FCC RF Test Report

APPLICANT	:	Huawei technologies Co., Ltd.
EQUIPMENT	:	eM300-8a
BRAND NAME	:	Quectel
MODEL NAME	:	eM300-8a
MARKETING NAME	:	Quectel
FCC ID	:	QIS201705EM300
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(FHSS)Frequency Hopping Systems

The product was received on Dec. 21, 2016 and testing was completed on Dec. 29, 2016. We, Sporton International (KunShan) INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (KunShan) INC., the test report shall not be reproduced except in full.

James Huang

Prepared by: James Huang / Manager

Jones Tsai

Approved by: Jones Tsai / Manager

Testing Laboratory
2627

Sporton International (KunShan) INC.
No.3-2, Pingxiang Road, Kunshan Development Zone, Jiangsu, China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR742612	Rev. 01	Initial issue of report	May 05, 2017

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(i)	Number of Channels	≥ 50Chs	Pass	-
3.2	15.247(a)(i)	Hopping Channel Separation	≥ 20dB BW	Pass	-
3.3	15.247(a)(i)	Dwell Time of Each Channel	≤ 0.4sec in 20sec period	Pass	-
3.4	15.247(a)(i)	20dB Bandwidth	N/A	Pass	-
3.5	15.247(b)(2)	Peak Output Power	≤ 1W	Pass	-
3.7	15.247(d)	Conducted Band Edges	≤ 20dBc	Pass	-
3.8	15.247(d)	Conducted Spurious Emission	≤ 20dBc	Pass	-
3.9	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 0.35 dB at 7419.000 MHz
3.10	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Huawei technologies Co., Ltd.
Administration Building, headquarters of Huawei technologies Co., Ltd. Bantian, longgang District, ShenZhen, 518129, P.R.China

1.2 Manufacturer

Quectel Wireless Solutions Co., Ltd.
Room 501, Building 13, No.99 Tianzhou Road, Xuhui District, Shanghai

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	eM300-8a
Brand Name	Quectel
Model Name	eM300-8a
Marketing Name	Quectel
FCC ID	QIS201705EM300
EUT supports Radios application	eLTE-IoT
HW Version	V1.1
SW Version	V100R001C00B105
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	902.5 MHz ~ 927.4 MHz
Number of Channels	756
Maximum Output Power to Antenna	eLTE-IoT : 25.36 dBm (0.3436 W)
Antenna Type	External Antenna
Type of Modulation	QPSK

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Test Site	Sporton International (KunShan) INC.,		
Test Site Location	No.3-2, Pingxiang Road, Kunshan Development Zone, Jiangsu, China TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958		
Test Site No.	**Sporton Site No.**		**FCC Registration No.**
	TH01-KS	03CH02-KS	418269

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

The RF output power was recorded in the following table:

Channel	Frequency	RF Output Power
		Modulation
		QPSK
Ch001	902.5MHz	25.23 dBm
Ch379	915.1MHz	25.21 dBm
Ch756	927.4MHz	**25.36 dBm**

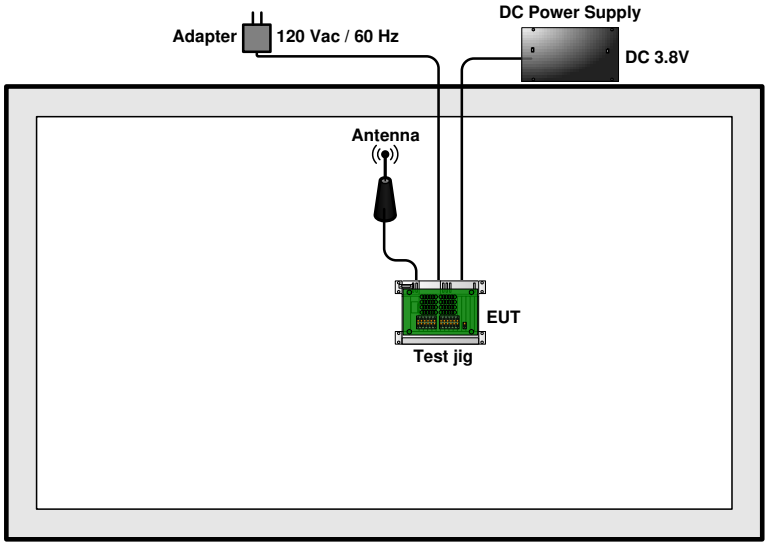
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

2.2 Test Mode

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	Modulation
	QPSK
Conducted Test Cases	Mode 1: CH001_902.5 MHz Mode 2: CH379_915.1 MHz Mode 3: CH756_927.4 MHz
Radiated Test Cases	QPSK
	Mode 1: CH001_902.5 MHz Mode 2: CH379_915.1 MHz Mode 3: CH756_927.4 MHz

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	DC Power Supply	GWINSTEK	GPS-3030D	N/A	N/A	Unshielded, 1.8 m
2.	Test jig	N/A	N/A	N/A	N/A	N/A
3.	Adapter	N/A	P-050B	N/A	N/A	Unshielded, 1.8 m
4.	Antenna	N/A	N/A	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For eLTE-IoT function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

2.6 Measurement Results Explanation Example

For all conducted test items:

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

Example:
The spectrum analyzer offset is RF cable loss.
Offset = RF cable loss.
Following shows an offset computation example with cable loss 4.5 dB.

Offset(dB) = RF cable loss(dB).
= 4.5 (dB)

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 902-928 MHz band shall use at least 50 channels.

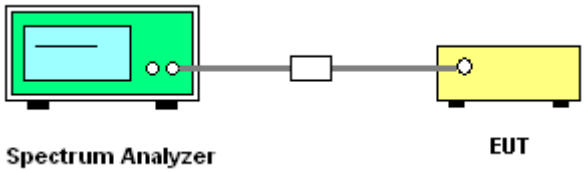
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW = 3kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

3.1.4 Test Setup

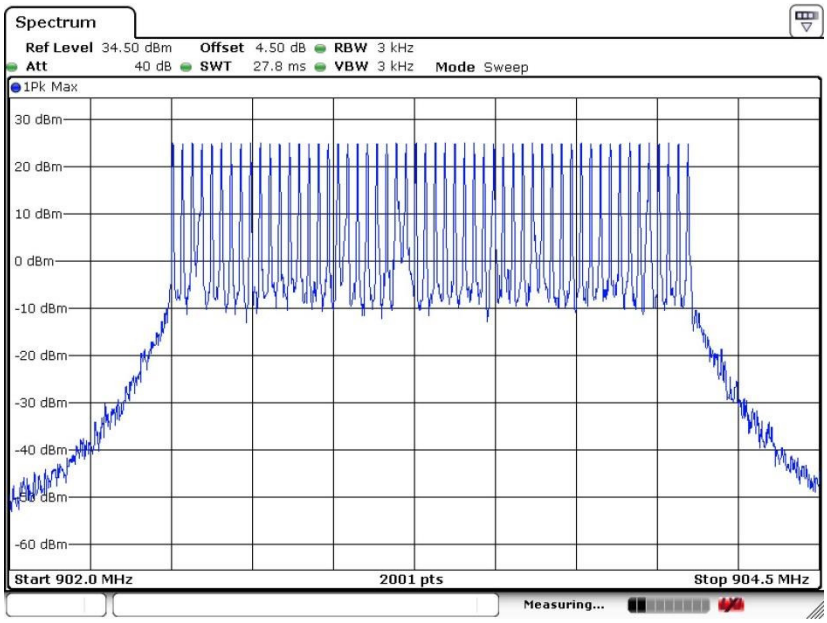


3.1.5 Test Result of Number of Hopping Frequency

Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Engineer :	Silent Hai	Relative Humidity :	51~55%

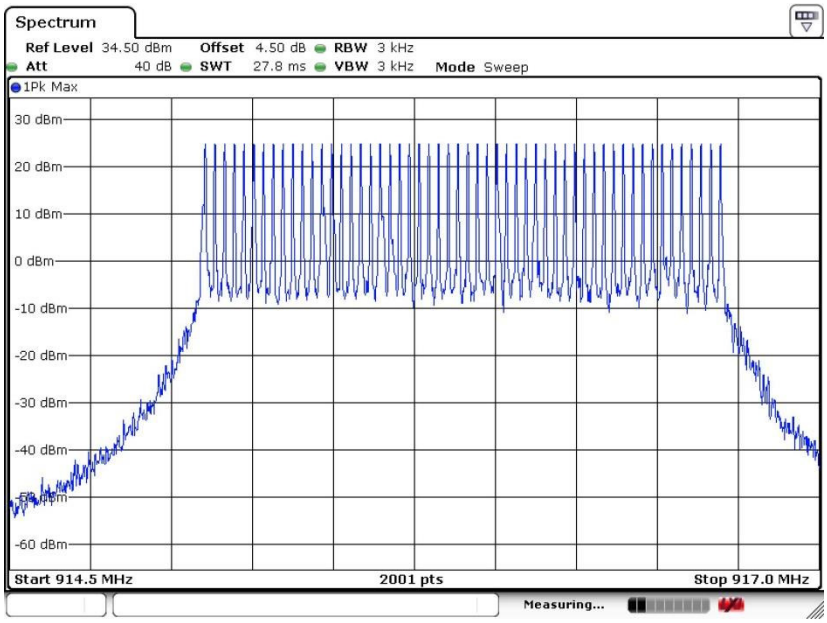
Number of Hopping (Channel)	Limits (Channel)	Pass/Fail
54	> 50	Pass

Number of Hopping Channel Plot on Channel 001 - 054



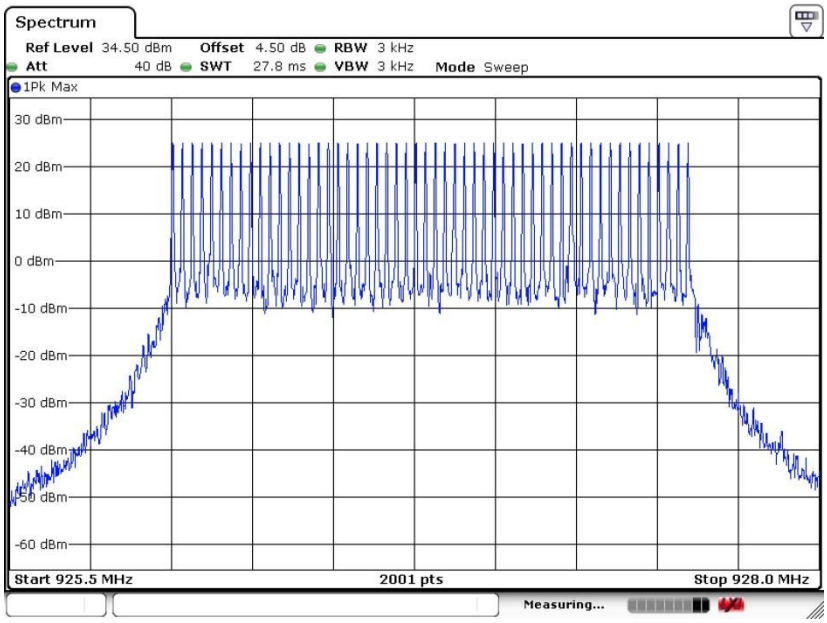
Date: 29.DEC.2016 16:09:01

Number of Hopping Channel Plot on Channel 379 - 432



Date: 29.DEC.2016 16:03:28

Number of Hopping Channel Plot on Channel 703 - 756



3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 902-928 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or 20 dB bandwidth of the hopping channel, whichever is greater.

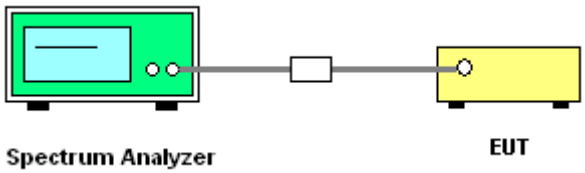
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.2.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 10kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.2.4 Test Setup

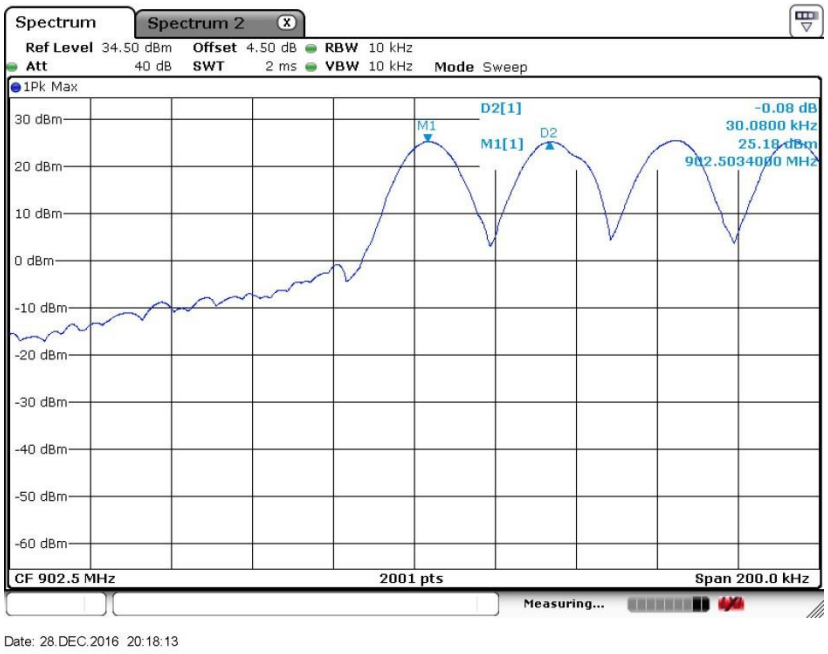


3.2.5 Test Result of Hopping Channel Separation

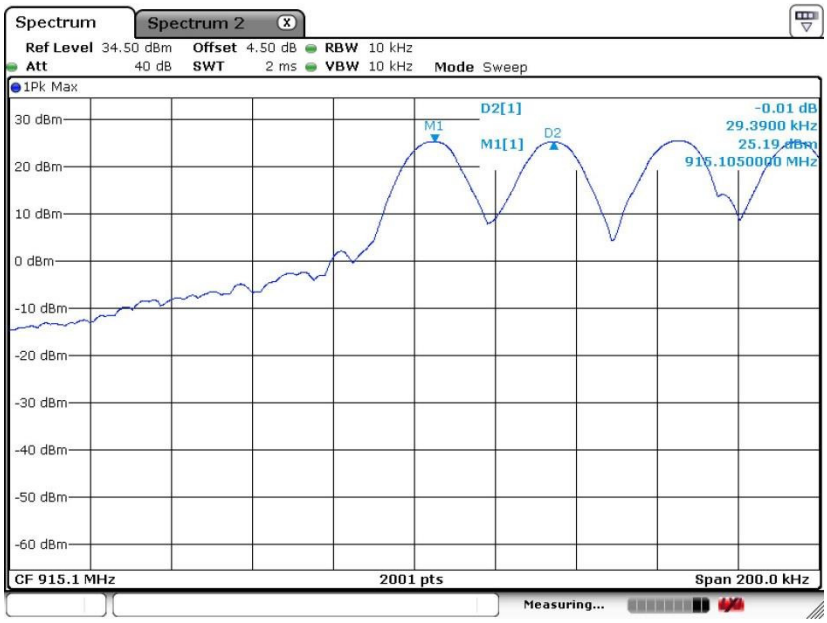
Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Engineer :	Silent Hai	Relative Humidity :	51~55%

Channel	Frequency (MHz)	Frequency Separation (kHz)	(20dB BW) Limits (kHz)	Pass/Fail
001	902.5	30.08	25.00	Pass
379	915.1	29.39	25.00	Pass
756	927.4	29.99	25.00	Pass

Channel Separation Plot on Channel 001- 002



Channel Separation Plot on Channel 379 - 380



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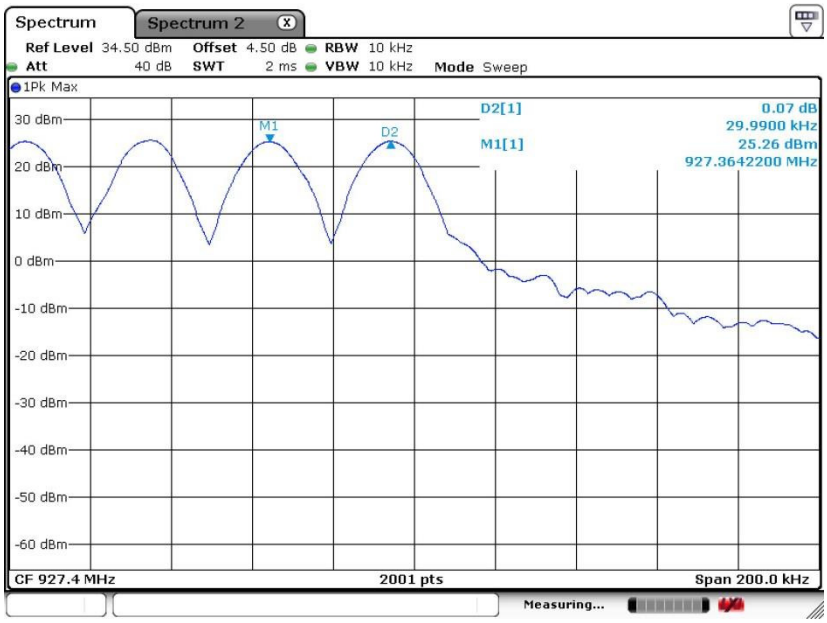
Channel Separation Plot on Channel 755 - 756



Date: 28.DEC.2016 20:28:32

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period.

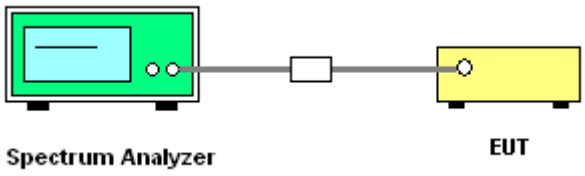
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 30kHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.3.4 Test Setup



3.3.5 Test Result of Dwell Time

Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Engineer :	Silent Hai	Relative Humidity :	51~55%

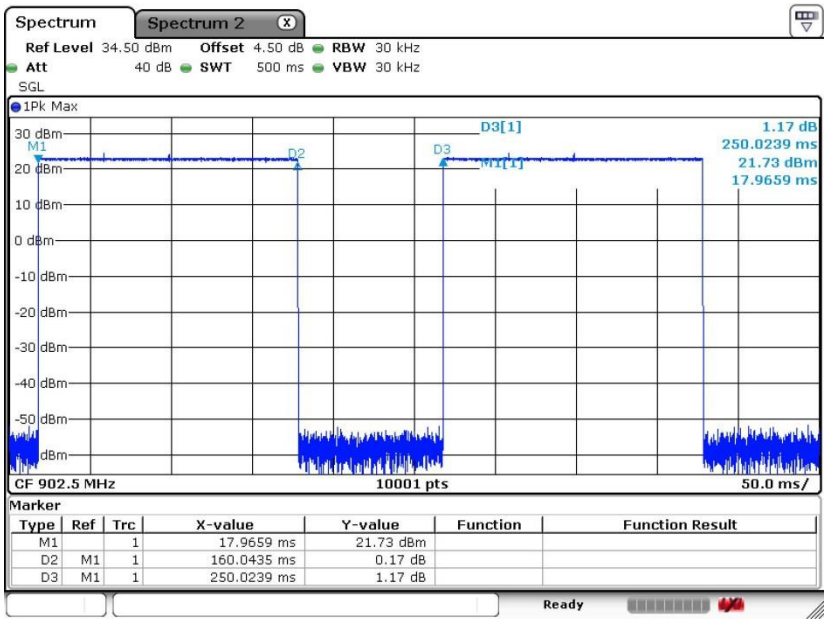
Channel	Frequency Occupation Time	Transmission duration (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
001	2	160.04	0.32	0.4	Pass
379	2	160.00	0.32	0.4	Pass
756	2	160.01	0.32	0.4	Pass

Remark:

The longest time of occupancy for each of 20 seconds is:

Frequency Occupation Time * Transmission duration (msec)/1000= Dwell Time(sec)

Transmission duration Plot on Channel 001



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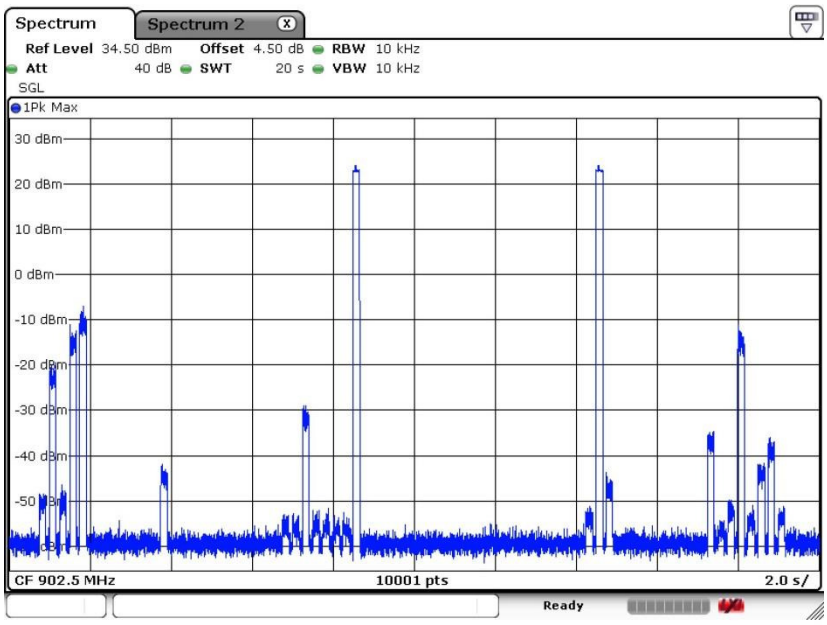
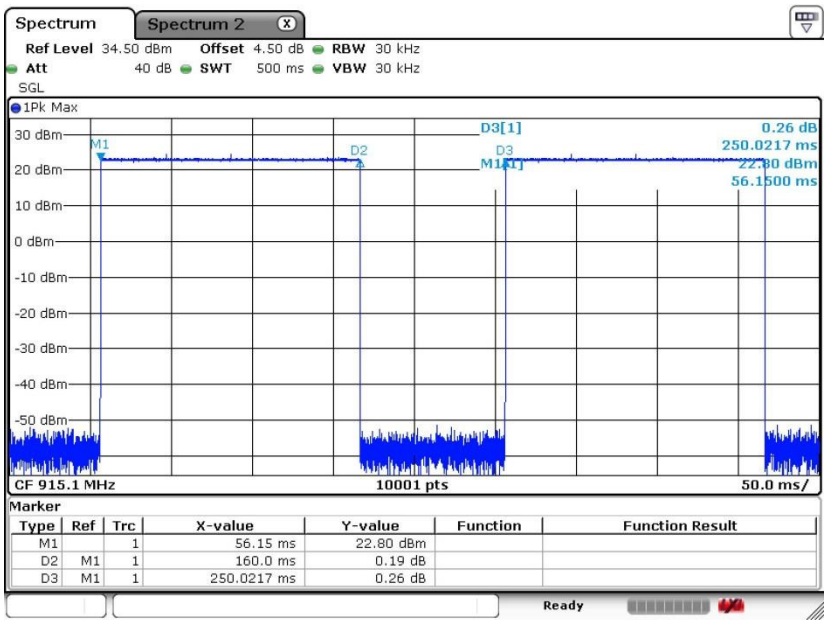
Frequency Occupation Time Plot on Channel 001



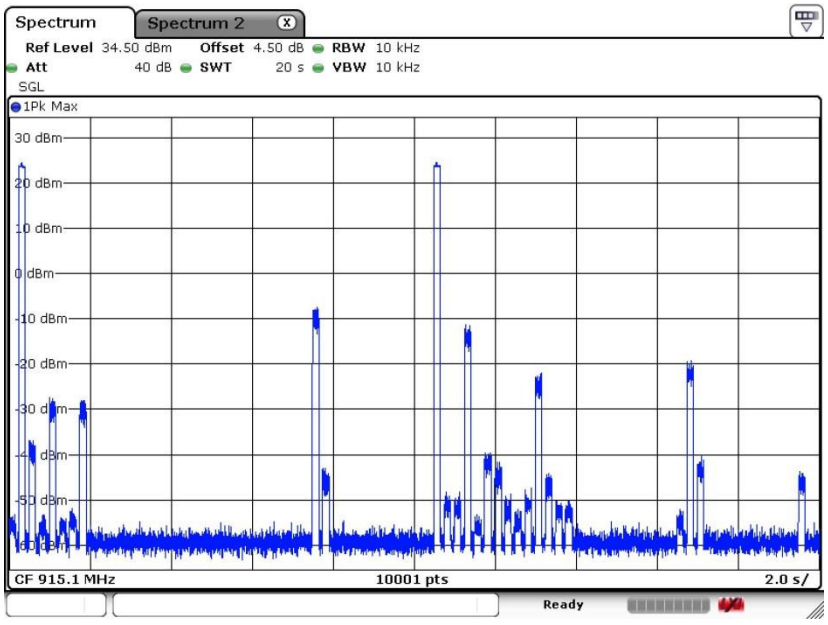
Date: 28.DEC.2016 18:10:25

Transmission duration Plot on Channel 379



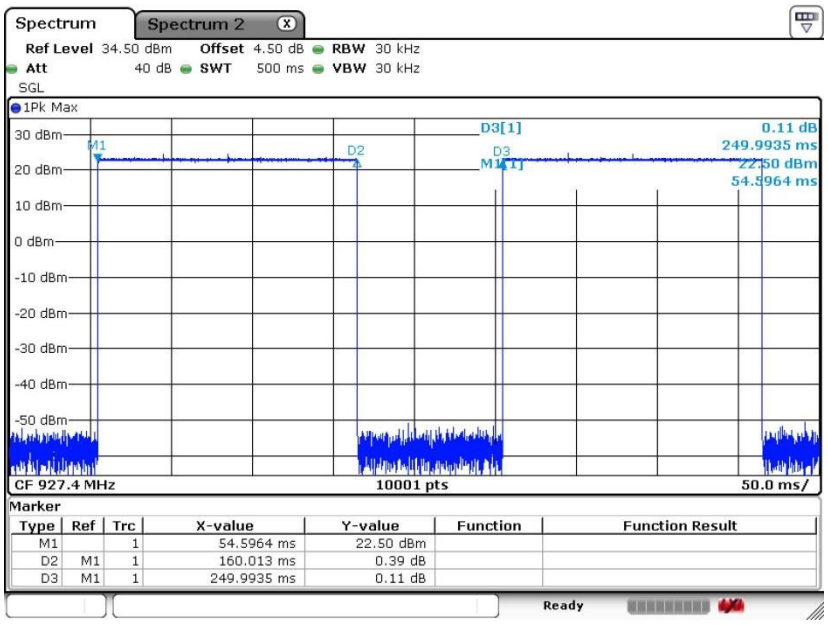
Date: 28.DEC.2016 19:22:46

Frequency Occupation Time Plot on Channel 379



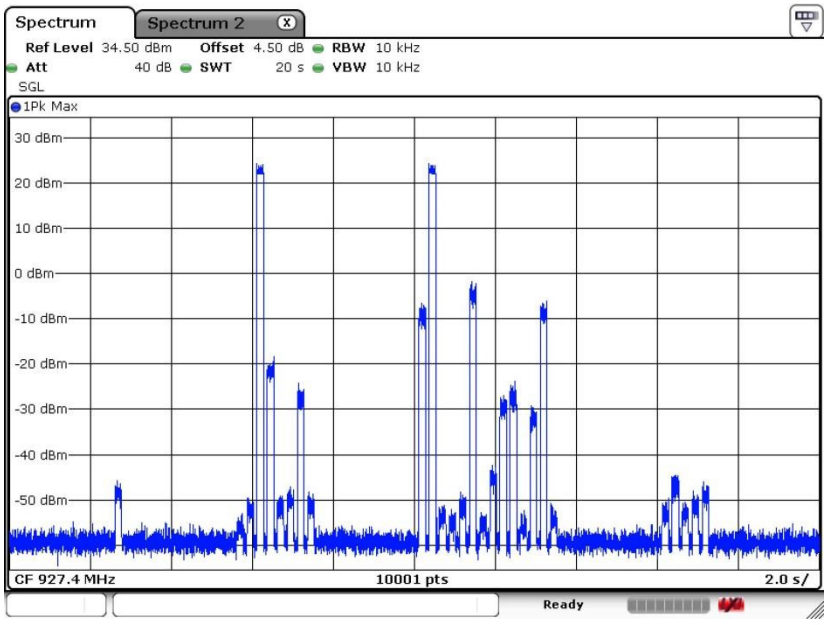
Date: 28.DEC.2016 18:06:12

Transmission duration Plot on Channel 756



Date: 28.DEC.2016 19:49:00

Frequency Occupation Time Plot on Channel 756



Date: 28.DEC.2016 18:16:32

3.4 20dB Bandwidth Measurement

3.4.1 Limit of 20dB Bandwidth

Reporting only

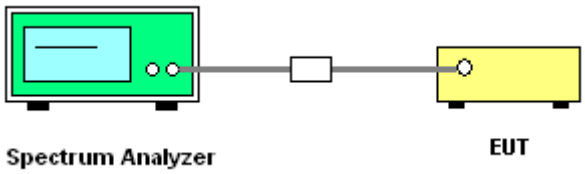
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
   Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
   Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 99% bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
6. Measure and record the results in the test report.

3.4.4 Test Setup

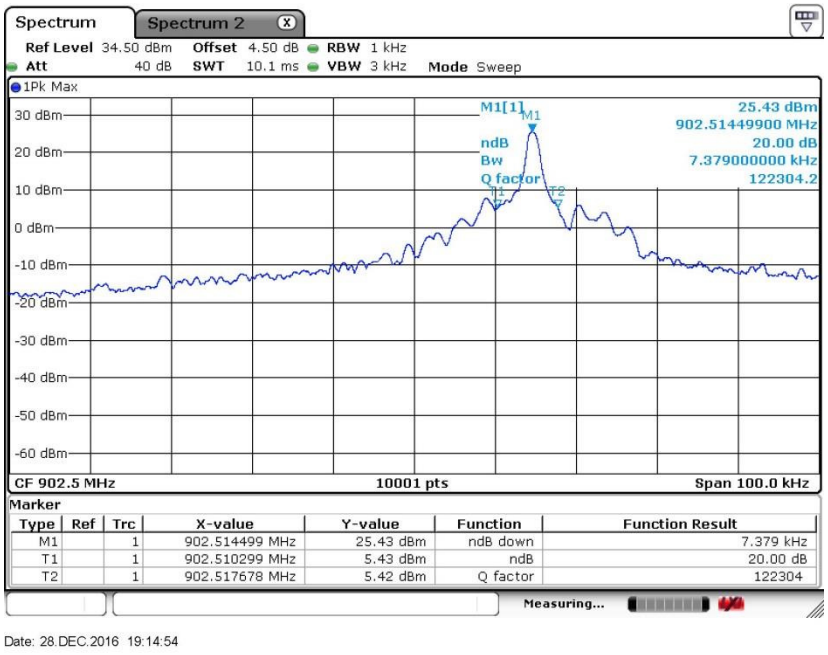


3.4.5 Test Result of 20dB Bandwidth

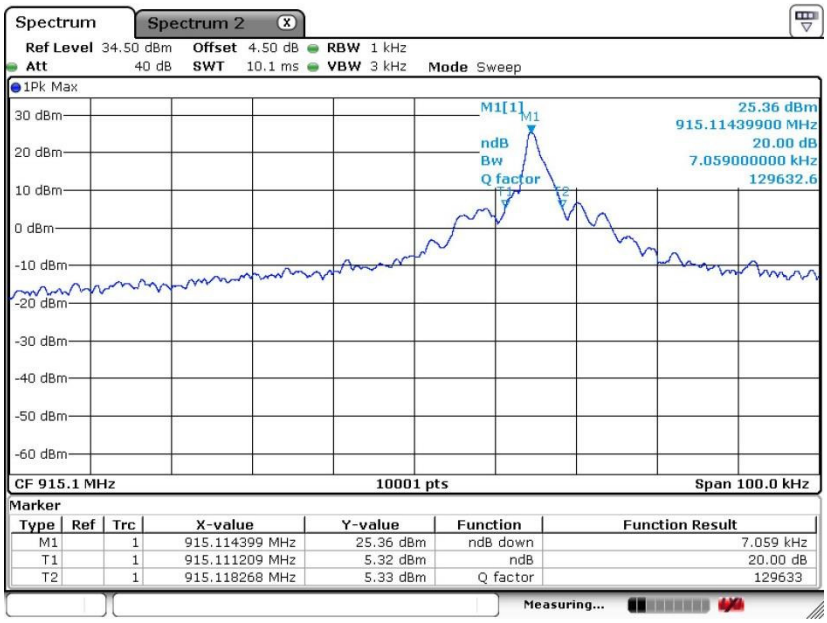
Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Engineer :	Silent Hai	Relative Humidity :	51~55%

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
001	902.5	7.379
379	915.1	7.059
756	927.4	7.819

20 dB Bandwidth Plot on Channel 001

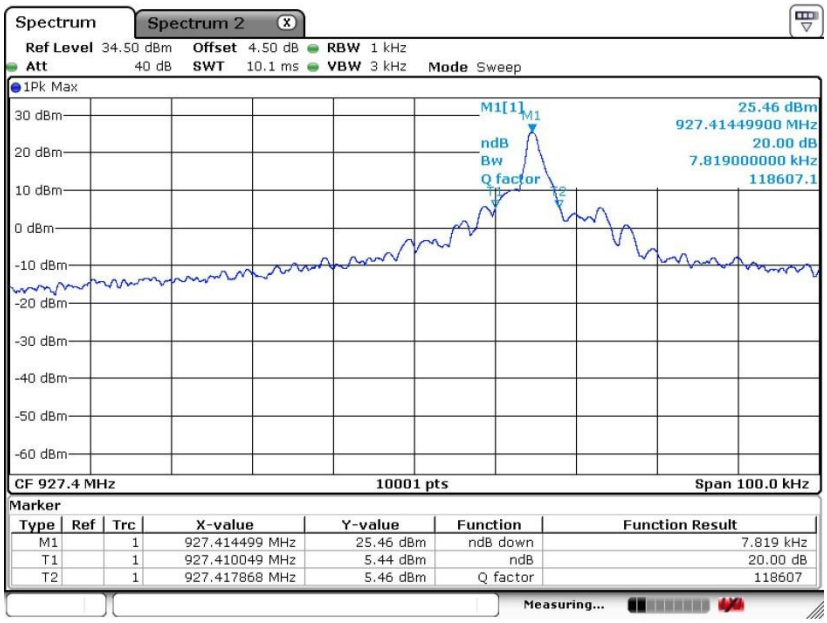


20 dB Bandwidth Plot on Channel 379



Date: 28.DEC.2016 19:08:26

20 dB Bandwidth Plot on Channel 756



Date: 28.DEC.2016 19:06:41

3.5 Peak Output Power Measurement

3.5.1 Limit of Peak Output Power

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

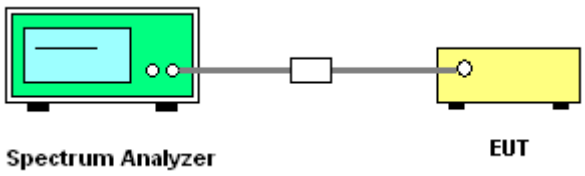
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.5.4 Test Setup

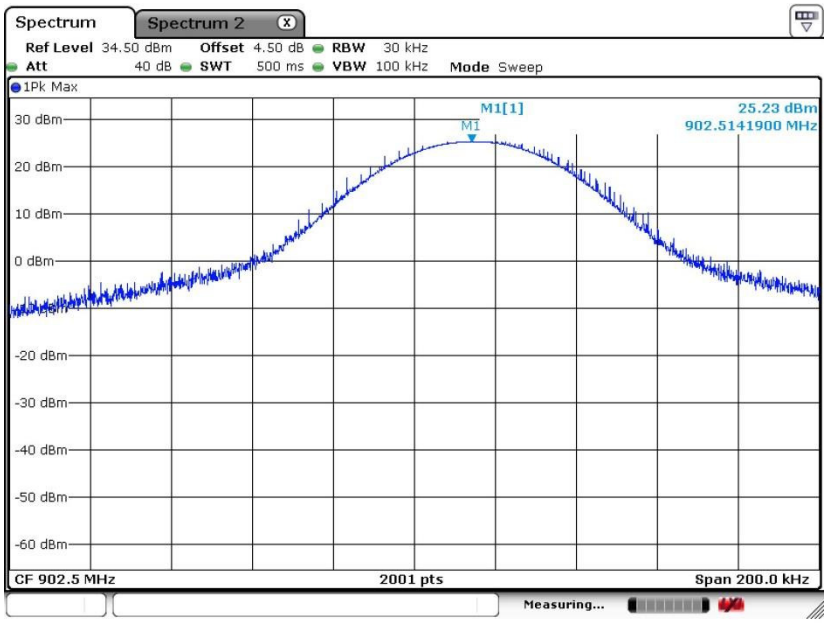


3.5.5 Test Result of Peak Output Power

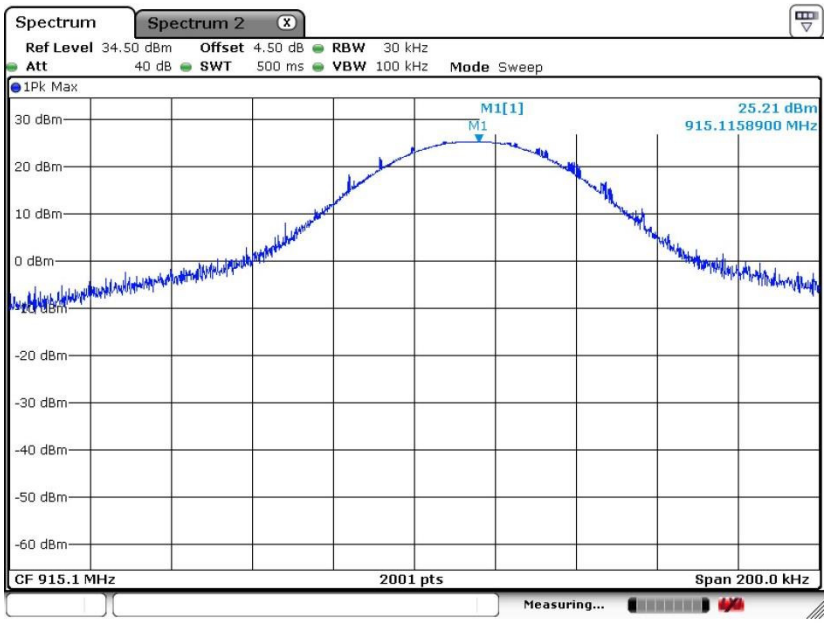
Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Engineer :	Silent Hai	Relative Humidity :	51~55%

Channel	Frequency (MHz)	RF Power (dBm)		
		QPSK	Max. Limits (dBm)	Pass/Fail
001	902.5	25.23	30	Pass
379	915.1	25.21	30	Pass
756	927.4	25.36	30	Pass

Peak Output Power Plot on Channel 001



Peak Output Power Plot on Channel 379



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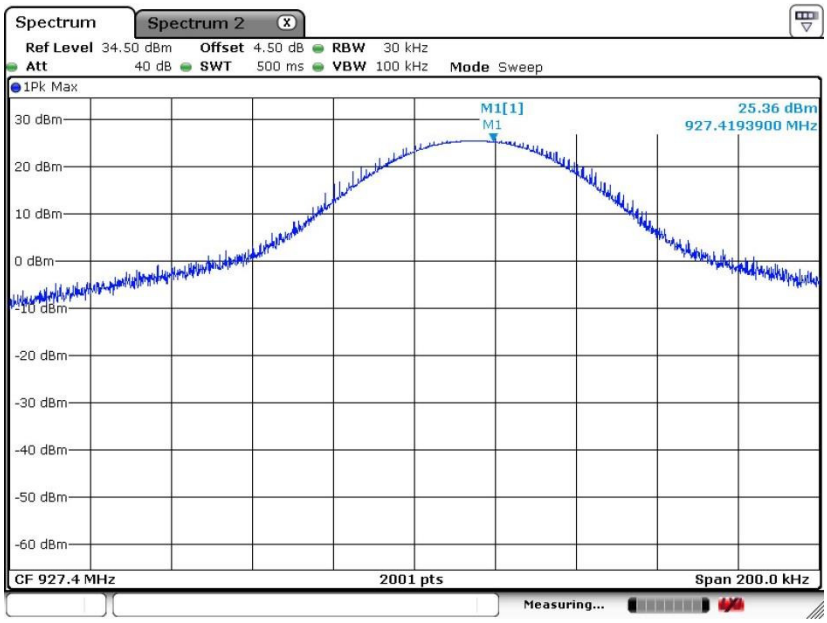
Peak Output Power Plot on Channel 756



Date: 28.DEC.2016 21:09:55

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

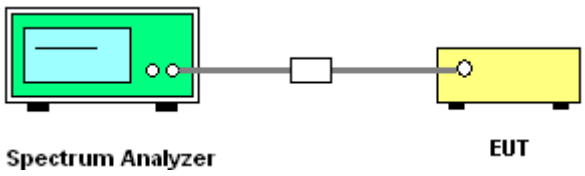
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

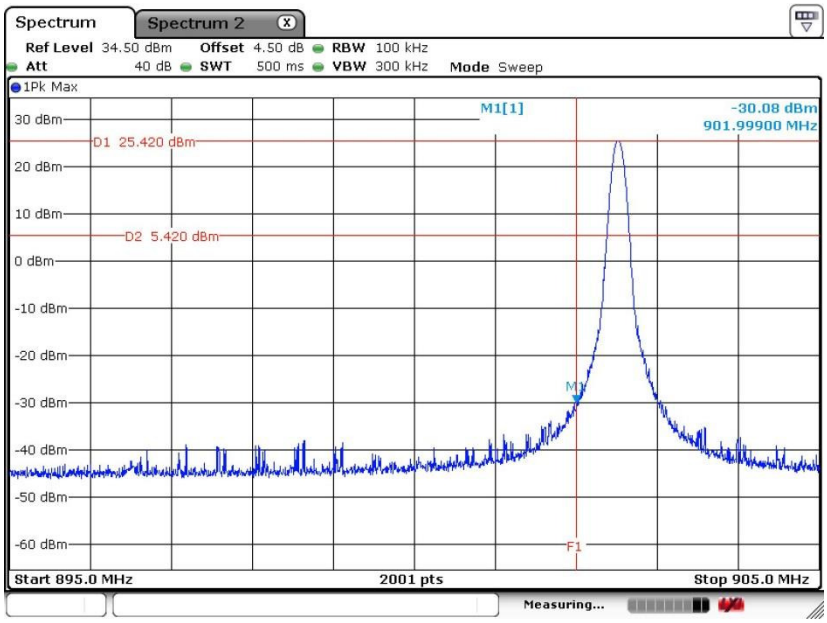
3.6.4 Test Setup



3.6.5 Test Result of Conducted Band Edges

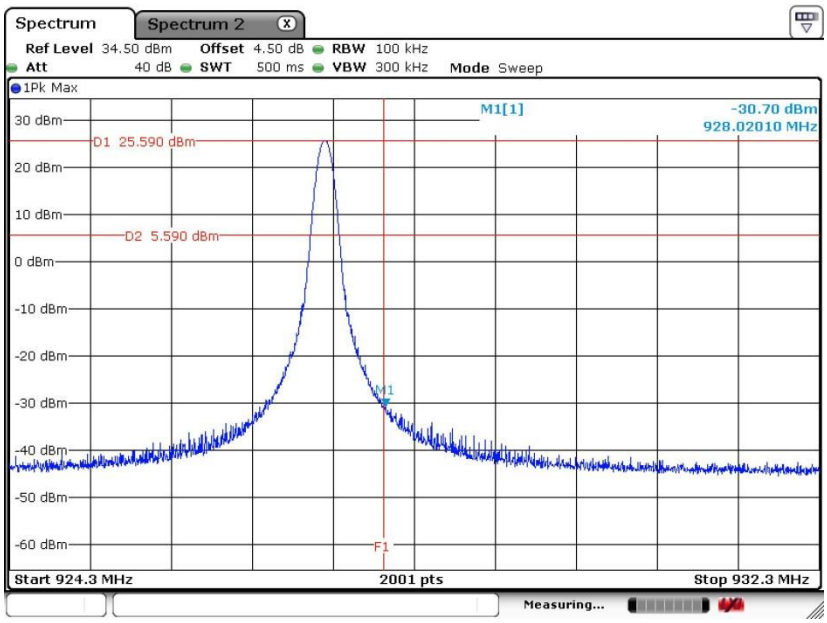
Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Channel :	001 and 756	Relative Humidity :	51~55%
		Test Engineer :	Silent Hai

Low Band Edge Plot on Channel 001



Date: 28.DEC.2016 19:32:31

High Band Edge Plot on Channel 756

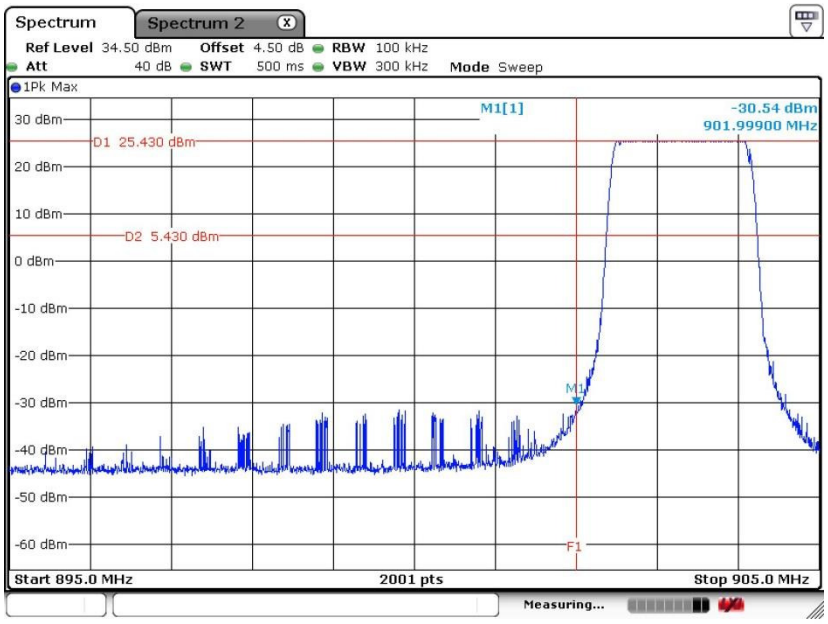


Date: 28.DEC.2016 19:53:22

3.6.6 Test Result of Conducted Hopping Mode Band Edges

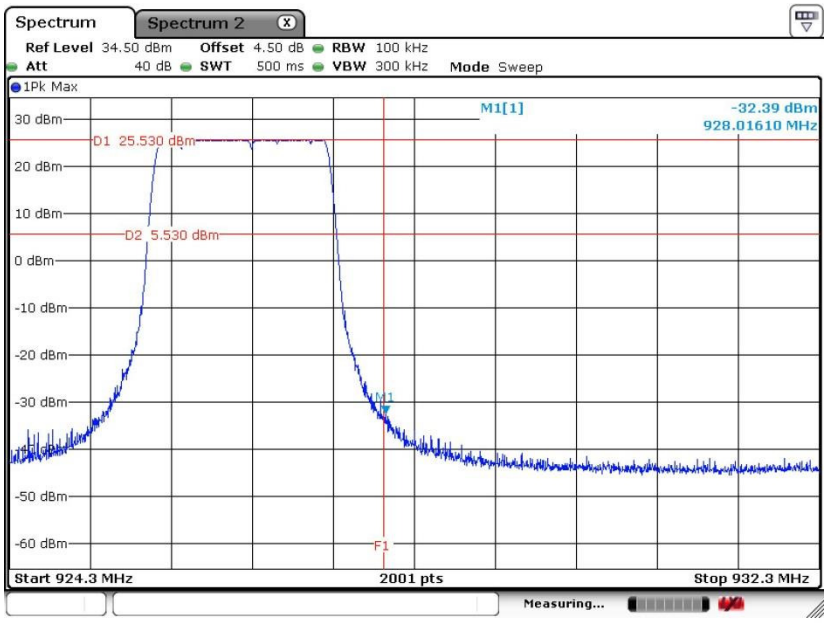
Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Engineer :	Silent Hai	Relative Humidity :	51~55%

Hopping Mode Low Band Edge Plot



Date: 28.DEC.2016 20:08:31

Hopping Mode High Band Edge Plot



Date: 28.DEC.2016 20:02:48

3.7 Conducted Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.7.3 Test Procedure

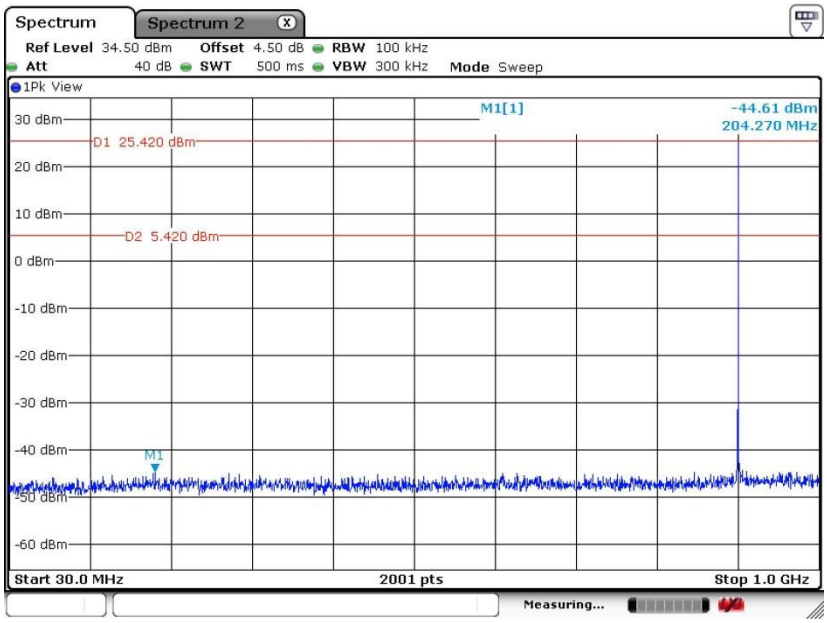
1. The testing follows ANSI C63.10-2013 clause 7.8.8.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.7.4 Test Setup

3.7.5 Test Result of Conducted Spurious Emission

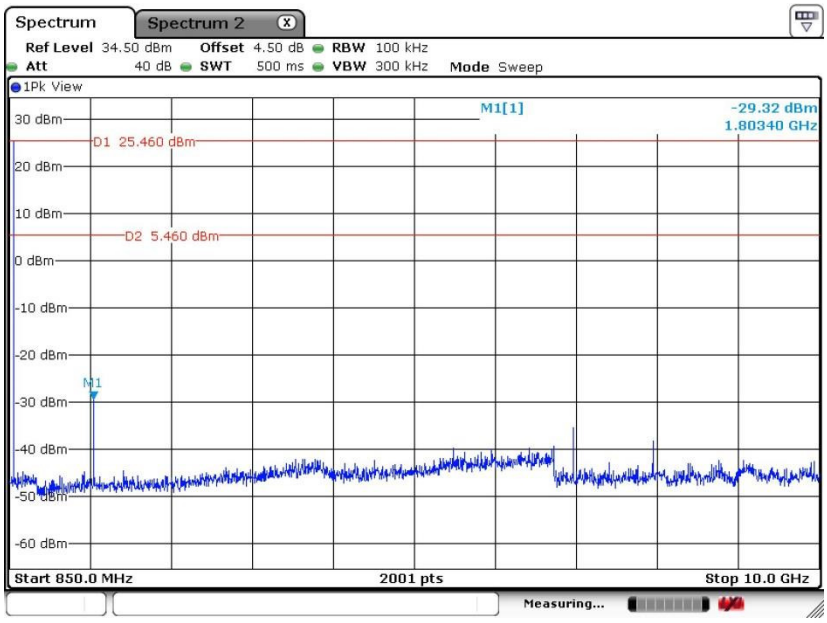
Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Channel :	001	Relative Humidity :	51~55%
		Test Engineer :	Silent Hai

CSE Plot on Ch 001 between 30MHz ~ 1 GHz



Date: 28.DEC.2016 19:31:09

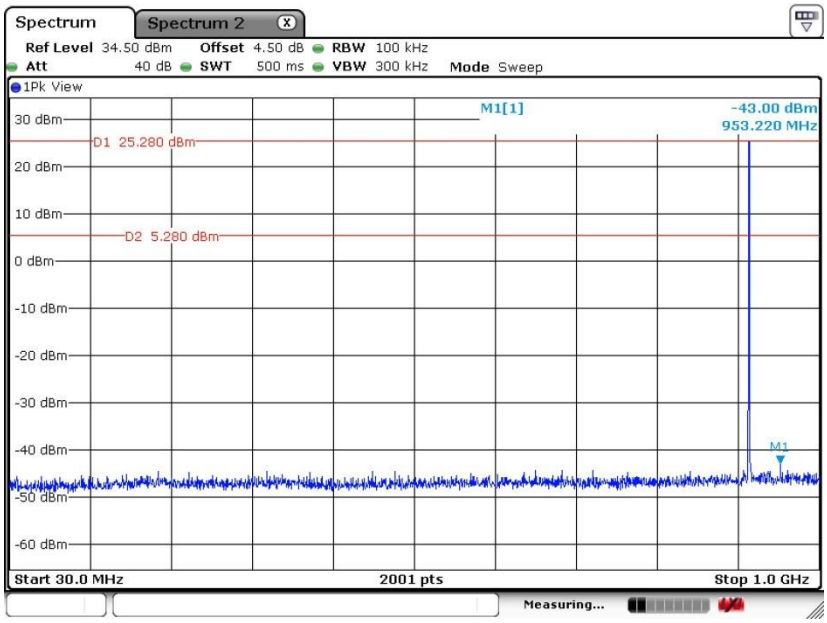
CSE Plot on Ch 001 between 850 MHz ~ 10 GHz



Date: 28.DEC.2016 19:30:08

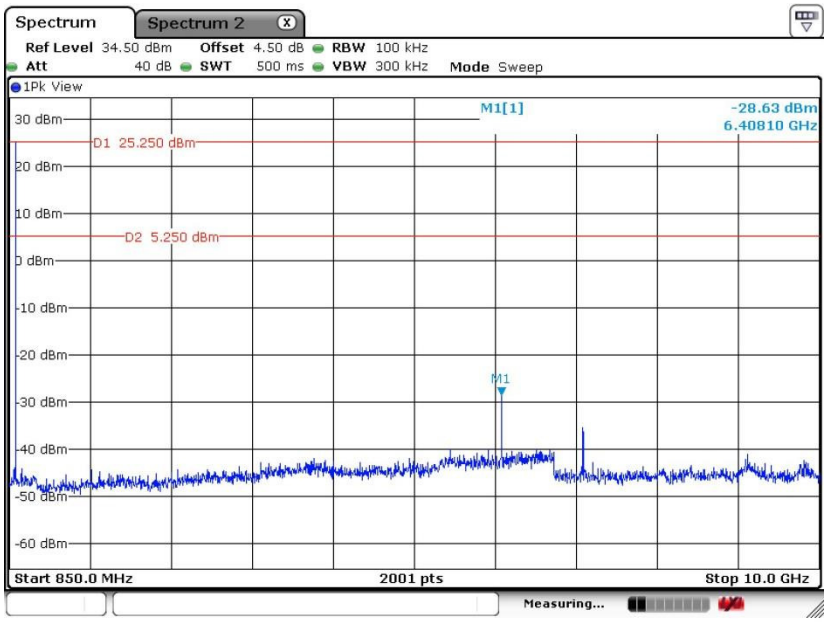
Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Channel :	379	Relative Humidity :	51~55%
		Test Engineer :	Silent Hai

CSE Plot on Ch 379 between 30MHz ~ 1 GHz



Date: 28.DEC.2016 20:53:16

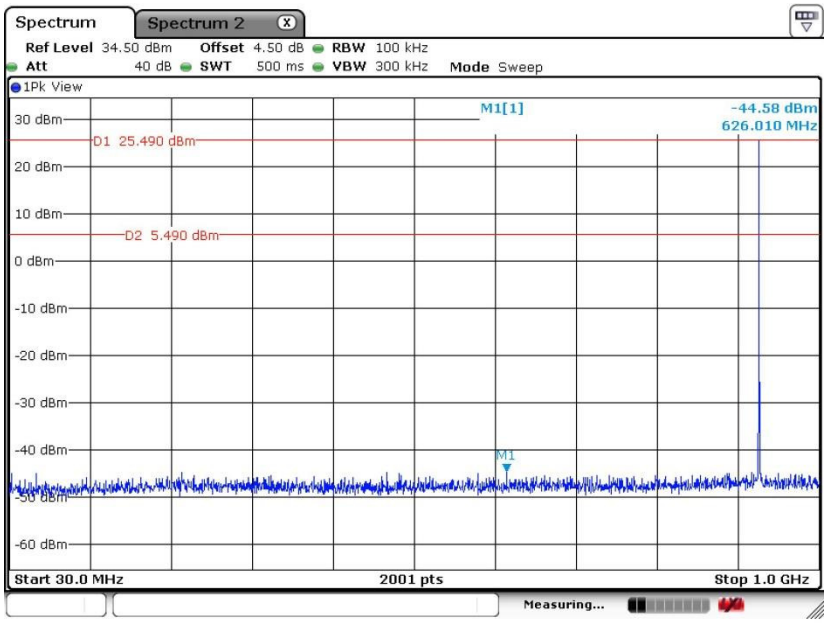
CSE Plot on Ch 379 between 850 MHz ~ 10 GHz



Date: 28.DEC.2016 20:54:38

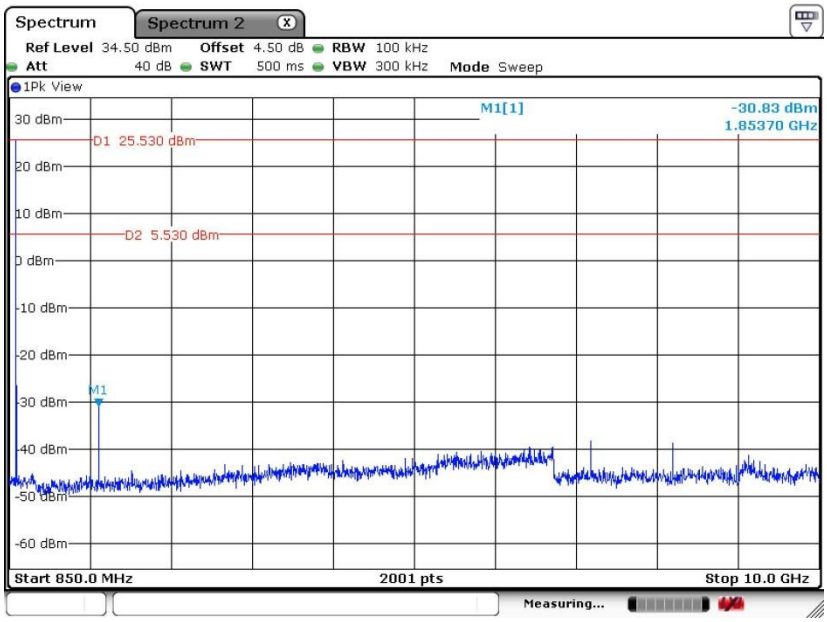
Test Mode :	eLTE-IoT	Temperature :	21~25℃
Test Channel :	756	Relative Humidity :	51~55%
		Test Engineer :	Silent Hai

CSE Plot on Ch 756 between 30MHz ~ 1 GHz



Date: 28.DEC.2016 19:55:38

CSE Plot on Ch 756 between 850 MHz ~ 10 GHz



Date: 28.DEC.2016 19:56:30

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.8.2 Measuring Instruments

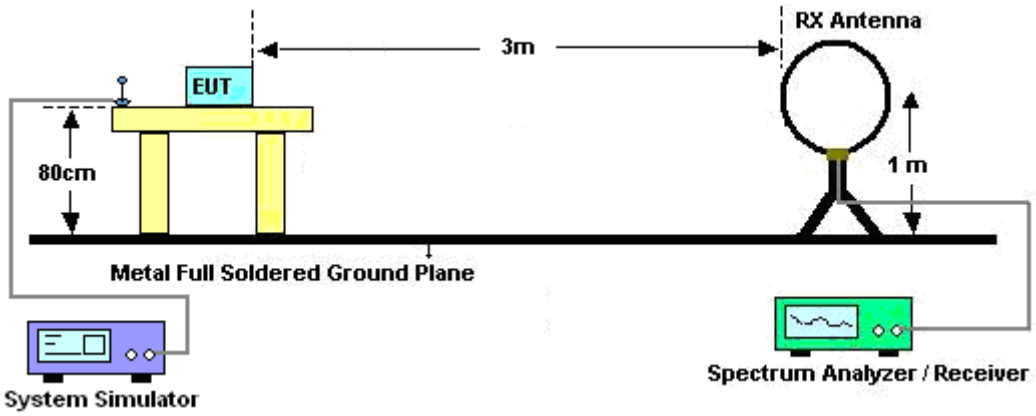
The measuring equipment is listed in the section 4 of this test report.

3.8.3 Test Procedures

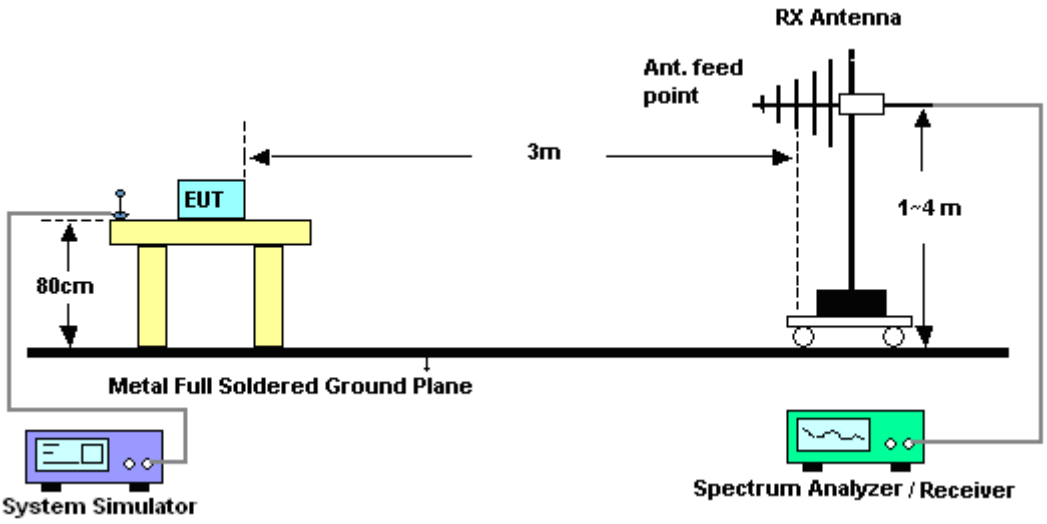
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use RBW=1MHz for f>1GHz ; VBW ≥ 1Hz; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (4) Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

3.8.4 Test Setup

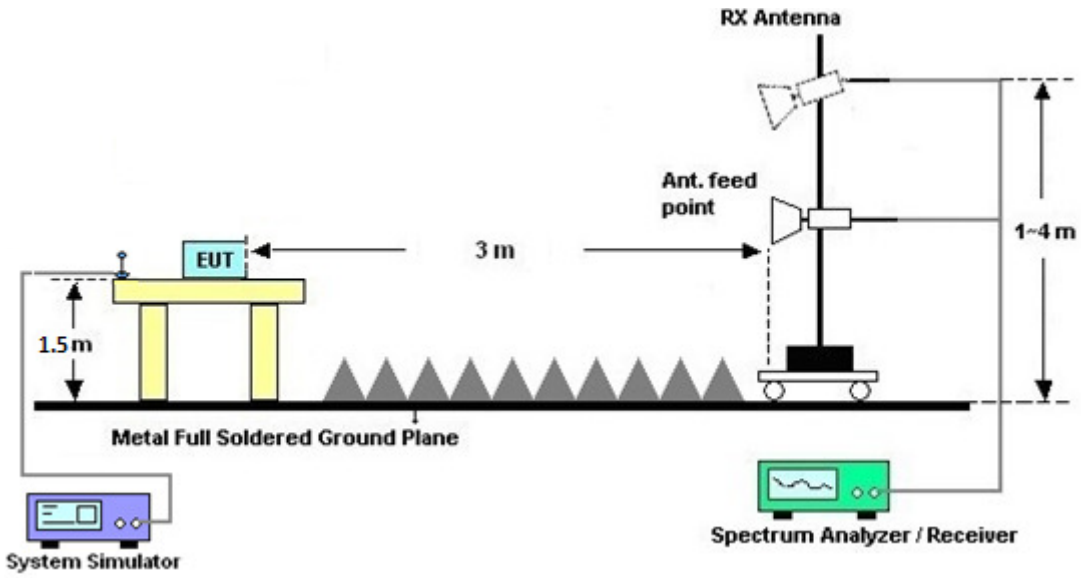
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.8.7 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix A.

3.9 Antenna Requirements

3.9.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

3.9.2 Antenna Anti-Replacement Construction

Non-standard antenna connector is used.

3.9.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Aug. 09, 2016	Dec. 28, 2016~ Dec. 29, 2016	Aug. 08, 2017	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 20, 2016	Dec. 28, 2016~ Dec. 29, 2016	Jan. 19, 2017	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 20, 2016	Dec. 28, 2016~ Dec. 29, 2016	Jan. 19, 2017	Conducted (TH01-KS)
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz; Max 30dBm	Aug. 09, 2016	Dec. 29, 2016	Aug. 08, 2017	Radiation (03CH02-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz~44GHz, MAX 30dB	Apr. 22, 2016	Dec. 29, 2016	Apr. 21, 2017	Radiation (03CH02-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 23, 2016	Dec. 29, 2016	Nov. 22, 2017	Radiation (03CH02-KS)
Bilog Antenna	TeseQ	CBL6112D	37879	30MHz~2GHz	Aug. 20, 2016	Dec. 29, 2016	Aug. 19, 2017	Radiation (03CH02-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Oct. 22, 2016	Dec. 29, 2016	Oct. 21, 2017	Radiation (03CH02-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Mar. 03, 2016	Dec. 29, 2016	Mar. 02, 2017	Radiation (03CH02-KS)
Amplifier	com-power	PA-103A	161069	1kHz~1000MHz / 32 dB	Apr. 22, 2016	Dec. 29, 2016	Apr. 21, 2017	Radiation (03CH02-KS)
Amplifier	Agilent	8449B	3008A02384	1GHz~26.5GHz	Oct. 13, 2016	Dec. 29, 2016	Oct. 12, 2017	Radiation (03CH02-KS)
Amplifier	MITEQ	TTA1840-35-HG	1887435	18GHz~40GHz	Jan. 20, 2016	Dec. 29, 2016	Jan. 19, 2017	Radiation (03CH02-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Dec. 29, 2016	NCR	Radiation (03CH02-KS)
Turn Table	MF	MF7802	N/A	0~360 degree	NCR	Dec. 29, 2016	NCR	Radiation (03CH02-KS)
Antenna Mast	MF	MF7802	N/A	1 m~4 m	NCR	Dec. 29, 2016	NCR	Radiation (03CH02-KS)

NCR: No Calibration Required

5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.1dB**

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.5dB**

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.1dB**

Appendix A. Radiated Spurious Emission

Emission above 1GHz

Harmonic @ 3m

	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Low channel		1354	49.89	-24.11	74	54.19	25.08	3.56	32.94	111	243	P	H
		1806	61.3	-38.43	99.73	64.23	24.97	4.04	31.94	248	201	P	H
		2256	49.51	-24.49	74	48.69	27.81	4.61	31.6	160	176	P	H
		2708	56.07	-17.93	74	54.99	27.88	4.62	31.42	131	168	P	H
		2708	49.16	-4.84	54	48.08	27.88	4.62	31.42	131	168	A	H
		6318	57.19	-42.54	99.73	46.45	33.68	7.94	30.88	100	226	P	H
		7221	57.87	-41.86	99.73	44.23	36.54	8.45	31.35	100	216	P	H
		8124	58.15	-15.85	74	43.9	36.82	8.91	31.48	100	268	P	H
		8124	50.26	-3.74	54	36.01	36.82	8.91	31.48	100	268	A	H
		1354	57.27	-16.73	74	61.57	25.08	3.56	32.94	100	244	P	V
		1354	42.17	-11.83	54	46.47	25.08	3.56	32.94	100	244	A	V
		1806	69.22	-29.45	98.67	72.15	24.97	4.04	31.94	100	360	P	V
		2256	55.17	-18.83	74	54.35	27.81	4.61	31.6	100	360	P	V
		2256	42.3	-11.7	54	41.48	27.81	4.61	31.6	100	49	A	V
		2708	58.08	-15.92	74	57	27.88	4.62	31.42	117	72	P	V
		2708	48.4	-5.6	54	47.32	27.88	4.62	31.42	117	72	A	V
		6318	60.29	-38.38	98.67	49.55	33.68	7.94	30.88	100	148	P	V
		7221	58.82	-39.85	98.67	45.18	36.54	8.45	31.35	100	249	P	V
		8124	55.69	-18.31	74	41.44	36.82	8.91	31.48	100	254	P	V
		8124	47.12	-6.88	54	32.87	36.82	8.91	31.48	100	254	A	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission above 1GHz

Harmonic @ 3m

	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Middle channel		1830	59.66	-40.13	99.79	62.4	25.1	4.09	31.93	100	360	P	H
		2746	50.53	-23.47	74	49.65	27.89	4.43	31.44	100	330	P	H
		6405	60.11	-39.68	99.79	49.12	34	8.08	31.09	100	360	P	H
		7320	59.78	-14.22	74	46.13	36.57	8.48	31.4	119	206	P	H
		7320	52.48	-1.52	54	38.83	36.57	8.48	31.4	119	206	A	H
		8235	54.99	-19.01	74	40.77	36.67	9.09	31.54	100	360	P	H
		8235	46.23	-7.77	54	32.01	36.67	9.09	31.54	100	360	A	H
		1830	67.62	-31.12	98.74	70.36	25.1	4.09	31.93	100	360	P	V
		2746	52.52	-21.48	74	51.64	27.89	4.43	31.44	100	150	P	V
		6405	60.7	-38.04	98.74	49.71	34	8.08	31.09	218	297	P	V
		7320	58.65	-15.35	74	45	36.57	8.48	31.4	218	297	P	V
		7320	51.61	-2.39	54	37.96	36.57	8.48	31.4	218	297	A	V
		8235	54.51	-19.49	74	40.29	36.67	9.09	31.54	100	297	P	V
		8235	44.66	-9.34	54	30.44	36.67	9.09	31.54	100	297	A	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission above 1GHz

Harmonic @ 3m

	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
High channel		1856	66.87	-32.56	99.43	69.52	25.16	4.11	31.92	300	0	P	H
		2782	47.17	-26.83	74	46.41	27.9	4.31	31.45	300	0	P	H
		6492	61.17	-38.26	99.43	49.97	34.21	8.14	31.15	200	0	P	H
		7419	56.91	-17.09	74	43.27	36.56	8.51	31.43	147	234	P	H
		7419	49.31	-4.69	54	35.67	36.56	8.51	31.43	147	234	A	H
		1856	70.44	-28.49	98.93	73.09	25.16	4.11	31.92	200	360	P	V
		2782	48.94	-25.06	74	48.18	27.9	4.31	31.45	200	360	P	V
		6492	68.99	-29.94	98.93	57.79	34.21	8.14	31.15	300	0	P	V
		7419	60.66	-13.34	74	47.02	36.56	8.51	31.43	300	0	P	V
		7419	53.65	-0.35	54	40.01	36.56	8.51	31.43	300	0	A	V
		8346	54.45	-19.55	74	40.12	36.68	9.03	31.38	300	0	P	V
		8346	47.33	-6.67	54	33	36.68	9.03	31.38	300	0	A	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission below 1GHz

	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Low channel		45.52	31.75	-8.25	40	44.01	19.5	0.14	31.9	-	-	P	H
		79.47	28.02	-11.98	40	44.33	15.2	0.2	31.71	-	-	P	H
		187.14	28.99	-14.51	43.5	44.17	15.9	0.39	31.47	-	-	P	H
		399.57	30.33	-15.67	46	34.76	25.2	0.92	30.55	-	-	P	H
		711.91	36	-10	46	36.3	26.64	1.22	28.16	-	-	P	H
		903	119.73	-	-	117.24	27.65	1.71	26.87	-	-	P	H
		945.68	38.34	-7.66	46	34.84	28.32	1.71	26.53	100	0	P	H
		33.88	36.2	-3.8	40	43.02	24.8	0.12	31.74	100	0	P	V
		79.47	24.9	-15.1	40	41.21	15.2	0.2	31.71	-	-	P	V
		187.14	24.29	-19.21	43.5	39.47	15.9	0.39	31.47	-	-	P	V
		451.95	29.66	-16.34	46	34.35	24.43	0.91	30.03	-	-	P	V
		709	34.99	-11.01	46	35.27	26.68	1.21	28.17	-	-	P	V
		903	118.67	-	-	116.18	27.65	1.71	26.87	-	-	P	V
		941.8	39.48	-6.52	46	36.07	28.26	1.71	26.56	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission below 1GHz

	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Middle channel		45.52	31.98	-8.02	40	44.24	19.5	0.14	31.9	-	-	P	H
		187.14	30.32	-13.18	43.5	45.5	15.9	0.39	31.47	-	-	P	H
		412.18	30	-16	46	34.24	25.11	0.94	30.29	-	-	P	H
		709.97	34.86	-11.14	46	35.13	26.67	1.22	28.16	-	-	P	H
		876.81	37.5	-8.5	46	35.59	27.42	1.55	27.06	-	-	P	H
		915.61	119.79	-	-	117.02	27.84	1.71	26.78	-	-	P	H
		936.95	44.72	-1.28	46	41.43	28.18	1.71	26.6	100	0	P	H
		33.88	36.9	-3.1	40	43.72	24.8	0.12	31.74	100	0	P	V
		185.2	23.52	-19.98	43.5	38.71	15.99	0.39	31.57	-	-	P	V
		440.31	29.6	-16.4	46	34.03	24.64	0.9	29.97	-	-	P	V
		681.84	35.75	-10.25	46	36.77	26.22	1.12	28.36	-	-	P	V
		844.8	37.36	-8.64	46	36.15	27.14	1.38	27.31	-	-	P	V
		915.61	118.74	-	-	115.97	27.84	1.71	26.78	-	-	P	V
		936.95	42.11	-3.89	46	38.82	28.18	1.71	26.6	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission below 1GHz

	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
High channel		46.49	31.87	-8.13	40	45.16	18.42	0.14	31.85	100	0	P	H
		79.47	27.68	-12.32	40	43.99	15.2	0.2	31.71	-	-	P	H
		172.59	26.63	-16.87	43.5	41.18	16.59	0.36	31.5	-	-	P	H
		400.54	30.94	-15.06	46	35.27	25.3	0.93	30.56	-	-	P	H
		736.16	34.86	-11.14	46	35.26	26.36	1.31	28.07	-	-	P	H
		865.17	37.34	-8.66	46	35.69	27.32	1.47	27.14	-	-	P	H
		928.22	119.43	-	-	116.35	28.04	1.71	26.67	-	-	P	H
		33.88	36.39	-3.61	40	43.21	24.8	0.12	31.74	100	0	P	V
		39.7	34.46	-5.54	40	44.26	21.9	0.13	31.83	-	-	P	V
		182.29	26.79	-16.71	43.5	42	16.13	0.38	31.72	-	-	P	V
		437.4	29.39	-16.61	46	33.78	24.69	0.91	29.99	-	-	P	V
		687.66	35.61	-10.39	46	36.36	26.42	1.14	28.31	-	-	P	V
		928.22	118.93	-	-	115.85	28.04	1.71	26.67	-	-	P	V
		945.68	40.3	-5.7	46	36.8	28.32	1.71	26.53	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".