FCC - TEST REPORT

Report Number	: **68.950.11.130.01**	Date of Issue:	16 November 2011

Model	:	**XC2900-F6C**
Product Type	:	XC2900-F6C Handheld RFID Reader
Applicant	:	Invengo Information Technology Co., Ltd.
Address	:	3/F, No. T2-B, High-tech Industrial Park South, Shenzhen 518057, China
Production Facility	:	Invengo Information Technology Co., Ltd.
Address	:	Invengo RFID Industrial Park, Guangming Hi-Tech Zone, Tongguan Road, Guangming New District, Shenzhen, Guangdong 518100, PRC
Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	40

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test site1:

Company name: Jiangsu TÜV Product Service Ltd. – Shenzhen Branch
6th Floor, H Hall,
Century Craftwork Culture Square,
No. 4001, Fuqiang Road,
Futian District 518048,
Shenzhen,P.R.C.

Telephone: 86 755 8828 6998
Fax: 86 755 8828 5299

Test site2:

Company name: Shenzhen Emtek Co., Ltd.,
Bldg. 69, Majialong Industry Zone, Nanshan District,
Shenzhen, China

Telephone: 86 755 26954280
Fax: 86 755 26954282

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3 Description of the Equipment Under Test

Description of the Equipment Under Test

Product:	XC2900-F6C Handheld RFID Reader
Model no.:	XC2900-F6C
Brand Name:	Invengo
Options and accessories:	NIL
Rating:	DC 3.7V (Supplied by battery 1500mAh, or Charged by external adapter: Adaptor Model No.: FSP020-DGAA1 Adaptor Input: 100-240VAC, 50-60Hz, 1.0A Adpator Ouput: 5.0VDC, 4.0A Max)
RF Transmission Frequency:	902.75-927.25MHz
Description of the EUT:	NIL

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

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5 Summary of Test Results

Technical Requirements					
FCC Part 15 Subpart C					
Test Condition	Pages	Test Result			Test Location
		Pass	Fail	N/A	
15.207 Conducted Emission AC Power Port	8	☒	☐	☐	Test Site2
15.247 (b) (2) Conducted peak output power	12	☒	☐	☐	Test Site2
15.247(d) Band edge compliance of RF emissions	14	☒	☐	☐	Test Site2
15.247(d) Spurious RF conducted emissions	17	☒	☐	☐	Test Site2
15.247(d) 15.209 15.205 Spurious radiated emissions	21	☒	☐	☐	Test Site2
15.247(a)(1) (i) 20dB bandwidth	26	☒	☐	☐	Test Site2
15.247(a)(1) Carrier frequency separation	30	☒	☐	☐	Test Site2
15.247(a)(1)(i) Number of hopping frequencies	34	☒	☐	☐	Test Site2
15.247(a)(1)(i) Dwell Time	37	☒	☐	☐	Test Site2

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6 General Remarks

Remarks
This submittal(s) (test report) is intended for FCC ID: TQ4XC2900-F6C complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

All the configurations of the product were tested and only the worst test results are listed in the report.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date: 19 August 2011

Testing Start Date: 21 August 2011

Testing End Date: 16 November 2011

- Jiangsu TÜV Product Service Ltd. – Shenzhen Branch -

Reviewed by:	Prepared by:	Prepared by:
Paul Yu	Cookies Bu	June Xie
Assistant EMC Manager	EMC Project Engineer	EMC Test Engineer

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7 Technical Requirement

7.1 Conducted Emission

Test Method

1 The EUT was placed on a table, which is 0.8m above ground plane
2 The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3 Maximum procedure was performed to ensure EUT compliance
4 A EMI test receiver (R&S Test Receiver ESCS30) is used to test the emissions from both sides of AC line

Limit

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

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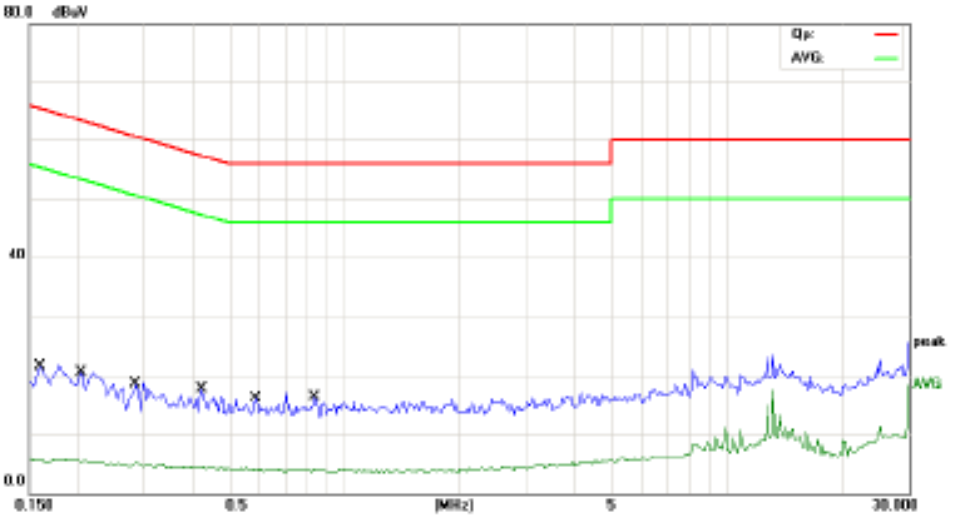
Conducted Emission



Site Conduction #1 Phase: L1 Temperature: 26
Limit: (CE)FCC PART 15 class B_QP Power: AC 120V/60Hz Humidity: 60 %
EUT: Handheld Reader
M/N: XC2900-F6C
Mode: Scan tag
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1600	21.58	0.00	21.58	65.46	-43.88	QP	
2		0.1600	5.71	0.00	5.71	55.46	-49.75	AVG	
3		0.2050	20.46	0.00	20.46	63.41	-42.95	QP	
4		0.2050	5.55	0.00	5.55	53.41	-47.86	AVG	
5		0.2850	18.48	0.00	18.48	60.67	-42.19	QP	
6		0.2850	5.18	0.00	5.18	50.67	-45.49	AVG	
7	*	0.4250	17.76	0.00	17.76	57.35	-39.59	QP	
8		0.4250	4.50	0.00	4.50	47.35	-42.85	AVG	
9		0.5916	15.67	0.00	15.67	56.00	-40.33	QP	
10		0.5916	4.13	0.00	4.13	46.00	-41.87	AVG	
11		0.8400	16.35	0.00	16.35	56.00	-39.65	QP	
12		0.8400	4.07	0.00	4.07	46.00	-41.93	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

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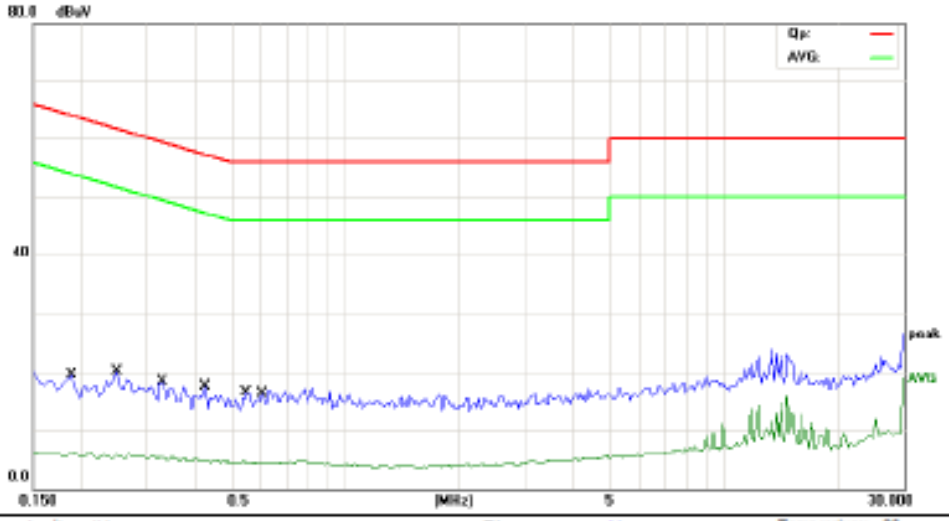
Conducted Emission



Site Conduction #1 Phase: N Temperature: 28
Limit: (CE)FCC PART 15 class B_QP Power: AC 120V/60Hz Humidity: 60 %
EUT: Handheld Reader
M/N: XC2900-F6C
Mode: Scan tag
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1904	19.23	0.00	19.23	64.02	-44.79	QP	
2		0.1904	6.18	0.00	6.18	54.02	-47.84	AVG	
3		0.2500	20.07	0.00	20.07	61.76	-41.69	QP	
4		0.2500	5.93	0.00	5.93	51.76	-45.83	AVG	
5		0.3300	18.29	0.00	18.29	59.45	-41.16	QP	
6		0.3300	5.51	0.00	5.51	49.45	-43.94	AVG	
7		0.4300	17.56	0.00	17.56	57.25	-39.69	QP	
8		0.4300	5.12	0.00	5.12	47.25	-42.13	AVG	
9	*	0.5500	16.56	0.00	16.56	56.00	-39.44	QP	
10		0.5500	4.65	0.00	4.65	46.00	-41.35	AVG	
11		0.6050	16.23	0.00	16.23	56.00	-39.77	QP	
12		0.6050	4.60	0.00	4.60	46.00	-41.40	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

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Test Equipment List

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Test Receiver	Rohde & Schwarz	ESCS30	100162	May 29, 2012
L.I.S.N.	Rohde & Schwarz	ENV216	101161	May 29, 2012
50Ω Coaxial Switch	Anritsu	MP59B	6100214550	N/A
Voltage Probe	Rohde & Schwarz	TK9416	N/A	May 29, 2012
I.S.N	Teseq GmbH	ISN T800	30327	May 29, 2012
LCL adaoter	Teseq GmbH	ADT800-Cat.5	30327.01	May 29, 2012
LCL adaoter	Teseq GmbH	ADT800-Cat.3	30327.02	May 29, 2012
LCL adaoter	Teseq GmbH	ADT800-R	30327.02	May 29, 2012

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7.2 Conducted peak output power

Test Method
1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an Power meter
3. Add a correction factor to the display.

Limits for conducted peak output power measurements

Frequency Range MHz	Limit W	Limit dBm
902-928	≤1	≤30

Conducted peak output power

Frequency MHz	Conducted Peak Output Power dBm	Result
CH1 902.75MHz	26.52	Pass
CH26 915.25MHz	26.35	Pass
CH50 927.25MHz	26.49	Pass

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Test Equipment

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL DUE DATE
RF Power Meter. Dual Channel	BOONTON	4232A	10539	May 29, 2012
50ohm Diode Power Sensor	BOONTON	51011EMC	34236/34238	May 29, 2012

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7.3 Band edge compliance of RF emissions

Test Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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.
3. Set RBW to 10kHz and VBW of spectrum analyzer to 30kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Limits

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

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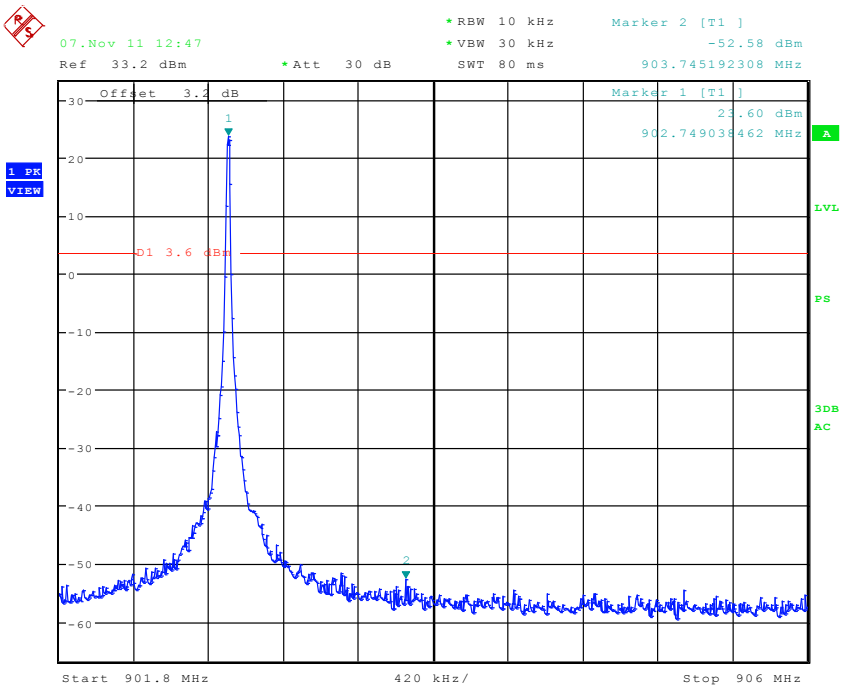
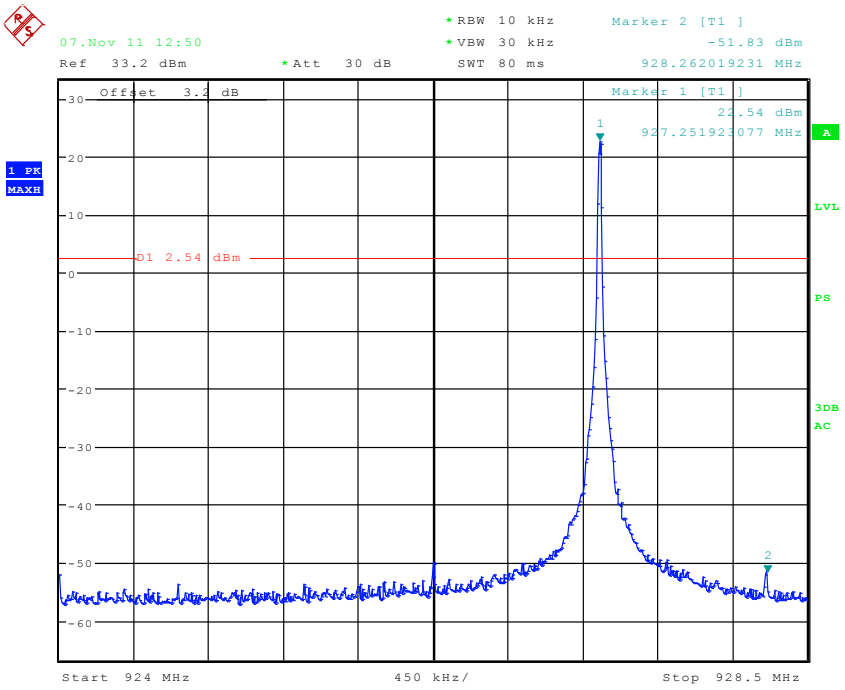
Band edge compliance of RF emissions

Lower edge Plot:



Upper edge Plot:



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Test Equipment List

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL.DUE.DATE
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	May 29, 2012

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7.4 Spurious RF conducted emissions

Test Method

1.The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.
2.Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.
3.The resolution bandwidth(RBW) and the video bandwidth (VBW) of the spectrum analyzer were respectively set to 100kHz and 300kHz.

Limit

Frequency Range MHz	Limit (dBc)
1000-25000	-20

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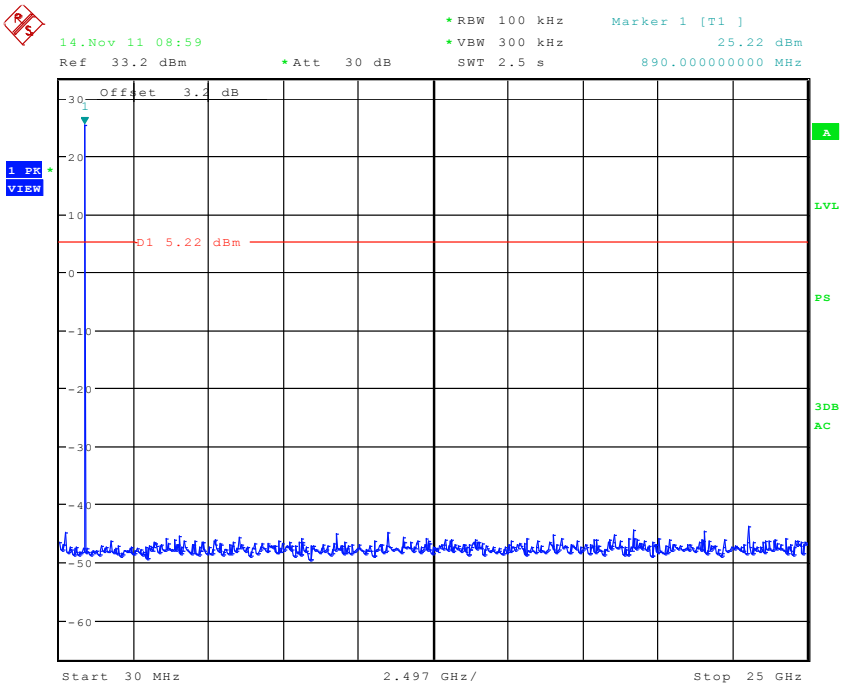
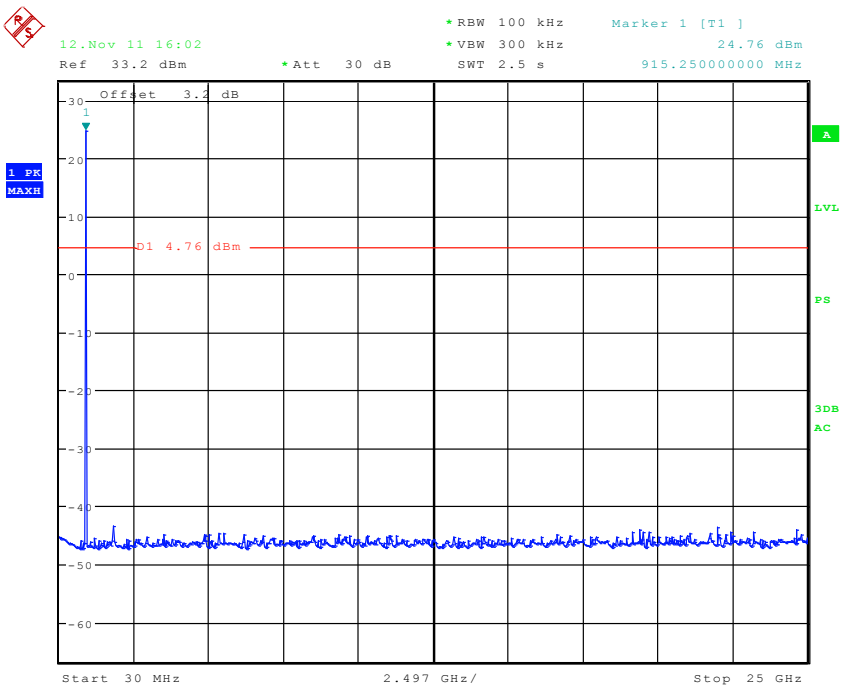
Spurious RF conducted emissions

902.75MHz



915.25MHz



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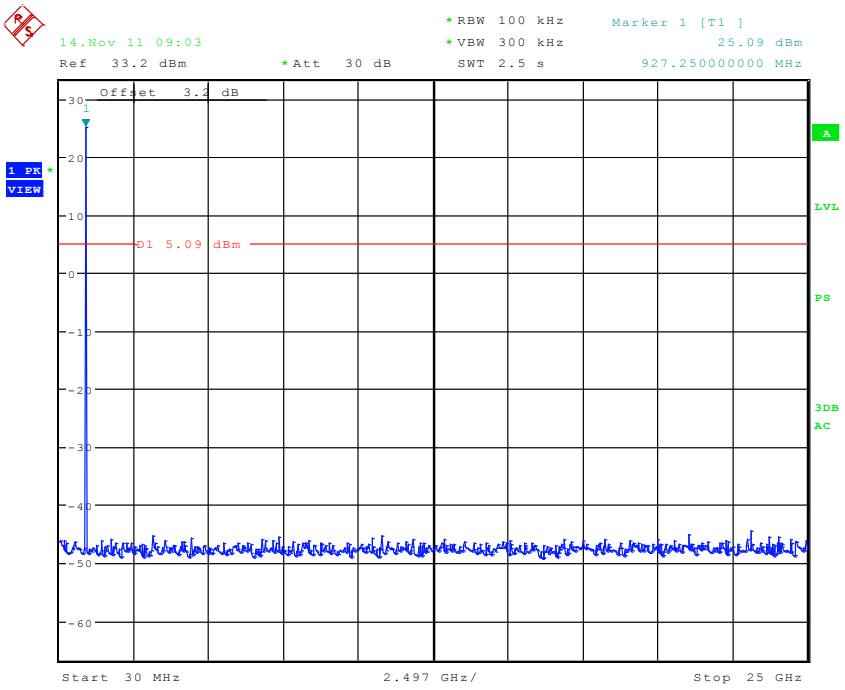
Spurious RF conducted emissions

927.25MHz



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Test Equipment List

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL.DUE.DATE
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	May 29, 2012

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7.5 Spurious radiated emissions

Test Method

1 The EUT is placed on a turntable, which is 0.8m above ground plane.
2 The turntable shall be rotated for 360 degrees to determine the position of maximum emission level
3 EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4 Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5 Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	Detector
30MHz – 1000 MHz	100 kHz	300 kHz	QP
1000 MHz – 25 GHz	1 MHz	3 MHz	PK
1000 MHz – 25 GHz	1 MHz	10 Hz	AV

Limit

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

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Radiated Emission

902.75MHz Test Result

Below 1GHz:

Frequency MHz	Correct Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
30.00	13.93	20.16	34.09	V	40.00	QP	-5.91
134.15	9.65	21.08	30.73	V	43.50	QP	-12.77
183.89	11.52	26.06	37.58	V	43.50	QP	-5.92
208.77	12.47	22.52	34.99	V	43.50	QP	-8.51
449.71	18.88	12.82	31.70	V	46.00	QP	-14.30
552.31	20.02	13.81	33.83	V	46.00	QP	-12.17
110.83	12.31	10.83	23.14	H	43.50	QP	-20.36
183.89	10.51	22.89	33.40	H	43.50	QP	-10.10
219.65	11.84	17.49	29.33	H	46.00	QP	-16.67
319.13	14.35	12.54	26.89	H	46.00	QP	-19.11
381.31	17.30	11.05	28.35	H	46.00	QP	-17.65
406.19	18.34	11.53	29.87	H	46.00	QP	-16.13

Above 1GHz:

Frequency MHz	Correct Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
1792	27.1	30.767	57.867	H	74	Peak	-16.133
1792	27.1	9.601	36.701	H	54	AVG	-17.299
2710	30.1	19.78	49.88	H	74	Peak	-24.12
2710	30.1	3.437	33.537	H	54	AVG	-20.463
3610	32.1	20.219	52.319	H	74	Peak	-21.681
3610	32.1	5.34	37.44	H	54	AVG	-16.56
1774	27.2	18.496	45.696	V	74	Peak	-28.304
1774	27.2	2.918	30.118	V	54	AVG	-23.882
2638	29.3	14.39	43.69	V	74	Peak	-30.31
2638	29.3	2.559	31.859	V	54	AVG	-22.141

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Radiated Emission

915.25MHz Test Result

Below 1GHz:

Frequency MHz	Correct Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
30.00	13.93	21.54	35.47	V	40.00	QP	-4.53
183.89	11.52	26.47	37.99	V	43.50	QP	-5.51
208.77	12.47	22.23	34.70	V	43.50	QP	-8.80
306.70	14.09	12.03	26.12	V	46.00	QP	-19.88
449.71	18.88	13.27	32.15	V	46.00	QP	-13.85
552.31	20.02	13.85	33.87	V	46.00	QP	-12.13
183.89	10.51	23.81	34.32	H	43.50	QP	-9.18
208.77	11.64	20.29	31.93	H	43.50	QP	-11.57
306.70	14.03	16.01	30.04	H	46.00	QP	-15.96
406.19	18.34	11.71	30.05	H	46.00	QP	-15.95
429.50	18.45	9.12	27.57	H	46.00	QP	-18.43
577.18	19.87	3.08	22.95	H	46.00	QP	-23.05

Above 1GHz:

Frequency MHz	Correct Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
1828	27.6	23.31	50.91	H	74	Peak	-23.09
1828	27.6	6.457	34.057	H	54	AVG	-19.943
2746	30.5	14.231	44.731	H	74	Peak	-29.269
2746	30.5	1.346	31.846	H	54	AVG	-22.154
1828	27.8	30.31	58.11	V	74	Peak	-15.89
1828	27.8	10.755	38.555	V	54	AVG	-15.445
2746	29.8	18.691	48.491	V	74	Peak	-25.509
2746	29.8	4.235	34.035	V	54	AVG	-19.965
3664	31.9	19.179	51.079	V	74	Peak	-22.921
3664	31.9	4.781	36.681	V	54	AVG	-17.319
4222	32.4	18.504	50.904	V	74	Peak	-23.096
4222	32.4	3.71	36.11	V	54	AVG	-17.89

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Radiated Emission

915.25MHz Test Result

Below 1GHz:

Frequency MHz	Correct Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
92.18	12.74	15.41	28.15	V	43.50		-15.35
134.15	9.65	21.77	31.42	V	43.50		-12.08
183.89	11.52	27.13	38.65	V	43.50		-4.85
208.77	12.47	21.97	34.44	V	43.50		-9.06
420.18	17.40	12.25	29.65	V	46.00		-16.35
552.31	20.02	13.64	33.66	V	46.00		-12.34
121.71	10.89	15.50	26.39	H	43.50		-17.11
183.89	10.51	24.29	34.80	H	43.50		-8.70
208.77	11.64	20.25	31.89	H	43.50		-11.61
306.70	14.03	17.33	31.36	H	46.00		-14.64
406.19	18.34	11.88	30.22	H	46.00		-15.78
552.31	20.02	6.81	26.83	H	46.00		-19.17

Above 1GHz:

Frequency MHz	Correct Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
1846	27.8	40.046	67.846	H	74	Peak	-6.154
1846	27.8	21.087	48.887	H	54	AVG	-5.113
2782	30.6	36.556	67.156	H	74	Peak	-6.844
2782	30.6	17.719	48.319	H	54	AVG	-5.681
3700	32.2	19.277	51.477	V	74	Peak	-22.523
3700	32.2	4.795	36.995	V	54	AVG	-17.005
1846	28.2	28.809	57.009	V	74	Peak	-16.991
1846	28.2	11.079	39.279	V	54	AVG	-14.721
2782	30	18.157	48.157	V	74	Peak	-25.843
2782	30	7.711	37.711	V	54	AVG	-16.289
3700	31.9	20.522	52.422	V	74	Peak	-21.578
3700	31.9	5.281	37.181	V	54	AVG	-16.819

Remark:

(1) Emission Level= Correct Factor + Reading

(2) Correct Factor= Cable Loss(include amplifier factor) + Antenna Factor

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Test Equipment List

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	May 29, 2012
Pre-Amplifier	HP	8447D	2944A07999	May 29, 2012
Bilog Antenna	Schwarzbeck	VULB9163	142	May 29, 2012
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170399	May 29, 2012
Horn Antenna	Schwarzbeck	BBHA 9120	D143	May 29, 2012
Cable	Schwarzbeck	AK9513	ACRX1	May 29, 2012
Cable	Rosenberger	N/A	FP2RX2	May 29, 2012
Cable	Schwarzbeck	AK9513	CRPX1	May 29, 2012
Cable	Schwarzbeck	AK9513	CRRX2	May 29, 2012
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	May 29, 2012

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7.6 20 dB bandwidth

Test Method

1 Place the EUT on the table and set it in the transmitting mode.
2 Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3 Mark the peak frequency and –20dB (upper and lower) frequency.

Limit

Limit [kHz]
≤500

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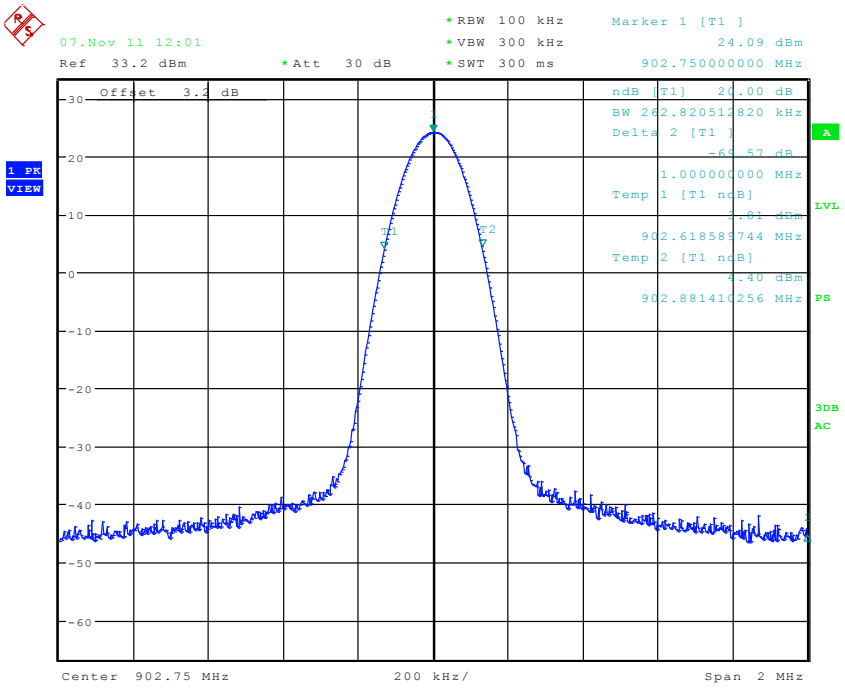
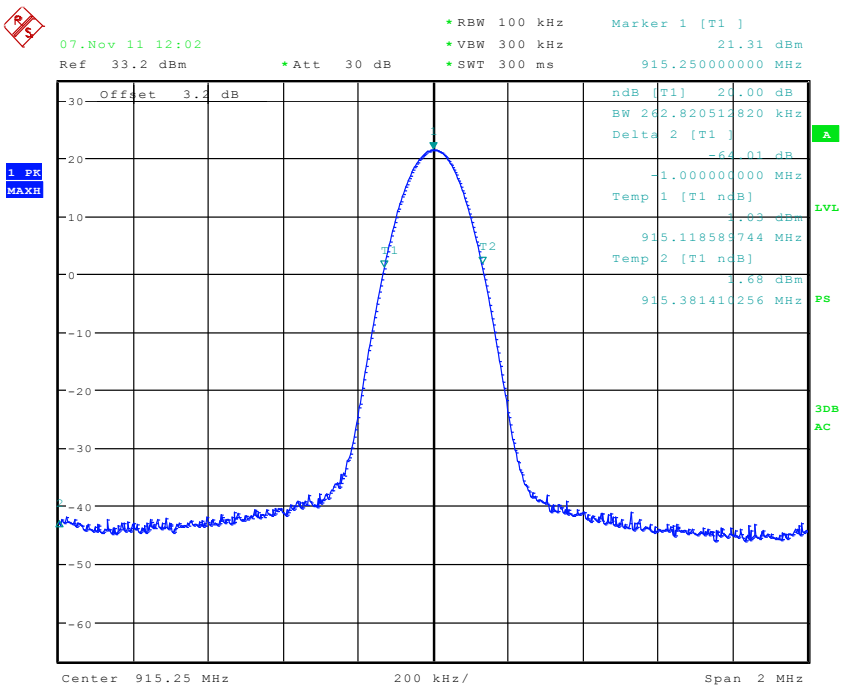
20 dB bandwidth

Test result:

Frequency MHz	Bandwidth kHz	Result
902.75	262.82	Pass
915.25	262.82	Pass
927.25	262.82	Pass





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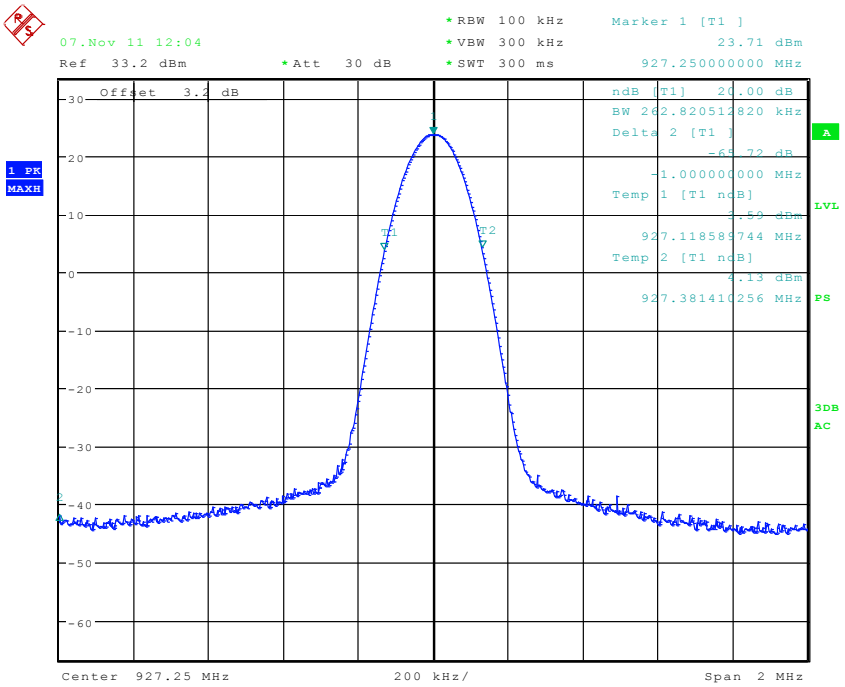
20 dB bandwidth



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Test Equipment

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7.7 Carrier Frequency Separation

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
RBW: 100KHz; VBW: 300KHz; SPAN:2MHz
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer Marker function.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit kHz
⩾25KHz or 20 dB bandwidth which is greater

Limit

Frequency MHz	20 dB Bandwidth kHz
902.75	262.82
915.25	262.82
927.25	262.82

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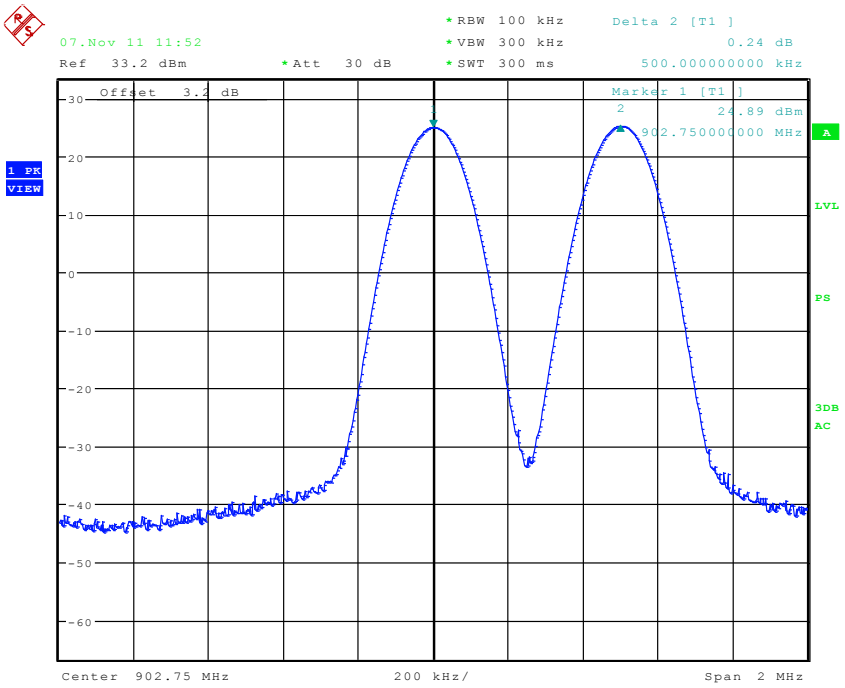
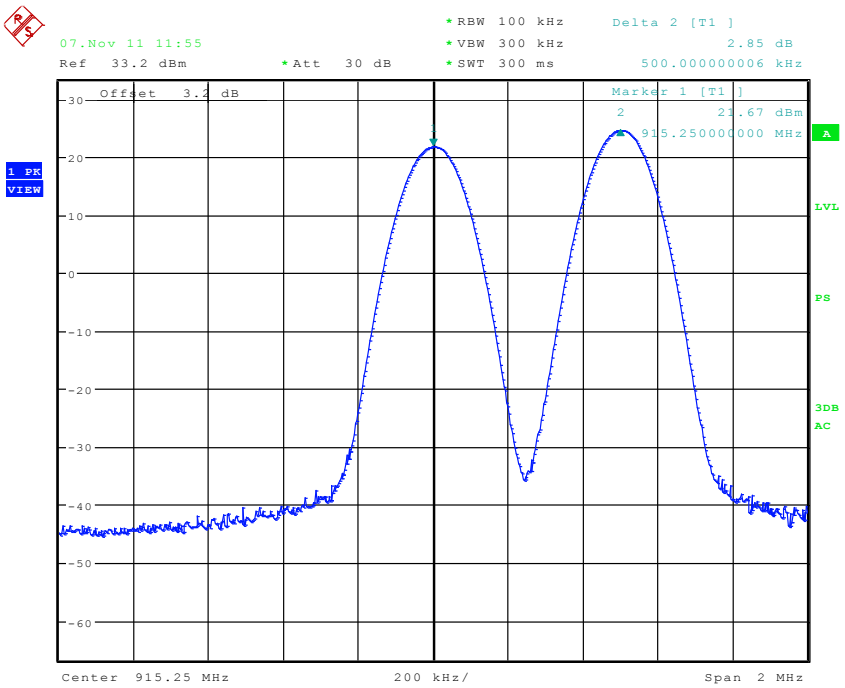
Carrier Frequency Separation

test result

Frequency MHz	Carrier Frequency Separation kHz	Result
2402	500	Pass
2441	500	Pass
2480	500	Pass





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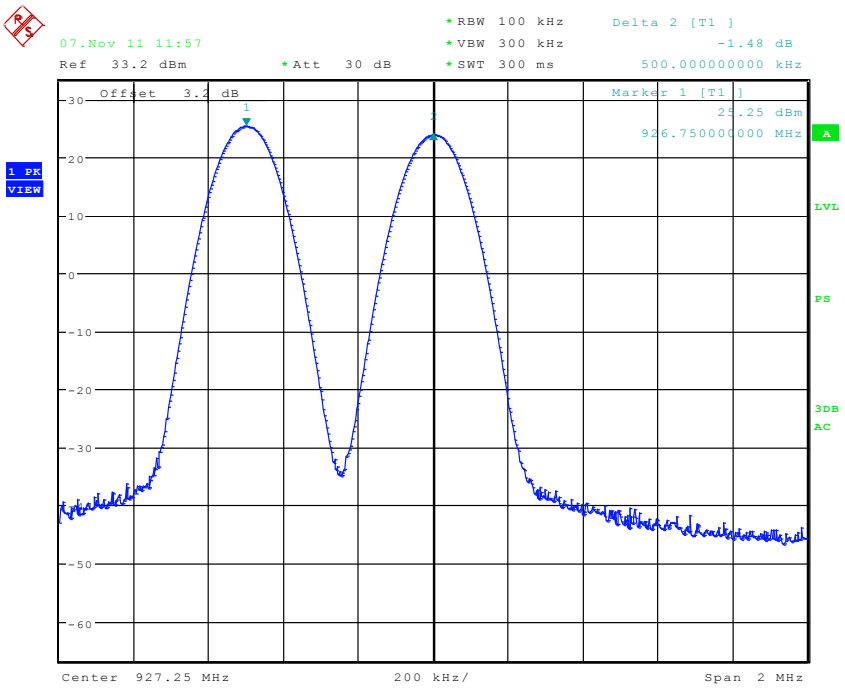
Carrier Frequency Separation



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Test Equipment

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL.DUE.DATE
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	May 29, 2012

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7.8 Number of hopping frequencies

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
RBW: 100KHz; VBW: 300KHz
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
3. Repeat above procedures until all frequencies measured were complete.

Limit

According to 15.247(a)(1)(i), 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.

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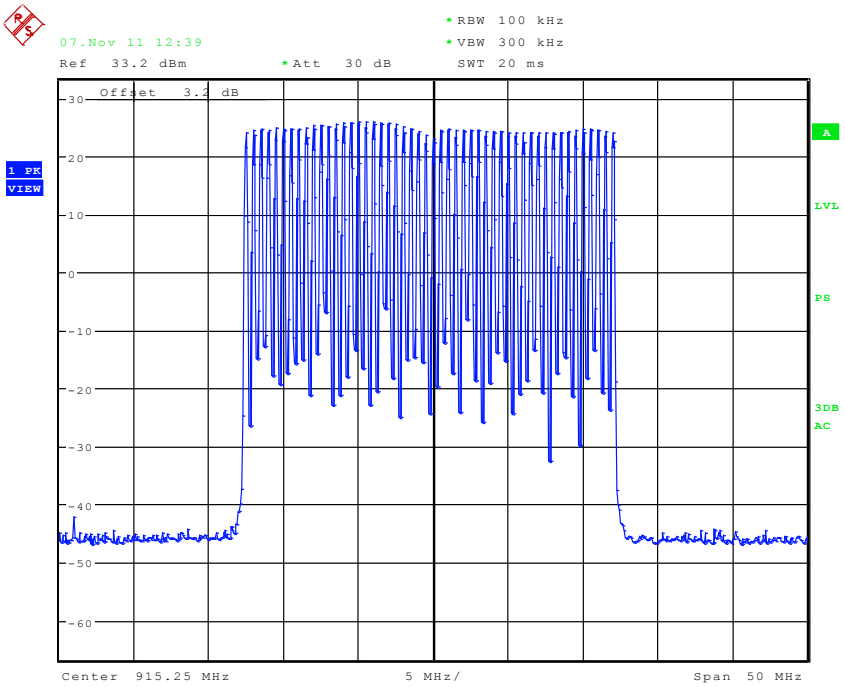
Number of hopping frequencies

Test result:

Number of hopping frequencies	Limit	Result
50	≥25	Pass



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Test Equipment

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7.9 Dwell Time

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
2. Adjust the center frequency of spectrum analyzer on any frequency be measured.
3. Measure the Dwell Time by spectrum analyzer Marker function.
4. Repeat above procedures until all frequencies measured were complete.

Limit

According to 15.247(a)(1)(i), 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.

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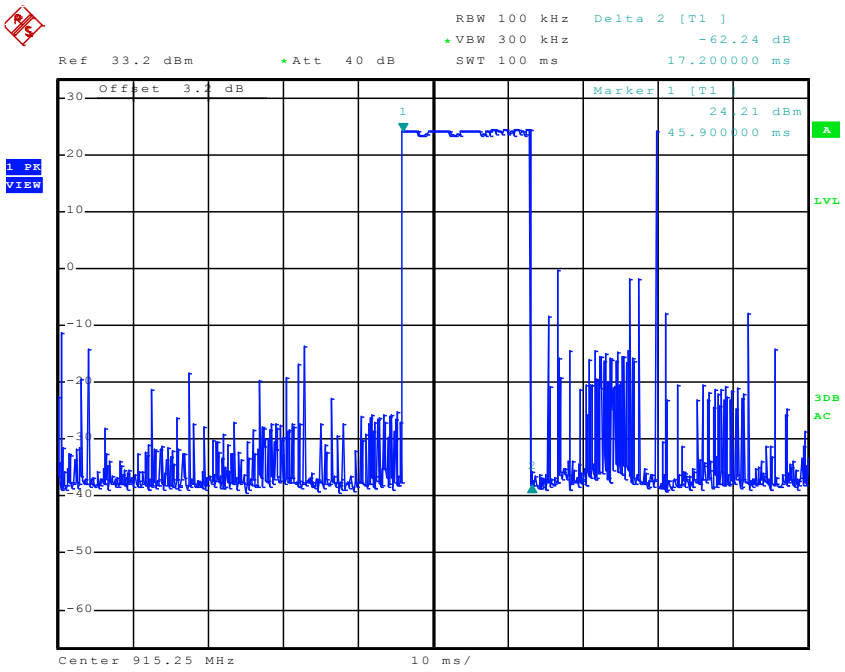
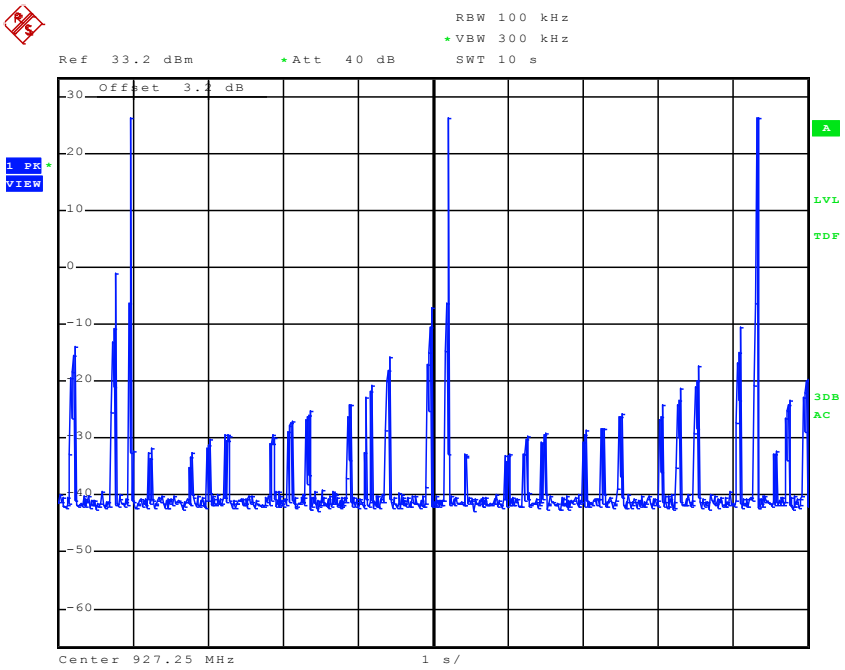
Dwell Time

Dwell time

time slot= 3(times)* 17.2(ms) = 51.6 (ms)< 0.4S





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8 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty

Items		Extended Uncertainty
RE	Field strength (dBμV/m)	U=4.32dB (30MHz-25GHz)
CE	Disturbance Voltage (dBμV)	U=2.4dB

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