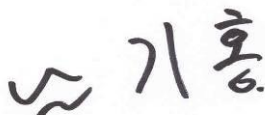
Test Report No. : W165R-D068
AGR No. : A164A-028R2
Applicant : SEOYON ELECTRONICS CO., LTD.
Address : 424, Sinwon-ro, Danwon-gu, Ansan-Si, Kyonggi-Do, South Korea
Manufacturer : SEOYON ELECTRONICS CO., LTD.
Address : 424, Sinwon-ro, Danwon-gu, Ansan-Si, Kyonggi-Do, South Korea
Type of Equipment : FOB-SMART KEY
FCC ID : NYOSYEC4FOB1608
Model No. : SYEC4FOB1608
Serial number : N/A
Total page of Report : 16 pages (including this page)
Date of Incoming : April 11, 2016
Date of issuing : May 26, 2016

SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART C Section 15.231**

This test report contains only the result of a single test of the sample supplied for the examination. It is not a general valid assessment of the features of the respective products of the mass-production.

Reviewed by:



Ki-Hong, Nam / Asst, Chief Engineer
ONETECH Corp.

Approved by:



Sung-Ik, Han/ Managing Director
ONETECH Corp.

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1. VERIFICATION OF COMPLIANCE

APPLICANT : SEOYON ELECTRONICS CO., LTD.
ADDRESS : 424, Sinwon-ro, Danwon-gu, Ansan-Si, Kyonggi-Do, South Korea
CONTACT PERSON : KEUNSU KIM / Assistant Manager
TELEPHONE NO : +82-31-420-3489
FCC ID : NYOSYEC4FOB1608
MODEL NAME : SYEC4FOB1608
BRAND NAME : HYUNDAI
DATE : May 26, 2016

EQUIPMENT CLASS	DSC - Part 15, Security/Remote Control Transmitter
E.U.T. DESCRIPTION	Folding Transmitter
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.231
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m, Semi Anechoic Chamber

The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. GENERAL INFORMATION

2.1 Product Description

The SEOYON ELECTRONICS CO., LTD., Model: SYEC4FOB1608 (referred to as the EUT in this report) is a Transmitter that it controls locking and unlocking the door of a vehicle. Product specification information described herein was obtained from product data sheet or user's manual.

CHASSIS TYPE		Plastic
OPERATING FREQUENCY	TX	433.92 MHz
	RX	134.20 kHz
MODULATION		FSK
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>= 1 MHz)		13.08 MHz
ANTENNA TYPE		PCB Pattern Antenna, LF 3D Antenna
RATED SUPPLY VOLTAGE		DC 3 V from a battery
NUMBER OF LAYERS		4 Layers

2.2 Model Differences:

-. None

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.231

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-666/ T-1842

IC (Industry Canada) – Registration No. Site# 3736-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. SYSTEM TEST CONFIGURATION

3.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	SEOYON ELECTRONICS CO., LTD.	FOB_H1-4B V3.2	N/A

3.2 Peripheral equipment

-. None

3.3 Mode of operation during the test

-. To get a maximum radiated emission from the EUT, the button on the EUT was continuously pressed to transmit the signal. To activate continuous transmission, place a small plastic block between rubber band and the push button on the EUT. To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes. The worst case data is XY axis.

3.4 Equipment Modifications

-. None

3.5 Configuration of Test System

Line Conducted Test:

It is not need to test this requirement, because the EUT shall be operated by DC battery.

Radiated Emission Test:

Preliminary radiated emissions tests were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m semi anechoic chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

Occupied Bandwidth Measurement:

This measurement is performed with the antenna located close enough to give a full-scale deflection of the modulated carrier on the spectrum analyzer. The plot is taken at 20 kHz/division frequency span, 10 kHz resolution bandwidth and 10 dB/division logarithmic display from the spectrum analyzer.

3.6 Antenna Requirement

For intentional device, according to FCC PART 15 SUBPART C Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device

Antenna Construction:

The transmitter antenna of the EUT is a pattern antenna on the main board in the EUT, so no consideration of replacement by the user.

4. PRELIMINARY TEST

4.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
It is not need to test this requirement, because the power of the EUT is supplied from a DC battery.	

4.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
TX Mode	X

5. FINAL RESULT OF MEASUREMENT

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

5.1 Field Strength of the Carrier Test

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 48 % R.H. Temperature: 24 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.231(b)

Result : PASSED

EUT : FOB-SMART KEY

Date: May 09, 2016

Operating Condition : TX mode

Distance : 3 m

Frequency (GHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
433.92	85.10	Peak	H	15.90	5.65	32.31	74.34	80.80	6.46
	78.60	Quasi-Peak	H				67.84	80.80	12.96
	76.00	Peak	V				65.24	80.80	15.56
	69.50	Quasi-Peak	V				58.74	80.80	22.06



Tested by: Seok-Jun, Lee / Engineer

5.2 Transmitter Transmission Duration

Humidity Level : 44.2 % R.H.

Temperature: 23.4 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.231(a)

Result : PASSED

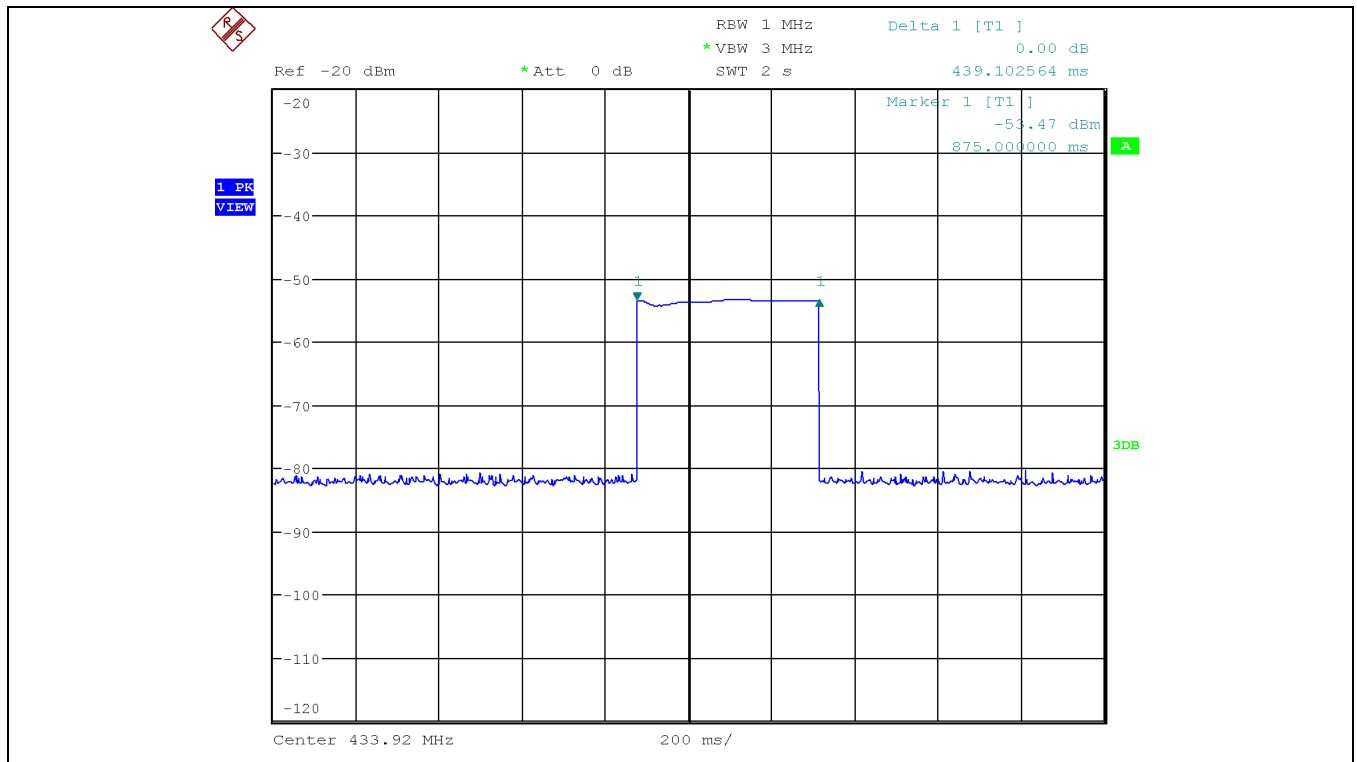
EUT : FOB-SMART KEY

Date: May 10, 2016

Operating Condition : TX mode

Distance : 3 m

Manually Activated Duration (s)	Limit (s)	Margin (s)	Result
0.439	5.0	4.6	Pass



Tested by: Seok-Jun, Lee / Engineer

5.3 Spurious Emission Test

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

5.3.1 Test data for Blow 30 MHz

-. Test Date : May 09, 2016

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Any emissions less than 20 dB below the limit were not observed.									

5.3.2 Test data for 30 MHz to 1 000 MHz

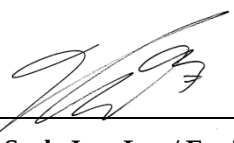
-. Test Date : May 09, 2016

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

-. Measurement distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Any emissions less than 20 dB below the limit were not observed.									


 Tested by: Seok-Jun, Lee / Engineer

5.3.3 Test data for above 1 GHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 48.0 % R.H.

Temperature: 24.0 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.231(b)

Measurement Freq. Range : 1 GHz ~ 4 GHz

Result : PASSED

EUT : FOB-SMART KEY

Date: May 09, 2016

Operating Condition : TX mode

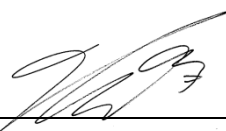
Distance : 3 m

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1 301.76	43.20	Peak	H	25.10	5.50	40.30	33.50	73.98	40.48
	38.50	Average	H				28.80	53.98	25.18
	42.70	Peak	V				33.00	73.98	40.98
	37.60	Average	V				27.90	53.98	26.08
1 735.68	43.80	Peak	H	25.30	6.50	40.30	35.30	73.98	38.68
	39.70	Average	H				31.20	53.98	22.78
	44.90	Peak	V				36.40	73.98	37.58
	40.30	Average	V				31.80	53.98	22.18
2 169.60	51.50	Peak	H	26.10	7.40	40.50	44.50	73.98	29.48
	46.90	Average	H				39.90	53.98	14.08
	43.40	Peak	V				36.40	73.98	37.58
	40.30	Average	V				33.30	53.98	20.68
2 603.52	49.70	Peak	H	27.60	8.00	40.70	44.60	73.98	29.38
	44.80	Average	H				39.70	53.98	14.28
	43.90	Peak	V				38.80	73.98	35.18
	39.50	Average	V				34.40	53.98	19.58
3 037.44	60.10	Peak	H	28.20	8.70	40.70	56.30	73.98	17.68
	55.60	Average	H				51.80	53.98	2.18
	50.70	Peak	V				46.90	73.98	27.08
	44.80	Average	V				41.00	53.98	12.98

3 471.36	52.00	Peak	H	28.20	9.40	40.70	48.90	73.98	25.08
	47.80	Average	H				44.70	53.98	9.28
	48.30	Peak	V				45.20	73.98	28.78
	42.90	Average	V				39.80	53.98	14.18
3 905.28	58.20	Peak	H	29.00	10.10	40.90	56.40	73.98	17.58
	53.00	Average	H				51.20	53.98	2.78
	53.40	Peak	V				51.60	73.98	22.38
	49.30	Average	V				47.50	53.98	6.48

Tabulated test data for Restricted Band

Remark : “H”: Horizontal, “V”: Vertical


Tested by: Seok-Jun, Lee / Engineer

5.4 Bandwidth of the operating frequency

Humidity Level : 44.2 % R.H. Temperature: 23.4 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.231(b)

Result : PASSED

EUT : FOB-SMART KEY

Date: May 10, 2016

Operating Condition : TX mode

Minimum Resolution

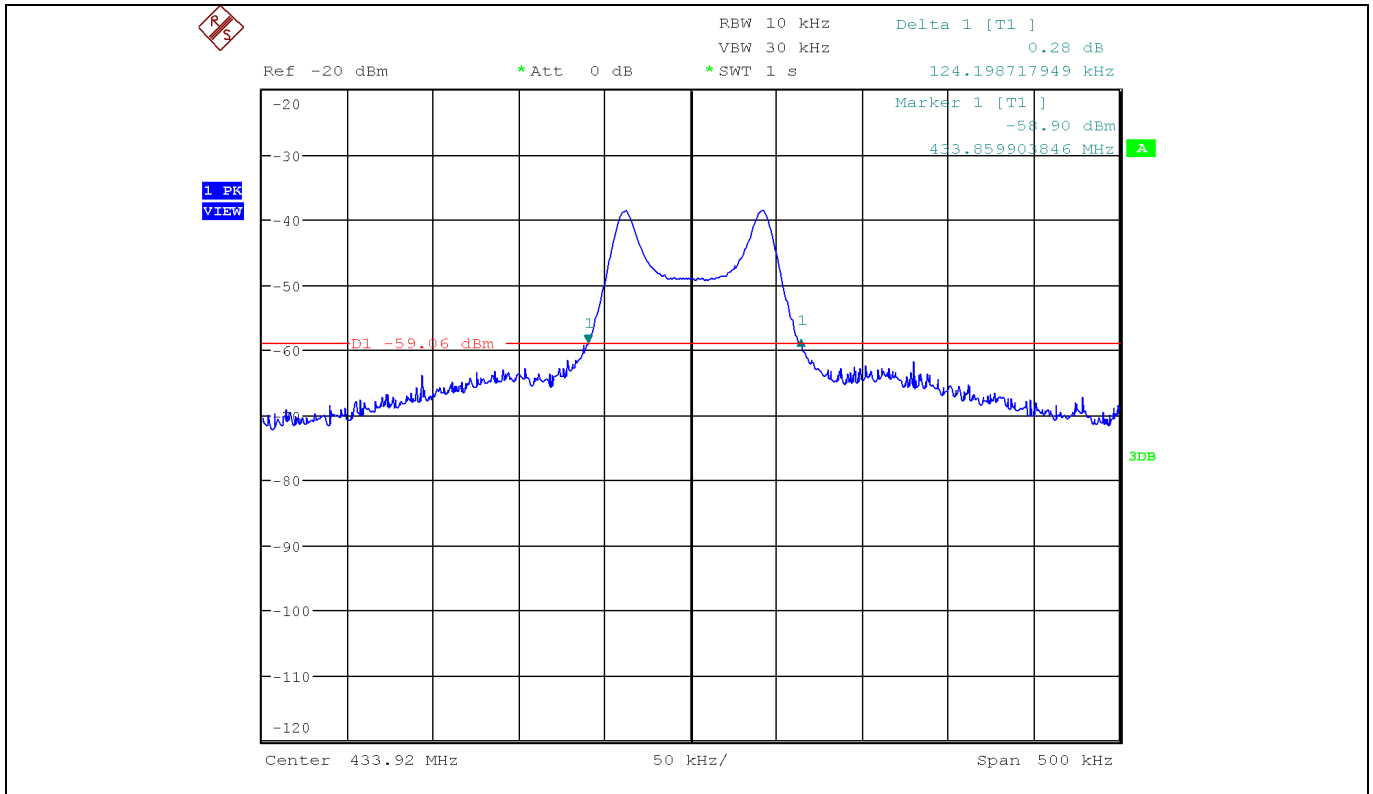
Bandwidth : 10 kHz

Carrier Freq. (MHz)	Bandwidth of the emission. (kHz)	Limit (kHz)	Remark
433.92	124.10	1 084.8	The point 20 dB down from the modulated carrier
433.92	229.90	1 084.8	99 %

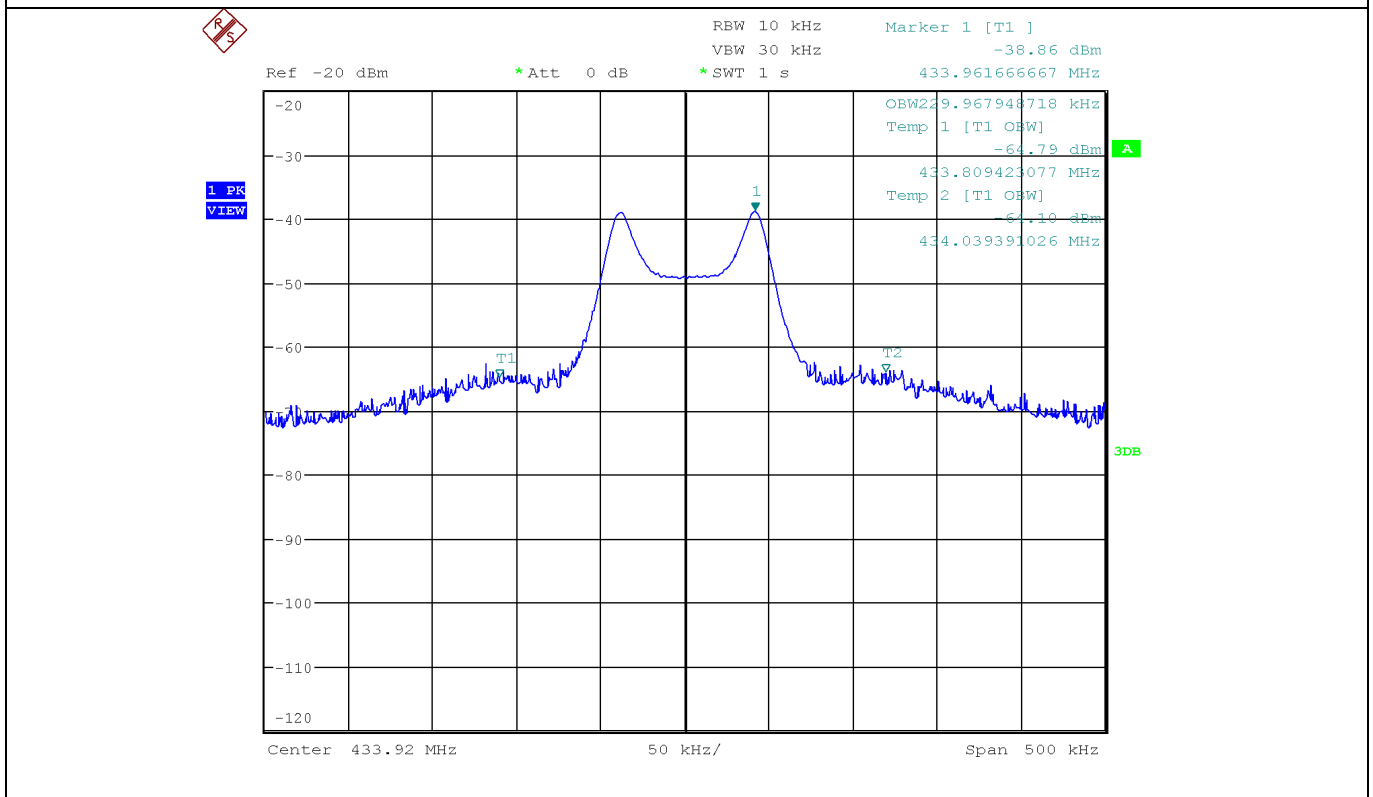
Remark: Please refer to photo data for bandwidth for test data.


Tested by: Seok-Jun, Lee / Engineer

Plotted Data for bandwidth



20 dB Bandwidth



99 % Bandwidth

6. FIELD STRENGTH CALCULATION

Meter readings are compared to the specification limit correcting for antenna and cable losses

+	Meter reading	(dB μ V)
+	Cable Loss	(dB)
+	Antenna Factor (Loss)	(dB/m)
-	Amplifier Gain	(dB)
=	Corrected Reading	(dB μ V/m)
-	Specification Limit	(dB μ V/m)
=	dB Relative to Spec	($\pm$ dB)

7. LIST OF TEST EQUIPMENT

No.	EQUIPMENTS	MFR.	MODEL	SER. NO.	LAST CAL	DUE CAL	USE
1.	Test receiver	R/S	ESCI	101013	Apr. 05, 2016	12MONTH	■
2.	Test Receiver	R/S	ESU	100261	Apr. 06, 2016	12MONTH	■
3.	SPECTRUM ANALYZER	R/S	FSU26	200319	Apr. 04, 2016	12MONTH	■
4.	Amplifier	Sonoma Instrument	310N	312544	Apr. 05, 2016	12MONTH	■
5.	Amplifier	Sonoma Instrument	310N	312545	Apr. 05, 2016	12MONTH	■
6.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-255	May 20, 2016	24MONTH	■
7.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-421	Apr. 15, 2016	24MONTH	■
8.	Controller	Innco System	CO3000	CO3000/904/ 37211215/L	N/A	N/A	■
9.	Turn Table	Innco System	DT3000	930611	N/A	N/A	■
10.	Antenna Master	Innco System	MA-4000XPET	MA4000/509/ 37211215/L	N/A	N/A	■
11.	Antenna Master	Innco System	MA4000-EP	MA4000/332/ 27030611/L	N/A	N/A	■
12.	Pre-Amplifier	R/S	SCU-18	102209	May 31, 2016	12MONTH	■
13.	Horn Antenna	Schwarzbeck	BBHA9120D	BBHA9120D295	Aug. 31, 2015	24MONTH	■
14.	Loop Antenna	R/S	HFH2-Z2	879285/26	Dec. 09, 2014	24MONTH	■