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RADIO TEST REPORT

Report No.: STS2007024W01

Issued for

MSG AUTOMOTIVE SOLUTIONS LIMITED

2 Chapman Way, High Brooms Industrial Estate, Tunbridge
Wells, Kent, United Kingdom

Product Name:	MDVR
Brand Name:	 VISIONTRACK
Model Name:	VT5500-G-LTE
Series Model:	N/A
FCC ID:	2AWHE-VT5500-G-LTE
Test Standard:	47 CFR Part 2, 90

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Shenzhen STS Test Services Co., Ltd.

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**TEST RESULT CERTIFICATION**

Applicant's Name: MSG AUTOMOTIVE SOLUTIONS LIMITED
Address: 2 Chapman Way, High Brooms Industrial Estate, Tunbridge Wells, Kent, United Kingdom
Manufacture's Name: Streamax Technology Co.,Ltd
Address: 21-23/F,Building B1,Zhiyuan,No.1001,Xueyuan Avenue,Nanshan District,Shenzhen,Guangdong,P.R.China

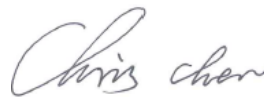
Product Description

Product Name: MDVR
Brand Name: 
Model Name: VT5500-G-LTE
Series Model: N/A
Test Standards.....: 47 CFR Part 2, 90
Test Procedure: KDB 971168 D01 v03r01, ANSI C63.26 2015

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test.....:
Date of receipt of test item.....: 08 July 2020
Date (s) of performance of tests.: 08 July 2020 ~ 09 July 2020
Date of Issue: 09 July 2020
Test Result: Pass

Testing Engineer :



(Chris Chen)

Technical Manager :



(Sean she)

Authorized Signatory :



(Vita Li)





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**Revision History**

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	09 July 2020	STS2007024W01	ALL	Initial Issue





1. SUMMARY OF TEST RESULTS

1.1 TEST RESULTS DESCRIPTION AND LABORATORY INFORMATION

FCC Rule	Description	Limit	Result
§2.1046 §90.542(a)(6)	Conducted Output Power Effective Radiated Power	Reporting Only ERP≤30W	PASS
§2.1053 §90.543(e)(3)	Radiated Spurious Emission	<43 + 10 log (P) Db	PASS

The certified module ID is FCC ID: XMR201808EC25AF, and report numbers of this certified module are R1806A0301-R1V1/ R1806A0301-R2V1/ R1806A0301-R3V1/ R1806A0301-R4V1/ R1806A0301-M1V3.

This certified module will be integrated into this host that is installed in a car to apply for a new FCC ID. Therefore, it is the same mobile condition as the original filling.

In this report, this certified module is same as the original filling. We have verified the power and test for new radiated emission to demonstrate full compliance.

1.2 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD

Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

1.3 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 30-1GHz	±5.6dB
4	All emissions, radiated 1G-6GHz	±5.5dB
5	All emissions, radiated>6G	±5.8dB
6	Conducted Emission (9KHz-150KHz)	±3.37dB
7	Conducted Emission (150KHz-30MHz)	±3.83dB




2. GENERAL INFORMATION

2.1 TECHNICAL SPECIFICATIONS AND REGULATIONS

2.1.1 PRODUCT DESCRIPTION

A major technical description of EUT is described as following:

Product Name:	MDVR
Trade Name	 VISIONTRACK
Model Name	VT5500-G-LTE
Series Model	N/A
Model Difference	N/A
Frequency Bands:	U.S. Bands: LTE FDD Band 14
SIM CARD:	Only support single SIM Card.
Antenna:	Passive antenna
Antenna gain:	Band14:3dBi
Power class:	Power Class 3
Power Rating:	Input: DC9-36V
Extreme Vol. Limits:	DC 9V to DC 36V (Nominal DC 18V)
Extreme Temp. Tolerance:	-30°C to +50°C
Hardware version number:	N/A
Software version number:	N/A



2.1.2 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Product Specification Subjective To This Standard	
Tx Frequency	LTE Band 14:788~798MHz
Rx Frequency	LTE Band 14:758~768MHz
Bandwidth	LTE Band 14: 5MHz / 10MHz
Maximum Output Power	LTE Band 14: 23.78 dBm
Type of Modulation	QPSK /16QAM

2.1.3 TEST CONFIGURATION OF EQUIPMENT UNDER TEST

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 v03r01 and ANSI C63.26 2015 Power Meas. License Digital Systems with maximum output power. Radiated measurements are performed by rotating the EUT in three different orthogonal test planes to find the maximum emission.

Remark:

1. The mark 'v' means that this configuration is chosen for testing
2. The mark '-' means that this bandwidth is not supported.
3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated.

ITEMS	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
Max. Output Power; E.R.P	14			v	v			v	v	v	v	v		v	
Radiated Spurious Emission	14			v	v			v		v				v	



2.1.4 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for filing to comply with the 47 CFR Part 2, 90.

2.1.5 SPECIAL ACCESSORIES

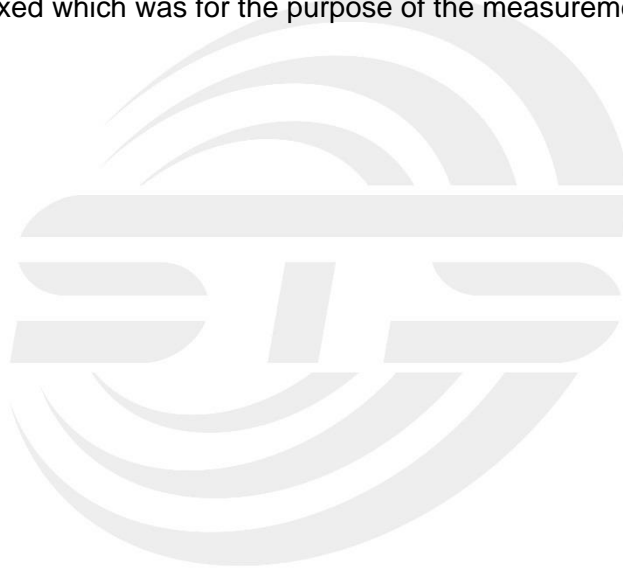
The battery and the charger, earphone supplied by the applicant were used as accessories and being tested with eut intended for fcc grant together.

2.1.6 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.1.7 EUT EXERCISE

The Transmitter was operated in the maximum output power mode through Communication Tester. The TX frequency was fixed which was for the purpose of the measurements.





2.1.8 CONFIGURATION OF EUT SYSTEM

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

E-1
EUT

Table 2-1 Equipment Used in EUT System

Item	Equipment	Model No.	Serial No.	Note
N/A	N/A	N/A	N/A	N/A

Note:

(1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.



2.1.9 MEASUREMENT INSTRUMENTS

The radiated emission testing was performed according to the procedures of ANSI C63.26 2015 and FCC CFR 47 rules of 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057.

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.10.09	2020.10.08
Signal Analyzer	Agilent	N9020A	MY51110105	2020.03.05	2021.03.04
Wireless Communications Test Set	R&S	CMW 500	133884	2020.03.05	2021.03.04
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.1
Horn Antenna	SCHWARZBECK	BBHA 9120D(1201)	9120D-1343	2018.10.19	2021.10.18
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2018.03.11	2021.03.10
Pre-Amplifier (0.1M-3GHz)	EM	EM330	060665	2019.10.09	2020.10.08
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2019.10.12	2020.10.11
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2019.10.12	2020.10.11
Turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Temperature & Humidity	HH660	Mieo	N/A	2019.10.17	2020.10.16
Test SW	BULUN	BL410-E/18.905			

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Universal Radio communication tester	R&S	CMU200	119907	2020.10.11	2021.10.10
Wireless Communications Test Set	R&S	CMW 500	133884	2020.03.05	2021.03.04
Signal Analyzer	Agilent	N9020A	MY49100060	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.17	2020.10.16
Test SW	FARAD	LZ-RF /LzRf-3A3			



2.1.10 MEASUREMENT RESULTS EXPLANATION EXAMPLE

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF Cable Loss + Attenuator Factor.



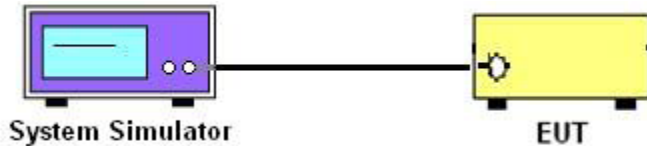
3. CONDUCTED OUTPUT POWER

3.1 DESCRIPTION OF THE CONDUCTED OUTPUT POWER MEASUREMENT

3.1.1 MEASUREMENT METHOD

A system simulator was used to establish communication with the eut. Its parameters were set to force the eut transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.
Configuration follows KDB 971168 D01 v03r01.

3.1.2 TEST SETUP



3.1.3 TEST PROCEDURES

1. The transmitter output port was connected to system simulator.
2. Set EUT at maximum power through the system simulator.
3. Select lowest/middle/highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.

5. Limit

Operating band	FCC Limit
----------------	-----------

Band 14	ERP 30 watts
---------	--------------

Note: $ERP \text{ or } EIRP = P_{Meas} + G_T$

where

ERP or EIRP: effective radiated power or equivalent isotropically radiated power, respectively
(expressed in the same units as P_{Meas} , e.g. dBm)

P_{Meas} : measured transmitter output power, in dBm

G_T : gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)



3.1.4 TEST RESULTS

Channel Bandwidth: 5 MHz						
Modulation	Channel	RB Configuration		Average Power [dBm]	E.r.p [dBm]	Verdict
		Size	Offset			
QPSK	LCH	1	0	23.17	24.02	PASS
		1	12	23.41	24.26	PASS
		1	24	23.24	24.09	PASS
		12	0	22.35	23.20	PASS
		12	6	22.44	23.29	PASS
		12	13	22.48	23.33	PASS
		25	0	22.44	23.29	PASS
	MCH	1	0	23.23	24.08	PASS
		1	12	23.57	24.42	PASS
		1	24	23.38	24.23	PASS
		12	0	22.52	23.37	PASS
		12	6	22.48	23.33	PASS
		12	13	22.59	23.44	PASS
		25	0	22.47	23.32	PASS
	HCH	1	0	23.27	24.12	PASS
		1	12	23.75	24.60	PASS
		1	24	23.28	24.13	PASS
		12	0	22.51	23.36	PASS
		12	6	22.53	23.38	PASS
		12	13	22.49	23.34	PASS
		25	0	22.43	23.28	PASS
16QAM	LCH	1	0	21.96	22.81	PASS
		1	12	21.95	22.80	PASS
		1	24	21.58	22.43	PASS
		12	0	21.41	22.26	PASS
		12	6	21.24	22.09	PASS
		12	13	21.19	22.04	PASS
		25	0	21.51	22.36	PASS
	MCH	1	0	21.98	22.83	PASS
		1	12	22.13	22.98	PASS
		1	24	21.91	22.76	PASS
		12	0	21.31	22.16	PASS
		12	6	21.37	22.22	PASS



		12	13	21.27	22.12	PASS
		25	0	21.44	22.29	PASS
	HCH	1	0	21.96	22.81	PASS
		1	12	22.02	22.87	PASS
		1	24	21.88	22.73	PASS
		12	0	21.16	22.01	PASS
		12	6	21.19	22.04	PASS
		12	13	21.08	21.93	PASS
		25	0	21.33	22.18	PASS

Channel Bandwidth: 10 MHz						
Modulation	Channel	RB Configuration		Average Power [dBm]	E.r.p [dBm]	Verdict
		Size	Offset			
QPSK	MCH	1	0	23.10	23.95	PASS
		1	24	23.78	24.63	PASS
		1	49	23.08	23.93	PASS
		25	0	22.52	23.37	PASS
		25	12	22.56	23.41	PASS
		25	25	22.38	23.23	PASS
		50	0	22.50	23.35	PASS
16QAM	MCH	1	0	22.46	23.31	PASS
		1	24	22.81	23.66	PASS
		1	49	22.35	23.20	PASS
		25	0	21.65	22.50	PASS
		25	12	21.67	22.52	PASS
		25	25	21.58	22.43	PASS
		50	0	21.53	22.38	PASS

4. RADIATED SPURIOUS EMISSION

4.1 DESCRIPTION OF RADIATED SPURIOUS EMISSION

4.1.1 MEASUREMENT METHOD

The radiated spurious emission was measured by substitution method according to ANSI C63.26 2015. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. For Band 7 The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $55 + 10 \log (P)$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.1.2 TEST SETUP

The procedure of radiated spurious emissions is as follows:

a) Pre-calibration With pre-calibration method, the Radiated Spurious Emissions(RSE) is calculated as, $RSE = Rx (dBuV) + CL (dB) + SA (dB) + Gain (dBi) - 107 (dBuV \text{ to } dBm)$ The SA is calibrated using following setup.

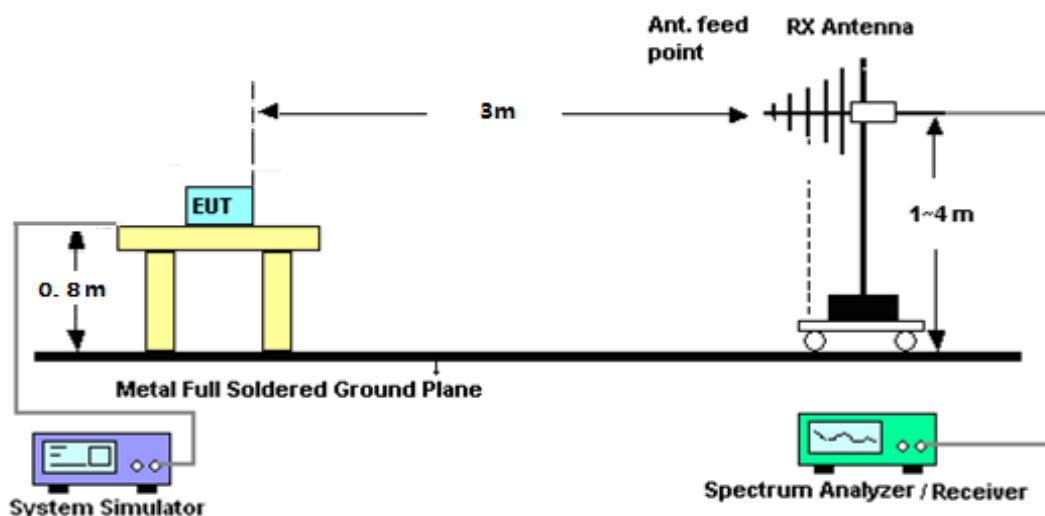
b) EUT was placed on 1.5 m non-conductive stand at a 3 m test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 m from the test item for emission measurements. The height of receiving antenna is 0.8m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the test item and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic measured with peak detector and 1MHz bandwidth.

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of any band into any of the other blocks.

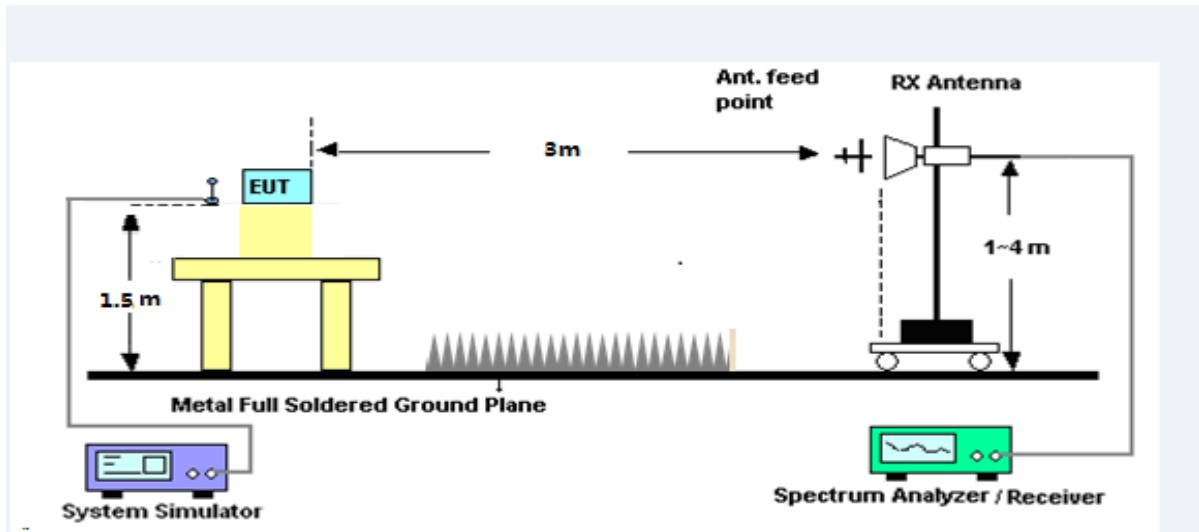
The substitution method is used. Substitution values at each frequency are measured before and saved to the test software. A "reference path loss" is established and the ARpl is the attenuation of "reference path loss", and including the gain of receive antenna, the gain of the preamplifier, the cable loss and the air loss. The measurement results are obtained as described below:

Power = P_{Mea} + AR_{pl}

For radiated test from 30MHz to 1GHz



For radiated test from above 1GHz



4.1.3 TEST PROCEDURES

1. The testing FCC KDB 971168 D01 Section 7 and ANSI C63.26 2015 Section 5.5.
2. The EUT was placed on a rotatable wooden table with 1.5 meter above ground.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
11. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10\log(P)]$ (dB)
 $= [30 + 10\log(P)]$ (dBm) - $[43 + 10\log(P)]$ (dB)
 $= -13$ dBm

For Band 7:

The limit line is derived from $55 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= [30 + 10\log(P)]$ (dBm) - $[55 + 10\log(P)]$ (dB)
 $= -25$ dBm

EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain

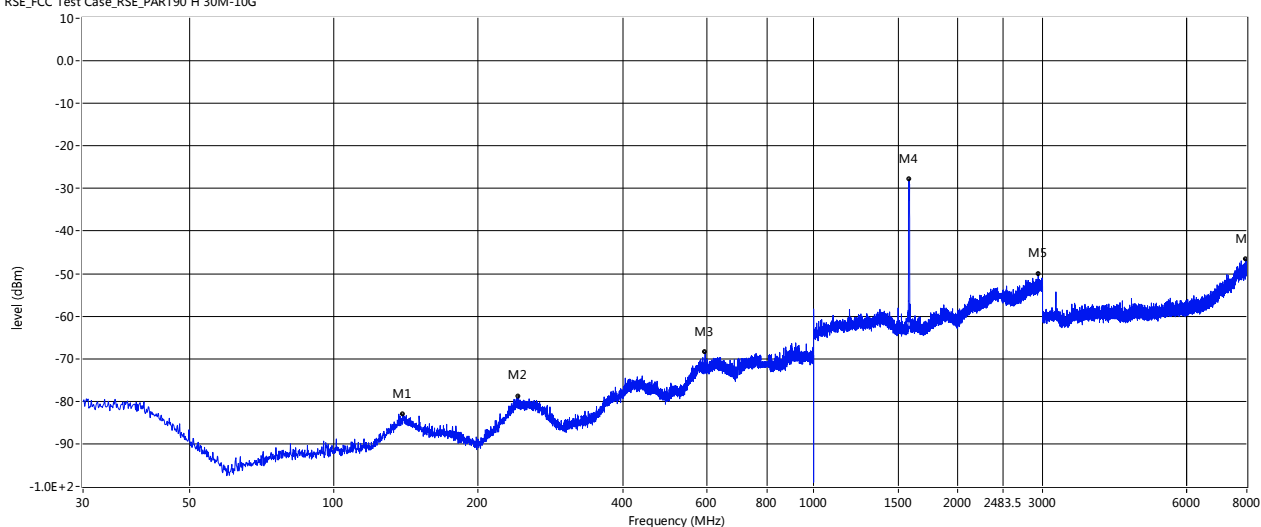
ERP (dBm) = EIRP - 2.15



4.1.4 TEST RESULTS

Band 14_5M_Low_Horizontal

RSE_FCC Test Case_RSE_PART90 H 30M-10G

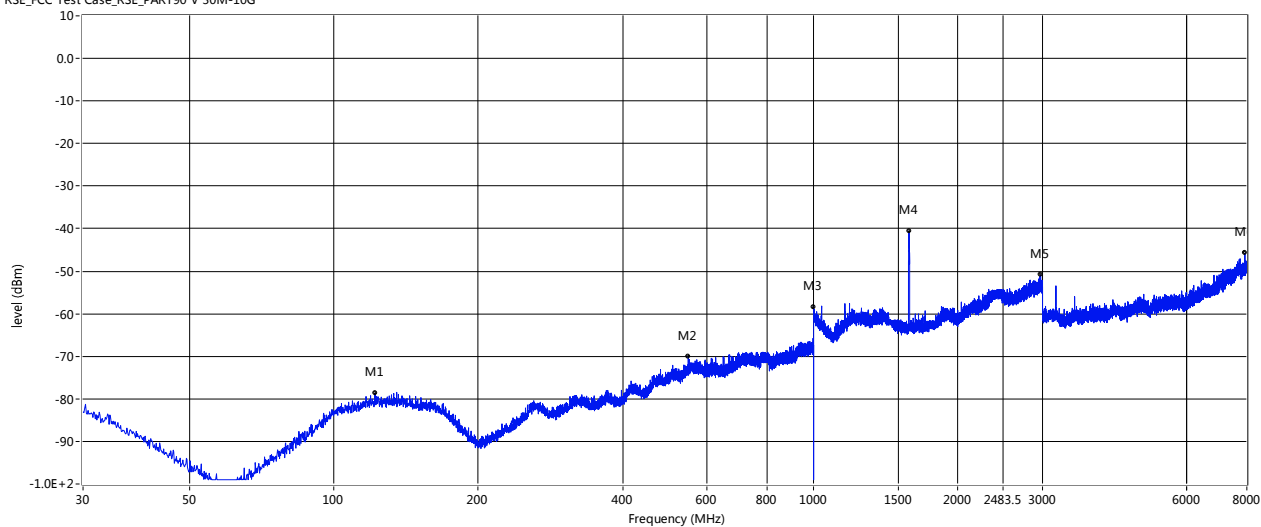


Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	ANT	Verdict
139.367	-83.14	-4.62	-13.0	-70.14	Horizontal	Pass
242.794	-78.77	-0.88	-13.0	-65.77	Horizontal	Pass
594.055	-58.38	6.23	-13.0	-45.38	Horizontal	Pass
1581.250	-27.91	12.90	-13.0	-14.91	Horizontal	Pass
2938.500	-50.05	20.91	-13.0	-37.05	Horizontal	Pass
7956.875	-46.52	15.11	-13.0	-33.52	Horizontal	Pass



Band 14_5M_Low_Vertical

RSE_FCC Test Case_RSE_PART90 V 30M-10G

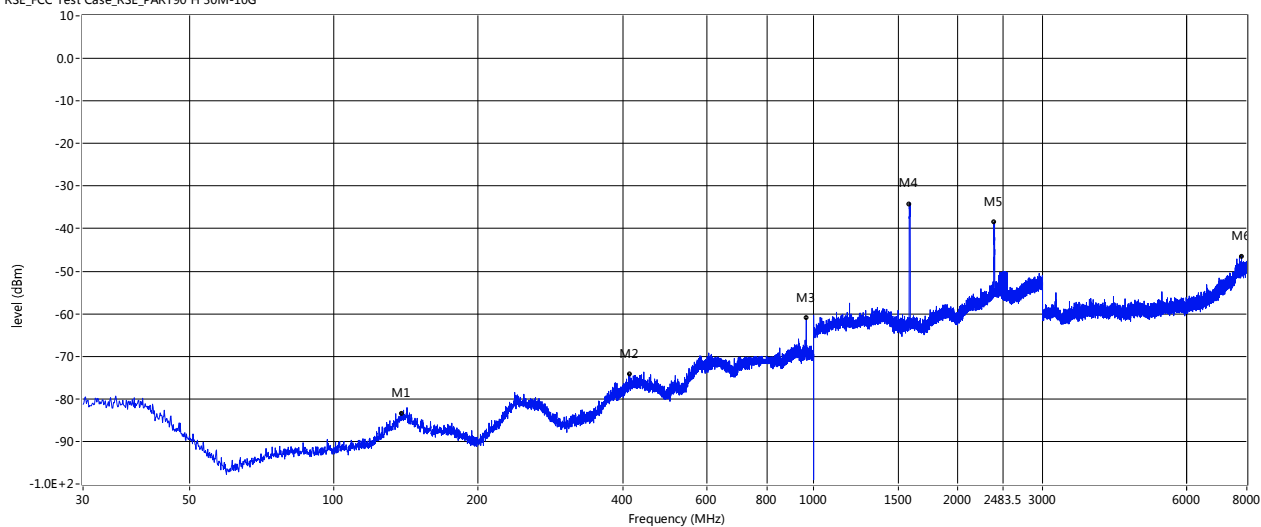


Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	ANT	Verdict
121.786	-78.69	-1.83	-13.0	-65.69	Vertical	Pass
547.859	-70.02	6.22	-13.0	-57.02	Vertical	Pass
1000.000	-99.00	-27.77	-13.0	-86.00	Vertical	Pass
1579.250	-40.57	12.16	-13.0	-27.57	Vertical	Pass
2973.250	-50.90	20.36	-13.0	-37.90	Vertical	Pass
7926.250	-45.79	15.15	-13.0	-32.79	Vertical	Pass



Band 14_5M_Mid_Horizontal

RSE_FCC Test Case_RSE_PART90 H 30M-10G

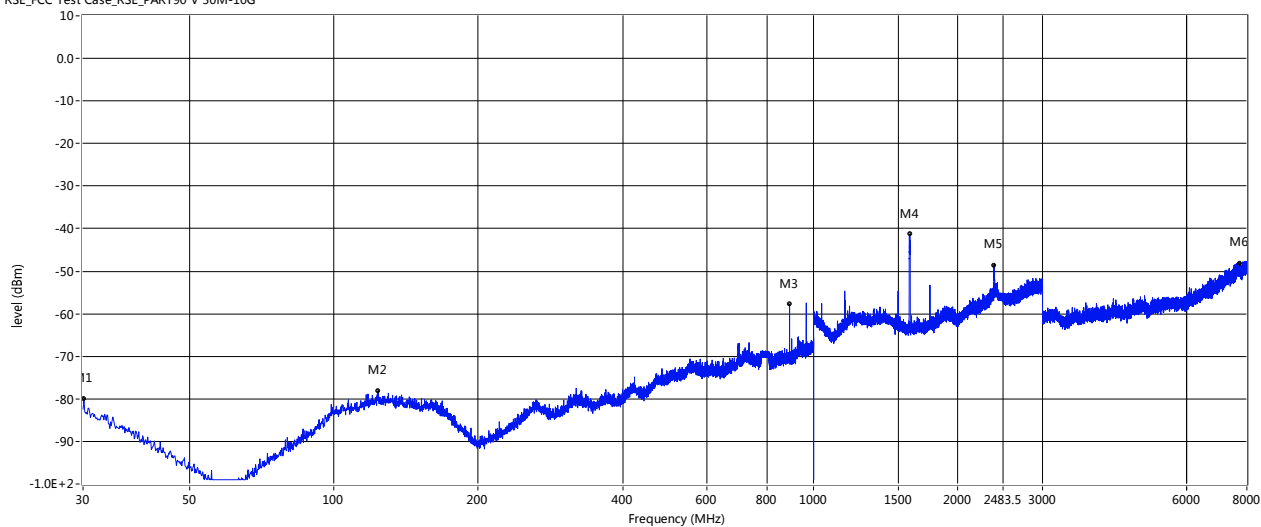


Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	ANT	Verdict
138.276	-83.45	-5.03	-13.0	-70.45	Horizontal	Pass
413.756	-74.31	2.46	-13.0	-61.31	Horizontal	Pass
965.322	-61.07	9.48	-13.0	-48.07	Horizontal	Pass
1583.000	-34.33	12.91	-13.0	-21.33	Horizontal	Pass
2379.750	-38.60	19.41	-13.0	-25.60	Horizontal	Pass
7797.500	-46.59	14.60	-13.0	-33.59	Horizontal	Pass



Band 14_5M_Mid_Vertical

RSE_FCC Test Case_RSE_PART90 V 30M-10G

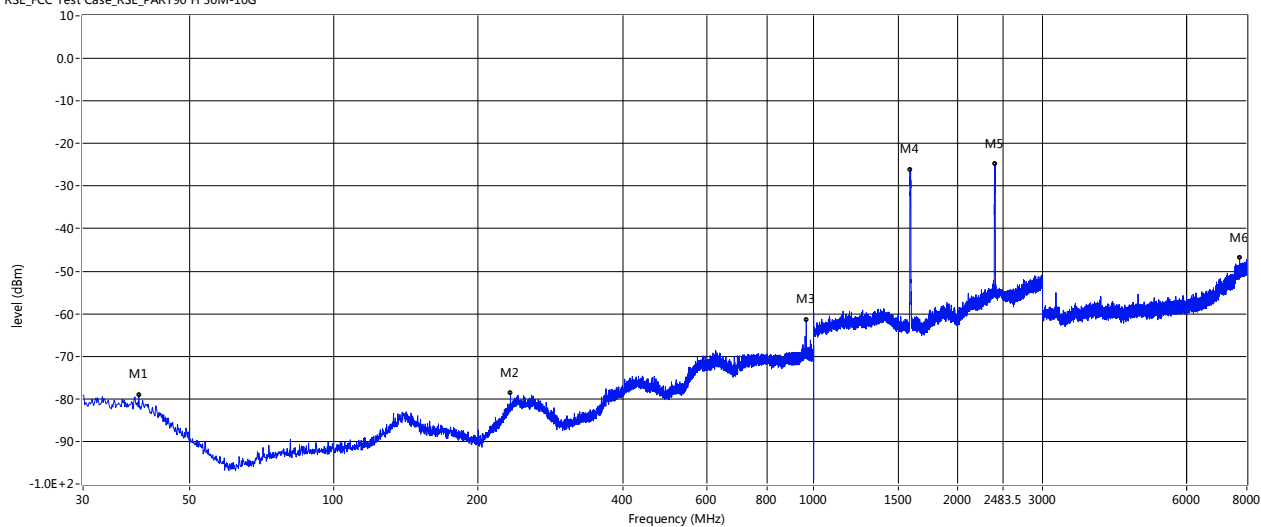


Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	ANT	Verdict
30.000	-82.52	-3.68	-13.0	-69.52	Vertical	Pass
123.605	-78.13	-1.76	-13.0	-65.13	Vertical	Pass
891.118	-57.88	8.21	-13.0	-44.88	Vertical	Pass
1586.500	-41.35	12.11	-13.0	-28.35	Vertical	Pass
2377.500	-48.61	19.22	-13.0	-35.61	Vertical	Pass
7733.750	-48.18	14.67	-13.0	-35.18	Vertical	Pass



Band 14_5M_High_Horizontal

RSE_FCC Test Case_RSE_PART90 H 30M-10G

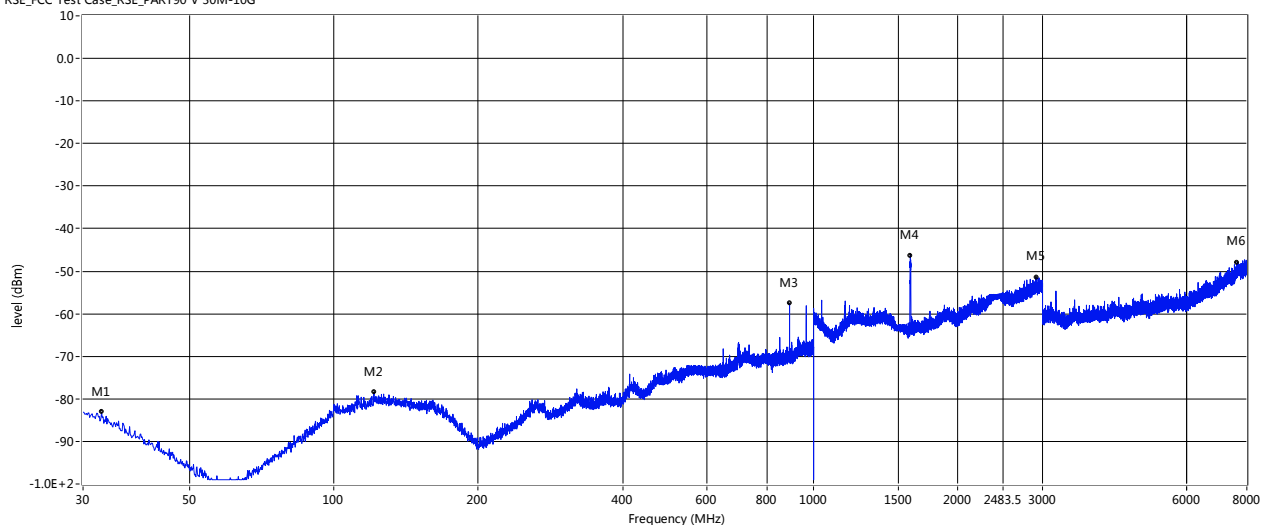


Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	ANT	Verdict
39.215	-79.10	-1.85	-13.0	-66.10	Horizontal	Pass
233.458	-78.72	-2.90	-13.0	-65.72	Horizontal	Pass
965.322	-61.53	9.48	-13.0	-48.53	Horizontal	Pass
1591.000	-26.15	12.95	-13.0	-13.15	Horizontal	Pass
2389.750	-24.91	19.59	-13.0	-11.91	Horizontal	Pass
7725.625	-46.93	14.55	-13.0	-33.93	Horizontal	Pass



Band 14_5M_High_Vertical

RSE_FCC Test Case_RSE_PART90 V 30M-10G

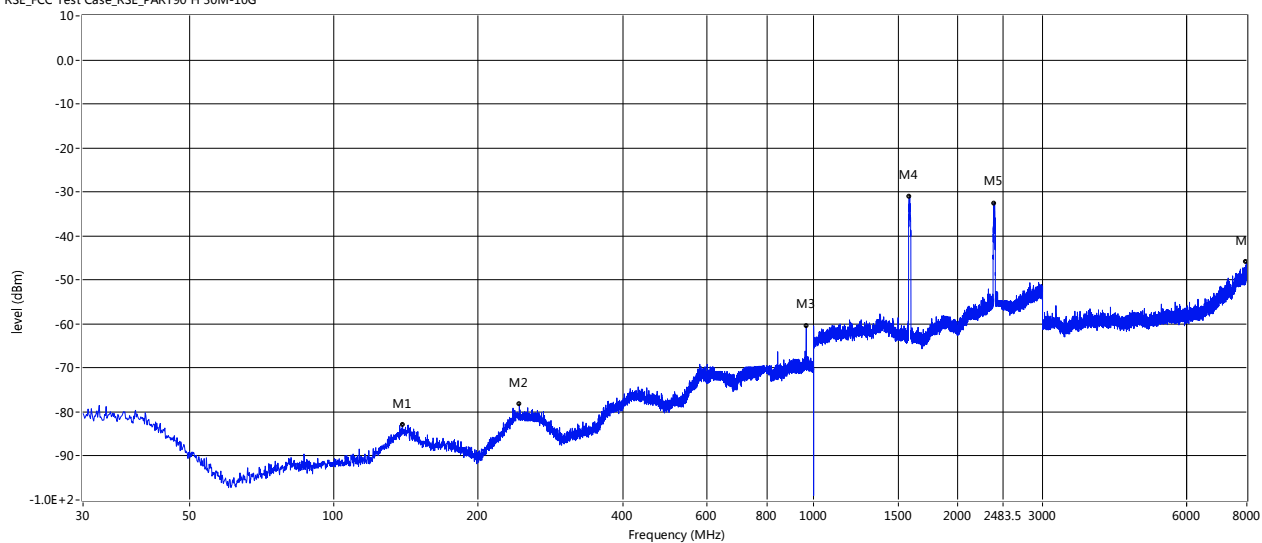


Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	ANT	Verdict
32.789	-83.16	-5.47	-13.0	-70.16	Vertical	Pass
121.180	-78.53	-1.86	-13.0	-65.53	Vertical	Pass
891.118	-57.55	8.21	-13.0	-44.55	Vertical	Pass
1591.000	-46.35	12.07	-13.0	-33.35	Vertical	Pass
2913.250	-51.43	20.27	-13.0	-38.43	Vertical	Pass
7628.750	-48.08	14.36	-13.0	-35.08	Vertical	Pass



Band 14_10M_Horizontal

RSE_FCC Test Case_RSE_PART90 H 30M-10G

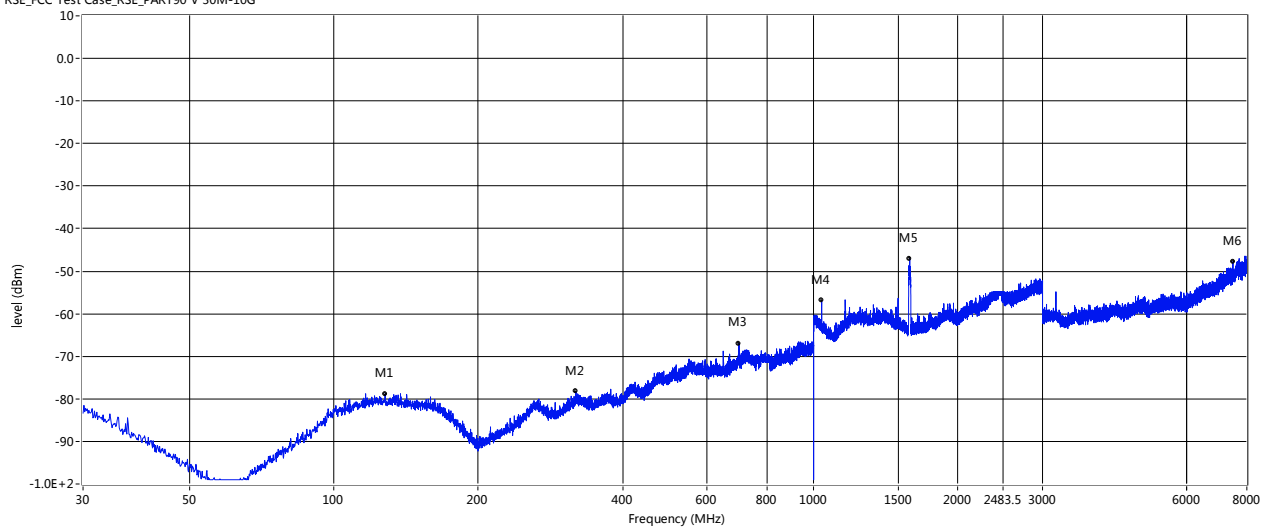


Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	ANT	Verdict
139.004	-82.96	-4.76	-13.0	-69.96	Horizontal	Pass
243.521	-78.23	-0.90	-13.0	-65.23	Horizontal	Pass
965.322	-60.52	9.48	-13.0	-47.52	Horizontal	Pass
1586.000	-31.14	12.93	-13.0	-18.14	Horizontal	Pass
2377.750	-32.60	19.38	-13.0	-19.60	Horizontal	Pass
7976.250	-45.98	15.18	-13.0	-32.98	Horizontal	Pass



Band 14_10M_ Vertical

RSE_FCC Test Case_RSE_PART90 V 30M-10G



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	ANT	Verdict
127.849	-78.80	-1.60	-13.0	-65.80	Vertical	Pass
319.666	-78.29	-1.45	-13.0	-65.29	Vertical	Pass
698.694	-66.94	6.74	-13.0	-53.94	Vertical	Pass
1039.500	-56.93	11.45	-13.0	-43.93	Vertical	Pass
1586.000	-47.02	12.11	-13.0	-34.02	Vertical	Pass
7481.875	-47.73	13.01	-13.0	-34.73	Vertical	Pass