STC Test Report

Date : 2016-08-12
No. : HM170348

Applicant: Venture Global Limited
Room 1102, 11/F., Fabrico Industrial Building, 78-84 Kwai Cheong Road, Kwai Chung, N.T., Hong Kong

Manufacturer: Venture Global Limited
Room 1102, 11/F., Fabrico Industrial Building, 78-84 Kwai Cheong Road, Kwai Chung, N.T., Hong Kong

Description of Sample(s):

Product:	Wireless Multi-Alert Receiver
Brand Name:	Guardman
Model Number:	MA-K100
FCC ID:	YAHMAKRK1

Date Sample(s) Received: 2016-07-20

Date Tested: 2016-08-04 to 2016-08-05

Investigation Requested: Perform ElectroMagnetic Interference measurement in accordance with FCC 47 CFR [Codes of Federal Regulations] Part 15: 2015 and ANSI C63.10-2013 for FCC Certification.

Conclusion(s): The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Remark(s): ---

CHEUNG Chi, Kenneth
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
The Hong Kong Standards and Testing Centre Ltd.

CONTENT:

1.0 General Details

1.1 Test Laboratory

The Hong Kong Standards and Testing Centre Ltd.
EMC Laboratory
10 Dai Wang Street, Taipo Industrial Estate

Telephone: (852) 26661888
Fax: (852) 26644353

1.2 Equipment Under Test [EUT]
Description of Sample(s)

Product:	Wireless Multi-Alert Receiver
Manufacturer:	Venture Global Limited Room 1102, 11/F., Fabrico Industrial Building, 78-84 Kwai Cheong Road, Kwai Chung, N.T., Hong Kong
Brand Name:	Guardman
Model Number:	MA-K100
Rating:	6Vd.c. (“AAA” size battery x 4) & 12Vd.c. 500mA (powered by adaptor)

The AC/DC Adaptor used for the tests was a "Winstar" adaptor: Two pins (Live / Neutral) only adaptor, Model Number: NA-12, Input: 100-120/220-240Va.c., Output: 3-15Vd.c. 1200mA max.

1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is a Wireless Multi-Alert Receiver. The R.F. signal was modulated by IC, the type of modulation is FSK modulation and the spread spectrum technique used is Frequency hopping spread spectrum modulation.

1.3 Date of Order

2016-07-20

1.4 Submitted Sample(s):

2 Sample(s)

1.5 Test Duration

2016-08-04 to 2016-08-05

1.6 Country of Origin

China

1.7 RF Module Details

Module Model Number:	Si4432
Modulation:	GFSK
Frequency Range:	902-928MHz
Carrier Frequencies:	902.25MHz – 926.75MHz

Module Specification (specification provided by manufacturer)

1.8 Antenna Details

Antenna Model:	N/A
Antenna Type:	Omnidirectional antenna
Antenna Length:	25.5mm
Antenna Gain:	0dBi

2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2015 Regulations and ANSI C63.10-2013 Test Method for FCC Certification.

2.2 Test Standards and Results Summary Tables

EMISSION (RFID) Results Summary						
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Fail	N/A
Maximum Peak Conducted Output Power	FCC 47CFR 15.247(b)(2)	ANSI C63.10-2013	N/A	☒	☐	☐
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.10-2013	N/A	☒	☐	☐
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.10-2013	N/A	☒	☐	☐
Number of Hopping Frequency	FCC 47CFR 15.247(a)(1)	ANSI C63.10-2013	N/A	☒	☐	☐
20dB Bandwidth	FCC 47CFR 15.247(a)(1)	ANSI C63.10-2013	N/A	☒	☐	☐
Hopping Channel Separation	FCC 47CFR 15.247(a)(1)	ANSI C63.10-2013	N/A	☒	☐	☐
Band-edge measurement (Radiated)	FCC 47CFR 15.247(d)	ANSI C63.10-2013	N/A	☒	☐	☐
Pseudorandom Hopping Algorithm	FCC 47CFR 15.247(a)(1)	N/A	N/A	☒	☐	☐
Time of Occupancy (Dwell Time)	FCC 47CFR 15.247(a)(1)	ANSI C63.10-2013	N/A	☒	☐	☐
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	☒	☐	☐
RF Exposure	FCC 47CFR 15.247(i)	N/A	N/A	☒	☐	☐

2.3 Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate in the table below is the worst case rate with respect to the specific test item.
Investigation has been done on all the possible configurations for searching the worst cases.
The following table is a list of the test modes shown in this test report.

Test Items	Mode
Maximum Peak Conducted Output Power	GFSK
Hopping Channel Separation	GFSK
Number of Hopping Frequency	GFSK
Time of Occupancy(Dwell Time)	GFSK
Radiated Spurious Emissions	GFSK
Band-edge compliance of Conducted Emission	GFSK

3.0 Test Results

3.1 Emission

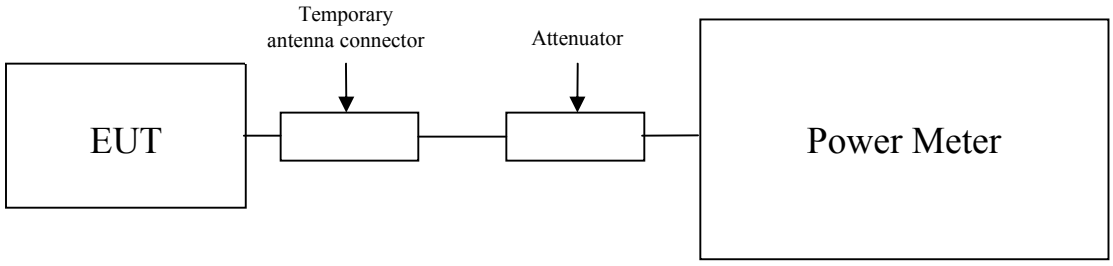
3.1.1 Maximum Peak Conducted Output Power

Test Requirement:	FCC 47CFR 15.247(b)(2)
Test Method:	ANSI C63.10-2013
Test Date:	2016-08-05
Mode of Operation:	Tx mode

Test Method:

The RF output of the EUT was connected to the Power Meter. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in dBm.

Test Setup:



Limits for Maximum Peak Conducted Output Power [FCC 47CFR 15.247]:

902–928 MHz band: For frequency hopping systems employing at least 50 hopping channels: 1Watt For frequency hopping systems employing less than 50 hopping: 0.25 Watts

Results of RFID mode (Fundamental Power): Pass

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
902.25	0.0723

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
914.75	0.0913

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
926.75	0.0891

Calculated measurement uncertainty : 30MHz to 1GHz 1.7dB
1GHz to 18GHz 1.7dB

Remark:
1. All test data for each data rate were verified, but only the worst case was reported.
2. The EUT is programmed to transmit signals continuously for all testing.

3.1.2 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10-2013
Test Date:	2016-08-05
Mode of Operation:	Tx mode

Test Method:

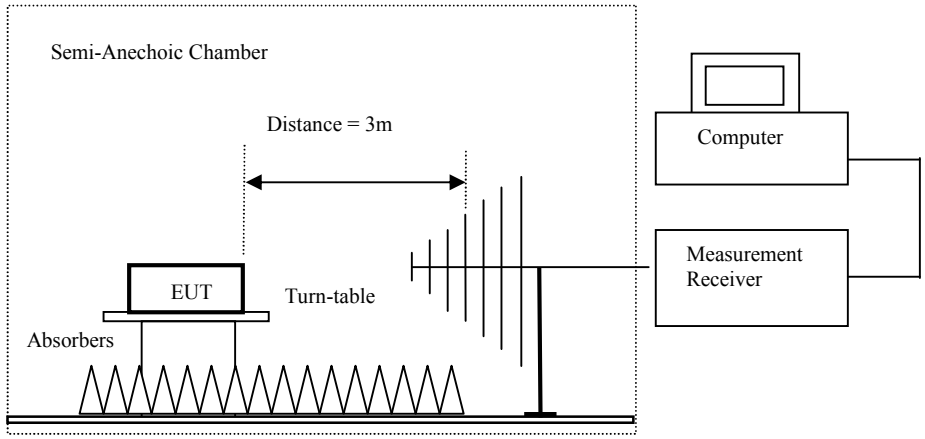
The sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

* Semi-anechoic chamber located on the G/F of "The Hong Kong Standards and Testing Centre Ltd." with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 607756.

Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)	RBW:	10kHz
	VBW:	30kHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold
30MHz – 1GHz (QP)	RBW:	120kHz
	VBW:	120kHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold
Above 1GHz (Pk & Av)	RBW:	1MHz
	VBW:	3MHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold

Test Setup:



- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used, 9kHz to 30MHz loop antennas are used.

Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[μV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Result of Rx mode (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	μV/m	μV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Radiated Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Result of Rx mode (30MHz – 1GHz): Pass

Radiated Emissions Quasi-Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
32.9	3.0	14.5	17.5	40.0	22.5	Vertical
149.4	0.4	9.7	10.1	43.5	33.4	Vertical
420.0	9.3	17.3	26.6	46.0	19.4	Horizontal
440.0	8.7	17.6	26.3	46.0	19.7	Horizontal
720.0	6.9	22.4	29.3	46.0	16.7	Horizontal
830.0	6.6	23.9	30.5	46.0	15.5	Horizontal

Result of Rx mode (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	μV/m	μV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Radiated Emissions Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Tx mode (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	μV/m	μV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Radiated Emissions Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Tx mode (30MHz – 1GHz): Pass

Radiated Emissions Quasi-Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Tx mode (Lower Channel 902.25MHz) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dBµV/m	E-Field Polarity
902.25	89.40	23.90	113.30	N/A	N/A	Vertical
1804.70	42.10	26.30	68.40	93.30	24.90	Vertical
2706.10	31.40	28.90	60.30	74.00	13.70	Vertical

Result of Tx mode (Lower Channel 902.25MHz) (Above 1GHz): Pass

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dBµV/m	E-Field Polarity
902.25	88.80	23.90	112.70	N/A	N/A	Vertical
1804.70	33.80	26.30	60.10	92.70	32.60	Vertical
2706.10	21.50	28.90	50.40	54.00	3.60	Vertical

Result of Tx mode (Middle Channel 914.75MHz) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dBµV/m	E-Field Polarity
914.75	91.20	23.90	115.10	N/A	N/A	Vertical
1829.50	41.70	26.40	68.10	95.10	27.00	Vertical
2744.25	32.40	28.90	61.30	74.00	12.70	Vertical

Result of Tx mode (Middle Channel 914.75MHz) (Above 1GHz): Pass

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dBµV/m	E-Field Polarity
914.75	90.60	23.90	114.50	N/A	N/A	Vertical
1829.50	32.80	26.40	59.20	94.50	35.30	Vertical
2744.25	22.70	28.90	51.60	54.00	2.40	Vertical

Result of Tx mode (Highest Channel 926.75MHz) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
926.75	92.40	23.90	116.30	N/A	N/A	Vertical
1853.50	41.20	26.40	67.60	96.30	28.70	Vertical
2780.25	31.30	29.10	60.40	74.00	13.60	Vertical

Result of Tx mode (Highest Channel 926.75MHz) (Above 1GHz): Pass

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
926.75	91.90	23.90	115.80	N/A	N/A	Vertical
1853.50	29.90	26.40	56.30	95.80	39.50	Vertical
2780.25	21.00	29.10	50.10	54.00	3.90	Vertical

Remarks:

* Denotes restricted band of operation.
Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty: (9kHz - 30MHz): 3.3dB
(30MHz - 1GHz): 4.6dB
(1GHz - 26GHz): 4.4dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

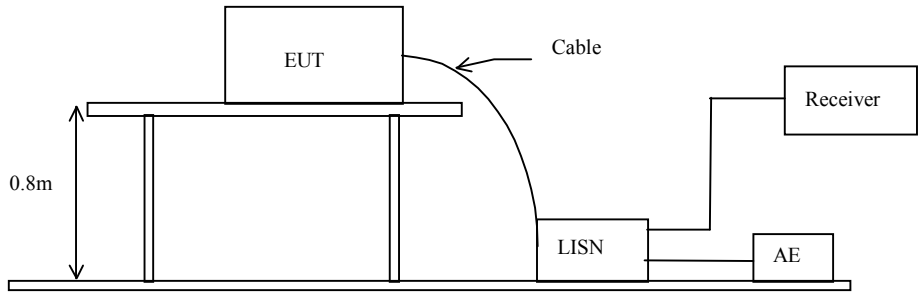
3.1.3 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.10-2013
Test Date:	2016-08-04
Mode of Operation:	On mode
Test Voltage:	120Va.c., 60Hz

Test Method:

The test was performed in accordance with ANSI C63.10-2013, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

Test Setup:



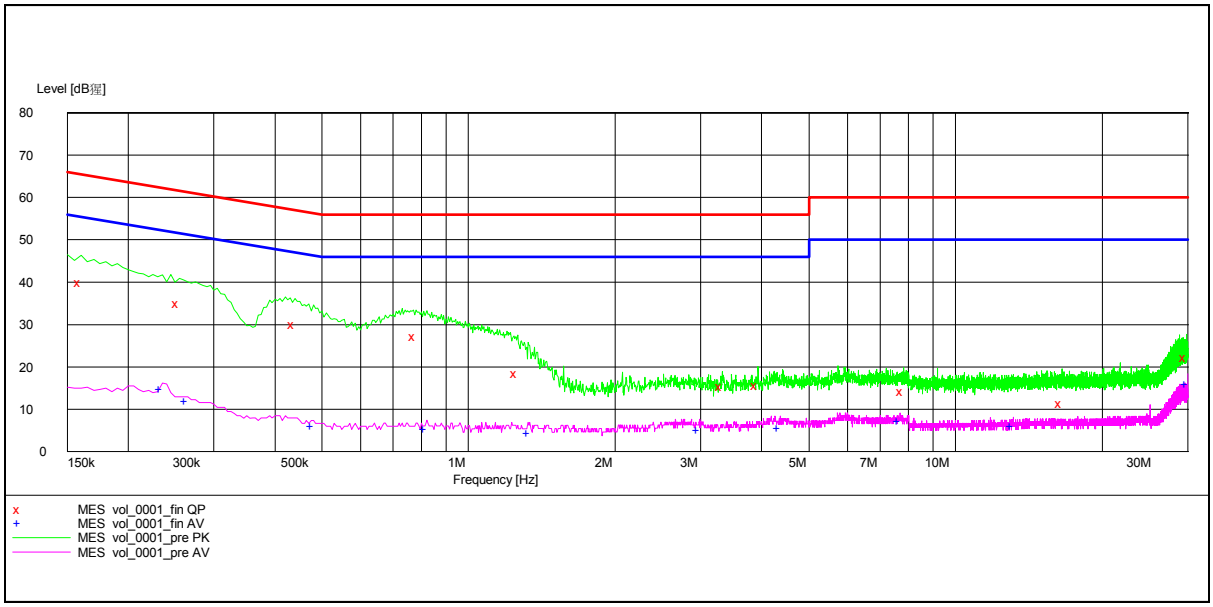
Limit for Conducted Emissions (FCC 47 CFR 15.207):

Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Results of On Mode: Pass
Please refer to the following diagram for individual results.



Results of On Mode- Live: Pass

Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBµV	Limit dBµV	Level dBµV	Limit dBµV
Live	0.160	40.0	66.0	-*-	-*-
Live	0.235	-*-	-*-	14.6	52.0
Live	0.265	-*-	-*-	11.8	51.0
Live	1.260	18.5	56.0	-*-	-*-
Live	1.335	-*-	-*-	4.3	46.0
Live	2.985	-*-	-*-	4.9	46.0
Live	3.320	15.4	56.0	-*-	-*-
Live	3.930	15.5	56.0	-*-	-*-
Live	4.360	-*-	-*-	5.5	46.0
Live	7.695	-*-	-*-	7.2	50.0
Live	29.830	22.1	60.0	-*-	-*-
Live	30.000	-*-	-*-	15.9	50.0
Neutral	0.255	34.9	62.0	-*-	-*-
Neutral	0.440	30.0	57.0	-*-	-*-
Neutral	0.480	-*-	-*-	6.0	46.0
Neutral	0.780	27.0	56.0	-*-	-*-
Neutral	0.820	-*-	-*-	5.1	46.0
Neutral	7.835	14.2	60.0	-*-	-*-
Neutral	13.135	-*-	-*-	5.9	50.0
Neutral	16.555	11.4	60.0	-*-	-*-

Remarks:
Calculated measurement uncertainty (0.15MHz – 30MHz): 3.2dB
-*- Emission(s) that is far below the corresponding limit line.

3.1.3 Number of Hopping Frequency

Limit of Number of Hopping Frequency

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels

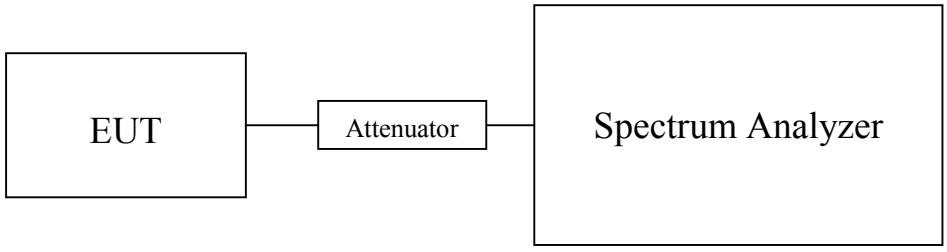
Frequency hopping systems in the 902–928 MHz band shall use at least 25 channels

The RF output of the EUT was connected to the spectrum analyzer by a low loss cable.

Spectrum Analyzer Setting:

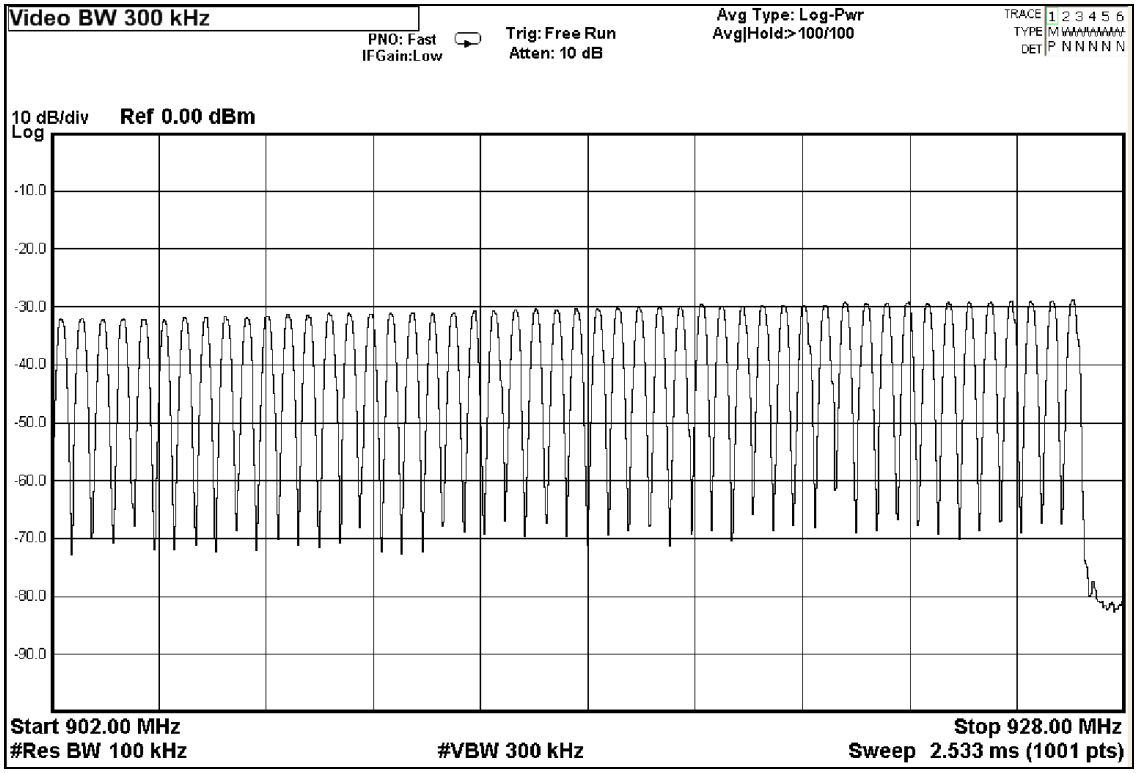
RBW = 1MHz, VBW ≥ RBW, Sweep = Auto, Span = the frequency band of operation
Detector = Peak, Trace = Max. hold

Test Setup:



Measurement Data:

[50 out of total 50 channel used in a hopping sequence]



3.1.4 20dB Bandwidth

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.10-2013
Test Date:	2016-08-05
Mode of Operation:	Tx mode

Remark:
The result has been done on all the possible configurations for searching the worst cases.

Test Method:

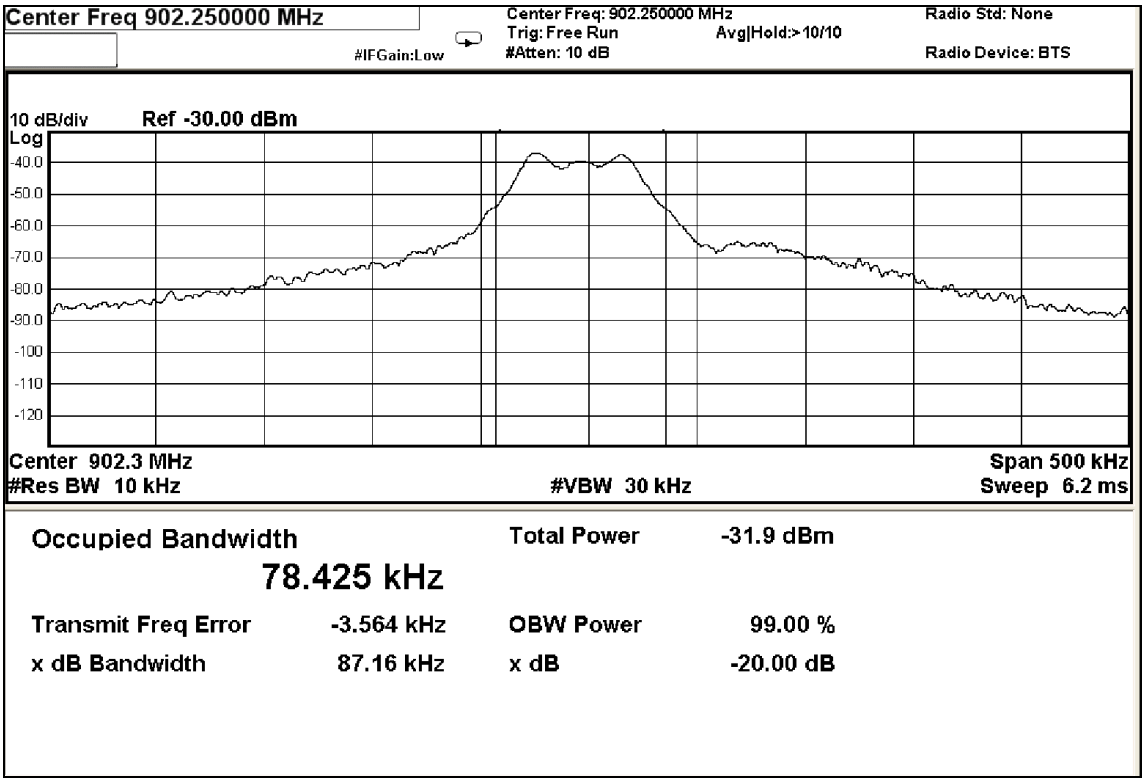
The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

Test Setup:

As Test Setup of clause 3.1.3 in this test report.

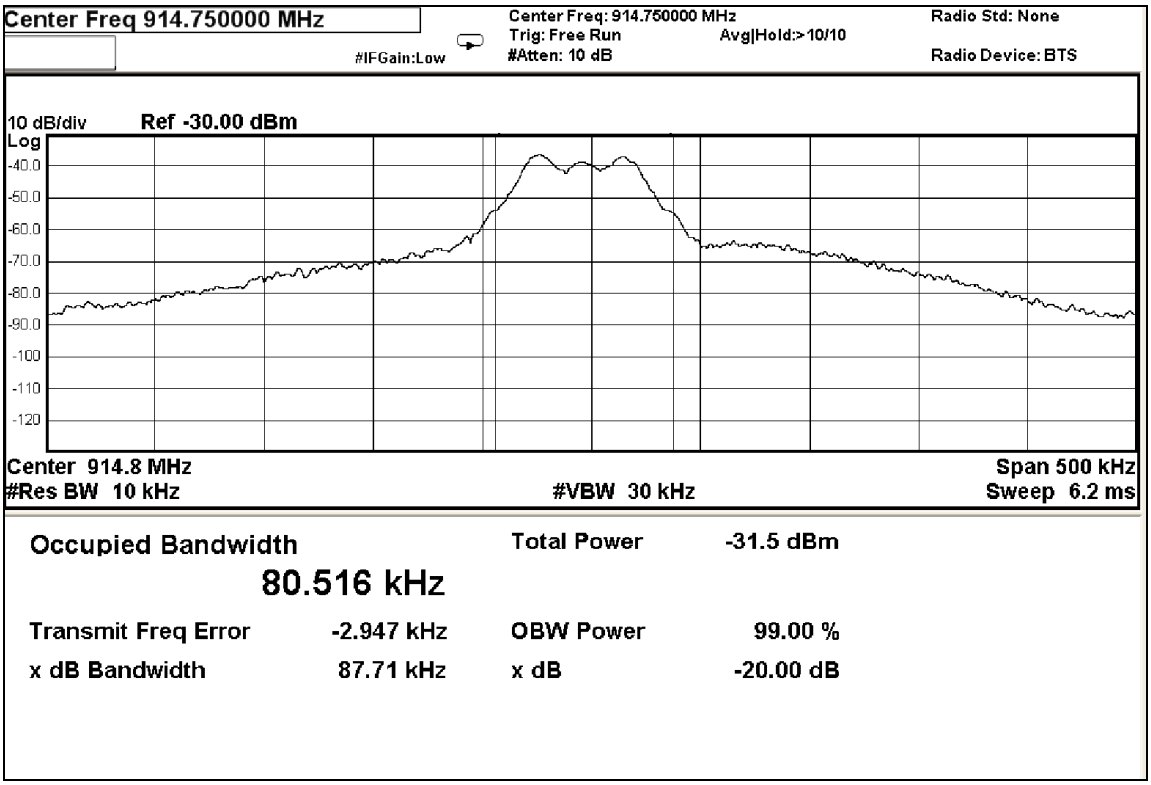
Fundamental Frequency [MHz]	20dB Bandwidth [kHz]	FCC Limits [MHz]
902.25	87.2	<0.5

(Lowest Operating Frequency)



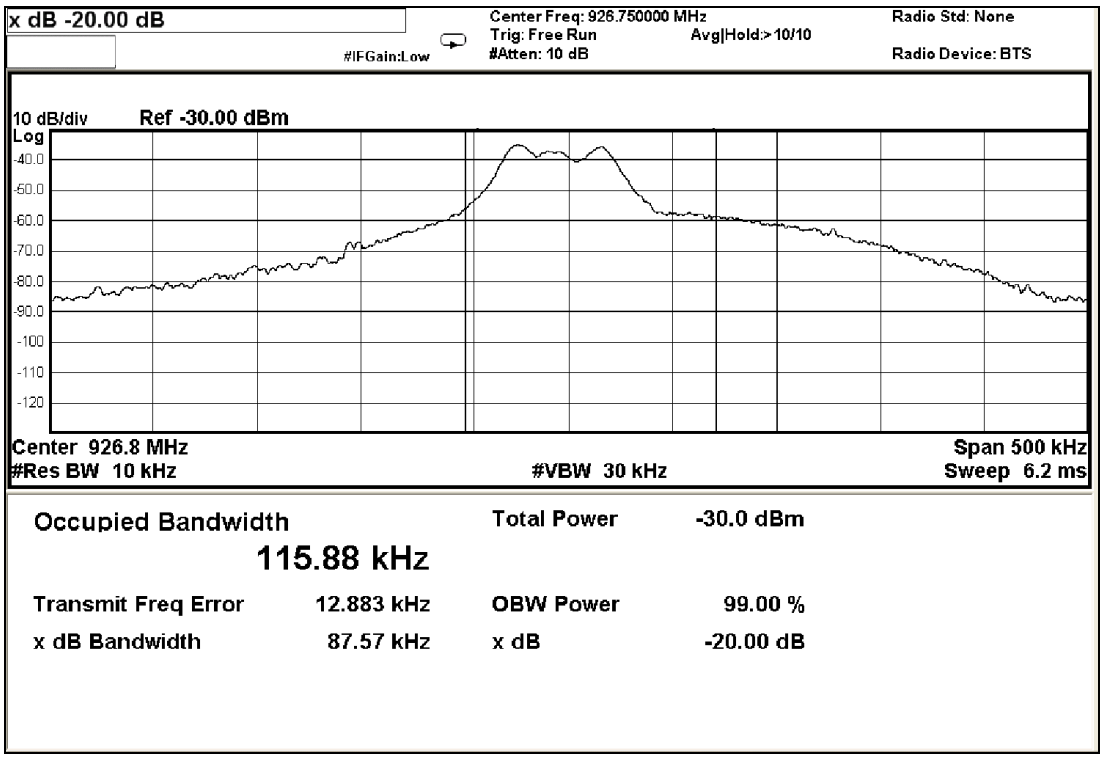
Fundamental Frequency [MHz]	20dB Bandwidth [kHz]	FCC Limits [MHz]
914.75	87.7	<0.5

(Middle Operating Frequency)



Fundamental Frequency [MHz]	20dB Bandwidth [kHz]	FCC Limits [MHz]
926.75	86.6	<0.5

(Highest Operating Frequency)



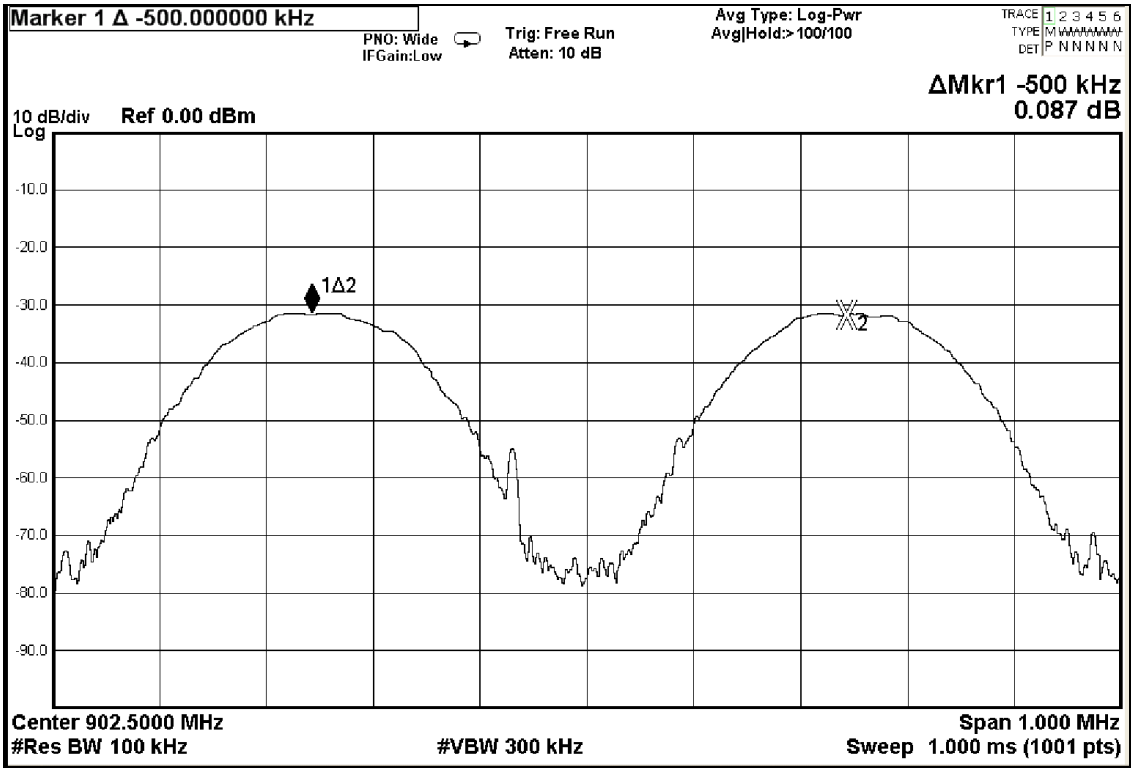
3.1.5 Hopping Channel Separation

Requirements:

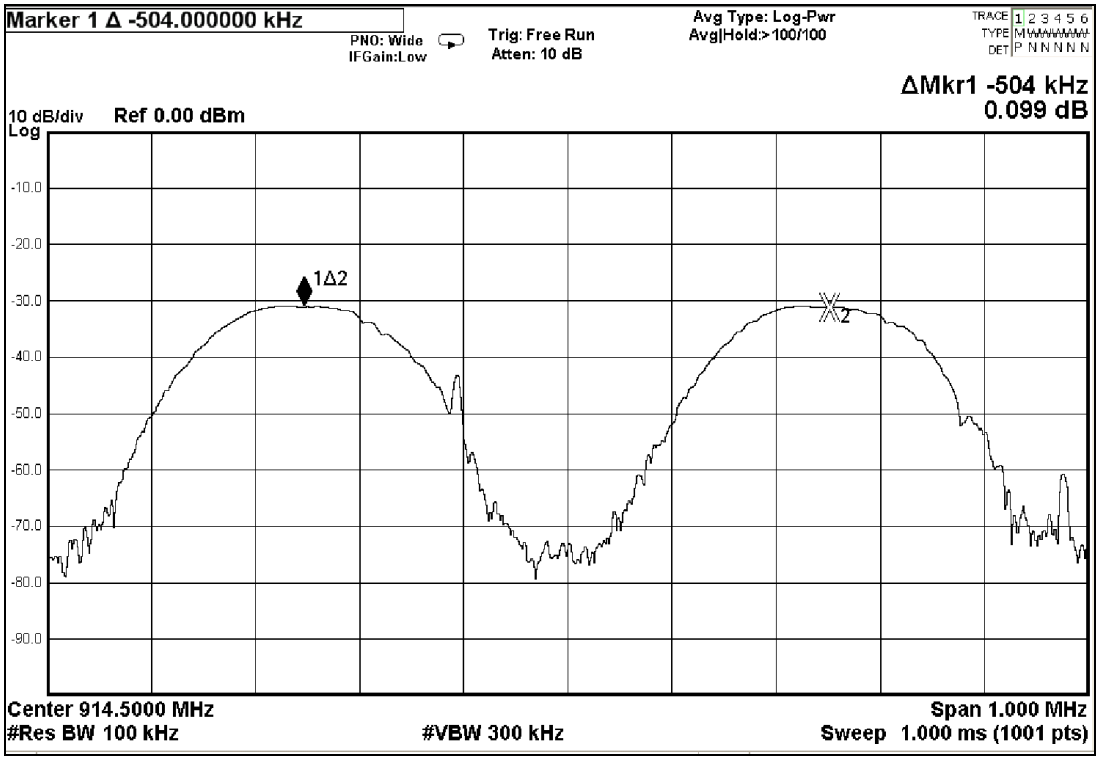
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater or the 20 dB bandwidth of the hopping channel, whichever is greater.

Limit:
The measured maximum bandwidth = 87.7 kHz

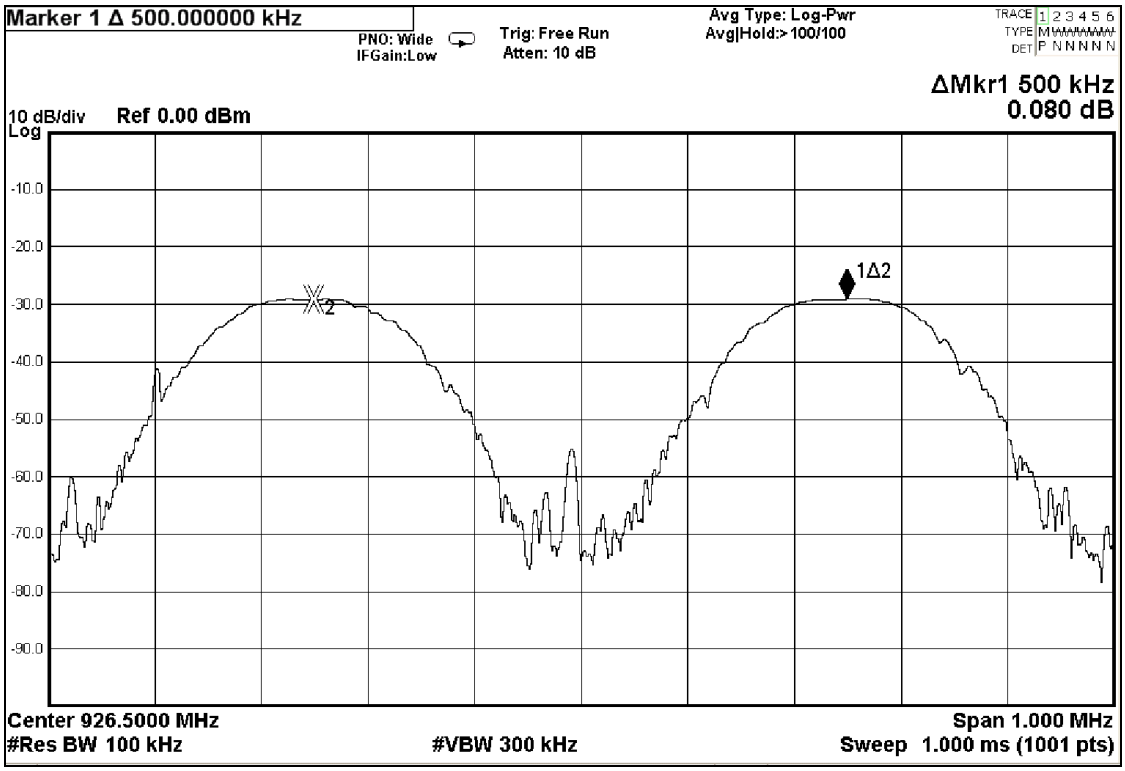
Channel separation = 500kHz
Channel 0 – Channel 1, Pass



Channel separation = 504kHz
Channel 24 – Channel 25, Pass



Channel separation = 500kHz
Channel 49 – Channel 50, Pass



3.1.6 Band-edge Compliance of RF Conducted Emissions Measurement:

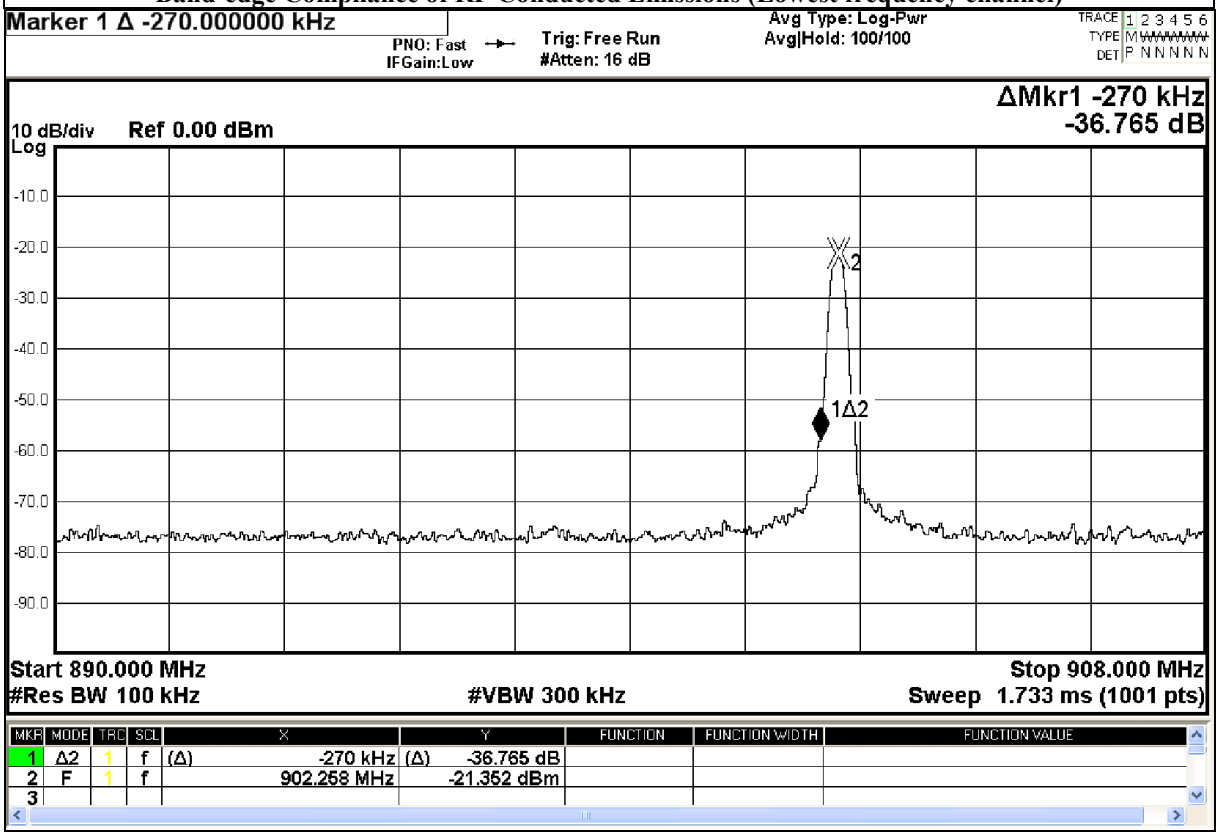
Limit：
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

Band-edge Compliance of RF Conducted Emissions Measurement:

Fixed Frequency:

Frequency Range [MHz]	Conducted Emission Attenuated below the Fundamental [dB]
902 - Lowest Fundamental (902.25)	36.8

Band-edge Compliance of RF Conducted Emissions (Lowest frequency channel)

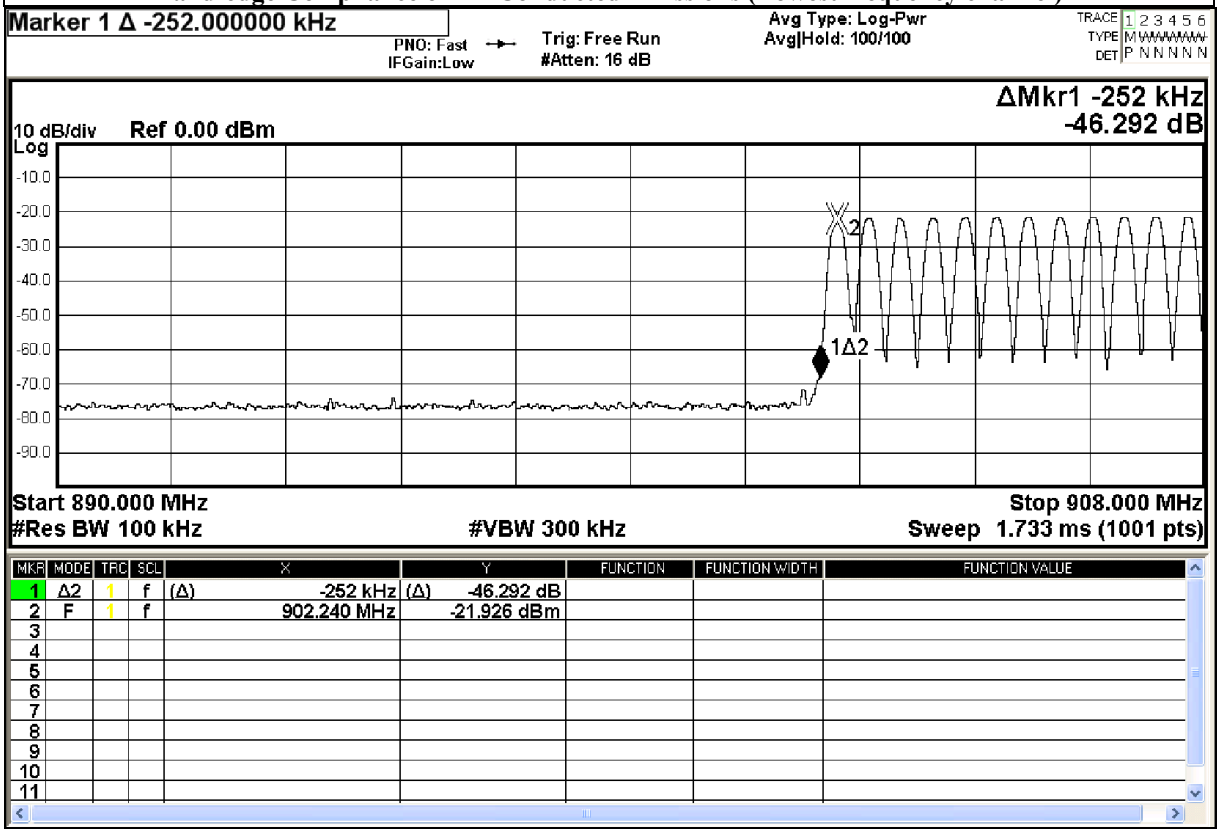


Band-edge Compliance of RF Conducted Emissions Measurement:

Hopping Frequency:

Frequency Range [MHz]	Conducted Emission Attenuated below the Fundamental [dB]
902 - Lowest Fundamental (902.25)	46.3

Band-edge Compliance of RF Conducted Emissions (Lowest frequency channel)



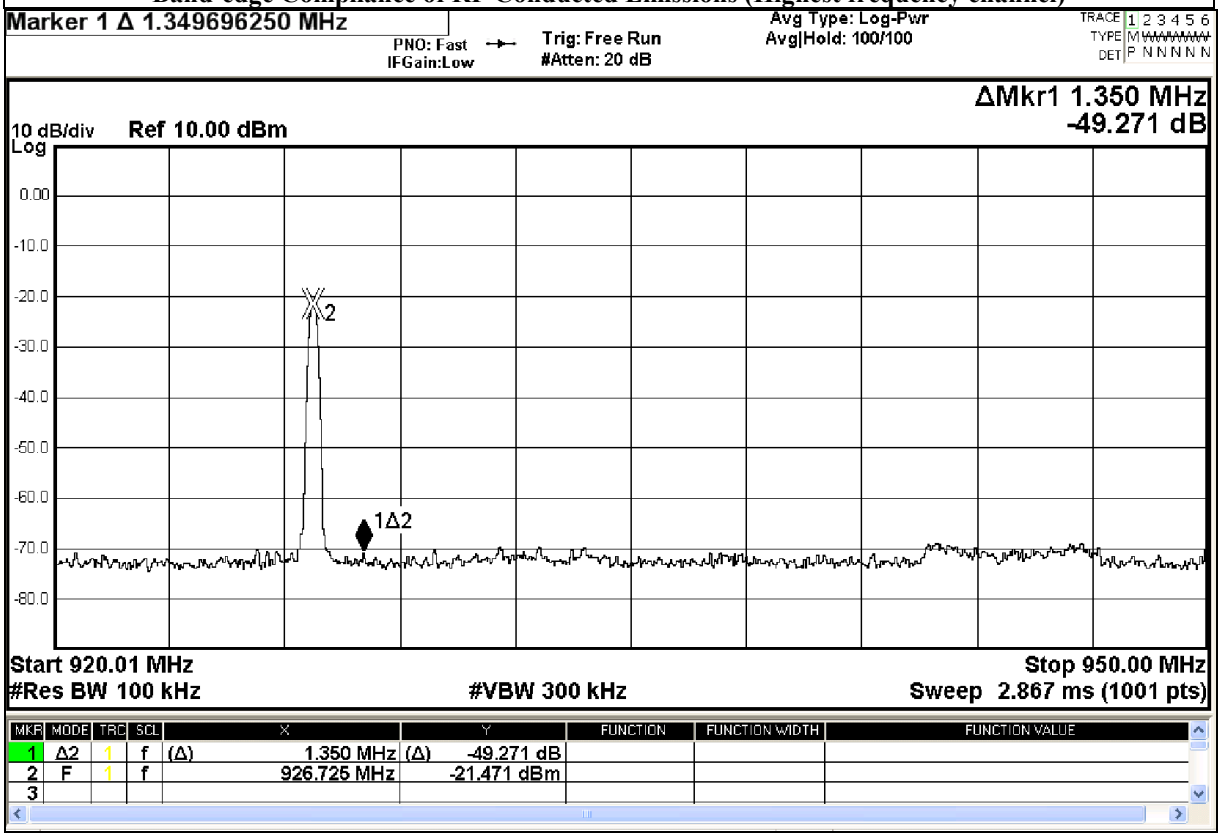
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	Δ2	1	f	(Δ) -252 kHz	(Δ) -46.292 dB			
2	F	1	f	902.240 MHz	-21.926 dBm			
3								
4								
5								
6								
7								
8								
9								
10								
11								

Band-edge Compliance of RF Conducted Emissions Measurement:

Fixed Frequency:

Frequency Range [MHz]	Conducted Emission Attenuated below the Fundamental [dB]
Highest Fundamental (926.75) - 928	49.3

Band-edge Compliance of RF Conducted Emissions (Highest frequency channel)

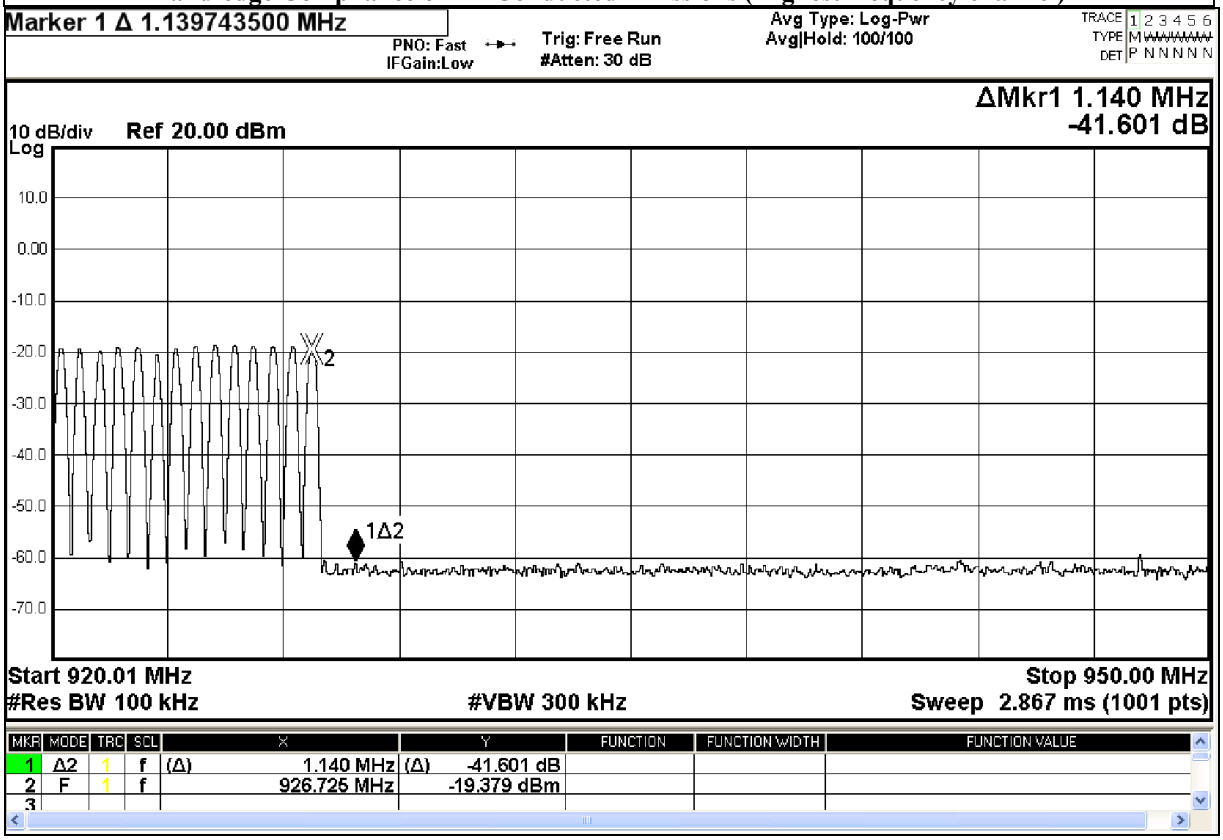


Band-edge Compliance of RF Conducted Emissions Measurement:

Hopping Frequency:

Frequency Range [MHz]	Conducted Emission Attenuated below the Fundamental [dB]
Highest Fundamental (926.75) - 928	41.6

Band-edge Compliance of RF Conducted Emissions (Highest frequency channel)



3.1.7 Time of Occupancy (Dwell Time)

Requirements

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

Dwell Time = Pulse Duration * hop rate

Observed duration: 20s

Measurement Data:

Channel Occupied: 50 of 50 Channel

Average Dwell time (at any 20s observation period) of
Lowest Channel = 27 pulses x 3.63ms(pulse period) x2 (double time of graph) = 196.0ms = 0.196s
Middle Channel = 28 pulses x 3.63ms(pulse period) x2 (double time of graph) = 203.3ms = 0.203s
Highest Channel = 28 pulses x 3.63ms(pulse period) x2 (double time of graph) = 203.3ms = 0.203s

For hopping system, channel bandwidth <250kHz, at least 50 hopping should be used (PASS), dwell time < 0.4s at any 20s period (PASS).

Fig. A
[50 out of total 50 channel used in a hopping sequence]

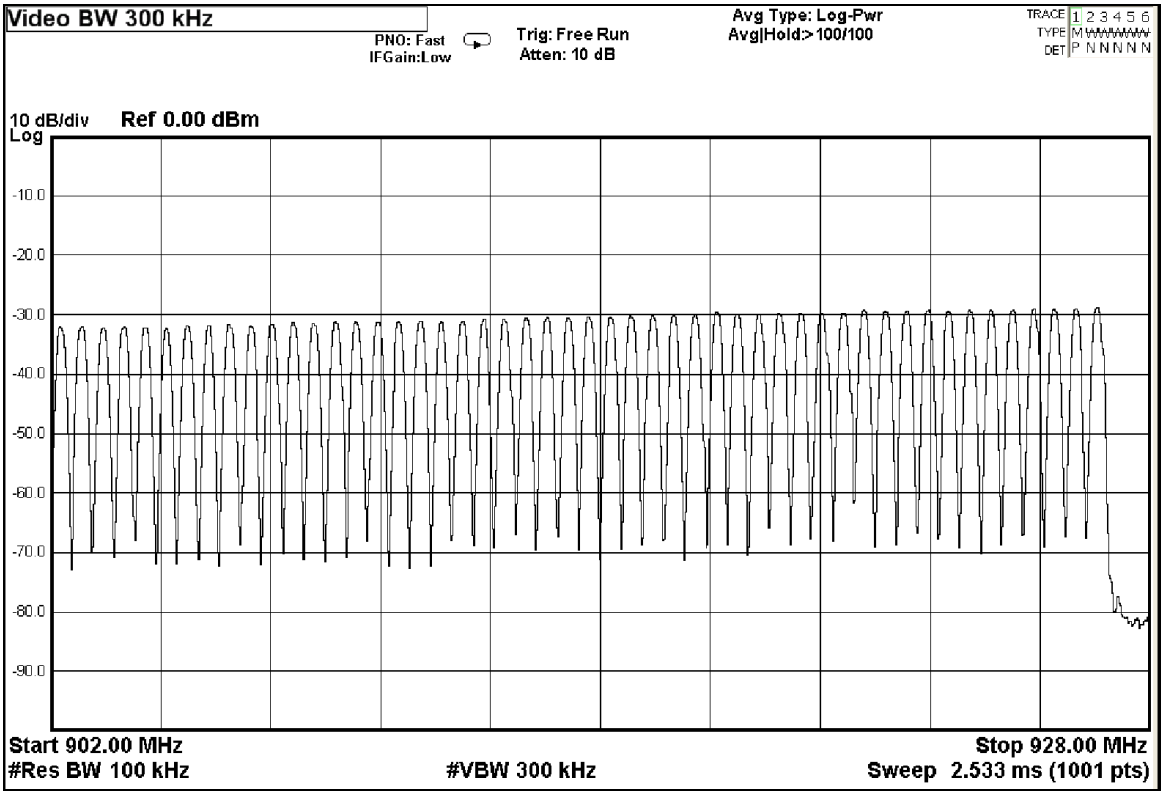


Fig. B
[27 pulses within 10s period]

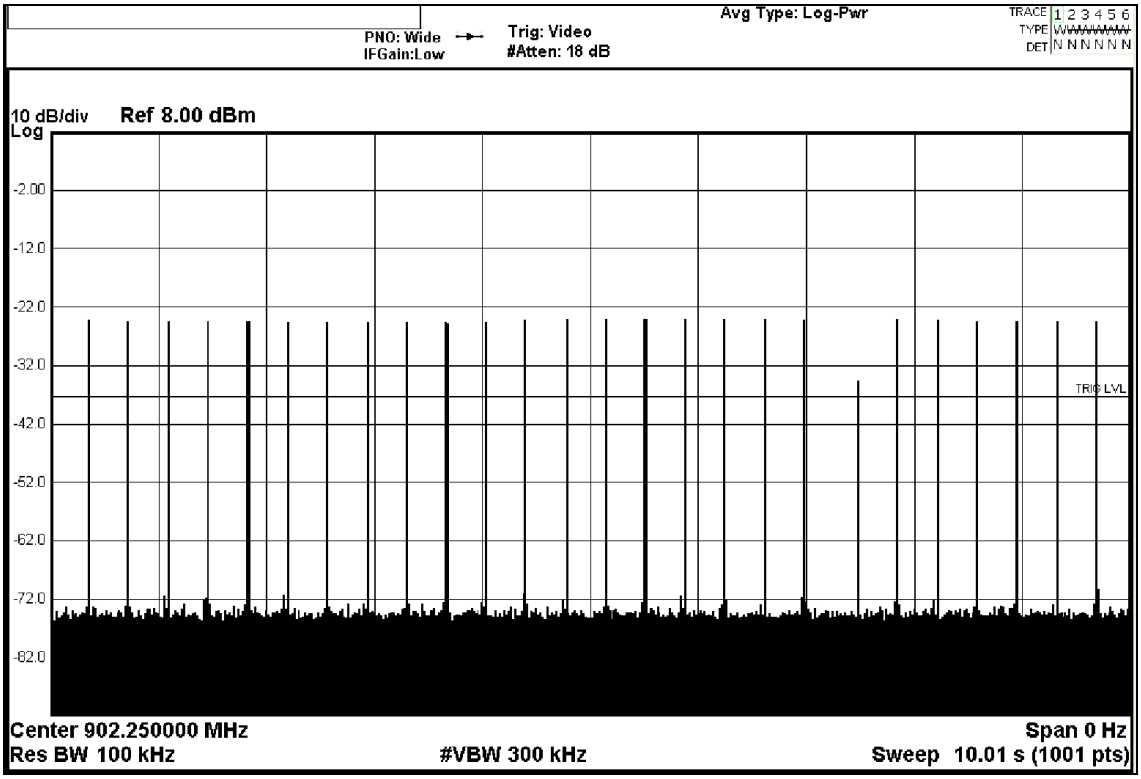


Fig. C
[Each pulse period = 3.630ms]

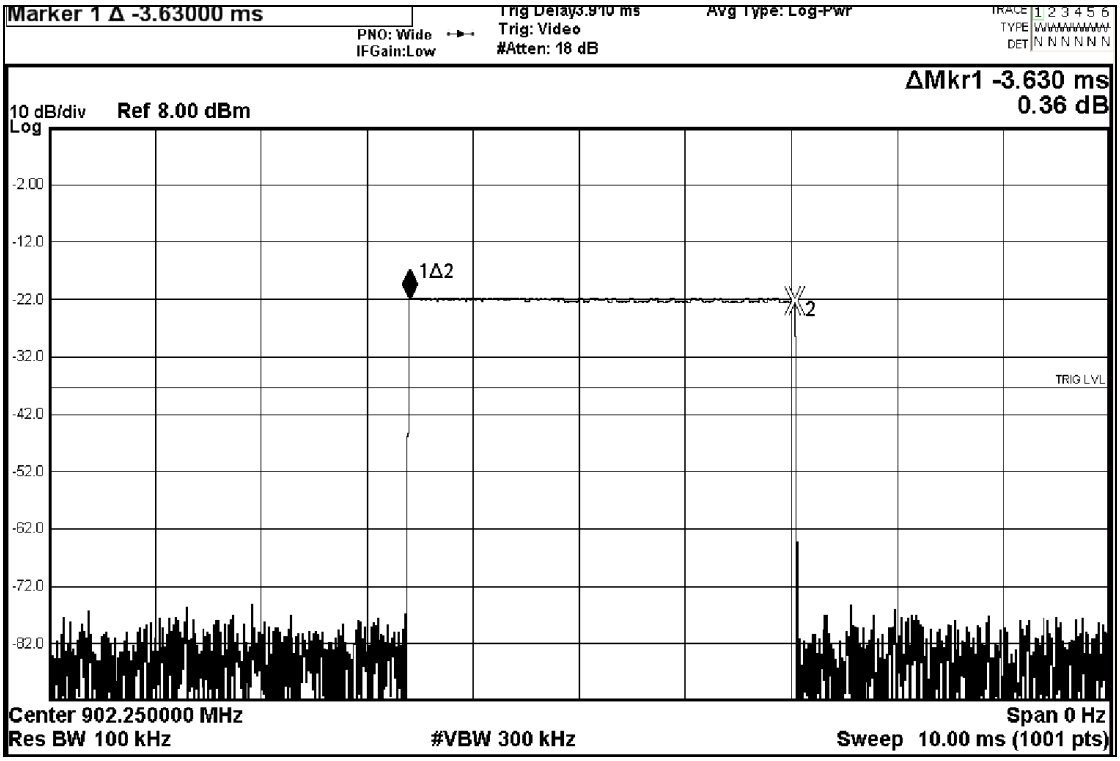


Fig. D
[28 pulses within 10s period]

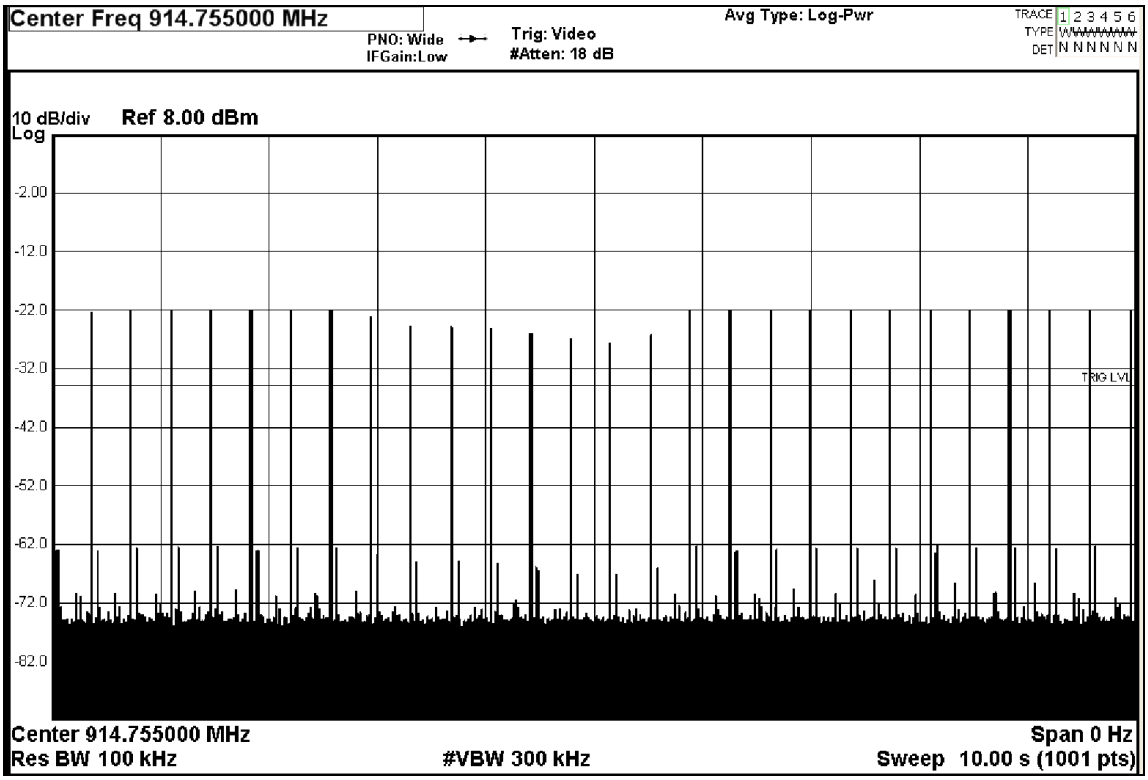


Fig. E
[Each pulse period = 3.630ms]

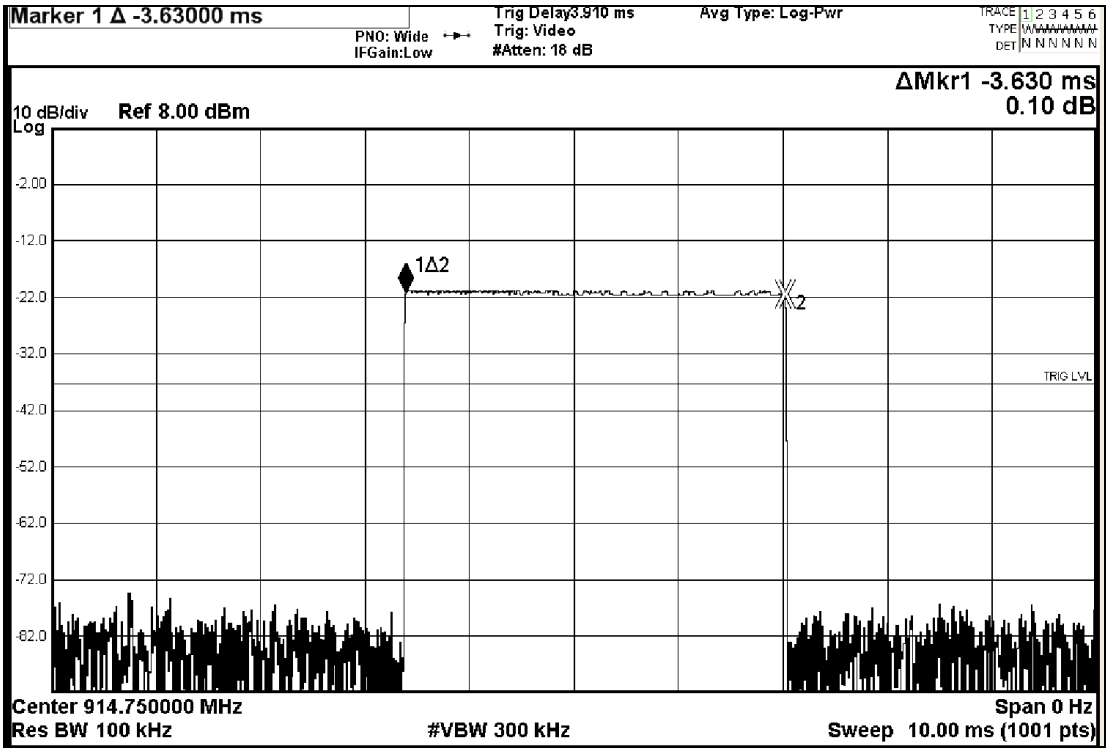


Fig. F
[28 pulses within 10s period]

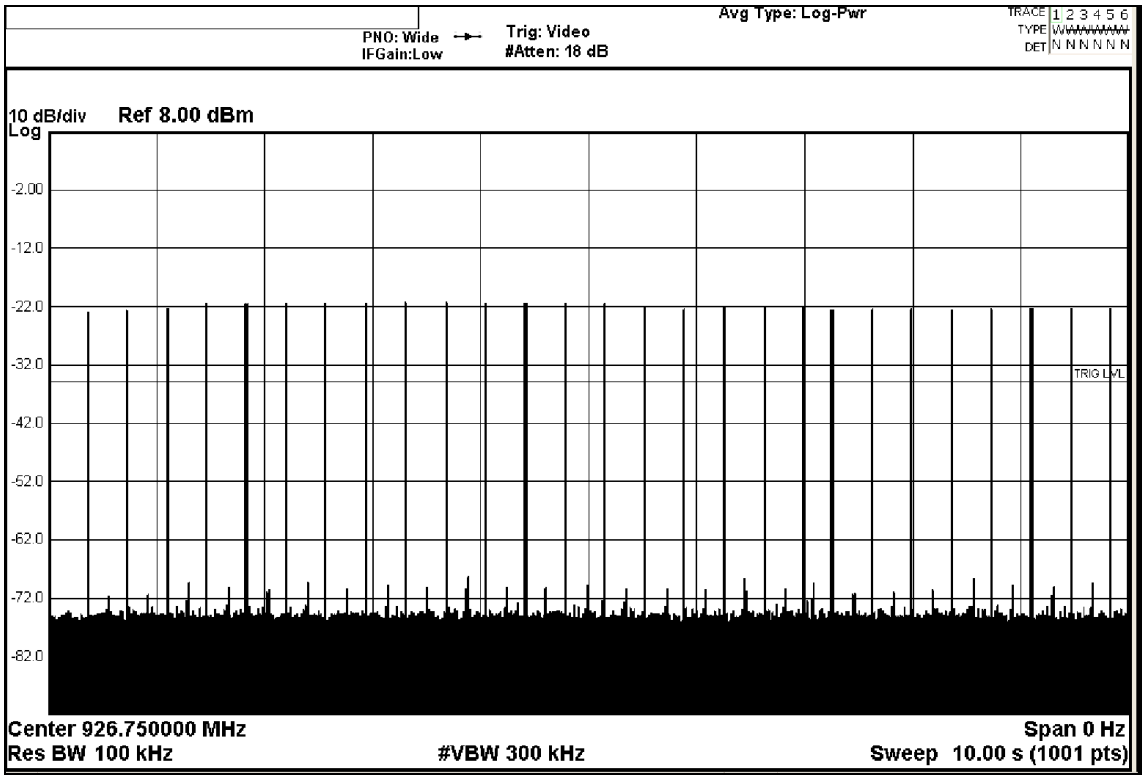
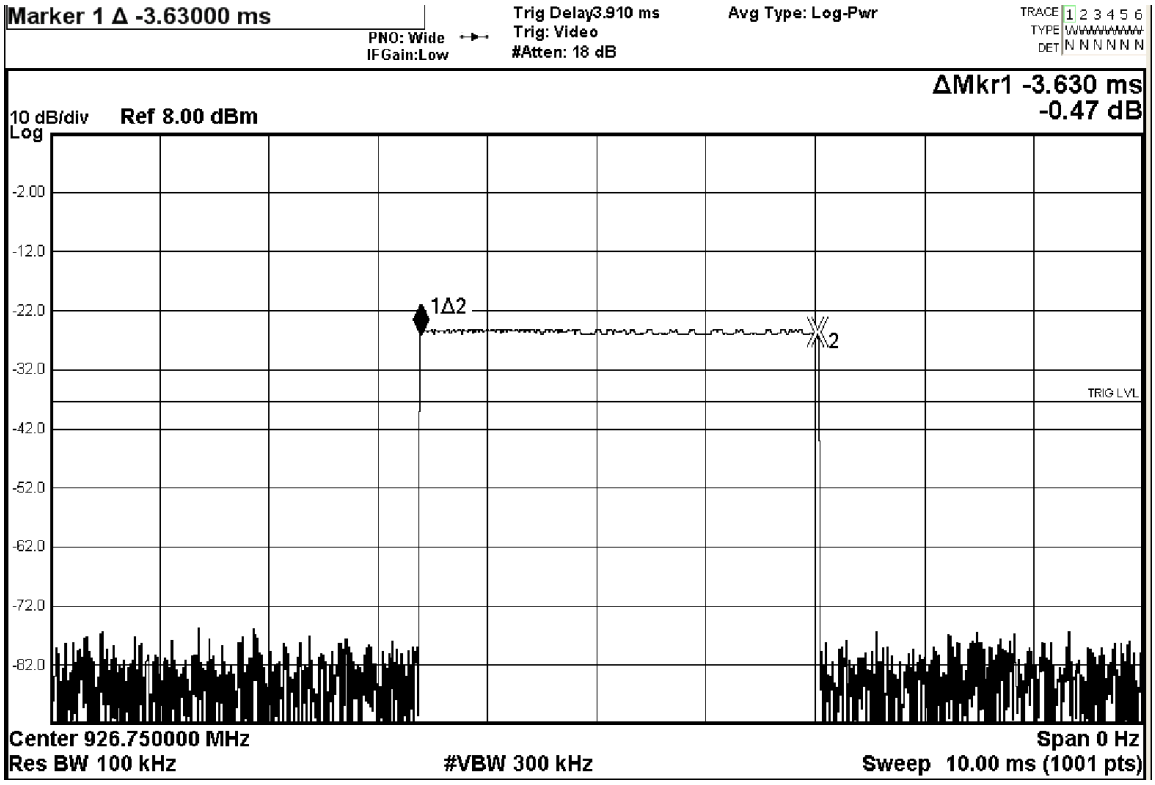


Fig. G
[Each pulse period = 3.630ms]



3.1.8 Channel Centre Frequency

Requirements:
Frequency hopping system in the 902-928MHz band shall use at least 50 (Channel 0 to 49) non-overlapping channels.

The EUT operates in according with the within the 902.25 – 926.75 MHz frequency band.
RF channels for the EUT are spaced 0.25 MHz and are ordered in channel number k. In order to comply with out-of-band regulations, a lower frequency guard band of 0.25 MHz and a higher frequency guard band of 0.25MHz is used.

The operating frequencies of each channel are as follows:

First RF channel start from 902MHz + 0.25MHz guard band = 902.25MHz
Frequency of RF Channel = 902.25+k MHz, k = 0,…,50 (Channel separation = 0.50MHz)

3.1.9 Pseudorandom Hopping Algorithm

Requirements:
The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

EUT Pseudorandom Hopping Algorithm
Refer to the R.F. module specification.

3.1.10 Antenna Requirement

Test Requirements: § 15.203

Test Specification:

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

Test Results:

This is Omnidirectional antenna. There is no external antenna, the antenna gain = 0dBi. User is unable to remove or change the Antenna.

3.1.11 RF Exposure -

Test Requirement:	FCC 47CFR 15.247(i)
Test Date:	2016-08-05
Mode of Operation:	Tx mode

Test Method:

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

Test Results:

The EUT complied with the requirement(s) of this section.
EUT meets the requirements of these sections as proven through MPE calculation
The MPE calculation for EUT @ 20cm
Based on the highest P =91.3 mW (@ 914.8MHz)

Pd = PG/ 4pi*R^2 = (91.3 x1)/12.566* $(20)^2$
= (91.3)/12.566x 400= 91.3 /5026.4
= 0.01816mW/cm^2

where:
*Pd = power density in mW/cm2
* G = Antenna numeric gain (1); Log G = g/10 (g = 0dBi).
* P = Conducted RF power to antenna (91.3 mW).
* R = Minimum allowable distance.(20 cm)

*The power density Pd = 0.01816 mW/cm^2 is less than 1 mW/cm^2 (listed MPE limit)
*The SAR evaluation is not needed (this is a desk top device, R> 20 cm)
* The EUT(antenna) must be 0.2 meters away from the General Population.

Appendix A

List of Measurement Equipment

LIST OF MEASUREMENT EQUIPMENT

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM299	DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA	ETS-LINDGREN	3115	00114120	2016/04/27	2018/04/27
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM216	MINI MAST SYSTEM	EMCO	2075	00026842	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2016/04/24	2017/04/24
EM355	BICONILOG ANTENNA	ETS-LINDGREN	3143B	00094856	2016/03/03	2018/03/03
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2016/06/01	2017/06/01
EM299	DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA	ETS-LINDGREN	3115	00114120	2016/04/27	2018/04/27
EM302	PRECISION OMNIDIRECTIONAL DIPOLE (1 – 6GHZ)	SEIBERSDORF LABORATORIES	POD 16	161806/L	2016/05/11	2018/05/11
EM303	PRECISION OMNIDIRECTIONAL DIPOLE (6 – 18GHZ)	SEIBERSDORF LABORATORIES	POD 618	6181908/L	2016/05/11	2018/05/11
EM011	ATTENNUATOR/SWITCH	H P	HP11713A	2508A10595	2015/11/16	2017/11/16
EM012	PRE-AMPLIFIER	H P	HP8449B	3008A00262	2015/11/16	2017/11/16
EM525	CABLE FOR ETS CHAMBER	SUHNER	N/A	N/A	2016/01/11	2017/01/11
EM529	MICROWAVE FREQUENCY CABLE	SUHNER	SUCOFLEX 104	238296	2016/07/22	2018/07/22

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM119	LISN	R & S	ESH3-Z5	0831.5518.52	2015/10/22	2016/10/22
EM181	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB7	100072	2016/06/01	2017/06/01
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2016/01/11	2017/01/11
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057-99A	2012/02/03	2017/02/03
N/A	MEASUREMENT AND EVALUATION SOFTWARE	ROHDE & SCHWARZ	ESIB-K1	V1.20	N/A	N/A

Remarks:-
CM Corrective Maintenance
N/A Not Applicable or Not Available
TBD To Be Determined

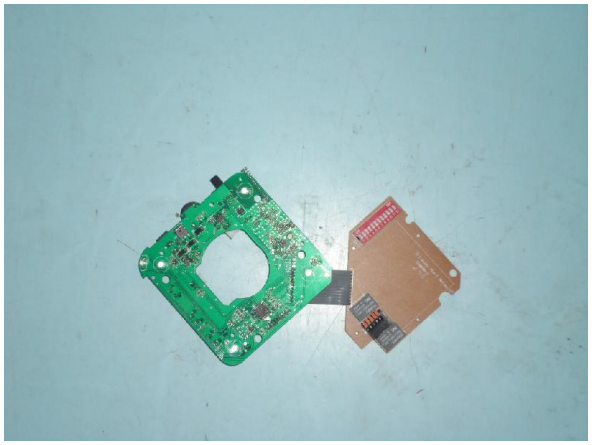
Appendix B

Photographs of EUT

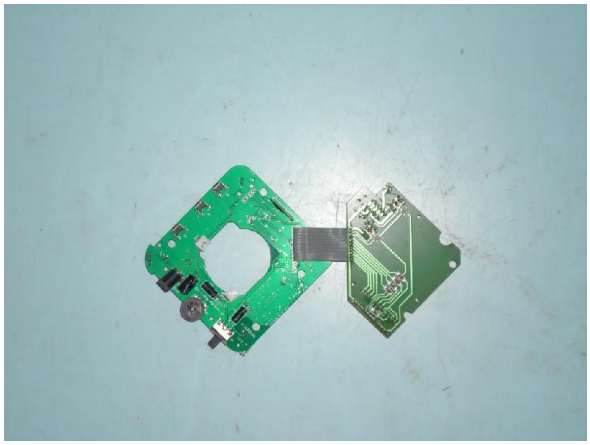
Front View of the product

Back View of the product

Inner Circuit Front View – All PCBs



Inner Circuit Back View - – All PCBs



Photographs of EUT

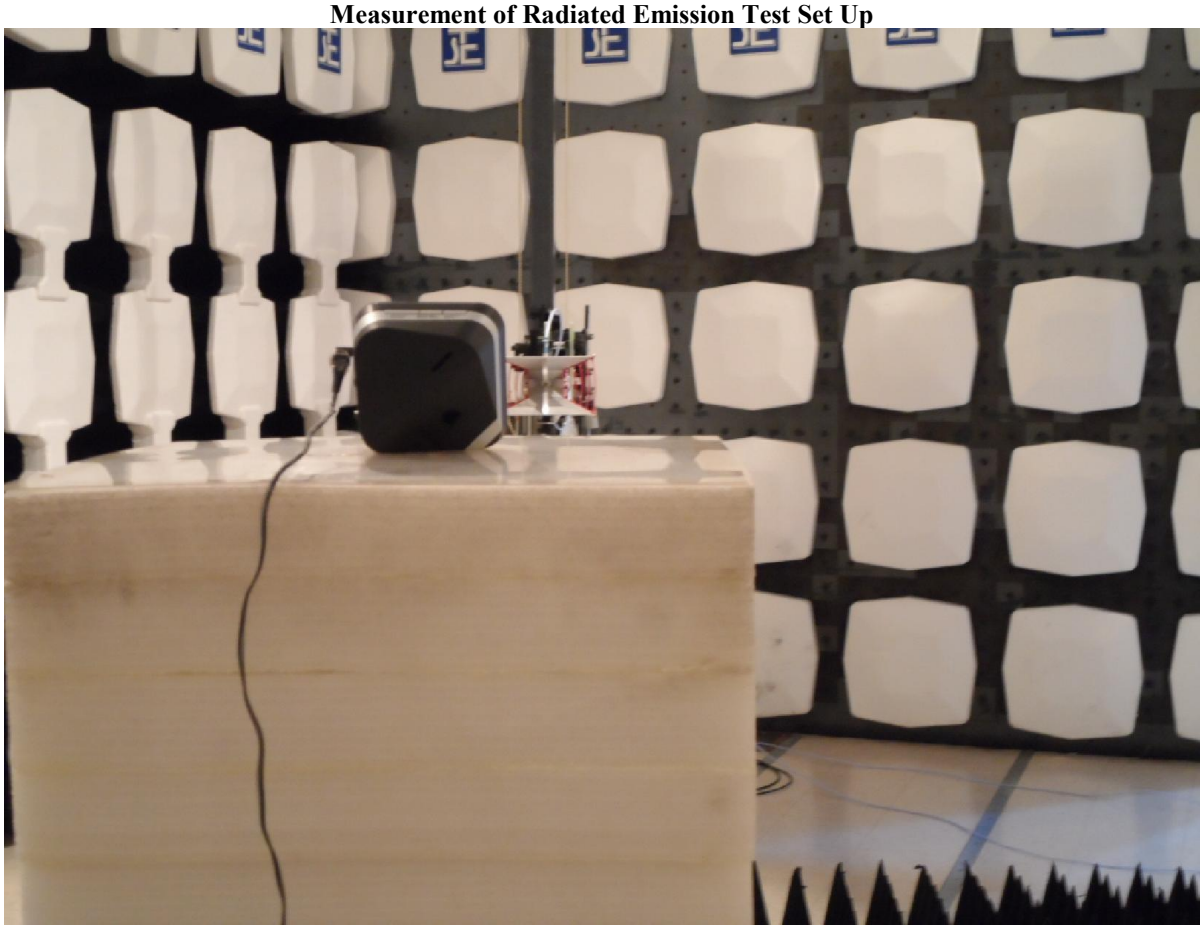
Measurement of Radiated Emission Test Set Up

Photographs of EUT

Measurement of Radiated Emission Test Set Up

Photographs of EUT

Measurement of Radiated Emission Test Set Up



Photographs of EUT

Measurement of Conducted Emission Test Set Up

******* End of Test Report *******

STC Test Report

Conditions of Issuance of Test Reports

1. All samples and goods are accepted by The Hong Kong Standards & Testing Centre Limited (the "Company") solely for testing and reporting in accordance with the following terms and conditions. The Company provides its services on the basis that such terms and conditions constitute express agreement between the Company and any person, firm or company requesting its services (the "Clients").

2. Any report issued by the Company as a result of this application for testing service (the "Report") shall be issued in confidence to the Clients and the Report will be strictly treated as such by the Company. It may not be reproduced either in its entirety or in part and it may not be used for advertising or other unauthorized purposes without the written consent of the Company. The Clients to whom the Report is issued may, however, show or send it, or a certified copy thereof prepared by the Company to his customer, supplier or other persons directly concerned. The Company will not, without the consent of the Clients, enter into any discussion or correspondence with any third party concerning the contents of the Report, unless required by the relevant governmental authorities, laws or court orders.

3. The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.

4. The Report refers only to the sample tested and does not apply to the bulk, unless the sampling has been carried out by the Company and is stated as such in the Report.

5. In the event of the improper use the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.

6. Sample submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.

7. The Company will not be liable for or accept responsibility for any loss or damage howsoever arising from the use of information contained in any of its Reports or in any communication whatsoever about its said tests or investigations.

8. Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.

9. Subject to the variable length of retention time for test data and report stored hereinto as to otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of this test report for a period of three years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after the retention period. Under no circumstances shall we be liable for damages of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.

10. Issuance records of the Report are available on the internet at www.stc-group.org. Further enquiry of validity or verification of the Reports should be addressed to the Company.