FCC Test Report

Report No.:	RF170329E05
FCC ID:	YAISN10-12
Test Model:	SN10-12
Received Date:	Mar. 29, 2017
Test Date:	Apr. 17 to May 08, 2017
Issued Date:	May 19, 2017
Applicant:	InnoComm Mobile Technology Corp.
Address:	3F, No. 6, Hsin Ann Rd., Hsinchu Science Park, Hsinchu 30078, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location (1):	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location (2):	No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RF170329E05	Original release.	May 19, 2017

1 Certificate of Conformity

Product:	SigFox module
Brand:	InnoComm
Test Model:	SN10-12
Sample Status:	ENGINEERING SAMPLE
Applicant:	InnoComm Mobile Technology Corp.
Test Date:	Apr. 17 to May 08, 2017
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** May 19, 2017

Claire Kuan / Specialist

:

Approved by _____ , **Date:** May 19, 2017

May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -5.02dB at 0.17734MHz.
15.247(a)(1)(iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.205 & 209 & 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.5dB at 2713.99MHz
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

NOTE: If The Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.30 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.16 dB
	6GHz ~ 18GHz	4.91 dB
	18GHz ~ 40GHz	5.30 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	SigFox module
Brand	InnoComm
Test Model	SN10-12
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 3.3V from host equipment
Modulation Type	TX: DBPSK RX: 2GFSK
Modulation Technology	FHSS
Transfer Rate	TX: 100bps RX: 600bps
Operating Frequency	902.1375MHz – 904.6625MHz
Number of Channel	Refer to 3.2
Output Power	230.144mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. The antenna provided to the EUT, please refer to the following table:

Brand	Model	Antenna Gain(dBi)	Frequency range	Antenna Type	Connector type
InnoComm	SN10-12	-2	850~930MHz	PCB	NA

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 Description of Test Modes

Channel frequencies are distributed into 9 groups of 6 channels.

Groups	Micro Channel 1 (MHz)	Micro Channel 2 (MHz)	Micro Channel 3 (MHz)	Micro Channel 4 (MHz)	Micro Channel 5 (MHz)	Micro Channel 6 (MHz)
1	902.1375	902.1625	902.1875	902.2125	902.2375	902.2625
2	902.4375	902.4625	902.4875	902.5125	902.5375	902.5625
3	902.7375	902.7625	902.7875	902.8125	902.8375	902.8625
4	903.0375	903.0625	903.0875	903.1125	903.1375	903.1625
5	903.3375	903.3625	903.3875	903.4125	903.4375	903.4625
6	903.6375	903.6625	903.6875	903.7125	903.7375	903.7625
7	903.9375	903.9625	903.9875	904.0125	904.0375	904.0625
8	904.2375	904.2625	904.2875	904.3125	904.3375	904.3625
9	904.5375	904.5625	904.5875	904.6125	904.6375	904.6625

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1GHz **RE<1G:** Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

NOTE:
1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

Operating Frequency (MHz ~ MHz)	Tested Frequency	Modulation Technology	Modulation Technology
902.1375 ~ 904.6625	902.1375, 904.6625	FHSS	DBPSK

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

Operating Frequency (MHz ~ MHz)	Tested Frequency	Modulation Technology	Modulation Technology
902.1375 ~ 904.6625	902.1375, 904.6625	FHSS	DBPSK

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

Operating Frequency (MHz ~ MHz)	Tested Frequency	Modulation Technology	Modulation Technology
902.1375 ~ 904.6625	904.6625	FHSS	DBPSK

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Operating Frequency (MHz ~ MHz)	Tested Frequency	Modulation Technology	Modulation Technology
902.1375 ~ 904.6625	902.1375, 904.6625	FHSS	DBPSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥1G	22deg. C, 67%RH	120Vac, 60Hz	Weiwei Lo
RE<1G	23deg. C, 62%RH 24deg. C, 65%RH	120Vac, 60Hz	Jyunchun Lin
PLC	25deg. C, 70%RH	120Vac, 60Hz	Barry Lee
APCM	25deg. C, 60%RH	120Vac, 60Hz	Anderson Chen

3.3 Description of Support Units

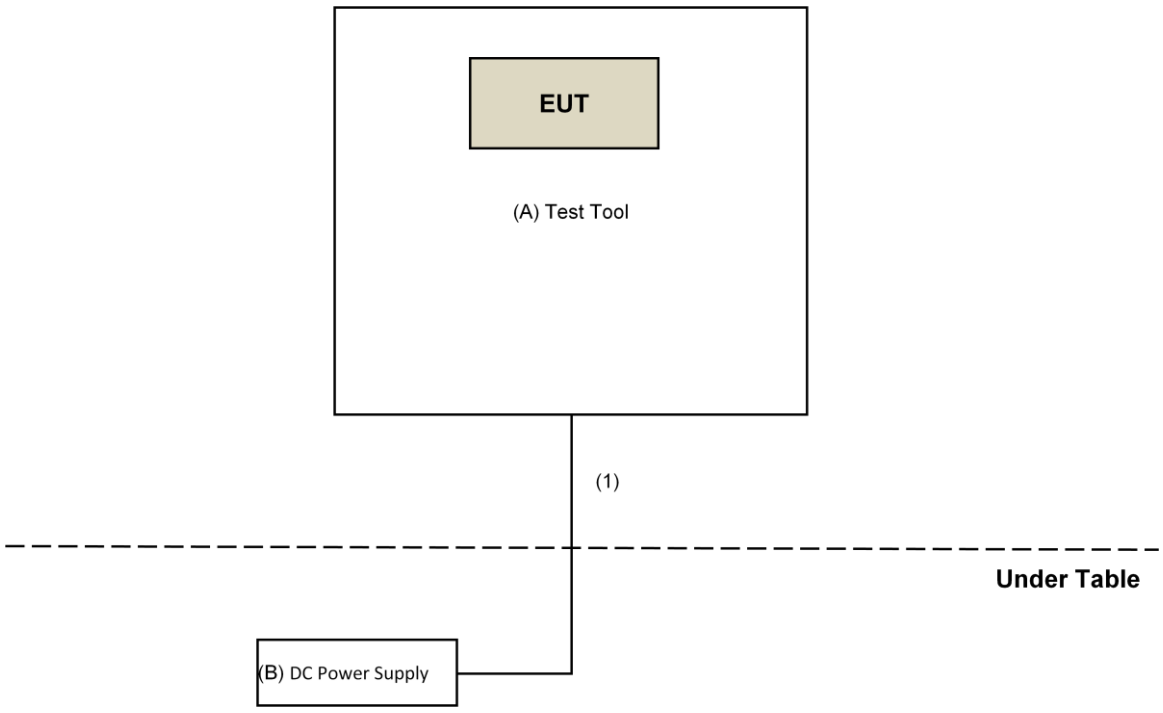
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Test Tool	freescal	NA	NA	NA	Supplied by client
B.	DC Power Supply	GOOD WILL INSTRUMENT CO., LTD.	GPC-3030D	7700087	NA	Provided by Lab

Note:
1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	2	3	No	0	Provided by Lab

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)
ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 20, 2016	July 19, 2017
Pre-Amplifier(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 17, 2017	Jan. 16, 2018
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 10, 2016	Nov. 09, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Dec. 13, 2016	Dec. 12, 2017
RF Cable	8D	966-4-1 966-4-2 966-4-3	Apr. 01, 2017	Mar. 31, 2018
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Oct. 05, 2016	Oct. 04, 2017
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Dec. 27, 2016	Dec. 26, 2017
Pre-Amplifier EMCI	EMC12630SE	980385	Feb. 02, 2017	Feb. 01, 2018
RF Cable	EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000	160923 150318 150323	Feb. 02, 2017 Mar. 29, 2017 Mar. 29, 2017	Feb. 01, 2018 Mar. 28, 2018 Mar. 28, 2018
Pre-Amplifier EMCI	EMC184045SE	980387	Feb. 02, 2017	Feb. 01, 2018
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 15, 2016	Dec. 14, 2017
RF Cable	SUCOFLEX 102	36432/2 36433/2	Jan. 15, 2017	Jan. 14, 2018
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP02	NA	NA
Spectrum Analyzer R&S	FSV40	100964	June 28, 2016	June 27, 2017
Spectrum Analyzer Agilent	E4446A	MY48250253	Dec. 21, 2016	Dec. 20, 2017
Power meter Anritsu	ML2495A	0824006	May 26, 2016	May 25, 2017
Power sensor Anritsu	MA2411B	0738172	May 26, 2016	May 25, 2017

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. *The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 4.
4. The FCC Site Registration No. is 292998
5. The CANADA Site Registration No. is 20331-2
6. Tested Date: Apr. 17 to May 06, 2017

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna 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.

d. 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

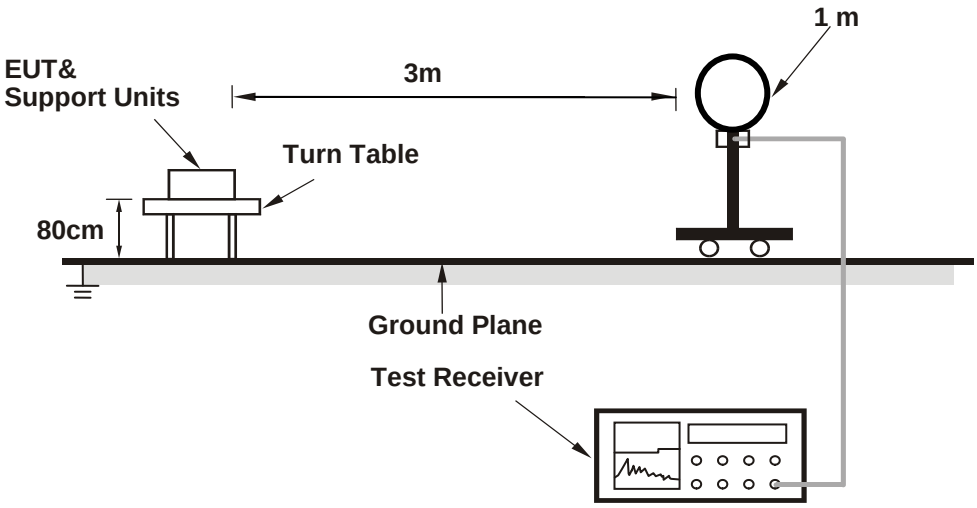
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

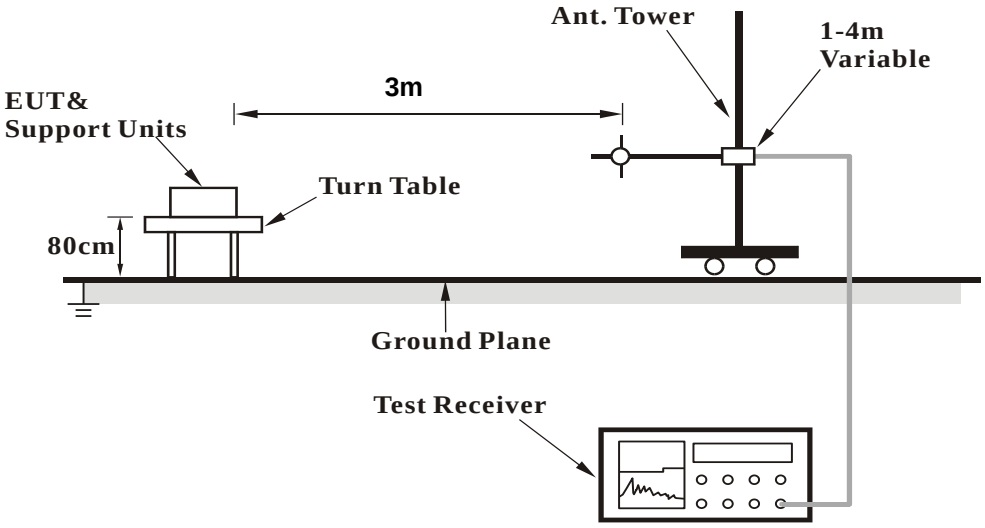
No deviation.

4.1.5 Test Setup

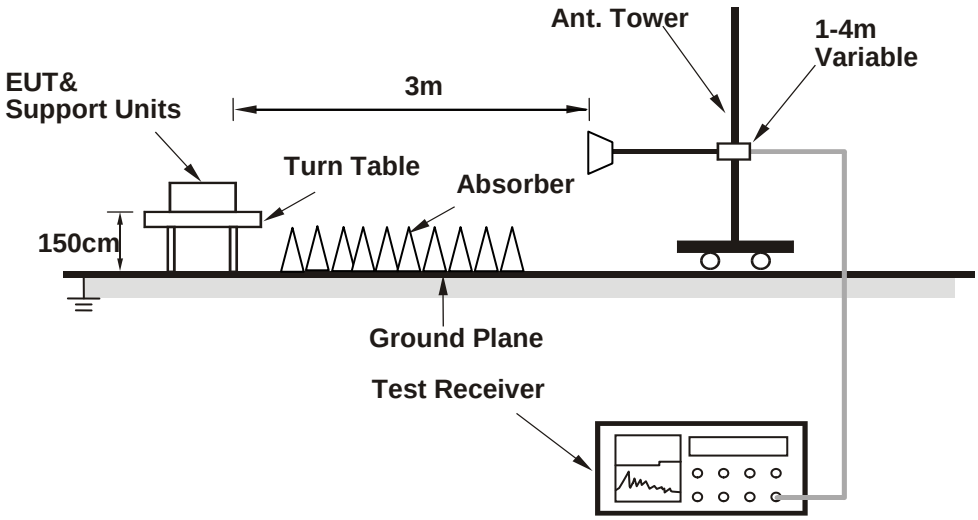
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

a. Contorlling software (Past hypertrm command) has been activated to set the EUT on specific status.

4.1.7 Test Results

Above 1GHz Data:

TESTED FREQUENCY	902.1375 MHz	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 10GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2706.41	62.0 PK	74.0	-12.0	1.31 H	352	62.5	-0.5
2	2706.41	53.4 AV	54.0	-0.6	1.31 H	352	53.9	-0.5
3	3608.55	55.0 PK	74.0	-19.0	1.26 H	22	53.8	1.2
4	3608.55	45.8 AV	54.0	-8.2	1.26 H	22	44.6	1.2
5	4510.69	57.4 PK	74.0	-16.6	2.88 H	106	55.1	2.3
6	4510.69	52.3 AV	54.0	-1.7	2.88 H	106	50.0	2.3
7	5412.82	52.3 PK	74.0	-21.7	1.95 H	120	47.9	4.4
8	5412.82	46.8 AV	54.0	-7.2	1.95 H	120	42.4	4.4
9	8119.24	52.5 PK	74.0	-21.5	2.15 H	11	41.2	11.3
10	8119.24	40.2 AV	54.0	-13.8	2.15 H	11	28.9	11.3
11	9021.37	54.8 PK	74.0	-19.2	2.00 H	81	44.0	10.8
12	9021.37	42.6 AV	54.0	-11.4	2.00 H	81	31.8	10.8
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2706.41	57.7 PK	74.0	-16.3	3.20 V	114	58.2	-0.5
2	2706.41	49.6 AV	54.0	-4.4	3.20 V	114	50.1	-0.5
3	3608.55	52.7 PK	74.0	-21.3	1.32 V	24	51.5	1.2
4	3608.55	43.8 AV	54.0	-10.2	1.32 V	24	42.6	1.2
5	4510.69	55.1 PK	74.0	-18.9	2.89 V	107	52.8	2.3
6	4510.69	49.0 AV	54.0	-5.0	2.89 V	107	46.7	2.3
7	5412.82	50.2 PK	74.0	-23.8	2.89 V	123	45.8	4.4
8	5412.82	44.9 AV	54.0	-9.1	2.89 V	123	40.5	4.4
9	8119.24	49.9 PK	74.0	-24.1	3.02 V	4	38.6	11.3
10	8119.24	38.2 AV	54.0	-15.8	3.02 V	4	26.9	11.3
11	9021.37	48.8 PK	74.0	-25.2	3.02 V	92	38.0	10.8
12	9021.37	39.2 AV	54.0	-14.8	3.02 V	92	28.4	10.8

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

TESTED FREQUENCY	904.6625 MHz	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 10GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2713.99	61.7 PK	74.0	-12.3	1.32 H	350	62.2	-0.5
2	**2713.99**	**53.5 AV**	**54.0**	**-0.5**	**1.32 H**	**350**	**54.0**	**-0.5**
3	3618.65	54.3 PK	74.0	-19.7	1.27 H	29	53.1	1.2
4	3618.65	46.1 AV	54.0	-7.9	1.27 H	29	44.9	1.2
5	4523.31	56.5 PK	74.0	-17.5	2.89 H	102	54.1	2.4
6	4523.31	52.6 AV	54.0	-1.4	2.89 H	102	50.2	2.4
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2713.99	58.2 PK	74.0	-15.8	3.21 V	117	58.7	-0.5
2	2713.99	50.0 AV	54.0	-4.0	3.21 V	117	50.5	-0.5
3	3618.65	52.9 PK	74.0	-21.1	1.31 V	16	51.7	1.2
4	3618.65	43.9 AV	54.0	-10.1	1.31 V	16	42.7	1.2
5	4523.31	54.8 PK	74.0	-19.2	2.86 V	96	52.4	2.4
6	4523.31	49.0 AV	54.0	-5.0	2.86 V	96	46.6	2.4

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

Below 1GHz Data:

TESTED FREQUENCY	902.1375 MHz	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	48.02	23.8 QP	40.0	-16.2	2.00 H	236	31.4	-7.6
2	144.00	26.4 QP	43.5	-17.1	1.50 H	80	34.5	-8.1
3	281.06	28.0 QP	46.0	-18.0	1.00 H	360	36.0	-8.0
4	562.17	32.2 QP	46.0	-13.8	1.50 H	360	33.9	-1.7
5	630.11	35.9 QP	46.0	-10.1	1.50 H	341	36.0	-0.1
6	770.98	34.1 QP	46.0	-11.9	1.00 H	63	32.0	2.1
7	902.00	69.4 QP	96.5	-27.1	1.00 H	225	38.1	31.3
8	*902.1375	116.5 QP			1.00 H	225	85.2	31.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	48.04	33.1 QP	40.0	-6.9	1.00 V	96	40.8	-7.7
2	144.02	23.0 QP	43.5	-20.5	1.00 V	310	31.1	-8.1
3	240.03	23.7 QP	46.0	-22.3	1.00 V	108	33.7	-10.0
4	345.01	23.0 QP	46.0	-23.0	1.50 V	136	29.6	-6.6
5	629.78	28.4 QP	46.0	-17.6	1.50 V	114	28.5	-0.1
6	995.15	34.3 QP	54.0	-19.7	1.00 V	255	29.3	5.0
7	902.00	64.4 QP	91.4	-27.0	1.00 V	80	33.1	31.3
8	*902.1375	111.4 QP			1.00 V	80	80.1	31.3

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

TESTED FREQUENCY	904.6625 MHz	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	32.62	27.0 QP	40.0	-13.0	2.00 H	288	36.2	-9.2
2	60.00	27.9 QP	40.0	-12.1	2.50 H	219	36.4	-8.5
3	168.01	31.3 QP	43.5	-12.2	1.50 H	51	39.5	-8.2
4	419.92	33.3 QP	46.0	-12.7	1.00 H	286	37.9	-4.6
5	562.17	32.2 QP	46.0	-13.8	1.50 H	360	33.9	-1.7
6	630.11	35.9 QP	46.0	-10.1	1.50 H	341	36.0	-0.1
7	*904.6625	117.6 QP			1.00 H	222	86.3	31.3
8	928.00	51.2 QP	97.6	-46.4	1.00 H	222	19.5	31.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	60.05	34.4 QP	40.0	-5.6	1.50 V	360	42.9	-8.5
2	168.01	25.1 QP	43.5	-18.4	2.00 V	352	33.3	-8.2
3	419.89	26.6 QP	46.0	-19.4	1.50 V	360	31.2	-4.6
4	491.89	27.0 QP	46.0	-19.0	2.00 V	245	30.0	-3.0
5	629.78	28.4 QP	46.0	-17.6	1.50 V	114	28.5	-0.1
6	957.42	38.1 QP	46.0	-7.9	1.50 V	62	33.5	4.6
7	*904.6625	110.7 QP			1.00 V	79	79.4	31.3
8	928.00	51.1 QP	90.7	-39.6	1.00 V	79	19.4	31.7

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	100287	Apr. 19, 2017	Apr. 18, 2018
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-523	Oct. 11, 2016	Oct. 10, 2017
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	848773/004	Oct. 26, 2016	Oct. 25, 2017
RF Cable	5D-FB	COACAB-001	May 24, 2016	May 23, 2017
10 dB PAD Mini-Circuits	HAT-10+	CONATT-006	June 20, 2016	June 19, 2017
50 ohms Terminator	50	3	Oct. 26, 2016	Oct. 25, 2017
50 ohms Terminator	N/A	EMC-04	Nov. 02, 2016	Nov. 01, 2017
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. D.
3. The VCCI Con D Registration No. is C-20005.
4. Tested Date: May 08, 2017

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

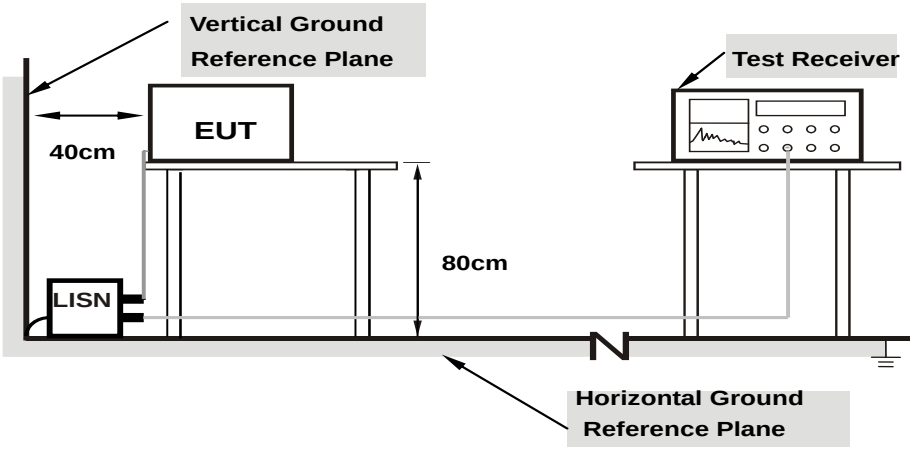
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation From Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Condition

Same as 4.1.6.

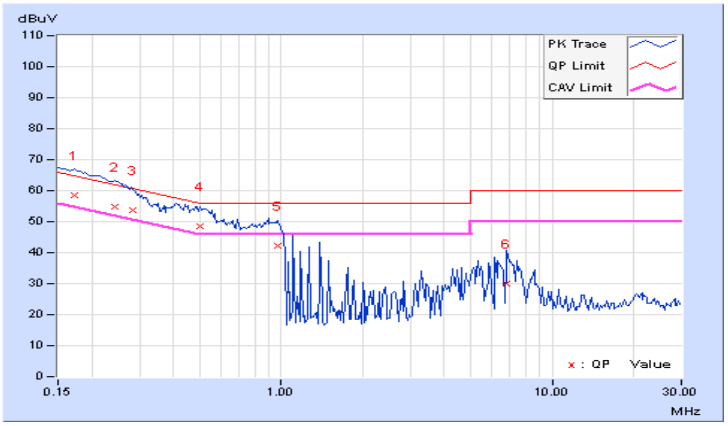
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17344	10.30	48.32	17.64	58.62	27.94	64.79	54.79	-6.17	-26.85
2	0.24375	10.30	44.62	13.81	54.92	24.11	61.97	51.97	-7.05	-27.86
3	0.28281	10.31	43.55	12.91	53.86	23.22	60.73	50.73	-6.87	-27.51
4	0.50000	10.37	38.16	8.31	48.53	18.68	56.00	46.00	-7.47	-27.32
5	0.97031	10.49	31.66	2.67	42.15	13.16	56.00	46.00	-13.85	-32.84
6	6.82422	10.57	19.61	-4.23	30.18	6.34	60.00	50.00	-29.82	-43.66

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

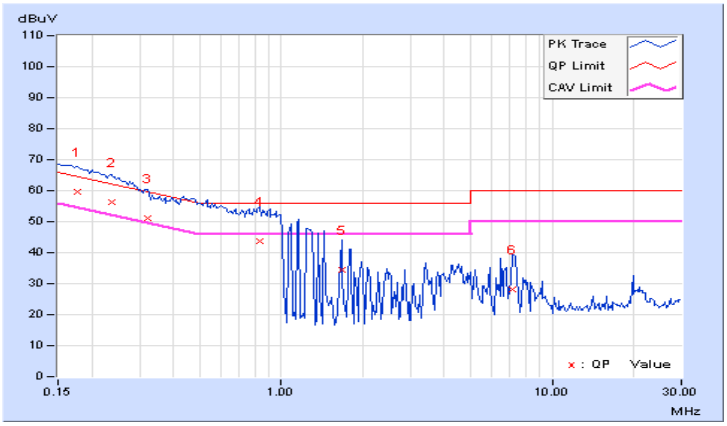


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.17734**	**10.36**	**49.23**	**18.61**	**59.59**	**28.97**	**64.61**	**54.61**	**-5.02**	**-25.64**
2	0.23594	10.37	46.11	15.45	56.48	25.82	62.24	52.24	-5.76	-26.42
3	0.32188	10.41	40.53	10.49	50.94	20.90	59.66	49.66	-8.72	-28.76
4	0.82969	10.52	33.24	3.72	43.76	14.24	56.00	46.00	-12.24	-31.76
5	1.66797	10.55	24.00	-2.30	34.55	8.25	56.00	46.00	-21.45	-37.75
6	7.11328	10.62	17.51	-4.80	28.13	5.82	60.00	50.00	-31.87	-44.18

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

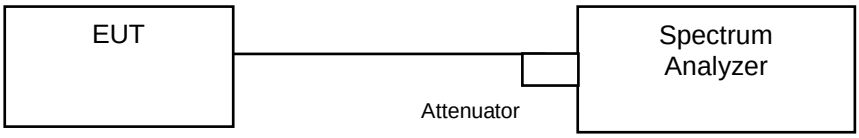


4.3 Number of Hopping Frequency Used

4.3.1 Limits of Hopping Frequency Used Measurement

CONDITION	HOPPING FREQUENCY USED	APPLICATION
20dB Bandwidth <250kHz	hopping channels ≧50	v
20dB Bandwidth >250kHz	hopping channels ≧25	x

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.

d. Set the SA on View mode and then plot the result on SA screen.

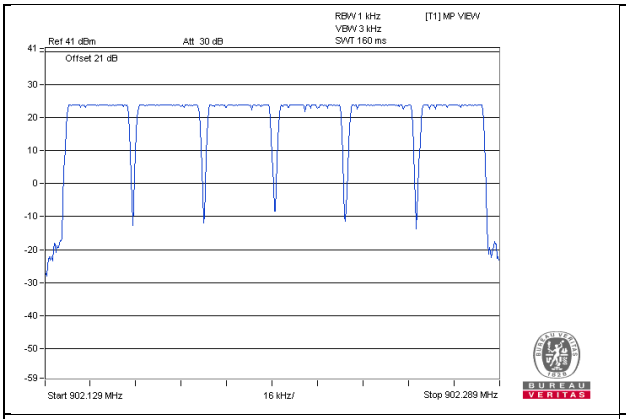
e. Repeat above procedures until all frequencies measured were complete.

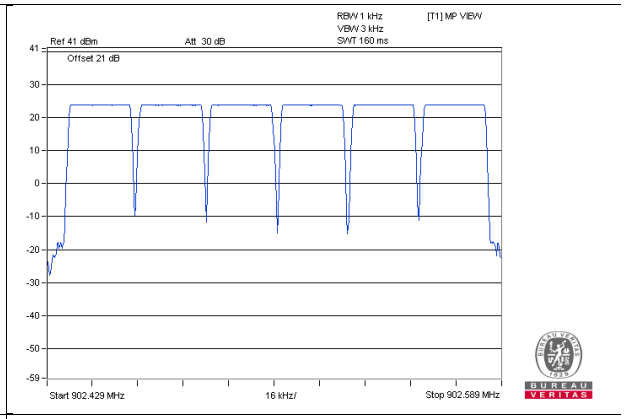
4.3.5 Deviation fromTest Standard

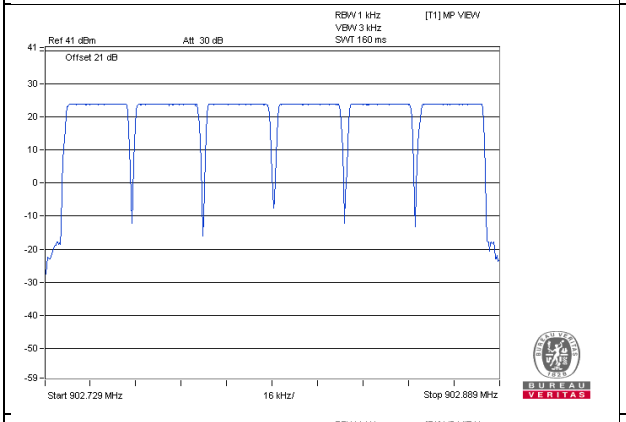
No deviation.

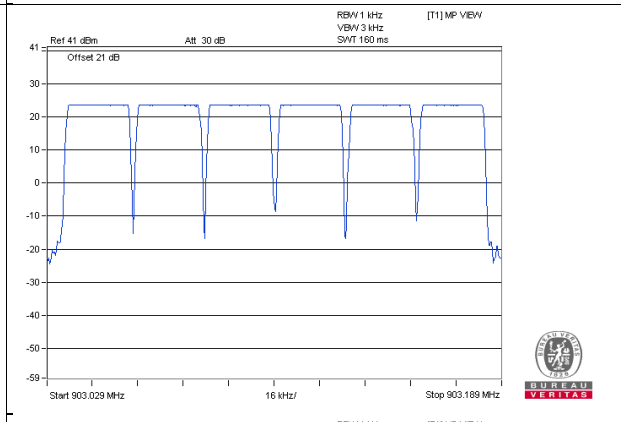
4.3.6 Test Results

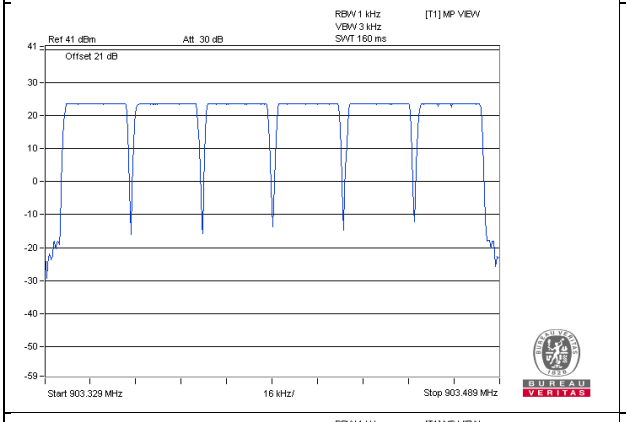
There are 54 hopping frequencies in the hopping mode. Please refer to the test result. On the plots, it shows that the hopping frequencies are equally spaced.

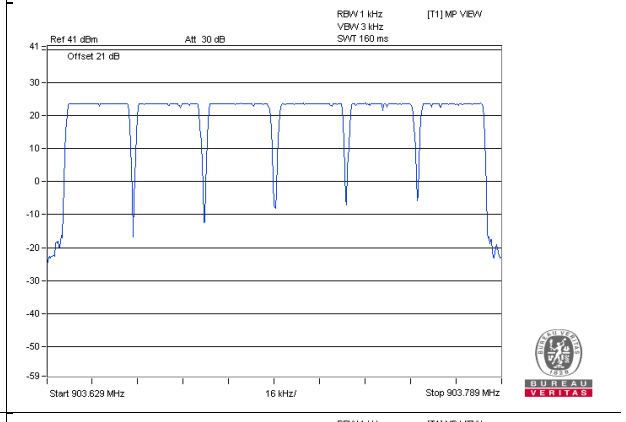

RBW 1 kHz
VBW 3 kHz
SWT 160 ms
[T1] MP VIEW
Ref 41 dBm
Att 30 dB
Offset 21 dB
Start 902.129 MHz
16 kHz/
Stop 902.289 MHz

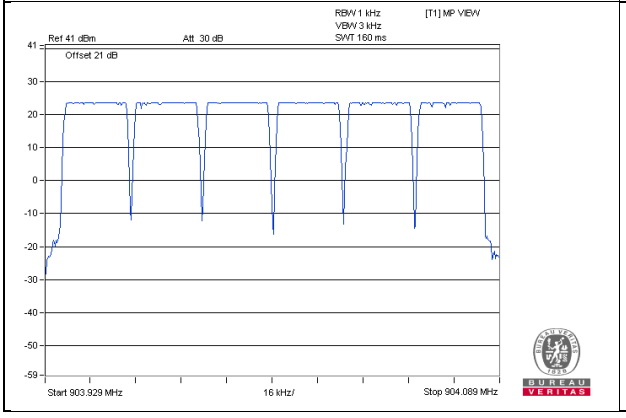

RBW 1 kHz
VBW 3 kHz
SWT 160 ms
[T1] MP VIEW
Ref 41 dBm
Att 30 dB
Offset 21 dB
Start 902.429 MHz
16 kHz/
Stop 902.589 MHz

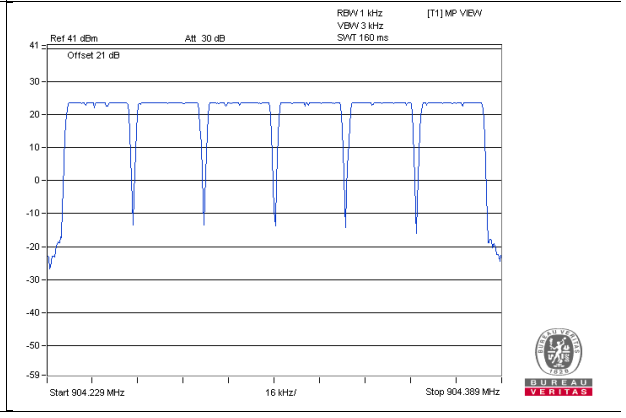

RBW 1 kHz
VBW 3 kHz
SWT 160 ms
[T1] MP VIEW
Ref 41 dBm
Att 30 dB
Offset 21 dB
Start 902.729 MHz
16 kHz/
Stop 902.889 MHz

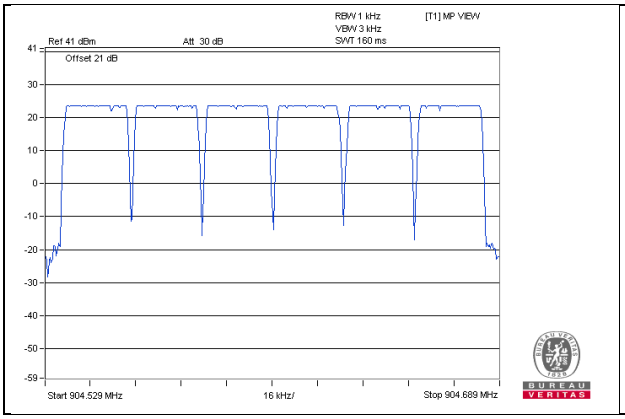

RBW 1 kHz
VBW 3 kHz
SWT 160 ms
[T1] MP VIEW
Ref 41 dBm
Att 30 dB
Offset 21 dB
Start 903.029 MHz
16 kHz/
Stop 903.189 MHz


RBW 1 kHz
VBW 3 kHz
SWT 160 ms
[T1] MP VIEW
Ref 41 dBm
Att 30 dB
Offset 21 dB
Start 903.329 MHz
16 kHz/
Stop 903.489 MHz


RBW 1 kHz
VBW 3 kHz
SWT 160 ms
[T1] MP VIEW
Ref 41 dBm
Att 30 dB
Offset 21 dB
Start 903.629 MHz
16 kHz/
Stop 903.789 MHz


RBW 1 kHz
VBW 3 kHz
SWT 160 ms
[T1] MP VIEW
Ref 41 dBm
Att 30 dB
Offset 21 dB
Start 903.929 MHz
16 kHz/
Stop 904.089 MHz


RBW 1 kHz
VBW 3 kHz
SWT 160 ms
[T1] MP VIEW
Ref 41 dBm
Att 30 dB
Offset 21 dB
Start 904.229 MHz
16 kHz/
Stop 904.389 MHz

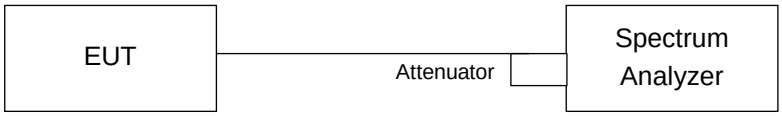

RBW 1 kHz
VBW 3 kHz
SWT 160 ms
[T1] MP VIEW
Ref 41 dBm
Att 30 dB
Offset 21 dB
41
30
20
10
0
-10
-20
-30
-40
-50
-59
Start 904.529 MHz
16 kHz/
Stop 904.689 MHz

4.4 Dwell Time on Each Channel

4.4.1 Limits of Dwell Time on Each Channel Measurement

CONDITION	DWELL TIME	APPLICATION
20dB Bandwidth <250kHz (hopping channels ≧50)	0.4 seconds within a 20 second period	v
20dB Bandwidth >250kHz (hopping channels ≧25)	0.4 seconds within a 10 second period	x

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
e. Repeat above procedures until all different time-slot modes have been completed.

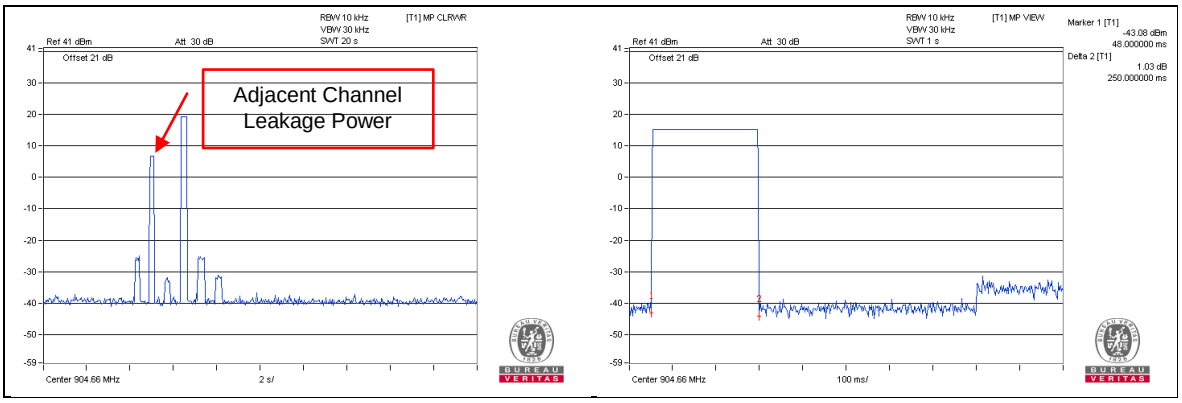
.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 Test Results

Number of transmission in a 20 s	Length of transmission time (msec)	Result (msec)	Limit (msec)
1 time	250	250	400

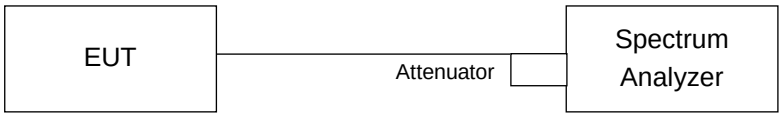


4.5 Channel Bandwidth

4.5.1 Limits of Channel Bandwidth Measurement

CONDITION	APPLICATION
20dB Bandwidth <250kHz (hopping channels ≧50)	v
20dB Bandwidth >250kHz (hopping channels ≧25)	x

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

4.5.5 Deviation from Test Standard

No deviation.

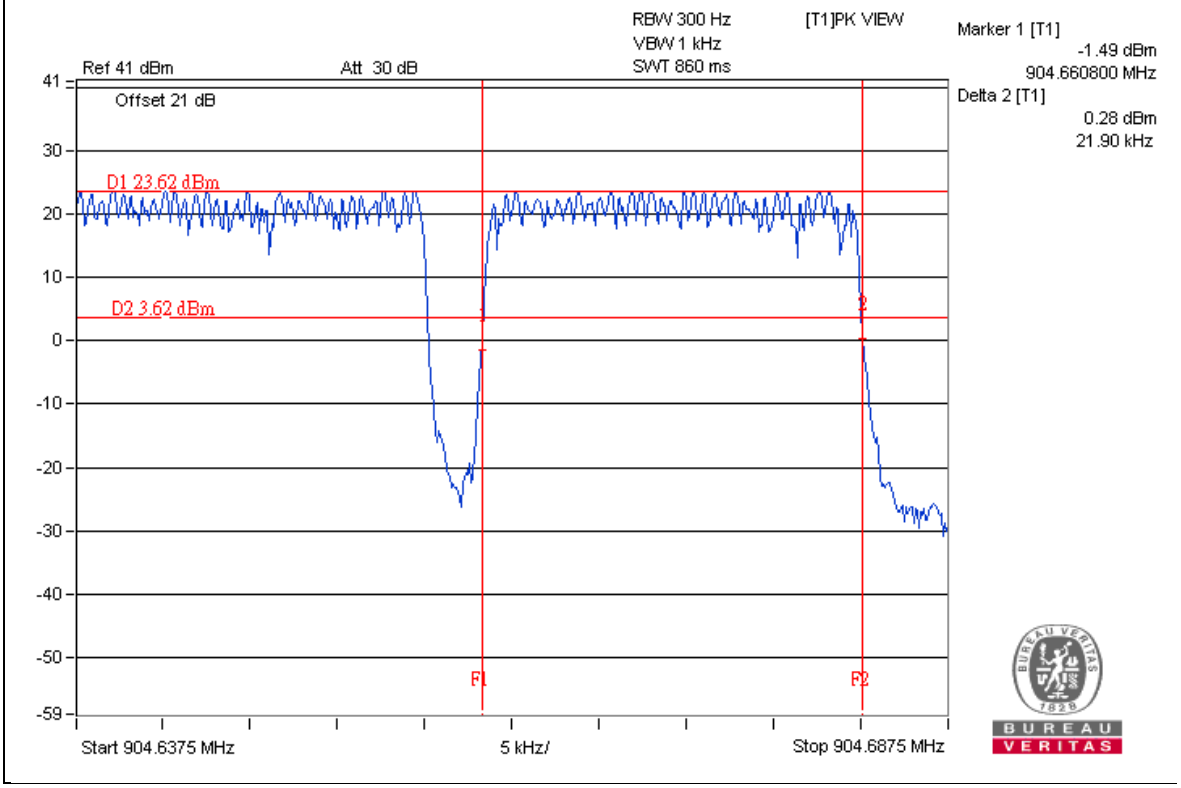
4.5.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.5.7 Test Results

Frequency (MHz)	20dB Bandwidth (MHz)
902.1375	0.0218
904.6625	0.0219

SPECTRUM PLOT OF MAX. VALUE

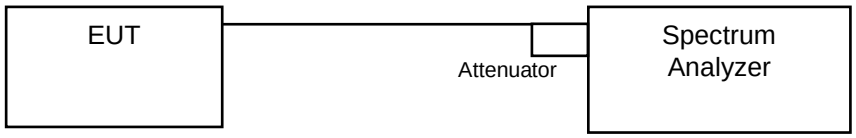


4.6 Hopping Channel Separation

4.6.1 Limits of Hopping Channel Separation Measurement

At least 25kHz or 20dB hopping channel bandwidth (whichever is greater).

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

Measurement Procedure REF

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.

c. By using the MaxHold function record the separation of two adjacent channels.

d. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.

e. Repeat above procedures until all frequencies measured were complete.

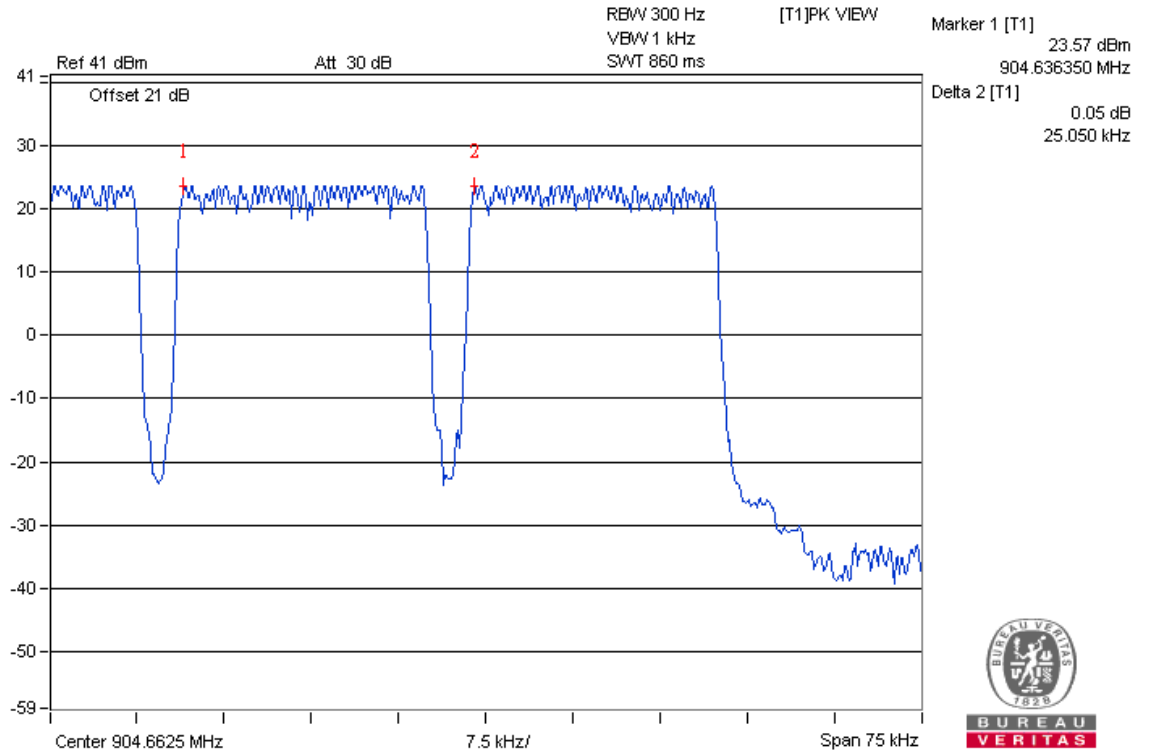
4.6.5 Deviation from Test Standard

No deviation.

4.6.6 Test Results

Frequency (MHz)	Adjacent Channel Separation (MHz)	Minimum Limit (MHz)	Pass / Fail
902.1375	0.025	0.025	Pass
904.6625	0.02505	0.025	Pass

SPECTRUM PLOT OF WORST VALUE

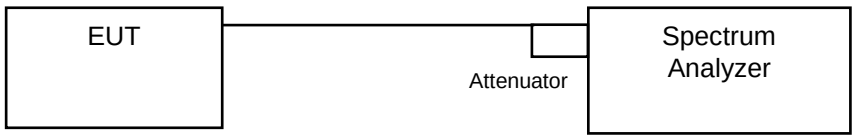


4.7 Maximum Output Power

4.7.1 Limits of Maximum Output Power Measurement

CONDITION	OUTPUT POWER	APPLICATION
hopping channels ≧50	1 W	v
hopping channels ≧25 & ≦50	0.25W	x

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 30kHz RBW and 100 kHz VBW.

d. Measure the captured power within the band and recording the plot.

e. Repeat above procedures until all frequencies required were complete.

4.7.5 Deviation from Test Standard

No deviation.

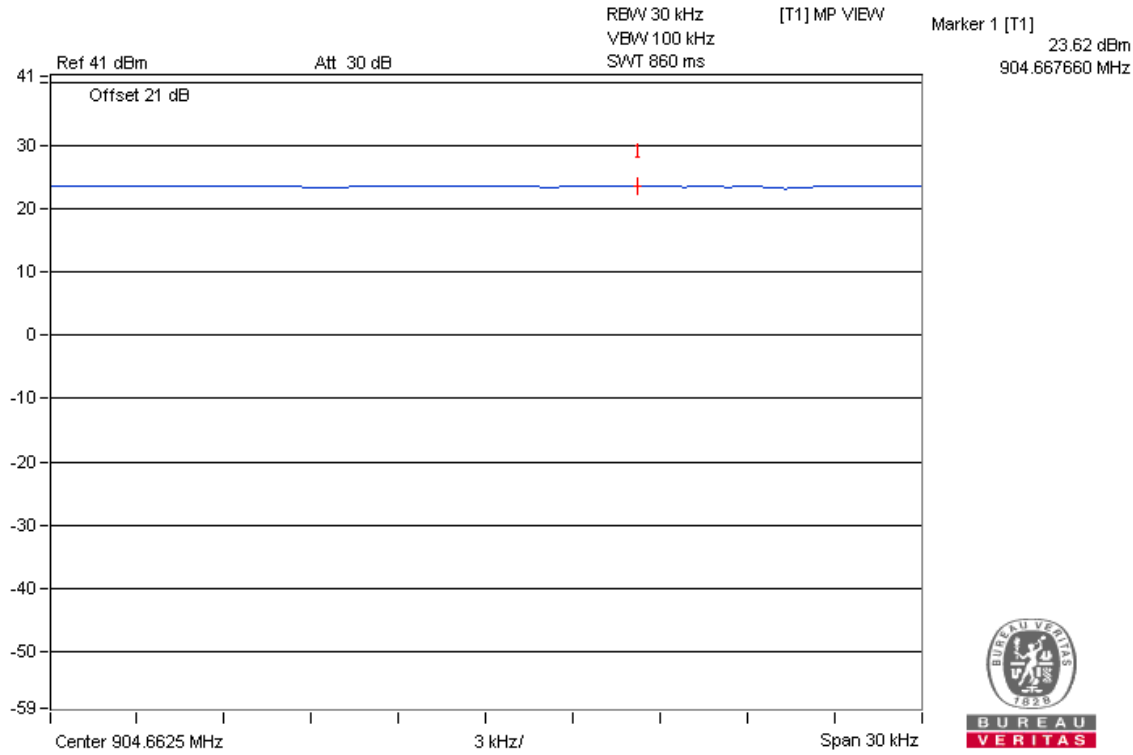
4.7.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest and highest channel frequencies individually.

4.7.7 Test Results

Frequency (MHz)	Output Power (mW)	Output Power (dBm)	Power Limit (dBm)	Pass / Fail
902.1375	226.986	23.56	30.00	Pass
904.6625	230.144	23.62	30.00	Pass

SPECTRUM PLOT OF WORST VALUE



4.8 Conducted Out of Band Emission Measurement

4.8.1 Limits of Conducted Out of Band Emission Measurement

Below –20dB of the highest emission level of operating band (in 100kHz RBW).

4.8.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.8.3 Test Procedure

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

4.8.4 Deviation from Test Standard

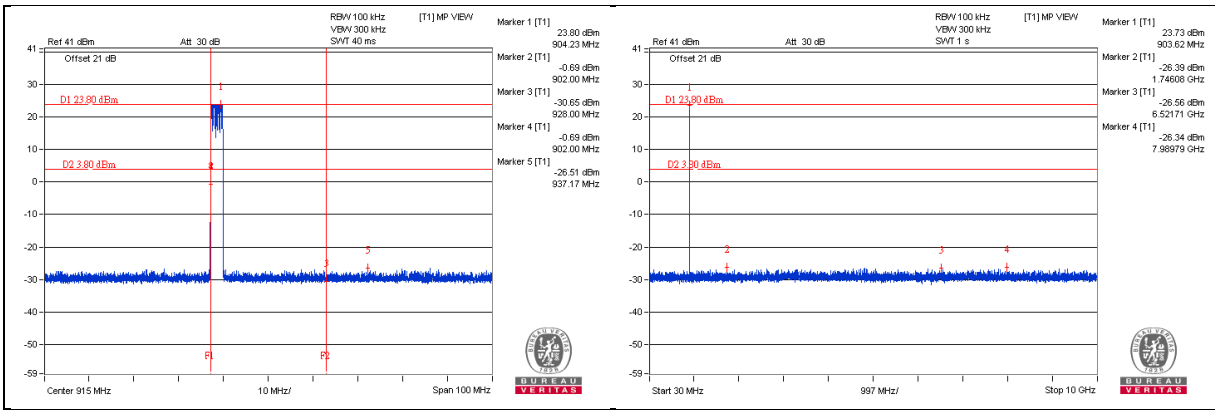
No deviation.

4.8.5 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.8.6 Test Results

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

--- END ---