

Test Report

FCC ID: 2AQ3N-TK318

Date of issue: Sept. 03, 2018

Report Number:	MTi180828E126
Sample Description:	GPS Tracker
Model(s):	TK318, TK309, TK312, TK315, GT02E, W208, W408, W608, W808
Applicant:	Dongguan SmartTrack Electronic Technology Co., Ltd.
Address:	No525, Jinxing Road, Juhui E Valley High Tech Industrial Park, Dongguan, Guangdong, China.
Date of Test:	June 23, 2018 to Sept. 03, 2018

Shenzhen Microtest Co., Ltd.
<http://www.mtitest.com>

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Test Result Certification

Applicant's name: Dongguan SmartTrack Electronic Technology Co., Ltd.

Address: No525, Jinxing Road, Juhui E Valley High Tech Industrial Park,
Dongguan, Guangdong, China.

Manufacture's Name: Dongguan SmartTrack Electronic Technology Co., Ltd.

Address: No525, Jinxing Road, Juhui E Valley High Tech Industrial Park,
Dongguan, Guangdong, China.

Product name: GPS Tracker

Trademark: N/A

Model name: TK318, TK309, TK312, TK315, GT02E, W208, W408, W608,
W808

Standards: FCC Part 22 Subpart H
FCC Part 24 Subpart E
FCC Part 2

Test Procedure: ANSI TIA-603-D: 2010
KDB 971168 D01 v02r02

This device described above has been tested by Shenzhen Microtest Co., Ltd. and the test results show that the equipment under test (EUT) compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

Tested by:

Leo Su

Leo Su

Sept. 03 , 2018

Reviewed by:

Blue Zheng

Blue Zheng

Sept. 03 , 2018

Approved by:

Smith Chen

Smith Chen

Sept. 03 , 2018

1 General description

1.1 Feature of equipment under test (EUT)

Product name:	GPS Tracker
Trade name:	N/A
Model name:	TK318, TK309, TK312, TK315, GT02E, W208, W408, W608, W808
Model difference:	All the model are the same circuit and RF module, except the model No..
Frequency range:	GSM 850:TX824.2MHz~848.8MHz,RX869.2MHz~893.8MHz PCS 1900:TX1850.2MHz~1909.8MHz,RX1930.2MHz~1989.8MHz WCDMA Band II:TX1852.4MHz~1907.6MHz/ RX1932.4MHz~1987.6MHz; WCDMA Band V: TX826.4MHz~846.6MHz RX871.4MHz~891.6MHz
Modulation type:	GMSK for GSM/GPRS; QPSK for WCDMA bands;
Power class:	Multi-Class12 Only 4 timeslots are used for GPRS
Multislot class:	The Tablet PC has One SIM Card socket
Antenna type:	PIFA Antenna
Antenna gain:	1.1dBi
Hardware version:	V01
Software version:	T01
Power supply:	N/A
Battery:	DC 3.7V/150mAh
Adapter information:	N/A

1.2 Test frequency channel

Frequency Band	Frequency	Channel	Frequency(MHz)
GSM 850	Low	128	824.2
	Middle	190	836.6
	High	251	848.8
GSM 1900	Low	512	1850.2
	Middle	661	1880
	High	810	1909.8
WCDMA Band II	Low	9262	1852.4
	Middle	9400	1880
	High	9538	1907.6
WCDMA Band V	Low	4132	826.4
	Middle	4183	836.6
	High	4233	846.6

1.3 EUT operation mode

During testing, RF test program provided by the manufacture to control the Tx operation followed the test requirement. The EUT is configured to transmit continuously (duty cycle > 98 %) at the maximum power control level.

1.4 Test conditions

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 20°C~30°C
- Humidity: 30%~70%
- Atmospheric pressure: 98kPa~101kPa

1.5 Testing site

Test Site	Shenzhen Microtest Co., Ltd.
Test Site Location	No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China
FCC Registration No.:	448573

1.6 Ancillary equipment list

Equipment	Model	S/N	Manufacturer	Certificate type
DC power supply	QJ3020E	015170	QJE	/

1.7 Measurement uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %, $U=2 \times U_c(y)$

RF frequency	1×10^{-7}
RF power, conducted	± 1 dB
Conducted emission(150kHz~30MHz)	± 2.5 dB
Radiated emission(30MHz~1GHz)	± 4.2 dB
Radiated emission (above 1GHz)	± 4.3 dB
Temperature	± 1 degree
Humidity	± 5 %

2 Summary of Test Result

Item	FCC Part No.	Description of Test	Result
1	2.1046, 22.913(a); 24.232(c)	Maximum output power	Pass
2	2.1046, 22.913(a); 24.232(c)	Peak to average power ratio(PAPR)	Pass
3	2.1046, 22.913(a); 24.232(c)	Transmitter Radiated Power (EIRP/ERP)	Pass
4	2.1049; 22.917(b); 24.238(b)	Occupied Bandwidth	Pass
5	2.1051; 22.917(a); 24.238(a)	Conducted spurious emissions	Pass
6	2.1051; 22.917(b); 24.238(b)	Spurious emissions at band edge	Pass
7	2.1053; 22.917(a); 24.238(a)	Radiated spurious emissions	Pass
8	2.1055; 22.355; 24.235	Frequency Stability	Pass

3 Test facilities and accreditations

3.1 Test laboratory

Test Laboratory	Shenzhen Microtest Co., Ltd
Location	No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China
FCC Registration No.:	FCC Registration No.: 448573

3.2 Environmental conditions

Temperature:	20°C~30°C
Humidity	30%~70%
Atmospheric pressure	98kPa~101kPa

3.3 Measurement uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %, $U=2 \times U_c(y)$

RF frequency	1×10^{-7}
RF power, conducted	± 1 dB
Conducted emission(150kHz~30MHz)	± 2.5 dB
Radiated emission(30MHz~1GHz)	± 4.2 dB
Radiated emission (above 1GHz)	± 4.3 dB
Temperature	± 1 degree
Humidity	± 5 %

3.4 Test software

Software Name	Manufacturer	Model	Version
RF Test System	Farad	LZ-RF	Lz_Rf 3A3

4 List of test equipment

Equipment No.	Equipment Name	Manufacturer	Model	Serial No.	Calibration date	Due date
MTI-E001	Spectrum Analyzer	Agilent	E4407B	MY41441082	2017/09/18	2018/09/17
MTI-E002	CMU 200 universal radio communication tester	Rohde&schwarz	CMU 200	114587	2017/09/18	2018/09/17
MTI-E004	EMI Test Receiver	Rohde&schwarz	ESPI	1000314	2017/09/18	2018/09/17
MTI-E006	Broadband antenna	schwarabeck	VULB9163	872	2017/09/18	2018/09/17
MTI-E007	Horn antenna	schwarabeck	BBHA9120D	1201	2017/09/18	2018/09/17
MTI-E014	amplifier	America	8447D	3113A06150	2017/09/18	2018/09/17
MTI-E015	Conduction Immunity Signal Generator	Schloder	CDG6000	126A1343/2015	2017/09/18	2018/09/17
MTI-E016	Coupled decoupling network	Schloder	CDA M2/M3	A2210332/2015	2017/09/18	2018/09/17
MTI-E032	Comprehensive test instrument	Rohde&schwarz	CMW500	124192	2017/09/13	2018/09/12
MTI-E034	amplifier	Agilent	8449B	3008A02400	2018/05/22	2019/05/21
MTI-E040	Spectrum analyzer	Agilent	N9020A	MY49100060	2017/09/05	2018/09/04
MTI-E041	Signal generator	Agilent	N5182A	MY49060455	2017/09/23	2018/09/22
MTI-E042	Analog signal generator	Agilent	E4421B	GB40051240	2017/09/23	2018/09/22
MTI-E043	Power probe	Dare Instruments	RPR3006W	16I00054SN O16	2017/09/29	2018/09/28
MTI-E047	10dB attenuator	Mini-Circuits	UNAT-10+	15542	2017/09/24	2018/09/23
MTI-E049	spectrum analyzer	Rohde&schwarz	FSP-38	100019	2017/09/18	2018/09/17
MTI-E050	PSG Signal generator	Agilent	E8257D	MY46520873	2017/09/24	2018/09/23
MTI-E051	Active Loop Antenna 9kHz - 30MHz	Schwarzbeek	FMZB 1519 B	00044	2017/09/26	2018/09/25
MTI-E052	18-40GHz amplifier	Chengdu step Micro Technology	ZLNA-18-40G-21	1608001	2017/09/18	2018/09/17
MTI-E053	15-40G Antenna	Schwarzbeek	BBHA9170	BBHA9170582	2017/09/18	2018/09/17
MTI-B046	DC power supply	QJE	QJ3020E	015170	2017/09/18	2018/09/17

Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

5 Test Result

5.1 Maximum output power and peak to average ratio

5.1.1 Limit

For FCC 22.913: The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

For FCC 24.234: 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. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13dB.

5.1.2 Test method

For Conducted output power:

1. Use a universal radio communication tester, the output power of EUT was measured at the antenna terminal. The path loss was calibrated and entered as an offset into the test equipment.
2. The EUT was configured to transmit on maximum power by the radio communication tester.
3. Measured the peak and average powers.

For EIRP & ERP:

1. In many cases, the RF output power limits for licensed digital transmission devices is specified in terms of effective radiated power (ERP) or equivalent isotropic radiated power (EIRP). Typically, ERP is specified when the operating frequency is less than or equal to 1 GHz and EIRP is specified when the operating frequency is greater than 1 GHz. Both are determined by adding the transmit antenna gain to the conducted RF output power with the primary difference between the two being that when determining the ERP, the transmit antenna gain is referenced to a dipole antenna (i.e., dBd) whereas when determining the EIRP, the transmit antenna gain is referenced to an isotropic antenna (dBi).

2. The relevant equation for determining the ERP or EIRP from the conducted RF output power measured using the guidance provided above is:

$$\text{ERP/EIRP} = P_{\text{Meas}} + \text{GT} - \text{LC}$$

where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as P_{Meas} , typically dBW or dBm);

P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

dBd (ERP)=dBi (EIRP) -2.15 dB

LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

5.1.3 Test Result

For Conducted output power:

Output Power for GSM850

Mode	Frequency(MHz)	Maximum Burst average Power(dBm)
GSM850	824.2	32.77
	836.6	32.68
	848.8	32.24

Mode	Frequency(MHz)	Maximum Burst average Power(dBm)
GPRS850 (1 Slot)	824.2	31.76
	836.6	31.04
	848.8	31.24
GPRS850 (2 Slot)	824.2	31.84
	836.6	31.72
	848.8	31.43
GPRS850 (3 Slot)	824.2	31.21
	836.6	31.07
	848.8	31.12
GPRS850 (4 Slot)	824.2	31.88
	836.6	31.75
	848.8	31.69

Output Power for PCS1900

Mode	Frequency(MHz)	Maximum conducted Power(dBm)
GSM1900	1850.2	32.17
	1880	32.09
	1909.8	32.11

Mode	Frequency(MHz)	Maximum conducted Power(dBm)
GPRS1900 (1 Slot)	1850.2	30.89
	1880	30.77
	1909.8	31.17
GPRS1900 (2 Slot)	1850.2	30.72
	1880	30.85
	1909.8	31.02
GPRS1900 (3 Slot)	1850.2	31.04
	1880	30.57
	1909.8	30.83
GPRS1900 (4 Slot)	1850.2	31.77
	1880	30.71
	1909.8	30.85

Output Power for WCDMA BAND II

Mode	Frequency(MHz)	Maximum Average Output Power(dBm)
WCDMA 1900 RMC	1852.4	29.70
	1880	29.17
	1907.6	29.84
HSDPA Subtest 1	1852.4	28.55
	1880	28.04
	1907.6	28.45
HSDPA Subtest 2	1852.4	28.85
	1880	28.77
	1907.6	28.82
HSDPA Subtest 3	1852.4	28.81
	1880	28.74
	1907.6	28.69
HSDPA Subtest 4	1852.4	28.85
	1880	28.80
	1907.6	28.77
HSUPA Subtest 1	1852.4	26.53
	1880	26.70
	1907.6	26.96
HSUPA Subtest 2	1852.4	26.65
	1880	26.61
	1907.6	26.42
HSUPA Subtest 3	1852.4	26.55
	1880	26.59
	1907.6	26.71
HSUPA Subtest 4	1852.4	26.83
	1880	26.57
	1907.6	26.69

Output Power for WCDMA BAND V

Mode	Frequency(MHz)	Maximum Average Output Power(dBm)
WCDMA 850 RMC	826.4	23.84
	836.6	24.90
	846.6	25.70
HSDPA Subtest 1	826.4	23.13
	836.6	23.86
	846.6	24.47
HSDPA Subtest 2	826.4	23.46
	836.6	23.74
	846.6	23.25
HSDPA Subtest 3	826.4	23.57
	836.6	23.90
	846.6	23.16
HSDPA Subtest 4	826.4	23.34
	836.6	23.95
	846.6	23.25
HSUPA Subtest 1	826.4	20.14
	836.6	20.27
	846.6	20.86
HSUPA Subtest 2	826.4	20.51
	836.6	20.03
	846.6	20.62
HSUPA Subtest 3	826.4	20.71
	836.6	20.22
	846.6	20.45
HSUPA Subtest 4	826.4	20.32
	836.6	20.11
	846.6	20.67

For EIRP & ERP:

For GSM 850

Frequency	Polarization	SG	Pcl	Ga Antenna Gain	Correction	ERP	ERP
		Level					
(MHz)		(dBm)	(dB)	(dB)	(dB)	(dBm)	(W)
824.2	H	32.74	0.39	1	2.15	31.20	1.3183
836.6	H	32.63	0.35	1.1	2.15	31.23	1.3274
848.8	H	32.81	0.32	1.2	2.15	31.54	1.4256
824.2	V	32.53	0.39	1	2.15	30.99	1.2560
836.6	V	32.49	0.35	1.1	2.15	31.09	1.2853
848.8	V	32.68	0.32	1.2	2.15	31.41	1.3836

For GPRS 850

Frequency	Polarization	SG	Pcl	Ga Antenna Gain	Correction	ERP	ERP
		Level					
(MHz)		(dBm)	(dB)	(dB)	(dB)	(dBm)	(W)
824.2	H	31.09	0.39	1	2.15	29.55	0.9016
836.6	H	31.41	0.35	1.1	2.15	30.01	1.0023
848.8	H	31.52	0.32	1.2	2.15	30.25	1.0593
824.2	V	31.68	0.39	1	2.15	30.14	1.0328
836.6	V	31.29	0.35	1.1	2.15	29.89	0.9750
848.8	V	31.37	0.32	1.2	2.15	30.10	1.0233

For GSM 1900

Frequency	Polarization	SG	Pcl	Ga Antenna Gain	EIRP	EIRP
		Level				
(MHz)		(dBm)	(dB)	(dB)	(dBm)	(W)
1850.2	H	30.38	0.47	1.58	29.91	0.9795
1880	H	30.17	0.47	1.72	29.70	0.9333
1909.8	H	30.05	0.46	1.85	29.59	0.9099
1850.2	V	30.41	0.47	1.58	29.94	0.9863
1880	V	30.03	0.47	1.72	29.56	0.9036
1909.8	V	30.24	0.46	1.85	29.78	0.9506

For GPRS 1900

Frequency	Polarization	SG	Pcl	Ga Antenna Gain	EIRP	EIRP
		Level				
(MHz)		(dBm)	(dB)	(dB)	(dBm)	(W)
1850.2	H	29.43	0.47	1.58	28.96	0.7870
1880	H	29.34	0.47	1.72	28.87	0.7709
1909.8	H	29.19	0.46	1.85	28.73	0.7464
1850.2	V	29.27	0.47	1.58	28.80	0.7586
1880	V	29.09	0.47	1.72	28.62	0.7278
1909.8	V	29.17	0.46	1.85	28.71	0.7430

For WCDMA BAND II

Frequency	Polarization	SG Level	Pcl	Ga Antenna Gain	EIRP	EIRP
(MHz)		(dBm)	(dB)	(dB)	(dBm)	(W)
1852.4	H	22.63	0.47	1.58	22.16	0.1644
1880	H	22.45	0.47	1.72	21.98	0.1578
1907.6	H	21.97	0.46	1.85	21.51	0.1416
1852.4	V	22.41	0.47	1.58	21.94	0.1563
1880	V	22.36	0.47	1.72	21.89	0.1545
1907.6	V	21.96	0.46	1.85	21.50	0.1413

For WCDMA BAND V

Frequency	Polarization	SG Level	Pcl	Ga Antenna Gain	ERP	EIRP
(MHz)		(dBm)	(dB)	(dB)	(dBm)	(W)
826.4	H	22.42	1	2.15	20.88	0.1225
836.6	H	22.36	1.1	2.15	20.96	0.1247
846.6	H	22.34	1.2	2.15	21.07	0.1279
826.4	V	22.15	1	2.15	20.61	0.1151
836.6	V	22.12	1.1	2.15	20.72	0.1180
846.6	V	22.08	1.2	2.15	20.81	0.1205

5.2 Peak to average power ratio (PAPR)

5.2.1 Limit

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

5.2.2 Test method

The EUT was connected to Spectrum Analyzer and Base Station via power divider.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

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

Set the measurement interval to 1 ms.

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

- a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
- b) Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
- c) Set the number of counts to a value that stabilizes the measured CCDF curve;
- d) Set the measurement interval as follows:
 - 1) for continuous transmissions, set to 1 ms,
 - 2) for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
- e) Record the maximum PAPR level associated with a probability of 0.1%.

5.2.3 Test Result

Cellular Band						
Modes	GSM850			GSM1900		
Channel	128 (Low)	190 (Mid)	251 (High)	512 (Low)	661 (Mid)	810 (High)
Frequency(MHz)	824.2	836.6	848.8	1850.2	1880	1909.8
Peak-to-Average Ratio (dB)	9.29	9.27	9.44	9.18	8.81	9.39

Cellular Band						
Modes	GPRS850			GPRS1900		
Channel	128 (Low)	190 (Mid)	251 (High)	512 (Low)	661 (Mid)	810 (High)
Frequency(MHz)	824.2	836.6	848.8	1850.2	1880	1909.8
Peak-to-Average Ratio (dB)	9.21	9.17	8.68	9.03	8.92	9.22

Cellular Band						
Modes	WCDMA BAND II			WCDMA BAND V		
Channel	9262 (Low)	9400 (Mid)	9538 (High)	4132 (Low)	4183 (Mid)	4233 (High)
Frequency(MHz)	1852.4	1880	1907.6	826.4	836.6	846.6
Peak-to-Average Ratio (dB)	3.01	2.73	2.90	1.99	1.95	1.85

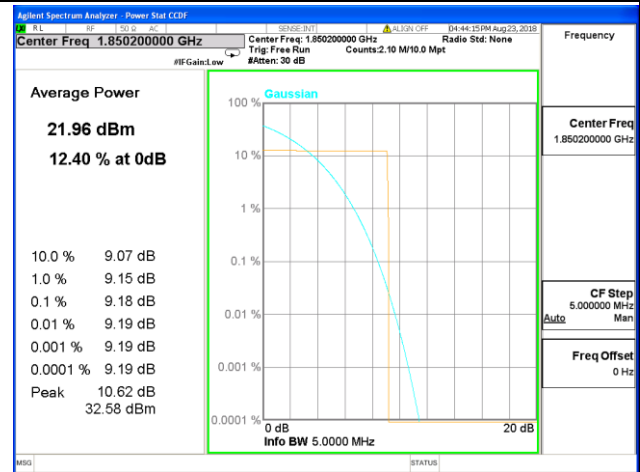
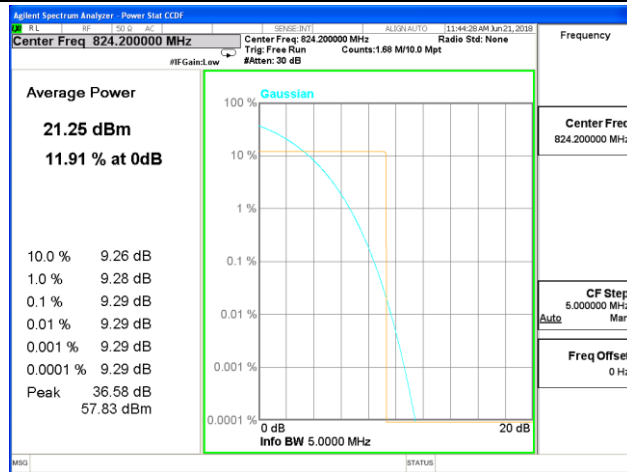
Test plot

(GSM850)

(GSM1900)

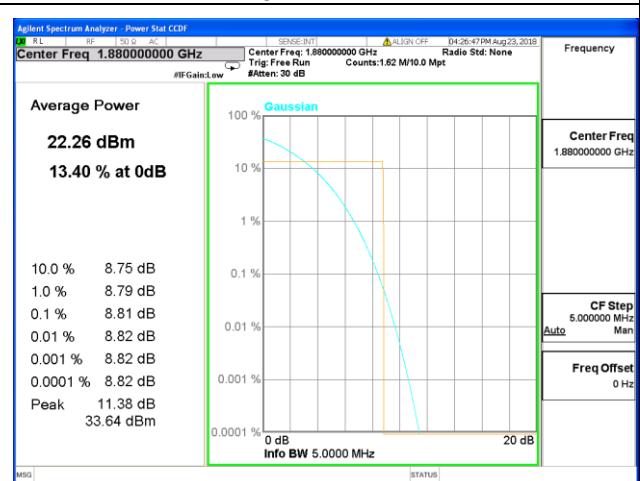
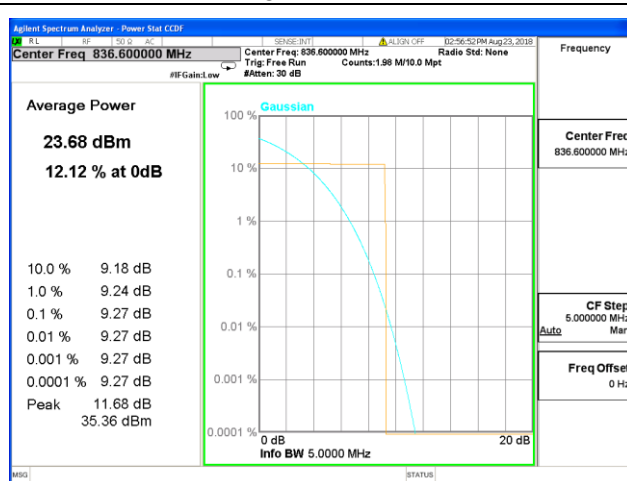
Peak-to-Average Ratio on channel 128

Peak-to-Average Ratio on channel 512



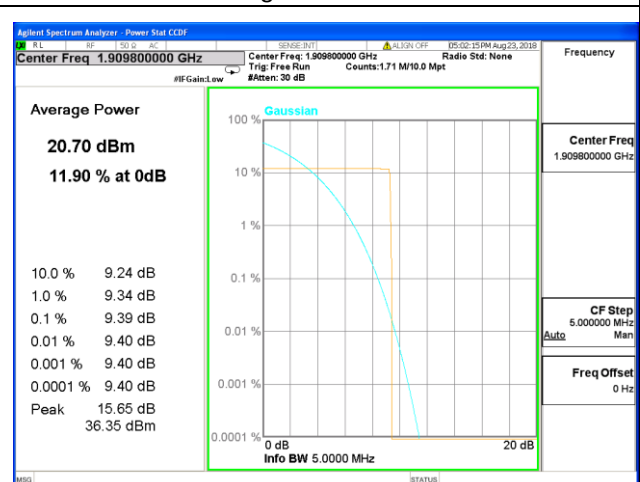
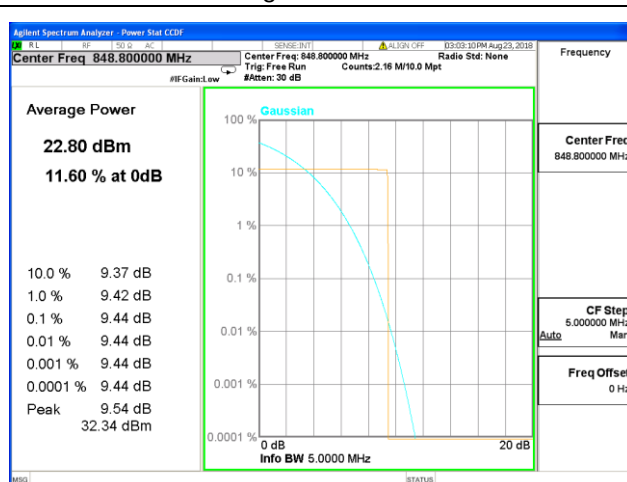
Peak-to-Average Ratio on channel 190

Peak-to-Average Ratio on channel 661



Peak-to-Average Ratio on channel 251

Peak-to-Average Ratio on channel 810



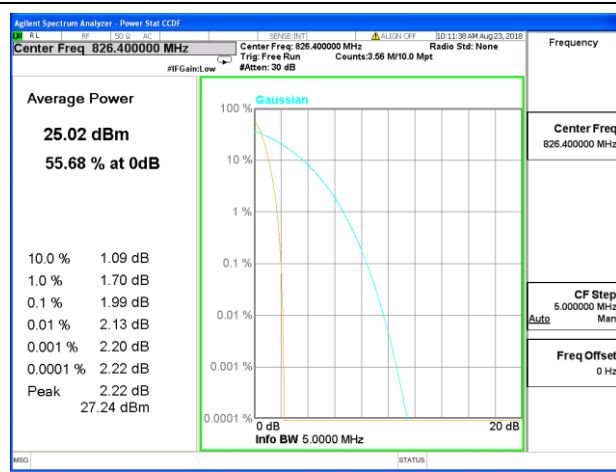
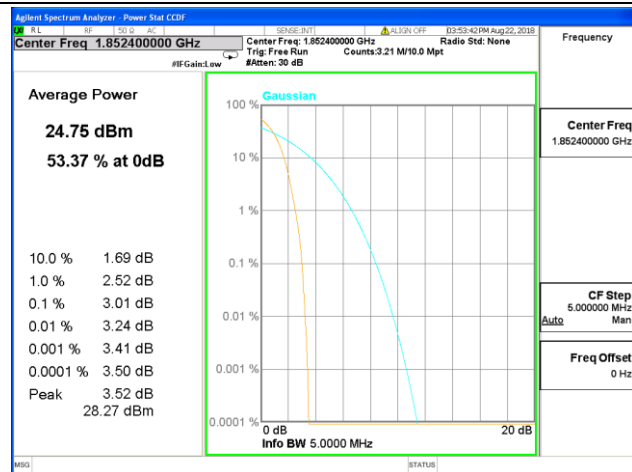
Test plot

(WCDMA BAND II)

(WCDMA BAND V)

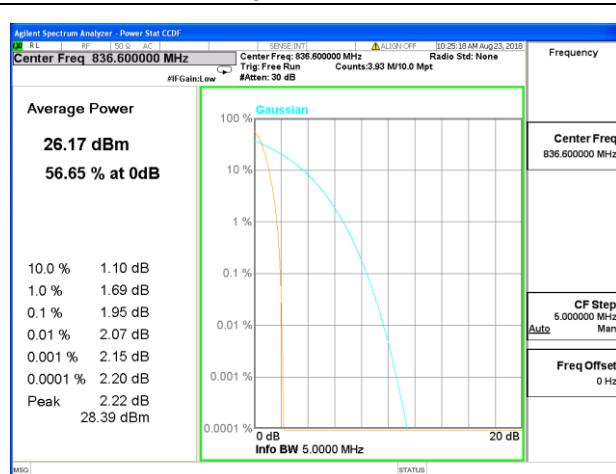
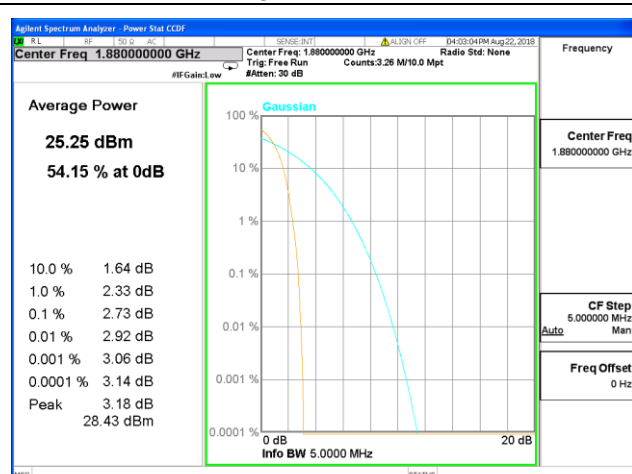
Peak-to-Average Ratio on channel 9262

Peak-to-Average Ratio on channel 4132



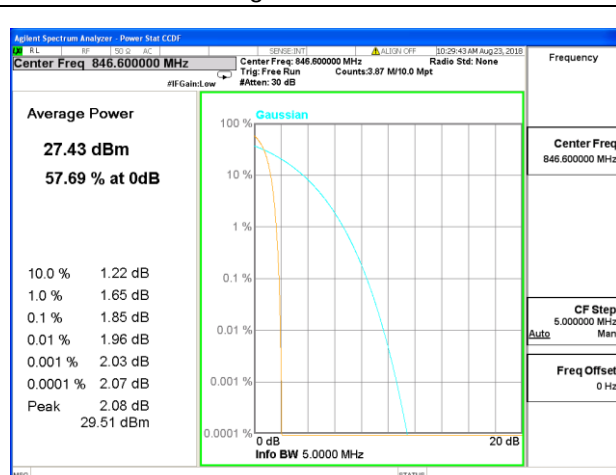
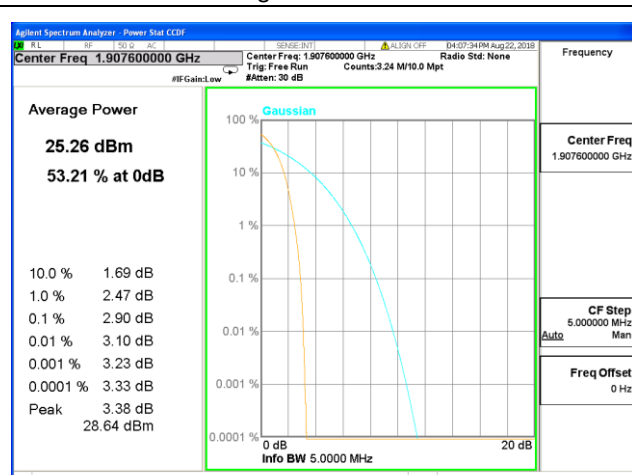
Peak-to-Average Ratio on channel 9400

Peak-to-Average Ratio on channel 4183



Peak-to-Average Ratio on channel 9538

Peak-to-Average Ratio on channel 4233



5.3 Occupied bandwidth

5.3.1 Test method

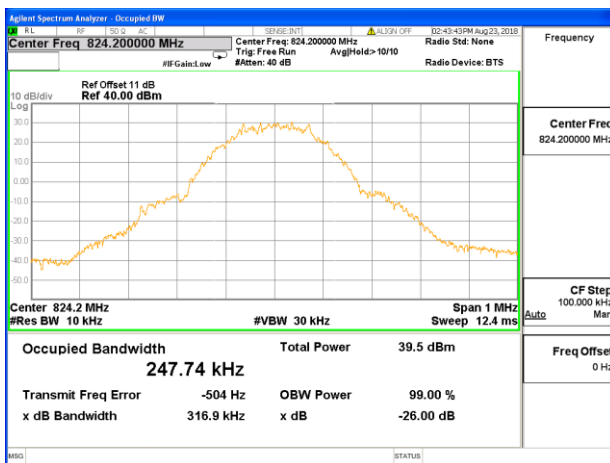
1. The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.
2. The resolution bandwidth of the Spectrum Analyzer is set to at least 1% of the occupied bandwidth.
3. The low, middle and high channels are selected to perform tests respectively.
4. Set the frequency range of the Spectrum Analyzer suitably to capture the waveform; search peak; make a line whose value is 26dB lower than the peak; mark two points which the line intersected the waveform at; finally record the delta of the two points as the occupied bandwidth and the plot.
5. Set the Spectrum Analyzer Occupied bandwidth function to measure the 99% occupied bandwidth.

5.3.2 Test result

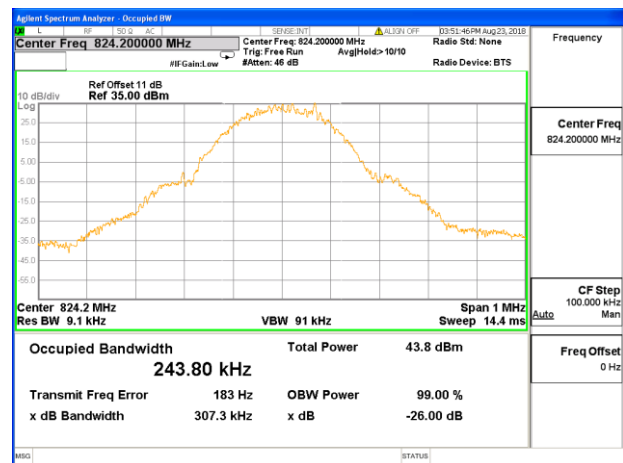
Channel	Channel Frequency (MHz)	26dB emission bandwidth (MHz)	99% occupied bandwidth (MHz)
GSM 850			
128	824.2	0.3169	0.24774
190	836.6	0.3126	0.24354
251	848.8	0.3243	0.24798
GPRS 850			
128	824.2	0.3073	0.24380
190	836.6	0.3187	0.24652
251	848.8	0.3192	0.24794
GSM 1900			
512	1850.2	0.3169	0.24811
661	1880	0.3208	0.24779
810	1909.8	0.3168	0.24660
GPRS 1900			
512	1850.2	0.3127	0.24413
661	1880	0.3160	0.24594
810	1909.8	0.3228	0.24519

WCDMA Band II			
9262	1852.4	4.672	4.1607
9400	1880	4.687	4.1725
9538	1907.6	4.657	4.1671
WCDMA Band V			
4132	826.4	5.291	4.4048
4183	836.4	5.547	4.3498
4233	846.6	5.611	4.2321

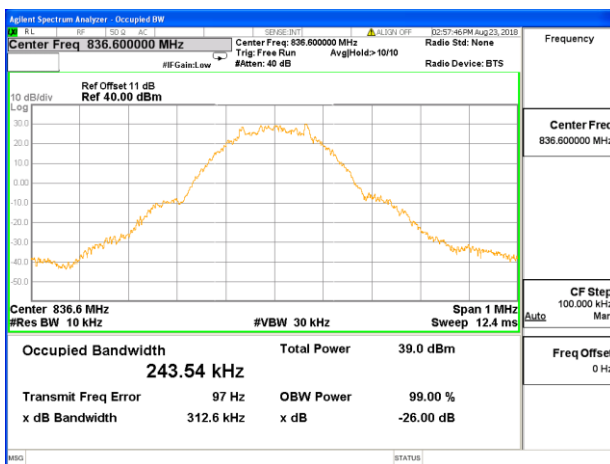
GSM 850 – 824.2MHz



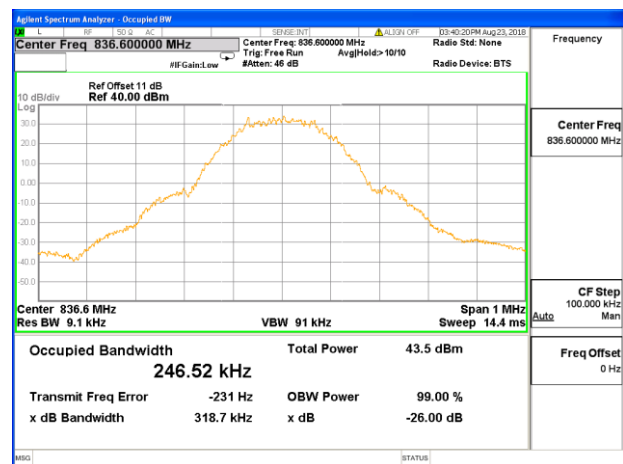
GPRS 850 – 824.2MHz



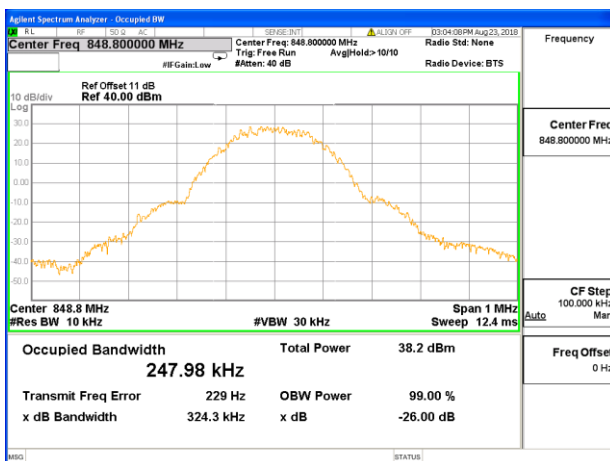
GSM 850 – 836.6MHz



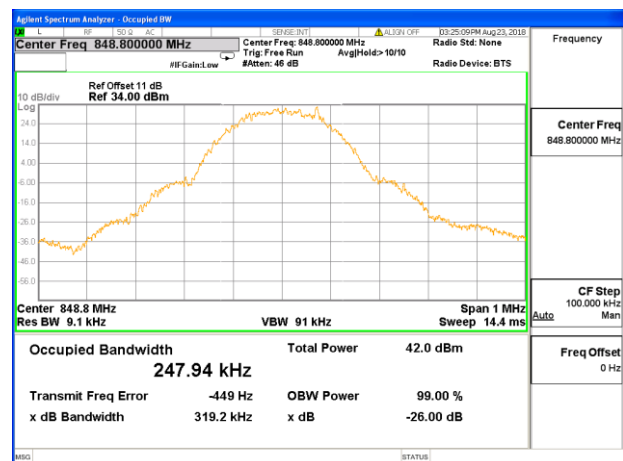
GPRS 850 – 836.6MHz



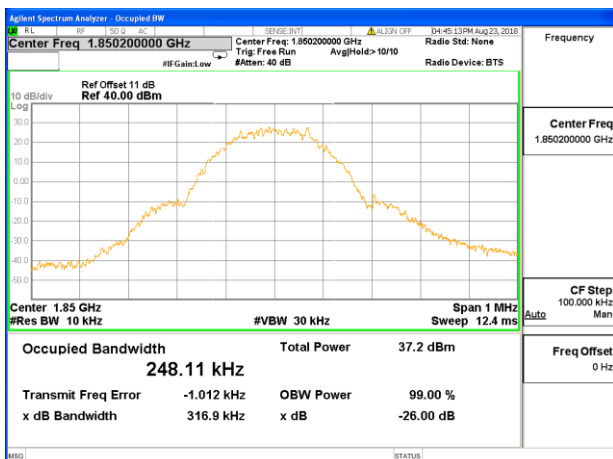
GSM 850 – 848.8MHz



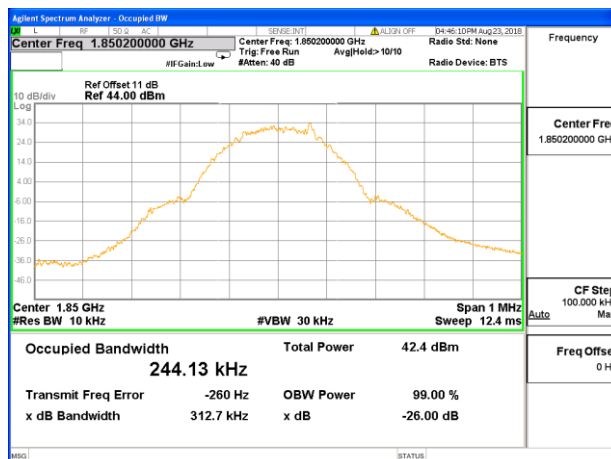
GPRS 850 – 848.8MHz



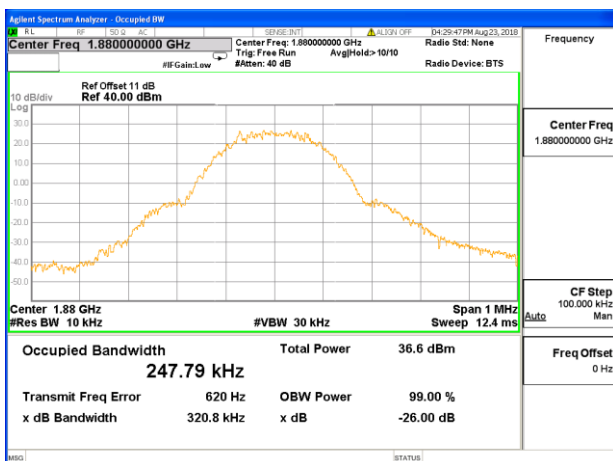
GSM 1900 - 1850MHz



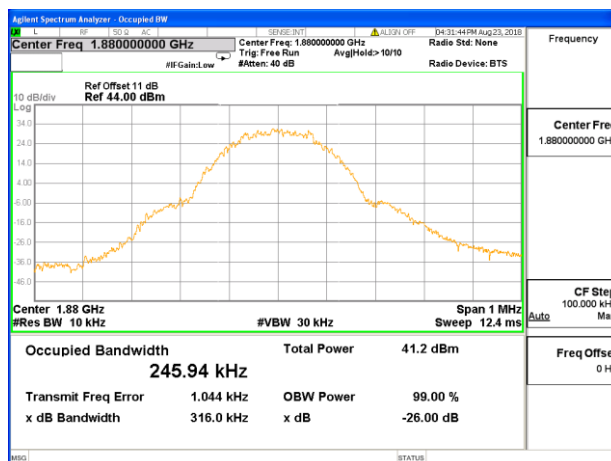
GPRS 1900 - 1850MHz



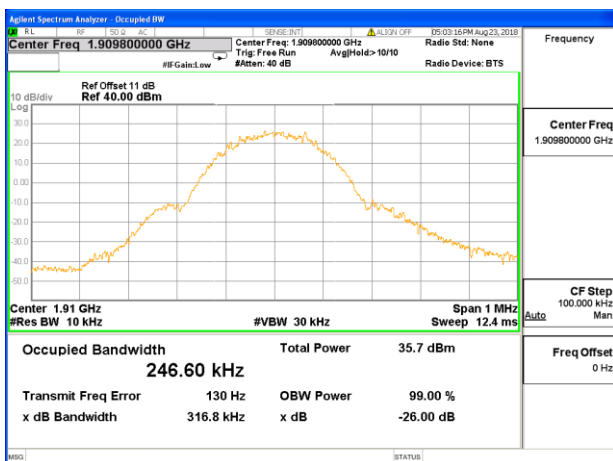
GSM 1900 - 1880MHz



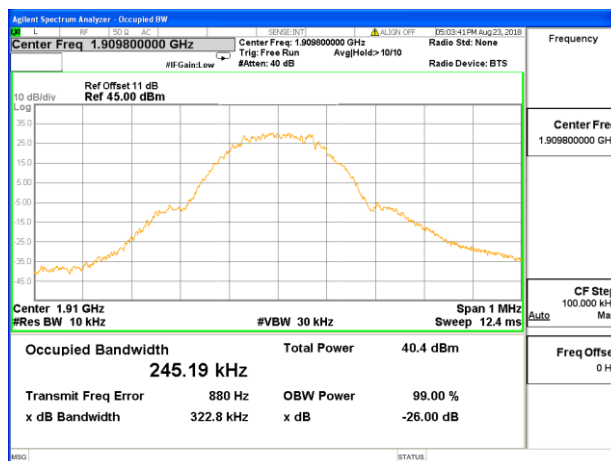
GPRS 1900 - 1880MHz



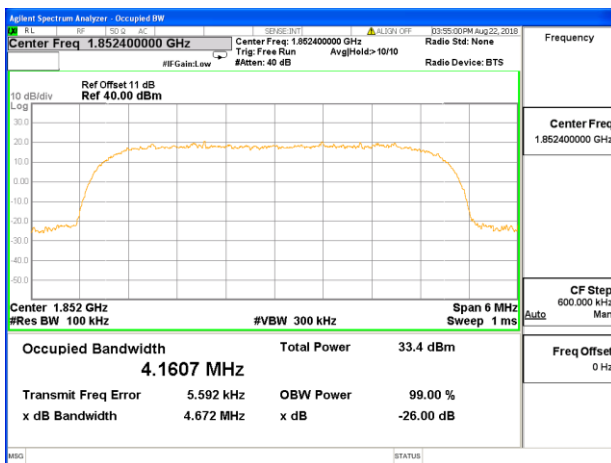
GSM 1900 - 1909.8MHz



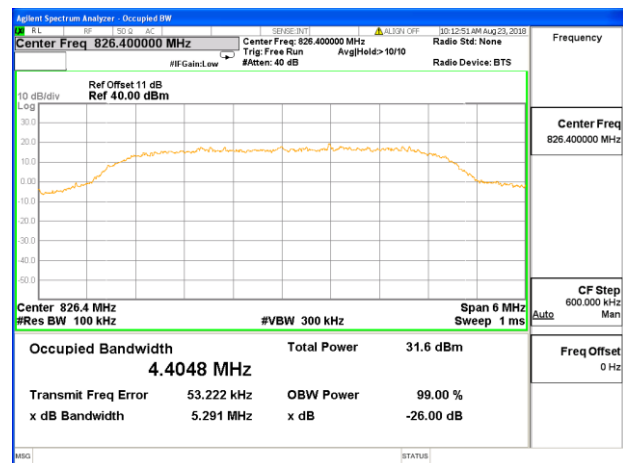
GPRS 1900 - 1909.8MHz



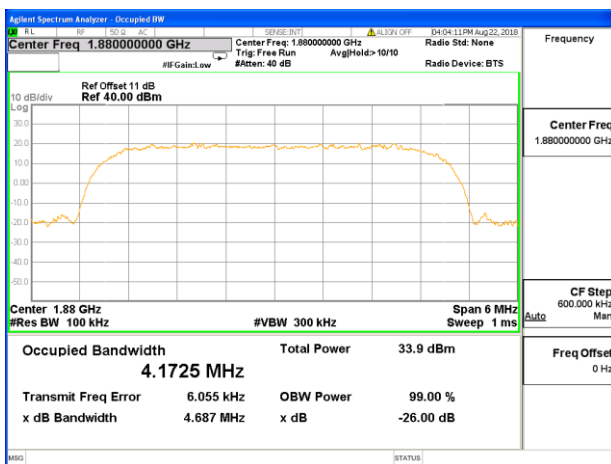
WCDMA Band II – 1852.4MHz



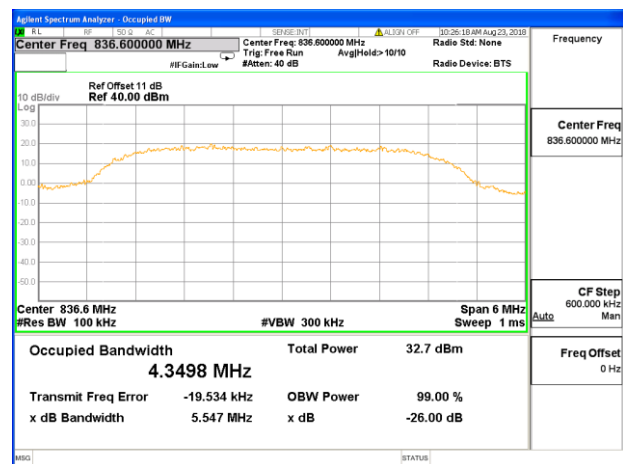
WCDMA Band V – 826.4MHz



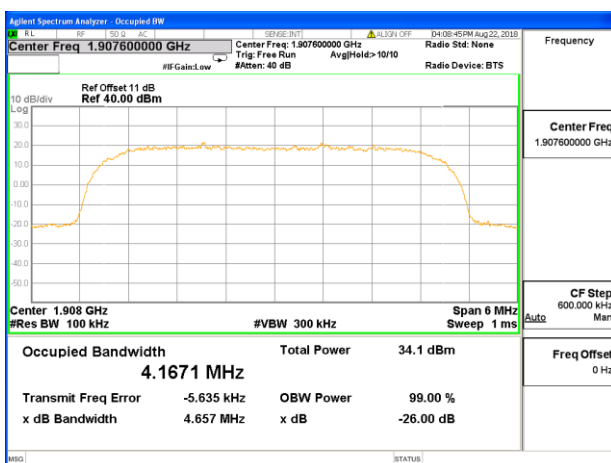
WCDMA Band II - 1880MHz



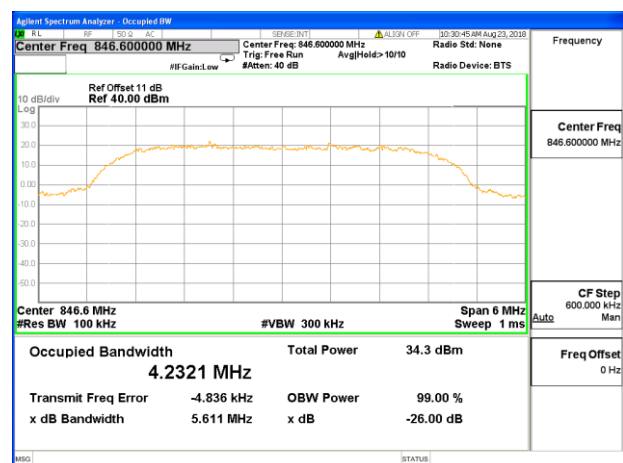
WCDMA Band V – 836.6MHz



WCDMA Band II – 1907.6MHz



WCDMA Band V – 846.6MHz



Note: all modes of EUT have been tested; only the data of worst case mode is reported.

5.4 Conducted spurious emissions

5.4.1 Limits

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

5.4.2 Test method

1, The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.

2, Spectrum Setting:

Frequency bellow 1 GHz: RBW=100 kHz, VBW=300 kHz.

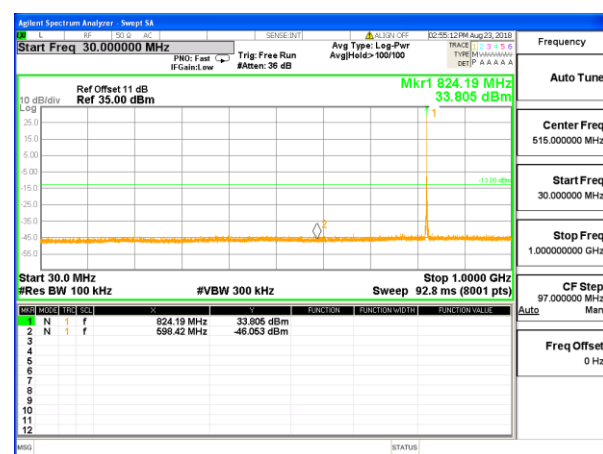
Frequency above 1 GHz: RBW=1 MHz, VBW=3 MHz.

3, The low, middle and high channels of each band and mode's spurious emissions for 30 MHz to 10th Harmonic were measured by Spectrum analyzer.

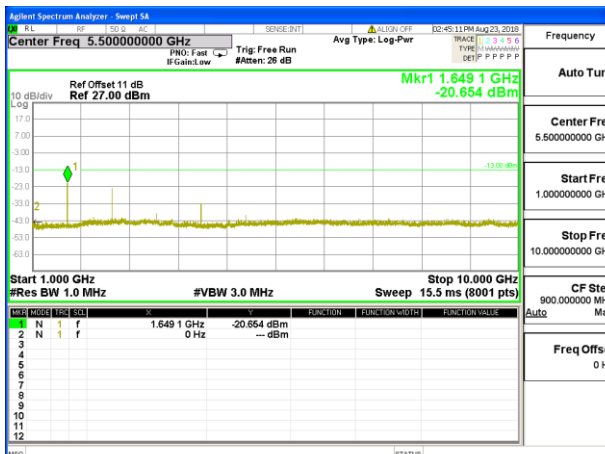
5.4.3 Test result

GSM 850

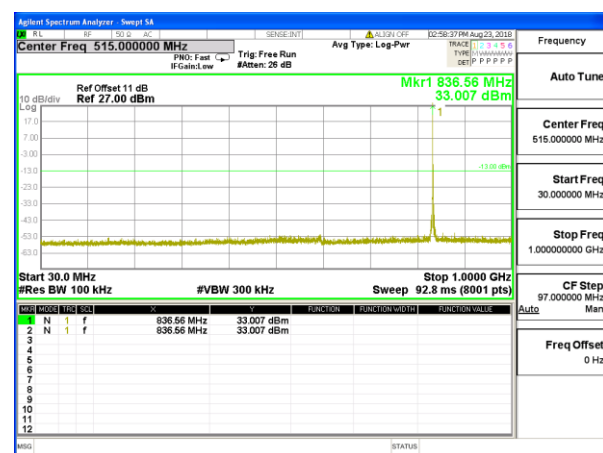
Low Channel – 30MHz-1GHz



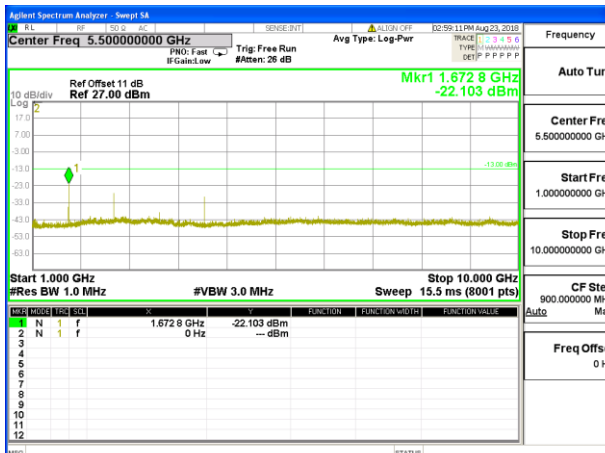
Low Channel –1GHz - 10GHz



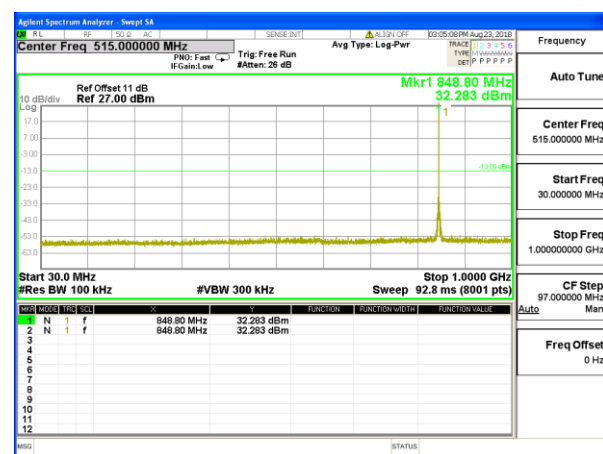
Middle Channel–30MHz-1GHz



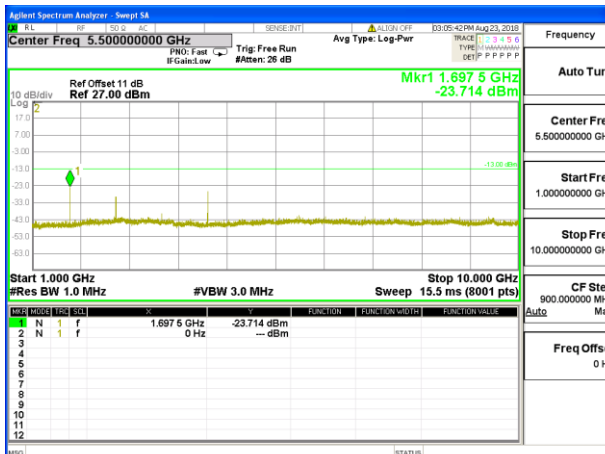
Middle Channel–1GHz - 10GHz



High Channel–30MHz-1GHz

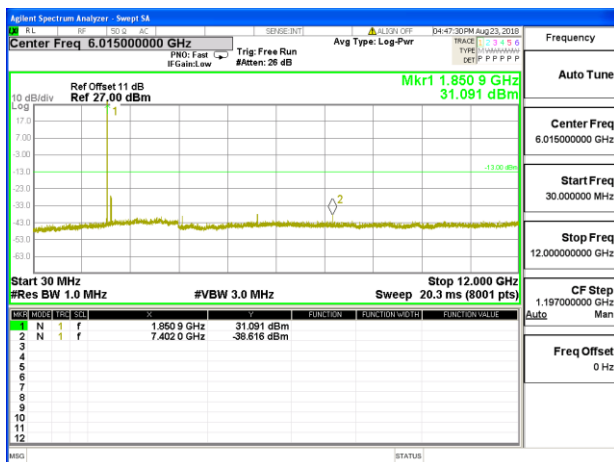


High Channel–1GHz - 10GHz

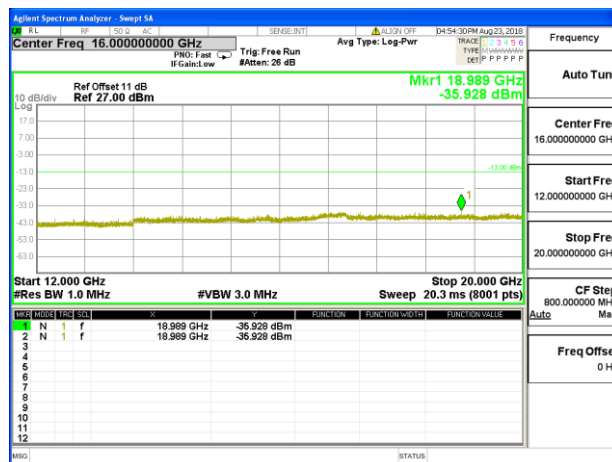


GSM 1900

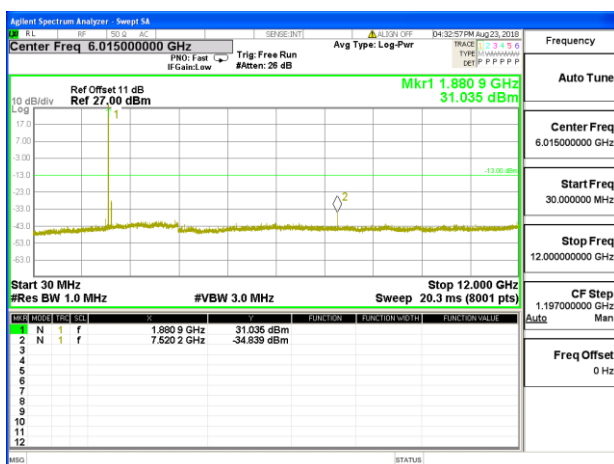
Low Channel – 30MHz-12GHz



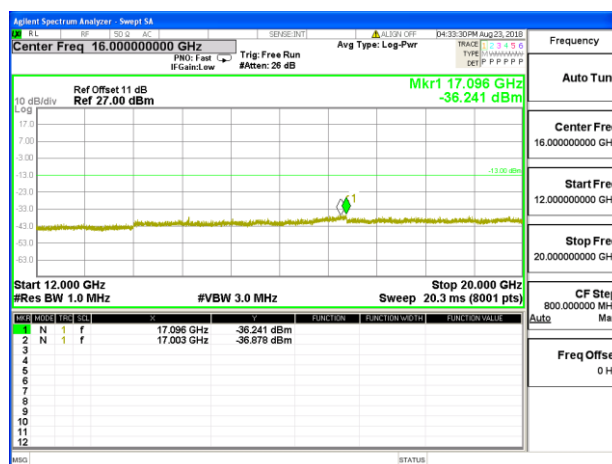
Low Channel –12GHz - 20GHz



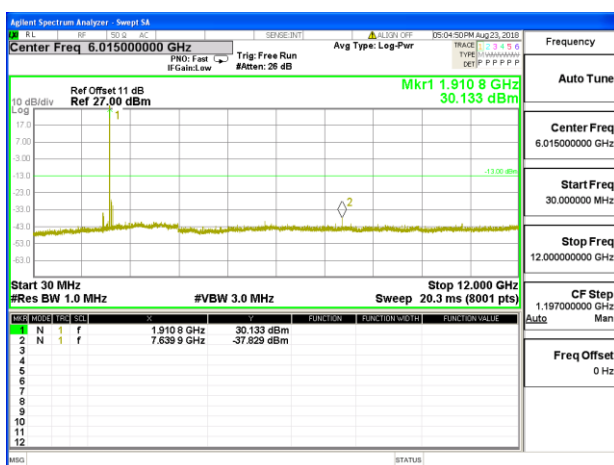
Middle Channel– 30MHz-12GHz



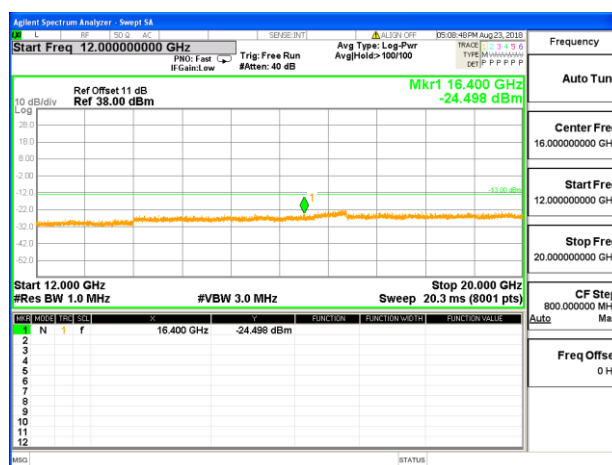
Middle Channel–12GHz - 20GHz



High Channel– 30MHz-12GHz

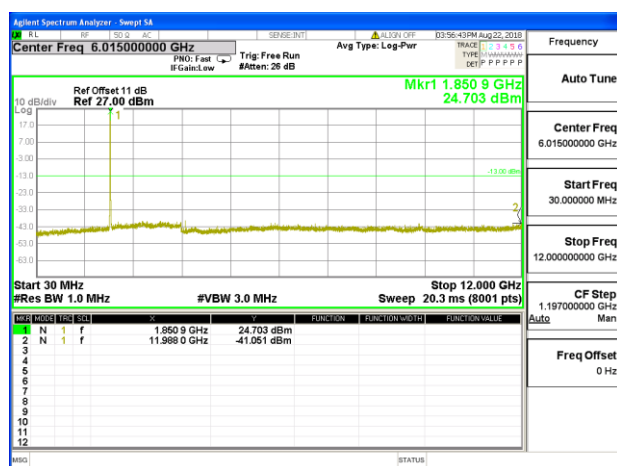


High Channel–12GHz - 20GHz

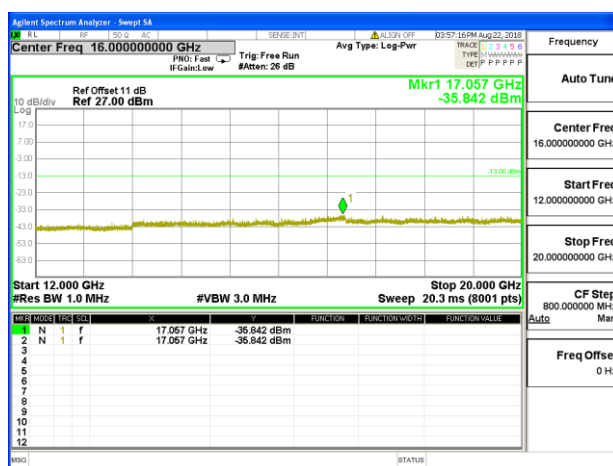


WCDMA Band II

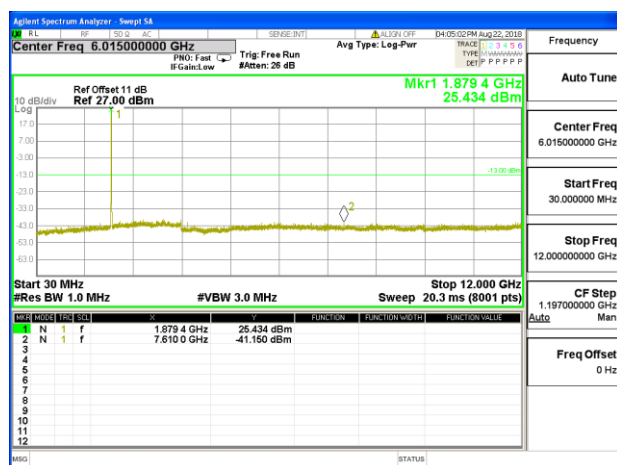
Low Channel – 30MHz-12GHz



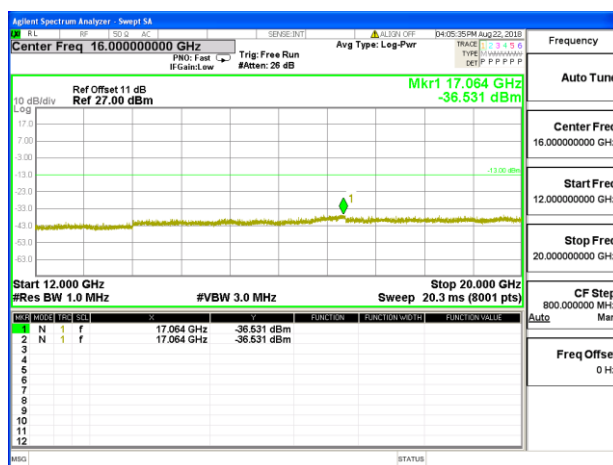
Low Channel –12GHz - 20GHz



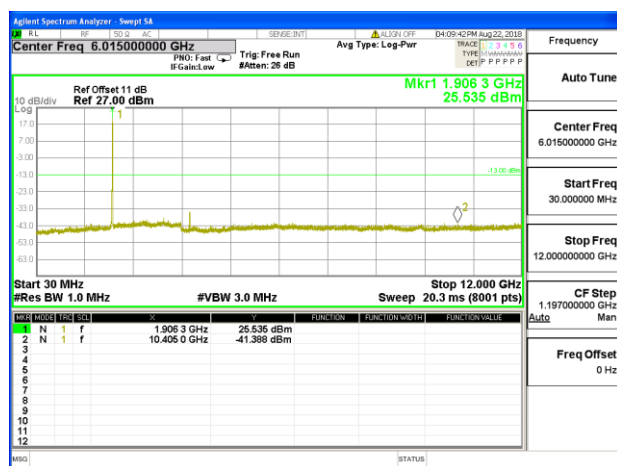
Middle Channel– 30MHz-12GHz



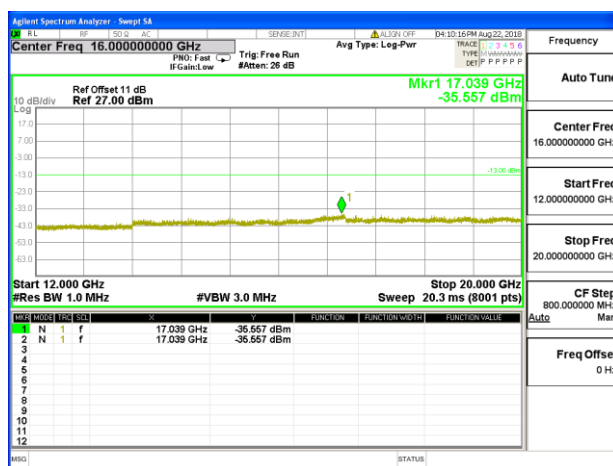
Middle Channel–12GHz - 20GHz



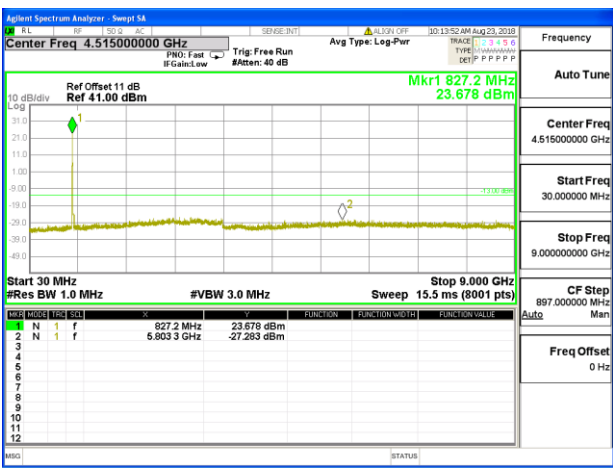
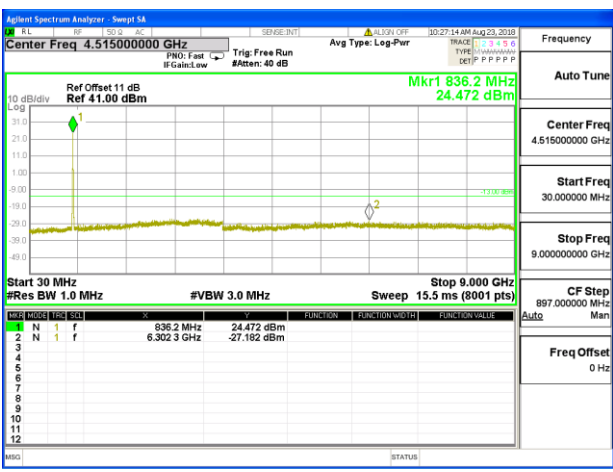
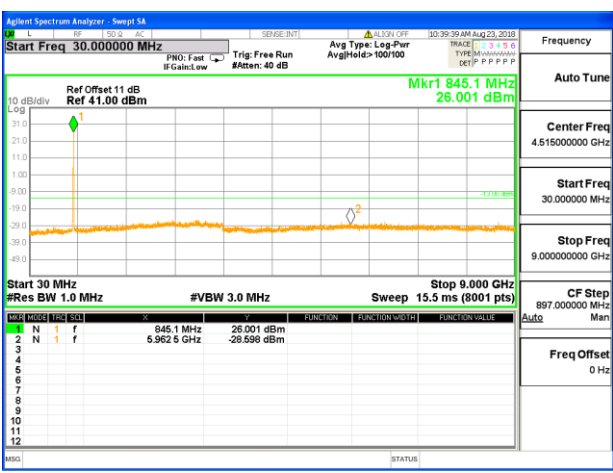
High Channel– 30MHz-12GHz



High Channel–12GHz - 20GHz



WCDMA Band V

Low Channel – 30MHz-9GHz	/
	/
Middle Channel–30MHz-9GHz	/
	/
High Channel–30MHz-9GHz	/
	/

Note: all modes of EUT have been tested; only the data of worst case mode is reported.

5.5 Band edge

5.5.1 Limits

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, for all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm

5.5.2 Test method

The testing follows FCC KDB 971168 v03 Section 6.0.

The EUT was connected to Spectrum Analyzer and Base Station via power divider.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

The band edges of low and high channels for the highest RF powers were measured.

The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)

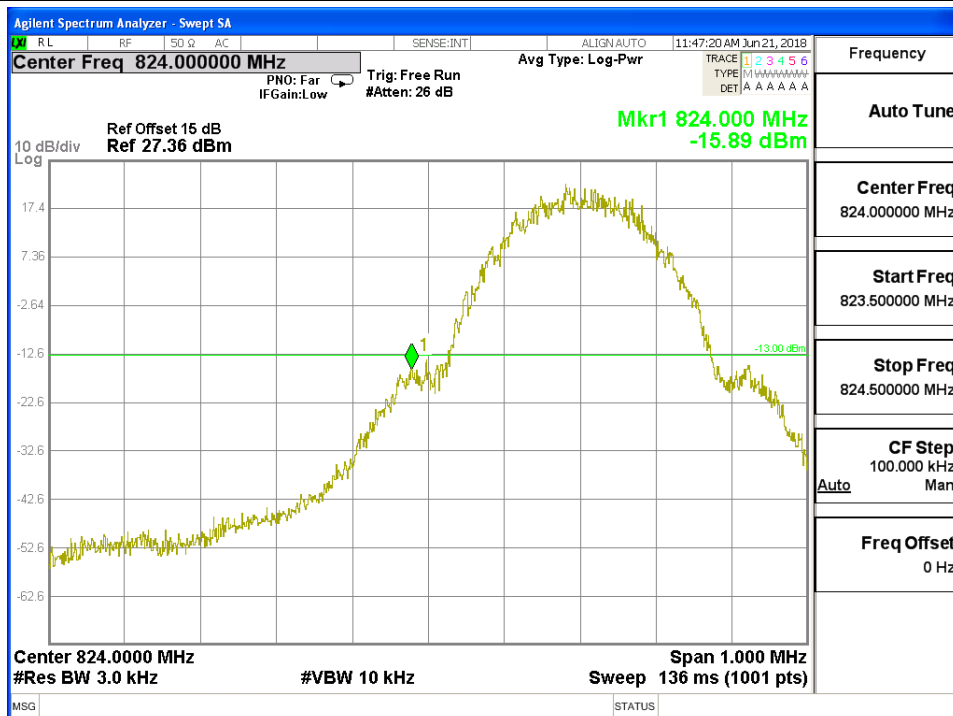
= $P(W) - [43 + 10\log(P)]$ (dB)

= $[30 + 10\log(P)]$ (dBm) - $[43 + 10\log(P)]$ (dB)

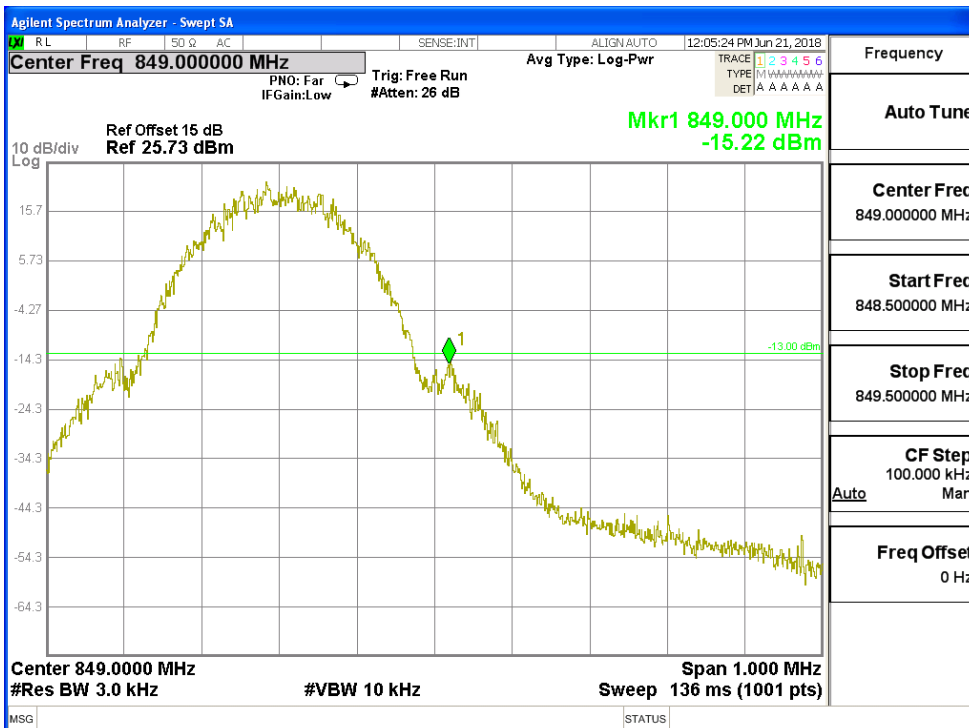
= -13dBm.

5.5.3 Test result

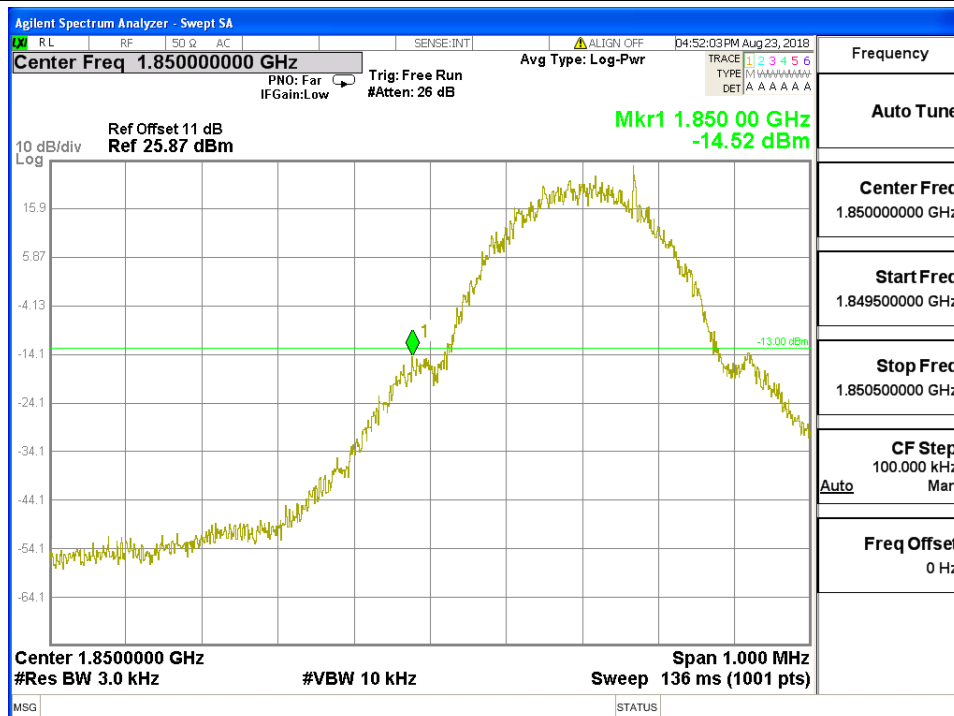
GSM 850 – Left band



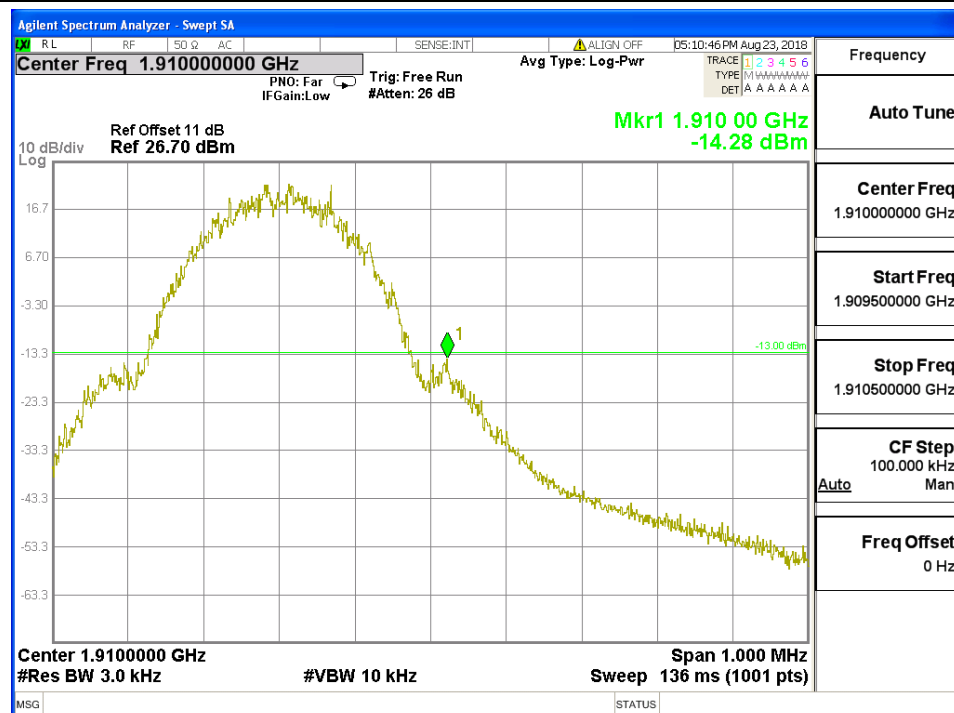
GSM 850 – Right band



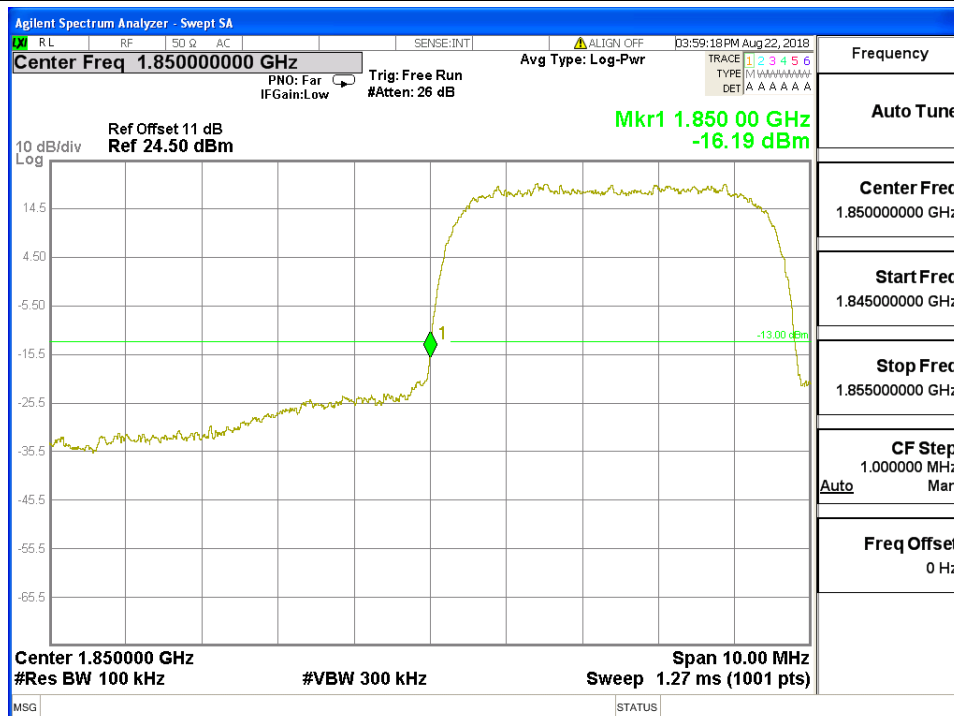
GSM 1900 – Left band



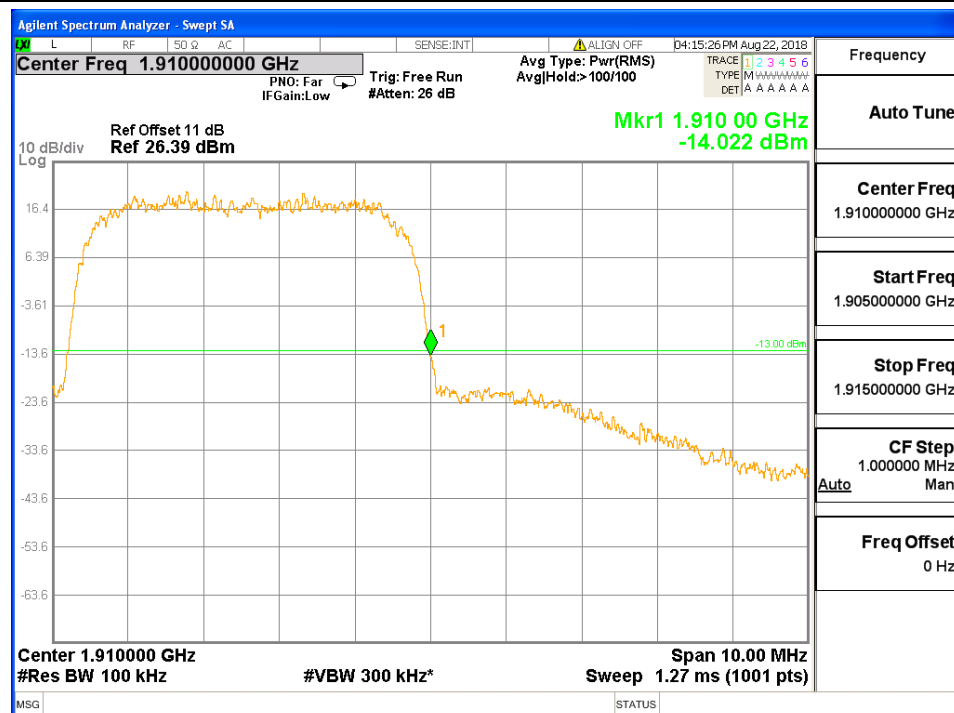
GSM 1900 – Right band



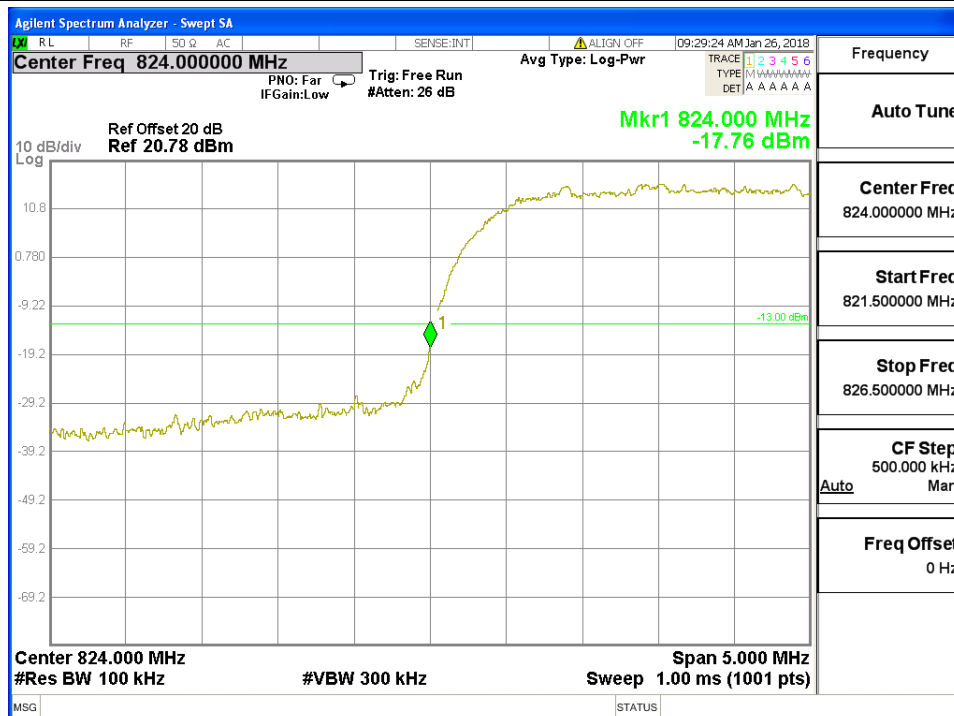
WCDMA Band II – Left band



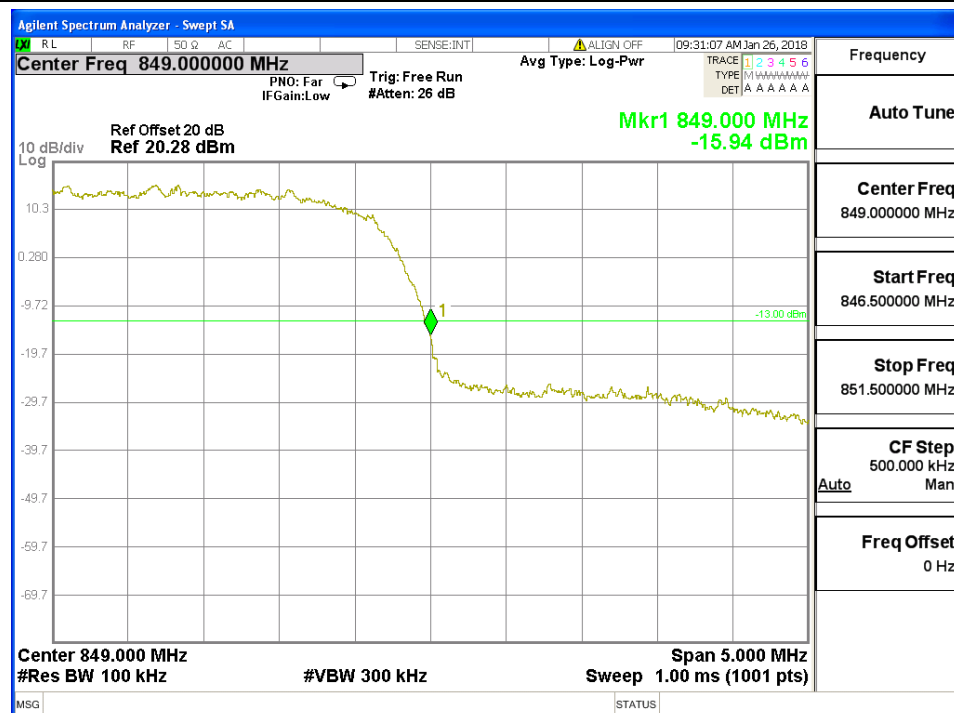
WCDMA Band II – Right band



WCDMA Band V – Left band



WCDMA Band V – Right band



Note: all modes of EUT have been tested; only the data of worst case mode is reported.

5.6 Radiated spurious emission

5.6.1 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

5.6.2 Test method

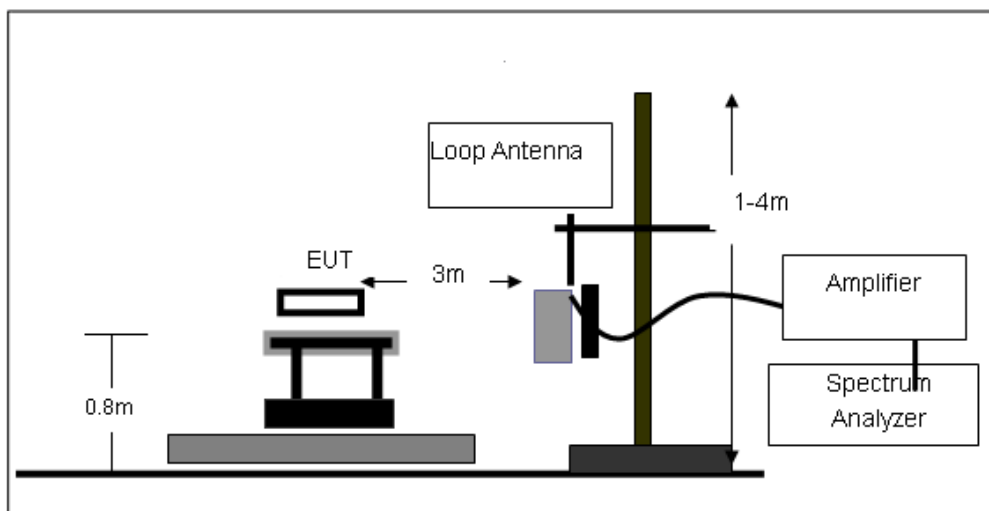
1. The test system setup as show in the block diagram above.
2. The EUT was placed on an non-conductive rotating platform in an anechoic chamber. The radiated spurious emissions from 30MHz to 10th harmonious of fundamental frequency were measured at 3 m with a test antenna and a spectrum analyzer with RBW=1 MHz, VBW=1 MHz, peak detector settings.
3. During the measurement, the EUT was enforced in maximum power and linked with a base station. All the spurious emissions at 3m were measured by rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations.
4. When found the maximum level of emissions from the EUT. 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.

Spurious emissions in dB= $10 \log(\text{TX power in Watts}/0.001)$ -the absolute level

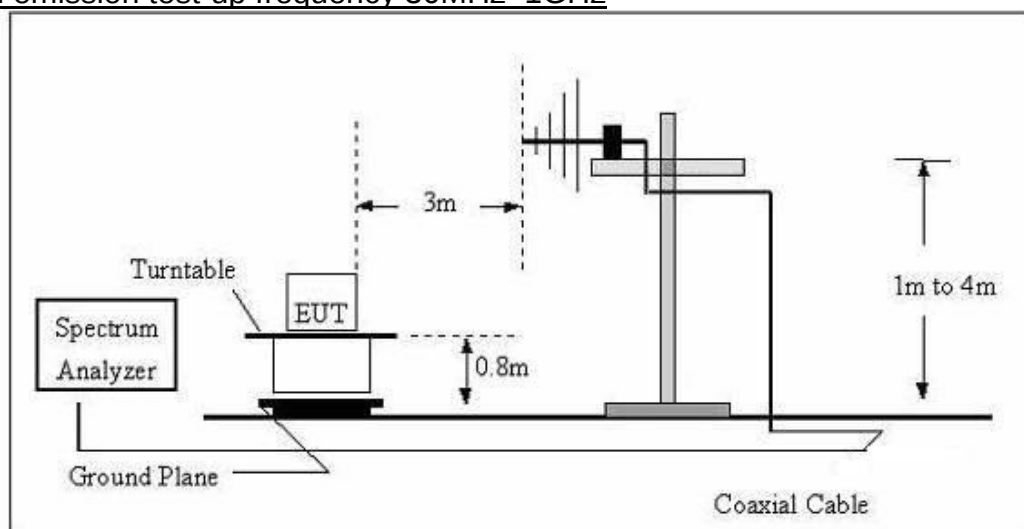
Spurious attenuation limit in dB= $43+10 \log(\text{power out in Watts})$.

5.6.3 Test setup

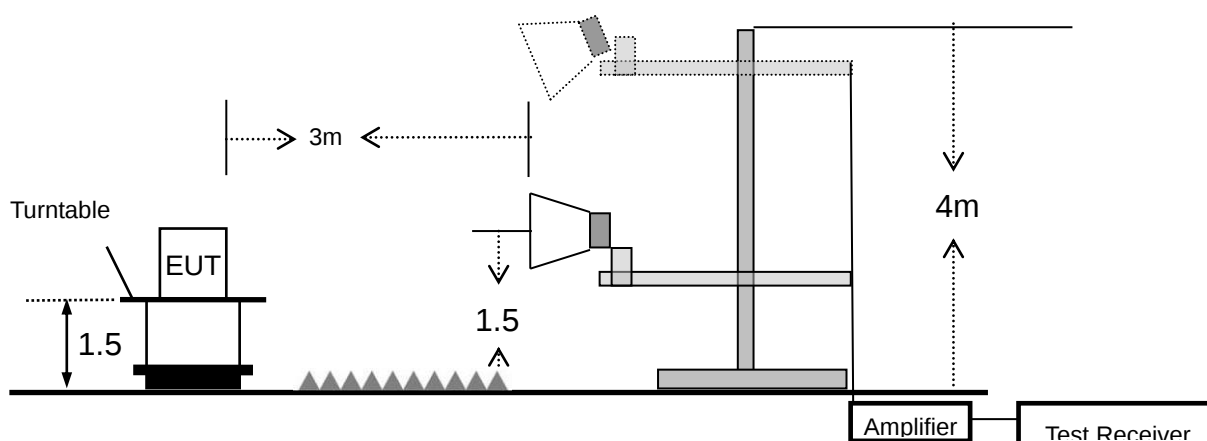
Radiated emission test-up frequency below 30MHz



Radiated emission test-up frequency 30MHz~1GHz



Radiated emission test-up frequency above 1GHz



5.6.4 Test Result

Note: All the configuration was tested and only the worse case was reported

For GSM850(30MHz – 9GHz)

GSM850_Low Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)		(dB)	(dBm)	(dBm)	(dB)	
1648.4	-41.40	5.98	3	9.11	-38.27	-13	-25.27	H
2472.6	-46.47	6.84	3	9.56	-43.75	-13	-30.75	H
1648.4	-37.87	5.98	3	9.11	-34.74	-13	-21.74	V
2472.6	-42.50	6.84	3	9.56	-39.78	-13	-26.78	V
GSM850_Middle Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)		(dB)	(dBm)	(dBm)	(dB)	
1673.2	-39.61	5.98	3	9.11	-36.48	-13	-23.48	H
2509.8	-42.11	6.84	3	9.56	-39.39	-13	-26.39	H
1673.2	-34.97	5.98	3	9.11	-31.84	-13	-18.84	V
2509.8	-38.17	6.84	3	9.56	-35.45	-13	-22.45	V
GSM850_High Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)		(dB)	(dBm)	(dBm)	(dB)	
1697.6	-45.84	5.98	3	9.11	-42.71	-13	-29.71	H
2546.4	-50.01	6.84	3	9.56	-47.29	-13	-34.29	H
1697.6	-41.86	5.98	3	9.11	-38.73	-13	-25.73	V
2546.4	-45.98	6.84	3	9.56	-43.26	-13	-30.26	V

GPRS850_Low Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
1648.4	-49.16	3.86	3	8.56	-44.46	-13	-31.46	H
2472.6	-52.99	4.29	3	6.98	-50.30	-13	-37.30	H
1648.4	-44.21	3.86	3	8.56	-39.51	-13	-26.51	V
2472.6	-51.03	4.29	3	6.98	-48.34	-13	-35.34	V
GPRS850_Middle Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
1673.2	-47.05	3.9	3	8.58	-42.37	-13	-29.37	H
2509.8	-52.57	4.32	3	6.8	-50.09	-13	-37.09	H
1673.2	-42.38	3.9	3	8.58	-37.70	-13	-24.70	V
2509.8	-48.49	4.32	3	6.8	-46.01	-13	-33.01	V
GPRS850_High Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
1697.6	-53.94	3.91	3	9.06	-48.79	-13	-35.79	H
2546.4	-55.45	4.32	3	6.65	-53.12	-13	-40.12	H
1697.6	-51.56	3.91	3	9.06	-46.41	-13	-33.41	V
2546.4	-52.01	4.32	3	6.65	-49.68	-13	-36.68	V

GSM1900_Low Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
3700.4	-43.41	5.26	3	9.88	-38.79	-13	-25.79	H
5550.6	-46.90	6.11	3	11.36	-41.65	-13	-28.65	H
3700.4	-45.33	5.26	3	9.88	-40.71	-13	-27.71	V
5550.6	-49.64	6.11	3	11.36	-44.39	-13	-31.39	V
GSM1900_Middle Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
3760	-40.01	5.32	3	10.03	-35.30	-13	-22.30	H
5640	-44.97	6.19	3	11.41	-39.75	-13	-26.75	H
3760	-43.24	5.32	3	10.03	-38.53	-13	-25.53	V
5640	-47.25	6.19	3	11.41	-42.03	-13	-29.03	V
GSM1900_High Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
3819.6	-47.03	5.36	3	9.62	-42.77	-13	-29.77	H
5729.4	-51.54	6.24	3	11.46	-46.32	-13	-33.32	H
3819.6	-49.59	5.36	3	9.62	-45.33	-13	-32.33	V
5729.4	-54.59	6.24	3	11.46	-49.37	-13	-36.37	V

GPRS1900_Low Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
3700.4	-50.74	5.26	3	9.88	-46.12	-13	-33.12	H
5550.6	-58.39	6.11	3	11.36	-53.14	-13	-40.14	H
3700.4	-54.44	5.26	3	9.88	-49.82	-13	-36.82	V
5550.6	-61.97	6.11	3	11.36	-56.72	-13	-43.72	V
GPRS1900_Middle Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	EIRP(dBm)	(dBm)	(dB)	
3760	-47.62	5.32	3	10.03	-42.91	-13	-29.91	H
5640	-56.06	6.19	3	11.41	-50.84	-13	-37.84	H
3760	-50.39	5.32	3	10.03	-45.68	-13	-32.68	V
5640	-58.76	6.19	3	11.41	-53.54	-13	-40.54	V
GPRS1900_High Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
3819.6	-59.04	5.36	3	9.62	-54.78	-13	-41.78	H
5729.4	-62.05	6.24	3	11.46	-56.83	-13	-43.83	H
3819.6	-60.21	5.36	3	9.62	-55.95	-13	-42.95	V
5729.4	-64.10	6.24	3	11.46	-58.88	-13	-45.88	V

WCDMA Band II _ Low Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
3704.8	-45.46	5.26	3	9.88	-40.84	-13	-27.84	H
5557.2	-48.85	6.11	3	11.36	-43.60	-13	-30.60	H
3704.8	-49.65	5.26	3	9.88	-45.03	-13	-32.03	V
5557.2	-56.13	6.11	3	11.36	-50.88	-13	-37.88	V
WCDMA Band II _ Middle Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
3760	-38.79	5.32	3	10.03	-34.08	-13	-21.08	H
5640	-48.56	6.19	3	11.41	-43.34	-13	-30.34	H
3760	-46.66	5.32	3	10.03	-41.95	-13	-28.95	V
5640	-55.01	6.19	3	11.41	-49.79	-13	-36.79	V
WCDMA Band II _ High Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
3815.2	-49.11	5.36	3	9.62	-44.85	-13	-31.85	H
5722.8	-54.43	6.24	3	11.46	-49.21	-13	-36.21	H
3815.2	-53.93	5.36	3	9.62	-49.67	-13	-36.67	V
5722.8	-57.92	6.24	3	11.46	-52.70	-13	-39.70	V

WCDMA Band V _ Low Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
1652.8	-46.44	3.86	3	8.56	-41.74	-13	-28.74	H
2479.2	-47.92	4.29	3	6.98	-45.23	-13	-32.23	H
1652.8	-42.79	3.86	3	8.56	-38.09	-13	-25.09	V
2479.2	-42.30	4.29	3	6.98	-39.61	-13	-26.61	V
WCDMA Band V _ Middle Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
1672.8	-44.05	3.9	3	8.58	-39.37	-13	-26.37	H
2509.2	-45.31	4.32	3	6.8	-42.83	-13	-29.83	H
1672.8	-38.33	3.9	3	8.58	-33.65	-13	-20.65	V
2509.2	-42.80	4.32	3	6.8	-40.32	-13	-27.32	V
WCDMA Band V _ High Channel								
Frequency	SG Level	Cable Loss	Diatance	Antenna Gain	Absolute Level	Limit	Margin	Polarization
(MHz)	(dBm)	(dB)	(m)	(dB)	(dBm)	(dBm)	(dB)	
1693.2	-47.57	3.91	3	9.06	-42.42	-13	-29.42	H
2539.8	-48.26	4.32	3	6.65	-45.93	-13	-32.93	H
1693.2	-44.13	3.91	3	9.06	-38.98	-13	-25.98	V
2539.8	-44.82	4.32	3	6.65	-42.49	-13	-29.49	V

5.7 Frequency stability

5.7.1 Limit

For FCC part 22.355: the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances 2.5ppm for mobile $\leq 3W$ condition.

For FCC part 24.235: The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

5.7.2 Test method

Test Procedures for Temperature Variation:

- 1, The EUT was set up in the thermal chamber and connected with the base station.
- 2, With power off, the temperature was decreased to -30°C and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.
- 3, With power off, the temperature was raised in 10°C set up to 50°C and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.
- 4, measure the carrier frequency error.

Test Procedures for Voltage Variation:

- 1, The EUT was placed in a temperature chamber at $25\pm 5^{\circ}\text{C}$ and connected with the base station.
- 2, Reduce the primary supply voltage to the battery operating end point.
- 3, measure the carrier frequency error.

5.7.3 Test Result

Band	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
GSM 850	3.5	27	0.0323
	3.7	21	0.0251
	4.2	15	0.0179

Band	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
GSM 850	-30	25	0.0299
	-20	19	0.0227
	-10	20	0.0239
	0	16	0.0191
	10	14	0.0167
	20	23	0.0275
	30	15	0.0179
	40	28	0.0335
	50	32	0.0383

Band	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
GSM 1900	3.5	36	0.0191
	3.7	30	0.0160
	4.2	25	0.0133

Band	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
GSM 1900	-30	36	0.0191
	-20	33	0.0176
	-10	30	0.0160
	0	32	0.0170
	10	25	0.0133
	20	27	0.0144
	30	35	0.0186
	40	24	0.0128
	50	22	0.0117

Band	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band II	3.5	13	0.0069
	3.7	19	0.0101
	4.2	27	0.0144

Band	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band II	-30	33	0.0394
	-20	26	0.0311
	-10	27	0.0323
	0	25	0.0299
	10	21	0.0251
	20	23	0.0275
	30	16	0.0191
	40	25	0.0299
	50	31	0.0371

Band	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band V	3.5	26	0.0311
	3.7	19	0.0227
	4.2	17	0.0203

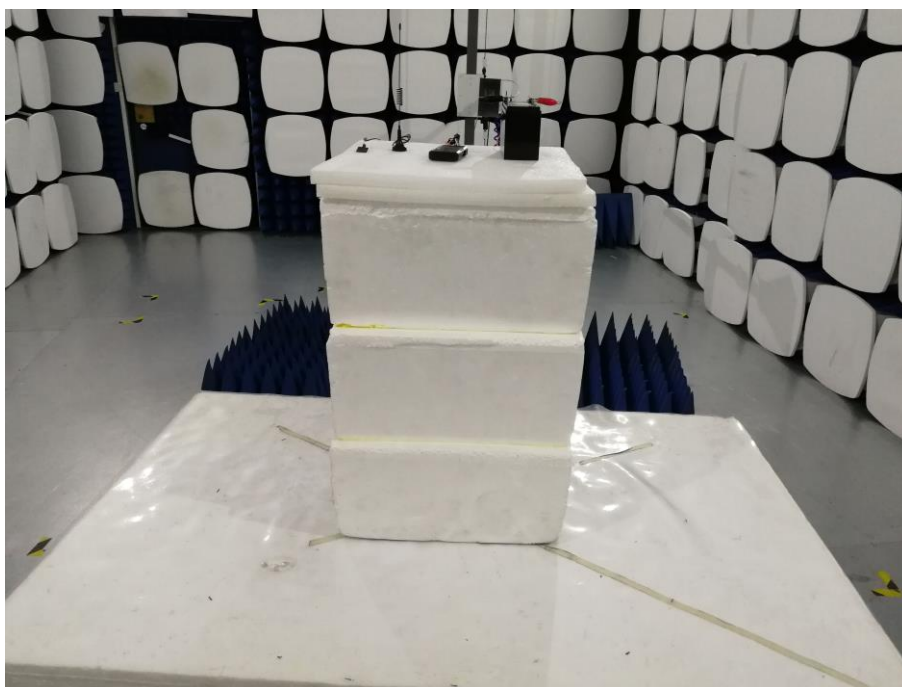
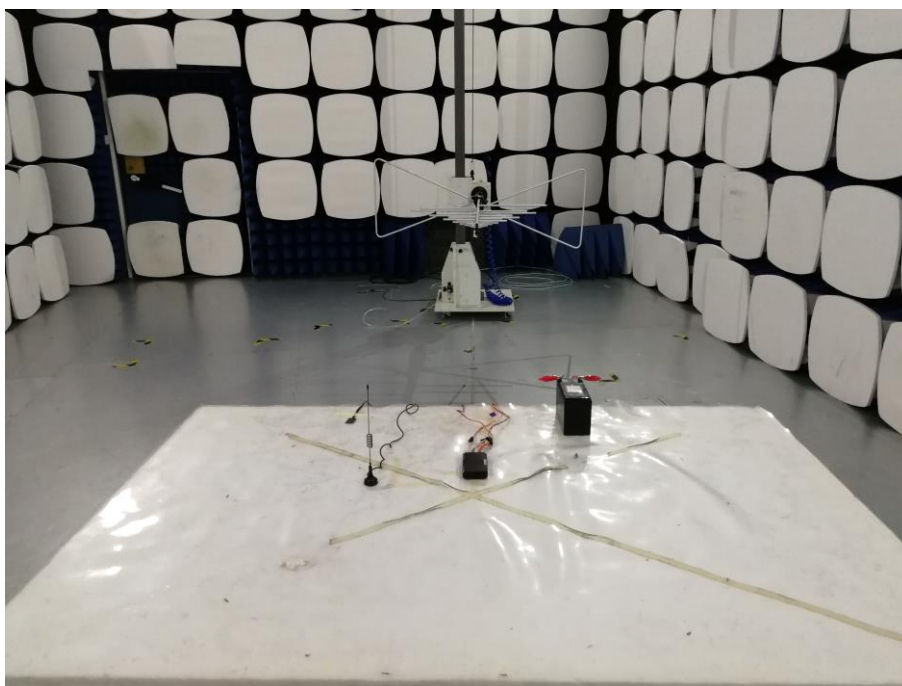
Band	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
WCDMA Band V	-30	35	0.0186
	-20	31	0.0165
	-10	27	0.0144
	0	29	0.0154
	10	25	0.0133
	20	35	0.0186
	30	26	0.0138
	40	24	0.0128
	50	22	0.0117

Note:

1. Normal Voltage = 3.7V; Battery End Point (BEP) = 3.5V; Maximum Voltage =4.2V
2. All modes of EUT have been tested; only the data of worst case mode is reported.

Photographs of the Test Setup

Radiated emission



Photographs of the EUT

See the APPENDIX 1: EUT PHOTO in the report No.: MTi180828E126-1.

----END OF REPORT----