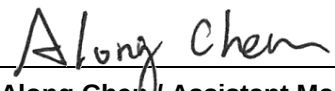


FCC Test Report

FCC ID : RID-LS134
Equipment : LoRa[®] Smoke and Heat Detector
Model No. : LS-134XX
(X can be any alphanumeric character for marketing purpose)
Brand Name : GlobalSat
Applicant : GlobalSat WorldCom Corporation
Address : 16F., No.186, Jian 1st Rd., Zhonghe Dist., New Taipei City, 23553, Taiwan
Standard : 47 CFR FCC Part 15.247
Received Date : Sep. 19, 2017
Tested Date : Jun. 05 ~ Jun. 15, 2018

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:


Along Chen / Assistant Manager

Approved by:

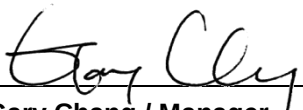

Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR791901-01	Rev. 01	Initial issue	Sep. 13, 2018

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	Note	N/A
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 955.38MHz 42.25 (Margin -3.75dB) - PK	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 18.65	Pass
15.247(a)(2)	6dB Bandwidth	Meet the requirement of limit	Pass
15.247(e)	Power Spectral Density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass
15.247(d)	Antenna-port Conducted Emission	Meet the requirement of limit	Pass

Note: The EUT consumes DC power, so the test is not required.

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information					
Frequency Range (MHz)	Ch. Freq. (MHz)	Channel Number	Physical bit rate (bit/s)	Spread Factor	Channel Bandwidth (kHz)
902 ~ 928	902.9 ~ 927.5	1 ~ 42 [42]	21900	7	500
Note 1: RF output power specifies that Maximum Peak Conducted Output Power. Note 2: The device uses FSK modulation.					

1.1.2 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)
1	chip	N/A	1.6

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3Vdc from battery
-------------------	-------------------

1.1.4 Accessories

Accessories		
No.	Equipment	Description
1	Lithium battery	Brand: Panasonic Model: CR123A Power Rating: 3Vdc
2	Sensor Programmable Cable	1m non-shielded without core.

1.1.5 Channel List

Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	902.9	17	912.5	33	922.1
2	903.5	18	913.1	34	922.7
3	904.1	19	913.7	35	923.3
4	904.7	20	914.3	36	923.9
5	905.3	21	914.9	37	924.5
6	905.9	22	915.5	38	925.1
7	906.5	23	916.1	39	925.7
8	907.1	24	916.7	40	926.3
9	907.7	25	917.3	41	926.9
10	908.3	26	917.9	42	927.5
11	908.9	27	918.5	---	---
12	909.5	28	919.1	---	---
13	910.1	29	919.7	---	---
14	910.7	30	920.3	---	---
15	911.3	31	920.9	---	---
16	911.9	32	921.5	---	---

1.1.6 Test Tool and Duty Cycle

Test Tool	Real Term, version: 2.0.0.70
Duty cycle	94.86 %

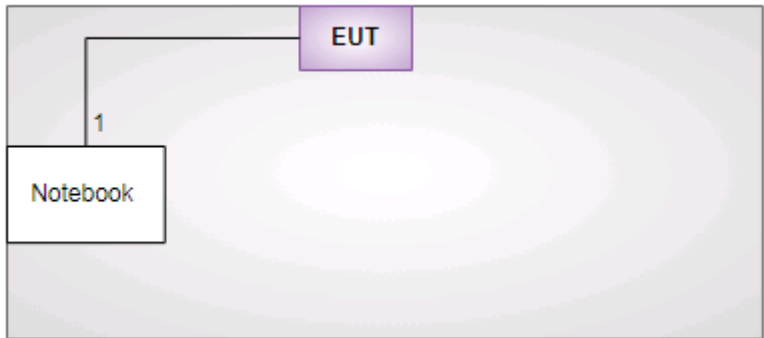
1.1.7 Power Setting

Modulation Mode	Test Frequency (MHz)		
	902.9	914.9	927.5
FSK	7	7	7

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E6440	DoC	---

1.3 Test Setup Chart

Test Setup Diagram	
	
No.	Signal cable / Length (m)
1	USB, 1m non-shielded. (Sending test comment to control EUT to transmit continuously)

1.4 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2017	Dec. 03, 2018
Receiver	R&S	ESR3	101658	Nov. 20, 2017	Nov. 19, 2018
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 25, 2017	Jul. 24, 2018
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 20, 2017	Dec. 19, 2018
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 23, 2017	Nov. 22, 2018
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2017	Nov. 12, 2018
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 07, 2017	Dec. 06, 2018
Preamplifier	EMC	EMC02325	980225	Jul. 28, 2017	Jul. 27, 2018
Preamplifier	Agilent	83017A	MY39501308	Oct. 06, 2017	Oct. 05, 2018
Preamplifier	EMC	EMC184045B	980192	Aug. 22, 2017	Aug. 21, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 07, 2017	Dec. 06, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 07, 2017	Dec. 06, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 07, 2017	Dec. 06, 2018
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	16052	Dec. 07, 2017	Dec. 06, 2018
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 07, 2017	Dec. 06, 2018
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 07, 2017	Dec. 06, 2018
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101486	Nov. 21, 2017	Nov. 20, 2018
Power Meter	Anritsu	ML2495A	1241002	Oct. 16, 2017	Oct. 15, 2018
Power Sensor	Anritsu	MA2411B	1207366	Oct. 16, 2017	Oct. 15, 2018
AC POWER SOURCE	APC	AFC-500W	F312060012	Dec. 01, 2017	Nov. 30, 2018
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247

ANSI C63.10-2013

FCC KDB 558074 D01 15.247 Meas Guidance v05

FCC KDB 453039

1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	±34.134 Hz
Conducted power	±0.808 dB
Power density	±0.463 dB
Conducted emission	±2.670 dB
AC conducted emission	±2.90 dB
Radiated emission ≤ 1GHz	±3.66 dB
Radiated emission > 1GHz	±5.63 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
Radiated Emissions	03CH01-WS	24°C / 61%	Akun Chung Vincent Yeh Roger Lu
RF Conducted	TH01-WS	22°C / 65%	Felix Sung

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- IC site registration No.: 10807A-1

2.2 The Worst Test Modes and Channel Details

Test item	Test Frequency (MHz)	Channel Bandwidth (kHz)	Modulation / SF	Test Configuration
Maximum Output Power 6dB Bandwidth Power Spectral Density Radiated Emissions ≤1GHz Radiated Emissions >1GHz	902.9 / 914.9 / 927.5	500	FSK / 7	---
Note: 1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.				

3 Transmitter Test Results

3.1 6dB and Occupied Bandwidth

3.1.1 Limit of 6dB Bandwidth

The minimum 6dB bandwidth shall be at least 500 kHz.

3.1.2 Test Procedures

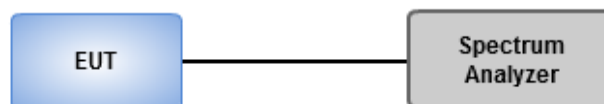
6dB Bandwidth

1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
2. Detector = Peak, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

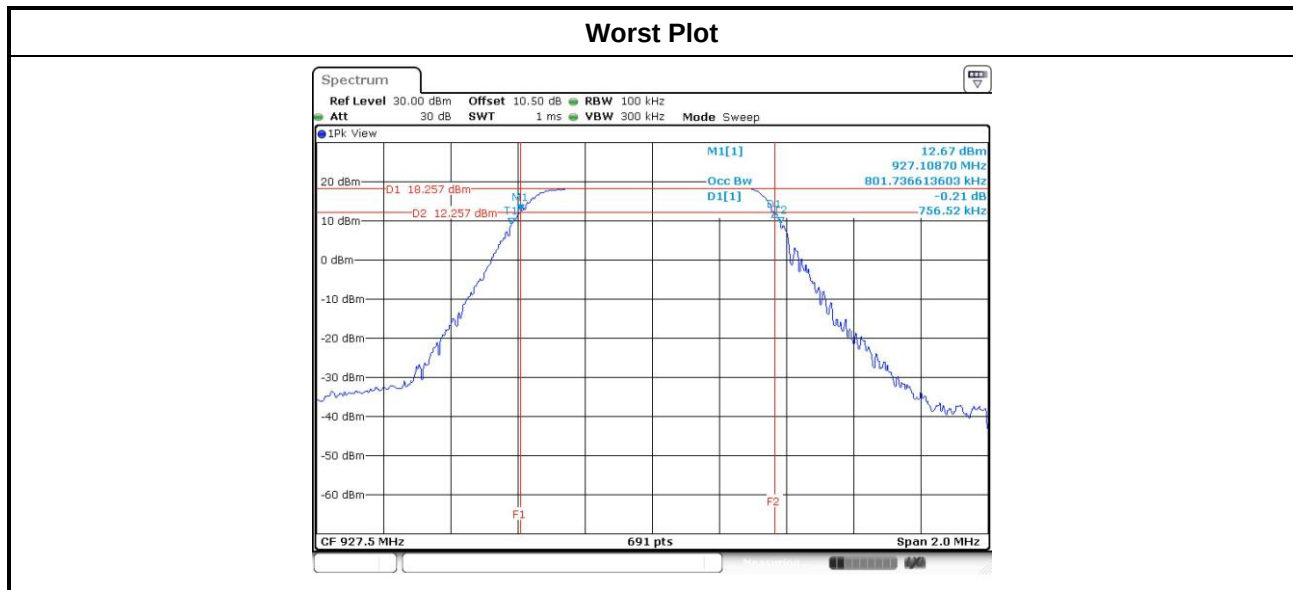
1. Set resolution bandwidth (RBW) = 10kHz, Video bandwidth = 30kHz.
2. Detector = Peak, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Use the OBW measurement function of spectrum analyzer to measure the occupied bandwidth.

3.1.3 Test Setup

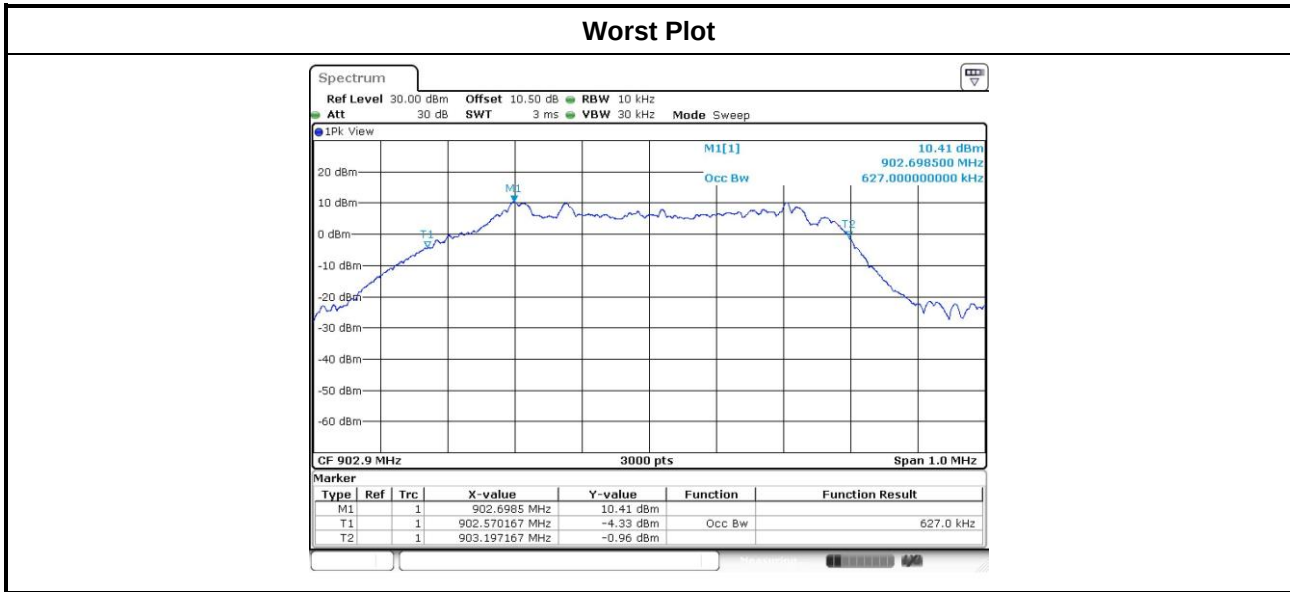


3.1.4 Test Result of 6dB and Occupied Bandwidth

Modulation / SF	Freq. (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
FSK / 7	902.9	0.768	0.5
FSK / 7	914.9	0.759	0.5
FSK / 7	927.5	0.757	0.5



Modulation / SF	Freq. (MHz)	99% Occupied Bandwidth (MHz)
FSK / 7	902.9	0.627
FSK / 7	914.9	0.621
FSK / 7	927.5	0.615



3.2 RF Output Power

3.2.1 Limit of RF Output Power

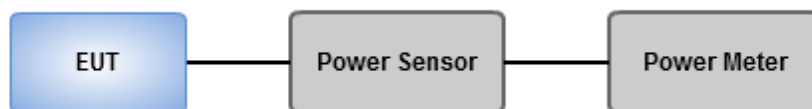
Conducted power shall not exceed 1Watt.

Antenna gain $\leq 6\text{dBi}$, no any corresponding reduction is in output power limit.

3.2.2 Test Procedures

A broadband RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

3.2.3 Test Setup



3.2.4 Test Result of Maximum Output Power

Modulation / SF	Freq. (MHz)	PK Output Power (mW)	PK Output Power (dBm)	Limit (dBm)
FSK / 7	902.9	73.28245	18.65	30
FSK / 7	914.9	72.94575	18.63	30
FSK / 7	927.5	72.77798	18.62	30

Modulation / SF	Freq. (MHz)	AV Output Power (mW)	AV Output Power (dBm)
FSK / 7	902.9	71.61434	18.55
FSK / 7	914.9	71.28530	18.53
FSK / 7	927.5	71.12135	18.52

Note: Average power is reference only.

3.3 Power Spectral Density

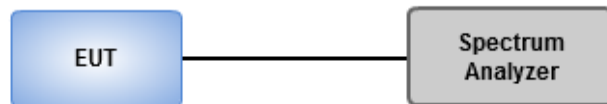
3.3.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band.

3.3.2 Test Procedures

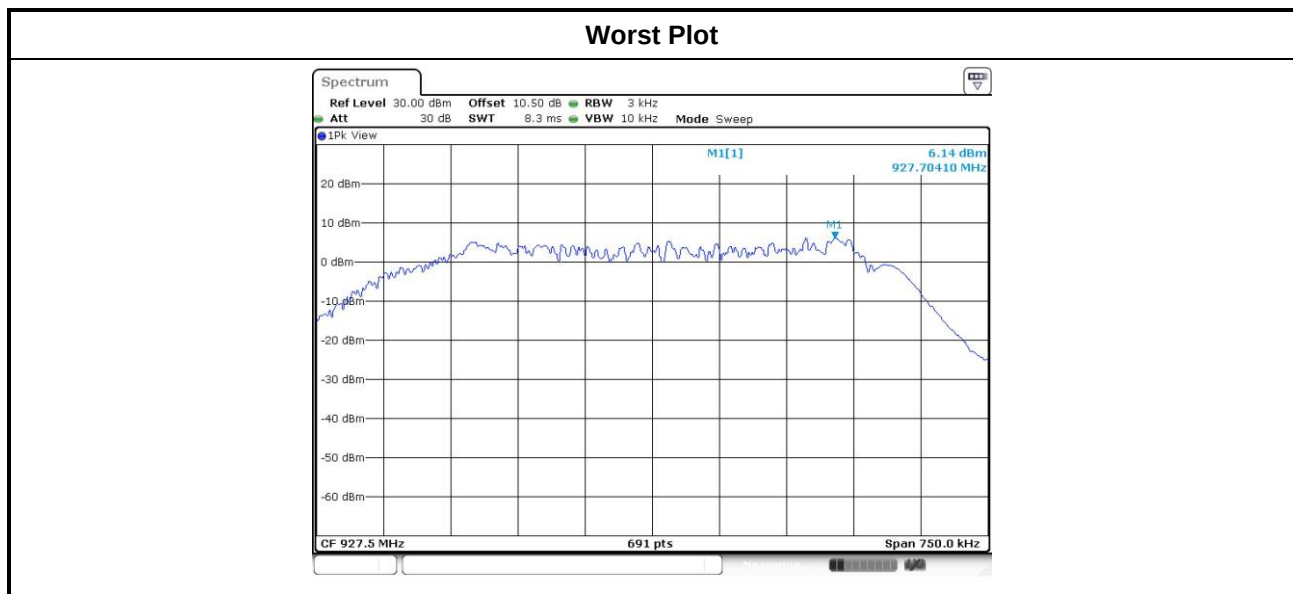
1. Set the RBW = 3 kHz, VBW = 10 kHz.
2. Detector = Peak, Sweep time = auto couple.
3. Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

3.3.3 Test Setup



3.3.4 Test Result of Power Spectral Density

Modulation / SF	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
FSK / 7	902.9	5.81	8.00
FSK / 7	914.9	5.99	8.00
FSK / 7	927.5	6.14	8.00



3.4 Unwanted Emissions into Restricted Frequency Bands

3.4.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Quasi-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.4.2 Test Procedures

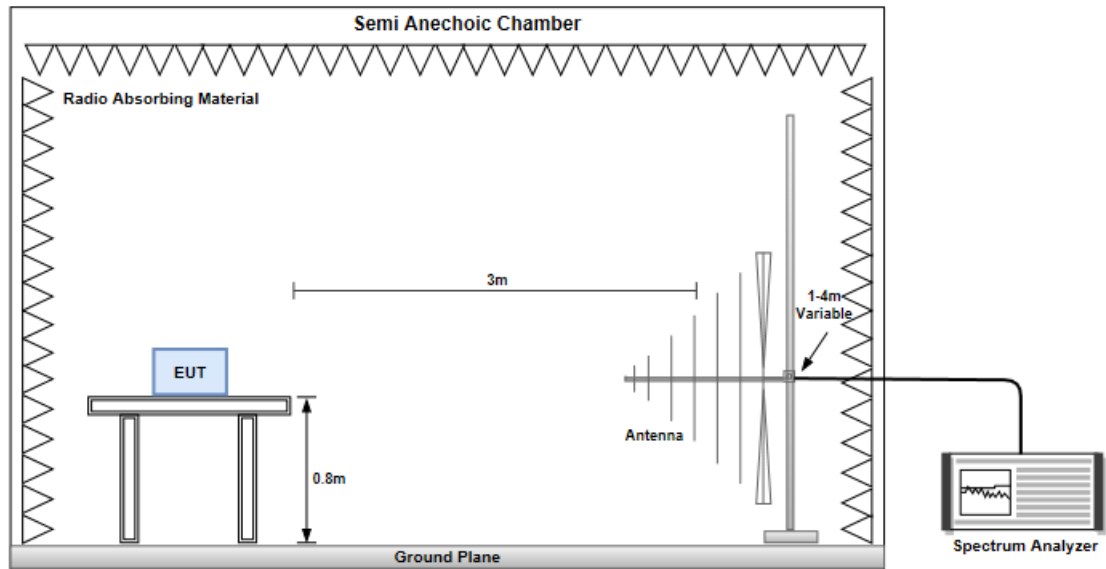
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

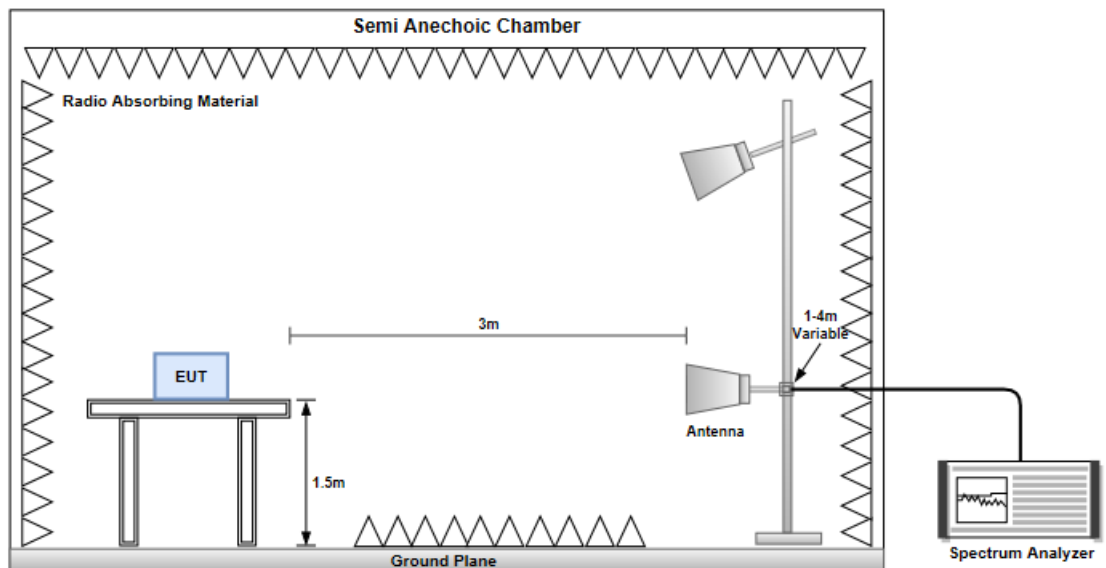
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

3.4.3 Test Setup

Radiated Emissions below 1 GHz



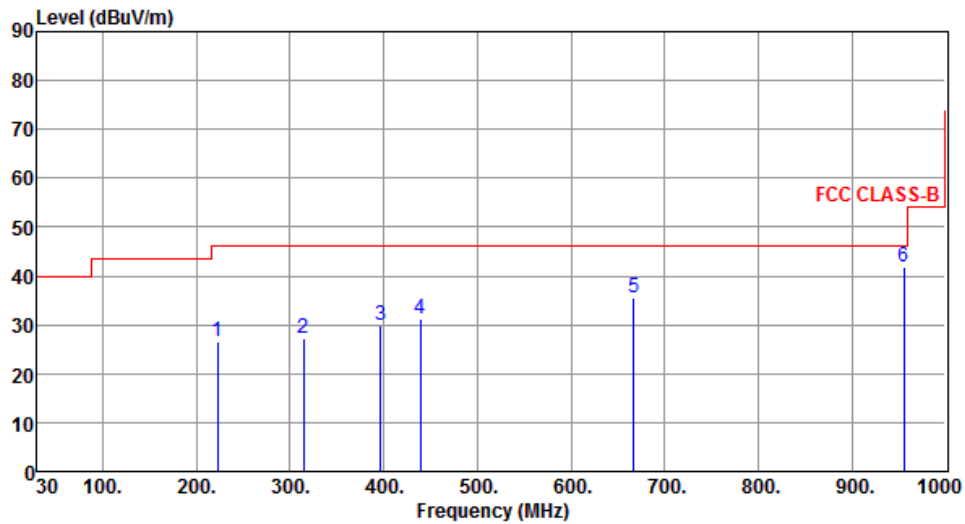
Radiated Emissions above 1 GHz



3.4.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation / SF	FSK / 7	Test Freq. (MHz)	902.9
Polarization	Horizontal		
Level (dBuV/m)			

Modulation / SF	FSK / 7	Test Freq. (MHz)	902.9
Polarization	Vertical		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	223.03	26.56	46.00	-19.44	37.18	-10.62	Peak	---	---
2	314.21	27.07	46.00	-18.93	34.36	-7.29	Peak	---	---
3	396.66	30.00	46.00	-16.00	35.04	-5.04	Peak	---	---
4	439.34	31.23	46.00	-14.77	35.27	-4.04	Peak	---	---
5	667.29	35.39	46.00	-10.61	35.21	0.18	Peak	---	---
6	955.38	41.96	46.00	-4.04	37.03	4.93	Peak	---	---

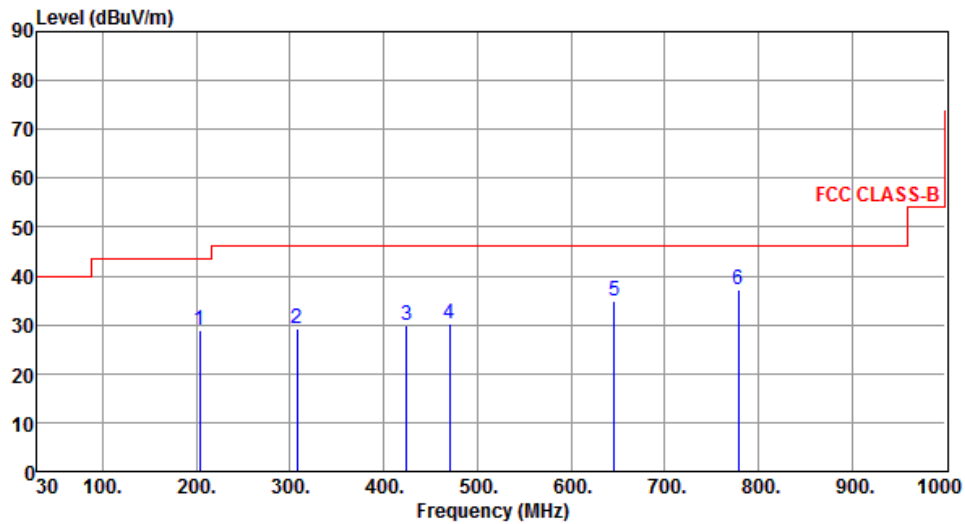
Note 1: Emission Level (dBUV/m) = SA Reading (dBUV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation / SF	FSK / 7	Test Freq. (MHz)	914.9
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	203.63	28.74	43.50	-14.76	39.53	-10.79	Peak	---	---
2	307.42	29.16	46.00	-16.84	36.62	-7.46	Peak	---	---
3	424.79	29.94	46.00	-16.06	34.32	-4.38	Peak	---	---
4	470.38	30.31	46.00	-15.69	33.72	-3.41	Peak	---	---
5	645.95	34.98	46.00	-11.02	35.15	-0.17	Peak	---	---
6	778.84	37.36	46.00	-8.64	35.21	2.15	Peak	---	---

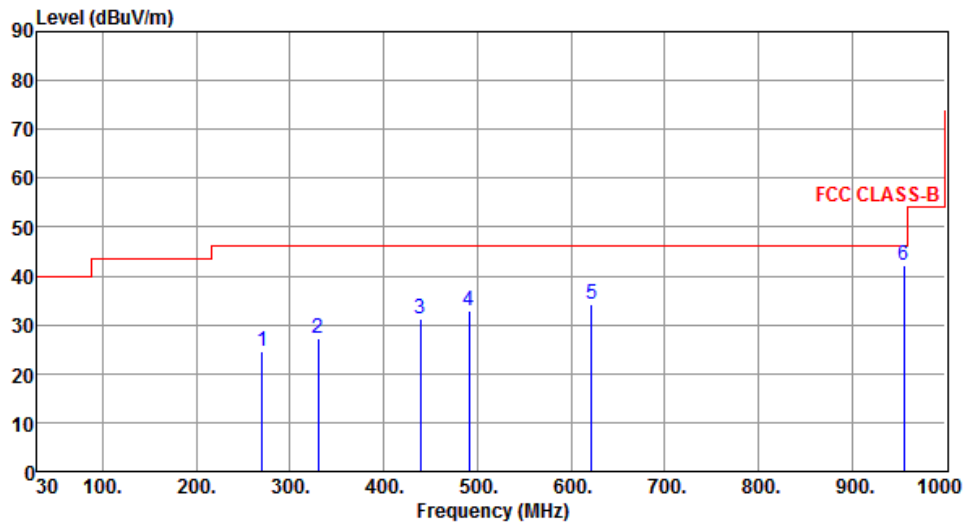
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation / SF	FSK / 7	Test Freq. (MHz)	914.9
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	270.56	24.58	46.00	-21.42	33.06	-8.48	Peak	---	---
2	329.73	27.10	46.00	-18.90	34.01	-6.91	Peak	---	---
3	439.34	31.37	46.00	-14.63	35.41	-4.04	Peak	---	---
4	490.75	32.89	46.00	-13.11	35.90	-3.01	Peak	---	---
5	621.70	34.15	46.00	-11.85	34.58	-0.43	Peak	---	---
6	955.38	42.25	46.00	-3.75	37.32	4.93	Peak	---	---

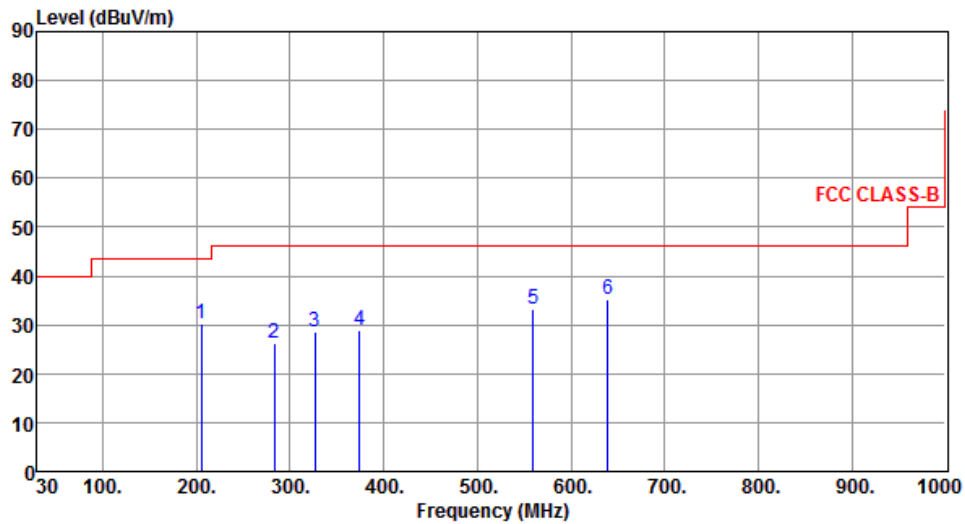
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation / SF	FSK / 7	Test Freq. (MHz)	927.5
Polarization	Horizontal		



	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	205.57	30.07	43.50	-13.43	40.86	-10.79	Peak	---	---
2	283.17	26.25	46.00	-19.75	34.26	-8.01	Peak	---	---
3	326.82	28.72	46.00	-17.28	35.70	-6.98	Peak	---	---
4	374.35	28.99	46.00	-17.01	34.69	-5.70	Peak	---	---
5	559.62	33.07	46.00	-12.93	34.60	-1.53	Peak	---	---
6	639.16	35.05	46.00	-10.95	35.30	-0.25	Peak	---	---

Note 1: Emission Level (dBUV/m) = SA Reading (dBUV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation / SF	FSK / 7	Test Freq. (MHz)	927.5
Polarization	Vertical		
Level (dBUV/m) <			

3.4.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation / SF	FSK / 7	Test Freq. (MHz)	902.9
Polarization	Horizontal		
Level (dBuV/m)			

Modulation / SF	FSK / 7		Test Freq. (MHz)		902.9				
Polarization	Vertical								
Level (dBuV/m)									

Modulation / SF	FSK / 7	Test Freq. (MHz)	914.9
Polarization	Horizontal		
Level (dBuV/m) <			

Modulation / SF	FSK / 7		Test Freq. (MHz)		914.9				
Polarization	Vertical								
Level (dBUV/m)									

Modulation / SF	FSK / 7	Test Freq. (MHz)	927.5
Polarization	Horizontal		
Level (dBuV/m) <			

Modulation / SF	FSK / 7		Test Freq. (MHz)		927.5				
Polarization	Vertical								
Level (dBUV/m)									

3.5 Emissions in Non-Restricted Frequency Bands

3.5.1 Emissions in Non-Restricted Frequency Bands Limit

Peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

3.5.2 Test Procedures

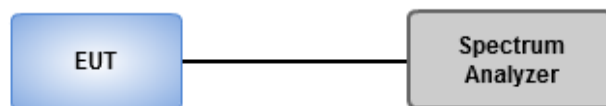
Reference level measurement

1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Use the peak marker function to determine the maximum PSD level

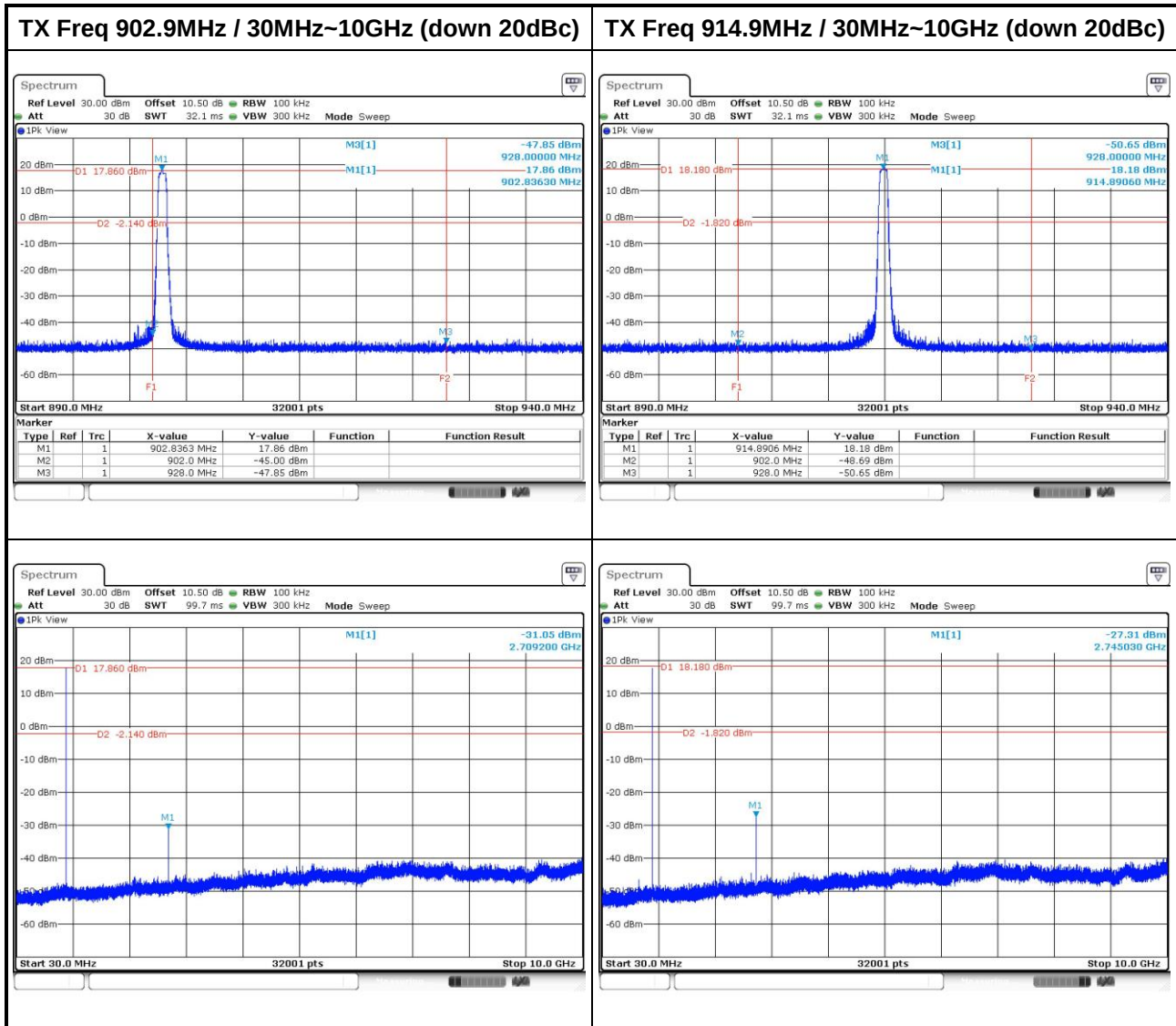
Emission level measurement

1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 25GHz
4. Use the peak marker function to determine the maximum amplitude level

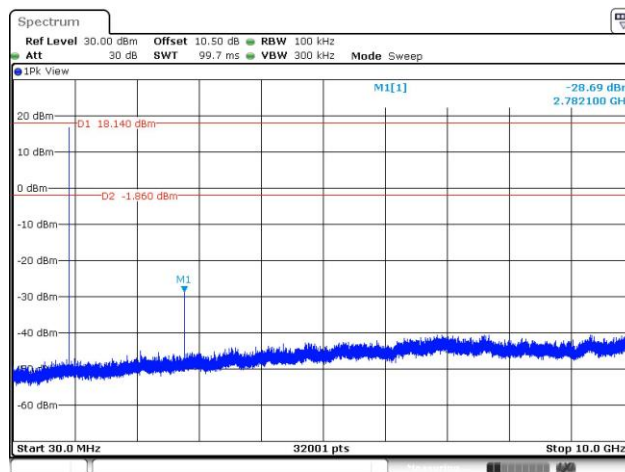
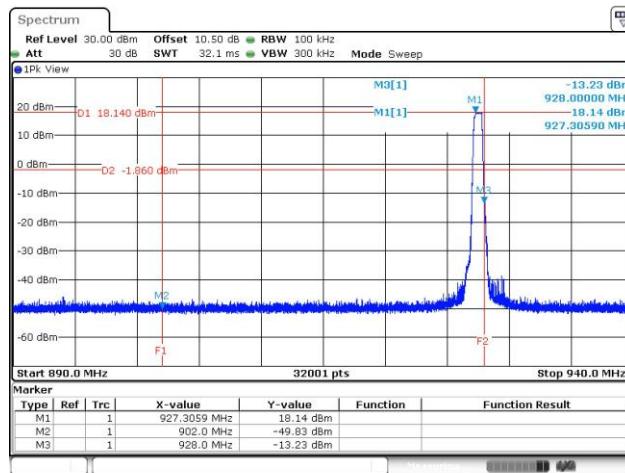
3.5.3 Test Setup



3.5.4 Unwanted Emissions into Non-Restricted Frequency Bands



TX Freq 927.5MHz / 30MHz~10GHz (down 20dBc)



4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin
Kou District, New Taipei City,
Taiwan, R.O.C.

Kwei Shan

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd St.,
Kwei Shan District, Tao Yuan City
333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

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