



TEST REPORT

Date: 2014-07-04

Report No.: 60.870.14.008.03F

Applicant: Sensitech Inc.
800 Cummings Ctr, Suite 258X Beverly, MA 01915-6197,
USA

Description of Samples: Model name: TempTale RF² Repeater, RF Signal Repeater
Brand name: Sensitech
Model no.: TempTale RF² Repeater
FCCID: SRMT11012295

Date Samples Received: 2014-06-10

Date Tested: 2014-06-12 to 2014-06-30

Investigation Requested: FCC Part 15 Subpart C, Section 15.249

Conclusions: 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.

Remarks: ----

Checked by:

Approved by:-

Ray Cheung
Project Engineer
Wireless & Telecom department

Jeff Pong
Operation Manager
Wireless & Telecom department



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1.0 General Details

1.1 Test Laboratory

Attestation of Global Compliance Co., Ltd
1&2F, No. 2 Building, Huafeng No.1 Industrial Park, Gushu
Community Xixiang Street, Bao'an District, Shenzhen,
China
Registration Number: 259865

Tested by:

A handwritten signature in blue ink that reads 'John Zhi'.

John Zhi

**1.2 Applicant Details
Applicant**

Sensitech INC.
800 Cummings Ctr, Suite 258X Beverly, MA
01915-6197, USA.

Manufacturer

Team Precision Public Company Limited.
198 Moo 13 Suwansorn Rd., Dong-Khee-Lek
Muang Prachinburi Thailand.



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1.3 Equipment Under Test [EUT]

Description of EUT

Model Name:	TempTale RF ² Repeater, RF Signal Repeater
Brand Name:	Sensitech
Model Number:	TempTale RF ² Repeater
FCCID:	SRMT11012295
Rating:	DC12.0V, 0.2A powered by AC/DC power adaptor
Antenna Type:	Integral
Antenna Gain:	1.9 dBi (921.5MHz to 924.5 MHz) 3.0 dBi (2442 MHz to 2454 MHz)
Operated Frequency:	921.5MHz to 924.5 MHz 2442 MHz to 2454 MHz
No. of Channel:	3 (923 MHz, 924 MHz and 924.5 MHz) 6 (2442 MHz, 2443 MHz, 2444 MHz, 2445 MHz, 2446 MHz and 2454 MHz)
Accessories and Auxiliary Equipment:	ThinkPad Notebook
EUT Exercising Software:	None

General Operation of EUT

The Equipment Under Test (EUT) is a Repeater of RF Temperature System operated at 921.5 MHz to 924.5 MHz which communicate with RF Temperature Sensor and 2442 MHz to 2454 MHz which communicate with the Gateway.

1.4 Equipment Modification

No modification was made to the tested unit by TÜV SÜD Hong Kong Ltd.

1.5 Related Submittal(s) Grants

This is a single application of certification for this transmitter.



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2.0 Technical Details

2.1 Investigations Requested

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2012 and ANSI C63.4: 2009.

2.2 Test Standards and Results Summary Tables

EMISSION Results Summary				
Test Condition	FCC Test Requirement	Test Result		
		Pass	Failed	N/A
Field Strength of Fundamental and Harmonics	Part 15.249 (a),(e)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spurious Radiated Emission	Part 15.249 (d) Part 15.209 Part 15.205	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Out of Band Emissions	Part 15.249 (d)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bandwidth Measurement	Part 15.215 (c)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conducted Emission	Part 15.207	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Note: N/A - Not Applicable

3.0 Test Methodology

3.1 Radiated Emission

The sample was placed 0.8m above the ground plane on a standard emission test site *. 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, rotated about all 3 axis (X, Y & Z) and 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.

3.2 Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

$$FS = R + \text{System Factor}$$
$$\text{System Factor} = AF + CF + FA - PA$$

Where FS = Net Field Strength in dBuV/m at 3 meters.

R = Reading of Spectrum Analyzer / Test Receiver in dBuV.

AF = Antenna Factor in dB.

CF = Cable Attenuation Factor in dB.

FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

3.3 Conducted Emissions

The EUT was placed on a non-metallic table 0.8m above the horizontal metal reference place and 0.4m from a vertical ground plane which is connected to the horizontal metal ground plane. Meanwhile, the AC main of EUT was connected to the distance of 0.8m line impedance stabilization network (LISN) during measurement.

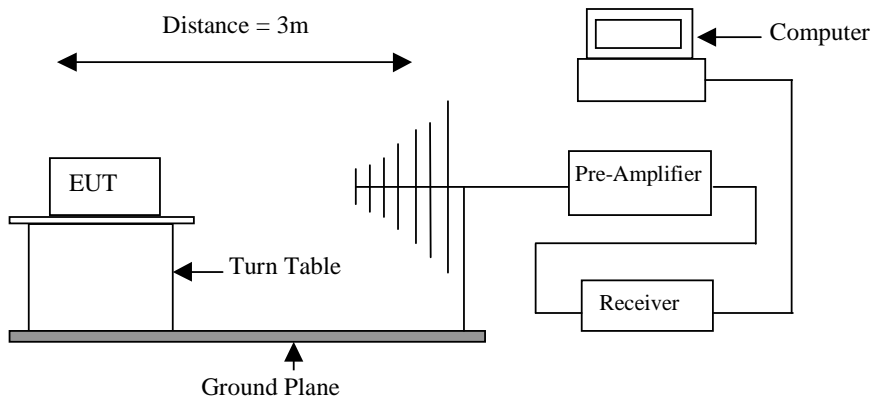
Initial measurements were performed in quasi-peak and average detection modes by the test receiver, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

4.0 Test Results

4.1 Field Strength of Fundamental and Harmonics

Test Requirement:	FCC part 15 section 15.249(a)(e)
Test Method:	ANSI C63.4:2009
Test Date:	2014-06-30
Mode of Operation:	Transmitting mode.
Detector Function:	Quasi-peak (Below 1000 MHz) Average and Peak (Above 1000 MHz)
Measurement BW:	120 kHz (Below 1000 MHz) 1 MHz (Above 1000 MHz)

Test Setup:



Results: PASS

Field Strength of Fundamental and Harmonics									
Antenna Port	Value	Emissions Frequency MHz	E-Field Polarity	Reading dB μ V/m	System Factor dB	Field Strength at 3m dB μ V/m	Limit dB μ V/m	Delta to Limit dB μ V/m	Remarks
J1	QP	923.00	H	46.30	27.50	73.80	94.00	-20.20	Fund.
	QP		V	55.80		83.30		-10.70	
J1	QP	924.00	H	49.20	27.50	76.70	94.00	-17.30	Fund.
	QP		V	59.20		86.70		-7.30	
J2	QP	924.50	H	54.00	27.50	81.50	94.00	-12.50	Fund.
	QP		V	64.00		91.50		-2.50	
J2	PK	1849.00	H	46.20	-3.30	42.90	74.00	-31.10	Harmonic
	PK		V	50.00		46.70		-27.30	

Field Strength of Fundamental and Harmonics									
Antenna Port	Value	Emissions Frequency MHz	E-Field Polarity	Reading dB μ V/m	System Factor dB	Field Strength at 3m dB μ V/m	Limit dB μ V/m	Delta to Limit dB μ V/m	Remarks
J2	PK	2442.00	H	95.90	0.20	96.10	114.00	-17.90	Fund.
	AV			90.47		90.67		-3.33	
	PK		V	85.70		85.90	-28.10		
				AV		79.90	80.10	-13.90	
J2	PK	2444.00	H	98.90	0.20	99.10	114.00	-14.90	Fund.
	AV			90.04		90.24		-3.76	
	PK		V	85.50		85.70	-28.30		
				AV		78.40	78.60	-15.40	
J2	PK	2446.00	H	94.10	0.20	94.30	114.00	-19.70	Fund.
	AV			90.16		90.36		-3.64	
	PK		V	85.10		85.30	-28.70		
				AV		80.70	80.90	-13.10	
J1	PK	2454.00	H	94.10	0.20	94.30	114.00	-19.70	Fund.
	AV			81.60		81.80		-12.20	
	PK		V	83.90		84.10	-29.90		
				AV		78.60	78.80	-15.20	
J1	PK	4908.00	H	66.40	9.10	66.40	74.00	-7.60	Harmonic
	PK		V	51.80		51.80		-22.20	

Remark : - (*) Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).
 - All emission more than 20 below the limit which does not be mentioned in the report
 - Calculated measurement uncertainty: ± 5.0 dB

Limits of Field Strength for Fundamental and Harmonics Frequency [Section 15.249 (a)]:

Fundamental Frequency [MHz]	Field Strength of Fundamental		Field Strength of Harmonics	
	[mV/m]	[dB μ V/m]	[μ V/m]	[dB μ V/m]
902 – 928	50	94	500	54
2400 – 2483.5	50	94	500	54

Compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

Limit Requirement under Section 15.249 (e) :

According to section 15.249 (e), for frequencies above 1000MHz, the above field strength limits is based on average limits. 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.

Limit for Radiated Emission [Section 15.209]:

Frequency (MHz)	Field Strength [μ V/m]	Field Strength [dB μ V/m]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

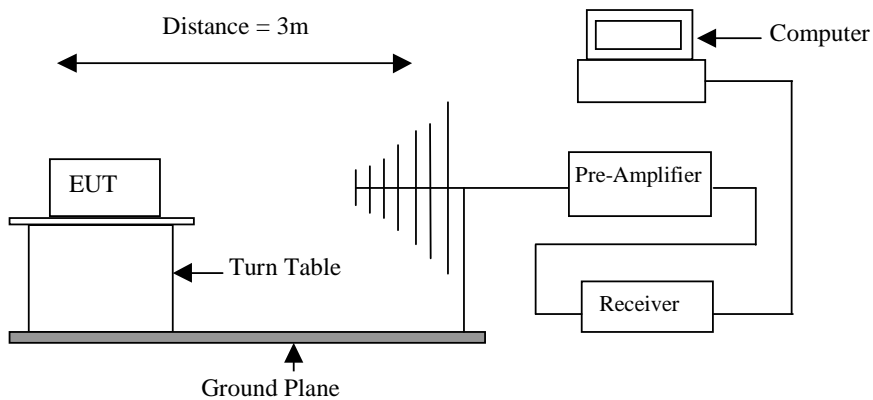
Radiated emissions, which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209.

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.

4.2 Spurious Radiated Emission

Test Requirement:	FCC part 15 section 15.249(d),15.209
Test Method:	ANSI C63.4:2009
Test Date:	2014-06-30
Mode of Operation:	Transmitting Mode
Detector Function:	Quasi-peak (Below 1000 MHz) Average and Peak (Above 1000 MHz)
Measurement BW:	120 kHz (Below 1000 MHz) 1 MHz (Above 1000 MHz)

Test Setup:





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Results: PASS

Transmitter Range: 921.5MHz to 924.5 MHz

Spurious Radiated Emissions							
Frequency MHz	Polarity	Reading dBuV	Factor dB/m	Measurement dBuV/m	Limit dBmV/m	Margin dB	Detector
37.760	V	12.8	21.2	34.0	40.0	-6.0	QP
82.380	V	27.4	9.7	37.1	40.0	-2.9	QP
119.240	V	18.6	12.5	31.1	43.5	-12.4	QP
130.880	V	18.4	14.2	32.6	43.5	-10.9	QP
179.380	V	18.3	13.8	32.1	43.5	-11.4	QP
239.520	V	18.6	13.5	32.1	46.0	-13.9	QP
350.100	V	12.7	18.4	31.1	46.0	-14.9	QP
377.260	V	18.2	18.2	36.4	46.0	-9.6	QP
433.520	V	12.1	19.5	31.6	46.0	-14.4	QP
458.740	V	12.3	20.0	32.3	46.0	-13.7	QP
596.480	V	10.2	23.0	33.2	46.0	-12.8	QP
37.760	H	9.8	21.2	31.0	40.0	-9.0	QP
70.740	H	24.3	10.3	34.6	40.0	-5.4	QP
95.960	H	30.4	9.6	40.0	43.5	-3.5	QP
130.880	H	24.5	14.2	38.7	43.5	-4.8	QP
142.520	H	26.1	14.9	41.0	43.5	-2.5	QP
156.100	H	24.6	15.2	39.8	43.5	-3.7	QP
167.740	H	23.1	14.9	38.0	43.5	-5.5	QP
175.500	H	24.7	14.4	39.1	43.5	-4.4	QP
191.020	H	24.6	12.8	37.4	43.5	-6.1	QP
334.580	H	21.2	17.5	38.7	46.0	-7.3	QP
377.260	H	22.5	18.2	40.7	46.0	-5.3	QP

Transmitter Range: 2442 MHz to 2454 MHz

Spurious Radiated Emissions							
Frequency MHz	Polarity	Reading dBuV	Factor dB/m	Measurement dBuV/m	Limit dBmV/m	Margin dB	Detector
95.960	H	30.3	9.6	39.9	43.5	-3.6	QP
142.520	H	26.0	14.9	40.9	43.5	-2.6	QP
154.160	H	25.1	15.2	40.3	43.5	-3.2	QP
175.500	H	26.2	14.4	40.6	43.5	-2.9	QP
179.380	H	26.3	13.8	40.1	43.5	-3.4	QP
191.020	H	26.5	12.8	39.3	43.5	-4.2	QP
37.760	V	12.8	21.2	34.0	40.0	-6.0	QP
82.380	V	26.5	9.7	36.2	40.0	-3.8	QP
130.880	V	18.5	14.2	32.7	43.5	-10.8	QP
179.380	V	19.2	13.8	33.0	43.5	-10.5	QP
377.260	V	19.1	18.2	37.3	46.0	-8.7	QP
897.180	V	9.8	27.7	37.5	46.0	-8.5	QP



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- Note:
- No further spurious emissions found between 30MHz and lowest internal used / generated frequency.
 - The result shown the worst case of the operating frequency.
 - All emission more than 20 below the limit which does not be mentioned in the report.
 - Result data graph is shown at the next pages for reference.

- Remark :
- (*) Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).
 - Calculated measurement uncertainty: ± 5.0 dB.

Limit of Outside of the Specified Bands [Section 15.249 (d)]

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lesser attenuation

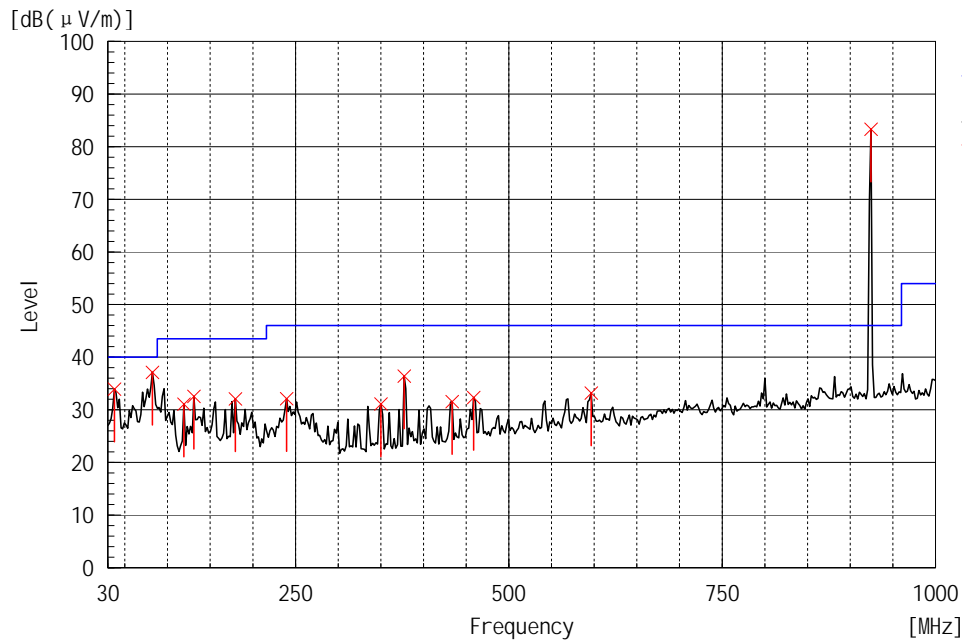
Limit for Radiated Emission [Section 15.209]:

Frequency (MHz)	Field Strength [μ V/m]	Field Strength [dB μ V/m]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

Radiated emissions, which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209.

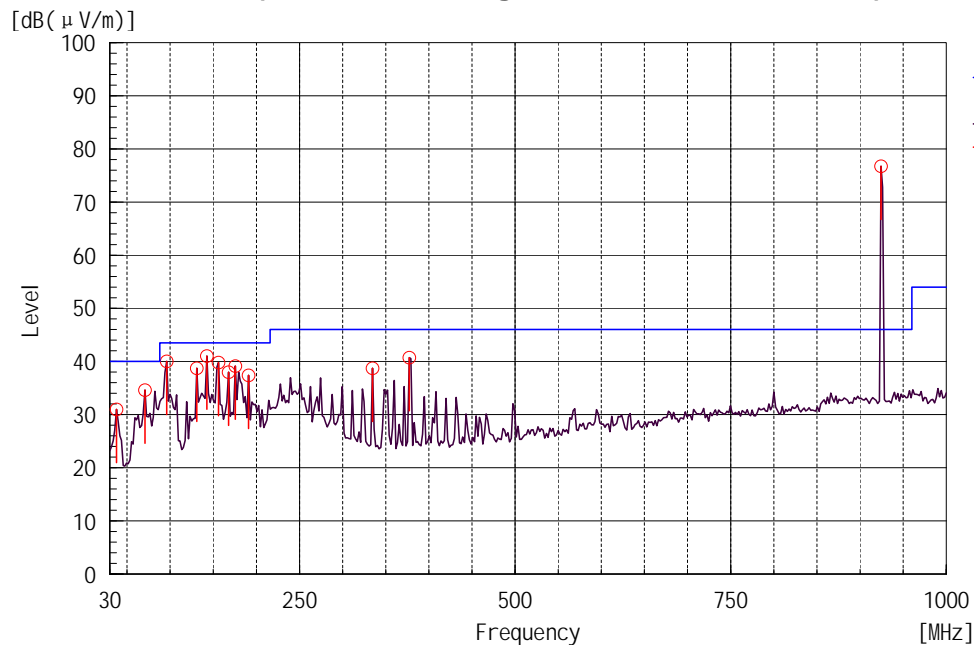
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Vertical (Transmitter Range 921.5 MHz to 924.5 MHz)



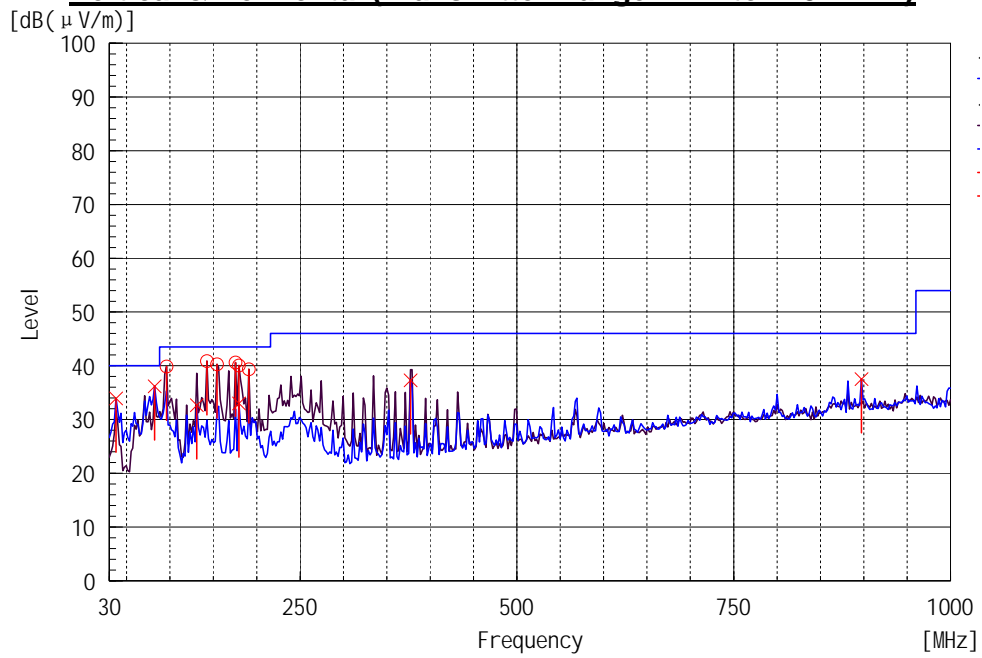
Remark: No significant emissions were detected above 1 GHz except the related operating frequency.

Horizontal (Transmitter Range 921.5 MHz to 924.5 MHz)



Remark: No significant emissions were detected above 1 GHz except the related operating frequency.

Vertical & Horizontal (Transmitter Range 2442 to 2454 MHz)



Remark: No significant emissions were detected above 1 GHz except the related operating frequency.



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4.3 Out of Band Emissions

Test Requirement:	FCC part 15 section 15.249 (d)
Test Method:	ANSI C63.4:2009
Test Date:	2014-06-30
Mode of Operation:	Transmitting mode.
Detector Function:	Peak

Results: PASS

Refer to the data graph, the lower and higher edge of the specified frequency bands fulfill the general radiated emission limits in section 15.209. Therefore, the EUT meets the requirement of section 15.249 (d).

Limit for Out of Band Emissions [Section 15.249 (d)]

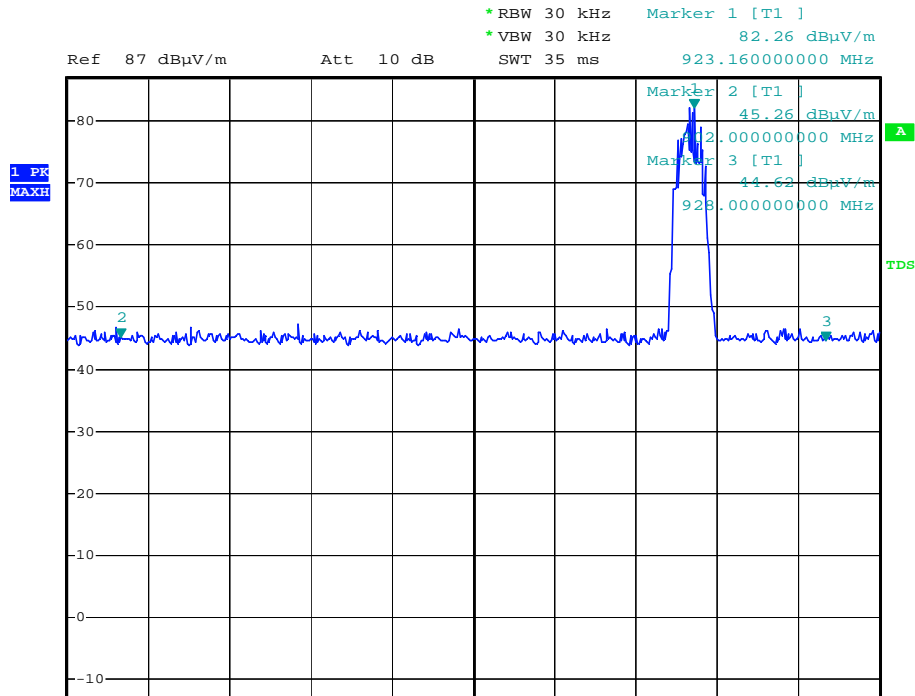
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lesser attenuation.

Test Result: Result data graph is shown at the next pages for reference.

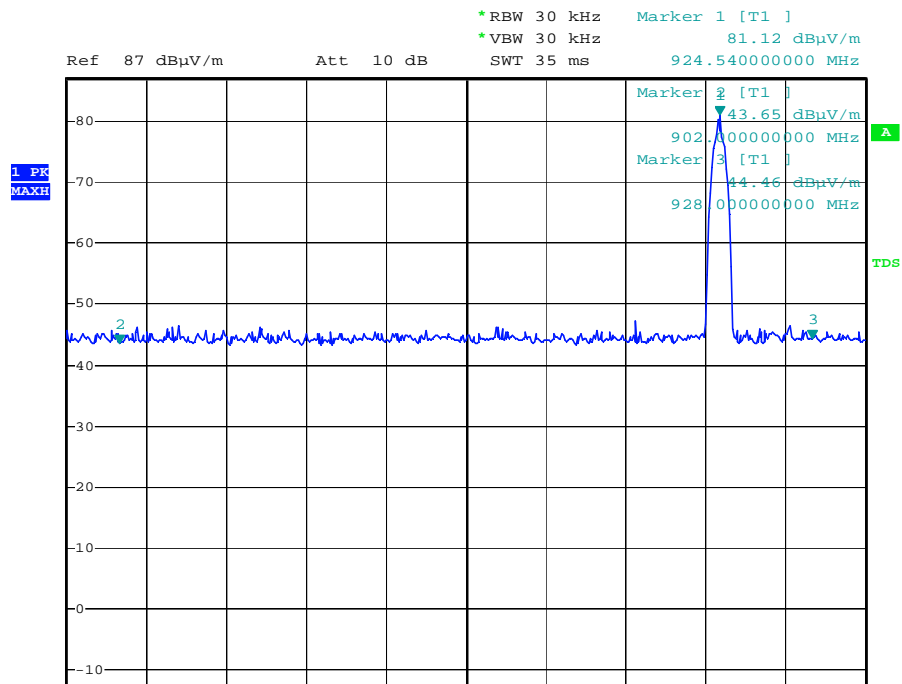


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Lowest Channel (902 – 928 MHz Range)

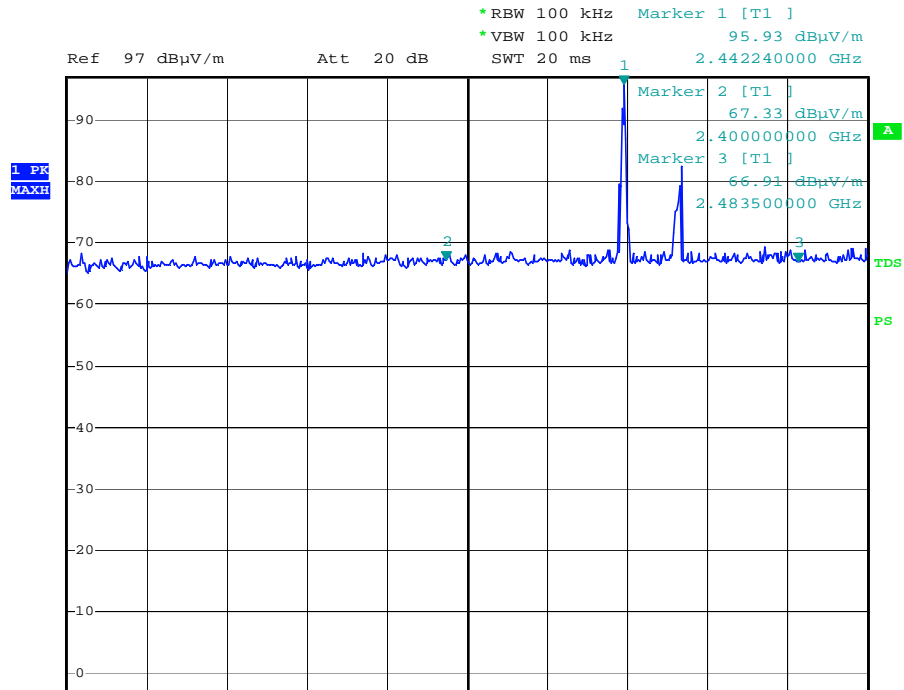


Highest Channel (902 – 928 MHz Range)

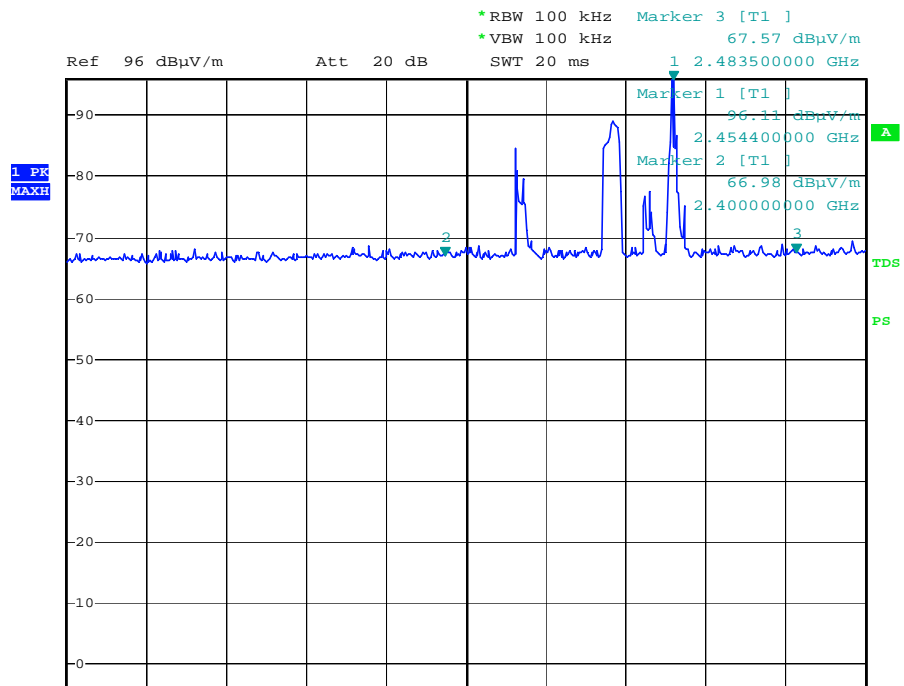




Lowest Channel (2400 – 2483.5 MHz Range)



Highest Channel (2400 – 2483.5 MHz Range)





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4.4 Bandwidth Measurement

Test Requirement:	FCC part 15 section 15.215 (c)
Test Method:	ANSI C63.4:2009
Test Date:	2014-06-30
Mode of Operation:	Transmitting mode.
Detector Function:	Peak

Results: PASS

Refer to the data graph, the 20dB points of Low Channel, Mid Channel and High Channel. All channels within the operation bandwidth when equipment is operated. Therefore, the EUT meets the requirement of section 15.215(c).

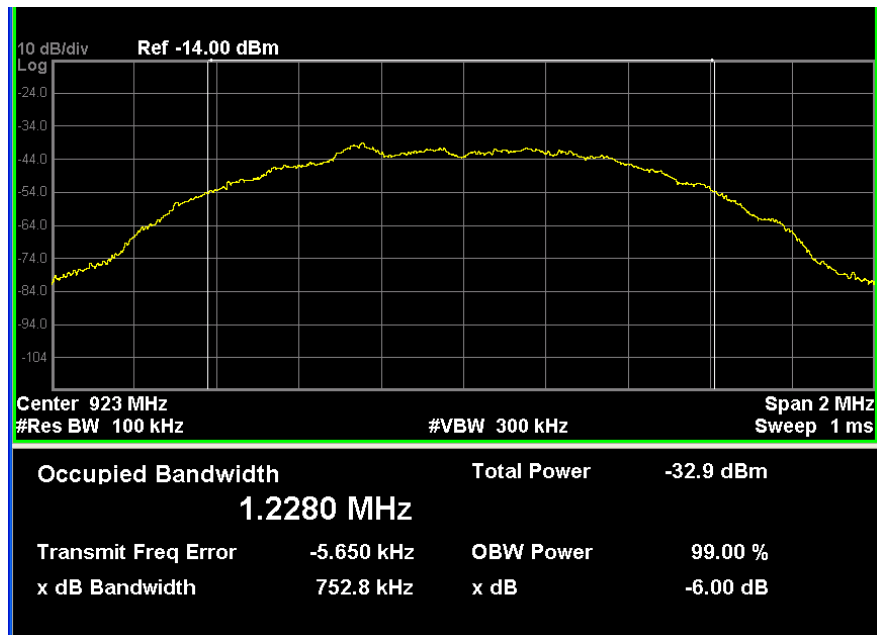
Limit for Bandwidth [Section 15.215 (c)]

The 20dB bandwidth of the emission shall be within the frequency band designated in the rule section under which the equipment is operated.

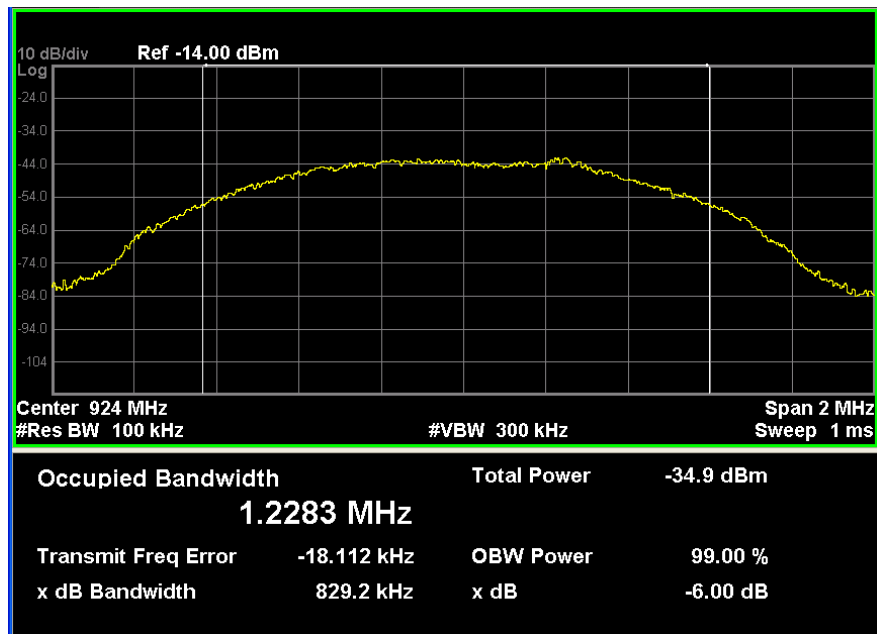
Test Result: Result data graph is shown at the next pages for reference.



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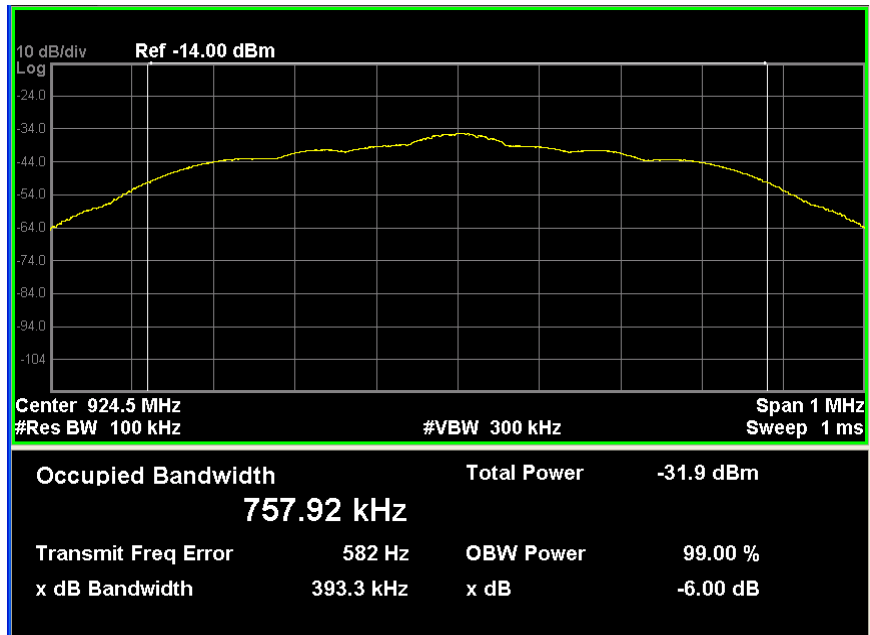
Low Channel – Bandwidth 1.228MHz



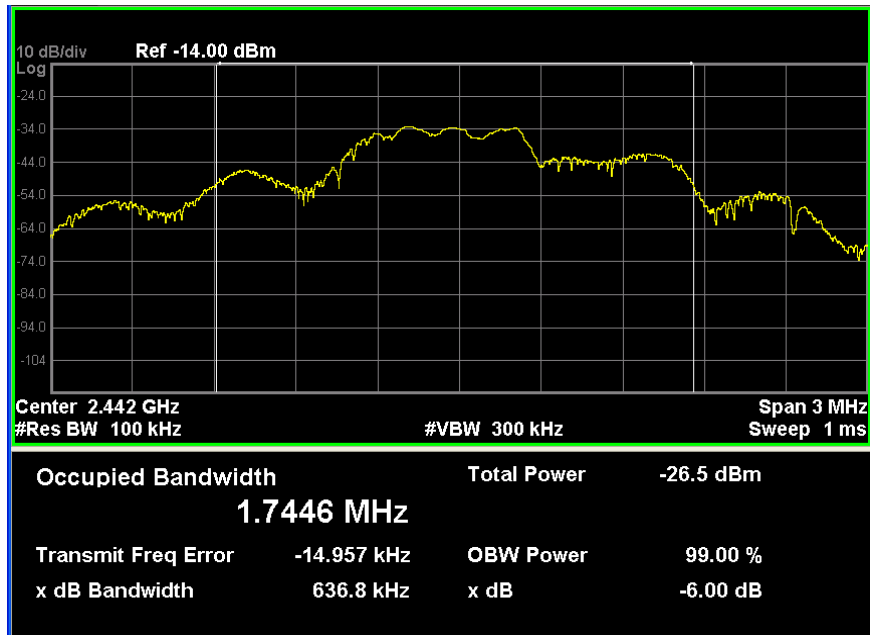
Mid Channel – Bandwidth 1.2283MHz



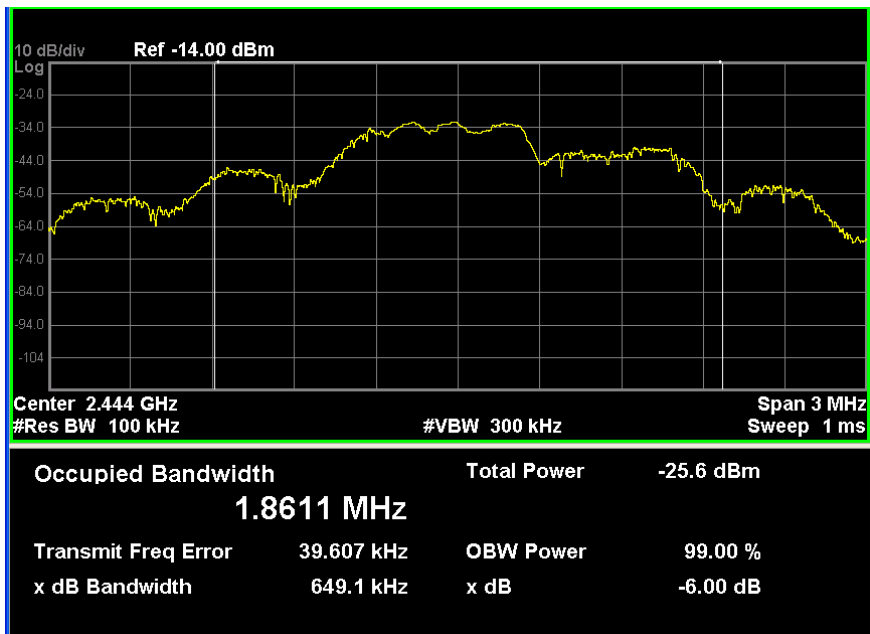
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High Channel – Bandwidth 757.92 kHz



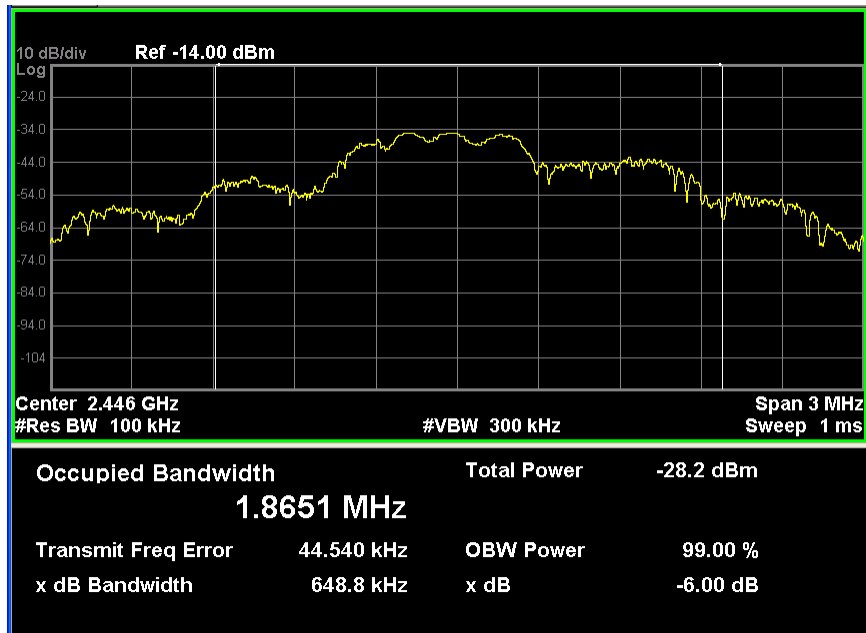
Low Channel – Bandwidth 1.7226MHz



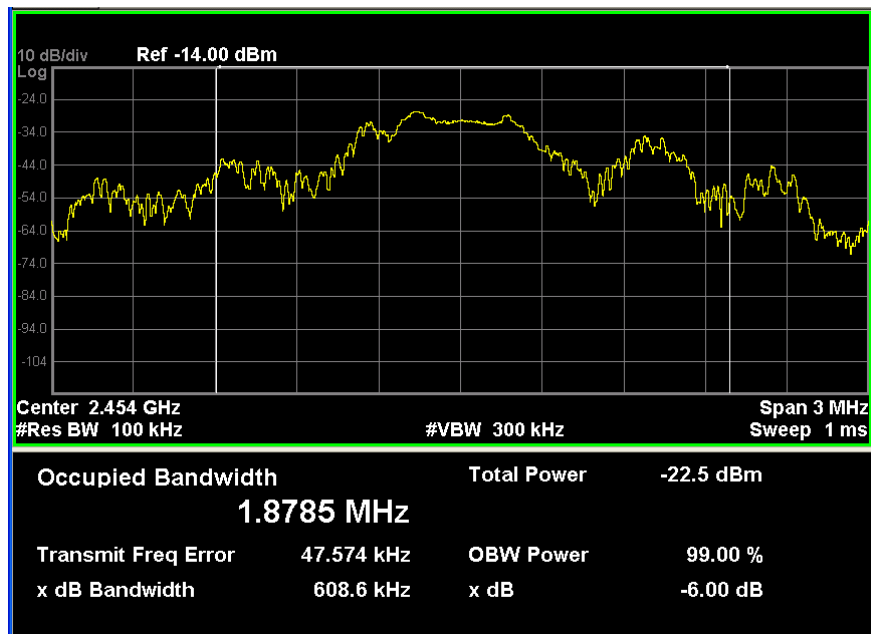
Mid Channel – Bandwidth 1.8611MHz



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High Channel – Bandwidth 1.8651MHz



Last Channel – Bandwidth 1.8785 MHz

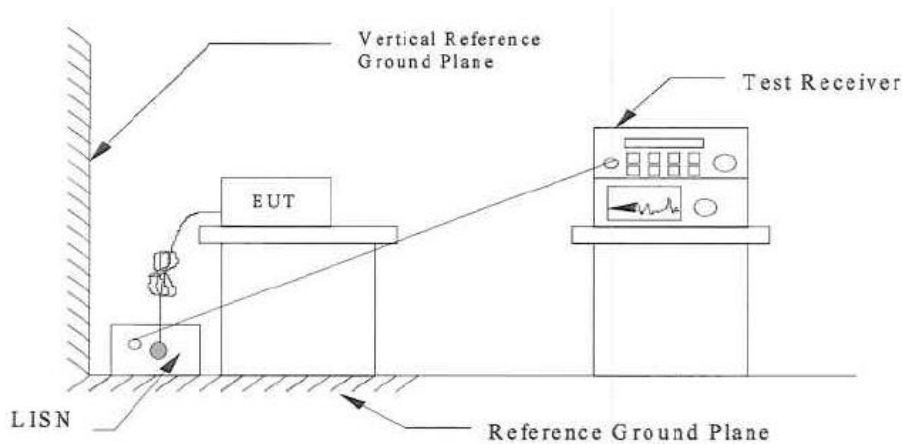
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4.5 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement: FCC part 15 Section 15.207 Class B
 Test Method: ANSI C63.4:2009
 Test Date: 2014-06-30
 Mode of Operation: Transmitting
 Detector Function: Quasi-peak, average
 Measurement BW: 9 kHz

Remark : ---

Test Setup:



Results: PASS

- Refer Figures and tables for the result.

Limits for Conducted Emission [Section 15.207]:

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

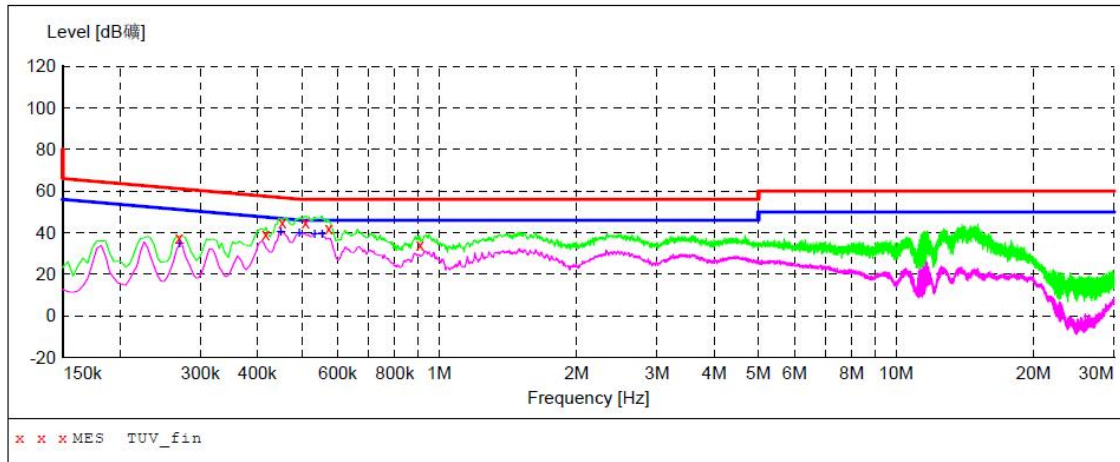
* Decreases with the logarithm of the frequency.

Remarks:

Calculated measurement uncertainty: ±2.8dB

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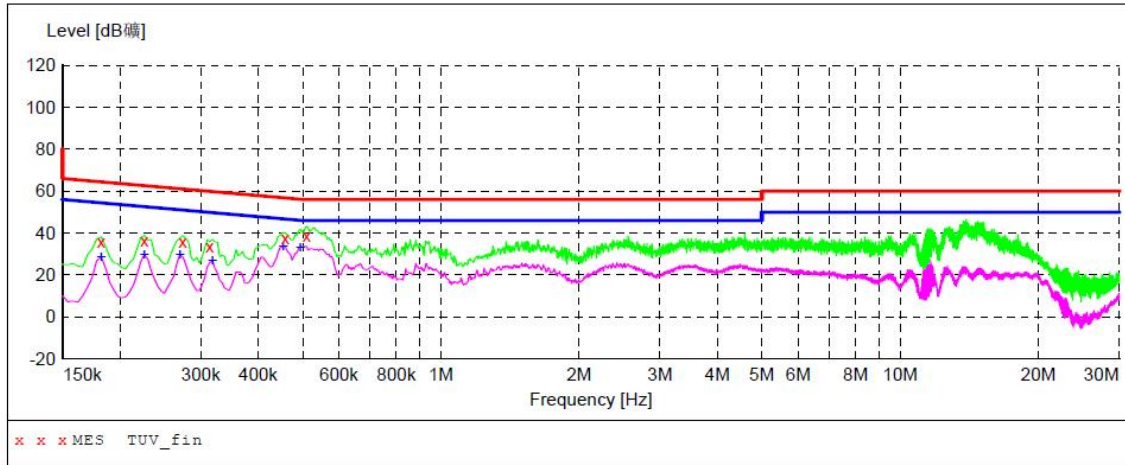
Result data graph shows the conducted emission (Live).



Refer to the following table for the result details:

Conducted Emission					
Frequency (MHz)	Detector (QP/AV)	Phase	Result (dBμV)	Limit (dBμV)	Margin
0.270	QP	L	37.40	61.10	-23.70
0.418	QP	L	39.10	57.50	-18.40
0.454	QP	L	45.10	56.80	-11.70
0.510	QP	L	45.20	56.00	-10.80
0.574	QP	L	42.30	56.00	-13.70
0.910	QP	L	34.40	56.00	-21.60

Result data graph shows the conducted emission (Neutral).



Refer to the following table for the result details:

Conducted Emission					
Frequency (MHz)	Detector (QP/AV)	Phase	Result (dBμV)	Limit (dBμV)	Margin
0.182	QP	N	36.10	64.40	-28.30
0.226	QP	N	36.50	62.60	-26.10
0.274	QP	N	35.70	61.00	-25.30
0.314	QP	N	33.60	59.90	-26.30
0.458	QP	N	37.70	56.70	-19.00
0.510	QP	N	38.70	56.00	-17.30

5.0 List of Measurement Equipment

Radiated Emission and Bandwidth Emissions

Description	Manufacturer	Model no.	Serial no.	CAL due
N/A	3m Semi- Anechoic Chamber	9.0(L)*6.0(W)*6.0(H)	N/A	Jul. 16 2014
Agilent	Spectrum Analyzer	E4440A	US41421290	Jul. 16 2014
R&S	EMI Test Receiver	ESCI	100694	Jul. 16 2014
A.H.	Wideband Antenna	SAS-521-4	26	Jul. 16 2014
EMCO	Antenna	3142C	60447	Jul. 16 2014
EM	Horn Antenna	EM-AH-10180	67	Jul. 16 2014
EM	Power Amplifier	EM30180	0607030	Jul. 16 2014
MF	Position Controller	MF-7802	MF780208138	N/A

Conducted Emissions

Description	Manufacturer	Model no.	Serial no.	CAL due
N/A	Shielding Room	7.(L)x4(W)x3(H)	N/A	Jul. 16 2014
R&S	EMI Test Receiver	ESCI	100694	Jul. 16 2014
R&S	LISN	ESH3-Z5	8389791009	Jul. 16 2014

N/A Not Applicable or Not Available