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# CFR 47 FCC Part 15.231 TEST REPORT

Product: TPMS

Trade Name: N/A

Model Number: TX-U002; TX-S001; TX-S003; TX-S004; TX-S005; TX-S006;

TX-S018; TX-S026; TX-S029; TX-S032; TX-S033; TX-S034; TX-S037; TX-S038; TX-S039; TX-S041; TX-S045; TX-S047; TX-S049; TX-S052; TX-S053; TX-S054; TX-S055; TX-S056; TX-S057; TX-S058; TX-S059; TX-S060; TX-S061; TX-S062; TX-S063; TX-S064; TX-S065; TX-S066; TX-S067; TX-S068; TX-S069; TX-S070; TX-S071; TX-S137; TX-S138; TX-S139; TX-S140; TX-S141; TX-S142; TX-S143; TX-S144; TX-S145; TX-S146; TX-S153; TX-S154; TX-S156; TX-S151; TX-S152; TX-S153; TX-S154; TX-S155; TX-S156; TX-S157; TX-S158; TX-S159; TX-S160; TX-S161; TX-S162; TX-S163; TX-S164; TX-S165; TX-S166; TX-S167; TX-S168; TX-S169; TX-S170; TX-S171; TX-S172; TX-S173; TX-S174; TX-S175; TX-S176; TX-S177; TX-S178; TX-S179; TX-S180; TX-S181; TX-S182; TX-S183; TX-S184; TX-S185; TX-S186; TX-S187;

TX-S188; TX-S189; TX-S190; TX-S191; TX-S192; TX-S193; TX-S194; TX-S195; TX-S196; TX-S197; TX-S198

FCC ID: ULZ-TXU02

#### MOBILETRON ELECTRONICS CO., LTD.

Prepared for

No. 85, Sec. 4, Chung-Ching Rd., Ta-Ya District, Taichung, 428, Taiwan

TEL.: +886 4 2568 3366

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Prepared by

#### Interocean EMC Technology Corp.

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TEL.: +886 2 2600 6861 FAX.: +886 2 2600 6859

#### Remark:

The test report consists of <u>28</u> pages in total. It shall not be reproduced except in full, without the written approval of IETC. This document may be altered or revised by IETC only, and shall be noted in the revision section of the document.

The test result in the report is only subjected to the test sample.

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# **Statement of Compliance**

**Applicant:** MOBILETRON ELECTRONICS CO., LTD. **Manufacturer:** MOBILETRON ELECTRONICS CO., LTD.

Product: TPMS

Model No.: TX-U002; TX-S001; TX-S003; TX-S004; TX-S005; TX-S006;

TX-S018; TX-S026; TX-S029; TX-S032; TX-S033; TX-S034; TX-S037; TX-S038; TX-S039; TX-S041; TX-S045; TX-S047; TX-S049; TX-S052; TX-S053; TX-S054; TX-S055; TX-S056; TX-S057; TX-S058; TX-S059; TX-S060; TX-S061; TX-S062; TX-S063; TX-S064; TX-S065; TX-S066; TX-S067; TX-S068; TX-S069; TX-S070; TX-S071; TX-S137; TX-S138; TX-S139; TX-S140; TX-S141; TX-S142; TX-S143; TX-S144; TX-S145; TX-S146; TX-S147; TX-S148; TX-S149; TX-S150; TX-S151; TX-S152; TX-S153; TX-S154; TX-S155; TX-S156; TX-S157; TX-S158; TX-S159; TX-S160; TX-S161; TX-S162; TX-S163; TX-S164; TX-S165; TX-S166; TX-S167; TX-S168; TX-S169; TX-S170; TX-S171; TX-S172; TX-S173; TX-S174; TX-S175; TX-S176; TX-S177; TX-S178; TX-S179; TX-S180; TX-S181; TX-S182; TX-S183; TX-S184; TX-S185; TX-S186; TX-S187; TX-S188; TX-S189; TX-S190; TX-S191; TX-S192; TX-S193;

TX-S194; TX-S195; TX-S196; TX-S197; TX-S198

**Tested Power Supply:** 3Vdc Battery **Date of Final Test:** Jul. 17, 2014

# Configuration of Measurements and Standards Used:

FCC Rules and Regulations Part 15 Subpart C

- 1. The result of the testing report relate only to the item tested.
- 2. The testing report shall not be reproduced expect in full, without the written approval of IETC.

Report Issued:	2014/09/03		
Project Engineer:	Zili Chang	Approved:	Zili Chang
	Elli Chang	<u> </u>	lerry Liu

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# 1 Summary of Measurement

Report Clause		Reference Document CFR47 Part15	Results
4	Timing requirement	§15.231(a)	Pass
4	Radiated Emission	§15.231(b), 15.209	Pass
5	Emission Bandwidth	§15.231(c)	Pass

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#### 2 General Information

## 2.1 Description of Equipment Under Test

**Product**: TPMS

Model Number : TX-U002; TX-S001; TX-S003; TX-S004; TX-S005; TX-S006;

TX-S018; TX-S026; TX-S029; TX-S032; TX-S033; TX-S034; TX-S037; TX-S038; TX-S039; TX-S041; TX-S045; TX-S047; TX-S049; TX-S052; TX-S053; TX-S054; TX-S055; TX-S056; TX-S057; TX-S058; TX-S059; TX-S060; TX-S061; TX-S062; TX-S063; TX-S064; TX-S065; TX-S066; TX-S067; TX-S068; TX-S069; TX-S070; TX-S071; TX-S137; TX-S138; TX-S139; TX-S140; TX-S141; TX-S142; TX-S143; TX-S144; TX-S145;

TX-S140; TX-S141; TX-S142; TX-S143; TX-S144; TX-S145; TX-S146; TX-S147; TX-S148; TX-S149; TX-S150; TX-S151; TX-S152; TX-S153; TX-S154; TX-S155; TX-S156; TX-S157;

TX-S158; TX-S159; TX-S160; TX-S161; TX-S162; TX-S163; TX-S164; TX-S165; TX-S166; TX-S167; TX-S168; TX-S169; TX-S170; TX-S171; TX-S172; TX-S173; TX-S174; TX-S175; TX-S176; TX-S177; TX-S178; TX-S179; TX-S180; TX-S181;

TX-S182; TX-S183; TX-S184; TX-S185; TX-S186; TX-S187; TX-S188; TX-S189; TX-S190; TX-S191; TX-S192; TX-S193;

TX-S194; TX-S195; TX-S196; TX-S197; TX-S198

Applicant : MOBILETRON ELECTRONICS CO., LTD.

No. 85, Sec. 4, Chung-Ching Rd., Ta-Ya District,

Taichung, 428, Taiwan

Manufacturer : MOBILETRON ELECTRONICS CO., LTD.

No. 85, Sec. 4, Chung-Ching Rd., Ta-Ya District,

Taichung, 428, Taiwan

**Power Supply**: 3Vdc Battery

Operating Frequency : 433.92MHz

Type of Modulation : ASK & FSK

**Antenna Description**: This device uses Monopole antenna.

The antenna is integral to the device, thereby meeting the

requirement of FCC 15.203.

Antenna Gain : 0 dBi

**Date of Test** : May 23 ~ Jul. 17, 2014

Additional Description: 1) The Model Number "TX-U002" is representative selected in

the test and included in this report.

2) The difference for all models included in this report is only for

software.

3) For more detail specification about EUT, please refer to the

user's manual.

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# 2.2 Details of Tested Peripheral Equipment

N/A

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#### 2.3 Test Facility

Site Description : ⊠OATS 1

Name of Firm : Interocean EMC Technology Corp.

Company web : http://www.ietc.com.tw

Location : No. 5-2, Lin 1, Tin-Fu, Lin-Kou Dist., New Taipei City,

Taiwan 244, R.O.C.

Site Filing : ● Federal Communication Commissions – USA

Registration No.: 96399 (OATS 1, 2, 3 & Chamber 3)

Designation No.: TW1020

Industry Canada (IC)

OUR FILE: 46405-4437

Registration No. (OATS 1): Site# 4437A-1 Registration No. (OATS 3): Site# 4437A-3 Registration No. (Chamber 3): Site# 4437A-5 Registration No. (OATS 5): Site# 4437A-6

Voluntary Control Council for Interference by Information

Technology Equipment (VCCI) - Japan

Member No.: 1349

Registration No. (Conducted Room): C-1094 Registration No. (Conducted Room): T-1562 Registration No. (OATS 1): R-1040; G-274

Registration No. (OATS 2): R-1041

**Site Accreditation** 

Bureau of Standards and Metrology and Inspection (BSMI) –

Taiwan, R.O.C.

Accreditation No.:

SL2-IN-E-0026 for CNS13438 / CISPR 22

SL2-IN-E-0026 for CNS14757-2 / IEC 62040-2

SL2-R1-E-0026 for CNS13439 / CISPR 13

SL2-R2-E-0026 for CNS13439 / CISPR 13

SL2-A1-E-0026 for CNS13783-1 / CISPR 14-1

SL2-L1-E-0026 for CNS 14115 / CISPR 15

Taiwan Accreditation Foundation (TAF)

Accreditation No.: 1113

Vehicle Safety Certification Center (VSCC)

Approval No.: TW16-11-0

TüV NORD

Certificate No: TNTW0801R-04

Nemko

Authorisation No: AeLA 011 Authorisation No: ELA 181

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# 3 Test Specifications

#### 3.1 Test Standard

The EUT was performed according to FCC Part 15 Subpart C Section 15.231 procedure and setup followed by ANSI C63.4, 2003 requirements.

#### 3.2 Operation Mode

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report

The EUT was operated in continuous transmission mode during all of the tests.







X axis mode

Y axis mode

Z axis mode

#### 3.3 Test Step of EUT

- 3.3.1 Setup the fixture to EUT for power supplying.
- 3.3.2 Turn on the power of all equipment.
- 3.3.3 Let the EUT continuous transmission. Executed the test.

#### 3.4 Test Equipment

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSP40	100478	2015/06/02
Preamplifier	Agilent	8449B	3008A01434	2015/05/07
Preamplifier	Agilent	83050A	3950A00225	2014/09/08
Horn Antenna	Schwarzbeck	BBHA 9120	9120D-583	2015/05/13
Horn Antenna	Schwarzbeck	BBHA 9170	213	2014/07/24
Cable	HARBOUR	27478LL142	CBL22	2015/01/01
EMI Test Receiver	Rohde & Schwarz	ESVS10	826148/011	2014/11/04
Biconical Antenna	Schwarzbeck	BBA 9106	VHA 9103-2418	2015/01/18
Log Antenna	Schwarzbeck	UHALP 9108 A	0738	2015/01/18
Pre-Amplifier	Agilent	8447D	2944A09703	2015/04/29
RF Cable	EMCI	EMC8D-NM-NM-25000	140105	2015/02/16
RF Cable	Mini-Circuits	CBL-3FL-NMNM	CBL56	2014/08/30
RF Cable	Insulated Wire	CBL59	CBL59	2015/01/22

Note: The above equipments are within the valid calibration period.

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#### 4 Radiated Emission Test

#### 4.1 Limits

According to FCC 15.231(b) requirement:

In addition to the provisions of §15.205, the field strength of emissions from intentional radiator operated under this section shall not exceed the following:

#### **Fundamental and Harmonics Emission Limits**

Frequency	Field Strength of Fundamental		Field Strength	of Harmonics
(MHz)	( μ V/m @3m)	(dB μ V/m @3m)	( $\mu$ V/m @3m)	(dB μ V/m@3m)
433.92	10996	80.8	1099.6	60.8

#### **General Radiated Emission Limit**

Spurious Emission tested through until 10<sup>th</sup> harmonic. Radiated emissions, which fall in the restricted bands, as defined in §15.205 (a), comply with the radiated emission limits specified in §15.209 (a).

Frequency	15.209 Limits			
(MHz)	( μ V/m@3m)	(dB μ V/m @3m)		
30-88	100	40		
88-216	150	43.5		
216-960	200	46		
Above 960	500	54		

#### Remark:

- 1. The table above tighter limit applies at the band edges.
- 2. The measurement distance in meters, which that between form closest point of EUT to instrument antenna.

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#### 4.2 Calculation of Average Factor

The output field strengths of specification in accordance with the FCC rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The duty cycle is measured in 100 ms or the repetition cycle period, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer to set zero span at 100kHz resolution bandwidth.

## (From ASK)

Averaging factor in dB =20 log (duty cycle)

The duration of one cycle = 423ms

The duty cycle is simply the on-time divided by 100ms

Duty Cycle =  $(8.68 \text{ms}^*1) = 8.68 \text{ ms} / 100 \text{ms}$ 

Therefore, the averaging factor is found by  $20 \log 0.0868 = -21.23 \text{ dB}$ 

#### (From FSK)

Averaging factor in dB =20 log (duty cycle)

The duration of one cycle = 423ms

The duty cycle is simply the on-time divided by 100ms

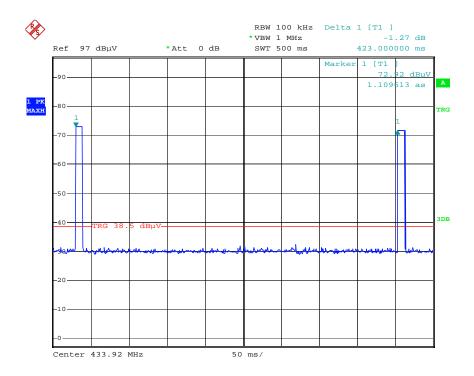
Duty Cycle =  $(8.98\text{ms}^*1) = 8.98\text{ ms} / 100\text{ms}$ 

Therefore, the averaging factor is found by  $20 \log 0.0898 = -20.93 \text{ dB}$ 

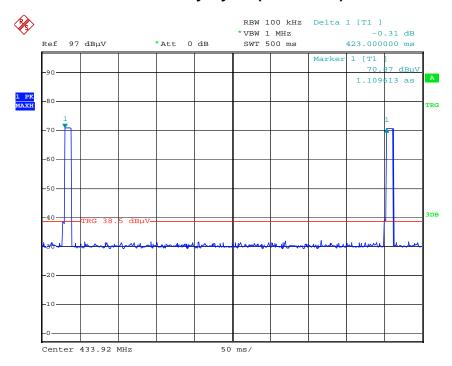
Please see the diagrams below.

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# Duty Cycle



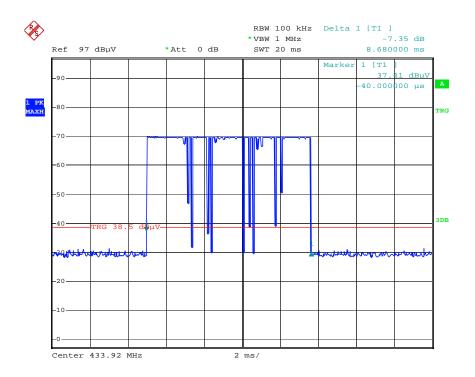
## **Duty Cycle (From ASK)**



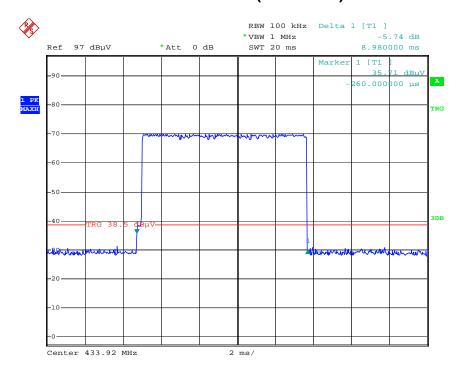
**Duty Cycle (From FSK)** 

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#### **Time Slot**



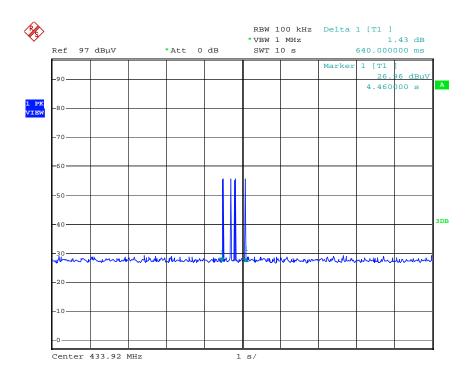
# Time Slot (From ASK)



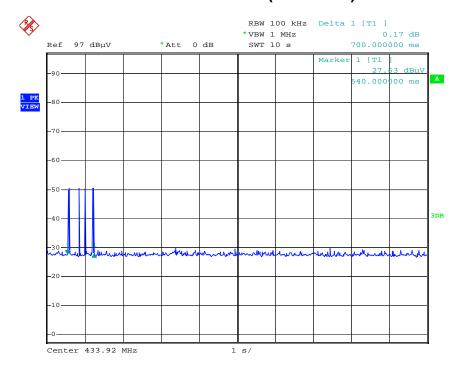
Time Slot (From FSK)

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The EUT was complied with the requirement of FCC 15.231 (a)(2), A transmitter activated automatically shall cease transmission within 5 seconds after activation.



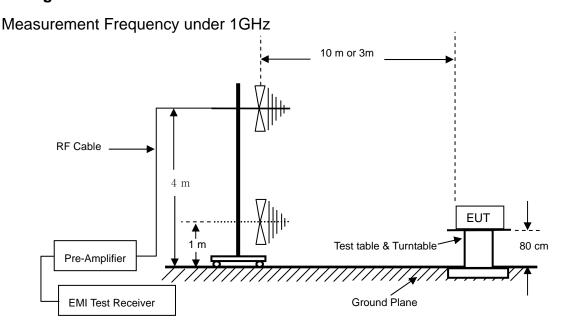
## **Deactivation (From ASK)**



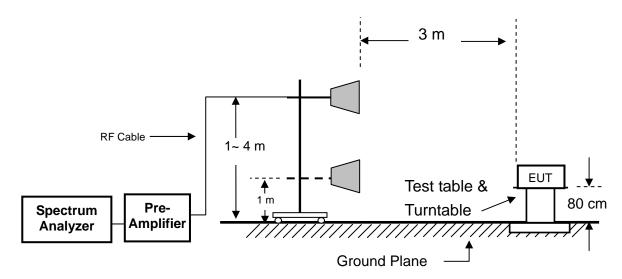
#### **Deactivation (From FSK)**

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#### 4.3 Configuration of Measurement



Measurement Frequency above 1GHz



#### 4.4 Test Procedure

Radiated emission measurements frequency range were performed from 30MHz to 4GHz. Spectrum Analyzer Resolution Bandwidth set to 100kHz or greater for frequencies from 30MHz to 1GHz, and set 1MHz Resolution Bandwidth for frequencies above 1GHz.

The EUT is place on non-conductive turntable for the test. If peripheral devices apply to the EUT, the peripheral devices will be connected to EUT and whole system. During the emission test, the signal is maximized through rotation and all cables were present worst-case emissions. The height of antenna and polarization is constantly changed for exploring maximum signal reading. The height of antenna can be up form reference ground to 4 meter and down to 1 meter.

#### 4.5 Test Result

#### PASS.

The final test emission data is shown as following tables.

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# Radiated Emission Below 1GHz (From Worse: ASK Modulation)

Frequency	Antenna	Reading	Preamp	Correction Factor	Corrected Level	Limits	Margin	Det
(MHz)	Polarization	(dBuV)	(dB)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Mode
115.780	Н	45.86	29.97	13.84	29.73	43.52	-13.79	PK
167.420	Н	43.98	29.59	17.65	32.04	43.52	-11.48	PK
207.320	Н	39.68	29.87	19.93	29.74	43.52	-13.78	PK
270.330	Н	40.95	29.58	21.94	33.31	46.02	-12.71	PK
347.720	Н	41.95	29.42	18.69	31.22	46.02	-14.80	PK
440.300	Н	40.80	30.21	21.47	32.06	46.02	-13.96	PK
65.890	V	50.26	30.58	8.15	27.83	40.00	-12.17	PK
138.290	V	46.29	30.75	17.01	32.55	43.52	-10.97	PK
187.200	V	41.80	29.85	19.66	31.61	43.52	-11.91	PK
268.720	V	42.76	29.59	21.99	35.16	46.02	-10.86	PK
365.780	V	43.96	29.49	19.32	33.79	46.02	-12.23	PK
458.220	V	41.19	30.51	21.72	32.40	46.02	-13.62	PK

Remark : Corrected Level = Reading + Correction Factor - Preamp Correction Factor = Antenna Factor + Cable Loss

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# **Fundamental and Harmonics Emissions (From ASK)**

(MHz)         Polarization         (dBuV)         (dB)         (dB/m)         (dB)         (dBuV/m)           433.92(X Axis)         H         55.10         0.00         21.30          76.40           433.92(X Axis)         H         55.10         0.00         21.30          82.67           433.92(Y Axis)         H         61.37         0.00         21.30          82.67           433.92(Y Axis)         H         61.37         0.00         21.30          85.03           433.92(Z Axis)         H         63.73         0.00         21.30          85.03           433.92(Z Axis)         H         52.25         30.10         29.36          51.51           867.84         H         52.25         30.10         29.36          51.51           867.84         H <th>(dBuV/m) 100.8 80.8 100.8 80.8 100.8 80.8 60.8 74.0 54.0 80.8 60.8 80.8</th> <th>(dB) -24.40 -25.63 -18.13 -19.36 -15.77 -17.00 -29.29 -30.52 -14.64 -15.87 -16.42 -17.65</th> <th>Mode PK AV PK</th>	(dBuV/m) 100.8 80.8 100.8 80.8 100.8 80.8 60.8 74.0 54.0 80.8 60.8 80.8	(dB) -24.40 -25.63 -18.13 -19.36 -15.77 -17.00 -29.29 -30.52 -14.64 -15.87 -16.42 -17.65	Mode PK AV PK
433.92(X Axis)         H         55.10         0.00         21.30          76.40           433.92(X Axis)         H         55.10         0.00         21.30         -21.23         55.17           433.92(Y Axis)         H         61.37         0.00         21.30          82.67           433.92(Y Axis)         H         61.37         0.00         21.30         -21.23         61.44           433.92(Z Axis)         H         63.73         0.00         21.30          85.03           433.92(Z Axis)         H         63.73         0.00         21.30          1.23         63.80           867.84         H         52.25         30.10         29.36          51.51           867.84 <td>100.8 80.8 100.8 80.8 100.8 80.8 60.8 74.0 54.0 80.8 60.8 80.8</td> <td>-25.63 -18.13 -19.36 -15.77 -17.00 -29.29 -30.52 -14.64 -15.87 -16.42</td> <td>AV PK AV PK AV PK AV PK AV PK AV PK AV</td>	100.8 80.8 100.8 80.8 100.8 80.8 60.8 74.0 54.0 80.8 60.8 80.8	-25.63 -18.13 -19.36 -15.77 -17.00 -29.29 -30.52 -14.64 -15.87 -16.42	AV PK AV PK AV PK AV PK AV PK AV PK AV
433.92(X Axis)         H         55.10         0.00         21.30         -21.23         55.17           433.92(Y Axis)         H         61.37         0.00         21.30          82.67           433.92(Y Axis)         H         61.37         0.00         21.30         -21.23         61.44           433.92(Z Axis)         H         63.73         0.00         21.30          85.03           433.92(Z Axis)         H         63.73         0.00         21.30         -21.23         63.80           867.84         H         52.25         30.10         29.36          51.51           867.84         H         52.25         30.10         29.36         -21.23         30.28           1301.76         H         58.61         27.36         28.11          59.36           1301.76         H         58.61         27.36         28.11         -21.23         38.13           1735.68         H         62.74         27.67         29.31          64.38           1735.68         H         62.74         27.67         29.31         -21.23         43.15           2169.60         H         36	100.8 80.8 100.8 80.8 80.8 60.8 74.0 54.0 80.8 60.8	-18.13 -19.36 -15.77 -17.00 -29.29 -30.52 -14.64 -15.87 -16.42	PK AV PK AV PK AV PK AV PK
433.92(Y Axis)         H         61.37         0.00         21.30         -21.23         61.44           433.92(Z Axis)         H         63.73         0.00         21.30          85.03           433.92(Z Axis)         H         63.73         0.00         21.30         -21.23         63.80           867.84         H         52.25         30.10         29.36          51.51           867.84         H         52.25         30.10         29.36         -21.23         30.28           1301.76         H         58.61         27.36         28.11          59.36           1301.76         H         58.61         27.36         28.11         -21.23         38.13           1735.68         H         62.74         27.67         29.31          64.38           1735.68         H         62.74         27.67         29.31         -21.23         43.15           2169.60         H         36.90         27.80         30.57         -21.23         18.44	80.8 100.8 80.8 80.8 60.8 74.0 54.0 80.8 60.8	-19.36 -15.77 -17.00 -29.29 -30.52 -14.64 -15.87 -16.42	AV PK AV PK AV PK AV PK
433.92(Z Axis)         H         63.73         0.00         21.30          85.03           433.92(Z Axis)         H         63.73         0.00         21.30         -21.23         63.80           867.84         H         52.25         30.10         29.36          51.51           867.84         H         52.25         30.10         29.36         -21.23         30.28           1301.76         H         58.61         27.36         28.11          59.36           1301.76         H         58.61         27.36         28.11         -21.23         38.13           1735.68         H         62.74         27.67         29.31          64.38           1735.68         H         62.74         27.67         29.31         -21.23         43.15           2169.60         H         36.90         27.80         30.57         -21.23         18.44	100.8 80.8 80.8 60.8 74.0 54.0 80.8 60.8	-15.77 -17.00 -29.29 -30.52 -14.64 -15.87 -16.42	PK AV PK AV PK AV PK
433.92(Z Axis)         H         63.73         0.00         21.30         -21.23         63.80           867.84         H         52.25         30.10         29.36          51.51           867.84         H         52.25         30.10         29.36         -21.23         30.28           1301.76         H         58.61         27.36         28.11          59.36           1301.76         H         58.61         27.36         28.11         -21.23         38.13           1735.68         H         62.74         27.67         29.31          64.38           1735.68         H         62.74         27.67         29.31         -21.23         43.15           2169.60         H         36.90         27.80         30.57          39.67           2169.60         H         36.90         27.80         30.57         -21.23         18.44	80.8 80.8 60.8 74.0 54.0 80.8 60.8	-17.00 -29.29 -30.52 -14.64 -15.87 -16.42	AV PK AV PK AV PK
867.84         H         52.25         30.10         29.36          51.51           867.84         H         52.25         30.10         29.36         -21.23         30.28           1301.76         H         58.61         27.36         28.11          59.36           1301.76         H         58.61         27.36         28.11         -21.23         38.13           1735.68         H         62.74         27.67         29.31          64.38           1735.68         H         62.74         27.67         29.31         -21.23         43.15           2169.60         H         36.90         27.80         30.57          39.67           2169.60         H         36.90         27.80         30.57         -21.23         18.44	80.8 60.8 74.0 54.0 80.8 60.8 80.8	-29.29 -30.52 -14.64 -15.87 -16.42	PK AV PK AV PK
867.84         H         52.25         30.10         29.36         -21.23         30.28           1301.76         H         58.61         27.36         28.11          59.36           1301.76         H         58.61         27.36         28.11         -21.23         38.13           1735.68         H         62.74         27.67         29.31          64.38           1735.68         H         62.74         27.67         29.31         -21.23         43.15           2169.60         H         36.90         27.80         30.57          39.67           2169.60         H         36.90         27.80         30.57         -21.23         18.44	60.8 74.0 54.0 80.8 60.8 80.8	-30.52 -14.64 -15.87 -16.42	AV PK AV PK
1301.76         H         58.61         27.36         28.11          59.36           1301.76         H         58.61         27.36         28.11         -21.23         38.13           1735.68         H         62.74         27.67         29.31          64.38           1735.68         H         62.74         27.67         29.31         -21.23         43.15           2169.60         H         36.90         27.80         30.57          39.67           2169.60         H         36.90         27.80         30.57         -21.23         18.44	74.0 54.0 80.8 60.8 80.8	-14.64 -15.87 -16.42	PK AV PK
1301.76     H     58.61     27.36     28.11     -21.23     38.13       1735.68     H     62.74     27.67     29.31      64.38       1735.68     H     62.74     27.67     29.31     -21.23     43.15       2169.60     H     36.90     27.80     30.57      39.67       2169.60     H     36.90     27.80     30.57     -21.23     18.44	54.0 80.8 60.8 80.8	-15.87 -16.42	AV PK
1735.68     H     62.74     27.67     29.31      64.38       1735.68     H     62.74     27.67     29.31     -21.23     43.15       2169.60     H     36.90     27.80     30.57      39.67       2169.60     H     36.90     27.80     30.57     -21.23     18.44	80.8 60.8 80.8	-16.42	PK
1735.68         H         62.74         27.67         29.31         -21.23         43.15           2169.60         H         36.90         27.80         30.57          39.67           2169.60         H         36.90         27.80         30.57         -21.23         18.44	60.8 80.8		
2169.60         H         36.90         27.80         30.57          39.67           2169.60         H         36.90         27.80         30.57         -21.23         18.44	80.8	-17.65	
2169.60 H 36.90 27.80 30.57 -21.23 18.44			AV
		-41.13	PK
2603.52   H   43.60   27.83   32.14     47.91	60.8	-42.36	AV
	80.8	-32.89	PK
2603.52 H 43.60 27.83 32.14 -21.23 26.68	60.8	-34.12	AV
3037.44 H 48.14 27.97 33.36 53.53	80.8	-27.27	PK
3037.44 H 48.14 27.97 33.36 -21.23 32.30	60.8	-28.50	AV
3471.36 H 38.52 27.79 33.68 44.41	80.8	-36.39	PK
3471.36 H 38.52 27.79 33.68 -21.23 23.18	60.8	-37.62	AV
3905.28 H 40.50 27.86 35.88 48.52	74.0	-25.48	PK
3905.28 H 40.50 27.86 35.88 -21.23 27.29	54.0	-26.71	AV
4339.20 H 39.12 27.61 36.53 48.04	74.0	-25.96	PK
4339.20 H 39.12 27.61 36.53 -21.23 26.81	54.0	-27.19	AV
433.92(X Axis) V 60.22 0.00 21.06 81.28	100.8	-19.52	PK
433.92(X Axis) V 60.22 0.00 21.06 -21.23 60.05	80.8	-20.75	AV
433.92(Y Axis) V 59.73 0.00 21.06 80.79	100.8	-20.01	PK
433.92(Y Axis) V 59.73 0.00 21.06 -21.23 59.56	80.8	-21.24	AV
433.92(Z Axis) V 56.06 0.00 21.06 77.12	100.8	-23.68	PK
433.92(Z Axis) V 56.06 0.00 21.06 -21.23 55.89	80.8	-24.91	AV
867.84 V 49.28 30.10 28.94 48.12	80.8	-32.68	PK
867.84 V 49.28 30.10 28.94 -21.23 26.89	60.8	-33.91	AV
1301.76 V 59.68 27.36 28.11 60.43 1301.76 V 59.68 27.36 28.11 21.23 39.20	74.0	-13.57	PK
1001110 1 00100 21100 20111 21120 00120	54.0	-14.80	AV
1735.68         V         61.67         27.67         29.31          63.31           1735.68         V         61.67         27.67         29.31         -21.23         42.08	80.8	-17.49	PK
	60.8	-18.72	AV
	80.8 60.8	-42.06 42.20	PK AV
2000 50 1/4 10 00 10 00 14	80.8	-43.29 -33.29	PK
2603.52 V 43.20 27.83 32.14 47.51 2603.52 V 43.20 27.83 32.14 -21.23 26.28	60.8	-34.52	AV
	80.8		PK
3037.44	60.8	-29.38 -30.61	AV
3037.44 V 46.03 27.97 33.36 -21.23 30.19 3471.36 V 39.53 27.79 33.68 45.42	80.8	-35.38	PK
3471.36 V 39.53 27.79 33.68 43.42 3471.36 V 39.53 27.79 33.68 -21.23 24.19	60.8	-36.61	AV
3905.28 V 41.73 27.86 35.88 49.75	74.0	-24.25	PK
3905.28 V 41.73 27.86 35.88 -21.23 28.52	54.0	-25.48	AV
4339.20 V 37.46 27.61 36.53 46.38	74.0	-23.46	PK
4339.20 V 37.46 27.61 36.53 -21.23 25.15	54.0	-28.85	AV

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# **Fundamental and Harmonics Emissions (From FSK)**

(MHz)         Polarization         (dBuV)         (dB)         (dB/m)         (dB)         (dBuV/m)         (dBuV/m)         (dB)           433.92(X Axis)         H         55.23         0.00         21.30          76.53         100.8         -24.27           433.92(X Axis)         H         55.23         0.00         21.30         -20.93         55.60         80.8         -25.20           433.92(Y Axis)         H         61.14         0.00         21.30          82.44         100.8         -18.36           433.92(Y Axis)         H         61.14         0.00         21.30          82.44         100.8         -18.36           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         53.07         0.00         21.30         -20.93         63.44         80.8 <t< th=""><th>Mode PK AV PK AV PK AV PK AV PK AV PK AV AV AV</th></t<>	Mode PK AV PK AV PK AV PK AV PK AV PK AV AV AV
433.92(X Axis)         H         55.23         0.00         21.30          76.53         100.8         -24.27           433.92(X Axis)         H         55.23         0.00         21.30         -20.93         55.60         80.8         -25.20           433.92(Y Axis)         H         61.14         0.00         21.30          82.44         100.8         -18.36           433.92(Y Axis)         H         61.14         0.00         21.30          84.37         100.8         -19.29           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          51.76         80.8         -17.36	PK AV PK AV PK AV PK AV PK AV AV AV
433.92(X Axis)         H         55.23         0.00         21.30         -20.93         55.60         80.8         -25.20           433.92(Y Axis)         H         61.14         0.00         21.30          82.44         100.8         -18.36           433.92(Y Axis)         H         61.14         0.00         21.30         -20.93         61.51         80.8         -19.29           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30         -20.93         63.44         80.8         -17.36           867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.97           1301.76         H         58.50         27.36         28.11          59.25         74.0         -14.75	AV PK AV PK AV PK AV PK AV AV
433.92(Y Axis)         H         61.14         0.00         21.30          82.44         100.8         -18.36           433.92(Y Axis)         H         61.14         0.00         21.30         -20.93         61.51         80.8         -19.29           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30          80.34         80.8         -17.36           867.84         H         52.50         30.10         29.36          51.76         80.8         -29.04           867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.97           1301.76         H         58.50         27.36         28.11         -20.93         38.32         54.0         -15.68      <	PK AV PK AV PK AV PK AV
433.92(Y Axis)         H         61.14         0.00         21.30         -20.93         61.51         80.8         -19.29           433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30         -20.93         63.44         80.8         -17.36           867.84         H         52.50         30.10         29.36          51.76         80.8         -29.04           867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.04           867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.04           867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.04           867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.04           867.84         H         58.50         27.36         28.11          59.25         74.0         -14.75           <	AV PK AV PK AV PK AV
433.92(Z Axis)         H         63.07         0.00         21.30          84.37         100.8         -16.43           433.92(Z Axis)         H         63.07         0.00         21.30         -20.93         63.44         80.8         -17.36           867.84         H         52.50         30.10         29.36          51.76         80.8         -29.04           867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.97           1301.76         H         58.50         27.36         28.11          59.25         74.0         -14.75           1301.76         H         58.50         27.36         28.11         -20.93         38.32         54.0         -15.68           1735.68         H         62.35         27.67         29.31         -20.93         38.32         54.0         -15.68           1735.68         H         62.35         27.67         29.31         -20.93         43.06         60.8         -17.74           2169.60         H         35.86         27.80         30.57          38.63         80.8         -42.17           260	PK AV PK AV PK AV
433.92(Z Axis)         H         63.07         0.00         21.30         -20.93         63.44         80.8         -17.36           867.84         H         52.50         30.10         29.36          51.76         80.8         -29.04           867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.97           1301.76         H         58.50         27.36         28.11          59.25         74.0         -14.75           1301.76         H         58.50         27.36         28.11         -20.93         38.32         54.0         -15.68           1735.68         H         62.35         27.67         29.31          63.99         80.8         -16.81           1735.68         H         62.35         27.67         29.31         -20.93         43.06         60.8         -17.74           2169.60         H         35.86         27.80         30.57          38.63         80.8         -42.17           2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52	AV PK AV PK AV
867.84         H         52.50         30.10         29.36          51.76         80.8         -29.04           867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.97           1301.76         H         58.50         27.36         28.11          59.25         74.0         -14.75           1301.76         H         58.50         27.36         28.11         -20.93         38.32         54.0         -15.68           1735.68         H         62.35         27.67         29.31          63.99         80.8         -16.81           1735.68         H         62.35         27.67         29.31         -20.93         43.06         60.8         -17.74           2169.60         H         35.86         27.80         30.57          38.63         80.8         -42.17           2169.60         H         35.86         27.80         30.57         -20.93         17.70         60.8         -43.10           2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52	PK AV PK AV
867.84         H         52.50         30.10         29.36         -20.93         30.83         60.8         -29.97           1301.76         H         58.50         27.36         28.11          59.25         74.0         -14.75           1301.76         H         58.50         27.36         28.11         -20.93         38.32         54.0         -15.68           1735.68         H         62.35         27.67         29.31          63.99         80.8         -16.81           1735.68         H         62.35         27.67         29.31         -20.93         43.06         60.8         -17.74           2169.60         H         35.86         27.80         30.57          38.63         80.8         -42.17           2169.60         H         35.86         27.80         30.57         -20.93         17.70         60.8         -43.10           2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52         H         44.12         27.83         32.14         -20.93         27.50         60.8         -33.30           3037.44	AV PK AV
1301.76         H         58.50         27.36         28.11          59.25         74.0         -14.75           1301.76         H         58.50         27.36         28.11         -20.93         38.32         54.0         -15.68           1735.68         H         62.35         27.67         29.31          63.99         80.8         -16.81           1735.68         H         62.35         27.67         29.31         -20.93         43.06         60.8         -17.74           2169.60         H         35.86         27.80         30.57          38.63         80.8         -42.17           2169.60         H         35.86         27.80         30.57         -20.93         17.70         60.8         -43.10           2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52         H         44.12         27.83         32.14         -20.93         27.50         60.8         -33.30           3037.44         H         48.34         27.97         33.36          53.73         80.8         -27.07           3037.44	PK AV
1301.76         H         58.50         27.36         28.11         -20.93         38.32         54.0         -15.68           1735.68         H         62.35         27.67         29.31          63.99         80.8         -16.81           1735.68         H         62.35         27.67         29.31         -20.93         43.06         60.8         -17.74           2169.60         H         35.86         27.80         30.57          38.63         80.8         -42.17           2169.60         H         35.86         27.80         30.57         -20.93         17.70         60.8         -43.10           2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52         H         44.12         27.83         32.14         -20.93         27.50         60.8         -33.30           3037.44         H         48.34         27.97         33.36          53.73         80.8         -27.07           3037.44         H         48.34         27.97         33.36         -20.93         32.80         60.8         -28.00	ΑV
1735.68         H         62.35         27.67         29.31          63.99         80.8         -16.81           1735.68         H         62.35         27.67         29.31         -20.93         43.06         60.8         -17.74           2169.60         H         35.86         27.80         30.57          38.63         80.8         -42.17           2169.60         H         35.86         27.80         30.57         -20.93         17.70         60.8         -43.10           2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52         H         44.12         27.83         32.14         -20.93         27.50         60.8         -33.30           3037.44         H         48.34         27.97         33.36          53.73         80.8         -27.07           3037.44         H         48.34         27.97         33.36         -20.93         32.80         60.8         -28.00	
1735.68         H         62.35         27.67         29.31         -20.93         43.06         60.8         -17.74           2169.60         H         35.86         27.80         30.57          38.63         80.8         -42.17           2169.60         H         35.86         27.80         30.57         -20.93         17.70         60.8         -43.10           2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52         H         44.12         27.83         32.14         -20.93         27.50         60.8         -33.30           3037.44         H         48.34         27.97         33.36          53.73         80.8         -27.07           3037.44         H         48.34         27.97         33.36         -20.93         32.80         60.8         -28.00	PK
2169.60         H         35.86         27.80         30.57          38.63         80.8         -42.17           2169.60         H         35.86         27.80         30.57         -20.93         17.70         60.8         -43.10           2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52         H         44.12         27.83         32.14         -20.93         27.50         60.8         -33.30           3037.44         H         48.34         27.97         33.36          53.73         80.8         -27.07           3037.44         H         48.34         27.97         33.36         -20.93         32.80         60.8         -28.00	AV
2169.60         H         35.86         27.80         30.57         -20.93         17.70         60.8         -43.10           2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52         H         44.12         27.83         32.14         -20.93         27.50         60.8         -33.30           3037.44         H         48.34         27.97         33.36          53.73         80.8         -27.07           3037.44         H         48.34         27.97         33.36         -20.93         32.80         60.8         -28.00	PK
2603.52         H         44.12         27.83         32.14          48.43         80.8         -32.37           2603.52         H         44.12         27.83         32.14         -20.93         27.50         60.8         -33.30           3037.44         H         48.34         27.97         33.36          53.73         80.8         -27.07           3037.44         H         48.34         27.97         33.36         -20.93         32.80         60.8         -28.00	AV
2603.52     H     44.12     27.83     32.14     -20.93     27.50     60.8     -33.30       3037.44     H     48.34     27.97     33.36      53.73     80.8     -27.07       3037.44     H     48.34     27.97     33.36     -20.93     32.80     60.8     -28.00	PK
3037.44     H     48.34     27.97     33.36      53.73     80.8     -27.07       3037.44     H     48.34     27.97     33.36     -20.93     32.80     60.8     -28.00	AV
3037.44 H 48.34 27.97 33.36 -20.93 32.80 60.8 -28.00	PK
	AV
	PK
3471.36 H 37.79 27.79 33.68 -20.93 22.75 60.8 -38.05	AV
3905.28 H 39.67 27.86 35.88 47.69 74.0 -26.31	PK
3905.28 H 39.67 27.86 35.88 -20.93 26.76 54.0 -27.24	AV
4339.20 H 38.82 27.61 36.53 47.74 74.0 -26.26	PK
4339.20 H 38.82 27.61 36.53 -20.93 26.81 54.0 -27.19	AV
433.92(X Axis) V 60.03 0.00 21.06 81.09 100.8 -19.71	PK
433.92(X Axis) V 60.03 0.00 21.06 -20.93 60.16 80.8 -20.64	AV
433.92(Y Axis) V 59.70 0.00 21.06 80.76 100.8 -20.04	PK
433.92(Y Axis) V 59.70 0.00 21.06 -20.93 59.83 80.8 -20.97	AV
433.92(Z Axis) V 55.75 0.00 21.06 76.81 100.8 -23.99	PK
433.92(Z Axis) V 55.75 0.00 21.06 -20.93 55.88 80.8 -24.92	AV
867.84 V 48.89 30.10 28.94 47.73 80.8 -33.07	PK
867.84 V 48.89 30.10 28.94 -20.93 26.80 60.8 -34.00	AV
1301.76 V 59.34 27.36 28.11 60.09 74.0 -13.91	PK
1301.76 V 59.34 27.36 28.11 -20.93 39.16 54.0 -14.84	AV
1735.68 V 60.76 27.67 29.31 62.40 80.8 -18.40	PK
1735.68 V 60.76 27.67 29.31 -20.93 41.47 60.8 -19.33	AV
2169.60 V 35.64 27.80 30.57 38.41 80.8 -42.39	PK
2169.60 V 35.64 27.80 30.57 -20.93 17.48 60.8 -43.32	AV
2603.52 V 43.70 27.83 32.14 48.01 80.8 -32.79	PK
2603.52 V 43.70 27.83 32.14 -20.93 27.08 60.8 -33.72	AV
3037.44 V 45.37 27.97 33.36 50.76 80.8 -30.04	PK
3037.44 V 45.37 27.97 33.36 -20.93 29.83 60.8 -30.97	AV
3471.36 V 39.02 27.79 33.68 44.91 80.8 -35.89	PK
3471.36 V 39.02 27.79 33.68 -20.93 23.98 60.8 -36.82	AV
3905.28 V 40.96 27.86 35.88 48.98 74.0 -25.02	
3905.28 V 40.96 27.86 35.88 -20.93 28.05 54.0 -25.95	PK
4339.20 V 36.68 27.61 36.53 45.60 74.0 -28.40	PK AV
4339.20 V 36.68 27.61 36.53 -20.93 24.67 54.0 -29.33	PK AV PK

#### Remark:

- Corrected Level = Reading + Correction Factor Preamp 1.
- Correction Factor = Antenna Factor + Cable Loss 2.
- 3.
- " \* " Mark indicated Background Noise Level The signal bandwidth was measured and less then 100KHz RBW so PDCF factor is not required to correct the fundamental signal peak result.

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#### 5 **Emission Bandwidth**

#### 5.1 Limits

According to FCC 15.231(c) requirement:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz to 900 MHz. Those devices operating above 900 MHz, the emission spurious shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

B.W (20dBc) Limit = 0.25% \* f(MHz) = 0.25% \* 433.92MHz = 1084.8kHz

#### 5.2 Test Result

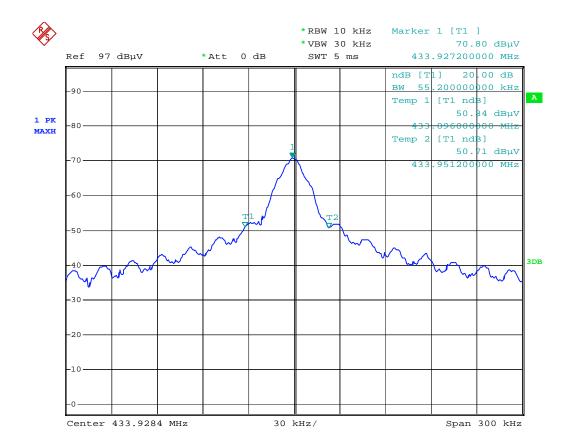
#### PASS.

The final test data is shown as following.

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## 20dB Bandwidth (From ASK)

Channel Frequency (MHz)	Measured 20dB Bandwidth (kHz)	Limit (kHz)	Result
433.92	55.2	1084.8	PASS



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## 20dB Bandwidth (From FSK)

Channel Frequency (MHz)	Measured 20dB Bandwidth (kHz)	Limit (kHz)	Result
433.92	142.8	1084.8	PASS

