

FCC 47 CFR PART 22H and 24E**Test Report**

Product Type : M2M Advanced Industrial Gateway
Applicant : Coretex Ltd
Address : Level 2, 135 Broadway, Newmarket, Auckland, New Zealand, 1023
Trade Name : ibright
Model Number : TMU-1500
Test Specification : FCC 47 CFR PART 22H
FCC 47 CFR PART 24E
ANSI/TIA-603-D 2010
Application Purpose : Original
Receive Date : Oct. 05, 2015
Test Period : Oct. 12 ~ Dec. 05, 2015
Issue Date : Dec. 29, 2015

Issue by

A Test Lab Techno Corp.
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Taiwan Accreditation Foundation accreditation number: 1330

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Revision History

Rev.	Issue Date	Revisions	Revised By
00	Dec. 18, 2015	Initial Issue	
01	Dec. 29, 2015	Revised report information.	Peggy Chang

Verification of Compliance

Issued Date: 12/29/2015

Product Type : M2M Advanced Industrial Gateway
Applicant : Coretex Ltd
Address : Level 2, 135 Broadway, Newmarket, Auckland, New Zealand, 1023
Trade Name : ibright
Model Number : TMU-1500
FCC ID : 2AGNLTMU1500
EUT Rated Voltage : DC 5 ~ 32V
Test Voltage : DC 12V
Applicable Standard : FCC 47 CFR PART 22H
FCC 47 CFR PART 24E
ANSI/TIA-603-D 2010
Application Purpose : Original
Test Result : Complied
Performing Lab. : A Test Lab Techno Corp.

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Taiwan Accreditation Foundation accreditation number: 1330
<http://www.atl-lab.com.tw/e-index.htm>

A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By : Fly Lu Reviewed By : Eric Ou Yang
(Manager) (Fly Lu) (Testing Engineer) (Eric Ou Yang)

TABLE OF CONTENTS

1	General Information	6
1.1.	EUT Description	6
1.2.	Mode of Operation.....	7
1.3.	EUT Exercise Software	7
1.4.	Configuration of Test System Details	8
1.5.	Test Site Environment	8
1.6.	Summary of Test Result	9
2	RF Output Power Test	10
2.1.	Limit	10
2.2.	Test Instruments	10
2.3.	Test Setup.....	10
2.4.	Test Procedure	10
2.5.	Uncertainty	10
2.6.	Test Result.....	11
3	Effective Radiated Power / Equivalent Isotropic Radiated Power Test.....	13
3.1.	Limit	13
3.2.	Test Instruments	13
3.3.	Setup	14
3.4.	Test Procedure	15
3.5.	Uncertainty	15
3.6.	Test Result.....	16
4	Peak to Average Ratio Test.....	17
4.1.	Limit	17
4.2.	Test Instruments	17
4.3.	Setup	17
4.4.	Test Procedure	18
4.5.	Uncertainty	18
4.6.	Test Result.....	18
4.7.	Test Graphs	19
5	Emission Bandwidth & Occupied Bandwidth Test.....	20
5.1.	Limit	20
5.2.	Test Instruments	20
5.3.	Setup	20
5.4.	Test Procedure	21
5.5.	Uncertainty	21
5.6.	Test Result.....	21
5.7.	Test Graphs	22

6	Band Edge Test	24
6.1.	Limit	24
6.2.	Test Instruments	24
6.3.	Setup	24
6.4.	Test Procedure	25
6.5.	Uncertainty	25
6.6.	Test Result.....	25
6.7.	Test Graphs	26
7	Conducted Spurious Emission Test	28
7.1.	Limit	28
7.2.	Test Instruments	28
7.3.	Setup	28
7.4.	Test Procedure	29
7.5.	Uncertainty	29
7.6.	Test Result.....	29
8	Field Strength of Spurious Radiation Test.....	63
8.1.	Limit	63
8.2.	Test Instruments	63
8.3.	Setup	64
8.4.	Test Procedure	65
8.5.	Uncertainty	65
8.6.	Test Result.....	66
9	Frequency Stability (Temperature & Voltage Variation) Test.....	68
9.1.	Limit	68
9.2.	Test Instruments	68
9.3.	Setup	68
9.4.	Test Procedure	69
9.5.	Uncertainty	69
9.6.	Test Result.....	70

1 General Information

1.1. EUT Description

Applicant	Coretex Ltd				
Applicant Address	Level 2, 135 Broadway, Newmarket, Auckland, New Zealand, 1023				
Manufacturer	Coretex Ltd				
Manufacturer Address	Level 2, 135 Broadway, Newmarket, Auckland, New Zealand, 1023				
Product Type	M2M Advanced Industrial Gateway				
Trade Name	ibright				
Model Number	TMU-1500				
FCC ID	2AGNLTMU1500				
IMEI No.	357164045288860				
Mode	WCDMA (RMC12.2K)/ HSDPA/ HSUPA/ HSPA+	Band	UL Frequency (MHz)	DL Frequency (MHz)	Modulation
		II	1852.4 ~ 1907.6	1932.4 ~ 1987.6	QPSK
		V	826.4 ~ 846.6	871.4 ~ 891.6	QPSK
Channel Control	Auto				
Type of Antenna	Super Combo Antenna				
Antenna Gain (dBi)	WCDMA/ HSDPA/ HSUPA/HSPA+ Band II : 3.3 dBi WCDMA/ HSDPA/ HSUPA/HSPA+ Band V : 2.0 dBi				
Max. RF Output power	WCDMA/ HSDPA/ HSUPA/HSPA+ Band II : 26.57 dBm / 0.454 W WCDMA/ HSDPA/ HSUPA/HSPA+ Band V : 26.75 dBm / 0.473 W				
Max. ERP/EIRP	WCDMA/ HSDPA/ HSUPA/HSPA+ Band II : 22.73 dBm / 0.187 W WCDMA/ HSDPA/ HSUPA/HSPA+ Band V : 23.52 dBm / 0.225 W				

1.2. Mode of Operation

ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

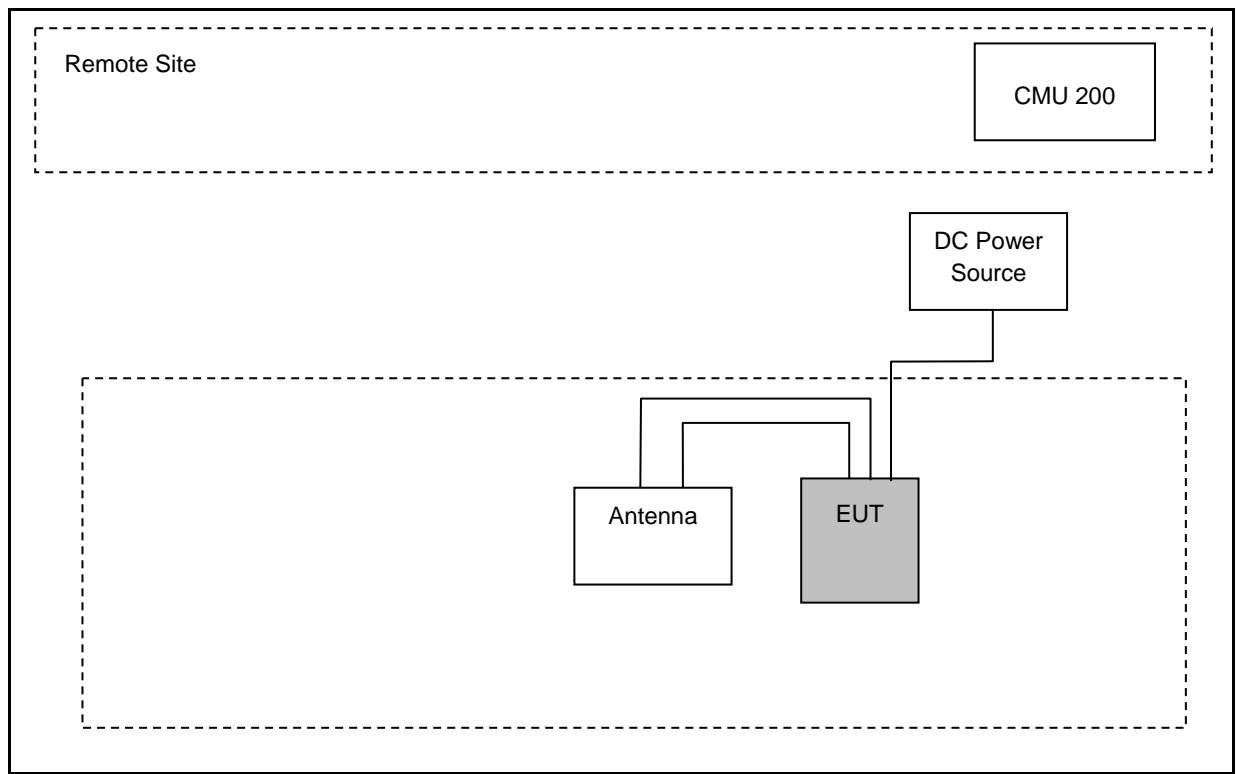
Test Mode
Mode 1: WCDMA Band II Link Mode
Mode 2: WCDMA Band V Link Mode

Note: Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.

1.3. EUT Exercise Software

1	Setup the EUT and Base Station (CMU200) as shown on 1.4.
2	Turn on the power of all equipment.

1.4. Configuration of Test System Details



1.5. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

1.6. Summary of Test Result

Description	FCC Rule	Limit	Result
Conducted Output Power	§2.1046	N/A	Pass
Effective Radiated Power	§22.913(a)(2)	< 7 Watts	Pass
Equivalent Isotropic Radiated Power	§24.232(c)	≤ 2 Watts	Pass
Peak to average ratio	§24.232(d)	< 13 dB	Pass
Emission Bandwidth & Occupied Bandwidth	§2.1049 §22.917(a) §24.238(a)	N/A	Pass
Band Edge Measurement	§2.1051 §22.917(a) §24.238(a)	< 43+10log ₁₀ (P[Watts])	Pass
Conducted Spurious Emission	§2.1051 §22.917(a) §24.238(a)	< 43+10log ₁₀ (P[Watts])	Pass
Field Strength of Spurious Radiation	§2.1053 §22.917(a) §24.238(a)	< 43+10log ₁₀ (P[Watts])	Pass
Frequency Stability for Temperature & Voltage	§2.1055 §22.355 §24.235	< 2.5 ppm	Pass

2 RF Output Power Test

2.1. Limit

N/A

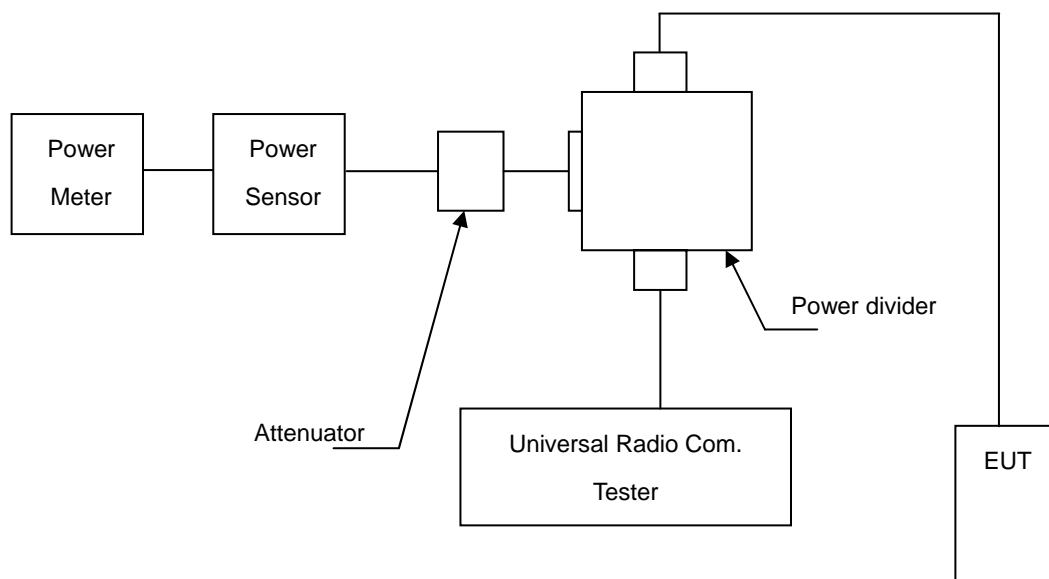
2.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Universal Radio Communication Tester	R & S	CMU200	109369	10/21/2014	(2)
Single Channel PK Power Sensor	Agilent	N1911A	MY45101619	12/15/2014	(1)
Wideband Power Meter	Agilent	N1921A	MY45241957	12/15/2014	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

2.3. Test Setup



2.4. Test Procedure

The measurement is made according to as follows:

1. The transmitter output was connected to power meter and base station through Power Divider.
2. Set base station for EUT at GSM 850: PCL=5 and PCS 1900: PCL=0.
3. Set base station for EUT at WCDMA Band V and WCDMA Band II, power level was set to maximum.
4. Select lowest, middle, and highest channels for each band.

2.5. Uncertainty

The measurement uncertainty is defined as for RF output power measurement is 1.2 dB.

2.6. Test Result

Model Number	TMU-1500						
Test Item	RF Output Power						
Date of Test	10/12/2015			Test Site		TE05	
Bands	Modulation Type	Sub-Test	Frequency (MHz)	Burst Average Power		Peak Power	
				(dBm)	(W)	(dBm)	(W)
WCDMA Band II	QPSK	-----	1852.4	23.16	0.207	26.34	0.431
			1880.0	23.39	0.218	26.57	0.454
			1907.6	23.21	0.209	26.42	0.439
HSDPA Band II	QPSK	1	1852.4	22.15	0.164	25.33	0.341
			1880.0	22.35	0.172	25.52	0.356
			1907.6	22.19	0.166	25.35	0.343
		2	1852.4	21.64	0.146	24.81	0.303
			1880.0	21.84	0.153	25.00	0.316
			1907.6	21.68	0.147	24.83	0.304
		3	1852.4	21.61	0.145	24.78	0.301
			1880.0	21.82	0.152	24.97	0.314
			1907.6	21.65	0.146	24.82	0.303
		4	1852.4	22.07	0.161	25.24	0.334
			1880.0	22.27	0.169	25.43	0.349
			1907.6	22.11	0.163	25.26	0.336
HSUPA Band II	QPSK	1	1852.4	21.51	0.142	24.69	0.294
			1880.0	21.70	0.148	24.89	0.308
			1907.6	21.53	0.142	24.73	0.297
		2	1852.4	19.50	0.089	22.67	0.185
			1880.0	19.69	0.093	22.87	0.194
			1907.6	19.52	0.090	22.71	0.187
		3	1852.4	20.48	0.112	23.64	0.231
			1880.0	20.67	0.117	23.84	0.242
			1907.6	20.50	0.112	23.68	0.233
		4	1852.4	19.48	0.089	22.64	0.184
			1880.0	19.67	0.093	22.84	0.192
			1907.6	19.50	0.089	22.68	0.185
		5	1852.4	21.43	0.139	24.60	0.288
			1880.0	21.62	0.145	24.80	0.302
			1907.6	21.45	0.140	24.64	0.291

Note: The peak power testing result was used peak detector.

Model Number	TMU-1500						
Test Item	RF Output Power						
Date of Test	10/12/2015			Test Site		TE05	
Bands	Modulation Type	Sub-Test	Frequency (MHz)	Burst Average Power		Peak Power	
				(dBm)	(W)	(dBm)	(W)
WCDMA Band V	QPSK	-----	826.4	23.44	0.221	26.61	0.458
			836.6	23.56	0.227	26.75	0.473
			846.6	23.38	0.218	26.56	0.453
HSDPA Band V	QPSK	1	826.4	22.42	0.175	25.63	0.366
			836.6	22.52	0.179	25.71	0.372
			846.6	22.37	0.173	25.55	0.359
		2	826.4	21.89	0.155	25.08	0.322
			836.6	21.99	0.158	25.16	0.328
			846.6	21.84	0.153	25.00	0.316
		3	826.4	21.86	0.153	25.05	0.320
			836.6	21.96	0.157	25.13	0.326
			846.6	21.81	0.152	24.97	0.314
		4	826.4	22.30	0.170	25.49	0.354
			836.6	22.40	0.174	25.57	0.361
			846.6	22.25	0.168	25.41	0.348
HSUPA Band V	QPSK	1	826.4	21.80	0.151	24.99	0.316
			836.6	21.89	0.155	25.05	0.320
			846.6	21.73	0.149	24.91	0.310
		2	826.4	19.77	0.095	22.94	0.197
			836.6	19.86	0.097	23.00	0.200
			846.6	19.70	0.093	22.86	0.193
		3	826.4	20.75	0.119	23.92	0.247
			836.6	20.84	0.121	23.98	0.250
			846.6	20.68	0.117	23.84	0.242
		4	826.4	19.74	0.094	22.92	0.196
			836.6	19.83	0.096	22.98	0.199
			846.6	19.67	0.093	22.84	0.192
		5	826.4	21.69	0.148	24.86	0.306
			836.6	21.78	0.151	24.92	0.310
			846.6	21.62	0.145	24.78	0.301

Note: The peak power testing result was used peak detector.

3 Effective Radiated Power / Equivalent Isotropic Radiated Power Test

3.1. Limit

For FCC Part 22.913(a)(2): The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

For FCC Part 24.232(c): The EIRP of mobile transmitters and auxiliary test transmitters must not exceed 2 Watts.

3.2. Test Instruments

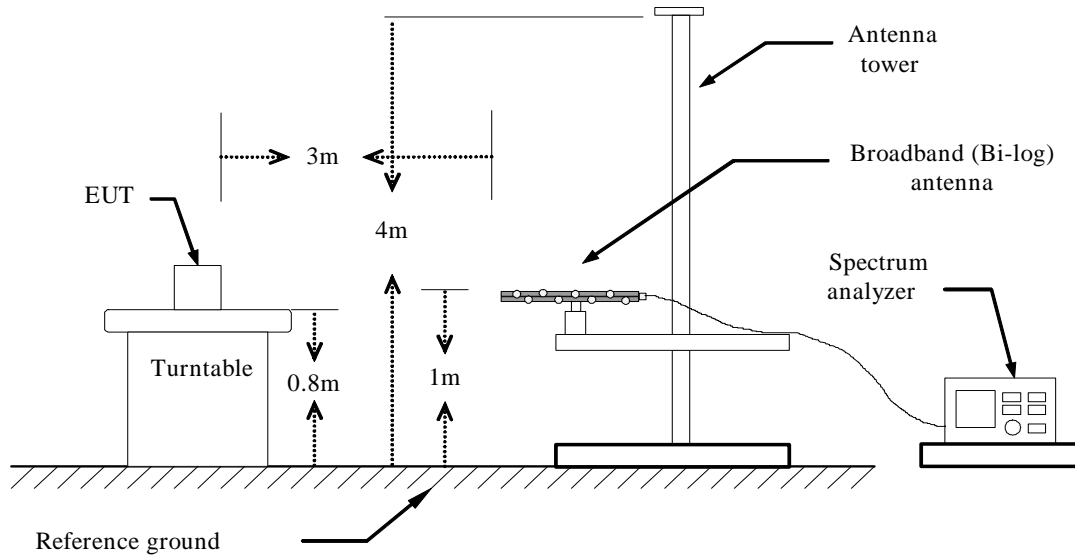
3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
RF Pre-selector	Agilent	N9039A	MY46520256	01/06/2015	(1)
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/06/2015	(1)
Pre Amplifier	Agilent	8449B	3008A02237	02/24/2015	(1)
Pre Amplifier	Agilent	8447D	2944A10961	02/24/2015	(1)
Broadband Antenna (30MHz~1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	9163-270	08/11/2015	(1)
Sleeve Dipole(CF880) (780-980MHz)	ETS	3126-880	00064344	10/06/2014	(2)
Sleeve Dipole(CF1845) (1695-1995MHz)	ETS	3126-1845	00083335	10/06/2014	(2)
Horn Antenna (1~18GHz)	ETS	3117	00152321	08/14/2015	(1)
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/12/2015	(1)
Horn Antenna (18~40GHz)	ETS	3116	00086467	09/01/2015	(1)
Horn Antenna (18~40GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170	9170-320	07/06/2015	(1)
Test Site	ATL	TE01	888001	08/27/2015	(1)

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

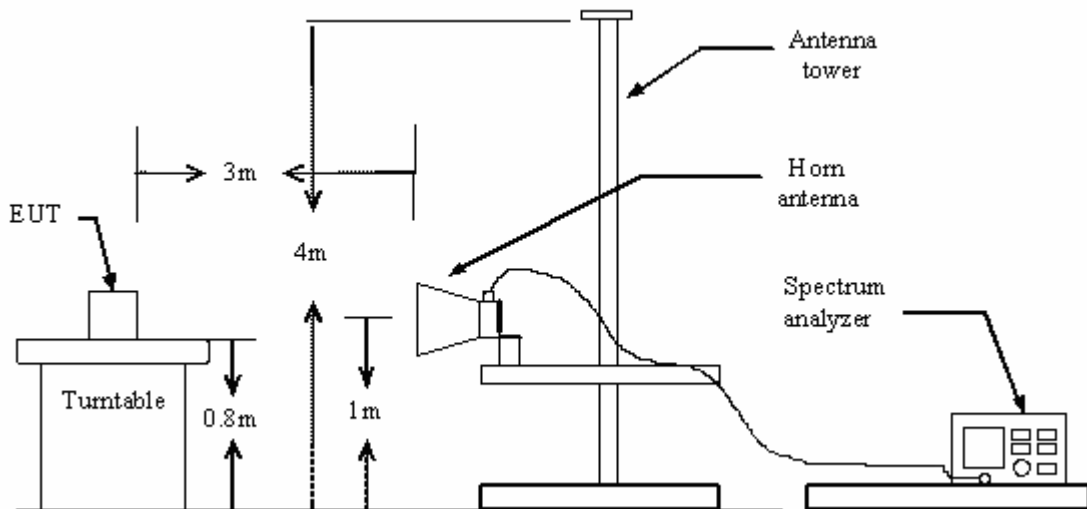
Note: N.C.R. = No Calibration Request.

3.3. Setup

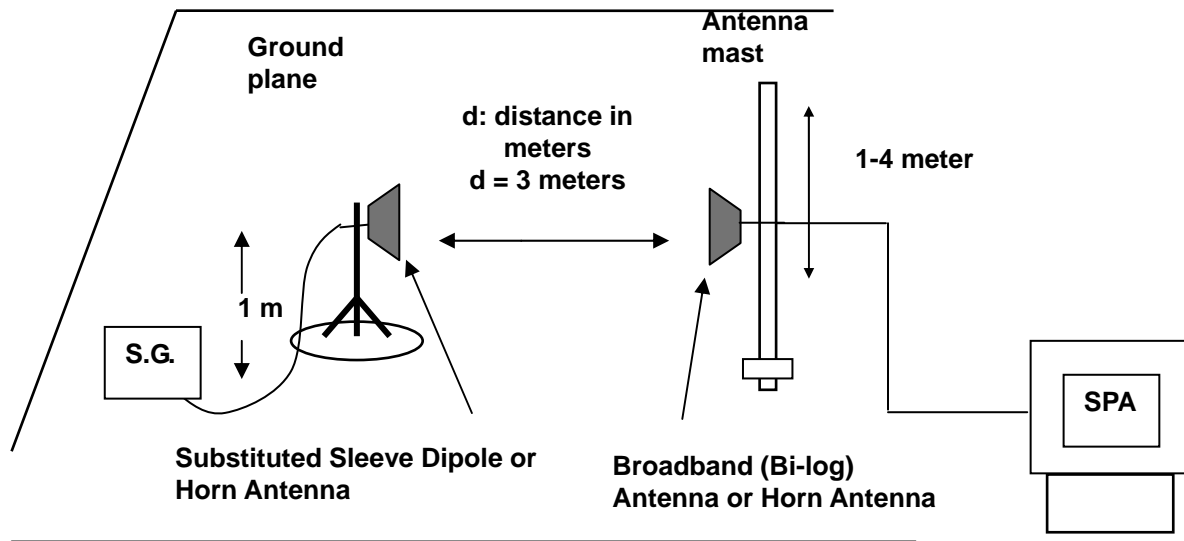
Below 1 GHz



Above 1 GHz



For Substituted Method Test Set-UP



3.4. Test Procedure

- The EUT was set up for the maximum power. The power was measured with Spectrum Analyzer. All measurements were done at 3 channels (low, middle and high operational frequency range).
- Radiation Emission measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The substitution antenna (Note:3 & 4) is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step a. Record the power level of S.G.
- $E.I.R.P. = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$
- $E.R.P. = E.I.R.P. - 2.15 \text{ dB}$

Note: 1. For WCDMA and CDMA signals, a peak detector is used with $RBW = VBW = 5\text{MHz}$.

2. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with $RBW = VBW = 1 \text{ MHz}$.

3. Below 1 GHz Substituted Method Test : Sleeve dipole antenna to Bi-Log Antenna

4. Above 1 GHz Substituted Method Test : Horn antenna to Horn Antenna

3.5. Uncertainty

The measurement uncertainty is defined as for Field Strength of Spurious Radiation measurement is $\pm 3.072 \text{ dB}$.

3.6. Test Result

Model Number	TMU-1500							
Test Item	ERP/EIRP							
Date of Test	12/05/2015					Test Site	TE01	
Bands	Modulation Type	Frequency (MHz)	Ant. Polar.	Read Level (dBm)	Correction Factor (dBm)	EIRP		Limit
						(dBm)	(W)	
WCDMA Band II	QPSK	1852.4	H	10.14	10.03	20.17	0.104	< 2W
			V	12.66	10.03	22.69	0.186	< 2W
		1880.0	H	10.25	10.02	20.27	0.106	< 2W
			V	12.71	10.02	22.73	0.187	< 2W
		1907.6	H	10.49	10.01	20.50	0.112	< 2W
			V	12.48	10.01	22.49	0.177	< 2W

Model Number	TMU-1500							
Test Item	ERP/EIRP							
Date of Test	12/05/2015					Test Site	TE01	
Bands	Modulation Type	Frequency (MHz)	Ant. Polar.	Read Level (dBm)	Correction Factor (dBm)	ERP		Limit
						(dBm)	(W)	
WCDMA Band V	QPSK	826.4	H	8.14	12.38	20.52	0.113	< 7W
			V	11.81	11.71	23.52	0.225	< 7W
		836.6	H	8.24	12.46	20.70	0.117	< 7W
			V	11.71	11.72	23.43	0.220	< 7W
		846.6	H	7.40	12.72	20.12	0.103	< 7W
			H	11.34	11.77	23.11	0.205	< 7W

Note: 1. ERP/EIRP = Read Level + Correction factor.

2. For WCDMA and CDMA signals, a peak detector is used with RBW = VBW = 5MHz.

3. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW= 1 MHz.

4 Peak to Average Ratio Test

4.1. Limit

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

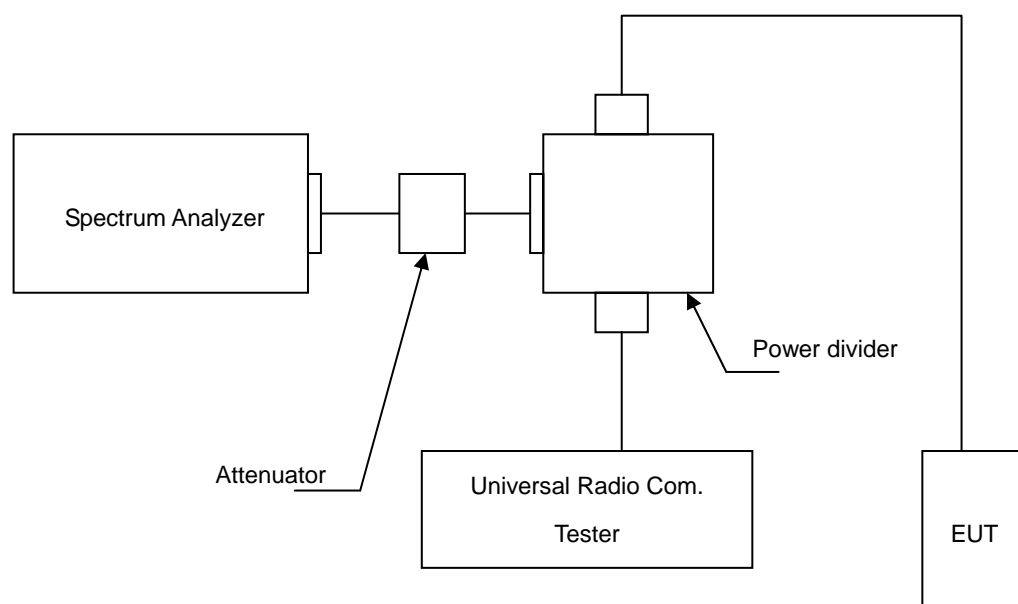
4.2. Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/14/2015	(1)
Wideband Radio Communication Test	R & S	CMW500	103168	11/05/2014	(1)
Attenuator	RADIALL	R41572000	0603033073	N.C.R.	-----
Power divider	Agilent	87302C	3239A00760	N.C.R.	-----
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

4.3. Setup



4.4. Test Procedure

The measurement is made according to FCC rules part 24:

- Set resolution/measurement bandwidth signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

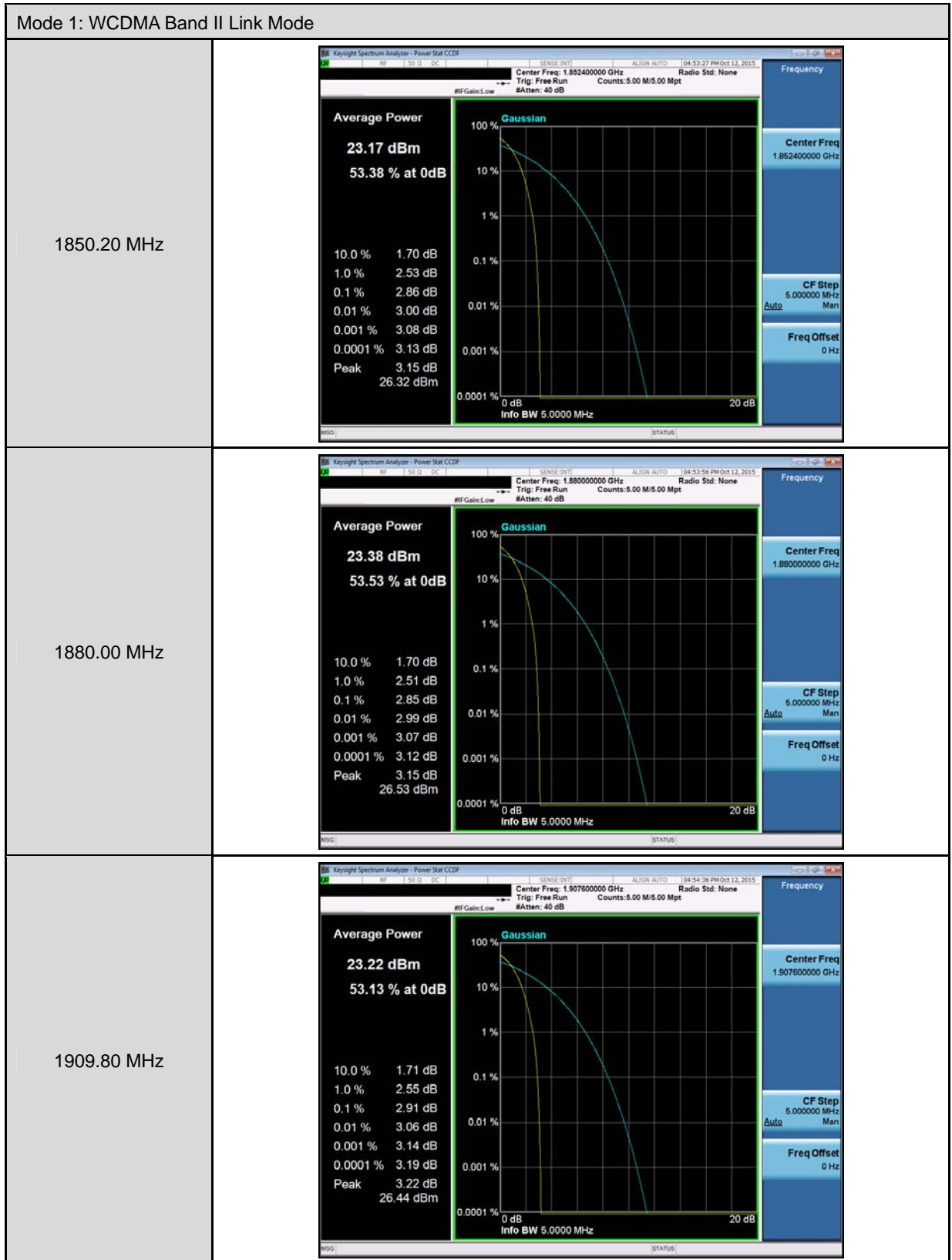
4.5. Uncertainty

The measurement uncertainty is defined as for Conducted Power measurement is 1.2 dB.

4.6. Test Result

Model Number	TMU-1500			
Test Item	Peak to Average Ratio			
Date of Test	10/12/2015			Test Site TE05
Bands	Channel	Frequency (MHz)	Peak to Average Ratio (dB)	Limit (dB)
WCDMA Band II	9262	1852.4	2.86	< 13
	9400	1880.0	2.85	< 13
	9538	1907.6	2.91	< 13

4.7. Test Graphs



5 Emission Bandwidth & Occupied Bandwidth Test

5.1. Limit

The Occupied Bandwidth Limit:

N/A.

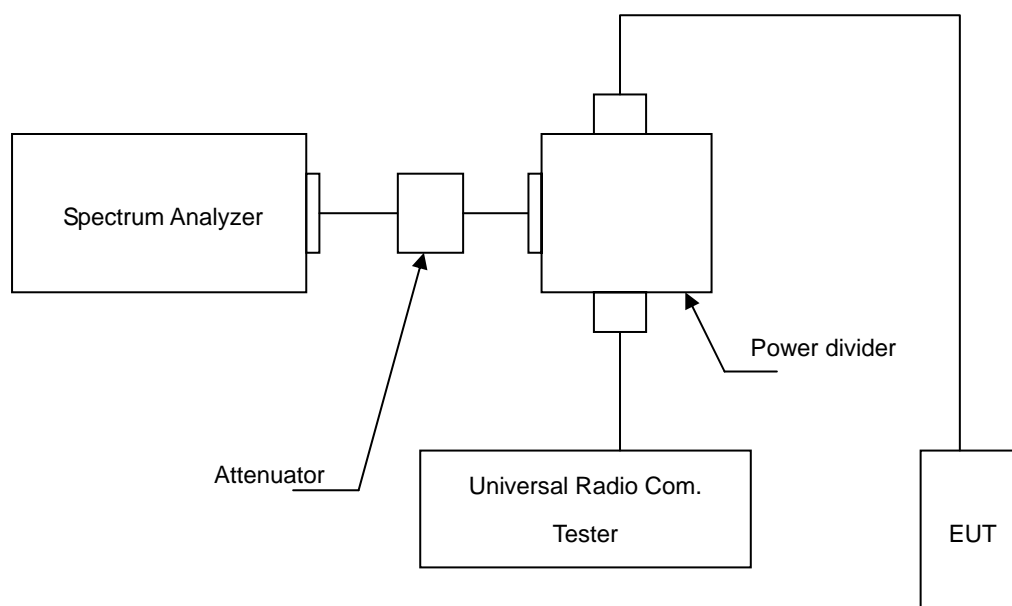
5.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Universal Radio Communication Tester	R & S	CMU200	109369	10/21/2014	(2)
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/14/2015	(1)
Attenuator	RADIALL	R41572000	0603033073	N.C.R.	-----
Power Divider	Agilent	87302C	3239A00760	N.C.R.	-----
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

5.3. Setup



5.4. Test Procedure

The measurement is made according to FCC rules part 22 and 24:

1. The EUT was connected to Spectrum Analyzer and Base Station via Power Divider.
2. The occupied bandwidth of middle channel for the highest and lowest RF powers was measured.

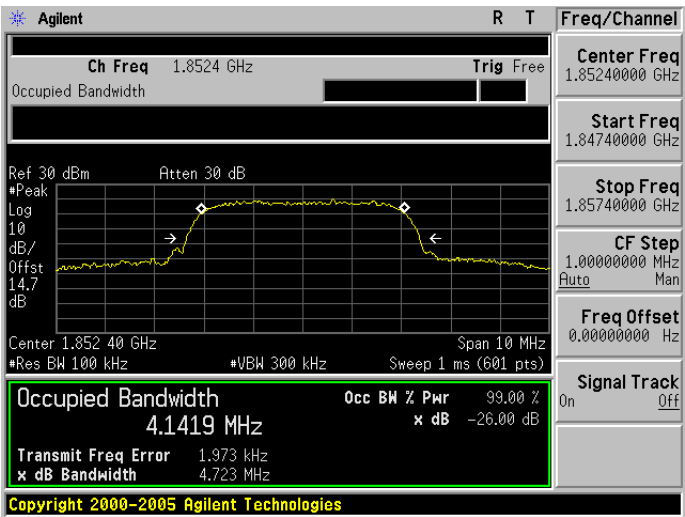
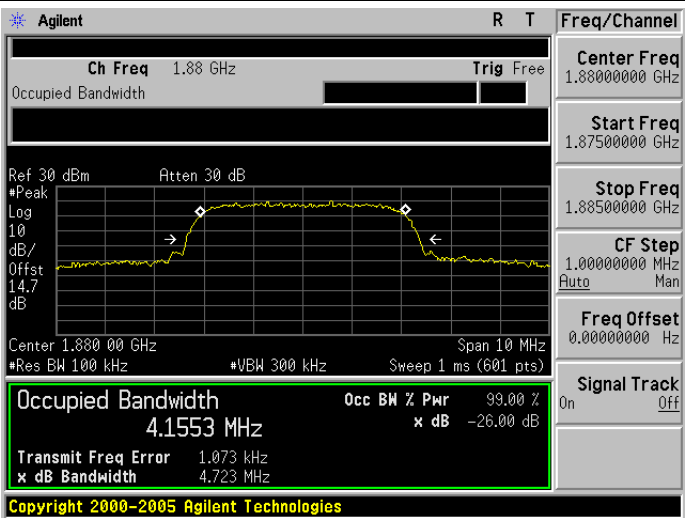
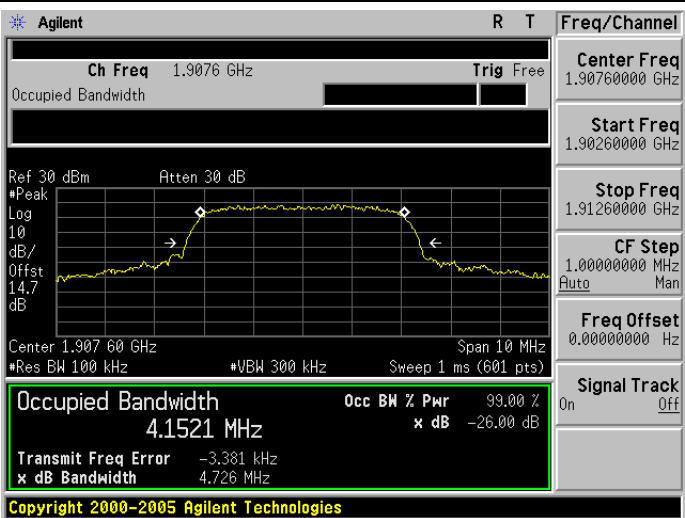
5.5. Uncertainty

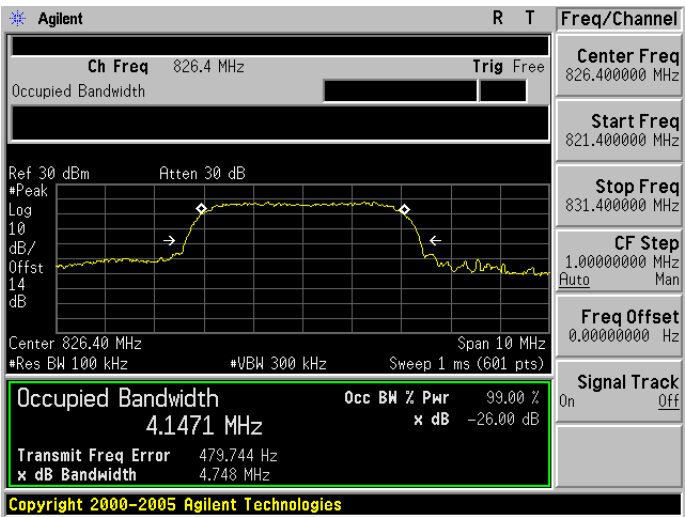
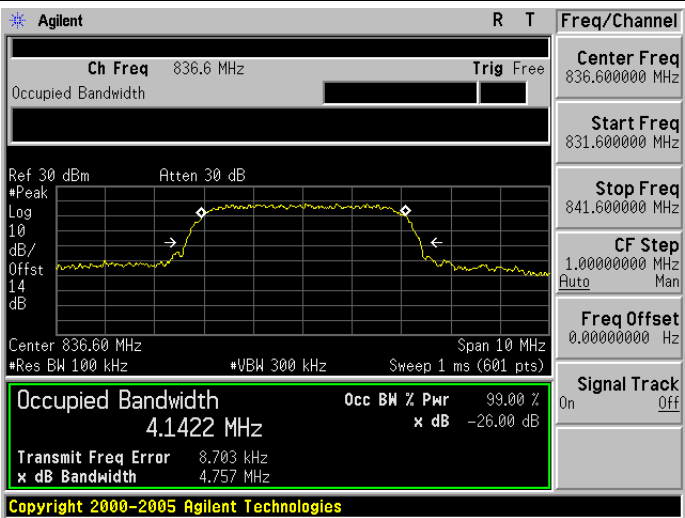
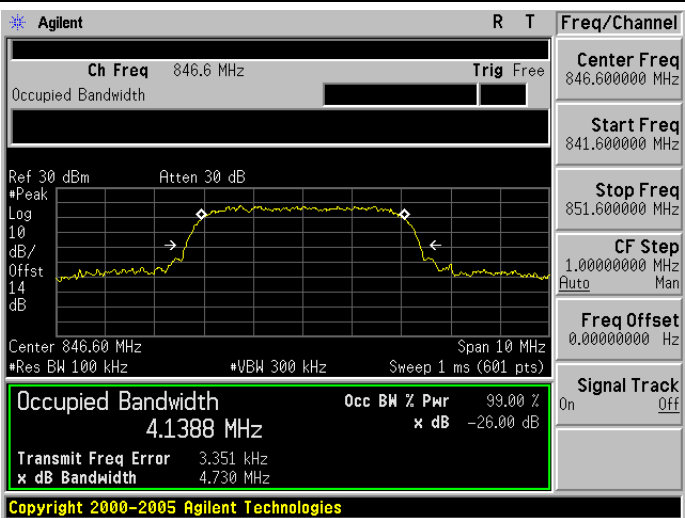
The measurement uncertainty is defined as $\pm 10\text{Hz}$

5.6. Test Result

Model Number	TMU-1500				
Test Item	Emission Bandwidth & Occupied Bandwidth				
Date of Test	10/12/2015			Test Site	TE05
Bands	Channel	Frequency (MHz)	-26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Note
WCDMA Band II	9262	1852.4	4.723	4.1419	RBW:100KHz , VBW:300KHz
	9400	1880.0	4.723	4.1553	RBW:100KHz , VBW:300KHz
	9538	1907.6	4.726	4.1521	RBW:100KHz , VBW:300KHz
WCDMA Band V	4132	826.4	4.748	4.1471	RBW:100KHz , VBW:300KHz
	4183	836.6	4.757	4.1422	RBW:100KHz , VBW:300KHz
	4233	846.6	4.730	4.1388	RBW:100KHz , VBW:300KHz

5.7. Test Graphs

Mode 1: WCDMA Band II Link Mode	
1850.20 MHz	 <p>Agilent R T Freq/Channel</p> <p>Ch Freq 1.8524 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 30 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offst 14.7 dB</p> <p>Center 1.8524 GHz Span 10 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 1 ms (601 pts)</p> <p>Occupied Bandwidth 4.1419 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB</p> <p>Transmit Freq Error 1.973 kHz x dB Bandwidth 4.723 MHz</p> <p>Copyright 2000-2005 Agilent Technologies</p> <p>Freq/Channel</p> <p>Center Freq 1.85240000 GHz</p> <p>Start Freq 1.84740000 GHz</p> <p>Stop Freq 1.85740000 GHz</p> <p>CF Step 1.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p>
1880.00 MHz	 <p>Agilent R T Freq/Channel</p> <p>Ch Freq 1.88 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 30 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offst 14.7 dB</p> <p>Center 1.8800 GHz Span 10 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 1 ms (601 pts)</p> <p>Occupied Bandwidth 4.1553 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB</p> <p>Transmit Freq Error 1.073 kHz x dB Bandwidth 4.723 MHz</p> <p>Copyright 2000-2005 Agilent Technologies</p> <p>Freq/Channel</p> <p>Center Freq 1.88000000 GHz</p> <p>Start Freq 1.87500000 GHz</p> <p>Stop Freq 1.88500000 GHz</p> <p>CF Step 1.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p>
1909.80 MHz	 <p>Agilent R T Freq/Channel</p> <p>Ch Freq 1.9076 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 30 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offst 14.7 dB</p> <p>Center 1.9076 GHz Span 10 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 1 ms (601 pts)</p> <p>Occupied Bandwidth 4.1521 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB</p> <p>Transmit Freq Error -3.381 kHz x dB Bandwidth 4.726 MHz</p> <p>Copyright 2000-2005 Agilent Technologies</p> <p>Freq/Channel</p> <p>Center Freq 1.90760000 GHz</p> <p>Start Freq 1.90260000 GHz</p> <p>Stop Freq 1.91260000 GHz</p> <p>CF Step 1.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p>

Mode 2: WCDMA Band V Link Mode	
826.4 MHz	 <p>Agilent R T Freq/Channel</p> <p>Ch Freq 826.4 MHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 30 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offst 14 dB</p> <p>Center 826.40 MHz Span 10 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 1 ms (601 pts)</p> <p>Occupied Bandwidth 4.1471 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB</p> <p>Transmit Freq Error 479.744 Hz x dB Bandwidth 4.748 MHz</p> <p>Copyright 2000-2005 Agilent Technologies</p> <p>Freq/Channel</p> <p>Center Freq 826.400000 MHz</p> <p>Start Freq 821.400000 MHz</p> <p>Stop Freq 831.400000 MHz</p> <p>CF Step 1.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p>
836.6 MHz	 <p>Agilent R T Freq/Channel</p> <p>Ch Freq 836.6 MHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 30 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offst 14 dB</p> <p>Center 836.60 MHz Span 10 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 1 ms (601 pts)</p> <p>Occupied Bandwidth 4.1422 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB</p> <p>Transmit Freq Error 8.703 kHz x dB Bandwidth 4.757 MHz</p> <p>Copyright 2000-2005 Agilent Technologies</p> <p>Freq/Channel</p> <p>Center Freq 836.600000 MHz</p> <p>Start Freq 831.600000 MHz</p> <p>Stop Freq 841.600000 MHz</p> <p>CF Step 1.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p>
846.6 MHz	 <p>Agilent R T Freq/Channel</p> <p>Ch Freq 846.6 MHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 30 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offst 14 dB</p> <p>Center 846.60 MHz Span 10 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 1 ms (601 pts)</p> <p>Occupied Bandwidth 4.1388 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB</p> <p>Transmit Freq Error 3.351 kHz x dB Bandwidth 4.730 MHz</p> <p>Copyright 2000-2005 Agilent Technologies</p> <p>Freq/Channel</p> <p>Center Freq 846.600000 MHz</p> <p>Start Freq 841.600000 MHz</p> <p>Stop Freq 851.600000 MHz</p> <p>CF Step 1.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p>

6 Band Edge Test

6.1. Limit

The Band Edge Limit:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

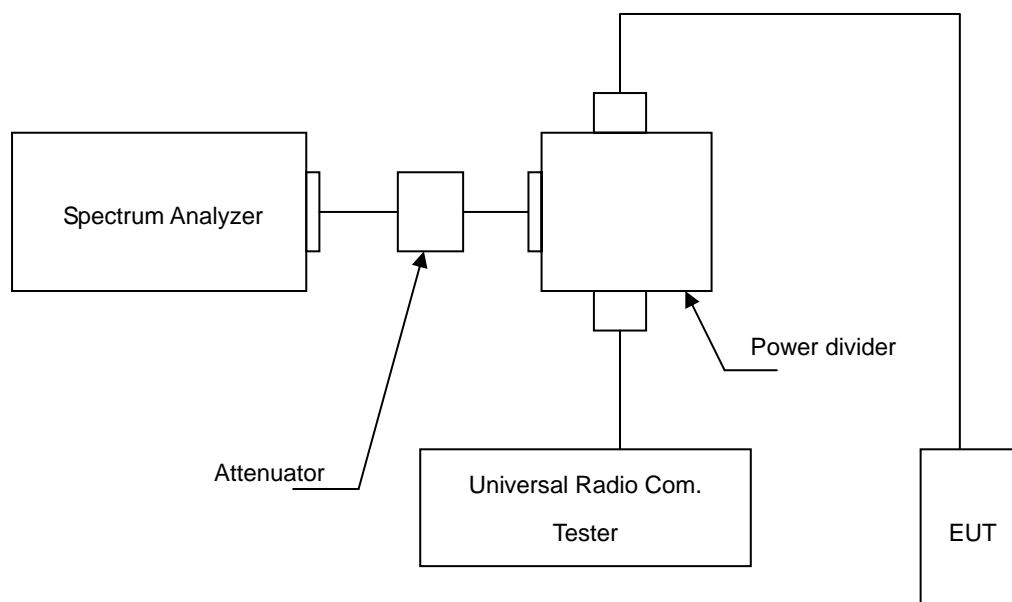
6.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Universal Radio Communication Tester	R & S	CMU200	109369	10/21/2014	(2)
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/14/2015	(1)
Attenuator	RADIALL	R41572000	0603033073	N.C.R.	-----
Power Divider	Agilent	87302C	3239A00760	N.C.R.	-----
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

6.3. Setup



6.4. Test Procedure

The measurement is made according to FCC rules part 22 and 24:

1. The EUT was connected to Spectrum Analyzer and Base Station via Power Divider.
2. The band edge of low and high channels for the highest RF powers within the transmitting frequency band were measured. Setting RBW as roughly BW/100.
3. The band edge setting:
 - a. RB=10 kHz; VB=30 kHz for GSM 850 and PCS 1900.
 - b. RB=51 kHz; VB=160 kHz for WCDMA Band V and WCDMA Band II.

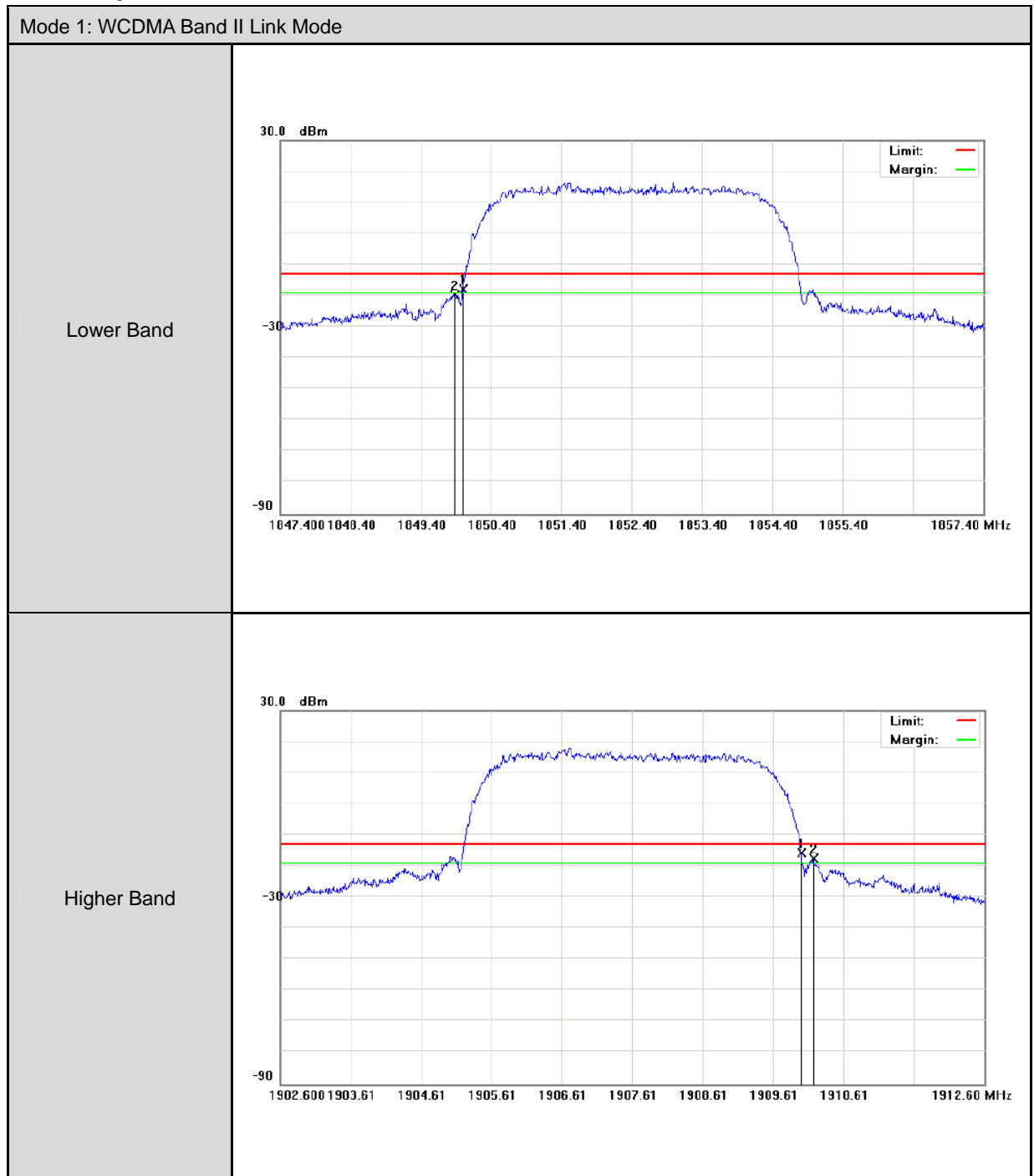
6.5. Uncertainty

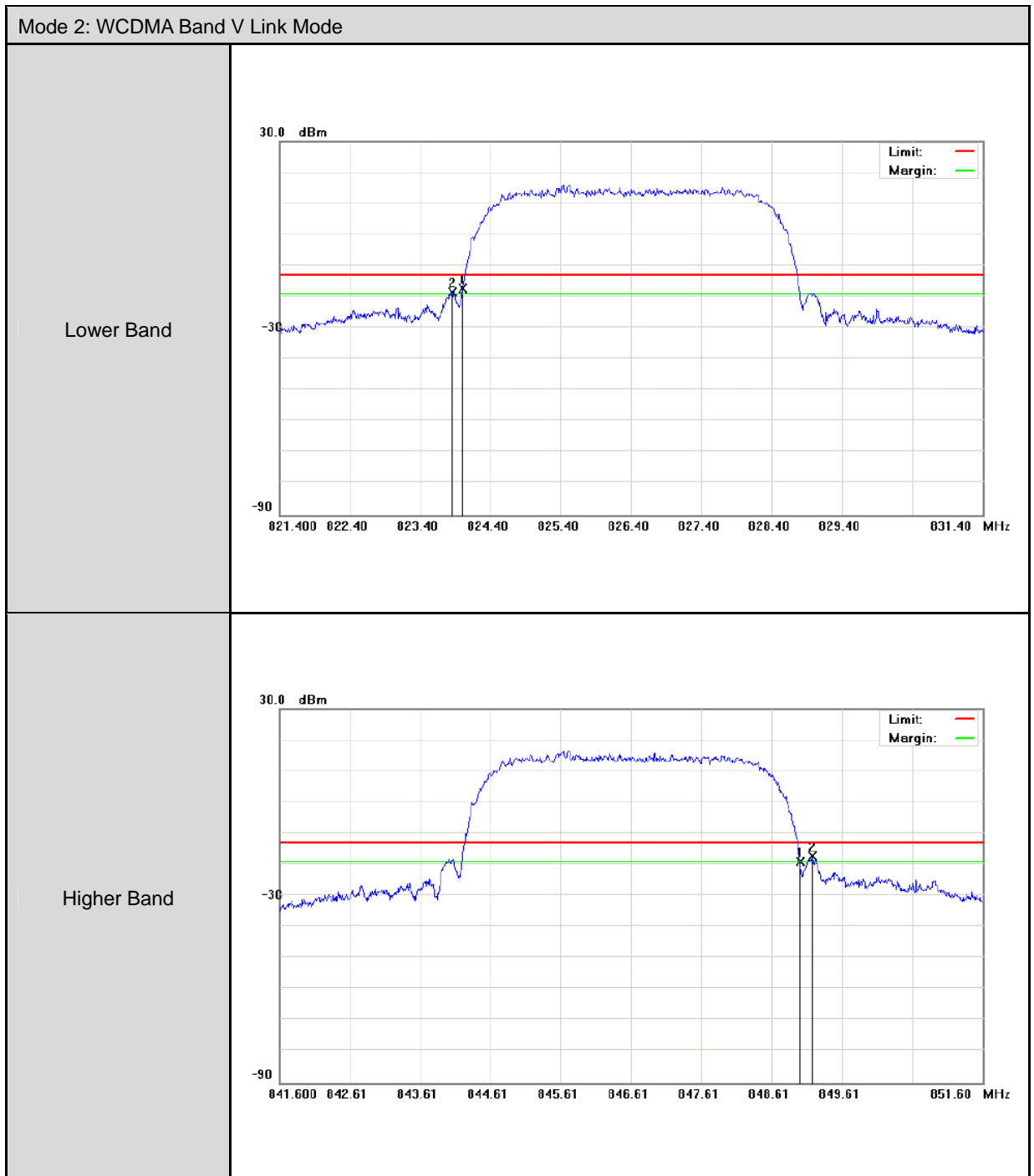
The measurement uncertainty is defined as $\pm 10\text{Hz}$

6.6. Test Result

Model Number		TMU-1500				
Test Item		Band Edge				
Date of Test		10/12/2015			Test Site	TE05
Bands		Channel	Frequency (MHz)	Bandwidth (dBm)	Limit (dBm)	Result
WCDMA Band II	Lower	9262	1850.000	-17.92	-13	Pass
	Higher	9538	1910.000	-15.86	-13	Pass
WCDMA Band V	Lower	4132	824.0000	-17.36	-13	Pass
	Higher	4233	849.0000	-17.21	-13	Pass

6.7. Test Graphs





7 Conducted Spurious Emission Test

7.1. Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

7.2. Test Instruments

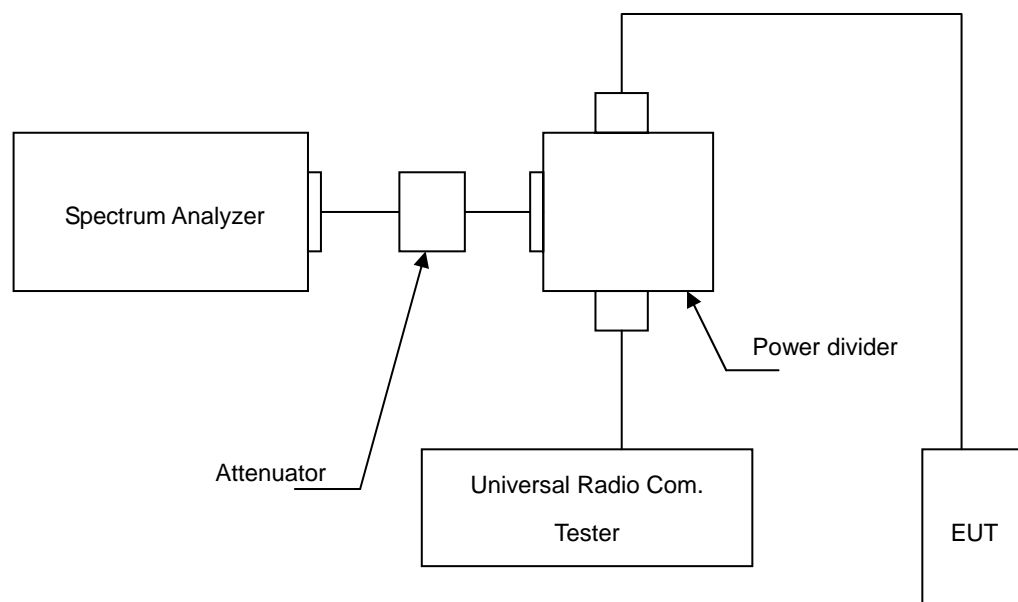
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Universal Radio Communication Tester	R & S	CMU200	109369	10/21/2014	(2)
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/14/2015	(1)
Attenuator	RADIALL	R41572000	0603033073	N.C.R.	-----
Power Divider	Agilent	87302C	3239A00760	N.C.R.	-----
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

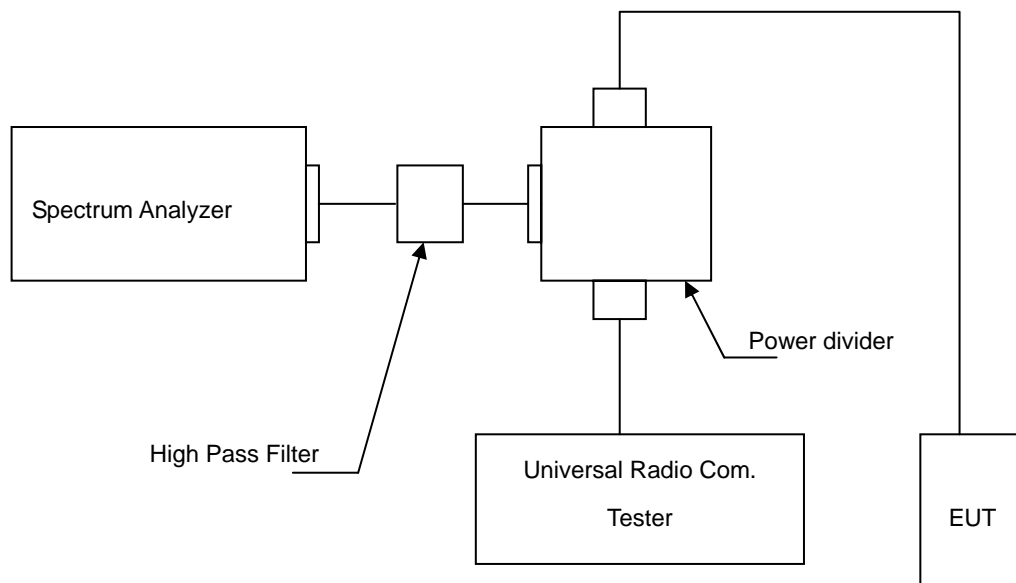
Note: N.C.R. = No Calibration Request.

7.3. Setup

Below 2.8GHz



Above 2.8GHz



7.4. Test Procedure

1. The EUT was connected to Spectrum Analyzer and Base Station via Power Divider.
2. The middle channel for the highest RF power within the transmitting frequency was measured.
3. The conducted spurious emission for the whole frequency range was taken.

7.5. Uncertainty

The measurement uncertainty is evaluated as ± 2.24 dB.

7.6. Test Result

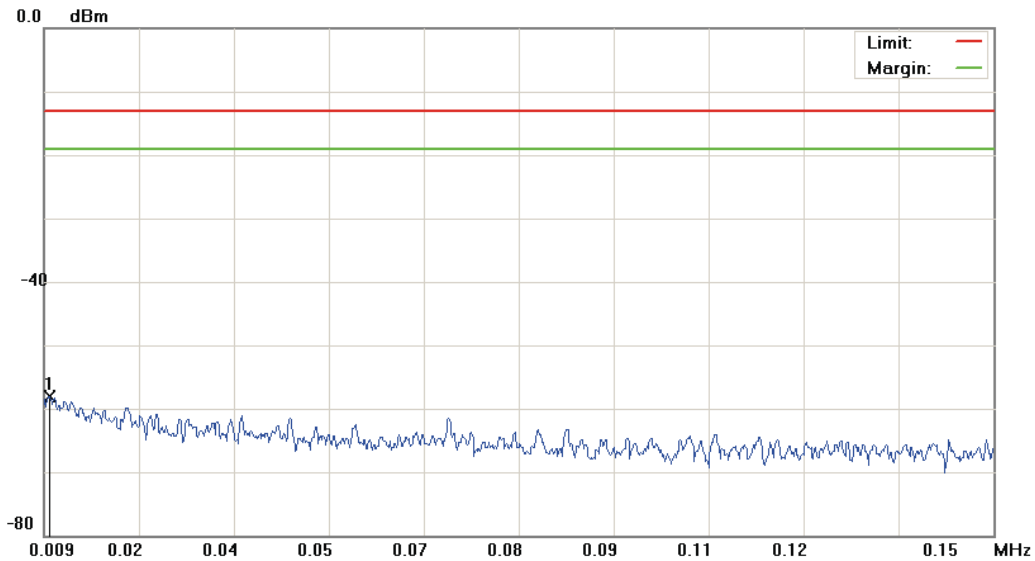
Model Number	TMU-1500		
Test Item	Conducted Spurious Emission		
Test Mode	Mode 1 / Mode 2		
Date of Test	10/12/2015	Test Site	TE05

File :TMU-1500(CH9262)

Data :#1

Date: 2015/10/12

Time: 上午 11:09:33



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

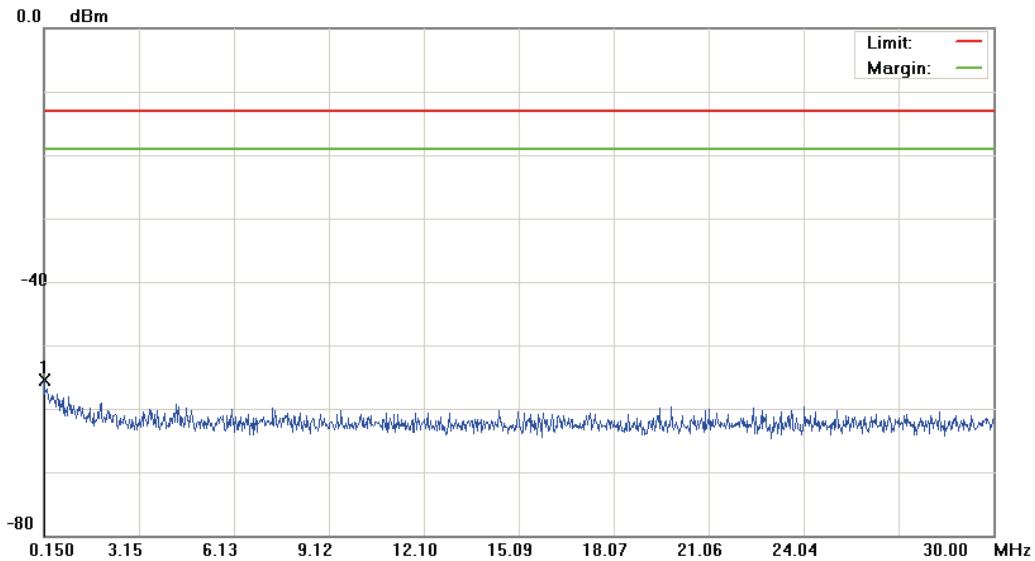
Humidity: 55 %

RBW: 1 KHz VBW: 3 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	0.0098	-69.50	11.33	-58.17	-13.00	-45.17	peak		

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH9262) Data :#2 Date: 2015/10/12 Time: 上午 11:09:57



Site: site #1 Polarization: *Conducted Power* Temperature: 26 °C
 Limit: FCC Part 24 conducted(9k-26.5G) Power: DC 12V Humidity: 55 %
 EUT: M2M Advanced Industrial Gateway Distance: RBW: 10 KHz VBW: 30 KHz
 M/N: TMU-1500
 Mode: WCDMA Band II
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	0.1650	-68.03	12.46	-55.57	-13.00	-42.57	peak		

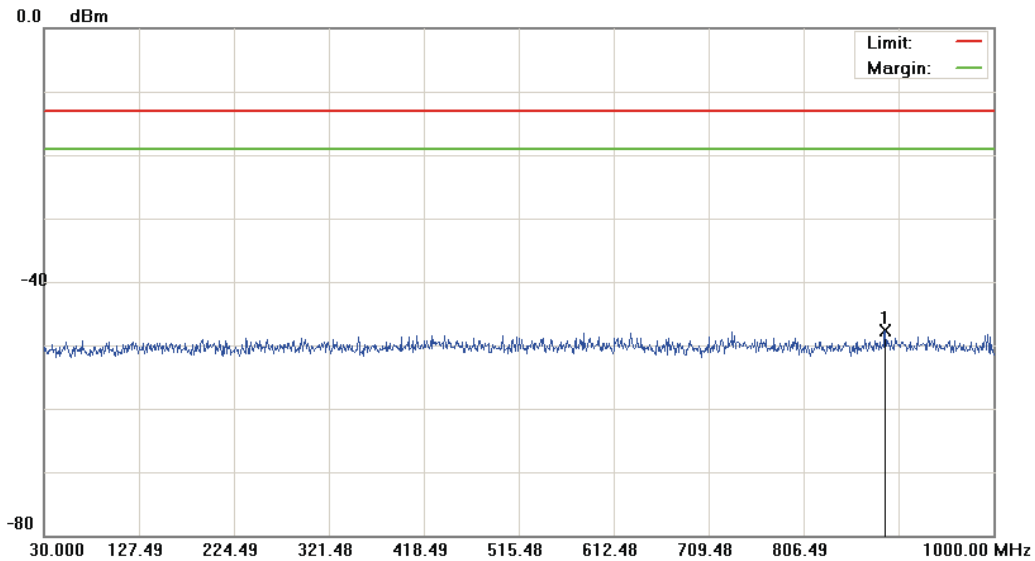
*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH9262)

Data :#3

Date: 2015/10/12

Time: 上午 11:10:21



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 100 KHz VBW: 300 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	889.4200	-61.00	13.22	-47.78	-13.00	-34.78	peak		Comment

*:Maximum data x:Over limit !:over margin

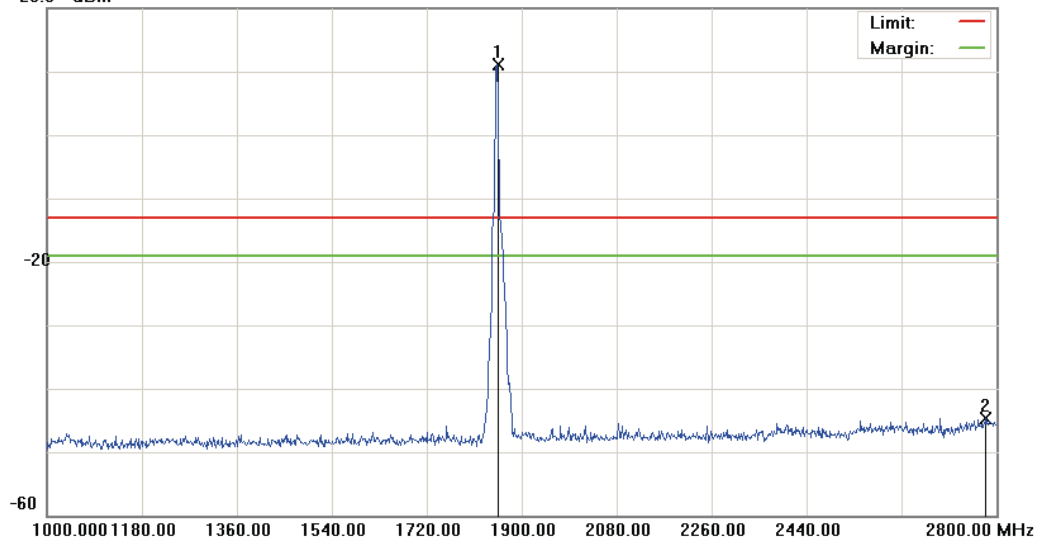
File :TMU-1500(CH9262)

Data :#4

Date: 2015/10/12

Time: 上午 11:35:38

20.0 dBm



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Over dB	Antenna Height cm	Table Degree degree	Comment
1	*	1854.100	6.86	4.28	11.14	-13.00	24.14	peak		Tx
2		2780.200	-50.62	5.88	-44.74	-13.00	-31.74	peak		

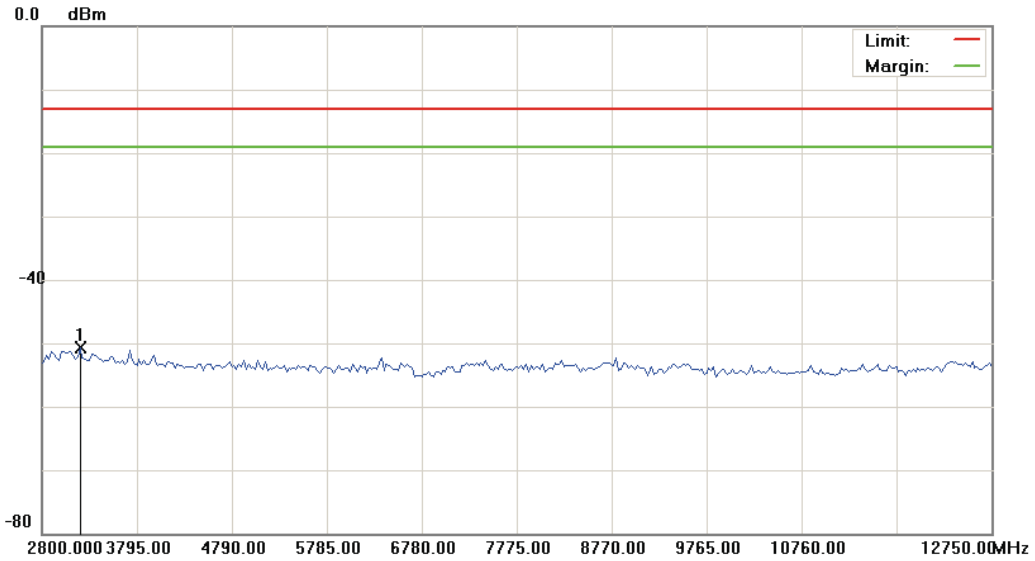
*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH9262)

Data :#5

Date: 2015/10/12

Time: 下午 02:01:32



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 24 conducted(9k-26.5G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 1000 KHz VBW: 3000 KHz

M/N: TMU-1500

Mode: WCDMA Band II

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	3198.000	-55.99	5.22	-50.77	-13.00	-37.77	peak		Comment

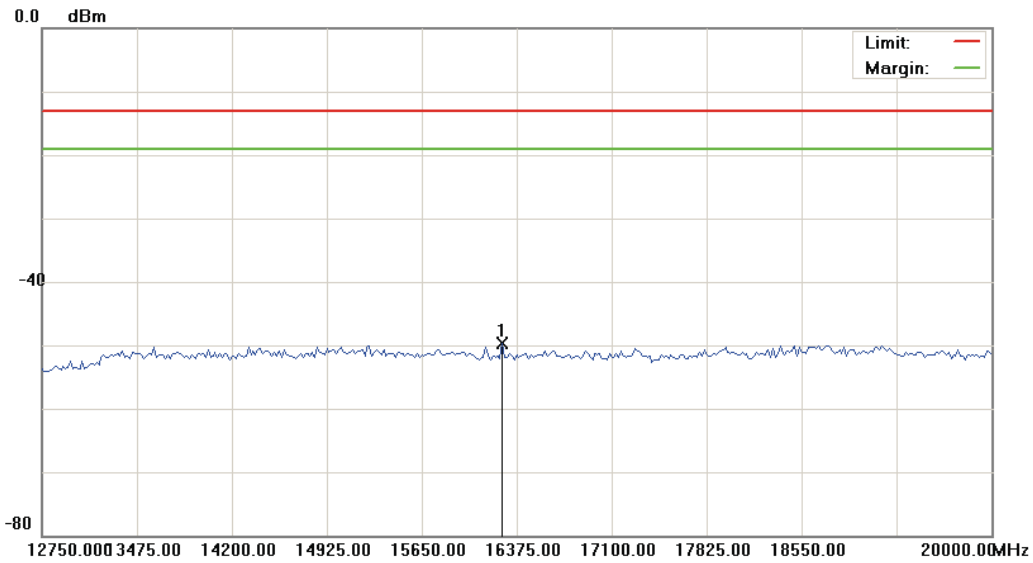
*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH9262)

Data :#6

Date: 2015/10/12

Time: 下午 02:01:51



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 24 conducted(9k-26.5G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 1000 KHz VBW: 3000 KHz

M/N: TMU-1500

Mode: WCDMA Band II

Note:

No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Over dB	Antenna Height cm	Table Degree	Comment
1	*	16266.250	-56.16	6.37	-49.79	-13.00	-36.79	peak		

*:Maximum data x:Over limit !:over margin

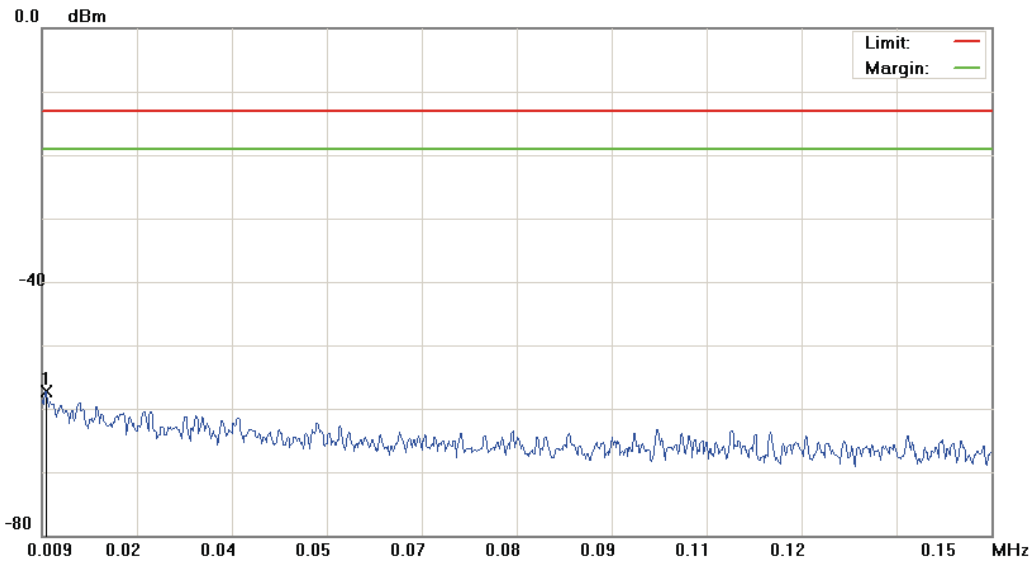


File :TMU-1500(CH9400)

Data :#1

Date: 2015/10/12

Time: 上午 11:11:20



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

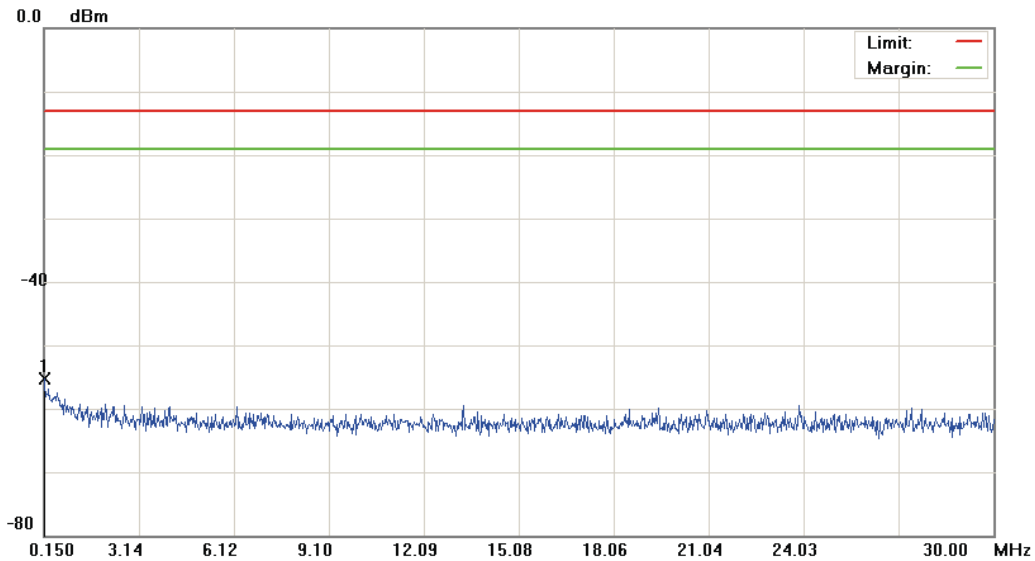
Humidity: 55 %

RBW: 1 KHz VBW: 3 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	0.0096	-68.68	11.33	-57.35	-13.00	-44.35	peak		

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH9400) Data :#2 Date: 2015/10/12 Time: 上午 11:11:44



Site: site #1 Polarization: *Conducted Power* Temperature: 26 °C
 Limit: FCC Part 24 conducted(9k-26.5G) Power: DC 12V Humidity: 55 %
 EUT: M2M Advanced Industrial Gateway Distance: RBW: 10 KHz VBW: 30 KHz
 M/N: TMU-1500
 Mode: WCDMA Band II
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	0.1500	-67.82	12.47	-55.35	-13.00	-42.35	peak		Comment

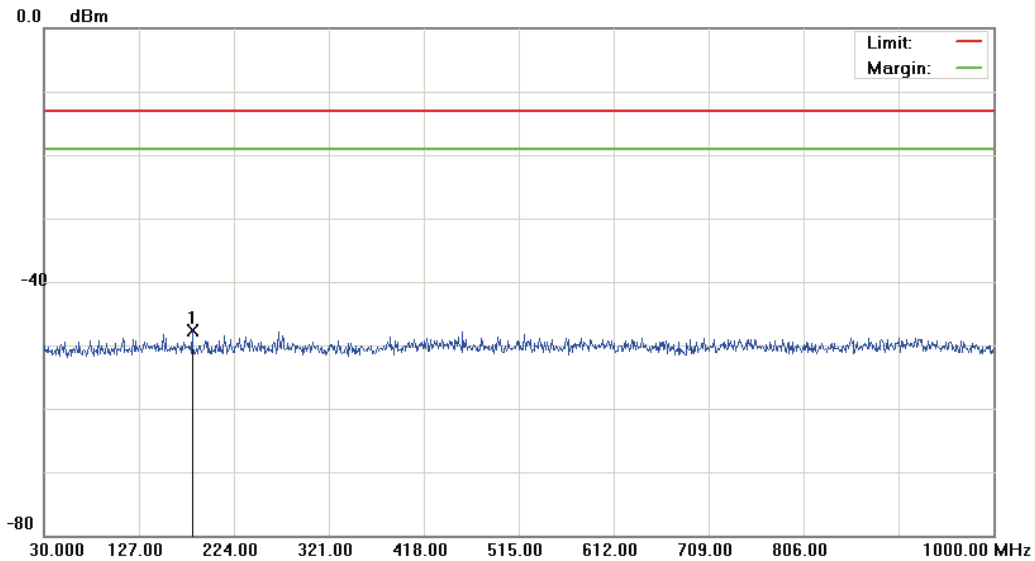
*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH9400)

Data :#3

Date: 2015/10/12

Time: 上午 11:12:08



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 24 conducted(9k-26.5G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 100 KHz VBW: 300 KHz

M/N: TMU-1500

Mode: WCDMA Band II

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	181.3200	-61.04	13.29	-47.75	-13.00	-34.75	peak		Comment

*:Maximum data x:Over limit !:over margin

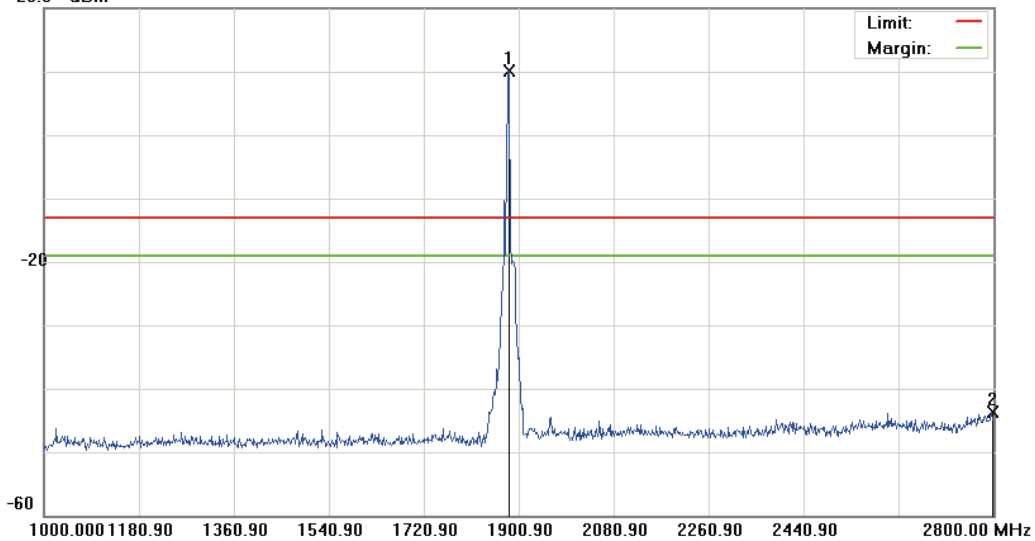
File :TMU-1500(CH9400)

Data :#4

Date: 2015/10/12

Time: 上午 11:37:07

20.0 dBm



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Over dB	Antenna Height cm	Table Degree degree	Comment
1	*	1881.100	5.36	4.74	10.10	-13.00	23.10	peak		Tx
2		2797.300	-49.69	5.91	-43.78	-13.00	-30.78	peak		

*:Maximum data x:Over limit !:over margin

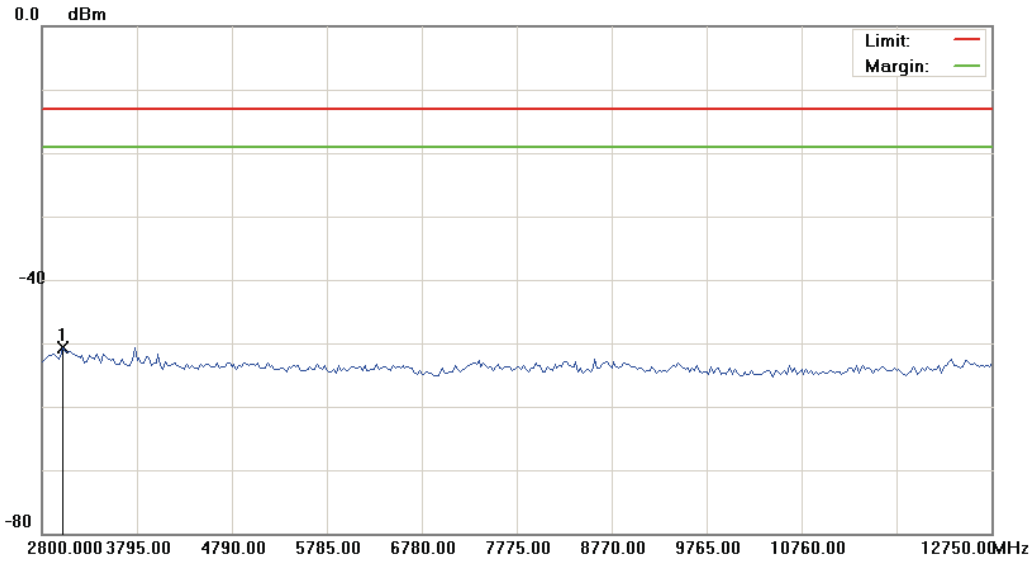


File :TMU-1500(CH9400)

Data :#5

Date: 2015/10/12

Time: 下午 02:02:36



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	3023.875	-56.22	5.48	-50.74	-13.00	-37.74	peak		Comment

*:Maximum data x:Over limit !:over margin

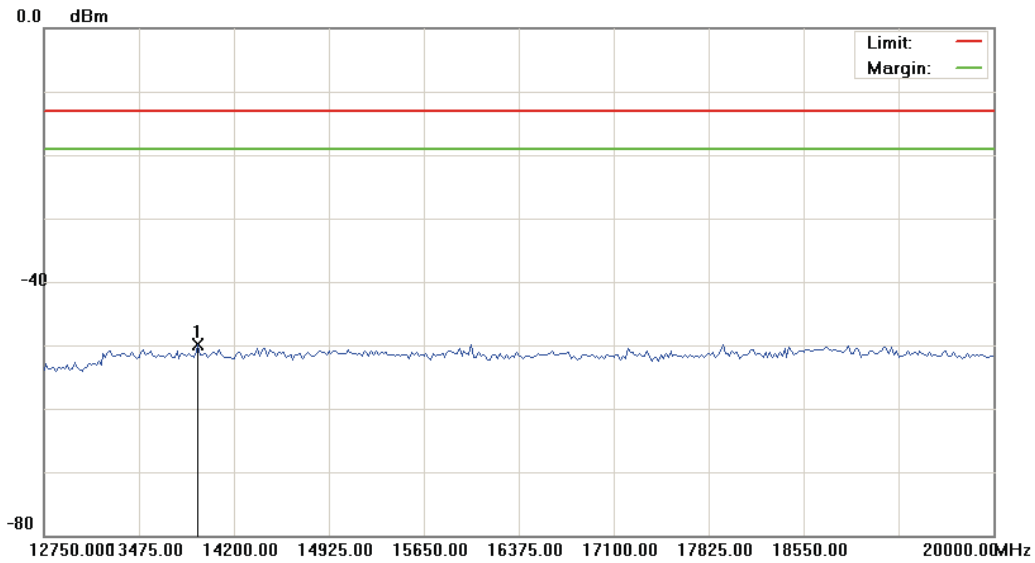


File :TMU-1500(CH9400)

Data :#6

Date: 2015/10/12

Time: 下午 02:02:55



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 24 conducted(9k-26.5G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 1000 KHz VBW: 3000 KHz

M/N: TMU-1500

Mode: WCDMA Band II

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	13928.125	-55.56	5.71	-49.85	-13.00	-36.85	peak		Comment

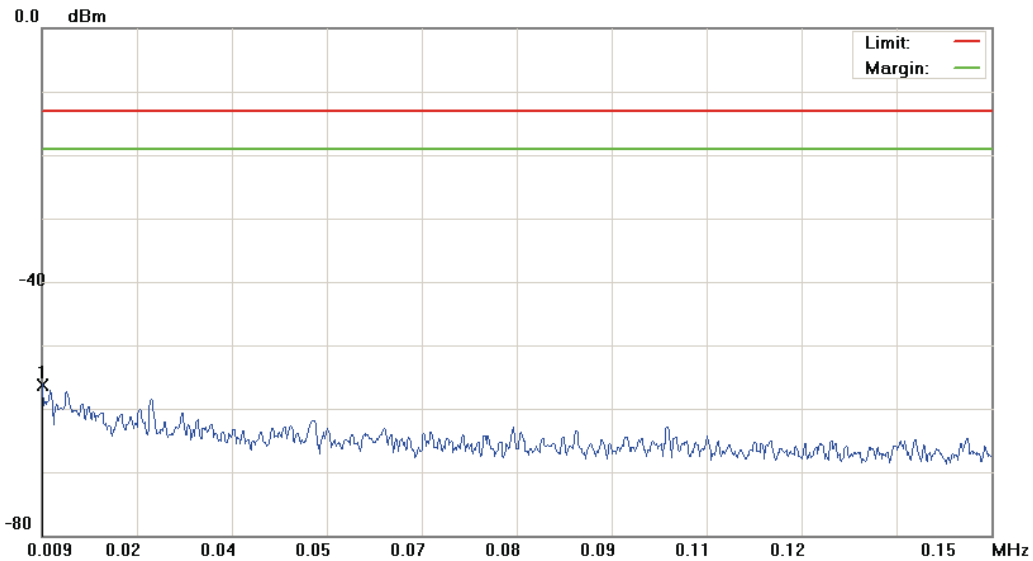
*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH9538)

Data : #1

Date: 2015/10/12

Time: 上午 11:12:52



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1 KHz VBW: 3 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	0.0090	-67.52	11.32	-56.20	-13.00	-43.20	peak		Comment

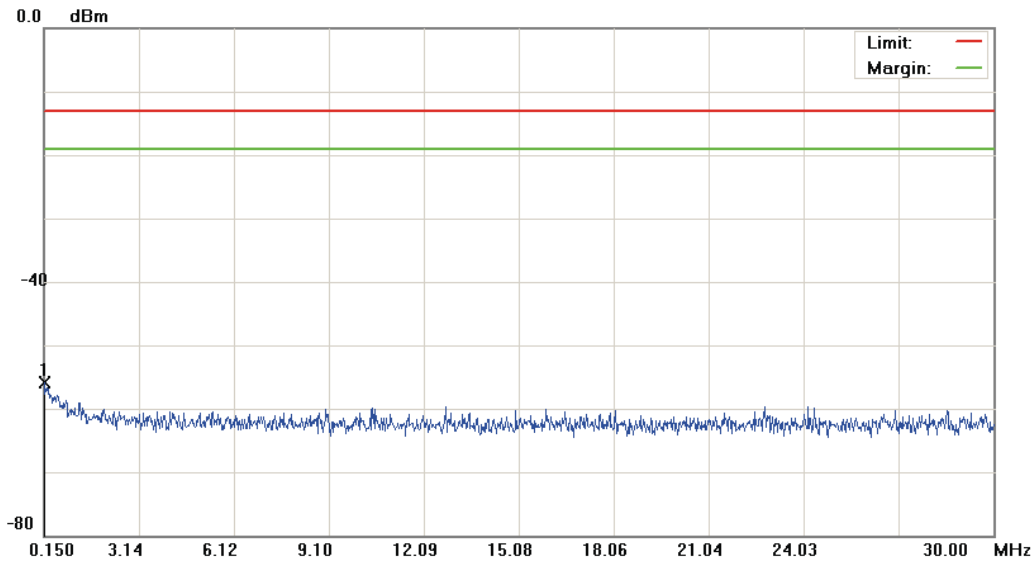
*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH9538)

Data :#2

Date: 2015/10/12

Time: 上午 11:13:16



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 10 KHz VBW: 30 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	0.1500	-68.43	12.47	-55.96	-13.00	-42.96	peak		

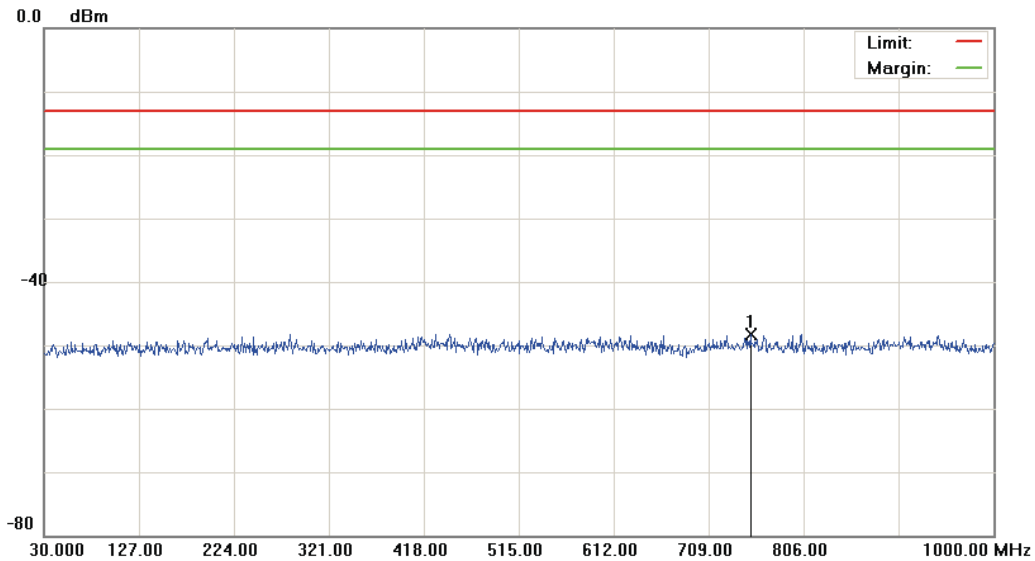
*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH9538)

Data :#3

Date: 2015/10/12

Time: 上午 11:13:40



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 24 conducted(9k-26.5G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 100 KHz VBW: 300 KHz

M/N: TMU-1500

Mode: WCDMA Band II

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	751.6800	-61.39	13.17	-48.22	-13.00	-35.22	peak		

*:Maximum data x:Over limit !:over margin

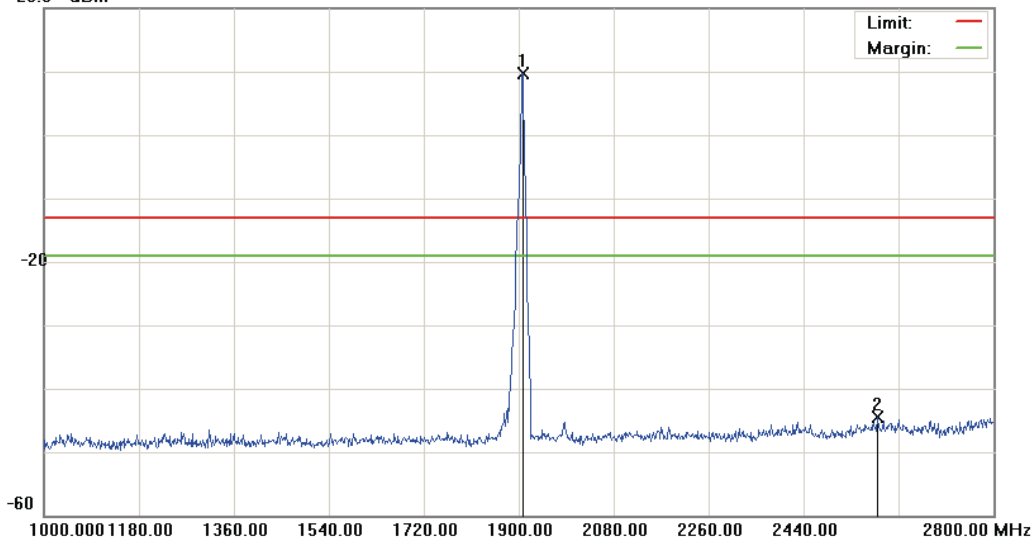
File : TMU-1500(CH9538)

Data :#4

Date: 2015/10/12

Time: 上午 11:39:05

20.0 dBm



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Over dB	Antenna Height cm	Table Degree degree	Comment
1	*	1908.100	3.85	5.88	9.73	-13.00	22.73	peak		Tx
2		2580.400	-49.90	5.35	-44.55	-13.00	-31.55	peak		

*:Maximum data x:Over limit !:over margin

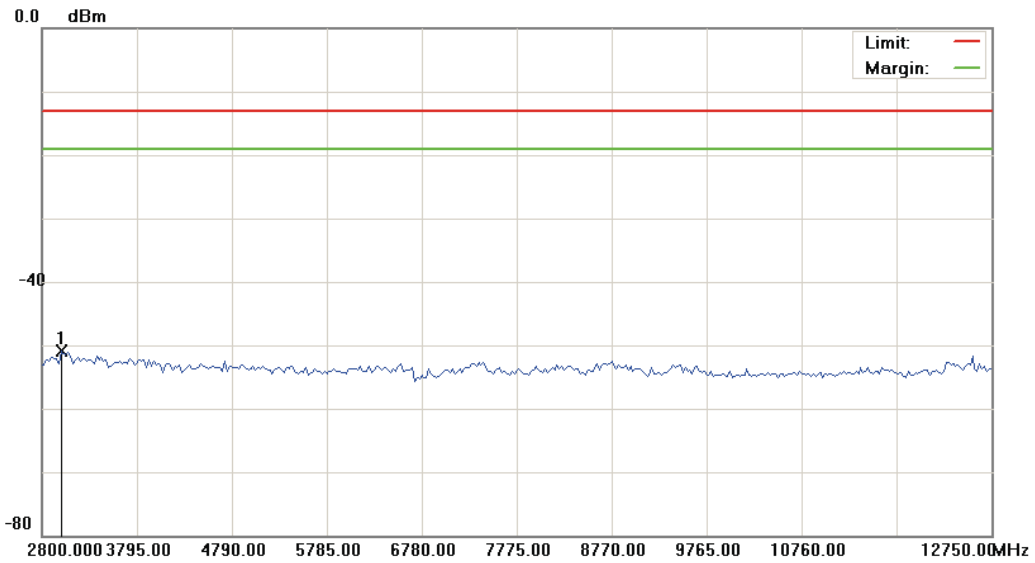


File :TMU-1500(CH9538)

Data :#5

Date: 2015/10/12

Time: 下午 02:03:26



Site: site #1

Limit: FCC Part 24 conducted(9k-26.5G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band II

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	2999.000	-56.41	5.48	-50.93	-13.00	-37.93	peak		Comment

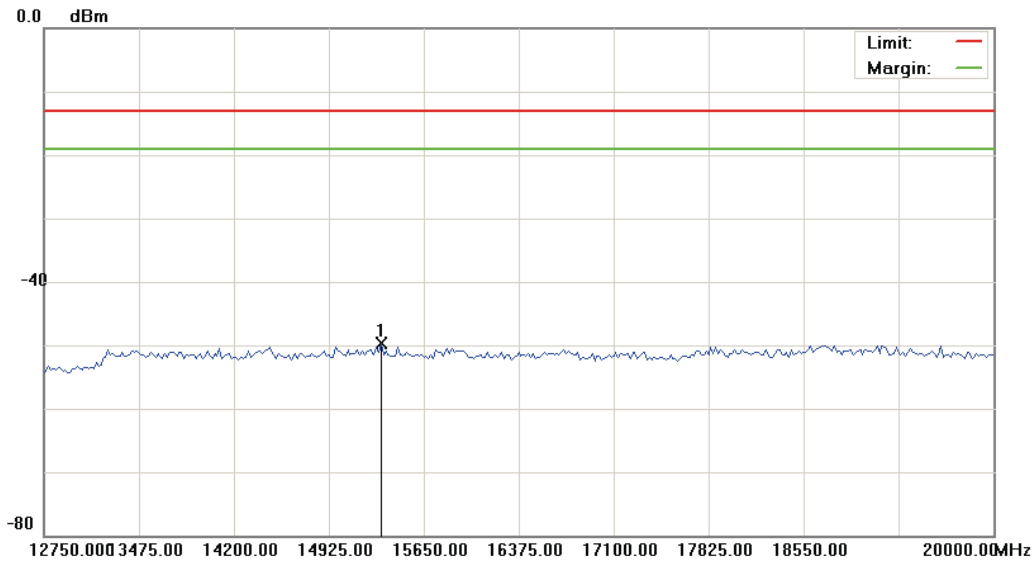
*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH9538)

Data :#6

Date: 2015/10/12

Time: 下午 02:03:46



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 24 conducted(9k-26.5G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 1000 KHz VBW: 3000 KHz

M/N: TMU-1500

Mode: WCDMA Band II

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	15323.750	-55.79	6.10	-49.69	-13.00	-36.69	peak		Comment

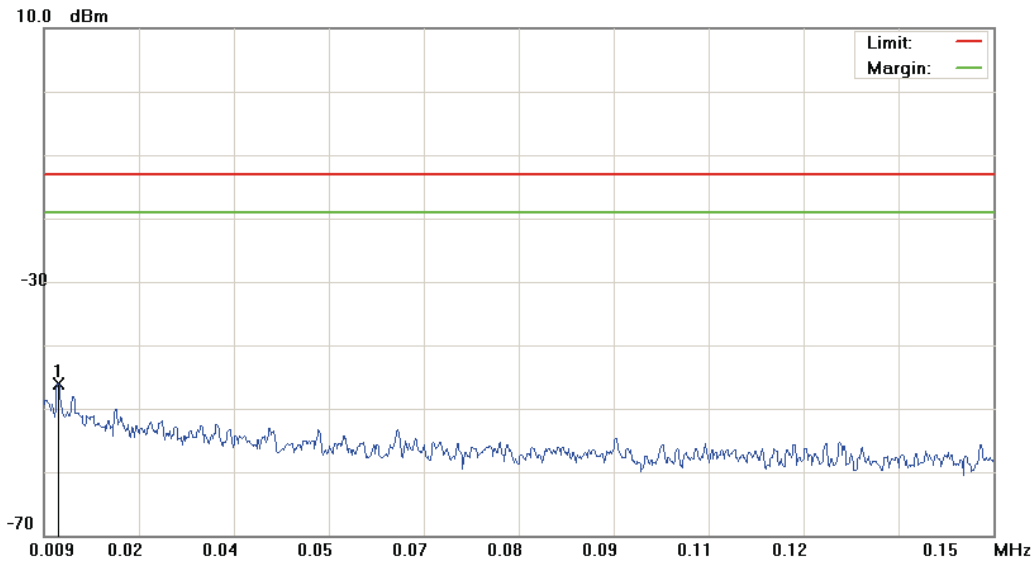
*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH4132)

Data : #1

Date: 2015/10/12

Time: 下午 12:00:26



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 22 conducted(9k-12.75G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 1 KHz VBW: 3 KHz

M/N: TMU-1500

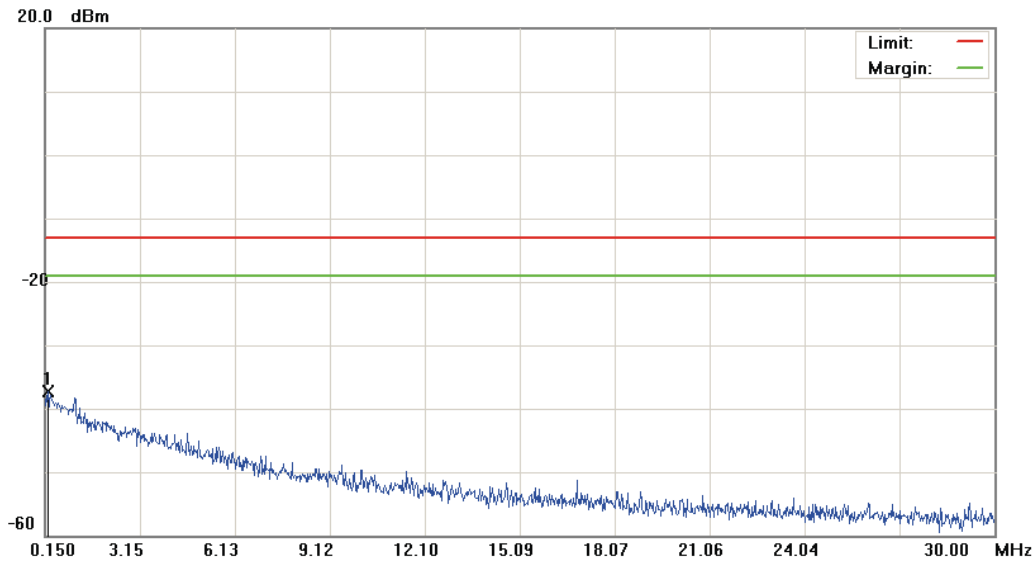
Mode: WCDMA Band V

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	0.0111	-76.65	30.57	-46.08	-13.00	-33.08	peak		Comment

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH4132) Data :#2 Date: 2015/10/12 Time: 下午 12:00:50



Site: site #1 Polarization: *Conducted Power* Temperature: 26 °C
Limit: FCC Part 22 conducted(9k-12.75G) Power: DC 12V Humidity: 55 %
EUT: M2M Advanced Industrial Gateway Distance: RBW: 10 KHz VBW: 30 KHz
M/N: TMU-1500
Mode: WCDMA Band V
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	0.2395	-68.57	31.24	-37.33	-13.00	-24.33	peak		

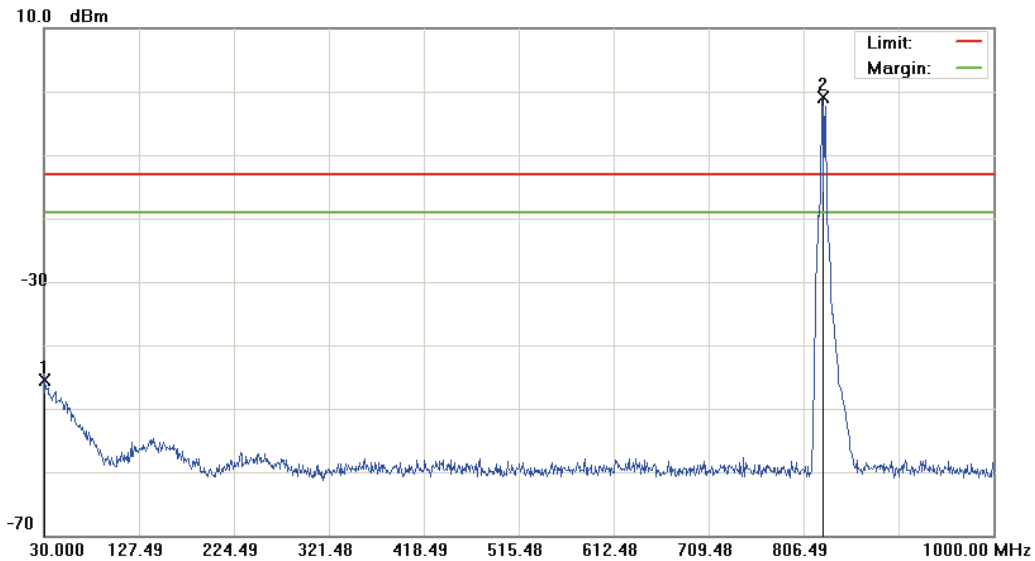
*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH4132)

Data :#3

Date: 2015/10/12

Time: 下午 12:01:14



Site: site #1

Limit: FCC Part 22 conducted(9k-12.75G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band V

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

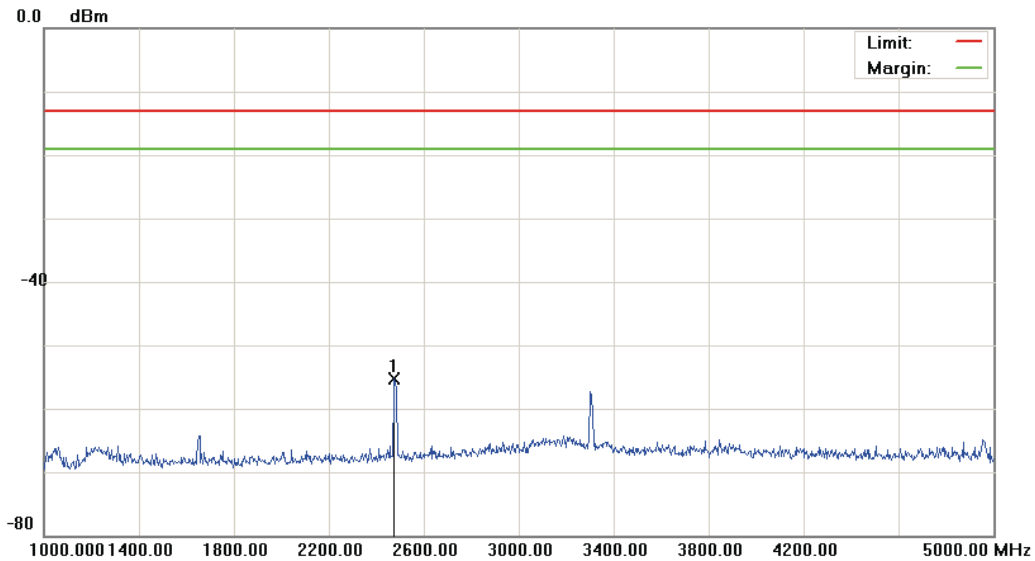
Humidity: 55 %

RBW: 100 KHz VBW: 300 KHz

No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Over dB	Antenna Height cm	Table Degree degree	Comment
1		30.9700	-62.52	17.10	-45.42	-13.00	-32.42	peak		
2	*	824.9150	-4.66	3.84	-0.82	-13.00	12.18	peak		Tx

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH4132) Data :#4 Date: 2015/10/12 Time: 下午 01:52:54



Site: site #1	Polarization: Conducted Power	Temperature: 26 °C
Limit: FCC Part 22 conducted(9k-12.75G)	Power: DC 12V	Humidity: 55 %
EUT: M2M Advanced Industrial Gateway	Distance:	RBW: 1000 KHz VBW: 3000 KHz
M/N: TMU-1500		
Mode: WCDMA Band V		
Note:		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	2476.000	-59.72	4.44	-55.28	-13.00	-42.28	peak		Comment

*:Maximum data x:Over limit !:over margin

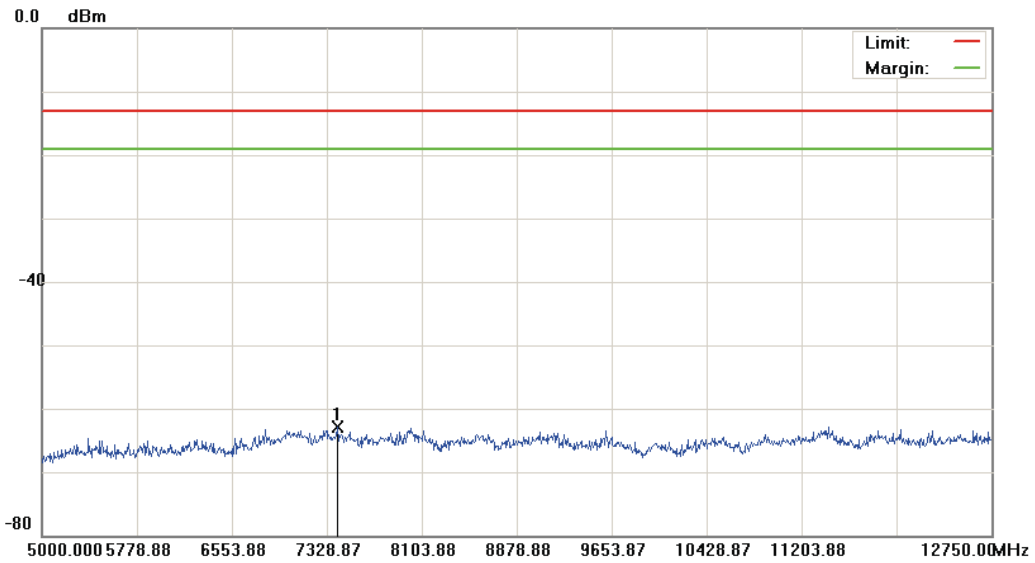


File :TMU-1500(CH4132)

Data :#5

Date: 2015/10/12

Time: 下午 01:53:17



Site: site #1

Limit: FCC Part 22 conducted(9k-12.75G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band V

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	7410.250	-68.01	5.20	-62.81	-13.00	-49.81	peak		

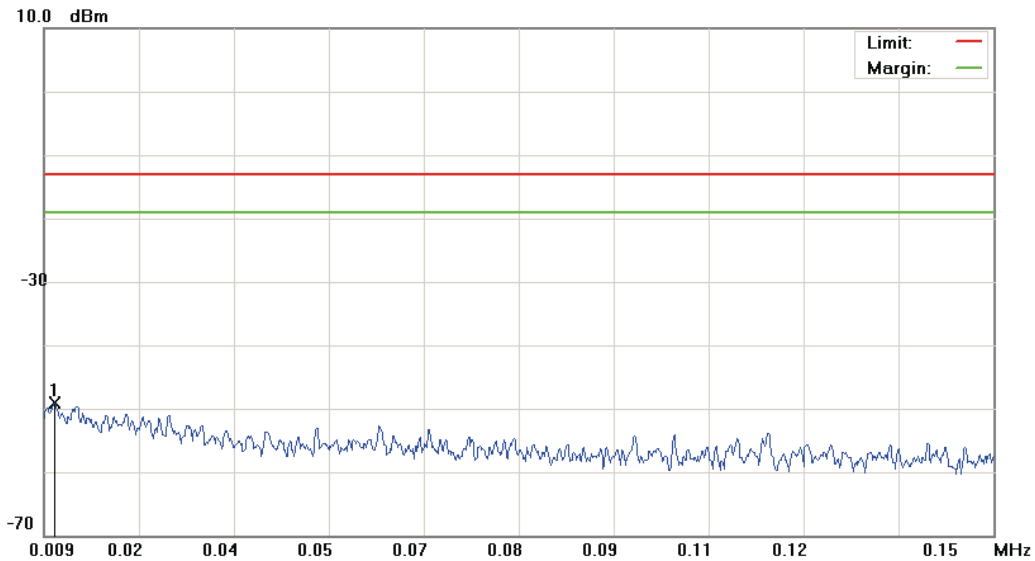
*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH4183)

Data :#1

Date: 2015/10/12

Time: 下午 12:03:32



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 22 conducted(9k-12.75G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 1 KHz VBW: 3 KHz

M/N: TMU-1500

Mode: WCDMA Band V

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	0.0106	-79.69	30.57	-49.12	-13.00	-36.12	peak		Comment

*:Maximum data x:Over limit !:over margin

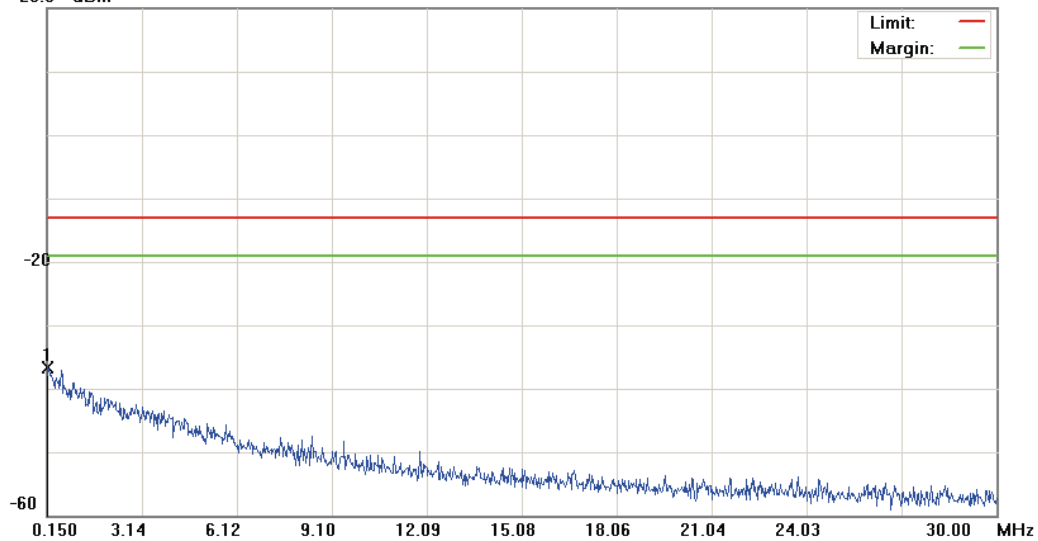
File :TMU-1500(CH4183)

Data :#2

Date: 2015/10/12

Time: 下午 12:03:56

20.0 dBm



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 22 conducted(9k-12.75G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 10 KHz VBW: 30 KHz

M/N: TMU-1500

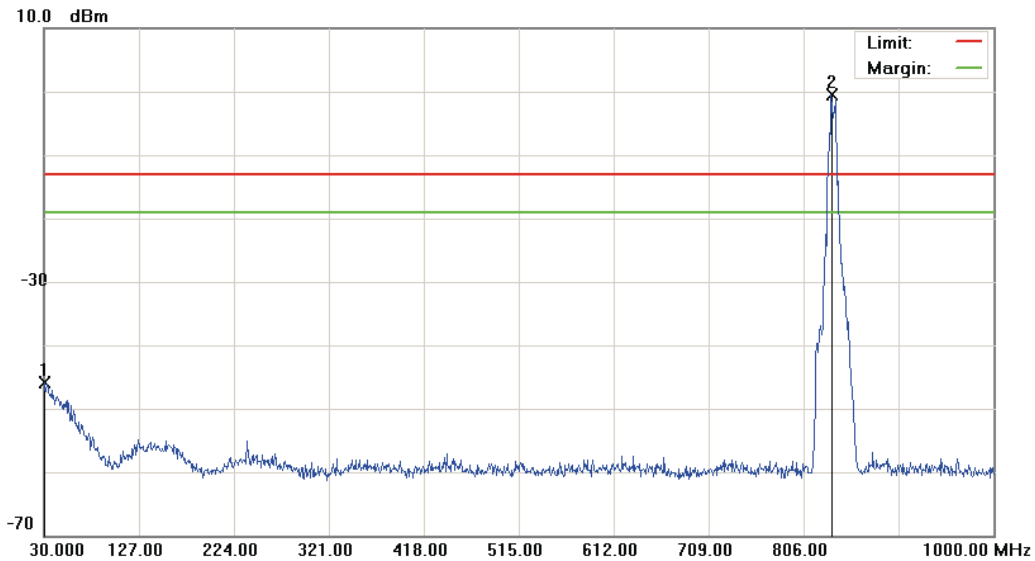
Mode: WCDMA Band V

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	0.1500	-67.11	30.51	-36.60	-13.00	-23.60	peak		

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH4183) Data :#3 Date: 2015/10/12 Time: 下午 12:04:21



Site: site #1 Polarization: *Conducted Power* Temperature: 26 °C
 Limit: FCC Part 22 conducted(9k-12.75G) Power: DC 12V Humidity: 55 %
 EUT: M2M Advanced Industrial Gateway Distance: RBW: 100 KHz VBW: 300 KHz
 M/N: TMU-1500
 Mode: WCDMA Band V
 Note:

No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Over dB	Antenna Height cm	Table Degree degree	Comment
1		30.0000	-63.16	17.21	-45.95	-13.00	-32.95	peak		
2	*	834.6150	-4.53	3.95	-0.58	-13.00	12.42	peak		Tx

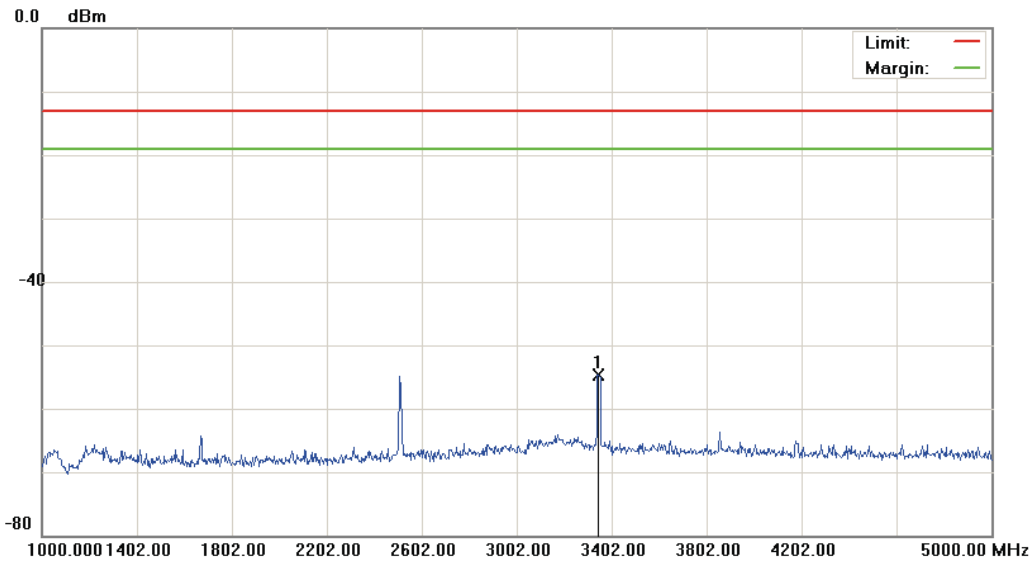
*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH4183)

Data :#4

Date: 2015/10/12

Time: 下午 01:54:01



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 22 conducted(9k-12.75G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 1000 KHz VBW: 3000 KHz

M/N: TMU-1500

Mode: WCDMA Band V

Note:

No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Over dB	Antenna Height cm	Table Degree	Comment
1	*	3342.000	-59.12	4.50	-54.62	-13.00	-41.62	peak		

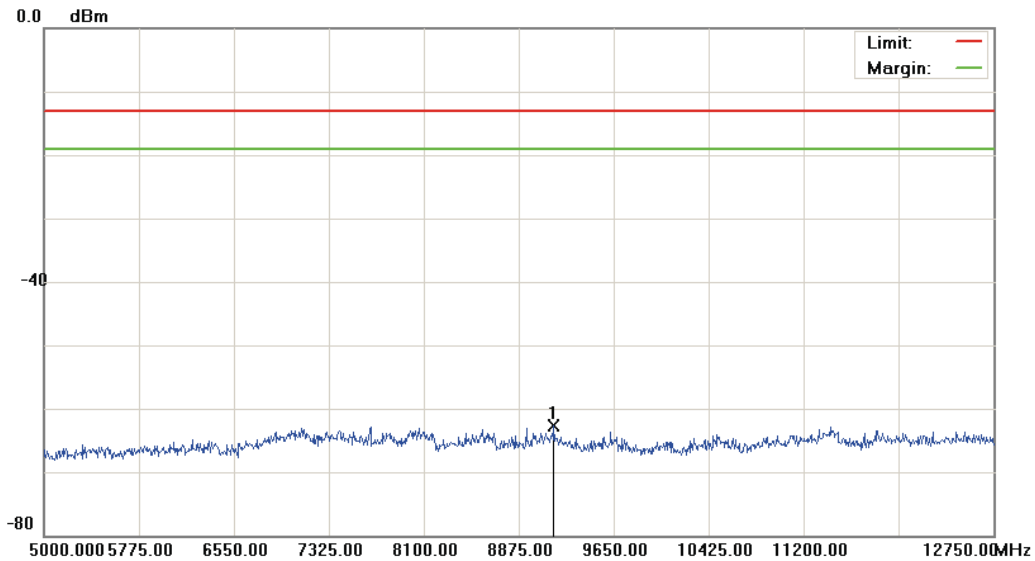
*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH4183)

Data : #5

Date: 2015/10/12

Time: 下午 01:54:24



Site: site #1

Polarization: Conducted Power

Temperature: 26 °C

Limit: FCC Part 22 conducted(9k-12.75G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 1000 KHz VBW: 3000 KHz

M/N: TMU-1500

Mode: WCDMA Band V

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	9161.750	-68.71	5.94	-62.77	-13.00	-49.77	peak		

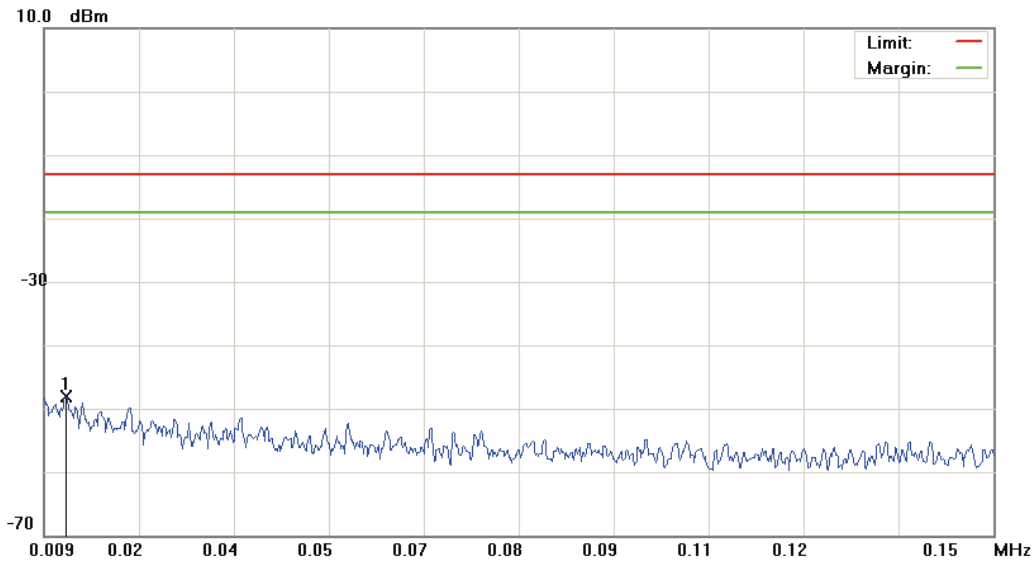
*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH4233)

Data :#1

Date: 2015/10/12

Time: 上午 11:54:56



Site: site #1

Limit: FCC Part 22 conducted(9k-12.75G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band V

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1 KHz VBW: 3 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree
1	*	0.0122	-78.60	30.57	-48.03	-13.00	-35.03	peak		Comment

*:Maximum data x:Over limit !:over margin

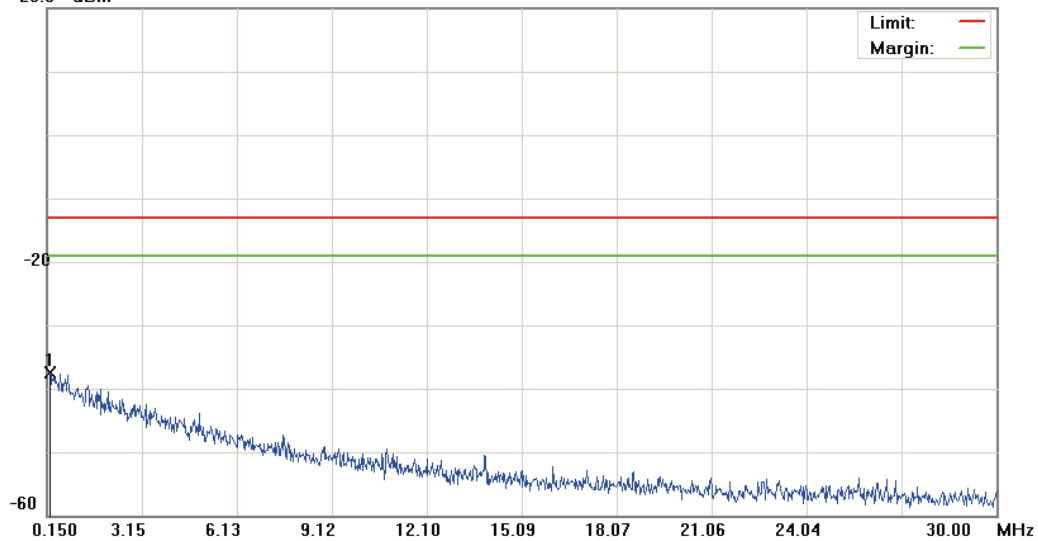
File :TMU-1500(CH4233)

Data :#2

Date: 2015/10/12

Time: 上午 11:55:20

20.0 dBm



Site: site #1

Polarization: *Conducted Power*

Temperature: 26 °C

Limit: FCC Part 22 conducted(9k-12.75G)

Power: DC 12V

Humidity: 55 %

EUT: M2M Advanced Industrial Gateway

Distance:

RBW: 10 KHz VBW: 30 KHz

M/N: TMU-1500

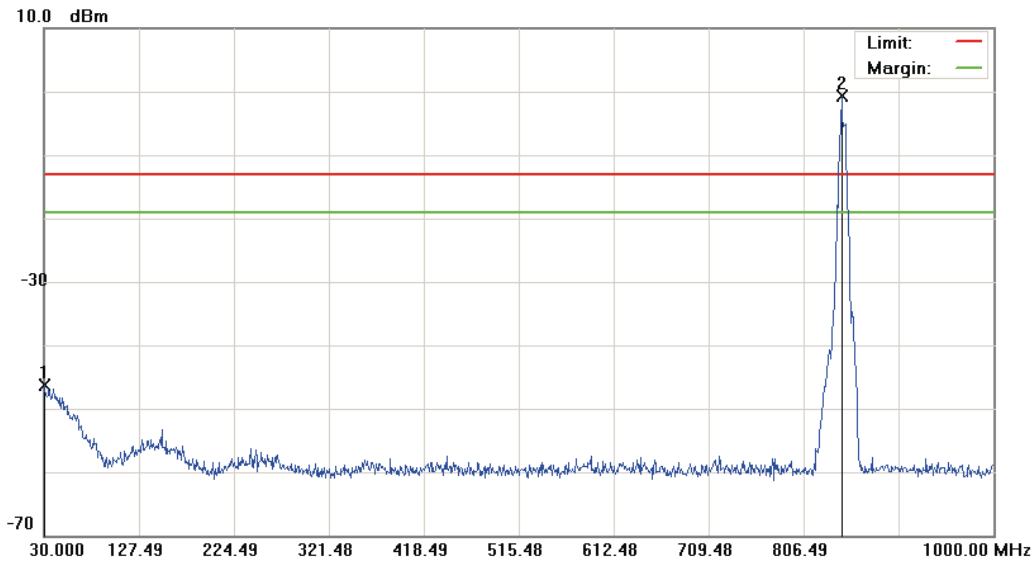
Mode: WCDMA Band V

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	0.2246	-68.56	31.12	-37.44	-13.00	-24.44	peak		

*:Maximum data x:Over limit !:over margin

File : TMU-1500(CH4233) Data :#3 Date: 2015/10/12 Time: 上午 11:55:44



Site: site #1	Polarization: Conducted Power	Temperature: 26 °C
Limit: FCC Part 22 conducted(9k-12.75G)	Power: DC 12V	Humidity: 55 %
EUT: M2M Advanced Industrial Gateway	Distance:	RBW: 100 KHz VBW: 300 KHz
M/N: TMU-1500		
Mode: WCDMA Band V		
Note:		

No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Over dB	Antenna Height cm	Table Degree degree	Comment
1		30.4850	-63.43	17.16	-46.27	-13.00	-33.27	peak		
2	*	845.2850	-4.76	3.99	-0.77	-13.00	12.23	peak		Tx

*:Maximum data x:Over limit !:over margin

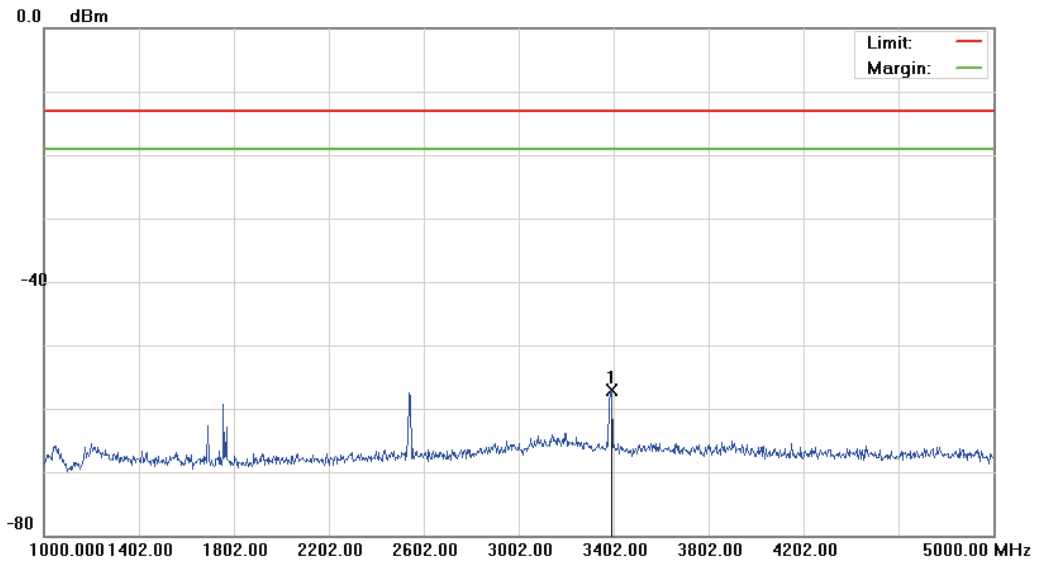


File :TMU-1500(CH4233)

Data :#4

Date: 2015/10/12

Time: 下午 01:55:12



Site: site #1

Limit: FCC Part 22 conducted(9k-12.75G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band V

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Over dB	Antenna Height cm	Table Degree	Comment
1	*	3390.000	-61.49	4.47	-57.02	-13.00	-44.02	peak		

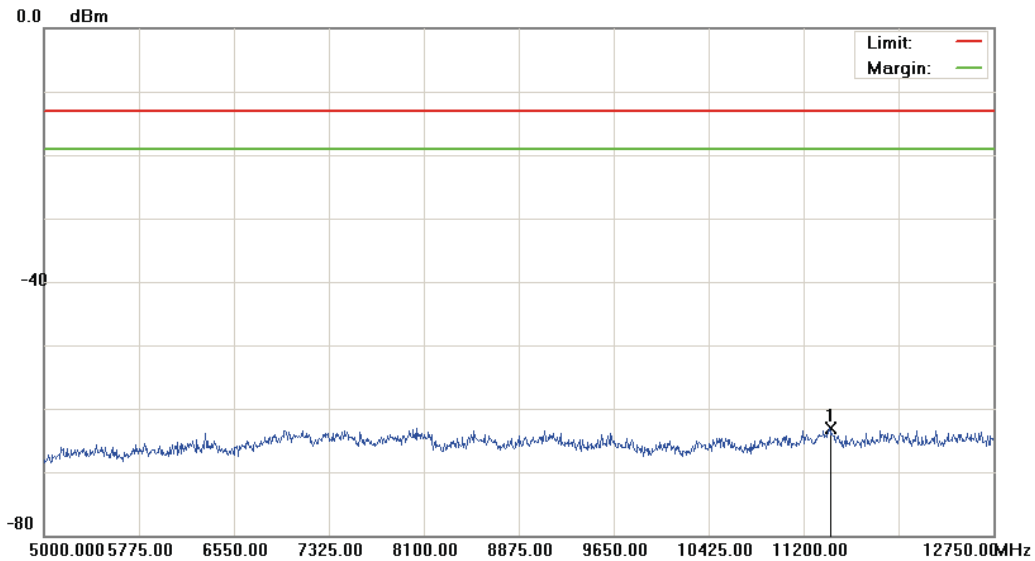
*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH4233)

Data :#5

Date: 2015/10/12

Time: 下午 01:55:35



Site: site #1

Limit: FCC Part 22 conducted(9k-12.75G)

EUT: M2M Advanced Industrial Gateway

M/N: TMU-1500

Mode: WCDMA Band V

Note:

Polarization: Conducted Power

Power: DC 12V

Distance:

Temperature: 26 °C

Humidity: 55 %

RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	cm	degree	Comment
1	*	11413.125	-68.58	5.57	-63.01	-13.00	-50.01	peak		

*:Maximum data x:Over limit !:over margin

8 Field Strength of Spurious Radiation Test

8.1. Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

8.2. Test Instruments

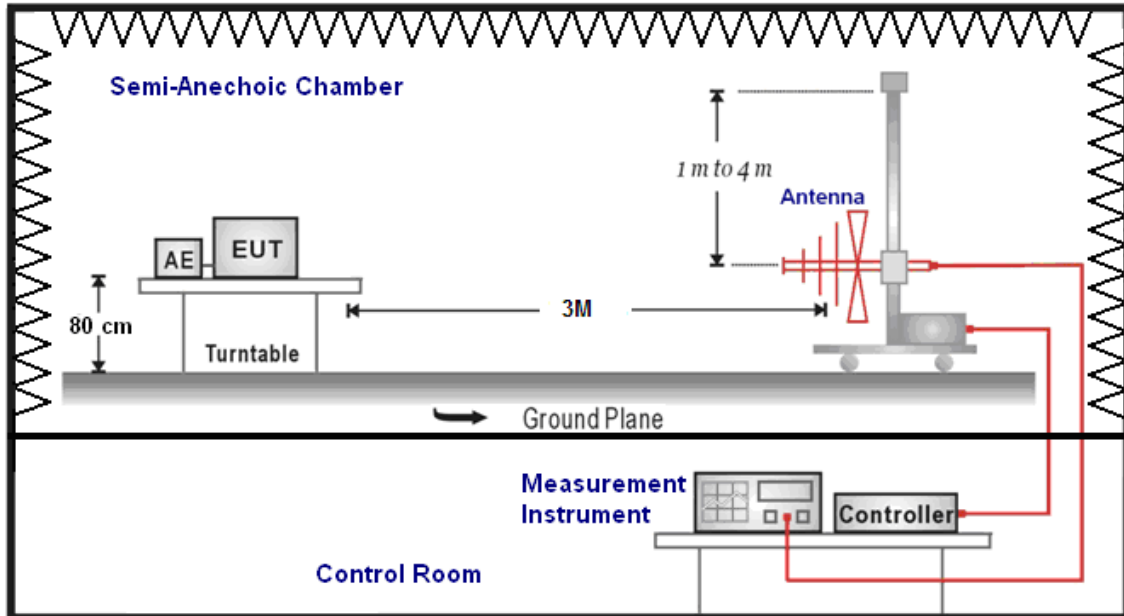
3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
RF Pre-selector	Agilent	N9039A	MY46520256	01/06/2015	(1)
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/06/2015	(1)
Pre Amplifier	Agilent	8449B	3008A02237	02/24/2015	(1)
Pre Amplifier	Agilent	8447D	2944A10961	02/24/2015	(1)
Broadband Antenna (30MHz~1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	9163-270	08/11/2015	(1)
Sleeve Dipole(CF880) (780-980MHz)	ETS	3126-880	00064344	10/06/2014	(2)
Sleeve Dipole(CF1845) (1695-1995MHz)	ETS	3126-1845	00083335	10/06/2014	(2)
Horn Antenna (1~18GHz)	ETS	3117	00152321	08/14/2015	(1)
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/12/2015	(1)
Horn Antenna (18~40GHz)	ETS	3116	00086467	09/01/2015	(1)
Horn Antenna (18~40GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170	9170-320	07/06/2015	(1)
Test Site	ATL	TE01	888001	08/27/2015	(1)

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

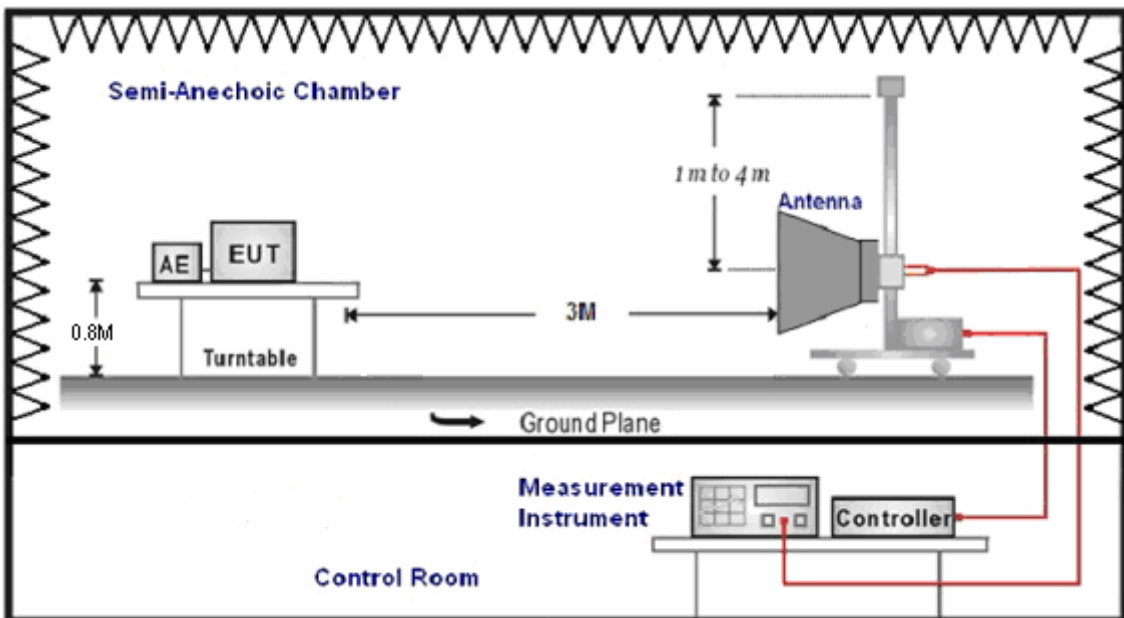
Note: N.C.R. = No Calibration Request.

8.3. Setup

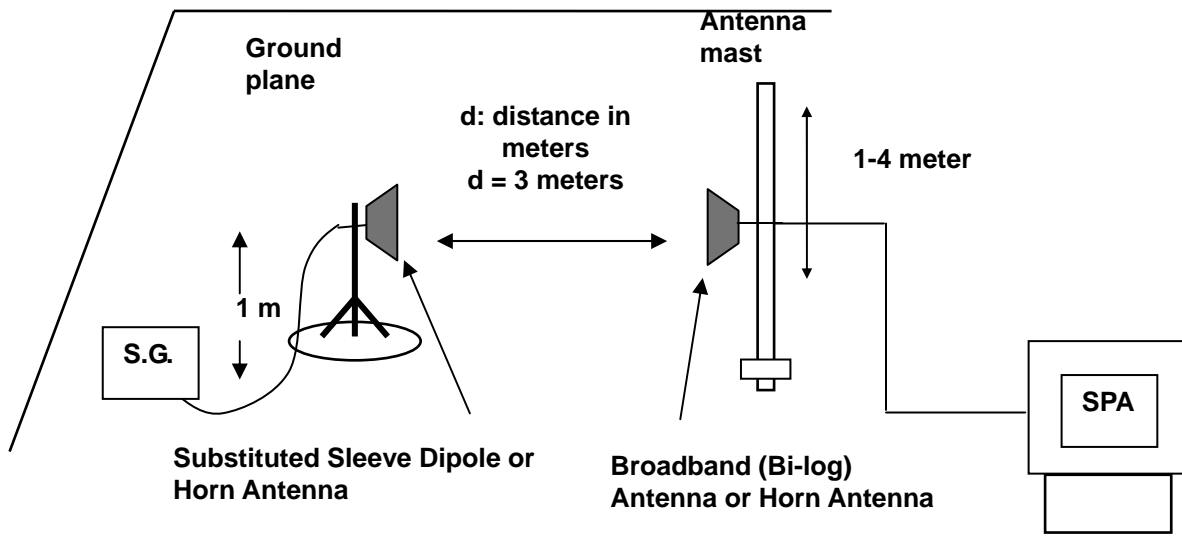
Below 1GHz



Above 1GHz



For Substituted Method Test Set-UP



8.4. Test Procedure

- The EUT was set up for the maximum power. The power was measured with Spectrum Analyzer. All measurements were done at 3 channels (low, middle and high operational frequency range). RWB and VBW is 1MHz.
- Radiation Emission measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The substitution antenna (Note:1 & 2) is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step a. Record the power level of S.G.
- $E.I.R.P. = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$
- $E.R.P. = E.I.R.P. - 2.15 \text{ dB}$

Note: 1. Below 1 GHz Substituted Method Test : Sleeve dipole antenna to Bi-Log Antenna

2. Above 1 GHz Substituted Method Test : Horn antenna to Horn Antenna

8.5. Uncertainty

The measurement uncertainty is defined as for Field Strength of Spurious Radiation measurement is $\pm 3.072 \text{ dB}$.

8.6. Test Result

Standard:	FCC Part 24	Test Distance:	3m
Test item:	Radiated Emission	Power:	DC 12V
Model Number:	TMU-1500	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	1	Date:	12/05/2015
Frequency:	1852.4 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
6268.000	-75.01	23.42	-51.59	-13.00	-38.59	peak	H
3704.800	-55.41	16.07	-39.34	-13.00	-26.34	peak	V

Standard:	FCC Part 24	Test Distance:	3m
Test item:	Radiated Emission	Power:	DC 12V
Model Number:	TMU-1500	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	1	Date:	12/05/2015
Frequency:	1880.0 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
5968.000	-76.11	22.03	-54.08	-13.00	-41.08	peak	H
3760.000	-53.96	16.11	-37.85	-13.00	-24.85	peak	V

Standard:	FCC Part 24	Test Distance:	3m
Test item:	Radiated Emission	Power:	DC 12V
Model Number:	TMU-1500	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	1	Date:	12/05/2015
Frequency:	1907.6 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
7420.000	-74.79	26.75	-48.04	-13.00	-35.04	peak	H
3815.200	-55.43	16.16	-39.27	-13.00	-26.27	peak	V

Standard:	FCC Part 22	Test Distance:	3m
Test item:	Radiated Emission	Power:	DC 12V
Model Number:	TMU-1500	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	2	Date:	12/05/2015
Frequency:	826.4 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
1652.800	-47.41	10.08	-37.33	-13.00	-24.33	peak	H
1652.800	-38.51	10.08	-28.43	-13.00	-15.43	peak	V

Standard:	FCC Part 22	Test Distance:	3m
Test item:	Radiated Emission	Power:	DC 12V
Model Number:	TMU-1500	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	2	Date:	12/05/2015
Frequency:	836.6 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
1673.200	-45.85	10.07	-35.78	-13.00	-22.78	peak	H
1673.200	-37.60	10.07	-27.53	-13.00	-14.53	peak	V

Standard:	FCC Part 22	Test Distance:	3m
Test item:	Radiated Emission	Power:	DC 12V
Model Number:	TMU-1500	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	2	Date:	12/05/2015
Frequency:	846.6 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
1692.800	-44.46	10.07	-34.39	-13.00	-21.39	peak	H
1692.800	-38.09	10.07	-28.02	-13.00	-15.02	peak	V

9 Frequency Stability (Temperature & Voltage Variation) Test

9.1. Limit

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency.

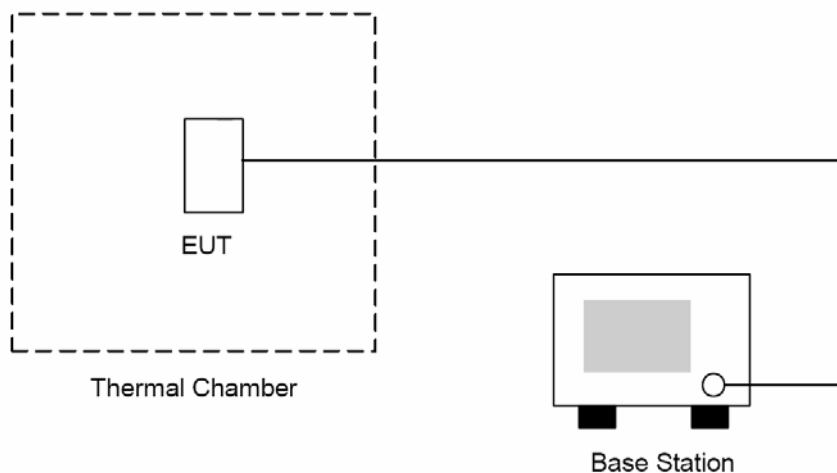
9.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Universal Radio Communication Tester	R & S	CMU200	109369	10/21/2015	(2)
Temperature & Humidity Chamber	TAICHY	MHU-225LA	980729	04/27/2015	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

9.3. Setup



9.4. Test Procedure

The measurement is made according to FCC rules part 22 and 24:

1. The EUT and test equipment were set up as shown on the following section.
2. With all power removed, the temperature was decreased to -30°C and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was note within one minute.
3. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.
4. The EUT was placed in a temperature chamber at $25 \pm 5^{\circ}\text{C}$ and connected as the following section.
5. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
6. The temperature tests were performed for the worst case.
7. Test data was recorded.

9.5. Uncertainty

The measurement uncertainty is defined as for Frequency Stability (Temperature Variation) measurement is $\pm 10\text{Hz}$.

9.6. Test Result

Model Number	TMU-1500					
Test Item	Frequency Stability (Temperature & Voltage Variation)					
Test Mode	Mode 1					
Date of Test	10/12/2015				Test Site	TE05
Level	Voltage [Vdc]	Temperature (°C)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Result
Normal	12.00	-30	-2.86	-0.002	±2.5	Pass
Normal	12.00	-20	1.77	0.001	±2.5	Pass
Normal	12.00	-10	-7.08	-0.004	±2.5	Pass
Normal	12.00	0	-3.81	-0.002	±2.5	Pass
Normal	12.00	10	-21.86	-0.012	±2.5	Pass
Battery full point	32.00	20	8.05	0.004	±2.5	Pass
Normal	12.00	20	-15.08	-0.008	±2.5	Pass
Battery cut-off point	5.00	20	6.53	0.003	±2.5	Pass
Normal	12.00	30	0.52	0.000	±2.5	Pass
Normal	12.00	40	13.19	0.007	±2.5	Pass
Normal	12.00	50	-9.45	-0.005	±2.5	Pass

Model Number	TMU-1500					
Test Item	Frequency Stability (Temperature & Voltage Variation)					
Test Mode	Mode 2					
Date of Test	10/12/2015				Test Site	TE05
Level	Voltage [Vdc]	Temperature (°C)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Result
Normal	12.00	-30	-7.46	-0.009	±2.5	Pass
Normal	12.00	-20	-9.26	-0.011	±2.5	Pass
Normal	12.00	-10	-8.47	-0.010	±2.5	Pass
Normal	12.00	0	-13.87	-0.017	±2.5	Pass
Normal	12.00	10	-12.26	-0.015	±2.5	Pass
Battery full point	32.00	20	-3.36	-0.004	±2.5	Pass
Normal	12.00	20	1.66	0.002	±2.5	Pass
Battery cut-off point	5.00	20	7.49	0.009	±2.5	Pass
Normal	12.00	30	5.77	0.007	±2.5	Pass
Normal	12.00	40	-16.74	-0.020	±2.5	Pass
Normal	12.00	50	9.98	0.012	±2.5	Pass