APPLICATION CERTIFICATION FCC Part 22&24
On Behalf of
Shenzhen Coban Electronics Co., Ltd.

GPS TRACKER

Model No.: 302

FCC ID: 2AA64-302

Prepared for	:	Shenzhen Coban Electronics Co., Ltd.
Address	:	No.601, 6/F, Bldg. 8, Zhiheng Industrial Park, Guankou 2nd Road, Nantou, Nanshan District, Shenzhen, Guangdong, China.
Prepared by	:	ACCURATE TECHNOLOGY CO., LTD
Address	:	F1, Bldg. A, Changyuan New Material Port, Keyuan Rd. Science & Industry Park, Nanshan, Shenzhen, Guangdong P.R. China Tel: (0755) 26503290 Fax: (0755) 26503396

Report No.	:	ATE20171086
Date of Test	:	June 13, 2017-July 04, 2017
Date of Report	:	July 05, 2017

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Test Report Certification

Applicant& address	:	Shenzhen Coban Electronics Co., Ltd No.601, 6/F, Bldg. 8, Zhiheng Industrial Park, Guankou 2nd Road, Nantou, Nanshan District, Shenzhen, Guangdong, China.
Manufacturer& address	:	Shenzhen Coban Electronics Co., Ltd No.601, 6/F, Bldg. 8, Zhiheng Industrial Park, Guankou 2nd Road, Nantou, Nanshan District, Shenzhen, Guangdong, China.
Product	:	GPS TRACKER
Model No.	:	302
Trade name	:	(DI QIU TU XING)

Measurement Procedure Used:

FCC Rules and Regulations Part 22 Subpart H - Public Mobile Services
Part 24 Subpart E - Personal Communication Services
FCC part 2
ANSI/TIA/EIA-603-D
KDB 971168 D01 Power Meas License Digital Systems v02r02

The device described above is tested by ACCURATE TECHNOLOGY CO. LTD to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 22H&24E limits. The measurement results are contained in this test report and ACCURATE TECHNOLOGY CO. LTD is assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC requirements.

This report applies to above tested sample only. This report shall not be reproduced in part without written approval of ACCURATE TECHNOLOGY CO. LTD.

Date of Test :	June 13, 2017-July 04, 2017
Date of Report :	July 05, 2017
Prepared by :	(Tim Jiang, Engineer)
Approved & Authorized Signer :	(Sean Liu, Manager)

1. GENERAL INFORMATION

1.1.Description of Device (EUT)

EUT	:	GPS TRACKER
Model Number	:	302
Type of Modulation	:	GSM/GPRS:GMSK
Number of channels	:	GSM 850: 824.2-848.8 MHz 125 Channels GSM 1900 : 1850.2-1909.8 MHz 300 Channels
Frequency	:	GSM 850/1900
GPRS Class	:	10
Antenna Gain	:	1dBi
Type of Antenna	:	External Antenna
Power Supply	:	1. DC 12-24V(Powered by Harness port) 2. DC 3.7V(Powered by battery)
HW VERSION	:	103-S2
SW VERSION	:	103_61_170523_S2_V1.4
Applicant	:	Shenzhen Coban Electronics Co., Ltd.
Address	:	No.601, 6/F, Bldg. 8, Zhiheng Industrial Park, Guankou 2nd Road, Nantou, Nanshan District, Shenzhen, Guangdong, China.
Manufacturer	:	Shenzhen Coban Electronics Co., Ltd.
Address	:	No.601, 6/F, Bldg. 8, Zhiheng Industrial Park, Guankou 2nd Road, Nantou, Nanshan District, Shenzhen, Guangdong, China.
Date of sample received	:	June 13, 2017
Date of Test	:	June 13, 2017-July 04, 2017

1.2.Carrier Frequency of Channels

Frequency Range:
Cellular Band: 824-849 MHz (TX), 869-894 MHz (RX)
PCS Band: 1850-1910 MHz (TX), 1930-1990 MHz (RX)

Modulation Mode: GMSK

Manufacturing tolerance

GSM

GSM 850			
Channel	Channel 251	Channel 190	Channel 128
Target (dBm)	31.50	31.50	31.50
Tolerance ±(dB)	1	1	1
GSM 1900			
Channel	Channel 810	Channel 661	Channel 512
Target (dBm)	29.0	29.0	29.0
Tolerance ±(dB)	1	1	1

GPRS (GMSK Modulation)

GSM 850 GPRS				
Channel		251	190	128
1 Txslot	Target (dBm)	31.5	31.5	31.5
	Tolerance ±(dB)	1	1	1
2 Txslot	Target (dBm)	31.5	31.5	31.5
	Tolerance ±(dB)	1	1	1
3 Txslot	Target (dBm)	28.5	28.5	28.5
	Tolerance ±(dB)	1	1	1
4 Txslot	Target (dBm)	27.5	27.5	27.5
	Tolerance ±(dB)	1	1	1
GSM 1900 GPRS				
Channel		810	661	512
1 Txslot	Target (dBm)	29.0	29.0	29.0
	Tolerance ±(dB)	1	1	1
2 Txslot	Target (dBm)	28.0	28.0	28.0
	Tolerance ±(dB)	1	1	1
3 Txslot	Target (dBm)	26.0	26.0	26.0
	Tolerance ±(dB)	1	1	1
4 Txslot	Target (dBm)	25.0	25.0	25.0
	Tolerance ±(dB)	1	1	1

1.3.Description of Test Facility

EMC Lab	:	Listed by Federal Communications Commission (FCC) The Registration Number is 752051 Listed by Innovation, Science and Economic Development Canada (ISEDC) The Registration Number is 5077A-2 Accredited by China National Accreditation Service for Conformity Assessment (CNAS) The Registration Number is CNAS L3193 Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 4297.01
Name of Firm	:	ACCURATE TECHNOLOGY CO. LTD
Site Location	:	F1, Bldg. A, Changyuan New Material Port, Keyuan Rd. Science & Industry Park, Nanshan, Shenzhen, Guangdong P.R. China

1.4.Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty (9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty (30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty (Above 1GHz)	=	4.06dB, k=2

2. MEASURING DEVICE AND TEST EQUIPMENT

Table 1: List of Test and Measurement Equipment

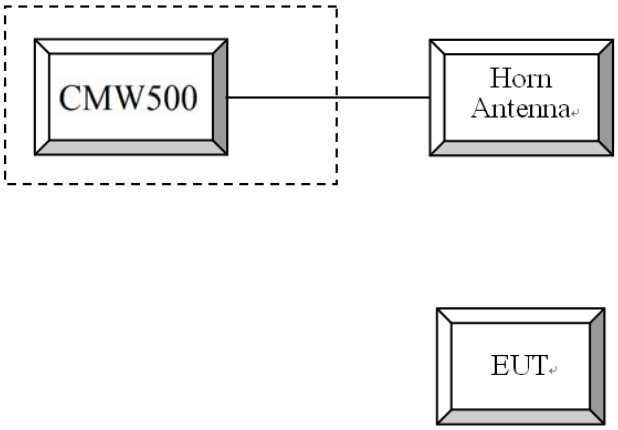
Kind of equipment	Manufacturer	Type	S/N	Calibrated dates	Calibrated until
EMI Test Receiver	Rohde&Schwarz	ESCS30	100307	Jan. 07, 2017	Jan. 06, 2018
EMI Test Receiver	Rohde&Schwarz	ESPI3	101526/003	Jan. 07, 2017	Jan. 06, 2018
Spectrum Analyzer	Agilent	E7405A	MY45115511	Jan. 07, 2017	Jan. 06, 2018
Pre-Amplifier	Rohde&Schwarz	CBLU1183540-01	3791	Jan. 07, 2017	Jan. 06, 2018
Loop Antenna	Schwarzbeck	FMZB1516	1516131	Jan. 13, 2017	Jan. 12, 2018
Bilog Antenna	Schwarzbeck	VULB9163	9163-194	Jan. 13, 2017	Jan. 12, 2018
Bilog Antenna	Schwarzbeck	VULB9163	9163-323	Jan. 13, 2017	Jan. 12, 2018
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-655	Jan. 13, 2017	Jan. 12, 2018
Horn Antenna	Schwarzbeck	BBHA9170	9170-359	Jan. 13, 2017	Jan. 12, 2018
LISN	Rohde&Schwarz	ESH3-Z5	100305	Jan. 07, 2017	Jan. 06, 2018
LISN	Schwarzbeck	NSLK8126	8126431	Jan. 07, 2017	Jan. 06, 2018
Highpass Filter	Wainwright Instruments	WHKX3.6/18G-10SS	N/A	Jan. 07, 2017	Jan. 06, 2018
Band Reject Filter	Wainwright Instruments	WRCG2400/2485-2375/2510-60/11SS	N/A	Jan. 07, 2017	Jan. 06, 2018
Wideband Radio Communication Tester	Rohde&Schwarz	CMW500	154606	Jan. 07, 2017	Jan. 06, 2018

3. SYSTEM TEST CONFIGURATION

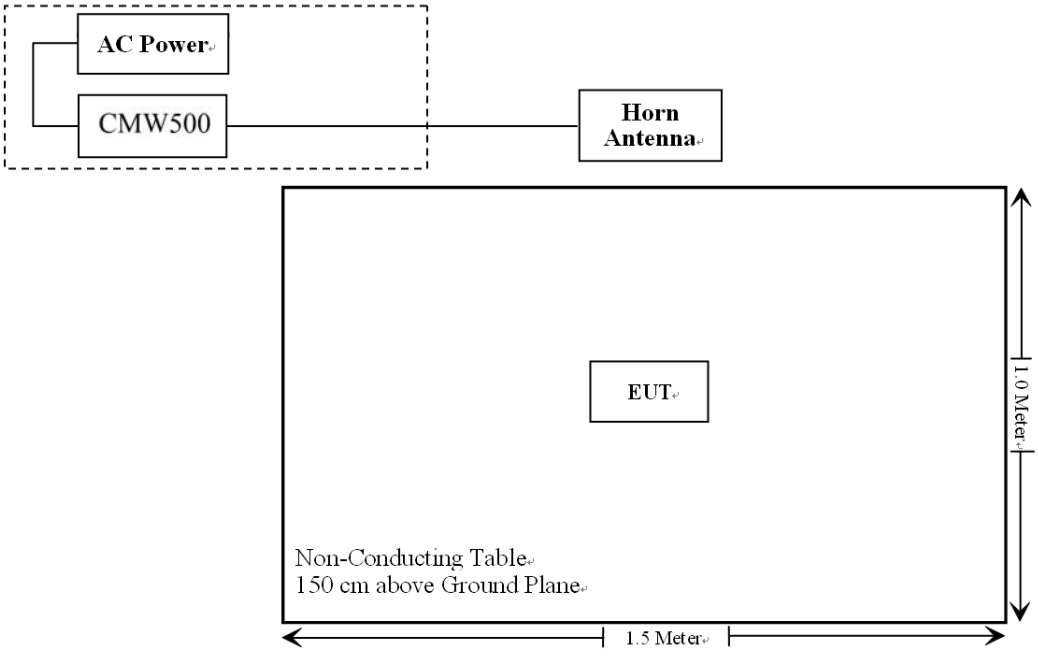
3.1.Justification

The EUT was configured for testing according to TIA/EIA-603-D.
The final qualification test was performed with the EUT operating at normal mode.

3.2.Configuration of Test Setup



3.3.Block Diagram of Test Setup



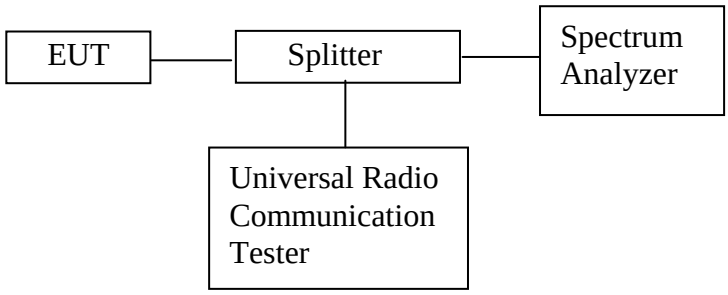
4. TEST PROCEDURES AND RESULTS

FCC Rules	Description of Test	Result
Section 15.207	N/A	N/A
§2.1046; § 22.913 (a); § 24.232 (c)	RF Output Power	Compliant
§ 2.1047	Modulation Characteristics	N/A
§ 2.1049; § 22.905 § 22.917; § 24.238	99% & -26 dB Occupied Bandwidth	Compliant
§ 2.1051, § 22.917 (a); § 24.238 (a)	Spurious Emissions at Antenna Terminal	Compliant
§ 2.1053 § 22.917 (a); § 24.238 (a)	Field Strength of Spurious Radiation	Compliant
§ 22.917 (a); § 24.238 (a)	Out of band emission, Band Edge	Compliant
§ 2.1055 § 22.355; § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
KDB 971168 D01 Power Meas License Digital Systems v02r02	Peak to average ratio	Compliant

Note: The power supply mode of the EUT is DC 3.7V(battery) or DC 12-24V(Harness port), According to the FCC standard requirements, conducted emission is not applicable.

5. BANDWIDTH MEASUREMENT

5.1.Block Diagram of Test Setup



5.2.Applicable Standard

FCC § 2.1049, § 22.917, § 22.905 and § 24.238.

5.3.Operating Condition of EUT

5.3.1.Setup the EUT and simulator as shown as Section 5.1.

5.3.2.Turn on the power of all equipment.

5.3.3.Let the EUT work in TX modes measure it. The transmit frequency are 824-849MHz and 1850-1910MHz. We select 824.2MHz, 836.6MHz, 848.8MHz and 1850.2MHz, 1880.0MHz, 1909.8MHz TX frequency to transmit.

5.4.Test Procedure

99% occupied bandwidth&-26dB occupied bandwidth test:
1. Set resolution bandwidth (RBW) = 3 kHz.
2. Set the video bandwidth (VBW) = 3 kHz.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

5.5.Test Result

Cellular Band (Part 22H) GSM mode			
Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dB occupied bandwidth (kHz)
128	824.2	243.126	305.400
190	836.6	241.679	309.700
251	848.8	243.126	303.900

PCS Band (Part 24E) GSM mode			
Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dB occupied bandwidth (kHz)
512	1850.2	246.020	309.700
661	1880.0	244.573	314.000
810	1909.8	243.126	312.600

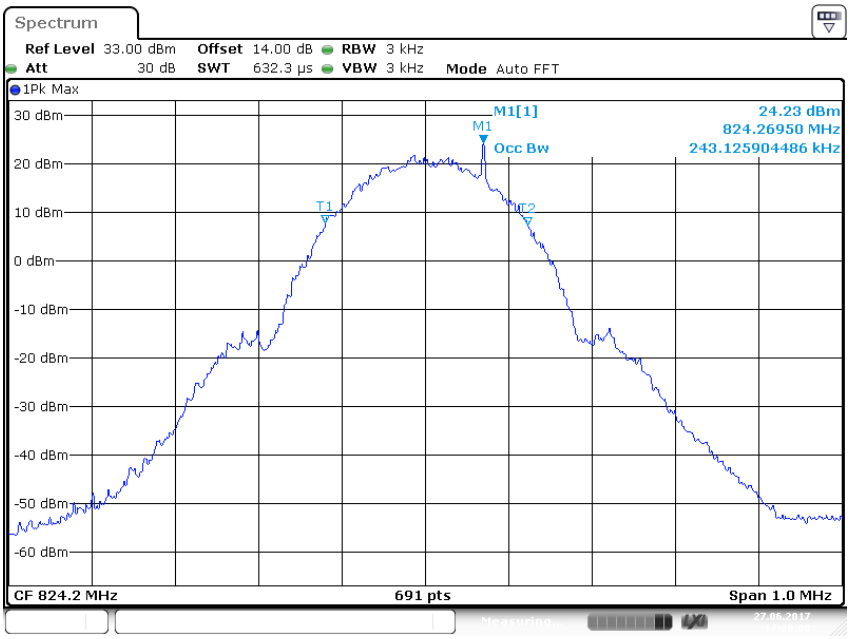
Cellular Band (Part 22H) GPRS mode			
Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dB occupied bandwidth (kHz)
128	824.2	241.679	309.700
190	836.6	244.573	308.200
251	848.8	243.126	306.800

PCS Band (Part 24E) GPRS mode			
Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dB occupied bandwidth (kHz)
512	1850.2	241.679	314.000
661	1880.0	243.126	315.500
810	1909.8	244.573	315.500

The spectrum analyzer plots are attached as below.

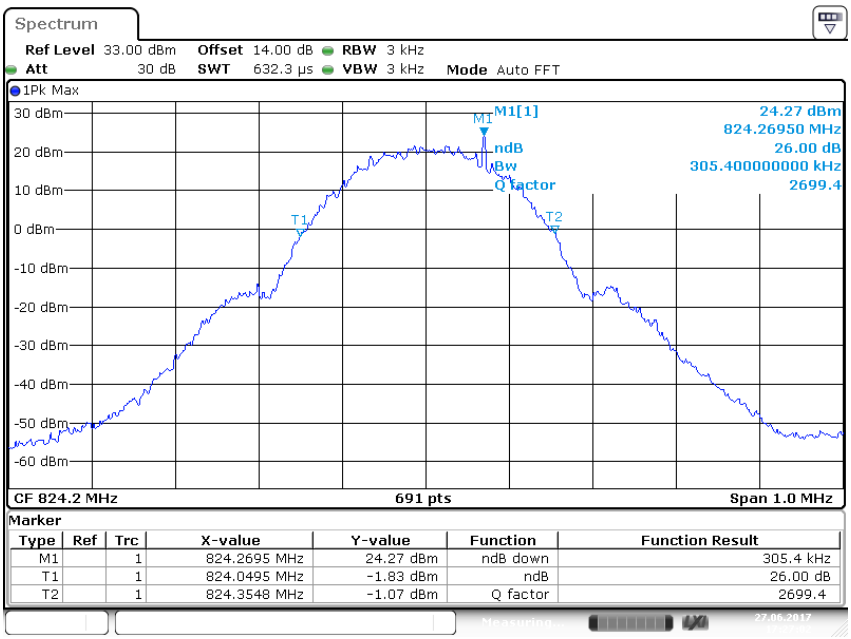
GSM mode

Cellular Band (Part 22H)
99% Occupied Bandwidth, Low Channel



Date: 27.JUN.2017 17:26:08

26 dB Occupied Bandwidth, Low Channel



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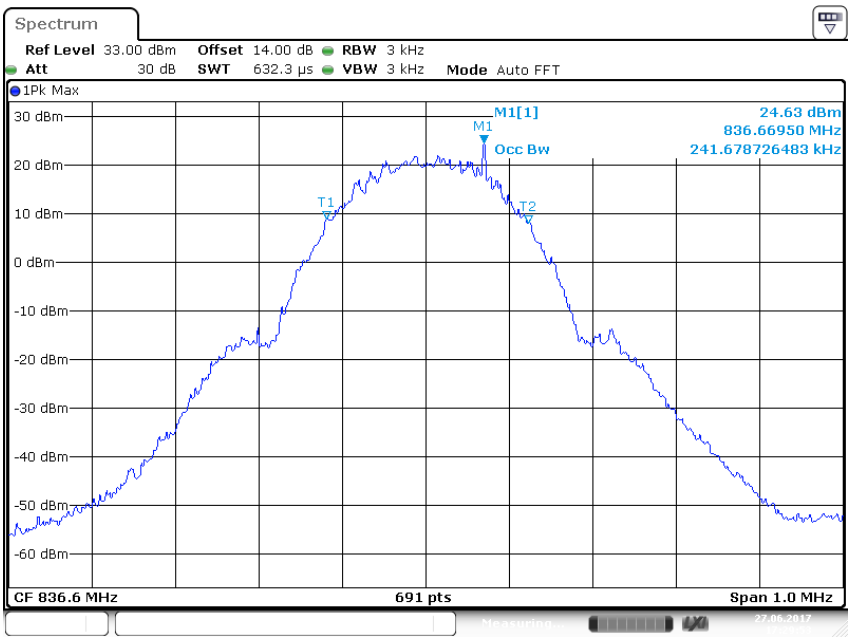
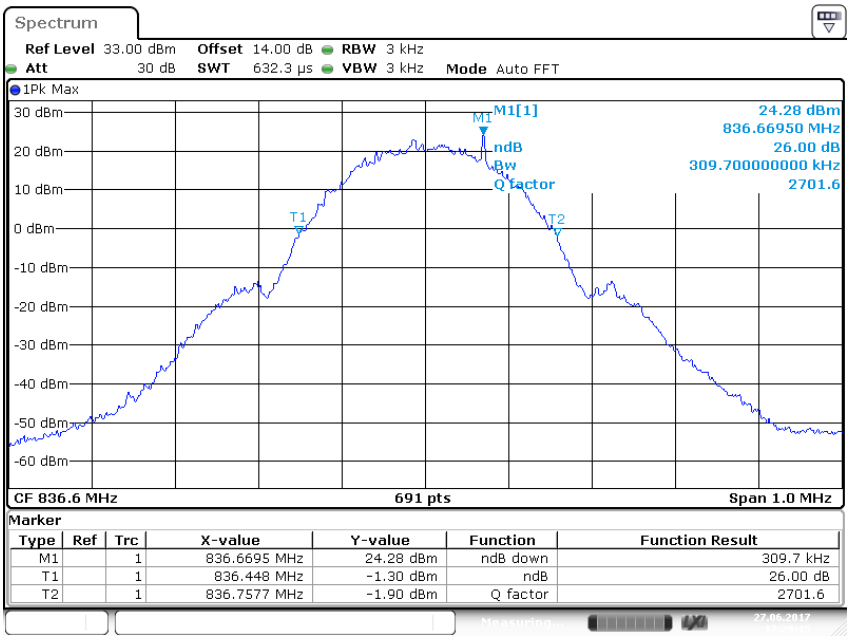
99% Occupied Bandwidth, Middle Channel



Date: 27.JUN.2017 17:29:53

26 dB Occupied Bandwidth, Middle Channel



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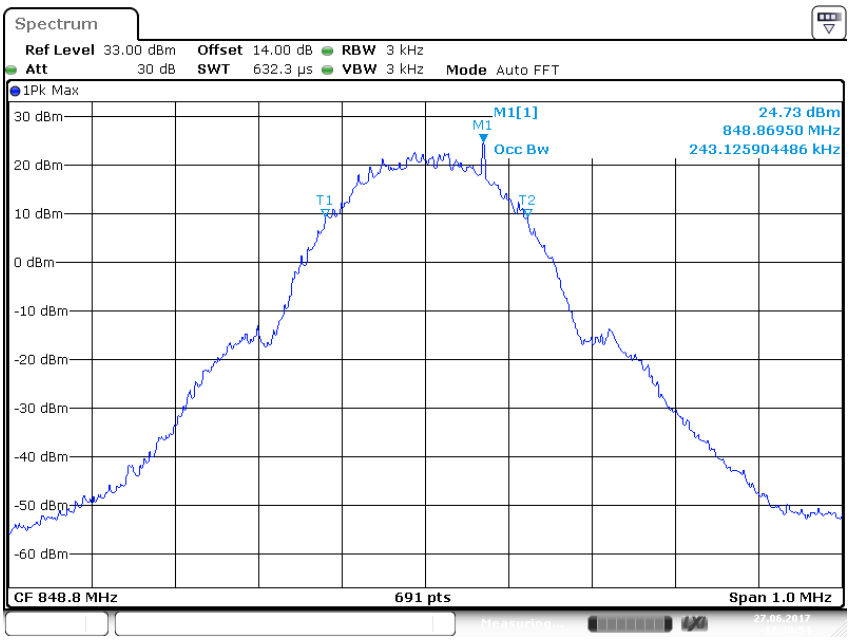
99% Occupied Bandwidth, High Channel



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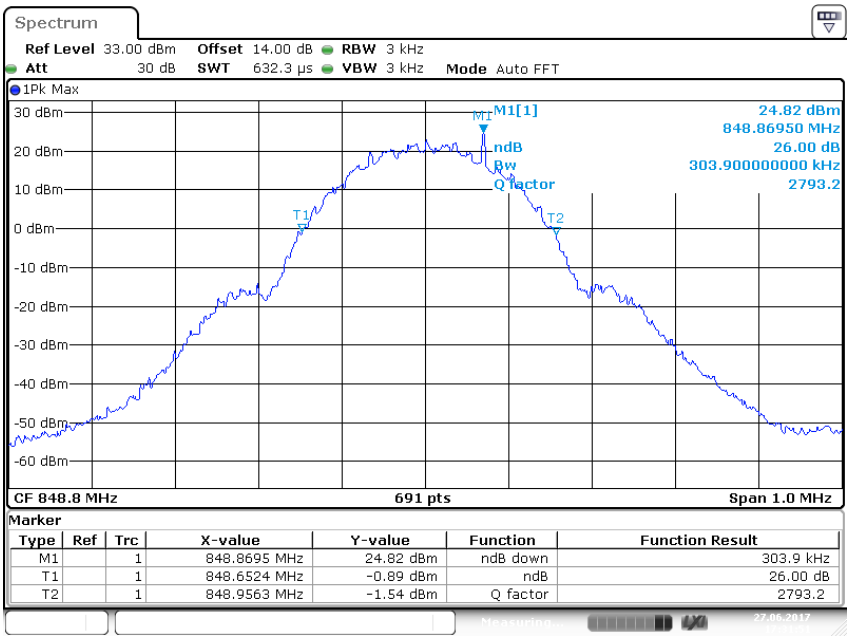
26 dB Occupied Bandwidth, High Channel



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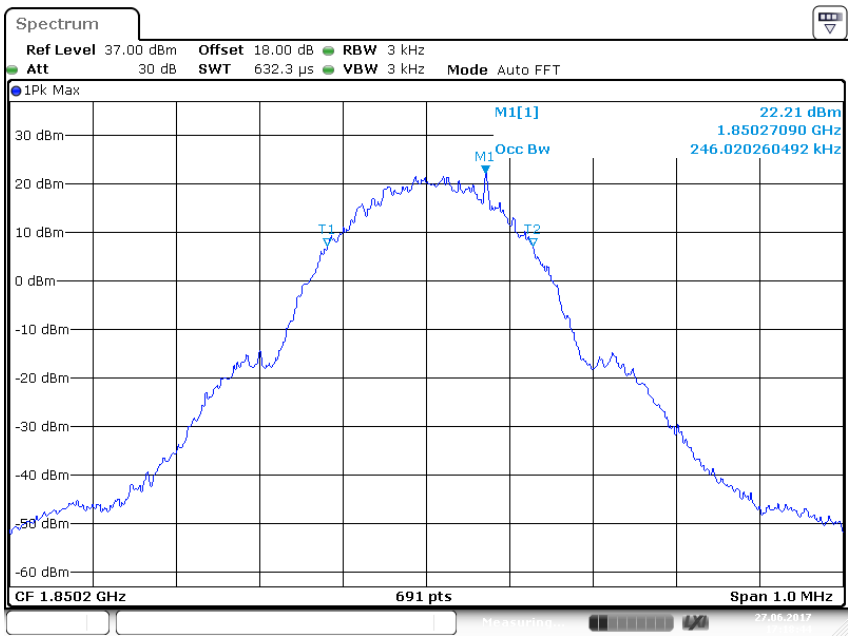
PCS Band (Part 24E)

99% Occupied Bandwidth, Low Channel



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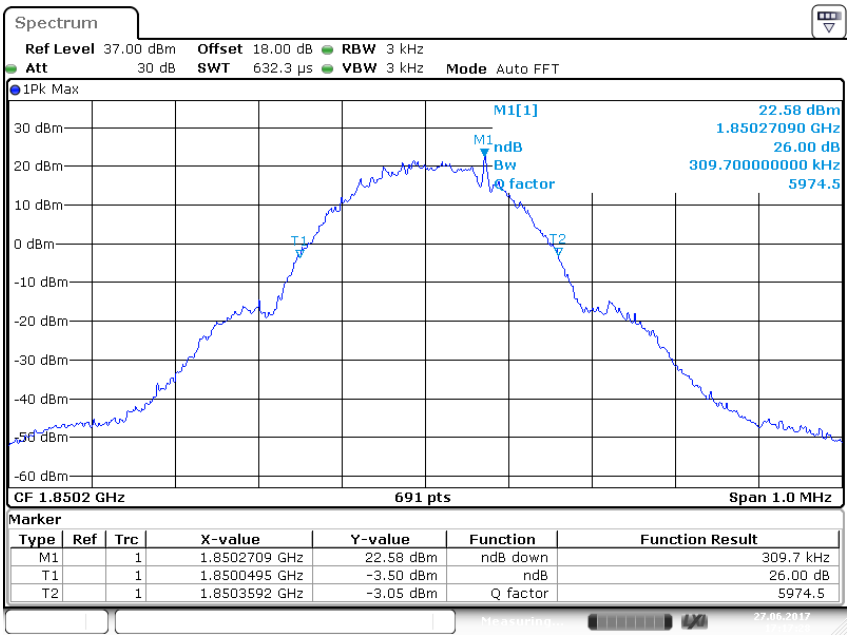
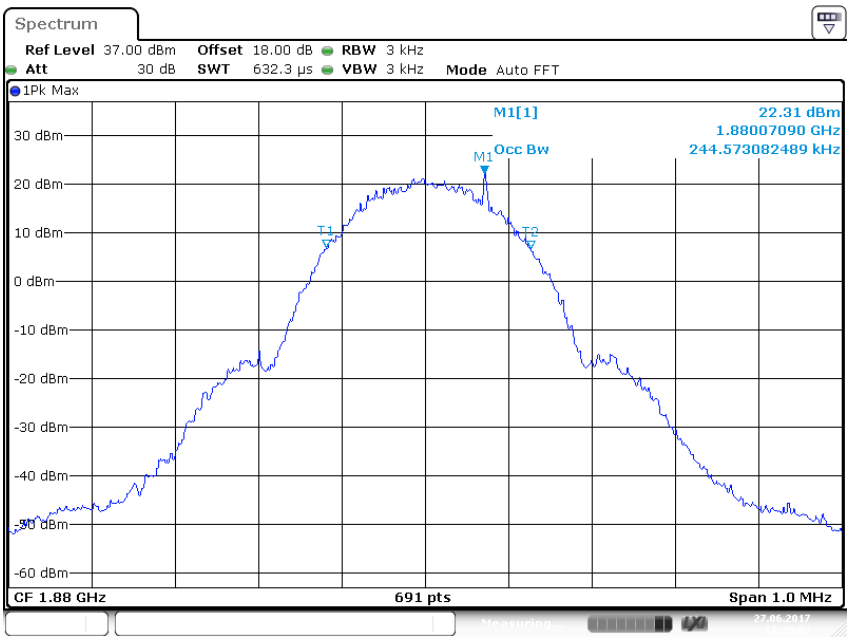
26 dB Occupied Bandwidth, Low Channel



Date: 27.JUN.2017 17:17:28

99% Occupied Bandwidth, Middle Channel



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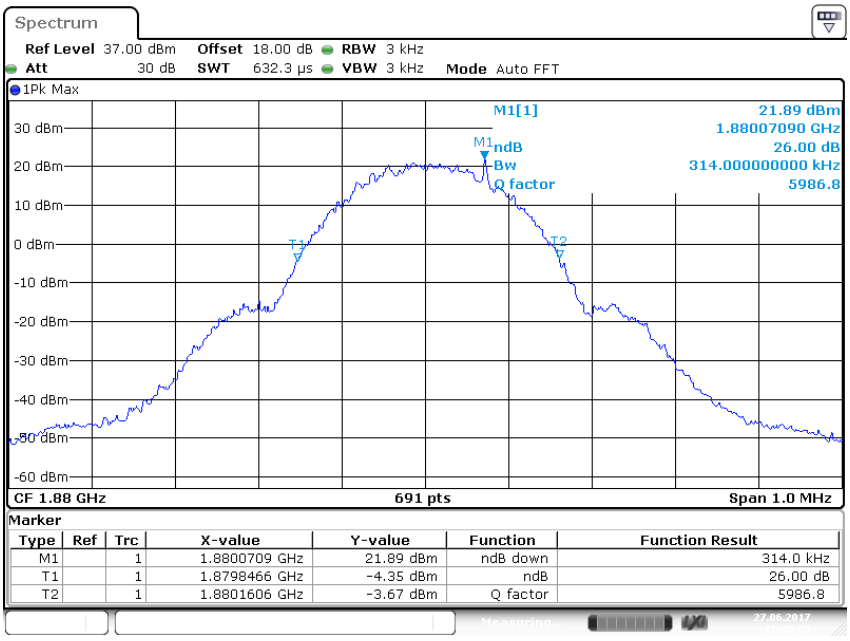
26 dB Occupied Bandwidth, Middle Channel



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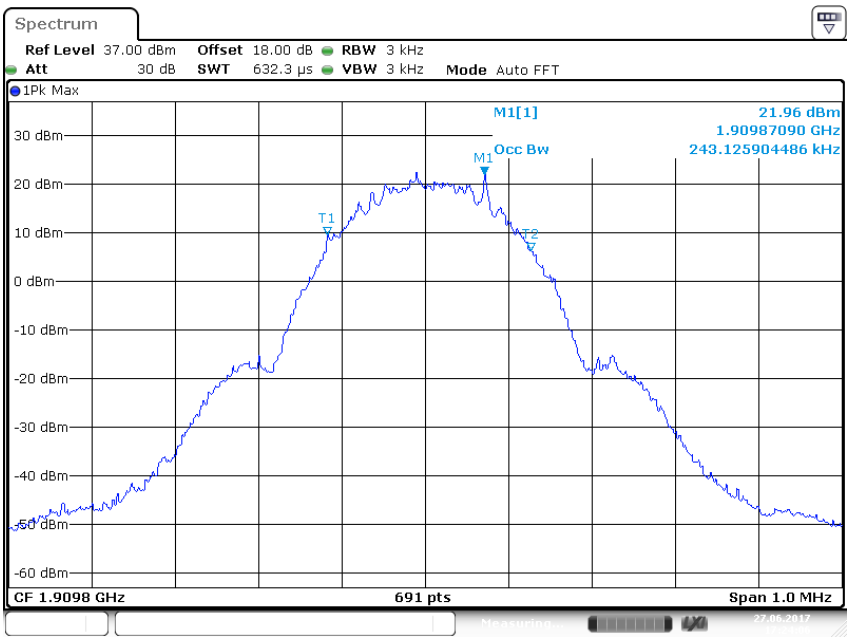
99% Occupied Bandwidth, High Channel



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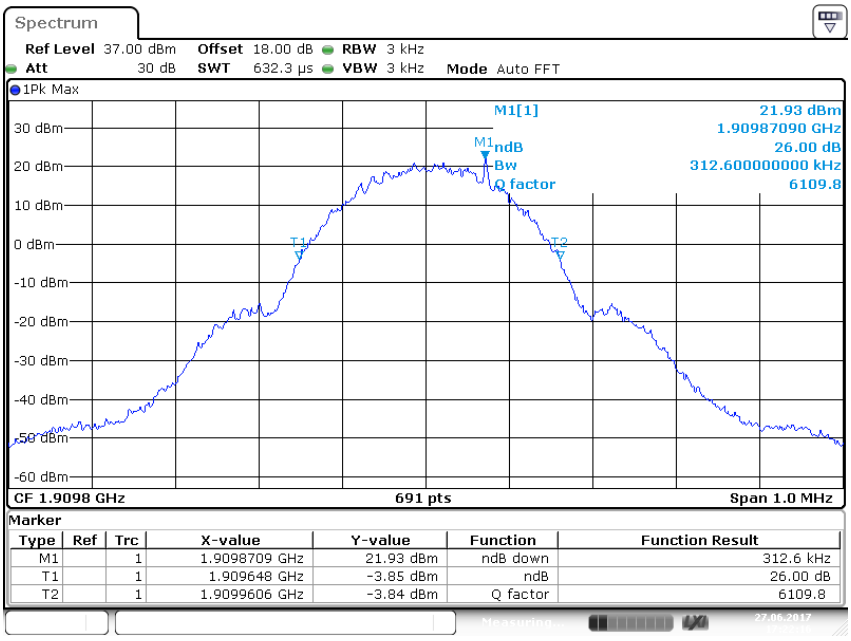
26 dB Occupied Bandwidth, High Channel



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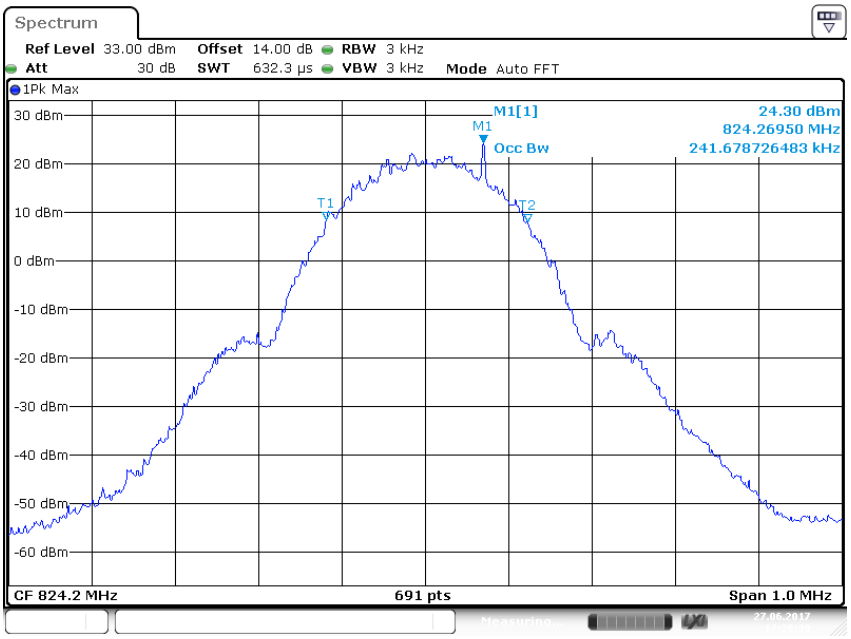
GPRS mode

Cellular Band (Part 22H)
99% Occupied Bandwidth, Low Channel



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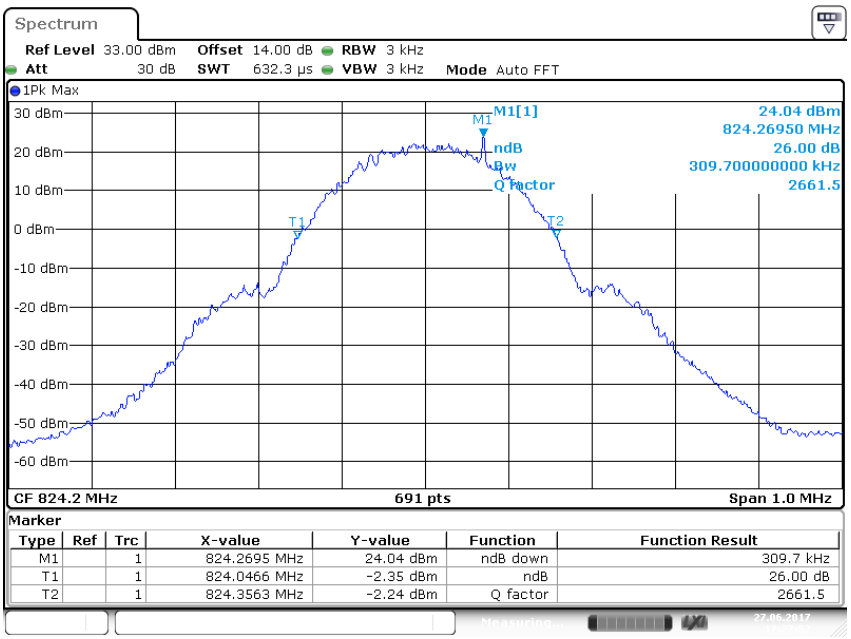
26 dB Occupied Bandwidth, Low Channel



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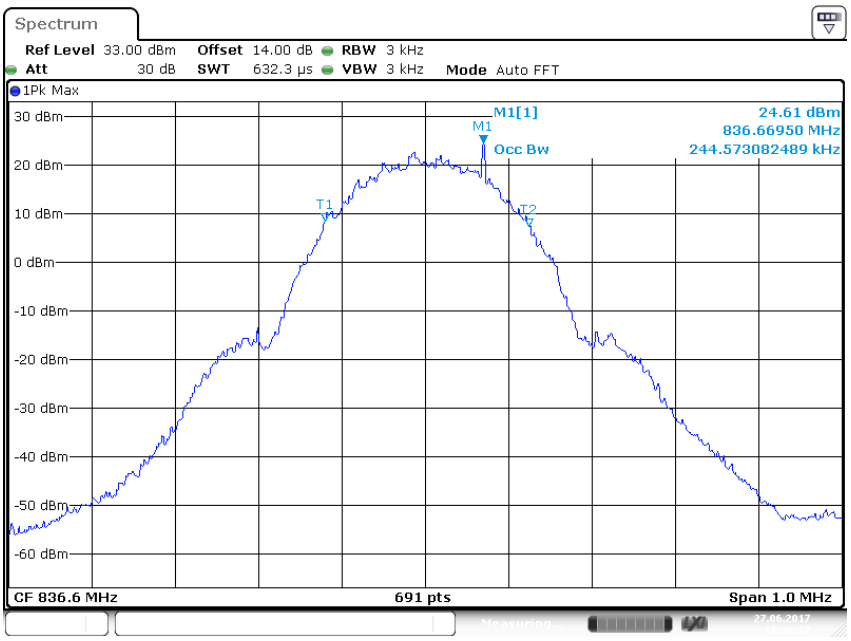
99% Occupied Bandwidth, Middle Channel



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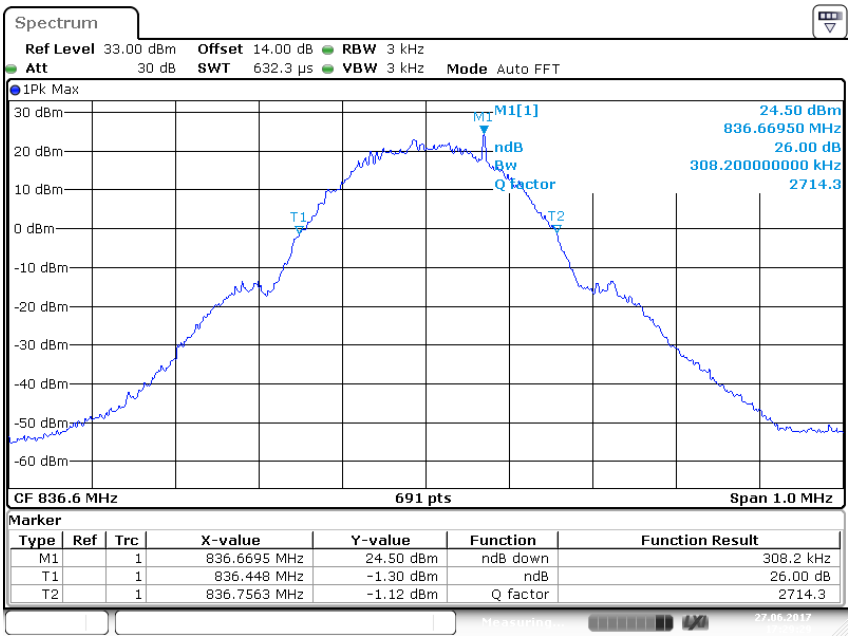
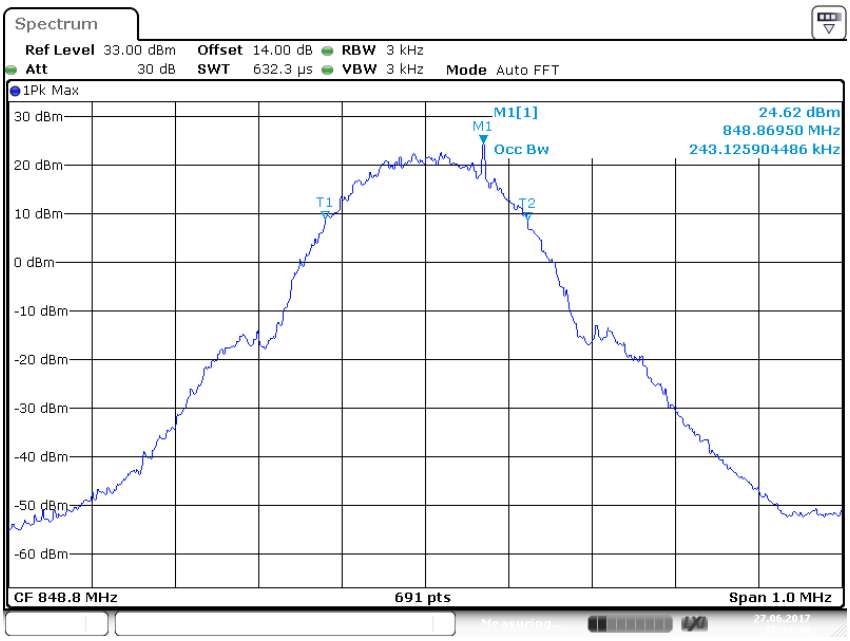
26 dB Occupied Bandwidth, Middle Channel



Date: 27.JUN.2017 17:29:28

99% Occupied Bandwidth, High Channel



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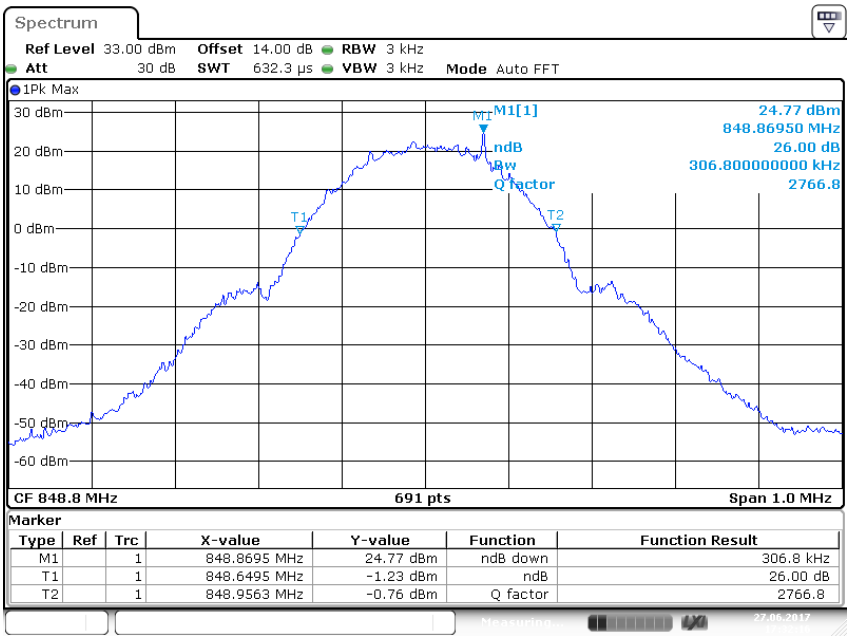
26 dB Occupied Bandwidth, High Channel



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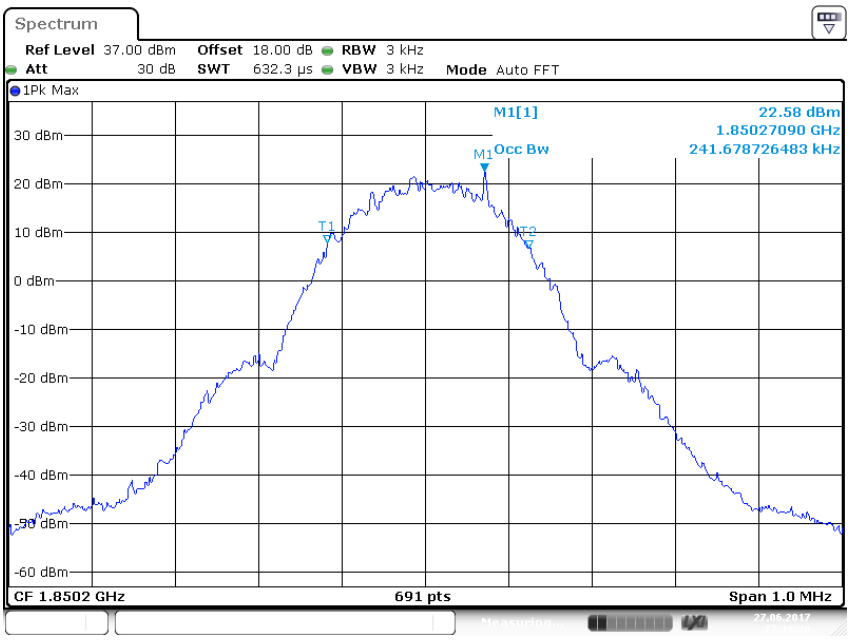
PCS Band (Part 24E)

99% Occupied Bandwidth, Low Channel



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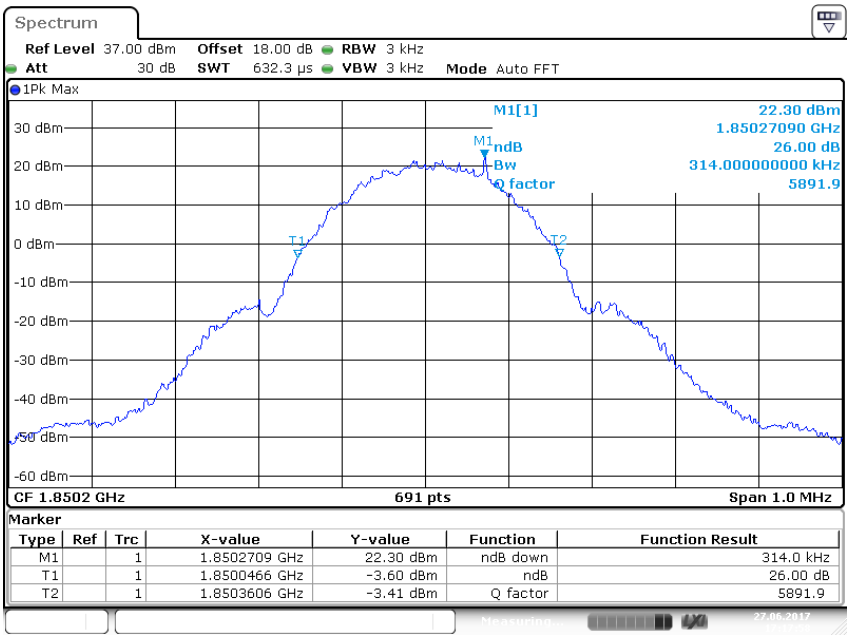
26 dB Occupied Bandwidth, Low Channel



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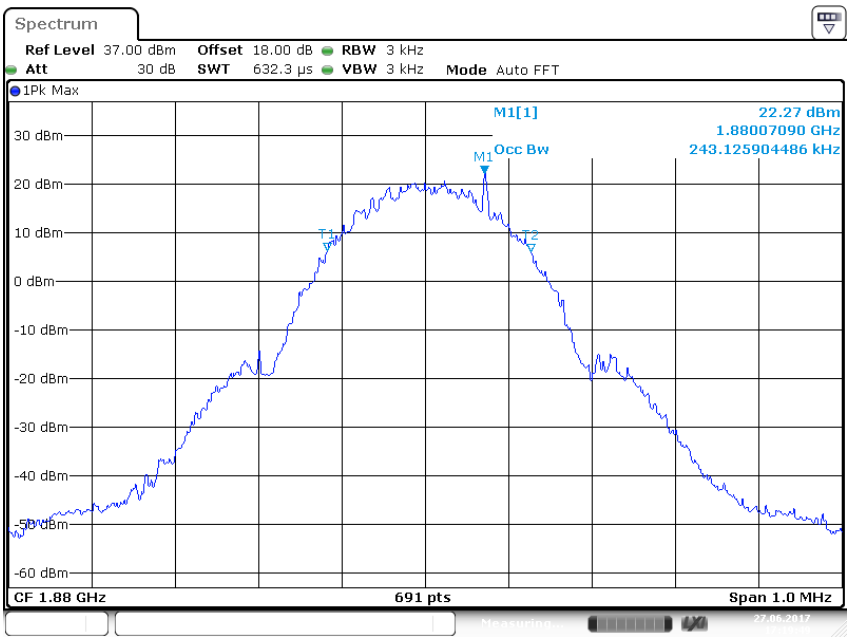
99% Occupied Bandwidth, Middle Channel



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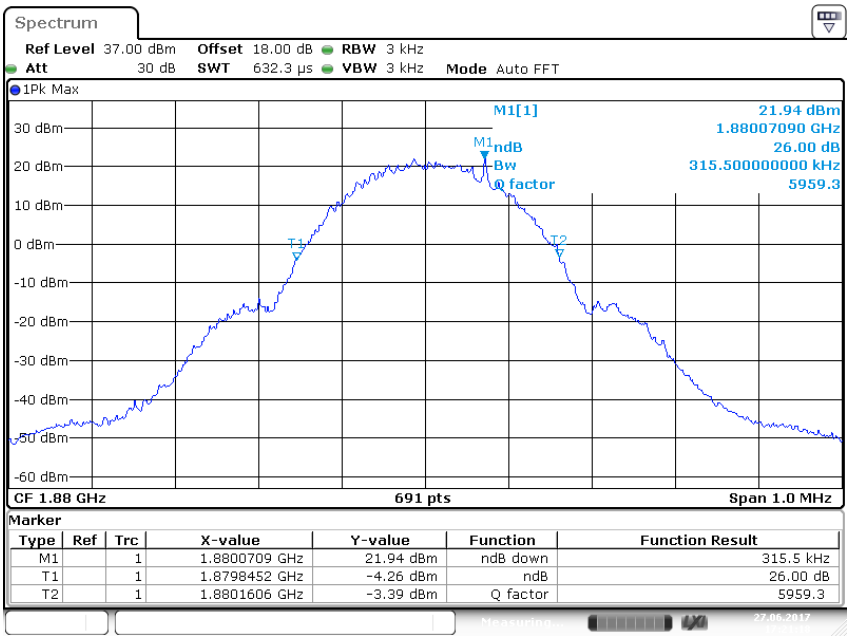
26 dB Occupied Bandwidth, Middle Channel



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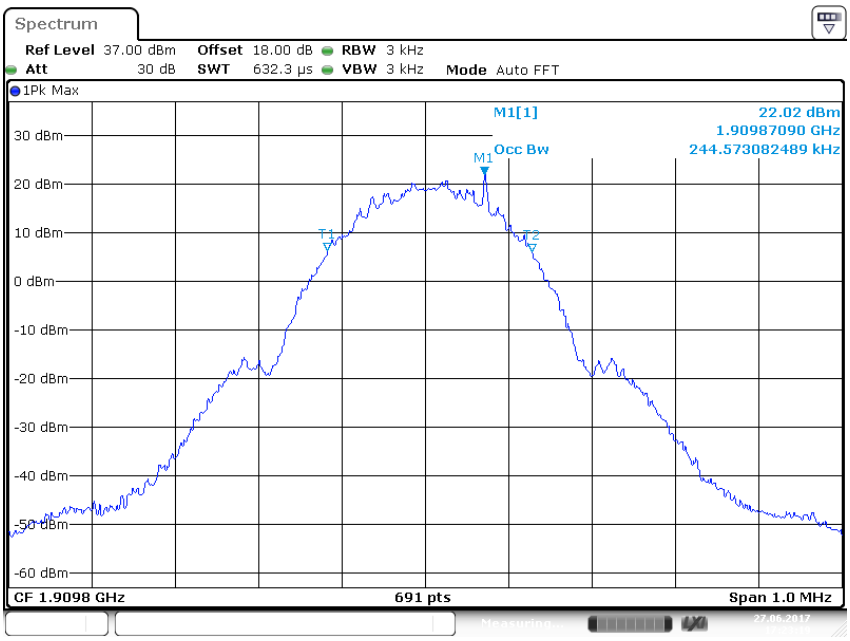
99% Occupied Bandwidth, High Channel



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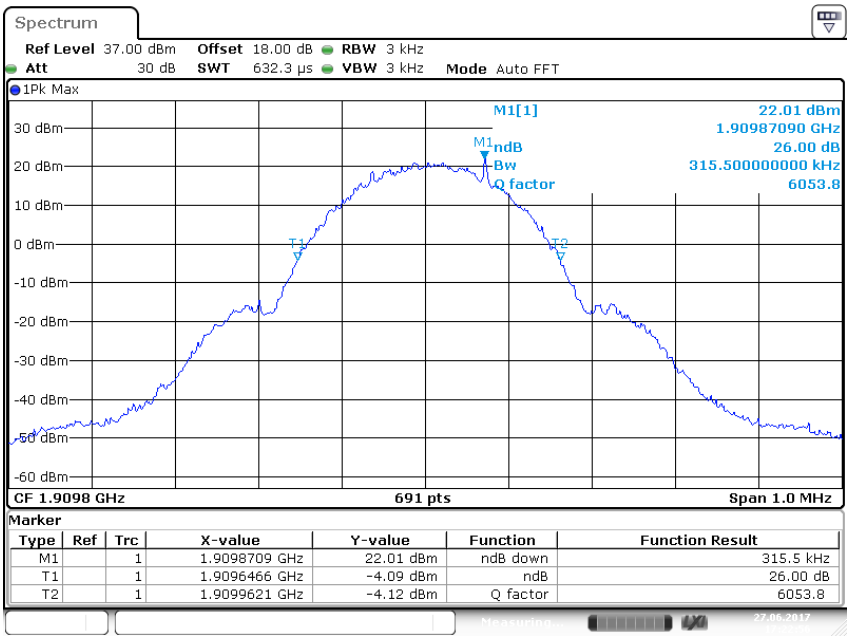
26 dB Occupied Bandwidth, High Channel



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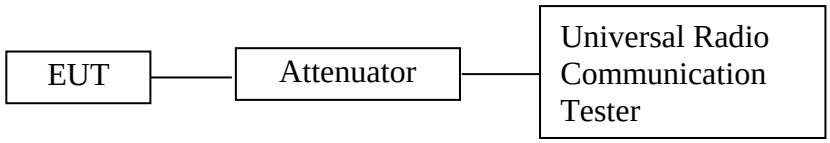
6. RF OUTPUT POWER

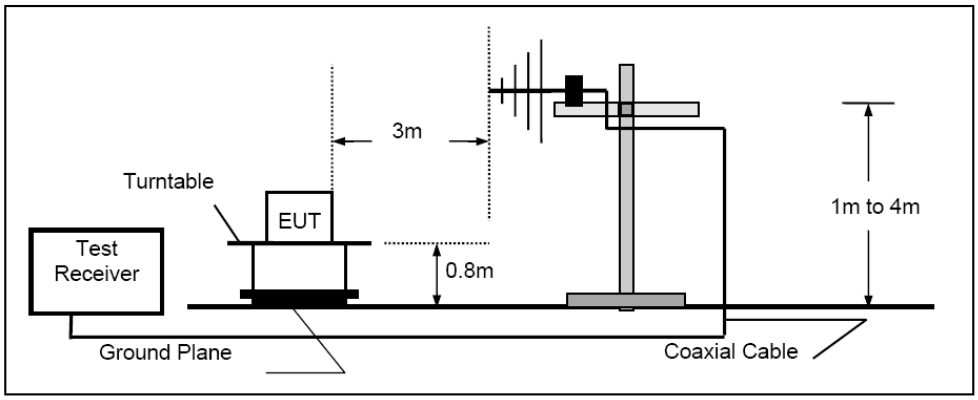
6.1. Block Diagram of Test Setup

Conducted method:

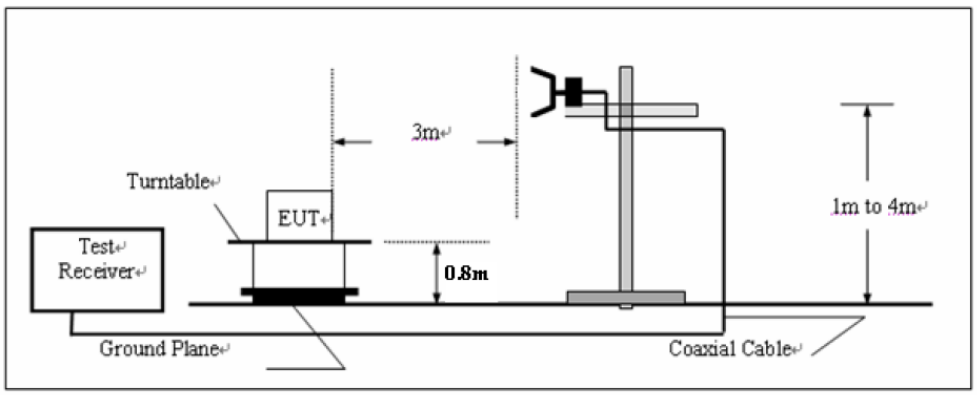


Radiated method:

Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



6.2. The Requirement For FCC Section §2.1046 and §22.913 (a) & §24.232 (C)

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (C), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

6.3.Operating Condition of EUT

6.3.1.Setup the EUT and simulator as shown as Section 6.1.

6.3.2.Turn on the power of all equipment.

6.3.3.Let the EUT work in TX modes measure it. The transmit frequency are 824-849MHz and 1850-1910MHz. We select 824.2MHz, 836.6MHz, 848.8MHz and 1850.2MHz, 1880.0MHz, 1909.8MHz TX frequency to transmit.

6.4.Test Procedure

Conducted method:
The RF output of the transmitter was connected to the wireless test set and the spectrum analyzer through sufficient attenuation.

Radiated method(For ERP&EIRP):

1. The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

2. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

3. The frequency range up to tenth harmonic of the fundamental frequency was investigated.

4. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

6.5.Test Result

Cellular Band (Part 22H)

Mode	Channel	Frequency (MHz)	Output Power (dBm)
GSM	128	824.2	32.16
	190	836.6	32.17
	251	848.8	32.23

Mode	Channel No	Frequency (MHz)	Output Power (dBm)			
			1 slot	2 slots	3 slots	4 slots
GPRS	128	824.2	32.12	31.13	29.26	27.02
	190	836.6	32.13	31.14	29.27	27.03
	251	848.8	32.19	31.20	29.21	27.01

PCS Band (Part 24E)

Mode	Channel	Frequency (MHz)	Output Power (dBm)
GSM	512	1850.2	29.14
	661	1880.0	29.38
	810	1909.8	29.64

Mode	Channel No	Frequency (MHz)	Output Power (dBm)			
			1 slot	2 slots	3 slots	4 slots
GPRS	512	1850.2	29.08	28.25	26.52	24.12
	661	1880.0	29.30	28.50	26.74	24.17
	810	1909.8	29.55	28.24	26.47	24.10

ERP & EIRP

ERP for GSM900 (Part 22H)

GSM:

Indicated		Table Angle Degree	Test Antenna		Substituted			Antenna Gain Correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Part 22H
Frequency (MHz)	S.A. Reading (dBμV/m)		Height (m)	Polar (H/V)	Frequency (MHz)	S.G. Level (dBm)	Polar (H/V)				Limit (dBm)
Low Channel											
824.2	98.26	29	1.0	V	824.2	30.7	V	0	0.9	29.8	38.45
824.2	84.54	207	1.5	H	824.2	20.2	H	0	0.9	19.3	38.45
Middle Channel											
836.6	99.38	35	1.2	V	836.6	31.2	V	0	0.9	30.3	38.45
836.6	85.22	211	1.6	H	836.6	21.3	H	0	0.9	20.4	38.45
High Channel											
848.8	98.46	214	1.0	V	848.8	30.8	V	0	0.9	29.9	38.45
848.8	85.68	209	1.5	H	848.8	21.1	H	0	0.9	20.2	38.45

GPRS:

Indicated		Table Angle Degree	Test Antenna		Substituted			Antenna Gain Correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Part 22H
Frequency (MHz)	S.A. Reading (dBμV/m)		Height (m)	Polar (H/V)	Frequency (MHz)	S.G. Level (dBm)	Polar (H/V)				Limit (dBm)
Low Channel											
824.2	98.41	31	1.1	V	824.2	30.9	V	0	0.9	30.0	38.45
824.2	91.53	205	1.2	H	824.2	22.2	H	0	0.9	21.3	38.45
Middle Channel											
836.6	97.65	38	1.0	V	836.6	30.1	V	0	0.9	29.2	38.45
836.6	90.23	210	1.2	H	836.6	23.3	H	0	0.9	22.4	38.45
High Channel											
848.8	97.70	215	1.1	V	848.8	30.1	V	0	0.9	29.2	38.45
848.8	90.07	211	1.5	H	848.8	22.2	H	0	0.9	21.3	38.45

EIRP for PCS1800 Band (Part 24E)

GSM:

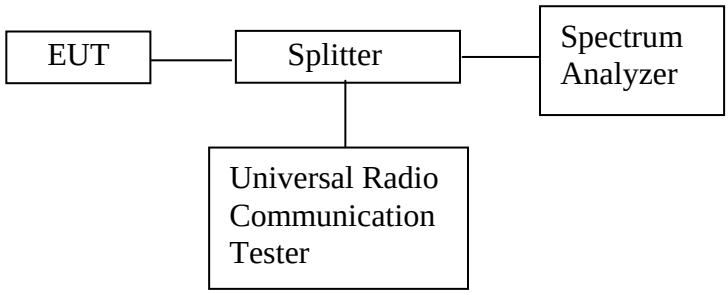
Indicated		Table Angle Degree	Test Antenna		Substituted			Antenna Gain Correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Part 24E
Frequency (MHz)	S.A. Reading (dBμV/m)		Height (m)	Polar (H/V)	Frequency (MHz)	S.G. Level (dBm)	Polar (H/V)				Limit (dBm)
Low Channel											
1850.2	93.25	225	1.1	V	1850.2	22.1	V	6.2	1.1	27.2	33
1850.2	85.89	113	1.5	H	1850.2	17.1	H	6.2	1.1	22.2	33
Middle Channel											
1880.0	93.27	56	1.7	V	1880.0	22.2	V	6.2	1.1	27.3	33
1880.0	85.37	120	1.6	H	1880.0	16.6	H	6.2	1.1	21.7	33
High Channel											
1909.8	92.40	332	2.0	V	1909.8	21.2	V	6.2	1.1	26.3	33
1909.8	84.52	89	2.0	H	1909.8	16.0	H	6.2	1.1	21.1	33

GPRS:

Indicated		Table Angle Degree	Test Antenna		Substituted			Antenna Gain Correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Part 24E
Frequency (MHz)	S.A. Reading (dBμV/m)		Height (m)	Polar (H/V)	Frequency (MHz)	S.G. Level (dBm)	Polar (H/V)				Limit (dBm)
Low Channel											
1850.2	94.23	358	1.1	V	1850.2	23.1	V	6.2	1.1	28.2	33
1850.2	84.72	20	1.4	H	1850.2	16.1	H	6.2	1.1	21.2	33
Middle Channel											
1880.0	93.18	32	1.1	V	1880.0	22.1	V	6.2	1.1	27.2	33
1880.0	84.55	17	1.4	H	1880.0	16.0	H	6.2	1.1	21.1	33
High Channel											
1909.8	93.10	323	1.1	V	1909.8	22.1	V	6.2	1.1	27.2	33
1909.8	84.95	15	1.5	H	1909.8	16.5	H	6.2	1.1	21.6	33

7. SPURIOUS EMISSIONS AT ANTENNA TERMINALS

7.1. Block Diagram of Test Setup



7.2. Applicable Standard

FCC §2.1051, §22.917(a) and §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1051

7.3. EUT Configuration on Measurement

The equipment are installed on the emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

7.4. Operating Condition of EUT

7.4.1. Setup the EUT and simulator as shown as Section 7.1.

7.4.2. Turn on the power of all equipment.

7.4.3. Let the EUT work in TX modes measure it. The transmit frequency are 824-849MHz and 1850-1910MHz. We select 836.6MHz and 1880.0MHz, TX frequency to transmit.

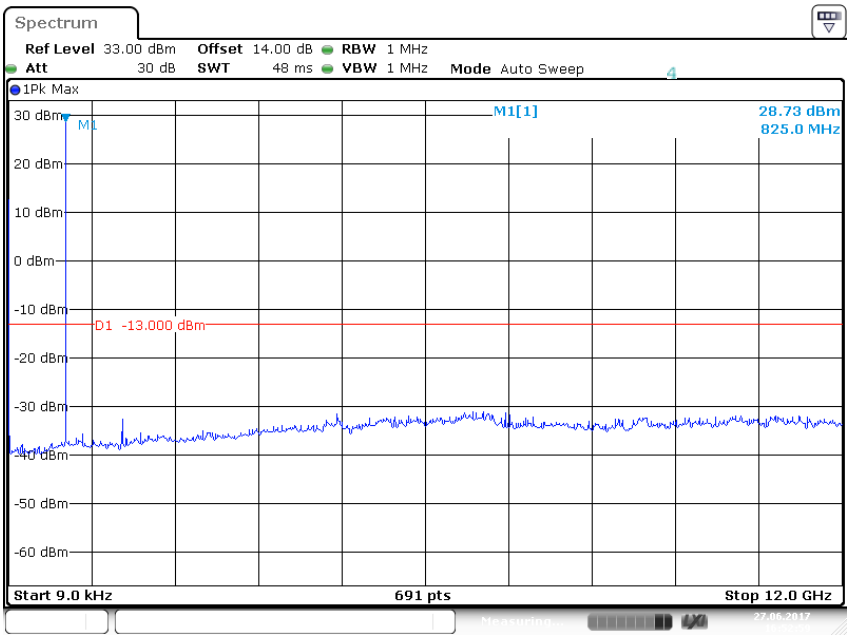
7.5. Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

7.6.Test Result

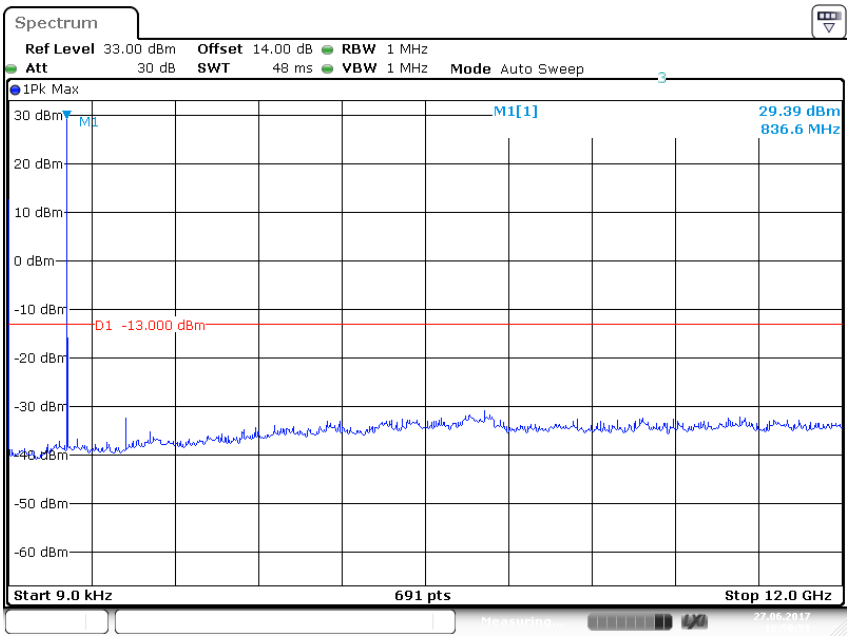
Cellular Band (Part 22H)

Low Channel(128)



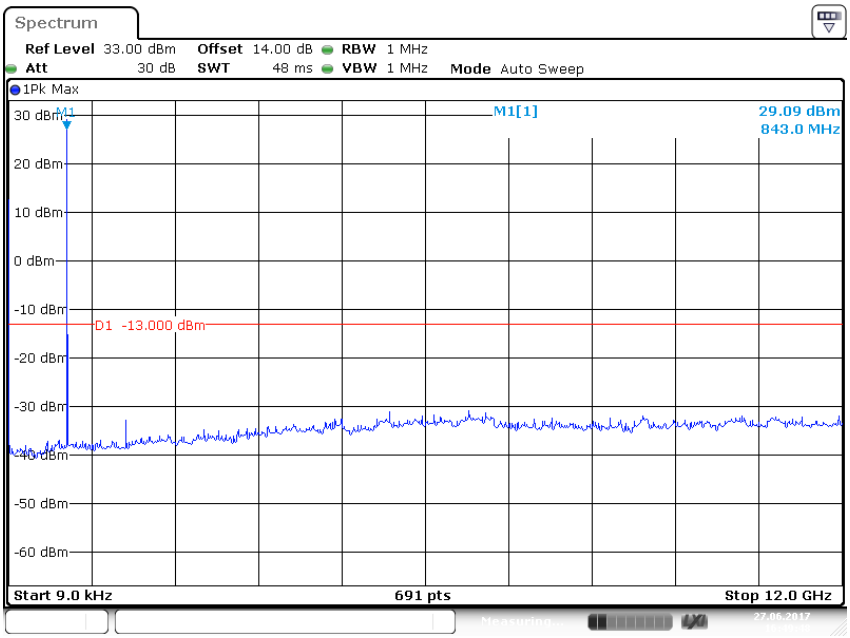
Date: 27.JUN.2017 16:52:59

Middle Channel(190)



Date: 27.JUN.2017 16:50:50

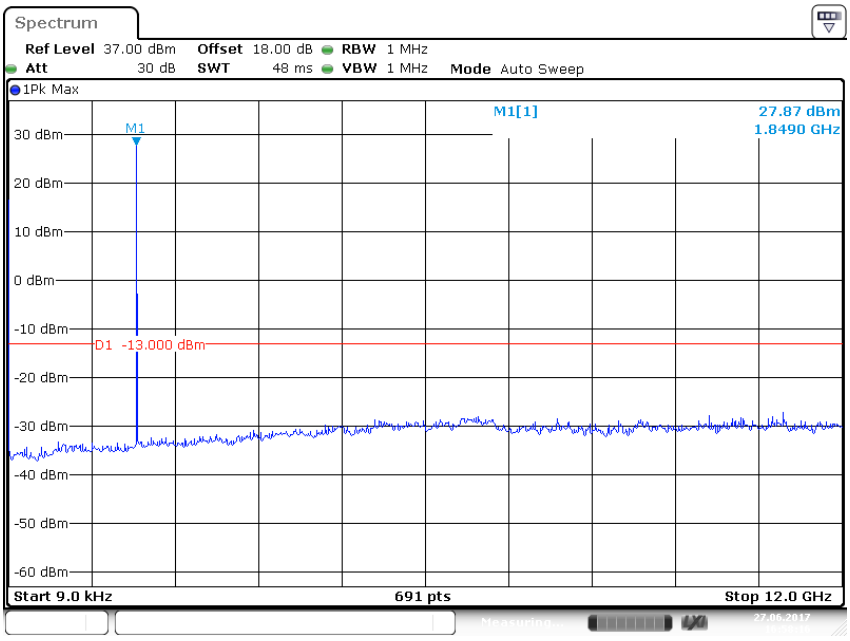
High channel(251)



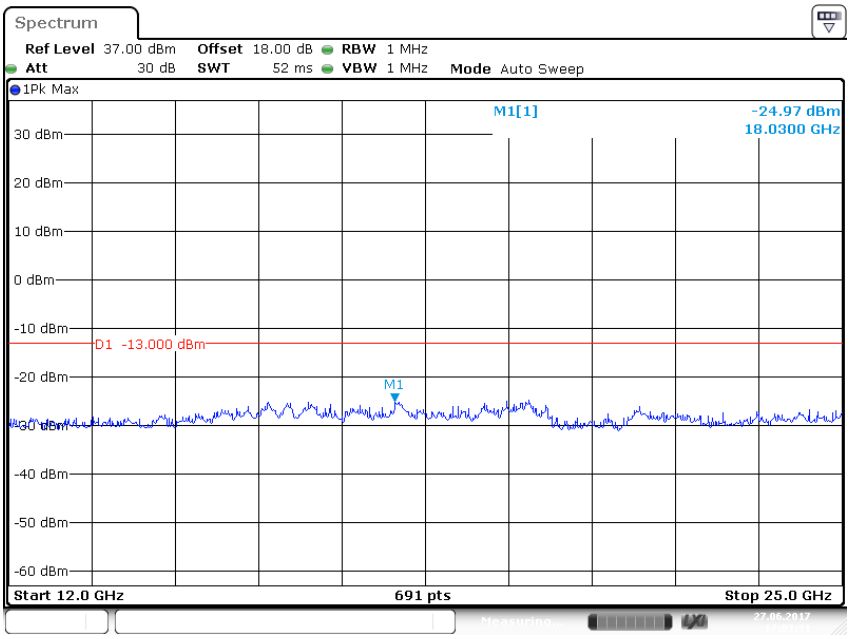
Date: 27.JUN.2017 16:49:48

PCS Band (Part24E)

Low Channel(512)

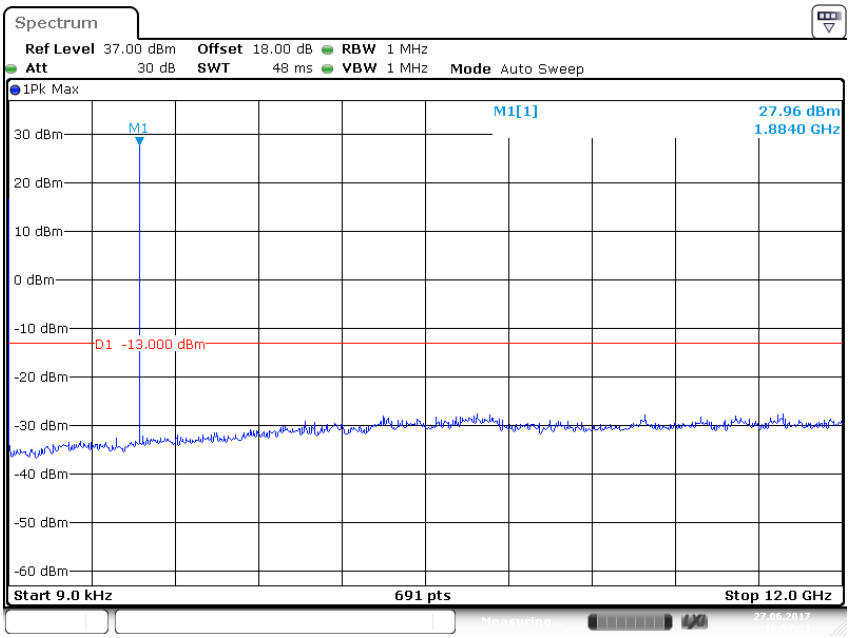


Date: 27.JUN.2017 16:58:16

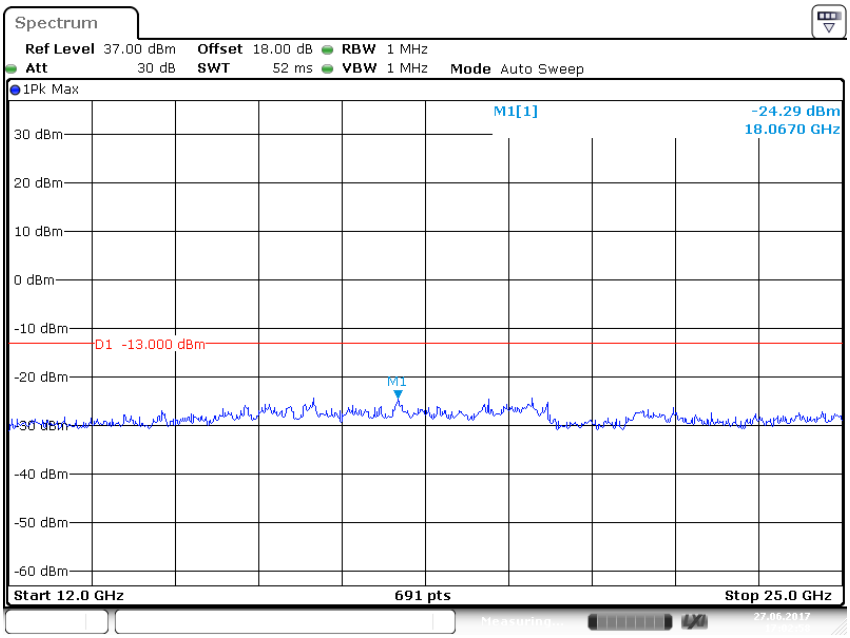


Date: 27.JUN.2017 17:03:30

Middle Channel(661)

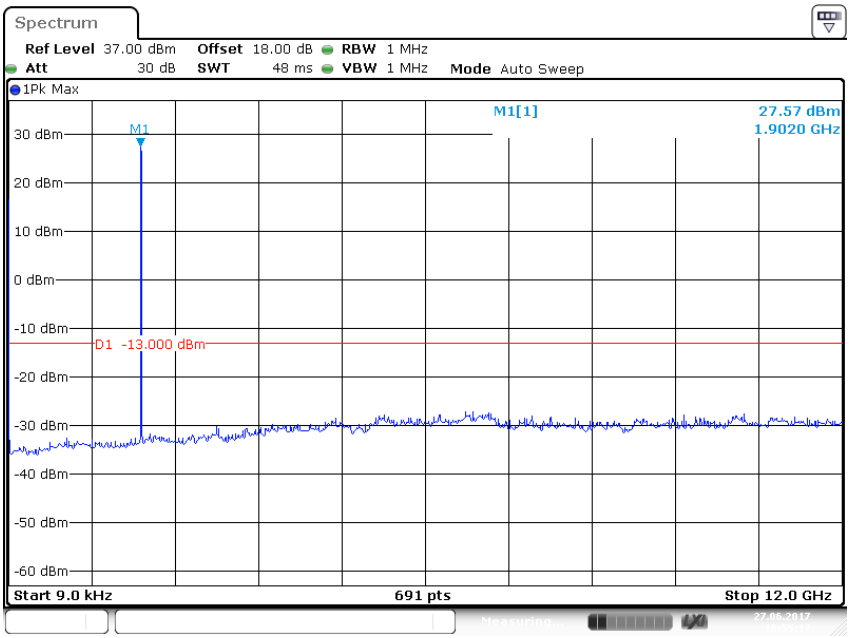


Date: 27.JUN.2017 16:57:20

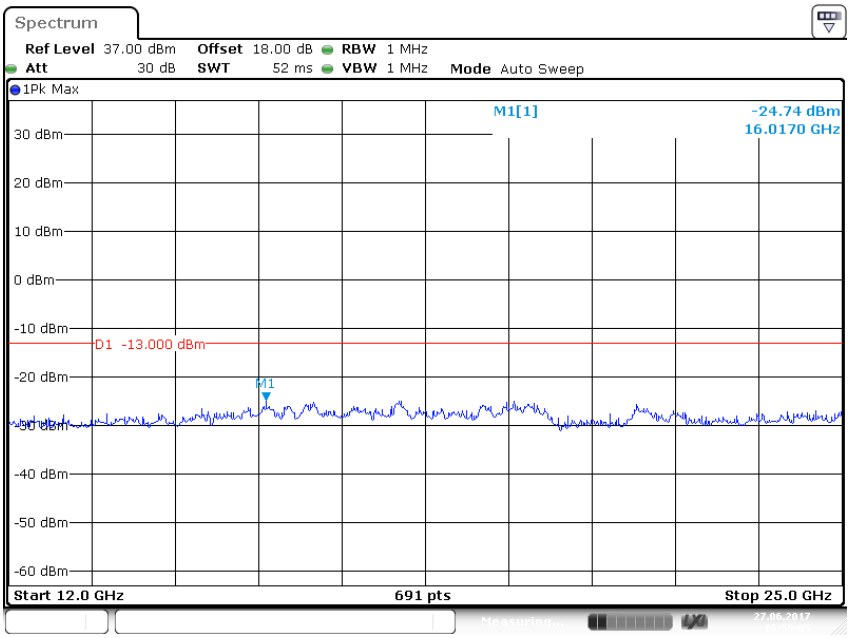


Date: 27.JUN.2017 17:02:58

High Channel(810)



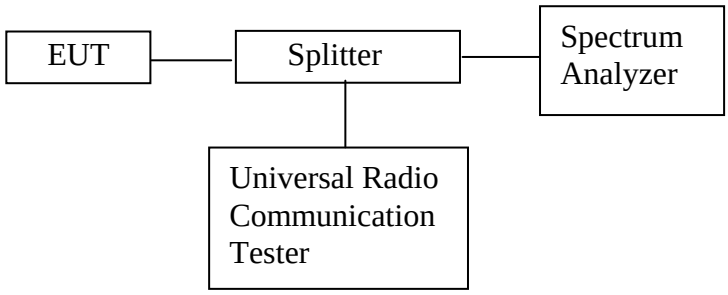
Date: 27.JUN.2017 16:55:17



Date: 27.JUN.2017 16:59:05

8. BAND EDGE TEST

8.1. Block Diagram of Test Setup



8.2. The Requirement For Section § 22.917(a), §24.238(a)

According to § 22.917(a), the power of any emissions 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.

According to §24.238(a), the power of any emissions 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.

8.3. Operating Condition of EUT

8.3.1. Setup the EUT and simulator as shown as Section 8.1.

8.3.2. Turn on the power of all equipment.

8.3.3. Let the EUT work in TX modes measure it. The transmit frequency are 823.980, 849.020 MHz, 1849.996MHz and 1910.016MHz.

8.4. Test Procedure

Conducted Band Edge:
The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency.

8.5.Test Result

GSM mode
Cellular Band (Part 22H)

Mode	Frequency (MHz)	Emission (dBm)	Limit (dBm)
GSM850	824.000	-13.75	-13
	849.000	-16.75	-13

PCS Band (Part 24E)

Mode	Frequency (MHz)	Emission (dBm)	Limit (dBm)
PCS1900	1850.000	-14.43	-13
	1910.000	-17.78	-13

GPRS mode
Cellular Band (Part 22H)

Mode	Frequency (MHz)	Emission (dBm)	Limit (dBm)
GSM850	824.000	-14.60	-13
	849.000	-15.08	-13

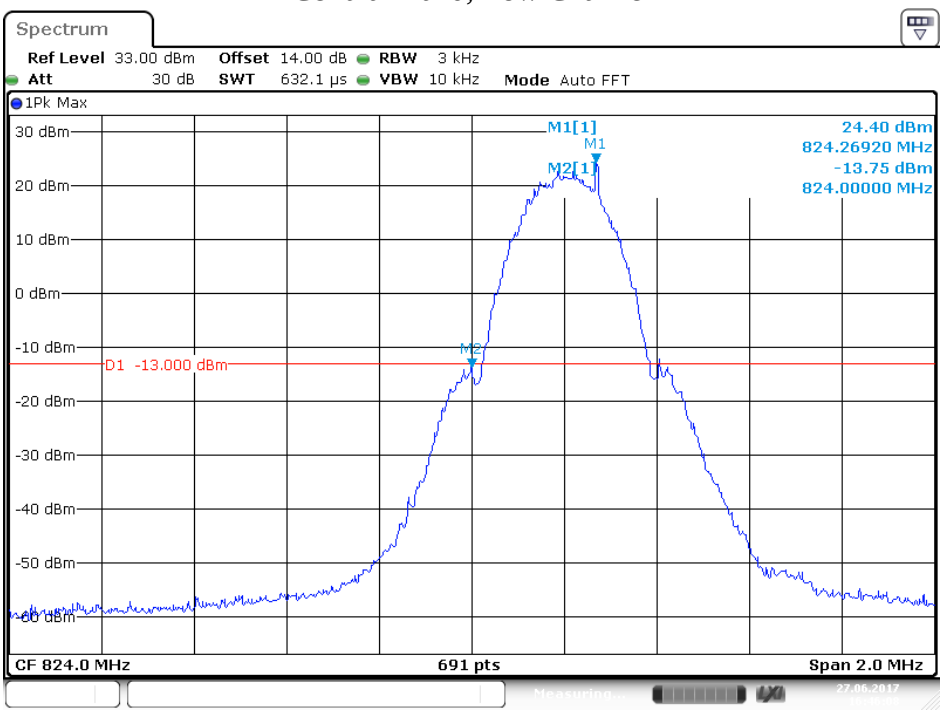
PCS Band (Part 24E)

Mode	Frequency (MHz)	Emission (dBm)	Limit (dBm)
PCS1900	1850.000	-14.56	-13
	1910.000	-19.59	-13

Note: The offset on the picture below =The loss of test cable+Splitter.

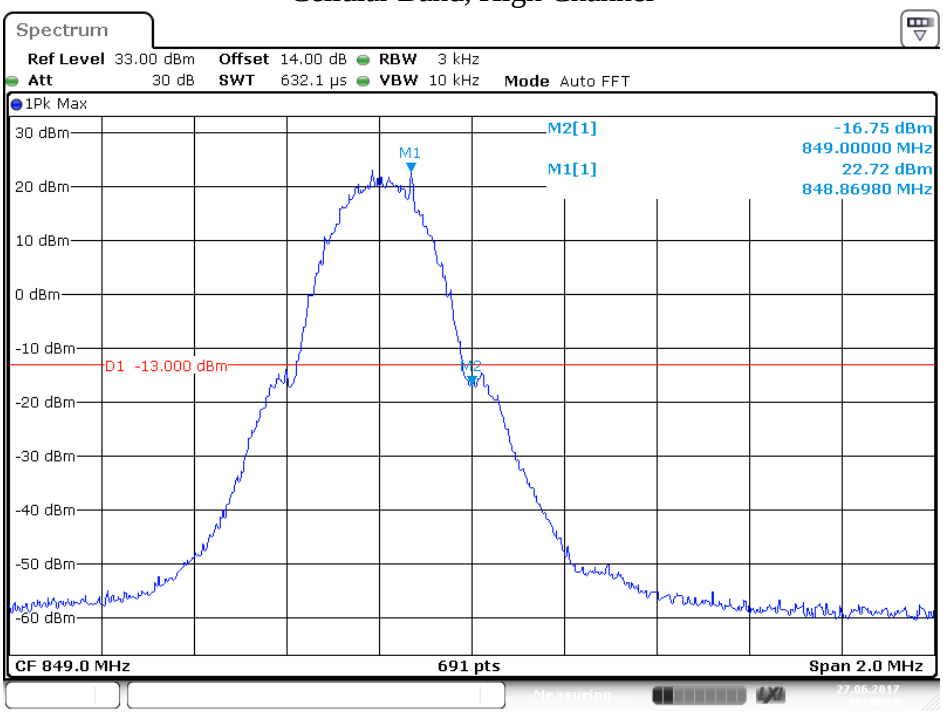
GSM mode

Cellular Band, Low Channel



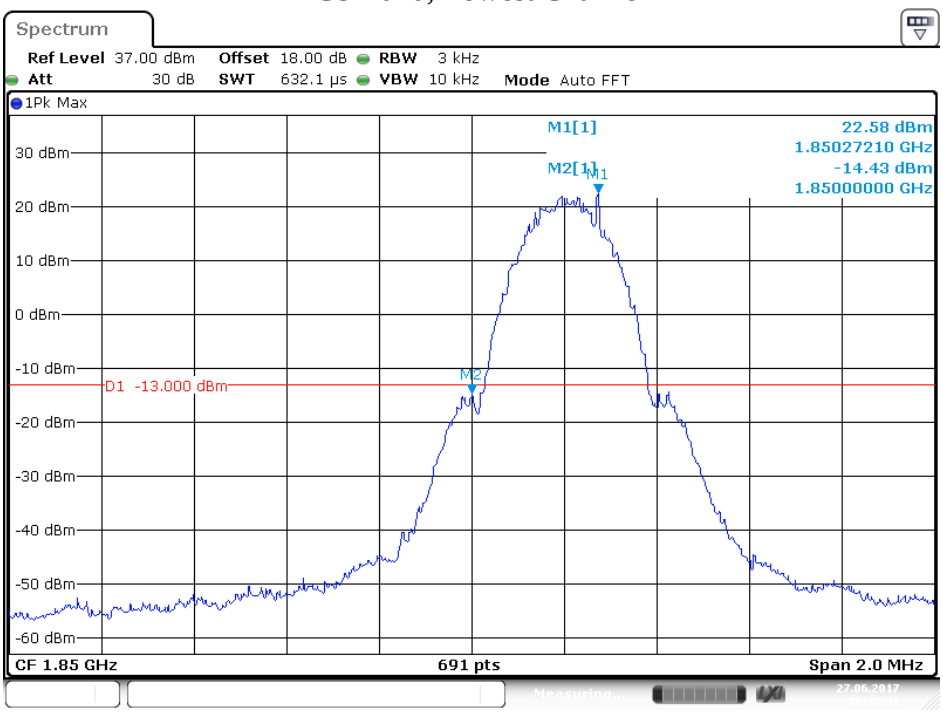
Date: 27.JUN.2017 16:46:08

Cellular Band, High Channel



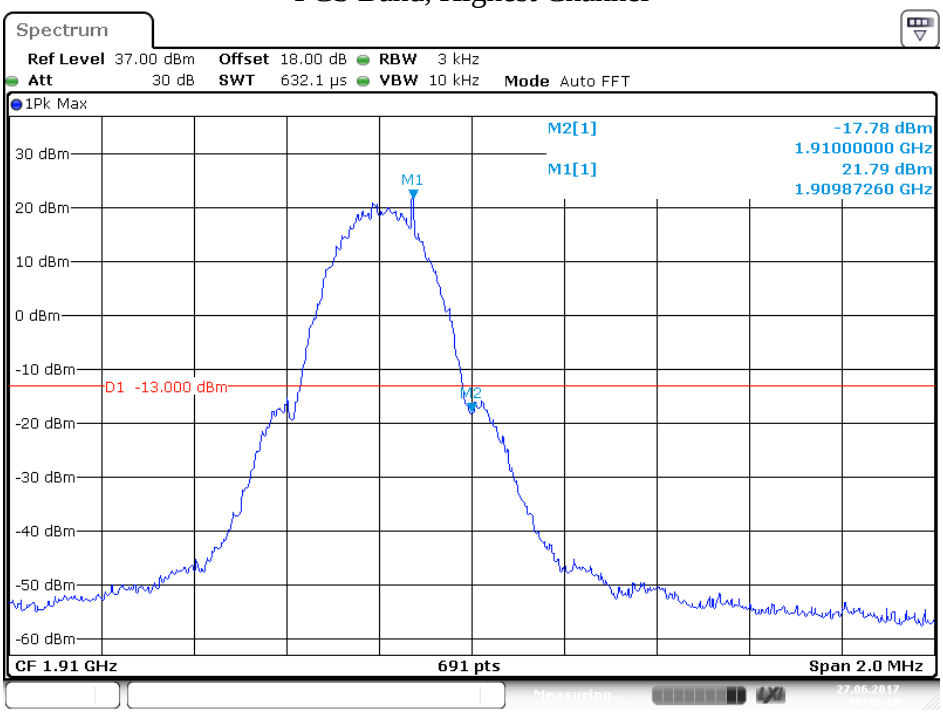
Date: 27.JUN.2017 16:48:10

PCS Band, Lowest Channel



Date: 27.JUN.2017 16:38:51

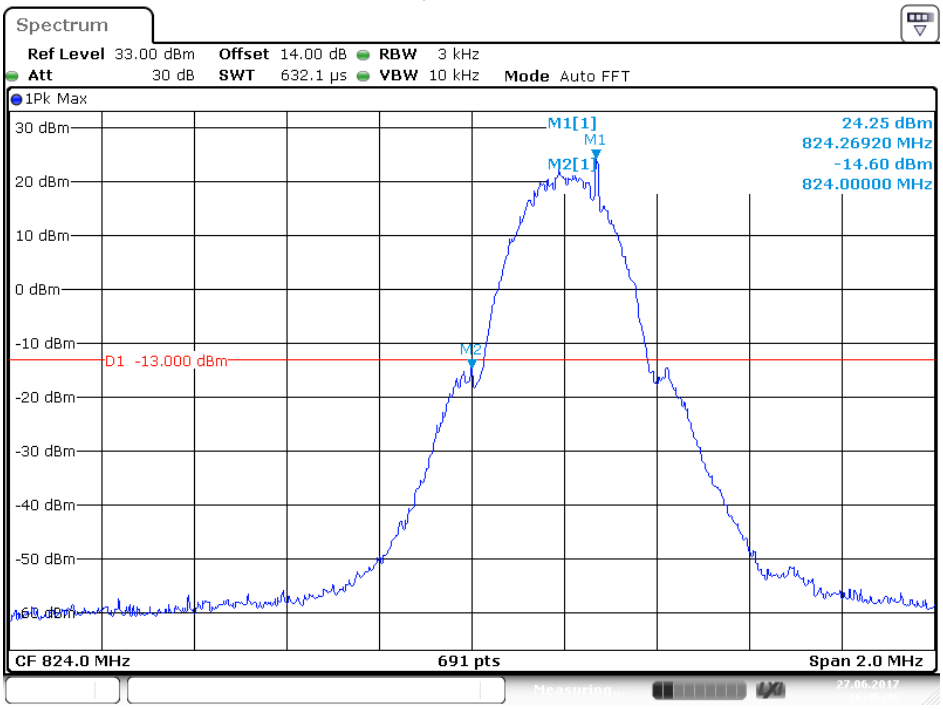
PCS Band, Highest Channel



Date: 27.JUN.2017 16:40:17

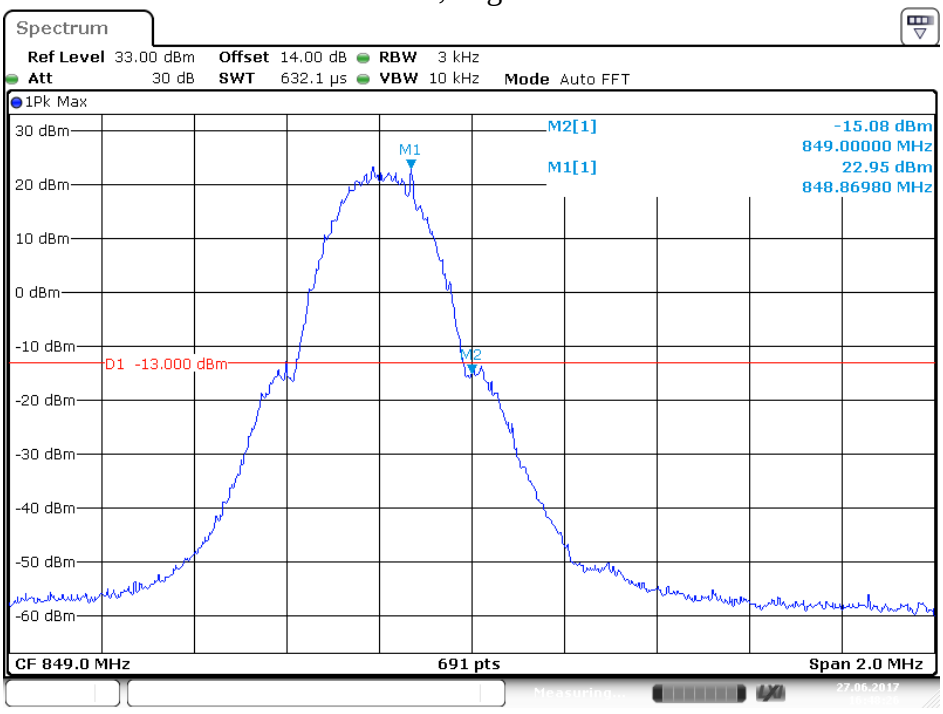
GPRS mode

Cellular Band, Low Channel



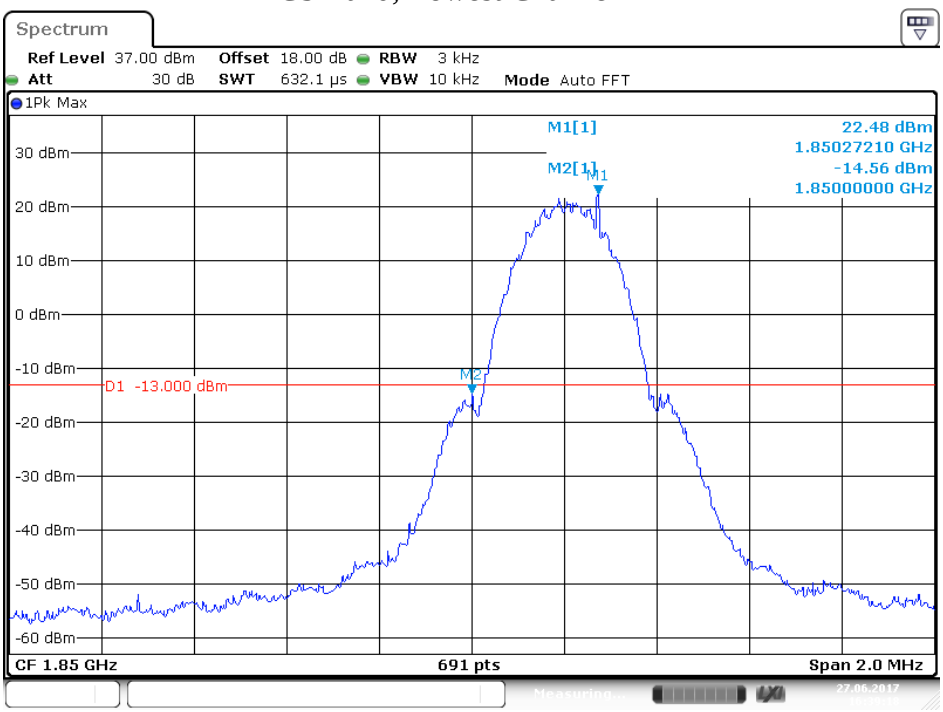
Date: 27.JUN.2017 16:46:46

Cellular Band, High Channel



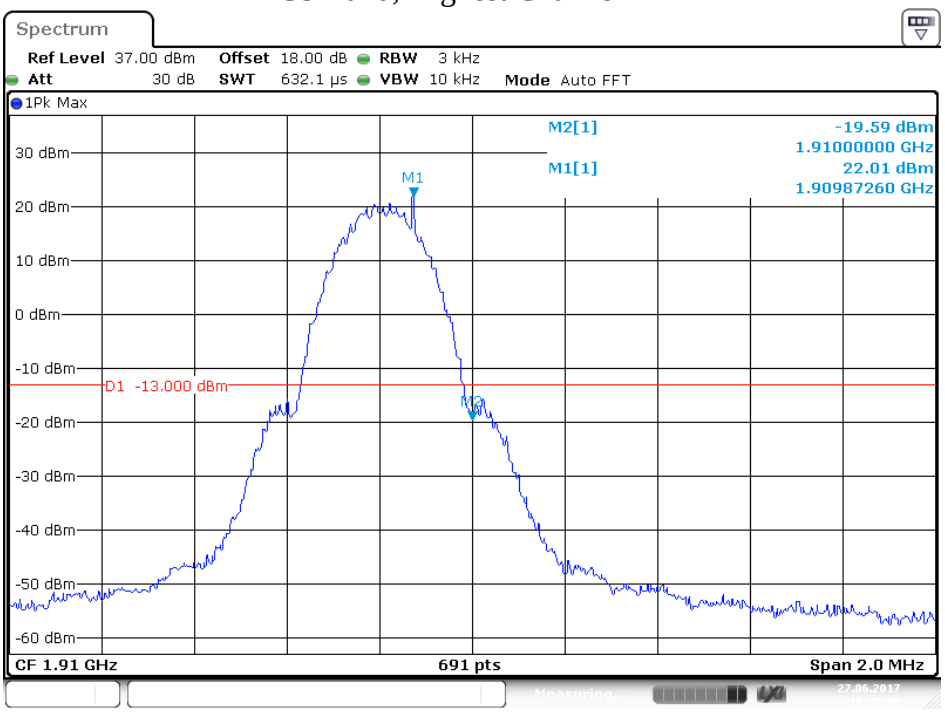
Date: 27.JUN.2017 16:48:26

PCS Band, Lowest Channel



Date: 27.JUN.2017 16:39:17

PCS Band, Highest Channel



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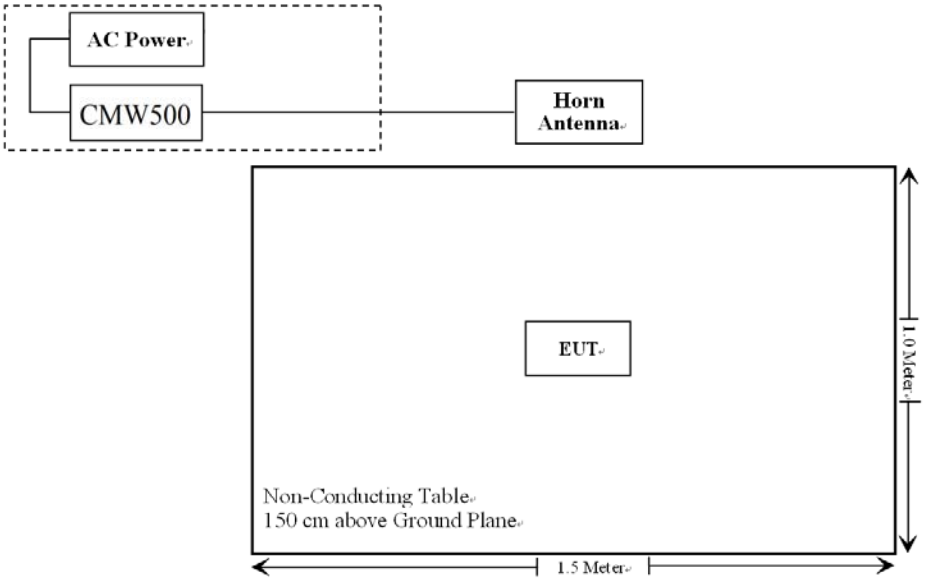
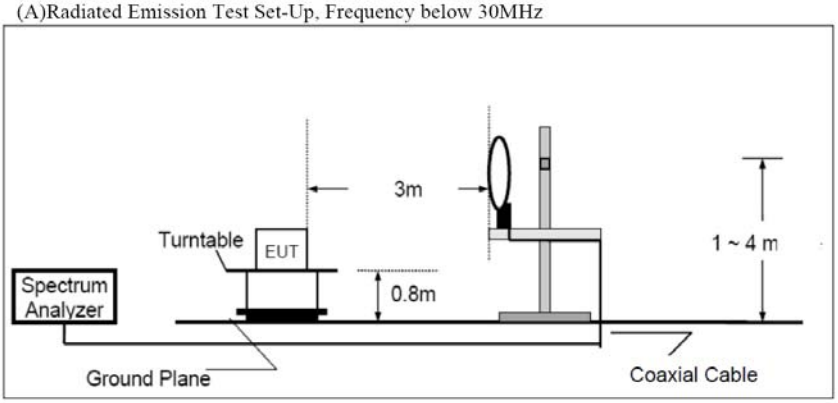
9. RADIATED SPURIOUS EMISSION TEST

9.1.Block Diagram of Test Setup

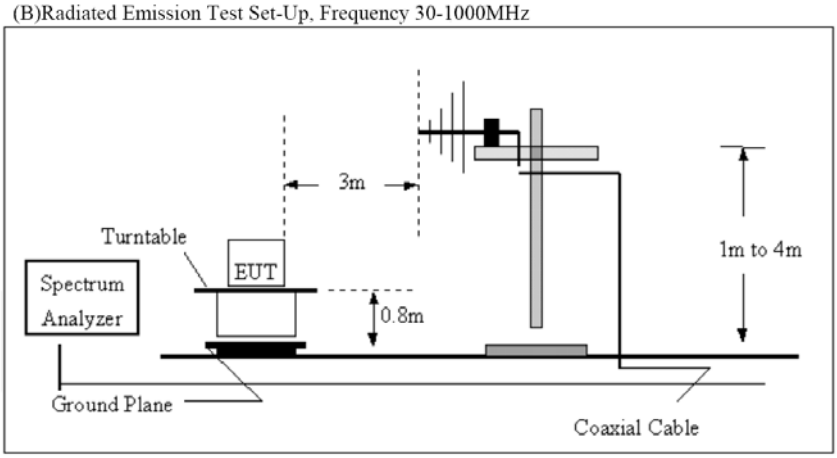


9.1.1.Semi-Anechoic Chamber Test Setup Diagram

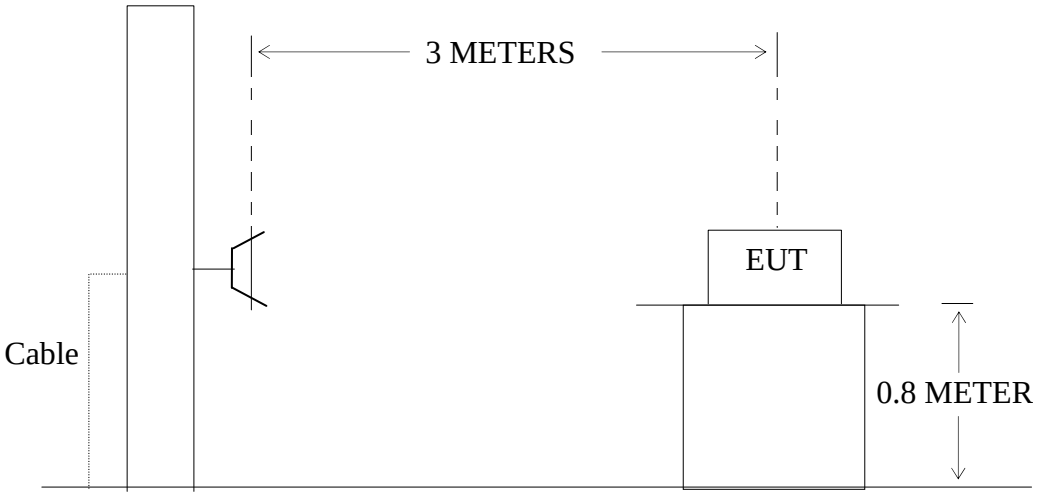
(A)Radiated Emission Test Set-Up, Frequency below 30MHz



(B)Radiated Emission Test Set-Up, Frequency 30-1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1GHz



9.2.Applicable Standard

FCC §2.1053, §22.917 and §24.238

9.3.Restricted bands of operation

9.3.1.FCC Part 15.205 Restricted bands of operation

(a) Except as shown in paragraph (d) of this section, Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

[1]Until February 1, 1999, this restricted band shall be 0.490-0.510
[2]Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emission appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000MHz, Compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

9.4. Configuration of EUT on Measurement

The equipment is installed on Radiated Emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

9.5. Operating Condition of EUT

9.5.1. Setup the EUT and simulator as shown as Section 9.1.

9.5.2. Turn on the power of all equipment.

9.5.3. Let the EUT work in TX modes measure it. The transmit frequency are 824-849MHz and 1850-1910MHz. We select 824.2MHz, 836.6MHz, 848.8MHz and 1850.2MHz, 1880.0MHz, 1909.8MHz TX frequency to transmit.

9.6. Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bilog antenna) is used as receiving antenna. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to TIA 603-D on radiated emission measurement. The EUT was tested in 3 orthogonal planes.

The bandwidth of test receiver is set at 9kHz in below 30MHz. and set at 120kHz in 30-1000MHz, and 1MHz in above 1000MHz.

The frequency range from 9KHz to 20GHz is checked.

The final measurement in band 9-90KHz, 110-490kHz and above 1000MHz is performed with Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.

Spurious emissions in dB = 10 lg(TXpwr in Watts/0.001) – the absolute level
Spurious attenuation limit in dB = 43 + 10Log $_{10}$ (power out in Watts)

9.7. The Field Strength of Radiation Emission Measurement Results

PASS

Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported.
2. The EUT is tested radiation emission at each test mode in three axes. The worst emissions are reported in all test mode and channels.
3. Absolute Level=SG Level- Cable loss + Antenna Gain
Margin=Limit- Absolute Level
4. The EUT is tested radiation emission at each test mode (GSM mode and GPRS mode) in three axes. The worst case emission(the GSM mode) are reflected in the following form.

Cellular Band (GSM850)

Indicated		Table	Test Antenna		Substituted				Absolute	Limit	Margin
Frequency (MHz)	S.A. Reading (dBμV/m)	Angle Degree	Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Level (dBm)	(dBm)	(dB)
Low Channel(824.2MHz)											
1648.4	53.47	322	1.7	V	1648.2	-48.6	9.4	0.95	-40.15	-13	27.15
1648.4	44.74	121	1.4	H	1648.2	-58.8	9.4	0.95	-50.35	-13	37.35
3296.8	44.32	226	1.6	V	3296.8	-49.2	10.1	2.08	-40.48	-13	27.48
3296.8	40.77	155	1.7	H	3296.8	-53.7	10.1	2.08	-44.98	-13	31.98
36.27	54.86	183	1.0	V	36.27	-40.7	0	0.32	-41.02	-13	28.02
324.86	57.47	72	1.0	H	324.86	-37.5	0	0.53	-38.03	-13	25.03

Indicated		Table	Test Antenna		Substituted				Absolute	Limit	Margin
Frequency (MHz)	S.A. Reading (dBμV/m)	Angle Degree	Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Level (dBm)	(dBm)	(dB)
Middle Channel (836.6MHz)											
1673.2	54.04	146	1.6	V	1673.2	-48.0	9.4	0.98	-39.58	-13	26.58
1673.2	45.31	269	1.5	H	1673.2	-58.2	9.4	0.98	-49.78	-13	36.78
3346.4	44.89	22	1.5	V	3346.4	-48.6	10.2	2.10	-40.50	-13	27.50
3346.4	41.34	55	1.8	H	3346.4	-53.1	10.2	2.10	-45.00	-13	32.00
36.27	55.43	280	1.0	V	36.27	-40.1	0	0.32	-40.42	-13	27.42
324.86	58.04	12	1.0	H	324.86	-36.9	0	0.53	-37.43	-13	24.43

Indicated		Table	Test Antenna		Substituted				Absolute	Limit	Margin
Frequency (MHz)	S.A. Reading (dBμV/m)	Angle Degree	Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Level (dBm)	(dBm)	(dB)
High Channel(848.8MHz)											
1697.6	52.20	228	1.9	V	1697.6	-49.9	9.4	1.00	-41.50	-13	28.50
1697.6	43.47	21	1.8	H	1697.6	-60.1	9.4	1.00	-51.70	-13	38.70
3395.2	43.05	128	1.4	V	3395.2	-50.5	10.2	2.10	-42.40	-13	29.40
3395.2	39.5	304	1.7	H	3395.2	-55.0	10.2	2.10	-46.90	-13	33.90
36.27	53.59	283	1.0	V	36.27	-42.0	0	0.32	-42.32	-13	29.32
324.86	56.20	76	1.0	H	324.86	-38.8	0	0.53	-39.33	-13	26.33

PCS Band (GSM1900)

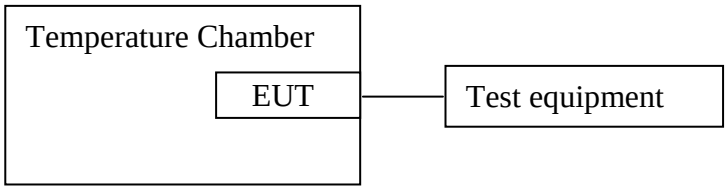
Indicated		Table Angle Degree	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Reading (dBμV/m)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)			
Low Channel(1850.2MHz)											
3700.4	50.88	57	1.5	V	3700.4	-45.63	10.3	2.58	-37.91	-13	24.91
3700.4	46.02	109	1.8	H	3700.4	-51.23	10.3	2.58	-43.51	-13	30.51
5550.6	38.35	266	1.7	V	5550.6	-52.83	11.6	3.93	-45.16	-13	32.16
5550.6	38.67	75	1.9	H	5550.6	-53.73	11.6	3.93	-46.06	-13	33.06
36.27	54.29	83	1.0	V	36.27	-41.23	0	0.32	-41.55	-13	28.55
330.62	56.38	282	1.0	H	330.62	-39.03	0	0.53	-39.56	-13	26.56

Indicated		Table Angle Degree	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Reading (dBμV/m)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)			
Middle Channel(1880.0MHz)											
3760	50.31	360	1.9	V	3760	-46.2	10.3	2.59	-38.39	-13	25.39
3760	45.45	110	2.0	H	3760	-51.8	10.3	2.59	-43.99	-13	30.99
5640	37.78	360	1.9	V	5640	-53.4	11.7	3.94	-45.64	-13	32.64
5640	38.10	175	1.8	H	5640	-54.3	11.7	3.94	-46.54	-13	33.54
36.27	53.72	183	1.0	V	36.27	-41.8	0	0.32	-41.48	-13	28.48
330.62	55.81	98	1.0	H	330.62	-39.6	0	0.53	-40.13	-13	27.13

Indicated		Table Angle Degree	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Reading (dBμV/m)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)			
High Channel(1909.8MHz)											
3819.6	49.04	127	2.0	V	3819.6	-47.47	10.4	2.60	-39.67	-13	26.67
3819.6	44.18	312	1.7	H	3819.6	-53.07	10.4	2.60	-45.27	-13	32.27
5729.4	36.51	86	1.8	V	5729.4	-54.67	11.8	3.95	-46.82	-13	33.82
5729.4	36.83	75	1.5	H	5729.4	-55.57	11.8	3.95	-47.72	-13	34.72
36.27	52.45	83	1.0	V	36.27	-43.07	0	0.32	-43.39	-13	30.39
330.62	54.54	21	1.0	H	330.62	-40.87	0	0.53	-41.40	-13	28.40

10.FREQUENCY STABILITY

10.1.Block Diagram of Test Setup



10.2.The Requirement For Section CFR47 § 2.1055 (a), § 2.1055 (d), §22.355, §24.235

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:
Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile ≤ 3 watts (ppm)	Mobile ≤ 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

10.3.Operating Condition of EUT

10.3.1.Setup the EUT and simulator as shown as Section 10.1.

10.3.2.Turn on the power of all equipment.

10.3.3.Let the EUT work in Test modes measure it. The test frequency are 836.6MHz and 1880MHz.

10.4.Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment. The output frequency was recorded for each voltage.

10.5.Test Result

Pass.

Note: Under normal conditions, we tested the data of two voltages(12V and 24V DC) and recorded the worst mode values.

GSM mode

Cellular Band (Part 22H)

Middle Channel, fo = 836.6 MHz				
Temperature (OC)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	24	19	0.0224	2.5
-20		20	0.0235	2.5
-10		21	0.0247	2.5
0		24	0.0282	2.5
10		25	0.0294	2.5
20		26	0.0306	2.5
30		25	0.0294	2.5
40		26	0.0306	2.5
50		28	0.0329	2.5
25	10.2	30	0.0353	2.5
	27.6	33	0.0388	2.5

PCS Band (Part 24E)

Middle Channel, fo = 1880 MHz				
Temperature (OC)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	24	30	0.0353	2.5
-20		35	0.0412	2.5
-10		32	0.0376	2.5
0		32	0.0376	2.5
10		35	0.0412	2.5
20		28	0.0329	2.5
30		30	0.0353	2.5
40		28	0.0329	2.5
50		26	0.0306	2.5
25	10.2	24	0.0282	2.5
	27.6	22	0.0259	2.5

GPRS mode

Cellular Band (Part 22H)

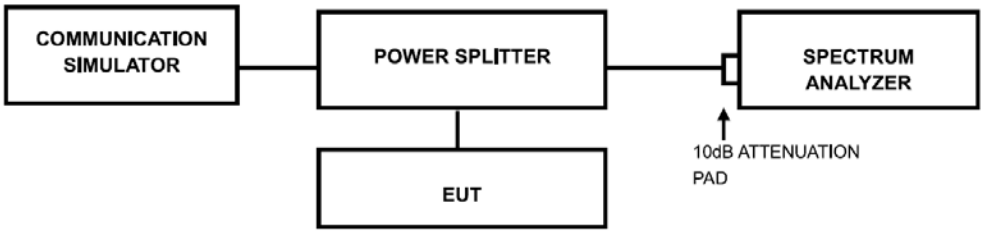
Middle Channel, fo = 836.6 MHz				
Temperature (OC)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	24	20	0.0235	2.5
-20		22	0.0259	2.5
-10		21	0.0247	2.5
0		25	0.0294	2.5
10		24	0.0282	2.5
20		26	0.0306	2.5
30		25	0.0294	2.5
40		26	0.0306	2.5
50		25	0.0294	2.5
25	10.2	28	0.0329	2.5
	27.6	30	0.0353	2.5

PCS Band (Part 24E)

Middle Channel, fo = 1880 MHz				
Temperature (OC)	Power Supplied (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	24	33	0.0388	2.5
-20		36	0.0424	2.5
-10		32	0.0376	2.5
0		30	0.0353	2.5
10		35	0.0412	2.5
20		26	0.0306	2.5
30		25	0.0294	2.5
40		28	0.0329	2.5
50		26	0.0306	2.5
25	10.2	22	0.0259	2.5
	27.6	20	0.0235	2.5

11.PEAK TO AVERAGE RATIO

11.1.Block Diagram of Test Setup



11.2.The LIMITS OF PEAK TO AVERAGE RATIO MEASUREMENT

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

11.3.Operating Condition of EUT

11.3.1.Setup the EUT and simulator as shown as Section 11.1.

11.3.2.Turn on the power of all equipment.

11.3.3.Let the EUT work in Test modes then measure it. The test frequency are 836.6MHz and 1880MHz.

11.4.Test Procedure

11.4.1.Set resolution/measurement bandwidth≥ signal's occupied bandwidth;

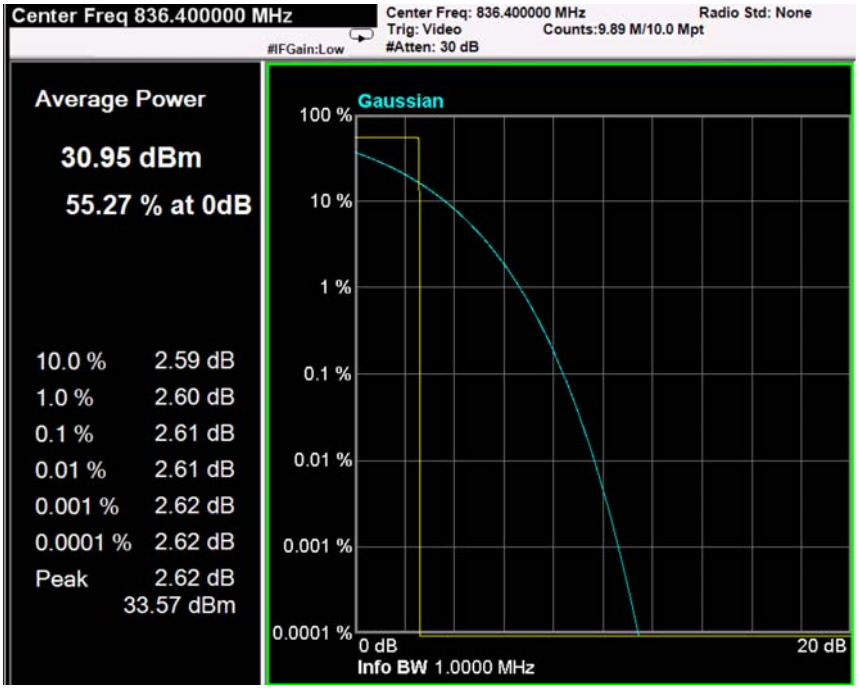
11.4.2.Set the number of counts to a value that stabilizes the measured CCDF curve;

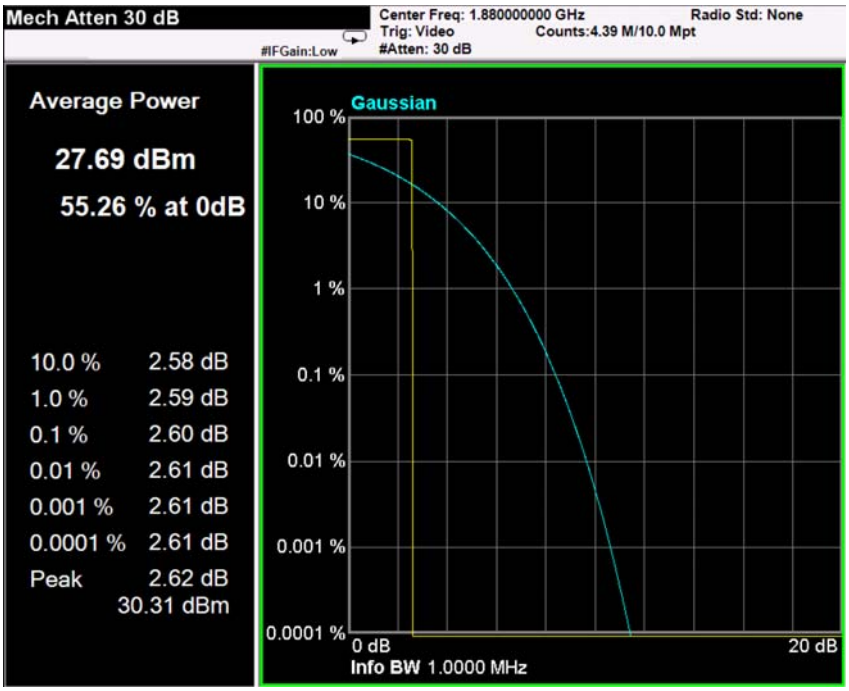
11.4.3.Record the maximum PAPR level associated with a probability pf 0.1%

11.5.Test Result

Pass.

Mode	CHANNEL	Frequency (MHz)	PEAK TO AVERAGE RATIO (dB)
GSM850	189	836.4	2.61
GSM1900	661	1880	2.60





12. ANTENNA REQUIREMENT

12.1. The Requirement

According to Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

12.2. Antenna Construction

The antenna use a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. The antenna jack of EUT correspond to the standard. The Antenna gain of EUT is 1dBi. Therefore, the equipment complies with the antenna requirement of Section 15.203.