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Report No.: SHEM160600398202
Page: 1 of 17

1 Cover Page

FCC REPORT

Application No.:	SHEM1606003982CR
Applicant:	Huangshan Goldenland Electronics Inc.
FCC ID:	2AI3UTECHO2
Equipment Under Test (EUT): NOTE: The following sample(s) was/were submitted and identified by the client as	
Product Name:	Transmitter
Model No.(EUT):	Echo-2
Standards:	FCC PART 15 Subpart C: 2015
Date of Receipt:	2016-06-22
Date of Test:	2016-06-22 to 2016-11-01
Date of Issue:	2016-11-24
Test Result:	Pass*

*In the configuration tested, the EUT detailed in this report complied with the standards specified above.



Parlam Zhan
E&E Section Manager
SGS-CSTC (Shanghai) Co., Ltd.

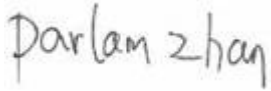
The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00	/	2015-11-24	/	Original

Authorized for issue by:				
Engineer		Eddy Zong		
		Print Name		
Clerk		Vincent Zhu		
		Print Name		
Reviewer		Parlam Zhan		
		Print Name		

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203	-	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10(2013) Section 6.2	N/A
Radiated Emissions	47 CFR Part 15, Subpart C Section 15.209	ANSI C63.10(2013) Section 6.4&6.5&6.6&6.10	PASS
20dB Bandwidth	47 CFR Part 15, Subpart C Section 15.215	ANSI C63.10(2013) Section 6.9.2	PASS

N/A: This EUT is powered by battery only; therefore the test on mains terminals is not applicable.



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5 General Information

5.1 Client Information

Applicant:	Huangshan Goldenland Electronics Inc.
Address of Applicant:	North Industrial Park, HuiZhou District, Huangshan, Anhui Province P.R.China
Manufacturer:	Huangshan Goldenland Electronics Inc.
Address of Manufacturer:	North Industrial Park, HuiZhou District, Huangshan, Anhui Province P.R.China
Factory:	Huangshan Goldenland Electronics Inc.
Address of Factory:	North Industrial Park, HuiZhou District, Huangshan, Anhui Province P.R.China

5.2 General Description of E.U.T.

Product Description:	Fixed product with 4KHz, 19KHz, 30KHz transmitting function
Rated Input:	DC 3V by 2*1.5V R14P size C battery Supply the EUT with new battery during the testing.

5.3 Technical Specifications:

Operation Frequency:	19KHz-30KHz
Number of Channel:	2
Channel Frequency:	19KHz, 30KHz
Modulation Type:	PM
Antenna Type	Integral Antenna

5.4 E.U.T Operation Mode

Engineering Mode	Keep EUT working in continuous transmitting mode.
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5.5 Description of Support Units

The EUT has been tested independently.

5.6 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.

588 West Jindu Road, Xinqiao, Songjiang, 201612 Shanghai, China.

Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

No tests were sub-contracted.

5.7 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **FCC – Registration No.: 402683**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered and fully described in a report filed with the Federal Communications Commission (FCC). The acceptance letter from the FCC is maintained in our files. Registration No.: 402683.

- **Industry Canada (IC) – IC Assigned Code: 8617A**

The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 8617A-1.

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-3868, C-4336, T-2221, G-830 respectively.

5.8 Measurement Uncertainty

No.	Parameter	Measurement Uncertainty
1	Radio Frequency	$< \pm 1 \times 10^{-5}$
2	Total RF power, conducted	$< \pm 1.5 \text{ dB}$
3	RF power density, conducted	$< \pm 3 \text{ dB}$
4	Spurious emissions, conducted	$< \pm 3 \text{ dB}$
5	All emissions, radiated	$< \pm 6 \text{ dB}$ (Below 1GHz) $< \pm 6 \text{ dB}$ (Above 1GHz)
6	Temperature	$< \pm 1^{\circ}\text{C}$
7	Humidity	$< \pm 5 \%$
8	DC and low frequency voltages	$< \pm 3 \%$

6 Equipments List

No.	Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date	Cal. Due date
1	Power Meter	R&S	NRP	SHEM057-1	2016-01-14	2017-01-13
2	Power Meter Sensor	R&S	NRP-Z22	SHEM136-1	2016-08-12	2017-08-11
3	Spectrum Analyzer	R&S	FSP-30	SHEM002-1	2016-01-14	2017-01-13
4	EMI Receiver	R&S	ESU40	SHEM051-1	2016-01-16	2017-01-15
5	EMI Receiver	R&S	ESR7	SHEM162-1	2016-01-14	2017-01-13
6	LISN	SCHWARZBECK	NSLK8127	SHEM061-1	2016-01-14	2017-01-13
7	LISN	EMCO	3816/2	SHEM019-1	2016-01-14	2017-01-13
8	Loop Antenna (9kHz to 30MHz)	R&S	FMZB1519	SHEM135-1	2016-01-18	2017-01-17
9	Broadband Antenna (25MHz to 2GHz)	SCHWARZBECK	VULB9168	SHEM048-1	2016-01-16	2017-01-15
10	Broadband Antenna (25MHz to 3GHz)	R&S	HL562	SHEM010-1	2016-01-16	2017-01-15
11	Horn Antenna (1GHz to 18GHz)	R&S	HF906	SHEM009-1	2016-01-16	2017-01-15
12	Horn Antenna (1GHz to 18GHz)	SCHWARZBECK	BBHA9120D	SHEM050-1	2016-01-16	2017-01-15
13	Horn Antenna (14GHz to 40GHz)	SCHWARZBECK	BBHA 9170	SHEM049-1	2016-01-16	2017-01-15
14	Pre-amplifier (9KHz – 2GHz)	TESEQ	LNA6900	SHEM074-1	2016-01-14	2017-01-13
15	Pre-amplifier (1GHz – 26.5GHz)	SCHWARZBECK	F0118-G40-BZ4	SHEM049-2	2016-01-14	2017-01-13
16	Pre-amplifier (14GHz – 40GHz)	SCHWARZBECK	F1840-G35-BZ3	SHEM050-2	2016-01-14	2017-01-13
17	Low Pass Filter	Mini-Circuits	VLF-2500	SHEM114-1		
18	High Pass Filter	LORCH	5BRX-2400	SHEM155-1	/	/
19	High-low Temperature Cabinet	Suzhou Zhihe	TL-40	SHEM087-1	2016-08-15	2017-08-14
20	AC Power Stabilizer	WOCEN	6100	SHEM045-1	2016-01-14	2017-01-13
21	DC Power Supply	QJE	QJ30003SII	SHEM046-1	2016-01-14	2017-01-13
22	Signal Generator (Interferer)	R&S	SMR40	SHEM058-1	2016-08-12	2017-08-11
23	Signal Generator (Blocker)	R&S	SMJ100A	SHEM141-1	2016-01-14	2017-01-13
24	Splitter	ANRITSU CORP	MA1612A	SHEM159-1	/	/
25	Coupler	Mini-Circuits	803-S-1	SHEM113-1	/	/

7 Test results and Measurement Data

7.1 Antenna Requirement

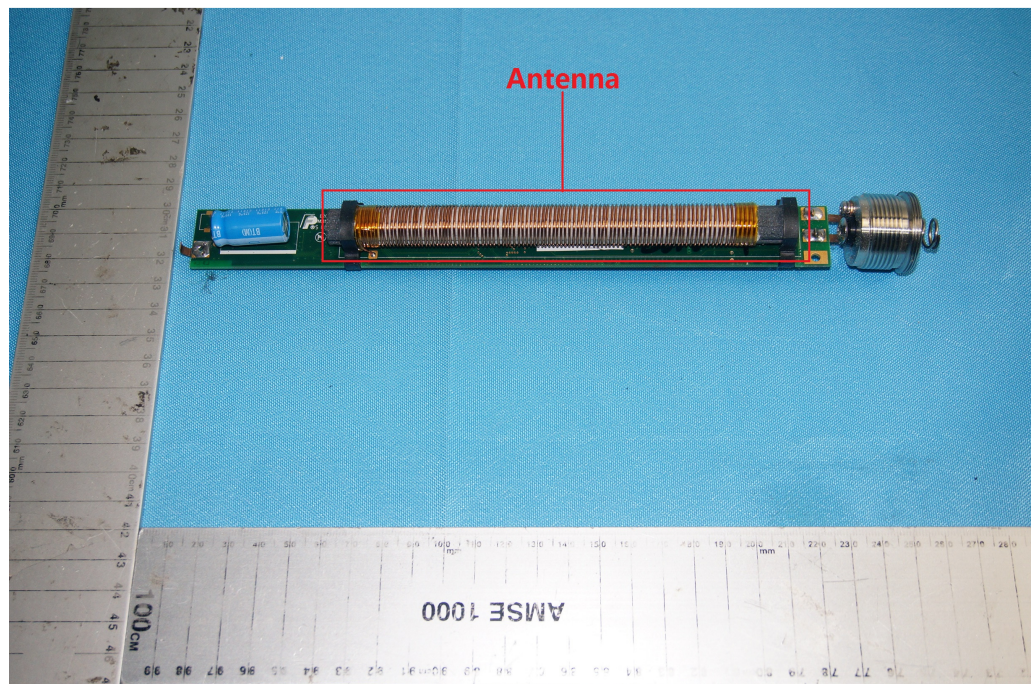
Standard requirement: 47 CFR Part 15C Section 15.203

15.203 Requirement: 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is integrated loop antenna and no consideration of replacement.

Antenna Configuration:



7.2 Conducted Emissions

Test Frequency Range: 150kHz to 30MHz

Limit:

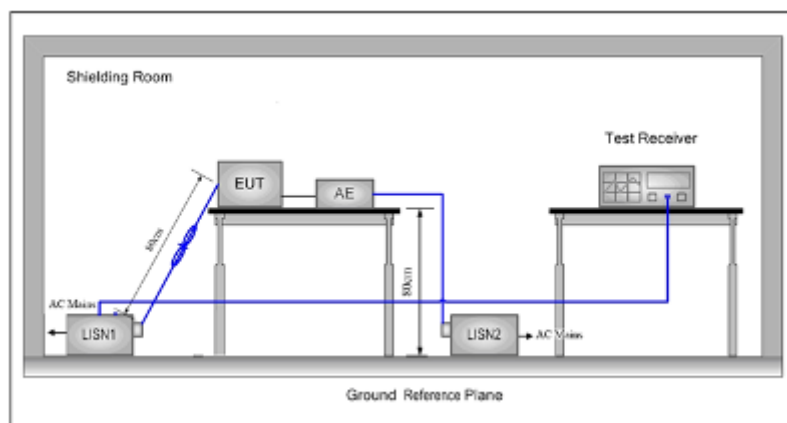
Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Procedure:

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2009 on conducted measurement.

Test Setup:



Test Results:

N/A

Measurement Data:

This EUT is powered by battery only; therefore the test on mains terminals is not applicable.

7.3 Radiated Emissions

Test frequency range: 9KHz – 1GHz

Test Site: Measurement Distance: 3m

Receiver Setup:

Frequency (MHz)	RBW	VBW	Detector
0.009-0.015	200Hz	1KHz	Quasi-peak
0.015-30	9kHz	30KHz	Quasi-peak
30-1000	120 kHz	300KHz	Quasi-peak

Note: The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector. For the frequency bands 9~90 kHz, 110~490 kHz and above 1000 MHz, the radiated emission limits are based on measurements employing an average detector.

Limit:

Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)	Limit @3m (dBμV/m)
0.009-0.490	2400/F(kHz)	300	128.5 ~ 93.8
0.490-1.705	24000/F(kHz)	30	73.8 ~63.0
1.705-30	30	30	69.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
960-1000	500	3	54.0

NOTE:

(1) For test distance other than what is specified, but fulfilling the requirements of section 15.31(f) (2) the field strength is calculated by adding additionally an extrapolation factor of 40dB/decade (inverse linear distance for field strength measurements).

So the Distance Extrapolation Factor in dB is $40 \cdot \log(D_{TEST} / D_{SPEC})$

where D_{TEST} = Test Distance and D_{SPEC} = Specified Distance.

Field strength limit (dBμV/m)@test distance= Field strength limit (dBμV/m)@specified distance -Distance Extrapolation Factor

(2) The lower limit shall apply at the transition frequencies.

Test Procedure:

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna 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 set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified

- Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
 - g. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.

Test Setup:

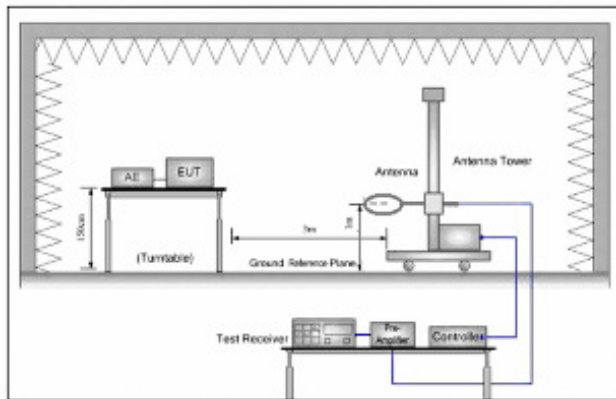


Figure 1. Below 30MHz

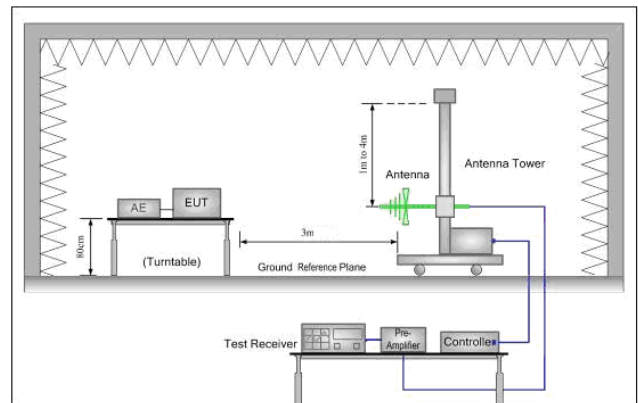
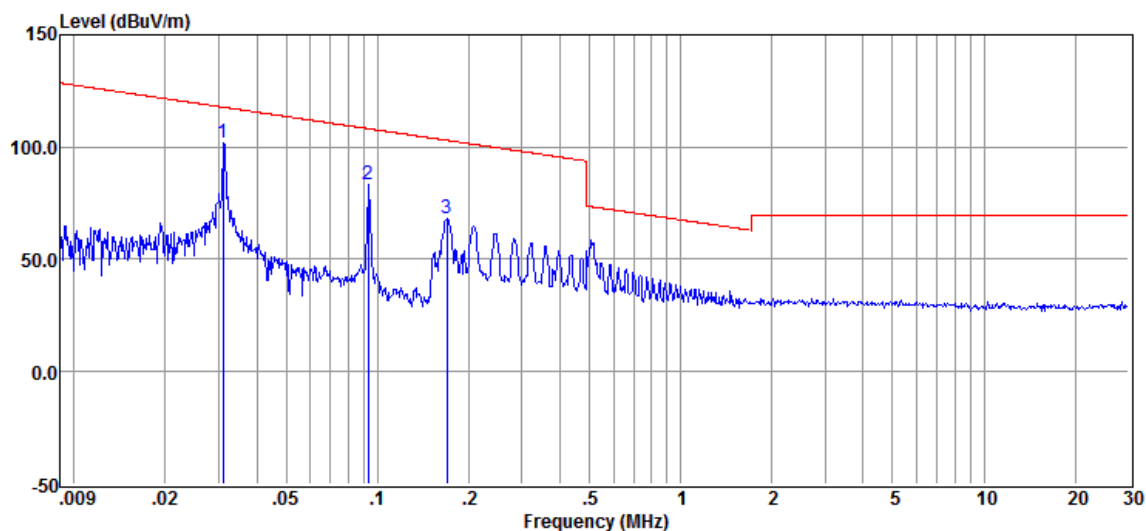


Figure 2. 30MHz to 1GHz

Test Results: Pass

Measurement Data

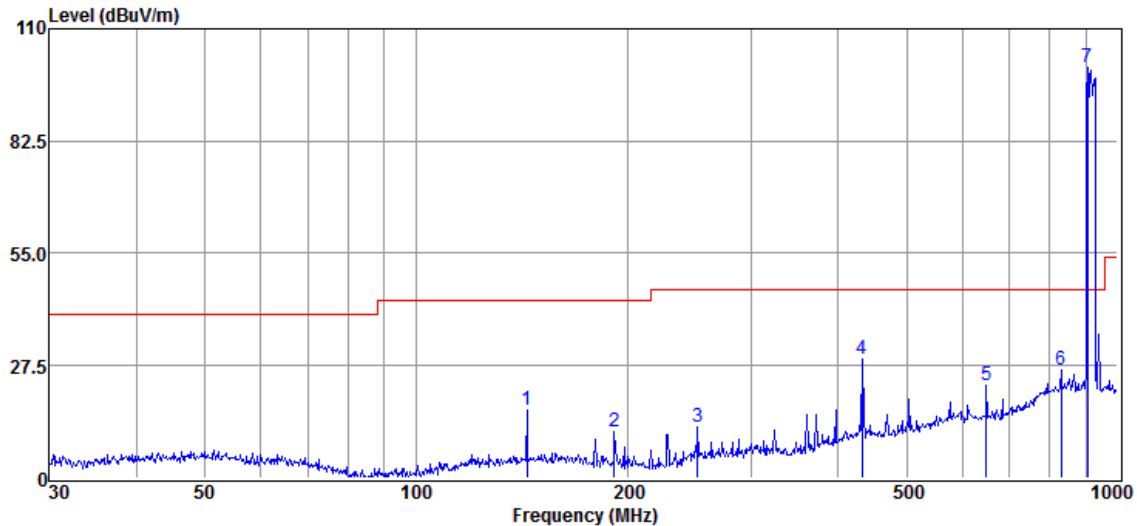
X:



Item	Freq.	Read Level	Antenna Factor	Preamplifier Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.03	81.67	20.26	0.00	0.10	102.03	117.80	-15.77	QP
2	0.09	63.20	19.82	0.00	0.10	83.12	108.22	-25.10	QP
3	0.17	47.89	19.95	0.00	0.10	67.94	103.01	-35.07	QP

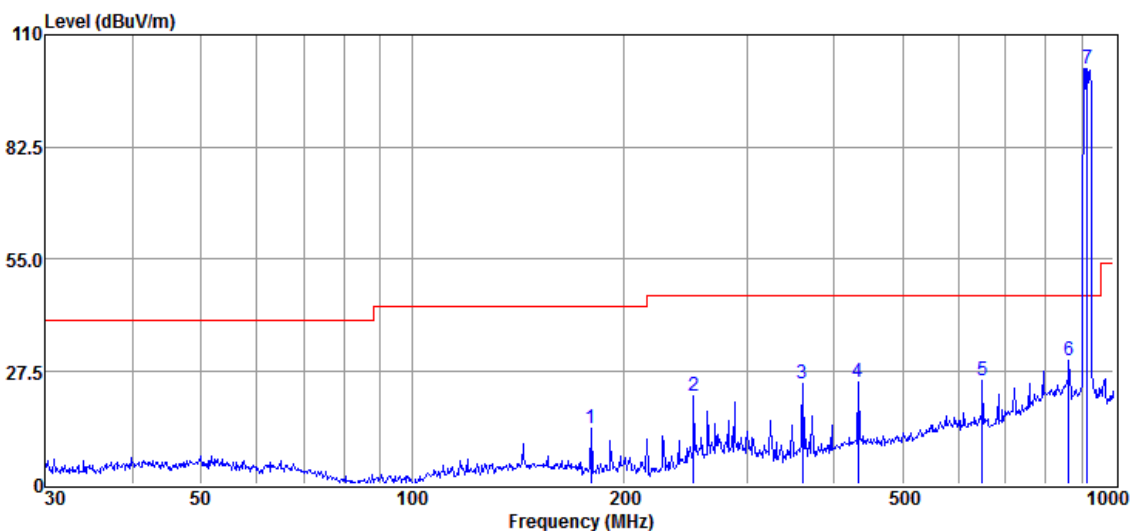
30MHz-1GHz:

Vertical:



Item	Freq.	Read Level	Antenna Factor	Preamplifier Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1	143.83	46.05	12.50	43.50	1.46	16.51	43.50	-26.99	QP
2	191.75	41.91	11.04	43.42	1.73	11.26	43.50	-32.24	QP
3	252.06	41.77	12.12	43.35	2.04	12.58	46.00	-33.42	QP
4	432.55	53.53	16.11	43.22	2.76	29.18	46.00	-16.82	QP
5	649.66	42.19	20.40	43.11	3.38	22.86	46.00	-23.14	QP
6	830.40	41.82	23.80	43.05	3.92	26.49	46.00	-19.51	QP
7	906.48	116.31	23.04	43.03	4.12	100.44	Fundamental signal		

Horizontal:



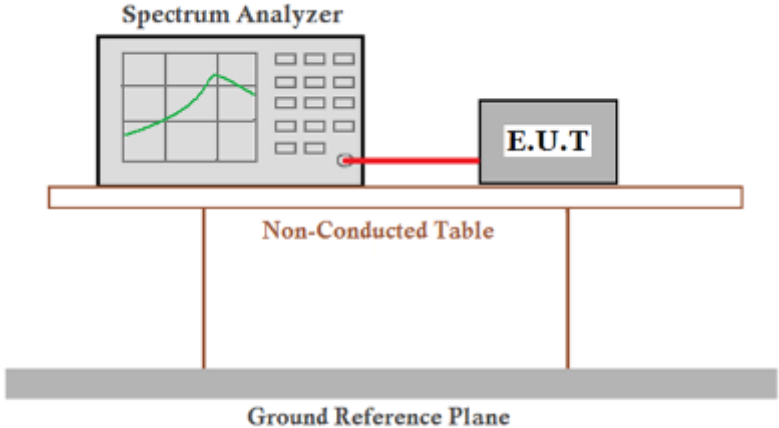
Item	Freq.	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1	180.02	44.34	10.90	43.44	1.69	13.49	43.50	-30.01	QP
2	252.06	50.79	12.12	43.35	2.04	21.60	46.00	-24.40	QP
3	360.45	52.60	12.70	43.26	2.43	24.47	46.00	-21.53	QP
4	432.55	49.40	16.11	43.22	2.76	25.05	46.00	-20.95	QP
5	649.66	44.62	20.40	43.11	3.38	25.29	46.00	-20.71	QP
6	863.06	45.94	23.32	43.04	3.96	30.18	46.00	-15.82	QP
7	916.07	117.42	23.31	43.02	4.13	101.84	Fundamental signal		

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

$$\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Preamplifier Factor}$$

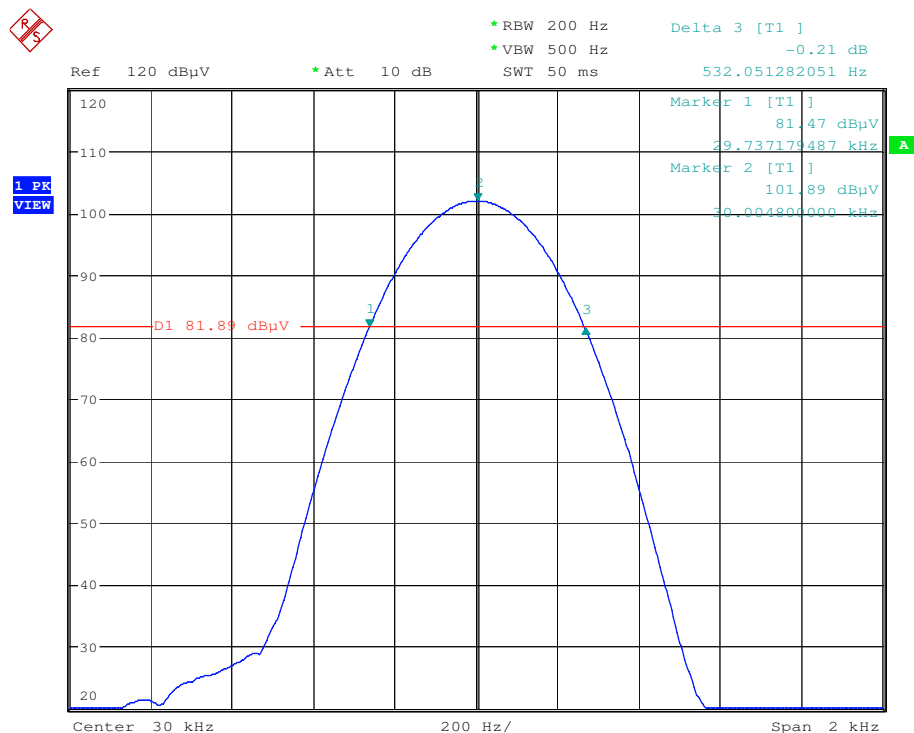
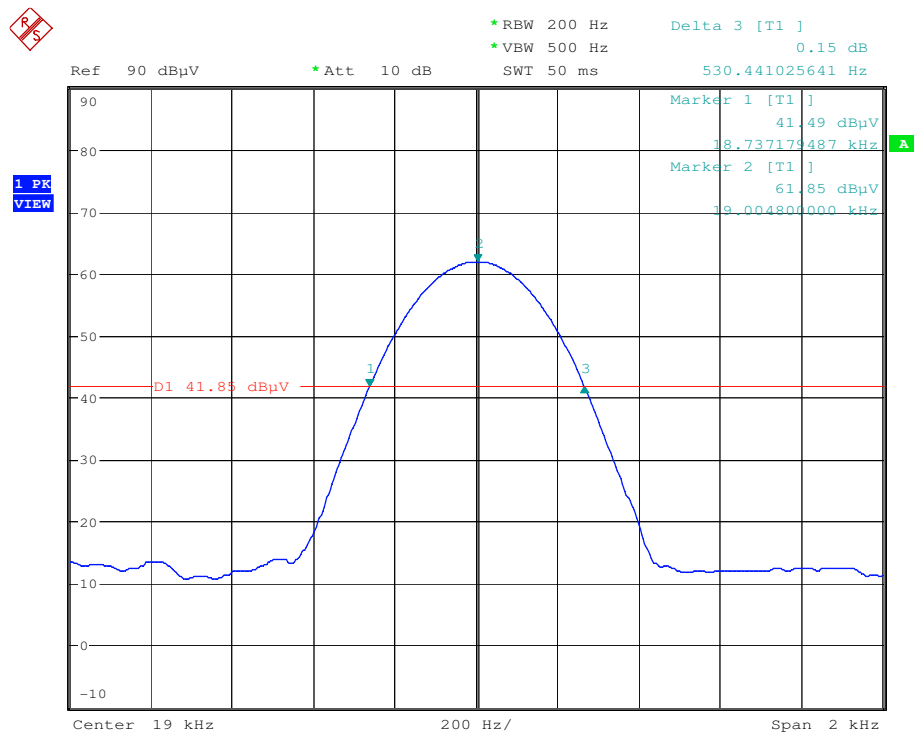
7.4 20dB Bandwidth

Test Setup:	
Frequency Range:	19k-30kHz
Requirements:	Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §15.217 through §15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.
Test Result:	Pass

Measurement Data:

Test Frequency	20dB bandwidth (Hz)	Result
19kHz	530.44	Pass
30kHz	532.05	Pass

Test plot as follows:





8 Test Setup Photographs

Refer to the < Echo-2 _Test Setup Photos-FCC>

9 EUT Constructional Details

Refer to the < Echo-2 _External Photos> & < Echo-2 _Internal Photos>.

--End of the Report--