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Report No.: GZEM141200692001 Page: 1 of 18 FCC ID: SY9WST002

TEST REPORT

Application No.:	GZEM1412006920CR	
Applicant:	GUANGDONG LFF TECHNOLOGY CO., LTD	
Manufacturer:	Same as the applicant.	
FCC ID:	SY9WST002	
Product Description:	TIRE PRESSURE MONITORING SYSTEM	
Model No.:	WST002, LP506, LP505*	
*	Please refer to section 3 of this report for further details.	
Trade Mark:	SPY	
Standards:	CFR 47 FCC PART 15 SUBPART C:2014 section 231	
Date of Receipt:	2015-01-05	
Date of Test:	2015-01-27 to 2015-03-31	
Date of Issue:	2015-04-29	
Test Result :	PASS *	

* In the configuration tested, the EUT detailed in this report complied with the standards specified above. Please refer to section 3 of this report for further details.



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.



Report No.: GZEM141200692001 Page: 2 of 18

2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2015-04-29		Original

Authorized for issue by:		
Tested By	Jack Ling	2015-01-27 to 2015-03-31
	(Jack Liang) / Project Engineer	Date
Prepared By	June Chen (June Chen) / Clerk	2015-04-03
Checked By	B	2015-04-07
	(Jerry Chan) / Reviewer	Date



Report No.: GZEM141200692001 Page: 3 of 18

3 Test Summary

Test	Test Requirement	Test method	Result
Padiated Emission	Radiated Emission FCC PART 15 ANSI C 63.10: Clasue		PASS**
Hadialed Emission	section 15.231(e)	6.4, 6.5 and 6.6	FA00
Occupied Bandwidth	FCC PART 15	ANSI C 63.10:	PASS
Occupied Bandwidth	section 15.231(c)	Clasue 6.9	FA00
Dwell Time	FCC PART 15	FCC PART 15:	PASS
Dweit Time	section 15.231(e)	Section 15.231(e)	L400

Remark:

EUT: In this whole report EUT means Equipment Under Test.

N/A: not applicable. Refer to the relative section for the details.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

& Model No.: WST002, LP506, LP505

According to the declaration from the applicant, the electrical circuit design, layout, components used and internal wiring were identical for all models, with only difference being the model number, plug portion and exported countries.

Therefore only one model WST002 was tested in this report.

** The EUT passed Radiated Emission test after modification by applicant.



Report No.: GZEM141200692001 Page: 4 of 18

4 Contents

1	COV	ER PAGE	1
2	VER	SION	2
3	TES	T SUMMARY	3
4	CON	ITENTS	4
5	GEN	ERAL INFORMATION	5
5	5.1	CLIENT INFORMATION	5
5	5.2	GENERAL DESCRIPTION OF E.U.T.	5
5	5.3	DETAILS OF E.U.T.	5
5	5.4	DESCRIPTION OF SUPPORT UNITS	5
5	5.5	DEVIATION FROM STANDARDS	5
5	5.6	ABNORMALITIES FROM STANDARD CONDITIONS	5
5	5.7	OTHER INFORMATION REQUESTED BY THE CUSTOMER	5
5	5.8	TEST LOCATION	
5	5.9	TEST FACILITY	6
6	EQU	IPMENT USED DURING TEST	7
7	TES	T RESULTS	8
7	7.1	E.U.T. TEST CONDITIONS	8
7	7.2	ANTENNA REQUIREMENT	
7	7.3	RADIATED EMISSIONS	10
7	7.4	OCCUPIED BANDWIDTH	
7	7.5	Dwell Time:	18



Report No.: GZEM141200692001 Page: 5 of 18

5 General Information

5.1 Client Information

Applicant:	GUANGDONG LFF TECHNOLOGY CO., LTD
Address of Applicant:	NO.9. YONGCHENG NORTH ROAD, XIAOLAN INDUSTRIAL AREA, XIAOLAN TOWN, ZHONGSHAN CITY, GUANGDONG PROVINCE, P.R. CHINA 528416
Manufacturer:	Same as the applicant.
Address of Manufacturer:	Same as the applicant.

5.2 General Description of E.U.T.

Product Description:	TIRE PRESSURE MONITORING SYSTEM
Model No.:	WST002

5.3 Details of E.U.T.

Modulation and Antenna Type:	The Tx is a narrow-band FSK modulation by internal signal, no voice
	application and with an integral antenna.
Power Supply:	DC 3.0V size "CR1632" battery.
Power cord:	N/A

5.4 Description of Support Units

The EUT has been tested as an independent unit.

5.5 Deviation from Standards

None.

5.6 Abnormalities from Standard Conditions

The EUT passed Radiated Emission test after modification.

5.7 Other Information Requested by the Customer

None.

5.8 Test Location

All tests were performed at: SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory, 198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663 Tel: +86 20 82155555 Fax: +86 20 82075059 No tests were sub-contracted.



Report No.: GZEM141200692001 Page: 6 of 18

5.9 Test Facility

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

• NVLAP (Lab Code: 200611-0)

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by t National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any aç of the Federal Government.

• ACMA

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for th Australian C-Tick mark as a result of our NVLAP accreditation.

• SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier EMC TESTING SERVICES and SAFETY TESTING SERVICES.

• CNAS (Lab Code: L0167)

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

• FCC (Registration No.: 282399)

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance le from the FCC is maintained in our files. Registration 282399, May 31, 2002.

• Industry Canada (Registration No.: 4620B-1)

The 3m/10m Alternate Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., L has been registered by Certification and Engineering of Industry Canada for radio equipment testinç with Registration No. 4620B-1.

• VCCI (Registration No.: R-2460, C-2584, G-449 and T-1179)

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2460, C-2584, G-449 and T-1179 respectively.

• CBTL (Lab Code: TL129)

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, the Basic Rules, IECEE 01:2006-10 and Rule procedure IECEE 02:2006-10, and the relevant IECEE CB-Scheme Operational documents.



Report No.: GZEM141200692001 Page: 7 of 18

6 Equipment Used during Test

RE in Chamber						
No.	Test Equipment	Manufacturer	rer Model No. Serial No.		Cal. date	Cal.Due date
NO.	rest Equipment	manufacturer	Model No.	Serial No.	(YYYY-MM-DD)	(YYYY-MM-DD)
EMC0525	Compact Semi- Anechoic Chamber	ChangZhou ZhongYu	N/A	N/A	2014-12-5	2015-12-5
EMC0522	EMI Test Receiver	Rohde & Schwarz	ESIB26	100283	2014-04-19	2015-04-19
EMC0528	RI High frequency Cable	SGS	20 m	N/A	2014-05-09	2015-05-09
EMC2025	Trilog Broadband Antenna 30-1000MHz	SCHWARZBECK MESS- ELEKTRONIK	VULB 9160	9160-3372	2014-07-14	2017-07-14
EMC0524	Bi-log Type Antenna	Schaffner -Chase	CBL6112B	2966	2013-08-31	2016-08-31
EMC0519	Bilog Type Antenna	Schaffner -Chase	CBL6143	5070	2014-05-04	2017-05-04
EMC2026	Horn Antenna 1-18GHz	SCHWARZBECK MESS- ELEKTRONIK	BBHA 9120D	9120D-841	2013-08-31	2016-08-31
EMC0518	Horn Antenna	Rohde & Schwarz	HF906	100096	2012-07-01	2015-07-01
EMC0521	1-26.5 GHz Pre-Amplifier	Agilent	8449B	3008A01649	2015-03-02	2016-03-02
EMC2065	Amplifier	HP	8447F	N/A	2014-08-25	2015-08-25
EMC0075	310N Amplifier	Sonama	310N	272683	2015-03-02	2016-03-02
EMC0523	Active Loop Antenna	EMCO	6502	42963	2014-03-03	2016-03-03
EMC2041	Broad-Band Horn Antenna (14)15-26.5(40)GHz	SCHWARZBECK MESS- ELEKTRONI	BBHA 9170	9170-375	2014-05-26	2017-05-26
EMC2079	High Pass Filter(915MHz)	FSY MICROWAVE	HM1465-9SS	009	2015-03-02	2016-03-02
EMC2069	2.4GHz filter	Micro-Tronics	BRM 50702	149	2014-04-19	2015-04-19
EMC0530	10m Semi- Anechoic Chamber	ETS	N/A	N/A	2014-05-03	2016-05-03

General used equipment						
No.	Toot Equipmont	Manufacturer	er Model No. Serial No.		Cal. date	Cal.Due date
NO.	Test Equipment	Manufacturer	woder no.	Serial No.	(YYYY-MM-DD)	(YYYY-MM-DD)
EMC0006	DMM	Fluke	73	70681569	2014-09-15	2015-09-15
EMC0007	DMM	Fluke	73	70671122	2014-09-15	2015-09-15



Report No.: GZEM141200692001 Page: 8 of 18

7 Test Results

7.1 E.U.T. test conditions

Test Voltage:	DC 3.0V (new battery)
Requirements:	15.31(e) : For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.
Operating Environment:	
Temperature:	22-25.0 °C
Humidity:	48-55% RH
Atmospheric Pressure:	1001-1010 mbar
Test frequencies and frequency range:	According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement	
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower	
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower	
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified	

Remark:Test frequency is 433.92MHz.



Report No.: GZEM141200692001 Page: 9 of 18

7.2 Antenna Requirement

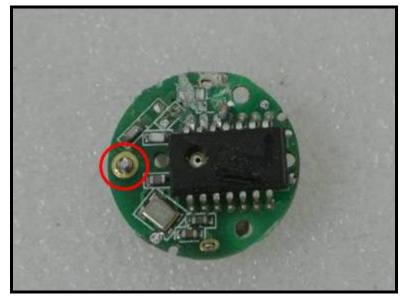
Standard requirement

15.203 requirement:

For intentional device. According to 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.

EUT Antenna

The antenna is an ISM Band Planar Chip Antenna integrated on the main PCB and no consideration of replacement. The maximum gain of the antenna is 0 dBi.



Test result: The unit does meet the FCC requirements.



Report No.: GZEM141200692001 Page: 10 of 18

7.3 Radiated Emissions

Test Requirement:	FCC Part15 C section 15.231(e)
Test Method:	ANSI C63.10: Clause 6.4, 6.5 and 6.6
Measurement Distance:	3 m (Semi-Anechoic Chamber)
Test Status:	Test in transmitting mode.
Requirements:	the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency MHz	Field Strength of Fundamental (dBµV/m @ 3 m)	Field Strength of Harmonics and Spurious Emissions (dBµV/m @ 3 m)	
40.66 to 40.70	60.00	40.00	
70 to 130	53.98	33.98	
130 to 174	53.98 to 63.52	33.98 to 43.52	
174 to 260	63.52	43.52	
260 to 470	63.52 to 73.98	43.52 to 53.98	
Above 470	73.98	53.98	
Detector:	Peak for pre-scan		
	QP for 30MHz to1000 MHz:120 kHz resolution bandwidth Peak for Above 1 GHz: 1 MHz resolution bandwidth		

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, μ V/m at 3 meters = 22.72727(F) - 2454.545; for the band 260-470 MHz, μ V/m at 3 meters = 16.6667(F) - 2833.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level

The fundamental frequency of the EUT is 433.92 MHz

The limit for average or QP field strength dBuv/m for the fundamental emission= 72.86 $dB\mu V/m$

No fundamental is allowed in the restricted bands.

The limit for average field strength dBuv/m for the spurious emission=52.86 dBuV/m.Spurious in the restricted bands must be less than 52.86 dBuV/m or 15.209, whichever limit permits a higher field strength.



Report No.: GZEM141200692001 Page: 11 of 18

And according 15.35(a)

15.35(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.

Note: For pulse modulated devices with a pulse-repetition frequency of 20 Hz or less and for which CISPR quasi-peak measurements are specified, compliance with the regulations shall be demonstrated using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, using the same measurement bandwidths that are indicated for CISPR quasi-peak measurements.

According to 15.35 (b) Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.255, and 15.509-15.519 of this part, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary. The average correction factor is computed by analyzing the on time in 100ms over one complete pulse train. Analysis of the remote transmitter on time in one complete pulse train, therefore the average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle), where the duty factor is calculated from following formula:

20log (Duty cycle) = 20log(1)=0



Report No.: GZEM141200692001 Page: 12 of 18

Test Procedure:

1) 9 kHz to 30 MHz emissions:

For testing performed with the loop antenna. The center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specied distance from the EUT.During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane.

2) 30 MHz to 1 GHz emissions:

For testing performed with the bi-log type antenna. The measurement is performed with the EUT rotated 360^e, the antenna height scaned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

3) 1 GHz to 40 GHz emissions:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2007 was used to perform radiated emission test above 1 GHz.

For testing performed with the horn antenna. The measurement is performed with the EUT rotated 360°, the antenna height scaned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

Detector: For PK value:

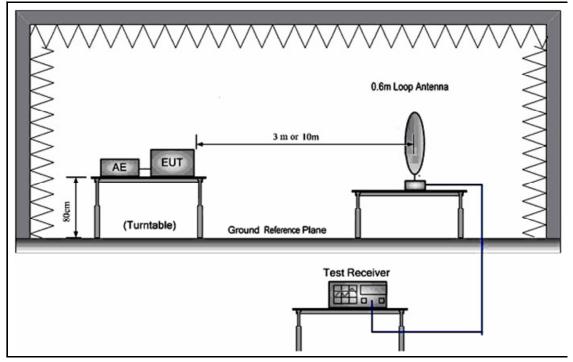
RBW = 1 MHz for $f \ge 1$ GHz, 100 kHz for f < 1 GHz VBW \ge RBW Sweep = auto Detector function = peak Trace = max hold For AV value: For harmonic emissions: Average = Peak value + 20log (Duty cycle), For other unwanted emissions: RBW = 1 MHz for $f \ge 1$ GHz, 100 kHz for f < 1 GHz VBW =10Hz Sweep = auto Detector function = peak Trace = max hold



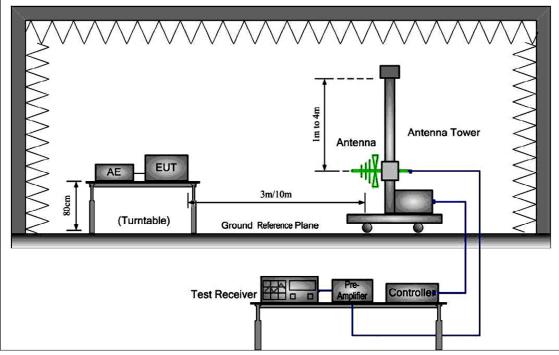
Report No.: GZEM141200692001 Page: 13 of 18

Test Configuration:

1) 9 kHz to 30 MHz emissions:



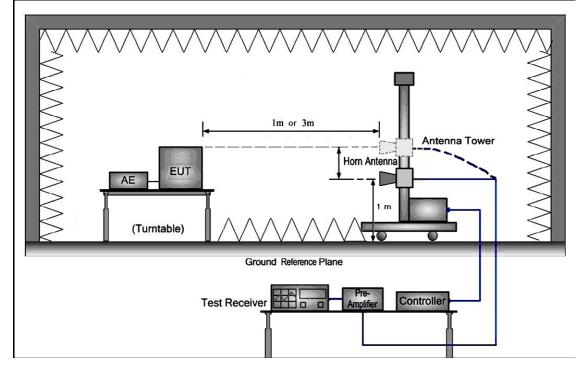
2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 40 GHz emissions:



Report No.: GZEM141200692001 Page: 14 of 18



1) Fundamental emission:

Antenna polarization: Horizontal:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
433.92	63.29	16.17	2.88	30.94	51.40	92.86	-41.46	Peak
433.92	-	-	-	-	-	72.86	-	Average

Antenna polarization: Vertical

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
433.92	61.91	16.17	2.88	30.94	50.02	92.86	-42.84	Peak
433.92	-	-	-	-	-	72.86	-	Average

Antenna polarization: Vertical

Y: rotate EUT by 90° vertically.

X: rotate EUT by 90° clockwise.

Z: EUT as Radiated Emission test setup photograph in section 6 of this report.

Remark: Radiated Emission test setup photograph in section 6 of this report is the worst case and reported.



Report No.: GZEM141200692001 Page: 15 of 18

2) other emissions:

The receive was scanned from the lowest frequency generated within the EUT to 5 GHz.When an emission was found, the table was rotated to produce the maximum signal strength. An initial prescan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. The worst case emissions were reported.

An initial pre-scan was performed in the 3 m chamber using the spectrum analyzer in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by Bilog antenna with 2 orthogonal polarities.

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

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Peramplifier Factor.

The following test results were performed on the EUT.

Since the peak emission level is lower than the average limit, the average emission level does not need to show.

Test the EUT in transmitting mode.:

9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.



Report No.: GZEM141200692001 Page: 16 of 18

Horizonta	Ι.							
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
215.27	39.77	9.4	1.3	27.21	23.26	43.5	-20.24	QP
323.91	40.36	13.58	1.6	27.26	28.28	46	-17.72	QP
866.14	48.2	20.62	2.6	27.03	44.39	46	-1.61	QP
1301.52	48.25	25.53	3.2	36.1	40.88	74	-33.12	Peak
1735.36	46.52	25.09	3.7	35.76	39.55	74	-34.45	Peak
2169.2	47.63	27.65	4.13	35.6	43.81	74	-30.19	Peak
2603.04	47.1	27.83	4.5	35.64	43.79	74	-30.21	Peak
3036.88	47.66	28.55	4.9	35.72	45.39	74	-28.61	Peak
3470.72	46.98	28.8	5.27	35.04	46.01	74	-27.99	Peak
Vertical.								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
126.03	28.37	11.93	0.9	27.53	13.67	43.5	-29.83	QP
260.86	38.52	12.5	1.5	27.13	25.39	46	-20.61	QP
866.14	48.29	20.62	2.6	27.03	44.48	46	-1.52	QP
1301.52	46.32	25.53	3.2	36.1	38.95	74	-35.05	Peak
1735.36	46.55	25.09	3.7	35.76	39.58	74	-34.42	Peak
2169.2	46.87	27.65	4.13	35.6	43.05	74	-30.95	Peak
2603.04	46.74	27.83	4.5	35.64	43.43	74	-30.57	Peak
3036.88	46.55	28.55	4.9	35.72	44.28	74	-29.72	Peak
3470.72	46.59	28.8	5.27	35.04	45.62	74	-28.38	Peak

30 MHz~5 GHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

Remark:

According to 15.35 (b) When average radiated emission measurements are specified in the regulations, including emission measurements below 1000 MHz, there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules, e.g., see Section 15.255.



Report No.: GZEM141200692001 Page: 17 of 18

7.4 Occupied Bandwidth

Test Requirement:	FCC Part 15 C section 15.231 (c)
Test Method:	ANSI C63.10: Clause 6.9
Test Status:	Test in transmitting mode at lowest and highest channel.
Requirements:	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.
Method of measurement:	The useful radiated emission from the EUT was detected by the

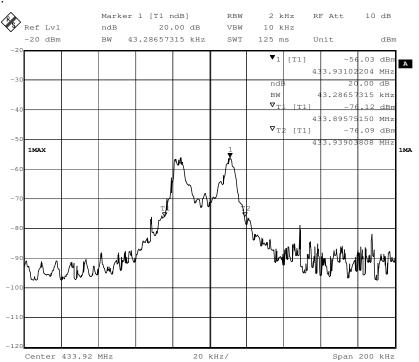
spectrum analyzer with peak detector. Record the 20 dB

bandwidth of the carrier.

Test result:

Test Channel	bandwidth	Limit
433.92MHz	43.29 kHz	1.08 MHz

Test plot:





Report No.: GZEM141200692001 Page: 18 of 18

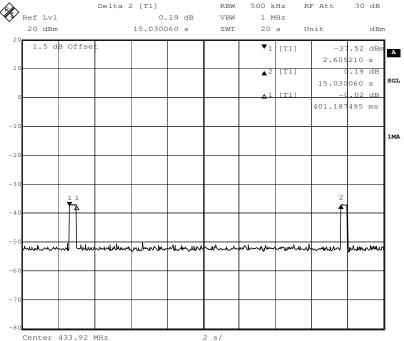
7.5 Dwell Time:

Requirements:	
Test Status:	Test in transmitting mode.
Test Method:	FCC Part 15 C section 15.231(e)
Test Requirement:	FCC Part 15 C section 15.231(e)

1. Regulation 15.231 (e) In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Result:

Item	Duration of each transmission (Td)	Silent period between transmissions(
Time	0.4 s	15 s	
Limit	≤1 s	\geq 10 s and 30*Td	
Result polt as follows:			
	Delta 2 [T1] RE	3W 500 kHz RF Att 30 dB	



--The End of Report--