

TEST REPORT

Application No.: SZEM1901010212CR
Applicant: Mattel Asia Pacific Sourcing Ltd.
Address of Applicant: 13/F., South Tower, World Finance Centre, Harbour City, Tsimshatsui, Kowloon, Hong Kong
Manufacturer: Mattel Asia Pacific Sourcing Ltd.
Address of Manufacturer: 13/F., South Tower, World Finance Centre, Harbour City, Tsimshatsui, Kowloon, Hong Kong
Factory: Gong Dong First Union Animation Technology Co., Ltd.
Address of Factory: Gonglian Industrial Park, Wanjiang District, Dongguan, Guangdong, China
Equipment Under Test (EUT):
EUT Name: TRANSFORMING BATMOBILE R/C
Model No.: GBK77, GMH33 ♣
 ♣ Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Trade mark: Mattel
FCC ID: PIYGBK77-19A5T
Standard(s) : 47 CFR Part 15, Subpart C 15.249
Date of Receipt: 2019-01-09
Date of Test: 2019-01-14 to 2019-01-25
Date of Issue: 2019-01-31

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
 EMC Laboratory Manager



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<i>Revision Record</i>				
<i>Version</i>	<i>Chapter</i>	<i>Date</i>	<i>Modifier</i>	<i>Remark</i>
01		2019-01-31		Original

Authorized for issue by:			
			
		<hr/> Gebin Sun /Project Engineer	
			
		<hr/> Eric Fu /Reviewer	



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2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.249	N/A	47 CFR Part 15, Subpart C 15.203	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
20dB Bandwidth	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.9	47 CFR Part 15, Subpart C 15.215	Pass
Field Strength of the Fundamental Signal (15.249(a))	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.5&6.6	47 CFR Part 15, Subpart C 15.249(a)	Pass
Restricted Band Around Fundamental Frequency	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.249(d) & 15.209	Pass
Radiated Emissions	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.4&6.5&6.6	47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)	Pass

Remark:

Model No.: GBK77, GMH33

Only the model GBK77 was tested, since the electrical circuit design, layout, components used, internal wiring and functions were identical for the above models, with only difference on packaging and one sound in firmware.



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4 General Information

4.1 Details of E.U.T.

Power supply:	3V DC (1.5V x 2 "AAA" Size Batteries) for TX
Operating Frequency:	2.4GHz(2420MHz-2465MHz)
Channel Number:	10
Modulation Type:	GFSK
Sample Type:	Portable production
Antenna Type:	Integral
Antenna Gain:	1.6dBi

Channel list					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2420	5	2435	9	2461
2	2422	6	2441	10	2465
3	2426	7	2447		
4	2428	8	2453		

4.2 Description of Support Units

The EUT has been tested as an independent unit.

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	RF conducted power	$\pm 0.75\text{dB}$
5	RF power density	$\pm 2.84\text{dB}$
6	Conducted Spurious emissions	$\pm 0.75\text{dB}$
7	RF Radiated power	$\pm 4.5\text{dB}$ (below 1GHz)
		$\pm 4.8\text{dB}$ (above 1GHz)
8	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
9	Temperature test	$\pm 1^\circ\text{C}$
10	Humidity test	$\pm 3\%$
11	Supply voltages	$\pm 1.5\%$
12	Time	$\pm 3\%$



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4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

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

- **CNAS (No. CNAS L2929)**

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

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

20dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2018-09-27	2019-09-26
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2018-07-12	2019-07-11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24

Field Strength of the Fundamental Signal (15.249(a))					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2018-07-12	2019-07-11
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2018-04-02	2019-04-01
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017-06-27	2020-06-26
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2018-09-25	2019-09-24
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-09-27	2019-09-26
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2018-04-02	2019-04-01
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2018-04-02	2019-04-01
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21
Band filter	N/A	N/A	SEM023-01	N/A	N/A



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Restricted Band Around Fundamental Frequency					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2018-07-12	2019-07-11
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2018-04-02	2019-04-01
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017-06-27	2020-06-26
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2018-09-25	2019-09-24
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-09-27	2019-09-26
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2018-04-02	2019-04-01
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2018-04-02	2019-04-01
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21
Band filter	N/A	N/A	SEM023-01	N/A	N/A

Radiated Emissions (30MHz-1GHz)					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date	Cal. Due date
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-08-05	2020-08-04
MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologies	N9038A	SEM004-05	2018-09-25	2019-09-24
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017-06-27	2020-06-26
Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2018-04-02	2019-04-01
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2018-07-12	2019-07-11



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Radiated Emissions(Above 1GHZ)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2018-07-12	2019-07-11
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2018-04-02	2019-04-01
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017-06-27	2020-06-26
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2018-09-25	2019-09-24
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-09-27	2019-09-26
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2018-04-02	2019-04-01
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2018-04-02	2019-04-01
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21
Band filter	N/A	N/A	SEM023-01	N/A	N/A

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2018-09-27	2019-09-26
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2018-04-08	2019-04-07



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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203

Limit:

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

6.1.2 Conclusion

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 1.6dBi.

Antenna location: Refer to Appendix(Internal photos)



7 Radio Spectrum Matter Test Results

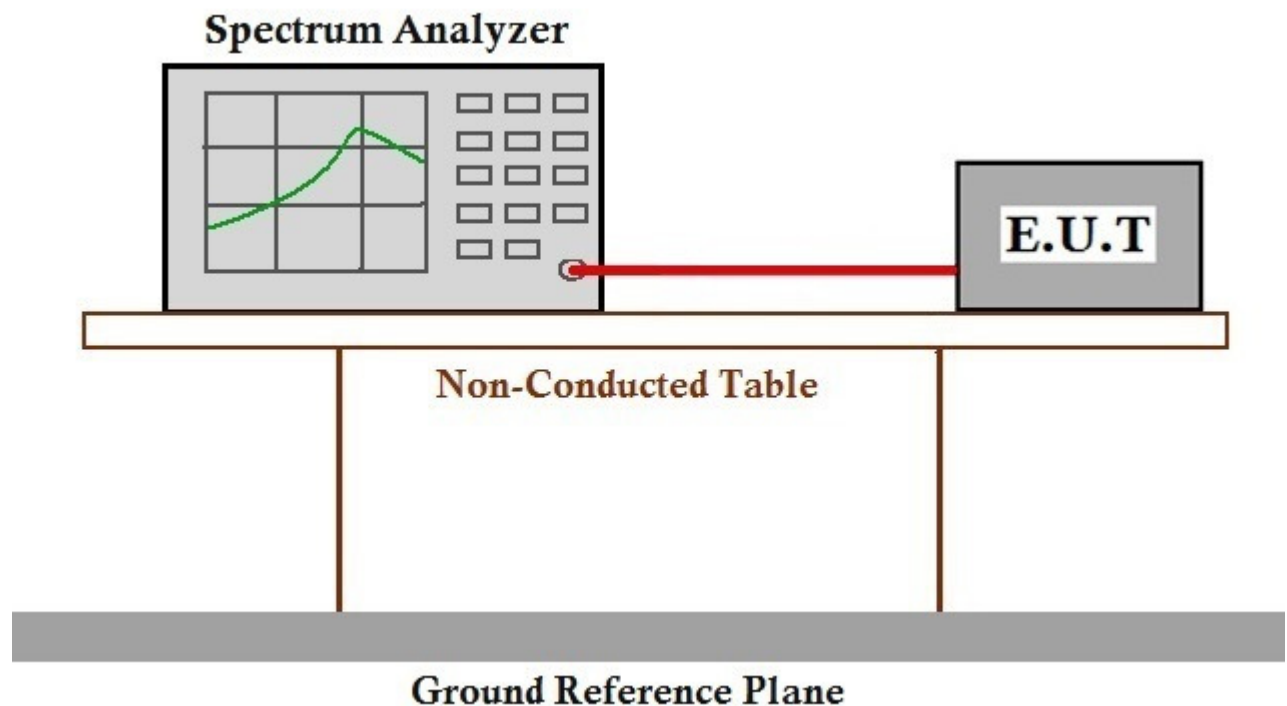
7.1 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.215
 Test Method: ANSI C63.10 (2013) Section 6.9
 Limit: N/A

7.1.1 E.U.T. Operation

Operating Environment:
 Temperature: 22.5 °C Humidity: 49.3 % RH Atmospheric Pressure: 1030 mbar
 Test mode b:TX mode_Keep the EUT in transmitting with modulation mode.

7.1.2 Test Setup Diagram



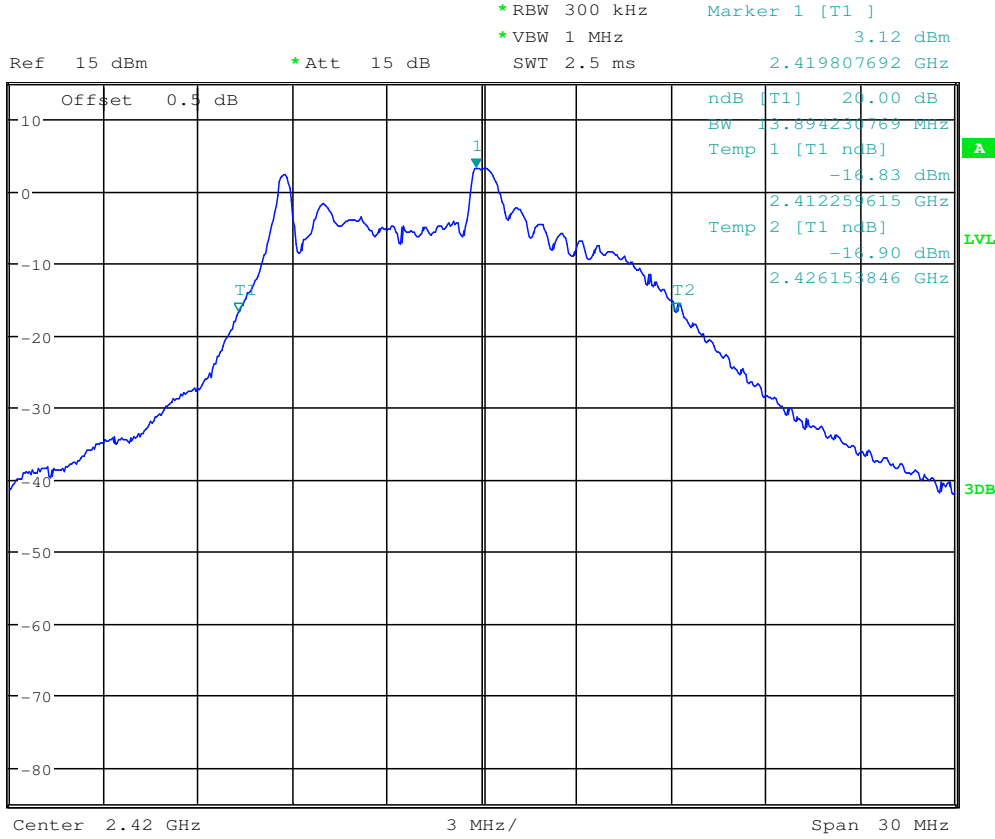
7.1.3 Measurement Procedure and Data

Test channel	20dB bandwidth (MHz)	Results
Lowest	13.89	Pass
Middle	14.38	Pass
Highest	14.47	Pass



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Mode:b; Channel:Low



1 PK
VIEW

A

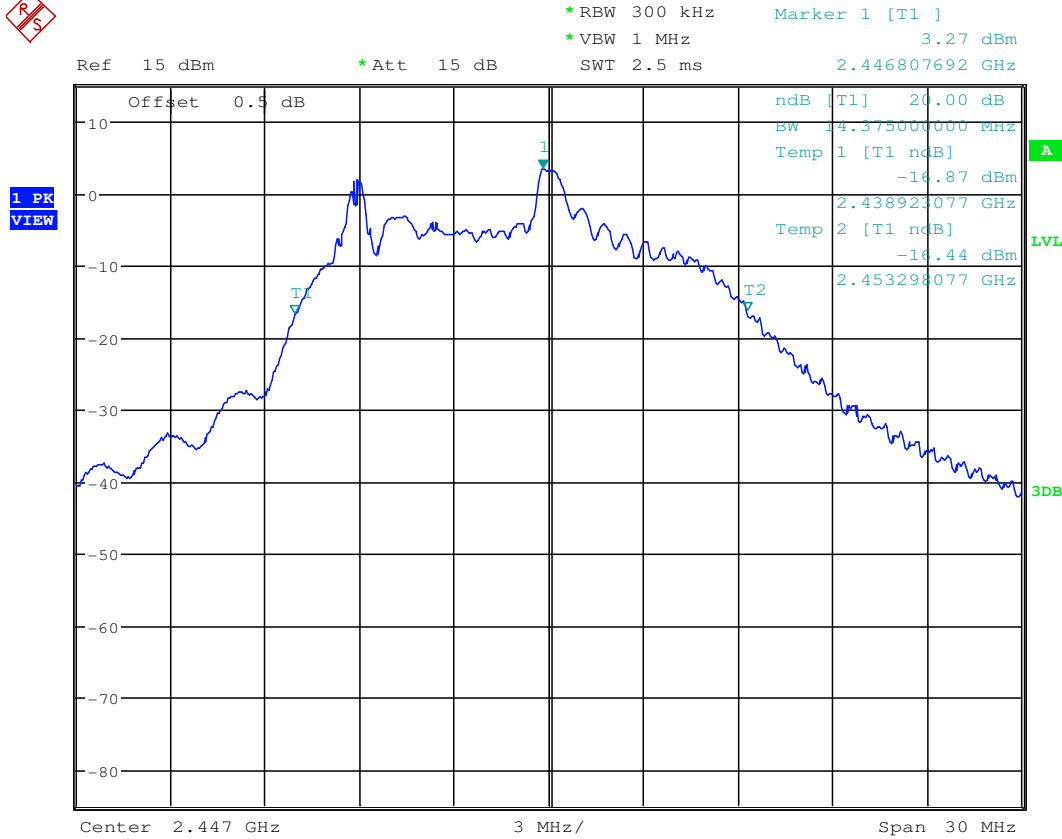
LVL

3DB



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Mode:b; Channel:middle



1 PK
VIEW

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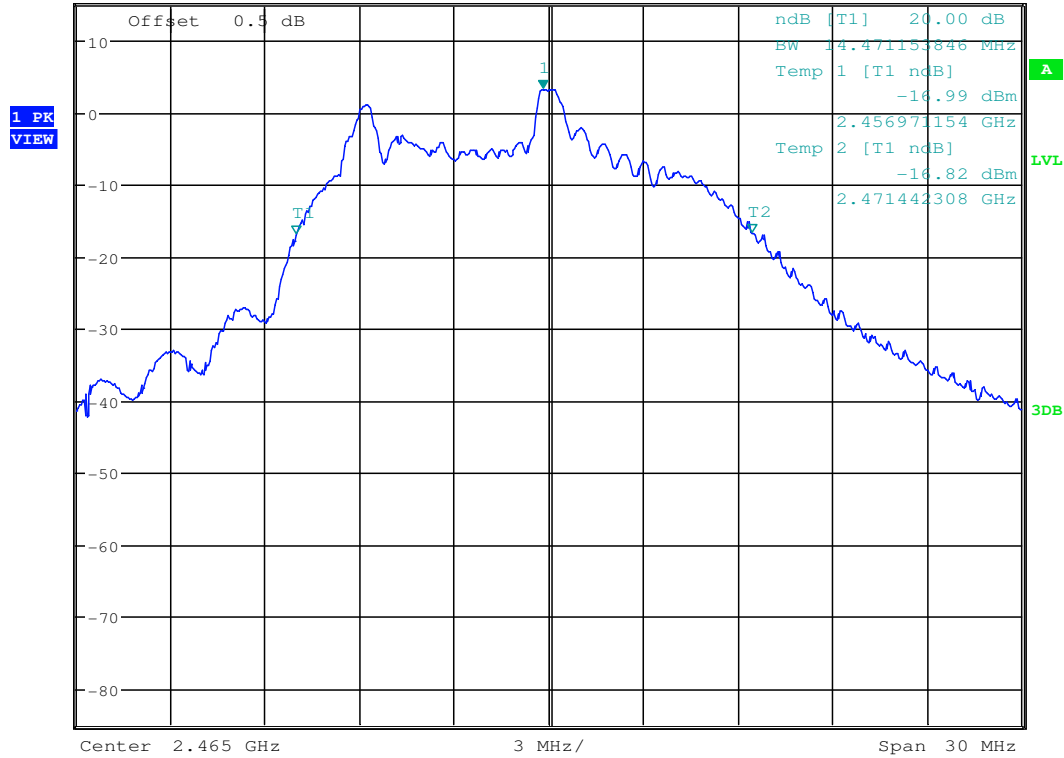
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Mode:b; Channel:High



*RBW 300 kHz Marker 1 [T1]
*VBW 1 MHz 3.23 dBm
Ref 15 dBm *Att 15 dB SWT 2.5 ms 2.464807692 GHz



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7.2 Field Strength of the Fundamental Signal (15.249(a))

Test Requirement 47 CFR Part 15, Subpart C 15.249(a)
 Test Method: ANSI C63.10 (2013) Section 6.5&6.6
 Measurement Distance: 3m
 Limit:

Fundamental frequency(MHz)	Field strength of fundamental(microvolts/meter)	Field strength of harmonics(microvolts/meter)
902-928	50	500
2400-2483.5	50	500
5725-5875	50	500
24000-24250	250	2500

Remark: The frequencies above 1000MHz are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

For fundamental frequency in "902-928MHz", the field strength of fundamental is based on Quasi-Peak.

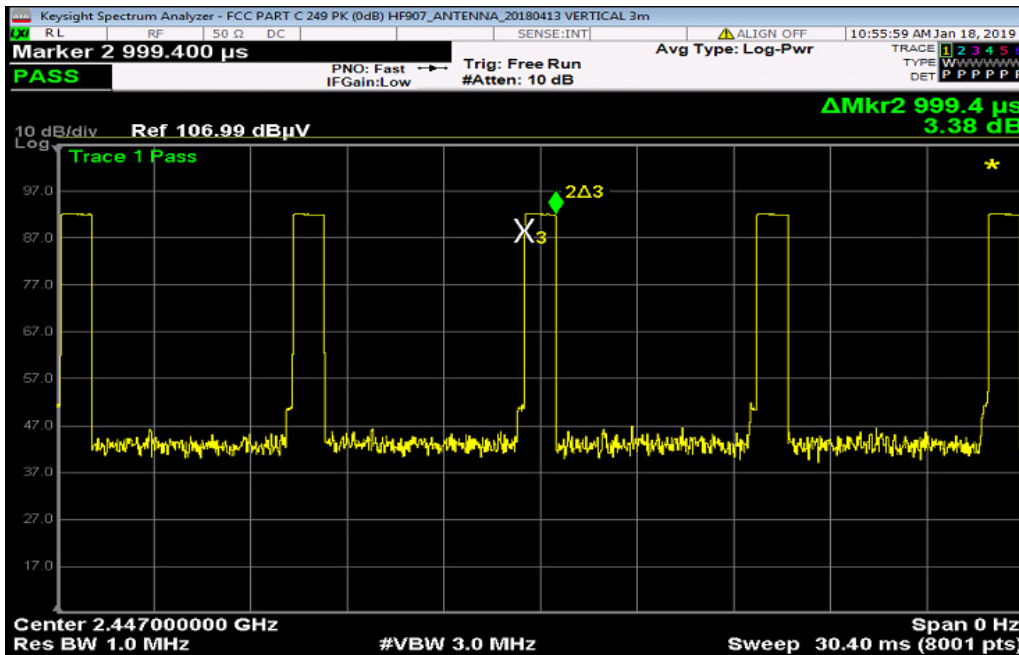
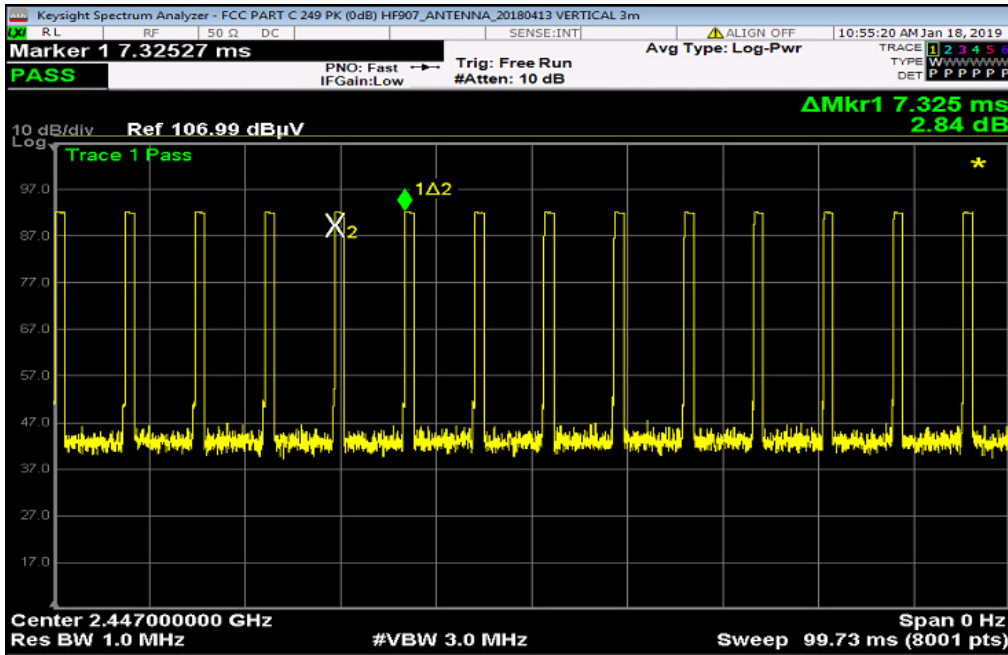
Average value:

Calculate Formula:	Average value=Peak value + PDCF
	PDCF=20 log(Duty cycle)
	Duty cycle= T on time / T period
Test data:	Ton time =0.9994ms
	T period =7.325ms
	Duty cycle=13.64%
	PDCF value= -17.30dB

Duty cycle test plots:



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7.2.1 E.U.T. Operation

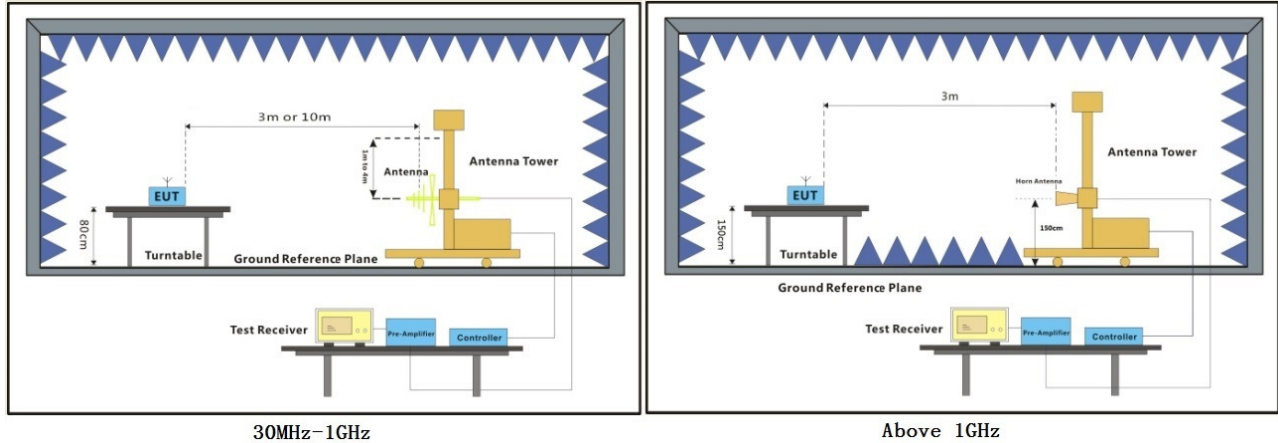
Operating Environment:

Temperature: 22.1 °C Humidity: 50.8 % RH Atmospheric Pressure: 1030 mbar
Test mode b:TX mode_Keep the EUT in transmitting with modulation mode.



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7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

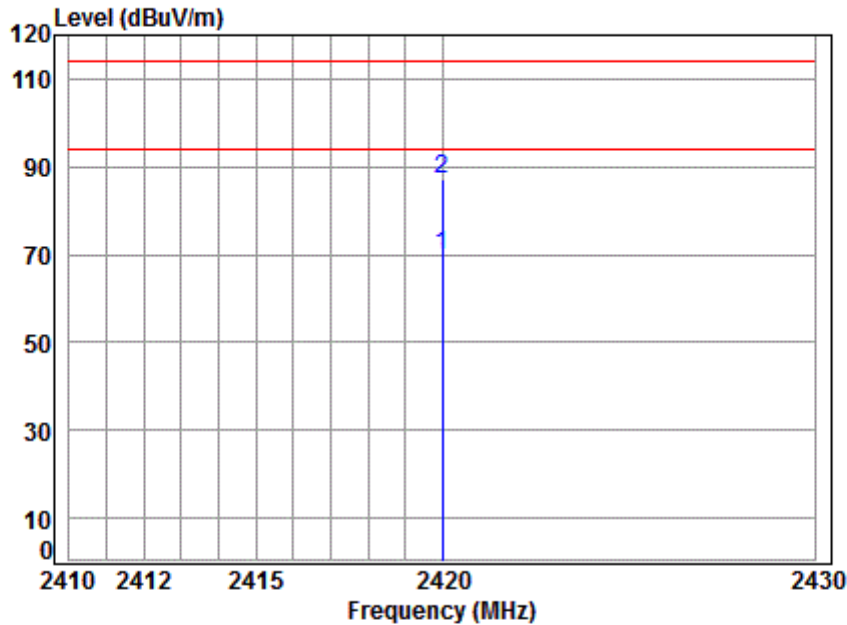
- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



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Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



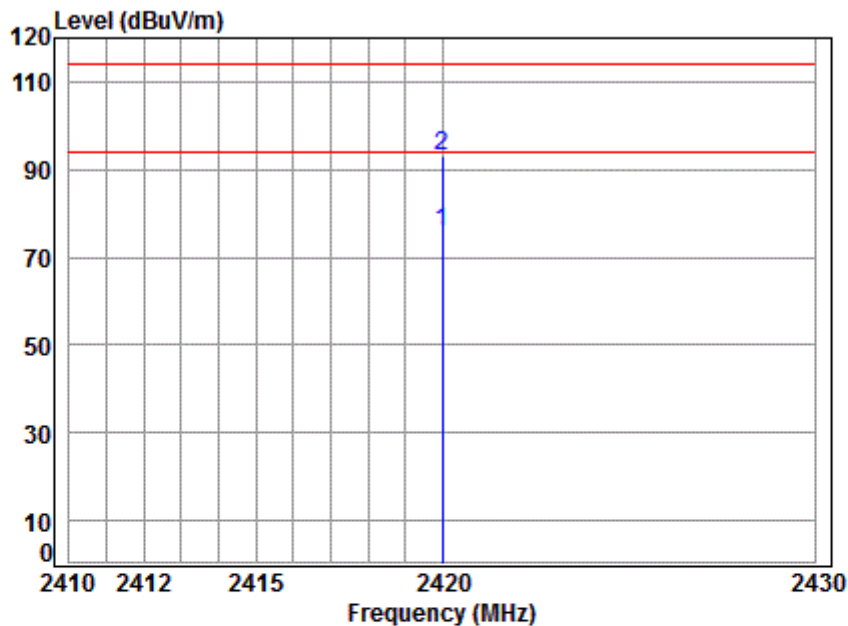
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 10212CR/10213CR
 Mode : 2420 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2420.000	5.52	28.57	41.18	76.84	69.75	94.00	-24.25 Average
2	2420.000	5.52	28.57	41.18	94.14	87.05	114.00	-26.95 Peak



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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



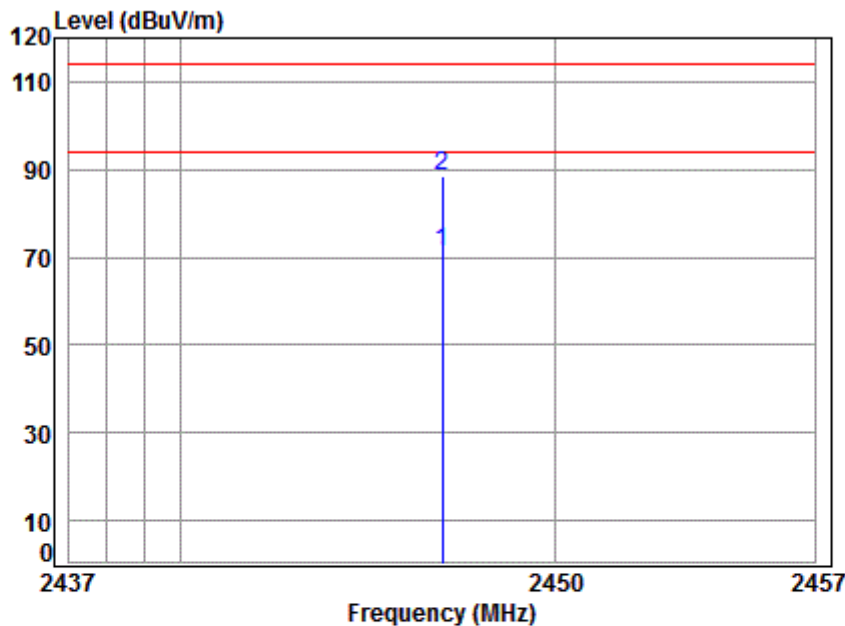
Site : chamber
 Condition: 3m VERTICAL
 Job No : 10212CR/10213CR
 Mode : 2420 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2420.000	5.52	28.57	41.18	82.70	75.61	94.00	-18.39 Average
2	2420.000	5.52	28.57	41.18	100.00	92.91	114.00	-21.09 Peak



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Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



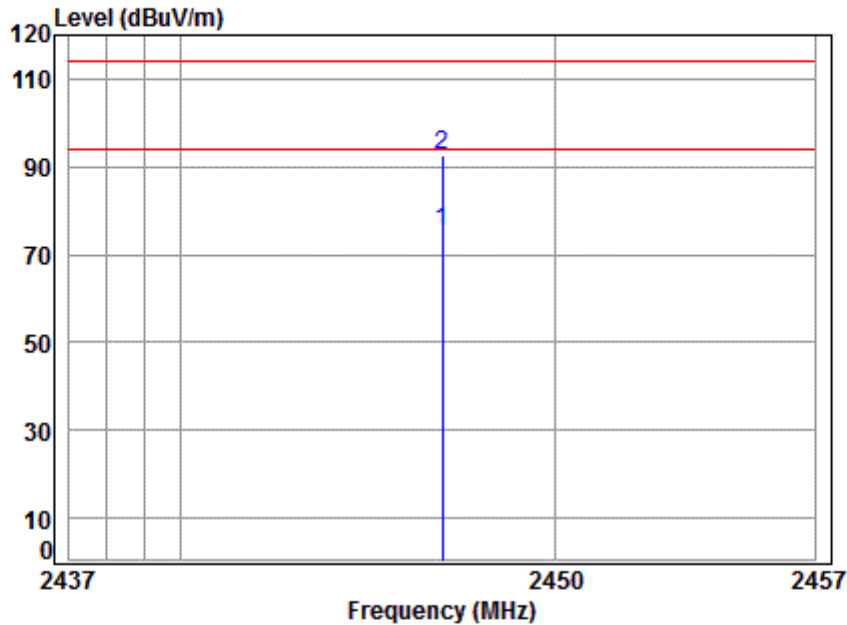
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 10212CR/10213CR
 Mode : 2447 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2447.000	5.55	28.61	41.20	78.21	71.17	94.00	-22.83	Average
2	2447.000	5.55	28.61	41.20	95.51	88.47	114.00	-25.53	Peak



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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



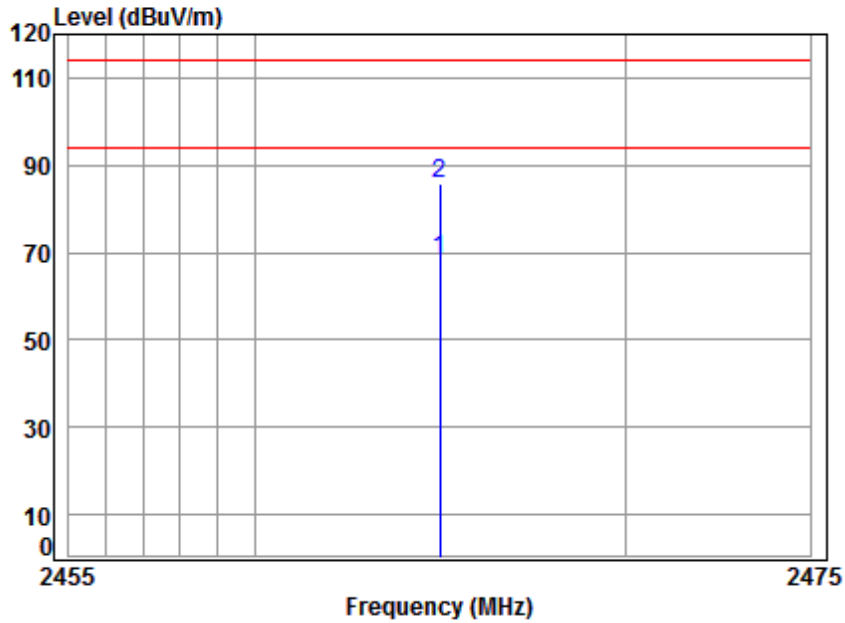
Site : chamber
 Condition: 3m VERTICAL
 Job No : 10212CR/10213CR
 Mode : 2447 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2447.000	5.55	28.61	41.20	82.49	75.45	94.00	-18.55	Average
2	2447.000	5.55	28.61	41.20	99.79	92.75	114.00	-21.25	Peak



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Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



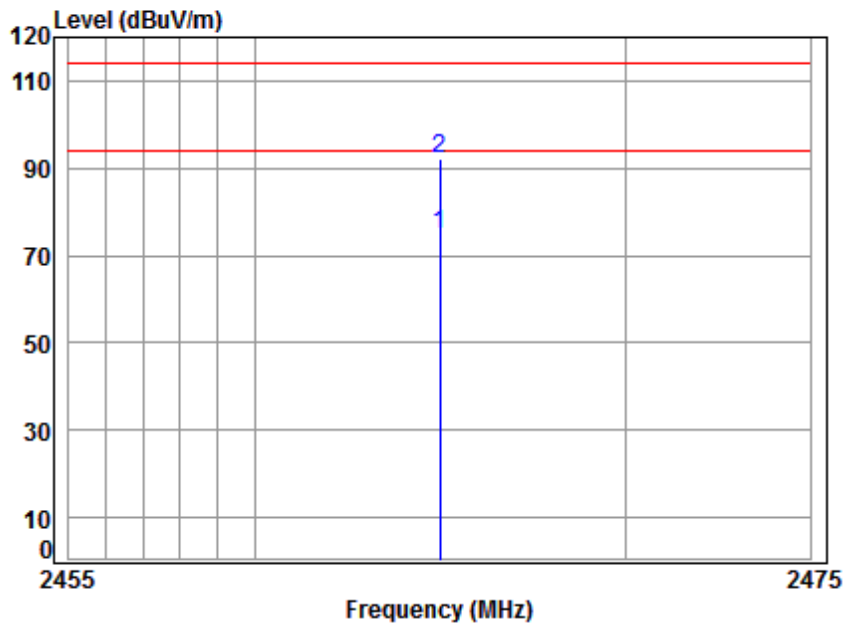
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 10212CR/10213CR
 Mode : 2465 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2465.000	5.57	28.64	41.20	75.50	68.51	94.00	-25.49	Average
2	2465.000	5.57	28.64	41.20	92.80	85.81	114.00	-28.19	Peak



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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Site : chamber
 Condition: 3m VERTICAL
 Job No : 10212CR/10213CR
 Mode : 2465 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2465.000	5.57	28.64	41.20	81.75	74.76	94.00	-19.24 Average
2	2465.000	5.57	28.64	41.20	99.05	92.06	114.00	-21.94 Peak

Remark:

As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only above measurement data were shown in the report.



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7.3 Restricted Band Around Fundamental Frequency

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.249(d) & 15.209
 Test Method: ANSI C63.10 (2013) Section 6.10.5
 Measurement Distance: 3m
 Limit:

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
Above 1GHz	74.0	Peak Value

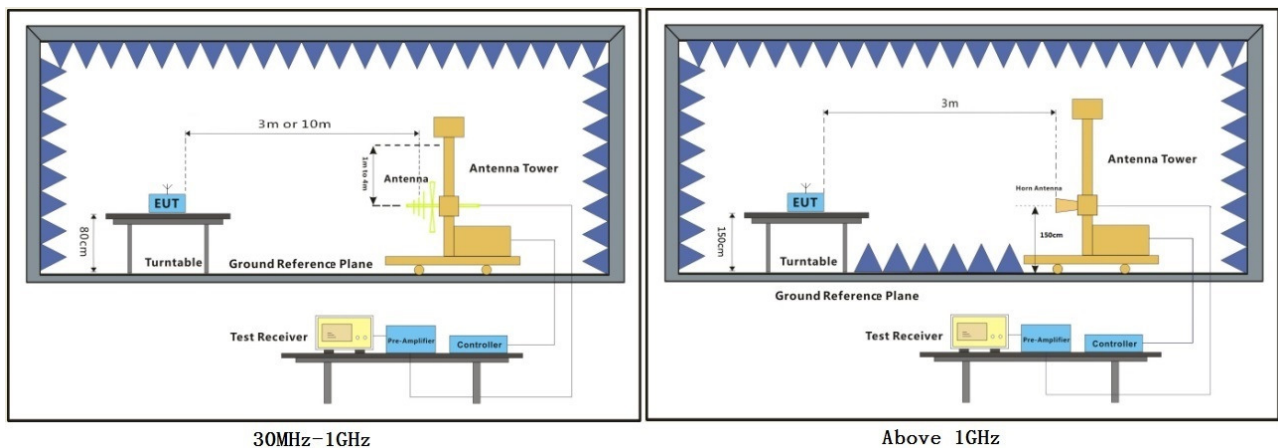
Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 22.1 °C Humidity: 50.8 % RH Atmospheric Pressure: 1030 mbar
 Test mode b:TX mode_Keep the EUT in transmitting with modulation mode.

7.3.2 Test Setup Diagram



30MHz-1GHz

Above 1GHz



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7.3.3 Measurement Procedure and Data

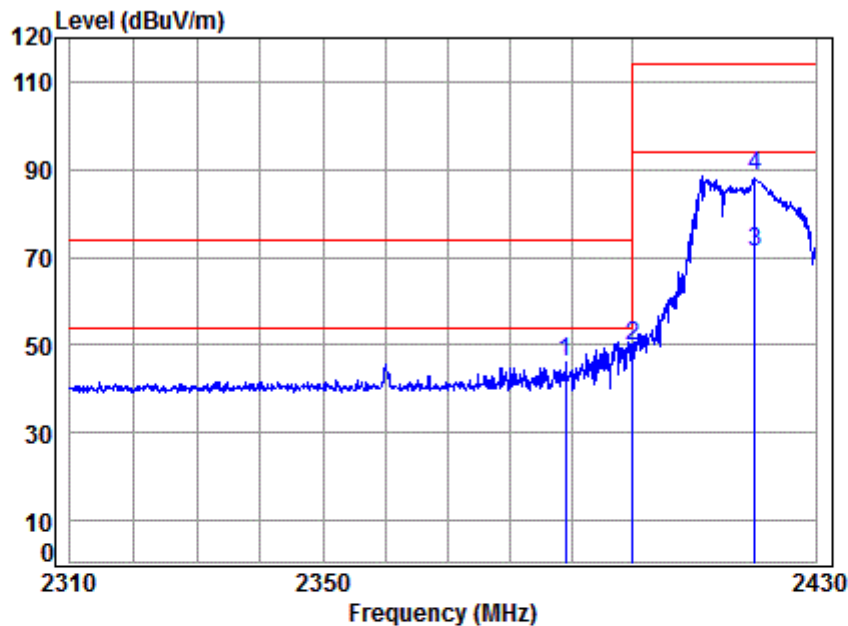
- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



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Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



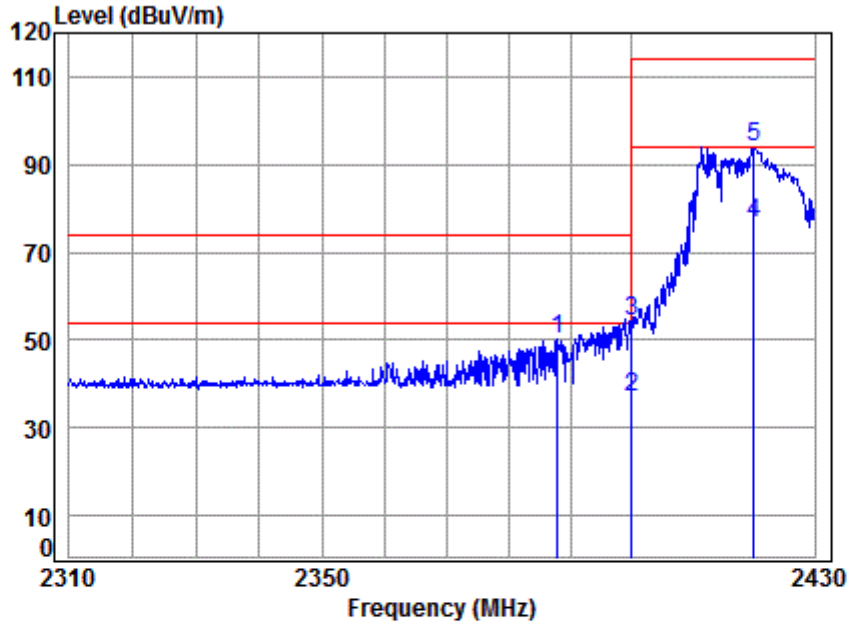
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 10212CR/10213CR
 Mode : 2420 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2389.000	5.47	28.52	41.17	53.32	46.14	74.00	-27.86 Peak
2	2400.000	5.49	28.54	41.18	56.66	49.51	74.00	-24.49 peak
3	2420.000	5.50	28.55	41.18	78.25	71.12	94.00	-22.88 Average
4	2420.000	5.50	28.55	41.18	95.55	88.42	114.00	-25.58 peak



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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



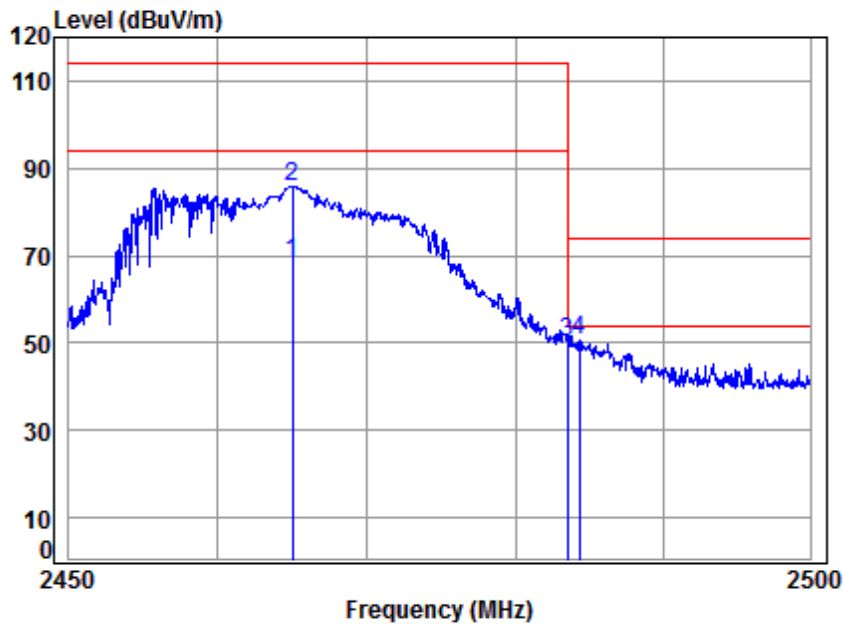
Site : chamber
 Condition: 3m VERTICAL
 Job No : 10212CR/10213CR
 Mode : 2420 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2387.912	5.47	28.51	41.17	57.48	50.29	74.00	-23.71 Peak
2	2400.000	5.49	28.54	41.18	44.07	36.92	54.00	-17.08 Average
3	2400.000	5.49	28.54	41.18	61.37	54.22	74.00	-19.78 peak
4	2420.000	5.50	28.55	41.18	83.79	76.66	94.00	-17.34 Average
5	2420.000	5.50	28.55	41.18	101.09	93.96	114.00	-20.04 peak



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Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



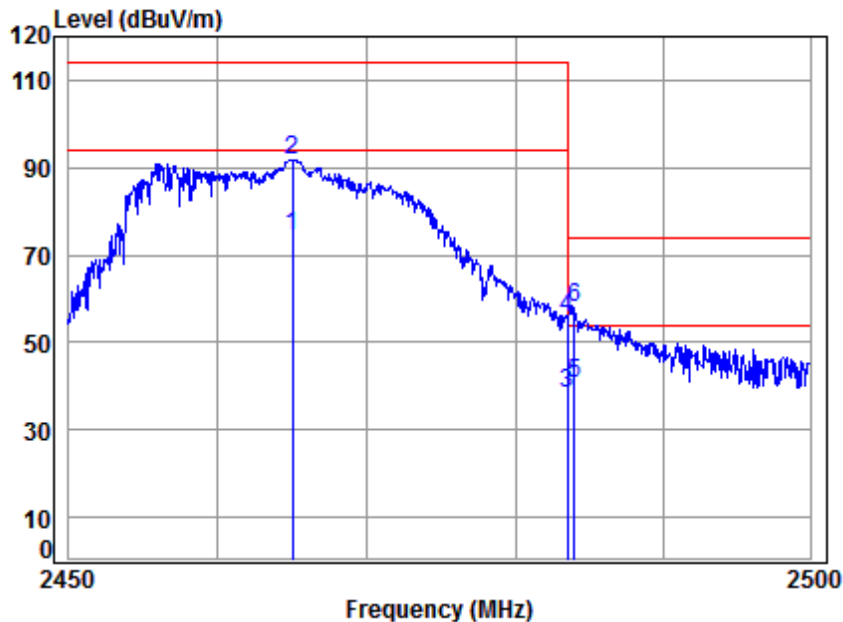
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 10212CR/10213CR
 Mode : 2465 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2465.000	5.57	28.64	41.20	75.42	94.00	-25.57	Average
2	2465.000	5.57	28.64	41.20	92.72	114.00	-28.27	peak
3	2483.500	5.60	28.67	41.21	56.98	74.00	-23.96	peak
4	2484.342	5.60	28.67	41.21	57.43	74.00	-23.51	peak



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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Site : chamber
 Condition: 3m VERTICAL
 Job No : 10212CR/10213CR
 Mode : 2465 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dB	
1	2465.000	5.57	28.64	41.20	81.33	94.00	-19.66	Average
2	2465.000	5.57	28.64	41.20	98.63	114.00	-22.36	peak
3	2483.500	5.60	28.67	41.21	45.37	54.00	-15.57	Average
4	2483.500	5.60	28.67	41.21	62.67	74.00	-18.27	peak
5	2483.990	5.60	28.67	41.21	47.40	54.00	-13.54	Average
6	2483.990	5.60	28.67	41.21	64.70	74.00	-16.24	peak

Remark:

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

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

As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only above measurement data were shown in the report.



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7.4 Radiated Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)
 Test Method: ANSI C63.10 (2013) Section 6.4&6.5&6.6
 Measurement Distance: 3m
 Limit:

Frequency(MHz)	Field strength (microvolts/meter)	Limit (dBuV/m)	Detector	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	-	300
0.490-1.705	24000/F(kHz)	-	-	30
1.705-30	30	-	-	30
30-88	100	40.0	QP	3
88-216	150	43.5	QP	3
216-960	200	46.0	QP	3
960-1000	500	54.0	QP	3
Above 1000	500	54.0	AV	3



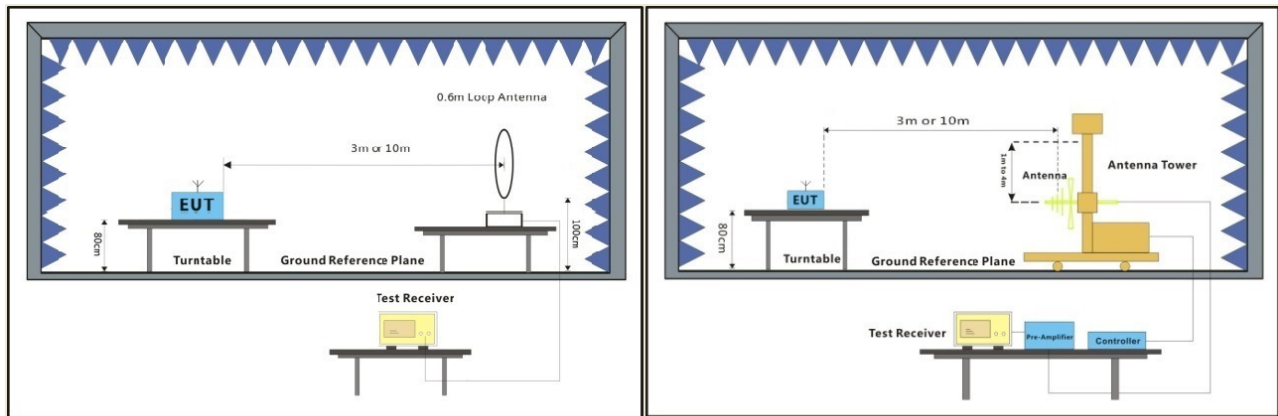
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7.4.1 E.U.T. Operation

Operating Environment:

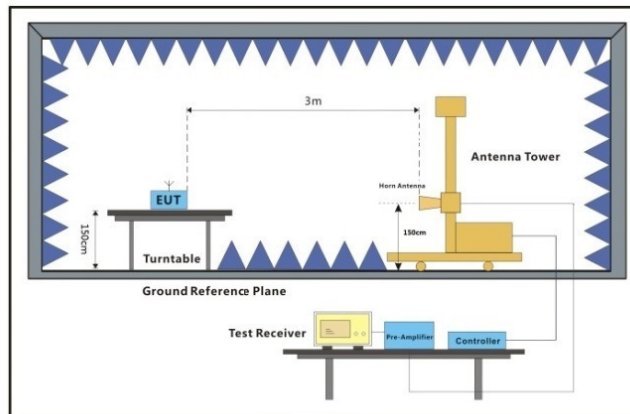
Temperature: 22.1 °C Humidity: 50.8 % RH Atmospheric Pressure: 1030 mbar
 Test mode b:TX mode_Keep the EUT in transmitting with modulation mode.

7.4.2 Test Setup Diagram



Below 30MHz

30MHz-1GHz



Above 1GHz



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7.4.3 Measurement Procedure and Data

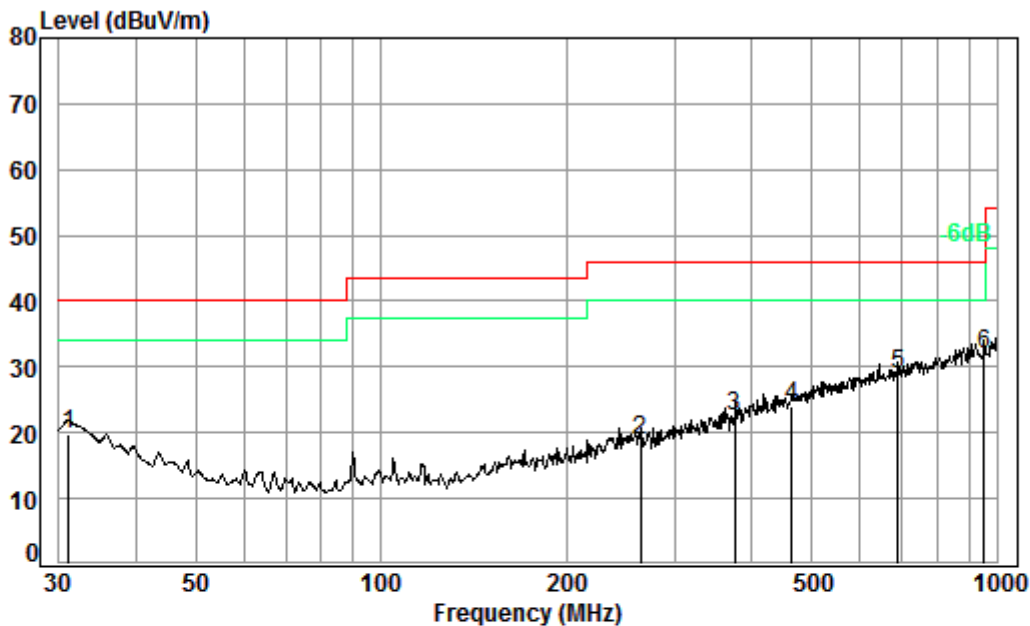
- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



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Radiated emission below 1GHz
 Mode: b; Polarization: Horizontal;



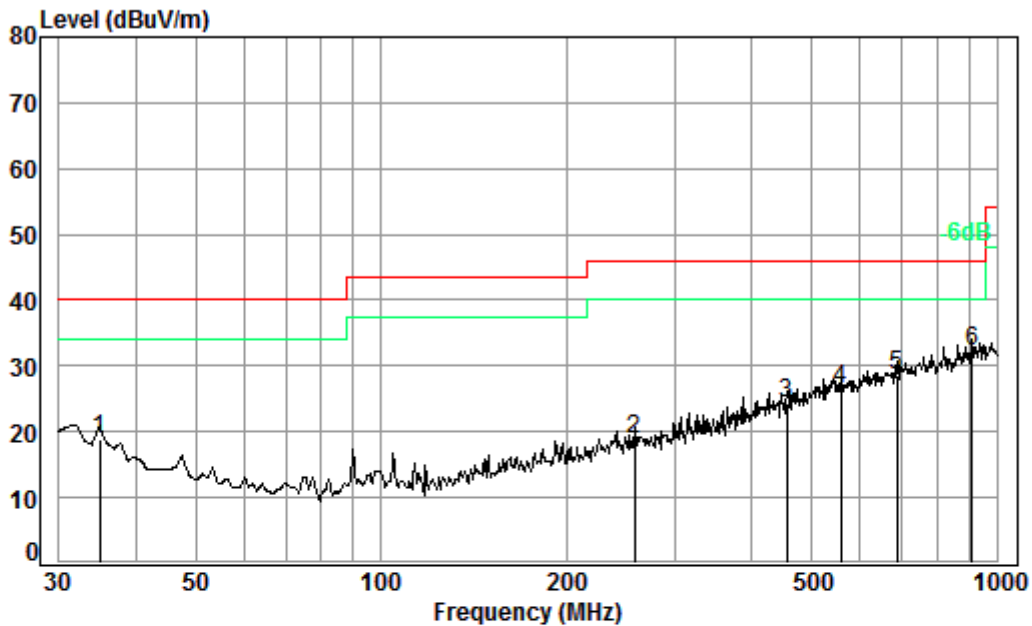
Condition: 3m Horizontal
 Job No. : 10212CR
 Test mode: b

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	0.60	21.89	27.45	24.81	19.85	40.00	-20.15
2	1.74	19.04	26.72	24.68	18.74	46.00	-27.26
3	2.13	21.80	27.07	25.70	22.56	46.00	-23.44
4	2.47	23.86	27.46	25.07	23.94	46.00	-22.06
5	2.89	27.80	27.80	25.90	28.79	46.00	-17.21
6 pp	3.65	30.07	26.77	24.99	31.94	46.00	-14.06



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Mode :b; Polarization: Vertical



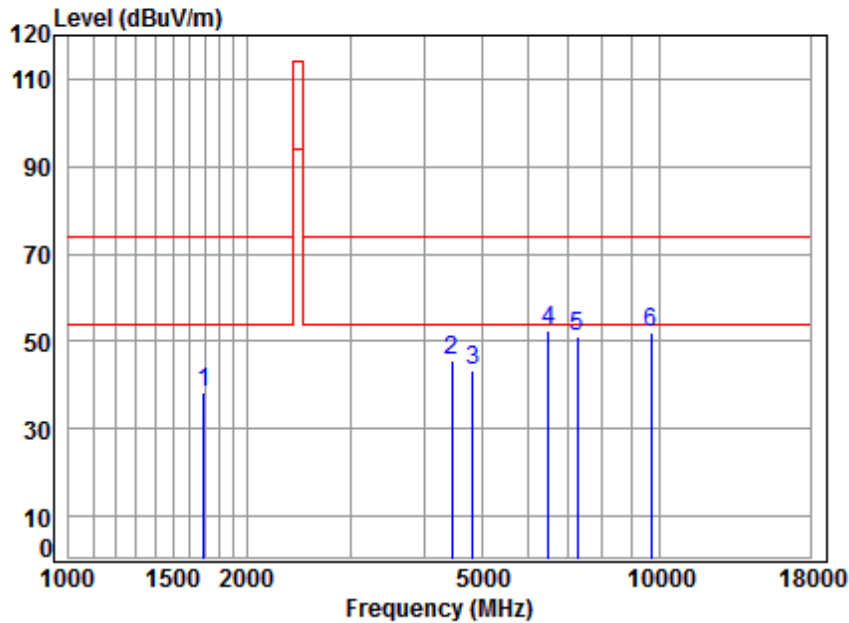
Condition: 3m Vertical
 Job No. : 10212CR
 Test mode: b

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	34.88	0.60	19.88	27.44	25.95	18.99	40.00	-21.01
2	258.33	1.71	19.08	26.74	24.70	18.75	46.00	-27.25
3	455.91	2.43	23.69	27.43	25.58	24.27	46.00	-21.73
4	558.73	2.66	25.82	27.82	25.76	26.42	46.00	-19.58
5	687.15	2.88	27.74	27.80	25.78	28.60	46.00	-17.40
6 pp	912.86	3.61	29.87	26.98	25.71	32.21	46.00	-13.79



Above 1GHz:

Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



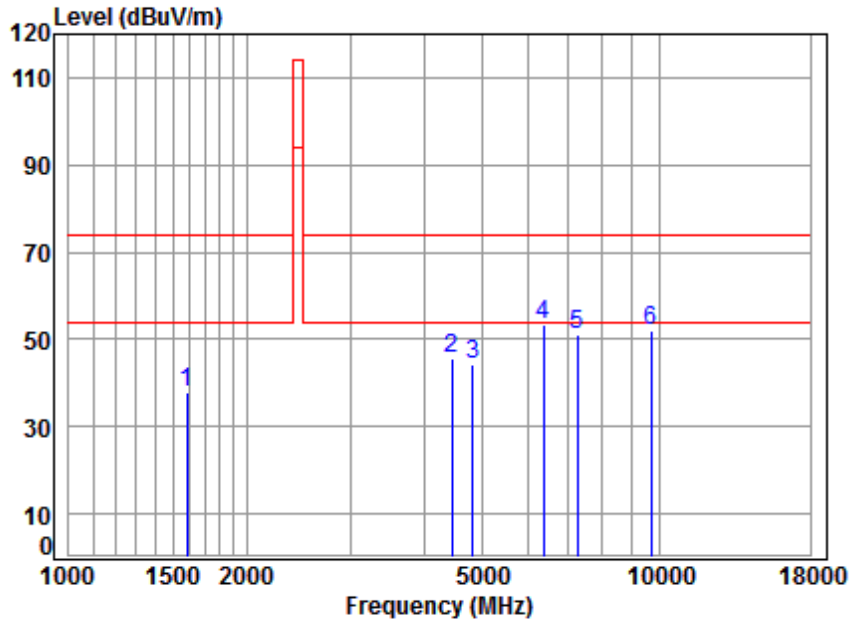
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 10212CR/10213CR
 Mode : 2420 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1692.231	5.24	26.64	40.83	47.13	38.18	74.00	-35.82 peak
2	4456.315	7.51	33.53	43.26	47.88	45.66	74.00	-28.34 peak
3	4840.000	7.93	34.01	43.65	45.16	43.45	74.00	-30.55 peak
4	6488.754	11.52	35.59	42.41	47.83	52.53	74.00	-21.47 peak
5	7260.000	10.06	36.11	41.82	46.97	51.32	74.00	-22.68 peak
6	9680.000	10.78	37.71	38.31	41.82	52.00	74.00	-22.00 peak



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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



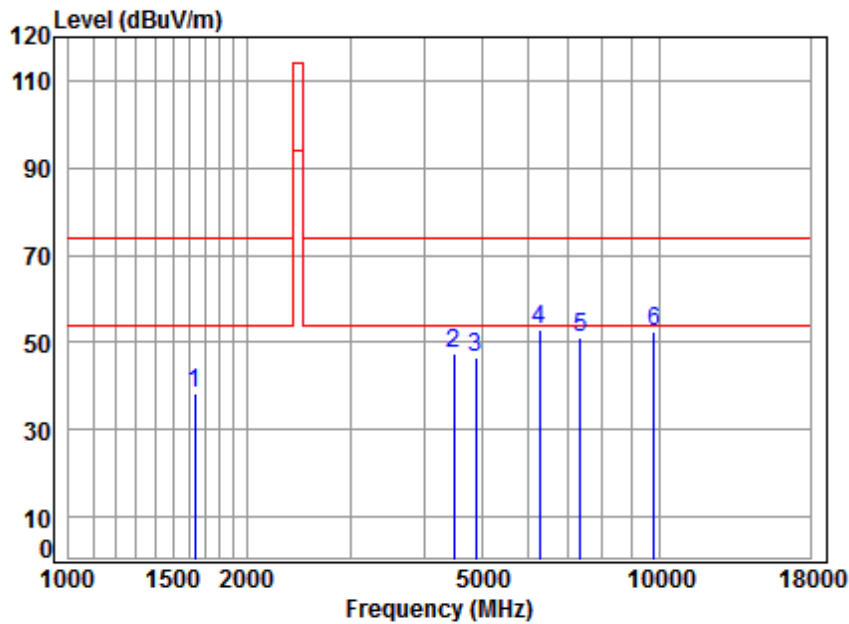
Site : chamber
 Condition: 3m VERTICAL
 Job No : 10212CR/10213CR
 Mode : 2420 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1587.975	5.37	26.20	40.76	46.87	37.68	74.00	-36.32 peak
2	4456.315	7.51	33.53	43.26	47.97	45.75	74.00	-28.25 peak
3	4840.000	7.93	34.01	43.65	45.87	44.16	74.00	-29.84 peak
4	6358.789	11.27	35.46	42.52	49.07	53.28	74.00	-20.72 peak
5	7260.000	10.06	36.11	41.82	46.72	51.07	74.00	-22.93 peak
6	9680.000	10.78	37.71	38.31	41.77	51.95	74.00	-22.05 peak



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Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



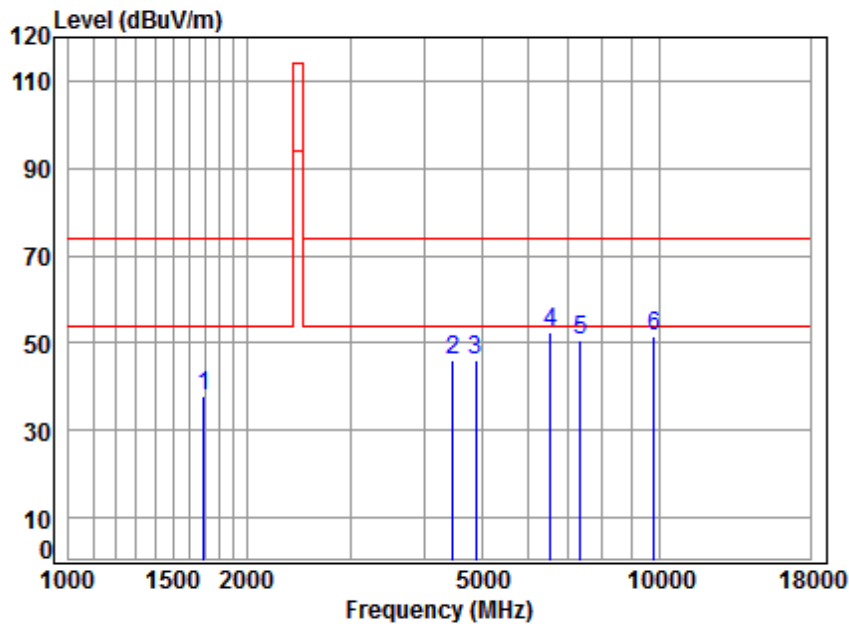
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 10212CR/10213CR
 Mode : 2447 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1634.543	5.31	26.40	40.79	47.21	38.13	74.00	-35.87	peak
2	4482.150	7.54	33.57	43.29	49.54	47.36	74.00	-26.64	peak
3	4894.000	7.98	34.08	43.70	48.08	46.44	74.00	-27.56	peak
4	6267.553	11.10	35.37	42.60	48.98	52.85	74.00	-21.15	peak
5	7341.000	10.04	36.18	41.76	46.56	51.02	74.00	-22.98	peak
6	9788.000	10.84	37.77	38.14	42.15	52.62	74.00	-21.38	peak



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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



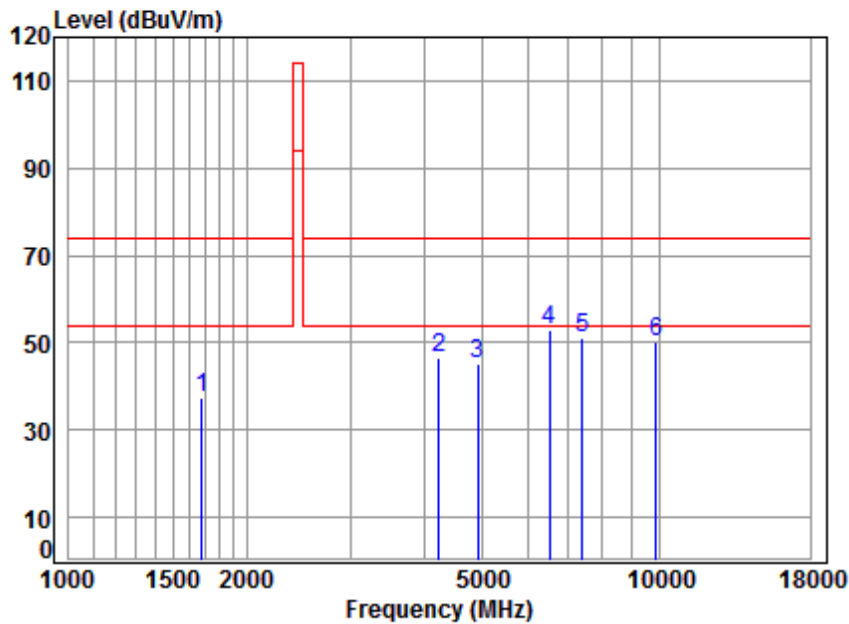
Site : chamber
 Condition: 3m VERTICAL
 Job No : 10212CR/10213CR
 Mode : 2447 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dB	
1	1692.231	5.24	26.64	40.83	46.80	74.00	-36.15	peak
2	4469.214	7.53	33.55	43.27	48.37	74.00	-27.82	peak
3	4894.000	7.98	34.08	43.70	47.91	74.00	-27.73	peak
4	6545.263	11.41	35.63	42.37	47.99	74.00	-21.34	peak
5	7341.000	10.04	36.18	41.76	46.35	74.00	-23.19	peak
6	9788.000	10.84	37.77	38.14	41.22	74.00	-22.31	peak



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Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



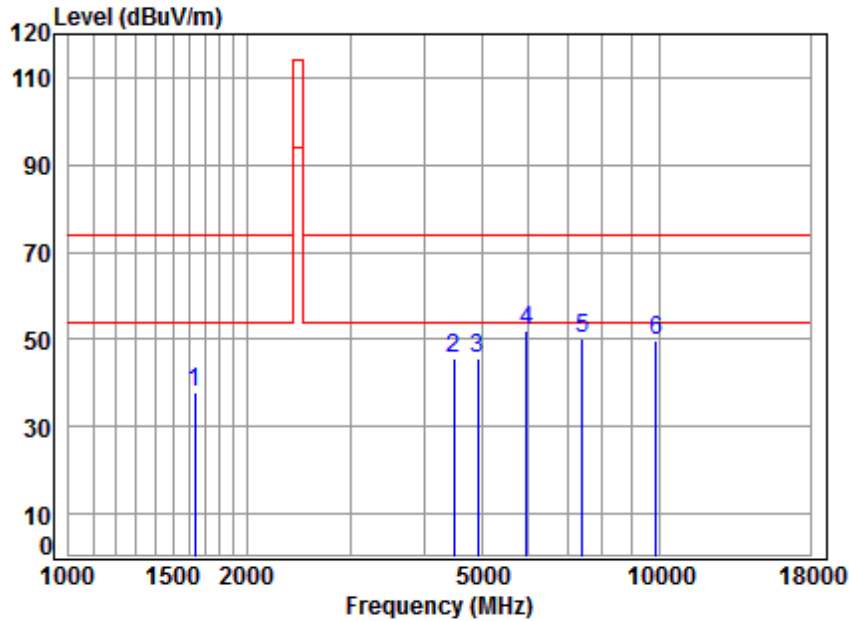
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 10212CR/10213CR
 Mode : 2465 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dB	
1	1682.477	5.25	26.60	40.82	46.50	74.00	-36.47	peak
2	4230.396	7.26	33.13	43.01	49.18	74.00	-27.44	peak
3	4930.000	8.02	34.12	43.73	46.87	74.00	-28.72	peak
4	6526.373	11.46	35.62	42.38	48.18	74.00	-21.12	peak
5	7395.000	10.03	36.22	41.72	46.37	74.00	-23.10	peak
6	9860.000	10.87	37.82	38.02	39.74	74.00	-23.59	peak



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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Site : chamber
 Condition: 3m VERTICAL
 Job No : 10212CR/10213CR
 Mode : 2465 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1634.543	5.31	26.40	40.79	46.73	74.00	-36.35	peak
2	4482.150	7.54	33.57	43.29	47.68	74.00	-28.50	peak
3	4930.000	8.02	34.12	43.73	47.02	74.00	-28.57	peak
4	5967.033	10.46	35.07	42.86	49.48	74.00	-21.85	peak
5	7395.000	10.03	36.22	41.72	45.84	74.00	-23.63	peak
6	9860.000	10.87	37.82	38.02	39.24	74.00	-24.09	peak



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Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only above measurement data were shown in the report.



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8 Photographs

8.1 Test Setup

Please refer to setup photos..

8.2 EUT Constructional Details (EUT Photos)

Please refer to external and internal photos for details.

- End of the Report -

