FCC PART 15 Subpart C

EMI MEASUREMENT AND TEST REPORT

For

Shenzhen Shidean Technology Industries Co., Ltd.

Block B9, Shahe Industrial Zone Baishizhou, Nan Shan District,
Shenzhen, P. R. China

FCC ID: P2MSD-690D4

November 13, 2001

This Report Concerns:	**Equipment Type:**
☒ Original Report	Wireless Observation System

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1 – General Information

1.1 Product Description for Equipment Under Test (EUT)

The S*henzhen Shidean Technology Industries Co., Ltd.* s product, FCC ID: P2MSD-690D4 or the "EUT" as referred to in this report is a 2.4GHz wireless observation system which consists of two parts. One part is transmitter (SD-690D4) which measures approximately 5.9'L x 2.75'W x 2.1'H. The other part is receiver (SD-680R3) which measures approximately 8.0'L x 6.75'W x 9.0'H.

1.2 Objective

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the 2.4 GHz wireless observation system. The EMI measurements were performed according to the measurement procedure described in ANSI C63.6: 1992.

The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the specification limits defined by FCC Title 47, Part 15, Subpart C, section 15.203, 15.205, 15.207, and 15.249.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Suite 2, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 22: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8564E	08303	12/6/2001
HP	Spectrum Analyzer	8593B	2919A00242	12/20/2001
HP	Amplifier	8349B	2644A02662	12/20/2001
HP	Quasi-Peak Adapter	85650A	917059	12/6/2001
HP	Amplifier	8447E	1937A01046	12/6/2001
A.H. System	Horn Antenna	SAS0200/571	261	12/27/2001
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/2002
Com-Power	Biconical Antenna	AB-100	14012	11/2/2002
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/2001
Com-Power	LISN	LI-200	12208	12/20/2001
Com-Power	LISN	LI-200	12005	12/20/2001
BACL	Data Entry Software	DES1	0001	12/20/2001

*** Statement of Traceability: Bay Area Compliance Laboratory Corp.** certifies all calibration has been performed using suitable standards traceable to the NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST).

2 – System Test Configuration

2.1 Description of Test Configuration

The EUT was configured for testing in a typical fashion (as normally used by a typical user).

Transmitter being tested: The EUT 2.4GHz wireless observation system – Transmitter, Model SD-690D4, was placed on the wooden table and tested in three orthogonal axis. The Low, middle, and high channels were tested. The handset was transmitting to and receiving from the Base unit. The EUT was investigated for emissions. The conducted as well as radiated data was taken in this mode of operation. All initial and final investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the 2.5.

Receiver being tested: The EUT 2.4 GHz wireless observation system – Receiver, Model SD-680R3, was placed on the wooden table. The Low, middle, and high channels were tested. The receiver was connected to an AC adapter via its power port. The receiver was receiving from the 2.4 GHz wireless observation system – Transmitter. The conducted as well as radiated data was taken in this mode of operation. All initial and final investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the 2.4.

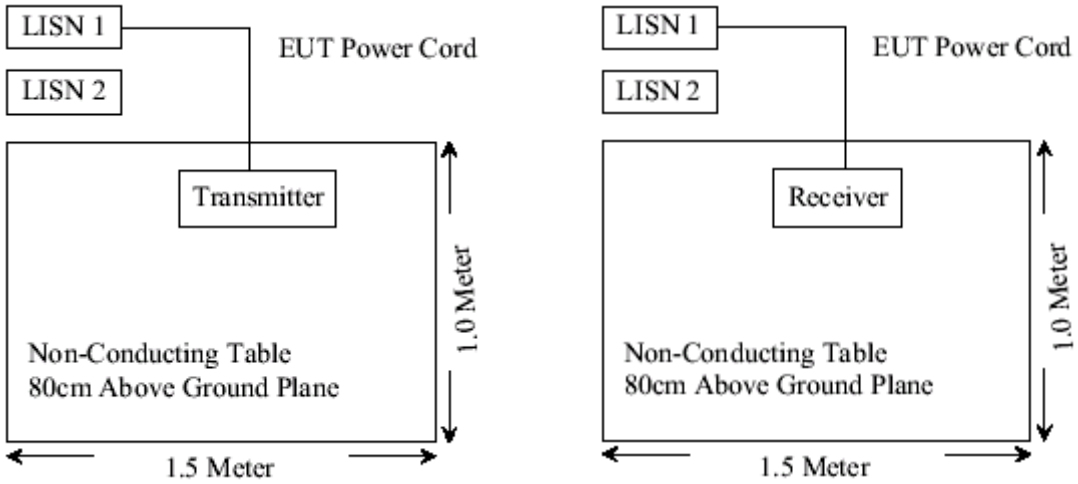
The EUT was tested with KTC AC/DC power adapter during the final testing configuration to represent the worst case result.

2.2 Equipment Modifications

No modification(s) to the EUT were made to comply with the applicable limits.

2.3 Configuration of Test System

2.4 Test Setup Block Diagram



3 – Test Summary

FCC RULES	REQUIREMENTS	RESULTS
§15.249 (a)	The 2.4GHz filed strength of emissions from intentional radiators operated within these frequency bands shall comply with the flowing: Field strength of fundamental (millivolts/meter): 50 Field strength of harmonics (microvolts/meter): 50	Complied
§15.249 (b)	Filed strength limits are specified at a distance of 3 meters	Complied
§15.249 (c)	Emissions radiated outside of the specified frequency bands, except fro harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation	Complied
§15.209	The emissions from an intentional radiator shall not exceed the field strength levels specified hereinafter: 30-88MHz: 100 (microvolts/meter) 3 meter 88-216MHz: 150 (microvolts/meter) 3 meter 216-960MHz: 200 (microvolts/meter) 3 meter above 960MHz: 500 (microvolts/meter) 3 meter	Complied
§15.249 (d)	As shown in §15.35(b), for frequencies above 1000 MHz, the above filed strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.	Complied
§15.35	On any frequency of frequencies above 1000MHz,, the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in the regulations, including emission measurements below 1000MHz, there is also a limits on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maxim permitted average limits for the frequency being investigated unless a different peak emission limits is otherwise specified. Unless otherwise specified, measurements above 1000MHz shall be performed using a minimum resolution bandwidth of 1MHz. Measurements of AC power line conducted emissions are performed using a CISPR quasi-peak detector, even for devices for which average radiated emission measurements are specified.	Complied
§15.203	Fixed and Permanent Antenna	Complied

* The test data was only good for the test sample. It may have deviation for other test samples.

4 – Conducted Emissions Test Data

4.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ±2.4 dB.

4.2 EUT Setup

The measurement was performed at the **O**pen **A**rea **T**est **S**ite, using the same setup per ANSI C63.4 - 1992 measurement procedure. Specification used was with the FCC Class B limits.

The transmitter was connected to 110VAC/60Hz power source and was placed on the center back edge of the test table.

The receiver was connected to 110VAC/60Hz power source and was placed on the center back edge of the test table.

The spacing between the peripherals was 10 centimeters.

External Input / Output cables were draped over edge of the test table and bundle when necessary.

4.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conducted emission test:

Start Frequency	450 kHz
Stop Frequency	30 MHz
Sweep Speed	Auto
IF Bandwidth	100 kHz
Video Bandwidth	100 kHz
Quasi-Peak Adapter Bandwidth	9 kHz
Quasi-Peak Adapter Mode	Normal

4.4 Test Procedure

During the conducted emission test, the EUT power cord was connected to the auxiliary outlet of the first LISN with all support equipment power cords connected to the second.

The EUT was tested with the *KTC*(KA12D150050044U) power adapter to represent worst case results for the final qualification test. Therefore, these results were used for final test data recorded in the table listed under section 3.6 of this report.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination. All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dB of specification limit). Quasi-peak readings are distinguished with a "**Qp**".

4.5 Summary of Test Results

According to the data in section 3.6, the EUT complied with the FCC Conducted margin, with the *worst* margin reading of:

-1.2 dBμV at **0.450 MHz** in the **Neutral** mode for Transmitter, with ***KTC*** power adapter, M/N: KA12D150050044U

-1.5 dBμV at **0.790 MHz** in the **Neutral** mode for Receiver, with ***KTC*** power adapter, M/N: KA12D150050044U

4.6 Conducted Emissions Test Data

4.6.1 Final Test Data, Transmitter, KTC AC/DC power adapter, M/N: KA12D150050044U, 0.45 ~ 30MHz

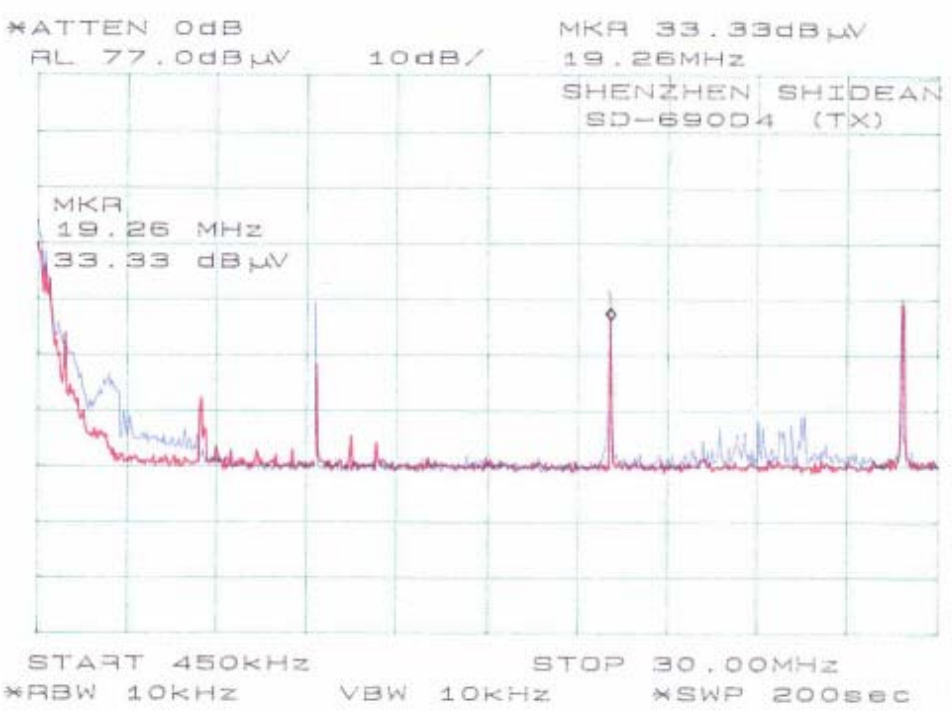
LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.450	46.8	QP	Neutral	48	-1.2
0.790	40.8	QP	Line	48	-7.2
19.200	38.7	QP	Line	48	-9.3
9.610	36.3	QP	Line	48	-11.7
19.260	33.3	QP	Neutral	48	-14.7
1.390	31.7	QP	Neutral	48	-16.3

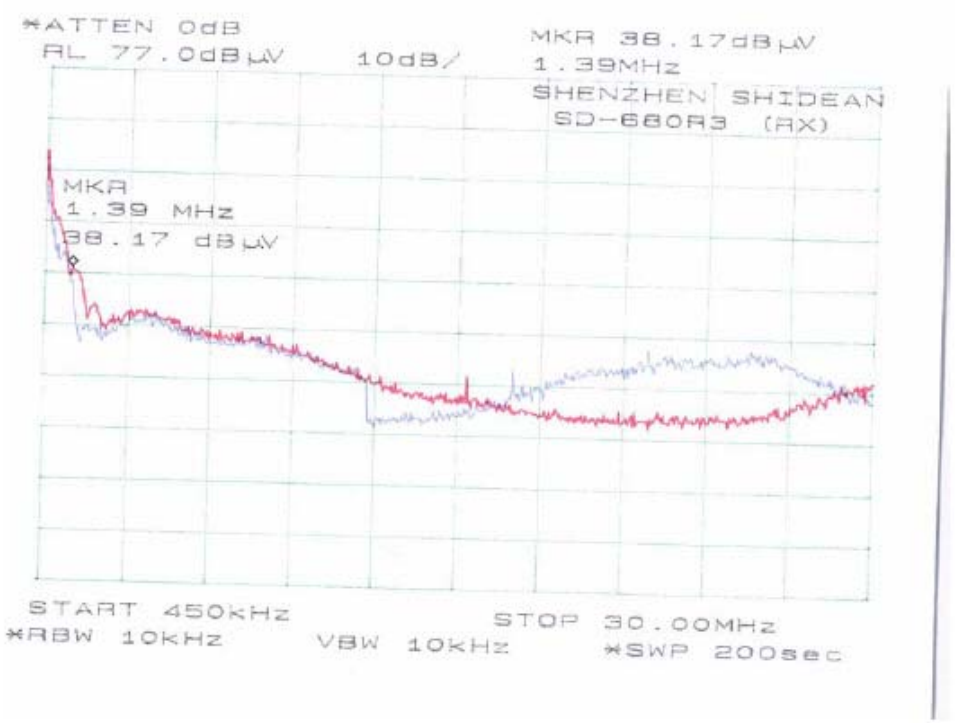
4.6.2 Final Test Data, Receiver, KTC AC/DC power adapter, M/N: KA12D150050044U, 0.45 ~ 30MHz

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.790	46.5	QP	Neutral	48	-1.5
0.840	42.5	QP	Line	48	-5.5
1.390	38.2	QP	Neutral	48	-9.8
2.220	30.8	QP	Neutral	48	-17.2
4.140	29.0	QP	Line	48	-19.0
25.670	24.7	QP	Line	48	-23.3

4.7 Plot of Conducted Emissions Test Data

Plot of Conducted Emissions test data for the *KTC Power Adapter*, model KA12D150050044U is presented hereinafter as reference.


*ATTEN 0dB
RL 77.0dBµV
10dB/
MKR 33.33dBµV
19.26MHz
SHENZHEN SHIDEAN
SD-690D4 (TX)
MKR
19.26 MHz
33.33 dBµV
START 450kHz
STOP 30.00MHz
*RBW 10kHz
VBW 10kHz
*SWP 200sec


*ATTEN 0dB
RL 77.0dBµV
10dB/
MKR 38.17dBµV
1.39MHz
SHENZHEN SHIDEAN
SD-680R3 (RX)
MKR
1.39 MHz
38.17 dBµV
START 450kHz
STOP 30.00MHz
*RBW 10kHz
VBW 10kHz
*SWP 200sec

5 – Radiated Emission Data

5.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is $\pm$4.0 dB.

5.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4 - 1992. The specification used was the FCC 15 Subpart C limits.

The transmitter was connected to 110VAC/60Hz power source and was placed on the center back edge of the test table.

The receiver was connected to 110VAC/60Hz power source and was placed on the center back edge of the test table.

The spacing between the peripherals was 10 centimeters.

The external Input / Output cables were draped over edge of the test table and bundle when necessary.

5.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR 15.33 (a) (1), the system was tested to 24000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Start Frequency	30 MHz
Stop Frequency	24000 MHz
Sweep Speed	Auto
IF Bandwidth	1 MHz
Video Bandwidth	1 MHz
Quasi-Peak Adapter Bandwidth	120 kHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth	1MHz

5.4 Test Procedure

For the radiated emissions test, both the EUT and all support equipment power cords were connected to the AC floor outlet since the power supply (KA12D150050044U) used in the EUT did not provide an accessory power outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "**Qp**" in the data table.

5.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. - Class B Limit

5.6 Summary of Test Results

According to the data in section 4.7, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207, and 15.249 after tested to 10th harmonics as required by FCC and had the worst margin of:

For Transmitter:

-0.6 dBμV at **4814.77 MHz** in the **Horizontal** polarization at Low Channel, **30 ~ 24000 MHz, 3 meters**

-0.7 dBμV at **4894.78 MHz** in the **Horizontal** polarization at Mid Channel, **30 ~ 24000 MHz, 3 meters**

-0.6 dBμV at **4934.78 MHz** in the **Vertical** polarization at High Channel, **30 ~ 24000 MHz, 3 meters**

-11.4 dBμV at **130.08 MHz** in the **Vertical** polarization, Unintentional Frequencies, **30 ~ 1000 MHz, 3 meters**

For Receiver:

-5.6 dBμV at **143.03 MHz** in the **Vertical** polarization, **30 ~ 1000 MHz, 3 meters**

5.7 Radiated Emissions Test Result Data

5.7.1 Final Test Data, Transmitter, Low Channel, 30 MHz to 24000 MHz, 3 meters

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 Subpart C	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBµV/m	Degree	Meter	H/ V	dBµV/m	dB	dB	dBµV/m	dBµV/m	dB
4814.77	46.0	180	1.4	H	32.5	4.9	30.0	53.4	54.0	-0.6
4814.77	45.0	225	1.0	V	32.5	4.9	30.0	52.4	54.0	-1.6
7222.21	40.0	225	1.0	V	35.1	5.6	30.0	50.7	54.0	-3.3
9629.66	36.7	45	2.0	H	35.1	5.6	30.0	47.4	54.0	-6.6
7222.21	33.3	360	1.5	H	35.1	5.6	30.0	44.1	54.0	-9.9
9629.66	33.0	45	1.6	V	35.1	5.6	30.0	43.7	54.0	-10.3
12037.11	32.2	90	1.0	V	35.1	5.6	30.0	42.9	54.0	-11.1
12037.11	31.7	315	1.8	H	35.1	5.6	30.0	42.4	54.0	-11.6
2407.55	77.7	180	1.5	H	28.1	3.4	30.0	79.1	94.0	-14.9
2407.55	73.2	225	1.0	V	28.1	3.4	30.0	74.6	94.0	-19.4

5.7.2 Final Test Data, Transmitter, Middle Channel, 30MHz to 24000 MHz, 3 meters

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 Subpart C	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBµV/m	Degree	Meter	H/ V	dBµV/m	dB	dB	dBµV/m	dBµV/m	dB
4894.78	45.9	315	1.5	H	32.5	4.9	30.0	53.3	54.0	-0.7
4894.78	43.5	180	1.0	V	32.5	4.9	30.0	50.9	54.0	-3.1
7342.17	37.8	90	1.5	H	35.1	5.6	30.0	48.6	54.0	-5.4
9789.56	36.2	135	1.5	V	35.1	5.6	30.0	46.9	54.0	-7.1
7342.17	35.6	225	1.4	V	35.1	5.6	30.0	46.3	54.0	-7.7
9789.56	35.2	315	1.5	H	35.1	5.6	30.0	45.9	54.0	-8.1
12236.95	34.5	225	1.5	H	35.1	5.6	30.0	45.2	54.0	-8.8
12236.95	28.7	0	1.0	V	35.1	5.6	30.0	39.4	54.0	-14.6
2447.39	76.5	135	1.5	H	28.1	3.4	30.0	78.0	94	-16.1
2447.39	73.2	270	1.0	V	28.1	3.4	30.0	74.7	94	-19.4

5.7.3 Final Test Data, Transmitter, High Channel, 30MHz to 24000 MHz, 3 meters

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 Subpart C	
Frequency MHz	Ampl. dBµV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBµV/m	Cable dB	Amp. dB	Corr. Ampl. dBµV/m	Limit dBµV/m	Margin dB
4934.78	46.0	315	1.0	V	32.5	4.9	30.0	53.4	54.0	-0.6
4934.78	44.5	360	1.7	H	32.5	4.9	30.0	51.9	54.0	-2.1
7402.17	36.8	315	1.7	H	35.1	5.6	30.0	47.6	54.0	-6.4
9869.57	32.5	180	1.5	H	35.1	5.6	30.0	43.2	54.0	-10.8
9869.57	32.3	270	1.8	V	35.1	5.6	30.0	43.1	54.0	-10.9
7402.17	31.8	360	2.0	V	35.1	5.6	30.0	42.6	54.0	-11.4
12337.15	28.3	90	1.3	H	35.1	5.6	30.0	39.1	54.0	-14.9
12337.15	26.0	90	2.0	V	35.1	5.6	30.0	36.7	54.0	-17.3
2467.39	73.7	135	1.0	H	28.1	3.4	30.0	75.1	94.0	-18.9
2467.39	73.0	135	1.2	V	28.1	3.4	30.0	74.5	94.0	-19.6

5.7.4 Final Test Data, Transmitter, Unintentional Frequencies, 30 MHz ~ 1000 MHz, 3 meters

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 Subpart C	
Frequency MHz	Ampl. dBµV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBµV/m	Cable dB	Amp. dB	Corr. Ampl. dBµV/m	Limit dBµV/m	Margin dB
130.08	42.5	90	1.5	V	12.6	2.0	25.0	32.1	43.5	-11.4
324.98	40.3	315	1.4	H	15.5	2.8	25.0	33.6	46.0	-12.4
110.02	43.0	90	1.7	V	11.7	1.3	25.0	31.0	43.5	-12.5
182.01	37.8	45	1.6	V	13.6	4.0	25.0	30.4	43.5	-13.1
149.51	39.7	315	1.0	V	13.4	1.6	25.0	29.7	43.5	-13.8
286.07	36.3	45	2.0	H	14.6	5.8	25.0	31.7	46.0	-14.3

5.7.5 Final Test Data, Receiver, 30 MHz ~ 1000 MHz, 3 meters

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 Subpart C	
Frequency MHz	Ampl. dBµV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBµV/m	Cable dB	Amp. dB	Corr. Ampl. dBµV/m	Limit dBµV/m	Margin dB
143.03	48.7	135	2.0	V	13.2	1.0	25.0	37.9	43.5	-5.6
120.04	45.8	45	1.8	V	12.1	2.2	25.0	35.1	43.5	-8.4
130.03	45.5	90	1.0	V	12.6	2.0	25.0	35.1	43.5	-8.4
280.00	37.8	180	1.0	H	14.6	5.8	25.0	33.2	46.0	-12.8
325.010	39.7	180	1.5	H	15.5	2.8	25.0	33.0	46.0	-13.0
171.95	38.7	135	1.6	V	13.3	1.4	25.0	28.4	43.5	-15.1
336.00	37.5	315	1.8	H	15.0	2.6	25.0	30.1	46.0	-15.9
360.000	33.5	360	1	H	15.5	5.2	25.0	29.2	46.0	-16.8
624.030	29.3	225	2	H	20.2	3.1	25.0	27.6	46.0	-18.4

6 – Band Edges Testing

Requirements: FCC 15.249 (c), the emission power at the START and STOP frequencies shall be at least 50 dB below the level of the fundamental or to the general radiated emission limits in FCC 15.209, whichever is the lesser attenuation.

6.1 Test Procedure

The antenna was removed and a low loss RF cable was connected to the transmitter output. The other end of cable was connected to a spectrum analyzer with the START and STOP frequencies set to the operation band. Transmitter output was read off the spectrum analyzer in dBm. The power output at the transmitter was determined by adding the value of the attenuator to the spectrum analyzer reading.

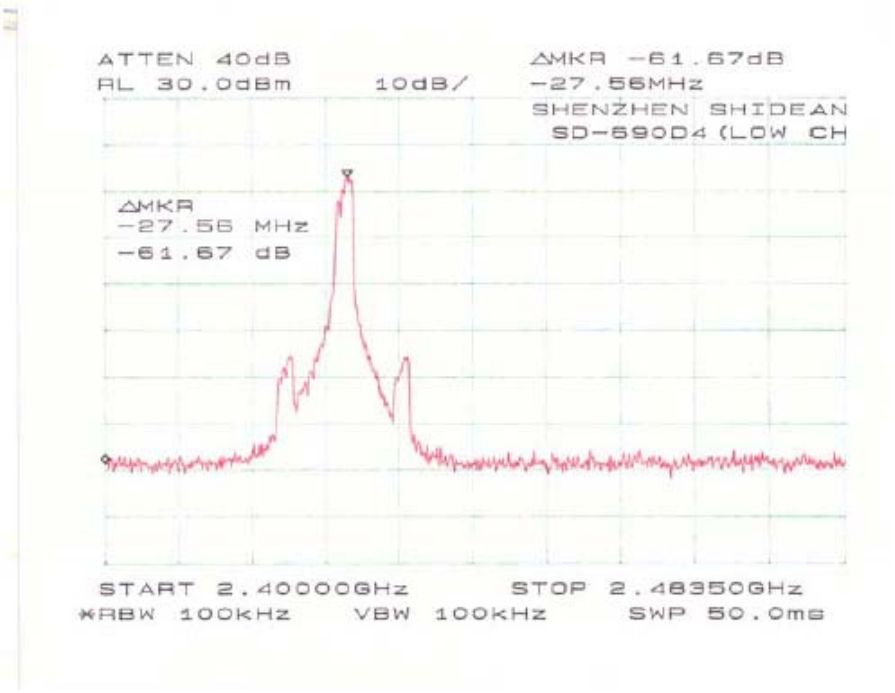
The test was performed for handset and the base respectively.

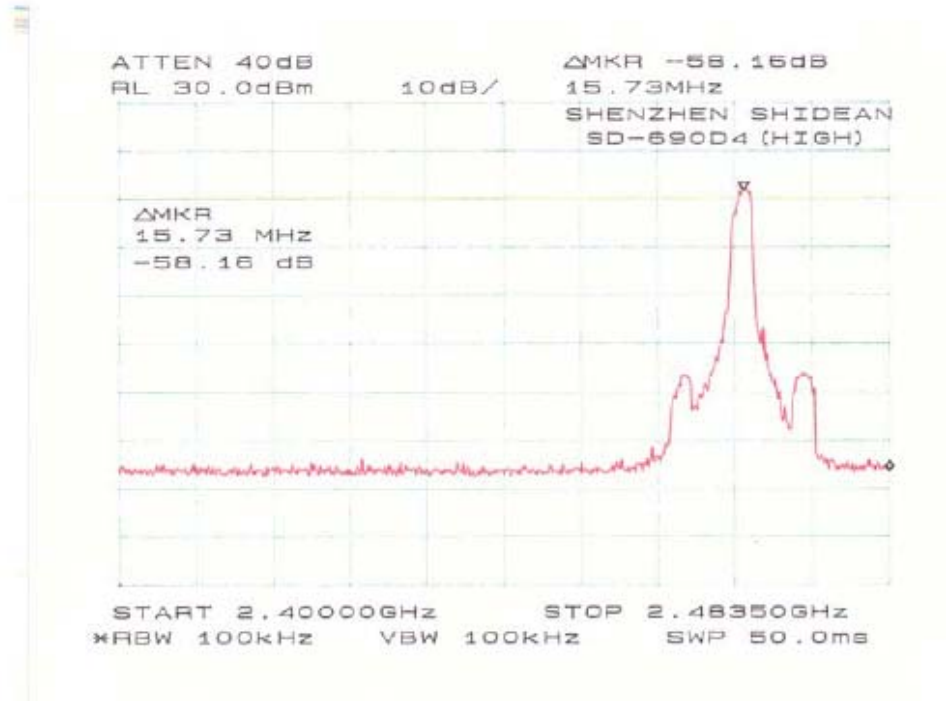
6.2 Test Equipment

HP 8566B Spectrum Analyzer
HP 7470A Plotter

6.3 Test Results

Please refer to the attached plots.


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -61.67dB
-27.56MHz
SHENZHEN SHIDEAN
SD-690D4 (LOW CH
ΔMKR
-27.56 MHz
-61.67 dB
START 2.40000GHz
STOP 2.48350GHz
#RBW 100kHz
VBW 100kHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -58.16dB
15.73MHz
SHENZHEN SHIDEAN
SD-690D4 (HIGH)
ΔMKR
15.73 MHz
-58.16 dB
START 2.40000GHz
STOP 2.48350GHz
#RBW 100kHz
VBW 100kHz
SWP 50.0ms